

**PERMIT RENEWAL TEST
PERMIT YEAR: MAY 1, 2018 - APRIL 30, 2019**



Monitoring and Technical Services
10124 Old Grove Road
San Diego, CA 92131

Nitrogen Oxides & Carbon Monoxide
Emissions Summary Report

SITE: SD State University Boiler #3
LOCATION: 5500 Campanile Dr San Diego, CA 92182
MAIL ADDRESS: SD State University 5500 Campanile Dr Mail Code 1243 San Diego, CA 92182

P/O NUMBER: APCD2004-PTO-000841
ID NUMBER: APCD1976-SITE-00208
TEST DATE: 5-Apr-19

EQUIPMENT: Boiler: International Boiler Works model BF-350C-W12X, equipped with low NOx burner, FGR, O2 monitor, rated at 12.6 MMBtu/hr fired on natural gas with diesel backup

REPORT BY: N. Gutzwiller
REPORT DATE: 9-Apr-19

APCD PERSONNEL: N. Gutzwiller, A. Fry

SITE PERSONNEL: Alvin Shoemaker

APPROVED BY: *David Sodeman* 6/14/19
David Sodeman, Senior Chemist

Table 1. Summary of Results - NOx and CO Stack Emissions Corrected to 3% O2

	TEST RESULTS	PERMIT LIMITS	PERFORMANCE	HOURS OF TEST
NOx (ppm)	25	30	PASS	0.75
NOx (lb/MMBtu)	0.0298		info only	0.75
NOx (lb/MMscf)	30.9		info only	0.75
CO (ppm)	4	400	PASS	0.75
CO (lb/MMBtu)	0.0028		info only	0.75
CO (lb/MMscf)	2.9		info only	0.75
Fuel	12,139 scfh natural gas			
Firing Rate (%)	100			

TEST REFERENCE: This testing was performed in accordance with the San Diego Air Pollution Control District Method 100: "Test Procedures For The Determination of Nitrogen Oxides, Carbon Monoxide and Diluent Gases by Continuous Emission Monitoring."

INTERMEDIATE SUMMARY TABLE

Test Hrs	Sub-test number	Avg NO2 % of total NOx	Avg Raw NOx ppm	Avg. Raw NO ppm	NOx adj for drift & bias ppm	Avg. Raw CO ppm	CO adj for drift & bias ppm	Avg. Raw O2 %	O2 adj for drift & bias %	Corr NOx @ 3 % O2 ppm	Corr CO @ 3 % O2 ppm
09:25-09:40	1	19.1%	21.8	17.8	22.9	4.0	4.0	3.91	3.92	24.2	4.2
09:56-10:11	2	19.4%	22.0	17.9	23.3	3.5	3.5	3.85	3.87	24.5	3.7
10:27-10:42	3	19.9%	22.0	17.9	23.7	3.3	3.4	3.85	3.88	24.9	3.6
Average		19.5%			23.3		3.6		3.89	24.5	3.8

Calibration Gases:

Gas	Cylinder	Manufacturer	Conc.
NO	CC233189	TechAir	44.72 ppm
NO2	CC501609	Praxair	7.18 ppm
CO	ALM-037113	Praxair	44.9 ppm
O2	CC505714	Praxair	8.00 %
O2	CC159087	TechAir	4.479 %
N2		TechAir	

Calibration Gas Dilutions:

Gas	Concn. 100%	dil. to: %	concn.
NO (ppm)	44.72	100	44.72
		50	22.36
NO2(ppm)	7.18	50	3.59
CO (ppm)	44.9	40	18.0
		20	8.98
O2 (%)	8.00	100	8.00
		4.479	100

Instrument scales :

NOx: 0-55 ppm
 NO: 0-55 ppm
 CO: 0-22 ppm
 O2: 0-10 %

Concentrations for SGD eval:

Gas Used	8.00	%O2
diluted to:		
%	%	
100	8.00	
60	4.80	
50	4.00	
40	3.20	
20	1.60	

Scale: 0-10 %

Direct challenge gas: 4.48 % O2

System Leak Checks:

Initial: good
 Final: good

DAS Trigger Times:

1 : 6:41:49
 2 : 8:11:00
 3 : 9:41:13
 4 : 10:25:19

INSTRUMENTATION.

NOx analyzer: CAI 600 (chemiluminescence) with low temperature converter.
 CO analyzer: Thermo 48i (NDIR).
 O2 analyzer: CAI 600, Servomex 1440C (paramagnetic).
 Standard gas divider: Stec model SGD-A10.

QA/QC CHECKS (continued).

SGD FIELD EVALUATION, (limits: all differences +/-2%).

Gas used: 8.00 %O2 Scale: 0 - 10 %

Gas diluted to: (%)	SGD gas values (%)			Average	Actual conc. (%)
	1	2	3		
100	8.07	8.05	8.04	8.05	8.00
				0.7%	% diff. of avg. from act. val.
	0.2%	0.0%	-0.2%		% diff. from avg.
60	4.79	4.79	4.79	4.79	4.80
				-0.2%	% diff. of avg. from act. val.
	0.0%	0.0%	0.0%		% diff. from avg.
50	3.99	3.99	3.99	3.99	4.00
				-0.2%	% diff. of avg. from act. val.
	0.0%	0.0%	0.0%		% diff. from avg.
40	3.19	3.18	3.17	3.18	3.20
				-0.6%	% diff. of avg. from act. val.
	0.3%	0.0%	-0.3%		% diff. from avg.
20	1.59	1.57	1.56	1.57	1.60
				-1.7%	% diff. of avg. from act. val.
	1.1%	-0.2%	-0.8%		% diff. from avg.

MID-LEVEL GAS CONCENTRATION DIRECT TO ANALYZER, (limit: difference +/-2%).

Gas used: 4.48 % O2 Scale: 0- 0-10

		Inj. #1	Inj. #2	Inj. #3	Avg.
Instrument response (%)	Dir. Val.	4.52	4.51	4.51	4.51
		Diff. %			0.8%

CONVERTER EFFICIENCY, (must be >90%).

	NOx Mode	NO Mode	NO2 gas: 3.590 ppm
NO2 dir (ppm)	3.3	0.0	
NO2 zero (ppm)	0.0	0.0	
Conv. Eff. (%)	91.9%		

MULTI-POINT CALIBRATION INSTRUMENT CHECK, (limit: instr. val. within 2% of full scale of predict. val.).

Conc. level	Gas Conc.			Instr. response					
	NO ppm	CO ppm	O2%	NO ppm	NO ACE	CO ppm	CO ACE	O2 %	O2 ACE
High	44.72	18.0	8.00	43.8	-1.7%	18.1	0.6%	7.98	-0.2%
Zero	0.00	0.0	0.00	0.0	0.0%	0.0	0.0%	0.02	0.2%
Mid	22.36	8.98	4.479	21.9	-0.8%	9.1	0.5%	4.49	0.1%
			Scale, 0-	55		22		10	
			Slope	1.0		0.99		1.01	
			Intercept	0.0		0.0		0.0	
			Mid (predict.)	21.9		9.1		4.48	
			Diff. (% full scale)	0.0		0.2		0.1	

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	21.9	1.8%	21.7	1.4%	21.8	22.36	-0.4%
	zero	0.0		0.0		0.0	0.00	0.0%
	system	21.5		21.4		21.5	22.36	-0.2%
	zero	0.0		0.0		0.0	0.00	0.0%
NO2	direct	3.3	12.1%	3.2	6.3%	3.3	3.59	-0.2%
	zero	0.0		0.0		0.0	0.00	0.0%
	system	3.0		3.1		3.1	3.59	0.2%
	zero	0.1		0.1		0.1	0.00	0.0%
CO	direct	9.1	0.0%	N/A	N/A	N/A	8.98	N/A
	zero	0.0		N/A		N/A	0.0	N/A
	system	9.1		9.0		9.1	8.98	-0.5%
	zero	0.0		0.0		0.0	0.0	0.0%
O2 as %	direct	4.49	0.9%	N/A	N/A	N/A	4.479	N/A
	zero	0.02		N/A		N/A	0.00	N/A
	system	4.47		4.46		4.47	4.479	-0.1%
	zero	0.04		0.03		0.04	0.00	-0.1%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	21.8	22.9	ppm
NO avg	17.8	18.6	ppm
NO2 avg	4.0	4.4	ppm
CO avg	4.0	4.0	ppm
O2 avg	3.91	3.92	%

NOx 0- 55 ppm
 CO 0- 22 ppm
 O2 0- 10 %

Stack NO2 %
 19.1%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	21.7	1.4%	21.5	1.4%	21.6	22.36	-0.4%
	zero	0.0		0.0		0.0	0.00	0.0%
	system	21.4		21.2		21.3	22.36	-0.4%
	zero	0.0		0.0		0.0	0.00	0.0%
NO2	direct	3.2	6.3%	3.2	12.5%	3.2	3.59	0.0%
	zero	0.0		0.0		0.0	0.00	0.0%
	system	3.1		2.9		3.0	3.59	-0.4%
	zero	0.1		0.1		0.1	0.00	0.0%
CO	direct	N/A	N/A	N/A	N/A	N/A	8.98	N/A
	zero	N/A		N/A		N/A	0.0	N/A
	system	9.0		8.9		9.0	8.98	-0.5%
	zero	0.0		-0.1		-0.1	0.0	-0.5%
O2 as %	direct	N/A	N/A	N/A	N/A	N/A	4.479	N/A
	zero	N/A		N/A		N/A	0.00	N/A
	system	4.46		4.45		4.46	4.479	-0.1%
	zero	0.03		0.03		0.03	0.00	0.0%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	22.0	23.3	ppm
NO avg	17.9	18.8	ppm
NO2 avg	4.1	4.5	ppm
CO avg	3.5	3.5	ppm
O2 avg	3.85	3.87	%

NOx 0- 55 ppm
 CO 0- 22 ppm
 O2 0- 10 %

Stack NO2 %
 19.4%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	21.5	1.4%	21.4	1.9%	21.5	22.36	-0.2%
	zero	0.0		0.0		0.0	0.00	0.0%
	system	21.2		21.0		21.1	22.36	-0.4%
	zero	0.0		0.0		0.0	0.00	0.0%
NO2	direct	3.2	12.5%	3.2	12.5%	3.2	3.59	0.0%
	zero	0.0		0.0		0.0	0.00	0.0%
	system	2.9		2.9		2.9	3.59	0.0%
	zero	0.1		0.1		0.1	0.00	0.0%
CO	direct	N/A	N/A	8.9	1.1%	N/A	8.98	N/A
	zero	N/A		-0.2		N/A	0.0	N/A
	system	8.9		8.9		8.9	8.98	0.0%
	zero	-0.1		-0.1		-0.1	0.0	0.0%
O2 as %	direct	N/A	N/A	4.47	1.1%	N/A	4.479	N/A
	zero	N/A		0.00		N/A	0.00	N/A
	system	4.45		4.44		4.45	4.479	-0.1%
	zero	0.03		0.02		0.03	0.00	-0.1%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	22.0	23.7	ppm
NO avg	17.9	19.0	ppm
NO2 avg	4.1	4.7	ppm
CO avg	3.3	3.4	ppm
O2 avg	3.85	3.88	%

NOx 0- 55 ppm
 CO 0- 22 ppm
 O2 0- 10 %

Stack NO2 %
 19.9%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

APPENDIX**Calculation of Gas Concentrations (Method 100).**

1) Concentrations for O₂ & CO (and CO₂ when required) are calculated using equation 1.

$$C_{gas} = (C_{avg} - C_o) * \frac{C_{ma}}{C_m - C_o} \quad 1$$

Where:

C_{gas} = Effluent gas concentration, ppm, dry basis.

C_{avg} = Average gas concentration, ppm, dry basis, indicated by the analyzer.

C_{ma} = Actual certified concentration, ppm, of the mid- or high-range calibration gas used for the system calibration checks.

C_m = Average of the initial and final system calibration responses, ppm, for the mid- or high-range calibration gas.

C_o = Average of the initial and final system calibration responses, ppm, for the zero calibration gas.

2) NO₂, NO, & NO_x gas concentrations, corrected for instrument drift, calibration error and system bias for NO & NO₂ are calculated using equations 2,3 & 4 respectively.

$$NO_2gas = [(NO_{xavg} - NO_{xod}) - (NO_{avg} - NO_{od})] * \frac{NO_{ma}}{NO_{md} - NO_{od}} * \frac{NO_{2md} - NO_{od}}{NO_{2m} - NO_{od}} \quad 2$$

$$NOgas = (NO_{avg} - NO_o) * \frac{NO_{ma}}{NO_{md} - NO_{od}} * \frac{NO_{md} - NO_{od}}{NO_m - NO_o} \quad 3$$

$$NOxgas = NOgas + NO_2gas \quad 4$$

Where:

NO_{xgas} = the total NO_x concentration, ppm, dry basis, in the stack effluent.

NO_{2gas} = the NO₂ concentration, ppm, dry basis, in the stack effluent.

NO_{gas} = the NO concentration, ppm, dry basis, in the stack effluent.

NO_{xavg} = the average NO_x concentration, ppm, dry basis, indicated by the analyzer.

NO_{avg} = the average NO concentration, ppm, dry basis, indicated by the analyzer.

NO_{ma} = the actual certified concentration, ppm, of the mid- or high-range NO calibration gas.

NO_{2md} = the average of the initial and final analyzer responses, ppm, for the NO₂ calibration gas when introduced directly to the analyzer.

NO_{md} = the average of the initial and final analyzer responses, ppm, for the NO calibration gas when introduced directly to the analyzer.

NO_{od} = the average of the initial and final zero calibration responses, ppm, when NO zero calibration gas is sampled directly to the analyzer.

NO_{2m} = the average of the initial and final system calibration responses, ppm, for the NO₂ calibration gas.

NO_m = the average of the initial and final system calibration responses, ppm, for the NO calibration gas.

NO_o = the average of the initial and final system calibration responses, ppm, for the NO zero calibration.

NO_{xod} = the average of the initial and final zero calibration responses, ppm, when the NO_x zero calibration gas is sampled directly to the analyzer.

3) Specific gaseous emission limits corrected to 3% or 15%O₂ are calculated using equations 5a & 5b.

$$C_{gas@3\%O_2} = C_{gas} * \frac{20.95 - 3\%O_2}{20.95 - C_{gasO_2\%}} \quad 5a$$

$$C_{gas@15\%O_2} = C_{gas} * \frac{20.95 - 15\%O_2}{20.95 - C_{gasO_2\%}} \quad 5b$$

Where:

C_{gas @ 3% or 15%} = the stack gas effluent for either NO_x or CO corrected to 3% or 15% O₂.

C_{gas} = the stack gas effluent for either NO_x or CO determined using equation 1.

C_{gas O₂%} = the stack effluent gas concentration of O₂, %.

NOTE: The NO_x analyzer used during this test is capable of measuring NO and total NO_x simultaneously. NO₂ calibration gas values are measured via the NO_x channel, thus NO₂ zero is the same as NO_x zero.

C_{gas @ 3% or 15%} = the stack gas effluent for either NO_x or CO corrected to 3% or 15% O₂.

SOURCE TEST ENGINEERING REPORT



SITE : SD State University
Boiler #3

PO# : APCD2004-PTO-000841

DATE : 5-Apr-19

APCD PERSONNEL : N. Gutzwiller, A. Fry

EQUIPMENT : Boiler: International Boiler Works model BF-350C-W12X, equipped with low NOx burner, FGR, O2 monitor, rated at 12.6 MMBtu/hr fired on natural gas with diesel backup

OPERATING PARAMETERS

	RUN 1	RUN 2	RUN 3	AVERAGE
Steam Pressure (psi)	135	134	135	135
Steam flow (lb/hr)	9600	7050	10190	8947
Fuel (scfh)*	12,139	12,139	12,139	12,139
Firing Rate (%)**	100	100	100	100
Fuel HHV (btu/scf)	1038			

*fuel meter OOS, needs calibration. Fuel based on firing rate, heat value and rated capacity

**set manually. Steam flow similar to previous years indicating >80% load

Emission Factor Calculations (EPA Method 19)

	RUN 1	RUN 2	RUN 3	AVERAGE
NOx (ppm)	22.9	23.3	23.7	23.3
NOx (lb/MMBtu)	0.0293	0.0298	0.0302	0.0298
NOx (lb/MMscf)	30.5	30.9	31.4	30.9
NOx (lb/hr)	0.370	0.375	0.381	0.375
CO (ppm)	4.0	3.5	3.4	3.6
CO (lb/MMBtu)	0.0031	0.0028	0.0026	0.0028
CO (lb/MMscf)	3.2	2.9	2.7	2.9
CO (lb/hr)	0.039	0.035	0.033	0.036
O2 (%)	3.92	3.87	3.88	3.89
Heat Input (MMBtu/hr)*	12.6	12.6	12.6	12.6

*assumed firing at rated capacity for lb/hr emissions

SAN DIEGO GAS & ELECTRIC MONTHLY GAS QUALITY REPORT

April 2019

	Thermal Zone 1 Oceanside		Thermal Zone 2 Rainbow		Thermal Zone 3 Sweetwater		Thermal Zone 4 Witherby		Thermal Zone 5 Harvest Station		Thermal Zone 6 Camino Del Norte		Thermal Zone 7 Point Loma	
	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv
04/01/2019	1044	0.5954	1042	0.5943	1041	0.5905	1034	0.5873	1038	0.5887	1044	0.5956		
04/02/2019	1041	0.5934	1038	0.5907	1037	0.5878	1034	0.5872	1041	0.5890	1040	0.5930		
04/03/2019	1039	0.5910	1041	0.5927	1039	0.5877	1034	0.5872	1041	0.5889	1039	0.5877		
04/04/2019	1038	0.5919	1036	0.5912	1041	0.5893	1034	0.5872	1039	0.5892	1041	0.5912		
04/05/2019	1034	0.5908	1036	0.5900	1038	0.5889	1034	0.5872	1037	0.5879	1036	0.5891		
04/06/2019	1034	0.5896	1033	0.5878	1035	0.5867	1035	0.5872	1033	0.5850	1035	0.5870		
04/07/2019	1033	0.5850	1033	0.5877	1032	0.5843	1035	0.5872	1031	0.5837	1033	0.5856		
04/08/2019	1034	0.5857			1027	0.5812	1035	0.5872	1028	0.5819	1031	0.5862		

	Thermal Zone 1 Oceanside	Thermal Zone 2 Rainbow	Thermal Zone 3 Sweetwater	Thermal Zone 4 Witherby	Thermal Zone 5 Harvest Station	Thermal Zone 6 Camino Del Norte	Thermal Zone 7 Point Loma
Avg BTU	1037	1037	1036	1034	1036	1037	
Min BTU	1033	1033	1027	1034	1028	1031	
Max BTU	1044	1042	1041	1035	1041	1044	
Avg Spec Gv	0.5904	0.5906	0.5871	0.5872	0.5868	0.5894	
Min Spec Gv	0.5850	0.5877	0.5812	0.5872	0.5819	0.5856	
Max SpeGvty	0.5954	0.5943	0.5905	0.5873	0.5892	0.5956	

*** Unofficial Data, Subject to Change ***

BTU data is now compiled based on the 7 thermal zones listed above as a result of CPUC approval of Advice No. 1863. Historic data for the previously designated 6 thermal zones may be accessed at http://www2.sdge.com/tariff/gas_quality_hist.pdf.

SOURCE TEST ENGINEERING REPORT



SITE : SD State University
Boiler #3

PO# : APCD2004-PTO-000841

DATE :

APCD PERSONNEL : N. Gutzwiller, A. Fry

EQUIPMENT : Boiler: International Boiler Works model BF-350C-W12X, equipped with low NOx burner, FGR, O2 monitor, rated at 12.6 MMBtu/hr fired on natural gas with diesel backup

OPERATING PARAMETERS

	RUN 1	RUN 2	RUN 3	AVERAGE
Steam Pressure (psi)	135	134	135	#DIV/0!
Steam flow (lb/hr)	9600	7050	10190	#DIV/0!
Fuel (scfh)*	N/A	N/A	N/A	#DIV/0!
Firing Rate (%)**	100	100	100	#DIV/0!
Fuel HHV (btu/scf)				

*fuel meter OOS, needs calibration. Fuel based on firing rate, heat value and rated capacity

**set manually. Steam flow similar to previous year indicating >80% load

Emission Factor Calculations (EPA Method 19)

	RUN 1	RUN 2	RUN 3	AVERAGE
NOx (ppm)	24.0	24.7	24.5	24.4
NOx (lb/MMBtu)	0.0309	0.0317	0.0312	0.0313
NOx (lb/MMscf)	0.0	0.0	0.0	0.0
NOx (lb/hr)	0.390	0.400	0.393	0.394
CO (ppm)	3.0	2.8	2.9	2.9
CO (lb/MMBtu)	0.0023	0.0022	0.0023	0.0023
CO (lb/MMscf)	0.0	0.0	0.0	0.0
CO (lb/hr)	0.029	0.028	0.029	0.028
O2 (%)	4.06	3.95	3.81	3.94
Heat Input (MMBtu/hr)*	12.6	12.6	12.6	12.6

*assumed firing at rated capacity for lb/hr emissions

the 1990s, the number of people with a diagnosis of schizophrenia has increased in the United Kingdom (Meltzer and Peck 1998).

There is a growing awareness of the need to improve the lives of people with mental health problems. The United Kingdom has a long history of psychiatric care, but in the 1950s and 1960s, the emphasis was on institutional care. In the 1970s, there was a move towards community care, and in the 1980s and 1990s, there has been a focus on recovery and self-help. The current emphasis is on recovery and self-help, and the need to improve the lives of people with mental health problems.

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Site	SDSU
	Boilers
Date	4/5/2019

PO#:	841/920191
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NOx/NO Range 0 -	55	CAI
CO Range 0 -	567	48i
O ₂ Range 0 -	10	Servomex

Triggers	
CALS	6:41:49
Run 1	8:11:00
Run 2	9:41:13
Run 3	10:25:19

Clock Time	O ₂	NOx CAI	NO CAI	O ₂ CAI	CO 48i	DAS SHEET: CALS
	Ch.2 ppmv	Ch.6 ppmv	Ch.7 ppmv	Ch.8 ppmv	Ch.9 ppmv	
8:56:40	6.78	23.5	19.5	18.10	95	
8:56:50	6.78	20.6	19.5	15.67	95	
8:57:00	6.78	19.5	19.5	0.63	76	
8:57:10	6.78	19.5	5.1	0.10	46	
8:57:20	6.78	19.5	0.2	0.06	20	
8:57:30	6.78	5.8	0.2	0.05	7	
8:57:40	6.78	0.3	0.2	0.05	3	
8:57:50	6.78	0.3	0.1	0.04	2	
8:58:00	6.78	0.3	0.0	0.04	2	
8:58:10	6.78	0.3	0.0	0.04	2	BIAS ZEROS
8:58:20	6.78	0.2	0.0	0.04	2	O ₂ /CO
8:58:30	6.78	0.2	0.0	0.04	1	
8:58:40	6.78	0.2	0.0	3.83	1	
8:58:50	6.78	1.0	0.0	4.44	1	
8:59:00	6.78	1.3	0.0	4.46	2	BIAS O ₂
8:59:10	6.78	1.3	0.0	4.47	2	
8:59:20	6.78	1.3	0.1	4.47	2	
8:59:30	6.78	0.5	0.1	4.47	2	
8:59:40	6.78	0.2	0.1	4.47	1	
8:59:50	6.78	0.2	0.0	2.96	1	
9:00:00	6.78	0.2	0.0	0.14	6	
9:00:10	6.78	0.2	0.0	0.06	46	
9:00:20	6.78	0.2	0.0	0.05	112	
9:00:30	6.79	0.2	0.0	0.05	174	
9:00:40	6.79	0.2	0.0	0.04	208	
9:00:50	6.79	0.1	0.0	0.04	219	
9:01:00	6.79	0.1	0.0	0.04	222	
9:01:10	6.79	0.1	0.0	0.04	223	BIAS CO
9:01:20	6.79	0.1	0.0	0.04	223	BIAS ZEROS
9:01:30	6.79	0.1	0.0	0.04	224	NOx/NO
9:01:40	6.79	0.1	0.0	0.04	223	
9:01:50	6.79	0.1	0.0	0.07	221	
9:02:00	6.79	0.1	0.0	0.04	191	
9:02:10	6.79	16.6	0.0	0.04	129	
9:02:20	6.79	23.0	0.0	0.04	65	
9:02:30	6.79	23.0	16.1	0.04	24	
9:02:40	6.79	23.0	21.5	0.03	7	
9:02:50	6.79	22.1	21.5	0.04	3	
9:03:00	6.79	21.8	21.5	0.04	2	
9:03:10	6.79	21.8	21.5	0.04	1	BIAS NO
9:03:20	6.79	21.8	21.5	0.05	2	
9:03:30	6.79	21.8	21.5	0.03	2	
9:03:40	6.79	21.8	21.5	0.69	2	
9:03:50	6.79	21.8	11.7	1.04	2	
9:04:00	6.79	21.8	8.4	1.05	1	
9:04:10	6.79	12.1	8.4	1.05	1	
9:04:20	6.79	8.4	8.4	1.05	1	
9:04:30	6.79	8.4	2.2	1.05	1	
9:04:40	6.79	8.4	0.1	1.05	2	
9:04:50	6.79	4.5	0.1	1.05	2	
9:05:00	6.79	3.0	0.1	1.05	1	
9:05:10	6.79	3.0	0.1	1.05	1	
9:05:20	6.79	3.0	0.1	1.06	1	
9:05:30	6.79	3.0	0.1	1.15	1	
9:05:40	6.79	3.0	0.1	1.15	2	
9:05:50	6.79	3.0	0.1	1.06	2	BIAS NO ₂
9:06:00	6.79	3.0	0.1	1.05	2	
9:06:10	6.79	3.2	0.1	1.05	1	
9:06:20	6.79	3.2	0.1	1.05	1	
9:06:30	6.80	3.2	0.1	1.05	1	
9:06:40	6.80	3.2	0.0	1.05	1	
9:06:50	6.80	3.3	0.0	1.05	2	CONV CHK
9:07:00	6.80	3.3	0.0	0.36	2	
9:07:10	6.80	3.3	8.5	0.03	2	
9:07:20	6.80	3.3	11.3	0.02	1	
9:07:30	6.80	11.7	14.7	0.02	1	
9:07:40	6.80	0.0	33.5	0.02	1	
9:07:50	6.80	0.0	43.7	0.02	2	DIRECT ZEROS
9:08:00	6.80	0.0	43.8	0.02	2	O ₂ /CO
9:08:10	6.80	0.0	43.8	0.02	2	

9:08:20	6.80	0.0	43.8	0.02	2	SPAN NO
9:08:30	6.80	0.0	43.8	0.02	1	
9:08:40	6.80	0.0	41.4	0.02	1	
9:08:50	6.80	0.0	25.0	0.02	1	
9:09:00	6.80	0.0	22.0	0.02	2	
9:09:10	6.80	0.0	21.9	0.02	2	
9:09:20	6.80	0.0	21.9	0.02	2	MID NO
9:09:30	6.80	0.0	21.9	0.02	1	
9:09:40	6.80	0.0	21.9	0.02	1	
9:09:50	6.80	0.0	19.7	0.07	1	
9:10:00	6.80	0.0	4.0	0.02	11	
9:10:10	6.80	0.0	0.1	0.02	59	
9:10:20	6.80	0.0	0.1	0.02	127	
9:10:30	6.80	0.0	0.0	0.02	184	
9:10:40	6.80	0.0	0.0	0.02	213	
9:10:50	6.80	0.0	0.0	0.02	222	
9:11:00	6.80	0.0	0.0	0.02	224	
9:11:10	6.80	0.0	0.0	0.02	225	DIRECT CO
9:11:20	6.80	0.0	0.0	0.02	225	
9:11:30	6.80	0.0	0.0	0.07	225	
9:11:40	6.80	0.0	0.2	4.26	163	
9:11:50	6.80	0.0	0.0	4.48	17	MID O2
9:12:00	6.80	0.0	0.0	4.49	56	
9:12:10	6.80	0.0	0.0	4.49	40	
9:12:20	6.80	0.0	0.0	4.49	25.6	CO RANGE
9:12:30	6.80	0.0	0.0	4.49	0.7	22
9:12:40	6.80	0.0	0.0	4.49	0.6	48I
9:12:50	6.80	0.0	0.0	5.46	0.5	
9:13:00	6.80	0.0	0.1	7.97	0.4	
9:13:10	6.80	0.0	0.0	7.98	0.4	
9:13:20	6.80	0.0	0.0	7.98	0.3	SPAN O2
9:13:30	6.80	0.0	0.0	7.98	0.3	
9:13:40	6.80	0.0	0.0	7.98	0.0	
9:13:50	6.81	0.0	0.0	7.98	0.0	DIRECT ZEROS
9:14:00	6.81	0.0	0.0	7.98	0.0	CO
9:14:10	6.81	0.0	0.0	1.64	0.0	
9:14:20	6.81	0.0	0.0	0.04	0.0	
9:14:30	6.81	0.0	0.0	0.03	0.1	
9:14:40	6.81	0.0	0.0	0.03	0.0	
9:14:50	6.81	0.0	0.0	0.17	0.0	
9:15:00	6.81	0.0	0.0	0.03	7.9	
9:15:10	6.81	0.0	0.0	0.03	25.5	
9:15:20	6.81	0.0	0.0	0.02	25.5	
9:15:30	6.81	0.0	0.0	0.02	25.5	DIRECT ZEROS
9:15:40	6.81	0.0	0.0	0.02	21.9	NOX/NO
9:15:50	6.81	0.0	0.0	0.02	19.6	
9:16:00	6.81	0.0	0.0	0.02	19.3	
9:16:10	6.81	0.0	0.0	0.02	19.3	
9:16:20	6.81	0.0	0.0	0.02	18.1	
9:16:30	6.81	0.0	0.0	0.02	18.2	
9:16:40	6.81	0.0	0.0	0.02	18.0	SPAN CO
9:16:50	6.81	0.0	0.0	0.02	18.1	
9:17:00	6.81	0.0	0.0	0.02	18.1	
9:17:10	6.81	0.0	0.0	0.04	18.0	
9:17:20	6.81	0.0	0.0	0.02	16.9	
9:17:30	6.81	0.0	0.0	0.02	13.8	
9:17:40	6.81	0.0	0.0	0.02	11.0	
9:17:50	6.81	0.0	0.0	0.02	9.6	
9:18:00	6.81	0.0	0.0	0.02	9.3	
9:18:10	6.81	0.0	0.0	0.02	9.2	
9:18:20	6.81	0.0	0.0	0.02	9.2	
9:18:30	6.81	0.0	0.0	0.02	9.1	MID CO
9:18:40	6.81	0.0	0.0	0.02	9.1	
9:18:50	6.81	0.0	0.0	0.02	9.1	
9:19:00	6.81	0.0	0.0	1.34	9.1	
9:19:10	6.81	0.3	0.0	2.34	9.2	
9:19:20	6.81	0.4	0.0	3.11	8.3	
9:19:30	6.81	0.4	0.4	0.08	5.7	
9:19:40	6.81	0.4	0.5	0.05	4.8	
9:19:50	6.81	0.4	0.5	0.04	6.0	
9:20:00	6.81	0.5	0.5	0.04	7.8	
9:20:10	6.81	0.5	0.1	0.04	8.9	
9:20:20	6.81	0.5	0.0	0.04	9.1	
9:20:30	6.81	0.2	0.0	0.04	9.1	
9:20:40	6.81	0.1	0.0	0.04	9.1	BIAS CO
9:20:50	6.81	0.1	0.0	0.04	9.1	
9:21:00	6.81	0.1	0.0	0.04	9.1	
9:21:10	6.81	0.1	0.0	0.04	9.1	
9:21:20	6.81	0.1	0.0	0.04	9.0	
9:21:30	6.81	0.1	0.0	0.04	7.1	
9:21:40	6.81	0.1	0.0	0.04	4.0	
9:21:50	6.81	0.1	0.0	0.04	1.5	
9:22:00	6.82	0.1	0.0	0.04	0.3	
9:22:10	6.82	0.1	0.0	0.03	0.1	
9:22:20	6.82	0.1	0.0	0.03	0.0	
9:22:30	6.82	0.1	0.0	0.04	0.0	BIAS ZEROS
9:22:40	6.82	0.1	0.0	0.03	0.1	CO
9:22:50	6.82	0.1	0.0	0.03	0.0	
9:23:00	6.82	0.1	0.0	0.04	0.1	
9:23:10	6.82	0.0	0.0	0.19	0.0	

9:23:20	6.82	0.0	0.0	0.17	0.1
9:23:30	6.82	0.0	0.0	0.66	0.2
9:23:40	6.82	0.0	0.1	3.61	0.3
9:23:50	6.82	0.1	0.1	2.78	0.3
9:24:00	6.82	0.1	0.1	4.03	0.5
9:24:10	6.82	0.1	12.9	4.13	1.5
9:24:20	6.82	0.1	17.2	4.14	2.7
9:24:30	6.82	16.0	17.2	3.92	3.4
9:24:40	6.82	22.2	17.2	3.97	3.7
9:24:50	6.82	22.2	17.3	3.96	4.0
9:25:00	6.82	22.2	17.3	3.99	4.1
9:25:10	6.82	21.5	17.3	3.92	4.2
9:25:20	6.82	21.2	17.3	3.89	4.4
9:25:30	6.82	21.2	17.5	3.93	4.3
9:25:40	6.82	21.2	17.6	4.03	4.1
9:25:50	6.82	21.8	17.6	3.94	4.0
9:26:00	6.82	22.0	17.6	3.80	4.0
9:26:10	6.82	22.0	17.3	3.85	4.0
9:26:20	6.82	22.0	17.2	3.93	4.4
9:26:30	6.82	21.8	17.2	3.98	4.7
9:26:40	6.82	21.7	17.2	3.84	4.6
9:26:50	6.82	21.7	17.4	3.81	4.4
9:27:00	6.82	21.7	17.5	3.89	4.2
9:27:10	6.82	21.5	17.5	3.86	4.2
9:27:20	6.82	21.4	17.5	3.72	4.1
9:27:30	6.82	21.4	17.2	3.76	4.5
9:27:40	6.82	21.4	17.1	3.76	4.7
9:27:50	6.82	21.5	17.1	3.77	4.6
9:28:00	6.82	21.6	17.1	3.85	4.3
9:28:10	6.82	21.6	17.3	3.82	4.0
9:28:20	6.82	21.6	17.4	3.96	4.1
9:28:30	6.82	21.4	17.4	3.97	4.4
9:28:40	6.82	21.3	17.4	4.06	4.5
9:28:50	6.82	21.3	17.9	4.03	4.3
9:29:00	6.82	21.3	18.1	4.05	4.2
9:29:10	6.82	22.0	18.1	4.09	4.0
9:29:20	6.82	22.2	18.1	4.10	3.8
9:29:30	6.82	22.2	18.6	4.11	3.5
9:29:40	6.82	22.2	18.7	3.96	3.4
9:29:50	6.82	22.0	18.7	3.84	3.7
9:30:00	6.82	21.9	18.7	3.82	4.0
9:30:10	6.82	21.9	17.7	3.79	4.1
9:30:20	6.82	21.9	17.4	3.82	4.0
9:30:30	6.82	21.4	17.4	3.72	4.0
9:30:40	6.82	21.2	17.4	3.72	4.3
9:30:50	6.82	21.2	17.1	3.81	4.5
9:31:00	6.82	21.2	17.0	3.85	4.3
9:31:10	6.82	21.1	17.0	3.86	4.4
9:31:20	6.82	21.1	17.0	3.82	4.4
9:31:30	6.82	21.1	17.4	3.78	4.4
9:31:40	6.83	21.1	17.5	3.83	4.3
9:31:50	6.83	21.5	17.5	3.92	4.3
9:32:00	6.83	21.6	17.5	3.96	4.2
9:32:10	6.83	21.6	18.0	3.97	4.1
9:32:20	6.83	21.6	18.2	3.86	3.8
9:32:30	6.83	21.6	18.2	3.94	3.9
9:32:40	6.83	21.6	18.2	4.00	4.4
9:32:50	6.83	21.6	18.1	3.98	4.5
9:33:00	6.83	21.6	18.1	4.05	4.3
9:33:10	6.83	22.1	18.1	3.94	4.0
9:33:20	6.83	22.2	18.1	3.98	3.8
9:33:30	6.83	22.2	18.1	3.99	3.7
9:33:40	6.83	22.2	18.1	4.01	3.6
9:33:50	6.83	22.0	18.1	4.01	3.8
9:34:00	6.83	21.9	18.1	4.05	3.8
9:34:10	6.83	21.9	18.3	3.99	3.8
9:34:20	6.83	21.9	18.4	4.05	3.9
9:34:30	6.83	22.4	18.4	4.08	3.9
9:34:40	6.83	22.6	18.4	4.11	3.7
9:34:50	6.83	22.6	18.5	3.88	3.8
9:35:00	6.83	22.6	18.5	3.85	3.7
9:35:10	6.83	21.9	18.5	3.83	3.8
9:35:20	6.83	21.7	18.5	3.74	4.2
9:35:30	6.83	21.7	17.7	3.66	4.6
9:35:40	6.83	21.7	17.5	3.64	4.6
9:35:50	6.83	21.3	17.5	3.67	4.6
9:36:00	6.83	21.2	17.5	3.67	4.8
9:36:10	6.83	21.2	17.0	3.60	4.9
9:36:20	6.83	21.2	16.9	3.66	4.9
9:36:30	6.83	21.0	16.9	3.69	4.7
9:36:40	6.83	20.9	16.9	3.73	4.6
9:36:50	6.83	20.9	17.0	3.73	4.4
9:37:00	6.83	20.9	17.0	3.65	4.3
9:37:10	6.83	21.2	17.0	3.79	4.1
9:37:20	6.83	21.3	17.0	3.87	3.9
9:37:30	6.83	21.3	17.2	3.90	3.9
9:37:40	6.83	21.3	17.2	4.08	3.7
9:37:50	6.83	22.1	17.2	4.12	3.6
9:38:00	6.83	22.5	17.2	4.09	3.5
9:38:10	6.83	22.5	18.4	4.08	3.3
9:38:20	6.83	22.5	18.8	4.05	3.4

START RI
B3

9:38:30	6.83	22.4	18.8	4.11	3.5
9:38:40	6.83	22.4	18.8	4.07	3.6
9:38:50	6.83	22.4	18.7	4.10	3.5
9:39:00	6.83	22.4	18.6	4.07	3.3
9:39:10	6.83	22.6	18.6	4.13	3.1
9:39:20	6.83	22.6	18.6	4.12	3.2
9:39:30	6.83	22.6	18.8	4.06	3.1
9:39:40	6.83	22.6	18.8	4.08	3.1
9:39:50	6.83	22.7	18.8	4.03	2.9
		21.8	17.8	3.91	4.0
9:40:00	6.83	22.7	18.8	3.94	2.9
9:40:10	6.83	22.7	18.6	3.92	3.0
9:40:20	6.83	22.7	18.5	3.80	3.0
9:40:30	6.83	21.8	18.5	2.10	2.5
9:40:40	6.83	21.4	18.5	0.11	2.7
9:40:50	6.83	21.4	5.0	0.04	2.8

Clock Time	O2	NOx CAI	NO CAI	O2 CAI	CO 48i
	Ch.2 ppmv	Ch.6 ppmv	Ch.7 ppmv	Ch.8 ppmv	Ch.9 ppmv
9:41:13	6.83	0.5	0.6	0.04	1.1
9:41:23	6.83	0.5	0.6	0.03	0.4
9:41:33	6.83	0.5	0.0	0.03	0.1
9:41:43	6.84	0.5	0.0	0.03	0.0
9:41:53	6.84	0.4	0.0	0.03	0.0
9:42:03	6.84	0.4	0.0	3.70	0.1
9:42:13	6.84	0.4	0.0	4.43	0.4
9:42:23	6.84	0.4	0.0	4.45	0.7
9:42:33	6.84	0.3	0.0	4.45	0.6
9:42:43	6.84	0.3	0.0	4.45	0.3
9:42:53	6.84	0.3	0.0	4.46	0.1
9:43:03	6.84	0.3	0.0	4.46	0.0
9:43:13	6.84	0.2	0.0	3.19	0.1
9:43:23	6.84	0.2	0.0	0.14	0.6
9:43:33	6.84	0.2	0.0	0.05	4.3
9:43:43	6.84	0.2	0.0	0.04	11.6
9:43:53	6.84	0.1	0.0	0.04	17.9
9:44:03	6.84	0.1	0.0	0.04	21.3
9:44:13	6.84	0.1	0.0	0.04	22.2
9:44:23	6.84	0.1	0.0	0.03	22.3
9:44:33	6.84	0.1	0.0	0.03	22.2
9:44:43	6.84	0.1	0.0	0.03	20.8
9:44:53	6.84	0.1	0.0	0.03	16.8
9:45:03	6.84	0.1	0.0	0.03	12.7
9:45:13	6.84	0.1	0.0	0.03	10.1
9:45:23	6.84	0.1	0.0	0.03	9.2
9:45:33	6.84	0.1	0.0	0.03	9.0
9:45:43	6.84	0.1	0.0	0.03	9.0
9:45:53	6.84	0.1	0.0	0.03	9.0
9:46:03	6.84	0.1	0.0	0.03	9.0
9:46:13	6.84	0.1	0.0	0.03	9.0
9:46:23	6.84	0.1	0.0	0.06	8.8
9:46:33	6.84	9.6	0.0	0.03	7.4
9:46:43	6.84	9.6	0.0	0.03	4.6
9:46:53	6.84	9.6	21.2	0.03	2.0
9:47:03	6.84	9.6	21.2	0.03	0.6
9:47:13	6.84	21.6	21.2	0.03	0.1
9:47:23	6.84	21.7	21.2	0.02	0.1
9:47:33	6.84	21.7	21.4	0.03	0.0
9:47:43	6.84	21.7	21.4	0.03	0.0
9:47:53	6.84	21.7	21.4	0.03	0.0
9:48:03	6.84	21.7	21.4	0.04	0.0
9:48:13	6.84	21.7	21.4	0.03	0.0
9:48:23	6.84	21.7	21.4	0.79	0.0
9:48:33	6.84	21.3	21.4	1.03	0.0
9:48:43	6.84	21.3	21.4	1.04	0.0
9:48:53	6.84	21.3	0.2	1.04	0.0
9:49:03	6.84	21.3	0.2	1.04	0.0
9:49:13	6.84	3.0	0.2	1.04	0.0
9:49:23	6.84	3.0	0.2	1.04	-0.1
9:49:33	6.84	3.0	0.1	1.04	0.0
9:49:43	6.84	3.0	0.1	1.04	0.0
9:49:53	6.84	3.1	0.1	1.27	0.0
9:50:03	6.84	3.1	0.1	1.27	0.0
9:50:13	6.84	3.0	0.1	1.04	0.0
9:50:23	6.84	3.0	0.1	1.04	0.0
9:50:33	6.84	3.2	0.1	1.04	0.1
9:50:43	6.84	3.2	0.1	1.04	0.2
9:50:53	6.84	3.2	0.0	1.04	0.2
9:51:03	6.84	3.2	0.0	1.04	0.2
9:51:13	6.84	3.2	0.0	0.73	0.2
9:51:23	6.84	3.2	0.0	0.03	0.2
9:51:33	6.84	3.2	15.3	0.01	0.3
9:51:43	6.84	3.2	15.3	0.01	0.3
9:51:53	6.84	22.4	15.3	0.01	0.2
9:52:03	6.84	22.4	15.3	0.01	0.2
9:52:13	6.84	22.4	21.6	0.01	0.3
9:52:23	6.84	22.4	21.7	0.01	0.3
9:52:33	6.84	21.9	21.7	0.01	0.3
9:52:43	6.84	21.9	21.7	0.01	0.2
9:52:53	6.84	21.9	21.7	0.01	0.3
9:53:03	6.84	21.9	21.7	0.01	0.2

BIAS ZEROS
O2/CO

BIAS O2

BIAS CO

BIAS ZEROS
NOX/NO

BIAS NO

BIAS NO2

DIRECT NO2

DIRECT NO

9:53:13	6.84	21.7	21.7	0.01	0.3
9:53:23	6.84	21.7	21.7	0.01	0.2
9:53:33	6.84	21.7	0.0	0.01	0.2
9:53:43	6.84	21.7	0.0	0.01	0.5
9:53:53	6.84	0.0	0.0	0.01	1.1
9:54:03	6.84	0.0	0.0	0.01	2.2
9:54:13	6.84	0.0	0.0	0.01	3.2
9:54:23	6.84	0.0	0.0	0.01	3.9
9:54:33	6.85	0.0	0.0	2.12	3.9
9:54:43	6.21	0.0	0.0	3.69	3.9
9:54:53	0.55	0.0	13.2	3.69	3.9
9:55:03	0.03	0.0	13.2	3.97	3.9
9:55:13	0.02	21.9	13.2	3.80	3.8
9:55:23	0.02	22.0	13.2	3.83	3.7
9:55:33	0.01	22.0	17.7	3.83	3.7
9:55:43	0.01	22.0	17.7	3.75	3.7
9:55:53	0.01	22.2	17.7	3.75	3.7
9:56:03	3.90	22.2	17.7	3.83	3.6
9:56:13	7.90	22.2	17.7	3.76	3.4
9:56:23	8.05	22.2	17.7	3.84	3.3
9:56:33	8.06	22.2	17.7	3.81	3.2
9:56:43	8.07	22.2	17.7	3.80	3.2
9:56:53	8.07	22.2	17.8	3.72	3.3
9:57:03	8.07	22.2	17.8	3.74	3.5
9:57:13	7.11	21.4	17.8	3.72	3.8
9:57:23	2.00	21.4	17.8	3.77	4.1
9:57:33	1.60	21.4	17.6	3.82	4.1
9:57:43	1.59	21.4	17.6	3.73	3.9
9:57:53	1.58	21.7	17.6	3.70	3.8
9:58:03	1.59	21.7	17.6	3.67	3.7
9:58:13	1.58	21.7	17.4	3.71	3.7
9:58:23	2.30	21.7	17.4	3.63	3.8
9:58:33	3.16	21.3	17.4	3.71	4.1
9:58:43	3.19	21.3	17.4	3.60	4.0
9:58:53	3.19	21.3	17.2	3.67	3.9
9:59:03	3.19	21.3	17.2	3.69	3.8
9:59:13	3.19	21.3	17.2	3.82	3.9
9:59:23	3.61	21.3	17.2	3.90	4.0
9:59:33	3.98	21.3	18.2	3.99	3.7
9:59:43	4.00	21.3	18.2	3.99	3.4
9:59:53	3.99	22.7	18.2	3.96	2.9
10:00:03	3.99	22.7	18.2	3.95	2.8
10:00:13	3.99	22.7	18.7	4.01	2.8
10:00:23	4.56	22.7	18.7	3.99	2.9
10:00:33	4.79	22.6	18.7	4.03	3.0
10:00:43	4.79	22.6	18.7	4.05	3.0
10:00:53	4.79	22.6	18.8	4.04	3.1
10:01:03	4.79	22.6	18.8	4.06	3.0
10:01:13	4.79	22.6	18.8	4.11	3.0
10:01:23	4.91	22.6	18.8	4.12	3.0
10:01:33	4.78	22.6	18.6	4.14	2.8
10:01:43	4.53	22.6	18.6	3.99	2.7
10:01:53	4.52	22.8	18.6	3.99	2.6
10:02:03	4.52	22.8	18.6	4.03	2.7
10:02:13	4.52	22.8	18.2	4.00	3.0
10:02:23	4.93	22.8	18.2	3.98	3.3
10:02:33	7.76	22.7	18.2	4.02	3.4
10:02:43	8.04	22.7	18.2	4.04	3.3
10:02:53	8.05	22.7	18.7	4.00	3.1
10:03:03	8.05	22.7	18.7	4.01	3.0
10:03:13	8.06	22.6	18.7	4.03	3.1
10:03:23	7.22	22.6	18.7	4.03	3.1
10:03:33	4.93	22.6	18.3	4.03	3.0
10:03:43	4.80	22.6	18.3	4.00	2.8
10:03:53	4.79	22.8	18.3	3.92	2.9
10:04:03	4.79	22.8	18.3	3.98	2.9
10:04:13	4.79	22.8	18.2	4.00	3.2
10:04:23	4.27	22.8	18.2	4.07	3.2
10:04:33	4.00	22.7	18.2	4.03	3.0
10:04:43	3.99	22.7	18.2	4.00	2.9
10:04:53	3.99	22.7	18.6	3.99	2.8
10:05:03	3.99	22.7	18.6	3.93	2.9
10:05:13	3.90	22.1	18.6	3.91	3.2
10:05:23	3.25	22.1	18.6	3.98	3.3
10:05:33	3.18	22.1	17.9	3.97	3.5
10:05:43	3.18	22.1	17.9	4.05	3.3
10:05:53	3.18	22.4	17.9	3.89	3.2
10:06:03	3.18	22.4	17.9	3.87	3.1
10:06:13	2.64	22.4	17.7	3.92	3.1
10:06:23	1.62	22.4	17.7	3.77	3.1
10:06:33	1.57	22.3	17.7	3.74	3.3
10:06:43	1.57	22.3	17.7	3.61	3.5
10:06:53	1.56	22.3	17.0	3.67	3.9
10:07:03	1.57	22.3	17.0	3.60	4.4
10:07:13	2.24	21.1	17.0	3.64	4.6
10:07:23	4.38	21.1	17.0	3.79	4.7
10:07:33	4.51	21.1	17.5	3.75	4.6
10:07:43	4.51	21.1	17.5	3.73	4.3
10:07:53	4.51	21.4	17.5	3.67	4.1
10:08:03	4.51	21.4	17.5	3.74	4.0
10:08:13	4.33	21.4	18.0	3.67	4.0

DIRECT ZEROS
NOX/NO

START R2 B3

SGD CHECK
100

20

40

50

60

CHALLENGE

100

60

50

40

20

CHALLENGE

10:08:23	1.90	21.4	18.0	3.64	4.1	
10:08:33	1.57	21.0	18.0	3.67	4.1	
10:08:43	1.56	21.0	18.0	3.73	3.9	20
10:08:53	1.56	21.0	17.4	3.68	3.7	
10:09:03	1.56	21.0	17.4	3.62	3.6	
10:09:13	1.92	20.6	17.4	3.63	3.9	
10:09:23	3.10	20.6	17.4	3.73	4.2	
10:09:33	3.17	20.6	17.0	3.79	4.3	
10:09:43	3.17	20.6	17.0	3.77	3.9	40
10:09:53	3.17	21.7	17.0	3.62	3.8	
10:10:03	3.17	21.7	17.0	3.58	3.6	
10:10:13	3.16	21.7	17.3	3.63	3.7	
10:10:23	4.26	21.7	17.3	3.63	3.9	
10:10:33	4.50	20.9	17.3	3.66	3.9	
10:10:43	4.51	20.9	17.3	3.89	3.8	CHALLENGE
10:10:53	4.51	20.9	17.8	3.79	3.6	
		22.0	17.9	3.85	3.5	
10:11:03	4.51	20.9	17.8	3.84	3.5	
10:11:13	4.49	21.8	17.8	3.93	3.4	
10:11:23	4.48	21.8	17.8	4.13	3.4	
10:11:33	4.48	21.8	18.8	4.15	3.0	
10:11:43	4.48	21.8	18.8	4.08	2.2	
10:11:53	4.48	21.9	18.8	8.63	1.1	
10:12:03	4.48	21.9	18.8	5.75	0.6	
10:12:13	4.48	21.9	13.5	1.11	0.7	
10:12:23	4.48	21.9	13.5	0.07	1.0	
10:12:33	4.48	13.4	13.5	0.05	0.8	
10:12:43	4.48	13.4	13.5	0.05	0.5	
10:12:53	4.48	13.4	0.0	0.03	0.2	
10:13:03	4.48	13.4	0.0	0.03	0.0	
10:13:13	4.48	0.4	0.0	0.03	-0.1	
10:13:23	4.48	0.4	0.0	0.02	-0.1	BIAS ZEROS O2/CO
10:13:33	4.48	0.4	0.0	1.14	-0.1	
10:13:43	4.48	0.4	0.0	4.39	-0.2	
10:13:53	4.48	0.2	0.0	4.44	0.0	BIAS O2
10:14:03	4.48	0.2	0.0	4.44	-0.1	
10:14:13	4.48	0.2	0.0	4.45	-0.1	
10:14:23	4.48	0.2	0.0	4.45	0.0	
10:14:33	4.48	0.2	0.0	4.29	0.0	
10:14:43	4.48	0.2	0.0	0.40	0.2	
10:14:53	4.48	0.2	0.0	0.05	2.5	
10:15:03	4.48	0.2	0.0	0.04	9.2	
10:15:13	4.48	0.1	0.0	0.03	16.0	
10:15:23	4.48	0.1	0.0	0.03	20.5	
10:15:33	4.48	0.1	0.0	0.03	21.7	
10:15:43	4.48	0.1	0.0	0.03	20.7	
10:15:53	4.48	0.1	0.0	0.02	17.0	
10:16:03	4.48	0.1	0.0	0.03	12.8	
10:16:13	4.48	0.1	0.0	0.03	10.1	
10:16:23	4.48	0.1	0.0	0.03	9.1	
10:16:33	4.48	0.1	0.0	0.02	8.9	BIAS CO
10:16:43	4.48	0.1	0.0	0.02	8.9	
10:16:53	4.49	0.1	0.0	0.02	8.9	BIAS ZEROS NOX/NO
10:17:03	4.49	0.1	0.0	0.02	8.8	
10:17:13	4.49	0.1	0.0	0.04	8.8	
10:17:23	4.49	0.1	0.0	0.03	8.5	
10:17:33	4.49	0.1	14.4	0.03	6.6	
10:17:43	4.49	0.1	14.4	0.02	3.7	
10:17:53	4.49	22.0	14.4	0.02	1.3	
10:18:03	4.49	22.0	14.4	0.02	0.3	
10:18:13	4.49	22.0	21.2	0.02	0.0	
10:18:23	4.49	22.0	21.2	0.02	-0.1	
10:18:33	4.49	21.5	21.2	0.02	-0.1	
10:18:43	4.49	21.5	21.2	0.03	-0.1	
10:18:53	4.49	21.5	21.2	0.02	-0.1	
10:19:03	4.49	21.5	21.2	0.56	-0.2	BIAS NO
10:19:13	4.49	21.2	21.2	1.02	-0.1	
10:19:23	4.49	21.2	21.2	1.03	-0.1	
10:19:33	4.49	21.2	0.2	1.04	-0.1	
10:19:43	4.49	21.2	0.2	1.04	-0.1	
10:19:53	4.49	2.9	0.2	1.03	-0.1	
10:20:03	4.49	2.9	0.2	1.04	-0.1	
10:20:13	4.50	2.9	0.1	1.04	-0.1	
10:20:23	4.50	2.9	0.1	1.04	-0.1	
10:20:33	4.50	2.9	0.1	1.04	-0.1	
10:20:43	4.50	2.9	0.1	1.59	-0.1	BIAS NO2
10:20:53	4.50	2.9	0.3	1.07	-0.1	
10:21:03	4.50	2.9	0.3	1.04	-0.1	
10:21:13	4.50	3.1	0.3	1.04	0.0	
10:21:23	4.50	3.1	0.3	1.04	0.1	
10:21:33	4.50	3.1	0.0	1.04	0.2	
10:21:43	4.50	3.1	0.0	1.04	0.2	
10:21:53	4.50	3.2	0.0	1.06	0.1	
10:22:03	4.50	3.2	0.0	0.07	0.2	DIRECT NO2
10:22:13	4.50	3.2	9.1	0.01	0.1	
10:22:23	4.50	3.2	9.1	0.01	0.1	
10:22:33	4.50	22.8	9.1	0.01	0.1	
10:22:43	4.50	22.8	9.1	0.01	0.1	
10:22:53	4.51	22.8	21.5	0.01	0.1	
10:23:03	4.51	22.8	21.5	0.01	0.1	
10:23:13	4.51	21.8	21.5	0.00	0.1	DIRECT NO

10:23:23	4.51	21.8	21.5	0.01	0.1
10:23:33	4.51	21.8	21.5	0.01	0.1
10:23:43	4.51	21.8	21.5	0.00	0.1

Clock Time	O2 Ch.2 ppmv	NOx CAI Ch.6 ppmv	NO CAI Ch.7 ppmv	O2 CAI Ch.8 ppmv	CO 48i Ch.9 ppmv
10:25:19	4.52	0.0	0.0	0.01	3.0
10:25:29	4.52	0.0	0.0	0.01	3.2
10:25:39	4.52	0.0	0.0	0.00	3.4
10:25:49	4.52	0.0	0.0	0.00	3.9
10:25:59	4.52	0.0	0.0	3.67	4.0
10:26:09	4.52	0.0	5.8	4.02	4.3
10:26:19	4.52	0.0	11.7	3.93	4.2
10:26:29	4.52	11.6	11.7	3.89	3.7
10:26:39	4.52	23.3	11.7	3.91	3.1
10:26:49	4.52	23.3	15.1	4.01	2.8
10:26:59	4.54	23.3	18.5	4.00	2.7
10:27:09	2.03	22.9	18.5	3.82	2.9
10:27:19	1.12	22.6	18.5	3.68	3.2
10:27:29	4.28	22.6	17.9	3.71	3.4
10:27:39	7.89	22.6	17.4	3.86	3.7
10:27:49	8.03	22.3	17.4	3.93	3.5
10:27:59	8.04	21.9	17.4	3.93	3.2
10:28:09	8.04	21.9	17.8	3.97	3.1
10:28:19	8.05	21.9	18.1	3.84	3.2
10:28:29	7.37	22.0	18.1	3.86	3.3
10:28:39	4.96	22.1	18.1	4.00	3.6
10:28:49	4.80	22.1	18.2	3.92	3.7
10:28:59	4.79	22.1	18.3	3.91	3.5
10:29:09	4.79	22.2	18.3	3.96	3.3
10:29:19	4.79	22.4	18.3	3.96	3.0
10:29:29	4.66	22.4	18.1	3.82	3.1
10:29:39	4.00	22.4	18.0	3.88	3.3
10:29:49	3.99	22.2	18.0	3.97	3.4
10:29:59	3.99	22.0	18.0	3.99	3.5
10:30:09	3.98	22.0	18.2	4.01	3.5
10:30:19	3.96	22.0	18.4	3.89	3.3
10:30:29	3.95	22.1	18.4	3.82	3.2
10:30:39	3.95	22.2	18.4	3.96	2.9
10:30:49	3.95	22.2	18.3	3.92	2.9
10:30:59	3.96	22.2	18.3	4.00	2.9
10:31:09	3.95	22.3	18.3	3.98	3.0
10:31:19	3.95	22.4	18.3	3.96	3.0
10:31:29	3.96	22.4	18.4	3.96	3.0
10:31:39	3.96	22.4	18.5	3.87	3.0
10:31:49	3.96	22.3	18.5	3.75	3.1
10:31:59	3.96	22.2	18.5	3.84	3.2
10:32:09	3.96	22.2	18.1	3.97	3.3
10:32:19	3.96	22.2	17.6	3.88	3.1
10:32:29	3.96	22.4	17.6	3.95	2.8
10:32:39	3.96	22.5	17.6	3.94	2.8
10:32:49	3.96	22.5	18.1	3.95	2.7
10:32:59	3.96	22.5	18.6	3.94	2.9
10:33:09	3.96	22.4	18.6	3.85	3.0
10:33:19	3.96	22.2	18.6	3.81	3.1
10:33:29	3.96	22.2	18.2	3.86	3.2
10:33:39	3.96	22.2	17.9	3.88	3.3
10:33:49	3.96	22.0	17.9	3.76	3.1
10:33:59	3.96	21.8	17.9	3.76	3.0
10:34:09	3.96	21.8	17.7	3.73	3.1
10:34:19	3.96	21.8	17.5	3.79	3.4
10:34:29	3.96	21.9	17.5	3.73	3.7
10:34:39	3.96	21.9	17.5	3.66	3.5
10:34:49	3.96	21.9	17.3	3.77	3.4
10:34:59	3.96	21.9	17.2	3.99	3.4
10:35:09	3.96	22.1	17.2	3.95	3.3
10:35:19	3.96	22.2	17.2	3.99	3.3
10:35:29	3.96	22.2	17.9	3.99	3.1
10:35:39	3.96	22.2	18.6	3.95	3.0
10:35:49	3.96	22.2	18.6	3.91	3.1
10:35:59	3.96	22.1	18.6	4.00	3.1
10:36:09	3.96	22.1	18.7	4.03	3.1
10:36:19	3.96	22.1	18.7	3.91	2.8
10:36:29	3.97	22.2	18.7	3.84	2.7
10:36:39	3.97	22.4	18.7	3.88	2.6
10:36:49	3.97	22.4	18.5	3.88	2.7
10:36:59	3.97	22.4	18.2	3.93	3.1
10:37:09	3.97	22.4	18.2	4.05	3.4
10:37:19	3.97	22.4	18.2	4.00	3.3
10:37:29	3.97	22.4	18.3	3.99	3.2
10:37:39	3.97	22.4	18.4	4.02	3.0
10:37:49	3.97	22.5	18.4	3.95	3.0
10:37:59	3.97	22.6	18.4	3.82	2.9
10:38:09	3.97	22.6	17.9	3.74	2.9
10:38:19	3.97	22.6	17.4	3.60	2.9
10:38:29	3.97	21.8	17.4	3.56	3.2
10:38:39	3.97	20.9	17.4	3.57	3.5
10:38:49	3.97	20.9	17.1	3.59	3.9
10:38:59	3.97	20.9	16.8	3.56	4.0
10:39:09	3.97	20.9	16.8	3.58	4.0

DIRECT ZEROS
NOX/NO

START R3 B3

100

60

50

10:39:19	3.97	20.9	16.8	3.59	4.1	
10:39:29	3.97	20.9	16.7	3.53	4.2	
10:39:39	3.98	20.9	16.5	3.59	4.2	
10:39:49	3.98	21.1	16.5	3.64	4.0	
10:39:59	3.98	21.2	16.5	3.75	4.0	
10:40:09	3.98	21.2	17.1	3.86	3.7	
10:40:19	3.98	21.2	17.7	3.89	3.5	
10:40:29	3.98	21.8	17.7	3.90	3.1	
10:40:39	3.98	22.4	17.7	3.99	3.1	
10:40:49	3.98	22.4	18.0	3.88	3.3	
10:40:59	3.98	22.4	18.2	3.74	3.2	
10:41:09	3.98	22.0	18.2	3.66	3.0	
10:41:19	3.98	21.6	18.2	3.66	3.0	
10:41:29	3.98	21.6	17.8	3.76	3.2	
10:41:39	3.98	21.6	17.3	3.75	3.4	
10:41:49	3.98	21.4	17.3	3.68	3.5	
10:41:59	3.99	21.1	17.3	3.77	3.6	
		22.0	17.9	3.85	3.3	
10:42:09	3.99	21.1	17.4	3.70	3.5	
10:42:19	3.99	21.1	17.5	3.69	3.5	
10:42:29	3.99	21.5	17.5	3.76	3.7	
10:42:39	3.99	21.8	17.5	3.66	3.6	
10:42:49	3.99	21.8	16.5	1.62	3.5	
10:42:59	3.99	21.8	15.6	0.42	2.9	
10:43:09	3.99	18.7	15.6	0.07	2.0	
10:43:19	3.99	15.6	15.6	0.03	0.9	
10:43:29	3.99	15.6	7.8	0.02	0.3	
10:43:39	3.99	15.6	0.0	0.02	-0.1	
10:43:49	3.99	8.0	0.0	0.02	0.0	
10:43:59	4.00	0.4	0.0	0.02	-0.1	BIAS ZEROS O2/CO
10:44:09	4.00	0.4	0.0	0.02	-0.1	
10:44:19	4.00	0.4	0.0	0.06	-0.1	
10:44:29	4.00	0.3	0.0	4.18	-0.1	
10:44:39	4.00	0.3	0.0	4.42	-0.1	
10:44:49	4.00	0.3	0.0	4.44	0.0	
10:44:59	4.00	0.3	0.0	4.44	-0.1	BIAS O2
10:45:09	4.00	0.2	0.0	4.44	0.0	
10:45:19	4.00	0.1	0.0	4.45	-0.1	
10:45:29	4.00	0.1	0.0	4.44	0.0	
10:45:39	4.00	0.1	0.0	3.37	-0.1	
10:45:49	4.01	0.1	0.0	0.15	0.0	
10:45:59	4.01	0.1	0.0	0.04	1.7	
10:46:09	4.01	0.1	0.0	0.03	4.8	
10:46:19	4.01	0.1	0.0	0.03	7.3	
10:46:29	4.01	0.1	0.0	0.03	8.5	
10:46:39	4.01	0.1	0.0	0.02	8.8	
10:46:49	4.01	0.1	0.0	0.02	8.9	
10:46:59	4.01	0.1	0.0	0.02	8.8	
10:47:09	4.01	0.1	0.0	0.02	8.9	BIAS CO
10:47:19	4.01	0.1	0.0	0.02	8.9	BIAS ZEROS
10:47:29	4.01	0.1	0.0	0.05	8.9	NOX/NO
10:47:39	4.02	0.1	0.0	0.03	8.5	
10:47:49	4.02	10.2	0.0	0.02	6.1	
10:47:59	4.02	20.4	0.0	0.02	3.2	
10:48:09	4.02	20.4	10.4	0.02	1.0	
10:48:19	4.02	20.4	20.9	0.02	0.1	
10:48:29	4.02	20.8	20.9	0.02	-0.1	
10:48:39	4.02	21.3	20.9	0.02	-0.1	
10:48:49	4.02	21.3	21.0	0.02	-0.1	
10:48:59	4.02	21.3	21.0	0.02	-0.1	
10:49:09	4.03	21.3	21.0	0.02	-0.1	
10:49:19	4.03	21.3	21.0	0.03	-0.1	
10:49:29	4.03	21.3	21.0	0.04	-0.1	
10:49:39	4.03	21.3	21.0	0.95	-0.1	BIAS NO
10:49:49	4.03	21.2	21.0	1.03	-0.1	
10:49:59	4.03	21.0	21.0	1.03	-0.1	
10:50:09	4.03	21.0	10.6	1.03	-0.1	
10:50:19	4.03	21.0	0.1	1.03	-0.1	
10:50:29	4.03	12.0	0.1	1.03	-0.1	
10:50:39	4.04	2.9	0.1	1.03	-0.1	
10:50:49	4.04	2.9	0.1	1.03	-0.1	
10:50:59	4.04	2.9	0.0	1.03	-0.2	
10:51:09	4.04	2.9	0.0	1.03	-0.1	
10:51:19	4.04	2.9	0.0	1.11	-0.2	BIAS NO2
10:51:29	4.04	2.9	0.1	1.15	0.0	
10:51:39	4.04	2.9	0.2	1.03	-0.1	
10:51:49	4.04	3.0	0.2	1.03	-0.1	
10:51:59	4.05	3.1	0.2	1.03	-0.2	
10:52:09	4.05	3.1	0.1	1.03	-0.2	
10:52:19	4.05	3.1	0.0	1.03	-0.1	
10:52:29	4.05	3.2	0.0	1.03	-0.1	
10:52:39	4.05	3.2	0.0	0.40	-0.1	DIRECT NO2
10:52:49	4.05	3.2	6.5	0.01	-0.1	
10:52:59	4.05	3.2	13.0	0.01	-0.1	
10:53:09	4.05	12.7	13.0	0.00	-0.2	
10:53:19	4.05	22.3	13.0	0.00	-0.1	
10:53:29	4.06	22.3	17.2	0.00	-0.2	
10:53:39	4.06	22.3	21.4	0.00	-0.2	DIRECT ZEROS O2/CO
10:53:49	4.06	22.0	21.4	0.00	-0.1	
10:53:59	4.06	21.6	21.4	0.00	-0.2	
10:54:09	4.06	21.6	21.4	0.00	-0.2	
10:54:19	4.06	21.6	21.4	0.02	-0.1	DIRECT NO

10:54:29	4.06	21.5	21.4	0.00	0.5	
10:54:39	4.06	21.4	21.4	0.00	3.3	
10:54:49	4.07	21.4	10.7	0.00	6.2	
10:54:59	4.07	21.4	0.0	0.00	8.1	
10:55:09	4.07	10.7	0.0	0.00	8.7	
10:55:19	4.07	0.0	0.0	0.00	8.8	
10:55:29	4.07	0.0	0.0	0.00	8.9	
10:55:39	4.07	0.0	0.0	0.00	8.8	
10:55:49	4.07	0.0	0.0	0.12	8.9	
10:55:59	4.07	0.0	0.0	4.27	8.8	
10:56:09	4.08	0.0	0.0	4.46	6.7	
10:56:19	4.08	0.0	0.1	4.47	3.7	
10:56:29	4.08	0.0	0.1	4.47	1.3	
10:56:39	4.08	0.1	0.1	4.47	0.2	
10:56:49	4.08	0.1	0.0	4.47	-0.1	
10:56:59	4.08	0.1	0.0	4.47	-0.1	
10:57:09	4.08	0.0	0.0	4.47	-0.1	

DIRECT CO
DIRECT ZEROS
NOX/NO

DIRECT O2



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Certificate of Analysis

EPA Protocol

Customer: Cty of San Diego APCD
CGA: 660
Customer PO#:
Cylinder #: CC233189
Part Number: EPA NINOSAL

Reference#: 04334062-00
Certification Date: 08/21/2018
Expiration Date: 08/21/2026
Pressure, psig: 2000

Method: This standard was analyzed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, Procedure G1 (May 2012).

Analyzed Cylinder-Components

Nitric Oxide
NOx
Nitrogen

Certified Concentration
44.72 ppm
45.42 ppm
Balance

Expanded Uncertainty
+/- 0.40 ppm
+/- 0.41 ppm

Assay Dates
08/14/2018, 08/21/2018
08/14/2018, 08/21/2018

Reference Standard-
Type/SRM Sample
Nitric Oxide/ GMIS
Oxides of Nitrogen/ GMIS
Traceable to SRM 1684b

Cylinder # Sample #
CC3648
CC36488
FF9273 44-T-22

Concentration
93.15 +/- 0.61 ppm
93.45 +/- 0.61 ppm
99.75 +/- 0.5 ppm NO/NOx

Expiration
10/03/2025
10/03/2025
01/25/2020

Instrument-
Instrument/ Model
Nicolet 42i-HL

Serial Number
921237088

Last Date Calibrated
07/23/2018

Analytical Method
Chemiluminescence

This report states accurately the results of the investigation made upon the material submitted to the analytical laboratory. Every effort has been made to determine objectively the information requested. However, in connection with this report, Tech Air shall have no liability in excess of the established charge for this service. Assayed at Tech Air, Long Beach CA. No correction required for interfering gases.

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025:2005. Do not use this standard when cylinder pressure is below 150 psig.

Produced by:

TECH AIR

6544 1/2 Chery Avenue
Long Beach, CA 90805
EPA PGVP ID# J12018

Principal Analyst: 

Date: 21 August 2018



Praxair Distribution, Inc.
 5700 S. Alameda Street
 Los Angeles, CA 90058
 Tel: 323-585-2154
 Fax: 714-542-6689

Customer & Order Information:

COUNTY OF SAN DIEGO
 10124 OLD GROVE RD, AIR POLLUTION CONTROL
 DISTRICT
 SAN DIEGO, CA 92131
 Praxair Order Number: 65443859
 Customer PO Number: DANA ERRETT

Certificate Modification Date: 11/5/2018

Certification Date: 11/5/2018
 Lot Number: 70086830302
 Part Number: NI NX7MN-AS

DocNumber: 18314
 Expiration Date: 5/1/2019

CERTIFICATE OF ANALYSIS
Primary Master

Component	Requested Concentration (Molar)	Certified Concentration (Molar)	Analytical Reference	Analytical Uncertainty
Nitrogen dioxide (as NOx)	7 ppm	7.18 ppm	1	± 0.1 ppm
Nitrogen	Balance	Balance		

Cylinder Style: AS
 Cylinder Pressure @ 70 F: 2000 psig
 Cylinder Volume: 142 ft³
 Valve Outlet Connection: CGA 660
 Cylinder Number(s): CC501609

Fill Date: 10/30/2018
 Analysis Date: 10/31/2018

Filling Method: Gravimetric

Analyst: Henry Koung

Approved Signer: Amalia Real

Key to Analytical Techniques:

Reference	Analytical Instrument - Analytical Principle	Reference Standard
1	MKS MG2031 - FTIR	NO2(as NOx)/N2 9.58 ppm GMIS# CC506633, Expiration Date: 01/29/2019, Traceable to PRM#5603981

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted. Analytical uncertainty is expressed as a Relative % unless otherwise noted.

IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution, Inc. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.



CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

COUNTY OF SAN DIEGO
10124 OLD GROVE RD
SAN DIEGO CA 92131

Certificate Modification Date: 08/29/2018

Praxair Order Number: 63241638

Part Number: NI CO45ME-AS

Customer PO Number: DANA ERRETT

Fill Date: 08/24/2018

Lot Number: 70086823803

Cylinder Style & Outlet: AS

CGA 350

Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

Expiration Date:	08/29/2026	NIST Traceable
Cylinder Number:	ALM-037113	Expanded Uncertainty
44.9 ppm	Carbon monoxide	± 0.6 %
Balance	Nitrogen	

ProSpec EZ Cert



Certification Information:

Certification Date: 08/29/2018

Term: 96 Months

Expiration Date: 08/29/2026

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.
Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: Carbon monoxide
Requested Concentration: 45 ppm
Certified Concentration: 44.9 ppm
Instrument Used: Horiba VIA-510 S/N 576878015
Analytical Method: NDIR
Last Multipoint Calibration: 08/09/2018

Reference Standard: Type / Cylinder #: GMIS / CC188812
Concentration / Uncertainty: 48.9 ppm ±0.431%
Expiration Date: 12/08/2025
Traceable to: SRM # / Sample # / Cylinder #: SRM 1678c / 04-L-41 / FF18402
SRM Concentration / Uncertainty: 48.136 PPM / ±0.065PPM
SRM Expiration Date: 02/04/2021

First Analysis Data:				Date
Z: 0	R: 48.9	C: 44.9	Conc: 44.9	08/28/2018
R: 48.9	Z: 0	C: 44.9	Conc: 44.9	
Z: 0	C: 45	R: 49	Conc: 45	
UOM: ppm				Mean Test Assay: 44.9 ppm

Second Analysis Data:				Date
Z: 0	R: 0	C: 0	Conc: 0	
R: 0	Z: 0	C: 0	Conc: 0	
Z: 0	C: 0	R: 0	Conc: 0	
UOM: ppm				Mean Test Assay: ppm

Analyzed By

Jose Vasquez

Certified By

Danielle Burns



Praxair
 5700 South Alameda Street
 Los Angeles, CA 90058
 Tel: (323) 585-2154 Fax: (714) 542-6689
 PGVPID: F22018

DocNumber: 000119245

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

COUNTY OF SAN DIEGO
 10124 OLD GROVE RD
 SAN DIEGO CA 92131

Praxair Order Number: 54569845
 Customer P. O. Number: Dana Errett
 Customer Reference Number:

Fill Date: 1/10/2018
 Part Number: NI OX8E-AS
 Lot Number: 70086801004
 Cylinder Style & Outlet: AS CGA 580
 Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date:	1/18/2026	NIST Traceable
Cylinder Number:	CC505714	Analytical Uncertainty:
8.00 %	OXYGEN	± 0.4 %
Balance	NITROGEN	

Certification Information: Certification Date: 1/18/2018 Term: 96 Months Expiration Date: 1/18/2026
 This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: OXYGEN

Requested Concentration: 8 %
 Certified Concentration: 8.00 %
 Instrument Used: PARA 1 OXYMAT SE
 Analytical Method: PARAMAGNETIC
 Last Multipoint Calibration: 1/3/2018

Reference Standard Type: NTRM
 Ref. Std. Cylinder #: DT0010402
 Ref. Std. Conc: 9.88%
 Ref. Std. Traceable to SRM #: 170701
 SRM Sample #: 17070115
 SRM Cylinder #:

First Analysis Data:				Date:
Z: 0	R: 9.88	C: 8	Conc: 7.997	1/18/2018
R: 9.88	Z: 0	C: 8	Conc: 7.997	
Z: 0	C: 8.01	R: 9.89	Conc: 8.007	
UOM: %	Mean Test Assay: 8.001 %			

Second Analysis Data:				Date:
Z: 0	R: 0	C: 0	Conc: 0	
R: 0	Z: 0	C: 0	Conc: 0	
Z: 0	C: 0	R: 0	Conc: 0	
UOM: %	Mean Test Assay: 0 %			

Analyzed by:

Jose Vasquez

Certified by:

Danielle Burns

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.



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Certificate of Analysis

EPA Protocol

Customer:	San Diego Cty APCD	Reference#:	04515966-00
CGA:	580	Certification Date:	12/18/2018
Customer PO#:		Expiration Date:	12/19/2026
Cylinder #:	CC159087	Pressure, psig:	2000
Part Number:	EPA NIOXSAL		

Method: This standard was analyzed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, Procedure G1 (May 2012).

Analyzed Cylinder-Components	Certified Concentration	Expanded Uncertainty	Assay Dates
Oxygen	4.478 %	+/-0.010 %	12/18/2018
Nitrogen	Balance		

Reference Standard-Type/SRM Sample	Cylinder #	Sample	Concentration	Expiration
Oxygen/GMIS	ALM034352		4.9025 +/- 0.010 %	09/01/2024
Traceable to SRM 2659a	CAL015489	71-D-50	20.72 +/- 0.043 %	08/23/2021

Instrument-Instrument/ Model	Serial Number	Last Date Calibrated	Analytical Method
Servomex 1100	1100-2228-C	12/17/2018	Paramagnetic

This report states accurately the results of the investigation made upon the material submitted to the analytical laboratory. Every effort has been made to determine objectively the information requested. However, in connection with this report, Specialty Air Technologies shall have no liability in excess of the established charge for this service. Assayed at Specialty Air Technologies, Long Beach CA. No correction required for interfering gases.

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025:2005. Do not use this standard when cylinder pressure is below 150 psig.

Produced by:

TECH AIR

6544 1/2 Cherry Avenue
Long Beach, CA 90805
EPA PGPV ID# J12018

Principal Analyst: 

Date: 18 December 2018

the 1990s, the number of people in the world who are under 15 years of age is expected to increase from 1.1 billion to 1.5 billion.

There are a number of reasons why the number of children in the world is expected to increase. One of the main reasons is that the number of children who are born in the world is still increasing. In 1990, there were 1.1 billion children in the world. In 2000, there were 1.2 billion children in the world. In 2010, there are expected to be 1.4 billion children in the world.

Another reason why the number of children in the world is expected to increase is that the number of children who are surviving is increasing. In 1990, 100 million children died before they were 5 years old. In 2000, 80 million children died before they were 5 years old. In 2010, it is expected that 60 million children will die before they are 5 years old.

There are a number of factors that are contributing to the increase in the number of children in the world. One of the main factors is the increase in the number of children who are surviving. This is due to a number of factors, including the increase in the number of children who are vaccinated, the increase in the number of children who are receiving medical care, and the increase in the number of children who are receiving education.

Another factor that is contributing to the increase in the number of children in the world is the increase in the number of children who are being born. This is due to a number of factors, including the increase in the number of children who are being born to women who are younger, the increase in the number of children who are being born to women who are having more children, and the increase in the number of children who are being born to women who are having children more often.

There are a number of ways in which the number of children in the world can be reduced. One of the main ways is to reduce the number of children who are being born. This can be done by increasing the age at which women are having children, by reducing the number of children that women are having, and by increasing the number of children who are being born to women who are having children less often.

Another way in which the number of children in the world can be reduced is to reduce the number of children who are surviving. This can be done by increasing the number of children who are vaccinated, by increasing the number of children who are receiving medical care, and by increasing the number of children who are receiving education.

There are a number of reasons why it is important to reduce the number of children in the world. One of the main reasons is that a large number of children in the world are living in poverty. This means that they do not have enough money to buy the things that they need to live, such as food, clothing, and shelter.

Another reason why it is important to reduce the number of children in the world is that a large number of children in the world are not receiving an education. This means that they do not have the skills that they need to find a job and support themselves when they are grown up.

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COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
 10124 OLD GROVE ROAD, SAN DIEGO, CA 92131
 PHONE (858) 586-2600 FAX (858) 586-2601
 www.sdapcd.org

Sectors: 3, K
 Site Record ID: APCD1976-SITE-00208
 Application Record ID: APCD2002-APP-978333

PERMIT RECORD ID
 APCD2004-PTO-000841



SD State University
 Environmental Compliance Specialist Dan Root
 5500 Campanile Dr Mail Code 1243
 San Diego CA 92182

EQUIPMENT ADDRESS
 SD State University
 Alvin Shoemaker
 5500 Campanile Dr
 San Diego CA 92182

PERMIT TO OPERATE
 EXPIRES: April 30, 2019

This permit is not valid until required fees have been paid.

The above is hereby granted a Permit To Operate the article, machine, equipment or contrivance described below. This permit is not transferable to a new owner nor is it valid for operation of the equipment at another location except as specified. This Permit To Operate or copy must be posted on or within 25 feet of the equipment, or readily available on the operating premises.

EQUIPMENT OWNER

EQUIPMENT DESCRIPTION

BOILER NO.3:12.6 MM BTU/HR INPUT:INTERNATIONAL BOILER WORKS/ UNIVERSAL ENERGY CORPORATION MODEL BF-350C-W12X, EQUIPPED WITH A LOW NOX BURNER, FGR, AND EXCESS OXYGEN CONTINUOUS MONITOR, NATURAL GAS-FIRED, AND ONLY USING DIESEL NO. 2 FUEL FOR BACKUP AND LIMITED USE. 40040 AS 0384 ID REPL 0295 DAS 972798 0999 EAD (08AUG2002 ADD CONDITION# 2800) 978333 EAD 060404

Every person who owns or operates this equipment is required to comply with the conditions listed below and all applicable requirements and District rules, including but not limited to Rules 10, 20, 40, 50, 51.

Fee Schedules: 1 [13A] Boiler/Heater
 1 [92F] NOx and CO Source Test

BEC: 12620

FAILURE TO OPERATE IN COMPLIANCE IS A MISDEMEANOR SUBJECT TO CIVIL AND CRIMINAL PENALTIES

1. The concentration of Oxides of Nitrogen emissions in the boiler flue exhaust, as nitrogen dioxide (NO2), shall not exceed a test average of 30 parts per million by volume on a dry basis (PPMV), corrected to 3% oxygen, when burning natural gas.
2. The concentration of carbon monoxide (CO) emissions in the boiler flue exhaust shall not exceed a test average of 400 parts per million by volume on a dry basis (PPMV), corrected to 3% oxygen, when burning natural gas.
3. The flue gas recirculation system shall be in operation in accordance with the manufacturer's instructions when the boiler is producing steam.
4. The unit shall be fired with natural gas, except that limited use of diesel fuel is allowed.
5. The unit shall be fired with diesel fuel only during a natural gas supply curtailment period, or during an unforeseen disruption or interruption in the supply of natural gas to the unit. The total cumulative time of diesel fuel use for these purposes shall not exceed 168 hours per calendar year. The total time that diesel fuel is used for maintenance and checkout purposes shall not exceed 3.0 hours per day and 48 hours per calendar year.



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PERMIT RECORD ID
APCD2004-PTO-000841



6. The Sulfur content of liquid fuel for the unit shall not exceed 0.05% by weight.
7. A daily record shall be maintained of unit operating hours and cumulative annual hours of operation while using diesel fuel, and the reason for its use. The three (3) most recent years' data shall be kept on site and be made available to a District representative upon request.
8. This equipment shall be source tested on an annual basis, using District approved test methods, unless authorized otherwise in writing by the APCD.
9. The aggregate NOx emissions from the two replacement turbines, two duct burners, and the two boilers (Permit to Operate Nos. 841 and 920191) shall be calculated and recorded on a monthly basis. The annual aggregate NOx emissions from this facility shall not exceed 50 tons in any twelve consecutive month period.
10. The maximum annual fuel consumption rate for the two gas turbines and the two duct burners combined shall not exceed 1490 million cubic feet in any 12 consecutive month period.
11. The total combined daily fuel consumption and the total combined fuel consumption in a 12 consecutive month period for the two gas turbines, two duct burners and the two existing boilers (Permit to Operate Nos. 841 and 920191) shall be recorded, reported in an APCD monthly report, SDSU Cogeneration Facility fuel gas usage and NOx emissions Log, and made readily available to the District upon request. A Continuous Emissions Monitoring System (CEMS) is not required.
12. Daily fuel consumption and NOx emissions for each gas turbine, duct burner and boiler at the facility shall be determined on a monthly basis and reported in the APCD monthly report, daily fuel gas consumption and NOx emissions log.
13. This equipment shall be source tested for compliance at least annually before the Permit to Operate renewal date, unless otherwise specified in writing by the District. Testing shall be conducted in accordance with District Source Test Method 100, or the Air Resources Board (ARB) Test Method 100 as approved by EPA, and a source test protocol approved in writing by the District to ensure compliance with District emission standards for NOx and CO prior to Permit renewal. Testing shall be performed at no less than 80% of full power rating, except as follows: if it is demonstrated to the satisfaction of the District that the duct burner cannot operate at these conditions as a result of insufficient steam demand, then emissions source testing shall be performed with the duct burner operating at the highest achievable continuous power rating.
14. Access, facilities, utilities and any necessary safety equipment for source testing and inspection shall be provided upon request of the Air Pollution Control District.
15. This Air Pollution Control District Permit does not relieve the holder from obtaining permits or authorizations required by other governmental agencies.
16. The permittee shall, upon determination of applicability and written notification by the District, comply with all applicable requirements of the Air Toxics "Hot Spots" Information and Assessment Act (California Health and Safety Code Section 44300 et seq.)

DISTRIBUTION CHECKLIST FOR METHOD 100 CO, NOx TEST

Site: **SD State University**
Boiler #3

Test Date: 4/5/2019
PO. No. APCD2004-PTO-000841

TEST REPORT CONTENTS

- | | |
|---|---|
| <input type="checkbox"/> COVER LETTER | <input checked="" type="checkbox"/> ANALYZER CHECK OFF SHEET (p. 5) |
| <input checked="" type="checkbox"/> SOURCE TEST SUMMARY SHEET (p.1) | <input checked="" type="checkbox"/> ENGINEERING REPORT |
| <input checked="" type="checkbox"/> DATA SHEET (p.2-4) | <input checked="" type="checkbox"/> DATA ACQUISITION TABLES |

MTS FILE NOTES

- | | |
|--|--|
| <input type="checkbox"/> FOLDER LABELLED | <input checked="" type="checkbox"/> PO and PAYMENT SHEET |
| <input checked="" type="checkbox"/> CHECK LIST IN FOLDER | |

REPORT BY: <u>N. Gutzwiller</u>	DATE: <u>9-Apr-19</u>
TEST CONDUCTED BY: <u>N. Gutzwiller, A. Fry</u>	DATE: <u>5-Apr-19</u>
REPORT QC BY: <u>Daryl Hawkes</u>	DATE: <u>05/23/19</u>
APPROVED BY: _____	DATE: _____

DISTRIBUTION

EXCEEDANCE

FULL REPORT TO:

- SITE
- ENGINEERING FILE
- ENGINEER
- COMPLIANCE
- DAVID SODEMAN

SUMMARY PAGE & ENG. REPORT TO:

SUMMARY PAGE ONLY TO:

NON-EXCEEDANCE

FULL REPORT TO:

- SITE
- DAVID SODEMAN

SUMMARY PAGE & ENG. REPORT TO:

- EMISSIONS INVENTORY
- ENGINEERING FILE
- COMPLIANCE

APPS & PTAs - LABOR TRACKING SHEET

- TEST RESULTS INTO DATA BASE
- ORIGINAL REPORT TO MT&S FILE

Emissions Summary Sheet

SD State University
GT B, DB On

PO: APCD2003-PTO-975399
DATE: 3-Apr-19

COMBINED TURBINE & DUCT BURNER EMISSIONS

	Run 1	Run 2	Run 3	Average	Limit
NOx (ppm)	17.5	17.6	17.5	17.5	
NOx (ppm @ 15% O2)	14.6	14.6	14.6	14.6	17
NOx (lb/MMBtu)	0.054	0.054	0.054	0.054	
NOx (lb/hr)	4.18	4.21	4.19	4.19	
NOx (lb/MMscf)	55.6	55.9	55.7	55.7	
CO (ppm)	4.97	4.98	4.94	4.96	
CO (ppm @ 15% O2)	4.12	4.14	4.11	4.12	50
CO (lb/MMBtu)	0.00922	0.00927	0.00920	0.00923	
CO (lb/hr)	0.720	0.726	0.720	0.722	
CO (lb/MMscf)	9.58	9.64	9.56	9.59	
O2 (%)	13.78	13.80	13.80	13.79	

Exhaust flow (dscfm)	33,229	33,431	33,448	33,369	
----------------------	--------	--------	--------	--------	--

Turbine gas flow, natural gas (mscfh)	57.1	57.2	57.2	57.2	
Turbine heat input (MMBtu/hr)	59.3	59.4	59.4	59.4	
DB gas flow, natural gas (mscfh)	18.0	18.1	18.1	18.1	
DB heat input (MMBtu/hr)	18.7	18.8	18.8	18.8	
Heat value (Btu/scf)	1,039				
Load (MW)	4.780	4.780	4.780	4.780	5.233

DUCT BURNER EMISSIONS*

NOx (ppm @ 15% O2)	23.3	23.5	23.3	23.3	
NOx (lb/MMBtu)	0.086	0.087	0.086	0.086	
NOx (lb/hr)	1.60	1.63	1.61	1.61	
NOx (lb/MMscf)	89.1	89.9	89.0	89.3	
CO (ppm @ 15% O2)	13.9	13.9	13.8	13.9	
CO (lb/MMBtu)	0.0311	0.0312	0.0310	0.0311	
CO (lb/hr)	0.582	0.588	0.582	0.584	
CO (lb/MMscf)	32.3	32.5	32.2	32.3	

* Calculated from difference of measured combined emissions and measured turbine emissions

GT NOx emission factor (lb/MMBtu) 0.0434
GT CO emission factor (lb/MMBtu) 0.00232

$$DB_{\frac{lb}{mmbtu}} = \frac{\text{Combined}_{\frac{lb}{mmbtu}} * \text{Combined}_{\frac{mmbtu}{hr}} - \text{Turbine}_{\frac{lb}{mmbtu}} * \text{Turbine}_{\frac{mmbtu}{hr}}}{DB_{\frac{mmbtu}{hr}}}$$

$$DB_{ppm @ 15\% O_2} = \frac{DB_{\frac{lb}{mmbtu}} * (20.9 - 15)}{2.596 \times 10^{-9} * MW * 8710 * 20.9}$$

**PERMIT RENEWAL TEST
PERMIT YEAR: MAY 1, 2018 - APRIL 30, 2019**



Monitoring and Technical Services
10124 Old Grove Road
San Diego, CA 92131

Nitrogen Oxides & Carbon Monoxide
Emissions Summary Report

SITE: SD State University
GT B, DB On
LOCATION: 5500 Campanile Dr.
San Diego, CA 92182

MAIL ADDRESS: SD State University
5500 Campanile Dr.
Mail Code 1243
San Diego, CA 92182

P/O NUMBER: APCD2003-PTO-975399
ID NUMBER: APCD1976-SITE-00208

TEST DATE: 3-Apr-19

EQUIPMENT: Solar turbine 60-T7300S GSC Taurus, natural gas fired, 59.48 MMBtu/hr (LHV), 5.233 MW net output with SoLoNOx technology. Combined with a John Zink low NOx duct burner, natural gas fired, 20 MMBtu/hr (HHV) and HRSG

REPORT BY: N. Gutzwiller
REPORT DATE: 10-Apr-19

APCD PERSONNEL: N. Gutzwiller, A. Fry

SITE PERSONNEL: Dan Root

APPROVED BY: *David A. Sodeiman* 6/14/19
David Sodeiman, Senior Chemist

Table 1. Summary of Results - NOx and CO Stack Emissions Corrected to 15% O2

	TEST RESULTS	PERMIT LIMITS	PERFORMANCE	HOURS OF TEST
NOx (ppm)	15	17	PASS	1.6
CO (ppm)	4	50	PASS	1.6
Fuel (scfh)	75,100			
Power output (MW)	4.780 rated @ 5.233			

TEST REFERENCE: This testing was performed in accordance with the San Diego Air Pollution Control District Method 100: "Test Procedures For The Determination of Nitrogen Oxides, Carbon Monoxide and Diluent Gases by Continuous Emission Monitoring."

INTERMEDIATE SUMMARY TABLE

Test Hrs	Sub-test number	Avg NO2 % of total NOx	Avg Raw NOx ppm	Avg. Raw NO ppm	NOx adj for drift & bias ppm	Avg. Raw CO ppm	CO adj for drift & bias ppm	Avg. Raw O2 %	O2 adj for drift & bias %	Corr NOx @ 15 % O2 ppm	Corr CO @ 15 % O2 ppm
12:24-12:56	1	26.3%	16.93	12.62	17.55	5.00	4.97	13.62	13.78	14.55	4.12
13:15-13:47	2	25.6%	16.84	12.68	17.56	4.93	4.98	13.63	13.80	14.61	4.14
14:07-14:39	3	25.0%	16.79	12.74	17.49	4.85	4.94	13.64	13.80	14.56	4.11
Average		25.7%			17.53		4.96		13.79	14.58	4.12

Calibration Gases:

Gas	Cylinder	Manufacturer	Conc.
NO	CC233189	TechAir	44.72 ppm
NO2	CC501609	Praxair	7.18 ppm
CO	ALM-037113	Praxair	44.9 ppm
O2	CC246193	Praxair	21.10 %
O2	EB0014605	TechAir	11.99 %
N2		TechAir	

Calibration Gas Dilutions:

Gas	Concn. 100%	dil. to: %	concn.
NO (ppm)	44.7	40	17.89
		20	8.94
NO2(ppm)	7.18	50	3.59
CO (ppm)	44.9	20	8.98
		10	4.49
O2 (%)	21.10	100	21.10
		100	11.99

Instrument scales :

NOx: 0-22 ppm
 NO: 0-22 ppm
 CO: 0-11 ppm
 O2: 0-25 %

Concentrations for SGD eval:

Gas Used	21.10	%O2
diluted to:		
%	%	
100	21.10	
60	12.66	
50	10.55	
40	8.44	
20	4.22	
10	2.11	
	0.00	

Scale: 0-25 %

Direct challenge gas: 11.99 % O2

System Leak Checks:

Initial: good
 Final: good

DAS Trigger Times:

1 : 6:54:00
 2 : 8:23:49
 3 : 9:54:16
 4 : 11:24:42
 5 : 12:54:50
 6 : 14:07:00

INSTRUMENTATION.

NOx analyzer: CAI 600 (chemiluminescence) with low temperature converter.
 CO analyzer: Thermo 48i (NDIR).
 O2 analyzer: Servomex 1440C (paramagnetic).
 Standard gas divider: Stec model SGD-A10.

QA/QC CHECKS (continued).

SGD FIELD EVALUATION, (limits: all differences +/-2%).

Gas used: 21.10 %O2 Scale: 0 - 25 %

Gas diluted to: (%)	SGD gas values (%)			Average	Actual conc. (%)
	1	2	3		
100	21.38	21.39	21.38	21.38	21.10
				1.3%	% diff. of avg. from act. val.
	0.0%	0.0%	0.0%		% diff. from avg.
60	12.66	12.68	12.68	12.67	12.66
				0.1%	% diff. of avg. from act. val.
	-0.1%	0.1%	0.1%		% diff. from avg.
50	10.54	10.56	10.55	10.55	10.55
				0.0%	% diff. of avg. from act. val.
	-0.1%	0.1%	0.0%		% diff. from avg.
40	8.39	8.41	8.40	8.40	8.44
				-0.5%	% diff. of avg. from act. val.
	-0.1%	0.1%	0.0%		% diff. from avg.
20	4.16	4.17	4.17	4.17	4.22
				-1.3%	% diff. of avg. from act. val.
	-0.2%	0.1%	0.1%		% diff. from avg.
10	2.11	2.10	2.09	2.10	2.11
				-0.5%	% diff. of avg. from act. val.
	0.5%	0.0%	-0.5%		% diff. from avg.

MID-LEVEL GAS CONCENTRATION DIRECT TO ANALYZER, (limit: difference +/-2%).

Gas used: 11.99 % O2 Scale: 0- 0-25

		Inj. #1	Inj. #2	Inj. #3	Avg.
Instrument response (%)	Dir. Val.	12.13	12.13	12.12	12.13
				Diff. %	1.1%

CONVERTER EFFICIENCY, (must be >90%).

	NOx Mode	NO Mode	NO2 gas: 3.59 ppm
NO2 dir (ppm)	3.36	0.05	
NO2 zero (ppm)	0.01	0.00	
Conv. Eff. (%)	91.9%		

MULTI-POINT CALIBRATION INSTRUMENT CHECK, (limit: instr. val. within 2% of full scale of predict. val.).

Conc. level	Gas Conc.			Instr. response					
	NO ppm	CO ppm	O2%	NO ppm	NO ACE	CO ppm	CO ACE	O2 %	O2 ACE
High	17.89	8.98	21.10	17.91	0.1%	8.99	0.1%	21.08	-0.1%
Zero	0.00	0.00	0.00	0.00	0.0%	0.02	0.2%	0.00	0.0%
Mid	8.94	4.49	11.99	8.92	-0.1%	4.56	0.6%	11.95	-0.2%
				Scale, 0-	22	11	25		
				Slope	1.00	1.00	1.00		
				Intercept	0.00	-0.02	0.00		
				Mid (predict.)	8.96	4.51	11.98		
				Diff. (% full scale)	-0.2	0.5	-0.1		

PO#: APCD2003-PTO-975399

DATE: 3-Apr-19

RUN #1

Time: 12:24- 12:56
 South - West
 12 pt

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	8.92	1.3%	8.77	1.4%	8.85	8.94	-0.7%
	zero	0.00		0.00		0.00	0.00	0.0%
	system	8.80		8.68		8.74	8.94	-0.5%
	zero	0.00		0.03		0.02	0.00	0.1%
NO2	direct	3.36	8.1%	3.28	9.5%	3.32	3.59	-0.4%
	zero	0.01		0.01		0.01	0.00	0.0%
	system	3.17		3.08		3.13	3.59	-0.4%
	zero	0.09		0.12		0.11	0.00	0.1%
CO	direct	4.56	-0.2%	N/A	N/A	N/A	4.49	N/A
	zero	0.02		N/A		N/A	0.00	N/A
	system	4.59		4.45		4.52	4.49	-1.3%
	zero	0.04		-0.04		0.00	0.00	-0.7%
O2 as %	direct	11.95	0.9%	N/A	N/A	N/A	11.99	N/A
	zero	0.00		N/A		N/A	0.00	N/A
	system	11.87		11.85		11.86	11.99	-0.1%
	zero	0.03		0.03		0.03	0.00	0.0%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	16.93	17.55	ppm
NO avg	12.62	12.92	ppm
NO2 avg	4.30	4.62	ppm
CO avg	5.00	4.97	ppm
O2 avg	13.62	13.78	%

NOx 0- 22 ppm
 CO 0- 11 ppm
 O2 0- 25 %

Stack NO2 %
 26.3%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

Stratification Check

Point	CO ppm	O2 %	NO ppm	NOX ppm	CO @15%O2	NOX @15%O2
S-1	5.09	13.71	12.34	16.62	4.18	13.66
S-2	4.91	13.74	12.01	16.50	4.05	13.62
S-3	4.70	13.73	11.85	16.45	3.87	13.56
S-4	4.45	13.48	12.64	17.43	3.54	13.88
S-5	5.26	13.21	13.73	18.32	4.04	14.08
S-6	5.58	13.21	14.20	18.49	4.29	14.21
W-1	4.23	13.69	13.99	16.76	3.47	13.74
W-2	4.18	13.68	13.48	16.66	3.42	13.64
W-3	3.98	13.66	13.06	16.83	3.25	13.74
W-4	5.56	13.83	11.53	16.17	4.65	13.51
W-5	6.04	13.78	11.23	16.43	5.01	13.63
W-6	6.00	13.74	11.41	16.45	4.95	13.58
avg	5.00	13.62	12.62	16.93	4.06	13.74
min	3.98	13.21	11.23	16.17	3.25	13.51
dif	-20.4%	-3.0%	-11.0%	-4.5%	-20.0%	-1.6%
max	6.04	13.83	14.20	18.49	5.01	14.21
dif	20.8%	1.5%	12.5%	9.2%	23.4%	3.5%
stack	60			1	8.6	
ext	6			2	14.8	
				3	23.8	
				4	48.2	
				5	57.2	
				6	63.4	

PO#: APCD2003-PTO-975399

DATE: 3-Apr-19

RUN #2

Time: 13:15- 13:47
West - South
12 pt

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	8.77	1.4%	8.78	1.1%	8.78	8.94	0.0%
	zero	0.00		0.00		0.00	0.00	0.0%
	system	8.68		8.70		8.69	8.94	0.1%
	zero	0.03		0.02		0.03	0.00	0.0%
NO2	direct	3.28	9.5%	3.28	9.2%	3.28	3.59	0.0%
	zero	0.01		0.01		0.01	0.00	0.0%
	system	3.08		3.10		3.09	3.59	0.1%
	zero	0.12		0.13		0.13	0.00	0.0%
CO	direct	N/A	N/A	N/A	N/A	N/A	4.49	N/A
	zero	N/A		N/A		N/A	0.00	N/A
	system	4.45		4.43		4.44	4.49	-0.2%
	zero	-0.04		-0.10		-0.07	0.00	-0.5%
O2 as %	direct	N/A	N/A	N/A	N/A	N/A	11.99	N/A
	zero	N/A		N/A		N/A	0.00	N/A
	system	11.85		11.85		11.85	11.99	0.0%
	zero	0.03		0.03		0.03	0.00	0.0%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	16.84	17.56	ppm
NO avg	12.68	13.06	ppm
NO2 avg	4.16	4.50	ppm
CO avg	4.93	4.98	ppm
O2 avg	13.63	13.80	%

NOx 0- 22 ppm
CO 0- 11 ppm
O2 0- 25 %

Stack NO2 %
25.6%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

Stratification Check

Point	CO ppm	O2 %	NO ppm	NOX ppm	CO @15%O2	NOX @15%O2
S-1	5.50	13.76	12.87	16.40	4.55	13.57
S-2	5.17	13.75	12.31	16.35	4.27	13.51
S-3	4.86	13.75	11.95	16.44	4.02	13.59
S-4	4.35	13.62	12.36	16.90	3.53	13.72
S-5	4.58	13.40	13.23	17.67	3.61	13.93
S-6	4.87	13.27	13.89	18.12	3.77	14.04
W-1	4.11	13.60	14.00	17.05	3.33	13.80
W-2	4.11	13.52	13.82	17.27	3.29	13.83
W-3	4.05	13.56	13.49	17.23	3.26	13.87
W-4	5.57	13.83	11.57	16.20	4.65	13.54
W-5	5.96	13.78	11.24	16.20	4.95	13.44
W-6	6.01	13.77	11.39	16.24	4.98	13.46
avg	4.93	13.63	12.68	16.84	4.02	13.69
min	4.05	13.27	11.24	16.20	3.26	13.44
dif	-17.8%	-2.7%	-11.3%	-3.8%	-18.8%	-1.8%
max	6.01	13.83	14.00	18.12	4.98	14.04
dif	21.9%	1.4%	10.4%	7.6%	24.0%	2.5%
stack	60			1	8.6	
ext	6			2	14.8	
				3	23.8	
				4	48.2	
				5	57.2	
				6	63.4	

RUN #3

Time: 14:07- 14:39
 South - West
 12 pt

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	8.78	1.1%	8.78	1.1%	8.78	8.94	0.0%
	zero	0.00		0.00		0.00	0.00	0.0%
	system	8.70		8.68		8.69	8.94	-0.1%
	zero	0.02		0.00		0.01	0.00	-0.1%
NO2	direct	3.28	9.2%	3.27	7.7%	3.28	3.59	0.0%
	zero	0.01		0.01		0.01	0.00	0.0%
	system	3.10		3.09		3.10	3.59	0.0%
	zero	0.13		0.08		0.11	0.00	-0.2%
CO	direct	N/A	N/A	4.37	0.9%	N/A	4.49	N/A
	zero	N/A		-0.15		N/A	0.00	N/A
	system	4.43		4.37		4.40	4.49	-0.5%
	zero	-0.10		-0.11		-0.11	0.00	-0.1%
O2 as %	direct	N/A	N/A	11.93	0.8%	N/A	11.99	N/A
	zero	N/A		0.00		N/A	0.00	N/A
	system	11.85		11.85		11.85	11.99	0.0%
	zero	0.03		0.02		0.03	0.00	0.0%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	16.79	17.49	ppm
NO avg	12.74	13.12	ppm
NO2 avg	4.05	4.37	ppm
CO avg	4.85	4.94	ppm
O2 avg	13.64	13.80	%

Stack NO2 % 25.0%

NOx 0- 22 ppm
 CO 0- 11 ppm
 O2 0- 25 %

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

Stratification Check

Point	CO ppm	O2 %	NO ppm	NOX ppm	CO @15%O2	NOX @15%O2
S-1	4.91	13.72	13.16	16.64	4.04	13.69
S-2	4.95	13.74	12.78	16.50	4.08	13.62
S-3	4.76	13.75	12.27	16.39	3.93	13.54
S-4	4.52	13.55	12.58	17.07	3.63	13.73
S-5	4.56	13.41	13.36	17.59	3.60	13.88
S-6	4.83	13.30	13.77	17.91	3.76	13.93
W-1	4.19	13.63	14.11	16.86	3.41	13.70
W-2	4.05	13.62	13.56	16.87	3.29	13.69
W-3	4.00	13.55	13.45	16.98	3.22	13.65
W-4	5.52	13.83	11.53	16.30	4.61	13.62
W-5	5.94	13.81	11.08	16.13	4.95	13.44
W-6	5.95	13.75	11.22	16.28	4.92	13.45
avg	4.85	13.64	12.74	16.79	3.95	13.66
min	4.00	13.30	11.08	16.13	3.22	13.44
dif	-17.5%	-2.5%	-13.0%	-3.9%	-18.6%	-1.6%
max	5.95	13.83	14.11	17.91	4.95	13.93
dif	22.7%	1.4%	10.8%	6.6%	25.2%	2.0%

APPENDIX**Calculation of Gas Concentrations (Method 100).**

1) Concentrations for O₂ & CO (and CO₂ when required) are calculated using equation 1.

$$C_{gas} = (C_{avg} - C_o) * \frac{C_{ma}}{C_m - C_o} \quad 1$$

Where:

C_{gas} = Effluent gas concentration, ppm, dry basis.

C_{avg} = Average gas concentration, ppm, dry basis, indicated by the analyzer.

C_{ma} = Actual certified concentration, ppm, of the mid- or high-range calibration gas used for the system calibration checks.

C_m = Average of the initial and final system calibration responses, ppm, for the mid- or high-range calibration gas.

C_o = Average of the initial and final system calibration responses, ppm, for the zero calibration gas.

2) NO₂, NO, & NO_x gas concentrations, corrected for instrument drift, calibration error and system bias for NO & NO₂ are calculated using equations 2,3 & 4 respectively.

$$NO_{2gas} = [(NO_{xavg} - NO_{xod}) - (NO_{avg} - NO_{od})] * \frac{NO_{ma}}{NO_{md} - NO_{od}} * \frac{NO_{2md} - NO_{od}}{NO_{2m} - NO_{od}} \quad 2$$

$$NO_{gas} = (NO_{avg} - NO_o) * \frac{NO_{ma}}{NO_{md} - NO_{od}} * \frac{NO_{md} - NO_{od}}{NO_m - NO_o} \quad 3$$

$$NO_{xgas} = NO_{gas} + NO_{2gas} \quad 4$$

Where:

NO_{xgas} = the total NO_x concentration, ppm, dry basis, in the stack effluent.

NO_{2gas} = the NO₂ concentration, ppm, dry basis, in the stack effluent.

NO_{gas} = the NO concentration, ppm, dry basis, in the stack effluent.

NO_{xavg} = the average NO_x concentration, ppm, dry basis, indicated by the analyzer.

NO_{avg} = the average NO concentration, ppm, dry basis, indicated by the analyzer.

NO_{ma} = the actual certified concentration, ppm, of the mid- or high-range NO calibration gas.

NO_{2md} = the average of the initial and final analyzer responses, ppm, for the NO₂ calibration gas when introduced directly to the analyzer.

NO_{md} = the average of the initial and final analyzer responses, ppm, for the NO calibration gas when introduced directly to the analyzer.

NO_{od} = the average of the initial and final zero calibration responses, ppm, when NO zero calibration gas is sampled directly to the analyzer.

NO_{2m} = the average of the initial and final system calibration responses, ppm, for the NO₂ calibration gas.

NO_m = the average of the initial and final system calibration responses, ppm, for the NO calibration gas.

NO_o = the average of the initial and final system calibration responses, ppm, for the NO zero calibration.

NO_{xod} = the average of the initial and final zero calibration responses, ppm, when the NO_x zero calibration gas is sampled directly to the analyzer.

3) Specific gaseous emission limits corrected to 3% or 15%O₂ are calculated using equations 5a & 5b.

$$C_{gas@3\%O_2} = C_{gas} * \frac{20.95 - 3\%O_2}{20.95 - C_{gas}O_2\%} \quad 5a$$

$$C_{gas@15\%O_2} = C_{gas} * \frac{20.95 - 15\%O_2}{20.95 - C_{gas}O_2\%} \quad 5b$$

Where:

C_{gas @ 3% or 15%} = the stack gas effluent for either NO_x or CO corrected to 3% or 15% O₂.

C_{gas} = the stack gas effluent for either NO_x or CO determined using equation 1.

C_{gas O₂%} = the stack effluent gas concentration of O₂, %.

NOTE: The NO_x analyzer used during this test is capable of measuring NO and total NO_x simultaneously. NO₂ calibration gas values are measured via the NO_x channel, thus NO₂ zero is the same as NO_x zero.

C_{gas @ 3% or 15%} = the stack gas effluent for either NO_x or CO corrected to 3% or 15% O₂.

SOURCE TEST ENGINEERING REPORT



SITE : SD State University
GT B, DB On

PO# : APCD2003-PTO-975399

DATE : 3-Apr-19

APCD PERSONNEL : N. Gutzwiller, A. Fry

EQUIPMENT : Solar turbine 60-T7300S GSC Taurus, natural gas fired, 59.48 MMBtu/hr (LHV),
5.233 MW net output with SoLoNOx technology. Combined with a John Zink
low NOx duct burner, natural gas fired, 20 MMBtu/hr (HHV) and HRSG

OPERATING PARAMETERS

	RUN 1	RUN 2	RUN 3	AVERAGE
Power, KW	4780	4780	4780	4780
GT Fuel Flow, MSCFH*	57.1	57.2	57.2	57.2
DB Fuel Flow, MSCFH*	18.0	18.1	18.1	18.1
Load, %	91.3%	91.3%	91.3%	91.3%
Pilot Valve Position, graph	11392	11392	11392	11392
Pilot Valve Position, %**	20.6%	20.6%	20.6%	20.6%
Inlet Air Temp, °F	56.1	56.1	56.1	56.1
Combustion Temp, °F	1250	1250	1250	1250

*timestamp value does not match run time, value estimated from graph

**Pilot valve position = $(x-6240)/24960$, where x=reading from graph

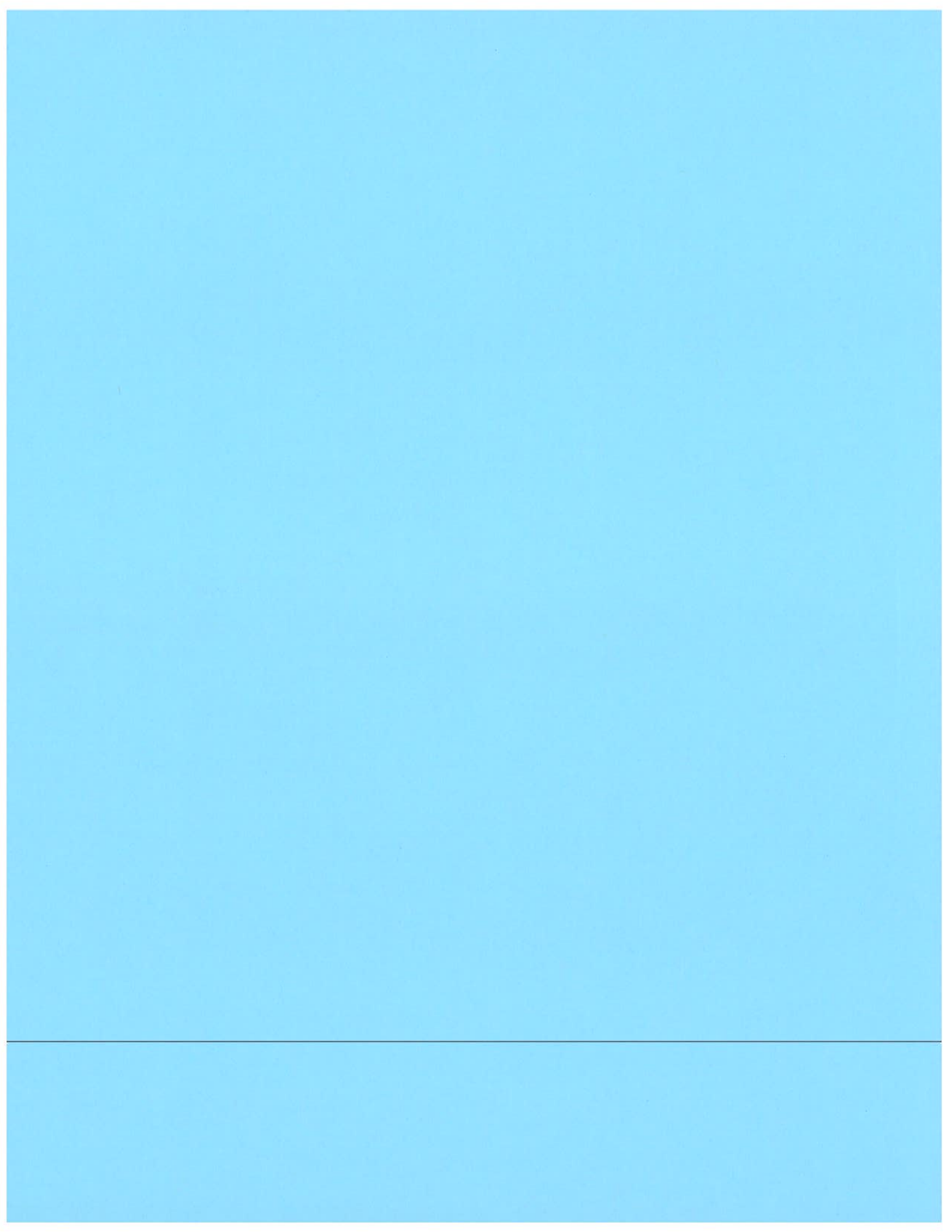
Engineering Guide

Page 1

1. Turbine gas flow (mscfh)
2. Duct burner gas flow (mscfh)
3. HRSG steam flow (kpph)
4. Ambient air temp (°F)

Page 2

1. Turbine combustion temp (°F)
2. Pilot valve position
3. Power output (KW)
4. compressor discharge pressure (PCD)
5. Turbine inlet air temp (°F)
6. N/A



SAN DIEGO GAS & ELECTRIC MONTHLY GAS QUALITY REPORT

April 2019

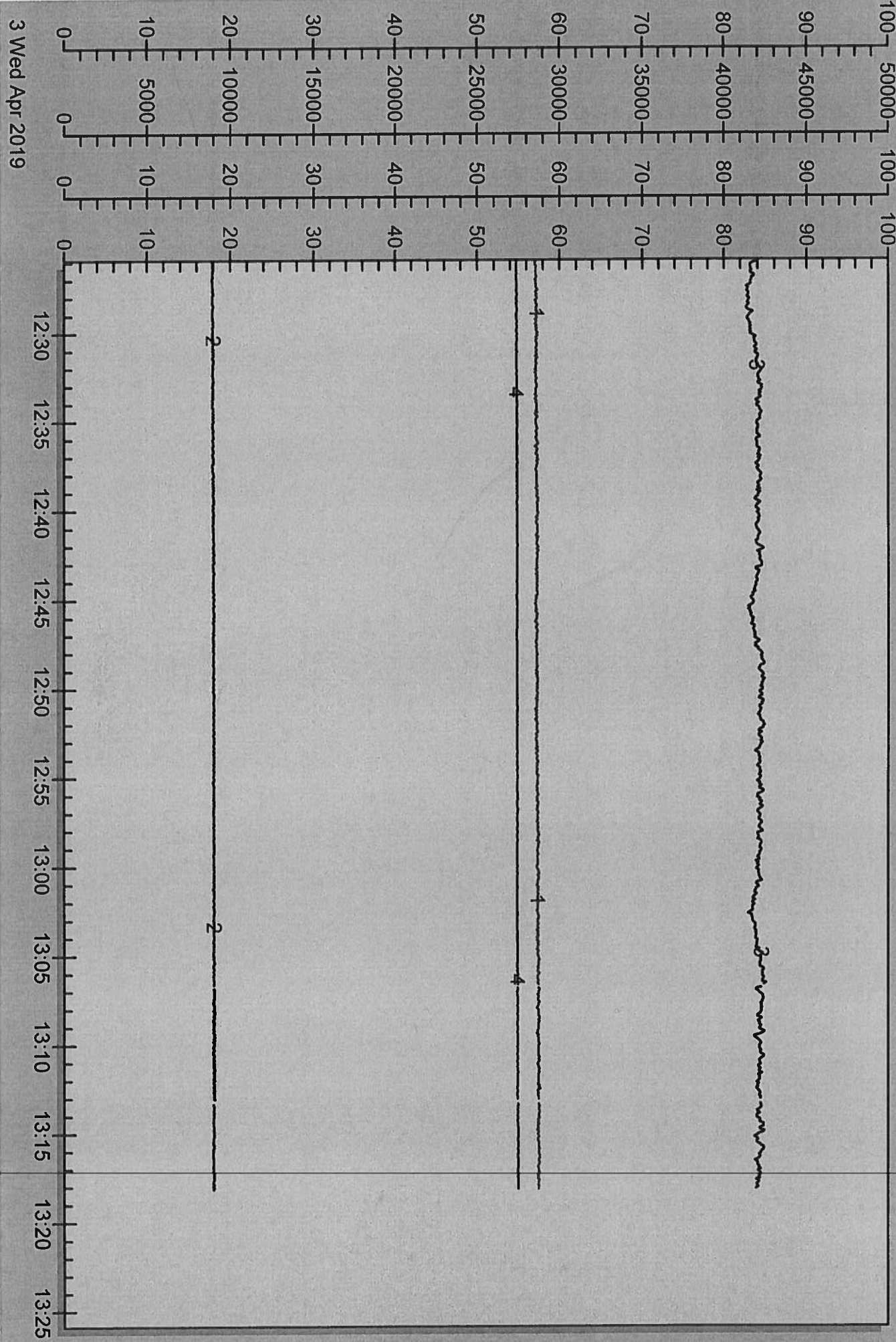
	Thermal Zone 1 Oceanside		Thermal Zone 2 Rainbow		Thermal Zone 3 Sweetwater		Thermal Zone 4 Witherby		Thermal Zone 5 Harvest Station		Thermal Zone 6 Camino Del Norte		Thermal Zone 7 Point Loma	
	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv
04/01/2019	1044	0.5954	1042	0.5943	1041	0.5905	1034	0.5873	1038	0.5887	1044	0.5956		
04/02/2019	1041	0.5934	1038	0.5907	1037	0.5878	1034	0.5872	1041	0.5890	1040	0.5930		
04/03/2019	1039	0.5910	1041	0.5927	1039	0.5877	1034	0.5872	1041	0.5889	1039	0.5877		
04/04/2019	1038	0.5919	1036	0.5912	1041	0.5893	1034	0.5872	1039	0.5892	1041	0.5912		
04/05/2019	1034	0.5908	1036	0.5900	1038	0.5889	1034	0.5872	1037	0.5879	1036	0.5891		
04/06/2019	1034	0.5896	1033	0.5878	1035	0.5867	1035	0.5872	1033	0.5850	1035	0.5870		
04/07/2019	1033	0.5850	1033	0.5877	1032	0.5843	1035	0.5872	1031	0.5837	1033	0.5856		
04/08/2019	1034	0.5856			1028	0.5816	1035	0.5872	1028	0.5820	1029	0.5860		
04/09/2019	1032	0.5855			1028	0.5818			1034	0.5852	1027	0.5859		

	Thermal Zone 1 Oceanside	Thermal Zone 2 Rainbow	Thermal Zone 3 Sweetwater	Thermal Zone 4 Witherby	Thermal Zone 5 Harvest Station	Thermal Zone 6 Camino Del Norte	Thermal Zone 7 Point Loma
Avg BTU	1037	1037	1035	1034	1036	1036	1036
Min BTU	1032	1033	1028	1034	1028	1027	1027
Max BTU	1044	1042	1041	1035	1041	1044	1044
Avg Spec Gv	0.5898	0.5906	0.5865	0.5872	0.5866	0.5890	0.5890
Min Spec Gv	0.5850	0.5877	0.5816	0.5872	0.5820	0.5856	0.5856
Max SpeGvty	0.5954	0.5943	0.5905	0.5873	0.5892	0.5956	0.5956

*** Unofficial Data, Subject to Change ***

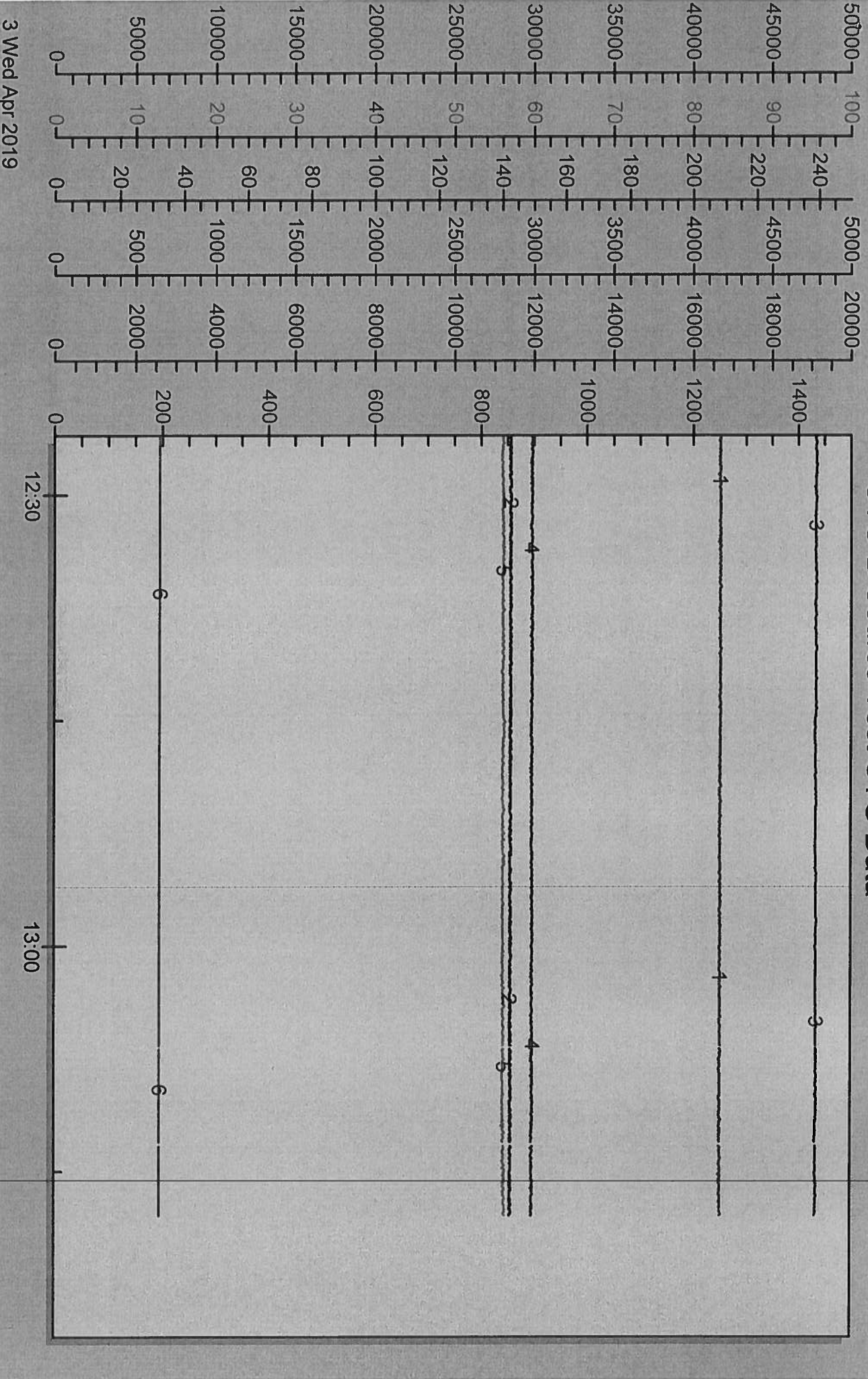
BTU data is now compiled based on the 7 thermal zones listed above as a result of CPUC approval of Advice No. 1863. Historic data for the previously designated 6 thermal zones may be accessed at http://www2.sdge.com/tariff/gas_quality_hist.pdf.

CTG-B Source Test DCS Data



3 Wed Apr 2019

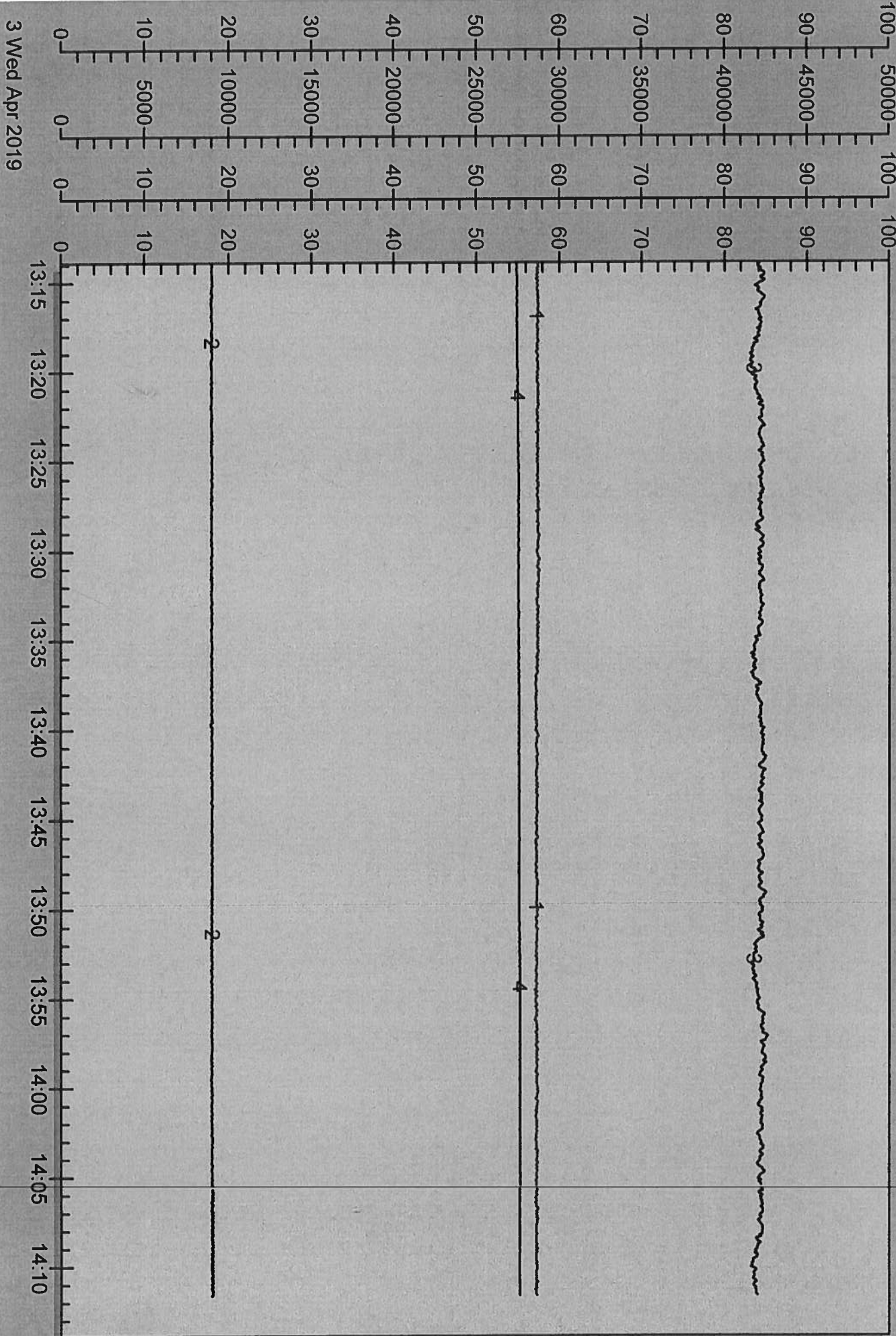
CTG-B Source Test CTG Data



3 Wed Apr 2019

Parameter Reference	Description	Value	Units	Timestamp
1 CGT-B_PLC/NS-CGT-28B CV	Control Module	1250.10		4/3/2019 12:56:03...
2 CGT-B_PLC/NT-263B_RAW CV	Control Module	11392		4/3/2019 12:56:03...
3 CGT-B_PLC/NS-CGT-199B CV	Control Module	4778.00		4/3/2019 12:56:03...
4 CGT-B_PLC/NS-CGT-75B CV	Control Module	149.58		4/3/2019 12:56:03...
5 CGT-B_PLC/NS-CGT-28B CV	Control Module	56.10		4/3/2019 12:56:03...
6 CGT-B_PLC/NT1-53B_RAW	Control Module	6507		4/3/2019 12:56:03...

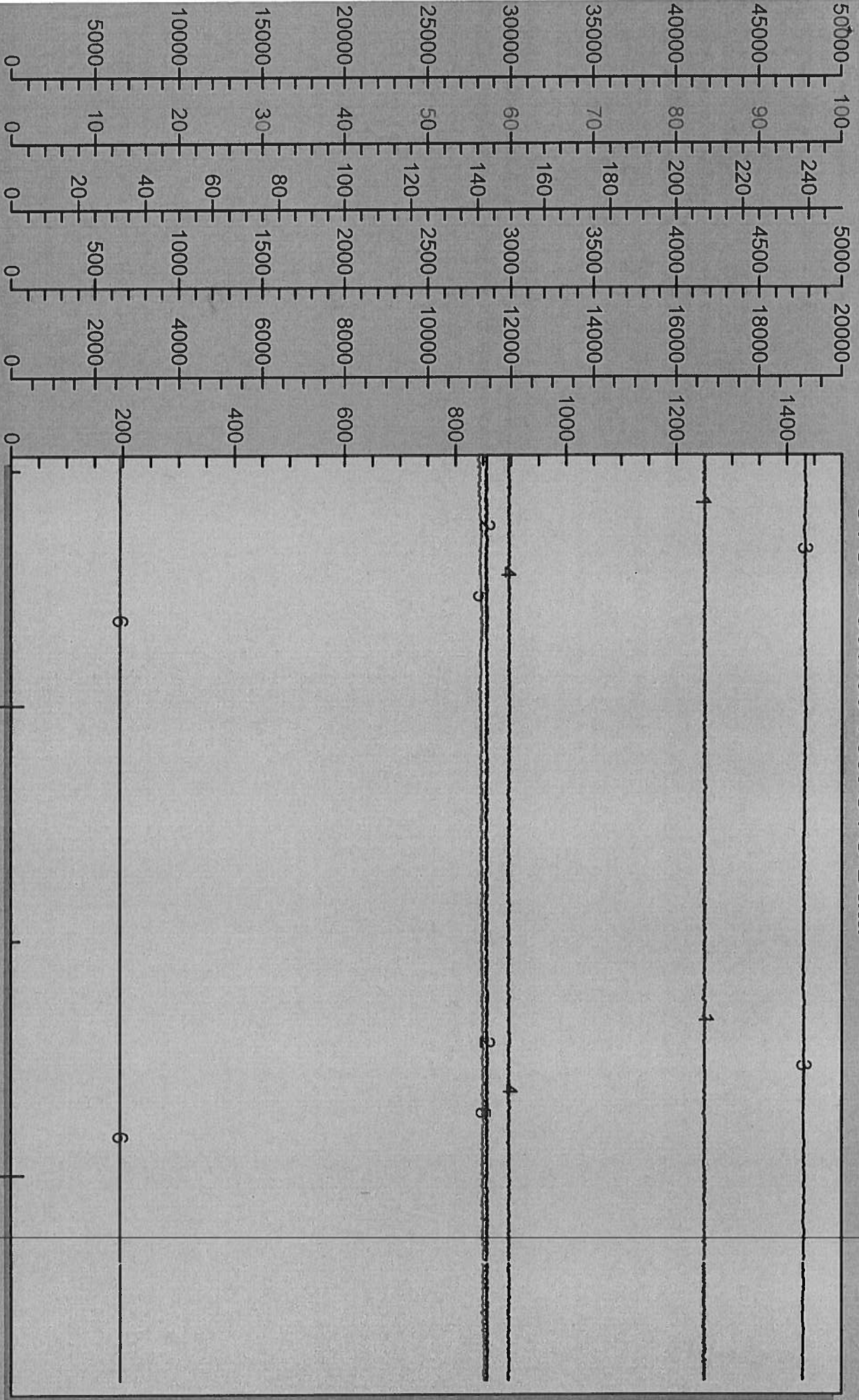
CTG-B Source Test DCS Data



3 Wed Apr 2019

Parameter Reference	Description	Value	Units	Timestamp	Y-Scale High	Y-Scale Low
1 FG_CGTB/ACT_GAS_FLOW/OUT/CTV	CGT-B Fuel Gas/NOx	57.22		4/3/2019 1:49:44 ...	100.00	0.00
2 FG_DBB/ACT_GAS_FLOW/OUT/CTV	Duct Burner-B Fuel Gas/NOx	18.05		4/3/2019 1:49:44 ...	100.00	0.00
3 HRSG-B_STM/FLO/STEAM_FLOW/...	HRSG Steam Flow	42105.77		4/3/2019 1:49:44 ...	50000.00	0.00
4 INAIR_MISC/TE-740_CGT-B/OUT/CTV	Fluid Cooler Miscellaneous	55.2	°F	4/3/2019 1:49:44 ...	100.0	0.0

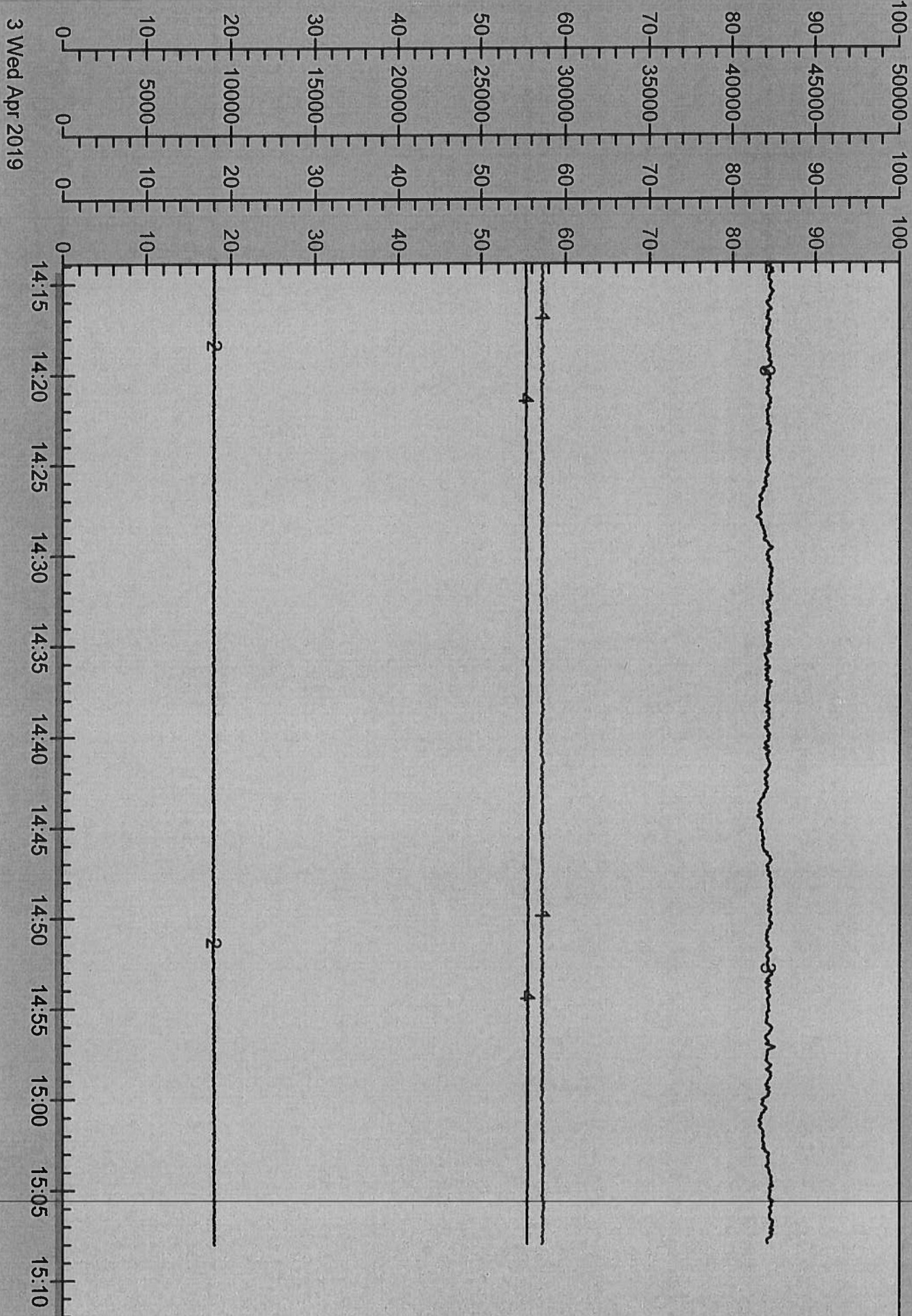
CTG-B Source Test CTG Data



3 Wed Apr 2019

Parameter Reference	Descriptor	Value	Units	Timestamp
1	CGT-B_PLCM1-2638_RAW.CV	Control Module	1250.10	4/3/2019 12:56:03...
2	CGT-B_PLCM1-2638_RAW.CV	Control Module	11392	4/3/2019 12:56:03...
3	CGT-B_PLCM1-1998.CV	Control Module	4778.00	4/3/2019 12:56:03...
4	CGT-B_PLCM1-758.CV	Control Module	149.58	4/3/2019 12:56:03...
5	CGT-B_PLCM1-288.CV	Control Module	56.10	4/3/2019 12:56:03...
6	CGT-B_PLCM1-538_RAW	Control Module	6507	4/3/2019 12:56:03...

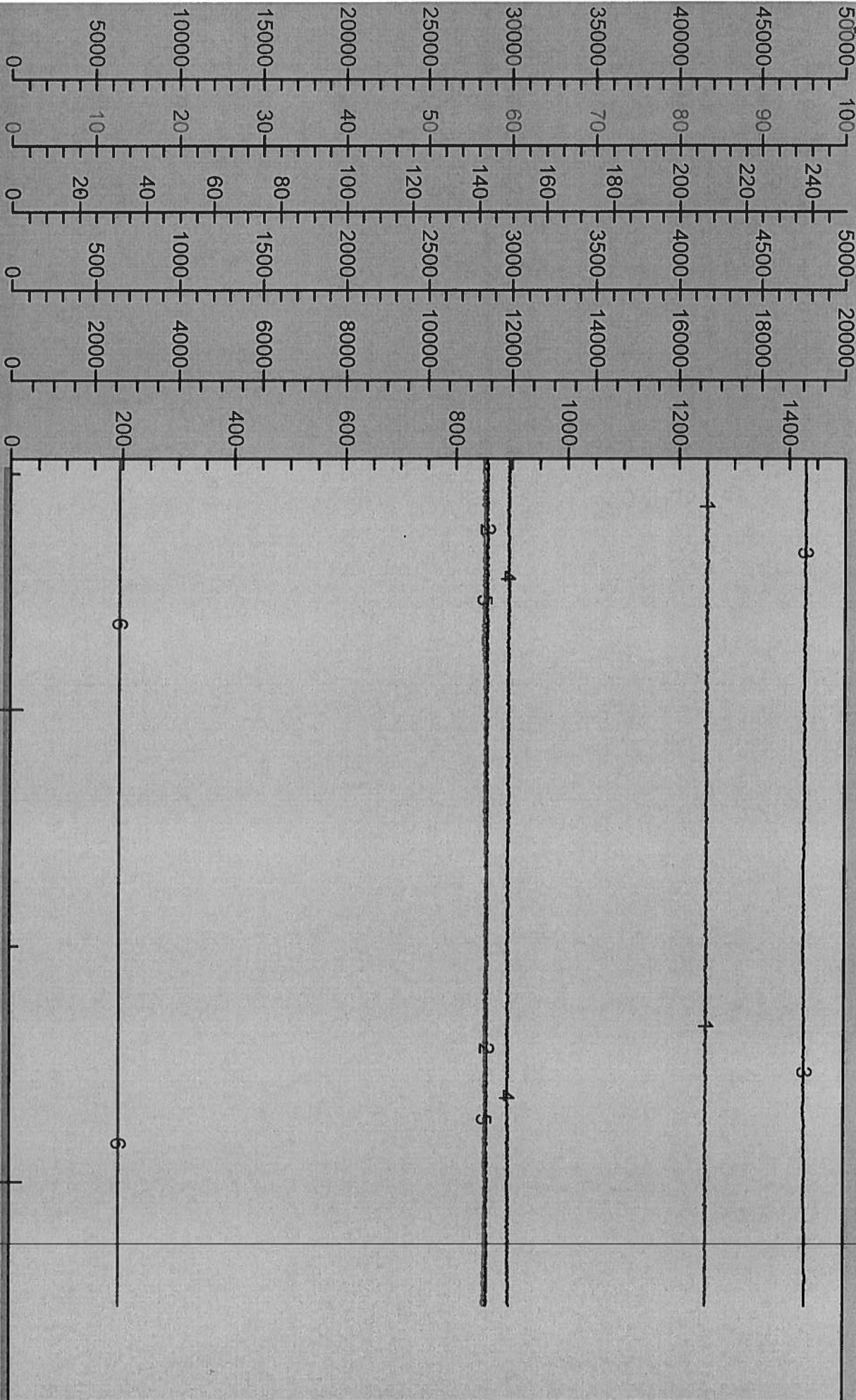
CTG-B Source Test DCS Data



3 Wed Apr 2019

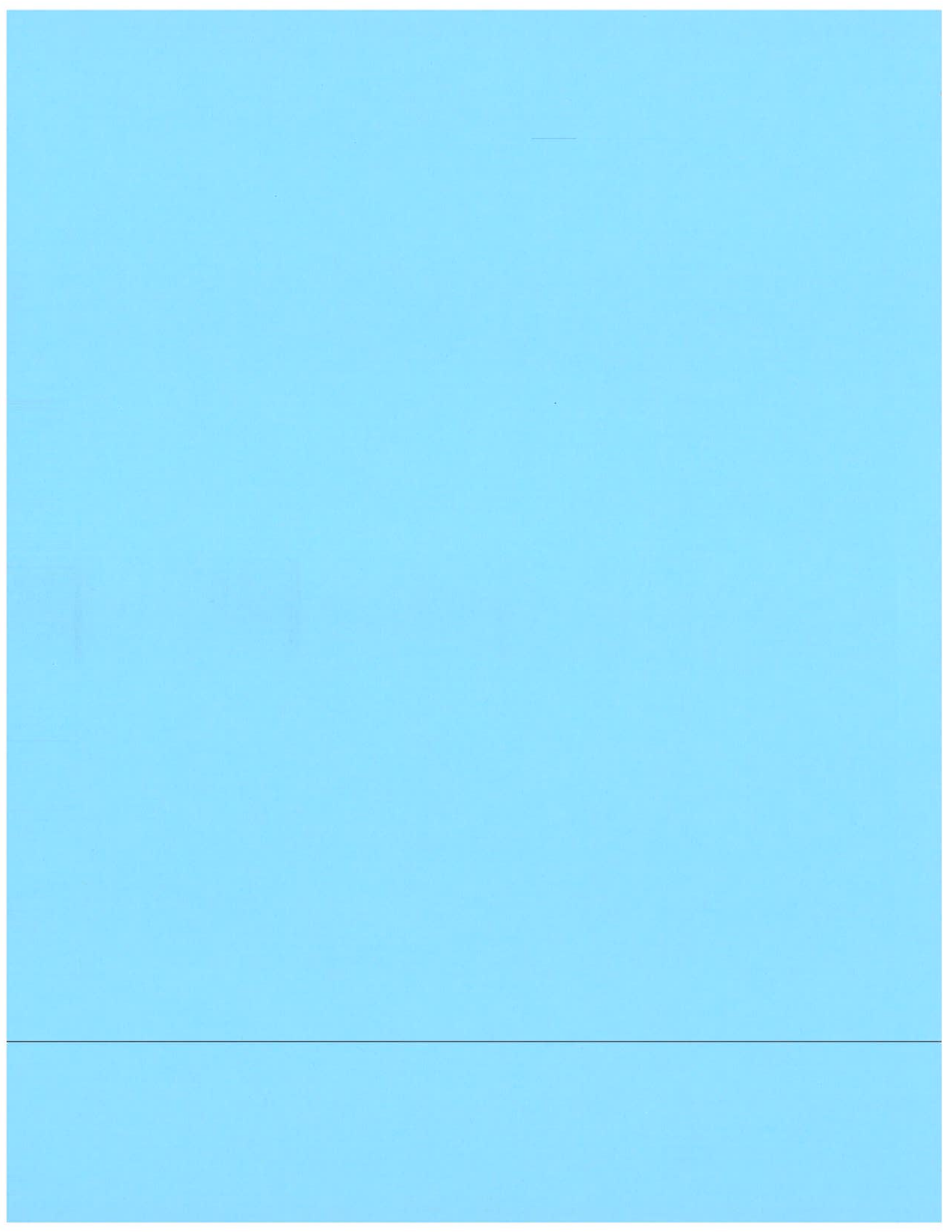
Parameter Reference	Description	Value	Units	Timestamp	Y-Scale High	Y-Scale Low
1 FG_CGTBACT_GAS_FLOW/OUTCV	CGT-B Fuel Gas/N ₂ Ox	57.22		4/3/2019 14:49:44 ...	100.00	0.00
2 FG_DBBACT_GAS_FLOW/OUTCV	Duct Burner-B Fuel Gas/N ₂ Ox	18.05		4/3/2019 14:49:44 ...	100.00	0.00
3 HRSG-B_STMFLO/STEAM_FLOW...	HRSG Steam Flow	42105.77		4/3/2019 14:49:44 ...	50000.00	0.00
4 INAIR_MISC/TE-740_CGT-B/OUTCV	Fluid Cooler Miscellaneous	55.2	°F	4/3/2019 14:49:44 ...	100.0	0.0

CTG-B Source Test CTG Data



3 Wed Apr 2019

Parameter Reference	Descriptor	Value	Units	Timestamp
1	CGT-B_PLCM/5-CGT-291B.CV	Control Module	1250.10	4/3/2019 12:56:03...
2	CGT-B_PLCM/1-263B_RAW.CV	Control Module	11392	4/3/2019 12:56:03...
3	CGT-B_PLCM/5-CGT-199B.CV	Control Module	4778.00	4/3/2019 12:56:03...
4	CGT-B_PLCM/5-CGT-758.CV	Control Module	149.58	4/3/2019 12:56:03...
5	CGT-B_PLCM/5-CGT-288.CV	Control Module	56.10	4/3/2019 12:56:03...
6	CGT-B_PLCM/11-53B_RAW	Control Module	6507	4/3/2019 12:56:03...



11:03:36	14.54	7.64	0.03	0.04	-0.34	
11:03:46	14.54	0.21	0.03	0.04	-0.34	
11:03:56	14.54	0.20	0.03	0.03	-0.34	BIAS ZEROS O2/CO -0.36
11:04:06	14.54	0.20	0.02	0.03	-0.35	
11:04:16	14.54	0.20	0.02	0.03	-0.34	
11:04:26	14.54	0.16	0.02	0.03	-0.39	
11:04:36	14.54	0.16	0.02	2.83	-0.36	
11:04:46	14.54	0.16	0.13	11.66	-0.30	
11:04:56	14.54	0.16	0.13	11.83	-0.32	
11:05:06	14.54	0.15	0.13	11.85	-0.34	
11:05:16	14.55	0.15	0.13	11.86	-0.34	
11:05:26	14.55	0.15	0.00	11.87	-0.31	
11:05:36	14.55	0.15	0.00	11.87	-0.33	BIAS O2
11:05:46	14.55	0.12	0.00	11.87	-0.32	
11:05:56	14.55	0.12	0.00	11.87	-0.37	
11:06:06	14.55	0.12	0.00	11.88	-0.36	
11:06:16	14.55	0.12	0.00	6.30	-0.34	
11:06:26	14.55	0.12	0.00	0.22	-0.23	
11:06:36	14.55	0.12	0.00	0.10	0.54	
11:06:46	14.55	0.12	0.02	0.06	1.87	
11:06:56	14.55	0.12	0.02	0.05	3.16	
11:07:06	14.55	0.11	0.02	0.04	3.92	
11:07:16	14.55	0.11	0.02	0.04	4.13	
11:07:26	14.55	0.11	0.01	0.04	4.16	BIAS CO 4.18 BIAS ZEROS NOX/NO
11:07:36	14.55	0.11	0.01	0.04	4.19	
11:07:46	14.56	0.10	0.01	0.03	4.19	
11:07:56	14.56	0.10	0.01	0.03	4.16	
11:08:06	14.56	0.10	0.02	0.03	4.19	
11:08:16	14.56	0.10	0.02	0.03	4.20	
11:08:26	14.56	0.10	0.02	0.10	4.16	
11:08:36	14.56	0.10	0.02	0.04	3.83	
11:08:46	14.56	0.10	6.28	0.02	2.77	
11:08:56	14.56	0.10	6.28	0.02	1.34	
11:09:06	14.56	8.27	6.28	0.02	0.29	
11:09:16	14.56	8.27	6.28	0.02	-0.19	
11:09:26	14.56	8.27	8.04	0.03	-0.30	
11:09:36	14.56	8.27	8.04	0.02	-0.29	
11:09:46	14.56	8.78	8.04	0.02	-0.33	
11:09:56	14.56	8.78	8.04	0.02	-0.34	
11:10:06	14.56	8.78	8.54	0.02	-0.33	
11:10:16	14.56	8.78	8.54	0.02	-0.36	
11:10:26	14.57	8.75	8.54	0.02	-0.34	
11:10:36	14.57	8.75	8.54	0.02	-0.33	
11:10:46	14.57	8.75	8.60	0.02	-0.33	
11:10:56	14.57	8.75	8.60	0.02	-0.31	
11:11:06	14.57	8.73	8.60	0.02	-0.33	
11:11:16	14.57	8.73	8.60	0.02	-0.31	
11:11:26	14.57	8.73	8.60	0.02	-0.29	
11:11:36	14.57	8.73	8.60	0.17	-0.35	
11:11:46	14.57	8.59	8.60	1.02	-0.34	BIAS NO
11:11:56	14.57	8.59	8.60	1.03	-0.30	
11:12:06	14.57	8.59	0.16	1.03	-0.30	
11:12:16	14.57	8.59	0.16	1.04	-0.28	
11:12:26	14.57	2.92	0.15	1.04	-0.32	
11:12:36	14.57	2.91	0.15	1.04	-0.35	
11:12:46	14.58	2.91	0.09	1.04	-0.35	
11:12:56	14.58	2.91	0.09	1.03	-0.33	
11:13:06	14.58	2.99	0.09	1.04	-0.34	
11:13:16	14.58	2.99	0.09	1.04	-0.35	
11:13:26	14.58	2.99	0.09	1.04	-0.35	
11:13:36	14.58	2.99	0.09	1.04	-0.35	
11:13:46	14.58	3.02	0.09	1.15	-0.34	BIAS NO2
11:13:56	14.58	3.02	0.09	1.29	-0.38	
11:14:06	14.58	3.02	0.11	1.04	-0.37	
11:14:16	14.58	3.02	0.11	1.03	-0.32	
11:14:26	14.58	3.23	0.11	1.03	-0.35	
11:14:36	14.58	3.23	0.11	1.03	-0.38	
11:14:46	14.58	3.23	0.05	1.03	-0.37	
11:14:56	14.58	3.23	0.05	1.03	-0.37	
11:15:06	14.58	3.24	0.05	1.03	-0.37	
11:15:16	14.59	3.24	0.05	1.03	-0.38	
11:15:26	14.59	3.24	0.05	1.03	-0.39	
11:15:36	14.59	3.24	0.05	1.03	-0.40	
11:15:46	14.59	3.26	0.05	0.70	-0.38	
11:15:56	14.59	3.26	0.05	0.01	-0.36	DIRECT NO2
11:16:06	14.59	3.26	6.99	0.00	-0.37	
11:16:16	14.59	3.26	6.99	0.00	-0.39	
11:16:26	14.59	8.90	6.99	0.00	-0.39	
11:16:36	14.59	0.01	8.63	0.00	-0.38	
11:16:46	14.59	0.00	8.66	0.00	-0.38	DIRECT ZEROS O2/CO -0.40
11:16:56	14.59	0.00	8.67	0.00	-0.41	
11:17:06	14.59	0.00	8.68	0.00	-0.43	
11:17:16	14.59	0.00	8.69	0.00	-0.38	
11:17:26	14.59	0.00	8.69	0.00	-0.36	
11:17:36	14.59	0.00	8.69	0.00	-0.37	DIRECT NO
11:17:46	14.59	0.00	8.68	0.01	-0.38	
11:17:56	14.59	0.00	8.68	0.00	-0.27	
11:18:06	14.60	0.00	2.49	0.00	0.52	
11:18:16	14.60	0.00	0.36	0.00	1.95	
11:18:26	14.60	0.22	0.36	0.00	3.20	
11:18:36	14.60	0.35	0.36	0.00	3.85	

11:18:46	14.60	0.35	0.11	0.00	4.08	
11:18:56	14.60	0.35	0.02	0.00	4.17	
11:19:06	14.60	0.14	0.02	0.00	4.16	DIRECT CO
11:19:16	14.60	0.02	0.02	0.00	4.17	4.16
11:19:26	14.60	0.02	0.01	0.00	4.15	
11:19:36	14.60	0.02	0.00	3.33	4.15	
11:19:46	14.60	0.08	0.00	11.81	3.95	
11:19:56	14.60	0.11	0.00	11.92	3.03	
11:20:06	14.60	0.11	0.00	11.94	1.61	
11:20:16	14.60	0.11	0.00	11.94	0.47	
11:20:26	14.60	0.05	0.00	11.95	-0.11	DIRECT O2
11:20:36	14.61	0.01	0.00	11.95	-0.32	
11:20:46	14.61	0.01	0.00	11.95	-0.36	DIRECT ZEROS
11:20:56	14.61	0.01	0.00	15.56	-0.35	NOX/NO
11:21:06	14.61	0.05	0.00	21.03	-0.35	
11:21:16	14.61	0.08	0.00	21.06	0.00	
11:21:26	14.61	0.08	0.00	21.07	0.00	
11:21:36	14.61	0.08	0.00	21.08	-0.01	SPAN O2
11:21:46	14.61	0.03	0.00	21.07	-0.02	
11:21:56	14.61	0.00	0.00	21.08	0.02	
11:22:06	14.61	0.00	0.01	21.08	0.03	REZERO
11:22:16	14.61	0.00	0.01	6.15	0.02	CO
11:22:26	14.61	0.00	1.38	0.26	0.01	0.02
11:22:36	14.61	0.00	13.88	0.04	0.01	
11:22:46	14.61	0.00	16.99	0.02	0.00	
11:22:56	14.61	0.00	17.28	0.02	0.01	
11:23:06	14.61	0.00	17.35	0.01	0.00	
11:23:16	14.61	0.00	17.37	0.01	0.02	
11:23:26	14.62	0.00	17.89	0.01	0.02	
11:23:36	14.62	0.00	17.89	0.01	0.03	RESPAN NO
11:23:46	14.62	0.00	17.90	0.01	0.03	17.91
11:23:56	14.62	0.00	17.93	0.01	0.01	
11:24:06	14.62	0.00	17.92	0.00	0.01	

Clock Time	O2	NOx CAI	NO CAI	O2 CAI	CO 481	DAS SHEET: RUN 3
	Ch.2 ppmv	Ch.6 ppmv	Ch.7 ppmv	Ch.8 ppmv	Ch.9 ppmv	
11:24:42	14.62	0.00	8.95	0.01	-0.01	
11:24:52	14.63	0.00	8.93	0.01	0.07	
11:25:02	14.63	0.00	8.93	0.01	0.02	MID NO
11:25:12	14.63	0.00	8.92	0.01	0.01	
11:25:22	14.63	0.00	8.91	0.00	0.00	
11:25:32	14.63	0.00	8.91	0.25	-0.01	
11:25:42	14.63	0.00	8.90	1.02	-0.03	
11:25:52	14.63	0.00	4.57	1.03	0.05	
11:26:02	14.63	0.00	0.22	1.03	0.03	
11:26:12	14.63	1.68	0.22	1.03	0.03	
11:26:22	14.63	3.36	0.22	1.03	0.03	
11:26:32	14.63	3.36	0.14	1.03	0.06	
11:26:42	14.63	3.36	0.06	1.03	0.06	
11:26:52	14.63	3.37	0.06	1.03	-0.06	
11:27:02	14.63	3.37	0.06	1.02	-0.03	
11:27:12	14.64	3.37	0.05	1.03	0.00	
11:27:22	14.64	3.37	0.04	1.03	-0.03	
11:27:32	14.64	3.36	0.04	1.02	0.05	
11:27:42	14.64	3.36	0.04	1.02	0.03	
11:27:52	14.64	3.36	0.05	1.03	0.02	
11:28:02	14.64	3.36	0.05	0.13	0.10	CONV CHK
11:28:12	14.64	2.04	0.05	0.00	1.12	
11:28:22	14.64	0.73	0.05	0.00	3.84	
11:28:32	14.64	0.73	0.02	0.00	6.54	
11:28:42	14.64	0.73	0.00	0.00	8.35	
11:28:52	14.64	0.37	0.00	0.00	8.95	
11:29:02	14.64	0.02	0.00	0.00	9.07	
11:29:12	14.64	0.02	0.00	0.00	9.07	
11:29:22	14.64	0.02	0.00	0.00	9.02	
11:29:32	14.64	0.02	0.00	0.00	8.90	
11:29:42	14.65	0.02	0.00	0.00	9.00	
11:29:52	14.65	0.02	0.00	0.00	9.01	
11:30:02	14.65	0.02	0.00	0.00	8.98	RESPAN CO
11:30:12	14.65	0.02	0.00	0.00	8.97	8.99
11:30:22	14.65	0.01	0.00	0.00	8.98	
11:30:32	14.65	0.01	0.01	0.00	8.65	
11:30:42	14.65	0.01	0.01	0.00	7.44	
11:30:52	14.65	0.01	0.01	0.00	6.01	
11:31:02	14.65	0.01	0.01	0.00	5.04	
11:31:12	14.65	0.01	0.00	0.00	4.67	
11:31:22	14.65	0.01	0.00	0.00	4.55	
11:31:32	14.65	0.00	0.00	0.00	4.58	MID CO
11:31:42	14.65	0.00	0.00	0.00	4.60	4.56
11:31:52	14.65	0.00	0.00	0.00	4.57	
11:32:02	14.65	0.00	0.00	0.00	4.51	
11:32:12	14.65	0.00	0.00	0.04	4.53	
11:32:22	14.66	0.01	0.00	1.86	4.46	
11:32:32	14.66	0.00	0.08	7.13	4.09	
11:32:42	14.66	0.00	0.16	0.56	2.88	
11:32:52	14.66	0.65	0.16	0.03	1.93	
11:33:02	14.66	1.29	0.16	0.02	2.33	
11:33:12	14.66	1.29	0.09	0.02	3.37	
11:33:22	14.66	1.29	0.02	0.02	4.21	
11:33:32	14.66	0.73	0.02	0.02	4.50	
11:33:42	14.66	0.16	0.02	0.01	4.57	

11:33:52	14.66	0.16	0.01	0.02	4.61	
11:34:02	14.66	0.16	0.01	0.02	4.58	
11:34:12	14.66	0.14	0.01	0.02	4.59	BIAS CO
11:34:22	14.66	0.12	0.01	0.01	4.57	4.59
11:34:32	14.66	0.12	0.01	0.02	4.58	
11:34:42	14.66	0.12	0.01	0.01	4.59	
11:34:52	14.66	0.11	0.01	0.02	4.57	
11:35:02	14.67	0.10	0.01	0.01	4.19	
11:35:12	14.67	0.10	0.01	0.01	3.03	
11:35:22	14.67	0.10	0.00	0.01	1.60	
11:35:32	14.67	0.09	0.00	0.01	0.55	
11:35:42	14.67	0.08	0.00	0.01	0.14	BIAS ZEROS
11:35:52	14.67	0.08	0.25	0.03	0.12	NOX/NO
11:36:02	14.67	0.08	0.50	0.02	0.26	
11:36:12	14.67	4.78	0.50	0.01	0.31	
11:36:22	14.67	9.47	0.50	0.01	0.26	
11:36:32	14.67	9.47	4.55	0.01	0.13	
11:36:42	14.67	9.47	8.61	0.01	0.02	
11:36:52	14.67	9.22	8.61	0.01	0.07	
11:37:02	14.67	8.96	8.61	0.01	0.07	
11:37:12	14.67	8.96	8.70	0.01	0.05	
11:37:22	14.68	8.96	8.79	0.02	0.04	BIAS ZEROS
11:37:32	14.68	8.95	8.79	0.01	0.04	CO
11:37:42	14.68	8.94	8.79	0.01	0.03	0.04
11:37:52	14.68	8.94	8.79	0.01	0.07	
11:38:02	14.68	8.94	8.80	0.01	-0.01	BIAS NO
11:38:12	14.68	8.94	8.80	0.24	0.08	
11:38:22	14.68	8.94	8.80	1.01	0.06	
11:38:32	14.68	8.94	4.53	1.02	0.06	
11:38:42	14.68	8.94	0.26	1.03	0.09	
11:38:52	14.68	5.97	0.26	1.03	0.03	
11:39:02	14.68	2.99	0.25	1.03	0.02	
11:39:12	14.68	2.99	0.17	1.03	0.04	
11:39:22	14.68	2.99	0.08	1.03	-0.01	
11:39:32	14.69	3.05	0.08	1.03	0.06	
11:39:42	14.69	3.12	0.08	1.03	0.05	
11:39:52	14.69	3.12	0.08	1.03	0.02	
11:40:02	14.69	3.12	0.08	1.03	0.01	
11:40:12	14.69	3.14	0.08	1.03	0.05	
11:40:22	14.69	3.16	0.08	1.03	0.02	
11:40:32	14.69	3.16	0.07	1.03	0.04	
11:40:42	14.69	3.16	0.07	1.03	0.06	BIAS NO2
11:40:52	14.69	3.16	0.07	1.03	0.02	
11:41:02	14.69	3.17	0.07	1.05	0.03	
11:41:12	14.69	3.17	0.13	1.23	0.06	
11:41:22	14.69	3.17	0.20	1.08	0.06	

12:10:02	4.13	13.18	10.15	14.85	1.39	
12:10:12	6.58	13.14	10.15	14.84	1.37	
12:10:22	19.89	13.11	10.15	14.85	1.41	SGD CHECK
12:10:32	21.16	13.11	10.12	14.84	1.38	
12:10:42	21.21	13.11	10.09	14.83	1.38	
12:10:52	21.27	13.14	10.09	14.83	1.35	
12:11:02	21.37	13.18	10.09	14.83	1.38	100
12:11:12	21.38	13.18	10.11	14.84	1.42	
12:11:22	21.38	13.18	10.12	14.85	1.36	
12:11:32	13.26	13.09	10.12	14.86	1.36	
12:11:42	2.44	13.00	10.12	14.88	1.35	
12:11:52	2.13	13.00	10.02	14.89	1.31	
12:12:02	2.11	13.00	9.92	14.91	1.37	
12:12:12	2.11	13.00	9.92	14.92	1.32	
12:12:22	2.10	12.99	9.92	14.93	1.31	10
12:12:32	2.10	12.99	9.81	14.95	1.31	
12:12:42	3.63	12.99	9.70	14.97	1.25	
12:12:52	4.16	12.81	9.70	14.94	1.28	
12:13:02	4.16	12.63	9.70	14.92	1.28	
12:13:12	4.16	12.63	9.69	14.92	1.29	
12:13:22	4.16	12.63	9.69	14.91	1.31	20
12:13:32	7.10	12.77	9.69	14.91	1.30	
12:13:42	8.36	12.91	9.69	14.88	1.27	
12:13:52	8.39	12.91	9.79	14.76	1.32	
12:14:02	8.39	12.91	9.90	14.59	1.33	40
12:14:12	8.39	13.35	9.90	14.47	1.47	
12:14:22	8.39	13.80	9.90	14.60	1.67	
12:14:32	9.26	13.80	10.33	14.62	1.87	
12:14:42	10.49	13.80	10.75	14.56	1.79	
12:14:52	10.54	13.90	10.75	14.47	1.77	
12:15:02	10.54	14.00	10.75	14.42	1.74	50
12:15:12	10.54	14.00	10.91	14.39	1.94	
12:15:22	10.54	14.00	11.07	14.35	2.13	
12:15:32	10.54	14.25	11.07	14.30	2.35	
12:15:42	12.41	14.49	11.07	14.24	2.53	
12:15:52	12.66	14.49	11.15	14.20	2.74	
12:16:02	12.66	14.49	11.23	14.14	2.97	
12:16:12	12.66	14.78	11.23	14.10	3.33	60
12:16:22	12.66	15.07	11.23	14.04	3.79	
12:16:32	12.51	15.07	11.35	14.03	4.14	
12:16:42	12.35	15.07	11.47	13.98	4.37	
12:16:52	12.15	15.37	11.47	13.93	4.60	
12:17:02	12.13	15.67	11.47	13.90	4.85	
12:17:12	12.13	15.67	11.62	13.87	5.01	CHALLENGE
12:17:22	12.13	15.67	11.76	13.85	5.20	
12:17:32	12.13	15.85	11.76	13.84	5.24	
12:17:42	12.41	16.02	11.76	13.80	5.17	
12:17:52	20.17	16.02	11.87	13.79	5.11	
12:18:02	21.34	16.02	11.97	13.79	5.07	
12:18:12	21.38	16.15	11.97	13.76	5.11	
12:18:22	21.39	16.29	11.97	13.76	5.17	100
12:18:32	21.39	16.29	12.03	13.75	5.17	
12:18:42	21.39	16.29	12.09	13.75	5.17	
12:18:52	17.69	16.32	12.09	13.74	5.30	
12:19:02	12.86	16.36	12.09	13.73	5.32	
12:19:12	12.69	16.36	12.09	13.71	5.33	
12:19:22	12.68	16.36	12.08	13.71	5.29	60
12:19:32	12.68	16.43	12.08	13.71	5.24	
12:19:42	12.68	16.49	12.08	13.70	5.13	
12:19:52	11.43	16.49	12.10	13.70	4.97	
12:20:02	10.58	16.49	12.12	13.69	4.96	
12:20:12	10.56	16.47	12.12	13.69	4.96	50.00
12:20:22	10.56	16.45	12.12	13.70	5.08	
12:20:32	10.56	16.45	12.11	13.69	5.14	
12:20:42	10.56	16.45	12.09	13.71	5.28	
12:20:52	9.45	16.51	12.09	13.67	5.29	
12:21:02	8.44	16.57	12.09	13.71	5.26	
12:21:12	8.41	16.57	12.10	13.70	5.26	
12:21:22	8.41	16.57	12.11	13.70	5.26	
12:21:32	8.41	16.56	12.11	13.71	5.30	40
12:21:42	8.41	16.55	12.11	13.71	5.26	
12:21:52	5.40	16.55	12.15	13.71	5.25	
12:22:02	4.20	16.55	12.19	13.71	5.21	
12:22:12	4.17	16.59	12.19	13.72	5.15	
12:22:22	4.17	16.63	12.19	13.69	5.12	
12:22:32	4.17	16.63	12.23	13.70	5.11	20
12:22:42	4.17	16.63	12.26	13.71	5.10	
12:22:52	2.66	16.65	12.26	13.71	5.06	
12:23:02	2.10	16.66	12.26	13.71	5.17	
12:23:12	2.10	16.66	12.21	13.71	5.21	
12:23:22	2.09	16.66	12.16	13.71	5.26	
12:23:32	2.09	16.67	12.16	13.70	5.29	
12:23:42	2.09	16.67	12.16	13.70	5.27	10
12:23:52	10.34	16.67	12.25	13.71	5.22	
12:24:02	12.06	16.67	12.35	13.72	5.11	START R1
12:24:12	12.12	16.65	12.35	13.72	5.05	GT B DB ON
12:24:22	12.13	16.63	12.35	13.71	5.06	
12:24:32	12.13	16.63	12.38	13.71	5.09	CHALLENGE
12:24:42	12.13	16.63	12.41	13.72	5.10	

12:24:52	11.12	16.61	12.41	13.72	5.09	
12:25:02	19.46	16.59	12.41	13.70	5.14	
12:25:12	21.30	16.59	12.36	13.69	5.19	
12:25:22	21.37	16.59	12.31	13.71	5.11	
12:25:32	21.38	16.63	12.31	13.69	5.11	
12:25:42	21.38	16.66	12.31	13.72	5.11	100
12:25:52	21.39	16.66	12.30	13.71	5.18	
12:26:02	16.23	16.66	12.29	13.72	5.11	
12:26:12	12.77	16.58	12.29	13.70	4.99	
12:26:22	12.68	16.51	12.29	13.70	4.95	
		16.62	12.34	13.71	5.09	
12:26:32	12.68	16.51	12.28	13.74	4.94	60
12:26:42	12.67	16.51	12.27	13.75	4.87	
12:26:52	12.67	16.44	12.27	13.73	4.92	
12:27:02	11.42	16.37	12.27	13.74	4.99	
12:27:12	10.57	16.37	12.09	13.74	4.96	
12:27:22	10.56	16.37	11.90	13.74	4.91	
12:27:32	10.55	16.46	11.90	13.74	4.84	50
12:27:42	10.55	16.55	11.90	13.72	4.88	
12:27:52	10.55	16.55	11.89	13.72	4.81	
12:28:02	9.23	16.55	11.88	13.74	4.81	
12:28:12	8.43	16.56	11.88	13.75	4.87	
12:28:22	8.40	16.57	11.88	13.74	4.89	
12:28:32	8.40	16.57	11.90	13.74	4.96	40
12:28:42	8.40	16.57	11.92	13.75	4.95	
12:28:52	8.40	16.53	11.92	13.76	4.98	
		16.50	12.01	13.74	4.91	
12:29:02	5.30	16.50	11.92	13.76	4.93	
12:29:12	4.20	16.50	11.79	13.75	4.86	
12:29:22	4.17	16.50	11.65	13.75	4.84	
12:29:32	4.17	16.51	11.65	13.76	4.77	
12:29:42	4.16	16.52	11.65	13.75	4.62	20
12:29:52	4.16	16.52	11.76	13.75	4.56	
12:30:02	2.94	16.52	11.86	13.77	4.50	
12:30:12	2.10	16.42	11.86	13.75	4.57	
12:30:22	2.09	16.32	11.86	13.76	4.61	10
12:30:32	2.09	16.32	11.90	13.76	4.63	
12:30:42	2.08	16.32	11.93	13.75	4.70	
12:30:52	3.76	16.40	11.93	13.75	4.66	
12:31:02	11.48	16.48	11.93	13.76	4.73	
12:31:12	12.10	16.48	11.97	13.69	4.79	
12:31:22	12.12	16.48	12.02	13.42	4.76	CHALLENGE
		16.45	11.85	13.73	4.70	
12:31:32	12.12	17.07	12.02	13.44	4.65	
12:31:42	12.12	17.66	12.02	13.44	4.60	
12:31:52	12.12	17.66	12.25	13.46	4.50	
12:32:02	12.08	17.66	12.49	13.52	4.46	
12:32:12	12.07	17.52	12.49	13.52	4.41	
12:32:22	12.07	17.39	12.49	13.50	4.40	
12:32:32	12.07	17.39	12.60	13.52	4.38	
12:32:42	12.07	17.39	12.72	13.52	4.37	
12:32:52	12.07	17.41	12.72	13.54	4.42	
12:33:02	12.07	17.42	12.72	13.50	4.46	
12:33:12	12.07	17.42	12.86	13.53	4.46	
12:33:22	12.07	17.42	13.01	13.52	4.36	
12:33:32	12.07	17.38	13.01	13.53	4.42	
12:33:42	12.07	17.33	13.01	13.42	4.39	
12:33:52	12.06	17.33	13.18	13.20	4.51	
		17.43	12.64	13.48	4.45	
12:34:02	12.07	17.33	13.35	13.21	4.64	
12:34:12	12.06	17.86	13.35	13.22	4.88	
12:34:22	12.06	18.40	13.35	13.21	5.07	
12:34:32	12.06	18.40	13.52	13.21	5.28	
12:34:42	12.06	18.40	13.70	13.20	5.28	
12:34:52	12.06	18.38	13.70	13.21	5.31	
12:35:02	12.06	18.37	13.70	13.21	5.35	
12:35:12	12.06	18.37	13.75	13.20	5.34	
12:35:22	12.06	18.37	13.81	13.18	5.21	
12:35:32	12.06	18.46	13.81	13.21	5.17	
12:35:42	12.06	18.55	13.81	13.22	5.27	
12:35:52	12.06	18.55	13.93	13.20	5.37	
12:36:02	12.06	18.55	14.05	13.22	5.53	
12:36:12	12.06	18.47	14.05	13.30	5.64	
12:36:22	12.06	18.39	14.05	13.18	5.61	
		18.32	13.73	13.21	5.26	
12:36:32	12.06	18.39	14.17	13.13	5.63	
12:36:42	12.06	18.39	14.28	13.19	5.45	
12:36:52	12.06	18.51	14.28	13.21	5.41	
12:37:02	12.06	18.62	14.28	13.22	5.44	
12:37:12	12.06	18.62	14.16	13.23	5.57	
12:37:22	12.06	18.62	14.05	13.21	5.74	
12:37:32	12.06	18.57	14.05	13.22	5.74	
12:37:42	12.06	18.51	14.05	13.23	5.71	
12:37:52	12.06	18.51	14.12	13.21	5.75	
12:38:02	12.06	18.51	14.20	13.22	5.80	
12:38:12	12.06	18.45	14.20	13.23	5.69	
12:38:22	12.06	18.38	14.20	13.21	5.57	
12:38:32	12.06	18.38	14.29	13.20	5.45	
12:38:42	12.06	18.38	14.37	13.21	5.33	
12:38:52	12.06	18.45	14.37	13.22	5.39	
		18.49	14.20	13.21	5.58	
12:39:02	12.06	18.52	14.37	13.23	5.70	

12:39:12	12.06	18.52	14.07	18.38	5.69
12:39:22	12.06	18.52	13.77	15.76	5.12
12:39:32	12.06	16.15	13.77	13.67	3.93
12:39:42	12.06	13.77	13.77	13.70	3.45
12:39:52	12.06	13.77	12.90	13.69	3.58
12:40:02	12.06	13.77	12.03	13.70	3.93
12:40:12	12.06	15.13	12.03	13.69	4.16
12:40:22	12.06	16.50	12.03	13.69	4.17
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12:40:42	12.06	16.50	13.27	13.69	4.34
12:40:52	12.06	16.73	13.27	13.70	4.35
12:41:02	12.06	16.96	13.27	13.71	4.33
12:41:12	12.06	16.96	13.59	13.70	4.35
12:41:22	12.06	16.96	13.91	13.70	4.33
12:41:32	12.06	16.79	13.91	13.69	4.38
12:41:42	12.06	16.61	13.91	13.68	4.39
12:41:52	12.06	16.61	14.08	13.68	4.31
12:42:02	12.06	16.61	14.24	13.67	4.23
12:42:12	12.06	16.71	14.24	13.69	4.13
12:42:22	12.06	16.80	14.24	13.67	4.10
12:42:32	12.06	16.80	14.19	13.67	4.10
12:42:42	12.06	16.80	14.13	13.70	4.08
12:42:52	12.06	16.75	14.13	13.70	4.07
12:43:02	12.05	16.71	14.13	13.69	4.21
12:43:12	12.05	16.71	14.01	13.66	4.24
12:43:22	12.06	16.71	13.89	13.69	4.20
		16.76	13.99	13.69	4.23
12:43:32	12.06	16.71	13.89	13.67	4.08
12:43:42	12.05	16.72	13.89	13.67	4.09
12:43:52	12.05	16.72	13.70	13.72	4.07
12:44:02	12.05	16.72	13.51	13.69	4.15
12:44:12	12.05	16.63	13.51	13.70	4.16
12:44:22	12.05	16.54	13.51	13.67	4.12
12:44:32	12.05	16.54	13.48	13.70	4.12
12:44:42	12.05	16.54	13.45	13.69	4.14
12:44:52	12.05	16.60	13.45	13.69	4.24
12:45:02	12.05	16.65	13.45	13.69	4.18
12:45:12	12.05	16.65	13.35	13.67	4.22
12:45:22	12.05	16.65	13.26	13.68	4.31
12:45:32	12.05	16.71	13.26	13.68	4.29
12:45:42	12.05	16.76	13.26	13.67	4.30
12:45:52	12.05	16.76	13.24	13.62	4.25
		16.66	13.48	13.68	4.18
12:46:02	12.05	16.76	13.22	13.64	4.21
12:46:12	12.05	16.77	13.22	13.64	4.18
12:46:22	12.05	16.79	13.22	13.65	4.12
12:46:32	12.05	16.79	13.05	13.66	4.08
12:46:42	12.05	16.79	12.88	13.64	4.03
12:46:52	12.05	16.81	12.88	13.65	4.01
12:47:02	12.05	16.83	12.88	13.66	3.88
12:47:12	12.05	16.83	12.93	13.65	3.76
12:47:22	12.05	16.83	12.98	13.65	3.81
12:47:32	12.05	16.85	12.98	13.66	3.93
12:47:42	12.05	16.87	12.98	13.64	3.93
12:47:52	12.05	16.87	13.09	13.65	3.98
12:48:02	12.05	16.87	13.20	13.66	3.99
12:48:12	12.05	16.89	13.20	13.64	3.95
12:48:22	12.05	16.90	13.20	13.75	3.84
		16.83	13.06	13.66	3.98
12:48:32	12.05	16.90	12.86	13.85	4.02
12:48:42	12.05	16.90	12.51	13.83	4.51
12:48:52	12.05	16.37	12.51	13.84	5.15
12:49:02	12.05	15.84	12.51	13.83	5.68
12:49:12	12.05	15.84	11.73	13.85	5.86
12:49:22	12.05	15.84	10.95	13.85	5.89
12:49:32	12.05	15.95	10.95	13.84	5.85
12:49:42	12.05	16.05	10.95	13.85	5.86
12:49:52	12.05	16.05	11.03	13.85	5.75
12:50:02	12.05	16.05	11.11	13.82	5.74
12:50:12	12.05	16.09	11.11	13.84	5.65
12:50:22	12.04	16.12	11.11	13.81	5.79
12:50:32	12.04	16.12	11.16	13.82	5.88
12:50:42	12.04	16.12	11.21	13.80	5.82
12:50:52	12.04	16.26	11.21	13.76	5.88
		16.17	11.53	13.83	5.56
12:51:02	12.04	16.41	11.21	13.78	5.90
12:51:12	12.04	16.41	11.18	13.76	5.90
12:51:22	12.04	16.41	11.15	13.79	6.04
12:51:32	12.04	16.41	11.15	13.78	5.98
12:51:42	12.04	16.42	11.15	13.78	5.85
12:51:52	12.04	16.42	11.17	13.77	5.85
12:52:02	12.04	16.42	11.19	13.78	5.89
12:52:12	12.04	16.42	11.19	13.78	6.05
12:52:22	12.04	16.42	11.19	13.77	6.07
12:52:32	12.04	16.42	11.25	13.77	6.30
12:52:42	12.04	16.42	11.32	13.77	6.30
12:52:52	12.04	16.45	11.32	13.79	6.28
12:53:02	12.04	16.47	11.32	13.79	6.12
12:53:12	12.04	16.47	11.35	13.81	6.04
12:53:22	12.04	16.47	11.38	13.76	5.98
		16.43	11.23	13.78	6.04

12:53:32	12.04	16.42	11.38	13.77	5.95
12:53:42	12.04	16.37	11.38	13.74	5.92
12:53:52	12.04	16.37	11.35	13.76	5.89
12:54:02	12.04	16.37	11.32	13.71	5.94
12:54:12	12.04	16.45	11.32	13.73	5.94
12:54:22	12.04	16.53	11.32	13.73	6.07
12:54:32	12.04	16.53	11.34	13.73	6.11
12:54:50	12.04	16.54	11.37	13.71	6.05
12:55:00	12.04	16.56	11.37	13.76	6.10
12:55:10	12.04	16.56	11.40	13.74	6.13
12:55:20	12.04	16.56	11.50	13.77	6.02
12:55:30	12.04	16.51	11.50	13.77	5.99
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12:55:50	12.04	16.35	11.53	13.71	6.01
12:56:00	12.04	16.35	11.61	13.73	5.97
		16.45	11.41	13.74	6.00
12:56:10	12.04	16.40	11.61	13.71	5.86
12:56:20	12.04	16.55	11.61	13.72	5.98
12:56:30	12.04	16.55	11.61	13.70	5.86
12:56:40	12.04	16.55	11.61	13.69	6.03
12:56:50	12.04	16.51	11.61	13.66	5.98
12:57:00	12.04	16.38	11.61	8.88	5.82
12:57:10	12.04	16.38	9.86	1.74	5.26
12:57:20	12.03	16.38	4.60	0.11	3.72
12:57:30	12.03	13.44	4.60	0.05	1.97
12:57:40	12.03	4.60	4.60	0.04	0.65
12:57:50	12.03	4.60	3.46	0.03	0.19
12:58:00	12.03	4.60	0.03	0.03	-0.09
12:58:10	12.03	3.51	0.03	0.03	-0.01
12:58:20	12.03	0.23	0.03	0.02	-0.06
12:58:30	12.03	0.23	0.02	0.02	-0.04
12:58:40	12.03	0.23	0.01	1.33	-0.05
12:58:50	12.03	0.22	0.01	11.48	-0.05
12:59:00	12.03	0.20	0.01	11.80	-0.02
12:59:10	12.03	0.20	0.01	11.82	-0.05
12:59:20	12.03	0.20	0.01	11.84	-0.02
12:59:30	12.03	0.20	0.01	11.84	-0.03
12:59:40	12.03	0.17	0.01	11.84	-0.05
12:59:50	12.03	0.17	0.01	11.85	-0.04
13:00:00	12.03	0.17	0.00	11.85	-0.06
13:00:10	12.03	0.17	0.00	11.85	-0.11
13:00:20	12.03	0.15	0.00	5.46	-0.04
13:00:30	12.03	0.15	0.01	0.36	-0.03
13:00:40	12.03	0.15	0.02	0.10	0.57
13:00:50	12.03	0.15	0.02	0.05	2.03
13:01:00	12.03	0.16	0.02	0.04	3.35
13:01:10	12.03	0.16	0.02	0.04	4.14
13:01:20	12.03	0.16	0.01	0.03	4.44
13:01:30	12.03	0.15	0.01	0.03	4.49
13:01:40	12.03	0.14	0.01	0.03	4.46
13:01:50	12.03	0.14	0.02	0.02	4.47
13:02:00	12.03	0.14	0.03	0.02	4.49
13:02:10	12.03	0.13	0.03	0.02	4.36
13:02:20	12.03	0.11	0.03	0.02	4.52
13:02:30	12.03	0.11	0.20	0.12	4.44
13:02:40	12.03	0.11	0.72	0.03	4.05
13:02:50	12.03	2.28	0.72	0.02	2.63
13:03:00	12.03	8.80	0.72	0.01	1.23
13:03:10	12.03	8.80	2.43	0.01	0.37
13:03:20	12.03	8.80	7.57	0.01	0.03
13:03:30	12.02	8.83	7.57	0.01	0.00
13:03:40	12.02	8.92	7.57	0.01	-0.05
13:03:50	12.02	8.92	7.84	0.01	-0.10
13:04:00	12.02	8.92	8.67	0.02	-0.02
13:04:10	12.02	8.91	8.67	0.01	-0.02
13:04:20	12.02	8.87	8.67	0.01	-0.01
13:04:30	12.02	8.87	8.67	0.02	-0.05
13:04:40	12.02	8.87	8.68	0.01	0.00
13:04:50	12.02	8.87	8.68	0.01	-0.12
13:05:00	12.02	8.87	8.68	0.87	-0.02
13:05:10	12.02	8.87	6.63	1.02	0.00
13:05:20	12.02	8.87	0.49	1.02	-0.03
13:05:30	12.02	7.39	0.49	1.02	-0.04
13:05:40	12.02	2.95	0.49	1.02	-0.06
13:05:50	12.02	2.95	0.39	1.02	-0.02
13:06:00	12.02	2.95	0.08	1.03	-0.05
13:06:10	12.02	2.97	0.08	1.03	-0.03
13:06:20	12.02	3.05	0.08	1.03	-0.03
13:06:30	12.02	3.05	0.08	1.03	-0.04
13:06:40	12.02	3.05	0.08	1.03	-0.04
13:06:50	12.02	3.06	0.08	1.03	-0.06
13:07:00	12.02	3.08	0.08	1.34	-0.04
13:07:10	12.02	3.08	0.09	1.08	-0.05
13:07:20	12.02	3.08	0.15	1.03	-0.04
13:07:30	12.02	3.13	0.15	1.03	0.00
13:07:40	12.02	3.27	0.15	1.03	0.03
13:07:50	12.02	3.27	0.12	1.03	0.15
13:08:00	12.02	3.27	0.03	1.03	0.11
13:08:10	12.02	3.27	0.03	1.03	0.10
13:08:20	12.02	3.28	0.03	1.02	0.10
13:08:30	12.02	3.28	0.07	0.63	0.09
13:08:40	12.02	3.28	0.17	0.01	0.09

BIAS ZEROS
O2/CO
-0.04

BIAS O2

BIAS CO
4.45
BIAS ZEROS
NOX/NO

BIAS NO

BIAS NO2

DIRECT NO2

13:08:50	12.02	4.86	0.17	0.00	0.06
13:09:00	12.02	9.59	0.18	0.00	0.05
13:09:10	12.02	9.59	2.27	-0.01	0.09
13:09:20	12.02	9.59	8.57	-0.01	0.09
13:09:30	12.02	9.42	8.58	0.00	0.09
13:09:40	12.02	8.90	8.58	-0.01	0.09
13:09:50	12.02	8.90	8.62	-0.01	0.10
13:10:00	12.02	8.90	8.75	0.00	0.07
13:10:10	12.02	8.89	8.75	0.00	0.13
13:10:20	12.02	8.87	8.75	-0.01	0.08
13:10:30	12.02	8.87	8.75	0.00	0.12
13:10:40	12.02	8.87	8.77	0.00	0.11
13:10:50	12.02	8.84	8.77	-0.01	0.07
13:11:00	12.02	8.77	8.77	-0.01	0.13
13:11:10	12.02	8.77	6.58	-0.01	0.15
13:11:20	12.02	8.77	0.02	-0.01	0.10
13:11:30	12.02	6.58	0.02	-0.01	0.09
13:11:40	12.01	0.03	0.02	-0.01	0.96
13:11:50	12.01	0.03	0.01	-0.01	2.42
13:12:00	12.02	0.03	0.01	-0.01	3.57
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13:12:30	12.01	0.01	0.01	-0.01	4.00
13:12:40	12.01	0.01	-0.01	0.01	3.99
13:12:50	12.01	0.42	-0.01	9.90	4.12
13:13:00	12.01	1.67	-0.01	13.61	4.14
13:13:10	12.01	1.67	3.64	13.62	4.05
13:13:20	12.01	1.67	14.58	13.62	3.97
13:13:30	12.01	5.53	14.58	13.61	4.03
13:13:40	12.01	17.11	14.58	13.61	4.18
13:13:50	12.01	17.11	14.49	13.60	4.27
13:14:00	12.01	17.12	14.21	13.61	4.12
13:14:10	12.01	17.16	14.21	13.58	4.11
13:14:20	12.01	17.31	14.21	13.61	3.97
13:14:30	12.01	17.31	14.23	13.60	3.97
13:14:40	12.01	17.31	14.27	13.62	3.99
13:14:50	12.01	17.27	14.27	13.61	4.05
13:15:00	12.01	17.14	14.27	13.60	4.08
13:15:10	12.01	17.14	14.25	13.61	4.13
13:15:20	12.01	17.14	14.19	13.61	4.19
13:15:30	12.01	17.11	14.19	13.61	4.18
13:15:40	12.01	17.00	14.19	13.62	4.21
13:15:50	12.01	17.00	14.11	13.60	4.20
13:16:00	12.01	17.00	13.87	13.60	4.27
13:16:10	12.01	17.02	13.87	13.60	4.28
13:16:20	12.01	17.08	13.87	13.63	4.22
13:16:30	12.01	17.08	13.87	13.59	4.16
13:16:40	12.01	17.08	13.89	13.62	4.06
13:16:50	12.01	17.05	13.89	13.62	4.02
13:17:00	12.01	16.94	13.89	13.62	3.92
13:17:10	12.01	16.94	13.86	13.58	3.89
13:17:20	12.01	16.94	13.77	13.51	3.88
13:17:30	12.01	17.05	14.00	13.60	4.11
13:17:40	12.01	17.40	13.77	13.50	3.94
13:17:50	12.01	17.40	13.80	13.52	4.03
13:18:00	12.01	17.40	13.89	13.52	4.13
13:18:10	12.00	17.36	13.89	13.54	4.00
13:18:20	12.00	17.23	13.89	13.52	4.09
13:18:30	12.00	17.23	13.88	13.52	4.15
13:18:40	12.00	17.23	13.83	13.50	4.17
13:18:50	12.00	17.25	13.83	13.51	4.19
13:19:00	12.00	17.29	13.83	13.53	4.14
13:19:10	12.00	17.29	13.81	13.52	4.04
13:19:20	12.00	17.29	13.81	13.50	4.08
13:19:30	12.00	17.29	13.77	13.51	4.08
13:19:40	12.00	17.27	13.77	13.53	4.24
13:19:50	12.00	17.20	13.77	13.54	4.14
13:20:00	12.00	17.20	13.73	13.51	4.24
13:20:10	12.00	17.27	13.82	13.52	4.11
13:20:20	12.00	17.20	13.60	13.51	4.15
13:20:30	12.00	17.22	13.60	13.53	4.15
13:20:40	12.00	17.30	13.60	13.56	4.07
13:20:50	12.00	17.30	13.57	13.56	3.99
13:21:00	12.00	17.30	13.46	13.57	3.86
13:21:10	12.00	17.26	13.46	13.57	3.93
13:21:20	12.00	17.12	13.46	13.56	4.02
13:21:30	12.00	17.12	13.46	13.56	4.11
13:21:40	12.00	17.12	13.46	13.55	4.11
13:21:50	12.00	17.12	13.45	13.55	4.05
13:22:00	12.00	17.15	13.45	13.54	4.10
13:22:10	12.00	17.15	13.45	13.56	4.06
13:22:20	12.00	17.26	13.45	13.53	4.11
13:22:30	12.00	17.26	13.45	13.55	4.11
13:22:40	12.00	17.26	13.45	13.55	4.23
13:22:50	12.00	17.26	13.44	13.55	4.10
13:23:00	12.00	17.26	13.44	13.54	4.02
13:23:10	12.00	17.26	13.44	13.73	3.86
13:23:20	12.00	17.23	13.49	13.56	4.05
13:23:30	12.00	17.26	13.13	13.84	4.09
13:23:40	12.00	17.26	12.21	13.84	4.73
13:23:50	11.99	16.92	12.21	13.83	5.33
13:24:00	12.00	15.90	12.21	13.82	5.67
13:23:10	11.99	15.90	11.95	13.85	5.77
13:23:20	11.99	15.90	11.14	13.84	5.68

DIRECT NO

DIRECT ZEROS
NOX/NO

START R2
GT B DB ON

13:23:30	12.00	15.91	11.14	13.84	5.82
13:23:40	11.99	15.95	11.14	13.83	5.78
13:23:50	11.99	15.95	11.14	13.82	5.85
13:24:00	11.99	15.95	11.15	13.83	5.89
13:24:10	11.99	15.97	11.15	13.83	5.90
13:24:20	11.99	16.04	11.15	13.84	5.82
13:24:30	11.99	16.04	11.19	13.83	5.72
13:24:40	11.99	16.04	11.33	13.84	5.77
13:24:50	11.99	16.05	11.32	13.79	5.79
		16.20	11.57	13.83	5.57
13:25:00	11.99	16.06	11.33	13.80	5.85
13:25:10	11.99	16.06	11.26	13.78	5.96
13:25:20	11.99	16.06	11.07	13.79	5.94
13:25:30	11.99	16.12	11.07	13.77	5.88
13:25:40	11.99	16.31	11.07	13.76	5.86
13:25:50	11.99	16.31	11.13	13.78	5.79
13:26:00	11.99	16.31	11.29	13.79	5.88
13:26:10	11.99	16.28	11.29	13.80	5.88
13:26:20	11.99	16.19	11.29	13.79	5.98
13:26:30	11.99	16.20	11.29	13.79	6.01
13:26:40	11.99	16.19	11.28	13.79	6.12
13:26:50	11.99	16.20	11.29	13.79	6.05
13:27:00	11.99	16.23	11.29	13.78	6.05
13:27:10	11.99	16.23	11.31	13.79	6.06
13:27:20	12.00	16.23	11.39	13.77	6.13
		16.20	11.24	13.78	5.96
13:27:30	11.99	16.24	11.39	13.76	6.08
13:27:40	11.99	16.27	11.39	13.75	6.00
13:27:50	12.00	16.27	11.38	13.78	5.98
13:28:00	12.00	16.27	11.34	13.75	6.12
13:28:10	12.00	16.25	11.34	13.76	6.11
13:28:20	12.00	16.20	11.34	13.74	6.03
13:28:30	12.00	16.20	11.36	13.77	6.08
13:28:40	12.00	16.20	11.42	13.79	6.06
13:28:50	12.00	16.21	11.42	13.78	5.93
13:29:00	12.00	16.23	11.42	13.78	6.03
13:29:10	12.00	16.23	11.41	13.79	5.96
13:29:20	12.00	16.23	11.38	13.78	5.97
13:29:30	12.00	16.24	11.38	13.79	6.00
13:29:40	12.00	16.29	11.38	13.76	5.97
13:29:50	12.00	16.29	11.41	13.78	5.90
		16.24	11.39	13.77	6.01
13:30:00	12.00	16.29	11.48	13.78	5.98
13:30:10	12.00	16.07	11.48	18.18	6.00
13:30:20	12.00	15.40	11.48	18.63	5.60
13:30:30	12.00	15.40	10.28	13.76	3.91
13:30:40	12.00	15.40	6.65	13.69	3.26
13:30:50	12.00	15.71	6.65	13.69	3.63
13:31:00	12.00	16.64	6.65	13.77	4.38
13:31:10	12.00	16.64	7.92	13.75	4.84
13:31:20	12.00	16.64	11.74	13.78	5.18
13:31:30	12.00	16.57	11.74	13.75	5.35
13:31:40	12.00	16.37	11.74	13.76	5.39
13:31:50	12.00	16.37	11.98	13.78	5.50
13:32:00	12.00	16.37	12.69	13.77	5.62
13:32:10	12.00	16.40	12.69	13.77	5.66
13:32:20	12.00	16.46	12.69	13.77	5.55
13:32:30	12.00	16.46	12.77	13.77	5.44
13:32:40	12.00	16.46	13.04	13.76	5.43
13:32:50	12.00	16.44	13.04	13.74	5.57
13:33:00	12.00	16.39	13.04	13.76	5.63
13:33:10	12.00	16.39	13.01	13.77	5.64
13:33:20	12.00	16.39	12.92	13.77	5.58
13:33:30	12.00	16.38	12.92	13.76	5.48
13:33:40	12.00	16.35	12.92	13.77	5.40
13:33:50	12.00	16.35	12.90	13.75	5.35
13:34:00	12.00	16.35	12.83	13.74	5.39
13:34:10	12.00	16.37	12.83	13.77	5.34
13:34:20	12.00	16.42	12.82	13.74	5.47
		16.40	12.87	13.76	5.50
13:34:30	12.00	16.42	12.75	13.74	5.37
13:34:40	12.01	16.42	12.51	13.75	5.24
13:34:50	12.01	16.42	12.51	13.74	5.13
13:35:00	12.01	16.41	12.51	13.75	5.11
13:35:10	12.01	16.41	12.44	13.76	5.08
13:35:20	12.01	16.41	12.22	13.75	5.10
13:35:30	12.01	16.37	12.22	13.76	5.12
13:35:40	12.01	16.26	12.22	13.74	5.22
13:35:50	12.01	16.26	12.22	13.75	5.15
13:36:00	12.01	16.26	12.20	13.75	5.12
13:36:10	12.01	16.28	12.30	13.74	5.25
13:36:20	12.01	16.34	12.20	13.74	5.25
13:36:30	12.01	16.34	12.19	13.72	5.15
13:36:40	12.01	16.34	12.14	13.76	5.19
13:36:50	12.01	16.36	12.14	13.77	5.07
		16.35	12.31	13.75	5.17
13:37:00	12.01	16.43	12.14	13.76	5.08
13:37:10	12.01	16.43	12.07	13.77	4.94
13:37:20	12.01	16.43	11.86	13.77	4.82
13:37:30	12.01	16.44	11.86	13.77	4.84
13:37:40	12.01	16.47	11.86	13.77	4.75

13:37:50	12.01	16.47	11.86	13.76	4.92
13:38:00	12.01	16.47	11.89	13.78	4.87
13:38:10	12.01	16.46	11.89	13.75	4.76
13:38:20	12.01	16.43	11.89	13.76	4.79
13:38:30	12.01	16.43	11.91	13.77	4.77
13:38:40	12.01	16.43	11.96	13.78	4.84
13:38:50	12.01	16.43	11.96	13.76	4.82
13:39:00	12.01	16.43	11.96	13.77	4.92
13:39:10	12.01	16.43	12.00	13.65	4.83
13:39:20	12.01	16.43	12.09	13.64	4.88
		16.44	11.95	13.75	4.86
13:39:30	12.01	16.53	12.09	13.63	4.75
13:39:40	12.01	16.83	12.09	13.62	4.44
13:39:50	12.01	16.83	12.13	13.63	4.32
13:40:00	12.02	16.83	12.24	13.62	4.22
13:40:10	12.02	16.87	12.24	13.62	4.20
13:40:20	12.02	16.96	12.24	13.61	4.28
13:40:30	12.02	16.97	12.28	13.63	4.35
13:40:40	12.02	16.97	12.38	13.63	4.39
13:40:50	12.02	16.95	12.38	13.62	4.36
13:41:00	12.02	16.90	12.38	13.62	4.41
13:41:10	12.02	16.90	12.44	13.63	4.40
13:41:20	12.02	16.90	12.61	13.63	4.39
13:41:30	12.02	16.94	12.61	13.62	4.29
13:41:40	12.02	17.04	12.61	13.62	4.26
13:41:50	12.02	17.04	12.64	13.51	4.21
		16.90	12.36	13.62	4.35
13:42:00	12.02	17.04	12.75	13.41	4.27
13:42:10	12.02	17.19	12.75	13.39	4.41
13:42:20	12.02	17.62	12.75	13.39	4.61
13:42:30	12.02	17.62	12.87	13.40	4.65
13:42:40	12.02	17.62	13.25	13.40	4.71
13:42:50	12.02	17.67	13.25	13.40	4.71
13:43:00	12.02	17.82	13.25	13.40	4.63
13:43:10	12.02	17.82	13.28	13.41	4.60
13:43:20	12.02	17.82	13.36	13.40	4.56
13:43:30	12.03	17.82	13.36	13.40	4.50
13:43:40	12.03	17.85	13.36	13.40	4.53
13:43:50	12.03	17.85	13.42	13.39	4.67
13:44:00	12.03	17.85	13.58	13.41	4.70
13:44:10	12.03	17.81	13.58	13.40	4.62
13:44:20	12.03	17.69	13.58	13.39	4.55
		17.67	13.23	13.40	4.58
13:44:30	12.03	17.69	13.59	13.41	4.55
13:44:40	12.03	17.69	13.61	13.29	4.57
13:44:50	12.03	17.82	13.61	13.24	4.53
13:45:00	12.03	18.21	13.61	13.25	4.66
13:45:10	12.03	18.21	13.70	13.24	4.81
13:45:20	12.03	18.21	13.94	13.26	4.95
13:45:30	12.03	18.23	13.94	13.26	4.91
13:45:40	12.03	18.26	13.94	13.25	4.90
13:45:50	12.03	18.26	13.96	13.26	4.87
13:46:00	12.03	18.26	14.03	13.27	4.97
13:46:10	12.03	18.24	14.03	13.26	5.02
13:46:20	12.03	18.17	14.03	13.26	5.13
13:46:30	12.03	18.17	14.06	13.25	5.12
13:46:40	12.03	18.17	14.17	13.25	5.06
13:46:50	12.03	18.18	14.17	13.24	4.98
		18.12	13.89	13.27	4.87
13:47:00	12.03	18.19	14.17	13.24	4.90
13:47:10	12.03	18.19	14.16	13.24	4.93
13:47:20	12.03	18.19	14.16	13.24	4.98
13:47:30	12.03	18.20	14.16	13.25	5.05
13:47:40	12.03	18.20	14.16	8.89	4.99
13:47:50	12.03	18.20	12.18	0.82	4.79
13:48:00	12.04	18.20	6.24	0.07	3.44
13:48:10	12.04	15.21	6.24	0.05	1.71
13:48:20	12.04	6.23	6.24	0.04	0.52
13:48:30	12.04	6.23	4.69	0.04	0.05
13:48:40	12.04	6.23	0.05	0.03	-0.04
13:48:50	12.04	4.73	0.05	0.03	-0.20
13:49:00	12.04	0.25	0.05	0.03	-0.04
13:49:10	12.04	0.25	0.04	0.04	-0.10
13:49:20	12.04	0.25	0.02	10.54	-0.16
13:49:30	12.04	0.39	0.02	11.78	-0.07
13:49:40	12.04	0.82	0.02	11.82	-0.13
13:49:50	12.04	0.82	0.03	11.83	-0.03
13:50:00	12.04	0.82	0.05	11.84	-0.12
13:50:10	12.04	0.66	0.05	11.84	-0.12
13:50:20	12.04	0.19	0.05	11.85	-0.08
		0.19	0.04	11.85	-0.08
13:50:30	12.04	0.19	0.02	11.85	-0.13
13:50:40	12.04	0.19	0.02	3.73	-0.10
13:50:50	12.04	0.19	0.02	0.14	-0.01
13:51:00	12.05	0.20	0.02	0.08	1.00
13:51:10	12.05	0.20	0.02	0.06	2.41
13:51:20	12.05	0.20	0.02	0.04	3.64
13:51:30	12.05	0.19	0.02	0.04	4.31
13:51:40	12.05	0.16	0.02	0.04	4.41
13:51:50	12.05	0.16	0.02	0.04	4.41
13:52:00	12.05	0.16	0.01	0.03	4.44

BIAS ZEROS
O2/CO
-0.10

BIAS O2

13:52:10	12.05	0.16	0.01	0.03	4.42	BIAS CO 4.43
13:52:20	12.05	0.15	0.01	0.03	4.44	
13:52:30	12.05	0.15	0.01	0.03	4.40	
13:52:40	12.05	0.15	0.02	0.03	4.43	
13:52:50	12.05	0.14	0.02	0.02	4.42	
13:53:00	12.05	0.12	0.02	0.08	4.31	BIAS ZEROS NOX/NO
13:53:10	12.05	0.12	1.45	0.03	3.74	
13:53:20	12.06	0.12	5.76	0.02	2.24	
13:53:30	12.06	2.25	5.76	0.02	0.89	
13:53:40	12.06	8.65	5.76	0.02	0.23	
13:53:50	12.06	8.65	6.42	0.02	0.00	
13:54:00	12.06	8.65	8.40	0.02	-0.05	
13:54:10	12.06	8.71	8.40	0.02	-0.06	
13:54:20	12.06	8.86	8.40	0.02	-0.07	
13:54:30	12.06	8.87	8.47	0.02	-0.07	
13:54:40	12.06	8.87	8.68	0.02	-0.07	
13:54:50	12.06	8.86	8.68	0.02	-0.14	
13:55:00	12.06	8.85	8.68	0.02	-0.04	
13:55:10	12.06	8.85	8.69	0.02	-0.07	BIAS NO
13:55:20	12.07	8.85	8.70	0.01	-0.07	
13:55:30	12.07	8.81	8.70	0.10	-0.06	
13:55:40	12.07	8.72	8.70	0.99	-0.04	
13:55:50	12.07	8.72	6.58	1.02	-0.13	
13:56:00	12.07	8.72	0.22	1.03	-0.04	
13:56:10	12.07	7.28	0.22	1.03	-0.05	
13:56:20	12.07	2.95	0.22	1.03	-0.10	
13:56:30	12.07	2.95	0.19	1.03	-0.19	
13:56:40	12.07	2.95	0.10	1.03	-0.05	
13:56:50	12.08	2.97	0.10	1.03	-0.05	
13:57:00	12.08	3.05	0.10	1.03	-0.07	
13:57:10	12.08	3.05	0.09	1.03	-0.07	
13:57:20	12.08	3.05	0.09	1.03	-0.05	
13:57:30	12.08	3.06	0.09	1.03	-0.14	
13:57:40	12.08	3.09	0.09	1.03	-0.04	
13:57:50	12.08	3.09	0.09	1.03	-0.11	
13:58:00	12.08	3.09	0.09	1.03	-0.11	
13:58:10	12.08	3.09	0.09	1.03	-0.05	
13:58:20	12.08	3.10	0.09	1.33	-0.06	BIAS NO2
13:58:30	12.08	3.10	0.10	1.05	-0.20	
13:58:40	12.08	3.10	0.15	1.03	-0.05	
13:58:50	12.09	3.14	0.15	1.03	0.02	
13:59:00	12.09	3.26	0.15	1.03	0.08	
13:59:10	12.09	3.26	0.12	1.03	0.11	
13:59:20	12.09	3.26	0.04	1.03	0.07	
13:59:30	12.09	3.26	0.04	1.03	0.07	
13:59:40	12.09	3.28	0.04	0.61	0.12	
13:59:50	12.09	3.28	1.36	0.01	0.06	
14:00:00	12.09	3.28	5.32	0.00	0.14	DIRECT NO2
14:00:10	12.09	4.75	5.32	0.00	0.05	
14:00:20	12.09	9.16	5.32	0.00	0.12	
14:00:30	12.10	9.16	6.16	0.00	0.13	
14:00:40	12.10	9.16	8.68	0.00	0.02	
14:00:50	12.10	9.08	8.68	0.00	0.15	
14:01:00	12.10	8.86	8.68	0.00	0.01	
14:01:10	12.10	8.86	8.70	0.00	0.06	
14:01:20	12.10	8.86	8.77	0.00	0.97	
14:01:30	12.10	8.86	8.77	0.00	2.68	
14:01:40	12.10	8.85	8.77	0.00	4.01	
14:01:50	12.10	8.85	8.77	0.00	4.64	DIRECT NO
14:02:00	12.10	8.85	8.78	0.00	4.84	
14:02:10	12.11	8.83	8.78	0.00	4.96	
14:02:20	12.11	8.78	8.78	0.00	5.22	
14:02:30	12.11	8.78	6.60	0.00	5.27	
14:02:40	12.11	8.78	0.04	0.00	5.11	
14:02:50	12.11	6.60	0.04	0.00	5.09	
14:03:00	12.11	0.04	0.04	0.00	4.91	
14:03:10	12.11	0.04	0.03	0.00	5.01	
14:03:20	12.11	0.04	-0.01	0.00	4.82	
14:03:30	12.11	0.03	-0.01	0.00	4.89	
14:03:40	12.11	0.01	-0.01	0.00	4.66	
14:03:50	12.11	0.01	-0.01	0.00	4.83	DIRECT ZEROS NOX/NO
14:04:00	12.12	0.01	0.00	0.00	4.81	
14:04:10	12.12	0.01	0.00	0.00	4.98	
14:04:20	12.12	0.01	0.00	5.89	5.06	
14:04:30	12.12	0.00	2.28	13.23	5.05	
14:04:40	12.12	0.00	9.13	13.25	4.96	
14:04:50	12.12	4.75	9.13	13.26	5.11	
14:05:00	12.12	18.99	9.13	13.24	5.14	
14:05:10	12.12	18.99	10.42	13.25	5.09	
14:05:20	12.12	18.99	14.28	13.26	5.05	
14:05:30	12.12	18.87	14.28	13.26	4.94	
14:05:40	12.12	18.50	14.28	13.26	4.99	

Clock Time	O2	NOx CAI	NO CAI	O2 CAI	CO 48i	DAS SHEET: SGD
	Ch.2 ppmv	Ch.6 ppmv	Ch.7 ppmv	Ch.8 ppmv	Ch.9 ppmv	
14:07:00	12.13	16.57	12.16	13.72	4.86	START R3 GT B DB ON
14:07:10	12.13	16.57	12.37	13.71	4.85	
14:07:20	12.13	16.57	12.99	13.72	4.87	
14:07:30	12.13	16.60	12.99	13.72	4.89	
14:07:40	12.13	16.69	12.99	13.71	4.84	
14:07:50	12.13	16.69	13.13	13.71	4.99	

14:08:00	12.13	16.69	13.53	13.72	4.84
14:08:10	12.14	16.69	13.53	13.72	4.95
14:08:20	12.14	16.70	13.53	13.70	4.96
14:08:30	12.14	16.70	13.49	13.72	4.96
14:08:40	12.14	16.70	13.38	13.72	4.89
14:08:50	12.14	16.67	13.38	13.71	4.97
14:09:00	12.14	16.59	13.38	13.71	4.91
14:09:10	12.14	16.59	13.35	13.73	5.01
14:09:20	12.14	16.59	13.24	13.73	4.92
		16.64	13.16	13.72	4.91
14:09:30	12.14	16.58	13.24	13.71	4.95
14:09:40	12.14	16.56	13.24	13.72	4.98
14:09:50	12.14	16.56	13.17	13.72	5.03
14:10:00	12.15	16.56	12.98	13.75	4.89
14:10:10	12.15	16.52	12.98	13.75	4.94
14:10:20	12.15	16.39	12.98	13.74	4.88
14:10:30	12.15	16.39	12.89	13.73	4.91
14:10:40	12.15	16.39	12.60	13.73	4.95
14:10:50	12.15	16.44	12.60	13.74	4.97
14:11:00	12.15	16.56	12.60	13.74	4.93
14:11:10	12.15	16.56	12.57	13.76	4.98
14:11:20	12.15	16.56	12.49	13.75	4.88
14:11:30	12.15	16.54	12.49	13.75	4.88
14:11:40	12.15	16.48	12.49	13.76	4.96
14:11:50	12.15	16.48	12.46	13.75	5.07
		16.50	12.78	13.74	4.95
14:12:00	12.16	16.48	12.37	13.75	5.07
14:12:10	12.16	16.45	12.37	13.76	4.90
14:12:20	12.16	16.34	12.37	13.77	4.89
14:12:30	12.16	16.34	12.31	13.77	4.84
14:12:40	12.16	16.34	12.13	13.77	4.64
14:12:50	12.16	16.34	12.13	13.76	4.71
14:13:00	12.16	16.34	12.13	13.75	4.64
14:13:10	12.16	16.34	12.18	13.75	4.71
14:13:20	12.16	16.34	12.33	13.76	4.53
14:13:30	12.16	16.37	12.33	13.76	4.61
14:13:40	12.17	16.45	12.33	13.76	4.62
14:13:50	12.17	16.45	12.31	13.77	4.72
14:14:00	12.17	16.45	12.25	13.76	4.80
14:14:10	12.17	16.44	12.25	13.77	4.84
14:14:20	12.17	16.39	12.25	13.58	4.87
		16.39	12.27	13.75	4.76
14:14:30	12.17	16.39	12.31	13.54	4.76
14:14:40	12.17	16.39	12.46	13.56	4.72
14:14:50	12.17	16.55	12.46	13.56	4.64
14:15:00	12.17	17.04	12.46	13.56	4.69
14:15:10	12.17	17.04	12.45	13.55	4.56
14:15:20	12.18	17.04	12.43	13.56	4.50
14:15:30	12.18	17.09	12.43	13.56	4.43
14:15:40	12.18	17.26	12.43	13.57	4.48
14:15:50	12.18	17.26	12.49	13.55	4.44
14:16:00	12.18	17.26	12.68	13.56	4.44
14:16:10	12.18	17.29	12.68	13.57	4.46
14:16:20	12.18	17.38	12.68	13.54	4.45
14:16:30	12.18	17.38	12.76	13.56	4.52
14:16:40	12.18	17.38	12.99	13.54	4.44
14:16:50	12.18	17.36	12.99	13.46	4.33
		17.07	12.58	13.55	4.52
14:17:00	12.18	17.30	12.99	13.42	4.44
14:17:10	12.18	17.30	13.08	13.42	4.30
14:17:20	12.19	17.30	13.36	13.40	4.43
14:17:30	12.19	17.41	13.36	13.43	4.57
14:17:40	12.19	17.72	13.36	13.42	4.57
14:17:50	12.19	17.72	13.36	13.42	4.52
14:18:00	12.19	17.72	13.34	13.41	4.52
14:18:10	12.19	17.72	13.34	13.41	4.50
14:18:20	12.19	17.72	13.34	13.41	4.57
14:18:30	12.19	17.72	13.38	13.39	4.47
14:18:40	12.19	17.72	13.51	13.44	4.68
14:18:50	12.19	17.69	13.51	13.43	4.76
14:19:00	12.19	17.60	13.51	13.41	4.78
14:19:10	12.19	17.60	13.50	13.41	4.67
14:19:20	12.20	17.60	13.48	13.39	4.69
		17.59	13.36	13.41	4.56
14:19:30	12.20	17.62	13.48	13.30	4.64
14:19:40	12.20	17.70	13.48	13.32	4.76
14:19:50	12.20	17.70	13.51	13.30	4.91
14:20:00	12.20	17.70	13.62	13.31	4.90
14:20:10	12.20	17.78	13.62	13.31	4.86
14:20:20	12.20	18.04	13.62	13.30	4.96
14:20:30	12.20	18.04	13.69	13.29	4.92
14:20:40	12.20	18.04	13.88	13.30	4.89
14:20:50	12.20	18.02	13.88	13.30	4.96
14:21:00	12.20	17.95	13.88	13.30	4.97
14:21:10	12.20	17.95	13.91	13.31	4.93
14:21:20	12.21	17.95	13.99	13.29	4.82
14:21:30	12.21	17.98	13.99	13.31	4.64
14:21:40	12.21	18.08	13.99	13.31	4.62
14:21:50	12.21	18.08	13.97	13.31	4.70
		17.91	13.77	13.30	4.83
14:22:00	12.21	18.08	13.91	13.31	4.67
14:22:10	12.21	17.67	13.91	18.31	4.83

14:22:20	12.21	16.45	13.91	14.64	4.31
14:22:30	12.21	16.45	13.43	13.63	3.69
14:22:40	12.21	16.45	11.99	13.63	3.52
14:22:50	12.21	16.53	11.99	13.63	3.79
14:23:00	12.21	16.78	11.99	13.64	3.95
14:23:10	12.21	16.78	12.26	13.65	4.06
14:23:20	12.22	16.78	13.06	13.65	4.08
14:23:30	12.22	16.80	13.06	13.63	4.21
14:23:40	12.22	16.85	13.06	13.63	4.17
14:23:50	12.22	16.85	13.32	13.65	4.22
14:24:00	12.22	16.85	14.13	13.65	4.15
14:24:10	12.22	16.85	14.13	13.64	4.20
14:24:20	12.22	16.83	14.13	13.65	4.14
14:24:30	12.22	16.83	14.15	13.62	4.09
14:24:40	12.22	16.83	14.23	13.61	4.10
14:24:50	12.22	16.85	14.23	13.64	4.16
14:25:00	12.22	16.94	14.23	13.63	4.20
14:25:10	12.22	16.94	14.18	13.63	4.33
14:25:20	12.23	16.94	14.06	13.65	4.32
14:25:30	12.23	16.90	14.06	13.63	4.32
14:25:40	12.23	16.80	14.06	13.63	4.27
14:25:50	12.23	16.80	14.04	13.64	4.15
14:26:00	12.23	16.80	13.99	13.63	4.13
14:26:10	12.23	16.82	13.99	13.64	4.17
14:26:20	12.23	16.89	13.99	13.63	4.10
		16.86	14.11	13.63	4.19
14:26:30	12.23	16.89	13.96	13.61	4.11
14:26:40	12.23	16.89	13.85	13.62	4.05
14:26:50	12.23	16.87	13.85	13.64	4.09
14:27:00	12.23	16.81	13.85	13.62	3.97
14:27:10	12.24	16.81	13.75	13.63	4.01
14:27:20	12.24	16.81	13.43	13.61	3.96
14:27:30	12.24	16.84	13.43	13.63	4.02
14:27:40	12.24	16.92	13.43	13.61	4.08
14:27:50	12.24	16.92	13.44	13.63	4.03
14:28:00	12.24	16.92	13.49	13.62	3.95
14:28:10	12.24	16.92	13.49	13.60	3.92
14:28:20	12.24	16.89	13.49	13.62	3.99
14:28:30	12.24	16.89	13.43	13.62	4.04
14:28:40	12.24	16.89	13.24	13.62	4.23
14:28:50	12.24	16.86	13.24	13.57	4.25
		16.87	13.56	13.62	4.05
14:29:00	12.24	16.78	13.24	13.54	4.17
14:29:10	12.25	16.78	13.31	13.53	4.08
14:29:20	12.25	16.78	13.50	13.55	3.98
14:29:30	12.25	16.87	13.50	13.56	3.96
14:29:40	12.25	17.14	13.50	13.54	4.05
14:29:50	12.25	17.14	13.47	13.55	4.06
14:30:00	12.25	17.14	13.39	13.55	4.06
14:30:10	12.25	17.12	13.39	13.58	4.01
14:30:20	12.25	17.07	13.39	13.55	3.99
14:30:30	12.25	17.07	13.42	13.55	3.80
14:30:40	12.25	17.07	13.53	13.57	3.92
14:30:50	12.25	17.03	13.53	13.57	3.97
14:31:00	12.25	16.89	13.53	13.56	4.02
14:31:10	12.25	16.89	13.52	13.53	3.99
14:31:20	12.26	16.89	13.51	13.56	3.89
		16.98	13.45	13.55	4.00
14:31:30	12.26	16.93	13.51	13.73	3.94
14:31:40	12.26	17.06	13.51	13.83	4.02
14:31:50	12.26	17.06	13.00	13.84	4.77
14:32:00	12.26	17.06	11.47	13.85	5.48
14:32:10	12.26	16.77	11.47	13.84	5.88
14:32:20	12.26	15.90	11.47	13.84	5.97
14:32:30	12.26	15.90	11.30	13.84	6.01
14:32:40	12.26	15.90	10.79	13.84	5.95
14:32:50	12.26	15.94	10.79	13.85	5.83
14:33:00	12.26	16.04	10.79	13.84	5.86
14:33:10	12.26	16.04	10.84	13.84	5.87
14:33:20	12.27	16.04	10.99	13.85	5.86
14:33:30	12.27	16.01	10.99	13.83	5.77
14:33:40	12.27	15.94	10.99	13.85	5.77
14:33:50	12.27	15.94	11.02	13.83	5.87
		16.30	11.53	13.83	5.52
14:34:00	12.27	15.94	11.12	13.84	5.78
14:34:10	12.27	15.98	11.12	13.83	5.73
14:34:20	12.27	16.11	11.12	13.85	5.81
14:34:30	12.27	16.11	11.14	13.86	5.76
14:34:40	12.27	16.11	11.20	13.83	5.76
14:34:50	12.27	16.11	11.20	13.79	5.84
14:35:00	12.27	16.08	11.20	13.79	5.91
14:35:10	12.27	16.08	11.14	13.79	5.92
14:35:20	12.28	16.08	10.95	13.79	6.12
14:35:30	12.28	16.12	10.95	13.77	6.14
14:35:40	12.28	16.25	10.95	13.79	6.12
14:35:50	12.28	16.25	10.97	13.79	6.06
14:36:00	12.28	16.25	11.03	13.80	6.03
14:36:10	12.28	16.23	11.03	13.79	6.05
14:36:20	12.28	16.15	11.03	13.80	6.06
		16.13	11.08	13.81	5.94
14:36:30	12.28	16.15	11.05	13.79	5.98

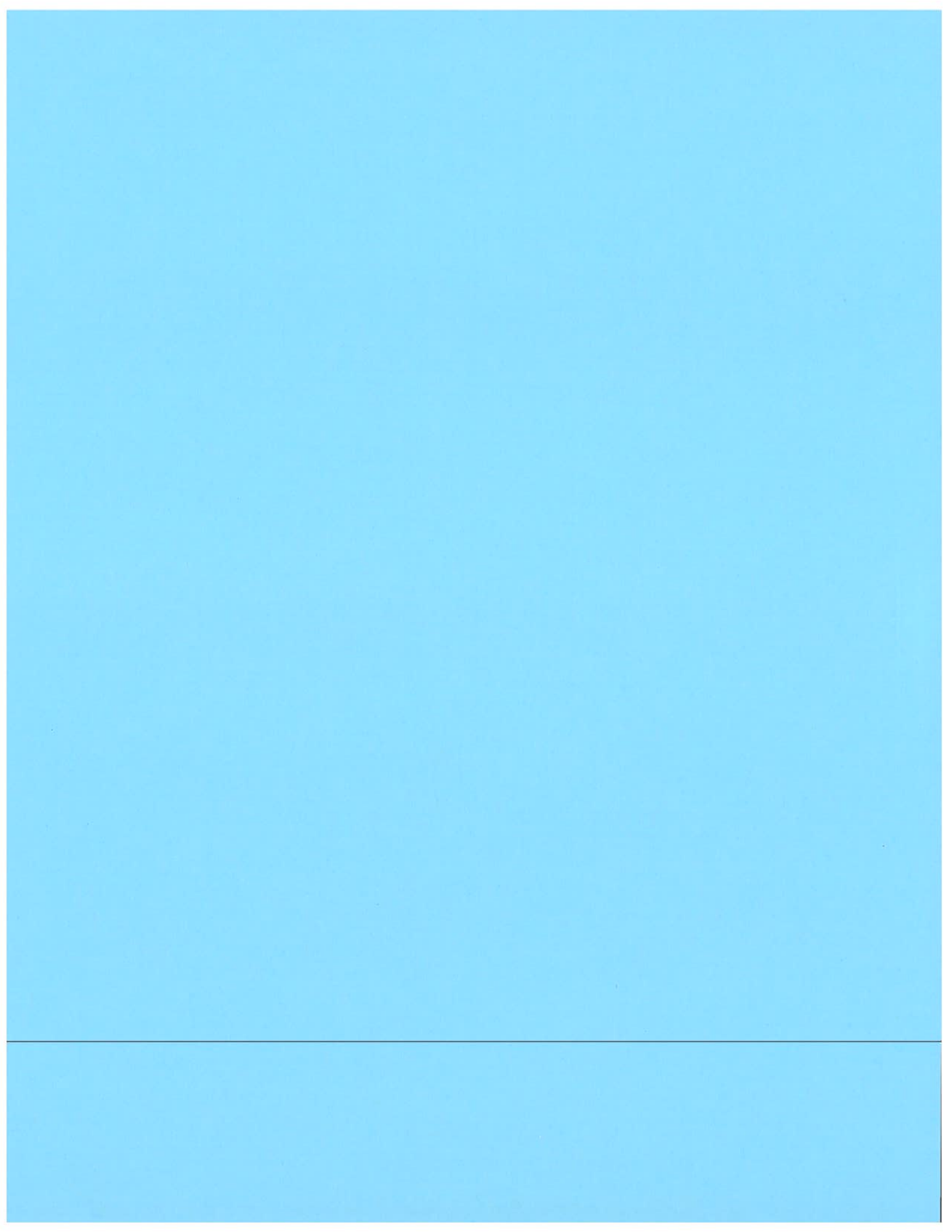
14:36:40	12.28	16.15	11.12	13.79	6.07
14:36:50	12.28	16.17	11.12	13.80	6.01
14:37:00	12.29	16.21	11.12	13.78	6.01
14:37:10	12.29	16.21	11.16	13.74	5.95
14:37:20	12.29	16.21	11.30	13.72	5.97
14:37:30	12.29	16.27	11.30	13.72	5.77
14:37:40	12.29	16.44	11.30	13.73	5.78
14:37:50	12.29	16.44	11.29	13.74	5.87
14:38:00	12.29	16.44	11.26	13.74	5.90
14:38:10	12.29	16.40	11.26	13.74	5.96
14:38:20	12.29	16.27	11.26	13.74	5.87
14:38:30	12.29	16.27	11.26	13.72	5.92
14:38:40	12.29	16.27	11.25	13.75	6.07
14:38:50	12.29	16.28	11.25	13.71	6.13
		16.28	11.22	13.75	5.95
14:39:00	12.30	16.30	11.25	13.73	6.14
14:39:10	12.30	16.30	11.28	13.74	6.15
14:39:20	12.30	16.30	11.37	13.74	6.01
14:39:30	12.30	16.19	11.37	13.78	4.69
14:39:40	12.30	15.85	11.37	13.76	2.83
14:39:50	12.30	15.85	11.73	13.75	1.35
14:40:00	12.30	15.85	12.80	13.73	0.72
14:40:10	12.30	15.89	12.80	13.73	0.57
14:40:20	12.30	16.02	12.80	13.75	0.50
14:40:30	12.30	16.02	12.80	13.74	0.50
14:40:40	12.30	16.02	12.81	13.77	0.52
14:40:50	12.31	15.98	12.81	13.79	0.54
14:41:00	12.31	15.86	12.81	13.79	0.54
14:41:10	12.31	15.86	12.83	13.77	0.52
14:41:20	12.31	15.86	12.88	13.76	0.51
14:41:30	12.31	15.83	12.88	13.75	0.53
14:41:40	12.31	15.73	12.88	13.75	0.47
14:41:50	12.31	15.73	12.73	13.74	0.54
14:42:00	12.31	15.73	12.28	13.76	0.54
14:42:10	12.31	15.25	12.28	14.71	0.44
14:42:20	12.31	13.82	12.28	17.06	0.52
14:42:30	12.31	13.82	10.49	19.09	0.49
14:42:40	12.32	13.82	5.10	20.05	0.49
14:42:50	12.32	11.64	5.10	20.30	0.50
14:43:00	12.32	5.10	5.10	20.36	0.39
14:43:10	12.32	5.10	4.01	20.38	0.45
14:43:20	12.32	5.09	0.72	20.40	0.35
14:43:30	12.32	4.10	0.72	20.41	0.28
14:43:40	12.32	1.10	0.72	20.43	0.39
14:43:50	12.32	1.10	0.63	18.46	0.27
14:44:00	12.32	1.10	0.36	1.59	0.28
14:44:10	12.32	1.14	0.36	0.17	0.22
14:44:20	12.32	1.27	0.36	0.10	0.01
14:44:30	12.32	1.27	0.27	0.08	-0.06
14:44:40	12.33	1.27	0.02	0.06	-0.16
14:44:50	12.33	1.01	0.02	0.06	-0.16
14:45:00	12.33	0.23	0.02	0.05	-0.10
14:45:10	12.33	0.23	0.02	0.04	-0.09
14:45:20	12.33	0.23	0.02	0.04	-0.18
14:45:30	12.33	0.22	0.02	0.03	-0.08
14:45:40	12.33	0.18	0.02	0.02	-0.11
14:45:50	12.33	0.18	0.01	0.02	-0.12
14:46:00	12.33	0.18	0.01	0.02	-0.13
14:46:10	12.33	0.18	0.01	0.02	-0.11
14:46:20	12.34	0.16	0.01	4.32	-0.13
14:46:30	12.34	0.16	0.17	11.69	-0.16
14:46:40	12.34	0.16	0.63	11.80	-0.05
14:46:50	12.34	0.28	0.63	11.82	-0.07
14:47:00	12.34	0.62	0.63	11.83	-0.06
14:47:10	12.34	0.62	0.48	11.83	-0.15
14:47:20	12.34	0.62	0.01	11.84	-0.12
14:47:30	12.34	0.50	0.01	11.85	-0.09
14:47:40	12.34	0.12	0.01	11.84	-0.11
14:47:50	12.34	0.12	0.01	11.85	-0.09
14:48:00	12.34	0.12	0.01	5.69	-0.11
14:48:10	12.35	0.14	0.01	0.19	-0.07
14:48:20	12.35	0.19	0.01	0.09	0.81
14:48:30	12.35	0.19	0.01	0.06	2.40
14:48:40	12.35	0.19	0.00	0.05	3.58
14:48:50	12.35	0.17	0.00	0.04	4.16
14:49:00	12.35	0.10	0.00	0.04	4.39
14:49:10	12.35	0.10	0.00	0.03	4.36
14:49:20	12.35	0.10	0.00	0.03	4.35
14:49:30	12.35	0.09	0.00	0.03	4.38
14:49:40	12.35	0.08	0.00	0.02	4.34
14:49:50	12.35	0.08	0.00	0.02	4.40
14:50:00	12.36	0.08	0.00	0.02	4.38
14:50:10	12.36	0.23	0.00	0.09	4.35
14:50:20	12.36	0.68	0.00	0.03	3.84
14:50:30	12.36	0.68	1.87	0.02	2.49
14:50:40	12.36	0.68	7.49	0.02	1.02
14:50:50	12.36	2.69	7.49	0.02	0.19
14:51:00	12.36	8.73	7.50	0.02	-0.07
14:51:10	12.36	8.73	7.77	0.02	-0.10
14:51:20	12.36	8.73	8.58	0.02	-0.08
14:51:30	12.36	8.75	8.58	0.02	-0.12
14:51:40	12.36	8.82	8.58	0.02	-0.09

BIAS ZEROS
O2/CO
-0.11

BIAS O2

BIAS CO
4.37
BIAS ZEROS
NOX/NO

14:51:50	12.36	8.82	8.60	0.02	-0.14	
14:52:00	12.37	8.82	8.66	0.02	-0.09	
14:52:10	12.37	8.82	8.66	0.02	-0.12	
14:52:20	12.37	8.82	8.66	0.02	-0.09	
14:52:30	12.37	8.82	8.67	0.02	-0.08	
14:52:40	12.37	8.82	8.68	0.02	-0.14	
14:52:50	12.37	8.79	8.68	0.15	-0.12	BIAS NO
14:53:00	12.37	8.71	8.68	1.01	-0.19	
14:53:10	12.37	8.71	6.56	1.02	-0.04	
14:53:20	12.37	8.71	0.20	1.03	-0.04	
14:53:30	12.37	7.28	0.20	1.03	-0.10	
14:53:40	12.37	2.96	0.20	1.03	-0.15	
14:53:50	12.37	2.96	0.18	1.03	-0.09	
14:54:00	12.38	2.96	0.10	1.03	-0.13	
14:54:10	12.38	2.98	0.10	1.03	-0.12	
14:54:20	12.38	3.06	0.10	1.03	-0.08	
14:54:30	12.38	3.06	0.09	1.03	-0.08	
14:54:40	12.38	3.06	0.07	1.03	-0.16	
14:54:50	12.38	3.07	0.07	1.03	-0.10	
14:55:00	12.38	3.09	0.07	1.20	-0.11	BIAS NO2
14:55:10	12.38	3.09	0.09	1.13	-0.18	
14:55:20	12.38	3.09	0.14	1.04	-0.08	
14:55:30	12.38	3.13	0.14	1.03	-0.11	
14:55:40	12.38	3.26	0.14	1.03	-0.16	
14:55:50	12.39	3.26	0.11	1.03	-0.15	
14:56:00	12.39	3.26	0.03	1.03	-0.21	
14:56:10	12.39	3.26	0.03	1.03	-0.14	
14:56:20	12.39	3.27	0.03	1.03	-0.21	
14:56:30	12.39	3.27	0.03	1.03	-0.13	DIRECT NO2
14:56:40	12.39	3.27	0.05	0.62	-0.17	
14:56:50	12.39	4.18	0.05	0.01	-0.20	
14:57:00	12.39	6.91	0.05	0.00	-0.23	
14:57:10	12.39	6.91	2.19	0.00	-0.17	
14:57:20	12.39	6.91	8.61	0.00	-0.21	
14:57:30	12.39	7.40	8.61	0.00	-0.12	
14:57:40	12.40	8.86	8.61	0.00	-0.16	DIRECT ZEROS
14:57:50	12.40	8.86	8.66	0.00	-0.19	O2/CO
14:58:00	12.40	8.87	8.80	0.00	-0.16	-0.15
14:58:10	12.40	8.86	8.80	0.00	-0.13	
14:58:20	12.40	8.83	8.80	0.00	-0.11	
14:58:30	12.40	8.83	8.79	0.00	-0.22	
14:58:40	12.40	8.83	8.78	0.01	-0.18	
14:58:50	12.40	8.82	8.78	0.00	0.01	DIRECT NO
14:59:00	12.40	8.79	8.78	0.00	1.19	
14:59:10	12.40	8.79	6.59	0.00	2.71	
14:59:20	12.41	8.79	0.02	0.00	3.80	
14:59:30	12.41	6.60	0.02	0.00	4.17	
14:59:40	12.41	0.02	0.02	0.00	4.40	
14:59:50	12.41	0.02	0.02	0.00	4.35	
15:00:00	12.41	0.02	0.00	0.00	4.40	DIRECT CO
15:00:10	12.41	0.02	0.00	0.00	4.34	4.37
15:00:20	12.41	0.01	0.00	0.00	4.43	
15:00:30	12.41	0.01	0.00	2.63	4.34	DIRECT ZEROS
15:00:40	12.41	0.00	0.00	11.79	4.31	NOX/NO
15:00:50	12.41	0.01	0.00	11.91	3.22	
15:01:00	12.42	0.02	0.00	11.92	1.76	
15:01:10	12.42	0.02	0.00	11.93	0.55	
15:01:20	12.42	0.02	-0.01	11.93	-0.04	
15:01:30	12.42	0.02	-0.01	11.94	-0.07	DIRECT O2
15:01:40	12.42	0.01	-0.01	11.64	-0.18	





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Certificate of Analysis
EPA Protocol

Customer: Cty of San Diego APCD
CGA: 660
Customer PO#:
Cylinder #: CC233189
Part Number: EPA NINOSAL
Reference#: 04334062-00
Certification Date: 08/21/2018
Expiration Date: 08/21/2026
Pressure, psig: 2000

Method: This standard was analyzed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, Procedure G1 (May 2012).

Table with 4 columns: Analyzed Cylinder-Components, Certified Concentration, Expanded Uncertainty, Assay Dates. Rows include Nitric Oxide, NOx, and Nitrogen.

Table with 5 columns: Reference Standard-Type/SRM Sample, Cylinder #, Sample #, Concentration, Expiration. Rows include Nitric Oxide/ GMIS, Oxides of Nitrogen/ GMIS, and Traceable to SRM 1684b.

Table with 4 columns: Instrument-Instrument/ Model, Serial Number, Last Date Calibrated, Analytical Method. Row includes Nicolet 42i-HL, 921237088, 07/23/2018, Chemiluminescence.

This report states accurately the results of the investigation made upon the material submitted to the analytical laboratory. Every effort has been made to determine objectively the information requested. However, in connection with this report, Tech Air shall have no liability in excess of the established charge for this service.

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted.

Produced by:
TECH AIR

6544 1/2 Cherry Avenue
Long Beach, CA 90805
EPA PGVP ID# J12018

Principal Analyst: [Signature]
Date: 21 August 2018



Praxair Distribution, Inc.
 5700 S. Alameda Street
 Los Angeles, CA 90058
 Tel: 323-585-2154
 Fax: 714-542-6689

Customer & Order Information:

COUNTY OF SAN DIEGO
 10124 OLD GROVE RD, AIR POLLUTION CONTROL
 DISTRICT
 SAN DIEGO, CA 92131
 Praxair Order Number: 65443859
 Customer PO Number: DANA ERRETT

Certificate Modification Date: 11/5/2018

Certification Date: 11/5/2018
 Lot Number: 70086830302
 Part Number: NI NX7MN-AS

DocNumber: 18314
 Expiration Date: 5/1/2019

CERTIFICATE OF ANALYSIS
Primary Master

Component	Requested Concentration (Molar)	Certified Concentration (Molar)	Analytical Reference	Analytical Uncertainty
Nitrogen dioxide (as NOx)	7 ppm	7.18 ppm	1	± 0.1 ppm
Nitrogen	Balance	Balance		

Cylinder Style: AS
 Cylinder Pressure @ 70 F: 2000 psig
 Cylinder Volume: 142 ft³
 Valve Outlet Connection: CGA 660
 Cylinder Number(s): CC501609

Fill Date: 10/30/2018
 Analysis Date: 10/31/2018

Filling Method: Gravimetric

Analyst: Henry Koung

Approved Signer: Amalia Real

Key to Analytical Techniques:

Reference	Analytical Instrument - Analytical Principle	Reference Standard
1	MKS MG2031 - FTIR	NO2(as NOx)/N2 9.58 ppm GMIS# CC506833, Expiration Date: 01/29/2019, Traceable to PRM#5603981

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted. Analytical uncertainty is expressed as a Relative % unless otherwise noted.

IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution, Inc.. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.



CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

COUNTY OF SAN DIEGO
10124 OLD GROVE RD
SAN DIEGO CA 92131

Certificate Modification Date: 08/29/2018

Praxair Order Number: 63241638

Part Number: NI CO45ME-AS

Customer PO Number: DANA ERRETT

Fill Date: 08/24/2018

Lot Number: 70086823803

Cylinder Style & Outlet: AS

CGA 350

Cylinder Pressure and Volume: 2000 psig 140 ft³

Certified Concentration

Expiration Date:	08/29/2028	NIST Traceable
Cylinder Number:	ALM-037113	Expanded Uncertainty
44.9 ppm	Carbon monoxide	± 0.6 %
Balance	Nitrogen	

ProSpec EZ Cert



Certification Information:

Certification Date: 08/29/2018

Term: 96 Months

Expiration Date: 08/29/2026

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-800/R-12/531, using Procedure G1.
Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component:

Carbon monoxide

Requested Concentration: 45 ppm
Certified Concentration: 44.9 ppm
Instrument Used: Horiba VIA-510 SN 576876015
Analytical Method: NDIR
Last Multipoint Calibration: 08/09/2018

Reference Standard:

Type / Cylinder #: GMIS / CC188812

Concentration / Uncertainty: 48.9 ppm ±0.431%

Expiration Date: 12/06/2025

Traceable to:

SRM # / Sample # / Cylinder #: SRM 1678c / 04-L-41 / FF16402

SRM Concentration / Uncertainty: 48.136 PPM / ±0.065PPM

SRM Expiration Date: 02/04/2021

First Analysis Data:				Date			
Z:	0	R:	48.9	C:	44.9	Conc:	44.9
R:	48.9	Z:	0	C:	44.9	Conc:	44.9
Z:	0	C:	45	R:	49	Conc:	45
UOM:	ppm	Mean Test Assay:		44.9	ppm		

Second Analysis Data:				Date			
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	ppm	Mean Test Assay:			ppm		

Analyzed By

Jose Vasquez

Certified By

Daniel Burns



Praxair
 5700 South Alameda Street
 Los Angeles, CA 90058
 Tel: (323) 585-2154 Fax: (714) 542-6689
 PGVPID: F22018

DocNumber: 000119193

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:
 COUNTY OF SAN DIEGO
 10124 OLD GROVE RD
 SAN DIEGO CA 92131

Praxair Order Number: 54569845
Customer P. O. Number: Dana Errett
Customer Reference Number:

Fill Date: 1/10/2018
Part Number: NI OX21E-AS
Lot Number: 70086801003
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

Certified Concentration:

Expiration Date:	1/17/2026	NIST Traceable
Cylinder Number:	CC246193	Analytical Uncertainty:
21.10 %	OXYGEN	± 0.1 %
Balance	NITROGEN	

Certification Information: Certification Date: 1/17/2018 Term: 96 Months Expiration Date: 1/17/2026
 This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: OXYGEN

Requested Concentration: 21 %
 Certified Concentration: 21.10 %
 Instrument Used: PARA 1 OXYMAT 5E
 Analytical Method: PARAMAGNETIC
 Last Multipoint Calibration: 1/3/2018

Reference Standard Type: GMIS
 Ref Std Cylinder #: CC76311
 Ref Std Conc: 20.88%
 Ref Std Traceable to SRM #: 2659a
 SRM Sample #: 71-E-19
 SRM Cylinder #: FF22331

First Analysis Data: Date: 1/17/2018

Z:	0	R:	20.88	C:	21.1	Conc:	21.093
R:	20.88	Z:	0	C:	21.1	Conc:	21.093
Z:	0	C:	21.12	R:	20.9	Conc:	21.113
UOM:	%	Mean Test Assay:	21.1 %				

Second Analysis Data: Date:

Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM:	%	Mean Test Assay:	0 %				

Analyzed by:

Jose Vasquez

Certified by:

Danielle Burns
 Danielle Burns

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.



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Family service.
National strength.

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Certificate of Analysis

EPA Protocol

Customer: San Diego APCD
CGA: 590
Customer PO#:
Cylinder #: EB0014605
Part Number: EPA NIOXSALCO

Reference#: 04237193-00
Certification Date: 05/21/2018
Expiration Date: 05/22/2026
Pressure, psig: 2000

Method: This standard was analyzed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, Procedure G1 (May 2012).

Analyzed Cylinder-Components	Certified Concentration	Expanded Uncertainty	Assay Dates
Oxygen	11.99 %	+/-0.05 %	05/21/2018
Nitrogen	Balance		

Reference Standard-Type/SRM Sample	Cylinder #	Concentration
Oxygen/GMIS	436978	20.83 +/- 0.052 %
Traceable to SRM 2659a	CAL015489 Lot 71-D-50	20.72 +/- 0.043 %

Instrument-Instrument/ Model	Serial Number	Last Date Calibrated	Analytical Method
Servomex 1100	1100-2228-C	05/02/2018	Paramagnetic

This report states accurately the results of the investigation made upon the material submitted to the analytical laboratory. Every effort has been made to determine objectively the information requested. However, in connection with this report, Specialty Air Technologies shall have no liability in excess of the established charge for this service. Assayed at Specialty Air Technologies, Long Beach CA. No correction required for interfering gases.

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025:2005. Do not use this standard when cylinder pressure is below 150 psig.

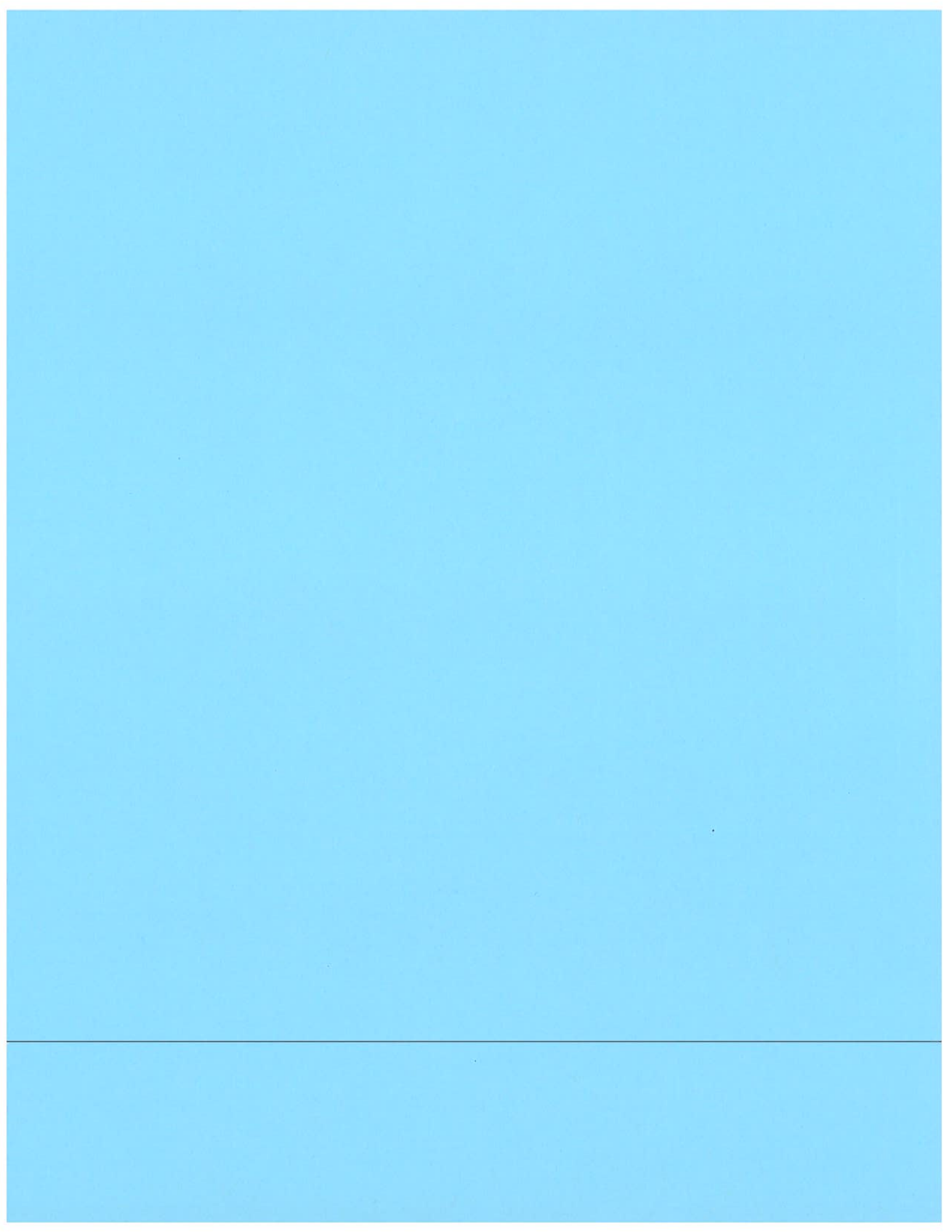
Produced by:

TECH AIR

6544 1/2 Cherry Avenue
Long Beach, CA 90805
EPA PGVP ID# J12018

Principal Analyst: 

Date: 21 May 2018





COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
10124 OLD GROVE ROAD, SAN DIEGO, CA 92131
PHONE (858) 586-2600 FAX (858) 586-2601
www.sdapcd.org

PERMIT RECORD ID

APCD2003-PTO-975399



Sectors: 3, K
Site Record ID: APCD1976-SITE-00208
Application Record ID: APCD2015-APP-004247

SD State University
 Environmental Compliance Specialist Dan Root
 5500 Campanile Dr Mail Code 1243
 San Diego CA 92182

EQUIPMENT ADDRESS

San Diego State University
 William Lekas
 5500 Campanile Dr
 San Diego CA 92182

PERMIT TO OPERATE
EXPIRES: April 30, 2019

This permit is not valid until required fees have been paid.

The above is hereby granted a Permit To Operate the article, machine, equipment or contrivance described below. This permit is not transferable to a new owner nor is it valid for operation of the equipment at another location except as specified. This Permit To Operate or copy must be posted on or within 25 feet of the equipment, or readily available on the operating premises.

EQUIPMENT OWNER

San Diego State University 5500 Campanile Dr, San Diego, CA 92182

EQUIPMENT DESCRIPTION

One (1) 60-T7300S GSC Solar Turbine Inc. Taurus Gas Turbine Engine, unit B, S/N 1129 T, S/N OHF15-T0573, natural gas fired, 59.48 million btu/hour, based upon lower heating value (LHV) at 46° F engine inlet temperature at 95% R.H, 5.233 MW net output power, with dry low oxides of nitrogen (NOx) (SoLoNOx) technology including an augmented backside cooled/ thermal barrier coating ABC/TBC combustor liner. One (1) John Zink Company low NOx duct burner (duct burner B), s/n 2001-70-1000, natural gas fired, 20 million btu/hour based upon higher heating value, and one (1) heat recovery steam generator. One (1) 4.169 MW steam turbine-generator set, S/N T-5613 is driven by unit A and unit B. The combined net power output of this cogeneration facility, consisting of two (2) gas turbine engines, each equipped with a duct burner and waste heat recovery system to supply steam and drive the steam turbine is 14.47 MW. 975399 EAD 12/11/03

Every person who owns or operates this equipment is required to comply with the conditions listed below and all applicable requirements and District rules, including but not limited to Rules 10, 20, 40, 50, 51.

Fee Schedules: 1 [20E] Non- Aircraft Turbine Engine
 2 [92F] NOx and CO Source Test

BEC: 12535

FAILURE TO OPERATE IN COMPLIANCE IS A MISDEMEANOR SUBJECT TO CIVIL AND CRIMINAL PENALTIES

1. This gas turbine with duct burner shall be properly maintained and kept in good operating condition at all times when the equipment is in operation.
2. This gas turbine and duct burner shall be fired on Public Utility Commission (PUC) quality natural gas only and shall be delivered to the facility through SDG&E infrastructure. The Permittee shall maintain a copy of General Order 58-A - PUC Standards for Gas Service in the State of California-Section 7-Purity of Gas, and SDG&E's Electric and Gas Tariff Book Rule 30 H-Gas quality that demonstrate the natural gas supplied to the facility has a Sulfur content of no more than 10 grains of Sulfur compounds, calculated as Hydrogen Sulfide, per 100 cubic feet of dry gaseous fuel, at standard conditions.



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3. When the duct burner is not in operation, the total concentration of Oxides of Nitrogen (NOx), calculated as Nitrogen Dioxide, shall not exceed 15 parts per million by volume corrected to fifteen (15) percent Oxygen, on a dry basis (PPMVD), as measured in the exhaust stack. Compliance with this limit shall be demonstrated during annual source tests.
4. When the duct burner is in operation, the total concentration of NOx, calculated as Nitrogen Dioxide shall not exceed 17 PPMV corrected to 15% Oxygen on a dry basis, as measured in the exhaust stack. Compliance with this limit shall be demonstrated during annual source tests.
5. The aggregate NOx emissions from the two replacement turbines, two duct burners, and the two boilers (Permit to Operate Nos. 841 and 920191) shall be calculated and recorded on a monthly basis. The annual aggregate NOx emissions from this facility shall not exceed 50 tons in any twelve consecutive month period.
6. The NOx emission factors used to determine the aggregate NOx emission rate for the turbines and duct burners shall be based upon the most recent District approved source test, as approved in writing by the District, except as follows: within 60 days after written approval from the District for a change in NOx emission factor values is received by the Permittee, the newly approved emission factor values shall be input into the automated NOx emissions reporting system.
7. The aggregate annual CO emission factors used to determine the aggregate annual CO emission rate for the turbines and duct burners for a given year shall be based upon annual gas turbine and duct burner Natural gas consumption rates and the District approved source test conducted in the year of that source test, as approved in writing by the District. An Automated CO Emissions Reporting System is not required.
8. A current print out from the automated NOx emission recording system indicating the current NOx emission factors used to report estimated daily, monthly and annual emissions, and the most recent written authorization from the District for a change of NOx emission factor values to be used by the automated system to estimate NOx emissions shall be made readily available upon request of District personnel.
9. The maximum annual fuel consumption rate for the two gas turbines and the two duct burners combined shall not exceed 1490 million cubic feet in any 12 consecutive month period.
10. Emissions of Carbon Monoxide (CO) from the gas turbine shall not exceed 50 PPMV corrected to 15% Oxygen, on a dry basis. Compliance with this limit shall be demonstrated at the time of the annual source tests.
11. The automated system to monitor and record excursions, and to provide a visual alarm when excursions occur shall be installed and operated in accordance with description of the Excursion Monitoring System provided in the SDSU letter to the District dated August 5, 2003. Any proposed modification to the Excursion Monitoring System which would result in a deviation from the description, as stated in the SDSU letter dated August 5, 2003 shall require an application for modification and a District Authority to construct letter for such modification.
12. Except during startups, shutdowns, and during operations in Low Emissions Mode where one or more self-correcting excursions do not exceed a combined duration of 360 seconds in a clock hour, the gas turbine shall be in Low Emissions Mode and shall not otherwise undergo any excursions at all times when the turbine is in operation. Low Emissions Mode is defined as the gas turbine operating mode when the unit load is 50% or greater (2617 KW or greater) and the pilot valve position (%) is less than or equal to the low pilot setting value indicated in the graph of Low Emissions Pilot Valve Setting vs. Load or equivalent table. For loads in excess of 100% (or 5233 KW), Low Emissions Mode is defined as the gas turbine operating mode when the pilot valve position (%) is less than or equal to the pilot valve position value setting corresponding with 100% load, as defined in the graph of Low Emissions Pilot Valve Settings vs. Load or equivalent table.
13. In the event that source test results do not demonstrate compliance with District Emission Standards, the applicant shall take corrective action that would result in a modification to the equipment shall require an application for modification and a District Authority to Construct letter for such modification.



COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
10124 OLD GROVE ROAD, SAN DIEGO, CA 92131
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PERMIT RECORD ID

APCD2003-PTO-975399

Sectors: 3, K
Site Record ID: APCD1976-SITE-00208
Application Record ID: APCD2015-APP-004247



14. The status of the Solo NOx Mode and the transient pilot setting shall be continuously monitored by the Distributed Control System (DCS). Except during startups and shutdowns, all excursions shall be monitored and recorded by the DCS at all times when the unit is operating and incorporated into the APCD monthly report of startups, shutdowns, and excursions, and shall be made readily available to the District upon request. An excursion is defined as the gas turbine operating mode when the unit load is 50% or greater (2617 KW or greater) and the pilot valve position (%) is greater than the low pilot setting value indicated in the graph of low emissions pilot valve settings vs. Load. For loads in excess of 100% (or 5233 KW), an excursion is defined as the gas turbine operating mode when the pilot valve position (%) is greater than the pilot valve position value setting corresponding with 100% load, as defined in the graph of Low Emissions Pilot Valve Settings vs. Load or equivalent table.
15. The DCS Control Panel screen shall visually display "L.E. Excursion" to indicate a Low Emissions Mode excursion is in progress during the duration of all excursions in excess of 60 seconds, beginning with the 60th consecutive second of an excursion.
16. The DCS Control Panel screen shall visually display "L.E. Excursion" to indicate a Low Emissions Mode excursion is in progress, during all excursions of any duration, beginning of the fourth excursion of a clock-hour, which begins within that same clock-hour.
17. The DCS shall record "L.E. Excursion" in the APCD monthly start-up and shut-down log, along with the date and time and duration of excursion, Unit Identifier (CGT_A or CGT_B) and amount of fuel consumed (in MSCF) for all excursions with duration in excess of 60 seconds.
18. The DCS shall record "L.E. Excursion" in the APCD monthly start-up and shut-down log, along with the date and time and duration of excursion, Unit Identifier (CGT_A or CGT_B) and amount of fuel consumed (in MSCF) during all excursions of any duration, beginning of the fourth excursion of a clock-hour, which begins within that same clock-hour.
19. NOx emission from the stack shall be monitored and recorded for at least 30 minutes using a Calibrated Portable NOx Analyzer following all major combustor and Solonox System related maintenance and repairs, and inspections, as determined by Solar Turbines Inc. Descriptions of actions taken to fix the problem and NOx Analyzer readings shall be documented and recorded to the satisfaction of the District. At a minimum, NOx measurements shall be monitored and recorded for at least 30 minutes as part of the semi-annual inspection and for at least 30 minutes as part of the annual inspection.
20. Continuous monitor and display of Pilot Valve Position (Pilot Vlv Pos), expressed in percentage of full open, gas turbine power real power, expressed in KW, and inlet air temperature, expressed in degrees Fahrenheit shall be readily available to view and/or take photos of the display screen by District personnel, at all times when the gas turbine is operating. The graph of Low Emissions Pilot Valve Settings vs. Load and the equivalent table shall be posted within 3 feet of the gas turbine panel view screen.
21. Except during startups and shutdowns, NOx emissions from the stack shall be monitored and recorded for at least 30 minutes at least once every 8-hour shift using a Calibrated Portable NOx Analyzer beginning within 48 operating hours after an excursion or multiple excursions have occurred for a total combined duration of 360 seconds or longer in a clock hour until Portable NOx Analyzer readings indicate NOx emission concentrations are equal to or below the applicable NOx emissions concentration limit stated on this Permit. NOx readings in excess of the applicable Permit limit, as indicated by a Portable NOx Analyzer does not constitute a Violation and shall only be used for informational purposes, as a means to determine when corrective action is required. Compliance with the emission limits stated on this Permit shall only be determined based upon a District approved source test. Calibration records and emission data, including data from the Calibrated Portable NOx Analyzer shall be maintained on-site for at least 3 years and made readily available to the District upon request.
22. The cause of all excursions that have occurred for a total combined duration of 360 seconds or longer within a clock-hour and description of actions taken to fix the problem shall be documented by Solar Turbines Inc. to the satisfaction of the District and made readily available to the District upon request.



COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
10124 OLD GROVE ROAD, SAN DIEGO, CA 92131
PHONE (858) 586-2600 FAX (858) 586-2601
www.sdapcd.org

PERMIT RECORD ID

APCD2003-PTO-975399



Sectors: 3, K
Site Record ID: APCD1976-SITE-00208
Application Record ID: APCD2015-APP-004247

23. Thirty days before testing is performed by an independent third party source test contractor, a written test protocol shall be submitted and approved by the District for NOx, and CO emissions testing of the two turbines. The protocol format and the requirements for Condition No. 5 and/or 6 can be obtained from the Monitoring Source Testing Group at (858) 586- 2775. A final test report shall be submitted for approval to the District no more than thirty days following completion of source testing. Proposed NOx and CO emission factors, calculated based upon source test results shall be included in the source test report. The Applicant should allow 30 days for source test protocol approval and should contact the Monitoring Source Testing Group at (858)586-2775 with any questions regarding test protocol format, submittal or approval of a test protocol. A test protocol shall not be required if the source testing is conducted by the District.
24. The NOx concentration limits in these Conditions shall not apply during start-up, or shut-down for a period not to exceed 120 continuous minutes.
25. The maximum combined daily natural gas consumption from the two (2) gas turbines and duct burners associated with Permits to Operate Nos. 975398 and 975399 shall not exceed 4 million cubic feet per day. This maximum combined daily fuel consumption limit shall be adjusted based upon source test results.
26. Dedicated non-resettable totalizing meters with an accuracy of +/- 5% shall be installed in the fuel line of each turbine and in the fuel line of each duct burner to measure the volumetric flow rate corrected for temperature and pressure of the fuel. Any correction factors shall be maintained on-site and made available to the District upon request.
27. Continuous monitors to record fuel flow to each turbine and each duct burner shall be calibrated on an annual basis. Calibration records shall be maintained on-site and made readily available to the District upon request.
28. The date, time, and duration of all excursions and the quantity of fuel consumed during each excursion shall be recorded by the Distributed Control System (DCS) and reported in the APCD monthly report - monthly start-up and shut-down log.
29. The total combined daily fuel consumption and the total combined fuel consumption in a 12 consecutive month period for the two gas turbines, two duct burners and the two existing boilers (Permit to Operate Nos. 841 and 920191) shall be recorded, reported in an APCD monthly report, SDSU Cogeneration Facility fuel gas usage and NOx emissions Log, and made readily available to the District upon request. A Continuous Emissions Monitoring System (CEMS) is not required.
30. Daily fuel consumption and NOx emissions for each gas turbine, duct burner and boiler at the facility shall be determined on a monthly basis and reported in the APCD monthly report, daily fuel gas consumption and NOx emissions log.
31. Records including natural gas purchase records shall be maintained and made available to the District upon request. The particular gas turbine or duct burner shall be identified on fuel records generated from continuous monitors serving the dedicated totalizing natural gas flow meters. The actual times and duration of all startups, shutdowns, and quantity of fuel consumed shall be recorded for each gas turbine and duct burner.
32. Visible emissions from the exhaust stacks and the lube oil vent mist eliminator serving the lube oil vent of the turbine shall not exceed 20% opacity for more than three (3) minutes in any period of 60 consecutive minutes.
33. This equipment shall be source tested for compliance at least annually before the Permit to Operate renewal date, unless otherwise specified in writing by the District. Testing shall be conducted in accordance with District Source Test Method 100, or the Air Resources Board (ARB) Test Method 100 as approved by EPA, and a source test protocol approved in writing by the District to ensure compliance with District emission standards for NOx and CO prior to Permit renewal. Testing shall be performed at no less than 80% of full power rating, except as follows: if it is demonstrated to the satisfaction of the District that the duct burner cannot operate at these conditions as a result of insufficient steam demand, then emissions source testing shall be performed with the duct burner operating at the highest achievable continuous power rating.
34. The following operational characteristics shall be continuously monitored at all times, and recorded, during source tests and submitted to the District within 24 hours after a source test is complete: time and duration of all excursions, percent turbine load, real power of turbine, pilot valve position, turbine inlet temperature, cumulative turbine fuel flow, cumulative duct burner fuel flow, average combustion temperature, gas turbine inlet air temperature, compressor discharge pressure, power output, and steam flow rate.
35. Access, facilities, utilities and any necessary safety equipment for source testing and inspection shall be provided upon request of the Air Pollution Control District.



COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
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PERMIT RECORD ID

APCD2003-PTO-975399



Sectors: 3, K
Site Record ID: APCD1976-SITE-00208
Application Record ID: APCD2015-APP-004247

- 36. This Air Pollution Control District Permit does not relieve the holder from obtaining permits or authorizations required by other governmental agencies.
- 37. The permittee shall, upon determination of applicability and written notification by the District, comply with all applicable requirements of the Air Toxics "Hot Spots" Information and Assessment Act (California Health and Safety Code Section 44300 et seq.)

DISTRIBUTION CHECKLIST FOR METHOD 100 CO, NOx TEST

Site: **SD State University**
GT B, DB On

Test Date: 4/3/2019
PO. No. APCD2003-PTO-975399

TEST REPORT CONTENTS

- | | |
|---|---|
| <input type="checkbox"/> COVER LETTER | <input checked="" type="checkbox"/> ANALYZER CHECK OFF SHEET (p. 5) |
| <input checked="" type="checkbox"/> SOURCE TEST SUMMARY SHEET (p.1) | <input checked="" type="checkbox"/> ENGINEERING REPORT |
| <input checked="" type="checkbox"/> DATA SHEET (p.2-4) | <input checked="" type="checkbox"/> DATA ACQUISITION TABLES |

MTS FILE NOTES

- | | |
|--|--|
| <input type="checkbox"/> FOLDER LABELLED | <input checked="" type="checkbox"/> PO and PAYMENT SHEET |
| <input checked="" type="checkbox"/> CHECK LIST IN FOLDER | |

REPORT BY: N. Gutzwiller

DATE: 10-Apr-19

TEST CONDUCTED BY: N. Gutzwiller, A. Fry

DATE: 3-Apr-19

REPORT QC BY: Daryl Hawkes

DATE: 05/22/19

APPROVED BY: D.A. Sodeiman

DATE: 6/14/19

DISTRIBUTION

EXCEEDANCE

FULL REPORT TO:

- SITE
- ENGINEERING FILE
- ENGINEER
- COMPLIANCE
- DAVID SODEMAN

SUMMARY PAGE & ENG. REPORT TO:

SUMMARY PAGE ONLY TO:

NON-EXCEEDANCE

FULL REPORT TO:

- SITE
- DAVID SODEMAN

SUMMARY PAGE & ENG. REPORT TO:

- EMISSIONS INVENTORY
- ENGINEERING FILE
- COMPLIANCE

APPS & PTAs - LABOR TRACKING SHEET

TEST RESULTS INTO DATA BASE

ORIGINAL REPORT TO MT&S FILE

Emissions Summary Sheet

SD State University
GT A, DB On

PO: APCD2003-PTO-975398
DATE: 4-Apr-19

COMBINED TURBINE & DUCT BURNER EMISSIONS

	Run 1	Run 2	Run 3	Average	Limit
NOx (ppm)	18.7	18.6	18.8	18.7	
NOx (ppm @ 15% O2)	15.4	15.4	15.5	15.4	17
NOx (lb/MMBtu)	0.057	0.057	0.057	0.057	
NOx (lb/hr)	4.41	4.43	4.46	4.43	
NOx (lb/MMscf)	58.9	58.9	59.4	59.1	
CO (ppm)	6.11	5.86	5.99	5.98	
CO (ppm @ 15% O2)	5.03	4.83	4.94	4.94	50
CO (lb/MMBtu)	0.0113	0.0108	0.0111	0.0111	
CO (lb/hr)	0.877	0.847	0.866	0.863	
CO (lb/MMscf)	11.7	11.3	11.5	11.5	
O2 (%)	13.72	13.74	13.75	13.74	

Exhaust flow (dscfm)	32,929	33,154	33,172	33,085
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Turbine gas flow, natural gas (mscfh)	57.84	58.13	58.03	58.00	
Turbine heat input (MMBtu/hr)	60.2	60.5	60.4	60.4	
DB gas flow, natural gas (mscfh)	17.00	17.00	17.10	17.03	
DB heat input (MMBtu/hr)	17.7	17.7	17.8	17.7	
Heat value (Btu/scf)	1,041				
Load (MW)	4.807	4.857	4.849	4.838	5.233

DUCT BURNER EMISSIONS*

NOx (ppm @ 15% O2)	34.0	34.1	34.6	34.2	
NOx (lb/MMBtu)	0.125	0.126	0.127	0.126	
NOx (lb/hr)	2.22	2.22	2.27	2.24	
NOx (lb/MMscf)	130.4	130.9	132.6	131.3	
CO (ppm @ 15% O2)	18.6	17.8	18.2	18.2	
CO (lb/MMBtu)	0.0417	0.0400	0.0408	0.0408	
CO (lb/hr)	0.739	0.707	0.727	0.724	
CO (lb/MMscf)	43.5	41.6	42.5	42.5	

*Calculated from difference of measured combined emissions and measured turbine emissions

GT NOx emission factor (lb/MMBtu) 0.0364
GT CO emission factor (lb/MMBtu) 0.00230

$$DB \frac{\text{lb}}{\text{mmbtu}} = \frac{\text{Combined} \frac{\text{lb}}{\text{mmbtu}} * \text{Combined} \frac{\text{mmbtu}}{\text{hr}} - \text{Turbine} \frac{\text{lb}}{\text{mmbtu}} * \text{Turbine} \frac{\text{mmbtu}}{\text{hr}}}{DB \frac{\text{mmbtu}}{\text{hr}}}$$

$$DB_{\text{ppm @ 15\% O}_2} = \frac{DB \frac{\text{lb}}{\text{mmbtu}} * (20.9 - 15)}{2.596 \times 10^{-9} * MW * 8710 * 20.9}$$

**PERMIT RENEWAL TEST
PERMIT YEAR: MAY 1, 2018 - APRIL 30, 2019**



Monitoring and Technical Services
10124 Old Grove Road
San Diego, CA 92131

Nitrogen Oxides & Carbon Monoxide
Emissions Summary Report

SITE: SD State University
GT A, DB On
LOCATION: 5500 Campanile Dr.
San Diego, CA 92182

MAIL ADDRESS: SD State University
5500 Campanile Dr.
Mail Code 1243
San Diego, CA 92182

P/O NUMBER: APCD2003-PTO-975398
ID NUMBER: APCD1976-SITE-00208

TEST DATE: 4-Apr-19

EQUIPMENT: Solar turbine 60-T7300S GSC Taurus, natural gas fired, 59.48 MMBtu/hr (LHV), 5.233 MW net output with SoLoNOx technology. Combined with a John Zink low NOx duct burner, natural gas fired, 20 MMBtu/hr (HHV) and HRSG

REPORT BY: N. Gutzwiller
REPORT DATE: 10-Apr-19

APCD PERSONNEL: N. Gutzwiller, A. Fry

SITE PERSONNEL: Dan Root

APPROVED BY: *David Sodeman* 6/14/19
David Sodeman, Senior Chemist

Table 1. Summary of Results - NOx and CO Stack Emissions Corrected to 15% O2

	TEST RESULTS	PERMIT LIMITS	PERFORMANCE	HOURS OF TEST
NOx (ppm)	15	17	PASS	1.6
CO (ppm)	5	50	PASS	1.6
Fuel (scfh)	74,840			
Power output (MW)	4.838 rated @ 5.233			

TEST REFERENCE: This testing was performed in accordance with the San Diego Air Pollution Control District Method 100: "Test Procedures For The Determination of Nitrogen Oxides, Carbon Monoxide and Diluent Gases by Continuous Emission Monitoring."

INTERMEDIATE SUMMARY TABLE

Test Hrs	Sub-test number	Avg NO2 % of total NOx	Avg Raw NOx ppm	Avg. Raw NO ppm	NOx adj for drift & bias ppm	Avg. Raw CO ppm	CO adj for drift & bias ppm	Avg. Raw O2 %	O2 adj for drift & bias %	Corr NOx @ 15 % O2 ppm	Corr CO @ 15 % O2 ppm
10:13-10:45	1	27.7%	18.26	13.31	18.68	6.26	6.11	13.60	13.72	15.38	5.03
11:05-11:37	2	25.9%	18.23	13.60	18.63	5.93	5.86	13.62	13.74	15.38	4.83
11:58-12:30	3	26.8%	18.25	13.48	18.79	6.01	5.99	13.60	13.75	15.52	4.94
Average		26.8%			18.70		5.98		13.74	15.43	4.94

Calibration Gases:

Gas	Cylinder	Manufacturer	Conc.
NO	CC233189	TechAir	44.72 ppm
NO2	CC501609	Praxair	7.18 ppm
CO	ALM-037113	Praxair	44.9 ppm
O2	CC246193	Praxair	21.10 %
O2	EB0014605	TechAir	11.99 %
N2		TechAir	

Calibration Gas Dilutions:

Gas	Concn. 100%	dil. to: %	concn.
NO (ppm)	44.7	40	17.89
		20	8.94
NO2(ppm)	7.18	50	3.59
CO (ppm)	44.9	20	8.98
		10	4.49
O2 (%)	21.10	100	21.10
		11.99	100

Instrument scales :

NOx: 0-22 ppm
 NO: 0-22 ppm
 CO: 0-11 ppm
 O2: 0-25 %

Concentrations for SGD eval:

Gas Used	21.10	%O2
diluted to:		
%	%	
100	21.10	
60	12.66	
50	10.55	
40	8.44	
20	4.22	
10	2.11	
	0.00	

Scale: 0-25 %

Direct challenge gas: 11.99 % O2

System Leak Checks:

Initial: good
 Final: good

DAS Trigger Times:

1 : 6:33:41
 2 : 7:24:00
 3 : 8:54:23
 4 : 10:13:00
 5 : 11:43:10

INSTRUMENTATION.

NOx analyzer: CAI 600 (chemiluminescence) with low temperature converter.
 CO analyzer: Thermo 48i (NDIR).
 O2 analyzer: Servomex 1440C (paramagnetic).
 Standard gas divider: Stec model SGD-A10.

QA/QC CHECKS (continued).

SGD FIELD EVALUATION, (limits: all differences +/-2%).

Gas used: **21.10** %O2 Scale: 0 - **25** %

Gas diluted to: (%)	SGD gas values (%)			Average	Actual conc. (%)
	1	2	3		
100	21.39	21.41	21.41	21.40	21.10
				1.4%	% diff. of avg. from act. val.
	-0.1%	0.0%	0.0%		% diff. from avg.
60	12.68	12.69	12.69	12.69	12.66
				0.2%	% diff. of avg. from act. val.
	-0.1%	0.0%	0.0%		% diff. from avg.
50	10.55	10.57	10.57	10.56	10.55
				0.1%	% diff. of avg. from act. val.
	-0.1%	0.1%	0.1%		% diff. from avg.
40	8.40	8.42	8.42	8.41	8.44
				-0.3%	% diff. of avg. from act. val.
	-0.2%	0.1%	0.1%		% diff. from avg.
20	4.17	4.18	4.17	4.17	4.22
				-1.1%	% diff. of avg. from act. val.
	-0.1%	0.2%	-0.1%		% diff. from avg.
10	2.11	2.10	2.09	2.10	2.11
				-0.5%	% diff. of avg. from act. val.
	0.5%	0.0%	-0.5%		% diff. from avg.

MID-LEVEL GAS CONCENTRATION DIRECT TO ANALYZER, (limit: difference +/-2%).

Gas used: **11.99** % O2 Scale: **0-0-25**

		Inj. #1	Inj. #2	Inj. #3	Avg.
Instrument response (%)	Dir. Val.	12.15	12.14	12.14	12.14
		Diff. %			1.3%

CONVERTER EFFICIENCY, (must be >90%).

	NOx Mode	NO Mode	NO2 gas: 3.59 ppm
NO2 dir (ppm)	3.36	0.04	
NO2 zero (ppm)	0.00	0.00	
Conv. Eff. (%)	92.5%		

MULTI-POINT CALIBRATION INSTRUMENT CHECK, (limit: instr. val. within 2% of full scale of predict. val.).

Conc. level	Gas Conc.			Instr. response					
	NO ppm	CO ppm	O2%	NO ppm	NO ACE	CO ppm	CO ACE	O2 %	O2 ACE
High	17.89	8.98	21.10	17.86	-0.1%	8.99	0.1%	21.10	0.0%
Zero	0.00	0.00	0.00	0.00	0.0%	0.01	0.1%	0.01	0.0%
Mid	8.94	4.49	11.99	8.92	-0.1%	4.61	1.1%	11.97	-0.1%
			Scale, 0-	22		11		25	
			Slope	1.00		1.00		1.00	
			Intercept	0.00		-0.01		-0.01	
			Mid (predict.)	8.93		4.50		11.99	
			Diff. (% full scale)	0.0		1.0		-0.1	

RUN #1

Time: 10:13- 10:45
East - South
12 pt

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	8.92	1.3%	8.92	1.1%	8.92	8.94	0.0%
	zero	0.00		0.00		0.00	0.0%	
	system	8.81		8.83		8.82	8.94	0.1%
	zero	0.01		0.01		0.01	0.00	0.0%
NO2	direct	3.36	8.0%	3.33	6.9%	3.35	3.59	-0.1%
	zero	0.00		0.01		0.01	0.00	0.0%
	system	3.17		3.24		3.21	3.59	0.3%
	zero	0.08		0.15		0.12	0.00	0.3%
CO	direct	4.61	0.7%	N/A	N/A	N/A	4.49	N/A
	zero	0.01		N/A		N/A	0.00	N/A
	system	4.65		4.58		4.6	4.49	-0.6%
	zero	0.08		0.01		0.0	0.00	-0.6%
O2 as %	direct	11.97	1.0%	N/A	N/A	N/A	11.99	N/A
	zero	0.01		N/A		N/A	0.00	N/A
	system	11.88		11.89		11.89	11.99	0.0%
	zero	0.04		0.04		0.04	0.00	0.0%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	18.26	18.68	ppm
NO avg	13.31	13.50	ppm
NO2 avg	4.95	5.18	ppm
CO avg	6.26	6.11	ppm
O2 avg	13.60	13.72	%

NOx 0- 22 ppm
CO 0- 11 ppm
O2 0- 25 %

Stack NO2 %
27.7%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

Stratification Check

Point	CO ppm	O2 %	NO ppm	NOX ppm	CO @15%O2	NOX @15%O2
E-1	4.66	13.62	13.83	17.98	3.78	14.59
E-2	4.56	13.62	13.55	17.95	3.70	14.57
E-3	4.64	13.70	13.23	17.77	3.81	14.58
E-4	6.87	13.83	11.99	17.46	5.74	14.59
E-5	7.93	13.77	11.83	17.67	6.57	14.64
E-6	8.28	13.95	11.64	17.46	7.04	14.84
S-1	5.41	13.43	14.60	18.75	4.28	14.84
S-2	5.33	13.54	14.15	18.58	4.28	14.92
S-3	5.45	13.68	13.34	18.16	4.46	14.86
S-4	6.75	13.50	13.25	18.57	5.39	14.83
S-5	7.38	13.30	13.87	19.14	5.74	14.89
S-6	7.90	13.21	14.38	19.58	6.07	15.05
avg	6.26	13.60	13.31	18.26	5.07	14.77
min	4.56	13.21	11.64	17.46	3.70	14.57
dif	-27.2%	-2.8%	-12.5%	-4.4%	-27.0%	-1.3%
max	8.28	13.95	14.60	19.58	7.04	15.05
dif	32.2%	2.6%	9.7%	7.3%	38.8%	1.9%
stack	60			1	8.6	
ext	6			2	14.8	
				3	23.8	
				4	48.2	
				5	57.2	
				6	63.4	

RUN #2

Time: 11:05- 11:37

South - East
12 pt

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	8.92	1.1%	8.91	1.5%	8.92	8.94	0.0%
	zero	0.00		-0.01		-0.01	0.00	0.0%
	system	8.83		8.81		8.82	8.94	-0.1%
	zero	0.01		0.02		0.02	0.00	0.0%
NO2	direct	3.33	6.9%	3.33	8.4%	3.33	3.59	0.0%
	zero	0.01		0.01		0.01	0.00	0.0%
	system	3.24		3.16		3.20	3.59	-0.4%
	zero	0.15		0.12		0.14	0.00	-0.1%
CO	direct	N/A	N/A	N/A	N/A	N/A	4.49	N/A
	zero	N/A		N/A		N/A	0.00	N/A
	system	4.58		4.51		4.55	4.49	-0.6%
	zero	0.01		-0.02		-0.01	0.00	-0.3%
O2 as %	direct	N/A	N/A	N/A	N/A	N/A	11.99	N/A
	zero	N/A		N/A		N/A	0.00	N/A
	system	11.89		11.88		11.89	11.99	0.0%
	zero	0.04		0.04		0.04	0.00	0.0%

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION		
	uncorrected	*corrected	
**NOx avg	18.23	18.63	ppm
NO avg	13.60	13.80	ppm
NO2 avg	4.63	4.83	ppm
CO avg	5.93	5.86	ppm
O2 avg	13.62	13.74	%

NOx 0- 22 ppm
CO 0- 11 ppm
O2 0- 25 %

Stack NO2 %
25.9%

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

Stratification Check

Point	CO ppm	O2 %	NO ppm	NOX ppm	CO @15%O2	NOX @15%O2
E-1	4.49	13.63	14.53	18.11	3.65	14.72
E-2	4.45	13.68	14.24	17.93	3.64	14.67
E-3	4.65	13.67	13.79	17.85	3.80	14.59
E-4	6.76	13.83	12.42	17.64	5.65	14.74
E-5	7.28	13.82	12.20	17.58	6.08	14.67
E-6	7.66	13.75	12.15	17.84	6.33	14.74
S-1	5.21	13.45	14.97	18.91	4.13	15.00
S-2	5.08	13.62	14.11	18.29	4.12	14.85
S-3	5.45	13.70	13.35	18.02	4.47	14.79
S-4	5.49	13.64	13.31	17.95	4.47	14.61
S-5	7.23	13.34	13.72	19.17	5.65	14.99
S-6	7.39	13.27	14.41	19.50	5.73	15.11
avg	5.93	13.62	13.60	18.23	4.81	14.79
min	4.45	13.27	12.15	17.58	3.64	14.59
dif	-24.9%	-2.5%	-10.7%	-3.6%	-24.3%	-1.4%
max	7.66	13.83	14.97	19.50	6.33	15.11
dif	29.2%	1.6%	10.1%	7.0%	31.6%	2.1%

PO#: APCD2003-PTO-975398

DATE: 4-Apr-19

RUN #3

Time: 11:58- 12:30
East - South
12 pt

CALIBRATIONS:

Gas	Calibration	INITIAL		FINAL		Conc. (ppm)		Drift (% FS)
		Conc. (ppm)	Syst. Bias (%)	Conc. (ppm)	Syst. Bias (%)	(avg.)	(actual)	
NO	direct	8.91	1.5%	8.82	1.0%	8.87	8.94	-0.4%
	zero	-0.01		-0.01		0.00	0.0%	
	system	8.81		8.78		8.94	-0.3%	
	zero	0.02		0.01		0.00	-0.1%	
NO2	direct	3.33	8.4%	3.32	7.9%	3.33	3.59	0.0%
	zero	0.01		0.01		0.00	0.0%	
	system	3.16		3.18		3.59	0.1%	
	zero	0.12		0.13		0.00	0.0%	
CO	direct	N/A	N/A	4.47	1.5%	N/A	4.49	N/A
	zero	N/A		-0.14		0.00	N/A	
	system	4.51		4.48		4.49	-0.3%	
	zero	-0.02		-0.06		0.00	-0.4%	
O2 as %	direct	N/A	N/A	11.94	0.9%	N/A	11.99	N/A
	zero	N/A		0.01		0.00	N/A	
	system	11.88		11.85		11.99	-0.1%	
	zero	0.04		0.03		0.00	0.0%	

EMISSION VALUES:

Analyzer Range:

GAS	CONCENTRATION			
	uncorrected	*corrected		
**NOx avg	18.25	18.79	ppm	
NO avg	13.48	13.75	ppm	Stack NO2 %
NO2 avg	4.77	5.04	ppm	26.8%
CO avg	6.01	5.99	ppm	
O2 avg	13.60	13.75	%	

NOx 0- 22 ppm
CO 0- 11 ppm
O2 0- 25 %

*Corrected for drift and system bias.

**NOx AVG corr. = (NO AVG corr.+NO2AVG corr.)

Stratification Check

Point	CO ppm	O2 %	NO ppm	NOX ppm	CO @15%O2	NOX @15%O2
E-1	4.42	13.64	14.44	18.11	3.60	14.74
E-2	4.35	13.65	14.08	17.94	3.55	14.62
E-3	4.50	13.70	13.61	17.81	3.69	14.62
E-4	6.32	13.81	12.45	17.63	5.27	14.69
E-5	7.52	13.76	12.07	17.83	6.22	14.76
E-6	8.04	13.74	12.13	17.85	6.63	14.73
S-1	5.15	13.39	14.85	18.85	4.05	14.84
S-2	5.18	13.62	14.04	18.29	4.20	14.85
S-3	5.46	13.71	13.17	17.91	4.49	14.72
S-4	6.51	13.54	13.05	18.31	5.23	14.70
S-5	7.15	13.37	13.68	19.06	5.61	14.96
S-6	7.47	13.25	14.24	19.40	5.77	14.99
avg	6.01	13.60	13.48	18.25	4.86	14.77
min	4.35	13.25	12.07	17.63	3.55	14.62
dif	-27.6%	-2.6%	-10.5%	-3.4%	-27.0%	-1.0%
max	8.04	13.81	14.85	19.40	6.63	14.99
dif	33.9%	1.6%	10.1%	6.3%	36.5%	1.5%

APPENDIX**Calculation of Gas Concentrations (Method 100).**

1) Concentrations for O₂ & CO (and CO₂ when required) are calculated using equation 1.

$$C_{gas} = (C_{avg} - C_o) * \frac{C_{ma}}{C_m - C_o} \quad 1$$

Where:

C_{gas} = Effluent gas concentration, ppm, dry basis.

C_{avg} = Average gas concentration, ppm, dry basis, indicated by the analyzer.

C_{ma} = Actual certified concentration, ppm, of the mid- or high-range calibration gas used for the system calibration checks.

C_m = Average of the initial and final system calibration responses, ppm, for the mid- or high-range calibration gas.

C_o = Average of the initial and final system calibration responses, ppm, for the zero calibration gas.

2) NO₂, NO, & NO_x gas concentrations, corrected for instrument drift, calibration error and system bias for NO & NO₂ are calculated using equations 2,3 & 4 respectively.

$$NO_2gas = [(NOx_{avg} - NOx_{od}) - (NO_{avg} - NO_{od})] * \frac{NO_{ma}}{NO_{md} - NO_{od}} * \frac{NO_{2md} - NO_{od}}{NO_{2m} - NO_{od}} \quad 2$$

$$NOgas = (NO_{avg} - NO_o) * \frac{NO_{ma}}{NO_{md} - NO_{od}} * \frac{NO_{md} - NO_{od}}{NO_m - NO_o} \quad 3$$

$$NOxgas = NOgas + NO_2gas \quad 4$$

Where:

NO_{xgas} = the total NO_x concentration, ppm, dry basis, in the stack effluent.

NO_{2gas} = the NO₂ concentration, ppm, dry basis, in the stack effluent.

NO_{gas} = the NO concentration, ppm, dry basis, in the stack effluent.

NO_{xavg} = the average NO_x concentration, ppm, dry basis, indicated by the analyzer.

NO_{avg} = the average NO concentration, ppm, dry basis, indicated by the analyzer.

NO_{ma} = the actual certified concentration, ppm, of the mid- or high-range NO calibration gas.

NO_{2md} = the average of the initial and final analyzer responses, ppm, for the NO₂ calibration gas when introduced directly to the analyzer.

NO_{md} = the average of the initial and final analyzer responses, ppm, for the NO calibration gas when introduced directly to the analyzer.

NO_{od} = the average of the initial and final zero calibration responses, ppm, when NO zero calibration gas is sampled directly to the analyzer.

NO_{2m} = the average of the initial and final system calibration responses, ppm, for the NO₂ calibration gas.

NO_m = the average of the initial and final system calibration responses, ppm, for the NO calibration gas.

NO_o = the average of the initial and final system calibration responses, ppm, for the NO zero calibration.

NO_{xod} = the average of the initial and final zero calibration responses, ppm, when the NO_x zero calibration gas is sampled directly to the analyzer.

3) Specific gaseous emission limits corrected to 3% or 15%O₂ are calculated using equations 5a & 5b.

$$C_{gas@3\%O_2} = C_{gas} * \frac{20.95 - 3\%O_2}{20.95 - C_{gasO_2\%}} \quad 5a$$

$$C_{gas@15\%O_2} = C_{gas} * \frac{20.95 - 15\%O_2}{20.95 - C_{gasO_2\%}} \quad 5b$$

Where;

C_{gas @ 3% or 15%} = the stack gas effluent for either NO_x or CO corrected to 3% or 15% O₂.

C_{gas} = the stack gas effluent for either NO_x or CO determined using equation 1.

C_{gas O₂%} = the stack effluent gas concentration of O₂, %.

NOTE: The NO_x analyzer used during this test is capable of measuring NO and total NO_x simultaneously. NO₂ calibration gas values are measured via the NO_x channel, thus NO₂ zero is the same as NO_x zero.

C_{gas @ 3% or 15%} = the stack gas effluent for either NO_x or CO corrected to 3% or 15% O₂.

SOURCE TEST ENGINEERING REPORT



SITE : SD State University
GT A, DB On

PO# : APCD2003-PTO-975398

DATE : 4-Apr-19

APCD PERSONNEL : N. Gutzwiller, A. Fry

EQUIPMENT : Solar turbine 60-T7300S GSC Taurus, natural gas fired, 59.48 MMBtu/hr (LHV),
5.233 MW net output with SoLoNOx technology. Combined with a John Zink
low NOx duct burner, natural gas fired, 20 MMBtu/hr (HHV) and HRSG

OPERATING PARAMETERS

	RUN 1	RUN 2	RUN 3	AVERAGE
Power, KW	4807	4857	4849	4838
GT Fuel Flow, MSCFH	57.84	58.13	58.03	58.00
DB Fuel Flow, MSCFH	17.0	17.0	17.1	17.0
Load, %	91.9%	92.8%	92.7%	92.4%
Pilot Valve Position, graph	10512	10512	10528	10517
Pilot Valve Position, %*	17.1%	17.1%	17.2%	17.1%
Inlet Air Temp, °F	61.3	58.4	58.8	59.5
Combustion Temp, °F	1250.00	1251.00	1252.00	1251.00

*Pilot valve position = $(x-6240)/24960$, where x=reading from graph

Engineering Guide

Page 1

1. Turbine gas flow (mscfh)
2. Duct burner gas flow (mscfh)
3. HRSG steam flow (kpph)
4. Ambient air temp (°F)

Page 2

1. Turbine combustion temp (°F)
2. Pilot valve position
3. Power output (KW)
4. compressor discharge pressure (PCD)
5. Turbine inlet air temp (°F)
6. N/A

**SAN DIEGO GAS & ELECTRIC
MONTHLY GAS QUALITY REPORT**

April 2019

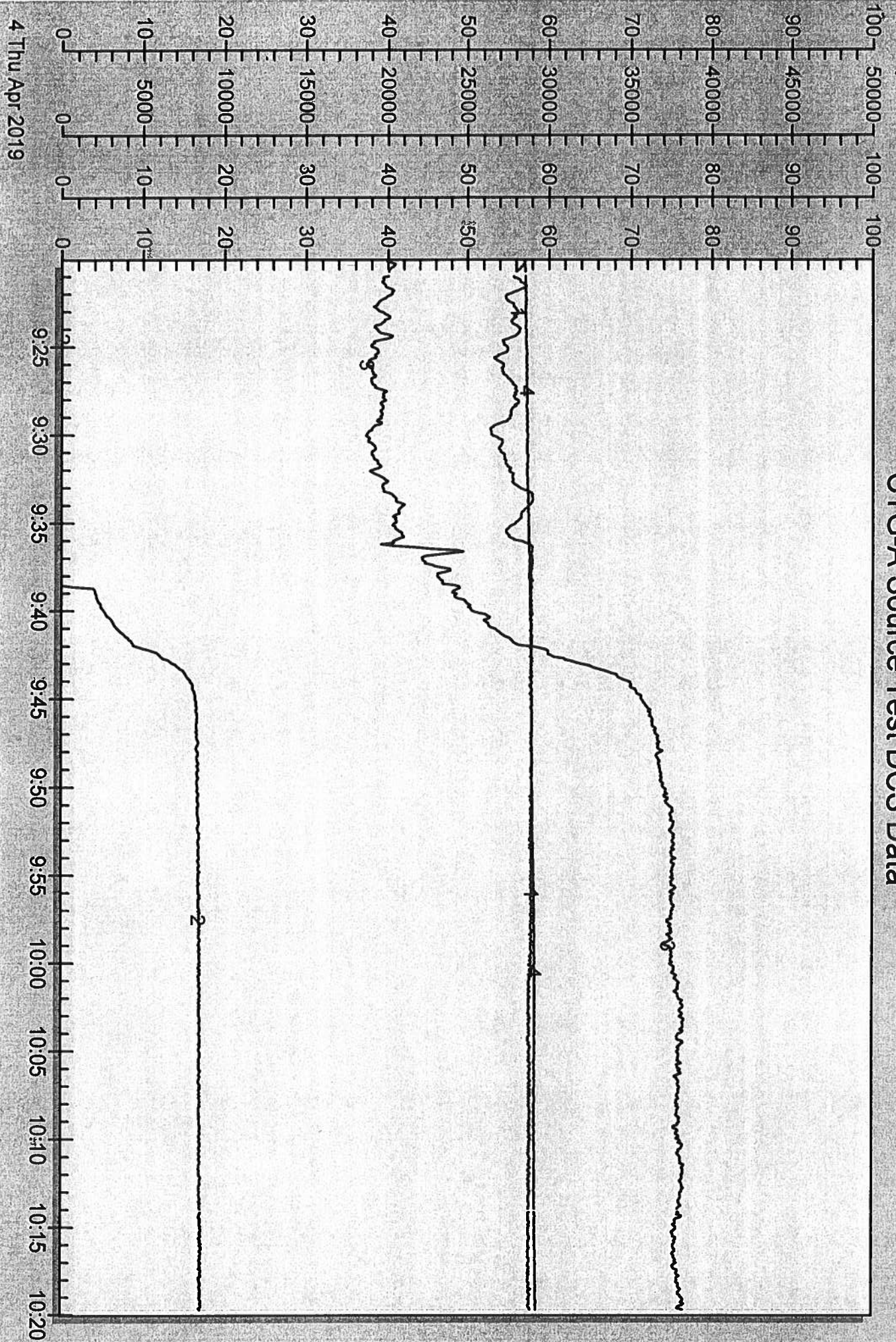
	Thermal Zone 1 Oceanside		Thermal Zone 2 Rainbow		Thermal Zone 3 Sweetwater		Thermal Zone 4 Witherby		Thermal Zone 5 Harvest Station		Thermal Zone 6 Camino Del Norte		Thermal Zone 7 Point Loma	
	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv	BTU	Spec Gv
04/01/2019	1044	0.5954	1042	0.5943	1041	0.5905	1034	0.5873	1038	0.5887	1044	0.5956		
04/02/2019	1041	0.5934	1038	0.5907	1037	0.5878	1034	0.5872	1041	0.5890	1040	0.5930		
04/03/2019	1039	0.5910	1041	0.5927	1039	0.5877	1034	0.5872	1041	0.5889	1039	0.5877		
04/04/2019	1038	0.5919	1036	0.5912	1041	0.5893	1034	0.5872	1039	0.5892	1041	0.5912		
04/05/2019	1034	0.5908	1036	0.5900	1038	0.5889	1034	0.5872	1037	0.5879	1036	0.5891		
04/06/2019	1034	0.5896	1033	0.5878	1035	0.5867	1035	0.5872	1033	0.5850	1035	0.5870		
04/07/2019	1033	0.5850	1033	0.5877	1032	0.5843	1035	0.5872	1031	0.5837	1033	0.5856		
04/08/2019	1034	0.5856			1028	0.5816	1035	0.5872	1028	0.5820	1029	0.5860		
04/09/2019	1032	0.5855			1028	0.5818			1034	0.5852	1027	0.5859		

	Thermal Zone 1 Oceanside	Thermal Zone 2 Rainbow	Thermal Zone 3 Sweetwater	Thermal Zone 4 Witherby	Thermal Zone 5 Harvest Station	Thermal Zone 6 Camino Del Norte	Thermal Zone 7 Point Loma
Avg BTU	1037	1037	1035	1034	1036	1036	
Min BTU	1032	1033	1028	1034	1028	1027	
Max BTU	1044	1042	1041	1035	1041	1044	
Avg Spec Gv	0.5898	0.5906	0.5865	0.5872	0.5866	0.5890	
Min Spec Gv	0.5850	0.5877	0.5816	0.5872	0.5820	0.5856	
Max SpeGvty	0.5954	0.5943	0.5905	0.5873	0.5892	0.5956	

*** Unofficial Data, Subject to Change ***

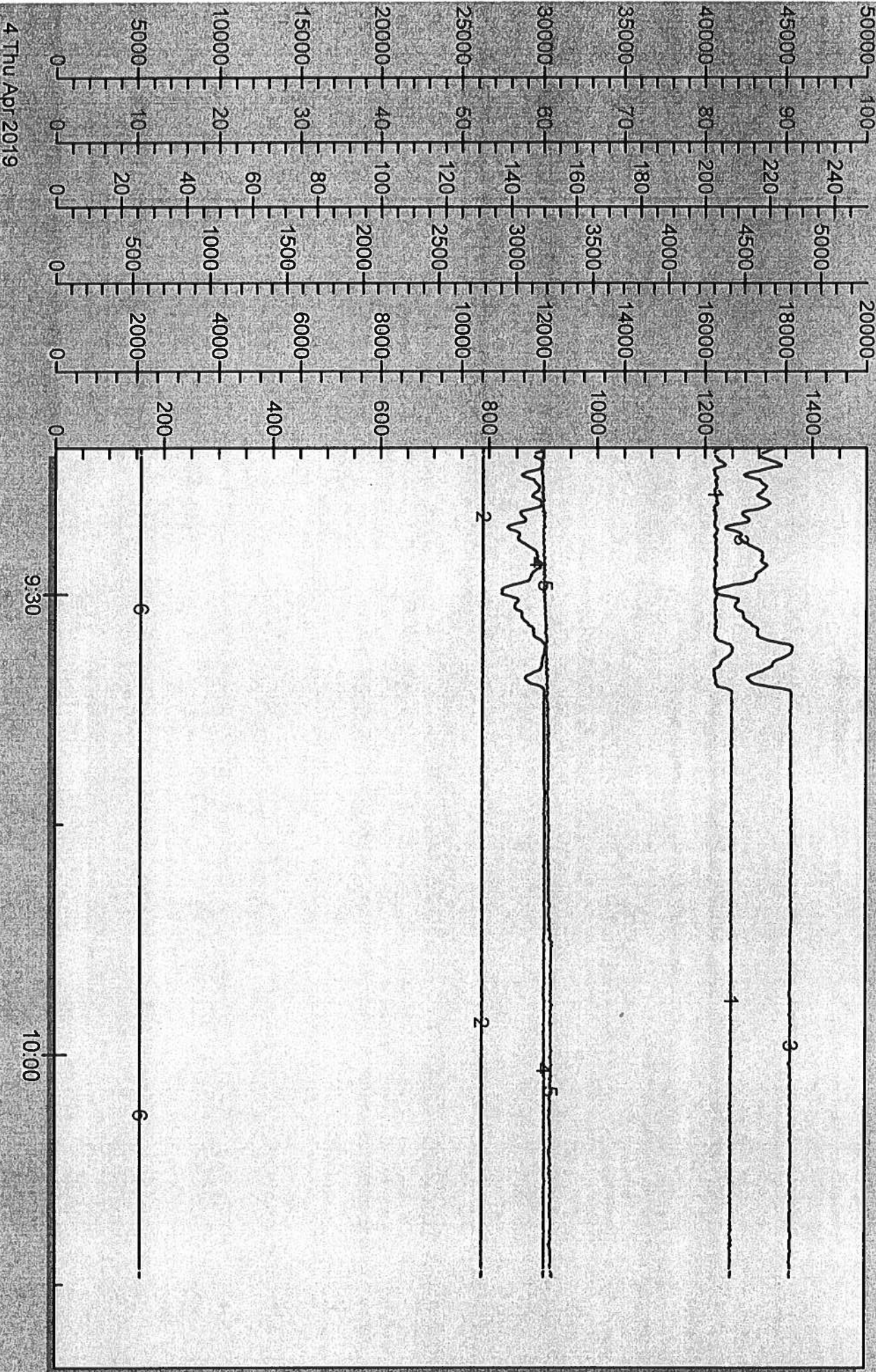
BTU data is now compiled based on the 7 thermal zones listed above as a result of CPUC approval of Advice No. 1863. Historic data for the previously designated 6 thermal zones may be accessed at http://www2.sdge.com/tariff/gas_quality_hist.pdf.

CTG-A Source Test DCS Data



Parameter Reference	Descriptor	Value	Units	Timestamp	V Scale High	V Scale Low
1 FG-CTGACT-GAS-FLOW/OUT CV	CGT-A Fuel Gas/NOx	57.84		4/4/2019 10:19:43 ...	100.00	0.00
2 FG-DPA/ACT-GAS-FLOW/OUT CV	Duct Burner-A Fuel Gas/NOx	17.02		4/4/2019 10:19:43 ...	100.00	0.00
3 HRSG-ASTM/FLOW/STEM/FLOW...	HRSG Steam Flow	38222.98		4/4/2019 10:19:43 ...	50000.00	0.00
4 INVAR_MISCITE-735_CGT-A/OUT CV	Fuel Cooler Miscellaneous	59.5	°F	4/4/2019 10:19:43 ...	100.0	0.0

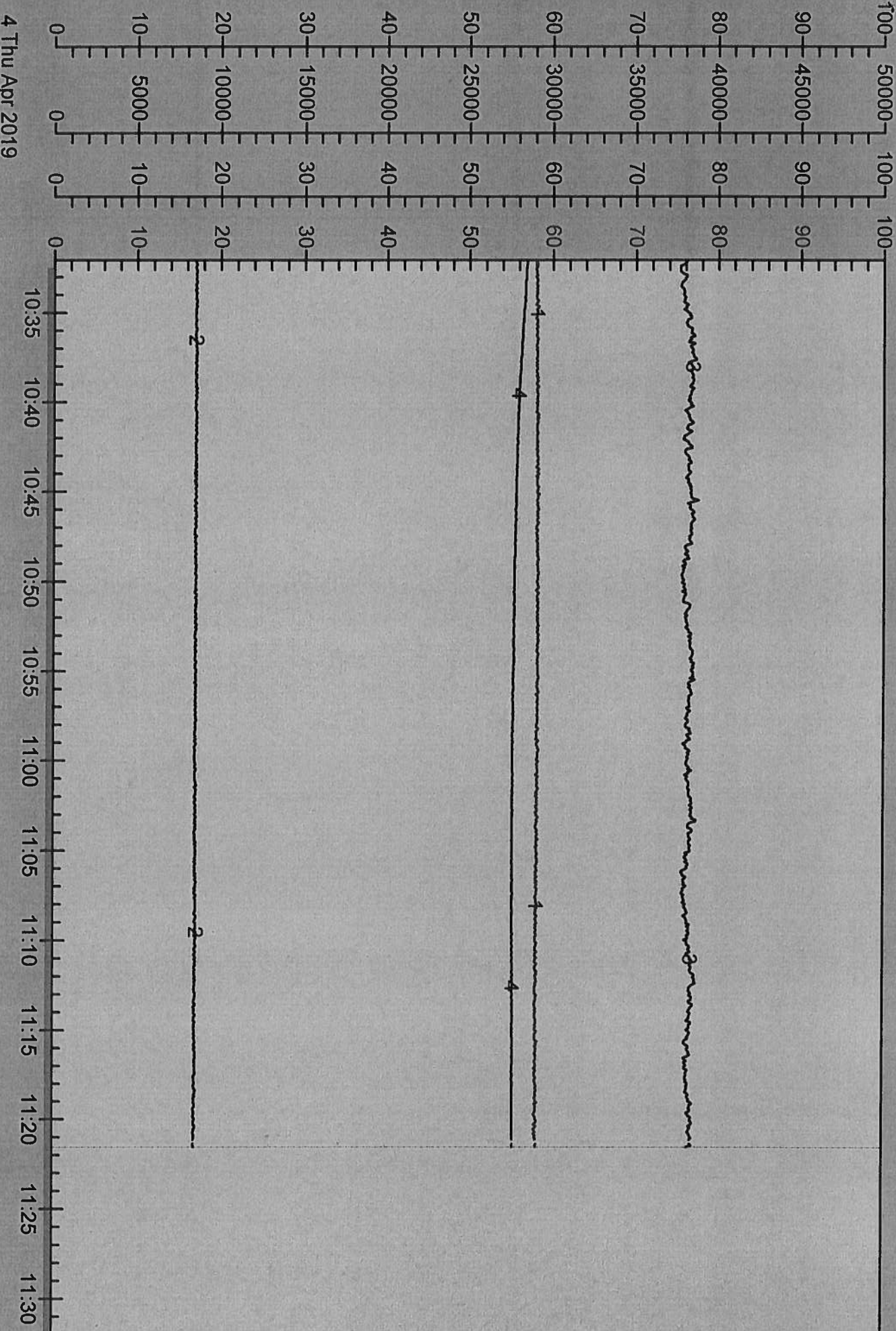
CTG-A Source Test CTG Data



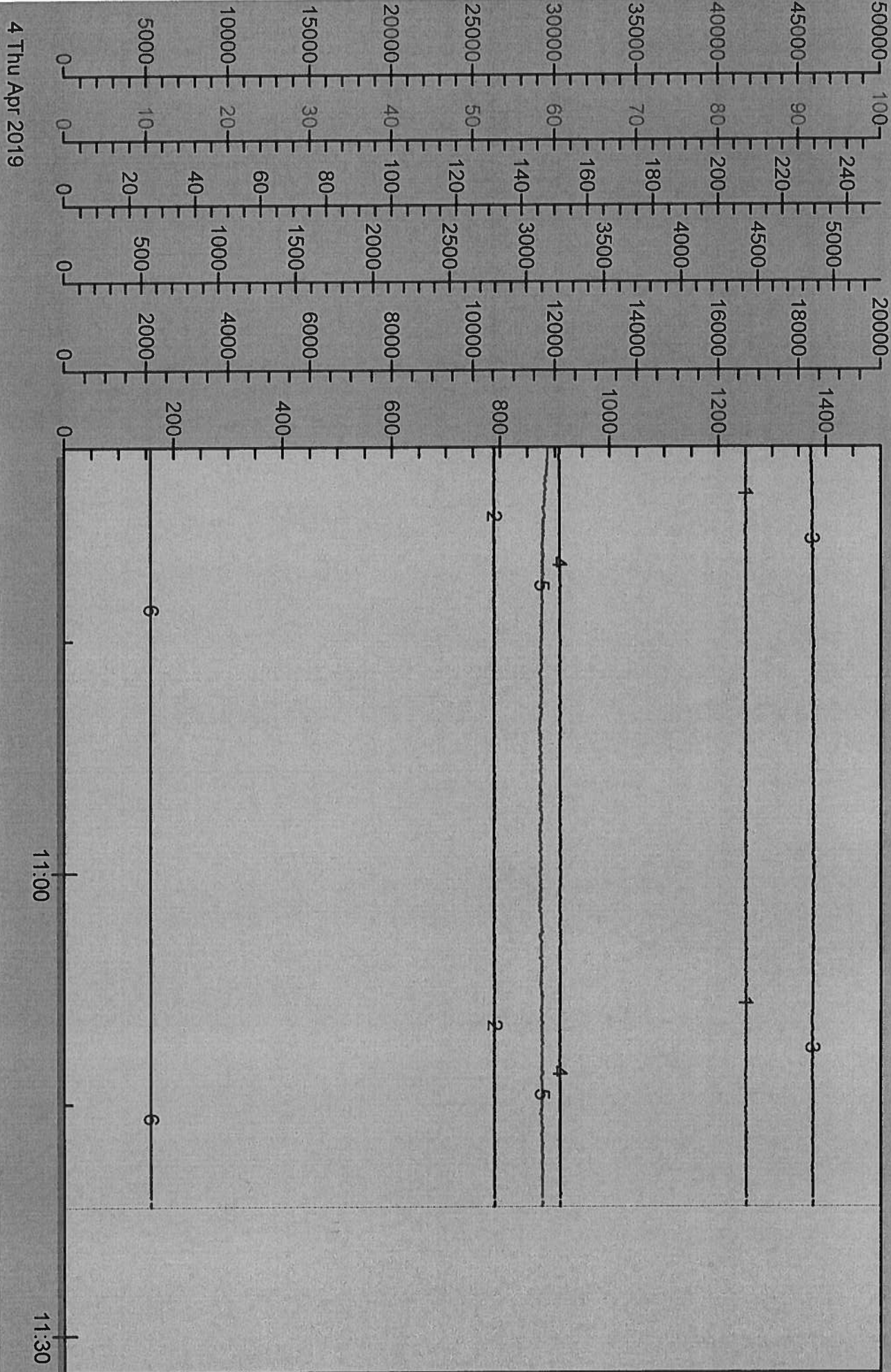
4 Thu Apr 2019

Parameter Reference	Descriptor	Value	Units	Timestamp	Y-Scale High	Y-Scale Low
1	CGT-A_PLCMS-CGT-291A CV	Control Module	1250.00	4/4/2019 10:14:32 ...	15000.00	0.00
2	CGT-A_PLCMS-CGT-291A RAW CV	Control Module	10512	4/4/2019 10:14:32 ...	20000	0
3	CGT-A_PLCMS-CGT-199A CV	Control Module	4807.00	4/4/2019 10:14:32 ...	5300.00	0.00
4	CGT-A_PLCMS-CGT-75A CV	Control Module	150.48	4/4/2019 10:14:32 ...	250.00	0.00
5	CGT-A_PLCMS-CGT-28A CV	Control Module	61.30	4/4/2019 10:14:32 ...	100.00	0.00
6	CGT-A_PLCMS-CGT-28A RAW	Control Module	5274	4/4/2019 10:14:32 ...	50000	0

CTG-A Source Test DCS Data



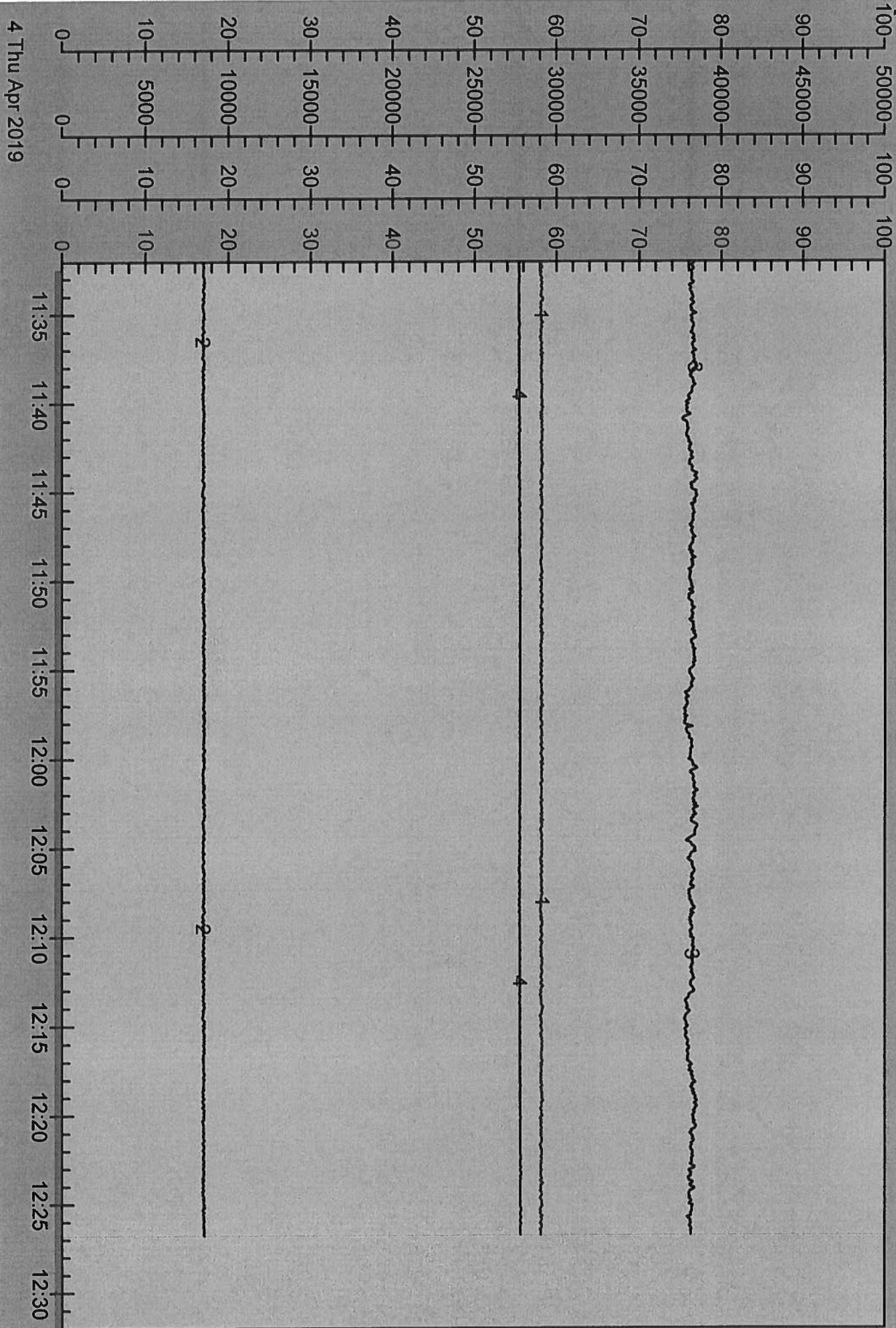
CTG-A Source Test CTG Data



4 Thu Apr 2019

Parameter Reference	Description	Value	Units	Timestamp	Y-Scale High	Y-Scale Low
1 CGT-A_PLCM/S-CGT-291A_CV	Control Module	1251.00		4/4/2019 11:21:42 ...	1500.00	0.00
2 CGT-A_PLCM/S-283A_RAW_CV	Control Module	10512		4/4/2019 11:21:42 ...	20000	0
3 CGT-A_PLCM/S-CGT-199A_CV	Control Module	4857.00		4/4/2019 11:21:42 ...	5300.00	0.00
4 CGT-A_PLCM/S-CGT-75A_CV	Control Module	151.54		4/4/2019 11:21:42 ...	250.00	0.00
5 CGT-A_PLCM/S-CGT-28A_CV	Control Module	58.40		4/4/2019 11:21:42 ...	100.00	0.00
6 CGT-A_PLCM/S-3A_RAW	Control Module	5274		4/4/2019 11:21:42 ...	50000	0

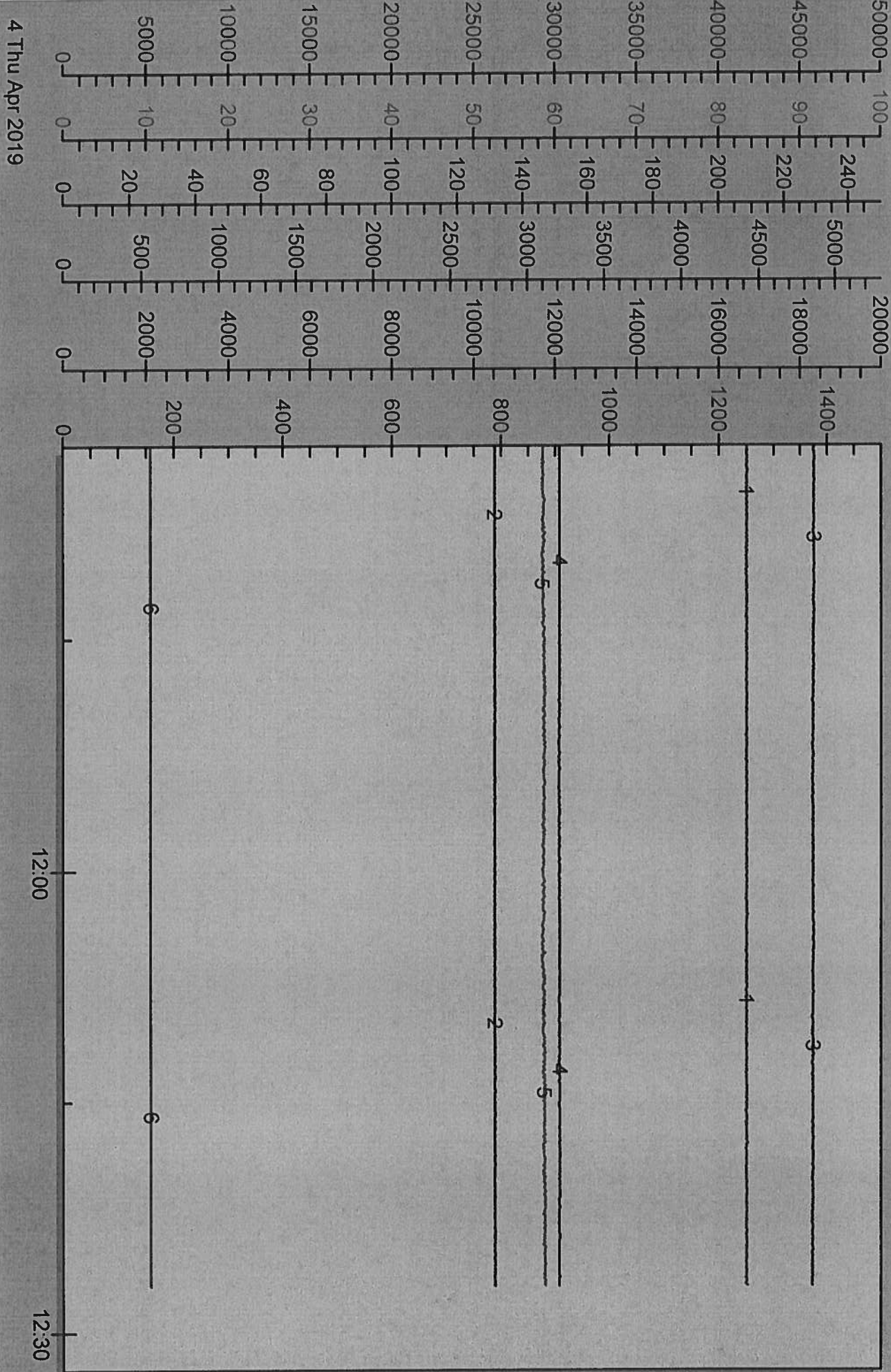
CTG-A Source Test DCS Data



Parameter Reference	Description	Value	Units	Timestamp	Y-Scale High	Y-Scale Low
1 PG_CGT/ACT_GAS_FLOW/OUT CV	CGT-A Fuel Gas/NiOx	58.03		4/4/2019 12:26:48 ...	100.00	0.00
2 PG_DBA/ACT_GAS_FLOW/OUT CV	Duct Burner-A Fuel Gas/NiOx	17.14		4/4/2019 12:26:48 ...	100.00	0.00
3 HRSG-A_STM/FLO/STEAM_FLOW...	HRSG Steam Flow	38059.46		4/4/2019 12:26:48 ...	50000.00	0.00
4 INAIR_MISC/TE-735_CGT-A/OUT CV	Fluid Cooler Miscellaneous	55.6	°F	4/4/2019 12:26:48 ...	100.0	0.0

4 Thu Apr 2019

CTG-A Source Test CTG Data



4 Thu Apr 2019

Parameter Reference	Descriptor	Value	Units	Timestamp	Y-Scale High	Y-Scale Low
1 CGT-A_PLCYS-CGT-291A_CV	Control Module	15028		4/4/2019 12:28:57 ...	1500.00	0.00
2 CGT-A_PLCN1-283A_RAW_CV	Control Module	4849.00		4/4/2019 12:28:57 ...	2000.00	0.00
3 CGT-A_PLCYS-CGT-199A_CV	Control Module	151.25		4/4/2019 12:28:57 ...	5300.00	0.00
4 CGT-A_PLCYS-CGT-75A_CV	Control Module	58.80		4/4/2019 12:28:57 ...	250.00	0.00
5 CGT-A_PLCYS-CGT-28A_CV	Control Module	5274		4/4/2019 12:28:57 ...	100.00	0.00
6 CGT-A_PLCN1-53A_RAW	Control Module			4/4/2019 12:28:57 ...	5000.00	0.00



Site	SDSU GT A
Date	4/4/2019

PO#:	975398.00
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Triggers	
CALS	6:33:41
Run 1	7:24:00
Run 2	8:54:23
Run 3	10:13:00
Run 4	11:43:10

NOx/NO Range 0 -	22	CAI
CO Range 0 -	11	48i
O₂ Range 0 -	25	Servomex

9:34:33	20.46	0.17	0.04	0.05	-0.40	
9:34:43	20.46	0.17	0.03	0.04	-0.43	
9:34:53	20.46	0.17	0.01	0.04	-0.43	
9:35:03	20.46	0.15	0.01	0.04	-0.41	
9:35:13	20.46	0.13	0.01	0.03	-0.39	
9:35:23	20.46	0.13	0.04	5.68	-0.42	
9:35:33	20.46	0.13	0.06	11.77	-0.42	BIAS ZEROS
9:35:43	20.46	0.17	0.06	11.84	-0.40	O2/CO
9:35:53	20.46	0.20	0.06	11.85	-0.45	-0.41
9:36:03	20.46	0.20	0.05	11.86	-0.40	
9:36:13	20.46	0.20	0.04	11.87	-0.39	
9:36:23	20.46	0.16	0.04	11.87	-0.42	
9:36:33	20.46	0.11	0.04	11.87	-0.39	BIAS O2
9:36:43	20.46	0.11	0.02	11.88	-0.41	
9:36:53	20.46	0.11	0.01	11.88	-0.39	
9:37:03	20.46	0.11	0.01	7.19	-0.39	
9:37:13	20.46	0.10	0.01	0.43	-0.40	
9:37:23	20.46	0.10	0.04	0.11	-0.16	
9:37:33	20.46	0.10	0.07	0.07	1.15	
9:37:43	20.46	0.09	0.07	0.06	2.66	
9:37:53	20.47	0.09	0.07	0.05	3.61	
9:38:03	20.47	0.09	0.04	0.05	4.07	
9:38:13	20.47	0.09	0.01	0.05	4.03	
9:38:23	20.47	0.08	0.01	0.04	4.14	
9:38:33	20.47	0.07	0.01	0.04	4.08	
9:38:43	20.47	0.07	0.00	0.04	4.15	BIAS CO
9:38:53	20.47	0.07	0.00	0.04	4.10	4.11
9:39:03	20.47	0.07	0.00	0.04	4.10	BIAS ZEROS
9:39:13	20.47	0.07	0.00	0.04	4.13	NOX/NO
9:39:23	20.47	0.07	0.00	0.06	4.07	
9:39:33	20.47	0.07	0.01	0.08	4.06	
9:39:43	20.47	3.88	0.01	0.03	3.24	
9:39:53	20.47	7.70	0.00	0.03	1.77	
9:40:03	20.47	7.70	3.99	0.03	0.48	
9:40:13	20.47	7.70	7.97	0.03	-0.23	
9:40:23	20.47	8.23	7.97	0.03	-0.36	
9:40:33	20.47	8.76	7.97	0.03	-0.40	
9:40:43	20.47	8.76	8.27	0.03	-0.38	
9:40:53	20.47	8.76	8.56	0.03	-0.40	
9:41:03	20.47	8.75	8.56	0.03	-0.38	
9:41:13	20.47	8.73	8.56	0.03	-0.40	
9:41:23	20.47	8.73	8.58	0.03	-0.40	
9:41:33	20.47	8.73	8.60	0.03	-0.42	
9:41:43	20.47	8.74	8.60	0.03	-0.40	
9:41:53	20.47	8.74	8.60	0.03	-0.39	
9:42:03	20.47	8.74	8.60	0.03	-0.40	
9:42:13	20.47	8.74	8.60	0.03	-0.43	
9:42:23	20.47	8.67	8.60	0.55	-0.37	
9:42:33	20.47	8.61	8.60	1.03	-0.41	BIAS NO
9:42:43	20.47	8.61	4.39	1.04	-0.30	
9:42:53	20.47	8.61	0.17	1.04	-0.32	
9:43:03	20.47	5.79	0.17	1.04	-0.42	
9:43:13	20.47	2.97	0.17	1.04	-0.37	
9:43:23	20.47	2.97	0.13	1.05	-0.48	
9:43:33	20.47	2.97	0.08	1.05	-0.40	
9:43:43	20.47	3.01	0.08	1.04	-0.36	
9:43:53	20.47	3.04	0.08	1.04	-0.44	
9:44:03	20.47	3.04	0.07	1.04	-0.46	
9:44:13	20.47	3.04	0.06	1.04	-0.39	
9:44:23	20.47	3.06	0.06	1.05	-0.39	
9:44:33	20.47	3.08	0.06	1.69	-0.44	
9:44:43	20.47	3.08	0.11	1.10	-0.35	BIAS NO2
9:44:53	20.47	3.08	0.15	1.04	-0.55	
9:45:03	20.47	3.16	0.15	1.04	-0.41	
9:45:13	20.47	3.24	0.15	1.04	-0.48	
9:45:23	20.47	3.24	0.09	1.04	-0.43	
9:45:33	20.47	3.24	0.04	1.04	-0.40	
9:45:43	20.47	3.25	0.04	1.05	-0.55	DIRECT NO2
9:45:53	20.48	3.25	0.04	0.26	-0.44	
9:46:03	20.48	3.25	3.37	0.01	-0.40	
9:46:13	20.48	3.25	6.71	0.02	-0.56	
9:46:23	20.48	6.09	6.71	0.01	-0.46	
9:46:33	20.48	8.94	6.71	0.01	-0.50	
9:46:43	20.48	8.94	7.70	0.01	-0.43	
9:46:53	20.48	8.94	8.69	0.01	-0.41	DIRECT ZEROS
9:47:03	20.48	8.85	8.69	0.02	-0.50	O2/CO
9:47:13	20.48	8.77	8.69	0.01	-0.47	-0.46
9:47:23	20.48	8.77	8.70	0.01	-0.49	
9:47:33	20.48	8.77	8.70	0.01	-0.52	
9:47:43	20.48	8.77	8.70	0.01	-0.46	
9:47:53	20.48	8.78	8.70	0.01	-0.46	
9:48:03	20.48	8.78	8.71	0.01	-0.44	
9:48:13	20.48	8.78	8.71	0.02	-0.45	
9:48:23	20.48	8.74	8.71	0.01	-0.32	DIRECT NO
9:48:33	20.48	8.71	8.71	0.01	0.88	
9:48:43	20.48	8.71	4.38	0.01	2.38	
9:48:53	20.48	8.71	0.05	0.01	3.50	
9:49:03	20.48	4.38	0.05	0.01	4.01	
9:49:13	20.48	0.04	0.05	0.01	4.08	
9:49:23	20.48	0.04	0.03	0.01	4.14	
9:49:33	20.48	0.04	0.00	0.01	4.01	
9:49:43	20.48	0.03	0.00	0.01	4.07	

9:49:53	20.48	0.02	0.00	0.01	4.10	DIRECT CO
9:50:03	20.48	0.02	0.00	1.93	4.12	4.09
9:50:13	20.48	0.02	0.00	11.71	4.06	
9:50:23	20.48	0.05	0.00	11.94	3.33	
9:50:33	20.48	0.09	0.00	11.96	1.90	
9:50:43	20.48	0.09	0.00	11.96	0.52	
9:50:53	20.48	0.09	0.00	11.97	-0.16	
9:51:03	20.48	0.05	0.00	11.97	-0.40	DIRECT O2
9:51:13	20.48	0.01	0.00	10.59	-0.45	
9:51:23	20.48	0.01	0.03	20.74	-0.40	
9:51:33	20.48	0.01	0.05	21.08	-0.38	
9:51:43	20.48	0.03	0.05	21.09	-0.12	
9:51:53	20.48	0.04	0.05	21.09	-0.01	SPAN O2
9:52:03	20.48	0.04	0.03	21.10	0.01	
9:52:13	20.48	0.04	0.00	21.10	0.08	
9:52:23	20.48	0.02	0.00	11.90	-0.05	REZERO
9:52:33	20.48	0.00	0.00	0.10	-0.02	CO
9:52:43	20.48	0.00	-0.00	0.39	0.03	0.01
9:52:53	20.48	0.00	0.00	0.05	0.52	DIRECT ZEROS
9:53:03	20.49	0.01	0.00	0.03	4.05	NOX/NO
9:53:13	20.49	0.02	0.00	0.03	7.00	
9:53:23	20.49	0.02	0.01	0.03	8.79	
9:53:33	20.49	0.02	0.01	0.03	9.07	
9:53:43	20.49	0.01	0.01	0.03	8.94	
9:53:53	20.49	0.00	0.01	0.02	9.03	SPAN CO
9:54:03	20.49	0.00	0.01	0.02	9.05	8.99
9:54:13	20.49	0.00	0.00	0.02	9.00	
9:54:23	20.49	0.00	0.00	0.03	8.94	
9:54:33	20.49	0.00	0.00	0.02	8.99	
9:54:43	20.49	0.00	0.00	0.02	7.87	
9:54:53	20.49	0.00	0.00	0.02	6.39	
9:55:03	20.49	0.01	0.00	0.02	5.18	
9:55:13	20.49	0.02	0.00	0.01	4.73	
9:55:23	20.49	0.02	0.00	0.02	4.63	
9:55:33	20.49	0.02	-0.01	0.01	4.57	MID CO
9:55:43	20.49	0.01	-0.01	0.01	4.60	4.61
9:55:53	20.49	0.00	-0.01	0.01	4.63	
9:56:03	20.49	0.00	-0.01	0.02	4.62	
9:56:13	20.49	0.00	0.00	0.04	4.63	
9:56:23	20.49	0.00	8.13	0.04	4.58	
9:56:33	20.49	0.00	17.11	0.01	3.86	
9:56:43	20.49	0.00	17.33	0.01	2.45	
9:56:53	20.49	0.00	17.44	0.01	0.97	
9:57:03	20.49	0.00	17.46	0.01	0.31	
9:57:13	20.49	0.00	17.46	0.01	0.01	
9:57:23	20.49	0.00	17.76	0.01	0.03	
9:57:33	20.49	0.00	17.86	0.01	0.05	
9:57:43	20.49	0.00	17.85	0.01	-0.06	RESPAN NO
9:57:53	20.49	0.00	17.85	0.01	0.04	
9:58:03	20.49	0.00	17.87	0.01	-0.01	
9:58:13	20.49	0.00	16.05	0.01	-0.06	
9:58:23	20.49	0.00	9.40	0.01	0.10	
9:58:33	20.49	0.00	8.90	0.01	0.17	
9:58:43	20.49	0.00	8.90	0.01	0.03	
9:58:53	20.49	0.00	8.92	0.01	0.06	MID NO
9:59:03	20.49	0.00	8.92	0.01	0.04	
9:59:13	20.49	0.00	8.92	0.01	-0.07	
9:59:23	20.49	0.00	8.92	0.01	0.05	
9:59:33	20.49	0.00	7.83	0.30	0.03	
9:59:43	20.49	0.00	1.51	1.03	0.01	
9:59:53	20.49	0.00	0.05	1.04	0.07	
10:00:03	20.49	0.00	0.05	1.04	0.07	
10:00:13	20.49	0.00	0.03	1.04	0.03	
10:00:23	20.49	0.00	0.02	1.04	-0.01	
10:00:33	20.49	1.68	0.02	1.04	0.04	
10:00:43	20.49	3.37	0.02	1.04	0.01	
10:00:53	20.49	3.37	0.03	1.04	0.02	
10:01:03	20.50	3.37	0.04	1.04	0.01	CONV CHK
10:01:13	20.49	3.37	0.04	1.09	-0.01	
10:01:23	20.49	3.36	0.04	3.87	-0.05	
10:01:33	20.50	3.36	0.20	5.46	0.59	
10:01:43	20.50	3.36	0.37	2.53	1.50	
10:01:53	20.50	2.96	0.37	0.16	1.39	
10:02:03	20.50	2.57	0.37	0.04	1.57	
10:02:13	20.50	2.57	0.19	0.04	2.29	
10:02:23	20.50	2.57	0.02	0.03	3.58	
10:02:33	20.50	1.36	0.02	0.03	4.30	
10:02:43	20.50	0.16	0.02	0.03	4.60	
10:02:53	20.50	0.16	0.01	0.03	4.63	
10:03:03	20.50	0.16	0.00	0.03	4.68	
10:03:13	20.50	0.14	0.00	0.03	4.65	BIAS CO
10:03:23	20.50	0.12	0.00	0.03	4.60	4.65
10:03:33	20.50	0.12	0.00	0.03	4.64	
10:03:43	20.50	0.12	0.00	0.03	4.66	
10:03:53	20.50	0.10	0.00	0.03	4.53	
10:04:03	20.50	0.09	0.00	0.03	4.65	
10:04:13	20.50	0.09	0.00	0.03	4.51	
10:04:23	20.50	0.09	0.01	0.03	3.22	
10:04:33	20.50	0.08	0.01	0.03	1.69	
10:04:43	20.50	0.08	0.01	0.03	0.56	BIAS ZEROS

10:04:53	20.50	0.08	0.01	0.04	0.16	NOX/NO
10:05:03	20.50	0.08	0.01	0.03	0.17	
10:05:13	20.50	4.74	0.01	0.03	0.31	
10:05:23	20.50	9.39	0.01	0.03	0.41	
10:05:33	20.50	9.39	4.35	0.03	0.20	
10:05:43	20.50	9.39	8.69	0.03	0.08	
10:05:53	20.50	9.18	8.69	0.03	0.07	BIAS ZEROS
10:06:03	20.50	8.96	8.70	0.03	0.08	CO
10:06:13	20.50	8.96	8.74	0.03	0.08	
10:06:23	20.50	8.96	8.79	0.03	0.08	
10:06:33	20.50	8.96	8.79	0.03	0.00	
10:06:43	20.50	8.96	8.79	0.03	0.11	
10:06:53	20.50	8.96	8.80	0.03	-0.04	
10:07:03	20.50	8.96	8.81	0.03	0.10	
10:07:13	20.50	8.88	8.81	0.75	-0.02	BIAS NO
10:07:23	20.50	8.80	8.81	1.04	0.10	
10:07:33	20.50	8.80	4.47	1.04	0.16	
10:07:43	20.50	8.80	0.14	1.04	0.11	
10:07:53	20.50	5.95	0.14	1.04	0.07	
10:08:03	20.50	3.09	0.14	1.04	0.05	
10:08:13	20.50	3.09	0.10	1.04	0.06	
10:08:23	20.50	3.09	0.07	1.05	0.07	
10:08:33	20.50	3.13	0.07	1.05	0.06	
10:08:43	20.50	3.16	0.07	1.04	-0.02	
10:08:53	20.50	3.16	0.06	1.04	0.05	
10:09:03	20.50	3.16	0.06	1.04	0.06	
10:09:13	20.50	3.17	0.06	1.04	0.08	
10:09:23	20.50	3.17	0.06	1.04	0.04	BIAS NO2
10:09:33	20.50	3.17	0.06	1.16	0.06	
10:09:43	20.50	3.17	0.06	2.70	0.04	
10:09:53	20.50	3.88	0.06	13.30	0.02	
10:10:03	20.50	4.60	0.06	13.54	0.68	
10:10:13	20.50	4.60	7.19	13.60	2.17	
10:10:23	20.50	4.60	14.32	13.62	3.43	
10:10:33	20.50	11.20	14.32	13.60	4.20	
10:10:43	20.50	17.80	14.32	13.61	4.55	
10:10:53	20.50	17.81	14.16	13.62	4.81	
10:11:03	20.50	17.81	14.00	13.61	4.83	
10:11:13	20.50	17.87	14.00	13.58	4.66	
10:11:23	20.50	17.93	14.00	13.61	4.65	
10:11:33	20.50	17.93	13.98	13.60	4.74	
10:11:43	20.50	17.93	13.97	13.62	4.77	
10:11:53	20.50	17.94	13.97	13.63	4.69	
10:12:03	20.50	17.95	13.97	13.62	4.71	
10:12:13	20.50	17.95	13.99	13.63	4.58	
10:12:23	20.50	17.95	14.00	13.64	4.60	
10:12:33	20.50	17.92	14.00	13.64	4.57	

Clock Time	O2	NOx CAI	NO CAI	O2 CAI	CO 481	DAS SHEET: RUN 3
	Ch.2 ppmv	Ch.6 ppmv	Ch.7 ppmv	Ch.8 ppmv	Ch.9 ppmv	
10:13:00	20.50	17.89	13.87	13.61	4.68	START R1 GT A DB ON
10:13:10	20.50	17.94	13.87	13.62	4.72	
10:13:20	20.50	18.09	13.87	13.60	4.69	
10:13:30	20.50	18.09	13.88	13.58	4.64	
10:13:40	20.50	18.09	13.91	13.61	4.62	
10:13:50	20.50	18.06	13.91	13.62	4.66	
10:14:00	20.50	17.97	13.91	13.61	4.67	
10:14:10	20.50	17.97	13.90	13.61	4.60	
10:14:20	20.50	17.97	13.87	13.63	4.61	
10:14:30	20.50	17.96	13.87	13.61	4.65	
10:14:40	20.50	17.92	13.87	13.64	4.67	
10:14:50	20.50	17.92	13.81	13.61	4.69	
10:15:00	20.50	17.92	13.64	13.64	4.68	
10:15:10	20.50	17.92	13.64	13.62	4.70	
10:15:20	20.50	17.92	13.64	13.64	4.58	
		17.98	13.83	13.62	4.66	
10:15:30	18.05	17.92	13.63	13.61	4.57	
10:15:40	1.36	17.92	13.57	13.63	4.59	
10:15:50	0.09	17.92	13.57	13.63	4.60	
10:16:00	0.05	17.90	13.57	13.60	4.65	
10:16:10	0.04	17.90	13.55	13.61	4.64	
10:16:20	0.03	17.90	13.48	13.63	4.56	
10:16:30	0.03	17.92	13.48	13.61	4.49	
10:16:40	0.02	17.99	13.48	13.62	4.54	
10:16:50	-0.01	17.99	13.48	13.62	4.54	
10:17:00	0.00	17.99	13.49	13.63	4.55	
10:17:10	0.01	17.99	13.49	13.60	4.55	
10:17:20	2.65	17.98	13.49	13.59	4.53	
10:17:30	19.39	17.98	13.54	13.60	4.51	
10:17:40	21.28	17.98	13.69	13.60	4.56	
10:17:50	21.36	17.99	13.69	13.71	4.55	
		17.95	13.55	13.62	4.56	
10:18:00	21.38	18.01	13.69	13.71	4.54	
10:18:10	21.39	18.01	13.55	13.70	4.52	
10:18:20	21.39	18.01	13.13	13.69	4.57	
10:18:30	21.40	17.95	13.13	13.70	4.69	
10:18:40	11.50	17.75	13.13	13.69	4.67	
10:18:50	2.36	17.75	13.15	13.72	4.68	
10:19:00	2.14	17.75	13.20	13.72	4.57	
10:19:10	2.12	17.73	13.20	13.70	4.53	

SGD CHECK

100

10:19:20	2.11	17.66	13.20	13.68	4.51	
10:19:30	2.11	17.66	13.19	13.72	4.57	10
10:19:40	2.10	17.66	13.17	13.71	4.75	
10:19:50	3.81	17.66	13.17	13.70	4.70	
10:20:00	4.17	17.68	13.17	13.70	4.74	
10:20:10	4.17	17.68	13.18	13.72	4.75	
10:20:20	4.17	17.68	13.23	13.71	4.74	20
		17.77	13.23	13.70	4.64	
10:20:30	4.17	17.67	13.23	13.81	4.67	
10:20:40	6.28	17.64	13.23	13.82	4.96	
10:20:50	8.33	17.64	12.85	13.84	5.67	
10:21:00	8.40	17.64	11.72	13.84	6.41	
10:21:10	8.40	17.57	11.72	13.83	6.95	40
10:21:20	8.40	17.36	11.72	13.84	7.31	
10:21:30	8.41	17.36	11.70	13.84	7.48	
10:21:40	9.63	17.36	11.64	13.84	7.27	
10:21:50	10.53	17.37	11.64	13.85	7.35	
10:22:00	10.55	17.38	11.64	13.84	7.52	50
10:22:10	10.55	17.38	11.67	13.84	7.61	
10:22:20	10.55	17.38	11.77	13.84	7.62	
10:22:30	10.56	17.38	11.77	13.85	7.49	
10:22:40	12.07	17.40	11.77	13.83	7.42	
10:22:50	12.67	17.40	11.80	13.80	7.37	
		17.46	11.99	13.83	6.87	60
10:23:00	12.67	17.40	11.89	13.76	7.53	
10:23:10	12.68	17.47	11.90	13.76	7.71	
10:23:20	12.68	17.68	11.89	13.77	7.79	
10:23:30	12.47	17.68	11.83	13.77	7.77	
10:23:40	12.42	17.68	11.64	13.76	7.78	
10:23:50	12.16	17.69	11.64	13.76	7.95	
10:24:00	12.15	17.70	11.64	13.76	8.06	
10:24:10	12.15	17.70	11.71	13.77	7.95	
10:24:20	12.15	17.70	11.94	13.77	7.97	CHALLENGE
10:24:30	13.34	17.70	11.94	13.77	7.86	
10:24:40	20.61	17.71	11.94	13.77	7.82	
10:24:50	21.37	17.71	11.92	13.77	7.83	
10:25:00	21.40	17.71	11.87	13.76	8.11	
10:25:10	21.41	17.73	11.88	13.77	8.45	
10:25:20	21.41	17.79	11.87	13.75	8.31	
		17.67	11.83	13.77	7.93	100
10:25:30	21.41	17.79	11.93	13.75	8.09	
10:25:40	17.36	17.79	12.11	13.91	7.95	
10:25:50	12.85	17.69	12.11	13.99	7.96	
10:26:00	12.70	17.39	12.11	13.96	7.94	
10:26:10	12.69	17.39	11.94	13.94	8.07	60
10:26:20	12.69	17.39	11.40	13.97	8.39	
10:26:30	12.69	17.37	11.40	13.95	8.59	
10:26:40	11.39	17.30	11.40	13.98	8.50	
10:26:50	10.58	17.30	11.39	13.95	8.29	
10:27:00	10.57	17.30	11.35	13.95	8.47	
10:27:10	10.57	17.34	11.35	13.96	8.51	50
10:27:20	10.57	17.47	11.35	13.96	8.59	
10:27:30	9.89	17.47	11.42	13.95	8.38	
10:27:40	8.49	17.47	11.64	13.95	8.30	
10:27:50	8.42	17.45	11.64	13.98	8.22	
		17.46	11.64	13.95	8.28	40
10:28:00	8.42	17.40	11.64	13.94	8.30	
10:28:10	8.41	17.40	11.51	17.88	8.30	
10:28:20	8.42	17.40	11.10	20.67	7.62	
10:28:30	5.96	15.83	11.10	20.20	5.49	
10:28:40	4.23	11.10	11.10	13.72	3.08	
10:28:50	4.18	11.10	11.73	13.46	2.31	20
10:29:00	4.18	11.10	13.61	13.44	3.14	
10:29:10	4.18	12.97	13.61	13.44	4.33	
10:29:20	4.17	18.58	13.61	13.40	5.09	
10:29:30	2.84	18.58	13.64	13.41	5.34	
10:29:40	2.11	18.58	13.71	13.43	5.34	
10:29:50	2.10	18.61	13.71	13.42	5.38	10
10:30:00	2.10	18.72	13.71	13.43	5.47	
10:30:10	2.09	18.72	13.92	13.42	5.53	
10:30:20	3.95	18.72	14.57	13.45	5.58	
10:30:30	11.55	18.73	14.57	13.45	5.54	
10:30:40	12.12	18.74	14.57	13.40	5.46	
10:30:50	12.14	18.74	14.65	13.42	5.35	CHALLENGE
10:31:00	12.14	18.74	14.89	13.44	5.31	
10:31:10	12.14	18.76	14.89	13.41	5.40	
10:31:20	12.14	18.82	14.89	13.43	5.36	
10:31:30	13.62	18.82	14.85	13.44	5.33	
10:31:40	20.78	18.82	14.74	13.44	5.37	
10:31:50	21.38	18.80	14.74	13.45	5.40	
10:32:00	21.40	18.73	14.74	13.42	5.34	
10:32:10	21.40	18.73	14.71	13.44	5.37	
10:32:20	21.41	18.73	14.63	13.42	5.39	100
		18.75	14.60	13.43	5.41	
10:32:30	21.41	18.76	14.63	13.42	5.44	
10:32:40	17.00	18.84	14.63	13.42	5.43	
10:32:50	12.82	18.84	14.61	13.43	5.44	
10:33:00	12.70	18.84	14.55	13.45	5.42	
10:33:10	12.69	18.80	14.55	13.56	5.49	
10:33:20	12.69	18.68	14.55	13.55	5.51	60
10:33:30	12.69	18.68	14.38	13.56	5.47	

10:33:40	11.38	18.68	13.88	13.59	5.37	
10:33:50	10.58	18.60	13.88	13.59	5.22	
10:34:00	10.57	18.34	13.88	13.60	5.20	
10:34:10	10.57	18.34	13.84	13.58	5.19	
10:34:20	10.57	18.34	13.71	13.60	5.20	50
10:34:30	9.85	18.33	13.71	13.58	5.11	
10:34:40	8.48	18.32	13.71	13.60	5.21	
10:34:50	8.42	18.32	13.74	13.58	5.29	
		18.58	14.15	13.54	5.33	
10:35:00	8.41	18.32	13.82	13.58	5.19	
10:35:10	8.42	18.35	13.82	13.57	5.26	40
10:35:20	8.41	18.46	13.82	13.70	5.31	
10:35:30	5.93	18.46	13.68	13.70	5.31	
10:35:40	4.22	18.46	13.26	13.70	5.20	
10:35:50	4.18	18.32	13.26	13.71	5.31	
10:36:00	4.17	17.91	13.26	13.69	5.33	
10:36:10	4.17	17.91	13.21	13.69	5.42	20
10:36:20	4.17	17.91	13.08	13.72	5.64	
10:36:30	2.90	17.95	13.08	13.70	5.64	
10:36:40	2.11	18.06	13.07	13.69	5.64	
10:36:50	2.09	18.06	13.10	13.72	5.72	
10:37:00	2.09	18.06	13.19	13.71	5.63	
10:37:10	2.09	18.05	13.19	13.70	5.62	10
10:37:20	2.09	18.03	13.19	13.69	5.51	
		18.16	13.34	13.68	5.45	
10:37:30	4.14	18.03	13.22	13.53	5.43	
10:37:40	11.60	18.03	13.31	13.55	5.80	
10:37:50	12.12	18.15	13.31	13.51	6.21	
10:38:00	12.14	18.52	13.31	13.51	6.57	
10:38:10	12.14	18.52	13.24	13.52	6.84	CHALLENGE
10:38:20	12.14	18.52	13.04	13.52	6.91	
10:38:30	12.14	18.59	13.04	13.53	7.05	
10:38:40	12.10	18.78	13.04	13.51	7.16	
10:38:50	12.08	18.78	13.10	13.50	7.11	
10:39:00	12.08	18.78	13.28	13.51	7.19	
10:39:10	12.08	18.78	13.28	13.55	7.16	
10:39:20	12.08	18.78	13.28	13.50	7.06	
10:39:30	12.08	18.78	13.33	13.45	6.89	
10:39:40	12.08	18.78	13.47	13.47	6.89	
10:39:50	12.08	18.78	13.47	13.35	6.94	
		18.57	13.25	13.50	6.75	
10:40:00	12.08	18.78	13.47	13.32	6.97	
10:40:10	12.08	18.78	13.53	13.31	7.28	
10:40:20	12.08	18.78	13.72	13.31	7.48	
10:40:30	12.08	18.90	13.72	13.30	7.48	
10:40:40	12.08	19.28	13.72	13.28	7.26	
10:40:50	12.08	19.28	13.78	13.29	7.21	
10:41:00	12.08	19.28	13.94	13.30	7.34	
10:41:10	12.08	19.27	13.94	13.31	7.36	
10:41:20	12.08	19.24	13.94	13.31	7.31	
10:41:30	12.08	19.24	13.97	13.30	7.20	
10:41:40	12.08	19.24	14.06	13.32	7.27	
10:41:50	12.08	19.25	14.06	13.29	7.37	
10:42:00	12.08	19.27	14.06	13.31	7.70	
10:42:10	12.08	19.27	14.07	13.31	7.81	
10:42:20	12.08	19.27	14.10	13.26	7.70	
		19.14	13.87	13.30	7.38	
10:42:30	12.08	19.35	14.10	13.19	7.53	
10:42:40	12.08	19.57	14.10	13.21	7.51	
10:42:50	12.08	19.57	14.15	13.21	7.82	
10:43:00	12.08	19.57	14.31	13.21	7.87	
10:43:10	12.08	19.58	14.31	13.21	7.83	
10:43:20	12.08	19.63	14.31	13.20	7.82	
10:43:30	12.08	19.63	14.32	13.19	8.01	
10:43:40	12.08	19.63	14.36	13.21	8.03	
10:43:50	12.08	19.63	14.36	13.20	8.03	
10:44:00	12.08	19.63	14.36	13.20	8.00	
10:44:10	12.08	19.63	14.43	13.19	7.97	
10:44:20	12.08	19.63	14.65	13.22	7.95	
10:44:30	12.08	19.61	14.65	13.21	8.02	
10:44:40	12.08	19.56	14.65	13.22	8.06	
10:44:50	12.08	19.56	14.60	13.22	8.05	
		19.58	14.38	13.21	7.90	
10:45:00	12.08	19.56	14.46	13.23	7.92	
10:45:10	12.08	19.57	14.46	13.23	7.81	
10:45:20	12.08	19.59	14.46	13.17	8.01	
10:45:30	12.08	19.59	14.55	13.19	8.07	
10:45:40	12.08	19.59	14.83	11.34	7.60	
10:45:50	12.08	18.40	14.83	1.53	7.23	
10:46:00	12.08	14.83	14.83	0.23	5.66	
10:46:10	12.08	14.83	11.14	0.08	3.48	
10:46:20	12.08	14.82	0.09	0.06	1.64	
10:46:30	12.08	11.20	0.09	0.06	0.51	
10:46:40	12.08	0.34	0.09	0.05	0.09	
10:46:50	12.08	0.33	0.08	0.05	0.03	
10:47:00	12.08	0.33	0.03	0.05	-0.09	
10:47:10	12.08	0.31	0.03	0.04	-0.01	
10:47:20	12.08	0.26	0.02	0.04	0.04	
10:47:30	12.08	0.26	0.02	0.04	0.02	
10:47:40	12.08	0.26	0.02	0.04	0.00	
10:47:50	12.08	0.26	0.03	8.19	0.01	BIAS ZEROS O2/CO
10:48:00	12.08	0.26	0.03	11.82	0.01	

10:48:10	12.08	0.26	0.02	11.86	0.02
10:48:20	12.08	0.26	0.00	11.87	0.00
10:48:30	12.08	0.24	0.00	11.88	0.02
10:48:40	12.08	0.19	0.00	11.88	0.05
10:48:50	12.08	0.19	0.00	11.89	0.03
10:49:00	12.08	0.19	0.01	11.89	0.04
10:49:10	12.08	0.19	0.01	11.89	0.02
10:49:20	12.08	0.17	0.00	3.59	-0.04
10:49:30	12.08	0.17	0.01	0.15	0.19
10:49:40	12.08	0.17	0.04	0.09	1.21
10:49:50	12.08	0.17	0.04	0.07	2.69
10:50:00	12.08	0.16	0.04	0.06	3.85
10:50:10	12.08	0.16	0.03	0.05	4.35
10:50:20	12.08	0.16	0.00	0.05	4.52
10:50:30	12.08	0.16	0.00	0.05	4.58
10:50:40	12.08	0.14	0.00	0.05	4.59
10:50:50	12.08	0.14	0.00	0.04	4.52
10:51:00	12.08	0.14	0.01	0.04	4.59
10:51:10	12.08	0.14	0.01	0.04	4.62
10:51:20	12.08	0.15	0.01	0.04	4.57
10:51:30	12.08	0.15	0.00	0.04	4.61
10:51:40	12.08	0.15	-0.01	0.13	4.53
10:51:50	12.08	1.97	-0.01	0.04	3.99
10:52:00	12.08	7.43	-0.01	0.03	2.67
10:52:10	12.08	7.43	2.05	0.03	1.28
10:52:20	12.08	7.43	8.24	0.03	0.47
10:52:30	12.08	7.84	8.24	0.03	0.10
10:52:40	12.08	9.05	8.24	0.03	0.02
10:52:50	12.08	9.05	8.37	0.03	-0.04
10:53:00	12.08	9.05	8.76	0.03	0.05
10:53:10	12.08	9.04	8.76	0.03	0.05
10:53:20	12.08	9.00	8.76	0.03	0.00
10:53:30	12.08	9.00	8.77	0.03	0.03
10:53:40	12.08	9.00	8.80	0.03	-0.05
10:53:50	12.08	9.00	8.80	0.03	0.01
10:54:00	12.08	9.00	8.80	0.03	0.02
10:54:10	12.08	9.00	8.81	0.03	0.04
10:54:20	12.08	9.00	8.83	0.03	0.04
10:54:30	12.08	8.95	8.83	0.50	0.02
10:54:40	12.08	8.82	8.83	1.03	0.03
10:54:50	12.08	8.82	6.66	1.04	0.03
10:55:00	12.08	8.82	0.14	1.04	0.06
10:55:10	12.08	7.40	0.14	1.04	0.00
10:55:20	12.08	3.14	0.14	1.04	0.02
10:55:30	12.08	3.14	0.12	1.04	-0.02
10:55:40	12.09	3.14	0.07	1.04	0.04
10:55:50	12.09	3.15	0.07	1.04	0.02
10:56:00	12.09	3.19	0.07	1.05	-0.03
10:56:10	12.09	3.19	0.07	1.04	0.01
10:56:20	12.09	3.19	0.06	1.04	0.01
10:56:30	12.09	3.20	0.06	1.04	0.03
10:56:40	12.09	3.22	0.06	1.04	0.03
10:56:50	12.09	3.22	0.06	1.04	-0.07
10:57:00	12.09	3.22	0.05	1.05	0.01
10:57:10	12.09	3.22	0.05	1.04	0.03
10:57:20	12.09	3.24	0.05	1.62	-0.01
10:57:30	12.09	3.24	0.11	1.15	-0.06
10:57:40	12.09	3.24	0.30	1.05	0.00
10:57:50	12.09	3.25	0.30	1.05	0.09
10:58:00	12.09	3.30	0.30	1.05	0.21
10:58:10	12.09	3.30	0.23	1.04	0.26
10:58:20	12.09	3.30	0.02	1.04	0.34
10:58:30	12.09	3.31	0.02	1.04	0.32
10:58:40	12.09	3.33	0.02	0.83	0.35
10:58:50	12.09	3.33	1.27	0.03	0.32
10:59:00	12.09	3.33	4.99	0.01	0.38
10:59:10	12.09	4.83	4.99	0.01	0.31
10:59:20	12.09	9.33	4.99	0.01	0.29
10:59:30	12.09	9.33	5.95	0.01	0.34
10:59:40	12.09	9.34	8.84	0.01	0.37
10:59:50	12.09	9.25	8.84	0.01	0.31
11:00:00	12.09	9.00	8.84	0.01	0.35
11:00:10	12.09	9.00	8.86	0.01	0.35
11:00:20	12.09	9.00	8.91	0.01	0.27
11:00:30	12.09	9.00	8.91	0.01	0.31
11:00:40	12.09	8.99	8.91	0.01	0.34
11:00:50	12.09	8.99	8.91	0.01	0.29
11:01:00	12.09	8.99	8.92	0.01	0.29
11:01:10	12.09	8.97	8.92	0.01	0.30
11:01:20	12.09	8.92	8.92	0.01	0.25
11:01:30	12.09	8.92	6.69	0.01	0.27
11:01:40	12.09	8.92	0.01	0.01	0.30
11:01:50	12.09	6.69	0.01	0.01	0.37
11:02:00	12.09	0.02	0.01	0.01	1.53
11:02:10	12.09	0.02	0.01	0.01	3.03
11:02:20	12.09	0.02	0.00	0.01	4.24
11:02:30	12.09	0.02	0.00	0.01	4.97
11:02:40	12.09	0.01	0.00	0.01	5.16
11:02:50	12.09	0.01	0.00	0.01	5.22
11:03:00	12.09	0.01	0.00	5.64	5.15
11:03:10	12.09	2.62	0.00	13.45	5.09
11:03:20	12.09	10.47	0.00	13.45	5.14

BIAS O2

BIAS CO
4.58
BIAS ZEROS
NOX/NO

BIAS NO

BIAS NO2

DIRECT NO2

DIRECT NO

DIRECT ZEROS
NOX/NO

11:03:30	12.09	10.47	3.86	13.43	5.06
11:03:40	12.10	10.47	15.43	13.44	5.03
11:03:50	12.09	12.64	15.43	13.47	5.01
11:04:00	12.10	19.15	15.43	13.42	5.18
11:04:10	12.10	19.15	15.41	13.48	5.19
11:04:20	12.10	19.15	15.33	13.47	5.27
11:04:30	12.10	19.14	15.33	13.44	5.28
11:04:40	12.10	19.09	15.33	13.44	5.27
11:04:50	12.10	19.09	15.30	13.44	5.21
11:05:00	12.10	19.09	15.21	13.48	5.26
11:05:10	12.10	19.06	15.21	13.43	5.25
11:05:20	12.10	18.96	15.21	13.42	5.26
11:05:30	12.10	18.96	15.16	13.47	5.23
11:05:40	12.10	18.96	15.02	13.46	5.23
11:05:50	12.10	18.94	15.02	13.47	5.19
11:06:00	12.10	18.86	15.02	13.43	5.13
11:06:10	12.10	18.86	14.99	13.43	5.05
11:06:20	12.10	18.86	14.91	13.44	5.06
11:06:30	12.10	18.86	14.91	13.46	5.13
11:06:40	12.10	18.86	14.91	13.45	5.19
11:06:50	12.10	18.86	14.86	13.44	5.32
11:07:00	12.10	18.86	14.71	13.47	5.34
11:07:10	12.10	18.85	14.71	13.44	5.31
11:07:20	12.10	18.83	14.71	13.42	5.29
		18.91	14.97	13.45	5.21
11:07:30	12.10	18.83	14.71	13.44	5.23
11:07:40	12.10	18.83	14.74	13.63	5.18
11:07:50	12.10	18.64	14.74	13.63	5.13
11:08:00	12.10	18.09	14.74	13.63	5.09
11:08:10	12.10	18.09	14.51	13.64	5.10
11:08:20	12.10	18.09	13.82	13.64	5.11
11:08:30	12.10	18.11	13.82	13.63	5.22
11:08:40	12.10	18.18	13.82	13.64	5.12
11:08:50	12.10	18.18	13.81	13.62	4.99
11:09:00	12.10	18.18	13.80	13.63	5.02
11:09:10	12.10	18.19	13.80	13.64	5.01
11:09:20	12.10	18.23	13.80	13.63	4.99
11:09:30	12.10	18.23	13.81	13.61	5.02
11:09:40	12.10	18.23	13.85	13.63	4.96
11:09:50	12.10	18.21	13.85	13.67	4.99
		18.29	14.11	13.62	5.08
11:10:00	12.10	18.17	13.85	13.71	5.09
11:10:10	12.10	18.17	13.71	13.69	5.17
11:10:20	12.10	18.17	13.29	13.72	5.45
11:10:30	12.10	18.12	13.29	13.71	5.46
11:10:40	12.10	17.96	13.29	13.71	5.58
11:10:50	12.10	17.96	13.28	13.69	5.61
11:11:00	12.10	17.96	13.25	13.71	5.49
11:11:10	12.11	17.97	13.25	13.71	5.40
11:11:20	12.11	18.00	13.25	13.70	5.37
11:11:30	12.11	18.00	13.26	13.70	5.46
11:11:40	12.11	18.00	13.29	13.71	5.56
11:11:50	12.11	17.99	13.29	13.70	5.62
11:12:00	12.11	17.95	13.29	13.69	5.58
11:12:10	12.11	17.95	13.31	13.71	5.50
11:12:20	12.11	17.95	13.37	13.69	5.48
		18.02	13.35	13.70	5.45
11:12:30	12.11	17.96	13.37	13.72	5.42
11:12:40	12.11	17.96	13.37	13.71	5.35
11:12:50	12.11	17.96	13.36	13.70	5.41
11:13:00	12.11	17.96	13.31	13.72	5.40
11:13:10	12.11	17.95	13.31	13.72	5.39
11:13:20	12.11	17.92	13.31	13.70	5.41
11:13:30	12.11	17.91	13.31	13.72	5.38
11:13:40	12.11	17.91	13.31	13.71	5.39
11:13:50	12.11	17.90	13.31	13.73	5.42
11:14:00	12.11	17.88	13.31	13.71	5.44
11:14:10	12.11	17.87	13.30	13.69	5.42
11:14:20	12.11	17.87	13.27	13.71	5.44
11:14:30	12.11	17.94	13.27	13.40	5.45
11:14:40	12.11	18.13	13.27	13.37	5.74
11:14:50	12.11	18.13	13.23	13.34	6.24
		17.95	13.31	13.64	5.49
11:15:00	12.11	18.13	13.12	13.35	6.72
11:15:10	12.11	18.41	13.12	13.35	6.96
11:15:20	12.11	19.25	13.12	13.33	7.02
11:15:30	12.11	19.25	13.25	13.35	7.17
11:15:40	12.11	19.25	13.64	13.35	7.42
11:15:50	12.12	19.27	13.64	13.34	7.53
11:16:00	12.12	19.33	13.64	13.35	7.51
11:16:10	12.12	19.33	13.74	13.34	7.46
11:16:20	12.12	19.33	14.06	13.33	7.30
11:16:30	12.12	19.33	14.06	13.35	7.22
11:16:40	12.12	19.33	14.06	13.35	7.17
11:16:50	12.12	19.33	14.07	13.34	7.25
11:17:00	12.12	19.33	14.10	13.32	7.28
11:17:10	12.12	19.35	14.10	13.34	7.22
11:17:20	12.12	19.40	14.10	13.35	7.19
		19.17	13.72	13.34	7.23

START R2
GT A DB ON

11:17:30	12.12	19.40	14.18	13.34	7.00
11:17:40	12.12	19.40	14.45	13.35	6.85
11:17:50	12.12	19.37	14.45	13.34	6.80
11:18:00	12.12	19.29	14.45	13.34	7.03
11:18:10	12.12	19.29	14.38	13.34	7.28
11:18:20	12.12	19.29	14.17	13.28	7.47
11:18:30	12.12	19.37	14.17	13.21	7.65
11:18:40	12.12	19.63	14.17	13.23	7.69
11:18:50	12.12	19.62	14.28	13.22	7.65
11:19:00	12.12	19.63	14.60	13.25	7.52
11:19:10	12.12	19.63	14.60	13.22	7.53
11:19:20	12.12	19.64	14.60	13.24	7.56
11:19:30	12.13	19.64	14.59	13.22	7.48
11:19:40	12.13	19.64	14.55	13.23	7.54
11:19:50	12.13	19.63	14.55	13.24	7.80
		19.50	14.41	13.27	7.39
11:20:00	12.13	19.60	14.55	13.24	8.07
11:20:10	12.13	19.60	14.55	13.23	8.14
11:20:20	12.13	19.60	14.57	17.32	8.02
11:20:30	12.13	18.34	14.57	20.67	7.32
11:20:40	12.13	14.57	14.57	14.36	5.39
11:20:50	12.13	14.57	14.15	13.62	3.72
11:21:00	12.13	14.57	12.88	13.65	3.29
11:21:10	12.13	15.40	12.88	13.63	3.66
11:21:20	12.13	17.91	12.88	13.61	4.08
11:21:30	12.13	17.91	12.99	13.65	4.39
11:21:40	12.13	17.91	13.33	13.60	4.48
11:21:50	12.13	17.98	13.33	13.62	4.54
11:22:00	12.13	18.18	13.33	13.63	4.54
11:22:10	12.13	18.18	13.61	13.62	4.54
11:22:20	12.13	18.18	14.45	13.61	4.54
11:22:30	12.13	18.19	14.45	13.64	4.49
11:22:40	12.13	18.20	14.45	13.64	4.38
11:22:50	12.13	18.20	14.53	13.63	4.48
11:23:00	12.13	18.20	14.77	13.64	4.50
11:23:10	12.13	18.15	14.77	13.64	4.50
11:23:20	12.14	18.01	14.77	13.61	4.48
11:23:30	12.14	18.01	14.79	13.62	4.47
11:23:40	12.14	18.01	14.86	13.62	4.47
11:23:50	12.14	18.02	14.86	13.64	4.43
11:24:00	12.14	18.07	14.86	13.62	4.49
11:24:10	12.14	18.07	14.80	13.64	4.53
11:24:20	12.14	18.07	14.64	13.63	4.51
		18.11	14.53	13.63	4.49
11:24:30	12.14	18.07	14.64	13.63	4.53
11:24:40	12.14	18.08	14.64	13.63	4.42
11:24:50	12.14	18.08	14.62	13.63	4.38
11:25:00	12.14	18.08	14.57	13.66	4.37
11:25:10	12.14	18.06	14.57	13.63	4.43
11:25:20	12.14	18.00	14.57	13.68	4.48
11:25:30	12.14	18.00	14.43	13.71	4.53
11:25:40	12.14	18.00	14.02	13.71	4.45
11:25:50	12.14	17.93	14.02	13.71	4.47
11:26:00	12.14	17.74	14.02	13.70	4.46
11:26:10	12.14	17.74	13.98	13.73	4.46
11:26:20	12.14	17.74	13.89	13.70	4.45
11:26:30	12.14	17.75	13.89	13.71	4.44
11:26:40	12.14	17.81	13.89	13.71	4.46
11:26:50	12.15	17.81	13.88	13.71	4.50
		17.93	14.24	13.68	4.45
11:27:00	12.15	17.81	13.84	13.71	4.35
11:27:10	12.15	17.81	13.84	13.71	4.39
11:27:20	12.15	17.80	13.84	13.69	4.33
11:27:30	12.15	17.80	13.85	13.69	4.35
11:27:40	12.15	17.80	13.86	13.70	4.40
11:27:50	12.15	17.81	13.86	13.66	4.49
11:28:00	12.15	17.85	13.86	13.65	4.65
11:28:10	12.15	17.85	13.84	13.67	4.73
11:28:20	12.15	17.85	13.75	13.68	4.79
11:28:30	12.15	17.86	13.75	13.67	4.81
11:28:40	12.15	17.89	13.75	13.66	4.85
11:28:50	12.15	17.89	13.74	13.67	4.82
11:29:00	12.15	17.89	13.69	13.65	4.87
11:29:10	12.15	17.91	13.69	13.66	4.86
11:29:20	12.15	17.96	13.69	13.65	4.97
		17.85	13.79	13.67	4.65
11:29:30	12.15	17.96	13.62	13.80	5.06
11:29:40	12.15	17.96	13.41	13.83	5.37
11:29:50	12.15	17.83	13.41	13.83	5.96
11:30:00	12.15	17.43	13.41	13.83	6.62
11:30:10	12.16	17.43	13.00	13.83	6.96
11:30:20	12.16	17.43	11.79	13.83	7.06
11:30:30	12.16	17.49	11.79	13.82	7.02
11:30:40	12.16	17.65	11.79	13.82	7.01
11:30:50	12.16	17.65	11.84	13.82	7.09
11:31:00	12.16	17.65	12.01	13.84	7.25
11:31:10	12.16	17.64	12.01	13.85	7.24
11:31:20	12.16	17.63	12.01	13.83	7.09
11:31:30	12.16	17.63	12.04	13.84	7.08
11:31:40	12.16	17.63	12.10	13.84	7.10
11:31:50	12.16	17.62	12.10	13.84	7.48

		17.64	12.42	13.83	6.76
11:32:00	12.16	17.60	12.10	13.84	7.55
11:32:10	12.16	17.60	12.12	13.84	7.47
11:32:20	12.16	17.60	12.19	13.83	7.28
11:32:30	12.16	17.61	12.19	13.83	7.35
11:32:40	12.16	17.63	12.19	13.84	7.44
11:32:50	12.16	17.63	12.20	13.82	7.29
11:33:00	12.16	17.63	12.22	13.85	7.17
11:33:10	12.17	17.60	12.22	13.82	7.27
11:33:20	12.17	17.51	12.22	13.83	7.32
11:33:30	12.17	17.51	12.23	13.83	7.25
11:33:40	12.17	17.51	12.25	13.83	7.19
11:33:50	12.17	17.53	12.25	13.82	7.12
11:34:00	12.17	17.58	12.25	13.77	7.08
11:34:10	12.17	17.58	12.22	13.76	7.17
11:34:20	12.17	17.58	12.12	13.77	7.27
		17.58	12.20	13.82	7.28
11:34:30	12.17	17.63	12.12	13.80	7.29
11:34:40	12.17	17.79	12.12	13.79	7.23
11:34:50	12.17	17.79	12.15	13.76	7.33
11:35:00	12.17	17.79	12.23	13.77	7.07
11:35:10	12.17	17.81	12.23	13.77	6.91
11:35:20	12.17	17.87	12.23	13.77	7.02
11:35:30	12.17	17.87	12.20	13.75	7.38
11:35:40	12.17	17.87	12.12	13.73	7.65
11:35:50	12.17	17.88	12.12	13.73	7.82
11:36:00	12.17	17.90	12.12	13.73	8.20
11:36:10	12.17	17.90	12.12	13.74	8.40
11:36:20	12.17	17.90	12.13	13.74	8.37
11:36:30	12.17	17.89	12.13	13.76	8.17
11:36:40	12.18	17.89	12.13	13.73	8.02
11:36:50	12.18	17.89	12.10	13.74	8.05
		17.84	12.15	13.75	7.66
11:37:00	12.18	17.89	12.00	13.74	8.14
11:37:10	12.18	17.90	12.00	13.75	8.17
11:37:20	12.18	17.92	12.00	13.75	8.19
11:37:30	12.18	17.92	12.07	13.76	8.18
11:37:40	12.18	17.92	12.29	12.55	7.83
11:37:50	12.18	16.84	12.29	1.30	7.51
11:38:00	12.18	13.59	12.29	0.10	6.04
11:38:10	12.18	13.59	9.25	0.07	3.79
11:38:20	12.18	13.59	0.11	0.06	1.71
11:38:30	12.18	10.29	0.11	0.05	0.44
11:38:40	12.18	0.36	0.11	0.04	0.07
11:38:50	12.18	0.36	0.10	0.04	0.00
11:39:00	12.18	0.36	0.06	0.04	0.01
11:39:10	12.18	0.34	0.06	0.04	-0.04
11:39:20	12.18	0.28	0.06	0.04	-0.02
11:39:30	12.18	0.28	0.05	2.17	-0.02
11:39:40	12.19	0.28	0.03	11.59	-0.03
11:39:50	12.19	0.34	0.03	11.82	-0.03
11:40:00	12.19	0.52	0.03	11.85	0.01
11:40:10	12.19	0.52	0.03	11.86	0.02
11:40:20	12.19	0.52	0.05	11.87	0.00
11:40:30	12.19	0.44	0.05	11.87	-0.01
11:40:40	12.19	0.21	0.04	11.87	-0.10
11:40:50	12.19	0.21	0.04	11.88	-0.02
11:41:00	12.19	0.21	0.03	11.88	0.02
11:41:10	12.19	0.20	0.03	11.56	-0.03
11:41:20	12.19	0.18	0.02	1.12	-0.07
11:41:30	12.19	0.18	0.06	0.14	0.06
11:41:40	12.19	0.18	0.18	0.09	1.04
11:41:50	12.19	0.18	0.18	0.06	2.47
11:42:00	12.19	0.18	0.18	0.06	3.67
11:42:10	12.19	0.18	0.14	0.05	4.33
11:42:20	12.19	0.18	0.01	0.05	4.43
11:42:30	12.19	0.17	0.01	0.04	4.51
11:42:40	12.19	0.14	0.01	0.04	4.54
11:42:50	12.19	0.14	0.02	0.04	4.53

BIAS ZEROS
O2/CO
-0.02

BIAS O2

BIAS CO
4.51

DAS SHEET: RUN 4

Clock Time	O2	NOx CAI	NO CAI	O2 CAI	CO 48i
	Ch.2 ppmv	Ch.6 ppmv	Ch.7 ppmv	Ch.8 ppmv	Ch.9 ppmv
11:43:10	12.20	0.14	0.02	0.03	4.51
11:43:20	12.20	0.12	0.02	0.04	4.52
11:43:30	12.20	0.12	0.02	0.04	4.48
11:43:40	12.20	0.12	0.01	0.04	4.56
11:43:50	12.20	0.22	0.01	0.07	4.53
11:44:00	12.20	0.51	0.01	0.04	3.91
11:44:10	12.20	0.51	2.08	0.03	2.71
11:44:20	12.20	0.50	8.28	0.03	1.35
11:44:30	12.20	2.61	8.28	0.03	0.40
11:44:40	12.20	8.92	8.28	0.03	0.02
11:44:50	12.20	8.92	8.39	0.03	0.01
11:45:00	12.20	8.92	8.74	0.03	0.01
11:45:10	12.20	8.93	8.74	0.03	-0.04
11:45:20	12.20	8.96	8.74	0.03	-0.03
11:45:30	12.20	8.96	8.76	0.03	-0.02
11:45:40	12.20	8.96	8.80	0.03	-0.02
11:45:50	12.21	8.97	8.80	0.03	0.00
11:46:00	12.21	8.98	8.80	0.03	-0.01
11:46:10	12.21	8.98	8.80	0.03	-0.02

BIAS ZEROS
NOX/NO

11:46:20	12.21	8.98	8.81	0.03	-0.04	
11:46:30	12.21	8.98	8.81	0.03	-0.02	BIAS NO
11:46:40	12.21	8.98	8.81	0.69	-0.06	
11:46:50	12.21	8.98	6.86	1.04	-0.01	
11:47:00	12.21	8.98	1.01	1.04	0.01	
11:47:10	12.21	7.48	1.01	1.04	-0.01	
11:47:20	12.21	2.96	1.01	1.04	-0.03	
11:47:30	12.21	2.96	0.78	1.04	0.02	
11:47:40	12.21	2.96	0.09	1.04	-0.06	
11:47:50	12.21	3.00	0.09	1.04	0.00	
11:48:00	12.21	3.13	0.09	1.04	0.02	
11:48:10	12.21	3.13	0.09	1.04	-0.09	
11:48:20	12.21	3.13	0.09	1.04	-0.04	
11:48:30	12.21	3.14	0.09	1.05	0.00	
11:48:40	12.21	3.16	0.09	1.04	-0.04	
11:48:50	12.21	3.16	0.09	1.04	-0.09	
11:49:00	12.21	3.16	0.09	1.04	-0.03	
11:49:10	12.22	3.16	0.09	1.04	0.00	BIAS NO2
11:49:20	12.22	3.16	0.09	1.69	-0.08	
11:49:30	12.22	3.16	0.12	1.08	-0.01	
11:49:40	12.21	3.16	0.19	1.04	0.05	
11:49:50	12.21	3.20	0.19	1.04	0.01	
11:50:00	12.21	3.31	0.19	1.04	0.09	
11:50:10	12.21	3.31	0.15	1.04	0.24	
11:50:20	12.21	3.31	0.02	1.04	0.19	
11:50:30	12.21	3.32	0.02	1.04	0.26	
11:50:40	12.21	3.34	0.02	1.04	0.21	
11:50:50	12.21	3.34	0.02	1.04	0.25	
11:51:00	12.21	3.34	0.02	1.04	0.24	
11:51:10	12.21	3.33	0.02	1.04	0.21	DIRECT NO2
11:51:20	12.21	3.33	0.02	0.40	0.28	
11:51:30	12.21	3.33	1.31	0.02	0.20	
11:51:40	12.21	3.33	5.17	0.01	0.23	
11:51:50	12.21	4.81	5.17	0.01	0.27	
11:52:00	12.21	9.27	5.17	0.01	0.25	
11:52:10	12.21	9.28	6.08	0.01	0.29	
11:52:20	12.21	9.28	8.81	0.01	0.29	
11:52:30	12.21	9.20	8.81	0.01	0.24	
11:52:40	12.21	8.99	8.81	0.01	0.21	
11:52:50	12.21	8.99	8.83	0.01	0.26	
11:53:00	12.21	8.99	8.89	0.01	0.23	
11:53:10	12.21	8.99	8.89	0.01	0.25	
11:53:20	12.21	9.00	8.89	0.01	0.24	
11:53:30	12.21	9.00	8.89	0.01	0.30	
11:53:40	12.21	9.00	8.91	0.01	0.26	
11:53:50	12.21	8.98	8.91	0.01	0.25	DIRECT NO
11:54:00	12.21	8.90	8.91	0.01	0.28	
11:54:10	12.21	8.90	6.69	0.01	0.32	
11:54:20	12.21	8.90	0.04	0.01	0.42	
11:54:30	12.21	6.69	0.04	0.01	0.97	
11:54:40	12.21	0.03	0.04	0.01	2.15	
11:54:50	12.21	0.03	0.03	0.01	3.21	
11:55:00	12.21	0.03	0.00	0.01	3.95	
11:55:10	12.21	0.03	0.00	0.01	4.25	
11:55:20	12.21	0.01	0.00	0.01	4.27	DIRECT ZEROS
11:55:30	12.21	0.01	0.00	0.01	4.39	NOX/NO
11:55:40	12.21	0.01	-0.01	0.01	4.47	
11:55:50	12.21	0.01	-0.01	0.01	4.55	
11:56:00	12.21	0.01	-0.01	6.47	4.48	
11:56:10	12.21	0.01	2.32	13.68	4.47	
11:56:20	12.21	0.01	9.31	13.65	4.38	
11:56:30	12.21	4.66	9.31	13.66	4.39	
11:56:40	12.21	18.64	9.31	13.64	4.39	
11:56:50	12.21	18.64	10.67	13.62	4.40	
11:57:00	12.21	18.64	14.78	13.65	4.40	
11:57:10	12.21	18.53	14.78	13.64	4.39	
11:57:20	12.21	18.21	14.78	13.62	4.45	
11:57:30	12.21	18.21	14.73	13.64	4.48	
11:57:40	12.21	18.21	14.58	13.63	4.46	
11:57:50	12.21	18.22	14.58	13.64	4.41	
11:58:00	12.21	18.24	14.58	13.63	4.36	START R3
11:58:10	12.21	18.24	14.55	13.63	4.39	GT A DB ON
11:58:20	12.21	18.24	14.47	13.63	4.41	
11:58:30	12.21	18.20	14.47	13.66	4.39	
11:58:40	12.21	18.09	14.47	13.64	4.42	
11:58:50	12.21	18.09	14.45	13.66	4.39	
11:59:00	12.21	18.09	14.39	13.63	4.32	
11:59:10	12.21	18.09	14.39	13.65	4.33	
11:59:20	12.21	18.09	14.39	13.61	4.42	
11:59:30	12.21	18.09	14.40	13.63	4.47	
11:59:40	12.21	18.09	14.44	13.62	4.51	
11:59:50	12.21	18.07	14.44	13.63	4.45	
12:00:00	12.21	18.02	14.44	13.65	4.48	
12:00:10	12.21	18.02	14.41	13.64	4.52	
12:00:20	12.21	18.02	14.32	13.65	4.44	
12:00:30	12.21	18.11	14.44	13.64	4.42	
12:00:40	12.21	18.00	14.32	13.63	4.44	
12:00:50	12.21	17.92	14.32	13.66	4.41	
12:01:00	12.21	17.92	14.31	13.65	4.35	
12:01:10	12.21	17.92	14.26	13.64	4.28	
12:01:10	12.21	17.92	14.26	13.66	4.30	

12:01:20	12.21	17.92	14.26	13.66	4.30
12:01:30	12.21	17.92	14.17	13.66	4.30
12:01:40	12.21	17.91	13.88	13.64	4.31
12:01:50	12.21	17.91	13.88	13.66	4.35
12:02:00	12.21	17.90	13.88	13.64	4.32
12:02:10	12.21	17.90	13.89	13.64	4.42
12:02:20	12.21	17.90	13.94	13.64	4.40
12:02:30	12.21	17.93	13.94	13.64	4.41
12:02:40	12.21	18.05	13.94	13.65	4.36
12:02:50	12.21	18.05	13.95	13.67	4.33
		17.94	14.08	13.65	4.35
12:03:00	12.21	18.05	13.95	13.71	4.41
12:03:10	12.21	17.97	13.95	13.70	4.43
12:03:20	12.21	17.75	13.95	13.69	4.48
12:03:30	12.21	17.75	13.83	13.70	4.56
12:03:40	12.21	17.75	13.47	13.72	4.60
12:03:50	12.21	17.75	13.47	13.70	4.54
12:04:00	12.21	17.74	13.47	13.70	4.56
12:04:10	12.21	17.74	13.48	13.69	4.63
12:04:20	12.21	17.74	13.52	13.71	4.60
12:04:30	12.21	17.76	13.52	13.73	4.58
12:04:40	12.21	17.83	13.52	13.69	4.46
12:04:50	12.21	17.83	13.52	13.71	4.37
12:05:00	12.21	17.83	13.51	13.69	4.44
12:05:10	12.21	17.82	13.51	13.69	4.47
12:05:20	12.21	17.81	13.51	13.69	4.44
		17.81	13.61	13.70	4.50
12:05:30	12.21	17.81	13.51	13.75	4.30
12:05:40	12.21	17.81	13.53	13.82	4.61
12:05:50	12.21	17.70	13.53	13.83	5.24
12:06:00	12.21	17.36	13.53	13.83	5.99
12:06:10	12.21	17.36	13.10	13.82	6.55
12:06:20	12.21	17.36	11.80	13.80	6.74
12:06:30	12.21	17.44	11.80	13.83	6.88
12:06:40	12.21	17.66	11.80	13.83	7.03
12:06:50	12.21	17.66	11.85	13.81	7.05
12:07:00	12.21	17.66	11.99	13.82	6.96
12:07:10	12.21	17.68	11.99	13.83	6.79
12:07:20	12.21	17.74	11.99	13.82	6.61
12:07:30	12.21	17.74	12.03	13.85	6.63
12:07:40	12.22	17.74	12.17	13.79	6.63
12:07:50	12.22	17.74	12.17	13.76	6.79
		17.63	12.45	13.81	6.32
12:08:00	12.22	17.77	12.17	13.75	6.79
12:08:10	12.22	17.77	12.14	13.77	6.89
12:08:20	12.22	17.77	12.04	13.77	7.06
12:08:30	12.22	17.78	12.04	13.75	7.44
12:08:40	12.22	17.82	12.04	13.76	7.63
12:08:50	12.22	17.82	12.00	13.77	7.75
12:09:00	12.22	17.82	11.89	13.75	7.82
12:09:10	12.22	17.84	11.89	13.75	8.06
12:09:20	12.22	17.90	11.89	13.76	8.07
12:09:30	12.22	17.90	11.97	13.73	7.88
12:09:40	12.22	17.90	12.22	13.76	7.64
12:09:50	12.22	17.88	12.22	13.77	7.50
12:10:00	12.22	17.85	12.22	13.75	7.32
12:10:10	12.22	17.85	12.20	13.77	7.36
12:10:20	12.22	17.85	12.16	13.76	7.60
		17.83	12.07	13.76	7.52
12:10:30	12.22	17.85	12.16	13.76	7.73
12:10:40	12.22	17.85	12.16	13.76	7.74
12:10:50	12.22	17.85	12.18	13.74	7.56
12:11:00	12.22	17.85	12.26	13.73	7.43
12:11:10	12.22	17.86	12.26	13.73	7.57
12:11:20	12.22	17.88	12.26	13.73	7.90
12:11:30	12.22	17.88	12.21	13.73	7.97
12:11:40	12.22	17.88	12.07	13.74	8.10
12:11:50	12.22	17.86	12.07	13.75	8.27
12:12:00	12.22	17.82	12.07	13.73	8.41
12:12:10	12.22	17.82	12.06	13.73	8.61
12:12:20	12.22	17.82	12.04	13.73	8.53
12:12:30	12.22	17.84	12.04	13.73	8.42
12:12:40	12.22	17.90	12.04	13.73	8.24
12:12:50	12.22	17.90	12.06	13.72	8.08
		17.85	12.13	13.74	8.04
12:13:00	12.23	17.90	12.11	13.72	7.99
12:13:10	12.23	17.91	12.11	13.75	7.84
12:13:20	12.23	17.96	12.11	20.03	7.68
12:13:30	12.23	17.96	9.35	18.26	6.58
12:13:40	12.23	17.96	1.09	13.50	4.65
12:13:50	12.23	18.42	1.09	13.42	3.73
12:14:00	12.23	19.81	1.09	13.38	3.82
12:14:10	12.23	19.81	4.26	13.39	4.45
12:14:20	12.23	19.81	13.78	13.40	4.87
12:14:30	12.23	19.54	13.78	13.40	5.14
12:14:40	12.23	18.73	13.78	13.39	5.33
12:14:50	12.23	18.73	13.94	13.38	5.44
12:15:00	12.23	18.73	14.41	13.39	5.44
12:15:10	12.23	18.77	14.41	13.39	5.37
12:15:20	12.23	18.90	14.41	13.41	5.21
12:15:30	12.23	18.90	14.54	13.39	5.18

12:15:40	12.23	18.90	14.94	13.38	5.13
12:15:50	12.23	18.90	14.94	13.39	5.11
12:16:00	12.23	18.91	14.94	13.41	5.03
12:16:10	12.23	18.91	14.96	13.40	4.93
12:16:20	12.23	18.91	15.00	13.40	5.00
12:16:30	12.23	18.89	15.01	13.39	5.04
12:16:40	12.23	18.81	15.00	13.38	5.08
12:16:50	12.23	18.81	15.02	13.40	5.15
12:17:00	12.23	18.81	15.05	13.39	5.16
12:17:10	12.23	18.82	15.05	13.38	5.21
12:17:20	12.23	18.83	15.05	13.40	5.23
		18.85	14.85	13.39	5.15
12:17:30	12.23	18.83	15.02	13.38	5.20
12:17:40	12.23	18.83	14.94	13.44	5.22
12:17:50	12.23	18.73	14.94	13.65	5.19
12:18:00	12.23	18.45	14.94	13.66	5.14
12:18:10	12.23	18.45	14.61	13.65	5.14
12:18:20	12.23	18.45	13.61	13.65	5.20
12:18:30	12.23	18.34	13.61	13.65	5.14
12:18:40	12.23	18.02	13.61	13.64	5.15
12:18:50	12.23	18.02	13.61	13.63	5.12
12:19:00	12.23	18.02	13.61	13.65	5.12
12:19:10	12.23	18.02	13.61	13.64	5.13
12:19:20	12.23	18.03	13.61	13.64	5.20
12:19:30	12.24	18.03	13.61	13.66	5.25
12:19:40	12.24	18.03	13.64	13.64	5.30
12:19:50	12.24	18.03	13.64	13.70	5.24
		18.29	14.04	13.62	5.18
12:20:00	12.24	18.04	13.64	13.71	5.23
12:20:10	12.24	18.04	13.51	13.71	5.32
12:20:20	12.24	18.04	13.13	13.72	5.39
12:20:30	12.24	17.98	13.13	13.71	5.41
12:20:40	12.24	17.80	13.13	13.71	5.60
12:20:50	12.24	17.80	13.11	13.72	5.69
12:21:00	12.24	17.80	13.07	13.71	5.57
12:21:10	12.24	17.82	13.07	13.71	5.60
12:21:20	12.24	17.89	13.07	13.71	5.57
12:21:30	12.24	17.89	13.08	13.69	5.59
12:21:40	12.24	17.89	13.12	13.70	5.48
12:21:50	12.24	17.90	13.12	13.69	5.43
12:22:00	12.24	17.93	13.12	13.70	5.36
12:22:10	12.24	17.93	13.13	13.69	5.35
12:22:20	12.24	17.93	13.17	13.71	5.36
		17.91	13.17	13.71	5.46
12:22:30	12.24	17.91	13.17	13.70	5.49
12:22:40	12.24	17.84	13.17	13.57	5.53
12:22:50	12.24	17.84	13.13	13.52	5.75
12:23:00	12.24	17.84	13.03	13.53	6.21
12:23:10	12.24	17.99	13.03	13.52	6.55
12:23:20	12.24	18.44	13.03	13.53	6.69
12:23:30	12.24	18.44	12.98	13.52	6.66
12:23:40	12.24	18.44	12.84	13.54	6.78
12:23:50	12.24	18.47	12.84	13.52	6.92
12:24:00	12.24	18.57	12.84	13.51	6.98
12:24:10	12.24	18.57	12.93	13.50	6.84
12:24:20	12.24	18.57	13.19	13.53	6.86
12:24:30	12.24	18.57	13.19	13.53	6.82
12:24:40	12.24	18.58	13.19	13.52	6.84
12:24:50	12.24	18.58	13.23	13.50	6.79
		18.31	13.05	13.54	6.51
12:25:00	12.24	18.58	13.34	13.38	6.75
12:25:10	12.25	18.71	13.34	13.37	6.85
12:25:20	12.25	19.10	13.34	13.36	6.80
12:25:30	12.25	19.10	13.41	13.36	7.01
12:25:40	12.25	19.10	13.63	13.38	7.23
12:25:50	12.25	19.12	13.63	13.36	7.36
12:26:00	12.25	19.18	13.63	13.37	7.34
12:26:10	12.25	19.18	13.68	13.37	7.24
12:26:20	12.25	19.18	13.84	13.37	7.13
12:26:30	12.25	19.17	13.84	13.35	7.13
12:26:40	12.25	19.13	13.84	13.36	7.30
12:26:50	12.25	19.13	13.87	13.36	7.35
12:27:00	12.25	19.13	13.95	13.38	7.35
12:27:10	12.25	19.10	13.95	13.38	7.27
12:27:20	12.25	19.03	13.95	13.36	7.20
		19.06	13.68	13.37	7.15
12:27:30	12.25	19.03	13.96	13.30	7.36
12:27:40	12.25	19.03	14.00	13.27	7.33
12:27:50	12.25	19.12	14.00	13.25	7.19
12:28:00	12.25	19.41	14.00	13.25	7.27
12:28:10	12.25	19.41	14.09	13.26	7.38
12:28:20	12.25	19.41	14.37	13.26	7.43
12:28:30	12.25	19.42	14.37	13.25	7.54
12:28:40	12.25	19.45	14.37	13.25	7.79
12:28:50	12.25	19.45	14.36	13.24	7.88
12:29:00	12.25	19.45	14.32	13.24	7.74
12:29:10	12.25	19.48	14.32	13.23	7.44
12:29:20	12.25	19.57	14.32	13.25	7.33
12:29:30	12.25	19.57	14.34	13.22	7.36
12:29:40	12.25	19.57	14.40	13.24	7.46
12:29:50	12.25	19.57	14.40	13.24	7.49
		19.40	14.24	13.25	7.47

12:30:00	12.25	19.54	14.40	13.25	7.34	
12:30:10	12.26	19.54	14.39	13.25	7.26	
12:30:20	12.26	19.54	14.34	13.21	7.48	
12:30:30	12.26	19.53	14.34	13.18	7.74	
12:30:40	12.26	19.50	14.34	13.21	8.01	
12:30:50	12.26	19.50	14.42	10.50	7.41	
12:31:00	12.26	19.50	14.65	0.92	6.84	
12:31:10	12.26	18.29	14.65	0.09	5.23	
12:31:20	12.26	14.65	14.65	0.07	3.14	
12:31:30	12.26	14.65	11.01	0.05	1.37	
12:31:40	12.26	14.65	0.06	0.04	0.31	
12:31:50	12.26	11.07	0.06	0.04	-0.01	
12:32:00	12.26	0.32	0.06	0.04	-0.03	
12:32:10	12.26	0.32	0.05	0.03	-0.08	
12:32:20	12.26	0.32	0.02	0.03	-0.09	
12:32:30	12.26	0.30	0.02	0.03	-0.06	
12:32:40	12.26	0.26	0.02	0.03	-0.04	
12:32:50	12.26	0.26	0.04	3.77	-0.07	BIAS ZEROS
12:33:00	12.26	0.26	0.08	11.69	-0.09	O2/CO
12:33:10	12.26	0.28	0.08	11.81	-0.07	-0.06
12:33:20	12.26	0.34	0.08	11.83	-0.05	
12:33:30	12.26	0.34	0.07	11.84	-0.06	
12:33:40	12.26	0.34	0.02	11.85	-0.04	
12:33:50	12.26	0.30	0.02	11.85	-0.05	
12:34:00	12.26	0.20	0.02	11.85	-0.04	
12:34:10	12.26	0.20	0.02	11.85	-0.08	
12:34:20	12.27	0.20	0.01	11.86	-0.11	BIAS O2
12:34:30	12.27	0.19	0.01	10.87	-0.06	
12:34:40	12.27	0.17	0.01	0.71	-0.06	
12:34:50	12.27	0.17	0.04	0.12	0.25	
12:35:00	12.27	0.17	0.12	0.07	1.45	
12:35:10	12.27	0.17	0.13	0.06	2.88	
12:35:20	12.27	0.14	0.13	0.05	3.94	
12:35:30	12.27	0.14	0.10	0.04	4.37	
12:35:40	12.27	0.14	0.03	0.04	4.45	
12:35:50	12.27	0.14	0.03	0.04	4.47	
12:36:00	12.27	0.14	0.03	0.04	4.43	
12:36:10	12.27	0.14	0.02	0.03	4.50	BIAS CO
12:36:20	12.27	0.14	0.00	0.03	4.47	4.48
12:36:30	12.27	0.13	0.00	0.03	4.50	BIAS ZEROS
12:36:40	12.27	0.13	0.00	0.03	4.50	NOX/NO
12:36:50	12.27	0.13	0.00	0.03	4.46	
12:37:00	12.27	0.13	0.01	0.09	4.40	
12:37:10	12.27	1.68	0.01	0.04	3.90	
12:37:20	12.27	6.33	0.00	0.03	2.62	
12:37:30	12.27	6.33	2.06	0.03	1.26	
12:37:40	12.27	6.33	8.24	0.02	0.36	
12:37:50	12.27	6.98	8.24	0.02	0.05	
12:38:00	12.27	8.94	8.24	0.02	-0.10	
12:38:10	12.27	8.94	8.36	0.02	-0.06	
12:38:20	12.27	8.94	8.69	0.02	-0.03	
12:38:30	12.27	8.93	8.70	0.02	-0.03	
12:38:40	12.27	8.92	8.70	0.02	-0.08	
12:38:50	12.27	8.92	8.70	0.02	-0.05	
12:39:00	12.27	8.92	8.72	0.02	-0.08	
12:39:10	12.27	8.92	8.72	0.02	-0.05	
12:39:20	12.27	8.90	8.72	0.02	-0.05	
12:39:30	12.27	8.90	8.73	0.02	-0.06	
12:39:40	12.27	8.90	8.74	0.02	-0.04	
12:39:50	12.27	8.86	8.74	0.76	-0.09	BIAS NO
12:40:00	12.27	8.73	8.74	1.03	-0.04	
12:40:10	12.27	8.73	6.59	1.03	-0.01	
12:40:20	12.27	8.73	0.14	1.03	-0.02	
12:40:30	12.27	7.32	0.14	1.03	-0.07	
12:40:40	12.28	3.09	0.14	1.03	-0.03	
12:40:50	12.28	3.09	0.12	1.04	-0.08	
12:41:00	12.28	3.09	0.07	1.03	-0.07	
12:41:10	12.28	3.11	0.07	1.03	-0.12	
12:41:20	12.28	3.16	0.07	1.04	-0.05	
12:41:30	12.28	3.16	0.07	1.03	-0.04	
12:41:40	12.28	3.16	0.06	1.03	-0.11	
12:41:50	12.28	3.17	0.06	1.04	-0.09	
12:42:00	12.28	3.18	0.06	1.61	-0.07	BIAS NO2
12:42:10	12.28	3.18	0.08	1.10	-0.05	
12:42:20	12.28	3.18	0.16	1.04	-0.19	
12:42:30	12.28	3.21	0.16	1.04	-0.14	
12:42:40	12.28	3.28	0.16	1.03	-0.12	
12:42:50	12.28	3.28	0.13	1.03	-0.12	
12:43:00	12.28	3.28	0.02	1.04	-0.12	
12:43:10	12.28	3.29	0.02	1.03	-0.10	
12:43:20	12.28	3.31	0.02	1.03	-0.14	
12:43:30	12.28	3.31	0.02	1.03	-0.11	
12:43:40	12.28	3.31	0.02	1.03	-0.08	
12:43:50	12.28	3.31	0.02	1.03	-0.08	
12:44:00	12.28	3.32	0.02	0.32	-0.14	DIRECT NO2
12:44:10	12.28	3.32	1.25	0.01	-0.12	
12:44:20	12.28	3.32	4.92	0.01	-0.09	
12:44:30	12.28	4.80	4.92	0.01	-0.14	
12:44:40	12.29	2.31	7.84	0.01	-0.15	
12:44:50	12.28	0.00	8.80	0.01	-0.11	
12:45:00	12.29	0.00	8.82	0.01	-0.13	

12:45:10	12.29	0.00	8.82	0.00	-0.13	DIRECT NO
12:45:20	12.29	0.00	8.83	0.01	-0.12	
12:45:30	12.29	0.00	8.82	0.00	-0.13	DIRECT ZEROS
12:45:40	12.29	0.00	8.79	0.01	-0.18	O2/CO
12:45:50	12.29	0.00	8.75	0.01	-0.10	-0.14
12:46:00	12.29	0.00	4.58	0.01	0.65	
12:46:10	12.29	0.00	0.40	0.00	1.96	
12:46:20	12.29	0.20	0.40	0.01	3.37	
12:46:30	12.29	0.39	0.40	0.00	4.15	
12:46:40	12.29	0.39	0.21	0.01	4.41	
12:46:50	12.29	0.39	0.02	0.01	4.44	
12:47:00	12.29	0.21	0.02	0.00	4.45	
12:47:10	12.29	0.02	0.02	0.00	4.46	
12:47:20	12.29	0.02	0.01	0.01	4.48	DIRECT CO
12:47:30	12.29	0.02	0.00	0.01	4.51	4.47
12:47:40	12.29	0.01	0.00	2.91	4.45	
12:47:50	12.29	0.00	0.00	11.80	4.31	
12:48:00	12.29	0.00	0.01	11.92	3.32	
12:48:10	12.29	0.00	0.02	11.93	1.95	
12:48:20	12.29	0.01	0.02	11.94	0.77	
12:48:30	12.29	0.02	0.02	11.94	0.12	DIRECT O2
12:48:40	12.29	0.02	0.01	11.94	-0.14	
12:48:50	12.29	0.02	-0.01	11.95	-0.08	
12:49:00	12.29	0.01	-0.01	5.88	-0.07	DIRECT ZEROS
12:49:10	12.29	0.01	-0.01	0.04	-0.15	NOX/NO
12:49:20	12.29	0.01	-0.01	0.02	-0.10	



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Certificate of Analysis

EPA Protocol

Customer:	City of San Diego APCD	Reference#:	04334062-00
CGA:	660	Certification Date:	08/21/2018
Customer PO#:		Expiration Date:	08/21/2026
Cylinder #:	CC233189	Pressure, psig:	2000
Part Number:	EPA NINOSAL		

Method: This standard was analyzed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, Procedure G1 (May 2012).

Analyzed Cylinder-Components

Components	Certified Concentration	Expanded Uncertainty	Assay Dates
Nitric Oxide	44.72 ppm	+/- 0.40 ppm	08/14/2018, 08/21/2018
NOx	45.42 ppm	+/- 0.41 ppm	08/14/2018, 08/21/2018
Nitrogen	Balance		

Reference Standard-

Type/SRM Sample	Cylinder #	Sample #	Concentration	Expiration
Nitric Oxide/ GMIS	CC3648		93.15 +/- 0.61 ppm	10/03/2025
Oxides of Nitrogen/ GMIS	CC36488		93.45 +/- 0.61 ppm	10/03/2025
Traceable to SRM 1684b	FF9273	44-T-22	99.75 +/- 0.5 ppm NO/NOx	01/25/2020

Instrument-

Instrument/ Model	Serial Number	Last Date Calibrated	Analytical Method
Nicolet 42i-HL	921237088	07/23/2018	Chemiluminescence

This report states accurately the results of the investigation made upon the material submitted to the analytical laboratory. Every effort has been made to determine objectively the information requested. However, in connection with this report, Tech Air shall have no liability in excess of the established charge for this service. Assayed at Tech Air, Long Beach CA. No correction required for interfering gases.

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025:2005. Do not use this standard when cylinder pressure is below 150 psig.

Produced by:

TECH AIR
6544 1/2 Chery Avenue
Long Beach, CA 90805
EPA PGVP ID# J12018

Principal Analyst: 

Date: 21 August 2018



Praxair Distribution, Inc.
 5700 S. Alameda Street
 Los Angeles, CA 90058
 Tel: 323-585-2154
 Fax: 714-542-6689

Customer & Order Information:

COUNTY OF SAN DIEGO
 10124 OLD GROVE RD, AIR POLLUTION CONTROL
 DISTRICT
 SAN DIEGO, CA 92131
 Praxair Order Number: 65443859
 Customer PO Number: DANA ERRETT

Certificate Modification Date: 11/5/2018

Certification Date: 11/5/2018
 Lot Number: 70086830302
 Part Number: NI NX7MN-AS

DocNumber: 18314
 Expiration Date: 5/1/2019

CERTIFICATE OF ANALYSIS
Primary Master

Component	Requested Concentration (Molar)	Certified Concentration (Molar)	Analytical Reference	Analytical Uncertainty
Nitrogen dioxide (as NOx)	7 ppm	7.18 ppm	1	± 0.1 ppm
Nitrogen	Balance	Balance		

Cylinder Style: AS
 Cylinder Pressure @ 70 F: 2000 psig
 Cylinder Volume: 142 ft³
 Valve Outlet Connection: CGA 660
 Cylinder Number(s): CC501609

Fill Date: 10/30/2018
 Analysis Date: 10/31/2018

Filling Method: Gravimetric

Analyst: Henry Koung

Approved Signer: Amalia Real

Key to Analytical Techniques:

Reference	Analytical Instrument - Analytical Principle	Reference Standard
1	MKS MG2031 - FTIR	NO2(as NOx)/N2 9.58 ppm GMIS# CC506833, Expiration Date: 01/29/2019, Traceable to PRM#5603981

The gas calibration cylinder standard prepared by Praxair Distribution, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Distribution, Inc. Reference Materials which are either prepared by weights traceable to the National Institute of Standards and Technology (NIST), Measurement Canada, or by using NIST Standard Reference Materials where available.

Note: All expressions for concentration (e.g., % or ppm) are for gas phase, by volume (e.g., ppmv) unless otherwise noted. Analytical uncertainty is expressed as a Relative % unless otherwise noted.

IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution, Inc. While we believe the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any particular purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall liability of Praxair Distribution, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.



CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

COUNTY OF SAN DIEGO
10124 OLD GROVE RD
SAN DIEGO CA 92131

Certificate Modification Date: 08/29/2018

Praxair Order Number: 63241638

Part Number: NI CO45ME-AS

Customer PO Number: DANA ERRETT

Fill Date: 08/24/2018

Lot Number: 70086823603

Cylinder Style & Outlet: AS

CGA 350

Cylinder Pressure and Volume: 2000 psig 140 ft³

Certified Concentration

Expiration Date:	08/29/2026	NIST Traceable
Cylinder Number:	ALM-037113	Expanded Uncertainty
44.9 ppm	Carbon monoxide	± 0.6 %
Balance	Nitrogen	

ProSpec EZ Cert



Certification Information:

Certification Date: 08/29/2018

Term: 96 Months

Expiration Date: 08/29/2026

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-800/R-12/531, using Procedure G1.
Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component:

Carbon monoxide

Requested Concentration: 45 ppm
Certified Concentration: 44.9 ppm
Instrument Used: Horiba VIA-510 S/N 576876015
Analytical Method: NDIR
Last Multipoint Calibration: 08/09/2018

Reference Standard:

Type / Cylinder #: GMIS / CC188812

Concentration / Uncertainty: 48.9 ppm ±0.431%

Expiration Date: 12/08/2025

Traceable to: SRM # / Sample # / Cylinder #: SRM 1678c / 04-L-41 / FF18402

SRM Concentration / Uncertainty: 48.136 PPM / ±0.065PPM

SRM Expiration Date: 02/04/2021

First Analysis Data:				Date: 08/29/2018			
Z:	0	R:	48.9	C:	44.9	Conc:	44.9
R:	48.9	Z:	0	C:	44.9	Conc:	44.9
Z:	0	C:	45	R:	48	Conc:	45
UOM: ppm		Mean Test Assay: 44.9 ppm					

Second Analysis Data:				Date			
Z:	0	R:	0	C:	0	Conc:	0
R:	0	Z:	0	C:	0	Conc:	0
Z:	0	C:	0	R:	0	Conc:	0
UOM: ppm		Mean Test Assay: ppm					

Analyzed By

Jose Vasquez

Certified By

Daniel Burns



Praxair
 5700 South Alameda Street
 Los Angeles, CA 90058
 Tel: (323) 585-2154 Fax: (714) 542-6689
 PGVPID: F22018

DocNumber: 000119193

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information:

COUNTY OF SAN DIEGO
 10124 OLD GROVE RD
 SAN DIEGO CA 92131

Praxair Order Number: 54569845
 Customer P. O. Number: Dana Errett
 Customer Reference Number:

Fill Date: 1/10/2018
 Part Number: NI OX21E-AS
 Lot Number: 70086801003
 Cylinder Style & Outlet: AS CGA 590
 Cylinder Pressure & Volume: 2000 psig 140 cu ft.

Certified Concentration:

Expiration Date:	1/17/2026	NIST Traceable
Cylinder Number:	CC246193	Analytical Uncertainty:
21.10 %	OXYGEN	± 0.1 %
Balance	NITROGEN	

Certification Information: Certification Date: 1/17/2018 Term: 96 Months Expiration Date: 1/17/2026
 This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1. Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. Component: OXYGEN

Requested Concentration: 21 %
 Certified Concentration: 21.10 %
 Instrument Used: PARA 1 OXYMAT 5E
 Analytical Method: PARAMAGNETIC
 Last Multipoint Calibration: 1/3/2018

Reference Standard Type: GMIS
 Ref. Std. Cylinder #: CC76311
 Ref. Std. Conc: 20.88%
 Ref. Std. Traceable to SRM #: 2659e
 SRM Sample #: 71-E-19
 SRM Cylinder #: FF22331

First Analysis Data:		Date: 1/17/2018	
Z: 0	R: 20.88	C: 21.1	Conc: 21.093
R: 20.88	Z: 0	C: 21.1	Conc: 21.093
Z: 0	C: 21.12	R: 20.9	Conc: 21.113
UOM: %	Mean Test Assay:	21.1 %	

Second Analysis Data:		Date:	
Z: 0	R: 0	C: 0	Conc: 0
R: 0	Z: 0	C: 0	Conc: 0
Z: 0	C: 0	R: 0	Conc: 0
UOM: %	Mean Test Assay:	0 %	

Analyzed by:

Jose Vasquez

Certified by:

Danielle Burns

Information contained herein has been prepared at your request by qualified experts within Praxair Distribution, Inc. While we believe that the information is accurate within the limits of the analytical methods employed and is complete to the extent of the specific analyses performed, we make no warranty or representation as to the suitability of the use of the information for any purpose. The information is offered with the understanding that any use of the information is at the sole discretion and risk of the user. In no event shall the liability of Praxair Distribution, Inc., arising out of the use of the information contained herein exceed the fee established for providing such information.



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Certificate of Analysis

EPA Protocol

Customer: San Diego APCD
CGA: 590
Customer PO#:
Cylinder #: EB0014605
Part Number: EPA NIOXSALCO

Reference#: 04237193-00
Certification Date: 05/21/2018
Expiration Date: 05/22/2026
Pressure, psig: 2000

Method: This standard was analyzed according to EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards, Procedure G1 (May 2012).

**Analyzed Cylinder-
Components**
Oxygen
Nitrogen

Certified Concentration
11.99 %
Balance

Expanded Uncertainty
+/-0.05 %

Assay Dates
05/21/2018

**Reference Standard-
Type/SRM Sample**
Oxygen/GMIS
Traceable to SRM 2659a

Cylinder #
436978
CAL015489

Lot 71-D-50

Concentration
20.83 +/- 0.052 %
20.72 +/- 0.043 %

**Instrument-
Instrument/ Model**
Servomex 1100

Serial Number
1100-2228-C

Last Date Calibrated
05/02/2018

Analytical Method
Paramagnetic

This report states accurately the results of the investigation made upon the material submitted to the analytical laboratory. Every effort has been made to determine objectively the information requested. However, in connection with this report, Specialty Air Technologies shall have no liability in excess of the established charge for this service. Assayed at Specialty Air Technologies, Long Beach CA. No correction required for interfering gases.

The calibration results published in this certificate were obtained using equipment and standards capable of producing results that are traceable to National Institute of Standards and Technology (NIST) and through NIST to the International System of Units (SI). The expanded uncertainties, if included on this certificate, use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. If uncertainties are not included on this certificate, they are available upon request. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from the calibration facility. Calibration certificates without signatures are not valid. This calibration meets the requirements of ISO/IEC 17025:2005. Do not use this standard when cylinder pressure is below 150 psig.

Produced by:
TECH AIR
6544 1/2 Cherry Avenue
Long Beach, CA 90805
EPA PGVP ID# J12018

Principal Analyst:
Date: 21 May 2018

the 1990s, the number of people in the UK who are aged 65 and over has increased from 10.5 million to 13.5 million, and the number of people aged 75 and over has increased from 4.5 million to 6.5 million (Office for National Statistics 2000).

There is a growing awareness of the need to address the needs of older people, and the need to ensure that the health care system is able to meet the needs of older people. The Department of Health (2000) has published a strategy for older people, which sets out the government's commitment to older people and the need to ensure that the health care system is able to meet the needs of older people.

The strategy for older people is based on the following principles: (1) older people should be able to live independently in their own homes; (2) older people should be able to participate in the community; (3) older people should be able to access the services they need; and (4) older people should be able to live in a safe and secure environment.

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COUNTY OF SAN DIEGO, AIR POLLUTION CONTROL DISTRICT
 10124 OLD GROVE ROAD, SAN DIEGO, CA 92131
 PHONE (858) 586-2600 FAX (858) 586-2601
 www.sdapcd.org

Sectors: 3, K
 Site Record ID: APCD1976-SITE-00208
 Application Record ID: APCD2015-APP-004246

PERMIT RECORD ID
 APCD2003-PTO-975398



SD State University
 Environmental Compliance Specialist Dan Root
 5500 Campanile Dr Mail Code 1243
 San Diego CA 92182

EQUIPMENT ADDRESS
 San Diego State University
 William Lekas
 5500 Campanile Dr
 San Diego CA 92182

PERMIT TO OPERATE
 EXPIRES: April 30, 2019

This permit is not valid until required fees have been paid.

The above is hereby granted a Permit To Operate the article, machine, equipment or contrivance described below. This permit is not transferable to a new owner nor is it valid for operation of the equipment at another location except as specified. This Permit To Operate or copy must be posted on or within 25 feet of the equipment, or readily available on the operating premises.

EQUIPMENT OWNER

San Diego State University 5500 Campanile Dr, San Diego, CA 92182

EQUIPMENT DESCRIPTION

One (1) 60-T7300S GSC Solar Turbine Inc. Taurus Gas Turbine Engine, unit A, S/N 1128 T, S/N OHF15-T9157, natural gas fired, 59.48 million btu/hour, based upon lower heating value (lhv) at 46° F engine inlet temperature at 95% R.H, 5.233 MW net output power, with dry low oxides of nitrogen (NOx) (SoLoNOx) technology including an augmented backside cooled/ thermal barrier coating ABC/TBC combustor liner. One (1) John Zink Company low NOx duct burner (duct burner A), s/n 2001-68-1000, natural gas fired, 20 million btu/hour based upon higher heating value, and one (1) heat recovery steam generator. One (1) 4.169 MW steam turbine-generator set, S/N T-5613 is driven by unit A and unit B. The combined net power output of this cogeneration facility, consisting of two (2) gas turbine engines, each equipped with a duct burner and waste heat recovery system to supply steam and drive the steam turbine is 14.47 MW. 975398 EAD 12/11/03

Every person who owns or operates this equipment is required to comply with the conditions listed below and all applicable requirements and District rules, including but not limited to Rules 10, 20, 40, 50, 51.

Fee Schedules: 1 [20E] Non- Aircraft Turbine Engine
 2 [92F] NOx and CO Source Test

BEC: 12535

FAILURE TO OPERATE IN COMPLIANCE IS A MISDEMEANOR SUBJECT TO CIVIL AND CRIMINAL PENALTIES

1. This gas turbine with duct burner shall be properly maintained and kept in good operating condition at all times when the equipment is in operation.
2. This gas turbine and duct burner shall be fired on Public Utility Commission (PUC) quality natural gas only and shall be delivered to the facility through SDG&E infrastructure. The Permittee shall maintain a copy of General Order 58-A - PUC Standards for Gas Service in the State of California-Section 7-Purity of Gas, and SDG&E's Electric and Gas Tariff Book Rule 30 H-Gas quality that demonstrate the natural gas supplied to the facility has a Sulfur content of no more than 10 grains of Sulfur compounds, calculated as Hydrogen Sulfide, per 100 cubic feet of dry gaseous fuel, at standard conditions.



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3. When the duct burner is not in operation, the total concentration of Oxides of Nitrogen (NOx), calculated as Nitrogen Dioxide, shall not exceed 15 parts per million by volume corrected to fifteen (15) percent Oxygen, on a dry basis (PPMVD), as measured in the exhaust stack. Compliance with this limit shall be demonstrated during annual source tests.
4. When the duct burner is in operation, the total concentration of NOx, calculated as Nitrogen Dioxide shall not exceed 17 PPMV corrected to 15% Oxygen on a dry basis, as measured in the exhaust stack. Compliance with this limit shall be demonstrated during annual source tests.
5. The aggregate NOx emissions from the two replacement turbines, two duct burners, and the two boilers (Permit to Operate Nos. 841 and 920191) shall be calculated and recorded on a monthly basis. The annual aggregate NOx emissions from this facility shall not exceed 50 tons in any twelve consecutive month period.
6. The NOx emission factors used to determine the aggregate NOx emission rate for the turbines and duct burners shall be based upon the most recent District approved source test, as approved in writing by the District, except as follows: within 60 days after written approval from the District for a change in NOx emission factor values is received by the Permittee, the newly approved emission factor values shall be input into the automated NOx emissions reporting system.
7. The aggregate annual CO emission factors used to determine the aggregate annual CO emission rate for the turbines and duct burners for a given year shall be based upon annual gas turbine and duct burner Natural gas consumption rates and the District approved source test conducted in the year of that source test, as approved in writing by the District. An Automated CO Emissions Reporting System is not required.
8. A current print out from the automated NOx emission recording system indicating the current NOx emission factors used to report estimated daily, monthly and annual emissions, and the most recent written authorization from the District for a change of NOx emission factor values to be used by the automated system to estimate NOx emissions shall be made readily available upon request of District personnel.
9. The maximum annual fuel consumption rate for the two gas turbines and the two duct burners combined shall not exceed 1490 million cubic feet in any 12 consecutive month period.
10. Emissions of Carbon Monoxide (CO) from the gas turbine shall not exceed 50 PPMV corrected to 15% Oxygen, on a dry basis. Compliance with this limit shall be demonstrated at the time of the annual source tests.
11. The automated system to monitor and record excursions, and to provide a visual alarm when excursions occur shall be installed and operated in accordance with description of the Excursion Monitoring System provided in the SDSU letter to the District dated August 5, 2003. Any proposed modification to the Excursion Monitoring System which would result in a deviation from the description, as stated in the SDSU letter dated August 5, 2003 shall require an application for modification and a District Authority to construct letter for such modification.
12. Except during startups, shutdowns, and during operations in Low Emissions Mode where one or more self-correcting excursions do not exceed a combined duration of 360 seconds in a clock hour, the gas turbine shall be in Low Emissions Mode and shall not otherwise undergo any excursions at all times when the turbine is in operation. Low Emissions Mode is defined as the gas turbine operating mode when the unit load is 50% or greater (2617 KW or greater) and the pilot valve position (%) is less than or equal to the low pilot setting value indicated in the graph of Low Emissions Pilot Valve Setting vs. Load or equivalent table. For loads in excess of 100% (or 5233 KW), Low Emissions Mode is defined as the gas turbine operating mode when the pilot valve position (%) is less than or equal to the pilot valve position value setting corresponding with 100% load, as defined in the graph of Low Emissions Pilot Valve Settings vs. Load or equivalent table.
13. In the event that source test results do not demonstrate compliance with District Emission Standards, the applicant shall take corrective action that would result in a modification to the equipment shall require an application for modification and a District Authority to Construct letter for such modification.



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14. The status of the Solo NOx Mode and the transient pilot setting shall be continuously monitored by the Distributed Control System (DCS). Except during startups and shutdowns, all excursions shall be monitored and recorded by the DCS at all times when the unit is operating and incorporated into the APCD monthly report of startups, shutdowns, and excursions, and shall be made readily available to the District upon request. An excursion is defined as the gas turbine operating mode when the unit load is 50% or greater (2617 KW or greater) and the pilot valve position (%) is greater than the low pilot setting value indicated in the graph of low emissions pilot valve settings vs. Load. For loads in excess of 100% (or 5233 KW), an excursion is defined as the gas turbine operating mode when the pilot valve position (%) is greater than the pilot valve position value setting corresponding with 100% load, as defined in the graph of Low Emissions Pilot Valve Settings vs. Load or equivalent table.
15. The DCS Control Panel screen shall visually display "L.E. Excursion" to indicate a Low Emissions Mode excursion is in progress during the duration of all excursions in excess of 60 seconds, beginning with the 60th consecutive second of an excursion.
16. The DCS Control Panel screen shall visually display "L.E. Excursion" to indicate a Low Emissions Mode excursion is in progress, during all excursions of any duration, beginning of the fourth excursion of a clock-hour, which begins within that same clock-hour.
17. The DCS shall record "L.E. Excursion" in the APCD monthly start-up and shut-down log, along with the date and time and duration of excursion, Unit Identifier (CGT_A or CGT_B) and amount of fuel consumed (in MSCF) for all excursions with duration in excess of 60 seconds.
18. The DCS shall record "L.E. Excursion" in the APCD monthly start-up and shut-down log, along with the date and time and duration of excursion, Unit Identifier (CGT_A or CGT_B) and amount of fuel consumed (in MSCF) during all excursions of any duration, beginning of the fourth excursion of a clock-hour, which begins within that same clock-hour.
19. NOx emission from the stack shall be monitored and recorded for at least 30 minutes using a Calibrated Portable NOx Analyzer following all major combustor and Solonox System related maintenance and repairs, and inspections, as determined by Solar Turbines Inc. Descriptions of actions taken to fix the problem and NOx Analyzer readings shall be documented and recorded to the satisfaction of the District. At a minimum, NOx measurements shall be monitored and recorded for at least 30 minutes as part of the semi-annual inspection and for at least 30 minutes as part of the annual inspection.
20. Continuous monitor and display of Pilot Valve Position (Pilot Vlv Pos), expressed in percentage of full open, gas turbine power real power, expressed in KW, and inlet air temperature, expressed in degrees Fahrenheit shall be readily available to view and/or take photos of the display screen by District personnel, at all times when the gas turbine is operating. The graph of Low Emissions Pilot Valve Settings vs. Load and the equivalent table shall be posted within 3 feet of the gas turbine panel view screen.
21. Except during startups and shutdowns, NOx emissions from the stack shall be monitored and recorded for at least 30 minutes at least once every 8-hour shift using a Calibrated Portable NOx Analyzer beginning within 48 operating hours after an excursion or multiple excursions have occurred for a total combined duration of 360 seconds or longer in a clock hour until Portable NOx Analyzer readings indicate NOx emission concentrations are equal to or below the applicable NOx emissions concentration limit stated on this Permit. NOx readings in excess of the applicable Permit limit, as indicated by a Portable NOx Analyzer does not constitute a Violation and shall only be used for informational purposes, as a means to determine when corrective action is required. Compliance with the emission limits stated on this Permit shall only be determined based upon a District approved source test. Calibration records and emission data, including data from the Calibrated Portable NOx Analyzer shall be maintained on-site for at least 3 years and made readily available to the District upon request.
22. The cause of all excursions that have occurred for a total combined duration of 360 seconds or longer within a clock-hour and description of actions taken to fix the problem shall be documented by Solar Turbines Inc. to the satisfaction of the District and made readily available to the District upon request.



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23. Thirty days before testing is performed by an independent third party source test contractor, a written test protocol shall be submitted and approved by the District for NOx, and CO emissions testing of the two turbines. The protocol format and the requirements for Condition No. 5 and/or 6 can be obtained from the Monitoring Source Testing Group at (858) 586- 2775. A final test report shall be submitted for approval to the District no more than thirty days following completion of source testing. Proposed NOx and CO emission factors, calculated based upon source test results shall be included in the source test report. The Applicant should allow 30 days for source test protocol approval and should contact the Monitoring Source Testing Group at (858)586-2775 with any questions regarding test protocol format, submittal or approval of a test protocol. A test protocol shall not be required if the source testing is conducted by the District.
24. The NOx concentration limits in these Conditions shall not apply during start-up, or shut-down for a period not to exceed 120 continuous minutes.
25. The maximum combined daily natural gas consumption from the two (2) gas turbines and duct burners associated with Permits to Operate Nos. 975398 and 975399 shall not exceed 4 million cubic feet per day. This maximum combined daily fuel consumption limit shall be adjusted based upon source test results.
26. Dedicated non-resettable totalizing meters with an accuracy of +/- 5% shall be installed in the fuel line of each turbine and in the fuel line of each duct burner to measure the volumetric flow rate corrected for temperature and pressure of the fuel. Any correction factors shall be maintained on-site and made available to the District upon request.
27. Continuous monitors to record fuel flow to each turbine and each duct burner shall be calibrated on an annual basis. Calibration records shall be maintained on-site and made readily available to the District upon request.
28. The date, time, and duration of all excursions and the quantity of fuel consumed during each excursion shall be recorded by the Distributed Control System (DCS) and reported in the APCD monthly report - monthly start-up and shut-down log.
29. The total combined daily fuel consumption and the total combined fuel consumption in a 12 consecutive month period for the two gas turbines, two duct burners and the two existing boilers (Permit to Operate Nos. 841 and 920191) shall be recorded, reported in an APCD monthly report, SDSU Cogeneration Facility fuel gas usage and NOx emissions Log, and made readily available to the District upon request. A Continuous Emissions Monitoring System (CEMS) is not required.
30. Daily fuel consumption and NOx emissions for each gas turbine, duct burner and boiler at the facility shall be determined on a monthly basis and reported in the APCD monthly report, daily fuel gas consumption and NOx emissions log.
31. Records including natural gas purchase records shall be maintained and made available to the District upon request. The particular gas turbine or duct burner shall be identified on fuel records generated from continuous monitors serving the dedicated totalizing natural gas flow meters. The actual times and duration of all startups, shutdowns, and quantity of fuel consumed shall be recorded for each gas turbine and duct burner.
32. Visible emissions from the exhaust stacks and the lube oil vent mist eliminator serving the lube oil vent of the turbine shall not exceed 20% opacity for more than three (3) minutes in any period of 60 consecutive minutes.
33. This equipment shall be source tested for compliance at least annually before the Permit to Operate renewal date, unless otherwise specified in writing by the District. Testing shall be conducted in accordance with District Source Test Method 100, or the Air Resources Board (ARB) Test Method 100 as approved by EPA, and a source test protocol approved in writing by the District to ensure compliance with District emission standards for NOx and CO prior to Permit renewal. Testing shall be performed at no less than 80% of full power rating, except as follows: if it is demonstrated to the satisfaction of the District that the duct burner cannot operate at these conditions as a result of insufficient steam demand, then emissions source testing shall be performed with the duct burner operating at the highest achievable continuous power rating.
34. The following operational characteristics shall be continuously monitored at all times, and recorded, during source tests and submitted to the District within 24 hours after a source test is complete: time and duration of all excursions, percent turbine load, real power of turbine, pilot valve position, turbine inlet temperature, cumulative turbine fuel flow, cumulative duct burner fuel flow, average combustion temperature, gas turbine inlet air temperature, compressor discharge pressure, power output, and steam flow rate.
35. Access, facilities, utilities and any necessary safety equipment for source testing and inspection shall be provided upon request of the Air Pollution Control District.



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- 36. This Air Pollution Control District Permit does not relieve the holder from obtaining permits or authorizations required by other governmental agencies.
- 37. The permittee shall, upon determination of applicability and written notification by the District, comply with all applicable requirements of the Air Toxics "Hot Spots" Information and Assessment Act (California Health and Safety Code Section 44300 et seq.)

DISTRIBUTION CHECKLIST FOR METHOD 100 CO, NOx TEST

Site: SD State University
GT A, DB On

Test Date: 4/4/2019
PO. No. APCD2003-PTO-975398

TEST REPORT CONTENTS

- | | |
|---|---|
| <input type="checkbox"/> COVER LETTER | <input checked="" type="checkbox"/> ANALYZER CHECK OFF SHEET (p. 5) |
| <input checked="" type="checkbox"/> SOURCE TEST SUMMARY SHEET (p.1) | <input checked="" type="checkbox"/> ENGINEERING REPORT |
| <input checked="" type="checkbox"/> DATA SHEET (p.2-4) | <input checked="" type="checkbox"/> DATA ACQUISITION TABLES |

MTS FILE NOTES

- | | |
|--|--|
| <input type="checkbox"/> FOLDER LABELLED | <input checked="" type="checkbox"/> PO and PAYMENT SHEET |
| <input checked="" type="checkbox"/> CHECK LIST IN FOLDER | |

REPORT BY: <u>N. Gutzwiller</u>	DATE: <u>10-Apr-19</u>
TEST CONDUCTED BY: <u>N. Gutzwiller, A. Fry</u>	DATE: <u>4-Apr-19</u>
REPORT QC BY: <u>Daryl Hawkes</u>	DATE: <u>08/22/19</u>
APPROVED BY: <u>D.A. Sodeman</u>	DATE: <u>6/14/19</u>

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