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**RESULTS OF THE APRIL 11, 2013
AIR EMISSION COMPLIANCE TESTING AT THE
UNIVERSITY OF MINNESOTA ARBORETUM
FACILITY IN CHASKA, MINNESOTA**

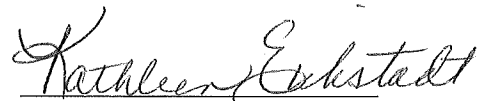
Submitted to:

ZIEGLER POWER SYSTEMS
8050 County Road 101 East
Shakopee, MN 55379

Attention:

Mark Reuter

Reviewed by:



Kathleen Eickstadt
Coordinator
Source Testing Department

Report Number 13-32020
May 1, 2013
DVH

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ABBREVIATIONS

ACFM	actual cubic feet per minute
cc (ml)	cubic centimeter (milliliter)
DSCFM	dry standard cubic foot of dry gas per minute
DSML	dry standard milliliter
DEG-F (°F)	degrees Fahrenheit
DIA.	Diameter
FT/SEC	feet per second
g	gram
GPM	gallons per minute
GR/ACF	grains per actual cubic foot
GR/DSCF	grains per dry standard cubic foot
g/dscm	grams per dry standard meter
HP	horsepower
HRS	hours
IN.	inches
IN.HG.	inches of mercury
IN.WC.	inches of water
LB	pound
LB/DSCF	pounds per dry standard cubic foot
LB/HR	pounds per hour
LB/10 ⁶ BTU	pounds per million British Thermal Units heat input
LB/MMBTU	pounds per million British Thermal Units heat input
MW	megawatt
mg/dscm	milligrams per dry standard cubic meter
ug/dscm	micrograms per dry standard cubic meter
microns (um)	micrometer
MIN.	minutes
ng	nanograms
PM	particulate matter
PPH	pounds per hour
PPM	parts per million
ppmC	parts per million carbon
ppm,d	parts per million, dry
ppm,w	parts per million, wet
ppt	parts per trillion
PSI	pounds per square inch
SQ.FT.	square feet
TPD	tons per day
ug	micrograms
v/v	percent by volume
w/w	percent by weight

Standard conditions are defined as 68 °F (20 °C) and 29.92 IN. of mercury pressure

1 INTRODUCTION

On April 11, 2013 Interpoll Laboratories personnel conducted Compliance Testing at the University of Minnesota Arboretum facility in Chaska, Minnesota. Testing was performed on a Caterpillar 3512 diesel generator equipped with a catalyst system. Testing was performed to determine compliance with 40 CFR 63 Subpart ZZZZ for nonemergency, non-black start generators. Ryan Andrews and Jake Traxler of Interpoll Laboratories performed the on-site testing. Tony Lyon of Ziegler Power Systems and Maury Giesen of the University of Minnesota provided coordination between testing activities and plant operation. A representative of the Minnesota Pollution Control Agency did not witness the test.

Oxygen and carbon monoxide sampling were conducted using EPA Methods 3A and 10. A slipstream of sample gas was withdrawn from the exhaust gas stream using a heat-traced probe and filter assembly. After passing through the filter, the gas passed through two condenser-type moisture removal systems operating in series. The particulate-free dry gas was then transported to the analyzers, with the excess exhausted to the atmosphere through a calibrated orifice, which was used to ensure that the flow from the stack exceeds the requirements of the analyzers. The instruments were calibrated before and after the runs using EPA Protocol 1 calibration gases. The reference method concentrations were recorded using a computer data logger.

The important results of the test are summarized in Section 2. Field data and all other supporting information are presented in the appendices.

2 SUMMARY AND DISCUSSION

An overview of the results of the testing performed on April 11, 2013 is presented below.

Summary of Performance Test Results

1(a) Emission Unit Tested	1(b) Limitation Basis	1(c) Pollutant and Emission Limit	1(d) Test Result
Caterpillar 3512 Generator S/N CMJ01333	Table 2D to Subpart ZZZZ of Part 63- Requirements for Existing Stationary RICE Non –emergency, non-black start CL stationary RICE >500hp	CO 23 ppm @ 15%O2 or 70% Removal	CO 7.89 ppm @ 15%O2 95.24 % Removal

No difficulties were encountered in the field or in the data reduction. On the basis of this fact and a complete review of the entire data and results, it is our opinion that the results reported herein are accurate and closely reflect the actual values, which existed at the time the test was performed.

Summary of the April 11, 2013 Carbon Monoxide Removal Efficiency Test on the (CI RICE) Ziegler Diesel Generator at the University of Minnesota Arboretum located in Chaska, MN.

Item		Run 1	Run 2	Run 3	Average
Date of test		04-11-13	04-11-13	04-11-13	
Time runs were done (Hrs)		1040 / 1140	1155 / 1255	1310 / 1410	
Analytical Results					
CO Inlet					
ω	CO ppm, dry	206.548	212.542	203.897	207.66
	O2 %, dry	13.516	13.557	13.452	
	CO @ 15% O2	165.029	170.778	161.517	165.77
CO Outlet					
	CO ppm, dry	11.931	8.992	8.661	9.86
	O2 %, dry	13.631	13.634	13.249	
	CO @ 15% O2	9.684	7.301	6.679	7.89
Removal Efficiency		94.132	95.725	95.865	95.24

APPENDIX A

TEST PLAN

February 5, 2013

Mr. George Czerniak
Air & Radiation Branch
USEPA-Region 5
77 West Jackson Blvd.
Chicago, IL 60604-3507

RE:Notification of 40CFR 63, Subp. ZZZZ Testing and Site-Specific Test Plan
U of M Arboretum, Chaska, MN

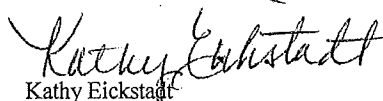
Dear Mr. Czerniak,

Interpoll Laboratories submits this notification and site specific test plan for testing required per Reciprocating Internal Combustion Engine (RICE) pursuant to 40 CFR 63, Subp. ZZZZ for nonemergency, non-black start generators. Testing will be conducted for carbon monoxide on one Caterpillar 3512 Generator located at the University of Minnesota Arboretum located in Chaska, Minnesota. Testing is scheduled for April 11, 2013. You will be notified if the test date changes for any reason.

Please feel free to contact me at 763-786-6020, Ext 38 or Maury Giesen of U of M Arboretum at 952-443-1417 if you have any questions or require additional information.

Sincerely,

INTERPOLL LABORATORIES, INC.



Kathy Eickstadt

Coordinator

Source Testing Department

KE/kce

Encl.

cc: Maury Giesen, U of M Arboretum
Chris Kaufhold, Ziegler Power Systems

**TEST PLAN FOR NESHAP EMISSION COMPLIANCE
TESTING OF AN AREA SOURCE GENERATOR**

PART 1. GENERAL INFORMATION

Test Plan Date: February 5, 2013
 Test Date: April 11, 2013

Name and address of emission facility: U of M Arboretum
 3675 Arboretum Blvd.
 Chaska, MN 55318

Permittee contact person: Maury Giesen
 Phone: (952) 443-1417
 Email:

Independent Testing Company: Interpoll Laboratories, Inc.
 Contact: Kathy Eickstadt/Ed Juers
 Phone: 763-786-6020
Kathy.eickstadt@interpoll-labs.com
Ed.juers@interpoll-labs.com

Reason for testing: Testing required per Reciprocating Internal Combustion Engine (RICE) pursuant to 40 CFR 63, Subp. ZZZZ for nonemergency, non-black start generators.

PART II. TESTING REQUIREMENTS

Stack Vent No.: Emission Unit No.	Limitation Basis of Pollutant Tested	Pollutant Tested and Applicable Emission Limit	Specific Methods/Procedures Required Citation:
Caterpillar 3512 s/n: CMJ01333	Table 2d to Subpart ZZZZ of Part 63-Requirements for Existing Stationary RICE Located at Area Sources of HAP Emissions NON-EMERGENCY, NON-BLACK START CL STATIONARY RICE >500 HP	Carbon monoxide 23 ppmvd @ 15% O2 or 70% removal	EPA Methods 3A & 10

PART III. OPERATING CONDITIONS

1. Process Equipment Description: Non-Emergency Generator.

Operating Capacity During Test: 50%

Control Equipment Description: Diesel Oxidation Catalyst

Control Equipment Operating Parameter During Test: Differential pressure and exhaust inlet temperature

Fuel Burned (list % ratios if more than one): Diesel
2. Rationale For Worst Case: 50%.
3. Normal Operating Capacity: 50% load factor
4. Description of How Process Equipment Will be Monitored During Testing: Electrical generation meters will be monitored.
5. Description of How Pollution Control Equipment Will be Monitored During Testing: Monitor and record differential pressure and inlet temperature.

PART IV. TEST METHODS

- A. EPA Method 3A. Three determinations; before and after catalyst; one (1) one-hour measurement taken concurrently with each test run for pollutant.
- B. EPA Method 10 for the determination of carbon monoxide. Three (3) one-hour determinations, before and after catalyst will be performed.¹

PART V. CEMS RELATIVE ACCURACY

N/A

PART VI. OTHER

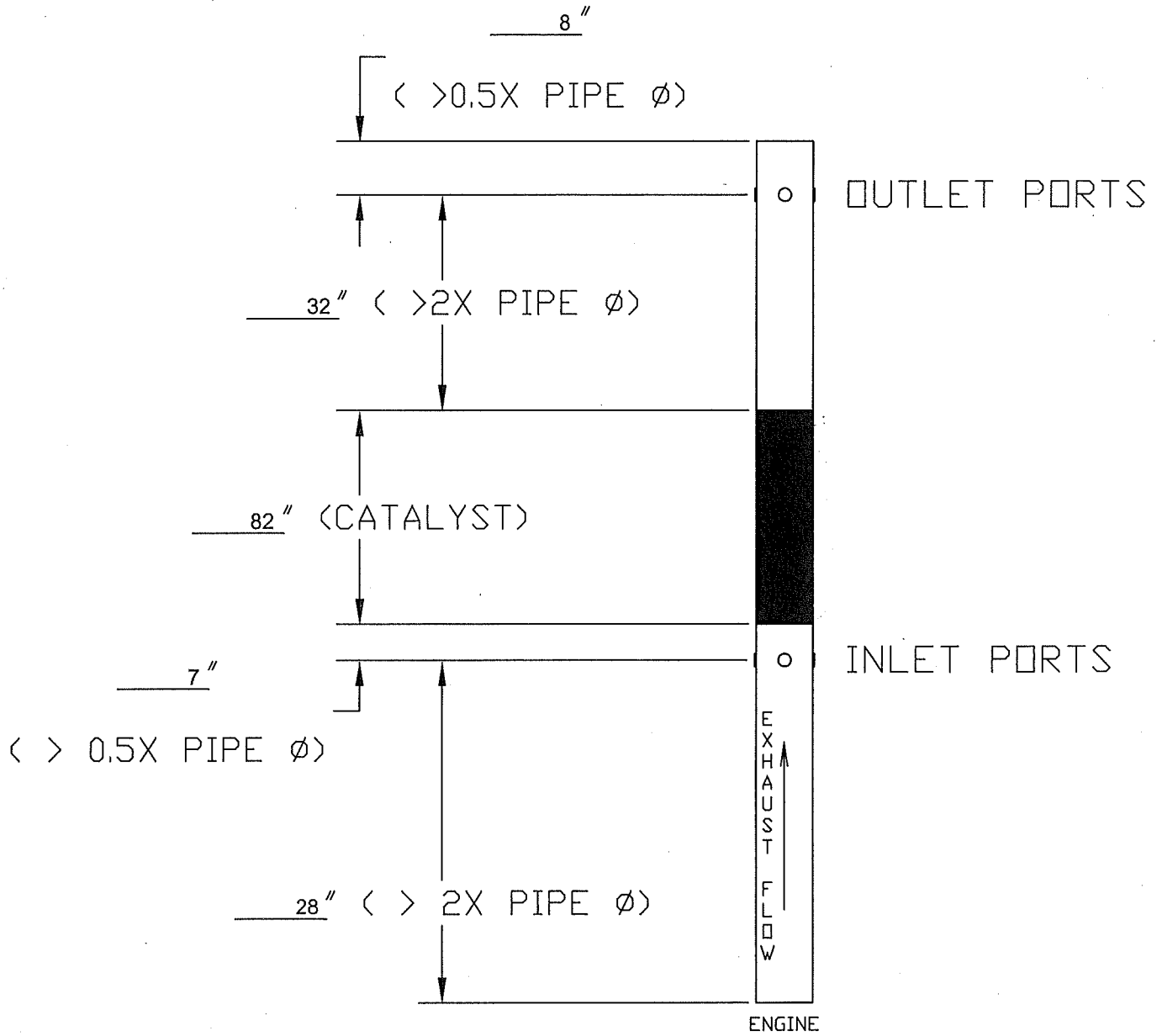
1. Carbon monoxide will be reported as ppmv,d @15% O₂, % removal.
2. List any special averaging times for emission limits if applicable: N/A

¹ The test port locations shown in the attached drawing will be utilized. Sampling will take place in the centroid area of the ducts per the proposed rule revisions in Federal Register/Vol. 77, No. 5/Monday, January 9, 2012/proposed rules/pg. 1137.

3. One complete test report will be submitted to:

Mr. George Czerniak
Air & Radiation Branch
USEPA-Region 5
77 West Jackson Blvd.
Chicago, IL 60604-3507

CUSTOMER/PROJECT NAME : U of M Arboretum



APPENDIX B

MEASUREMENT SYSTEM PERFORMANCE SPECIFICATIONS

Calibration Error Outlet

U of M Arboretum
Chaska, MN
CI RICE Generator
04/11/13
Test 1

CO (TEI Model 48i)

	Cylinder Value (ppm)	Analyzer Response	Difference (ppm)	Span Value (ppm)	% of Span
		(ppm)			
Zero	0.00	-0.05	0.05	25.10	0.20
Mid Level	12.80	13.05	0.25	25.10	1.00
High Level	25.10	25.26	0.16	25.10	0.64

O₂ (Servomex Series 1400)

	Cylinder Value (%)	Analyzer Response	Difference (%)	Span Value (%)	% of (%)
		(%)			
Zero	0.00	0.05	0.05	20.90	0.24
Mid Level	10.90	10.93	0.03	20.90	0.14
High Level	20.90	20.89	0.01	20.90	0.05

**** All Calibrations must be within 2% of the span value...

U of M Arboretum
 Chaska, MN
 CI RICE Generator
 4/11/2013

		O ₂					
		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	0.01	-0.04%	0.02	0.00%	0.02	0.04%
	Upscale	10.94	-0.04%	10.88	-0.28%	10.91	-0.24%
2	Zero	0.02	0.00%	0.04	0.08%	0.03	0.08%
	Upscale	10.88	-0.28%	10.96	0.04%	10.92	0.32%
3	Zero	0.04	0.08%	0.02	0.00%	0.03	-0.08%
	Upscale	10.96	0.04%	10.84	-0.44%	10.90	-0.48%

	Cylinder Value		Analyzer Value	
Zero	0.00	%	0.02	%
Upscale	10.90	%	10.95	%
Span	25	%	25	%

All calibrations must be within 3% of the span value.

U of M Arboretum
 Chaska, MN
 CI RICE Generator
 4/11/2013

		CO					
		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.20	0.56%	0.14	0.32%	0.17	-0.24%
	Upscale	12.96	-0.36%	12.77	-1.12%	12.87	-0.76%
2	Zero	0.14	0.32%	0.08	0.08%	0.11	-0.24%
	Upscale	12.77	-1.12%	12.87	-0.72%	12.82	0.40%
3	Zero	0.08	0.08%	0.03	-0.12%	0.06	-0.20%
	Upscale	12.87	-0.72%	12.59	-1.83%	12.73	-1.12%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.06 ppm
Upscale	12.80 ppm	13.05 ppm
Span	25.10 ppm	25.1 ppm

All calibrations must be within 3% of the span value.

Calibration Error Inlet

U of M Arboretum
Chaska, MN
CI RICE Generator
04/11/13
Test 1

CO (Thermo Model 48c)

	Cylinder Value (ppm)	Analyzer Response	Difference (ppm)	Span Value (ppm)	% of Span
		(ppm)			
Zero	0.00	0.06	0.06	245.00	0.02
Low Level	51.50	51.82	0.32	245.00	0.13
Mid Level	114.00	113.79	0.21	245.00	0.09
High Level	245.00	244.45	0.55	245.00	0.22

O₂ (Servomex Series 1400)

	Cylinder Value (%)	Analyzer Response	Difference (%)	Span Value (%)	% of (%)
		(%)			
Zero	0.00	0.02	0.02	20.90	0.10
Mid Level	10.90	10.95	0.05	20.90	0.24
High Level	20.90	20.91	0.01	20.90	0.05

**** All Calibrations must be within 2% of the span value...

U of M Arboretum
 Chaska, MN
 CI RICE Generator
 4/11/2013

		O ₂					
		Initial	Pre-Cal Bias	Final	Post-cal Bias	Avg.	% Drift of Span
1	Zero	-0.01	-0.12%	0.03	0.04%	0.01	0.16%
	Upscale	10.92	-0.12%	10.89	-0.24%	10.91	-0.12%
2	Zero	0.03	0.04%	0.02	0.00%	0.03	-0.04%
	Upscale	10.89	-0.24%	10.85	-0.40%	10.87	-0.16%
3	Zero	0.02	0.00%	0.03	0.04%	0.03	0.04%
	Upscale	10.85	-0.40%	10.89	-0.24%	10.87	0.16%

	Cylinder Value		Analyzer Value	
Zero	0.00	%	0.02	%
Upscale	10.90	%	10.95	%
Span	25	%	25	%

All calibrations must be within 3% of the span value.

U of M Arboretum
 Chaska, MN
 CI RICE Generator
 4/11/2013

		CO					
		Initial	Pre-Cal Bias	Final	Post-Cal Bias	Avg.	% Drift of Span
1	Zero	0.24	0.07%	-0.25	-0.13%	-0.01	-0.20%
	Upscale	114.72	0.38%	113.89	0.04%	114.31	-0.34%
2	Zero	-0.25	-0.13%	0.26	0.08%	0.01	0.21%
	Upscale	113.89	0.04%	114.61	0.33%	114.25	0.29%
3	Zero	0.26	0.08%	0.23	0.07%	0.25	-0.01%
	Upscale	114.61	0.33%	114.53	0.30%	114.57	-0.03%

	Cylinder Value	Analyzer Response
Zero	0.00 ppm	0.06 ppm
Upscale	114.00 ppm	113.79 ppm
Span	245.00 ppm	245 ppm

All calibrations must be within 3% of the span value.

APPENDIX C

INTERPOLL LABORATORIES COMPUTER PRINTOUTS

U of M Arboretum
Chaska, MN
CI RICE Generator

4/11/2013
Test 1 Run 1

Start 10:40 AM
Stop 11:40 AM

Time	In O ₂ % d	In CO ppm, d	Out O ₂ % d	Out CO ppm, d
10:40:00	13.413	203.201	13.510	12.338
10:41:00	13.298	197.268	13.356	12.103
10:42:00	13.282	194.109	13.307	11.173
10:43:00	13.721	206.853	13.741	11.704
10:44:00	13.824	216.280	13.883	12.049
10:45:00	13.916	224.093	13.988	11.987
10:46:00	13.775	217.506	13.845	11.999
10:47:00	13.581	212.028	13.664	11.966
10:48:00	13.319	199.361	13.437	12.059
10:49:00	13.285	198.275	13.342	11.889
10:50:00	13.200	196.032	13.278	11.816
10:51:00	13.326	197.275	13.484	11.670
10:52:00	13.566	205.947	13.692	11.580
10:53:00	13.518	207.618	13.521	11.628
10:54:00	13.253	198.048	13.269	12.175
10:55:00	13.150	193.209	13.242	12.723
10:56:00	13.118	192.794	13.249	12.787
10:57:00	13.120	193.036	13.228	12.899
10:58:00	13.131	192.949	13.274	13.079
10:59:00	13.260	194.948	13.473	12.640
11:00:00	13.505	203.201	13.816	13.030
11:01:00	13.912	225.023	14.035	21.795
11:02:00	13.747	218.851	13.788	17.120
11:03:00	13.626	211.285	13.774	12.825
11:04:00	13.624	210.187	13.759	12.163
11:05:00	13.521	208.452	13.674	11.935
11:06:00	13.328	203.450	13.467	11.703
11:07:00	13.258	199.529	13.394	11.782
11:08:00	13.286	198.961	13.429	11.505
11:09:00	13.497	203.623	13.720	11.386
11:10:00	13.679	212.860	13.857	11.132
11:11:00	13.788	219.769	13.934	11.249
11:12:00	13.669	214.533	13.774	11.427
11:13:00	13.680	211.118	13.872	11.329
11:14:00	13.733	216.362	13.820	11.393
11:15:00	13.595	214.263	13.735	11.591
11:16:00	13.513	209.373	13.570	11.386
11:17:00	13.445	202.298	13.643	11.359
11:18:00	13.707	212.356	13.868	11.372
11:19:00	13.679	214.358	13.781	11.336
11:20:00	13.628	209.625	13.745	11.568
11:21:00	13.687	211.199	13.811	11.587
11:22:00	13.613	210.118	13.752	11.628
11:23:00	13.421	205.281	13.458	11.612
11:24:00	13.293	198.870	13.460	11.353
11:25:00	13.496	205.950	13.736	11.319
11:26:00	13.846	220.108	13.917	11.335
11:27:00	13.766	217.610	13.914	11.449
11:28:00	13.780	216.870	13.973	11.542
11:29:00	13.993	225.853	14.134	11.444
11:30:00	14.034	231.112	14.156	11.500
11:31:00	13.867	222.259	13.834	11.544
11:32:00	13.506	208.297	13.601	11.649
11:33:00	13.150	198.132	13.165	11.879
11:34:00	13.150	195.203	13.401	11.517
11:35:00	13.224	195.297	13.398	11.194
11:36:00	13.368	197.130	13.488	11.163
11:37:00	13.425	199.788	13.624	11.380
11:38:00	13.490	202.456	13.612	11.208
11:39:00	13.580	204.450	13.692	11.241
Average	13.519	207.105	13.639	12.003

FIELD CALCULATIONS

RAW DATA TABLE

Instrument	ppm or %	Zero	Span	Gas	Gas Corrected for Calibration	
Inlet O ₂ (dry)	13.519	0.01	10.91	10.90	13.52	dry
Inlet CO (dry)	207.105	-0.01	114.31	114.0	206.55	dry
Outlet O ₂ (dry)	13.639	0.02	10.91	10.90	13.63	dry
Outlet CO (dry)	12.003	0.17	12.87	12.8	11.93	dry

RESULTS

Inlet		Outlet	
O ₂ %, dry	13.52	O ₂ %, dry	13.63
CO @ 15% O ₂	165.03	CO @ 15% O ₂	9.68
CO ppm, dry	206.55	CO ppm, dry	11.931

Removal Efficiency 94.132

U of M Arboretum
Chaska, MN
CI RICE Generator

4/11/2013
Test 1

Run 2

Start
Stop

11:55 AM
12:55 PM

Time	In O ₂ %, d	In CO ppm, d	Out O ₂ %, d	Out CO ppm, d
11:55:00	13.642	222.178	13.639	9.136
11:56:00	13.159	202.199	12.966	9.295
11:57:00	12.759	189.191	12.956	9.029
11:58:00	12.949	190.122	13.231	8.824
11:59:00	13.452	212.107	13.914	8.714
12:00:00	13.913	235.094	14.076	9.044
12:01:00	13.874	230.847	13.888	9.009
12:02:00	13.761	222.193	13.859	9.043
12:03:00	13.694	221.845	13.822	9.142
12:04:00	13.674	222.010	13.649	9.150
12:05:00	13.252	203.038	13.175	9.001
12:06:00	12.914	191.853	12.986	9.114
12:07:00	12.915	191.296	13.314	8.884
12:08:00	13.446	208.366	13.720	8.748
12:09:00	13.618	217.770	13.792	8.837
12:10:00	13.589	216.623	13.667	9.036
12:11:00	13.491	212.206	13.655	8.902
12:12:00	13.516	212.692	13.724	9.093
12:13:00	13.688	223.032	13.892	9.124
12:14:00	13.804	226.847	13.849	9.130
12:15:00	13.694	219.932	13.916	9.061
12:16:00	13.853	228.274	13.988	9.128
12:17:00	13.865	229.100	13.955	9.199
12:18:00	13.758	222.435	13.836	9.206
12:19:00	13.733	223.444	13.808	9.288
12:20:00	13.688	222.676	13.897	9.263
12:21:00	13.844	228.495	13.984	9.264
12:22:00	13.829	229.181	13.925	9.299
12:23:00	13.777	225.278	13.898	9.396
12:24:00	13.785	225.853	13.897	9.422
12:25:00	13.701	221.944	13.827	9.440
12:26:00	13.637	215.858	13.697	9.212
12:27:00	13.511	209.465	13.692	9.086
12:28:00	13.624	217.010	13.781	9.280
12:29:00	13.552	216.847	13.711	9.323
12:30:00	13.617	218.706	13.777	9.223
12:31:00	13.519	212.188	13.611	9.214
12:32:00	13.511	211.118	13.738	9.063
12:33:00	13.668	218.602	13.853	9.124
12:34:00	13.708	221.283	13.855	9.264
12:35:00	13.650	219.273	13.726	9.189
12:36:00	13.463	208.534	13.336	9.251
12:37:00	12.945	191.441	13.095	9.061
12:38:00	12.967	190.033	13.174	8.887
12:39:00	13.102	192.367	13.307	8.738
12:40:00	13.186	195.198	13.432	8.775
12:41:00	13.464	206.029	13.727	8.640
12:42:00	13.516	206.962	13.601	8.634
12:43:00	13.481	206.626	13.639	8.739
12:44:00	13.496	210.011	13.740	8.817
12:45:00	13.721	219.861	13.892	8.851
12:46:00	13.684	217.620	13.727	8.743
12:47:00	13.528	210.777	13.596	8.843
12:48:00	13.411	206.286	13.598	8.785
12:49:00	13.464	208.775	13.601	8.908
12:50:00	13.473	209.607	13.428	9.079
12:51:00	13.131	198.036	13.377	8.896
12:52:00	13.443	206.535	13.615	8.900
12:53:00	13.401	204.101	13.525	8.824
12:54:00	13.388	202.939	13.521	8.747
Average	13.515	213.003	13.651	9.039

FIELD CALCULATIONS

RAW DATA TABLE

Instrument	ppm or %	Zero	Span	Gas	Gas Corrected for Calibration	
Inlet O ₂ (dry)	13.515	0.02	10.87	10.90	13.56	dry
Inlet CO (dry)	213.003	0.01	114.25	114.0	212.54	dry
Outlet O ₂ (dry)	13.651	0.03	10.92	10.90	13.63	dry
Outlet CO (dry)	9.039	0.11	12.82	12.8	8.99	dry

RESULTS

Inlet		Outlet	
O ₂ %, dry	13.56	O ₂ %, dry	13.63
CO @ 15% O ₂	170.78	CO @ 15% O ₂	7.30
CO ppm, dry	212.54	CO ppm, dry	8.99

Removal Efficiency 95.725

Start
Stop

1:10 PM
2:10 PM

Time	In O ₂ % d	In CO ppm, d	Out O ₂ % d	Out CO ppm, d
13:10:00	13.427	206.520	13.285	8.788
13:11:00	13.527	209.526	13.332	8.843
13:12:00	13.623	211.436	13.415	8.813
13:13:00	13.637	213.017	13.484	8.803
13:14:00	13.783	220.863	13.624	8.886
13:15:00	13.895	228.106	13.656	9.087
13:16:00	13.724	220.939	13.468	9.179
13:17:00	13.664	217.926	13.437	9.056
13:18:00	13.623	216.275	13.430	9.125
13:19:00	13.567	213.183	13.323	8.972
13:20:00	13.448	204.111	13.303	8.820
13:21:00	13.527	205.116	13.355	8.887
13:22:00	13.504	206.939	13.283	8.970
13:23:00	13.457	207.618	13.235	8.845
13:24:00	13.365	202.120	13.178	8.694
13:25:00	13.375	203.857	13.227	8.616
13:26:00	13.336	203.270	13.189	8.687
13:27:00	13.511	208.114	13.379	8.782
13:28:00	13.627	215.428	13.526	8.810
13:29:00	13.705	217.432	13.418	8.809
13:30:00	13.543	209.292	13.422	8.821
13:31:00	13.646	213.864	13.480	8.755
13:32:00	13.600	212.529	13.209	8.880
13:33:00	13.181	197.629	12.903	8.924
13:34:00	13.045	191.701	12.942	8.664
13:35:00	13.111	191.523	12.989	8.576
13:36:00	13.186	192.868	13.074	8.521
13:37:00	13.336	199.373	13.163	8.379
13:38:00	13.305	200.047	13.071	8.492
13:39:00	13.216	194.859	13.125	8.458
13:40:00	13.356	198.043	13.373	8.435
13:41:00	13.721	216.362	13.506	8.557
13:42:00	13.626	212.521	13.469	8.514
13:43:00	13.599	210.029	13.458	8.487
13:44:00	13.654	213.518	13.396	8.605
13:45:00	13.328	199.033	13.155	8.493
13:46:00	13.408	202.697	13.318	8.599
13:47:00	13.412	206.298	13.232	8.719
13:48:00	13.392	202.870	13.260	8.522
13:49:00	13.321	201.382	13.125	8.607
13:50:00	13.069	193.870	12.913	8.741
13:51:00	13.089	193.382	12.898	8.689
13:52:00	12.971	188.702	12.728	8.612
13:53:00	12.715	184.204	12.650	8.728
13:54:00	12.876	186.037	12.847	8.579
13:55:00	13.111	195.200	12.985	8.371
13:56:00	13.071	192.194	13.055	8.312
13:57:00	13.436	202.026	13.317	8.118
13:58:00	13.413	204.027	13.277	8.306
13:59:00	13.576	209.365	13.499	8.295
14:00:00	13.706	215.451	13.580	8.362
14:01:00	13.753	220.296	13.478	8.426
14:02:00	13.415	207.532	13.041	8.437
14:03:00	13.098	193.117	13.014	8.399
14:04:00	13.247	195.780	13.209	8.319
14:05:00	13.429	203.951	13.223	8.365
14:06:00	13.336	201.690	13.111	8.388
14:07:00	13.247	198.204	13.154	8.355
14:08:00	13.307	199.452	13.179	8.313
14:09:00	13.367	200.700	13.204	8.271
Average	13.409	204.724	13.243	8.631

FIELD CALCULATIONS

RAW DATA TABLE

Instrument	ppm or %	Zero	Span	Gas	Gas Corrected for Calibration
Inlet O ₂ (dry)	13.409	0.03	10.87	10.90	13.45 dry
Inlet CO (dry)	204.724	0.25	114.57	114.0	203.90 dry
Outlet O ₂ (dry)	13.243	0.03	10.90	10.90	13.25 dry
Outlet CO (dry)	8.631	0.06	12.73	12.8	8.66 dry

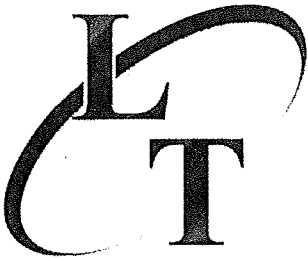
RESULTS

Inlet	Outlet
O ₂ %, dry	O ₂ %, dry
CO @ 15% O ₂	CO @ 15% O ₂
CO ppm, dry	CO ppm, dry

Removal Efficiency 95.865

APPENDIX D

CALIBRATION GAS CERTIFICATION SHEETS



LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis - EPA PROTOCOL GAS -

Customer Minneapolis Oxygen (Minneapolis, MN)
Date October 31, 2012
Delivery Receipt DR-44666
Gas Standard 17.0% CO₂, 21.0% Oxygen/Nitrogen - EPA PROTOCOL
Final Analysis Date October 23, 2012
Expiration Date October 23, 2015

DO NOT USE BELOW 150 psig

Cylinder Data
Cylinder Serial Number: CC-166415 Cylinder Outlet: CGA 590
Cylinder Volume: 135 Cubic Feet Cylinder Pressure: 1925 psig, 70°F
Expiration Date: October 23, 2015


Analytical Data
EPA Protocol, Section No. 2.2, Procedure G-1

Replicate Concentrations
Carbon Dioxide: 16.7% +/- 0.09%
Oxygen: 20.9% +/- 0.09%
Nitrogen: Balance

Reference Standard(s):
GMIS/SRM: GMIS/GMIS GMIS
Cylinder Number: CC-252091/CC-184404 CC-159090
Concentration: 15.816% CO₂/19.87% CO₂ 20.68% Oxygen
Expiration Date: 02/04/13 - 02/04/14 04/06/14

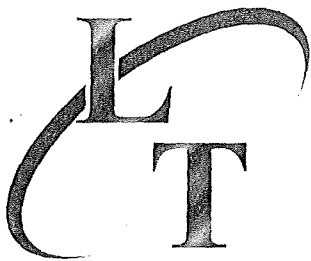
Certification Instrumentation
Component: Carbon Dioxide Oxygen
Make/Model: Horiba -VIA 510 Servomex 244a
Serial Number: SN075GSF 1847
Principal of Measurement: NDIR Paramagnetic
Last Calibration: October 24, 2012 October 26, 2012

Analytical uncertainty and NIST Traceability are in compliance with EPA-600/R-97/121.

Certified by: 
David Scott

PGVP Vendor ID: E12012

"UNMATCHED EXCELLENCE"



LIQUID TECHNOLOGY CORPORATION
 "INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis
- EPA PROTOCOL GAS -

Customer Minneapolis Oxygen (Minneapolis, MN)
Date February 28, 2013
Delivery Receipt DR-45914
Gas Standard 8.50% CO2, 11.0% Oxygen/Nitrogen - EPA PROTOCOL
Part Number: SPC NAE 03075
Final Analysis Date February 25, 2013
Expiration Date February 25, 2021

DO NOT USE BELOW 100 psig

Cylinder Data
 Cylinder Serial Number: EB-0042731 Cylinder Outlet: CGA 590
 Cylinder Volume: 136 Cubic Feet Cylinder Pressure: 1950 psig, 70°F
 Expiration Date: February 25, 2021

Analytical Data
 EPA Protocol, Section No. 2.2, Procedure G-1

Replicate Concentrations
Carbon Dioxide: 8.07% +/- 0.07%
Oxygen: 10.9% +/- 0.08%
Nitrogen: Balance

Reference Standard(s):
 GMIS/SRM: GMIS/GMIS GMIS
 Cylinder Number: EB-0026839/CC-185129 CC-231332
 Concentration: 6.847% CO2/13.92% CO2 9.97% Oxygen
 Expiration Date: 10/13/20 - 06/24/14 04/06/14

Certification Instrumentation

Component:	Carbon Dioxide	Oxygen
Make/Model:	Horiba -VIA 510	Servomex 244a
Serial Number:	SN075GSF	1847
Principal of Measurement:	NDIR	Paramagnetic
Last Calibration:	February 13, 2013	February 06, 2013

Analytical uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by: 
 David Scott

PGVP Vendor ID: E12013

"UNMATCHED EXCELLENCE"

THE LINDE GROUP



CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

PGVP ID#: I12012
 CUSTOMER: HAMMOND
 SALES#: 501103829
 PROD#: 1218574
 P.O.# : 4501103829
 MATERIAL#: 24086350
 CERTIFICATION DATE: 11-Jun-2012
 EXPIRATION DATE: 11-Jun-2014

GAS CODE: SNC
CYLINDER # : CC-278914
CYLINDER PRES: 2000 PSIG
CYLINDER VALVE: CGA 660
CYLINDER SIZE: 2A
CYLINDER MATERIAL: Aluminum
GAS VOLUME: 4000 Liter
BLEND TOLERANCE: 5% Relative
PAGE: 1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Carbon Monoxide	31-May-2012	244.3 ppm	245 ppm	+/- 1%
	11-Jun-2012	244.7 ppm		
Nitric Oxide	04-Jun-2012	251.7 ppm	251 ppm	+/- 1%
	11-Jun-2012	251.1 ppm		
NOx			251 ppm	Reference Value Only
Sulfur Dioxide	04-Jun-2012	252.1 ppm	252 ppm	+/- 1%
	11-Jun-2012	252.4 ppm		

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None


REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Carbon Monoxide	GMIS-1	cc-279053	500 ppm
Nitric Oxide	GMIS-1	CC-143752	254 ppm
Sulfur Dioxide	GMIS-1	CC-118364	355 ppm

INSTRUMENTATION

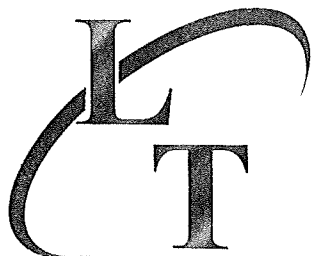
COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	01-Jun-2012
Nitric Oxide	CAI 400-CLD	6L09004	Cheml	24-May-2012
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	04-Jun-2012

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE EPA PROTOCOL PROCEDURES. DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 150 PSIG.

ANALYST: 
JUSTIN KUTZ

Linde Gas North America LLC

DATE: 11-Jun-2012



LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

<u>Customer</u>	<u>Minneapolis Oxygen (Minneapolis, MN)</u>
<u>Date</u>	<u>December 10, 2012</u>
<u>Delivery Receipt</u>	<u>DR-45097</u>
<u>Gas Standard</u>	<u>112.5 ppm CO, 112.5 ppm NO, 112.5 ppm SO2/Nitrogen - EPA PROTOCOL</u>
<u>Final Analysis Date</u>	<u>December 05, 2012</u>
<u>Expiration Date</u>	<u>December 05, 2020</u>

DO NOT USE BELOW 150 psig

Analytical Data:

EPA Protocol, Section No. 2.2, Procedure G-1.

Reported Concentrations

Carbon Monoxide: 114 ppm +/- 1.1 ppm

Nitric Oxide: 110 ppm +/- 0.40 ppm

Sulfur Dioxide: 114 ppm +/- 1.0 ppm

Nitrogen: Balance

Total NOx: 110 ppm

**** NOx for Reference Use Only ****

Reference Standards

SRM/GMIS:	GMIS	GMIS/GMIS	GMIS/GMIS
Cylinder Number:	EB-0015851	ND-45693/ND-45515	EB-0014653/CC-251490
Concentration:	104.90 ppm CO	97.434 ppm/245.26 ppm NO	103.89 ppm SO2/507.877 ppm SO2
Expiration Date:	10/21/13	08/23/15 - 10/22/14	12/01/14 - 04/12/13

Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	NEXUS 6700	NEXUS 6700	NEXUS 6700
Serial Number:	AEP99000154	AEP99000154	AEP99000154
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	November 15, 2012	November 15, 2012	November 15, 2012

Cylinder Data

Cylinder Number:	EB-0027123	Cylinder Volume:	138 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1975 psig, 70°F
Expiration Date:	December 05, 2020		

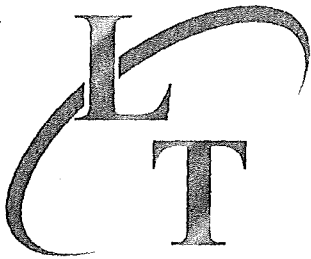
Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by:

David Scott

PGVP Vendor ID: E12012

"UNMATCHED EXCELLENCE"



LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis - EPA PROTOCOL GAS -

Customer Minneapolis Oxygen (Minneapolis, MN)
Date March 07, 2013
Delivery Receipt DR-46138
Gas Standard 50.0 ppm CO, 50.0 ppm NO, 50.0 ppm SO2/Nitrogen - EPA PROTOCOL
Final Analysis Date March 05, 2013
Expiration Date March 05, 2016
Part Number: SPC NAE04019

DO NOT USE BELOW 100 psig

Analytical Data:
 EPA Protocol, Section No. 2.2, Procedure G-1.

Reported Concentrations
Carbon Monoxide: 51.5 ppm +/- 0.30 ppm
Nitric Oxide: 49.4 ppm +/- 0.27 ppm
Sulfur Dioxide: 51.2 ppm +/- 0.51 ppm
Nitrogen: Balance
Total NOx: 49.7 ppm
 ** NOx for Reference Use Only **

Reference Standards

SRM/GMIS:	GMIS	GMIS ^d	GMIS
Cylinder Number:	CC-128982	CC-88803	EB-0014698
Concentration:	50.89 ppm CO	49.52 ppm NO	50.67 ppm SO2
Expiration Date:	10/20/14	07/18/13	09/20/14

Certification Instrumentation

Component:	Carbon Monoxide	Nitric Oxide	Sulfur Dioxide
Make/Model:	Nicolet 6700	Nicolet 6700	Nicolet 6700
Serial Number:	APW1200289	APW1200289	APW1200289
Principal of Measurement:	FTIR	FTIR	FTIR
Last Calibration:	February 27, 2013	February 27, 2013	February 27, 2013

Cylinder Data

Cylinder Number:	EB-0040947	Cylinder Volume:	133 Cubic Feet
Cylinder Outlet:	CGA 660	Cylinder Pressure:	1900 psig, 70°F
Expiration Date:	March 06, 2016		

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-12/531.

Certified by: 
 David Scott

PGVP Vendor ID: E12013

"UNMATCHED EXCELLENCE"

2048 APEX COURT APOPKA, FLORIDA 32703 ~ PHONE (407)-292-2990 FAX (407)-292-3313
 WWW.LIQUIDTECHCORP.COM
 APOPKA, FL • HOUSTON, TX

THE LINDE GROUP



CERTIFICATE OF ANALYSIS

EPA PROTOCOL MIXTURE

PROCEDURE # : G1

PGVP ID#: I12012
 CUSTOMER: HAMMOND
 SALES#: 501144474
 PROD#: 1232322
 P.O.# : 4501144474
 MATERIAL#: 24089260
 CERTIFICATION DATE: 10-Oct-2012
 EXPIRATION DATE: 11-Oct-2016
 (Using the May 2012 Revision of the EPA Protocol)

GAS CODE: SNC
CYLINDER # : CC-18097
CYLINDER PRES: 2000 PSIG
CYLINDER VALVE: CGA 660
CYLINDER SIZE: 2A
CYLINDER MATERIAL: Aluminum
GAS VOLUME: 4000 Liter
BLEND TOLERANCE: 5% Relative
PAGE: 1 of 1

CERTIFICATION HISTORY

COMPONENT	DATE OF ASSAY	MEAN CONCENTRATION	CERTIFIED CONCENTRATION	ANALYTICAL ACCURACY
Nitric Oxide	01-Oct-2012	25.2 ppm	25.2 ppm	+/- 1%
	10-Oct-2012	25.19 ppm		
NOx			25.2 ppm	Reference Value Only
Carbon Monoxide	03-Oct-2012	25.06 ppm	25.1 ppm	+/- 1%
Sulfur Dioxide	01-Oct-2012	25.16 ppm	25.2 ppm	+/- 1%
	10-Oct-2012	25.3 ppm		

BALANCE Nitrogen

PREVIOUS CERTIFICATION DATES: None

REFERENCE STANDARDS

COMPONENT	SRM/NTRM#	CYLINDER#	CONCENTRATION
Nitric Oxide	NTRM-81684	CC-349580	95.2 ppm
Carbon Monoxide	GMIS-1	CC-88590	96.8 ppm
Sulfur Dioxide	GMIS-1	CC-65793	101 ppm

INSTRUMENTATION

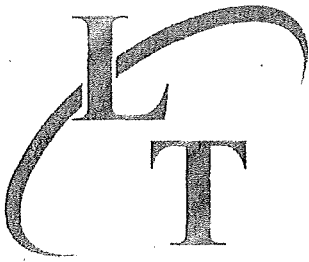
COMPONENT	MAKE/MODEL	SERIAL #	DETECTOR	CALIBRATION DATE(S)
Nitric Oxide	CAI 440-CLD	6L09004	Cheml	08-Oct-2012
Carbon Monoxide	Horiba VIA-510	570423011	NDIR	07-Sep-2012
Sulfur Dioxide	Horiba VIA-510	851221093	NDIR	05-Oct-2012

THIS STANDARD IS NIST TRACEABLE. IT WAS CERTIFIED ACCORDING TO THE 1997 EPA PROTOCOL PROCEDURES. DO NOT USE THIS STANDARD IF THE CYLINDER PRESSURE IS LESS THAN 100 PSIG.

ANALYST: Justin Kutz
JUSTIN KUTZ

Linde Gas North America LLC

DATE: 10-Oct-2012



LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis

- EPA PROTOCOL GAS -

Customer Minneapolis Oxygen (Minneapolis, MN)
Date July 09, 2012
Delivery Receipt DR-43024
Gas Standard 12.5 ppm Carbon Monoxide/Nitrogen - EPA PROTOCOL
Final Analysis Date July 06, 2012
Expiration Date July 06, 2015

Component Carbon Monoxide
Balance Gas Nitrogen

Analytical Data: **DO NOT USE BELOW 150 psig**
EPA Protocol, Section No. 2.2, Procedure G-1

Replicate Concentrations

Carbon Monoxide: 12.8 ppm +/- 0.12 ppm

Nitrogen: Balance

Reference Standards:

SRM/GMIS: GMIS
Cylinder Number: CC-115999
Concentration: 10.268 ppm CO/Nitrogen
Expiration Date: 03/07/14

Certification Instrumentation

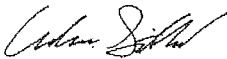
Component: Carbon Monoxide
Make/Model: Horiba - VIA 510
Serial Number: UUBKWXYZV
Principal of Measurement: NDIR
Last Calibration: June 28, 2012

Cylinder Data

Cylinder Serial Number: CC-125542 Cylinder Outlet: CGA 350
Cylinder Volume: 135 Cubic Feet Cylinder Pressure: 1925 psig, 70°F

Analytical Uncertainty and NIST Traceability are in compliance with EPA-600/R-97/121.

Certified by:


Adam Strickland

PGVP Vendor ID: E12012

"UNMATCHED EXCELLENCE"

APPENDIX E

CALCULATION EQUATIONS

Sample Calculations
Run 1

Correction of Pollutant to Specified % Oxygen		
Calculator		Equation
Correct to X% Oxygen (X)=	15	
Oxygen in effluent Gas Stream (%)=	13.631	ppm@x% O ₂ =ppm *((20.9-x)/(20.9-measured O ₂))
Pollutant Concentration (ppm)=	11.931	
ppm @ 15 % O ₂	9.684	

APPENDIX F

PROCEDURES

Please Note: In an effort to conserve paper, the procedure section of the appendix has been reserved for explanations of EPA methodology deviations. Please refer to the specific EPA Methods on the following EPA website:

<http://www.epa.gov/ttn/emc/>

APPENDIX G
OPERATING DATA

Run 1

Start Time
 Stop Time

10:40 AM
 11:40 AM

<u>Time</u>	Side 1		Side 2	
	Temp (°F)	Pressure (in H2O)	Temp (°F)	Pressure (in H2O)
10:40 AM	647	1.50	650	1.50
10:55 AM	651	1.50	658	1.50
11:10 AM	634	1.40	638	1.50
11:25 AM	641	1.50	647	1.50
11:40 AM	637	1.40	643	1.50
Average	642	1.460	647	1.500

Run 2

Start Time
 Stop Time

11:50 AM
 12:50 PM

<u>Time</u>	Side 1		Side 2	
	Temp (°F)	Pressure (in H2O)	Temp (°F)	Pressure (in H2O)
11:50 AM	633	1.40	637	1.50
12:05 PM	627	1.20	631	1.40
12:20 PM	630	1.30	635	1.50
12:35 PM	633	1.30	639	1.50
12:50 PM	629	1.20	635	1.60
Average	630	1.280	635	1.500

Run 3

Start Time
 Stop Time

1:00 PM
 2:00 PM

<u>Time</u>	Side 1		Side 2	
	Temp (°F)	Pressure (in H2O)	Temp (°F)	Pressure (in H2O)
1:00 PM	632	1.20	634	1.50
1:15 PM	632	1.30	634	1.60
1:30 PM	643	1.20	646	1.60
1:45 PM	651	1.20	654	1.60
2:00 PM	645	1.20	650	1.50
Average	641	1.220	644	1.560