

## REM TECHNOLOGY SLIPSTREAM GTS-12

### MANUFACTURER'S CERTIFICATION PERFORMANCE TEST

*Manufacturer's performance test for an enclosed combustion device according to 40 CFR Part 60, Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution, Section 60.5413(d).*



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## 1 Introduction

The following is a report on the performance of an enclosed combustion device SlipStream GTS-12 manufactured by REM Technology Inc., a Division of Spartan Controls. The report provides the test data as specified in 40 CFR 60.5413(d).

## 2 Report Summary

### 2.1 Contacts

#### 2.1.1 Equipment Manufacturer and Contacts

REM Technology Inc.  
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Canada

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Howard Malm, Chief Technical Officer  
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#### 2.1.2 Report Review

Trinity Consultants  
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Wexford, Pennsylvania 15090  
Office: 724-935-2611 x2 | Mobile: 412-779-2272

#### 2.1.3 Testing Companies

AGAT Laboratories  
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Calgary, Alberta

Contact Person  
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403.250.2793  
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Maxxam Analytical  
Environmental Services  
2021 – 41 Avenue NE,  
Calgary, Alberta T2E 6P2

Contact Person  
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Director, Air Services  
403 219 3652  
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#### **2.1.4 Analytical Laboratory**

ORTECH Environmental  
804 Southdown Road  
Mississauga, ON L5J 2Y4  
Canada

Contact Person  
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905-822-4120 Ext 399  
Fax: 905-855-0406  
[eshereshevsky@ortech.ca](mailto:eshereshevsky@ortech.ca)

### **2.2 Model Name and Number**

The model tested was a SlipStream GTS-12

### **2.3 Maximum and Minimum Ratings for the SlipStream GTS-12**

Ratings with Propylene test gas

Minimum Flow = 12 lb/h, 115 scfh

Minimum gross heat output = 0.26 MM BTU/h

Maximum Flow = 17 lb/h, 164 scfh

Maximum gross heat output = 0.38 MMBTU/h

### 2.3.1 Date and Location of the Test

The test was performed at Calgary, Alberta, Canada on Dec 10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup>, 2014. For the purposes of this report the results are reported as **Runs**. Correlation between the Run number and the field data is shown in the table below.

Firing Rate – Between max and min flows	Run Number	REM Test No.	AGAT Test No.	Test Date [YYYY-MM-DD]	Test Start Time	Test End Time
0% to 30%	1A	9	7	2014-12-10	15:00	16:10
0% to 30%	1B	13	11	2014-12-11	8:30	9:36
0% to 30%	1C	14	12	2014-12-11	10:05	11:10
30% to 70%	2A	6	4	2014-12-11	11:35	12:41
30% to 70%	2B	7	5	2014-12-11	13:05	14:10
30% to 70%	2C	8	6	2014-12-11	14:40	15:46
70% to 100%	3A	3	1	2014-12-11	16:10	17:16
70% to 100%	3B	4	2	2014-12-12	8:25	9:31
70% to 100%	3C	5	3	2014-12-12	9:55	11:01
90% to 100%	4A	10	8	2014-12-12	11:30	12:36
90% to 100%	4B	11	9	2014-12-12	13:00	14:05
90% to 100%	4C	12	10	2014-12-12	14:30	15:35

### 2.3.2 VOC Destruction Efficiency for each of 4 Test Conditions

Table 1 - VOC Destruction Efficiency

Test Condition – Percent of Rated Firing Rate	VOC Destruction Efficiency	VOC Destruction > 95%
0% to 30%	99.9994%	Yes
30% to 70%	99.9992%	Yes
70% to 100%	99.9991%	Yes
90% to 100%	99.9998%	Yes



### 2.3.3 Tabulated Results for the 12 Tests

#### 0 to 30% Flow

Test ID - REM	9	13	14	Average	Pass
Run Number	1A	1B	1C		
Visual Observation	No Smoke	No Smoke	No Smoke		Yes
CO ppmvd normalized to 3% CO <sub>2</sub>	4.79	4.78	4.90	4.83	Yes
THC ppmvw normalized to 3% CO <sub>2</sub>	0.148	0.134	0.109	0.131	Yes
Excess Air %	224%	219%	216%	220%	Yes

#### 30 to 70% Flow

Test ID – REM	3	4	5	Average	Pass
Run Number	2A	2B	2C		
Visual Observation	No Smoke	No Smoke	No Smoke		Yes
CO ppmvd normalized to 3% CO <sub>2</sub>	3.82	3.37	3.46	3.55	Yes
THC ppmvw normalized to 3% CO <sub>2</sub>	0.239	0.217	0.132	0.196	Yes
Excess Air %	195%	186%	191%	190%	Yes

#### 70 to 100% Flow

Test ID – REM	3	4	5	Average	Pass
Run Number	3A	3B	3C		
Visual Observation	No Smoke	No Smoke	No Smoke		Yes
CO ppmvd normalized to 3% CO <sub>2</sub>	2.16	2.72	2.72	2.53	Yes
THC ppmvw normalized to 3% CO <sub>2</sub>	0.248	0.212	0.204	0.222	Yes
Excess Air %	167%	164%	165%	166%	Yes

#### 90 to 100% Flow

Test ID – REM	10	11	12	Average	Pass
Run Number	4A	4B	4C		
Visual Observation	No Smoke	No Smoke	No Smoke		Yes
CO ppmvd normalized to 3% CO <sub>2</sub>	2.02	1.66	1.95	1.87	Yes
THC ppmvw normalized to 3% CO <sub>2</sub>	0.064	0.011	0.091	0.055	Yes
Excess Air %	163%	163%	163%	163%	Yes

Table 2 - Tabulated Results for Visual, CO & THC ppm, Excess Air%

### 2.3.4 Charts for CO and THC Emissions Normalized to 3% CO<sub>2</sub>

Note: The first part of the exhaust sampling was performed during the initial 30 minutes of elapsed time, followed by a period of 5 to 8 minutes during which the sampling locations were changes to locations oriented at 90 degrees to the initial sampling positions. During the transition period the fuel flow was held steady. The second part of the sampling occurred during the next 30 minute period.

(a) 0 to 30% of Rated Fuel Flow

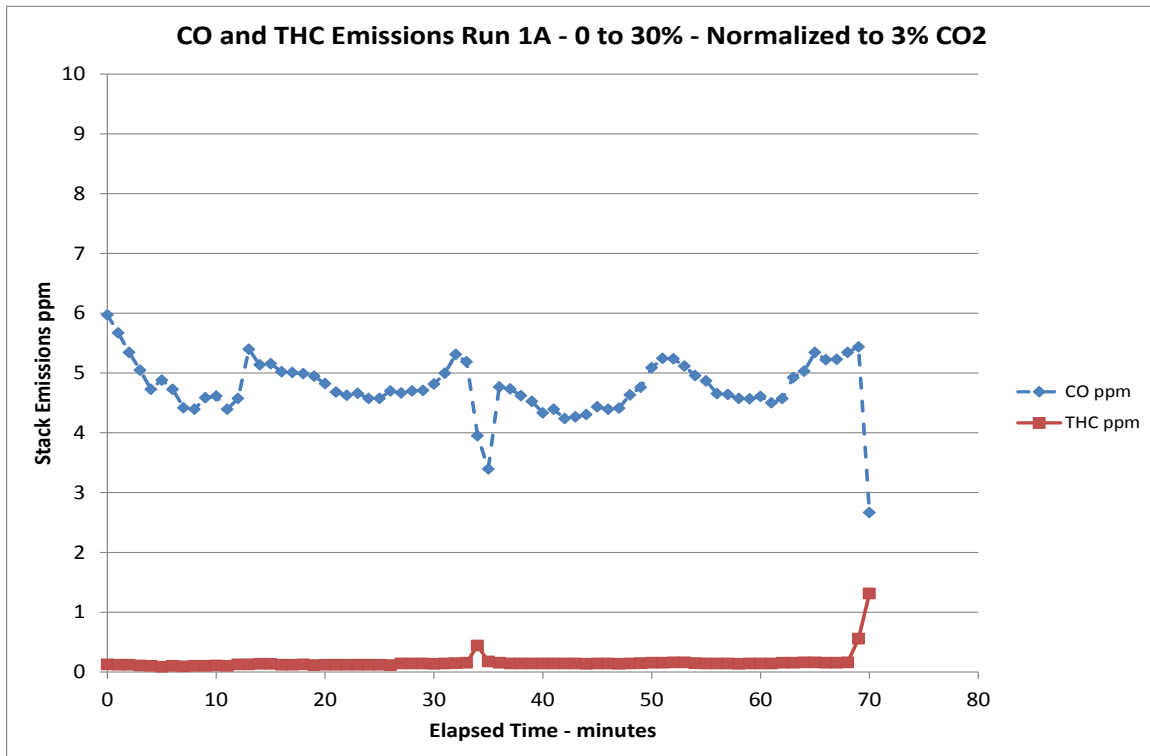


Figure 1 - Run 1A - CO and THC Emissions - 0 to 30% Normalized to 3% CO<sub>2</sub>

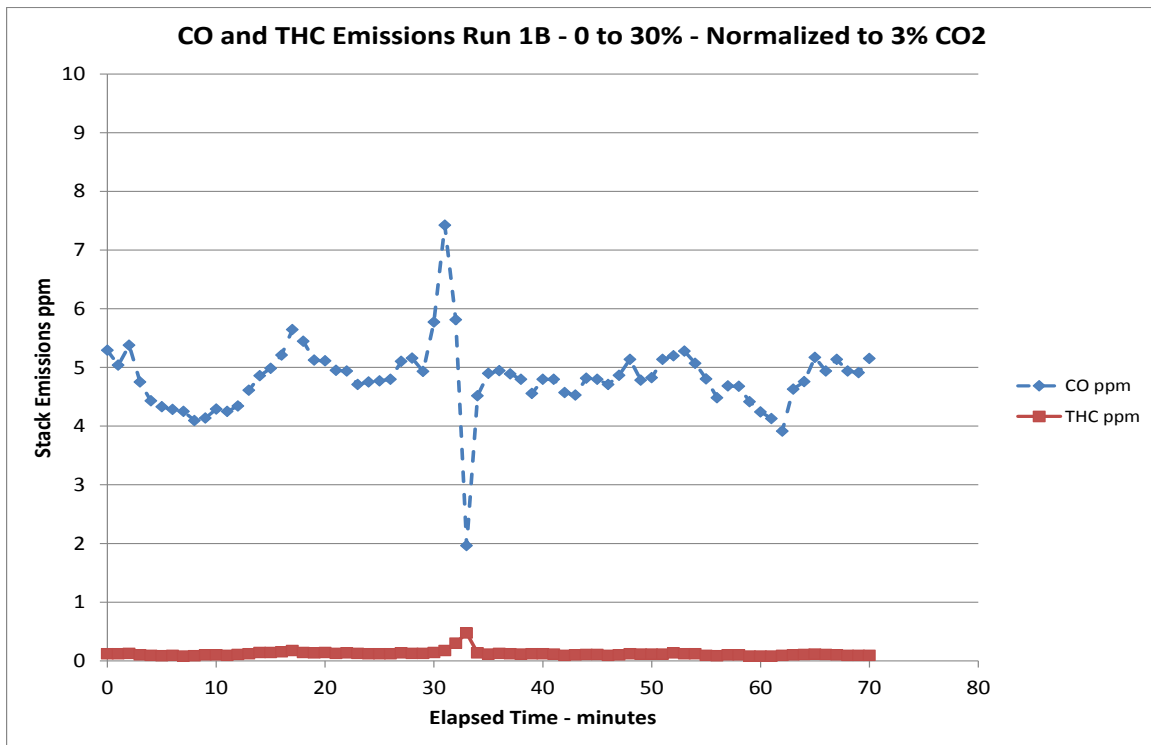


Figure 2- Run 1B - CO and THC Emissions - 0 to 30% Normalized to 3% CO<sub>2</sub>

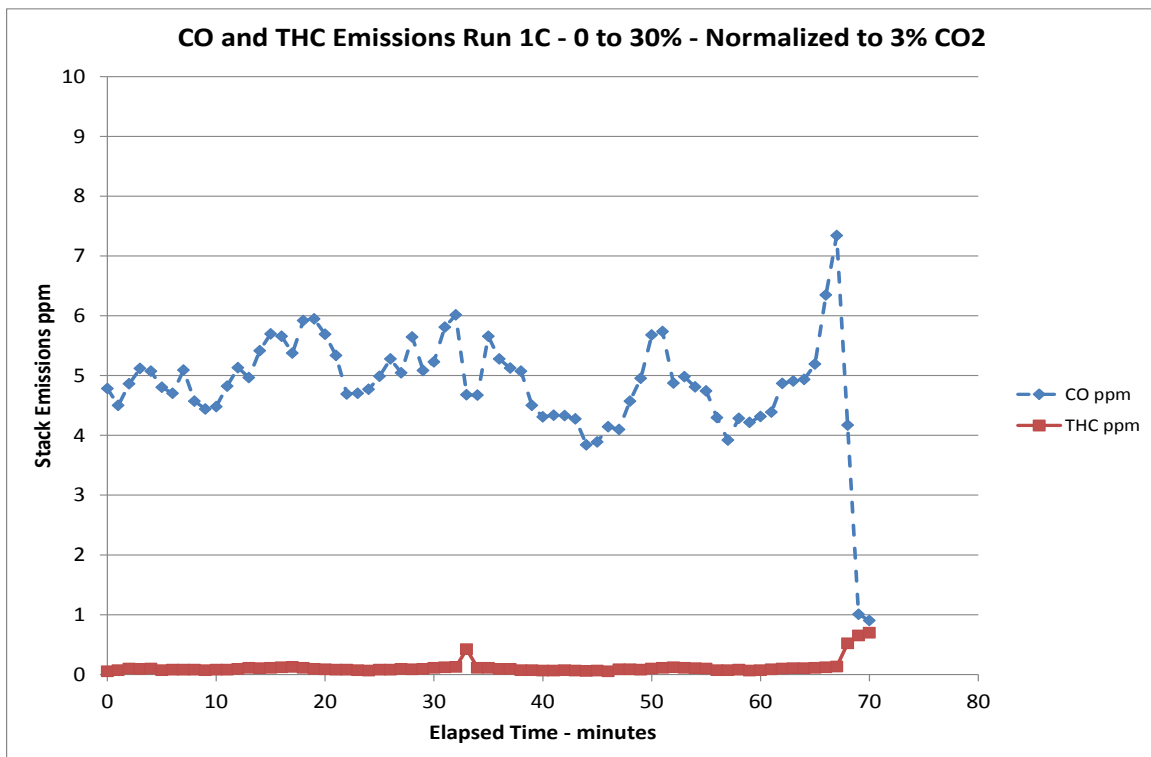
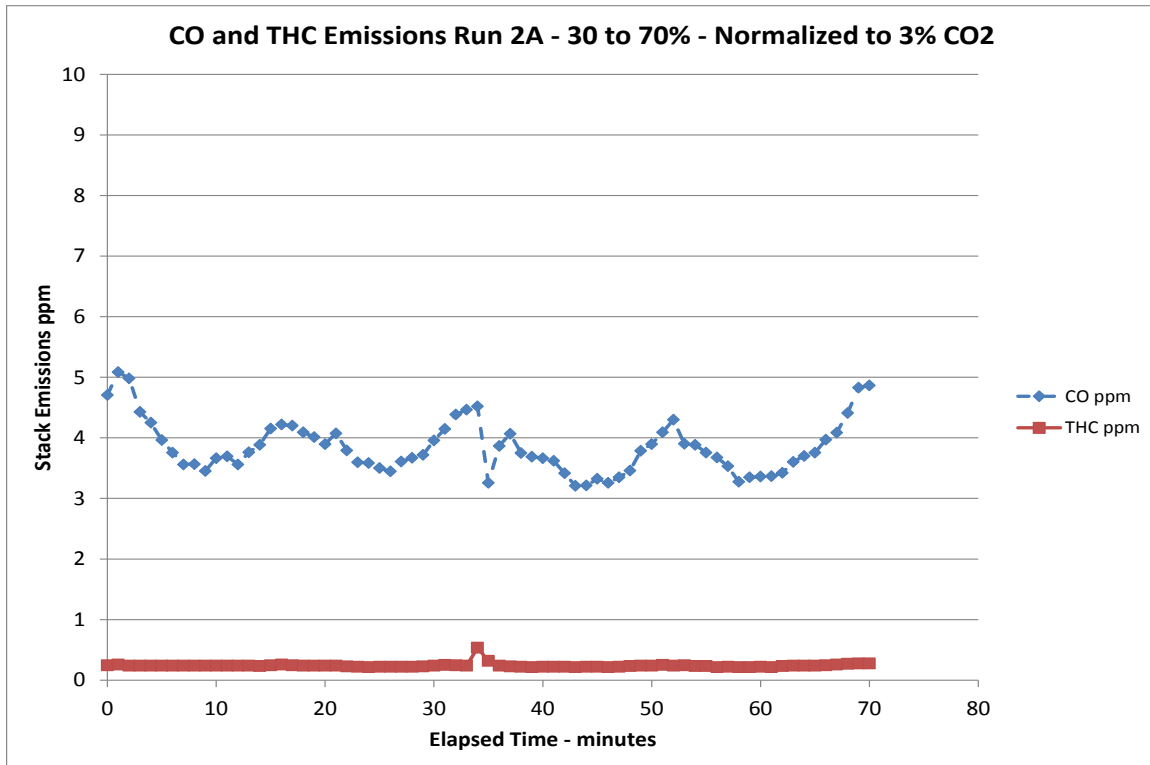
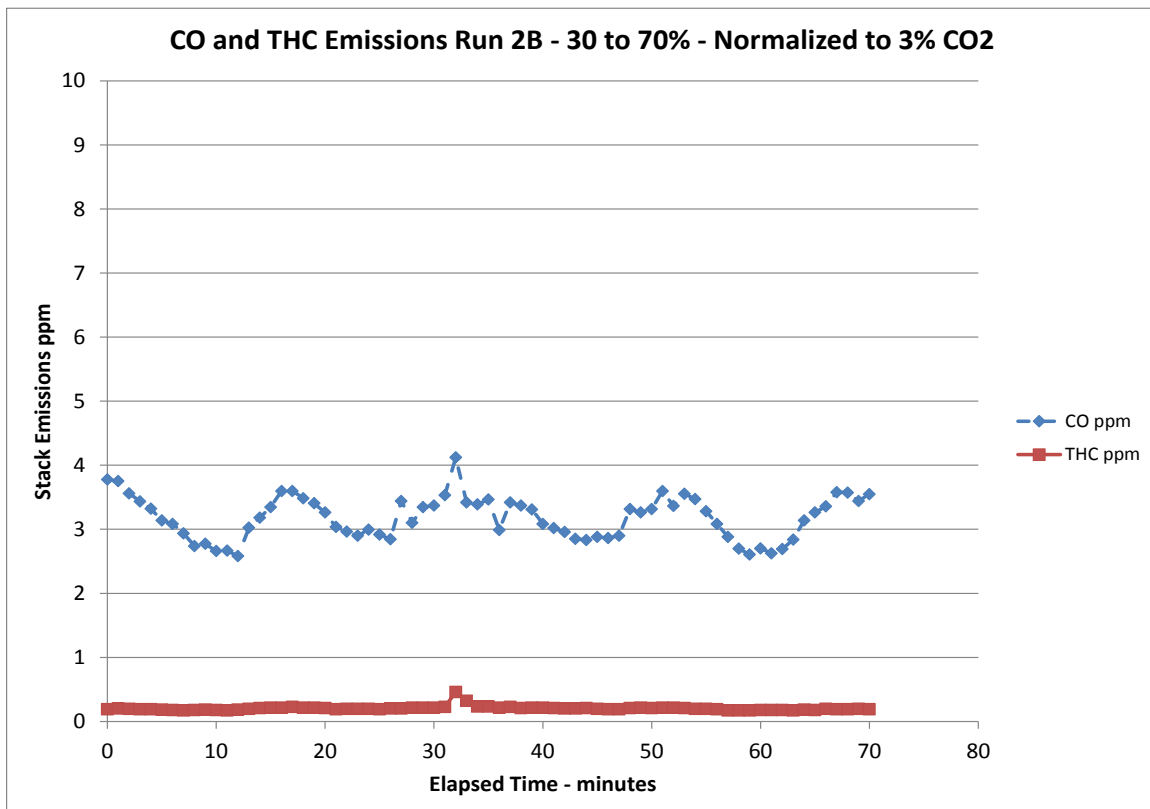


Figure 3 - Run 1C - CO and THC Emissions - 0 to 30% Normalized to 3% CO<sub>2</sub>

(b) 30% to 70% of Rated Fuel Flow

Figure 4 - Run 2A - CO and THC Emissions - 30 to 70% Normalized to 3% CO<sub>2</sub>Figure 5 - Run 2B - CO and THC Emissions - 30 to 70% Normalized to 3% CO<sub>2</sub>



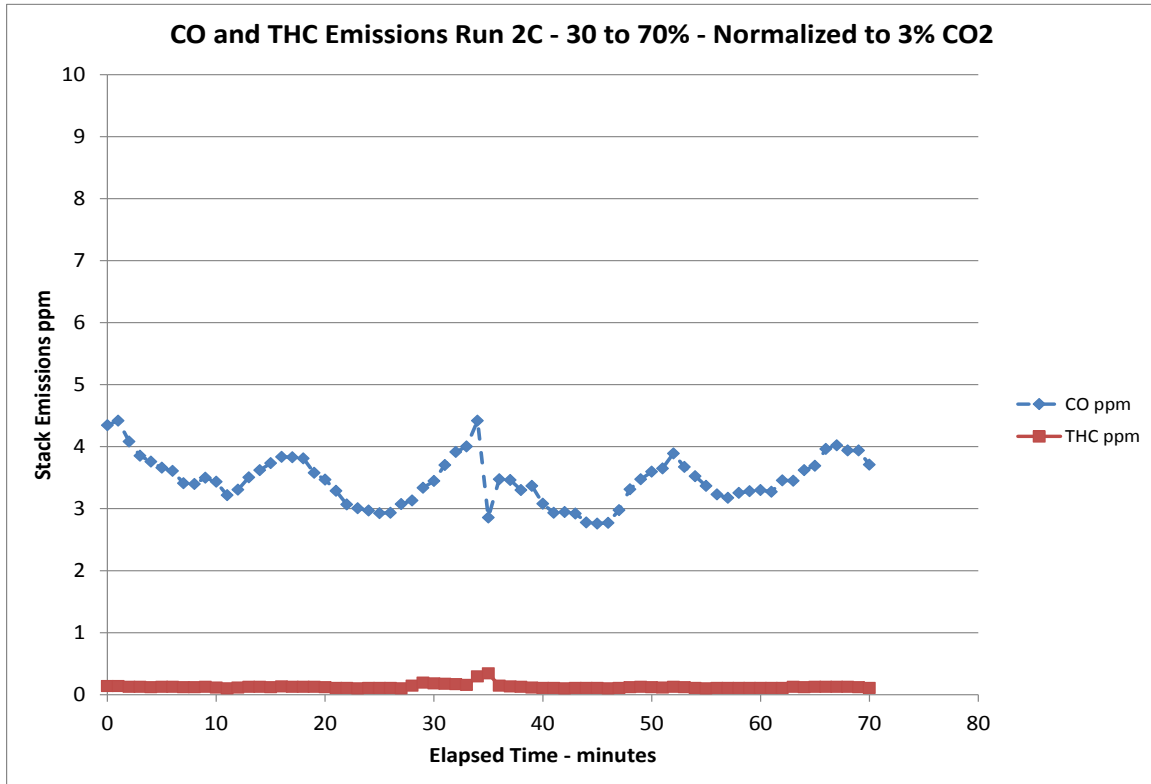
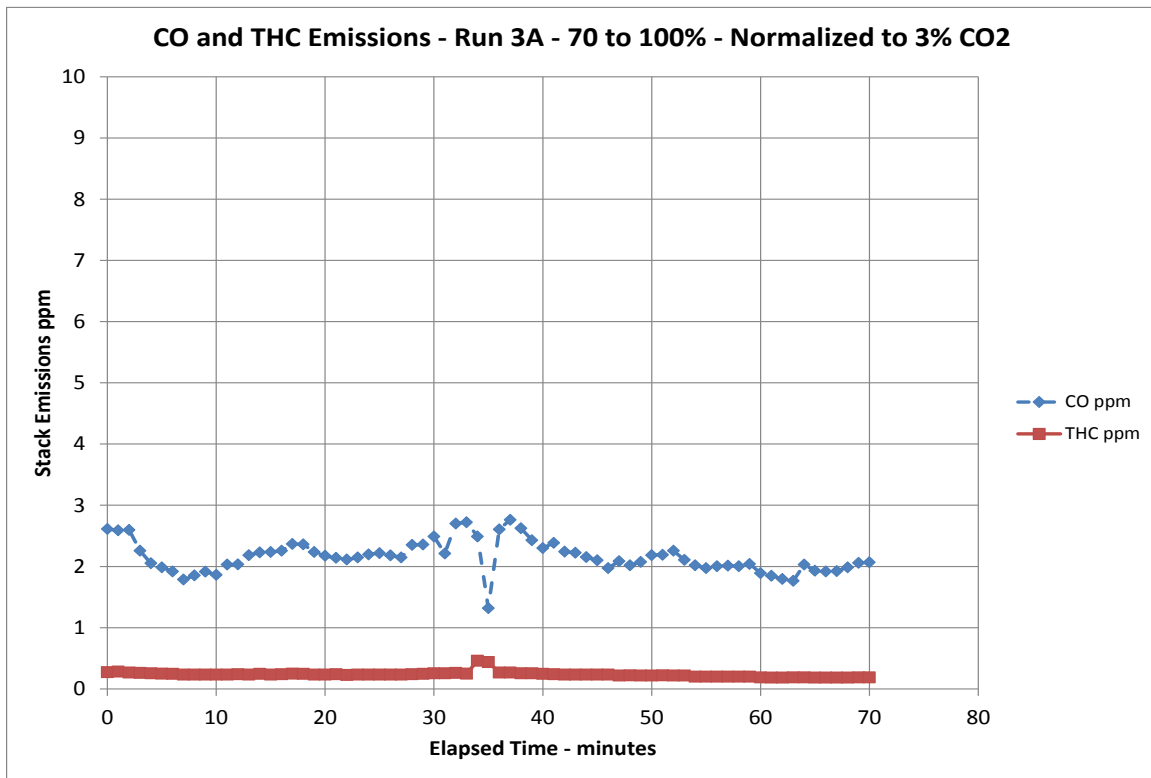
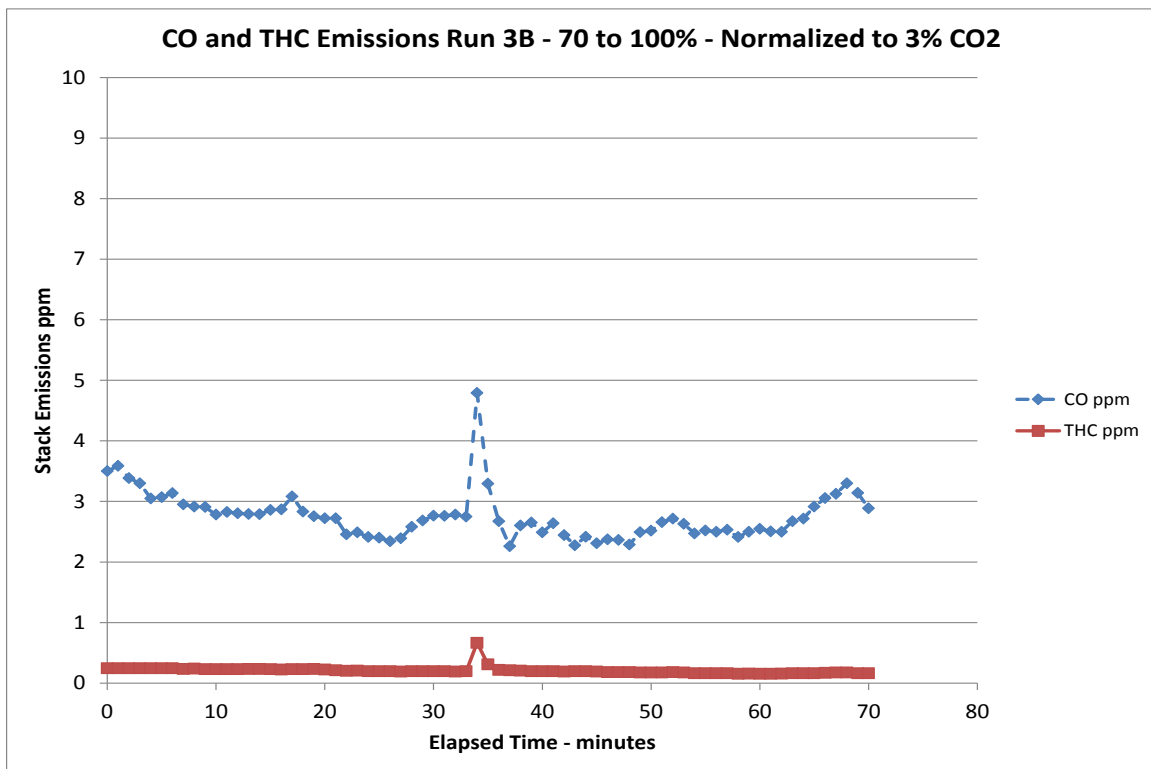


Figure 6 - Run 2C - CO and THC Emissions - 30 to 70% Normalized to 3% CO<sub>2</sub>

(c) 70 to 100% of Rated Flow

Figure 7 - Run 3A - CO and THC Emissions - 70 to 100% Normalized to 3% CO<sub>2</sub>Figure 8 - Run 3B - CO and THC Emissions - 70 to 100% Normalized to 3% CO<sub>2</sub>

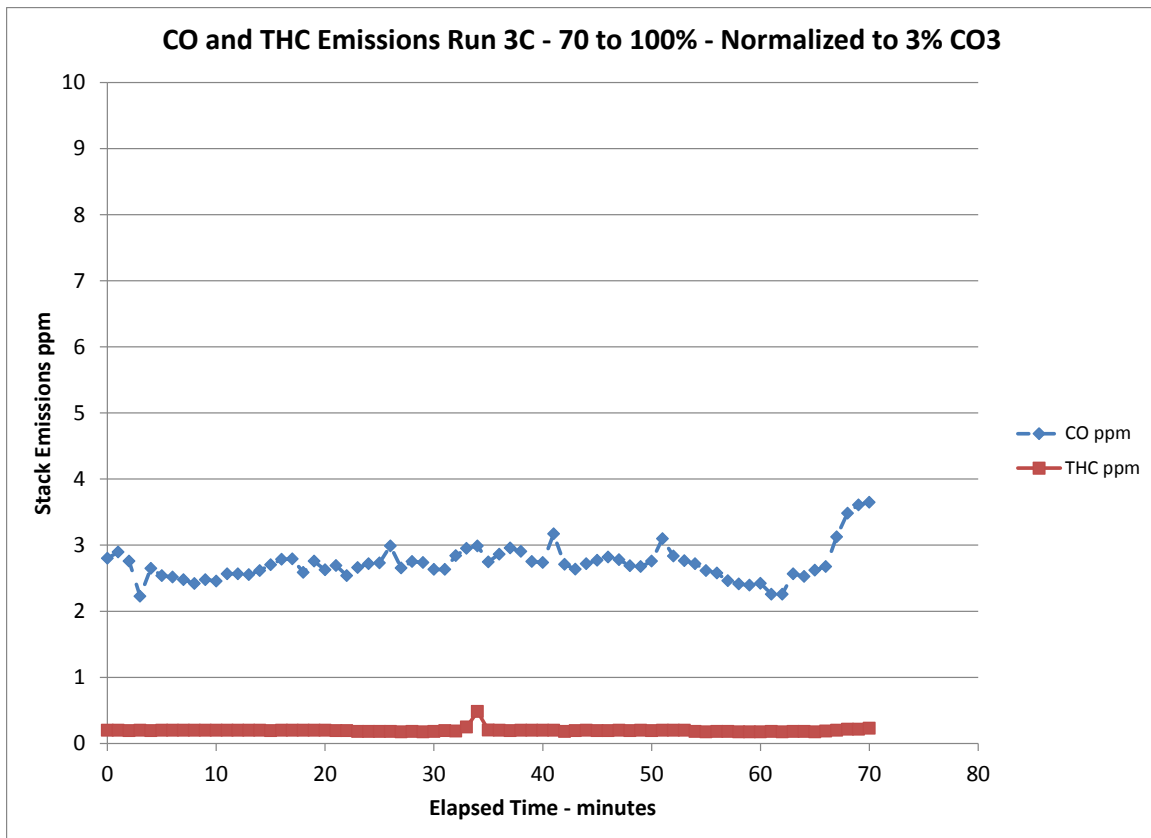
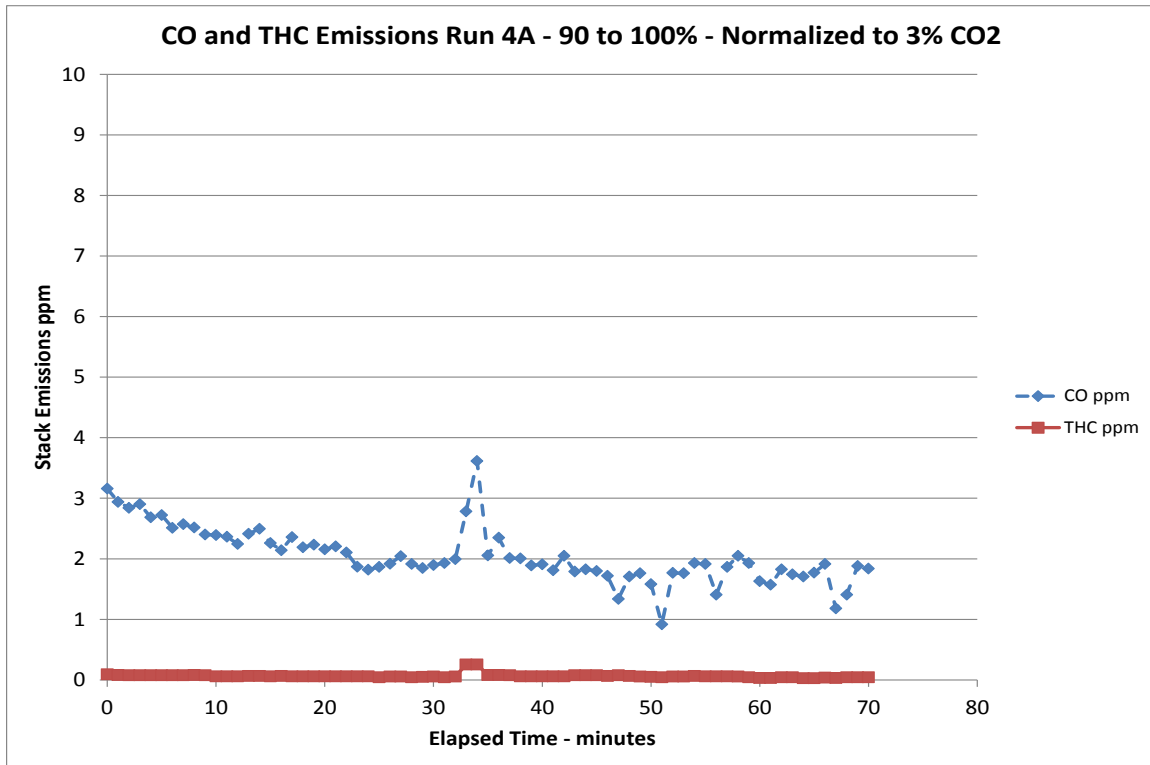
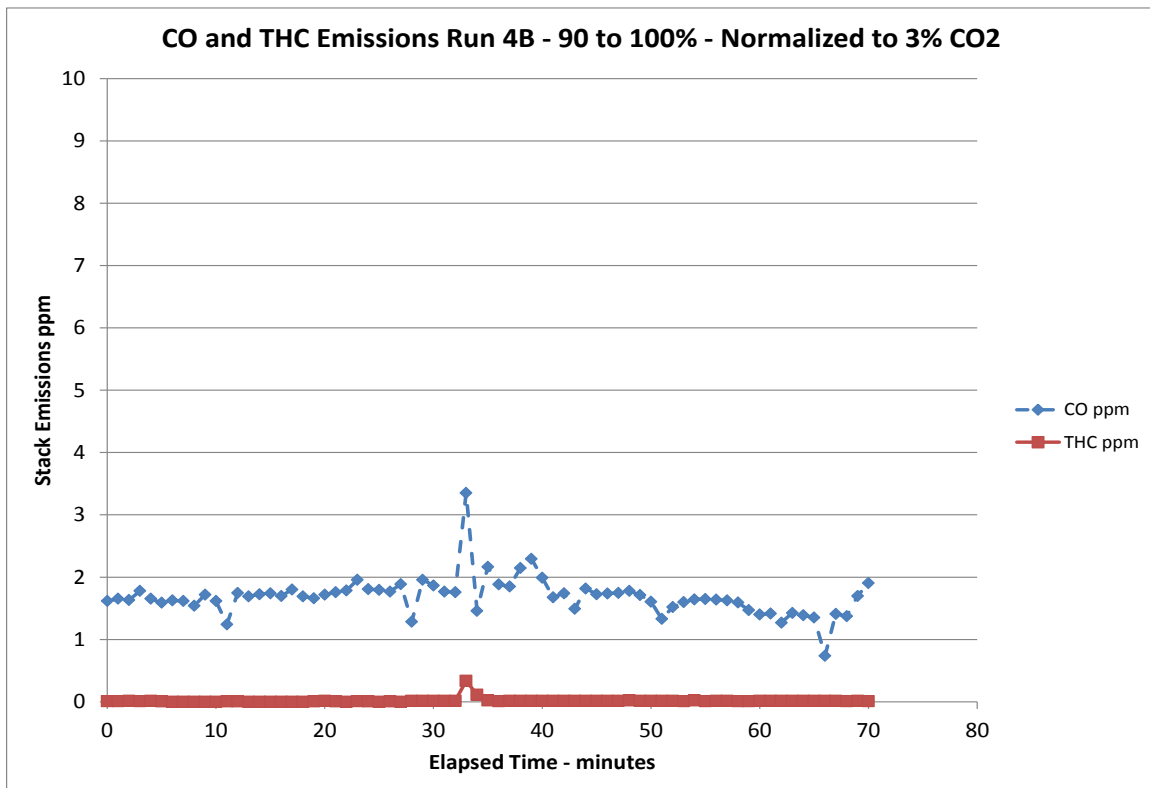
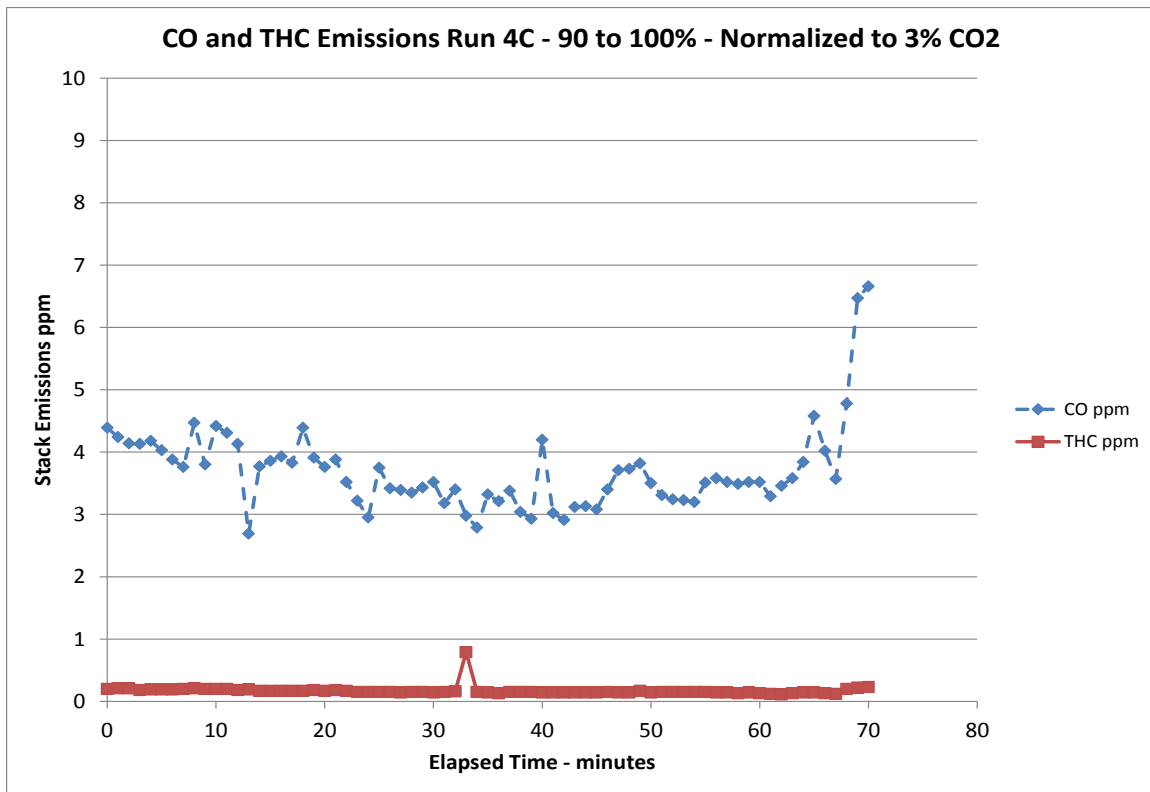


Figure 9 - Run 3C - CO and THC Emissions - 70 to 100% Normalized to 3% CO<sub>2</sub>

(d) 90 to 100% of Rated Flow

Figure 10 - Run 4A - CO and THC Emissions - 90 to 100% Normalized to 3% CO<sub>2</sub>Figure 11 - Run 4B - CO and THC Emissions - 90 to 100% Normalized to 3% CO<sub>2</sub>





**Figure 12 - Run 4C - CO and THC Emissions - 90 to 100% Normalized to 3% CO<sub>2</sub>**

### 3 Test Report

#### 3.1 Introduction

The GTS equipment was tested in Calgary, Alberta, Canada on Dec 10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup>, 2014. Testing was performed by REM Technology and Spartan personnel and AGAT Laboratories personnel.

**REM Technology and Spartan** personnel were responsible for:

- Coordination of test personnel
- Synchronization of all devices with respect to time and date
- Adjustment of fuel flow as per the desired fuel delivery rates
- Collection of fuel gas samples in the evacuated canisters

**AGAT Laboratories** was responsible for:

- Collection and analysis of Exhaust gas samples for Method 3C analysis
- Stack gas flow and temperature measurements
- Collection of Tedlar bag samples
- Method 22 stack observations and photography

**ORTECH** was responsible for

- Analysis of fuel samples collected by REM Technology and Spartan personnel

**Maxxam Analytics** was responsible for

- Analysis of the Tedlar bag samples

## 3.2 Test Information

Prior to the start of tests for each day all data recording clocks and watches were synchronized to within 10 s.

### 3.2.1 Test times and test number correlation

A **Run Number** is used to correlate the test data.

The tests were conducted as per the table provided below.

REM Test Number	AGAT Test Number	Run Number	Test Condition [% of Rated Flow]	Test Date [YYYY-MM-DD]	Test Start Time	Test End Time	Tedlar Bag ID
1			70 to 100%	2014-12-10	Trial Run		N/A
2			70 to 100%	2014-12-10	Trial Run		N/A
3	1	3A	70 to 100%	2014-12-10	15:00	16:10	T3B1A, T3B1B
4	2	3B	70 to 100%	2014-12-11	8:30	9:36	T4B1A, T4B1B
5	3	3C	70 to 100%	2014-12-11	10:05	11:10	T5B1A, T5B1B
6	4	2A	30 to 70%	2014-12-11	11:35	12:41	T6B1A, T6B1B
7	5	2B	30 to 70%	2014-12-11	13:05	14:10	T7B1A, T7B1B
8	6	2C	30 to 70%	2014-12-11	14:40	15:46	T8B1A, T8B1B
9	7	1A	0 to 30%	2014-12-11	16:10	17:16	T9B1A, T9B1B
10	8	4A	90 to 100%	2014-12-12	8:25	9:31	T10B1A, T10B1B
11	9	4B	90 to 100%	2014-12-12	9:55	11:01	T11B1A, T11B1B
12	10	4C	90 to 100%	2014-12-12	11:30	12:36	T12B1A, T12B1B
13	11	1B	0 to 30%	2014-12-12	13:00	14:05	T13B1A, T13B1B
14	12	1C	0 to 30%	2014-12-12	14:30	15:35	T14B1A, T14B1B

**Table 3 - Test Identifications and Test Times**

Tedlar bag samples were taken for each 30 minute traverse from each stack sampling port. At the end of the initial 30 minutes of sampling during a test run, the sample probe location was changed to the other port before the second 30 minute sampling period. The total sampling period was extended for the time needed for the change such that each total test period met the 60 minute test requirement.

### 3.2.2 Inlet Gas Sampling

The inlet gas was collected in summa canisters, silonite-coated stainless steel evacuated canisters, that met EPA requirements.

The table below shows the collection times and pressures with reference to local atmospheric pressure.

The inlet gas analysis results are reported in Appendix B.

**Table 4 - Inlet Gas Sampling Detail**

Run No.	REM Test Number	Test Condition [% of Rated Flow]	Test Date [YYYY-MM-DD]	Summa Canister ID	Canister Start Pressure [“Hg]	Canister End Pressure [“Hg]
	1	70 to 100%	2014-12-10	N/A	N/A	N/A
	2	70 to 100%	2014-12-10	N/A	N/A	N/A
3A	3	70 to 100%	2014-12-10	Test 1A, B, C Canister 14714	-28	-8
3B	4	70 to 100%	2014-12-11		-8	0
3C	5	70 to 100%	2014-12-11		0	1
2A	6	30 to 70%	2014-12-11	Test 2A, B, C Canister 5634	-27.5	-16
2B	7	30 to 70%	2014-12-11		-16	-4
2C	8	30 to 70%	2014-12-11		-4	0
1A	9	0 to 30%	2014-12-11	Test 3A Canister 14717	-28	-16
4A	10	90 to 100%	2014-12-12	Test 4A, B, C Canister 17124	-26.5	-16
4B	11	90 to 100%	2014-12-12		-16	-3.5
4C	12	90 to 100%	2014-12-12		-3.5	0
1B	13	0 to 30%	2014-12-12	Test 3B, 3C Canister 14717	-16	-4.5
1C	14	0 to 30%	2014-12-12		-4.5	0

### 3.2.3 Wind Velocity and Direction

A Kestral 4500 Pocket Weather Tracker was used for measuring the wind velocity and direction values recorded in the Method 22 observations by AGAT personnel. The calibration information is in Appendix F and the wind, velocity, direction, and absolute atmospheric pressure data is reported in Appendix I.

### 3.3 Deviations from the Specified Test Procedures

#### 3.3.1 Use of a Mass Flow Meter

The use of a mass flow meter in lieu of a volumetric flow meter in conducting Method 2A was approved. Refer to a letter dated Mar 26, 2014 from Steffan Johnson, Acting Group Leader, Measurement Technology Group, United States Environmental Protection Agency to Christi Wilson, Managing Consultant, Trinity Consultants in Appendix H. Trinity Consultants were retained by REM Technology Inc.

A calibrated RTD was used for the gas temperature measurements.

#### 3.3.2 Alternative Calibration Gas

The use of Propane in Nitrogen for the Method 25A testing in lieu of Propane in Air was approved. Refer to an email from Robin R. Segall, Senior Environmental Scientist, Measurement Technology Group (E143-02), Office of Air Quality Planning & Standards, US Environmental Protection Agency to Patty Centofanti, Senior Consultant, Trinity Consultants in Appendix H. Trinity Consultants were retained by REM Technology Inc.

#### 3.3.3 Inlet Gas Analysis

The inlet gas was collected from the pipe leading to the burner; the supply pressure at this point was 4 to 12 Oz/in<sup>2</sup> relative to local atmospheric pressure. The site altitude was 1037m (3204 ft.) above sea-level so the maximum absolute canister pressure at the end of each test segment was less than the atmospheric pressure at the test laboratory with a the reduced site altitude of 156 m (512 ft). In the connection to the gas chromatograph at the lower altitude, air was introduced. As per the analysis report ***“It should be noted that the nitrogen and oxygen present in the analytical results is due to the transfer/injection process from the summa canister to the gas chromatograph and not from the sample gas itself.”***

### 3.4 Test Results

The inlet flow data and charts are reported in Appendix A

The inlet gas analysis from an independent test laboratory is in Appendix B.

The inlet gas analysis from the supplier is reported in Appendix C.

The outlet data and charts for average CO and THC stack gas concentrations following Methods 10 and 25A respectively are reported in Appendices D1 and D2.

The outlet data for O<sub>2</sub>, CO<sub>2</sub>, methane, and Nitrogen concentrations collected following Method 4 and analyzed following Method 3C is reported in Appendix E.

The observer data is reported in Appendix D1.

The wind and atmospheric pressure is reported in Appendix I.

The duct velocity measured following Method 2 is reported in Appendix D1.

The VOC destruction % was calculated according to the formula

$$100 * (\text{Ave Flow (lb/h)} - \text{THC emissions Ave lb/h}) / \text{Ave Flow lb/h}$$

### 3.4.1 0 to 30% of Maximum Flow Rate

Inlet Gas Sample Canister 14717

Inlet gas heating value = 2318.9 BTU/scf (See Appendix B)

#### 0 to 30% Flow

Run Number	1A	1B	1C	
Test ID - REM	9	13	14	Average
Test ID - AGAT	7	11	12	
Start Time	16:10	13:00	14:30	
End Time	17:16	14:05	15:35	
Test Duration - min	66	65	65	
Inlet Fuel Heat				
Min flow scfm	1.92	1.92	1.92	1.92
Max flow scfm	2.19	2.18	2.18	2.18
Ave Flow lb/h	12.9	12.9	12.9	12.90
CO (Ave) ppmvd	7.16	7.16	7.45	7.26
THC (Ave) ppmvw	0.221	0.201	0.166	0.20
Stack Velocity m/s	2.804	2.15	2.12	2.36
Stack Velocity ft/s	9.20	7.05	6.96	7.74
Stack Temperature Deg C	475	474	480	476
Stack Temperature Deg F	887	885	896	889
Stack Flow wstd m <sup>3</sup> /h	255	196	192	214
Stack Flow wscfm	150	115	113	126
Stack Flow dstd m <sup>3</sup> /h	245	188	183	205
Stack Flow dscfm	144	111	108	121
Water mole%	3.70	4.32	4.53	4.18
Bag IDs	T9B1A, T9B1B	T13B1A, T13B1B	T14B1A, T14B1B	
CO2% (Ave)	4.48	4.49	4.56	4.51
O2% (Ave)	14.59	14.51	14.45	14.52
N2% (Ave)	79.99	80.04	80.03	80.02
CH4%	0.00	0.00	0.00	0.00
CO ppmvd normalized to 3% CO2	4.79	4.78	4.90	4.83
THC ppmvw normalized to 3% CO2	0.148	0.134	0.109	0.131
Excess Air %	224%	219%	216%	220%
THC emissions Ave kg/h	0.0000394	0.0000276	0.0000297	0.0000322
THC emissions Ave lb/h	0.0000869	0.0000608	0.0000655	0.0000711
VOC Destruction %	99.9993%	99.9995%	99.9995%	99.9994%

Table 5 - Results for the Firing Rate of 0 to 30%

### 3.4.2 30 to 70% of Maximum Flow Rate

Inlet Gas Sample Canister 5634

Inlet gas heating value = 2328.6 BTU/scf

#### 30 to 70% Flow

Run Number	2A	2B	2C	
Test ID - REM	6	7	8	Average
Test ID - AGAT	4	5	6	
Start Time	11:35	13:05	14:40	
End Time	12:41	14:10	15:46	
Test Duration - min	66	65	66	
Min flow scfm	2.16	2.15	2.15	2.15
Max flow scfm	2.50	2.51	2.51	2.51
Ave Flow lb/h	14.7	14.7	14.7	14.70
CO (Ave) ppmvd	6.26	5.33	5.75	5.78
THC (Ave) ppmvw	0.392	0.344	0.219	0.32
Stack Velocity m/s	2.49	2.97	2.98	2.81
Stack Velocity ft/s	8.17	9.74	9.78	9.23
Stack Temperature Deg C	511	519	512	514
Stack Temperature Deg F	952	966	954	957
Stack Flow wstd m <sup>3</sup> /h	216	255	259	243
Stack Flow wscfm	127	150	152	143
Stack Flow dstd m <sup>3</sup> /h	207	243	248	233
Stack Flow dscfm	122	142	146	137
Water mole%	3.75	4.21	4.11	4.02
Bag IDs	T6B1A, T6B1B	T7B1A, T7B1B	T8B1A, T8B1B	
CO <sub>2</sub> % (Ave)	4.92	4.75	4.99	4.89
O <sub>2</sub> % (Ave)	13.98	13.77	13.88	13.88
N <sub>2</sub> % (Ave)	80.15	80.2	80.17	80.17
CH <sub>4</sub> (Ave)%	0.00	0.00	0.00	0.00
CO ppmvd normalized to 3% CO <sub>2</sub>	3.82	3.37	3.46	3.55
THC ppmvw normalized to 3% CO <sub>2</sub>	0.239	0.217	0.132	0.196
Excess Air %	195%	186%	191%	190%
THC emissions Ave kg/h	0.0000589	0.0000611	0.0000396	0.0000532
THC emissions Ave lb/h	0.0001299	0.0001347	0.0000873	0.0001173
VOC Destruction %	99.9991%	99.9991%	99.9994%	99.9992%

Table 6 - Results for the Firing Rate of 30 to 70%



### 3.4.3 70 to 100% of Maximum Flow Rate

Inlet Gas Sample Canister 14717

Inlet gas heating value = 2335.4 BTU/scf

#### 70 to 100% Flow

Run Number	3A	3B	3C	
Test ID - REM	3	4	5	Average
Test ID - AGAT	1	2	3	
Start Time	15:00	8:30	10:05	
End Time	16:10	9:36	11:10	
Test Duration - min	70	66	65	
Min flow scfm	2.48	2.49	2.48	2.48
Max flow scfm	2.74	2.75	2.74	2.74
Ave Flow lb/h	16.4	16.4	16.4	16.40
CO (Ave) ppmvd	3.90	5.00	4.95	4.61
THC (Ave) ppmvw	0.45	0.39	0.37	0.40
Stack Velocity m/s	2.59	2.86	2.80	2.75
Stack Velocity ft/s	8.50	9.38	9.19	9.02
Stack Temperature Deg C	558	527	537	541
Stack Temperature Deg F	1036	981	999	1005
Stack Flow wstd m <sup>3</sup> /h	215	243	235	231
Stack Flow wscfm	126	143	138	136
Stack Flow dstd m <sup>3</sup> /h	202	234	225	220
Stack Flow dscfm	119	138	132	129
Water mole%	5.80	3.83	4.40	4.68
Bag IDs	T3B1A, T3B1B	T14B1A, T14B1B	T5B1A, T14B1B	
CO <sub>2</sub> % (Ave)	5.41	5.51	5.46	5.46
O <sub>2</sub> % (Ave)	13.28	13.18	13.22	13.23
N <sub>2</sub> % (Ave)	80.36	80.36	80.35	80.36
CH <sub>4</sub> (Ave)%	0.00	0.00	0.00	0.00
CO ppmvd normalized to 3% CO <sub>2</sub>	2.16	2.72	2.72	2.53
THC ppmvw normalized to 3% CO <sub>2</sub>	0.248	0.212	0.204	0.222
Excess Air %	167%	164%	165%	166%
THC emissions Ave kg/h	0.0000668	0.0000662	0.000061	0.0000647
THC emissions Ave lb/h	0.0001473	0.0001459	0.0001345	0.0001426
VOC Destruction %	99.9991%	99.9991%	99.9992%	99.9991%

Table 7 - Results for the Firing Rate of 70 to 100%

**3.4.4 90 to 100% of Maximum Flow Rate**

Inlet Gas Sample Canister 17124

Inlet gas heating value = 2329.2 BTU/scf

**90 to 100% Flow**

Run Number	4A	4B	4C	
Test ID - REM	10	11	12	Average
Test ID - AGAT	8	9	10	
Start Time	8:25	9:55	11:30	
End Time	9:31	11:01	12:36	
Test Duration - min	66	66	66	
Min flow scfm	2.65	2.63	2.65	2.64
Max flow scfm	2.73	2.73	2.73	2.73
Ave Flow lb/h	16.7	16.7	16.7	16.70
CO (Ave) ppmvd	3.71	3.06	3.59	3.45
THC (Ave) ppmvw	0.117	0.0209	0.167	0.10
Stack Velocity m/s	2.44	2.58	2.34	2.45
Stack Velocity ft/s	8.01	8.46	7.68	8.05
Stack Temperature Deg C	523	527	539	530
Stack Temperature Deg F	973	981	1002	985
Stack Flow wstd m <sup>3</sup> /h	209	220	197	209
Stack Flow wscfm	123	129	116	123
Stack Flow dstd m <sup>3</sup> /h	199	210	187	199
Stack Flow dscfm	117	124	110	117
Water mole%	4.78	4.57	4.75	4.70
Bag IDs	T10B1A, T10B1B	T11B1A, T11B1B	T12B1A, T12B1B	
CO <sub>2</sub> % (Ave)	5.52	5.53	5.53	5.53
O <sub>2</sub> % (Ave)	13.16	13.16	13.16	13.16
N <sub>2</sub> % (Ave)	80.36	80.35	80.36	80.36
CH <sub>4</sub> (Ave)%	0.00	0.00	0.00	0.00
CO ppmvd normalized to 3% CO <sub>2</sub>	2.02	1.66	1.95	1.87
THC ppmvw normalized to 3% CO <sub>2</sub>	0.064	0.011	0.091	0.055
Excess Air %	163%	163%	163%	163%
THC emissions Ave kg/h	0.000017	0.00000321	0.0000229	0.0000144
THC emissions Ave lb/h	0.0000375	0.0000071	0.0000505	0.0000317
VOC Destruction %	99.9998%	100.0000%	99.9997%	99.9998%

**Table 8 - Results for the Firing Rate of 90 to 100%**

## 3.5 Equipment Description

### 3.5.1 Operation Description

The REM Technology SlipStream GTS is a system where combustible vapors from one or more storage tank vessels can be used as a fuel for existing process equipment or can be combusted by the GTS auxiliary burner. The GTS may be applied to an existing process gas burner apparatus used to provide heat either to an intermediate heat transfer liquid or to a liquid directly such as a line heater.

When using the GTS system, the NSPS OOOO affected storage vessels are equipped with pressure and vacuum relief devices or blanket gas systems meeting the cover and closed vent specification of 40 CFR 60.511(b)&(c) to contain the vapors within the storage vessel and to prevent large negative pressures. Typical pressure relief values are 16 Oz/in<sup>2</sup> of positive pressure, relative to atmospheric pressure and 0.4 Oz/in<sup>2</sup> of negative pressure relative to atmospheric pressure. The GTS systems employs vacuum and pressure relief devices on the storage vessels for safety reasons as allowed by 40 CFR 60.5411(c)(3)(ii).

A pipe from the closed storage vessel transmits the tank vapors to the gas process burner equipped with a GTS auxiliary burner. A suitable liquid-gas separation device prevents liquids reaching the burner apparatus. The GTS measures the pressure of the vapors and if the pressure is sufficient, routes the vapors to the process burner to be used as fuel. If the process burner is not in operation and the pressure is sufficient, the gas is routed to the GTS auxiliary burner located in the exhaust stack of the existing process burner. If the pressure is less than the minimum burner operation pressure, gas remains in closed storage vessel until pressure builds to exceed the minimum GTS turn-on pressure.

A maximum allowed pressure is specified for auxiliary burner operation. If this pressure is exceeded for more than 15 minutes, the auxiliary burner is shut off and the storage vessel vapors are allowed to vent via the pressure relief device on the storage vessel.

The GTS auxiliary burner apparatus is controlled by a Model 3200 flame ionization system manufactured by ACL<sup>1</sup>. The model 3200 has a spark ignited pilot. The GTS system may be configured so the pilot is on at all times (Stand-by Pilot) or is started with the spark ignition and kept on when there is a requirement to combust gas in the auxiliary burner (Continuous Pilot). In the starting cycle, if the pilot flame ionization is not present within 10 seconds of the ignition of the pilot, the spark is repeated. The pilot, as determined by the flame ionization current, must be on for 20 seconds before the storage vessel vapors are allowed to flow to the GTS auxiliary burner. The GTS auxiliary burner pilot uses the ion current produced by the pilot flame to verify the pilot flame is healthy. If, for some reason the pilot flame goes out, the storage vessel vapors are turned off by the burner controller and the ignition spark continues until the pilot is

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<sup>1</sup> The **ACL3200 Flame Ionization (FI) System manual states**: “The ACL3200 Flame Ionization (FI) System uses a continuous pilot and a high voltage sparker to light the pilot. It uses a single ignitor/flame rod to provide both flame acknowledgment and ignition. An alarm will signal if the ACL3200 detects that the pilot is out, or if the flame failed to light. Once the Start button is pressed on the front of the unit, the ACL3200 will automatically start sparking in regular intervals based on the onboard timer settings until it detects that the pilot is lit.”

reignited. The pilot uses the normal process gas that is present and used by the process burner in the absence of available storage vessel vapors.

The GTS auxiliary burner is only on when the process burner is off. The combustion air for the GTS auxiliary burner comes from the existing process burner air inlet with its flame arrestor. An additional flame arrestor in the pipe conveying vapors from the storage vessel ensures that any flash-back flame cannot reach the storage vessel.

The SlipStream GTS is shown schematically in Figure 13 - SlipStream GTS schematic.

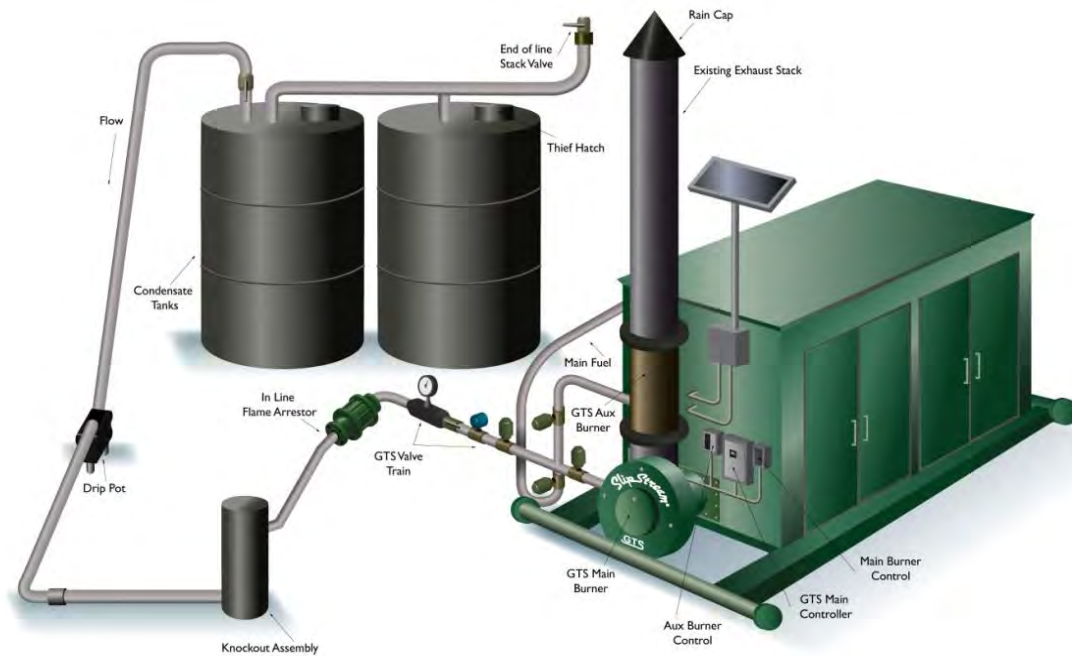


Figure 13 - SlipStream GTS schematic

The Auxiliary Burner section is shown in Figure 14 - Auxiliary Burner Section

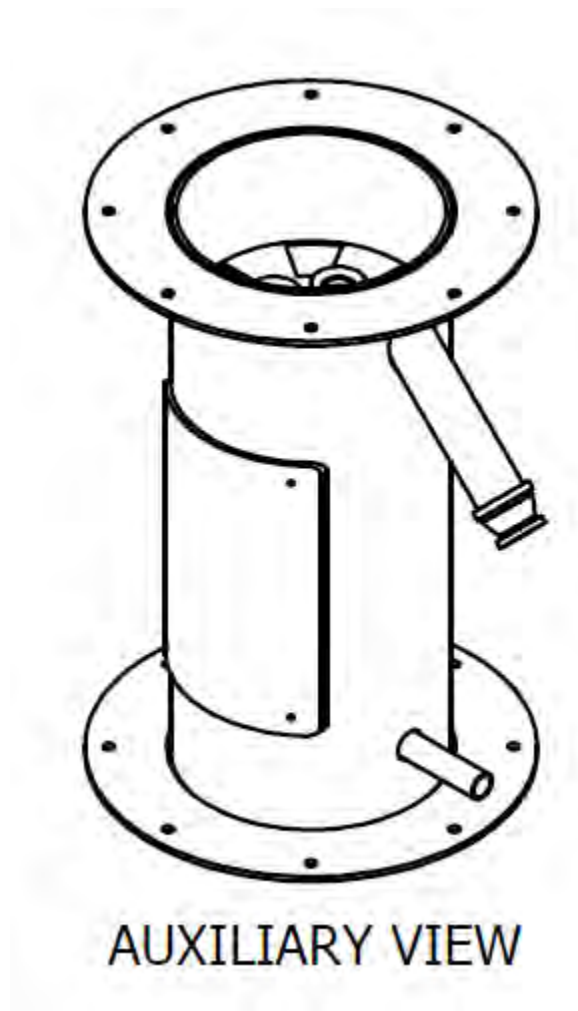
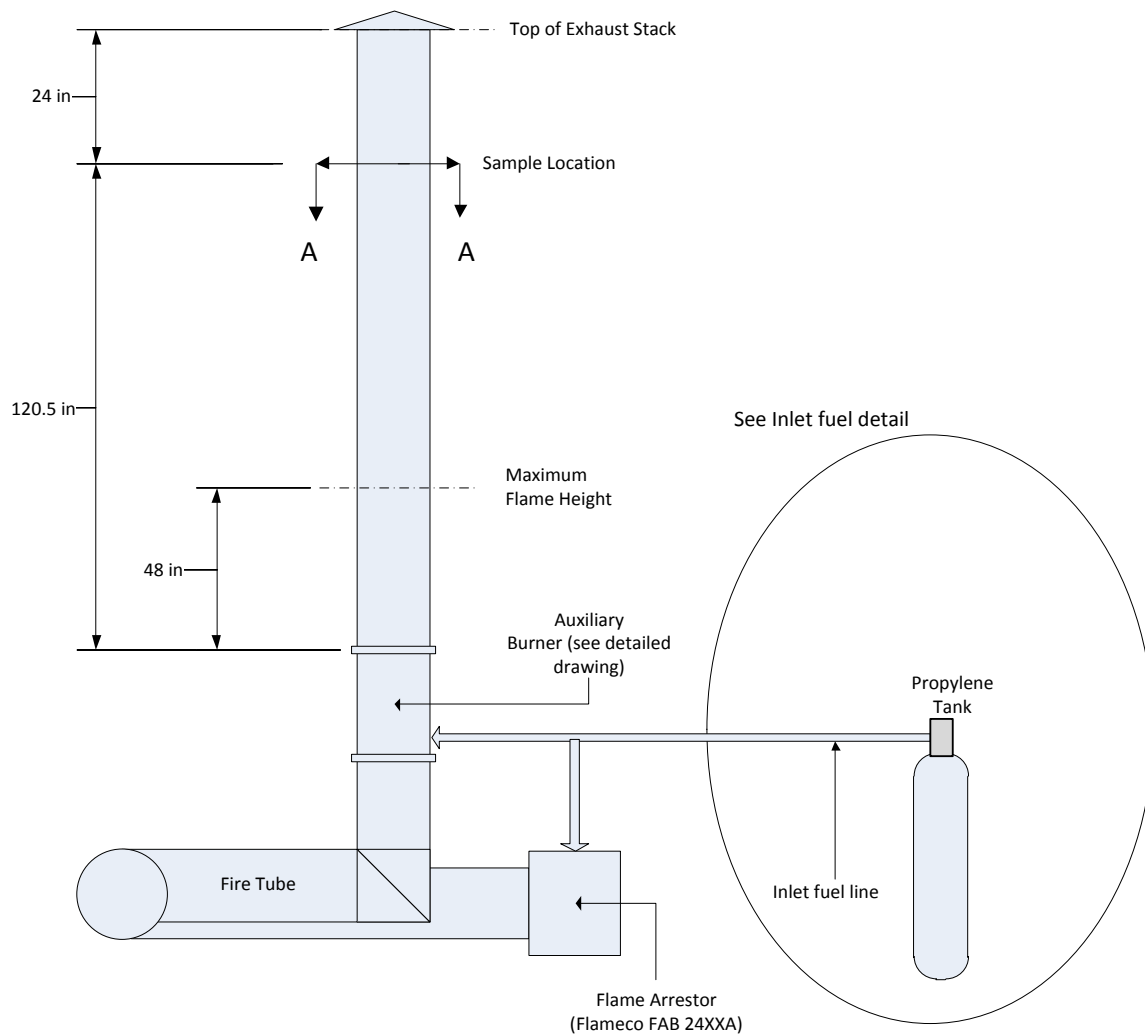


Figure 14 - Auxiliary Burner Section

### 3.5.2 Diagrams with Dimensions

**General Arrangement** - Note that additional length has been added to the stack to accommodate the sampling port requirements for this test. Observation has shown a maximum flame height of 48 inches above the top of the auxiliary burner section.



**Figure 15 - Key Dimensions of Stack Sample Locations**





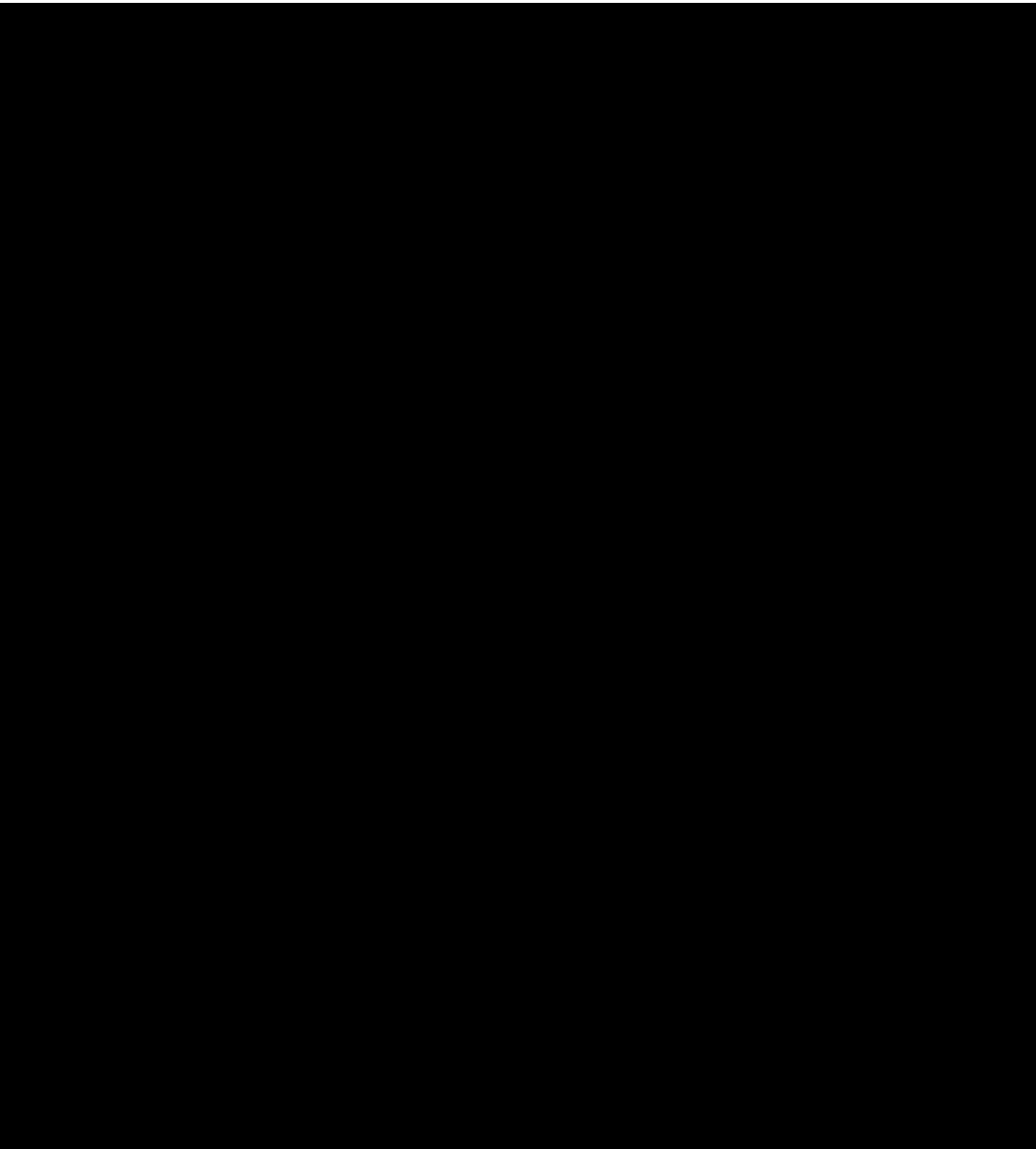


### 3.5.3 Flame Arrestor – Incoming Air

For the incoming air the burner is equipped with a flame arrestor supplied by ZIRCO, and manufactured by Flamco Industries Inc.

Flame Arrested One Piece Burner Housing  
Model FAH 24-12A  
Complete with 24" flame cell element

For field installations an in-line flame arrestor is installed in the pipe leading from the storage vessel gas source to the GTS. For the test installation an in-line flame arrestor was not required as the fuel source did not contain any air.



### 3.5.5 Flame Arrester – Incoming Vessel Gases

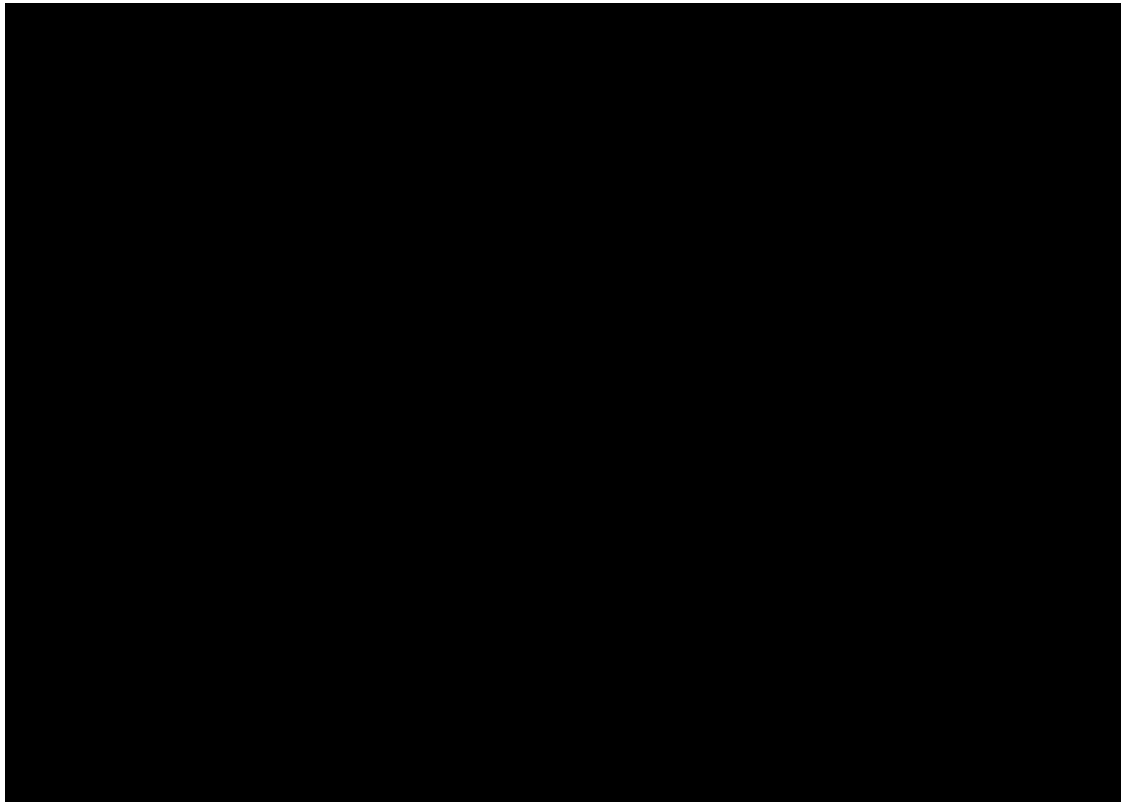
In field installations a flame arrester for incoming vessel gases is located in the pipe between the gases originating from the storage vessel and the GTS-12 no more than 10 feet upstream from the GTS-12. For this test where the burner fuel comes from a known pressurized source the flame arrester for incoming gases was not deemed to be necessary.

Manufacturer: Shand & Jurs.

Model: 94307-12-11-77

Details: 2", Aluminum, No Drain plug

Dimensions: A = 14 ½      B = 8 5/32      D = 6"    F = 5/8"



### 3.5.6 Burner manifold

A three burner manifold was used for the GTS auxiliary burner.

### 3.5.7 Pilot Flame Indicator

The pilot flame indicator measures the ionization current produced in the flame when a voltage is applied between the igniter rod and the pilot nozzle. To initially ignite the pilot, a high voltage is applied to the insulated igniter rod to generate a spark. After the spark is extinguished, a voltage is applied between the igniter rod and the pilot nozzle and the **ACL CSC 3200 Combustion Safety Control** measures the current. If the ionization current exceeds a pre-set threshold for a specified period of time, the pilot is verified. Otherwise the spark is repeated and the ionization current re-measured.

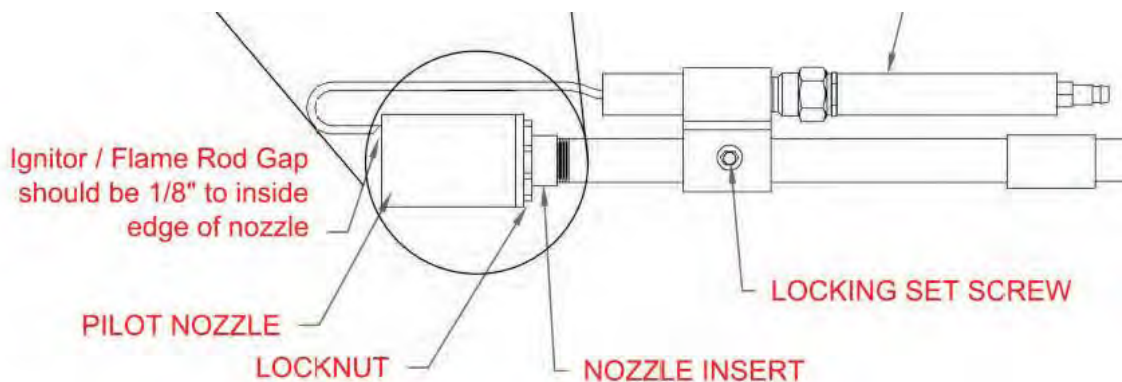


Figure 22 - Pilot Flame Indicator

### 3.5.8 Pilot Fuel

The pilot uses normal process gas with more than 80% methane content at approximately 1.5 psig. The pilot uses a #60 orifice. The gas flow has been estimated using tables for gas flow provided in the Eclipse Combustion Engineering Guide EFE 828 Copyright 1986.

<http://www.metroservicesinc.com/Combustion%20University/Eclipse%20Engineering%20Guide.pdf> - 1 CHAPTER 1 – ORIFICES & FLOWS

The pilot gas pressure was set to approximately 1.5 psig. The gas flow is provided by the expression

$$Q = 1658.5 A C_d (h/g)^{0.5}$$

Where Q is the flow in cfh

A is the orifice area in sq. in.

C<sub>d</sub> is the discharge coefficient of the orifice

h is the pressure drop across the orifice in "H<sub>2</sub>O

g is the specific gravity of the gas based on standard air at 1.0

For this estimation C<sub>d</sub> = 0.8 and g = 0.6 for natural gas.

$$A = \pi/4 * 0.040^2 = 0.001257 \text{ in}^2$$

$$\text{At } 1.5 \text{ psig} = 1.5 * 27.7 = 41.5 \text{ "H}_2\text{O}$$

$$\text{The estimated pilot gas flow is } Q = 1658.5 * 0.001257 * 0.8 * (41.5/0.6)^{0.5} = 17.5 \text{ cfh}$$

### 3.5.9 Other

- (A) The fuel test pressures and temperatures are reported in Appendix A
- (B) The fuel gas moisture was 0.39 ppm (mol.) as documented by the fuel gas supplier in Appendix C2
- (C) No purge gas was used.
- (D) No condensate occurred during the tests. In field installations a liquids separation pot is placed in the fuel piping before the feed gas reaches the burner control apparatus.
- (E) The combustion zone temperature was not measured.
- (F) The excess combustion air for the tests ranged from a minimum of 163% in the 90% to 100% flow range to a maximum of 224% in the 0% to 30% range. Individual test data is provided in sections 3.4.1 to 3.4.4.
- (G) The flame arrestor for the air is shown in Section 0. Field Installation specifications call for an in-line flame arrestor located not more than 10 ft. from the GTS control apparatus. The flame arrestor for the incoming vessel gases, shown in Section 3.5.5, was not used for these tests.
- (H) Burner manifold – The burner manifold is 12 inches in diameter. The burner manifold pressure was - 0.1 "H<sub>2</sub>O.
- (I) The pilot flame indicator is described in section 0.
- (J) The pilot design fuel is process natural gas. The normal operating pressure and fuel consumption are described in section 3.5.8.
- (K) The calculated velocity at a burner orifice is shown below

No. of burners	3
Min flow rate scfm	1.92
Minimum tip velocity ft/s	158
Maximum flow rate	2.73
Maximum tip velocity	225

- (L) Momentum flux ratio – unavailable from the supplier of the burner
- (M) The exit temperature of the stack gases ranges from 887°F at the lowest fuel flow rate to 1036°F at the highest fuel flow rate. Individual test values are given in sections 3.4.1 to 3.4.4.
- (N) Exit Flow rate – The stack flow varies from about 125 scfm to 190 scfm. Individual stack flow rates are given in sections 3.4.1 to 3.4.4.
- (O) The wind velocity and direction data is provided in Appendix I.

### 3.5.10 Control System Schematic

Figure 23 on the following page shows the process and instrument diagram for the Standard GTS. The Mass Flow-meter, the inlet gas sampling port, and the RTD were added for the tests as shown in a previous section. The outputs of the pressure transmitter, mass flow meter, and RTD were connected to the FloBoss controller, which recorded the data electronically. The software configuration showing the units of measure from the transmitter inputs to the recorded values are included in Appendix F.

The main process burner was not used during the tests.



### 3.6 Calibration Reports

Pressure Transducer Calibration – See Appendix F

Flow Meter Calibration – See Appendix F

RTD Calibration – See Appendix F

FloBoss Calibration – See Appendix F

Notes on the flow meter:

- Approval for use of a thermal mass flow meter was provided March 26, 2014 by Steffan Johnson, Acting Group Leader, Measurement Technology Group, EPA
- Make note that the Fox Model FT2 Flow meter reports the gas flow in mass units or in volumetric units at standard conditions according to the meter set-up. The flow output was chosen as lb/h.

From the FT2 Manual: “The Model FT2A measures mass flow, an advantage over other flow meters which measure volumetric flow rate. Volumetric flow is incomplete because temperature and pressure are unknown and must be measured separately. For example, the mass flow of a gas depends on its temperature and pressure. As temperature and pressure changes, the gas volume changes but not it’s mass.”

“Therefore a device measuring mass flow is independent of temperature and pressure. The Model FT2A provides a direct measurement of gas flow in Mass units (kg/hr, lb/hr), standard units (SCFM, SLPM) or normal units (NM3/hr, NLPM) with no additional temperature or pressure measurements required.”

## **Appendices**

**Appendix A – Flow and Temperature Data**

**Appendix B – Input Gas Analysis Report – ORTECH**

**Appendix C – Input Gas Analysis by Supplier**

**Appendix D1 – Stack Gas Emissions Report – AGAT**

**Appendix D2 – Stack Gas Emissions Report –Graphs**

**Appendix E – Tedlar Bag Stack Gas Analysis Report – Maxxam**

**Appendix F – Instrument Calibration Reports**

**Appendix G – Chain of Custody Forms**

**Appendix H – Miscellaneous Information**

**Appendix I – Wind Velocity, Direction and Atmospheric Pressure**



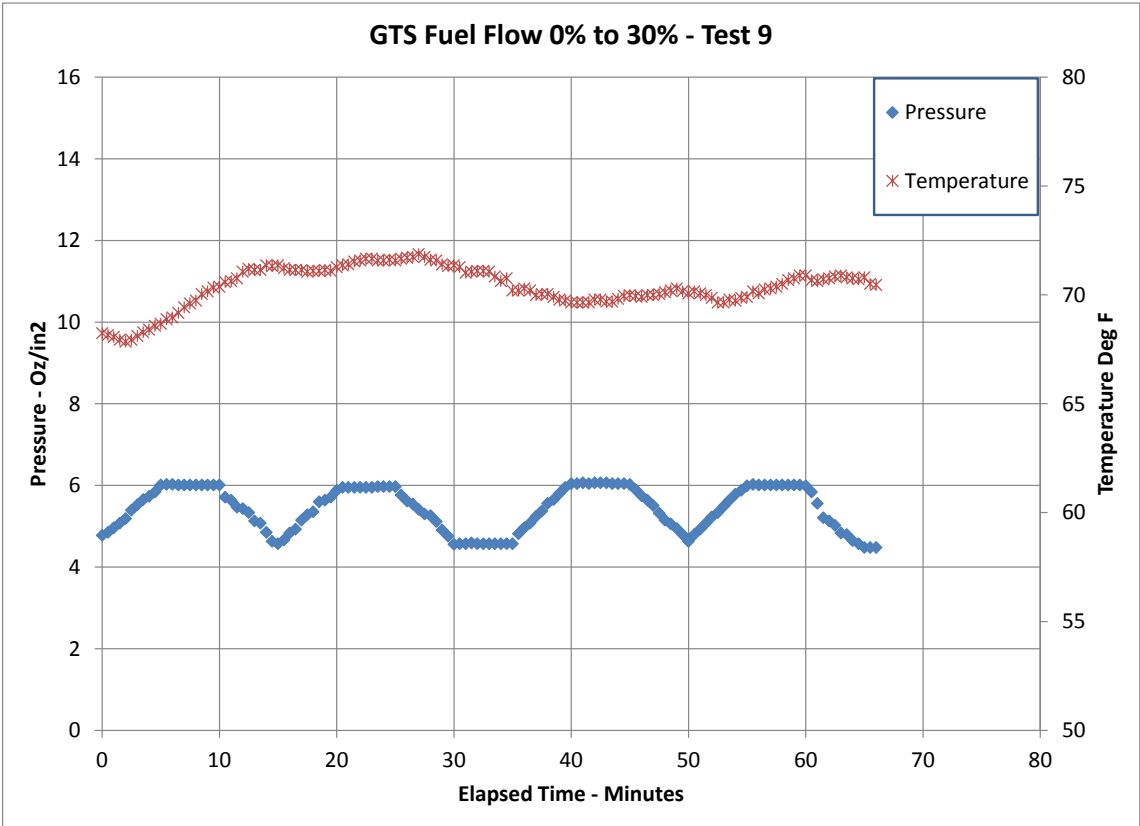
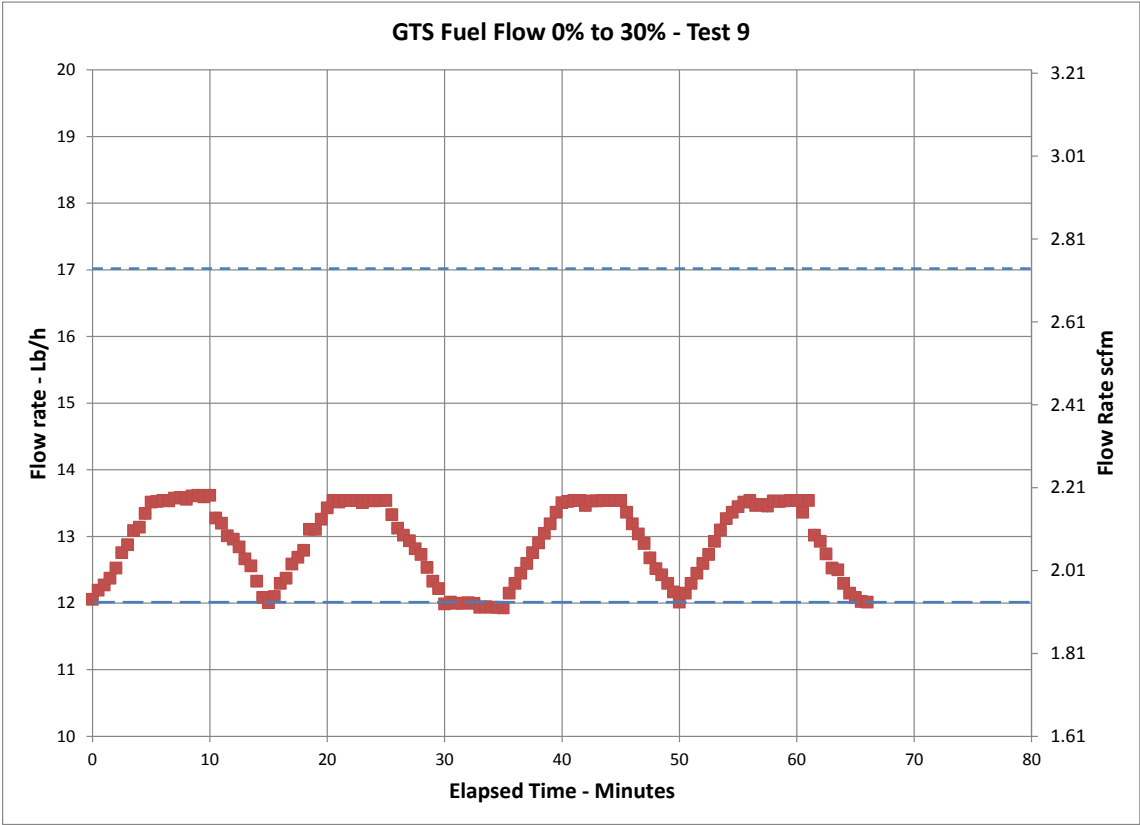
## Appendix A

### Appendix A – Flow and Temperature Data

Runs 1A, 1B, 1C	GTS Gas Flow – 0% to 30%	A2 to A13
Runs 2A, 2B, 2C	GTS Gas Flow – 30% to 70%	A14 to A25
Runs 3A, 3B, 3C	GTS Gas Flow – 70% to 100%	A26 to A37
Runs 4A, 4B, 4C	GTS Gas Flow – 90% to 100%	A38 to A49

Appendix A

Run 1A



## Appendix A

### Run 1A GTS Fuel Flow 0% to 30% - Test 9

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	16:10:00	0.0	12.1	1.94	68.2	1	4.78
12/11/2014	16:10:30	0.5	12.2	1.96	68.2	1	4.85
12/11/2014	16:11:00	1.0	12.3	1.97	68.1	1	4.96
12/11/2014	16:11:30	1.5	12.4	1.99	67.9	1	5.08
12/11/2014	16:12:00	2.0	12.5	2.01	67.9	1	5.19
12/11/2014	16:12:30	2.5	12.8	2.05	67.9	1	5.39
12/11/2014	16:13:00	3.0	12.9	2.07	68.1	1	5.52
12/11/2014	16:13:30	3.5	13.1	2.11	68.3	1	5.65
12/11/2014	16:14:00	4.0	13.1	2.11	68.4	1	5.73
12/11/2014	16:14:30	4.5	13.3	2.15	68.6	1	5.84
12/11/2014	16:15:00	5.0	13.5	2.17	68.7	1	6.01
12/11/2014	16:15:30	5.5	13.5	2.18	68.9	1	6.03
12/11/2014	16:16:00	6.0	13.5	2.18	69.0	1	6.03
12/11/2014	16:16:30	6.5	13.5	2.18	69.2	1	6.01
12/11/2014	16:17:00	7.0	13.6	2.18	69.4	1	6.01
12/11/2014	16:17:30	7.5	13.6	2.19	69.6	1	6.01
12/11/2014	16:18:00	8.0	13.6	2.18	69.7	1	6.01
12/11/2014	16:18:30	8.5	13.6	2.19	70.0	1	6.01
12/11/2014	16:19:00	9.0	13.6	2.19	70.2	1	6.01
12/11/2014	16:19:30	9.5	13.6	2.19	70.3	1	6.01
12/11/2014	16:20:00	10.0	13.6	2.19	70.4	1	6.01
12/11/2014	16:20:30	10.5	13.3	2.14	70.6	1	5.71
12/11/2014	16:21:00	11.0	13.2	2.12	70.6	1	5.63
12/11/2014	16:21:30	11.5	13.0	2.09	70.8	1	5.47
12/11/2014	16:22:00	12.0	13.0	2.08	71.1	1	5.43
12/11/2014	16:22:30	12.5	12.8	2.07	71.2	1	5.34
12/11/2014	16:23:00	13.0	12.7	2.04	71.1	1	5.13
12/11/2014	16:23:30	13.5	12.6	2.02	71.1	1	5.08
12/11/2014	16:24:00	14.0	12.3	1.98	71.4	1	4.85
12/11/2014	16:24:30	14.5	12.1	1.94	71.3	1	4.63
12/11/2014	16:25:00	15.0	12.0	1.93	71.4	1	4.57
12/11/2014	16:25:30	15.5	12.1	1.95	71.2	1	4.67
12/11/2014	16:26:00	16.0	12.3	1.98	71.1	1	4.83
12/11/2014	16:26:30	16.5	12.4	1.99	71.1	1	4.93
12/11/2014	16:27:00	17.0	12.6	2.02	71.1	1	5.15
12/11/2014	16:27:30	17.5	12.7	2.04	71.1	1	5.28
12/11/2014	16:28:00	18.0	12.8	2.06	71.1	1	5.35
12/11/2014	16:28:30	18.5	13.1	2.11	71.1	1	5.60
12/11/2014	16:29:00	19.0	13.1	2.11	71.1	1	5.63
12/11/2014	16:29:30	19.5	13.3	2.13	71.1	1	5.71
12/11/2014	16:30:00	20.0	13.4	2.16	71.3	1	5.88
12/11/2014	16:30:30	20.5	13.5	2.18	71.4	1	5.95
12/11/2014	16:31:00	21.0	13.5	2.17	71.4	1	5.95
12/11/2014	16:31:30	21.5	13.5	2.18	71.5	1	5.95
12/11/2014	16:32:00	22.0	13.5	2.18	71.6	1	5.95
12/11/2014	16:32:30	22.5	13.5	2.18	71.7	1	5.95
12/11/2014	16:33:00	23.0	13.5	2.17	71.7	1	5.95

## Appendix A

### Run 1A GTS Fuel Flow 0% to 30% - Test 9

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	16:33:30	23.5	13.5	2.18	71.6	1	5.97
12/11/2014	16:34:00	24.0	13.5	2.18	71.6	1	5.97
12/11/2014	16:34:30	24.5	13.5	2.18	71.6	1	5.97
12/11/2014	16:35:00	25.0	13.5	2.18	71.6	1	5.97
12/11/2014	16:35:30	25.5	13.3	2.14	71.7	1	5.76
12/11/2014	16:36:00	26.0	13.1	2.11	71.7	1	5.62
12/11/2014	16:36:30	26.5	13.0	2.09	71.7	1	5.54
12/11/2014	16:37:00	27.0	12.9	2.08	71.9	1	5.41
12/11/2014	16:37:30	27.5	12.8	2.06	71.7	1	5.30
12/11/2014	16:38:00	28.0	12.7	2.05	71.6	1	5.26
12/11/2014	16:38:30	28.5	12.5	2.02	71.6	1	5.11
12/11/2014	16:39:00	29.0	12.3	1.98	71.4	1	4.91
12/11/2014	16:39:30	29.5	12.2	1.97	71.3	1	4.76
12/11/2014	16:40:00	30.0	12.0	1.93	71.4	1	4.55
12/11/2014	16:40:30	30.5	12.0	1.93	71.3	1	4.57
12/11/2014	16:41:00	31.0	12.0	1.93	71.0	1	4.57
12/11/2014	16:41:30	31.5	12.0	1.93	71.1	1	4.59
12/11/2014	16:42:00	32.0	12.0	1.93	71.1	1	4.57
12/11/2014	16:42:30	32.5	12.0	1.93	71.1	1	4.57
12/11/2014	16:43:00	33.0	11.9	1.92	71.1	1	4.57
12/11/2014	16:43:30	33.5	11.9	1.92	70.8	1	4.57
12/11/2014	16:44:00	34.0	11.9	1.92	70.6	1	4.57
12/11/2014	16:44:30	34.5	11.9	1.92	70.8	1	4.57
12/11/2014	16:45:00	35.0	11.9	1.92	70.2	1	4.57
12/11/2014	16:45:30	35.5	12.2	1.95	70.2	1	4.81
12/11/2014	16:46:00	36.0	12.3	1.98	70.3	1	4.96
12/11/2014	16:46:30	36.5	12.5	2.00	70.2	1	5.08
12/11/2014	16:47:00	37.0	12.6	2.03	70.0	1	5.24
12/11/2014	16:47:30	37.5	12.8	2.05	70.0	1	5.37
12/11/2014	16:48:00	38.0	12.9	2.08	70.0	1	5.56
12/11/2014	16:48:30	38.5	13.0	2.10	69.9	1	5.65
12/11/2014	16:49:00	39.0	13.2	2.12	69.8	1	5.80
12/11/2014	16:49:30	39.5	13.4	2.15	69.7	1	5.95
12/11/2014	16:50:00	40.0	13.5	2.17	69.6	1	6.04
12/11/2014	16:50:30	40.5	13.5	2.18	69.6	1	6.04
12/11/2014	16:51:00	41.0	13.5	2.18	69.6	1	6.06
12/11/2014	16:51:30	41.5	13.5	2.18	69.6	1	6.04
12/11/2014	16:52:00	42.0	13.5	2.17	69.8	1	6.06
12/11/2014	16:52:30	42.5	13.5	2.18	69.8	1	6.06
12/11/2014	16:53:00	43.0	13.5	2.18	69.7	1	6.06
12/11/2014	16:53:30	43.5	13.5	2.18	69.7	1	6.04
12/11/2014	16:54:00	44.0	13.5	2.18	69.8	1	6.04
12/11/2014	16:54:30	44.5	13.5	2.18	69.9	1	6.04
12/11/2014	16:55:00	45.0	13.5	2.18	70.0	1	6.03
12/11/2014	16:55:30	45.5	13.4	2.15	69.9	1	5.89
12/11/2014	16:56:00	46.0	13.2	2.12	69.9	1	5.75

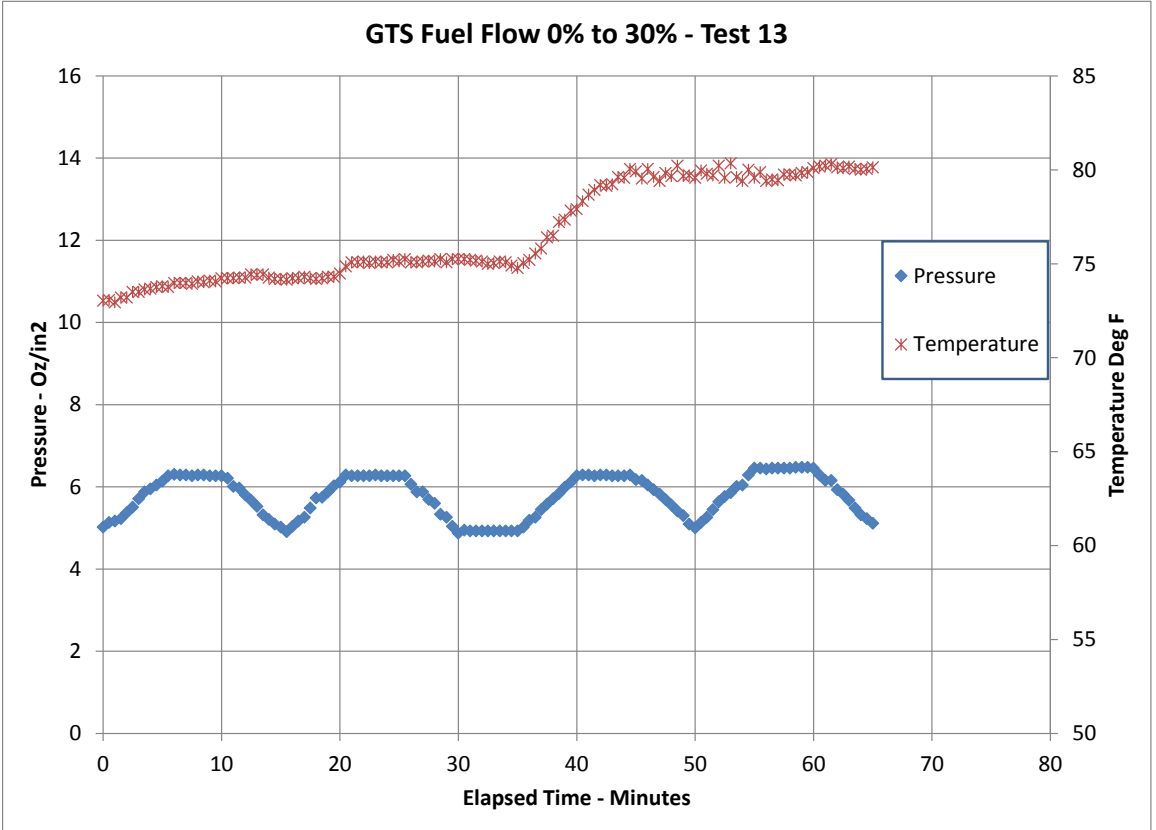
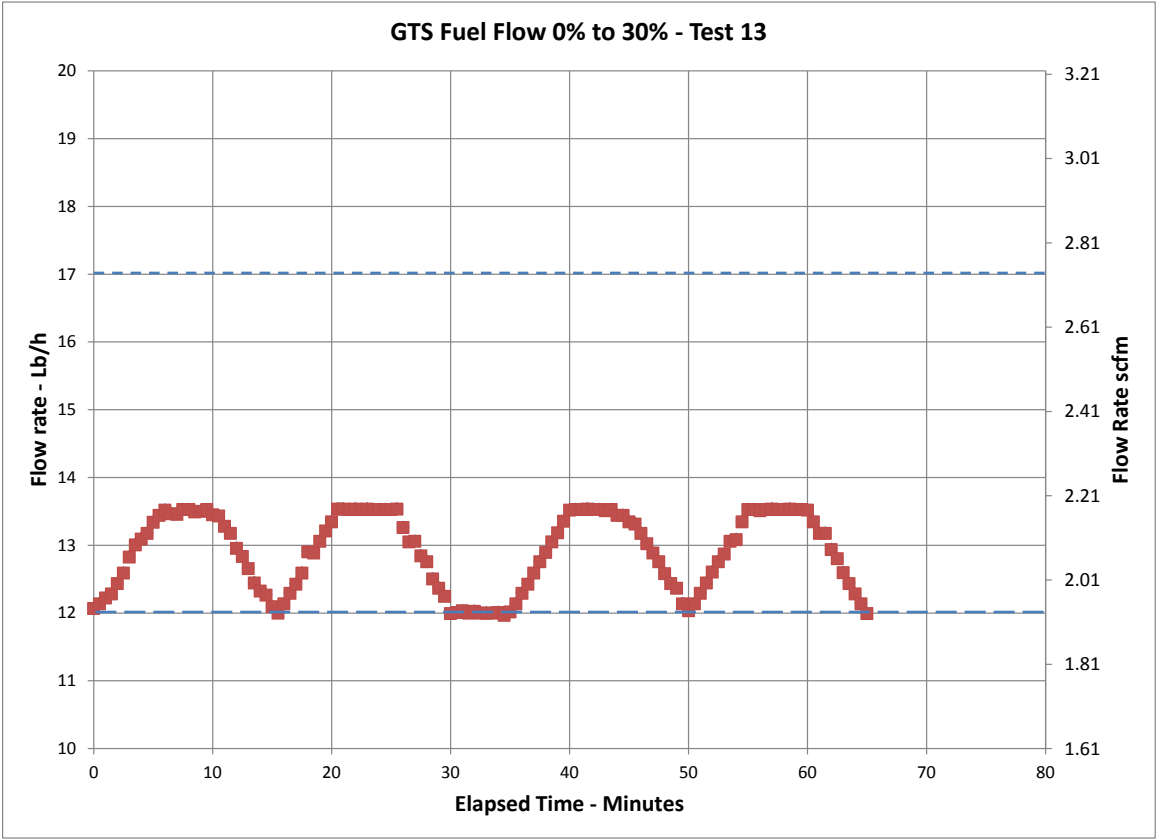
## Appendix A

### Run 1A GTS Fuel Flow 0% to 30% - Test 9

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	16:56:30	46.5	13.0	2.10	70.0	1	5.63
12/11/2014	16:57:00	47.0	12.9	2.07	70.0	1	5.50
12/11/2014	16:57:30	47.5	12.7	2.04	70.0	1	5.32
12/11/2014	16:58:00	48.0	12.5	2.01	70.1	1	5.15
12/11/2014	16:58:30	48.5	12.4	2.00	70.2	1	5.06
12/11/2014	16:59:00	49.0	12.3	1.98	70.3	1	4.94
12/11/2014	16:59:30	49.5	12.2	1.96	70.2	1	4.80
12/11/2014	17:00:00	50.0	12.0	1.93	70.1	1	4.63
12/11/2014	17:00:30	50.5	12.2	1.95	70.2	1	4.80
12/11/2014	17:01:00	51.0	12.3	1.98	70.1	1	4.93
12/11/2014	17:01:30	51.5	12.5	2.00	70.0	1	5.08
12/11/2014	17:02:00	52.0	12.6	2.03	69.9	1	5.22
12/11/2014	17:02:30	52.5	12.7	2.05	69.6	1	5.34
12/11/2014	17:03:00	53.0	12.9	2.08	69.6	1	5.48
12/11/2014	17:03:30	53.5	13.1	2.11	69.8	1	5.63
12/11/2014	17:04:00	54.0	13.3	2.13	69.7	1	5.78
12/11/2014	17:04:30	54.5	13.4	2.15	69.9	1	5.88
12/11/2014	17:05:00	55.0	13.4	2.16	69.9	1	5.99
12/11/2014	17:05:30	55.5	13.5	2.17	70.2	1	6.03
12/11/2014	17:06:00	56.0	13.5	2.18	70.1	1	6.01
12/11/2014	17:06:30	56.5	13.5	2.17	70.2	1	6.01
12/11/2014	17:07:00	57.0	13.5	2.17	70.3	1	6.01
12/11/2014	17:07:30	57.5	13.5	2.16	70.4	1	6.01
12/11/2014	17:08:00	58.0	13.5	2.18	70.5	1	6.01
12/11/2014	17:08:30	58.5	13.5	2.18	70.7	1	6.01
12/11/2014	17:09:00	59.0	13.5	2.18	70.8	1	6.01
12/11/2014	17:09:30	59.5	13.5	2.18	70.9	1	6.01
12/11/2014	17:10:00	60.0	13.5	2.18	70.9	1	5.99
12/11/2014	17:10:30	60.5	13.4	2.15	70.7	1	5.84
12/11/2014	17:11:00	61.0	13.5	2.18	70.6	1	5.56
12/11/2014	17:11:30	61.5	13.0	2.09	70.7	1	5.21
12/11/2014	17:12:00	62.0	12.9	2.08	70.8	1	5.13
12/11/2014	17:12:30	62.5	12.7	2.05	70.8	1	5.02
12/11/2014	17:13:00	63.0	12.5	2.01	70.9	1	4.83
12/11/2014	17:13:30	63.5	12.5	2.01	70.8	1	4.80
12/11/2014	17:14:00	64.0	12.3	1.98	70.8	1	4.65
12/11/2014	17:14:30	64.5	12.2	1.95	70.7	1	4.57
12/11/2014	17:15:00	65.0	12.1	1.94	70.8	1	4.48
12/11/2014	17:15:30	65.5	12.0	1.93	70.5	1	4.48
12/11/2014	17:16:00	66.0	12.0	1.93	70.5	1	4.48

Appendix A

Run 1B



## Appendix A

### Run 1B GTS Fuel Flow 0% to 30% - Test 13

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	13:00:00	0.0	12.1	1.94	73.0	1	5.02
12/12/2014	13:00:30	0.5	12.1	1.95	73.1	1	5.13
12/12/2014	13:01:00	1.0	12.2	1.97	72.9	1	5.17
12/12/2014	13:01:30	1.5	12.3	1.98	73.2	1	5.22
12/12/2014	13:02:00	2.0	12.4	2.00	73.2	1	5.37
12/12/2014	13:02:30	2.5	12.6	2.03	73.5	1	5.50
12/12/2014	13:03:00	3.0	12.8	2.06	73.5	1	5.71
12/12/2014	13:03:30	3.5	13.0	2.09	73.6	1	5.88
12/12/2014	13:04:00	4.0	13.1	2.11	73.7	1	5.95
12/12/2014	13:04:30	4.5	13.2	2.12	73.8	1	6.04
12/12/2014	13:05:00	5.0	13.3	2.15	73.8	1	6.14
12/12/2014	13:05:30	5.5	13.4	2.16	73.8	1	6.27
12/12/2014	13:06:00	6.0	13.5	2.17	74.0	1	6.30
12/12/2014	13:06:30	6.5	13.5	2.17	74.0	1	6.29
12/12/2014	13:07:00	7.0	13.5	2.16	74.0	1	6.29
12/12/2014	13:07:30	7.5	13.5	2.18	73.9	1	6.27
12/12/2014	13:08:00	8.0	13.5	2.18	74.1	1	6.29
12/12/2014	13:08:30	8.5	13.5	2.17	74.0	1	6.29
12/12/2014	13:09:00	9.0	13.5	2.17	74.1	1	6.27
12/12/2014	13:09:30	9.5	13.5	2.18	74.1	1	6.27
12/12/2014	13:10:00	10.0	13.5	2.16	74.2	1	6.27
12/12/2014	13:10:30	10.5	13.4	2.16	74.2	1	6.21
12/12/2014	13:11:00	11.0	13.3	2.14	74.2	1	6.01
12/12/2014	13:11:30	11.5	13.2	2.12	74.3	1	5.97
12/12/2014	13:12:00	12.0	13.0	2.08	74.3	1	5.80
12/12/2014	13:12:30	12.5	12.8	2.06	74.4	1	5.67
12/12/2014	13:13:00	13.0	12.7	2.04	74.4	1	5.52
12/12/2014	13:13:30	13.5	12.5	2.00	74.4	1	5.32
12/12/2014	13:14:00	14.0	12.3	1.98	74.3	1	5.21
12/12/2014	13:14:30	14.5	12.3	1.97	74.2	1	5.09
12/12/2014	13:15:00	15.0	12.1	1.95	74.2	1	5.02
12/12/2014	13:15:30	15.5	12.0	1.93	74.1	1	4.91
12/12/2014	13:16:00	16.0	12.1	1.95	74.2	1	5.04
12/12/2014	13:16:30	16.5	12.3	1.98	74.2	1	5.17
12/12/2014	13:17:00	17.0	12.4	2.00	74.3	1	5.26
12/12/2014	13:17:30	17.5	12.6	2.03	74.2	1	5.48
12/12/2014	13:18:00	18.0	12.9	2.08	74.2	1	5.73
12/12/2014	13:18:30	18.5	12.9	2.07	74.2	1	5.75
12/12/2014	13:19:00	19.0	13.1	2.10	74.3	1	5.88
12/12/2014	13:19:30	19.5	13.2	2.13	74.3	1	6.03
12/12/2014	13:20:00	20.0	13.4	2.15	74.5	1	6.12
12/12/2014	13:20:30	20.5	13.5	2.18	74.9	1	6.29
12/12/2014	13:21:00	21.0	13.5	2.18	75.1	1	6.27
12/12/2014	13:21:30	21.5	13.5	2.18	75.1	1	6.27
12/12/2014	13:22:00	22.0	13.5	2.18	75.1	1	6.27
12/12/2014	13:22:30	22.5	13.5	2.18	75.0	1	6.27
12/12/2014	13:23:00	23.0	13.5	2.18	75.1	1	6.29

## Appendix A

### Run 1B GTS Fuel Flow 0% to 30% - Test 13

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	13:23:30	23.5	13.5	2.18	75.1	1	6.27
12/12/2014	13:24:00	24.0	13.5	2.18	75.1	1	6.27
12/12/2014	13:24:30	24.5	13.5	2.18	75.2	1	6.27
12/12/2014	13:25:00	25.0	13.5	2.18	75.1	1	6.27
12/12/2014	13:25:30	25.5	13.5	2.18	75.3	1	6.27
12/12/2014	13:26:00	26.0	13.3	2.13	75.1	1	6.06
12/12/2014	13:26:30	26.5	13.1	2.10	75.1	1	5.88
12/12/2014	13:27:00	27.0	13.1	2.10	75.1	1	5.88
12/12/2014	13:27:30	27.5	12.9	2.07	75.2	1	5.69
12/12/2014	13:28:00	28.0	12.8	2.05	75.1	1	5.60
12/12/2014	13:28:30	28.5	12.5	2.01	75.3	1	5.34
12/12/2014	13:29:00	29.0	12.4	1.99	75.1	1	5.26
12/12/2014	13:29:30	29.5	12.3	1.97	75.3	1	5.04
12/12/2014	13:30:00	30.0	12.0	1.93	75.3	1	4.87
12/12/2014	13:30:30	30.5	12.0	1.93	75.3	1	4.94
12/12/2014	13:31:00	31.0	12.0	1.94	75.2	1	4.93
12/12/2014	13:31:30	31.5	12.0	1.93	75.2	1	4.93
12/12/2014	13:32:00	32.0	12.0	1.93	75.1	1	4.93
12/12/2014	13:32:30	32.5	12.0	1.93	75.0	1	4.93
12/12/2014	13:33:00	33.0	12.0	1.93	75.0	1	4.93
12/12/2014	13:33:30	33.5	12.0	1.93	75.1	1	4.93
12/12/2014	13:34:00	34.0	12.0	1.93	75.1	1	4.93
12/12/2014	13:34:30	34.5	12.0	1.92	74.9	1	4.93
12/12/2014	13:35:00	35.0	12.0	1.93	74.8	1	4.93
12/12/2014	13:35:30	35.5	12.1	1.95	75.0	1	5.02
12/12/2014	13:36:00	36.0	12.3	1.98	75.2	1	5.19
12/12/2014	13:36:30	36.5	12.4	2.00	75.6	1	5.26
12/12/2014	13:37:00	37.0	12.6	2.03	75.8	1	5.45
12/12/2014	13:37:30	37.5	12.8	2.05	76.4	1	5.58
12/12/2014	13:38:00	38.0	12.9	2.07	76.5	1	5.71
12/12/2014	13:38:30	38.5	13.1	2.10	77.2	1	5.84
12/12/2014	13:39:00	39.0	13.2	2.12	77.3	1	5.99
12/12/2014	13:39:30	39.5	13.4	2.15	77.8	1	6.12
12/12/2014	13:40:00	40.0	13.5	2.17	77.9	1	6.27
12/12/2014	13:40:30	40.5	13.5	2.18	78.3	1	6.29
12/12/2014	13:41:00	41.0	13.5	2.18	78.7	1	6.29
12/12/2014	13:41:30	41.5	13.5	2.18	78.9	1	6.27
12/12/2014	13:42:00	42.0	13.5	2.18	79.2	1	6.29
12/12/2014	13:42:30	42.5	13.5	2.18	79.1	1	6.29
12/12/2014	13:43:00	43.0	13.5	2.17	79.2	1	6.27
12/12/2014	13:43:30	43.5	13.5	2.18	79.6	1	6.27
12/12/2014	13:44:00	44.0	13.4	2.16	79.6	1	6.27
12/12/2014	13:44:30	44.5	13.4	2.16	80.0	1	6.29
12/12/2014	13:45:00	45.0	13.4	2.15	79.9	1	6.17
12/12/2014	13:45:30	45.5	13.3	2.14	79.5	1	6.16
12/12/2014	13:46:00	46.0	13.2	2.12	80.0	1	6.04



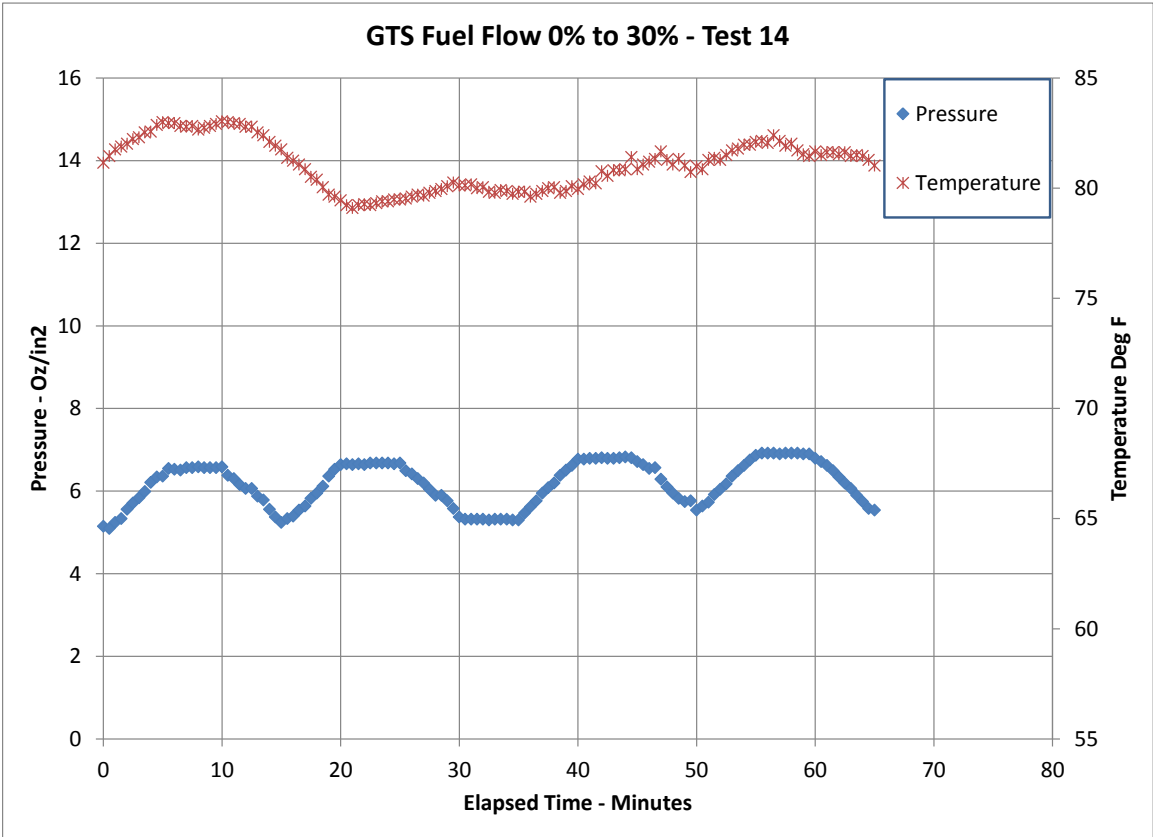
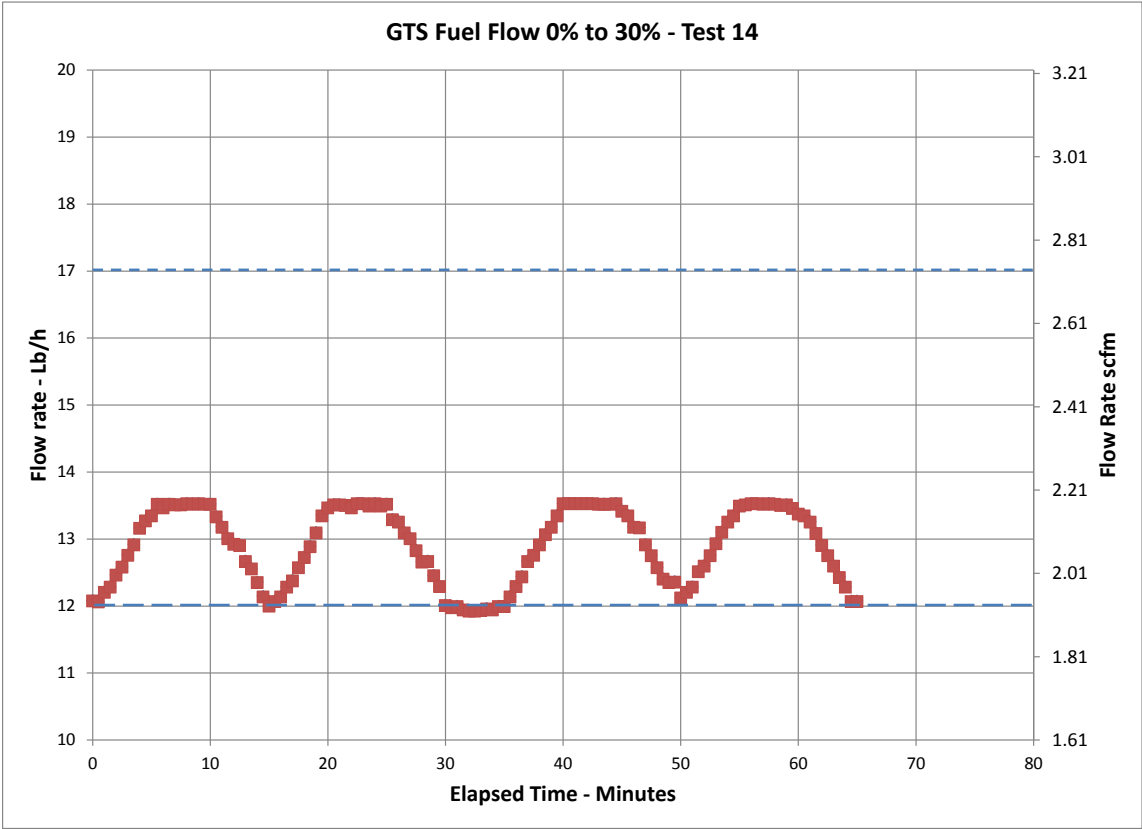
## Appendix A

### Run 1B GTS Fuel Flow 0% to 30% - Test 13

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	13:46:30	46.5	13.0	2.09	79.6	1	5.93
12/12/2014	13:47:00	47.0	12.9	2.07	79.4	1	5.82
12/12/2014	13:47:30	47.5	12.8	2.05	79.8	1	5.69
12/12/2014	13:48:00	48.0	12.6	2.02	79.7	1	5.56
12/12/2014	13:48:30	48.5	12.4	2.00	80.2	1	5.41
12/12/2014	13:49:00	49.0	12.4	1.99	79.7	1	5.30
12/12/2014	13:49:30	49.5	12.1	1.95	79.7	1	5.09
12/12/2014	13:50:00	50.0	12.0	1.94	79.6	1	5.00
12/12/2014	13:50:30	50.5	12.1	1.95	80.0	1	5.13
12/12/2014	13:51:00	51.0	12.3	1.98	79.8	1	5.26
12/12/2014	13:51:30	51.5	12.5	2.00	79.7	1	5.45
12/12/2014	13:52:00	52.0	12.6	2.03	80.2	1	5.63
12/12/2014	13:52:30	52.5	12.8	2.05	79.6	1	5.76
12/12/2014	13:53:00	53.0	12.9	2.07	80.3	1	5.86
12/12/2014	13:53:30	53.5	13.1	2.10	79.6	1	6.01
12/12/2014	13:54:00	54.0	13.1	2.10	79.4	1	6.04
12/12/2014	13:54:30	54.5	13.4	2.15	80.0	1	6.29
12/12/2014	13:55:00	55.0	13.5	2.18	79.6	1	6.45
12/12/2014	13:55:30	55.5	13.5	2.18	79.9	1	6.45
12/12/2014	13:56:00	56.0	13.5	2.17	79.4	1	6.44
12/12/2014	13:56:30	56.5	13.5	2.18	79.5	1	6.45
12/12/2014	13:57:00	57.0	13.5	2.18	79.4	1	6.45
12/12/2014	13:57:30	57.5	13.5	2.18	79.7	1	6.45
12/12/2014	13:58:00	58.0	13.5	2.18	79.7	1	6.45
12/12/2014	13:58:30	58.5	13.5	2.18	79.7	1	6.47
12/12/2014	13:59:00	59.0	13.5	2.18	79.8	1	6.47
12/12/2014	13:59:30	59.5	13.5	2.18	79.9	1	6.47
12/12/2014	14:00:00	60.0	13.5	2.17	80.1	1	6.45
12/12/2014	14:00:30	60.5	13.4	2.15	80.2	1	6.29
12/12/2014	14:01:00	61.0	13.2	2.12	80.2	1	6.16
12/12/2014	14:01:30	61.5	13.2	2.12	80.3	1	6.16
12/12/2014	14:02:00	62.0	12.9	2.08	80.1	1	5.93
12/12/2014	14:02:30	62.5	12.8	2.06	80.1	1	5.82
12/12/2014	14:03:00	63.0	12.6	2.03	80.2	1	5.67
12/12/2014	14:03:30	63.5	12.4	2.00	80.0	1	5.48
12/12/2014	14:04:00	64.0	12.3	1.98	80.0	1	5.32
12/12/2014	14:04:30	64.5	12.1	1.95	80.0	1	5.22
12/12/2014	14:05:00	65.0	12.0	1.93	80.1	1	5.11

Appendix A

Run 1C



## Appendix A

### Run 1C GTS Fuel Flow 0% to 30% - Test 14

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	14:30:00	0.0	12.1	1.94	81.2	1	5.15
12/12/2014	14:30:30	0.5	12.1	1.94	81.5	1	5.09
12/12/2014	14:31:00	1.0	12.2	1.96	81.8	1	5.24
12/12/2014	14:31:30	1.5	12.3	1.98	81.9	1	5.34
12/12/2014	14:32:00	2.0	12.5	2.00	82.0	1	5.56
12/12/2014	14:32:30	2.5	12.6	2.02	82.2	1	5.71
12/12/2014	14:33:00	3.0	12.8	2.05	82.3	1	5.84
12/12/2014	14:33:30	3.5	12.9	2.08	82.5	1	5.99
12/12/2014	14:34:00	4.0	13.2	2.12	82.6	1	6.21
12/12/2014	14:34:30	4.5	13.3	2.13	82.9	1	6.34
12/12/2014	14:35:00	5.0	13.4	2.15	83.0	1	6.36
12/12/2014	14:35:30	5.5	13.5	2.17	83.0	1	6.55
12/12/2014	14:36:00	6.0	13.5	2.17	83.0	1	6.53
12/12/2014	14:36:30	6.5	13.5	2.17	82.8	1	6.51
12/12/2014	14:37:00	7.0	13.5	2.17	82.8	1	6.57
12/12/2014	14:37:30	7.5	13.5	2.17	82.8	1	6.57
12/12/2014	14:38:00	8.0	13.5	2.18	82.7	1	6.58
12/12/2014	14:38:30	8.5	13.5	2.17	82.7	1	6.57
12/12/2014	14:39:00	9.0	13.5	2.18	82.8	1	6.57
12/12/2014	14:39:30	9.5	13.5	2.17	82.9	1	6.57
12/12/2014	14:40:00	10.0	13.5	2.17	83.0	1	6.58
12/12/2014	14:40:30	10.5	13.3	2.14	83.0	1	6.38
12/12/2014	14:41:00	11.0	13.2	2.12	83.0	1	6.30
12/12/2014	14:41:30	11.5	13.0	2.09	82.9	1	6.16
12/12/2014	14:42:00	12.0	12.9	2.08	82.8	1	6.06
12/12/2014	14:42:30	12.5	12.9	2.08	82.8	1	6.06
12/12/2014	14:43:00	13.0	12.7	2.04	82.5	1	5.88
12/12/2014	14:43:30	13.5	12.6	2.02	82.4	1	5.78
12/12/2014	14:44:00	14.0	12.4	1.99	82.1	1	5.56
12/12/2014	14:44:30	14.5	12.1	1.95	81.9	1	5.37
12/12/2014	14:45:00	15.0	12.0	1.93	81.8	1	5.24
12/12/2014	14:45:30	15.5	12.1	1.94	81.4	1	5.34
12/12/2014	14:46:00	16.0	12.1	1.95	81.2	1	5.39
12/12/2014	14:46:30	16.5	12.3	1.98	81.1	1	5.54
12/12/2014	14:47:00	17.0	12.4	1.99	80.9	1	5.63
12/12/2014	14:47:30	17.5	12.6	2.02	80.5	1	5.82
12/12/2014	14:48:00	18.0	12.7	2.05	80.4	1	5.95
12/12/2014	14:48:30	18.5	12.9	2.07	80.0	1	6.12
12/12/2014	14:49:00	19.0	13.1	2.11	79.7	1	6.36
12/12/2014	14:49:30	19.5	13.4	2.15	79.6	1	6.53
12/12/2014	14:50:00	20.0	13.5	2.17	79.4	1	6.64
12/12/2014	14:50:30	20.5	13.5	2.17	79.2	1	6.66
12/12/2014	14:51:00	21.0	13.5	2.17	79.1	1	6.64
12/12/2014	14:51:30	21.5	13.5	2.17	79.2	1	6.66
12/12/2014	14:52:00	22.0	13.5	2.17	79.3	1	6.64
12/12/2014	14:52:30	22.5	13.5	2.18	79.2	1	6.68
12/12/2014	14:53:00	23.0	13.5	2.18	79.3	1	6.68

## Appendix A

### Run 1C GTS Fuel Flow 0% to 30% - Test 14

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	14:53:30	23.5	13.5	2.17	79.4	1	6.68
12/12/2014	14:54:00	24.0	13.5	2.18	79.4	1	6.68
12/12/2014	14:54:30	24.5	13.5	2.17	79.5	1	6.66
12/12/2014	14:55:00	25.0	13.5	2.17	79.5	1	6.68
12/12/2014	14:55:30	25.5	13.3	2.14	79.5	1	6.49
12/12/2014	14:56:00	26.0	13.3	2.13	79.6	1	6.42
12/12/2014	14:56:30	26.5	13.1	2.11	79.7	1	6.30
12/12/2014	14:57:00	27.0	13.0	2.09	79.7	1	6.19
12/12/2014	14:57:30	27.5	12.8	2.06	79.8	1	6.04
12/12/2014	14:58:00	28.0	12.7	2.04	79.9	1	5.89
12/12/2014	14:58:30	28.5	12.7	2.04	80.0	1	5.89
12/12/2014	14:59:00	29.0	12.5	2.00	80.1	1	5.76
12/12/2014	14:59:30	29.5	12.3	1.98	80.3	1	5.58
12/12/2014	15:00:00	30.0	12.0	1.93	80.1	1	5.37
12/12/2014	15:00:30	30.5	12.0	1.93	80.1	1	5.32
12/12/2014	15:01:00	31.0	12.0	1.93	80.2	1	5.32
12/12/2014	15:01:30	31.5	11.9	1.92	80.0	1	5.32
12/12/2014	15:02:00	32.0	11.9	1.92	80.0	1	5.32
12/12/2014	15:02:30	32.5	11.9	1.92	79.8	1	5.30
12/12/2014	15:03:00	33.0	11.9	1.92	79.8	1	5.32
12/12/2014	15:03:30	33.5	12.0	1.92	79.9	1	5.32
12/12/2014	15:04:00	34.0	11.9	1.92	79.9	1	5.32
12/12/2014	15:04:30	34.5	12.0	1.93	79.7	1	5.30
12/12/2014	15:05:00	35.0	12.0	1.93	79.8	1	5.30
12/12/2014	15:05:30	35.5	12.1	1.95	79.8	1	5.47
12/12/2014	15:06:00	36.0	12.3	1.98	79.6	1	5.62
12/12/2014	15:06:30	36.5	12.4	2.00	79.7	1	5.76
12/12/2014	15:07:00	37.0	12.7	2.04	79.9	1	5.95
12/12/2014	15:07:30	37.5	12.8	2.05	80.0	1	6.08
12/12/2014	15:08:00	38.0	12.9	2.08	80.0	1	6.19
12/12/2014	15:08:30	38.5	13.1	2.10	79.8	1	6.38
12/12/2014	15:09:00	39.0	13.2	2.12	79.9	1	6.51
12/12/2014	15:09:30	39.5	13.4	2.15	80.1	1	6.62
12/12/2014	15:10:00	40.0	13.5	2.18	80.0	1	6.77
12/12/2014	15:10:30	40.5	13.5	2.18	80.2	1	6.77
12/12/2014	15:11:00	41.0	13.5	2.18	80.3	1	6.79
12/12/2014	15:11:30	41.5	13.5	2.18	80.2	1	6.79
12/12/2014	15:12:00	42.0	13.5	2.18	80.8	1	6.81
12/12/2014	15:12:30	42.5	13.5	2.18	80.6	1	6.79
12/12/2014	15:13:00	43.0	13.5	2.17	80.8	1	6.79
12/12/2014	15:13:30	43.5	13.5	2.17	80.8	1	6.81
12/12/2014	15:14:00	44.0	13.5	2.17	80.9	1	6.83
12/12/2014	15:14:30	44.5	13.5	2.18	81.4	1	6.81
12/12/2014	15:15:00	45.0	13.4	2.16	80.9	1	6.71
12/12/2014	15:15:30	45.5	13.4	2.15	81.1	1	6.64
12/12/2014	15:16:00	46.0	13.2	2.12	81.2	1	6.55

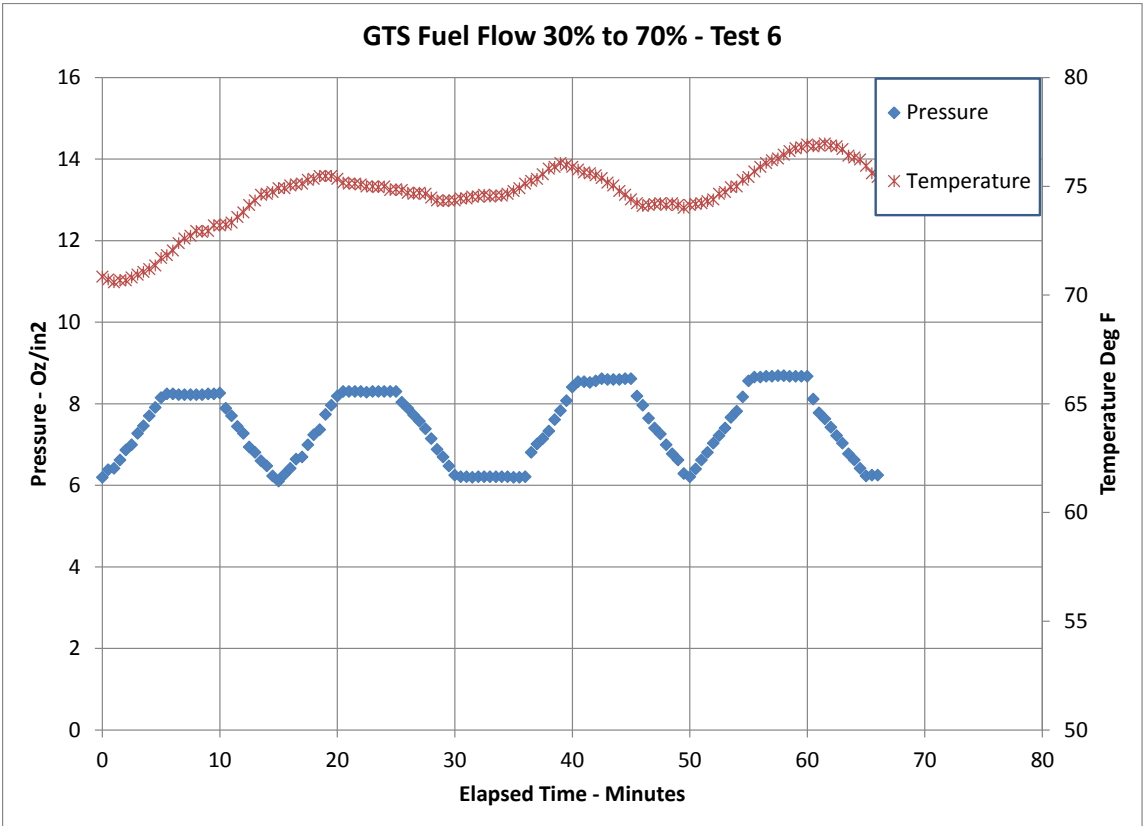
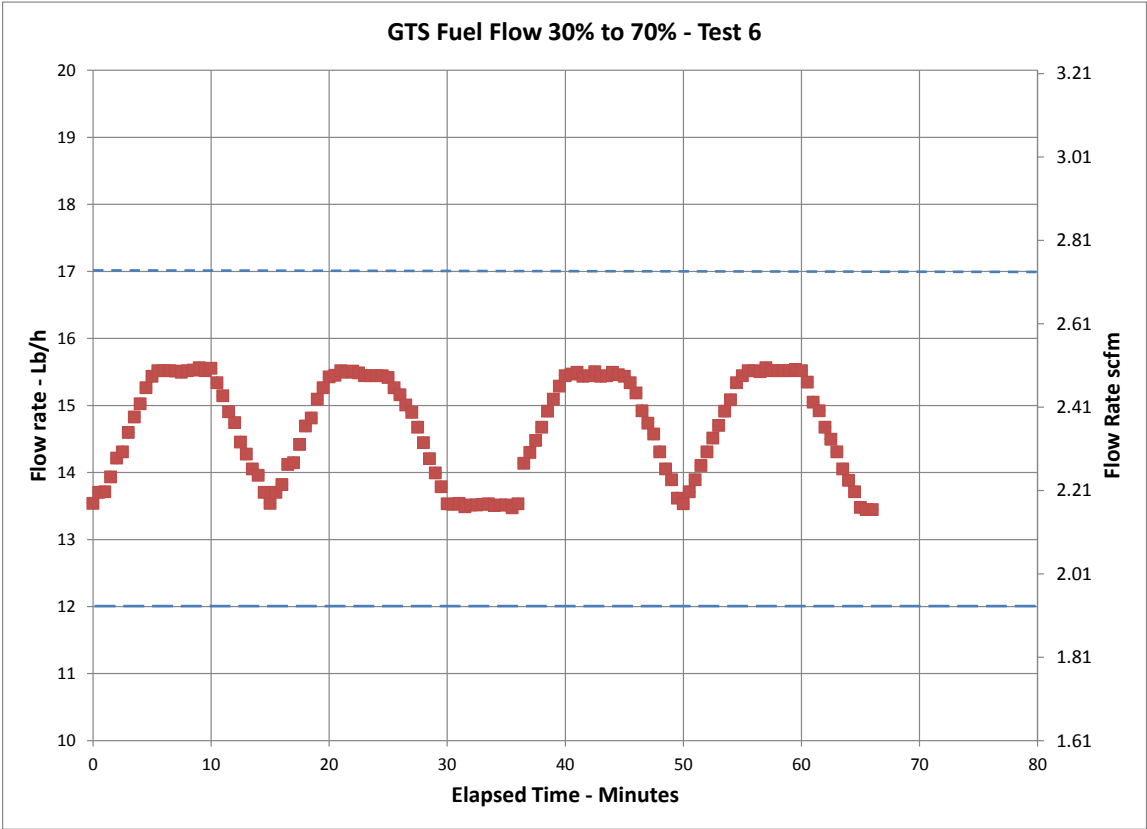
## Appendix A

### Run 1C GTS Fuel Flow 0% to 30% - Test 14

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	15:16:30	46.5	13.2	2.12	81.3	1	6.57
12/12/2014	15:17:00	47.0	12.9	2.08	81.7	1	6.29
12/12/2014	15:17:30	47.5	12.8	2.05	81.3	1	6.10
12/12/2014	15:18:00	48.0	12.6	2.02	81.1	1	5.95
12/12/2014	15:18:30	48.5	12.4	1.99	81.3	1	5.82
12/12/2014	15:19:00	49.0	12.4	1.99	81.0	1	5.75
12/12/2014	15:19:30	49.5	12.4	1.99	80.7	1	5.76
12/12/2014	15:20:00	50.0	12.1	1.95	81.0	1	5.54
12/12/2014	15:20:30	50.5	12.2	1.96	80.9	1	5.63
12/12/2014	15:21:00	51.0	12.3	1.98	81.3	1	5.73
12/12/2014	15:21:30	51.5	12.5	2.01	81.4	1	5.91
12/12/2014	15:22:00	52.0	12.6	2.03	81.3	1	6.04
12/12/2014	15:22:30	52.5	12.8	2.05	81.5	1	6.17
12/12/2014	15:23:00	53.0	12.9	2.08	81.7	1	6.36
12/12/2014	15:23:30	53.5	13.1	2.11	81.8	1	6.49
12/12/2014	15:24:00	54.0	13.3	2.13	82.0	1	6.62
12/12/2014	15:24:30	54.5	13.4	2.15	82.0	1	6.75
12/12/2014	15:25:00	55.0	13.5	2.17	82.1	1	6.86
12/12/2014	15:25:30	55.5	13.5	2.17	82.1	1	6.92
12/12/2014	15:26:00	56.0	13.5	2.18	82.1	1	6.92
12/12/2014	15:26:30	56.5	13.5	2.18	82.4	1	6.92
12/12/2014	15:27:00	57.0	13.5	2.17	82.1	1	6.90
12/12/2014	15:27:30	57.5	13.5	2.18	81.9	1	6.92
12/12/2014	15:28:00	58.0	13.5	2.17	82.0	1	6.92
12/12/2014	15:28:30	58.5	13.5	2.17	81.7	1	6.92
12/12/2014	15:29:00	59.0	13.5	2.17	81.5	1	6.90
12/12/2014	15:29:30	59.5	13.5	2.16	81.5	1	6.90
12/12/2014	15:30:00	60.0	13.4	2.15	81.7	1	6.79
12/12/2014	15:30:30	60.5	13.4	2.15	81.5	1	6.71
12/12/2014	15:31:00	61.0	13.3	2.13	81.6	1	6.62
12/12/2014	15:31:30	61.5	13.1	2.10	81.6	1	6.49
12/12/2014	15:32:00	62.0	12.9	2.08	81.5	1	6.34
12/12/2014	15:32:30	62.5	12.8	2.05	81.6	1	6.19
12/12/2014	15:33:00	63.0	12.6	2.03	81.5	1	6.06
12/12/2014	15:33:30	63.5	12.4	2.00	81.5	1	5.89
12/12/2014	15:34:00	64.0	12.3	1.98	81.5	1	5.75
12/12/2014	15:34:30	64.5	12.1	1.94	81.3	1	5.58
12/12/2014	15:35:00	65.0	12.1	1.94	81.0	1	5.54

Appendix A

Run 2A



## Appendix A

### Run 2A GTS Fuel Flow 30% to 70% - Test 6

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	11:35:00	0.0	13.5	2.18	70.8	1	6.19
12/11/2014	11:35:30	0.5	13.7	2.20	70.7	1	6.38
12/11/2014	11:36:00	1.0	13.7	2.21	70.6	1	6.42
12/11/2014	11:36:30	1.5	13.9	2.24	70.7	1	6.62
12/11/2014	11:37:00	2.0	14.2	2.29	70.7	1	6.86
12/11/2014	11:37:30	2.5	14.3	2.30	70.8	1	6.99
12/11/2014	11:38:00	3.0	14.6	2.35	70.9	1	7.27
12/11/2014	11:38:30	3.5	14.8	2.39	71.1	1	7.46
12/11/2014	11:39:00	4.0	15.0	2.42	71.2	1	7.70
12/11/2014	11:39:30	4.5	15.3	2.46	71.4	1	7.91
12/11/2014	11:40:00	5.0	15.4	2.48	71.7	1	8.15
12/11/2014	11:40:30	5.5	15.5	2.50	71.8	1	8.24
12/11/2014	11:41:00	6.0	15.5	2.50	72.0	1	8.24
12/11/2014	11:41:30	6.5	15.5	2.50	72.4	1	8.22
12/11/2014	11:42:00	7.0	15.5	2.50	72.6	1	8.22
12/11/2014	11:42:30	7.5	15.5	2.49	72.7	1	8.22
12/11/2014	11:43:00	8.0	15.5	2.50	72.9	1	8.22
12/11/2014	11:43:30	8.5	15.5	2.50	72.9	1	8.22
12/11/2014	11:44:00	9.0	15.6	2.50	72.9	1	8.24
12/11/2014	11:44:30	9.5	15.5	2.50	73.2	1	8.24
12/11/2014	11:45:00	10.0	15.6	2.50	73.2	1	8.26
12/11/2014	11:45:30	10.5	15.3	2.47	73.2	1	7.89
12/11/2014	11:46:00	11.0	15.1	2.44	73.3	1	7.70
12/11/2014	11:46:30	11.5	14.9	2.40	73.6	1	7.44
12/11/2014	11:47:00	12.0	14.7	2.37	73.8	1	7.27
12/11/2014	11:47:30	12.5	14.5	2.32	74.1	1	6.94
12/11/2014	11:48:00	13.0	14.3	2.30	74.4	1	6.81
12/11/2014	11:48:30	13.5	14.1	2.26	74.6	1	6.60
12/11/2014	11:49:00	14.0	14.0	2.25	74.7	1	6.47
12/11/2014	11:49:30	14.5	13.7	2.20	74.7	1	6.23
12/11/2014	11:50:00	15.0	13.5	2.18	74.9	1	6.10
12/11/2014	11:50:30	15.5	13.7	2.20	74.9	1	6.27
12/11/2014	11:51:00	16.0	13.8	2.22	75.0	1	6.42
12/11/2014	11:51:30	16.5	14.1	2.27	75.1	1	6.64
12/11/2014	11:52:00	17.0	14.1	2.28	75.1	1	6.70
12/11/2014	11:52:30	17.5	14.4	2.32	75.3	1	6.99
12/11/2014	11:53:00	18.0	14.7	2.36	75.3	1	7.24
12/11/2014	11:53:30	18.5	14.8	2.38	75.5	1	7.37
12/11/2014	11:54:00	19.0	15.1	2.43	75.5	1	7.74
12/11/2014	11:54:30	19.5	15.3	2.46	75.5	1	7.96
12/11/2014	11:55:00	20.0	15.4	2.48	75.3	1	8.19
12/11/2014	11:55:30	20.5	15.5	2.49	75.2	1	8.30
12/11/2014	11:56:00	21.0	15.5	2.50	75.1	1	8.30
12/11/2014	11:56:30	21.5	15.5	2.49	75.1	1	8.30
12/11/2014	11:57:00	22.0	15.5	2.50	75.1	1	8.30
12/11/2014	11:57:30	22.5	15.5	2.49	75.0	1	8.28
12/11/2014	11:58:00	23.0	15.4	2.48	75.0	1	8.30

## Appendix A

### Run 2A GTS Fuel Flow 30% to 70% - Test 6

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	11:58:30	23.5	15.4	2.48	75.0	1	8.30
12/11/2014	11:59:00	24.0	15.4	2.48	75.0	1	8.30
12/11/2014	11:59:30	24.5	15.4	2.48	74.8	1	8.30
12/11/2014	12:00:00	25.0	15.4	2.48	74.9	1	8.30
12/11/2014	12:00:30	25.5	15.3	2.46	74.8	1	8.04
12/11/2014	12:01:00	26.0	15.2	2.44	74.7	1	7.89
12/11/2014	12:01:30	26.5	15.0	2.41	74.7	1	7.72
12/11/2014	12:02:00	27.0	14.9	2.40	74.7	1	7.57
12/11/2014	12:02:30	27.5	14.7	2.36	74.7	1	7.39
12/11/2014	12:03:00	28.0	14.4	2.32	74.5	1	7.14
12/11/2014	12:03:30	28.5	14.2	2.29	74.4	1	6.88
12/11/2014	12:04:00	29.0	14.0	2.25	74.3	1	6.70
12/11/2014	12:04:30	29.5	13.8	2.22	74.4	1	6.47
12/11/2014	12:05:00	30.0	13.5	2.18	74.4	1	6.25
12/11/2014	12:05:30	30.5	13.5	2.18	74.4	1	6.21
12/11/2014	12:06:00	31.0	13.5	2.18	74.4	1	6.21
12/11/2014	12:06:30	31.5	13.5	2.17	74.5	1	6.19
12/11/2014	12:07:00	32.0	13.5	2.17	74.5	1	6.21
12/11/2014	12:07:30	32.5	13.5	2.17	74.6	1	6.21
12/11/2014	12:08:00	33.0	13.5	2.18	74.5	1	6.21
12/11/2014	12:08:30	33.5	13.5	2.18	74.6	1	6.21
12/11/2014	12:09:00	34.0	13.5	2.17	74.6	1	6.21
12/11/2014	12:09:30	34.5	13.5	2.17	74.7	1	6.21
12/11/2014	12:10:00	35.0	13.5	2.17	74.8	1	6.19
12/11/2014	12:10:30	35.5	13.5	2.17	74.9	1	6.19
12/11/2014	12:11:00	36.0	13.5	2.18	75.1	1	6.21
12/11/2014	12:11:30	36.5	14.1	2.27	75.3	1	6.81
12/11/2014	12:12:00	37.0	14.3	2.30	75.3	1	7.01
12/11/2014	12:12:30	37.5	14.5	2.33	75.6	1	7.14
12/11/2014	12:13:00	38.0	14.7	2.36	75.8	1	7.33
12/11/2014	12:13:30	38.5	14.9	2.40	75.9	1	7.61
12/11/2014	12:14:00	39.0	15.1	2.43	76.1	1	7.83
12/11/2014	12:14:30	39.5	15.3	2.46	76.0	1	8.08
12/11/2014	12:15:00	40.0	15.4	2.48	75.9	1	8.41
12/11/2014	12:15:30	40.5	15.5	2.49	75.8	1	8.54
12/11/2014	12:16:00	41.0	15.5	2.49	75.6	1	8.54
12/11/2014	12:16:30	41.5	15.4	2.48	75.6	1	8.52
12/11/2014	12:17:00	42.0	15.4	2.48	75.5	1	8.56
12/11/2014	12:17:30	42.5	15.5	2.49	75.4	1	8.62
12/11/2014	12:18:00	43.0	15.4	2.48	75.2	1	8.60
12/11/2014	12:18:30	43.5	15.4	2.48	75.0	1	8.60
12/11/2014	12:19:00	44.0	15.5	2.49	74.8	1	8.60
12/11/2014	12:19:30	44.5	15.5	2.49	74.6	1	8.62
12/11/2014	12:20:00	45.0	15.4	2.48	74.4	1	8.62
12/11/2014	12:20:30	45.5	15.3	2.47	74.2	1	8.19
12/11/2014	12:21:00	46.0	15.2	2.44	74.1	1	7.96



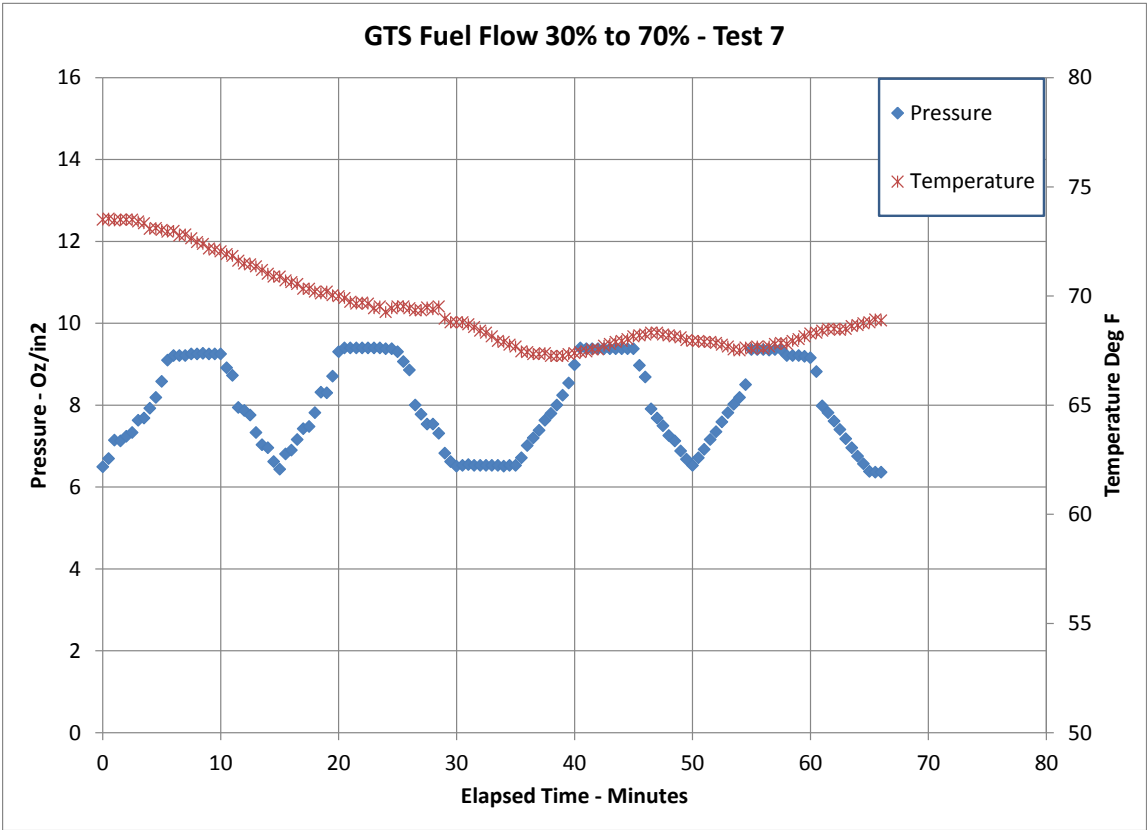
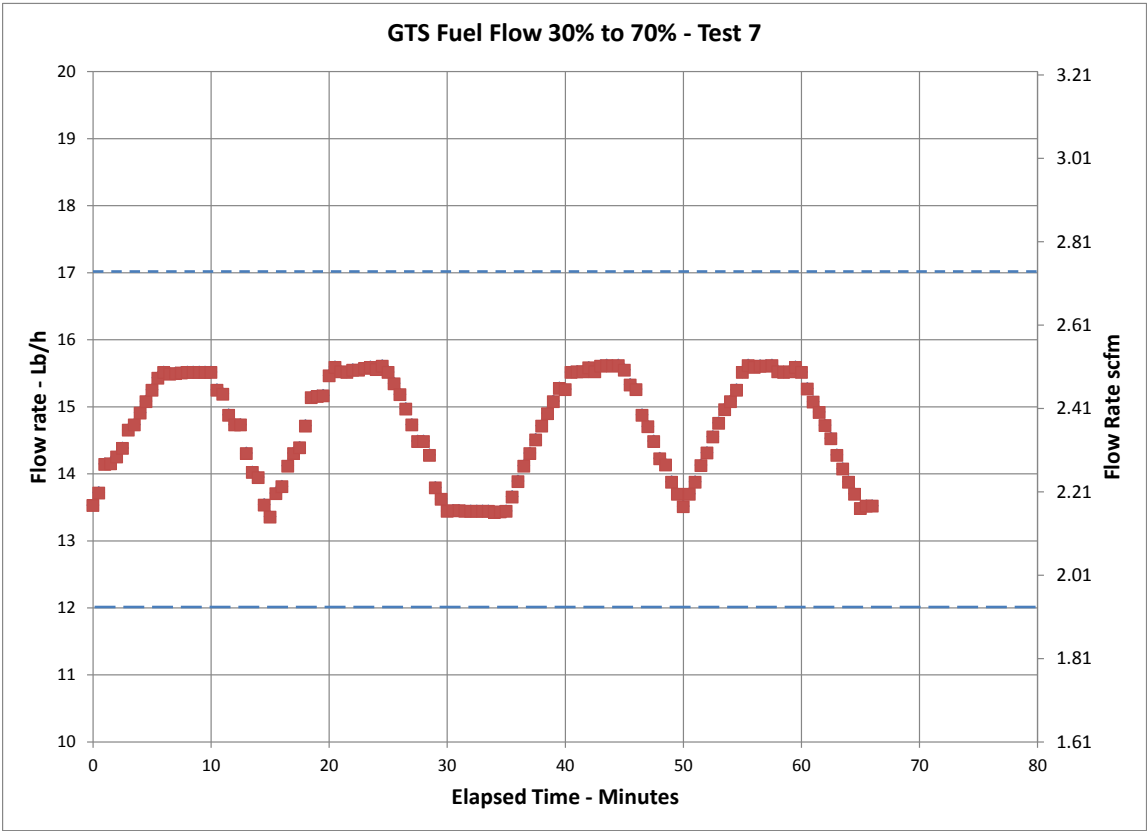
## Appendix A

### Run 2A GTS Fuel Flow 30% to 70% - Test 6

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	12:21:30	46.5	14.9	2.40	74.1	1	7.65
12/11/2014	12:22:00	47.0	14.7	2.37	74.2	1	7.40
12/11/2014	12:22:30	47.5	14.6	2.34	74.2	1	7.26
12/11/2014	12:23:00	48.0	14.3	2.30	74.1	1	6.99
12/11/2014	12:23:30	48.5	14.1	2.26	74.2	1	6.77
12/11/2014	12:24:00	49.0	13.9	2.23	74.1	1	6.62
12/11/2014	12:24:30	49.5	13.6	2.19	74.0	1	6.29
12/11/2014	12:25:00	50.0	13.5	2.18	74.1	1	6.21
12/11/2014	12:25:30	50.5	13.7	2.21	74.2	1	6.40
12/11/2014	12:26:00	51.0	13.9	2.23	74.2	1	6.62
12/11/2014	12:26:30	51.5	14.1	2.27	74.3	1	6.81
12/11/2014	12:27:00	52.0	14.3	2.30	74.4	1	7.03
12/11/2014	12:27:30	52.5	14.5	2.33	74.7	1	7.22
12/11/2014	12:28:00	53.0	14.7	2.36	74.7	1	7.40
12/11/2014	12:28:30	53.5	14.9	2.40	75.0	1	7.67
12/11/2014	12:29:00	54.0	15.1	2.43	75.0	1	7.81
12/11/2014	12:29:30	54.5	15.3	2.47	75.3	1	8.17
12/11/2014	12:30:00	55.0	15.4	2.48	75.4	1	8.56
12/11/2014	12:30:30	55.5	15.5	2.50	75.7	1	8.65
12/11/2014	12:31:00	56.0	15.5	2.50	75.9	1	8.65
12/11/2014	12:31:30	56.5	15.5	2.49	76.1	1	8.67
12/11/2014	12:32:00	57.0	15.6	2.50	76.2	1	8.67
12/11/2014	12:32:30	57.5	15.5	2.50	76.3	1	8.69
12/11/2014	12:33:00	58.0	15.5	2.50	76.4	1	8.69
12/11/2014	12:33:30	58.5	15.5	2.50	76.6	1	8.67
12/11/2014	12:34:00	59.0	15.5	2.50	76.7	1	8.67
12/11/2014	12:34:30	59.5	15.5	2.50	76.8	1	8.67
12/11/2014	12:35:00	60.0	15.5	2.50	76.9	1	8.67
12/11/2014	12:35:30	60.5	15.3	2.47	76.8	1	8.11
12/11/2014	12:36:00	61.0	15.1	2.42	76.9	1	7.78
12/11/2014	12:36:30	61.5	14.9	2.40	77.0	1	7.63
12/11/2014	12:37:00	62.0	14.7	2.36	76.9	1	7.42
12/11/2014	12:37:30	62.5	14.5	2.33	76.8	1	7.22
12/11/2014	12:38:00	63.0	14.3	2.30	76.7	1	7.03
12/11/2014	12:38:30	63.5	14.1	2.26	76.4	1	6.77
12/11/2014	12:39:00	64.0	13.9	2.23	76.3	1	6.62
12/11/2014	12:39:30	64.5	13.7	2.21	76.2	1	6.42
12/11/2014	12:40:00	65.0	13.5	2.17	75.9	1	6.23
12/11/2014	12:40:30	65.5	13.4	2.16	75.6	1	6.25
12/11/2014	12:41:00	66.0	13.4	2.16	75.4	1	6.25

Appendix A

Run 2B



## Appendix A

### Run 2B GTS Fuel Flow 30% to 70% - Test 7

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	13:05:00	0.0	13.5	2.18	73.5	1	6.49
12/11/2014	13:05:30	0.5	13.7	2.21	73.5	1	6.70
12/11/2014	13:06:00	1.0	14.1	2.27	73.5	1	7.14
12/11/2014	13:06:30	1.5	14.2	2.28	73.5	1	7.12
12/11/2014	13:07:00	2.0	14.3	2.29	73.5	1	7.24
12/11/2014	13:07:30	2.5	14.4	2.31	73.5	1	7.33
12/11/2014	13:08:00	3.0	14.7	2.36	73.4	1	7.63
12/11/2014	13:08:30	3.5	14.7	2.37	73.3	1	7.68
12/11/2014	13:09:00	4.0	14.9	2.40	73.1	1	7.93
12/11/2014	13:09:30	4.5	15.1	2.43	73.1	1	8.19
12/11/2014	13:10:00	5.0	15.3	2.45	73.0	1	8.58
12/11/2014	13:10:30	5.5	15.4	2.48	72.9	1	9.10
12/11/2014	13:11:00	6.0	15.5	2.50	73.0	1	9.21
12/11/2014	13:11:30	6.5	15.5	2.49	72.8	1	9.21
12/11/2014	13:12:00	7.0	15.5	2.49	72.8	1	9.21
12/11/2014	13:12:30	7.5	15.5	2.49	72.6	1	9.25
12/11/2014	13:13:00	8.0	15.5	2.50	72.5	1	9.25
12/11/2014	13:13:30	8.5	15.5	2.50	72.4	1	9.27
12/11/2014	13:14:00	9.0	15.5	2.50	72.2	1	9.25
12/11/2014	13:14:30	9.5	15.5	2.50	72.1	1	9.25
12/11/2014	13:15:00	10.0	15.5	2.50	72.0	1	9.25
12/11/2014	13:15:30	10.5	15.3	2.45	71.9	1	8.91
12/11/2014	13:16:00	11.0	15.2	2.44	71.8	1	8.73
12/11/2014	13:16:30	11.5	14.9	2.39	71.6	1	7.94
12/11/2014	13:17:00	12.0	14.7	2.37	71.5	1	7.87
12/11/2014	13:17:30	12.5	14.7	2.37	71.4	1	7.76
12/11/2014	13:18:00	13.0	14.3	2.30	71.4	1	7.33
12/11/2014	13:18:30	13.5	14.0	2.26	71.2	1	7.03
12/11/2014	13:19:00	14.0	14.0	2.24	71.0	1	6.96
12/11/2014	13:19:30	14.5	13.5	2.18	70.9	1	6.62
12/11/2014	13:20:00	15.0	13.4	2.15	70.9	1	6.44
12/11/2014	13:20:30	15.5	13.7	2.20	70.7	1	6.81
12/11/2014	13:21:00	16.0	13.8	2.22	70.6	1	6.90
12/11/2014	13:21:30	16.5	14.1	2.27	70.5	1	7.16
12/11/2014	13:22:00	17.0	14.3	2.30	70.3	1	7.42
12/11/2014	13:22:30	17.5	14.4	2.31	70.3	1	7.48
12/11/2014	13:23:00	18.0	14.7	2.37	70.2	1	7.81
12/11/2014	13:23:30	18.5	15.1	2.43	70.1	1	8.32
12/11/2014	13:24:00	19.0	15.2	2.44	70.2	1	8.30
12/11/2014	13:24:30	19.5	15.2	2.44	70.0	1	8.71
12/11/2014	13:25:00	20.0	15.5	2.49	70.0	1	9.30
12/11/2014	13:25:30	20.5	15.6	2.51	69.9	1	9.40
12/11/2014	13:26:00	21.0	15.5	2.50	69.7	1	9.40
12/11/2014	13:26:30	21.5	15.5	2.50	69.6	1	9.40
12/11/2014	13:27:00	22.0	15.6	2.50	69.7	1	9.40
12/11/2014	13:27:30	22.5	15.6	2.50	69.6	1	9.40
12/11/2014	13:28:00	23.0	15.6	2.50	69.4	1	9.40

## Appendix A

### Run 2B GTS Fuel Flow 30% to 70% - Test 7

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	13:28:30	23.5	15.6	2.51	69.5	1	9.40
12/11/2014	13:29:00	24.0	15.6	2.50	69.3	1	9.38
12/11/2014	13:29:30	24.5	15.6	2.51	69.4	1	9.38
12/11/2014	13:30:00	25.0	15.5	2.50	69.5	1	9.30
12/11/2014	13:30:30	25.5	15.3	2.47	69.5	1	9.06
12/11/2014	13:31:00	26.0	15.2	2.44	69.4	1	8.86
12/11/2014	13:31:30	26.5	15.0	2.41	69.3	1	8.00
12/11/2014	13:32:00	27.0	14.7	2.37	69.3	1	7.78
12/11/2014	13:32:30	27.5	14.5	2.33	69.5	1	7.53
12/11/2014	13:33:00	28.0	14.5	2.33	69.4	1	7.53
12/11/2014	13:33:30	28.5	14.3	2.30	69.5	1	7.31
12/11/2014	13:34:00	29.0	13.8	2.22	69.0	1	6.83
12/11/2014	13:34:30	29.5	13.6	2.19	68.8	1	6.62
12/11/2014	13:35:00	30.0	13.4	2.16	68.8	1	6.51
12/11/2014	13:35:30	30.5	13.5	2.16	68.8	1	6.53
12/11/2014	13:36:00	31.0	13.5	2.16	68.7	1	6.55
12/11/2014	13:36:30	31.5	13.4	2.16	68.6	1	6.53
12/11/2014	13:37:00	32.0	13.4	2.16	68.4	1	6.53
12/11/2014	13:37:30	32.5	13.4	2.16	68.3	1	6.53
12/11/2014	13:38:00	33.0	13.4	2.16	68.2	1	6.53
12/11/2014	13:38:30	33.5	13.4	2.16	67.9	1	6.53
12/11/2014	13:39:00	34.0	13.4	2.16	67.9	1	6.51
12/11/2014	13:39:30	34.5	13.4	2.16	67.8	1	6.53
12/11/2014	13:40:00	35.0	13.4	2.16	67.7	1	6.53
12/11/2014	13:40:30	35.5	13.7	2.20	67.5	1	6.71
12/11/2014	13:41:00	36.0	13.9	2.23	67.4	1	7.01
12/11/2014	13:41:30	36.5	14.1	2.27	67.3	1	7.20
12/11/2014	13:42:00	37.0	14.3	2.30	67.3	1	7.39
12/11/2014	13:42:30	37.5	14.5	2.33	67.4	1	7.63
12/11/2014	13:43:00	38.0	14.7	2.37	67.3	1	7.80
12/11/2014	13:43:30	38.5	14.9	2.40	67.3	1	8.00
12/11/2014	13:44:00	39.0	15.1	2.43	67.3	1	8.24
12/11/2014	13:44:30	39.5	15.3	2.46	67.3	1	8.54
12/11/2014	13:45:00	40.0	15.3	2.45	67.4	1	8.99
12/11/2014	13:45:30	40.5	15.5	2.50	67.4	1	9.40
12/11/2014	13:46:00	41.0	15.5	2.50	67.5	1	9.38
12/11/2014	13:46:30	41.5	15.5	2.50	67.6	1	9.38
12/11/2014	13:47:00	42.0	15.6	2.51	67.6	1	9.38
12/11/2014	13:47:30	42.5	15.5	2.50	67.7	1	9.38
12/11/2014	13:48:00	43.0	15.6	2.51	67.8	1	9.38
12/11/2014	13:48:30	43.5	15.6	2.51	67.9	1	9.38
12/11/2014	13:49:00	44.0	15.6	2.51	67.9	1	9.38
12/11/2014	13:49:30	44.5	15.6	2.51	68.0	1	9.38
12/11/2014	13:50:00	45.0	15.6	2.50	68.2	1	9.38
12/11/2014	13:50:30	45.5	15.3	2.47	68.2	1	8.97
12/11/2014	13:51:00	46.0	15.3	2.45	68.2	1	8.69

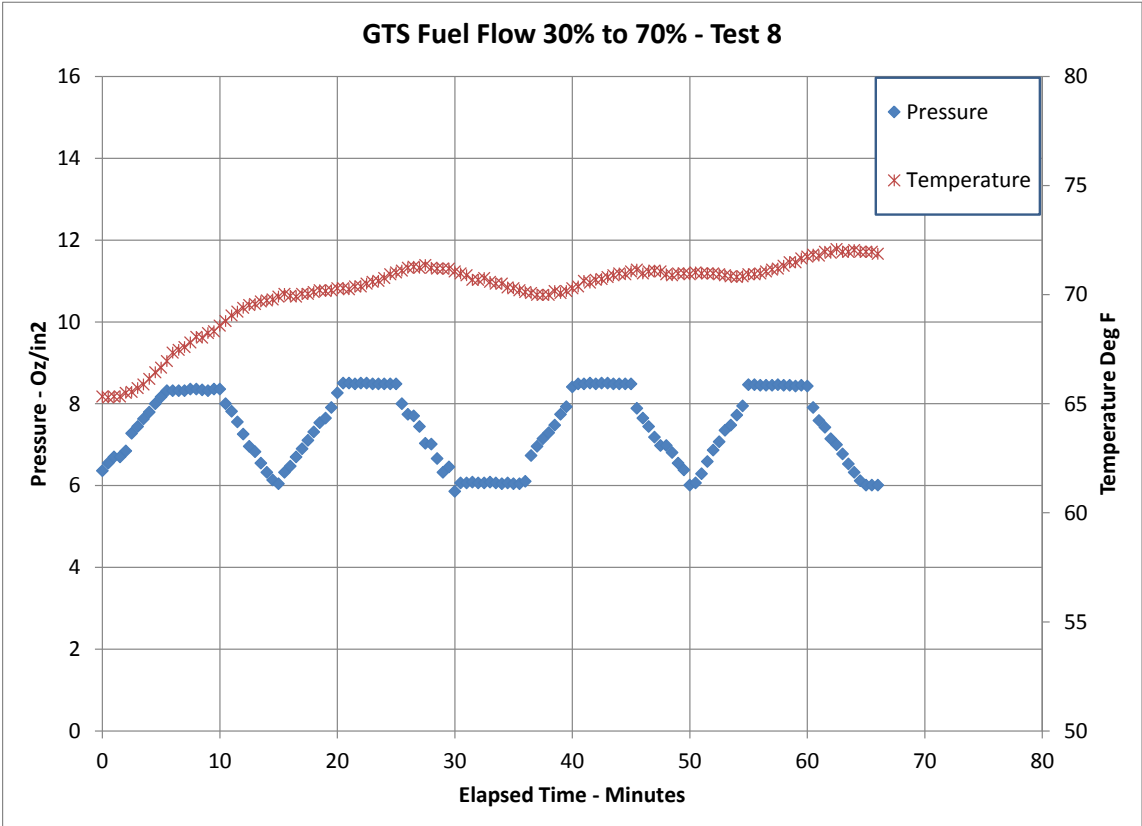
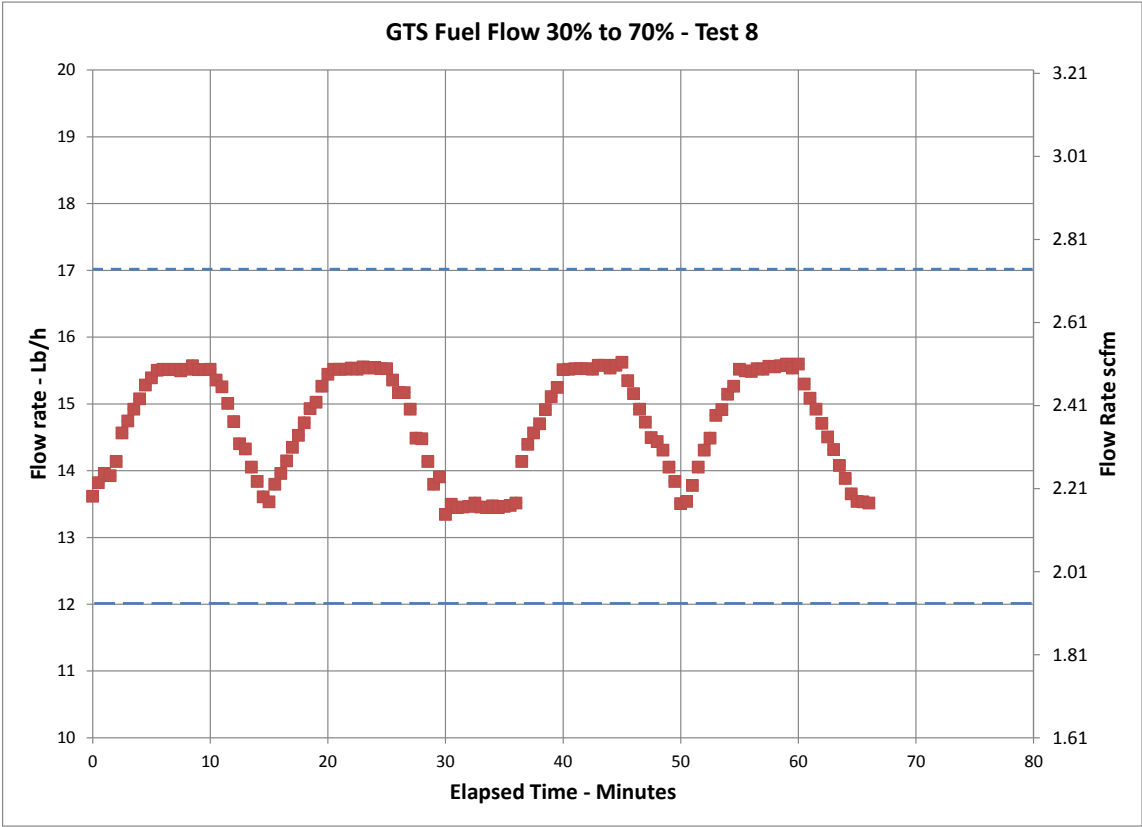
## Appendix A

### Run 2B GTS Fuel Flow 30% to 70% - Test 7

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	13:51:30	46.5	14.9	2.39	68.3	1	7.91
12/11/2014	13:52:00	47.0	14.7	2.36	68.3	1	7.68
12/11/2014	13:52:30	47.5	14.5	2.33	68.2	1	7.50
12/11/2014	13:53:00	48.0	14.2	2.29	68.2	1	7.26
12/11/2014	13:53:30	48.5	14.1	2.27	68.2	1	7.12
12/11/2014	13:54:00	49.0	13.9	2.23	68.1	1	6.88
12/11/2014	13:54:30	49.5	13.7	2.20	68.0	1	6.68
12/11/2014	13:55:00	50.0	13.5	2.17	67.9	1	6.53
12/11/2014	13:55:30	50.5	13.7	2.20	67.9	1	6.71
12/11/2014	13:56:00	51.0	13.9	2.23	67.9	1	6.92
12/11/2014	13:56:30	51.5	14.1	2.27	67.9	1	7.16
12/11/2014	13:57:00	52.0	14.3	2.30	67.9	1	7.35
12/11/2014	13:57:30	52.5	14.6	2.34	67.8	1	7.59
12/11/2014	13:58:00	53.0	14.8	2.37	67.7	1	7.81
12/11/2014	13:58:30	53.5	15.0	2.41	67.6	1	8.02
12/11/2014	13:59:00	54.0	15.1	2.43	67.5	1	8.19
12/11/2014	13:59:30	54.5	15.3	2.45	67.6	1	8.50
12/11/2014	14:00:00	55.0	15.5	2.50	67.6	1	9.36
12/11/2014	14:00:30	55.5	15.6	2.51	67.7	1	9.36
12/11/2014	14:01:00	56.0	15.6	2.51	67.6	1	9.36
12/11/2014	14:01:30	56.5	15.6	2.51	67.7	1	9.34
12/11/2014	14:02:00	57.0	15.6	2.51	67.8	1	9.36
12/11/2014	14:02:30	57.5	15.6	2.51	67.9	1	9.36
12/11/2014	14:03:00	58.0	15.5	2.50	67.8	1	9.21
12/11/2014	14:03:30	58.5	15.5	2.50	67.9	1	9.21
12/11/2014	14:04:00	59.0	15.5	2.50	68.0	1	9.21
12/11/2014	14:04:30	59.5	15.6	2.51	68.2	1	9.19
12/11/2014	14:05:00	60.0	15.5	2.50	68.3	1	9.16
12/11/2014	14:05:30	60.5	15.3	2.46	68.3	1	8.82
12/11/2014	14:06:00	61.0	15.1	2.42	68.4	1	7.98
12/11/2014	14:06:30	61.5	14.9	2.40	68.5	1	7.81
12/11/2014	14:07:00	62.0	14.7	2.37	68.5	1	7.61
12/11/2014	14:07:30	62.5	14.5	2.34	68.4	1	7.40
12/11/2014	14:08:00	63.0	14.3	2.30	68.5	1	7.18
12/11/2014	14:08:30	63.5	14.1	2.26	68.6	1	6.96
12/11/2014	14:09:00	64.0	13.9	2.23	68.7	1	6.75
12/11/2014	14:09:30	64.5	13.7	2.20	68.7	1	6.57
12/11/2014	14:10:00	65.0	13.5	2.17	68.8	1	6.38
12/11/2014	14:10:30	65.5	13.5	2.17	68.9	1	6.36
12/11/2014	14:11:00	66.0	13.5	2.17	68.9	1	6.36

Appendix A

Run 2C



## Appendix A

### Run 2C GTS Fuel Flow 30% to 70% - Test 8

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	14:40:00	0.0	13.6	2.19	65.3	1	6.36
12/11/2014	14:40:30	0.5	13.8	2.22	65.3	1	6.55
12/11/2014	14:41:00	1.0	14.0	2.25	65.3	1	6.70
12/11/2014	14:41:30	1.5	13.9	2.24	65.3	1	6.70
12/11/2014	14:42:00	2.0	14.1	2.27	65.5	1	6.85
12/11/2014	14:42:30	2.5	14.6	2.34	65.5	1	7.27
12/11/2014	14:43:00	3.0	14.7	2.37	65.7	1	7.44
12/11/2014	14:43:30	3.5	14.9	2.40	65.9	1	7.63
12/11/2014	14:44:00	4.0	15.1	2.43	66.1	1	7.80
12/11/2014	14:44:30	4.5	15.3	2.46	66.4	1	8.00
12/11/2014	14:45:00	5.0	15.4	2.48	66.7	1	8.17
12/11/2014	14:45:30	5.5	15.5	2.49	67.0	1	8.32
12/11/2014	14:46:00	6.0	15.5	2.50	67.3	1	8.32
12/11/2014	14:46:30	6.5	15.5	2.50	67.5	1	8.32
12/11/2014	14:47:00	7.0	15.5	2.50	67.6	1	8.32
12/11/2014	14:47:30	7.5	15.5	2.49	67.8	1	8.35
12/11/2014	14:48:00	8.0	15.5	2.50	68.1	1	8.35
12/11/2014	14:48:30	8.5	15.6	2.50	68.0	1	8.34
12/11/2014	14:49:00	9.0	15.5	2.50	68.2	1	8.32
12/11/2014	14:49:30	9.5	15.5	2.50	68.3	1	8.35
12/11/2014	14:50:00	10.0	15.5	2.50	68.6	1	8.35
12/11/2014	14:50:30	10.5	15.4	2.47	68.8	1	8.00
12/11/2014	14:51:00	11.0	15.3	2.45	69.0	1	7.81
12/11/2014	14:51:30	11.5	15.0	2.41	69.2	1	7.55
12/11/2014	14:52:00	12.0	14.7	2.37	69.4	1	7.26
12/11/2014	14:52:30	12.5	14.4	2.32	69.5	1	6.96
12/11/2014	14:53:00	13.0	14.3	2.30	69.6	1	6.83
12/11/2014	14:53:30	13.5	14.1	2.26	69.7	1	6.55
12/11/2014	14:54:00	14.0	13.8	2.23	69.7	1	6.32
12/11/2014	14:54:30	14.5	13.6	2.19	69.8	1	6.14
12/11/2014	14:55:00	15.0	13.5	2.18	69.9	1	6.04
12/11/2014	14:55:30	15.5	13.8	2.22	70.0	1	6.32
12/11/2014	14:56:00	16.0	14.0	2.25	69.9	1	6.47
12/11/2014	14:56:30	16.5	14.1	2.28	69.9	1	6.70
12/11/2014	14:57:00	17.0	14.4	2.31	70.0	1	6.90
12/11/2014	14:57:30	17.5	14.5	2.34	70.0	1	7.11
12/11/2014	14:58:00	18.0	14.7	2.37	70.1	1	7.31
12/11/2014	14:58:30	18.5	14.9	2.40	70.2	1	7.53
12/11/2014	14:59:00	19.0	15.0	2.42	70.2	1	7.65
12/11/2014	14:59:30	19.5	15.3	2.46	70.2	1	7.91
12/11/2014	15:00:00	20.0	15.4	2.48	70.3	1	8.26
12/11/2014	15:00:30	20.5	15.5	2.50	70.3	1	8.50
12/11/2014	15:01:00	21.0	15.5	2.50	70.2	1	8.50
12/11/2014	15:01:30	21.5	15.5	2.50	70.4	1	8.48
12/11/2014	15:02:00	22.0	15.5	2.50	70.4	1	8.50
12/11/2014	15:02:30	22.5	15.5	2.50	70.5	1	8.50
12/11/2014	15:03:00	23.0	15.6	2.50	70.6	1	8.48

## Appendix A

### Run 2C GTS Fuel Flow 30% to 70% - Test 8

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	15:03:30	23.5	15.5	2.50	70.6	1	8.48
12/11/2014	15:04:00	24.0	15.5	2.50	70.8	1	8.48
12/11/2014	15:04:30	24.5	15.5	2.50	70.9	1	8.48
12/11/2014	15:05:00	25.0	15.5	2.50	71.0	1	8.48
12/11/2014	15:05:30	25.5	15.4	2.47	71.1	1	8.00
12/11/2014	15:06:00	26.0	15.2	2.44	71.2	1	7.74
12/11/2014	15:06:30	26.5	15.2	2.44	71.3	1	7.70
12/11/2014	15:07:00	27.0	14.9	2.40	71.2	1	7.44
12/11/2014	15:07:30	27.5	14.5	2.33	71.4	1	7.03
12/11/2014	15:08:00	28.0	14.5	2.33	71.2	1	7.01
12/11/2014	15:08:30	28.5	14.1	2.27	71.2	1	6.66
12/11/2014	15:09:00	29.0	13.8	2.22	71.2	1	6.32
12/11/2014	15:09:30	29.5	13.9	2.24	71.2	1	6.45
12/11/2014	15:10:00	30.0	13.3	2.15	71.1	1	5.86
12/11/2014	15:10:30	30.5	13.5	2.17	71.0	1	6.06
12/11/2014	15:11:00	31.0	13.4	2.16	70.9	1	6.06
12/11/2014	15:11:30	31.5	13.5	2.16	70.7	1	6.08
12/11/2014	15:12:00	32.0	13.5	2.17	70.7	1	6.06
12/11/2014	15:12:30	32.5	13.5	2.17	70.8	1	6.06
12/11/2014	15:13:00	33.0	13.5	2.16	70.6	1	6.08
12/11/2014	15:13:30	33.5	13.4	2.16	70.5	1	6.06
12/11/2014	15:14:00	34.0	13.5	2.17	70.5	1	6.04
12/11/2014	15:14:30	34.5	13.4	2.16	70.3	1	6.06
12/11/2014	15:15:00	35.0	13.5	2.17	70.3	1	6.04
12/11/2014	15:15:30	35.5	13.5	2.17	70.2	1	6.04
12/11/2014	15:16:00	36.0	13.5	2.17	70.1	1	6.10
12/11/2014	15:16:30	36.5	14.1	2.27	70.1	1	6.73
12/11/2014	15:17:00	37.0	14.4	2.32	70.0	1	6.96
12/11/2014	15:17:30	37.5	14.6	2.34	70.0	1	7.14
12/11/2014	15:18:00	38.0	14.7	2.36	70.0	1	7.29
12/11/2014	15:18:30	38.5	14.9	2.40	70.2	1	7.48
12/11/2014	15:19:00	39.0	15.1	2.43	70.1	1	7.74
12/11/2014	15:19:30	39.5	15.2	2.45	70.2	1	7.93
12/11/2014	15:20:00	40.0	15.5	2.50	70.3	1	8.41
12/11/2014	15:20:30	40.5	15.5	2.50	70.4	1	8.48
12/11/2014	15:21:00	41.0	15.5	2.50	70.6	1	8.48
12/11/2014	15:21:30	41.5	15.5	2.50	70.5	1	8.50
12/11/2014	15:22:00	42.0	15.5	2.50	70.7	1	8.48
12/11/2014	15:22:30	42.5	15.5	2.50	70.7	1	8.50
12/11/2014	15:23:00	43.0	15.6	2.51	70.8	1	8.50
12/11/2014	15:23:30	43.5	15.6	2.51	70.9	1	8.48
12/11/2014	15:24:00	44.0	15.5	2.50	71.0	1	8.48
12/11/2014	15:24:30	44.5	15.6	2.51	70.9	1	8.48
12/11/2014	15:25:00	45.0	15.6	2.51	71.1	1	8.48
12/11/2014	15:25:30	45.5	15.3	2.47	71.1	1	7.89
12/11/2014	15:26:00	46.0	15.2	2.44	71.0	1	7.65



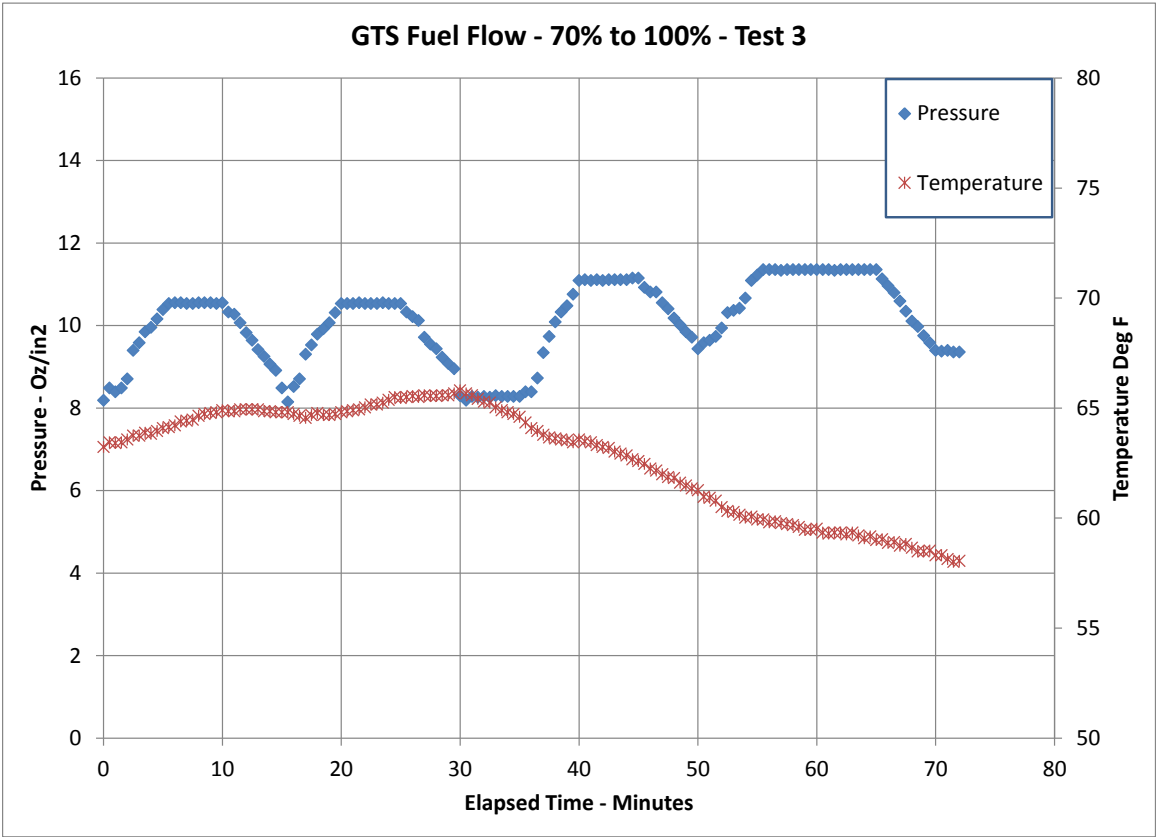
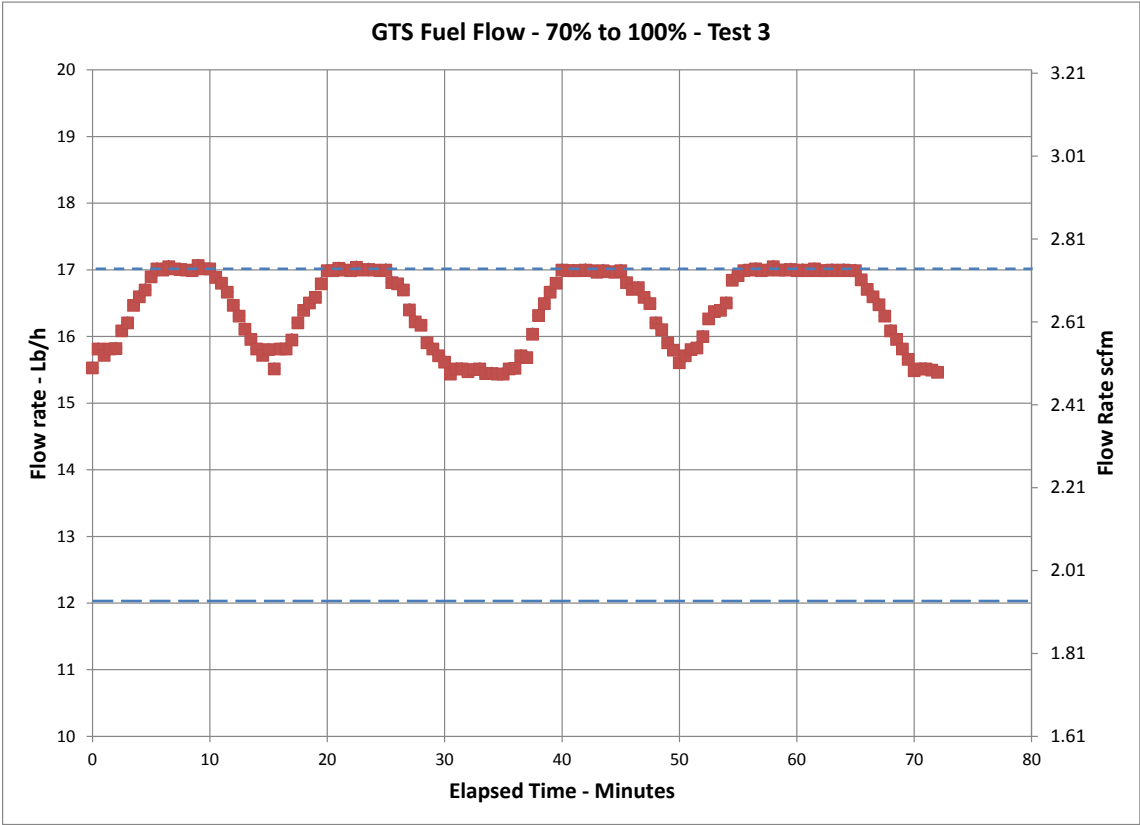
## Appendix A

### Run 2C GTS Fuel Flow 30% to 70% - Test 8

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	15:26:30	46.5	14.9	2.40	71.1	1	7.44
12/11/2014	15:27:00	47.0	14.7	2.37	71.1	1	7.18
12/11/2014	15:27:30	47.5	14.5	2.33	71.1	1	6.98
12/11/2014	15:28:00	48.0	14.4	2.32	70.9	1	6.98
12/11/2014	15:28:30	48.5	14.3	2.30	70.9	1	6.81
12/11/2014	15:29:00	49.0	14.1	2.26	71.0	1	6.55
12/11/2014	15:29:30	49.5	13.8	2.23	71.0	1	6.38
12/11/2014	15:30:00	50.0	13.5	2.17	70.9	1	6.01
12/11/2014	15:30:30	50.5	13.5	2.18	71.0	1	6.06
12/11/2014	15:31:00	51.0	13.8	2.22	71.0	1	6.29
12/11/2014	15:31:30	51.5	14.1	2.26	71.0	1	6.58
12/11/2014	15:32:00	52.0	14.3	2.30	71.0	1	6.86
12/11/2014	15:32:30	52.5	14.5	2.33	70.9	1	7.07
12/11/2014	15:33:00	53.0	14.8	2.39	70.9	1	7.35
12/11/2014	15:33:30	53.5	14.9	2.40	70.8	1	7.48
12/11/2014	15:34:00	54.0	15.1	2.44	70.8	1	7.72
12/11/2014	15:34:30	54.5	15.3	2.46	70.8	1	7.94
12/11/2014	15:35:00	55.0	15.5	2.50	70.9	1	8.47
12/11/2014	15:35:30	55.5	15.5	2.49	70.9	1	8.47
12/11/2014	15:36:00	56.0	15.5	2.49	71.0	1	8.45
12/11/2014	15:36:30	56.5	15.5	2.50	71.1	1	8.45
12/11/2014	15:37:00	57.0	15.5	2.50	71.1	1	8.45
12/11/2014	15:37:30	57.5	15.6	2.50	71.2	1	8.47
12/11/2014	15:38:00	58.0	15.6	2.50	71.3	1	8.45
12/11/2014	15:38:30	58.5	15.6	2.50	71.5	1	8.45
12/11/2014	15:39:00	59.0	15.6	2.51	71.5	1	8.43
12/11/2014	15:39:30	59.5	15.5	2.50	71.7	1	8.45
12/11/2014	15:40:00	60.0	15.6	2.51	71.7	1	8.43
12/11/2014	15:40:30	60.5	15.3	2.46	71.8	1	7.91
12/11/2014	15:41:00	61.0	15.1	2.43	71.8	1	7.59
12/11/2014	15:41:30	61.5	14.9	2.40	72.0	1	7.42
12/11/2014	15:42:00	62.0	14.7	2.37	71.9	1	7.14
12/11/2014	15:42:30	62.5	14.5	2.33	72.1	1	6.99
12/11/2014	15:43:00	63.0	14.3	2.30	72.0	1	6.77
12/11/2014	15:43:30	63.5	14.1	2.26	72.0	1	6.53
12/11/2014	15:44:00	64.0	13.9	2.23	72.0	1	6.32
12/11/2014	15:44:30	64.5	13.7	2.20	72.0	1	6.12
12/11/2014	15:45:00	65.0	13.5	2.18	72.0	1	6.01
12/11/2014	15:45:30	65.5	13.5	2.18	72.0	1	6.01
12/11/2014	15:46:00	66.0	13.5	2.17	71.9	1	6.01

Appendix A

Run 3A



## Appendix A

### Run 3A 70% to 100% Fuel Flow - Test 3

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/10/2014	15:00:00	0.0	15.5	2.50	63.2	1	8.19
12/10/2014	15:00:30	0.5	15.8	2.54	63.4	1	8.48
12/10/2014	15:01:00	1.0	15.7	2.53	63.4	1	8.39
12/10/2014	15:01:30	1.5	15.8	2.54	63.4	1	8.48
12/10/2014	15:02:00	2.0	15.8	2.54	63.6	1	8.71
12/10/2014	15:02:30	2.5	16.1	2.59	63.7	1	9.40
12/10/2014	15:03:00	3.0	16.2	2.61	63.7	1	9.58
12/10/2014	15:03:30	3.5	16.5	2.65	63.9	1	9.85
12/10/2014	15:04:00	4.0	16.6	2.67	63.8	1	9.96
12/10/2014	15:04:30	4.5	16.7	2.69	64.0	1	10.16
12/10/2014	15:05:00	5.0	16.9	2.72	64.1	1	10.39
12/10/2014	15:05:30	5.5	17.0	2.74	64.1	1	10.53
12/10/2014	15:06:00	6.0	17.0	2.73	64.2	1	10.55
12/10/2014	15:06:30	6.5	17.1	2.74	64.4	1	10.55
12/10/2014	15:07:00	7.0	17.0	2.74	64.4	1	10.53
12/10/2014	15:07:30	7.5	17.0	2.74	64.5	1	10.53
12/10/2014	15:08:00	8.0	17.0	2.73	64.6	1	10.55
12/10/2014	15:08:30	8.5	17.0	2.73	64.7	1	10.55
12/10/2014	15:09:00	9.0	17.1	2.74	64.8	1	10.55
12/10/2014	15:09:30	9.5	17.0	2.74	64.8	1	10.53
12/10/2014	15:10:00	10.0	17.0	2.74	64.9	1	10.55
12/10/2014	15:10:30	10.5	16.9	2.72	64.9	1	10.33
12/10/2014	15:11:00	11.0	16.8	2.70	64.9	1	10.27
12/10/2014	15:11:30	11.5	16.7	2.68	64.9	1	10.07
12/10/2014	15:12:00	12.0	16.5	2.65	64.9	1	9.83
12/10/2014	15:12:30	12.5	16.3	2.62	64.9	1	9.64
12/10/2014	15:13:00	13.0	16.1	2.59	64.9	1	9.42
12/10/2014	15:13:30	13.5	16.0	2.57	64.9	1	9.25
12/10/2014	15:14:00	14.0	15.8	2.54	64.9	1	9.06
12/10/2014	15:14:30	14.5	15.7	2.53	64.8	1	8.91
12/10/2014	15:15:00	15.0	15.8	2.54	64.8	1	8.48
12/10/2014	15:15:30	15.5	15.5	2.50	64.8	1	8.15
12/10/2014	15:16:00	16.0	15.8	2.54	64.7	1	8.52
12/10/2014	15:16:30	16.5	15.8	2.54	64.6	1	8.71
12/10/2014	15:17:00	17.0	16.0	2.57	64.6	1	9.30
12/10/2014	15:17:30	17.5	16.2	2.61	64.7	1	9.53
12/10/2014	15:18:00	18.0	16.4	2.64	64.8	1	9.79
12/10/2014	15:18:30	18.5	16.5	2.65	64.7	1	9.92
12/10/2014	15:19:00	19.0	16.6	2.67	64.7	1	10.07
12/10/2014	15:19:30	19.5	16.8	2.70	64.7	1	10.31
12/10/2014	15:20:00	20.0	17.0	2.73	64.8	1	10.53
12/10/2014	15:20:30	20.5	17.0	2.73	64.9	1	10.53
12/10/2014	15:21:00	21.0	17.0	2.74	64.9	1	10.53
12/10/2014	15:21:30	21.5	17.0	2.73	64.9	1	10.55
12/10/2014	15:22:00	22.0	17.0	2.73	65.0	1	10.53
12/10/2014	15:22:30	22.5	17.0	2.74	65.2	1	10.53
12/10/2014	15:23:00	23.0	17.0	2.73	65.2	1	10.53

## Appendix A

### Run 3A 70% to 100% Fuel Flow - Test 3

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/10/2014	15:23:30	23.5	17.0	2.74	65.2	1	10.55
12/10/2014	15:24:00	24.0	17.0	2.73	65.4	1	10.53
12/10/2014	15:24:30	24.5	17.0	2.73	65.5	1	10.53
12/10/2014	15:25:00	25.0	17.0	2.73	65.5	1	10.53
12/10/2014	15:25:30	25.5	16.8	2.70	65.5	1	10.33
12/10/2014	15:26:00	26.0	16.8	2.70	65.5	1	10.22
12/10/2014	15:26:30	26.5	16.7	2.69	65.5	1	10.12
12/10/2014	15:27:00	27.0	16.4	2.64	65.6	1	9.71
12/10/2014	15:27:30	27.5	16.2	2.61	65.5	1	9.55
12/10/2014	15:28:00	28.0	16.2	2.60	65.5	1	9.44
12/10/2014	15:28:30	28.5	15.9	2.56	65.6	1	9.23
12/10/2014	15:29:00	29.0	15.8	2.54	65.6	1	9.08
12/10/2014	15:29:30	29.5	15.7	2.53	65.7	1	8.95
12/10/2014	15:30:00	30.0	15.6	2.51	65.8	1	8.30
12/10/2014	15:30:30	30.5	15.4	2.48	65.7	1	8.19
12/10/2014	15:31:00	31.0	15.5	2.50	65.6	1	8.28
12/10/2014	15:31:30	31.5	15.5	2.50	65.4	1	8.26
12/10/2014	15:32:00	32.0	15.5	2.49	65.3	1	8.28
12/10/2014	15:32:30	32.5	15.5	2.49	65.2	1	8.26
12/10/2014	15:33:00	33.0	15.5	2.50	65.0	1	8.30
12/10/2014	15:33:30	33.5	15.5	2.48	64.9	1	8.28
12/10/2014	15:34:00	34.0	15.5	2.48	64.8	1	8.28
12/10/2014	15:34:30	34.5	15.4	2.48	64.7	1	8.28
12/10/2014	15:35:00	35.0	15.4	2.48	64.6	1	8.28
12/10/2014	15:35:30	35.5	15.5	2.50	64.3	1	8.39
12/10/2014	15:36:00	36.0	15.5	2.50	64.1	1	8.39
12/10/2014	15:36:30	36.5	15.7	2.53	64.0	1	8.73
12/10/2014	15:37:00	37.0	15.7	2.52	63.8	1	9.34
12/10/2014	15:37:30	37.5	16.0	2.58	63.7	1	9.73
12/10/2014	15:38:00	38.0	16.3	2.62	63.6	1	10.09
12/10/2014	15:38:30	38.5	16.5	2.65	63.6	1	10.33
12/10/2014	15:39:00	39.0	16.7	2.68	63.5	1	10.48
12/10/2014	15:39:30	39.5	16.8	2.70	63.4	1	10.76
12/10/2014	15:40:00	40.0	17.0	2.73	63.6	1	11.09
12/10/2014	15:40:30	40.5	17.0	2.73	63.5	1	11.11
12/10/2014	15:41:00	41.0	17.0	2.73	63.4	1	11.09
12/10/2014	15:41:30	41.5	17.0	2.73	63.3	1	11.11
12/10/2014	15:42:00	42.0	17.0	2.73	63.2	1	11.09
12/10/2014	15:42:30	42.5	17.0	2.73	63.2	1	11.11
12/10/2014	15:43:00	43.0	17.0	2.73	63.0	1	11.11
12/10/2014	15:43:30	43.5	17.0	2.73	62.9	1	11.11
12/10/2014	15:44:00	44.0	17.0	2.73	62.8	1	11.11
12/10/2014	15:44:30	44.5	17.0	2.73	62.7	1	11.15
12/10/2014	15:45:00	45.0	17.0	2.73	62.6	1	11.15
12/10/2014	15:45:30	45.5	16.8	2.70	62.5	1	10.93
12/10/2014	15:46:00	46.0	16.7	2.69	62.2	1	10.81

## Appendix A

### Run 3A 70% to 100% Fuel Flow - Test 3

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/10/2014	15:46:30	46.5	16.7	2.69	62.2	1	10.81
12/10/2014	15:47:00	47.0	16.6	2.67	62.0	1	10.55
12/10/2014	15:47:30	47.5	16.5	2.65	61.9	1	10.40
12/10/2014	15:48:00	48.0	16.2	2.61	61.8	1	10.18
12/10/2014	15:48:30	48.5	16.1	2.59	61.6	1	10.01
12/10/2014	15:49:00	49.0	15.9	2.56	61.5	1	9.85
12/10/2014	15:49:30	49.5	15.8	2.54	61.3	1	9.71
12/10/2014	15:50:00	50.0	15.6	2.51	61.3	1	9.44
12/10/2014	15:50:30	50.5	15.7	2.53	61.0	1	9.58
12/10/2014	15:51:00	51.0	15.8	2.54	60.9	1	9.64
12/10/2014	15:51:30	51.5	15.8	2.55	60.8	1	9.73
12/10/2014	15:52:00	52.0	16.0	2.57	60.5	1	9.94
12/10/2014	15:52:30	52.5	16.3	2.62	60.3	1	10.31
12/10/2014	15:53:00	53.0	16.4	2.63	60.3	1	10.37
12/10/2014	15:53:30	53.5	16.4	2.64	60.2	1	10.42
12/10/2014	15:54:00	54.0	16.5	2.65	60.0	1	10.67
12/10/2014	15:54:30	54.5	16.9	2.71	60.1	1	11.09
12/10/2014	15:55:00	55.0	16.9	2.72	59.9	1	11.22
12/10/2014	15:55:30	55.5	17.0	2.73	59.9	1	11.35
12/10/2014	15:56:00	56.0	17.0	2.73	59.8	1	11.35
12/10/2014	15:56:30	56.5	17.0	2.74	59.9	1	11.35
12/10/2014	15:57:00	57.0	17.0	2.73	59.8	1	11.34
12/10/2014	15:57:30	57.5	17.0	2.73	59.7	1	11.35
12/10/2014	15:58:00	58.0	17.1	2.74	59.7	1	11.35
12/10/2014	15:58:30	58.5	17.0	2.73	59.6	1	11.35
12/10/2014	15:59:00	59.0	17.0	2.73	59.5	1	11.35
12/10/2014	15:59:30	59.5	17.0	2.74	59.5	1	11.35
12/10/2014	16:00:00	60.0	17.0	2.73	59.5	1	11.35
12/10/2014	16:00:30	60.5	17.0	2.73	59.3	1	11.35
12/10/2014	16:01:00	61.0	17.0	2.73	59.3	1	11.35
12/10/2014	16:01:30	61.5	17.0	2.74	59.3	1	11.34
12/10/2014	16:02:00	62.0	17.0	2.73	59.3	1	11.35
12/10/2014	16:02:30	62.5	17.0	2.73	59.3	1	11.35
12/10/2014	16:03:00	63.0	17.0	2.73	59.3	1	11.35
12/10/2014	16:03:30	63.5	17.0	2.73	59.2	1	11.35
12/10/2014	16:04:00	64.0	17.0	2.73	59.1	1	11.35
12/10/2014	16:04:30	64.5	17.0	2.73	59.2	1	11.35
12/10/2014	16:05:00	65.0	17.0	2.73	59.0	1	11.35
12/10/2014	16:05:30	65.5	16.9	2.71	59.0	1	11.13
12/10/2014	16:06:00	66.0	16.7	2.69	58.9	1	10.96
12/10/2014	16:06:30	66.5	16.6	2.67	58.9	1	10.80
12/10/2014	16:07:00	67.0	16.5	2.65	58.7	1	10.59
12/10/2014	16:07:30	67.5	16.3	2.62	58.8	1	10.35
12/10/2014	16:08:00	68.0	16.1	2.59	58.7	1	10.11
12/10/2014	16:08:30	68.5	16.0	2.57	58.5	1	9.98
12/10/2014	16:09:00	69.0	15.8	2.54	58.5	1	9.75

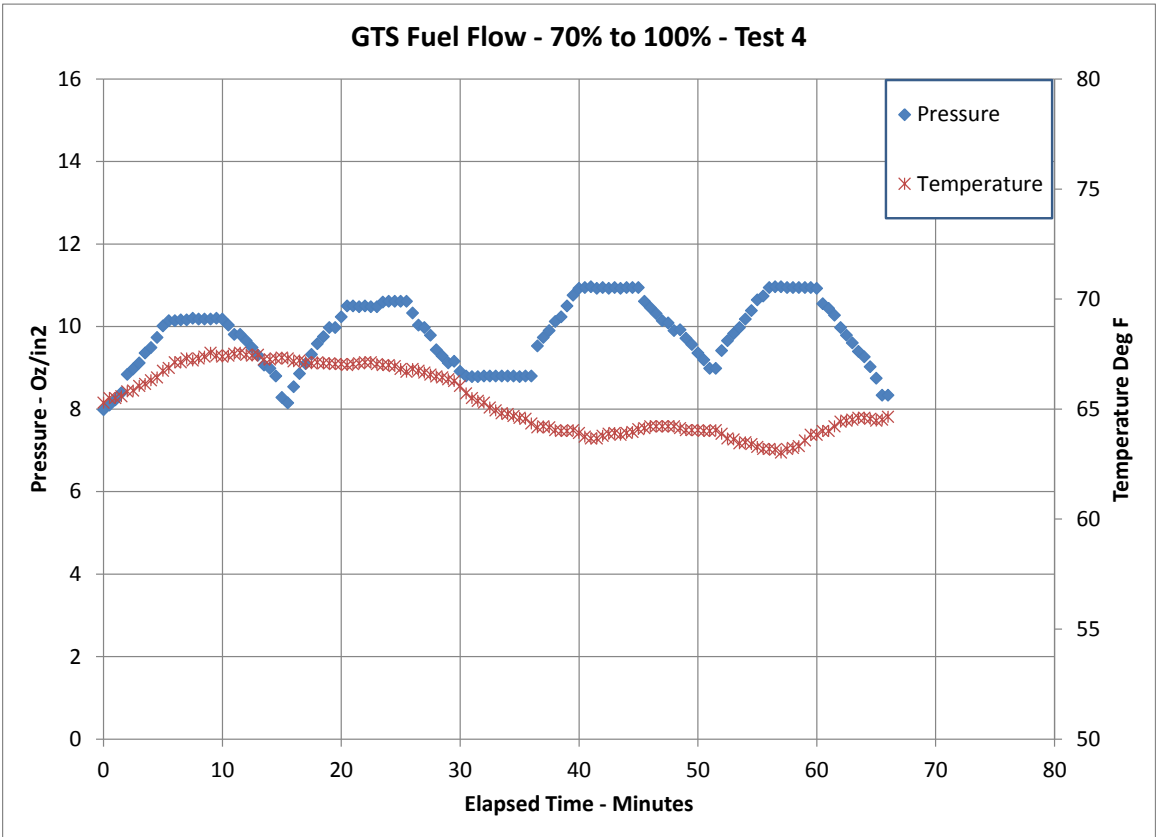
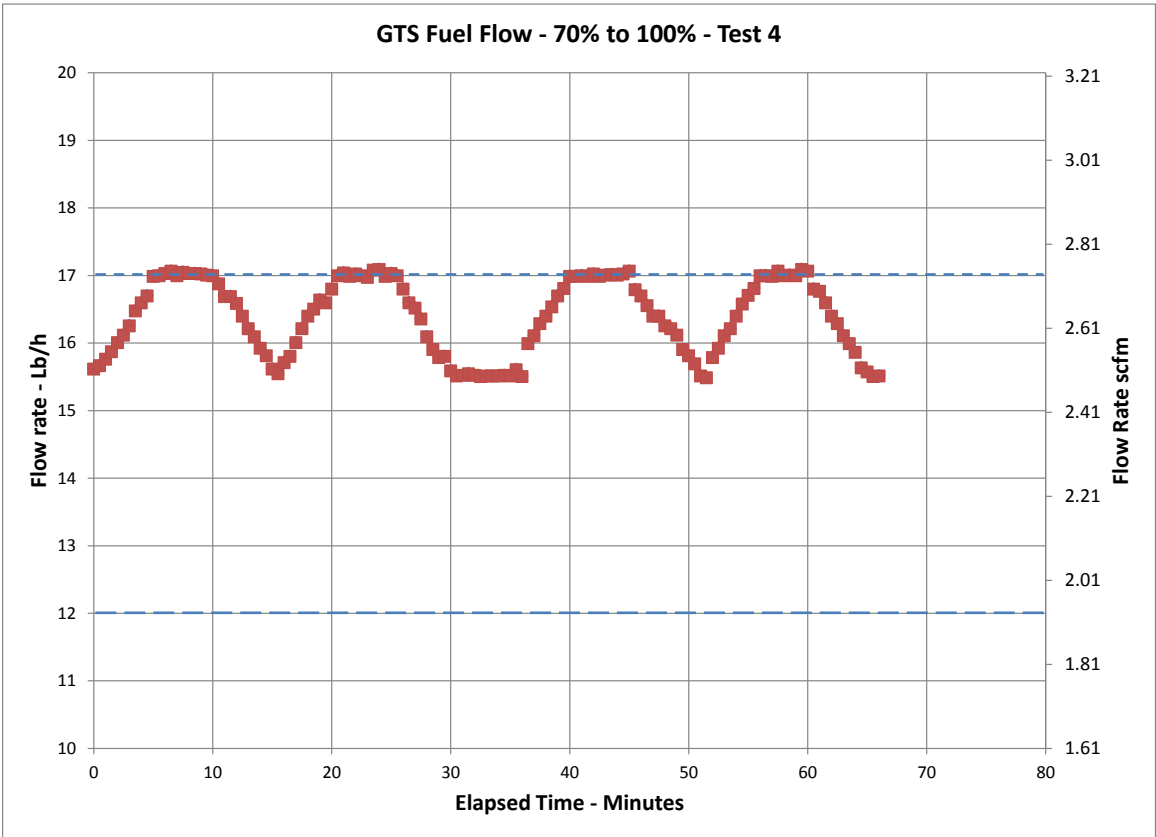
## Appendix A

### Run 3A 70% to 100% Fuel Flow - Test 3

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/10/2014	16:09:30	69.5	15.7	2.52	58.5	1	9.58
12/10/2014	16:10:00	70.0	15.5	2.49	58.3	1	9.40
12/10/2014	16:10:30	70.5	15.5	2.50	58.3	1	9.38
12/10/2014	16:11:00	71.0	15.5	2.50	58.1	1	9.40
12/10/2014	16:11:30	71.5	15.5	2.49	58.0	1	9.36
12/10/2014	16:12:00	72.0	15.5	2.49	58.1	1	9.36

Appendix A

Run 3B



## Appendix A

### Run 3B 70% to 100% Fuel Flow - Test 4

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	8:30:00	0.0	15.6	2.51	65.3	1	7.98
12/11/2014	8:30:30	0.5	15.7	2.52	65.5	1	8.09
12/11/2014	8:31:00	1.0	15.8	2.54	65.5	1	8.22
12/11/2014	8:31:30	1.5	15.9	2.55	65.6	1	8.39
12/11/2014	8:32:00	2.0	16.0	2.57	65.8	1	8.84
12/11/2014	8:32:30	2.5	16.1	2.59	65.8	1	8.97
12/11/2014	8:33:00	3.0	16.3	2.61	66.1	1	9.12
12/11/2014	8:33:30	3.5	16.5	2.65	66.1	1	9.36
12/11/2014	8:34:00	4.0	16.6	2.67	66.3	1	9.49
12/11/2014	8:34:30	4.5	16.7	2.69	66.4	1	9.73
12/11/2014	8:35:00	5.0	17.0	2.73	66.7	1	10.01
12/11/2014	8:35:30	5.5	17.0	2.73	66.9	1	10.14
12/11/2014	8:36:00	6.0	17.0	2.74	67.1	1	10.14
12/11/2014	8:36:30	6.5	17.1	2.74	67.1	1	10.16
12/11/2014	8:37:00	7.0	17.0	2.73	67.3	1	10.16
12/11/2014	8:37:30	7.5	17.1	2.74	67.2	1	10.20
12/11/2014	8:38:00	8.0	17.0	2.74	67.3	1	10.18
12/11/2014	8:38:30	8.5	17.0	2.74	67.4	1	10.18
12/11/2014	8:39:00	9.0	17.0	2.74	67.6	1	10.18
12/11/2014	8:39:30	9.5	17.0	2.74	67.4	1	10.20
12/11/2014	8:40:00	10.0	17.0	2.73	67.4	1	10.18
12/11/2014	8:40:30	10.5	16.9	2.71	67.4	1	10.03
12/11/2014	8:41:00	11.0	16.7	2.68	67.5	1	9.81
12/11/2014	8:41:30	11.5	16.7	2.68	67.6	1	9.81
12/11/2014	8:42:00	12.0	16.6	2.67	67.5	1	9.66
12/11/2014	8:42:30	12.5	16.4	2.64	67.4	1	9.49
12/11/2014	8:43:00	13.0	16.2	2.61	67.5	1	9.30
12/11/2014	8:43:30	13.5	16.1	2.59	67.3	1	9.06
12/11/2014	8:44:00	14.0	15.9	2.56	67.3	1	8.99
12/11/2014	8:44:30	14.5	15.8	2.54	67.3	1	8.80
12/11/2014	8:45:00	15.0	15.6	2.51	67.3	1	8.28
12/11/2014	8:45:30	15.5	15.6	2.50	67.3	1	8.15
12/11/2014	8:46:00	16.0	15.7	2.53	67.2	1	8.54
12/11/2014	8:46:30	16.5	15.8	2.54	67.2	1	8.86
12/11/2014	8:47:00	17.0	16.0	2.57	67.1	1	9.10
12/11/2014	8:47:30	17.5	16.2	2.61	67.1	1	9.32
12/11/2014	8:48:00	18.0	16.4	2.64	67.1	1	9.58
12/11/2014	8:48:30	18.5	16.5	2.65	67.1	1	9.75
12/11/2014	8:49:00	19.0	16.6	2.68	67.1	1	9.98
12/11/2014	8:49:30	19.5	16.6	2.67	67.0	1	9.98
12/11/2014	8:50:00	20.0	16.8	2.70	67.0	1	10.24
12/11/2014	8:50:30	20.5	17.0	2.73	67.0	1	10.50
12/11/2014	8:51:00	21.0	17.0	2.74	67.0	1	10.50
12/11/2014	8:51:30	21.5	17.0	2.73	67.1	1	10.48
12/11/2014	8:52:00	22.0	17.0	2.74	67.1	1	10.50
12/11/2014	8:52:30	22.5	17.0	2.73	67.1	1	10.48
12/11/2014	8:53:00	23.0	17.0	2.73	67.0	1	10.48



## Appendix A

### Run 3B 70% to 100% Fuel Flow - Test 4

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	8:53:30	23.5	17.1	2.75	67.0	1	10.59
12/11/2014	8:54:00	24.0	17.1	2.75	67.0	1	10.61
12/11/2014	8:54:30	24.5	17.0	2.73	67.0	1	10.61
12/11/2014	8:55:00	25.0	17.0	2.74	66.8	1	10.61
12/11/2014	8:55:30	25.5	17.0	2.73	66.7	1	10.61
12/11/2014	8:56:00	26.0	16.8	2.70	66.8	1	10.33
12/11/2014	8:56:30	26.5	16.6	2.67	66.7	1	10.03
12/11/2014	8:57:00	27.0	16.5	2.66	66.7	1	9.98
12/11/2014	8:57:30	27.5	16.4	2.63	66.6	1	9.79
12/11/2014	8:58:00	28.0	16.1	2.59	66.5	1	9.44
12/11/2014	8:58:30	28.5	15.9	2.56	66.4	1	9.29
12/11/2014	8:59:00	29.0	15.8	2.54	66.4	1	9.12
12/11/2014	8:59:30	29.5	15.8	2.54	66.3	1	9.16
12/11/2014	9:00:00	30.0	15.6	2.51	66.1	1	8.91
12/11/2014	9:00:30	30.5	15.5	2.50	65.7	1	8.80
12/11/2014	9:01:00	31.0	15.5	2.50	65.5	1	8.78
12/11/2014	9:01:30	31.5	15.6	2.50	65.4	1	8.78
12/11/2014	9:02:00	32.0	15.5	2.50	65.3	1	8.80
12/11/2014	9:02:30	32.5	15.5	2.49	65.1	1	8.80
12/11/2014	9:03:00	33.0	15.5	2.50	64.9	1	8.80
12/11/2014	9:03:30	33.5	15.5	2.50	64.8	1	8.80
12/11/2014	9:04:00	34.0	15.5	2.50	64.8	1	8.80
12/11/2014	9:04:30	34.5	15.5	2.50	64.7	1	8.80
12/11/2014	9:05:00	35.0	15.5	2.50	64.6	1	8.78
12/11/2014	9:05:30	35.5	15.6	2.51	64.6	1	8.80
12/11/2014	9:06:00	36.0	15.5	2.49	64.3	1	8.80
12/11/2014	9:06:30	36.5	16.0	2.57	64.2	1	9.53
12/11/2014	9:07:00	37.0	16.1	2.59	64.2	1	9.73
12/11/2014	9:07:30	37.5	16.3	2.62	64.2	1	9.90
12/11/2014	9:08:00	38.0	16.4	2.64	64.0	1	10.12
12/11/2014	9:08:30	38.5	16.5	2.66	64.0	1	10.24
12/11/2014	9:09:00	39.0	16.7	2.69	64.0	1	10.50
12/11/2014	9:09:30	39.5	16.8	2.70	64.0	1	10.76
12/11/2014	9:10:00	40.0	17.0	2.73	63.9	1	10.93
12/11/2014	9:10:30	40.5	17.0	2.73	63.7	1	10.94
12/11/2014	9:11:00	41.0	17.0	2.73	63.7	1	10.96
12/11/2014	9:11:30	41.5	17.0	2.73	63.7	1	10.93
12/11/2014	9:12:00	42.0	17.0	2.74	63.8	1	10.94
12/11/2014	9:12:30	42.5	17.0	2.73	63.9	1	10.93
12/11/2014	9:13:00	43.0	17.0	2.74	63.9	1	10.94
12/11/2014	9:13:30	43.5	17.0	2.74	63.8	1	10.93
12/11/2014	9:14:00	44.0	17.0	2.74	63.9	1	10.94
12/11/2014	9:14:30	44.5	17.0	2.74	64.0	1	10.94
12/11/2014	9:15:00	45.0	17.1	2.74	64.1	1	10.94
12/11/2014	9:15:30	45.5	16.8	2.70	64.1	1	10.61
12/11/2014	9:16:00	46.0	16.7	2.69	64.2	1	10.46

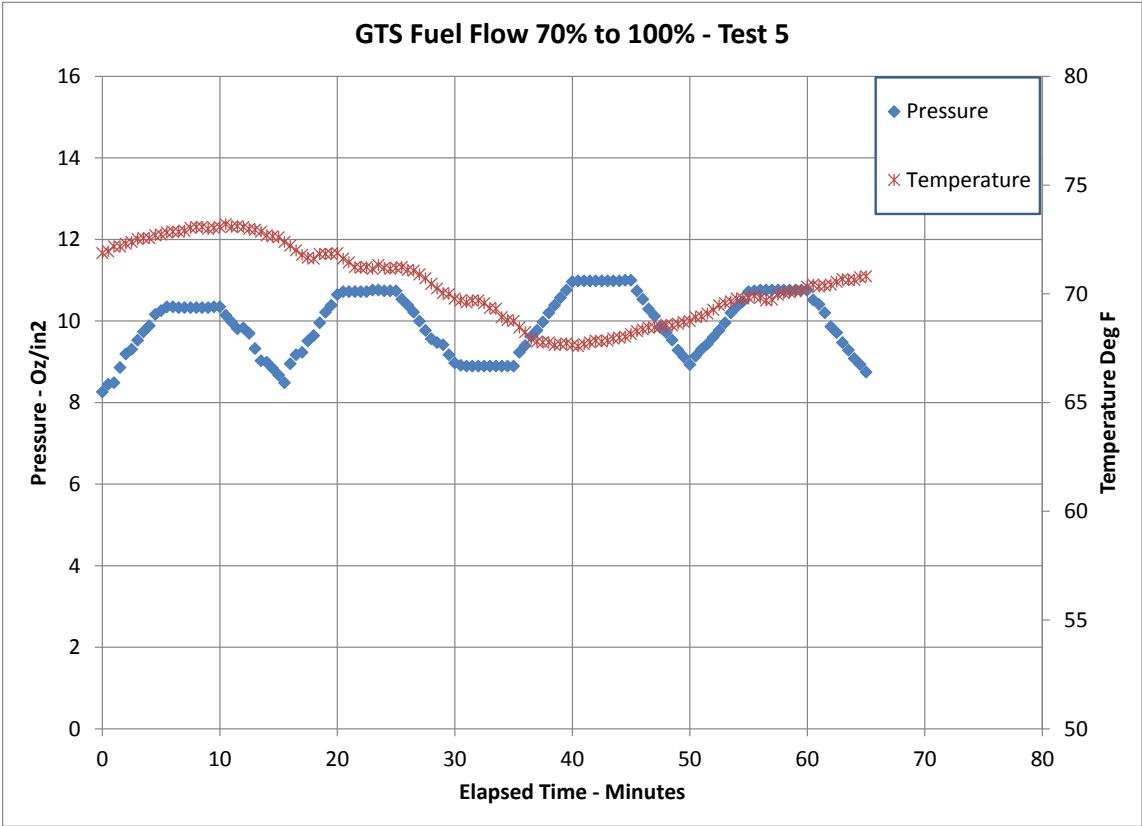
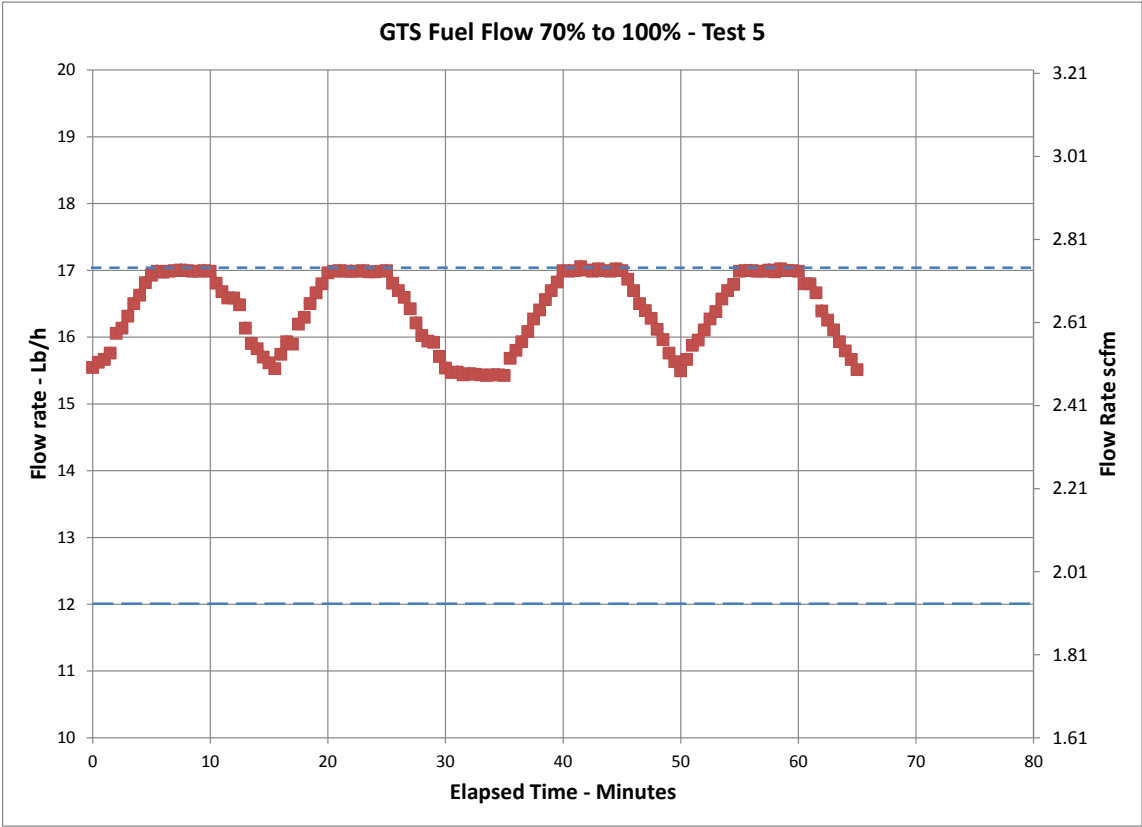
## Appendix A

### Run 3B 70% to 100% Fuel Flow - Test 4

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	9:16:30	46.5	16.6	2.66	64.2	1	10.31
12/11/2014	9:17:00	47.0	16.4	2.64	64.2	1	10.14
12/11/2014	9:17:30	47.5	16.4	2.64	64.2	1	10.09
12/11/2014	9:18:00	48.0	16.3	2.61	64.2	1	9.90
12/11/2014	9:18:30	48.5	16.2	2.61	64.1	1	9.92
12/11/2014	9:19:00	49.0	16.1	2.59	64.0	1	9.71
12/11/2014	9:19:30	49.5	15.9	2.56	64.0	1	9.57
12/11/2014	9:20:00	50.0	15.8	2.54	64.0	1	9.36
12/11/2014	9:20:30	50.5	15.7	2.52	64.0	1	9.19
12/11/2014	9:21:00	51.0	15.5	2.50	64.0	1	8.99
12/11/2014	9:21:30	51.5	15.5	2.49	64.0	1	8.99
12/11/2014	9:22:00	52.0	15.8	2.54	63.9	1	9.42
12/11/2014	9:22:30	52.5	15.9	2.56	63.7	1	9.66
12/11/2014	9:23:00	53.0	16.1	2.59	63.6	1	9.83
12/11/2014	9:23:30	53.5	16.2	2.61	63.4	1	9.98
12/11/2014	9:24:00	54.0	16.4	2.64	63.5	1	10.18
12/11/2014	9:24:30	54.5	16.6	2.67	63.4	1	10.39
12/11/2014	9:25:00	55.0	16.7	2.69	63.3	1	10.65
12/11/2014	9:25:30	55.5	16.8	2.70	63.2	1	10.74
12/11/2014	9:26:00	56.0	17.0	2.73	63.2	1	10.94
12/11/2014	9:26:30	56.5	17.0	2.73	63.1	1	10.96
12/11/2014	9:27:00	57.0	17.0	2.73	63.0	1	10.96
12/11/2014	9:27:30	57.5	17.1	2.74	63.2	1	10.94
12/11/2014	9:28:00	58.0	17.0	2.73	63.2	1	10.94
12/11/2014	9:28:30	58.5	17.0	2.74	63.3	1	10.94
12/11/2014	9:29:00	59.0	17.0	2.73	63.6	1	10.94
12/11/2014	9:29:30	59.5	17.1	2.75	63.8	1	10.94
12/11/2014	9:30:00	60.0	17.1	2.74	63.8	1	10.93
12/11/2014	9:30:30	60.5	16.8	2.70	64.0	1	10.55
12/11/2014	9:31:00	61.0	16.8	2.70	64.0	1	10.44
12/11/2014	9:31:30	61.5	16.6	2.67	64.2	1	10.27
12/11/2014	9:32:00	62.0	16.4	2.64	64.4	1	9.98
12/11/2014	9:32:30	62.5	16.3	2.62	64.5	1	9.79
12/11/2014	9:33:00	63.0	16.1	2.59	64.5	1	9.60
12/11/2014	9:33:30	63.5	16.0	2.57	64.6	1	9.40
12/11/2014	9:34:00	64.0	15.9	2.55	64.6	1	9.27
12/11/2014	9:34:30	64.5	15.6	2.51	64.6	1	9.03
12/11/2014	9:35:00	65.0	15.6	2.50	64.5	1	8.75
12/11/2014	9:35:30	65.5	15.5	2.49	64.5	1	8.34
12/11/2014	9:36:00	66.0	15.5	2.50	64.6	1	8.34

Appendix A

Run 3C



## Appendix A

### Run 3C GTS Fuel Flow 70% to 100% - Test 5

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	10:05:00	0.0	15.6	2.50	71.9	1	8.26
12/11/2014	10:05:30	0.5	15.6	2.51	72.0	1	8.45
12/11/2014	10:06:00	1.0	15.7	2.52	72.2	1	8.48
12/11/2014	10:06:30	1.5	15.8	2.54	72.2	1	8.86
12/11/2014	10:07:00	2.0	16.1	2.58	72.3	1	9.19
12/11/2014	10:07:30	2.5	16.1	2.60	72.4	1	9.30
12/11/2014	10:08:00	3.0	16.3	2.62	72.5	1	9.53
12/11/2014	10:08:30	3.5	16.5	2.65	72.6	1	9.73
12/11/2014	10:09:00	4.0	16.6	2.67	72.6	1	9.88
12/11/2014	10:09:30	4.5	16.8	2.70	72.7	1	10.16
12/11/2014	10:10:00	5.0	16.9	2.72	72.7	1	10.26
12/11/2014	10:10:30	5.5	17.0	2.73	72.8	1	10.35
12/11/2014	10:11:00	6.0	17.0	2.73	72.9	1	10.35
12/11/2014	10:11:30	6.5	17.0	2.73	72.9	1	10.33
12/11/2014	10:12:00	7.0	17.0	2.73	72.9	1	10.33
12/11/2014	10:12:30	7.5	17.0	2.74	73.0	1	10.33
12/11/2014	10:13:00	8.0	17.0	2.73	73.1	1	10.33
12/11/2014	10:13:30	8.5	17.0	2.73	73.1	1	10.33
12/11/2014	10:14:00	9.0	17.0	2.73	73.0	1	10.33
12/11/2014	10:14:30	9.5	17.0	2.73	73.0	1	10.35
12/11/2014	10:15:00	10.0	17.0	2.73	73.1	1	10.35
12/11/2014	10:15:30	10.5	16.8	2.70	73.2	1	10.14
12/11/2014	10:16:00	11.0	16.7	2.68	73.1	1	9.98
12/11/2014	10:16:30	11.5	16.6	2.67	73.1	1	9.81
12/11/2014	10:17:00	12.0	16.6	2.67	73.1	1	9.83
12/11/2014	10:17:30	12.5	16.5	2.65	73.0	1	9.70
12/11/2014	10:18:00	13.0	16.1	2.60	72.9	1	9.32
12/11/2014	10:18:30	13.5	15.9	2.56	72.9	1	9.03
12/11/2014	10:19:00	14.0	15.8	2.55	72.7	1	8.99
12/11/2014	10:19:30	14.5	15.7	2.53	72.6	1	8.84
12/11/2014	10:20:00	15.0	15.6	2.51	72.6	1	8.67
12/11/2014	10:20:30	15.5	15.5	2.50	72.4	1	8.48
12/11/2014	10:21:00	16.0	15.8	2.53	72.2	1	8.95
12/11/2014	10:21:30	16.5	15.9	2.56	72.0	1	9.17
12/11/2014	10:22:00	17.0	15.9	2.56	71.8	1	9.23
12/11/2014	10:22:30	17.5	16.2	2.60	71.7	1	9.51
12/11/2014	10:23:00	18.0	16.3	2.62	71.6	1	9.64
12/11/2014	10:23:30	18.5	16.5	2.65	71.8	1	9.96
12/11/2014	10:24:00	19.0	16.7	2.68	71.8	1	10.22
12/11/2014	10:24:30	19.5	16.8	2.70	71.8	1	10.39
12/11/2014	10:25:00	20.0	17.0	2.73	71.9	1	10.65
12/11/2014	10:25:30	20.5	17.0	2.73	71.6	1	10.72
12/11/2014	10:26:00	21.0	17.0	2.73	71.4	1	10.72
12/11/2014	10:26:30	21.5	17.0	2.73	71.2	1	10.72
12/11/2014	10:27:00	22.0	17.0	2.73	71.2	1	10.72
12/11/2014	10:27:30	22.5	17.0	2.73	71.2	1	10.72
12/11/2014	10:28:00	23.0	17.0	2.73	71.1	1	10.76

## Appendix A

### Run 3C GTS Fuel Flow 70% to 100% - Test 5

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	10:28:30	23.5	17.0	2.73	71.3	1	10.76
12/11/2014	10:29:00	24.0	17.0	2.73	71.2	1	10.74
12/11/2014	10:29:30	24.5	17.0	2.73	71.1	1	10.74
12/11/2014	10:30:00	25.0	17.0	2.73	71.2	1	10.74
12/11/2014	10:30:30	25.5	16.8	2.70	71.2	1	10.53
12/11/2014	10:31:00	26.0	16.7	2.69	71.1	1	10.39
12/11/2014	10:31:30	26.5	16.6	2.67	71.1	1	10.22
12/11/2014	10:32:00	27.0	16.4	2.64	70.9	1	9.99
12/11/2014	10:32:30	27.5	16.2	2.61	70.7	1	9.77
12/11/2014	10:33:00	28.0	16.0	2.58	70.5	1	9.57
12/11/2014	10:33:30	28.5	15.9	2.56	70.2	1	9.47
12/11/2014	10:34:00	29.0	15.9	2.56	70.0	1	9.42
12/11/2014	10:34:30	29.5	15.7	2.53	70.0	1	9.17
12/11/2014	10:35:00	30.0	15.5	2.50	69.8	1	8.97
12/11/2014	10:35:30	30.5	15.5	2.49	69.7	1	8.91
12/11/2014	10:36:00	31.0	15.5	2.49	69.6	1	8.89
12/11/2014	10:36:30	31.5	15.4	2.48	69.7	1	8.89
12/11/2014	10:37:00	32.0	15.5	2.49	69.7	1	8.89
12/11/2014	10:37:30	32.5	15.5	2.48	69.6	1	8.89
12/11/2014	10:38:00	33.0	15.4	2.48	69.3	1	8.89
12/11/2014	10:38:30	33.5	15.4	2.48	69.3	1	8.89
12/11/2014	10:39:00	34.0	15.4	2.48	68.9	1	8.89
12/11/2014	10:39:30	34.5	15.4	2.48	68.8	1	8.89
12/11/2014	10:40:00	35.0	15.4	2.48	68.7	1	8.89
12/11/2014	10:40:30	35.5	15.7	2.52	68.4	1	9.23
12/11/2014	10:41:00	36.0	15.8	2.54	68.2	1	9.40
12/11/2014	10:41:30	36.5	15.9	2.56	67.9	1	9.62
12/11/2014	10:42:00	37.0	16.1	2.59	67.8	1	9.77
12/11/2014	10:42:30	37.5	16.3	2.62	67.8	1	9.98
12/11/2014	10:43:00	38.0	16.4	2.64	67.8	1	10.20
12/11/2014	10:43:30	38.5	16.6	2.66	67.6	1	10.39
12/11/2014	10:44:00	39.0	16.7	2.69	67.7	1	10.57
12/11/2014	10:44:30	39.5	16.8	2.71	67.7	1	10.76
12/11/2014	10:45:00	40.0	17.0	2.73	67.6	1	10.96
12/11/2014	10:45:30	40.5	17.0	2.73	67.6	1	10.98
12/11/2014	10:46:00	41.0	17.0	2.73	67.7	1	10.98
12/11/2014	10:46:30	41.5	17.1	2.74	67.8	1	10.98
12/11/2014	10:47:00	42.0	17.0	2.74	67.9	1	10.98
12/11/2014	10:47:30	42.5	17.0	2.73	67.8	1	10.98
12/11/2014	10:48:00	43.0	17.0	2.74	67.9	1	10.98
12/11/2014	10:48:30	43.5	17.0	2.73	67.9	1	10.98
12/11/2014	10:49:00	44.0	17.0	2.73	68.0	1	10.98
12/11/2014	10:49:30	44.5	17.0	2.74	68.0	1	11.00
12/11/2014	10:50:00	45.0	17.0	2.73	68.2	1	11.00
12/11/2014	10:50:30	45.5	16.9	2.71	68.3	1	10.74
12/11/2014	10:51:00	46.0	16.7	2.69	68.4	1	10.53

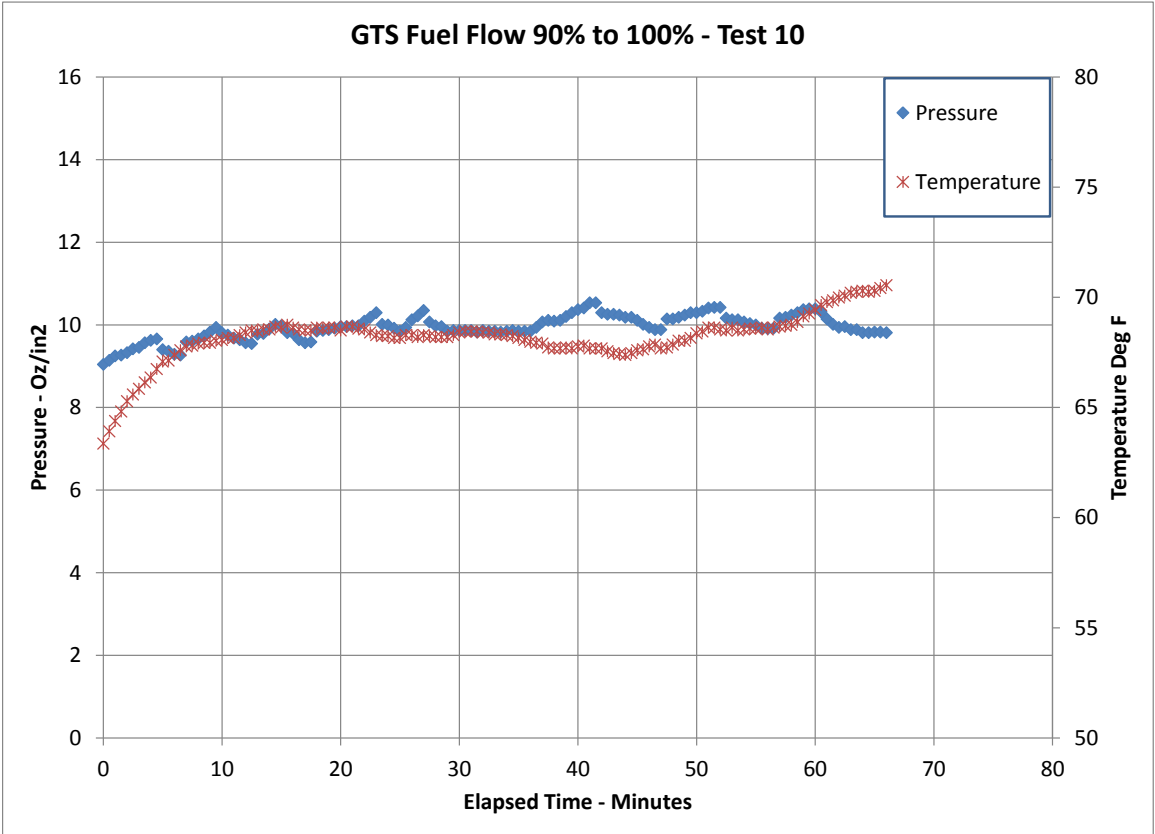
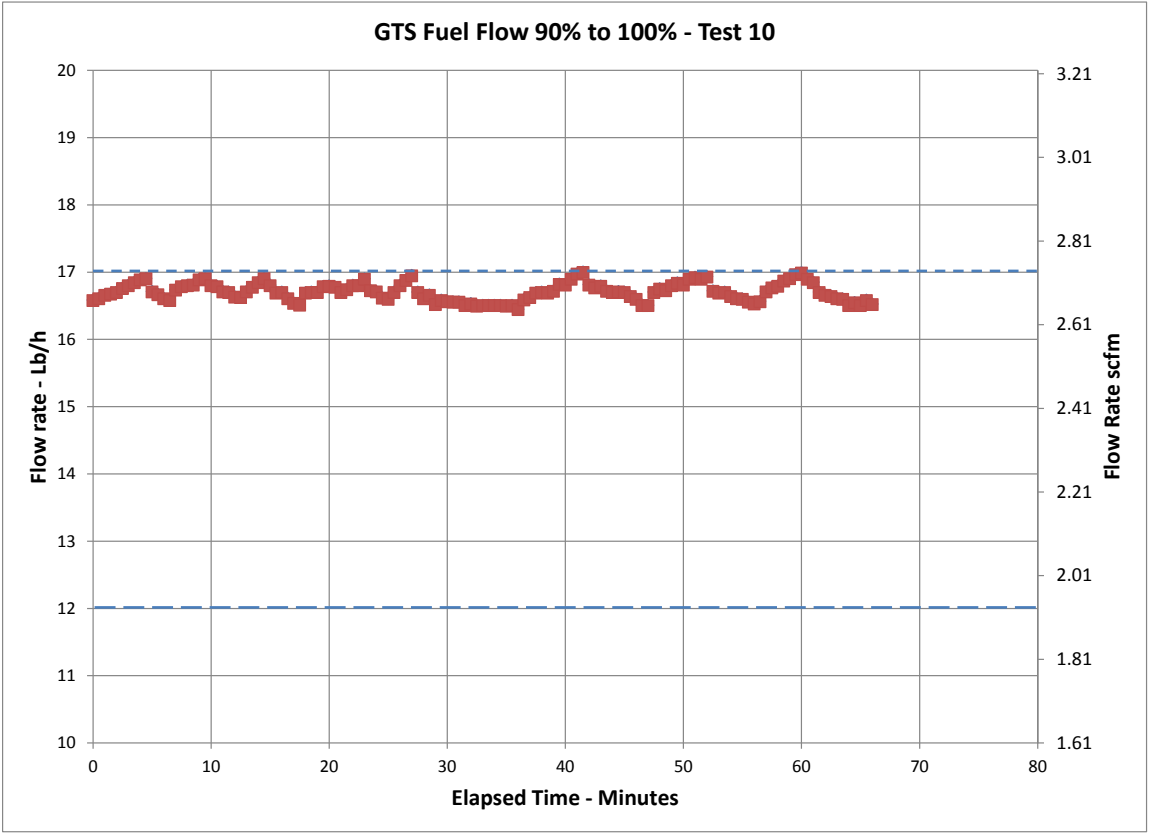
## Appendix A

### Run 3C GTS Fuel Flow 70% to 100% - Test 5

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/11/2014	10:51:30	46.5	16.5	2.65	68.4	1	10.29
12/11/2014	10:52:00	47.0	16.4	2.64	68.4	1	10.12
12/11/2014	10:52:30	47.5	16.3	2.62	68.5	1	9.86
12/11/2014	10:53:00	48.0	16.1	2.59	68.6	1	9.71
12/11/2014	10:53:30	48.5	16.0	2.57	68.5	1	9.53
12/11/2014	10:54:00	49.0	15.8	2.54	68.6	1	9.29
12/11/2014	10:54:30	49.5	15.6	2.51	68.7	1	9.12
12/11/2014	10:55:00	50.0	15.5	2.49	68.7	1	8.93
12/11/2014	10:55:30	50.5	15.7	2.52	68.9	1	9.14
12/11/2014	10:56:00	51.0	15.9	2.55	69.0	1	9.30
12/11/2014	10:56:30	51.5	16.0	2.57	69.1	1	9.44
12/11/2014	10:57:00	52.0	16.1	2.59	69.3	1	9.60
12/11/2014	10:57:30	52.5	16.3	2.62	69.5	1	9.77
12/11/2014	10:58:00	53.0	16.4	2.64	69.6	1	9.96
12/11/2014	10:58:30	53.5	16.6	2.67	69.6	1	10.20
12/11/2014	10:59:00	54.0	16.7	2.69	69.8	1	10.35
12/11/2014	10:59:30	54.5	16.8	2.70	69.8	1	10.48
12/11/2014	11:00:00	55.0	17.0	2.73	69.8	1	10.72
12/11/2014	11:00:30	55.5	17.0	2.73	69.9	1	10.74
12/11/2014	11:01:00	56.0	17.0	2.73	69.8	1	10.76
12/11/2014	11:01:30	56.5	17.0	2.73	69.7	1	10.76
12/11/2014	11:02:00	57.0	17.0	2.73	69.7	1	10.76
12/11/2014	11:02:30	57.5	17.0	2.74	69.9	1	10.76
12/11/2014	11:03:00	58.0	17.0	2.73	70.0	1	10.76
12/11/2014	11:03:30	58.5	17.0	2.74	70.1	1	10.76
12/11/2014	11:04:00	59.0	17.0	2.73	70.1	1	10.76
12/11/2014	11:04:30	59.5	17.0	2.73	70.2	1	10.76
12/11/2014	11:05:00	60.0	17.0	2.73	70.3	1	10.76
12/11/2014	11:05:30	60.5	16.8	2.70	70.4	1	10.52
12/11/2014	11:06:00	61.0	16.8	2.70	70.3	1	10.40
12/11/2014	11:06:30	61.5	16.7	2.68	70.4	1	10.20
12/11/2014	11:07:00	62.0	16.4	2.64	70.4	1	9.86
12/11/2014	11:07:30	62.5	16.3	2.61	70.5	1	9.71
12/11/2014	11:08:00	63.0	16.1	2.59	70.7	1	9.47
12/11/2014	11:08:30	63.5	15.9	2.56	70.6	1	9.29
12/11/2014	11:09:00	64.0	15.8	2.54	70.6	1	9.08
12/11/2014	11:09:30	64.5	15.7	2.52	70.8	1	8.93
12/11/2014	11:10:00	65.0	15.5	2.50	70.8	1	8.75

Appendix A

Run 4A



## Appendix A

### Run 4A GTS Fuel Flow 90% to 100% - Test 10

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	8:25:00	0.0	16.6	2.67	63.4	1	9.04
12/12/2014	8:25:30	0.5	16.6	2.67	63.9	1	9.14
12/12/2014	8:26:00	1.0	16.7	2.68	64.4	1	9.25
12/12/2014	8:26:30	1.5	16.7	2.68	64.8	1	9.27
12/12/2014	8:27:00	2.0	16.7	2.69	65.3	1	9.32
12/12/2014	8:27:30	2.5	16.8	2.70	65.6	1	9.42
12/12/2014	8:28:00	3.0	16.8	2.70	65.8	1	9.45
12/12/2014	8:28:30	3.5	16.9	2.71	66.1	1	9.57
12/12/2014	8:29:00	4.0	16.9	2.72	66.4	1	9.62
12/12/2014	8:29:30	4.5	16.9	2.72	66.7	1	9.66
12/12/2014	8:30:00	5.0	16.7	2.69	67.1	1	9.40
12/12/2014	8:30:30	5.5	16.7	2.68	67.1	1	9.36
12/12/2014	8:31:00	6.0	16.6	2.67	67.4	1	9.29
12/12/2014	8:31:30	6.5	16.6	2.67	67.6	1	9.27
12/12/2014	8:32:00	7.0	16.7	2.69	67.8	1	9.58
12/12/2014	8:32:30	7.5	16.8	2.70	67.8	1	9.60
12/12/2014	8:33:00	8.0	16.8	2.70	67.9	1	9.66
12/12/2014	8:33:30	8.5	16.8	2.70	67.9	1	9.73
12/12/2014	8:34:00	9.0	16.9	2.72	67.9	1	9.83
12/12/2014	8:34:30	9.5	16.9	2.72	68.0	1	9.94
12/12/2014	8:35:00	10.0	16.8	2.70	68.1	1	9.81
12/12/2014	8:35:30	10.5	16.8	2.70	68.2	1	9.75
12/12/2014	8:36:00	11.0	16.7	2.69	68.2	1	9.68
12/12/2014	8:36:30	11.5	16.7	2.69	68.3	1	9.64
12/12/2014	8:37:00	12.0	16.6	2.67	68.4	1	9.57
12/12/2014	8:37:30	12.5	16.6	2.67	68.5	1	9.55
12/12/2014	8:38:00	13.0	16.7	2.69	68.4	1	9.77
12/12/2014	8:38:30	13.5	16.8	2.70	68.5	1	9.79
12/12/2014	8:39:00	14.0	16.9	2.71	68.5	1	9.90
12/12/2014	8:39:30	14.5	16.9	2.72	68.7	1	10.01
12/12/2014	8:40:00	15.0	16.8	2.70	68.6	1	9.98
12/12/2014	8:40:30	15.5	16.7	2.68	68.7	1	9.81
12/12/2014	8:41:00	16.0	16.7	2.69	68.6	1	9.79
12/12/2014	8:41:30	16.5	16.6	2.67	68.5	1	9.64
12/12/2014	8:42:00	17.0	16.5	2.66	68.5	1	9.57
12/12/2014	8:42:30	17.5	16.5	2.66	68.5	1	9.58
12/12/2014	8:43:00	18.0	16.7	2.68	68.6	1	9.85
12/12/2014	8:43:30	18.5	16.7	2.69	68.6	1	9.86
12/12/2014	8:44:00	19.0	16.7	2.69	68.6	1	9.88
12/12/2014	8:44:30	19.5	16.8	2.70	68.6	1	9.92
12/12/2014	8:45:00	20.0	16.8	2.70	68.5	1	9.96
12/12/2014	8:45:30	20.5	16.8	2.70	68.7	1	9.96
12/12/2014	8:46:00	21.0	16.7	2.69	68.7	1	9.98
12/12/2014	8:46:30	21.5	16.7	2.69	68.6	1	9.98
12/12/2014	8:47:00	22.0	16.8	2.70	68.5	1	10.09



## Appendix A

### Run 4A GTS Fuel Flow 90% to 100% - Test 10

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	8:47:30	22.5	16.8	2.70	68.4	1	10.18
12/12/2014	8:48:00	23.0	16.9	2.72	68.3	1	10.29
12/12/2014	8:48:30	23.5	16.7	2.69	68.2	1	10.01
12/12/2014	8:49:00	24.0	16.7	2.69	68.2	1	9.99
12/12/2014	8:49:30	24.5	16.6	2.67	68.2	1	9.92
12/12/2014	8:50:00	25.0	16.6	2.67	68.2	1	9.85
12/12/2014	8:50:30	25.5	16.7	2.69	68.3	1	9.94
12/12/2014	8:51:00	26.0	16.8	2.70	68.3	1	10.12
12/12/2014	8:51:30	26.5	16.9	2.71	68.2	1	10.22
12/12/2014	8:52:00	27.0	17.0	2.73	68.3	1	10.35
12/12/2014	8:52:30	27.5	16.7	2.69	68.2	1	10.07
12/12/2014	8:53:00	28.0	16.6	2.67	68.2	1	9.98
12/12/2014	8:53:30	28.5	16.7	2.68	68.2	1	9.96
12/12/2014	8:54:00	29.0	16.5	2.66	68.2	1	9.85
12/12/2014	8:54:30	29.5	16.6	2.67	68.3	1	9.86
12/12/2014	8:55:00	30.0	16.6	2.66	68.4	1	9.86
12/12/2014	8:55:30	30.5	16.6	2.66	68.4	1	9.86
12/12/2014	8:56:00	31.0	16.6	2.66	68.4	1	9.86
12/12/2014	8:56:30	31.5	16.5	2.65	68.4	1	9.83
12/12/2014	8:57:00	32.0	16.5	2.66	68.4	1	9.86
12/12/2014	8:57:30	32.5	16.5	2.65	68.4	1	9.85
12/12/2014	8:58:00	33.0	16.5	2.65	68.3	1	9.85
12/12/2014	8:58:30	33.5	16.5	2.65	68.3	1	9.83
12/12/2014	8:59:00	34.0	16.5	2.65	68.3	1	9.85
12/12/2014	8:59:30	34.5	16.5	2.65	68.2	1	9.86
12/12/2014	9:00:00	35.0	16.5	2.65	68.2	1	9.85
12/12/2014	9:00:30	35.5	16.5	2.65	68.1	1	9.85
12/12/2014	9:01:00	36.0	16.4	2.64	68.0	1	9.85
12/12/2014	9:01:30	36.5	16.6	2.67	67.9	1	9.94
12/12/2014	9:02:00	37.0	16.6	2.67	67.9	1	10.07
12/12/2014	9:02:30	37.5	16.7	2.68	67.7	1	10.11
12/12/2014	9:03:00	38.0	16.7	2.69	67.7	1	10.09
12/12/2014	9:03:30	38.5	16.7	2.68	67.7	1	10.11
12/12/2014	9:04:00	39.0	16.7	2.69	67.7	1	10.20
12/12/2014	9:04:30	39.5	16.8	2.70	67.7	1	10.29
12/12/2014	9:05:00	40.0	16.8	2.70	67.8	1	10.37
12/12/2014	9:05:30	40.5	16.9	2.72	67.8	1	10.40
12/12/2014	9:06:00	41.0	17.0	2.73	67.7	1	10.53
12/12/2014	9:06:30	41.5	17.0	2.73	67.7	1	10.53
12/12/2014	9:07:00	42.0	16.8	2.70	67.7	1	10.29
12/12/2014	9:07:30	42.5	16.8	2.70	67.6	1	10.26
12/12/2014	9:08:00	43.0	16.8	2.70	67.5	1	10.26
12/12/2014	9:08:30	43.5	16.7	2.69	67.4	1	10.24
12/12/2014	9:09:00	44.0	16.7	2.69	67.4	1	10.18
12/12/2014	9:09:30	44.5	16.7	2.69	67.5	1	10.18
12/12/2014	9:10:00	45.0	16.7	2.69	67.6	1	10.11

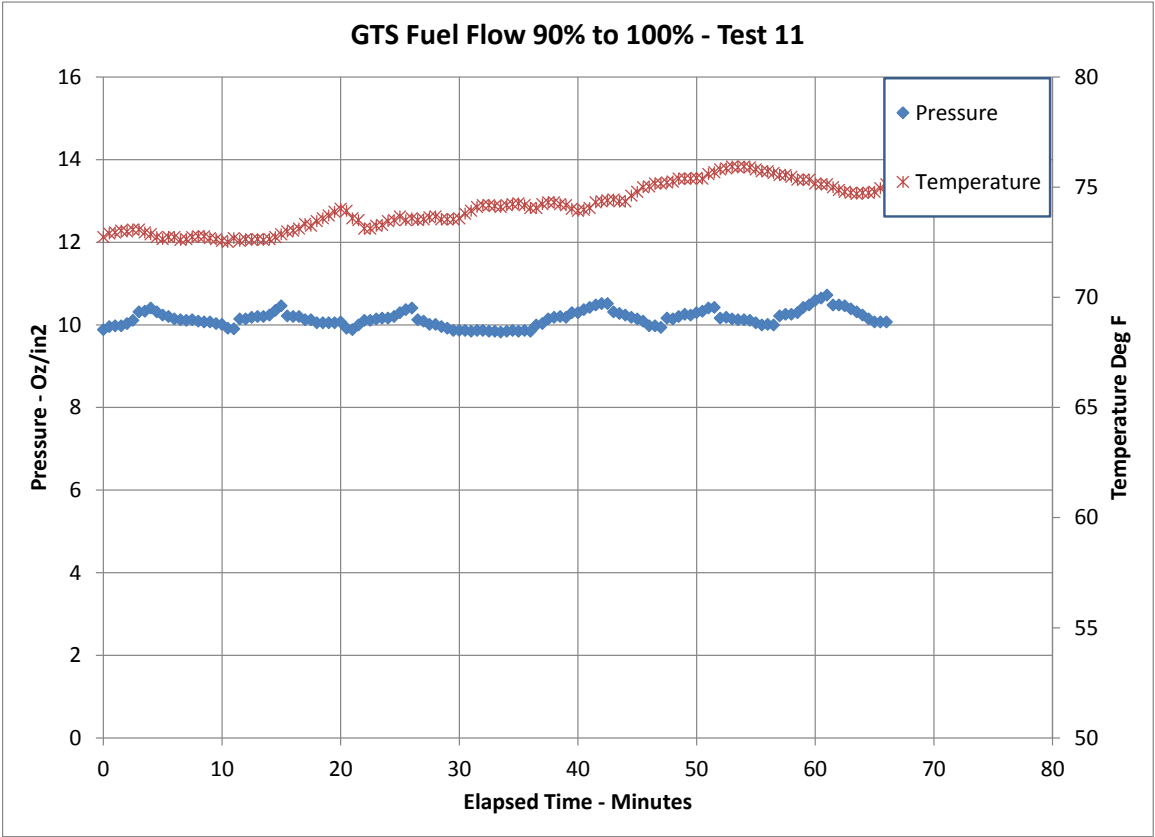
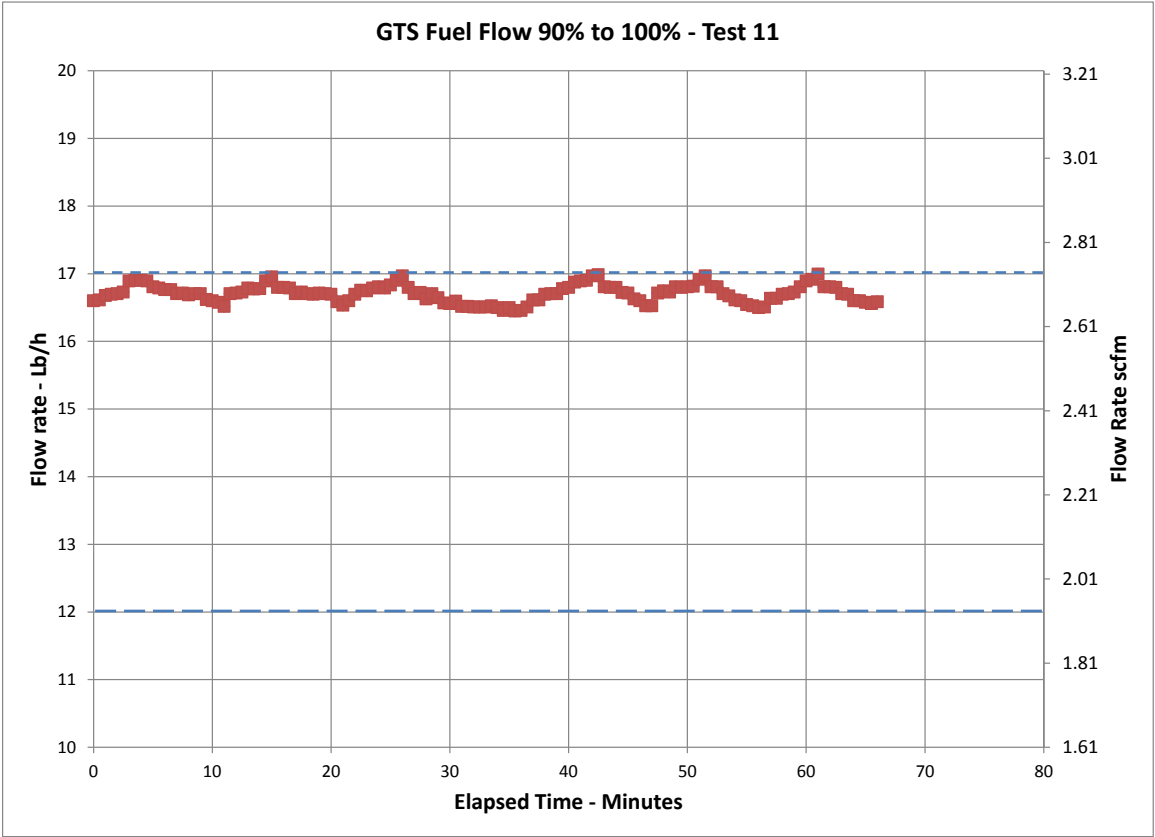
## Appendix A

### Run 4A GTS Fuel Flow 90% to 100% - Test 10

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	9:10:30	45.5	16.6	2.68	67.6	1	10.01
12/12/2014	9:11:00	46.0	16.6	2.67	67.8	1	9.94
12/12/2014	9:11:30	46.5	16.5	2.65	67.9	1	9.88
12/12/2014	9:12:00	47.0	16.5	2.65	67.7	1	9.88
12/12/2014	9:12:30	47.5	16.7	2.69	67.7	1	10.14
12/12/2014	9:13:00	48.0	16.8	2.69	67.9	1	10.14
12/12/2014	9:13:30	48.5	16.7	2.69	68.0	1	10.18
12/12/2014	9:14:00	49.0	16.8	2.70	68.0	1	10.24
12/12/2014	9:14:30	49.5	16.8	2.71	68.2	1	10.29
12/12/2014	9:15:00	50.0	16.8	2.70	68.4	1	10.29
12/12/2014	9:15:30	50.5	16.9	2.72	68.4	1	10.33
12/12/2014	9:16:00	51.0	16.9	2.72	68.6	1	10.40
12/12/2014	9:16:30	51.5	16.9	2.72	68.6	1	10.42
12/12/2014	9:17:00	52.0	16.9	2.72	68.5	1	10.42
12/12/2014	9:17:30	52.5	16.7	2.69	68.5	1	10.16
12/12/2014	9:18:00	53.0	16.7	2.68	68.6	1	10.12
12/12/2014	9:18:30	53.5	16.7	2.69	68.5	1	10.12
12/12/2014	9:19:00	54.0	16.6	2.68	68.5	1	10.07
12/12/2014	9:19:30	54.5	16.6	2.67	68.6	1	10.03
12/12/2014	9:20:00	55.0	16.6	2.67	68.6	1	9.99
12/12/2014	9:20:30	55.5	16.6	2.66	68.6	1	9.92
12/12/2014	9:21:00	56.0	16.5	2.66	68.5	1	9.90
12/12/2014	9:21:30	56.5	16.6	2.66	68.6	1	9.92
12/12/2014	9:22:00	57.0	16.7	2.69	68.7	1	10.16
12/12/2014	9:22:30	57.5	16.8	2.70	68.7	1	10.18
12/12/2014	9:23:00	58.0	16.8	2.70	68.7	1	10.24
12/12/2014	9:23:30	58.5	16.9	2.71	68.9	1	10.29
12/12/2014	9:24:00	59.0	16.9	2.72	69.1	1	10.37
12/12/2014	9:24:30	59.5	17.0	2.73	69.3	1	10.39
12/12/2014	9:25:00	60.0	17.0	2.73	69.4	1	10.39
12/12/2014	9:25:30	60.5	16.9	2.72	69.6	1	10.31
12/12/2014	9:26:00	61.0	16.9	2.71	69.8	1	10.14
12/12/2014	9:26:30	61.5	16.7	2.69	69.9	1	10.01
12/12/2014	9:27:00	62.0	16.7	2.68	70.0	1	9.94
12/12/2014	9:27:30	62.5	16.6	2.68	70.1	1	9.96
12/12/2014	9:28:00	63.0	16.6	2.67	70.2	1	9.88
12/12/2014	9:28:30	63.5	16.6	2.67	70.2	1	9.88
12/12/2014	9:29:00	64.0	16.5	2.65	70.3	1	9.81
12/12/2014	9:29:30	64.5	16.6	2.66	70.2	1	9.81
12/12/2014	9:30:00	65.0	16.5	2.65	70.3	1	9.83
12/12/2014	9:30:30	65.5	16.6	2.67	70.4	1	9.83
12/12/2014	9:31:00	66.0	16.5	2.66	70.5	1	9.81

Appendix A

Run 4B



## Appendix A

### Run 4B GTS Fuel Flow 90% to 100% - Test 11

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	9:55:00	0.0	16.6	2.67	72.7	1	9.88
12/12/2014	9:55:30	0.5	16.6	2.67	72.9	1	9.96
12/12/2014	9:56:00	1.0	16.7	2.68	72.9	1	9.98
12/12/2014	9:56:30	1.5	16.7	2.69	73.0	1	9.98
12/12/2014	9:57:00	2.0	16.7	2.69	73.0	1	10.03
12/12/2014	9:57:30	2.5	16.7	2.69	73.1	1	10.11
12/12/2014	9:58:00	3.0	16.9	2.72	73.1	1	10.31
12/12/2014	9:58:30	3.5	16.9	2.72	72.9	1	10.33
12/12/2014	9:59:00	4.0	16.9	2.72	72.9	1	10.40
12/12/2014	9:59:30	4.5	16.9	2.72	72.7	1	10.31
12/12/2014	10:00:00	5.0	16.8	2.70	72.6	1	10.24
12/12/2014	10:00:30	5.5	16.8	2.70	72.7	1	10.20
12/12/2014	10:01:00	6.0	16.8	2.70	72.7	1	10.14
12/12/2014	10:01:30	6.5	16.8	2.70	72.6	1	10.12
12/12/2014	10:02:00	7.0	16.7	2.69	72.6	1	10.11
12/12/2014	10:02:30	7.5	16.7	2.69	72.7	1	10.12
12/12/2014	10:03:00	8.0	16.7	2.68	72.8	1	10.09
12/12/2014	10:03:30	8.5	16.7	2.69	72.8	1	10.07
12/12/2014	10:04:00	9.0	16.7	2.69	72.7	1	10.07
12/12/2014	10:04:30	9.5	16.6	2.67	72.6	1	10.03
12/12/2014	10:05:00	10.0	16.6	2.67	72.6	1	10.01
12/12/2014	10:05:30	10.5	16.6	2.67	72.5	1	9.92
12/12/2014	10:06:00	11.0	16.5	2.66	72.7	1	9.90
12/12/2014	10:06:30	11.5	16.7	2.69	72.6	1	10.14
12/12/2014	10:07:00	12.0	16.7	2.69	72.6	1	10.14
12/12/2014	10:07:30	12.5	16.7	2.69	72.6	1	10.18
12/12/2014	10:08:00	13.0	16.8	2.70	72.6	1	10.20
12/12/2014	10:08:30	13.5	16.8	2.70	72.6	1	10.20
12/12/2014	10:09:00	14.0	16.8	2.70	72.6	1	10.24
12/12/2014	10:09:30	14.5	16.9	2.72	72.7	1	10.35
12/12/2014	10:10:00	15.0	17.0	2.73	72.9	1	10.46
12/12/2014	10:10:30	15.5	16.8	2.70	73.0	1	10.22
12/12/2014	10:11:00	16.0	16.8	2.70	73.0	1	10.20
12/12/2014	10:11:30	16.5	16.8	2.70	73.1	1	10.20
12/12/2014	10:12:00	17.0	16.7	2.69	73.3	1	10.12
12/12/2014	10:12:30	17.5	16.7	2.69	73.2	1	10.12
12/12/2014	10:13:00	18.0	16.7	2.69	73.5	1	10.05
12/12/2014	10:13:30	18.5	16.7	2.69	73.6	1	10.05
12/12/2014	10:14:00	19.0	16.7	2.69	73.7	1	10.05
12/12/2014	10:14:30	19.5	16.7	2.69	73.9	1	10.05
12/12/2014	10:15:00	20.0	16.7	2.69	74.0	1	10.07
12/12/2014	10:15:30	20.5	16.6	2.67	73.9	1	9.92
12/12/2014	10:16:00	21.0	16.5	2.66	73.6	1	9.88
12/12/2014	10:16:30	21.5	16.6	2.67	73.5	1	9.99
12/12/2014	10:17:00	22.0	16.7	2.69	73.1	1	10.11
12/12/2014	10:17:30	22.5	16.8	2.70	73.1	1	10.11
12/12/2014	10:18:00	23.0	16.7	2.69	73.2	1	10.14

## Appendix A

### Run 4B GTS Fuel Flow 90% to 100% - Test 11

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	10:18:30	23.5	16.8	2.70	73.3	1	10.16
12/12/2014	10:19:00	24.0	16.8	2.70	73.5	1	10.16
12/12/2014	10:19:30	24.5	16.8	2.70	73.5	1	10.20
12/12/2014	10:20:00	25.0	16.8	2.71	73.7	1	10.29
12/12/2014	10:20:30	25.5	16.9	2.72	73.5	1	10.37
12/12/2014	10:21:00	26.0	17.0	2.73	73.6	1	10.40
12/12/2014	10:21:30	26.5	16.8	2.70	73.5	1	10.12
12/12/2014	10:22:00	27.0	16.7	2.69	73.5	1	10.09
12/12/2014	10:22:30	27.5	16.7	2.69	73.6	1	10.01
12/12/2014	10:23:00	28.0	16.6	2.67	73.7	1	10.01
12/12/2014	10:23:30	28.5	16.7	2.69	73.5	1	9.96
12/12/2014	10:24:00	29.0	16.6	2.68	73.5	1	9.92
12/12/2014	10:24:30	29.5	16.6	2.67	73.5	1	9.86
12/12/2014	10:25:00	30.0	16.6	2.66	73.6	1	9.86
12/12/2014	10:25:30	30.5	16.6	2.67	73.8	1	9.86
12/12/2014	10:26:00	31.0	16.5	2.66	73.9	1	9.85
12/12/2014	10:26:30	31.5	16.5	2.66	74.1	1	9.86
12/12/2014	10:27:00	32.0	16.5	2.66	74.2	1	9.86
12/12/2014	10:27:30	32.5	16.5	2.66	74.2	1	9.85
12/12/2014	10:28:00	33.0	16.5	2.66	74.1	1	9.85
12/12/2014	10:28:30	33.5	16.5	2.66	74.1	1	9.83
12/12/2014	10:29:00	34.0	16.5	2.65	74.2	1	9.85
12/12/2014	10:29:30	34.5	16.5	2.65	74.2	1	9.86
12/12/2014	10:30:00	35.0	16.5	2.65	74.3	1	9.85
12/12/2014	10:30:30	35.5	16.4	2.65	74.2	1	9.86
12/12/2014	10:31:00	36.0	16.5	2.65	74.1	1	9.85
12/12/2014	10:31:30	36.5	16.5	2.66	74.1	1	9.99
12/12/2014	10:32:00	37.0	16.6	2.67	74.2	1	10.03
12/12/2014	10:32:30	37.5	16.6	2.67	74.3	1	10.14
12/12/2014	10:33:00	38.0	16.7	2.69	74.3	1	10.18
12/12/2014	10:33:30	38.5	16.7	2.69	74.2	1	10.20
12/12/2014	10:34:00	39.0	16.7	2.69	74.2	1	10.18
12/12/2014	10:34:30	39.5	16.8	2.70	74.0	1	10.29
12/12/2014	10:35:00	40.0	16.8	2.70	73.9	1	10.29
12/12/2014	10:35:30	40.5	16.9	2.71	74.0	1	10.37
12/12/2014	10:36:00	41.0	16.9	2.72	74.1	1	10.42
12/12/2014	10:36:30	41.5	16.9	2.72	74.3	1	10.48
12/12/2014	10:37:00	42.0	17.0	2.73	74.4	1	10.52
12/12/2014	10:37:30	42.5	17.0	2.73	74.4	1	10.52
12/12/2014	10:38:00	43.0	16.8	2.70	74.4	1	10.31
12/12/2014	10:38:30	43.5	16.8	2.70	74.4	1	10.27
12/12/2014	10:39:00	44.0	16.8	2.70	74.4	1	10.24
12/12/2014	10:39:30	44.5	16.7	2.69	74.6	1	10.18
12/12/2014	10:40:00	45.0	16.7	2.69	74.8	1	10.14
12/12/2014	10:40:30	45.5	16.6	2.67	75.0	1	10.09
12/12/2014	10:41:00	46.0	16.6	2.67	75.0	1	9.98

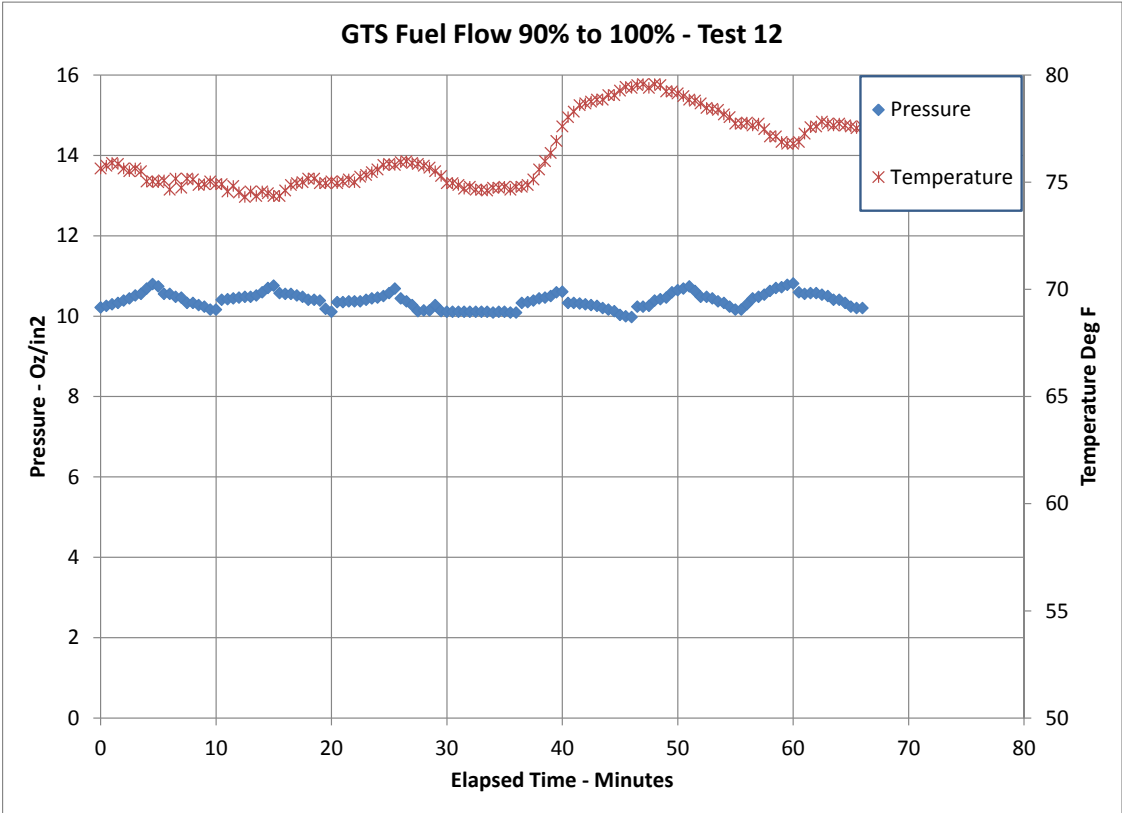
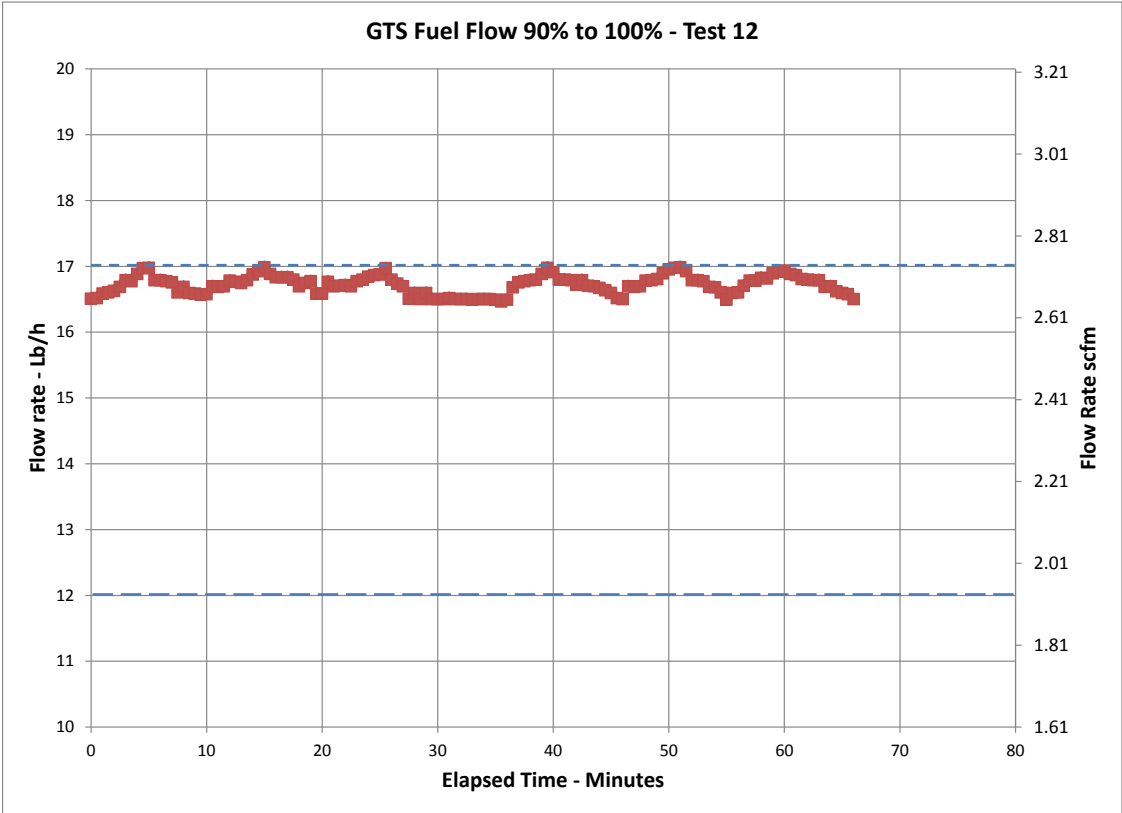
## Appendix A

### Run 4B GTS Fuel Flow 90% to 100% - Test 11

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	10:41:30	46.5	16.5	2.66	75.2	1	9.98
12/12/2014	10:42:00	47.0	16.5	2.66	75.2	1	9.94
12/12/2014	10:42:30	47.5	16.7	2.69	75.2	1	10.16
12/12/2014	10:43:00	48.0	16.7	2.69	75.3	1	10.14
12/12/2014	10:43:30	48.5	16.7	2.69	75.4	1	10.20
12/12/2014	10:44:00	49.0	16.8	2.70	75.4	1	10.26
12/12/2014	10:44:30	49.5	16.8	2.70	75.4	1	10.24
12/12/2014	10:45:00	50.0	16.8	2.70	75.4	1	10.29
12/12/2014	10:45:30	50.5	16.8	2.71	75.4	1	10.33
12/12/2014	10:46:00	51.0	16.9	2.72	75.6	1	10.40
12/12/2014	10:46:30	51.5	17.0	2.73	75.7	1	10.42
12/12/2014	10:47:00	52.0	16.8	2.70	75.8	1	10.16
12/12/2014	10:47:30	52.5	16.8	2.70	75.9	1	10.18
12/12/2014	10:48:00	53.0	16.7	2.69	75.9	1	10.14
12/12/2014	10:48:30	53.5	16.7	2.68	75.9	1	10.12
12/12/2014	10:49:00	54.0	16.6	2.67	75.9	1	10.12
12/12/2014	10:49:30	54.5	16.6	2.67	75.9	1	10.11
12/12/2014	10:50:00	55.0	16.5	2.66	75.8	1	10.05
12/12/2014	10:50:30	55.5	16.5	2.66	75.7	1	9.99
12/12/2014	10:51:00	56.0	16.5	2.65	75.7	1	10.01
12/12/2014	10:51:30	56.5	16.5	2.66	75.6	1	9.99
12/12/2014	10:52:00	57.0	16.6	2.68	75.6	1	10.22
12/12/2014	10:52:30	57.5	16.6	2.68	75.6	1	10.26
12/12/2014	10:53:00	58.0	16.7	2.69	75.5	1	10.26
12/12/2014	10:53:30	58.5	16.7	2.69	75.3	1	10.29
12/12/2014	10:54:00	59.0	16.7	2.69	75.3	1	10.42
12/12/2014	10:54:30	59.5	16.8	2.70	75.3	1	10.48
12/12/2014	10:55:00	60.0	16.9	2.72	75.2	1	10.59
12/12/2014	10:55:30	60.5	16.9	2.72	75.1	1	10.65
12/12/2014	10:56:00	61.0	17.0	2.73	75.1	1	10.72
12/12/2014	10:56:30	61.5	16.8	2.70	75.0	1	10.48
12/12/2014	10:57:00	62.0	16.8	2.70	74.9	1	10.48
12/12/2014	10:57:30	62.5	16.8	2.70	74.8	1	10.46
12/12/2014	10:58:00	63.0	16.7	2.69	74.7	1	10.39
12/12/2014	10:58:30	63.5	16.7	2.69	74.7	1	10.31
12/12/2014	10:59:00	64.0	16.6	2.67	74.7	1	10.24
12/12/2014	10:59:30	64.5	16.6	2.67	74.7	1	10.14
12/12/2014	11:00:00	65.0	16.6	2.67	74.8	1	10.07
12/12/2014	11:00:30	65.5	16.6	2.66	75.0	1	10.07
12/12/2014	11:01:00	66.0	16.6	2.67	75.1	1	10.07

Appendix A

Run 4C



## Appendix A

### Run 4C GTS Fuel Flow 90% to 100% - Test 12

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	11:30:00	0.0	16.5	2.66	75.6	1	10.22
12/12/2014	11:30:30	0.5	16.5	2.66	75.8	1	10.26
12/12/2014	11:31:00	1.0	16.6	2.67	75.9	1	10.29
12/12/2014	11:31:30	1.5	16.6	2.67	75.9	1	10.33
12/12/2014	11:32:00	2.0	16.6	2.67	75.6	1	10.39
12/12/2014	11:32:30	2.5	16.7	2.68	75.5	1	10.44
12/12/2014	11:33:00	3.0	16.8	2.70	75.6	1	10.52
12/12/2014	11:33:30	3.5	16.8	2.70	75.5	1	10.55
12/12/2014	11:34:00	4.0	16.9	2.72	75.0	1	10.68
12/12/2014	11:34:30	4.5	17.0	2.73	75.0	1	10.80
12/12/2014	11:35:00	5.0	17.0	2.73	75.0	1	10.74
12/12/2014	11:35:30	5.5	16.8	2.70	75.1	1	10.55
12/12/2014	11:36:00	6.0	16.8	2.70	74.7	1	10.55
12/12/2014	11:36:30	6.5	16.8	2.70	75.2	1	10.48
12/12/2014	11:37:00	7.0	16.8	2.70	74.7	1	10.46
12/12/2014	11:37:30	7.5	16.6	2.67	75.2	1	10.33
12/12/2014	11:38:00	8.0	16.7	2.68	75.1	1	10.33
12/12/2014	11:38:30	8.5	16.6	2.67	74.9	1	10.27
12/12/2014	11:39:00	9.0	16.6	2.67	74.9	1	10.24
12/12/2014	11:39:30	9.5	16.6	2.67	75.0	1	10.16
12/12/2014	11:40:00	10.0	16.6	2.67	74.9	1	10.16
12/12/2014	11:40:30	10.5	16.7	2.69	74.9	1	10.40
12/12/2014	11:41:00	11.0	16.7	2.68	74.6	1	10.42
12/12/2014	11:41:30	11.5	16.7	2.69	74.8	1	10.44
12/12/2014	11:42:00	12.0	16.8	2.70	74.5	1	10.46
12/12/2014	11:42:30	12.5	16.8	2.70	74.3	1	10.48
12/12/2014	11:43:00	13.0	16.8	2.69	74.6	1	10.48
12/12/2014	11:43:30	13.5	16.8	2.70	74.4	1	10.52
12/12/2014	11:44:00	14.0	16.9	2.71	74.6	1	10.59
12/12/2014	11:44:30	14.5	16.9	2.72	74.5	1	10.70
12/12/2014	11:45:00	15.0	17.0	2.73	74.4	1	10.76
12/12/2014	11:45:30	15.5	16.9	2.72	74.4	1	10.57
12/12/2014	11:46:00	16.0	16.8	2.71	74.6	1	10.55
12/12/2014	11:46:30	16.5	16.8	2.71	74.9	1	10.55
12/12/2014	11:47:00	17.0	16.8	2.71	75.0	1	10.52
12/12/2014	11:47:30	17.5	16.8	2.70	75.0	1	10.48
12/12/2014	11:48:00	18.0	16.7	2.69	75.2	1	10.40
12/12/2014	11:48:30	18.5	16.8	2.69	75.2	1	10.40
12/12/2014	11:49:00	19.0	16.8	2.70	75.0	1	10.39
12/12/2014	11:49:30	19.5	16.6	2.67	75.0	1	10.18
12/12/2014	11:50:00	20.0	16.6	2.67	75.0	1	10.11
12/12/2014	11:50:30	20.5	16.8	2.70	75.0	1	10.35
12/12/2014	11:51:00	21.0	16.7	2.69	75.0	1	10.35
12/12/2014	11:51:30	21.5	16.7	2.69	75.1	1	10.37
12/12/2014	11:52:00	22.0	16.7	2.69	75.0	1	10.37
12/12/2014	11:52:30	22.5	16.7	2.69	75.3	1	10.37
12/12/2014	11:53:00	23.0	16.8	2.70	75.3	1	10.40



## Appendix A

### Run 4C GTS Fuel Flow 90% to 100% - Test 12

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	11:53:30	23.5	16.8	2.70	75.5	1	10.44
12/12/2014	11:54:00	24.0	16.9	2.71	75.6	1	10.46
12/12/2014	11:54:30	24.5	16.9	2.71	75.8	1	10.50
12/12/2014	11:55:00	25.0	16.9	2.71	75.9	1	10.57
12/12/2014	11:55:30	25.5	17.0	2.73	75.8	1	10.68
12/12/2014	11:56:00	26.0	16.8	2.70	75.9	1	10.44
12/12/2014	11:56:30	26.5	16.7	2.69	76.0	1	10.37
12/12/2014	11:57:00	27.0	16.7	2.69	75.9	1	10.27
12/12/2014	11:57:30	27.5	16.5	2.66	75.9	1	10.12
12/12/2014	11:58:00	28.0	16.6	2.67	75.8	1	10.14
12/12/2014	11:58:30	28.5	16.5	2.65	75.7	1	10.14
12/12/2014	11:59:00	29.0	16.6	2.67	75.5	1	10.27
12/12/2014	11:59:30	29.5	16.5	2.65	75.3	1	10.12
12/12/2014	12:00:00	30.0	16.5	2.65	75.0	1	10.11
12/12/2014	12:00:30	30.5	16.5	2.65	75.0	1	10.11
12/12/2014	12:01:00	31.0	16.5	2.66	74.9	1	10.11
12/12/2014	12:01:30	31.5	16.5	2.65	74.7	1	10.11
12/12/2014	12:02:00	32.0	16.5	2.65	74.8	1	10.11
12/12/2014	12:02:30	32.5	16.5	2.65	74.7	1	10.11
12/12/2014	12:03:00	33.0	16.5	2.65	74.7	1	10.11
12/12/2014	12:03:30	33.5	16.5	2.65	74.6	1	10.11
12/12/2014	12:04:00	34.0	16.5	2.65	74.7	1	10.09
12/12/2014	12:04:30	34.5	16.5	2.65	74.7	1	10.11
12/12/2014	12:05:00	35.0	16.5	2.65	74.8	1	10.11
12/12/2014	12:05:30	35.5	16.5	2.65	74.7	1	10.09
12/12/2014	12:06:00	36.0	16.5	2.65	74.8	1	10.09
12/12/2014	12:06:30	36.5	16.7	2.68	74.8	1	10.33
12/12/2014	12:07:00	37.0	16.8	2.70	74.9	1	10.35
12/12/2014	12:07:30	37.5	16.8	2.70	75.1	1	10.39
12/12/2014	12:08:00	38.0	16.8	2.70	75.6	1	10.44
12/12/2014	12:08:30	38.5	16.8	2.70	76.0	1	10.46
12/12/2014	12:09:00	39.0	16.9	2.72	76.4	1	10.50
12/12/2014	12:09:30	39.5	17.0	2.73	76.9	1	10.59
12/12/2014	12:10:00	40.0	16.9	2.72	77.6	1	10.61
12/12/2014	12:10:30	40.5	16.8	2.70	78.0	1	10.33
12/12/2014	12:11:00	41.0	16.8	2.70	78.3	1	10.33
12/12/2014	12:11:30	41.5	16.8	2.70	78.6	1	10.31
12/12/2014	12:12:00	42.0	16.7	2.69	78.7	1	10.29
12/12/2014	12:12:30	42.5	16.8	2.70	78.8	1	10.27
12/12/2014	12:13:00	43.0	16.7	2.69	78.8	1	10.26
12/12/2014	12:13:30	43.5	16.7	2.69	78.8	1	10.20
12/12/2014	12:14:00	44.0	16.7	2.68	79.1	1	10.16
12/12/2014	12:14:30	44.5	16.6	2.68	79.1	1	10.12
12/12/2014	12:15:00	45.0	16.6	2.67	79.3	1	10.03
12/12/2014	12:15:30	45.5	16.5	2.66	79.4	1	9.99
12/12/2014	12:16:00	46.0	16.5	2.65	79.4	1	9.98

## Appendix A

### Run 4C GTS Fuel Flow 90% to 100% - Test 12

Date	Time	Elapsed Time	Flow	Flow	Temperature	Pilot	Pressure
mm/dd/yyyy	hh:mm:ss	Minutes	lb/h	scfm	Deg F	Off=0; On=1	Oz/in <sup>2</sup>
12/12/2014	12:16:30	46.5	16.7	2.69	79.5	1	10.24
12/12/2014	12:17:00	47.0	16.7	2.68	79.6	1	10.24
12/12/2014	12:17:30	47.5	16.7	2.69	79.4	1	10.26
12/12/2014	12:18:00	48.0	16.8	2.70	79.6	1	10.39
12/12/2014	12:18:30	48.5	16.8	2.70	79.5	1	10.42
12/12/2014	12:19:00	49.0	16.8	2.70	79.2	1	10.46
12/12/2014	12:19:30	49.5	16.9	2.72	79.2	1	10.59
12/12/2014	12:20:00	50.0	17.0	2.73	79.1	1	10.65
12/12/2014	12:20:30	50.5	17.0	2.73	79.0	1	10.68
12/12/2014	12:21:00	51.0	17.0	2.73	78.8	1	10.74
12/12/2014	12:21:30	51.5	16.9	2.72	78.8	1	10.63
12/12/2014	12:22:00	52.0	16.8	2.70	78.7	1	10.48
12/12/2014	12:22:30	52.5	16.8	2.70	78.5	1	10.48
12/12/2014	12:23:00	53.0	16.8	2.70	78.4	1	10.44
12/12/2014	12:23:30	53.5	16.7	2.68	78.4	1	10.37
12/12/2014	12:24:00	54.0	16.7	2.68	78.2	1	10.33
12/12/2014	12:24:30	54.5	16.6	2.67	78.0	1	10.24
12/12/2014	12:25:00	55.0	16.5	2.65	77.7	1	10.16
12/12/2014	12:25:30	55.5	16.6	2.67	77.7	1	10.16
12/12/2014	12:26:00	56.0	16.6	2.67	77.8	1	10.29
12/12/2014	12:26:30	56.5	16.7	2.69	77.6	1	10.44
12/12/2014	12:27:00	57.0	16.8	2.70	77.7	1	10.48
12/12/2014	12:27:30	57.5	16.8	2.70	77.5	1	10.53
12/12/2014	12:28:00	58.0	16.8	2.71	77.1	1	10.63
12/12/2014	12:28:30	58.5	16.8	2.70	77.1	1	10.70
12/12/2014	12:29:00	59.0	16.9	2.72	76.9	1	10.72
12/12/2014	12:29:30	59.5	16.9	2.72	76.8	1	10.78
12/12/2014	12:30:00	60.0	16.9	2.72	76.8	1	10.81
12/12/2014	12:30:30	60.5	16.9	2.72	76.9	1	10.59
12/12/2014	12:31:00	61.0	16.9	2.71	77.3	1	10.55
12/12/2014	12:31:30	61.5	16.8	2.70	77.6	1	10.57
12/12/2014	12:32:00	62.0	16.8	2.70	77.6	1	10.57
12/12/2014	12:32:30	62.5	16.8	2.70	77.8	1	10.53
12/12/2014	12:33:00	63.0	16.8	2.70	77.7	1	10.50
12/12/2014	12:33:30	63.5	16.7	2.68	77.6	1	10.40
12/12/2014	12:34:00	64.0	16.7	2.69	77.7	1	10.40
12/12/2014	12:34:30	64.5	16.6	2.67	77.6	1	10.33
12/12/2014	12:35:00	65.0	16.6	2.67	77.6	1	10.24
12/12/2014	12:35:30	65.5	16.6	2.67	77.5	1	10.20
12/12/2014	12:36:00	66.0	16.5	2.65	77.6	1	10.20

## Appendix B – Inlet Gas Sampling Record

Test Number	Test Condition [% of Rated Flow]	Test Date [YYYY-MM-DD]	Test Start Time	Test End Time	Summa Canister ID	Canister Start Pressure ["Hg]	Canister End Pressure ["Hg]
1	70 to 100%	2014-12-10	Set-up Testing		N/A	N/A	N/A
2	70 to 100%	2014-12-10	Set-up Testing		N/A	N/A	N/A
3	70 to 100%	2014-12-10	15:00	16:10	Test 1A, B, C	-28	-15
4	70 to 100%	2014-12-11	8:30	9:36	Canister 14714	-15	-6
5	70 to 100%	2014-12-11	10:05	11:10		-6	1
6	30 to 70%	2014-12-11	11:35	12:41	Test 2A, B, C	-27.5	-16
7	30 to 70%	2014-12-11	13:05	14:10	Canister 5634	-16	-4
8	30 to 70%	2014-12-11	14:40	15:46		-4	0
9	0 to 30%	2014-12-11	16:10	17:16	Test 3A Canister 14717	-28	-16
10	90 to 100%	2014-12-12	8:25	9:31	Test 4A, B, C Canister 17124	-26.5	-16
11	90 to 100%	2014-12-12	9:55	11:01		-16	-3.5
12	90 to 100%	2014-12-12	11:30	12:36		-3.5	0
13	0 to 30%	2014-12-12	13:00	14:05	Test 3B, 3C Canister 14717	-16	-4.5
14	0 to 30%	2014-12-12	14:30	15:35		-4.5	0



## Report:

### Spartan Controls Analysis of Fuel Gas Samples

Date: January 26, 2015



# Report:

## Spartan Controls Analysis of Fuel Gas Samples

Submitted to: Mr. Greg Brown  
Spartan Controls  
305 – 27 Street S.E.  
Calgary, AB T2A 7V2  
Tel: (403) 695-2312  
Email: [Brown.Greg@spartancontrols.com](mailto:Brown.Greg@spartancontrols.com)

Client Reference: P.O. # 6808220P

Prepared by: Eugene Shereshevsky, B.Sc.  
Manager, Analytical Services  
ORTECH Consulting Inc.  
804 Southdown Rd., Mississauga, Ontario L5J 2Y4  
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Report No.: 26077  
5 pages, 2 Appendices

### Revision History

Version	Date	Summary Changes/Purpose of Revision
1	January 26, 2015	None

### NOTICE:

This report was prepared by ORTECH Consulting Inc. (ORTECH) solely for the Client identified above and is to be used exclusively for the purposes set out in the report. The material in this report reflects the judgment of ORTECH based on information available to them at the time of preparation. Unless manifestly incorrect, ORTECH assumes information provided by others is accurate. Changed conditions or information occurring or becoming known after the date of this report could affect the results and conclusions presented. Unless otherwise required by law or regulation, this report shall not be shared with any Third Party without the express written consent of ORTECH. ORTECH accepts no responsibility for damages, if any, suffered by any Third Party which makes use of the results and conclusions presented in this report.

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## 1. INTRODUCTION

ORTECH Environmental Inc. (ORTECH) received four fuel gas samples in summa canisters on December 15<sup>th</sup>, 2014 from Spartan Controls for the determination of the fuel gas composition and heating values. The results are reported in Appendix A in a one page per sample format.

## 2. ANALYTICAL PROCEDURE

Standard Reference Gases:

- Praxair Calorific Natural Gas Mixture - Primary Standard, Maxitherm, certified, traceable to NIST, Lot # Z 582 4224 1B . Refer to Appendix B for Certificate of Analysis.
- Praxair Fuel Gas Mixture - Primary Standard, Maxitherm, certified, traceable to NIST, Lot # Z 582 4224 1B. Refer to Appendix B for Certificate of Analysis.
- Praxair 2% Oxygen standard, helium balance, Lot # PGP104549

Method References:

- GPA Standard 2261; "Method of Analysis for Natural Gas and Similar Gaseous Mixtures by Gas Chromatography".
- GPA Standard 2172; "Calculation of Gross Heating Value, Relative Density and Compressibility Factor for Natural Gas Mixtures from Compositional Analysis".
- GPA Standard 2145-03; "Table of Physical Constants for Hydrocarbons and Other Compounds of Interest to the Natural Gas Industry".
- ASTM D-1945; "Standard Test Method for Analysis of Natural Gas by Gas Chromatography".
- ASTM D-3588; "Standard Practice for Calculating Heat Value, Compressibility Factor and Relative Density (Specific Gravity) of Gaseous Fuels".

## 3. RESULTS

ORTECH Environmental Inc. (ORTECH) received four fuel gas samples in summa canisters on December 15<sup>th</sup>, 2014 from Spartan Controls for the determination of the fuel gas composition and heating values. The samples were analyzed for specific compounds and fuel gas heating values were calculated. The samples were collected prior to the burner which operates at a pressure just slightly above atmospheric and is at an altitude of approximately 1000 metres above sea level. Due to these factors it was not possible to collect the samples at a positive pressure. It should be noted that the nitrogen and oxygen present in the analytical results is due to the transfer/injection process from the summa canister to the gas chromatograph and not from the sample gas itself. Due to the setup of ORTECH's chromatography system it is recommended that any future samples should be collected under a positive pressure. Appendix A is a detailed report of the fuel gas composition and heating value results of the fuel gas samples.

## 4. QUALITY ASSURANCE

### Precision

The standard deviation of ten analysis pairs in the month of December, 2014 was calculated based on the BTU/CF values for each pair analyzed. Ten duplicate analyses were performed for the samples acquired during the month resulting in a mean of 1039.2 BTU/CF and a standard deviation of 0.078 BTU/CF.

### Accuracy

The average of the differences was calculated between the reported ORTECH BTU/CF values and the mean values reported by the Scott Natural Gas Global Cross Reference program. The resulting accuracy is  $\pm 0.53$  BTU/CF.

Appendix B contains the certificates of calibration for the calibration gases used.

ORTECH is approved for natural gas analysis and landfill gas analysis by Measurement Canada (approval # AG-0572).



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Eugene Shereshevsky, B.Sc.  
Manager  
Analytical Services

ES:or

Approved by:



---

Stephen Thorndyke, M.Eng., P.Eng.  
Principal  
Odour Assessment/Analytical Services



## **APPENDIX A**

### **Composition and Heating Value Results (4 pages)**

# FUEL GAS ANALYSIS for Spartan Controls

Analysis By: E. Shereshevsky  
ORTECH<sup>1</sup> ID: 26077-C-1

Analysis Date: 16-Dec-14

Customer:<sup>2</sup> Spartan Controls

Sample ID: Test 1 A, B, C - 14714

Sample Date: 12-Dec-14

Sample Time: NA

Component	Component Mole Percent	BTU/CF <sup>3</sup>
Hydrogen	0.000	0.000
Oxygen	0.451	0.000
Nitrogen	1.909	0.000
Carbon Monoxide	0.000	0.000
Carbon Dioxide	0.000	0.000
Methane	0.000	0.000
Acetylene	0.000	0.000
Ethylene	0.000	0.000
Ethane	0.000	0.000
Propylene	97.639	2277.918
Propane	0.000	0.000
Isobutane	0.000	0.000
n-Butane	0.000	0.000
Neopentane	0.000	0.000
Isopentane	0.000	0.000
n-Pentane	0.000	0.000
n-Hexane	0.000	0.000
Benzene	0.000	0.000

Total 100.000 2283.2  
1/Z 1.01564

BTU/CF (14.73,60,DRY) 2318.9  
MJ/m3 (101.325 kPa,15°C,DRY) 86.367

Specific Gravity 1.4421

1. ORTECH Environmental.
2. Sample description.
3. The ORTECH sample pressure is reported.
3. Normalized values. Analysis: GPA Standard 2261. Calculation: GPA Standard 2145-03 / 2172 (25-Feb-03).

FUEL GAS ANALYSIS  
for Spartan Controls

Analysis By: E. Shereshevsky  
ORTECH<sup>1</sup> ID: 26077-C-2

Analysis Date: 16-Dec-14

Customer:<sup>2</sup> Spartan Controls

Sample ID: Test 2 A, B, C - 5634

Sample Date: 11-Dec-14

Sample Time: NA

Component	Component Mole Percent	BTU/CF <sup>3</sup>
Hydrogen	0.000	0.000
Oxygen	0.313	0.000
Nitrogen	1.650	0.000
Carbon Monoxide	0.000	0.000
Carbon Dioxide	0.000	0.000
Methane	0.000	0.000
Acetylene	0.000	0.000
Ethylene	0.000	0.000
Ethane	0.000	0.000
Propylene	98.037	2287.203
Propane	0.000	0.000
Isobutane	0.000	0.000
n-Butane	0.000	0.000
Neopentane	0.000	0.000
Isopentane	0.000	0.000
n-Pentane	0.000	0.000
n-Hexane	0.000	0.000
Benzene	0.000	0.000
Total	100.000	2292.5
1/Z		1.01575
BTU/CF (14.73,60,DRY)		2328.6
MJ/m3 (101.325 kPa,15°C,DRY)		86.728
Specific Gravity		1.4439

1. ORTECH Environmental.  
2. Sample description.  
3. The ORTECH sample pressure is reported.  
3. Raw values. Analysis: GPA Standard 2261. Calculation: GPA Standard 2145-03 / 2172 (25-Feb-03).

FUEL GAS ANALYSIS  
for Spartan Controls

Analysis By: E. Shereshevsky  
ORTECH<sup>1</sup> ID: 26077-C-3

Analysis Date: 16-Dec-14

Customer:<sup>2</sup> Spartan Controls

Sample ID: Test 3 A, B, C - 14717

Sample Date: 11-Dec-14

Sample Time: NA

Component	Component Mole Percent	BTU/CF <sup>3</sup>
Hydrogen	0.000	0.000
Oxygen	0.284	0.000
Nitrogen	1.401	0.000
Carbon Monoxide	0.000	0.000
Carbon Dioxide	0.000	0.000
Methane	0.000	0.000
Acetylene	0.000	0.000
Ethylene	0.000	0.000
Ethane	0.000	0.000
Propylene	98.315	2293.689
Propane	0.000	0.000
Isobutane	0.000	0.000
n-Butane	0.000	0.000
Neopentane	0.000	0.000
Isopentane	0.000	0.000
n-Pentane	0.000	0.000
n-Hexane	0.000	0.000
Benzene	0.000	0.000
Total	100.000	2299.0
1/Z		1.01583
BTU/CF (14.73,60,DRY)		2335.4
MJ/m3 (101.325 kPa,15°C,DRY)		86.980
Specific Gravity		1.4452

1. ORTECH Environmental.  
2. Sample description.  
3. The ORTECH sample pressure is reported.  
3. Raw values. Analysis: GPA Standard 2261. Calculation: GPA Standard 2145-03 / 2172 (25-Feb-03).

FUEL GAS ANALYSIS  
for Spartan Controls

Analysis By: E. Shereshevsky  
ORTECH<sup>1</sup> ID: 26077-C-4

Analysis Date: 16-Dec-14

Customer:<sup>2</sup> Spartan Controls  
Sample Date: 12-Dec-14  
Sample ID: Test 4 A, B, C  
Sample Time: NA

Component	Component Mole Percent	BTU/CF <sup>3</sup>
Hydrogen	0.000	0.000
Oxygen	0.310	0.000
Nitrogen	1.630	0.000
Carbon Monoxide	0.000	0.000
Carbon Dioxide	0.000	0.000
Methane	0.000	0.000
Acetylene	0.000	0.000
Ethylene	0.000	0.000
Ethane	0.000	0.000
Propylene	98.060	2287.740
Propane	0.000	0.000
Isobutane	0.000	0.000
n-Butane	0.000	0.000
Neopentane	0.000	0.000
Isopentane	0.000	0.000
n-Pentane	0.000	0.000
n-Hexane	0.000	0.000
Benzene	0.000	0.000

Total  
1/Z 100.000 2293.0  
1.01576

BTU/CF (14.73,60,DRY) 2329.2  
MJ/m3 (101.325 kPa,15°C,DRY) 86.749

Specific Gravity 1.4440

1. ORTECH Environmental.  
2. Sample description.  
3. The ORTECH sample pressure is reported.  
3. Raw values. Analysis: GPA Standard 2261. Calculation: GPA Standard 2145-03 / 2172 (25-Feb-03).

## **APPENDIX B**

### **Calibration Gases Certificates of Analysis (2 pages)**



Praxair Distribution, Inc.  
37256 Highway 30  
Geismar, LA 70734  
Tel: 225-677-7700  
Fax: 225-673-3531

05/12/2014

PRAXAIR BRAMPTON ON GRC  
165 BISCAYNE CRES  
ATT TODD SMITH  
BRAMPTON, ON L6W 4R3  
Attention: KEVIN BYFORD

Work Order No. 20716239  
Customer Reference No. CANADIAN  
ORTECH  
ENVIRONMENTAL

Product Lot/Batch No. Z582 4122 1C  
Product Part No. NI CD1EX1ZC-AS

### CERTIFICATE OF ANALYSIS

*Certified Standard*

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
1-Hexene	1 %	0.996 %	D	+/-2 %
Carbon dioxide	1 %	0.996 %	J	+/-2 %
Ethane	6 %	5.97 %	J	+/-2 %
Ethylene	25 %	24.9 %	J	+/-2 %
Hydrogen	2 %	2.01 %	J	+/-2 %
Methane	1 %	0.995 %	J	+/-2 %
Propylene	7 %	6.97 %	D	+/-2 %
Nitrogen	balance	balance 57.163		

Analytical Instruments: Agilent 7890A  
Cylinder Style: AS  
Cylinder Pressure @70F: 97 psig  
Cylinder Volume: 8.2 ft<sup>3</sup>  
Valve Outlet Connection: CGA-350  
Cylinder No(s): DT0006271  
Comments: Dew Point: 32 F

Filling Method: Gravimetric  
Date of Fill: 05/02/2014  
Expiration Date: 05/02/2016

Analyst:  Sabrina Williams - Chemist

QA Reviewer:  Oscar Del Bosque - OLP

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.

Key to Analytical Techniques:			
A	Flame Ionization with Methanizer	B	Gas Chromatography with Discharge Ionization Detector
E	Gas Chromatography with Flame Photometric Detector	F	Gas Chromatography with Helium Ionization Detector
I	Gas Chromatography with Reduction Gas Analyzer	J	Gas Chromatography with Thermal Conductivity Detector
M	Mass Spectrometry - MS or GC/MS	N	By Difference of Typical Impurities
Q	Total Hydrocarbon Analyzer	R	Wet Chemical
U	Gas Chromatography with Chemiluminescence Detector	V	Electrochemical
Y	Certified Gravimetrically	Z	N/A
C	Gas Chromatography with Electrolytic Conductivity Detector	D	Gas Chromatography with Flame Ionization Detector
G	Gas Chromatography with Methanizer Carbonizer	H	Gas Chromatography with Photoionization Detector
K	Binary Gas Analyzer with Thermal Conductivity Detector	L	Infrared - FTIR or NDIR
O	Paramagnetic	P	Specific Water Analyzer
S	Detector Tube	T	Odor
W	Hygrometer	X	Electron Capture Detector

#### 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.



Praxair Distribution, Inc.  
37256 Highway 30  
Geismar, LA 70734  
Tel: 225-677-7700  
Fax: 225-673-3531

08/19/2014

PRAXAIR BRAMPTON ON GRC  
165 BISCAYNE CRES  
ATT TODD SMITH  
BRAMPTON, ON L6W 4R3  
Attention: KEVIN BYFORD

Work Order No. **21441320**  
Customer Reference No. **CANADIAN  
ORTECH  
ENVIROMENTAL**

Product Lot/Batch No. **Z582 4224 1B**  
Product Part No. **ME BU4000X16CFX**

### CERTIFICATE OF ANALYSIS

*Certified Standard*

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Butane	0.4 %	0.399 %	D	+/-2 %
Carbon dioxide	3 %	3.01 %	J	+/-2 %
Ethane	3.5 %	3.51 %	D	+/-2 %
n-Heptane	200 ppm	208 ppm	D	+/-2 %
n-Hexane	500 ppm	513 ppm	D	+/-2 %
Isobutane	0.4 %	0.399 %	D	+/-2 %
Isopentane	0.15 %	0.150 %	D	+/-2 %
2,2-Dimethylpropane	0.1 %	0.100 %	D	+/-2 %
Nitrogen	2.5 %	2.40 %	J	+/-2 %
n-Pentane	0.15 %	0.150 %	D	+/-2 %
Propane	1 %	0.997 %	D	+/-2 %
Methane	balance	balance 88.829 %		

Analytical Instruments: **Hewlett Packard 6890**  
Cylinder Style: **FX**  
Cylinder Pressure @70F: **240 psig**  
Cylinder Volume: **68.1 ft3**  
Valve Outlet Connection: **CGA-510**  
Cylinder No(s): **65208 AW**

Filling Method: **Gravimetric**  
Date of Fill: **08/12/2014**  
Expiration Date: **08/12/2016**

Analyst: **Sabrina Williams - Chemist**

QA Reviewer: **Oscar Del Bosque - OLP**

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.

#### Key to Analytical Techniques:

A Flame Ionization with Methanizer	B Gas Chromatography with Discharge Ionization Detector	C Gas Chromatography with Electrolytic Conductivity Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Helium Ionization Detector	G Gas Chromatography with Methanizer Carbonizer	H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer	J Gas Chromatography with Thermal Conductivity Detector	K Binary Gas Analyzer with Thermal Conductivity Detector	L Infrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
Q Total Hydrocarbon Analyzer	R Wet Chemical	S Detector Tube	T Odor
U Gas Chromatography with Chemiluminescence Detector	V Electrochemical	W Hygrometer	X Electron Capture Detector
Y Certified Gravimetrically	Z N/A		

#### 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.



## Appendix C

### **Appendix C – Input Gas Analysis by Supplier**



Redwater, Alberta Canada

## Olefins Final Shipping Product Purity Report

Car Number:

GATX78149

Product: Polymer Grade Propylene

Total Lbs:

Net Lbs:

Sample Date:	8/19/2014 18:37		
Sample			
Storage			
Quantity		Measurement:	Praxair Specification:
Propylene	99.75	mol %	99.5 min.
Propane	0.244	mol %	0.5 max
Water	0.39	ppm mol	11.7 max
Methane	0.96	ppm mol	300.0 max
Acetylene	0.00	ppm wt.	1.2 max
MAPD	0.00	ppm mol	4.0 max
Ethane	0.19	ppm mol	450.0 max
1,3 Butadiene	0.00	ppm mol	6.0 max
Total Butenes	0.00	ppm mol	10.0 max
Carbonyl Sulfide	0.00	ppb wt.	53.0 max
Total Sulphur	0.01	ppm wt.	1.1 max
Oxygenated Compounds	0.03	ppm wt.	3.4 max
Oxygen	0.61	ppm wt.	4.0 max
Carbon Monoxide	0.00	ppm wt.	0.7 max
Carbon Dioxide	0.14	ppm wt.	1.0 max
Arsine & Phosphine	0.00	ppb wt.	2.0 max
Ammonia	0.00	ppm wt.	1.0 max
Total Saturated C4's	0.00	ppm mol	10.0 max
Total C6's	0.00	ppm mol	10.0 max
H2S	0.00	ppm wt.	0.47 max
Methyl Chloride	0.00	ppm wt.	5.6 max
Hydrogen	0.04	ppm mol	21.0 max
Analyst	SP		

*OK B. Smith*

\* Time based on 24hr Clock Mountain Standard Time

\*\*Report Based on Grab Sample Stream results on AIT5303 &amp; AIT5405 on Shipping Date &amp; Time

\*\*\* Total Sulfur reported in ppm weight not ppm Mole (alarm level @ 0.2 ppm weight. This is a lower value than .5 ppm Mole as value includes more sulfurs than just H2S, COS, Methyl &amp; Ethyl Mercaptans)

**Heating Value****ASTM****D3588-98**

<b>Component</b>	<b>%</b>	<b>Measurement</b>	<b>mol %</b>	<b>Component BTU/scf</b>	<b>Sample BTU/scf</b>
<b>Propylene</b>	<b>99.75</b>	<b>mol %</b>	<b>99.75</b>	<b>2333</b>	<b>2327</b>
<b>Propane</b>	<b>0.24</b>	<b>mol %</b>	<b>0.24</b>	<b>2516</b>	<b>6</b>
<b>Water</b>	<b>0.39</b>	<b>ppm mol</b>	<b>0.00</b>	<b>50</b>	<b>0</b>
<b>Methane</b>	<b>0.96</b>	<b>ppm mol</b>	<b>0.00</b>	<b>1010</b>	<b>0</b>
<b>Acetylene</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>	<b>1474</b>	<b>0</b>
<b>MAPD</b>	<b>0.00</b>	<b>ppm mol</b>	<b>0.00</b>		
<b>Ethane</b>	<b>0.19</b>	<b>ppm mol</b>	<b>0.00</b>	<b>1770</b>	<b>0</b>
<b>1,3 Butadiene</b>	<b>0.00</b>	<b>ppm mol</b>	<b>0.00</b>		
<b>Total Butenes</b>	<b>0.00</b>	<b>ppm mol</b>	<b>0.00</b>		
<b>Carbonyl Sulfide</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Total Sulphur</b>	<b>0.01</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Oxygenated Compounds</b>	<b>0.03</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Oxygen</b>	<b>0.61</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Carbon Monoxide</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>	<b>320</b>	<b>0</b>
<b>Carbon Dioxide</b>	<b>0.14</b>	<b>ppm wt.</b>	<b>0.00</b>	<b>0</b>	<b>0</b>
<b>Arsine and Phosphine</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Ammonia</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Total saturated C4's</b>	<b>0.00</b>	<b>ppm mol</b>	<b>0.00</b>		
<b>Total C6's</b>	<b>0.00</b>	<b>ppm mol</b>	<b>0.00</b>		
<b>H2S</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Methyl Chloride</b>	<b>0.00</b>	<b>ppm wt.</b>	<b>0.00</b>		
<b>Hydrogen</b>	<b>0.04</b>	<b>ppm mol</b>	<b>0.00</b>	<b>324</b>	<b>0</b>
<b>Total</b>			<b>99.99</b>		<b>2333</b>

## Appendix D1 – Stack Gas Emissions Report – AGAT

Run No.	Fuel Flow Rate	AGAT Test No.
1A	0 to 30%	7
1B	0 to 30%	11
1C	0 to 30%	12
2A	30 to 70%	4
2B	30 to 70%	5
2C	30 to 70%	6
3A	70 to 100%	1
3B	70 to 100%	2
3C	70 to 100%	3
4A	90 to 100%	8
4B	90 to 100%	9
4C	90 to 100%	10

Note:

In the AGAT Summary tables 6 to 9 the stack flows are reported on a wet basis. The dry flows are reported in the body of the AGAT report.

Both dry and wet flows are reported in Tables 5 to 8 of the main report.

## SOURCE EMISSION SURVEY

### Spartan Controls Ltd.

REM Technology Inc.

14C914464

Spartan Controls Ltd.

REM Technology Inc.

305 – 27 St. SE

Calgary, Alberta

T2A 7V2

Attention: Dr. Howard Malm

December 10-12, 2014

Report Revised February 11, 2015

Submitted By:

AGAT Laboratories Ltd.

2420 42<sup>nd</sup> Avenue NE

Calgary, Alberta T2E 7T6

Phone: 403.736.5300



#### Canadian Technology in Action:

Accredited by:

- The Canadian Association for Laboratory Accreditation (CALA)
- The Standards Council of Canada (SCC) for ISO 17025:2005 Certification

(Accreditation is limited to specific laboratory locations and registered tests)

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# AGAT Laboratories



# AGAT Laboratories

January 07, 2015

Spartan Controls Ltd  
REM Technology Inc.  
305 – 27 St. SE  
Calgary, Alberta  
T2A 7V2

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Attention: Dr. Howard Malm

Subject: REM Technology Inc. – December 2014 Source Emission Survey

---

AGAT Laboratories' Source Testing Services Group is pleased to submit the following Source Emission report. The test program was conducted for Spartan Controls Ltd. – REM Technology Inc. on December 10-12, 2014. Parameters tested were Carbon Monoxide, Total Hydrocarbons, Flow, and Sample Level Temperature.

If you have any questions or concerns regarding this report, please contact Mr. Steve Millar at (403) 736-5304 or via E-mail at [millar@agatlabs.com](mailto:millar@agatlabs.com). Alternatively, please contact Mr. Nitin Monteiro at (403) 736-5305, or via E-mail at [monteiro@agatlabs.com](mailto:monteiro@agatlabs.com). Thank you for your patronage, and we look forward to being of service to you in the future.

Yours truly,

**AGAT Laboratories**

Steve Millar  
Source Testing Manager

Nitin Monteiro, B.Sc., EPT.  
Client Project Manager

## SUMMARY

**Table 1: Summary of Results for Process Condition of 0 to 30%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>6.88</b>
CO Emission Rate	t/d	<b>0.0000420</b>
	kg/hr	<b>0.00175</b>
Total Hydrocarbons	ppmvd	<b>0.195</b>
THC Emission Rate	t/d	<b>0.000000667</b>
	kg/hr	<b>0.0000278</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.15</b>
	lb/hr	<b>561</b>
	ft <sup>3</sup> /hr	<b>7,573</b>
	m <sup>3</sup> /sec	<b>0.0596</b>
Stack Temperature	°C	<b>476</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 2: Summary of Results for Process Condition of 30 to 70%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>5.12</b>
CO Emission Rate	t/d	<b>0.0000356</b>
	kg/hr	<b>0.00148</b>
Total Hydrocarbons	ppmvd	<b>0.318</b>
THC Emission Rate	t/d	<b>0.00000120</b>
	kg/hr	<b>0.0000500</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.83</b>
	lb/hr	<b>633</b>
	ft <sup>3</sup> /hr	<b>8,583</b>
	m <sup>3</sup> /sec	<b>0.0675</b>
Stack Temperature	°C	<b>514</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C



**Table 3: Summary of Results for Process Condition of 70 to 100%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>4.36</b>
CO Emission Rate	t/d	<b>0.0000291</b>
	kg/hr	<b>0.00121</b>
Total Hydrocarbons	ppmvd	<b>0.403</b>
THC Emission Rate	t/d	<b>0.00000146</b>
	kg/hr	<b>0.0000608</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.54</b>
	lb/hr	<b>602</b>
	ft <sup>3</sup> /hr	<b>8,157</b>
	m <sup>3</sup> /sec	<b>0.0642</b>
Stack Temperature	°C	<b>541</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 4: Summary of Results for Process Condition of 90 to 100%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>3.45</b>
CO Emission Rate	t/d	<b>0.0000207</b>
	kg/hr	<b>0.000862</b>
Total Hydrocarbons	ppmvd	<b>0.102</b>
THC Emission Rate	t/d	<b>0.000000325</b>
	kg/hr	<b>0.0000135</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.01</b>
	lb/hr	<b>543</b>
	ft <sup>3</sup> /hr	<b>7,367</b>
	m <sup>3</sup> /sec	<b>0.0579</b>
Stack Temperature	°C	<b>530</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

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## **Part 1 – INTRODUCTION**

### **1.1 Background Information**

AGAT Laboratories' Source Testing Services Group was retained by Dr. Howard Malm of Spartan Controls Ltd. – REM Technology Inc. to perform a Source Emission Survey. These tests were conducted from December 10-12, 2014.

### **1.2 Key Personnel**

Mr. Claude Ricketts was the AGAT project manager with Dr. Howard Malm acting as the client contact and coordinator. Mr. Claude Ricketts, Mr. Joseph Woehleke, Mr. Alexander Sanguino and Mr. Nitin Monteiro performed the on-site sampling program. Mr. Nitin Monteiro performed the data reduction and produced the final report.

### **1.3 Project Scope**

Project scope included Source Emission Survey tests for Carbon Monoxide, Total Hydrocarbons, Volumetric Flow, and Sample Level Temperature.

## Part 2 – TEST PROCEDURE

### 2.1 Standard Methods

**Table 5: Standard Methods**

PARAMETER	METHOD
Velocity Traverse	Method 1 – Sample and Velocity Traverses for Stationary Sources, U.S. EPA
Stack Gas Velocity and Volumetric Flow Rate	Method 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate (type S pitot tube), U.S. EPA
Stack Gas Molecular Weight	Method 3A/3C – Gas Analysis for the Determination of Dry Molecular Weight, U.S. EPA
Moisture Content	Method 4 – Determination of Moisture Content in Stack Gases, U.S. EPA
Carbon Monoxide	Method 10 - Determination of Carbon Monoxide Emissions from Stationary Sources, U.S. EPA
Total Hydrocarbons	Method 25A – Determination of Total Hydrocarbons Emissions from Stationary Sources, USEPA
Fugitive Opacity	Method 22 – Determination of Fugitive Opacity from Stationary Sources, U.S. EPA

In the determination of percent CO<sub>2</sub> and percent O<sub>2</sub> content of the exhaust gas, an integrated bag sampling procedure was used as a grab-sample of the exhaust gas over the course of each test. One 10L bag was filled during every half hour, which amounted to two 10L bags for each test run. The exhaust gas was sampled at a constant rate of 0.30 L/min for five minutes at each traverse point and this was done simultaneously with flow measurements.

#### Gaseous Sampling System

Stack gas was withdrawn via an out-of-stack probe system with a 1:1 ratio that ensures the gas delivered to the analyzer is what is drawn out of the stack. The gas is delivered to a manifold through an inert teflon line. Test gas is passed through the manifold to a gas filter where it is analyzed for CO by a broad band infrared light. Additionally, the sample gas is also delivered through the manifold of a second analyzer for analysis of Total Hydrocarbons by a flame ionization detector. The sample gas is passed through the analyzer at a precise rate of flow and pressure to maintain sample integrity.

---

## **Volumetric Flow Measurements**

Stack gas velocity was determined from moisture content of the stack gas as well as differential pressure and temperature readings collected at six points along two diameters of the stack. Pressure differentials are measured by calibrated S-type Pitot tube and inclined oil manometer. Temperature measurements are made with a calibrated K-type thermocouple. Velocity, when multiplied by the cross sectional area of the stack equates to the volumetric flow.

### **2.2 Quality Assurance / Quality Control**

AGAT Laboratories is accredited by Canadian Association for Laboratory Accreditation (CALA), the Standards Council of Canada (SCC), and is an ISO 17025:2005 registered company. AGAT Laboratories is also ISO 9001:2008 registered company.

- Regular maintenance and calibration of all field-sampling equipment as per the applicable sampling protocols.
- Linearity and response time checks are conducted on all analyzers prior to use.
- Calibration drift is checked between all tests to assure instruments are performing within allowable limits.
- QA/QC on all final lab analysis and final written reports.

---

## **PART 3 – DISCUSSION**

The source emission survey for Spartan Controls Ltd. – REM Technology Inc. was conducted through four different process conditions (0-30%, 30-70%, 70-100% and 90-100%) comprising of a total of twelve tests.

At each traverse point of the stack at which the probe was placed, five (5) minutes of data were collected throughout each of the sixty (60) minute test runs. Therefore twelve (12) traverse points were measured during each of the one (1) hour test runs.

During the determination of fugitive opacity, two observers were used, alternating every 20 minutes, for the continuous observation period for each of the twelve (12) tests and it was determined that zero emissions were observed during each of the twelve (12) tests.

The survey was conducted over a span of three days and the test results are an accurate representation of emission characteristics for the process conditions maintained on the Spartan Controls Ltd. – REM Technology Inc. Incinerator Stack on the test dates of December 10-12, 2014.

## Part 4 – RESULTS

**Table 6: Parameter Results for Process Condition of 0 to 30%**

REM Technology Inc.					
Parameter	Units	Test 7	Test 11	Test 12	Average
Date and Time	14/12/11-12	16:10-17:20	13:00-14:10	14:30-15:40	
Flow Rate	%	0-30%	0-30%	0-30%	
Carbon Monoxide	ppmvw	6.47	6.82	7.34	6.88
CO Emission Rate	t/d	0.0000471	0.0000384	0.0000406	0.0000420
	kg/hr	0.00196	0.00160	0.00169	0.00175
Total Hydrocarbons	ppmvd	0.221	0.197	0.166	0.195
THC Emission Rate	t/d	0.000000889	0.000000610	0.000000501	0.000000667
	kg/hr	0.0000370	0.0000254	0.0000209	0.0000278
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	6.12	4.71	4.61	5.15
	lb/hr	673	510	500	561
	ft <sup>3</sup> /hr	9,005	6,931	6,783	7,573
	m <sup>3</sup> /sec	0.0708	0.0545	0.0534	0.0596
Stack Temperature	°C	475	474	480	476

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C



**Table 7: Parameter Results for Process Condition of 30 to 70%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 4</b>	<b>Test 5</b>	<b>Test 6</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/11</b>	<b>11:35-12:45</b>	<b>13:05-14:15</b>	<b>14:40-15:50</b>	
<b>Flow Rate</b>	<b>%</b>	<b>30-70%</b>	<b>30-70%</b>	<b>30-70%</b>	
Carbon Monoxide	ppmvw	<b>5.40</b>	<b>4.72</b>	<b>5.24</b>	<b>5.12</b>
CO Emission Rate	t/d	<b>0.0000332</b>	<b>0.0000347</b>	<b>0.0000388</b>	<b>0.0000356</b>
	kg/hr	<b>0.00139</b>	<b>0.00145</b>	<b>0.00162</b>	<b>0.00148</b>
Total Hydrocarbons	ppmvd	<b>0.392</b>	<b>0.344</b>	<b>0.219</b>	<b>0.318</b>
THC Emission Rate	t/d	<b>0.00000133</b>	<b>0.00000138</b>	<b>0.000000893</b>	<b>0.00000120</b>
	kg/hr	<b>0.0000554</b>	<b>0.0000575</b>	<b>0.0000372</b>	<b>0.0000500</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.17</b>	<b>6.12</b>	<b>6.21</b>	<b>5.83</b>
	lb/hr	<b>562</b>	<b>664</b>	<b>673</b>	<b>633</b>
	ft <sup>3</sup> /hr	<b>7,607</b>	<b>9,005</b>	<b>9,138</b>	<b>8,583</b>
	m <sup>3</sup> /sec	<b>0.0598</b>	<b>0.0708</b>	<b>0.0719</b>	<b>0.0675</b>
Stack Temperature	°C	<b>511</b>	<b>519</b>	<b>512</b>	<b>514</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 8: Parameter Results for Process Condition of 70 to 100%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Test 3</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/10/11</b>	<b>15:00-16:10</b>	<b>08:30-09:40</b>	<b>10:05-11:15</b>	
<b>Flow Rate</b>	<b>%</b>	<b>70-100%</b>	<b>70-100%</b>	<b>70-100%</b>	
Carbon Monoxide	ppmvw	<b>4.24</b>	<b>4.59</b>	<b>4.27</b>	<b>4.36</b>
CO Emission Rate	t/d	<b>0.0000265</b>	<b>0.0000319</b>	<b>0.0000288</b>	<b>0.0000291</b>
	kg/hr	<b>0.00110</b>	<b>0.00133</b>	<b>0.00120</b>	<b>0.00121</b>
Total Hydrocarbons	ppmvd	<b>0.447</b>	<b>0.390</b>	<b>0.372</b>	<b>0.403</b>
THC Emission Rate	t/d	<b>0.00000151</b>	<b>0.00000149</b>	<b>0.00000138</b>	<b>0.00000146</b>
	kg/hr	<b>0.0000629</b>	<b>0.0000622</b>	<b>0.0000574</b>	<b>0.0000608</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.15</b>	<b>5.84</b>	<b>5.64</b>	<b>5.54</b>
	lb/hr	<b>556</b>	<b>635</b>	<b>614</b>	<b>602</b>
	ft <sup>3</sup> /hr	<b>7,578</b>	<b>8,593</b>	<b>8,299</b>	<b>8,157</b>
	m <sup>3</sup> /sec	<b>0.0596</b>	<b>0.0676</b>	<b>0.0653</b>	<b>0.0642</b>
Stack Temperature	°C	<b>558</b>	<b>527</b>	<b>537</b>	<b>541</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 9: Parameter Results for Process Condition of 90 to 100%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 8</b>	<b>Test 9</b>	<b>Test 10</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/12</b>	<b>08:25-09:35</b>	<b>09:55-11:05</b>	<b>11:30-12:40</b>	
<b>Flow Rate</b>	<b>%</b>	<b>90-100%</b>	<b>90-100%</b>	<b>90-100%</b>	
Carbon Monoxide	ppmvw	<b>3.73</b>	<b>3.12</b>	<b>3.49</b>	<b>3.45</b>
CO Emission Rate	t/d	<b>0.0000225</b>	<b>0.0000198</b>	<b>0.0000198</b>	<b>0.0000207</b>
	kg/hr	<b>0.000938</b>	<b>0.000823</b>	<b>0.000825</b>	<b>0.000862</b>
Total Hydrocarbons	ppmvd	<b>0.117</b>	<b>0.0209</b>	<b>0.167</b>	<b>0.102</b>
THC Emission Rate	t/d	<b>0.000000384</b>	<b>0.0000000724</b>	<b>0.000000517</b>	<b>0.000000325</b>
	kg/hr	<b>0.0000160</b>	<b>0.00000302</b>	<b>0.0000215</b>	<b>0.0000135</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.02</b>	<b>5.28</b>	<b>4.72</b>	<b>5.01</b>
	lb/hr	<b>543</b>	<b>574</b>	<b>511</b>	<b>543</b>
	ft <sup>3</sup> /hr	<b>7,387</b>	<b>7,769</b>	<b>6,945</b>	<b>7,367</b>
	m <sup>3</sup> /sec	<b>0.0581</b>	<b>0.0611</b>	<b>0.0546</b>	<b>0.0579</b>
Stack Temperature	°C	<b>523</b>	<b>527</b>	<b>539</b>	<b>530</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

## **Appendix I**

### **Emission Data and Calculations**

# Appendix D1

	Company: Date:	Spartan Controls 2014/12/10-12										
Actual Span Gas Conc	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13
Pre Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Pre Test Span	4.45	5.18	5.56	5.81	5.63	5.41	5.39	4.95	4.77	4.84	5.21	5.10
RATA Test #	1	2	3	4	5	6	7	8	9	10	11	12
Process Condition	70-100%	70-100%	70-100%	30-70%	30-70%	30-70%	0-30%	90-100%	90-100%	90-100%	0-30%	0-30%
PPM Dry to Wet	4.235	4.589	4.270	5.404	4.718	5.238	6.467	3.729	3.118	3.491	6.817	7.341
CO PPM drift corrected	4.495	4.772	4.467	5.614	4.953	5.463	6.715	3.916	3.267	3.665	7.125	7.690
Reference ppm, dry	3.895	4.995	4.950	6.260	5.330	5.750	7.160	3.710	3.060	3.590	7.160	7.450
mg/m3 wet	5.15	5.46	5.11	6.43	5.67	6.25	7.69	4.48	3.74	4.20	8.16	8.80
Reference Flow (E <sup>3</sup> M <sup>3</sup> /Day)	5.15	5.84	5.64	5.17	6.12	6.21	6.12	5.02	5.28	4.72	4.71	4.61
CO kg/h	0.001104	0.001329	0.001202	0.001385	0.001446	0.001618	0.001960	0.000938	0.000823	0.000825	0.001601	0.001691
CO t/d	0.00002651	0.00003191	0.00002884	0.00003323	0.00003471	0.00003884	0.00004705	0.00002251	0.00001975	0.00001981	0.00003842	0.00004059
Ref Temp °C All Points	558.4	526.7	536.8	511.4	518.9	511.6	475.3	523.2	526.5	539.3	474.3	479.5
Velocity (m/sec)	2.590	2.862	2.800	2.485	2.970	2.983	2.804	2.441	2.581	2.342	2.153	2.122
Stack Gas Moisture	0.0580	0.0383	0.0440	0.0375	0.0475	0.0411	0.0370	0.0478	0.0457	0.0475	0.0432	0.0453
CO Test Time start	15:00	08:30	10:05	11:35	13:05	14:40	16:10	08:25	09:55	11:30	13:00	14:30
End	16:10	09:40	11:15	12:45	14:15	15:50	17:20	09:35	11:05	12:40	14:10	15:40
Velocity Test Times Start	15:56	08:34	10:06	11:38	13:08	14:44	16:14	08:28	09:58	11:33	13:03	14:33
End	16:06	09:38	11:06	12:41	14:11	15:47	17:16	09:33	11:03	12:37	14:06	15:37
Post Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Post Test Span	4.44	5.56	5.81	5.63	5.41	5.39	5.55	4.77	4.84	5.21	5.10	4.84

# Appendix D1

	Company: Date:	Spartan 2014/12/10-12 RATA Table										
Actual Span Gas Conc	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09
Pre Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Pre Test Span	8.13	8.56	8.24	8.86	8.76	8.70	7.88	8.93	8.20	9.20	8.23	7.43
RATA Test #	1	2	3	4	5	6	7	8	9	10	11	12
Process Condition	70-100%	70-100%	70-100%	30-70%	30-70%	30-70%	0-30%	90-100%	90-100%	90-100%	0-30%	0-30%
THC PPM drift corrected	0.447	0.390	0.372	0.392	0.344	0.219	0.221	0.117	0.0209	0.167	0.197	0.166
Reference ppm_wet	0.410	0.360	0.350	0.380	0.330	0.200	0.200	0.110	0.0200	0.160	0.170	0.135
mg/m3 wet	0.293	0.256	0.244	0.257	0.225	0.144	0.145	0.077	0.0137	0.109	0.129	0.109
Reference Flow (E <sup>3</sup> M <sup>3</sup> /Day)	5.15	5.84	5.64	5.17	6.12	6.21	6.12	5.02	5.28	4.72	4.71	4.61
THC kg/h	0.0000629	0.0000622	0.0000574	0.0000554	0.0000575	0.0000372	0.0000370	0.0000160	0.00000302	0.0000215	0.0000254	0.0000209
THC t/d	0.00000151	0.00000149	0.00000138	0.00000133	0.00000138	0.000000893	0.000000889	0.000000384	0.0000000724	0.000000517	0.000000610	0.000000501
Ref Temp °C All Points	558.4	526.7	536.8	511.4	518.9	511.6	475.3	523.2	526.5	539.3	474.3	479.5
Velocity (m/sec)	2.590	2.862	2.800	2.485	2.970	2.983	2.804	2.441	2.581	2.342	2.153	2.122
Stack Gas Moisture	0.0580	0.0383	0.0440	0.0375	0.0475	0.0411	0.0370	0.0478	0.0457	0.0475	0.0432	0.0453
THC Test Time start	1500	0830	1005	1135	1305	1440	1610	0825	0955	1130	1300	1430
End	1610	0940	1115	1245	1415	1550	1720	0935	1105	1240	1410	1540
Velocity Test Times Start	1556	0834	1006	1138	1308	1444	1614	0828	0958	1133	1303	1433
End	1606	0938	1106	1241	1411	1547	1716	0933	1103	1237	1406	1537
Post Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Post Test Span	8.56	8.24	8.86	8.76	8.70	7.88	8.54	8.20	9.20	8.23	7.43	7.38

Source Incinerator Test # 1 Date 2014/12/10

Start Time 15:56 End Time 16:06

Summary

Average Stack Gas Velocity 2.59 m/s

Average Stack Gas Volumetric Flow Rate  
 Dry 202 std m3/hour  
 Wet 215 std m3/hour  
 Dry 0.0562 std m3/sec  
 Wet 0.0596 std m3/sec

Average Stack Gas Mass Flow Rate  
 Dry 238 kg/hour  
 Wet 252 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 558 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
 Wet Molecular Weight 28.8 kg/kg-mol

Molar Fraction Water Vapor 0.058

Fixed Gas		%O2	%CO2	%N2	CO ppm
	Dry	13.5	5.5	81.0	#N/A
	Wet	12.7	5.2	76.3	#N/A

## Data and Calculations

Source Incinerator Test # 1 Date 2014/12/10

Start Time 15:56 End Time 16:06

Average Stack Gas Velocity. **2.590 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

214.60 std m3/hour

5.15 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 252.25 \text{ kg/hour}$$

Dry Molecular Wt. **29.42 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.76 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 5.8012142 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0580**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0217 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5066 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0095 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	558.4	Temperature Stack C
_Ts	831.6	Absolute stack temperature K
_Bp	668.6	Barometric Pressure mmHg
_Pst	-0.3048	Static Pressure mmH2O
_Ps	668.56	Absolute stack pressure mm Hg
_Ms	28.76	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
		0.3048 Diameter Meters

_Tstd	298.15	Standard absolute temperature K
_Pstd	760	Standard absolute pressure



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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.56328	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	18.50	Temperature meter Celsius
_Tm	291.7	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	9.20	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 2 Date 2014/12/11  
Start Time 8:34 End Time 9:38

Summary

Average Stack Gas Velocity 2.86 m/s

Average Stack Gas Volumetric Flow Rate Dry 234 std m3/hour  
Wet 243 std m3/hour  
Dry 0.065 std m3/sec  
Wet 0.0676 std m3/sec

Average Stack Gas Mass Flow Rate Dry 277 kg/hour  
Wet 288 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 527 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.0383

Fixed Gas		%O2	%CO2	%N2	CO ppm
	Dry	13.0	5.5	81.5	#N/A
	Wet	12.5	5.3	78.4	#N/A

## Data and Calculations

Source Incinerator Test # 2 Date 2014/12/11

Start Time 8:34 End Time 9:38

Average Stack Gas Velocity. **2.862 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
243.41 std m3/hour  
5.84 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 288.17 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.96 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.8263946 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0383**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0176 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5111 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0027 \_V_{sg}(\text{std})$$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	526.7	Temperature Stack C
$\_T_s$	799.8	Absolute stack temperature K
$\_B_p$	660.2	Barometric Pressure mmHg
$\_P_{st}$	-0.3302	Static Pressure mmH2O
$\_P_s$	660.17	Absolute stack pressure mm Hg
$\_M_s$	28.96	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	13.0	Final Weight of water in grams
_V	0.57852	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 3 Date 2014/12/11  
Start Time 10:06 End Time 11:06

Summary

Average Stack Gas Velocity 2.8 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 225 std m3/hour  
Wet 235 std m3/hour  
Dry 0.0625 std m3/sec  
Wet 0.0653 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 266 kg/hour  
Wet 279 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 537 Celsius

Dry Molecular Weight 29.5 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.044

Fixed Gas		%O2	%CO2	%N2	CO ppm
	Dry	13.5	6.0	80.5	#N/A
	Wet	12.9	5.7	77.0	#N/A

## Data and Calculations

Source Incinerator Test # 3 Date 2014/12/11

Start Time 10:06 End Time 11:06

Average Stack Gas Velocity. **2.800 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
235.18 std m3/hour  
5.64 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 278.71 \text{ kg/hour}$$

Dry Molecular Wt. **29.5 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.99 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.402453 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0440**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5005 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

\_Kp 34.9219 Pitot tube constant  
\_Cp 0.803 Pitot tube coefficient  
\_NP 12 Number of traverse points  
\_Dts 536.8 Temperature Stack C  
\_Ts 810.0 Absolute stack temperature K  
\_Bp 660.2 Barometric Pressure mmHg  
\_Pst -0.2794 Static Pressure mmH2O  
\_Ps 660.18 Absolute stack pressure mm Hg  
\_Ms 28.99 Molecular weight of stack gas, wet basis g/g-mole  
\_A 0.0730 Area Square Meters 0.3048 Diameter Meters

\_Tstd 298.15 Standard absolute temperature K  
\_Pstd 760 Standard absolute pressure

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.56652	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	6	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	80.5	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 4 Date 2014/12/11

Start Time 11:38 End Time 12:41

Summary

Average Stack Gas Velocity 2.49 m/s

Average Stack Gas Volumetric Flow Rate  
 Dry 207 std m3/hour  
 Wet 216 std m3/hour  
 Dry 0.0576 std m3/sec  
 Wet 0.0599 std m3/sec

Average Stack Gas Mass Flow Rate  
 Dry 245 kg/hour  
 Wet 255 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 511 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
 Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0375

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.0	5.0	81.0	#N/A
Wet	13.5	4.8	78.0	#N/A



## Data and Calculations

Source Incinerator Test # 4 Date 2014/12/11

Start Time 11:38 End Time 12:41

Average Stack Gas Velocity. **2.485 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**  
215.50 std m3/hour  
5.17 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 254.87 \text{ kg/hour}$$

Dry Molecular Wt. **29.36 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.93 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.7478721 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0375**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0163 \_V_w(\text{str})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5224 \_V_m(\text{st})$$

$$V_{sg}(\text{std}) = K_2(\text{sg}) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0041 \_V_{sg}(\text{sl})$$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	511.4	Temperature Stack C
$\_T_s$	784.6	Absolute stack temperature K
$\_B_p$	660.2	Barometric Pressure mmHg
$\_P_{st}$	-0.2794	Static Pressure mmH2O
$\_P_s$	660.18	Absolute stack pressure mm Hg
$\_M_s$	28.93	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	12.0	Final Weight of water in grams
_V	0.59124	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 5 Date 2014/12/11  
Start Time 13:08 End Time 14:11

Summary

Average Stack Gas Velocity 2.97 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 243 std m3/hour  
Wet 255 std m3/hour  
Dry 0.0675 std m3/sec  
Wet 0.0709 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 287 kg/hour  
Wet 301 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 519 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0475

Fixed Gas		%O2	%CO2	%N2	CO ppm
	Dry	13.5	5.5	81.0	#N/A
	Wet	12.9	5.2	77.2	#N/A

## Data and Calculations

Source Incinerator Test # 5 Date 2014/12/11

Start Time 13:08 End Time 14:11

Average Stack Gas Velocity. **2.970 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

255.11 std m3/hour

6.12 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 301.12 \text{ kg/hour}$$

Dry Molecular Wt. **29.42 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.88 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7515786 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0475**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0217 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5164 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	518.9	Temperature Stack C
_Ts	792.1	Absolute stack temperature K
_Bp	660.2	Barometric Pressure mmHg
_Pst	-0.2794	Static Pressure mmH2O
_Ps	660.18	Absolute stack pressure mm Hg
_Ms	28.88	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
		0.3048 Diameter Meters

_Tstd	298.15	Standard absolute temperature K
_Pstd	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.58447	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 6 Date 2014/12/11

Start Time 14:44 End Time 15:47

Summary

Average Stack Gas Velocity 2.98 m/s

Average Stack Gas Volumetric Flow Rate	Dry	248 std m3/hour
	Wet	259 std m3/hour
	Dry	0.0689 std m3/sec
	Wet	0.0718 std m3/sec

Average Stack Gas Mass Flow Rate	Dry	293 kg/hour
	Wet	305 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 512 Celsius

Dry Molecular Weight 29.4 kg/kg-mol

Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0411

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.0	5.0	81.0	#N/A
Wet	13.4	4.8	77.7	#N/A

## Data and Calculations

Source Incinerator Test # 6 Date 2014/12/11

Start Time 14:44 End Time 15:47

Average Stack Gas Velocity. **2.983 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

258.60 std m3/hour

6.21 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 305.40 \text{ kg/hour}$$

Dry Molecular Wt. **29.36 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.89 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.1075717 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0411**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0163 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5383 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0068 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant	
$\_C_p$	0.803	Pitot tube coefficient	
$\_NP$	12	Number of traverse points	
$\_D_{ts}$	511.6	Temperature Stack C	
$\_T_s$	784.7	Absolute stack temperature K	
$\_B_p$	660.2	Barometric Pressure mmHg	
$\_P_{st}$	-0.2794	Static Pressure mmH2O	
$\_P_s$	660.18	Absolute stack pressure mm Hg	
$\_M_s$	28.89	Molecular weight of stack gas, wet basis g/g-mole	
$\_A$	0.0730	Area Square Meters	0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	12.0	Final Weight of water in grams
_V	0.60928	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm



Source Incinerator Test # 7 Date 2014/12/11

Start Time 16:14 End Time 17:16

Summary

Average Stack Gas Velocity 2.8 m/s

Average Stack Gas Volumetric Flow Rate  
 Dry 245 std m3/hour  
 Wet 255 std m3/hour  
 Dry 0.0682 std m3/sec  
 Wet 0.0708 std m3/sec

Average Stack Gas Mass Flow Rate  
 Dry 290 kg/hour  
 Wet 301 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 475 Celsius

Dry Molecular Weight 29.3 kg/kg-mol  
 Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.037

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	4.5	81.0	#N/A
Wet	14.0	4.3	78.0	#N/A

## Data and Calculations

Source Incinerator Test # 7 Date 2014/12/11

Start Time 16:14 End Time 17:16

Average Stack Gas Velocity. **2.804 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

254.85 std m3/hour

6.12 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 300.85 \text{ kg/hour}$$

Dry Molecular Wt. **29.3 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.88 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.7042476 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0370**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0136 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.4936 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0054 \_V_{sg}(\text{std})$$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	475.3	Temperature Stack C
_Ts	748.4	Absolute stack temperature K
_Bp	660.2	Barometric Pressure mmHg
_Pst	-0.254	Static Pressure mmH2O
_Ps	660.18	Absolute stack pressure mm Hg
_Ms	28.88	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
	0.3048	Diameter Meters

\_Tstd 298.15 Standard absolute temperature K

\_Pstd 760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	10.0	Final Weight of water in grams
_V	0.55872	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	4.5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Source Incinerator Test # 8 Date 2014/12/12

Start Time 8:28 End Time 9:33

Summary

Average Stack Gas Velocity 2.44 m/s

Average Stack Gas Volumetric Flow Rate Dry 199 std m3/hour  
Wet 209 std m3/hour  
Dry 0.0553 std m3/sec  
Wet 0.058 std m3/sec

Average Stack Gas Mass Flow Rate Dry 235 kg/hour  
Wet 246 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 523 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0478

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.4	5.2	77.6	#N/A

## Data and Calculations

Source Incinerator Test # 8 Date 2014/12/12

Start Time 8:28 End Time 9:33

Average Stack Gas Velocity. **2.441 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

208.96 std m3/hour

5.02 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 246.45 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.85 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7813766 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0478**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5132 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0068 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	523.2	Temperature Stack C
_Ts	796.3	Absolute stack temperature K
_Bp	661.5	Barometric Pressure mmHg
_Pst	-0.1778	Static Pressure mmH2O
_Ps	661.45	Absolute stack pressure mm Hg
_Ms	28.85	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
	0.3048	Diameter Meters

_Tstd	298.15	Standard absolute temperature K
_Pstd	760	Standard absolute pressure

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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.57774	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	19.00	Temperature meter Celsius
_Tm	292.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 9 Date 2014/12/12  
Start Time 9:58 End Time 11:03

Summary

Average Stack Gas Velocity 2.58 m/s  
Average Stack Gas Volumetric Flow Rate Dry 210 std m3/hour  
Wet 220 std m3/hour  
Dry 0.0583 std m3/sec  
Wet 0.0611 std m3/sec  
Average Stack Gas Mass Flow Rate Dry 248 kg/hour  
Wet 260 kg/hour  
Stack Cross Sectional Area 0.073 m2  
Average Stack Gas Temperature 527 Celsius  
Dry Molecular Weight 29.5 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol  
Molar Fraction Water Vapor 0.0457

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	6.0	81.0	#N/A
Wet	12.4	5.7	77.3	#N/A

## Data and Calculations

Source Incinerator Test # 9 Date 2014/12/12

Start Time 9:58 End Time 11:03

Average Stack Gas Velocity. **2.581 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

220.01 std m3/hour

5.28 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 260.39 \text{ kg/hour}$$

Dry Molecular Wt. **29.48 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.96 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.5679914 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0457**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0217 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5098 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0027 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_N_P$	12	Number of traverse points
$\_D_{ts}$	526.5	Temperature Stack C
$\_T_s$	799.7	Absolute stack temperature K
$\_B_p$	661.5	Barometric Pressure mmHg
$\_P_{st}$	-0.1524	Static Pressure mmH2O
$\_P_s$	661.46	Absolute stack pressure mm Hg
$\_M_s$	28.96	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure



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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.57589	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	6	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 10 Date 2014/12/12  
Start Time 11:33 End Time 12:37

Summary

Average Stack Gas Velocity 2.34 m/s

Average Stack Gas Volumetric Flow Rate Dry 187 std m3/hour  
Wet 197 std m3/hour  
Dry 0.052 std m3/sec  
Wet 0.0546 std m3/sec

Average Stack Gas Mass Flow Rate Dry 221 kg/hour  
Wet 232 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 539 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0475

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.4	5.2	77.6	#N/A

## Data and Calculations

Source Incinerator Test # 10 Date 2014/12/12

Start Time 11:33 End Time 12:37

Average Stack Gas Velocity. **2.342 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

196.51 std m3/hour

4.72 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 231.80 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.86 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7487394 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0475**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0203 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5168 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0054 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	539.3	Temperature Stack C
$\_Ts$	812.4	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.86	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$	298.15	Standard absolute temperature K
$\_Pstd$	760	Standard absolute pressure

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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	15.0	Final Weight of water in grams
_V	0.58381	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 11 Date 2014/12/12  
 Start Time 13:00 End Time 14:06

Summary

Average Stack Gas Velocity 2.15 m/s

Average Stack Gas Volumetric Flow Rate  
 Dry 188 std m3/hour  
 Wet 196 std m3/hour  
 Dry 0.0522 std m3/sec  
 Wet 0.0545 std m3/sec

Average Stack Gas Mass Flow Rate  
 Dry 221 kg/hour  
 Wet 231 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 474 Celsius

Dry Molecular Weight 29.3 kg/kg-mol  
 Wet Molecular Weight 28.8 kg/kg-mol

Molar Fraction Water Vapor 0.0432

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	4.5	81.0	#N/A
Wet	13.9	4.3	77.5	#N/A

## Data and Calculations

Source Incinerator Test # 11 Date 2014/12/12

Start Time 13:00 End Time 14:06

Average Stack Gas Velocity. **2.153 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

196.37 std m3/hour

4.71 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 231.25 \text{ kg/hour}$$

Dry Molecular Wt. **29.3 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.81 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.3239159 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0432**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.51 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	474.3	Temperature Stack C
$\_Ts$	747.5	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.81	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$	298.15	Standard absolute temperature K
$\_Pstd$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.57618	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	4.5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 12 Date 2014/12/12

Start Time 14:33 End Time 15:37

Summary

Average Stack Gas Velocity 2.12 m/s

Average Stack Gas Volumetric Flow Rate Dry 183 std m3/hour  
Wet 192 std m3/hour  
Dry 0.051 std m3/sec  
Wet 0.0534 std m3/sec

Average Stack Gas Mass Flow Rate Dry 216 kg/hour  
Wet 227 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 480 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0453

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	5.0	80.5	#N/A
Wet	13.8	4.8	76.9	#N/A



## Data and Calculations

Source Incinerator Test # 12 Date 2014/12/12

Start Time 14:33 End Time 15:37

Average Stack Gas Velocity. **2.122 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

192.15 std m3/hour

4.61 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437$$

226.71 kg/hour

Dry Molecular Wt. **29.38 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.86 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.5270035 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0453**

$$V_w(\text{std}) = K (W_f - W_i)$$

Volume Water vapor at s.t.p. M<sup>3</sup>

0.0217  $\_V_w(\text{std})$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m)$$

Volume meter gas at s.t.p. M<sup>3</sup>

0.5146  $\_V_m(\text{std})$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i)$$

Water Water in silica s.t.p. M<sup>3</sup>

0.0027  $\_V_{sg}(\text{std})$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

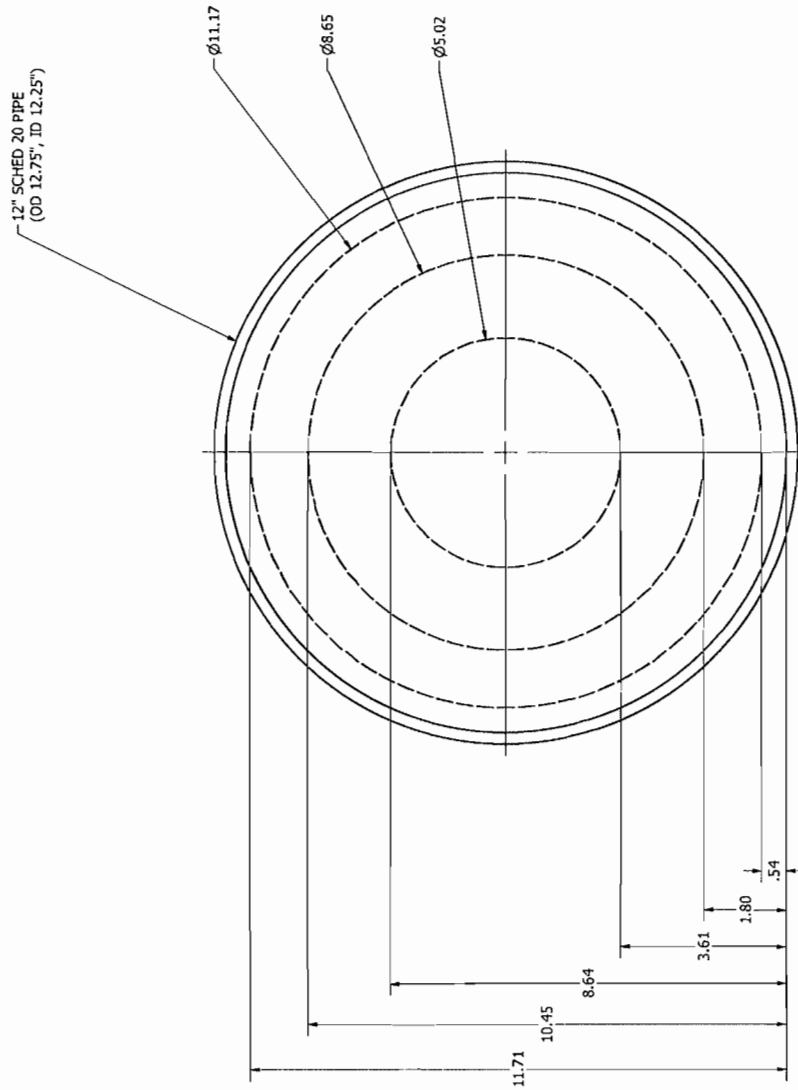
$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	479.5	Temperature Stack C
$\_Ts$	752.7	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.86	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K

$\_Pstd$  760 Standard absolute pressure

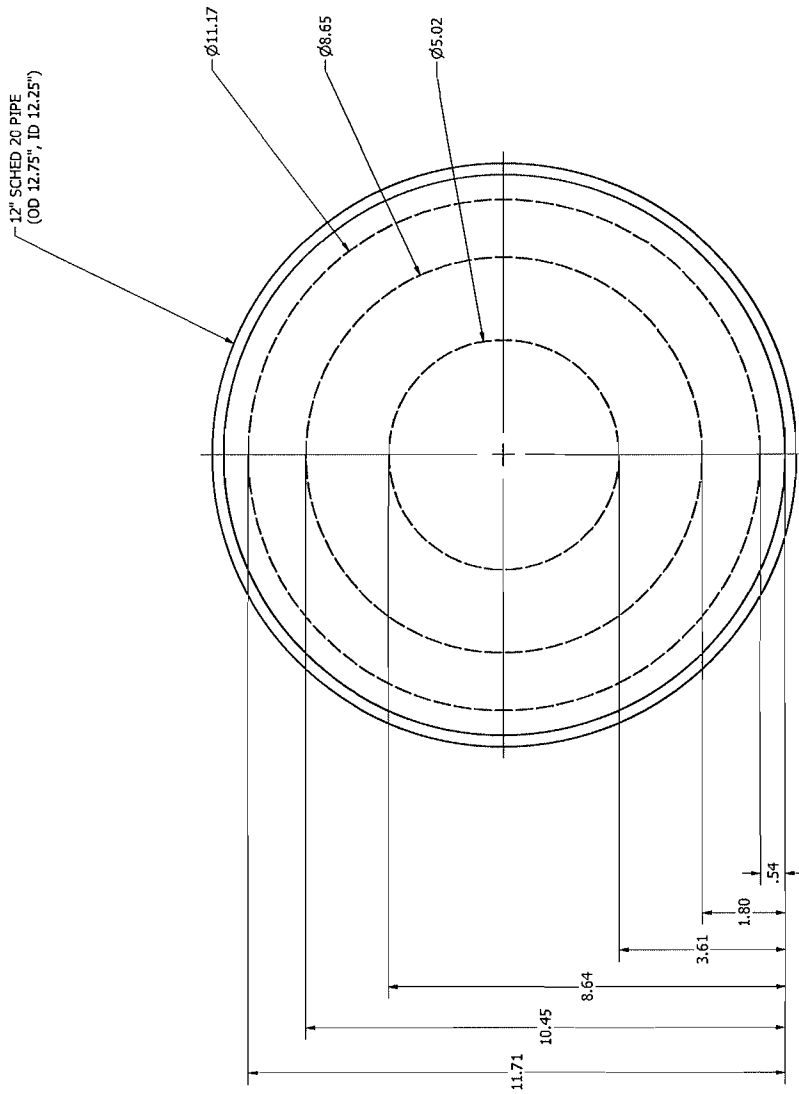
---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.58135	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	80.5	Molar Percent Nitrogen
_CO	#N/A	ppm



NOTES:  
 -ALL DIMENSION IN INCHES.  
 -CROSS SECTION OF SLIPSTREAM GTS EXHAUST AT 6 POINT TRAVERSE.

DRAWN JHS	12/15/2014	SPARTAN CONTROLS	
CHECKED		TITLE	
QA		SLIPSTREAM GTS EPA TEST - 6 POINT TRAVERSE	
MFG		SIZE	
APPROVED		C	
		DWG NO	
		12inchSched20_pipe	
		REV	
		SCALE	
		SHEET 1 OF 1	



NOTES:  
 -ALL DIMENSION IN INCHES.  
 -CROSS SECTION OF SLIPSTREAM GTS EXHAUST AT 6 POINT TRAVERSE.

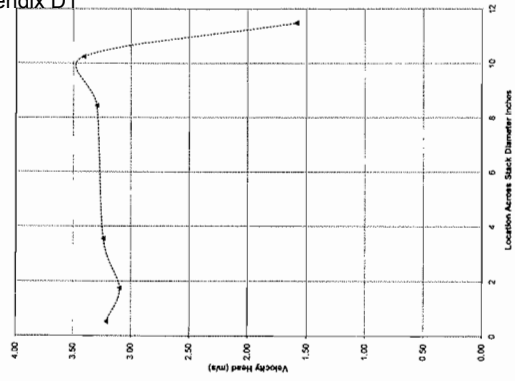
DRAWN JHS		12/15/2014	SPARTAN CONTROLS	
CHECKED			TITLE	
QA			SLIPSTREAM GTS EPA TEST - 6 POINT TRAVERSE	
MFG			SIZE	
APPROVED			C	
			DWG NO	
			12InchSched20_pipe	
			REV	
			SCALE	
			SHEET 1 OF 1	

## **Appendix II**

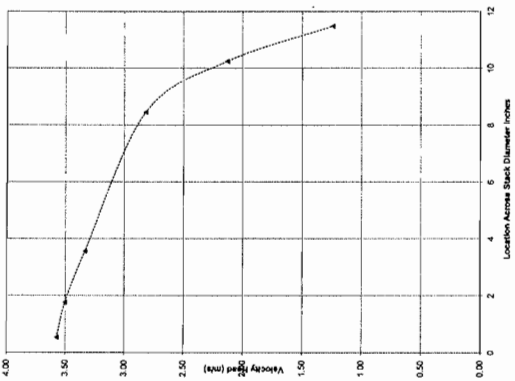
### **Velocity Traverse Profiles**

Appendix D1

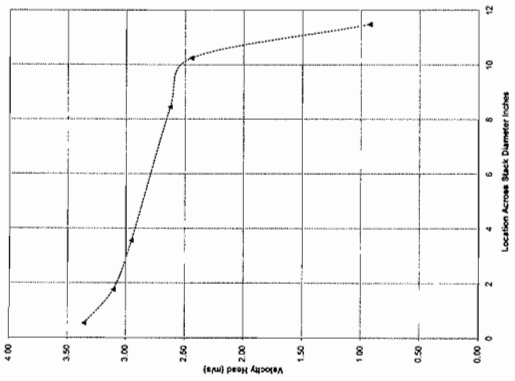
Velocity Profile North to South  
Incinerator Test # 2 2014/12/11



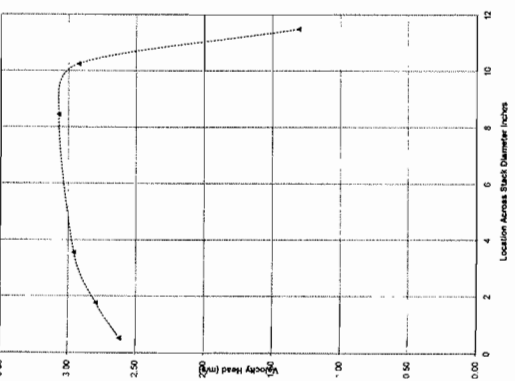
Velocity Profile East to West  
Incinerator Test # 2 2014/12/11



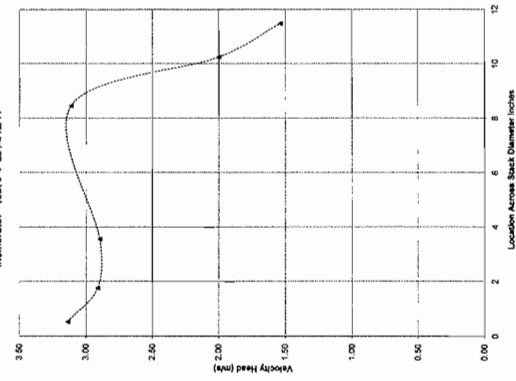
Velocity Profile North to South  
Incinerator Test # 1 2014/12/10



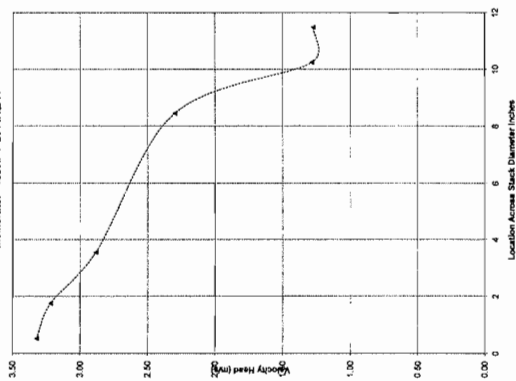
Velocity Profile East to West  
Incinerator Test # 1 2014/12/10



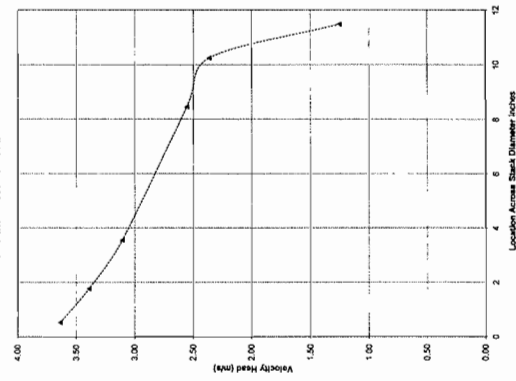
Velocity Profile North to South  
Incinerator Test # 4 2014/12/11



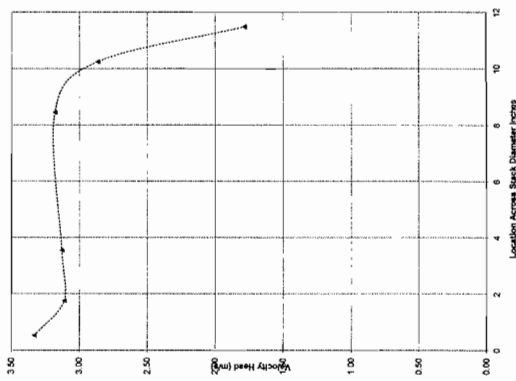
Velocity Profile East to West  
Incinerator Test # 4 2014/12/11



Velocity Profile North to South  
Incinerator Test # 3 2014/12/11

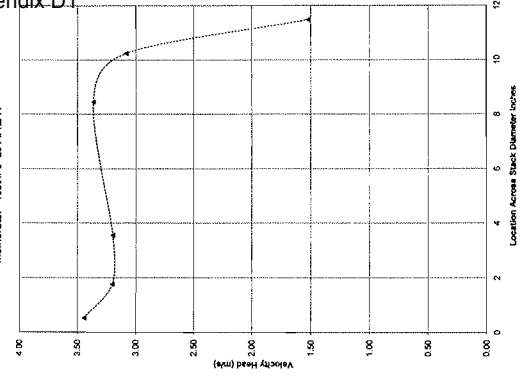


Velocity Profile East to West  
Incinerator Test # 3 2014/12/11

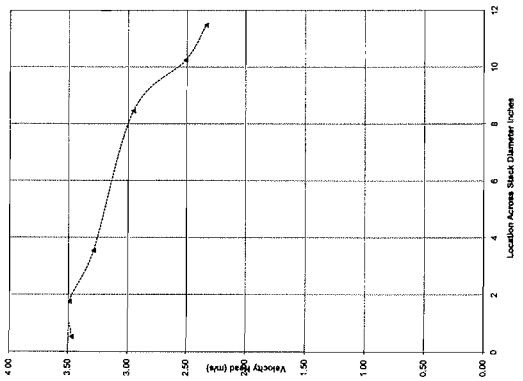


Appendix D1

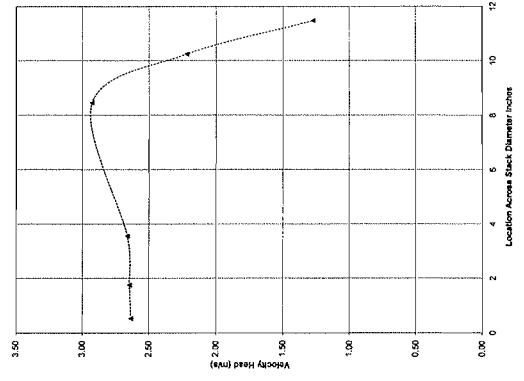
Velocity Profile North to South  
Incinerator Test #6 2014/12/11



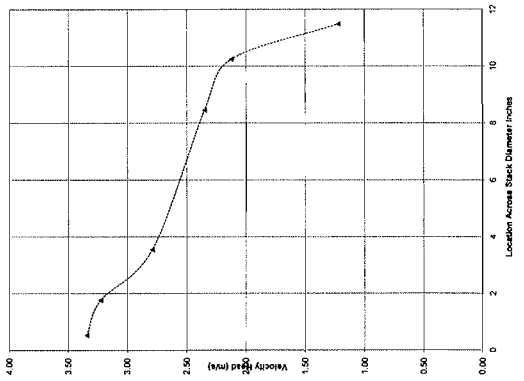
Velocity Profile East to West  
Incinerator Test #6 2014/12/11



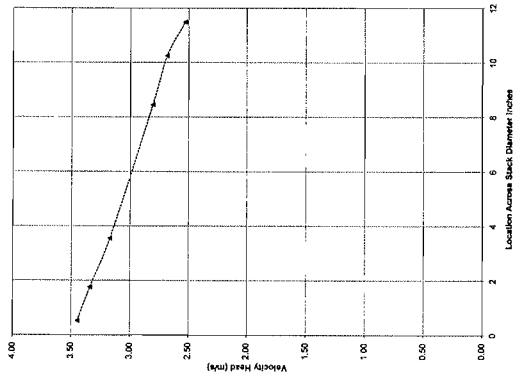
Velocity Profile North to South  
Incinerator Test #8 2014/12/12



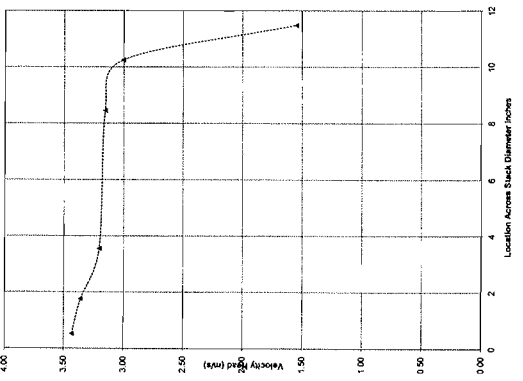
Velocity Profile East to West  
Incinerator Test #8 2014/12/12



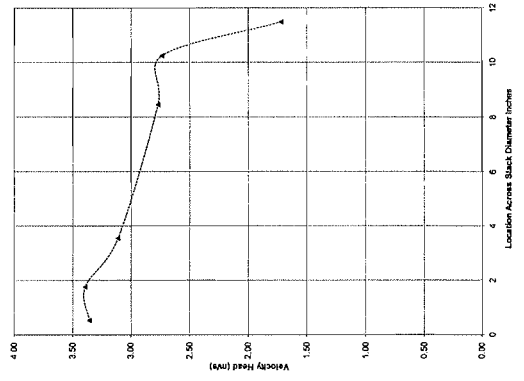
Velocity Profile North to South  
Incinerator Test #5 2014/12/11



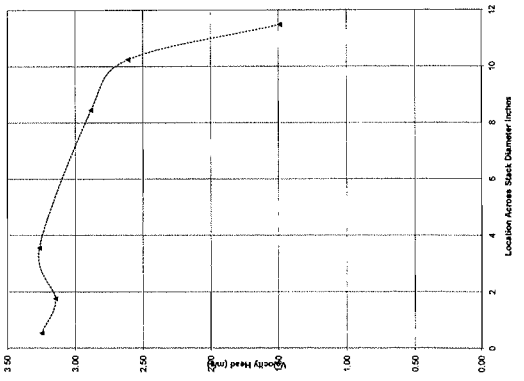
Velocity Profile East to West  
Incinerator Test #5 2014/12/11



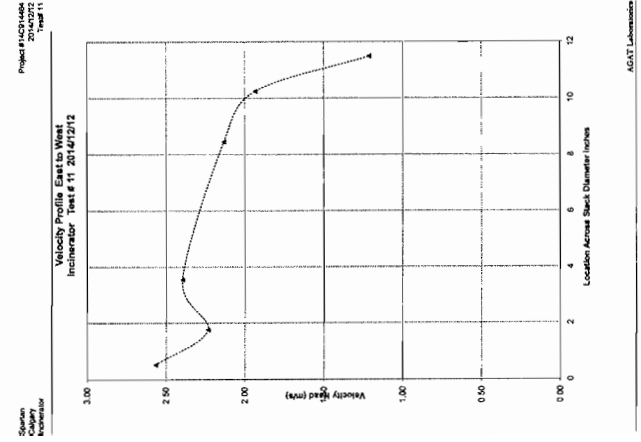
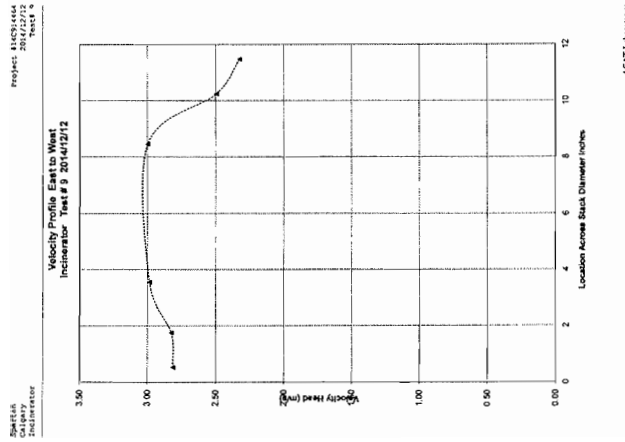
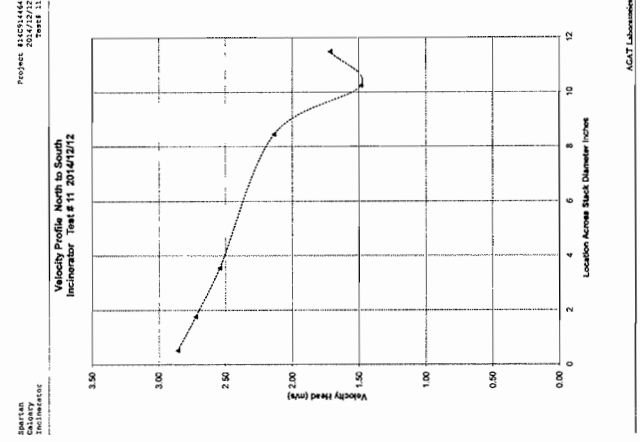
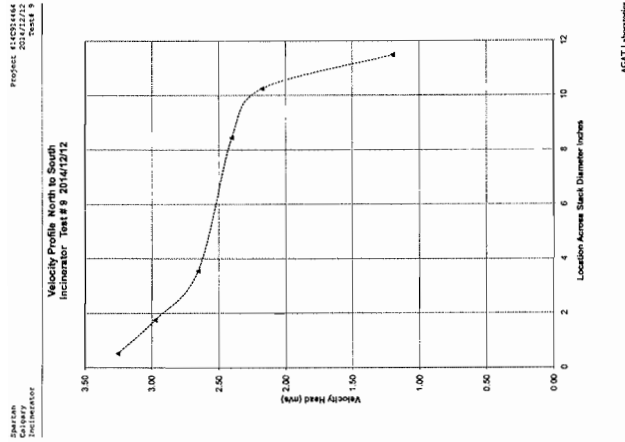
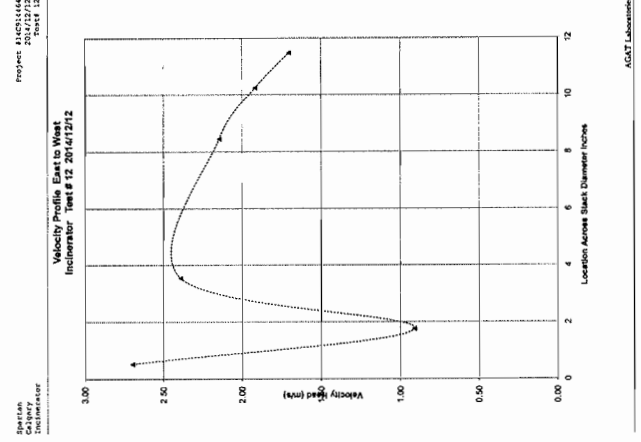
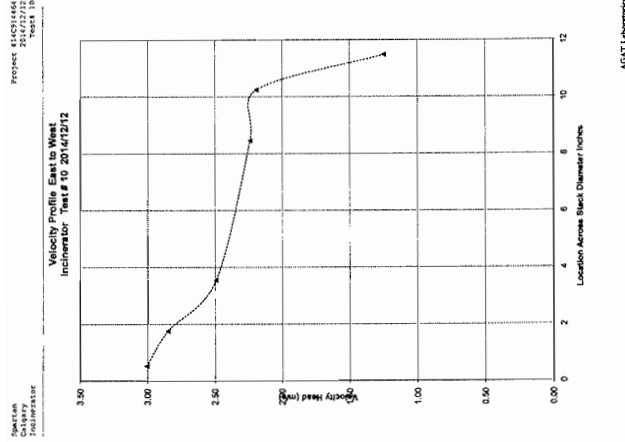
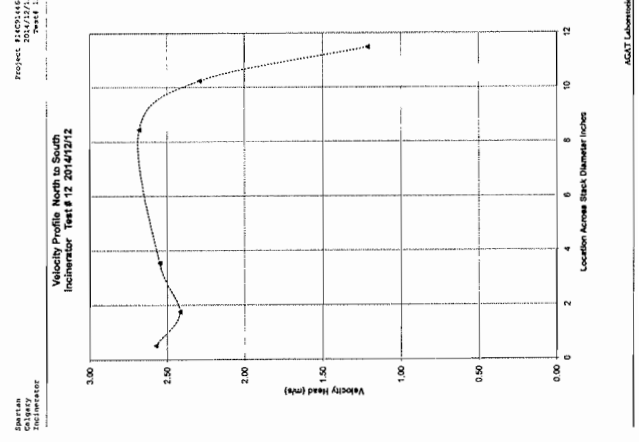
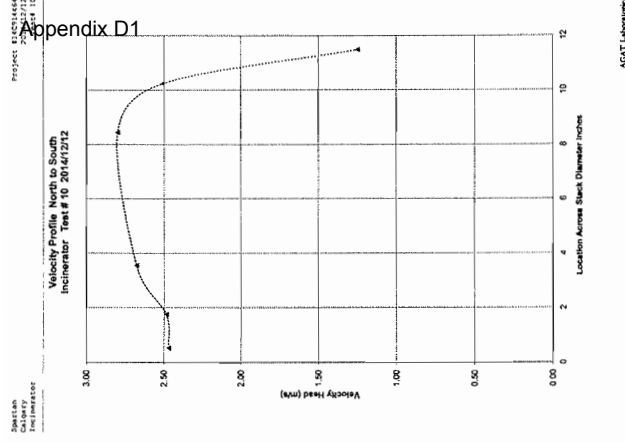
Velocity Profile North to South  
Incinerator Test #7 2014/12/11



Velocity Profile East to West  
Incinerator Test #7 2014/12/11



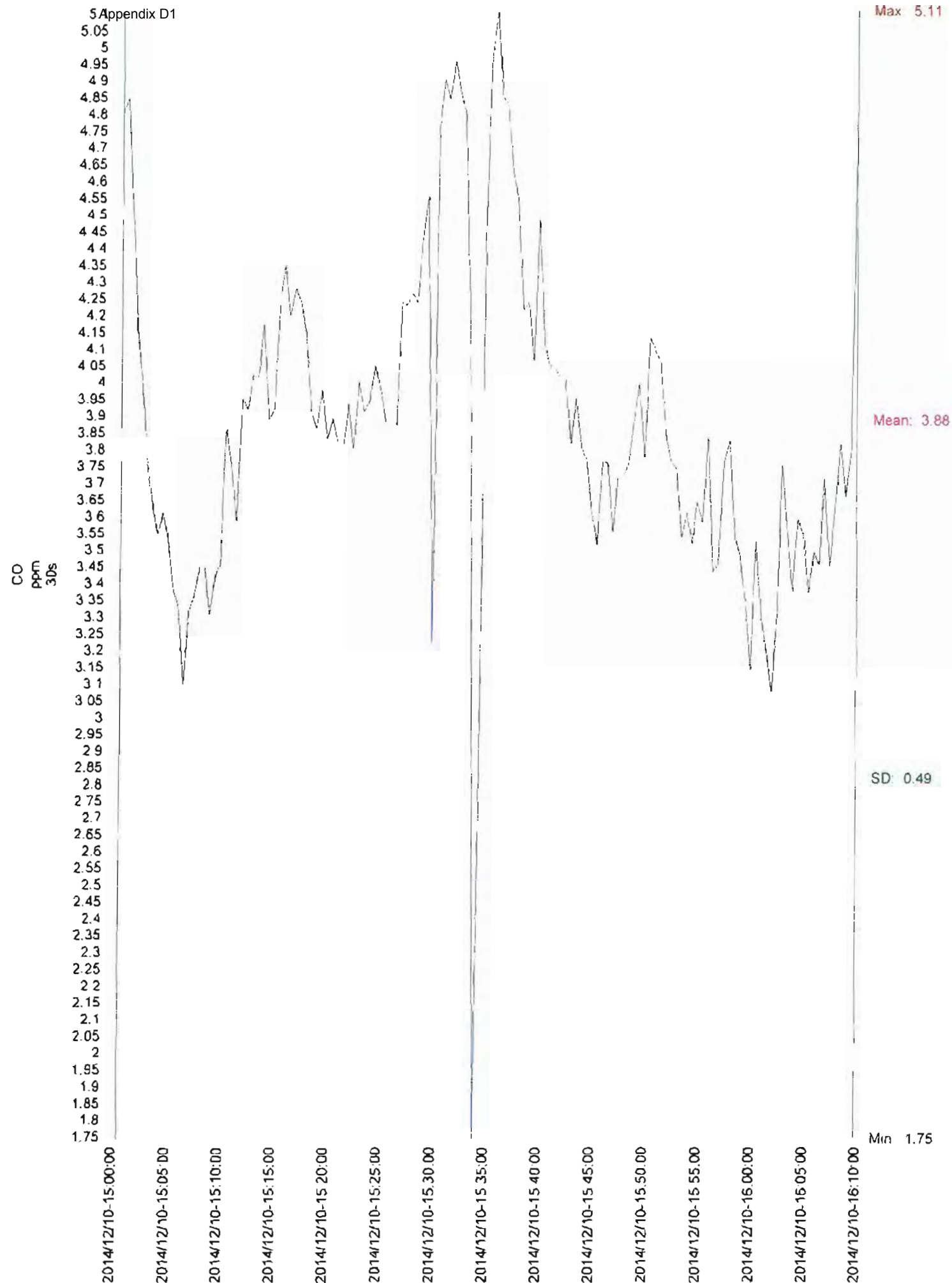
# Appendix D1



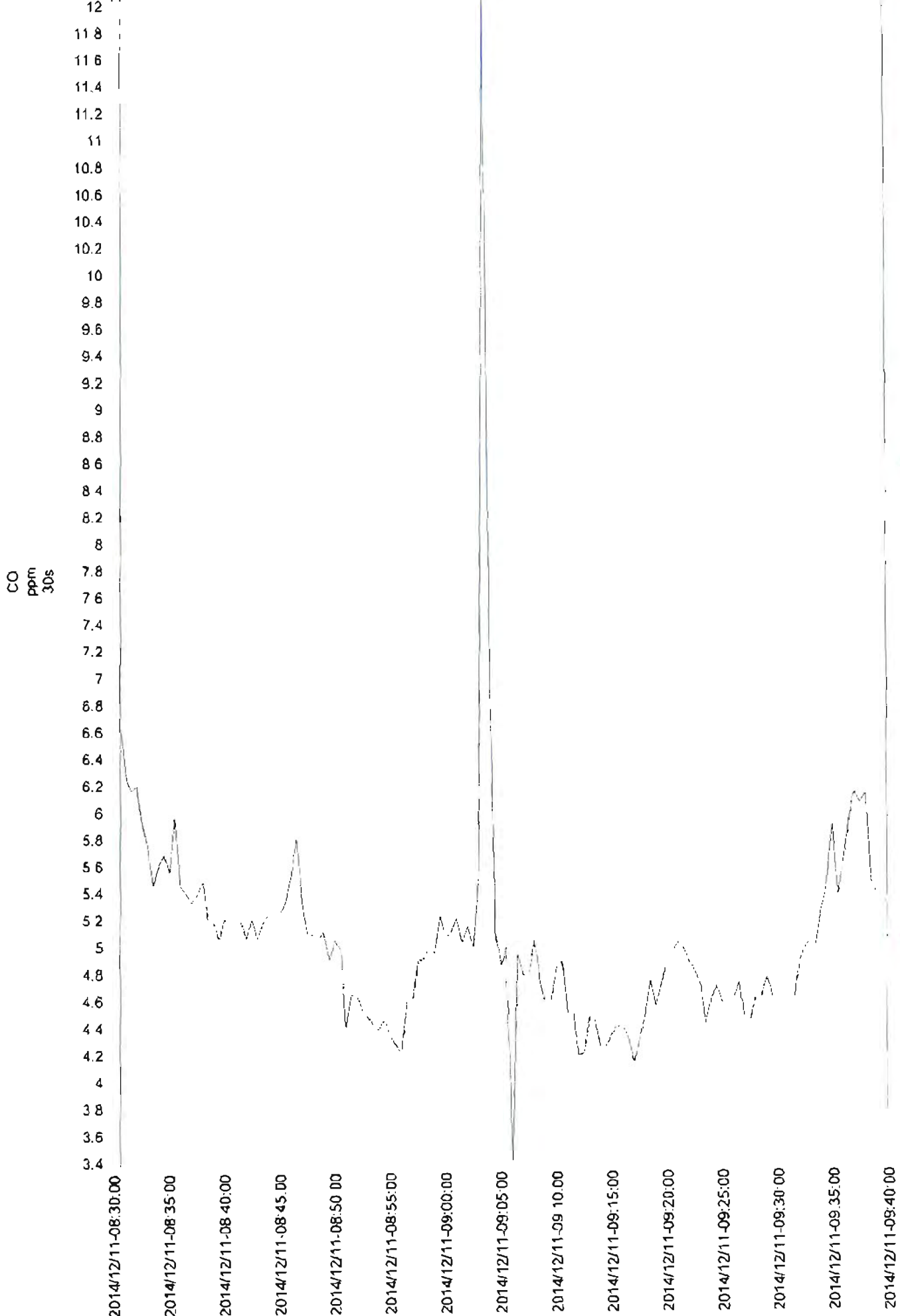


## **Appendix III**

### **AGAT CEMS Data**



Appendix D1

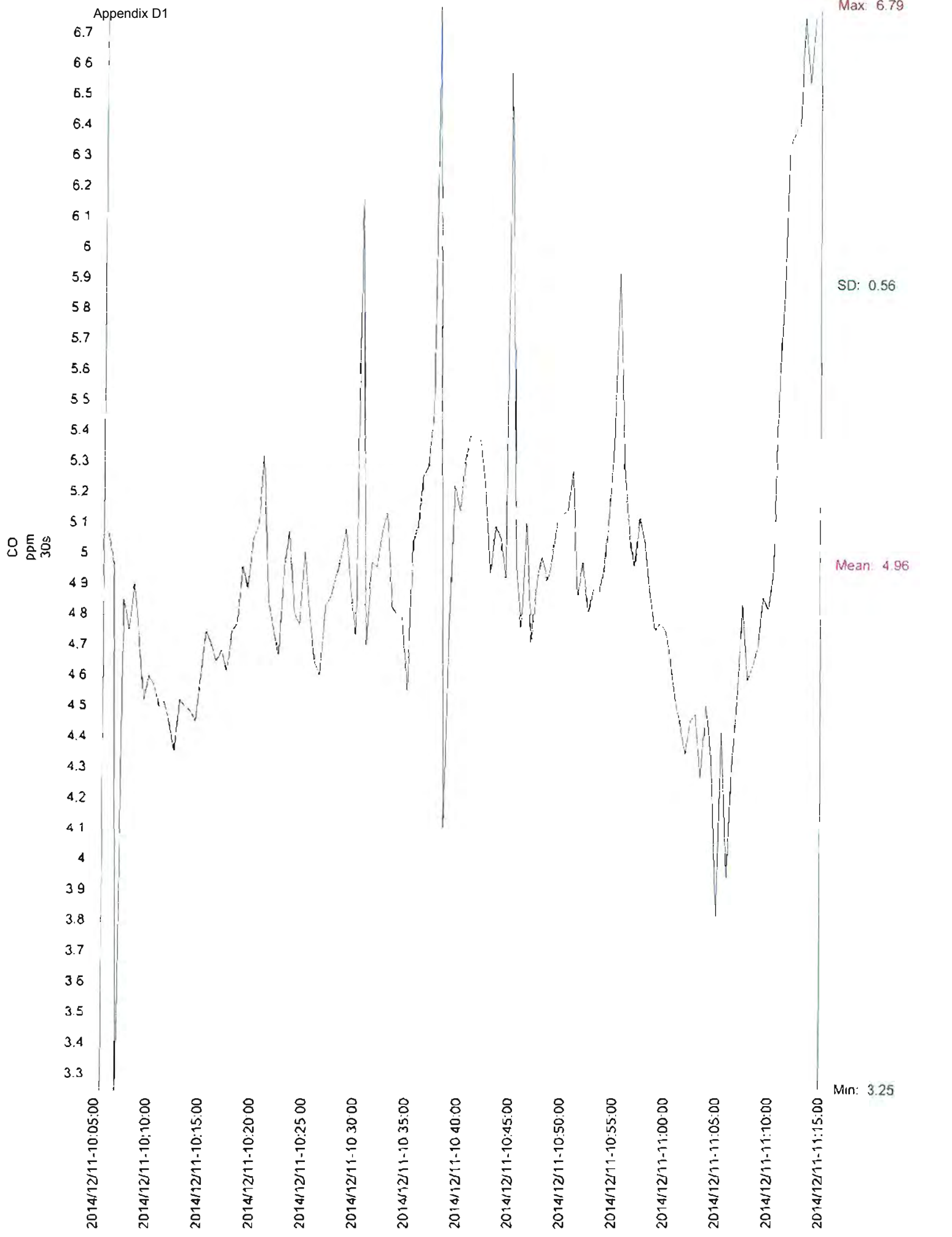


Max 12.09

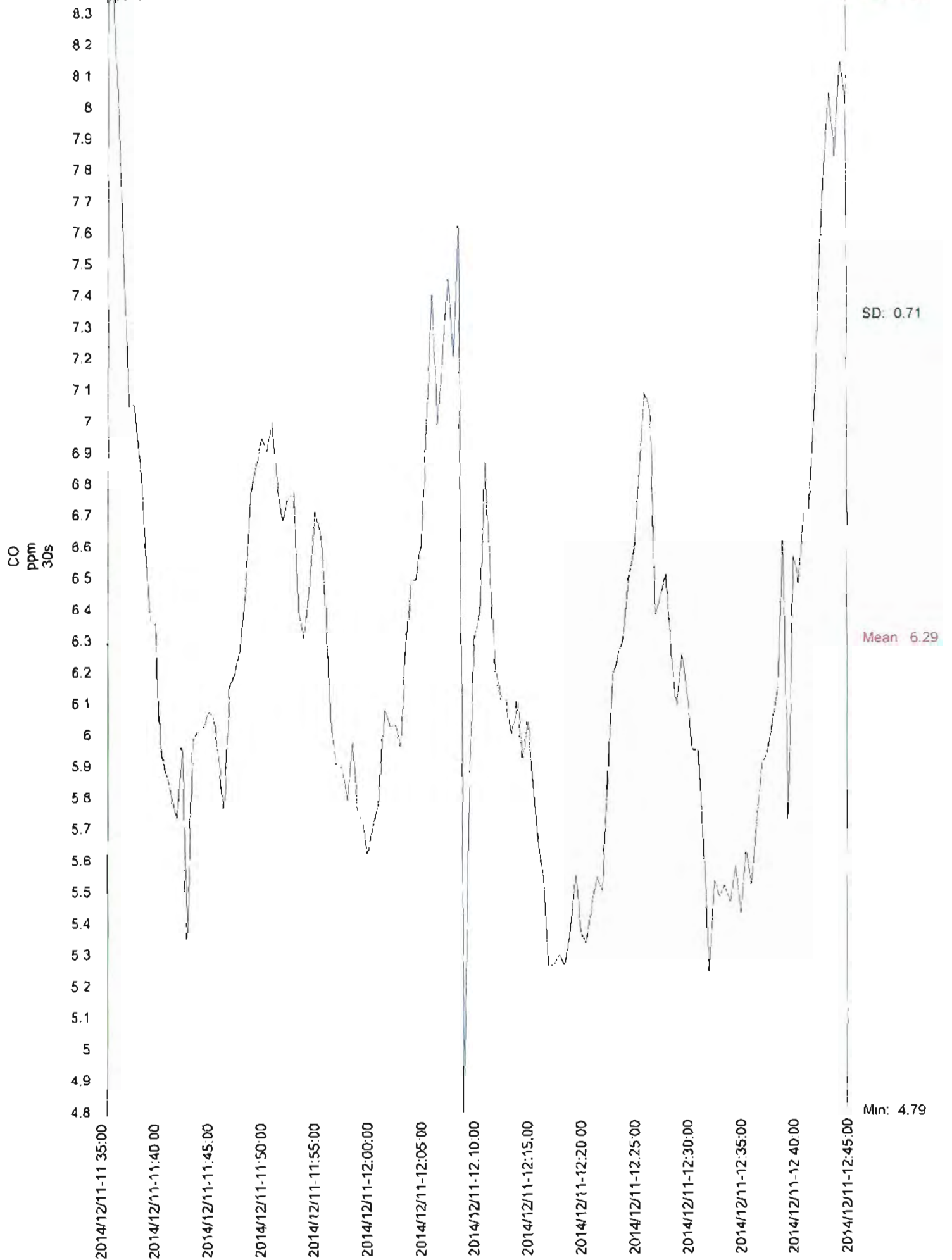
SD 0.81

Mean 5.03

Min: 3.38



Appendix D1



Appendix D1

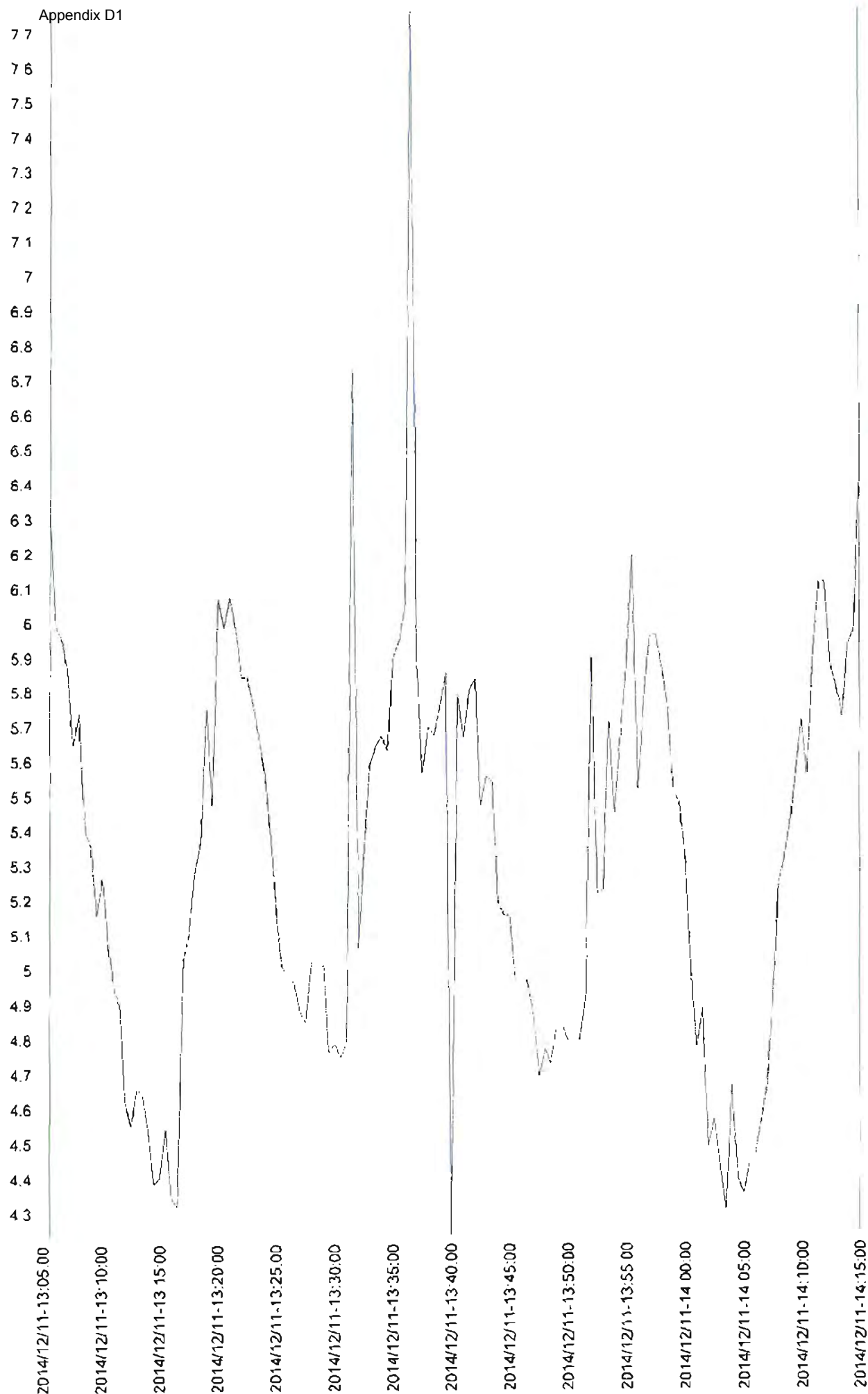
CO  
ppm  
30s

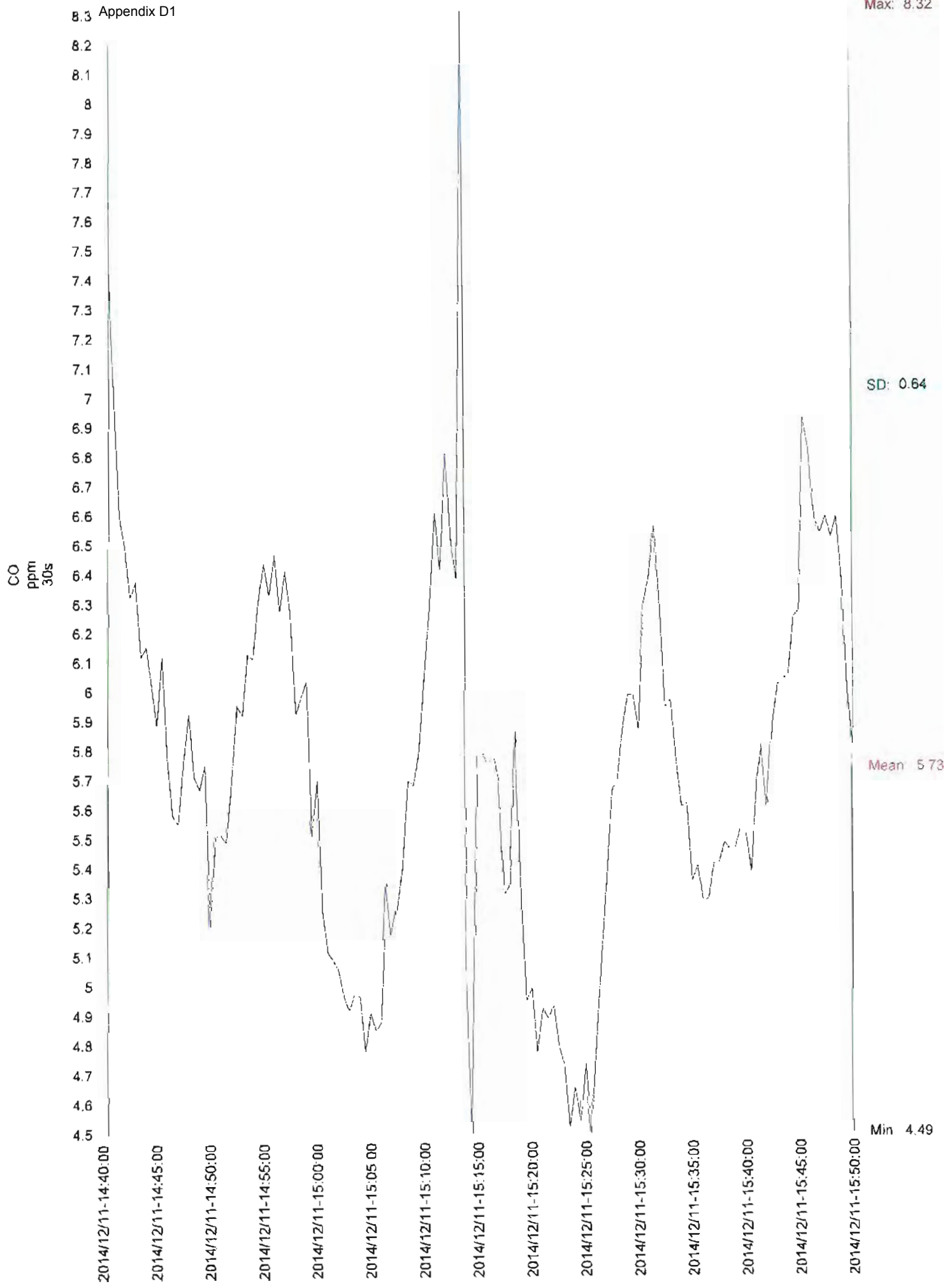
Max: 7.77

SD: 0.59

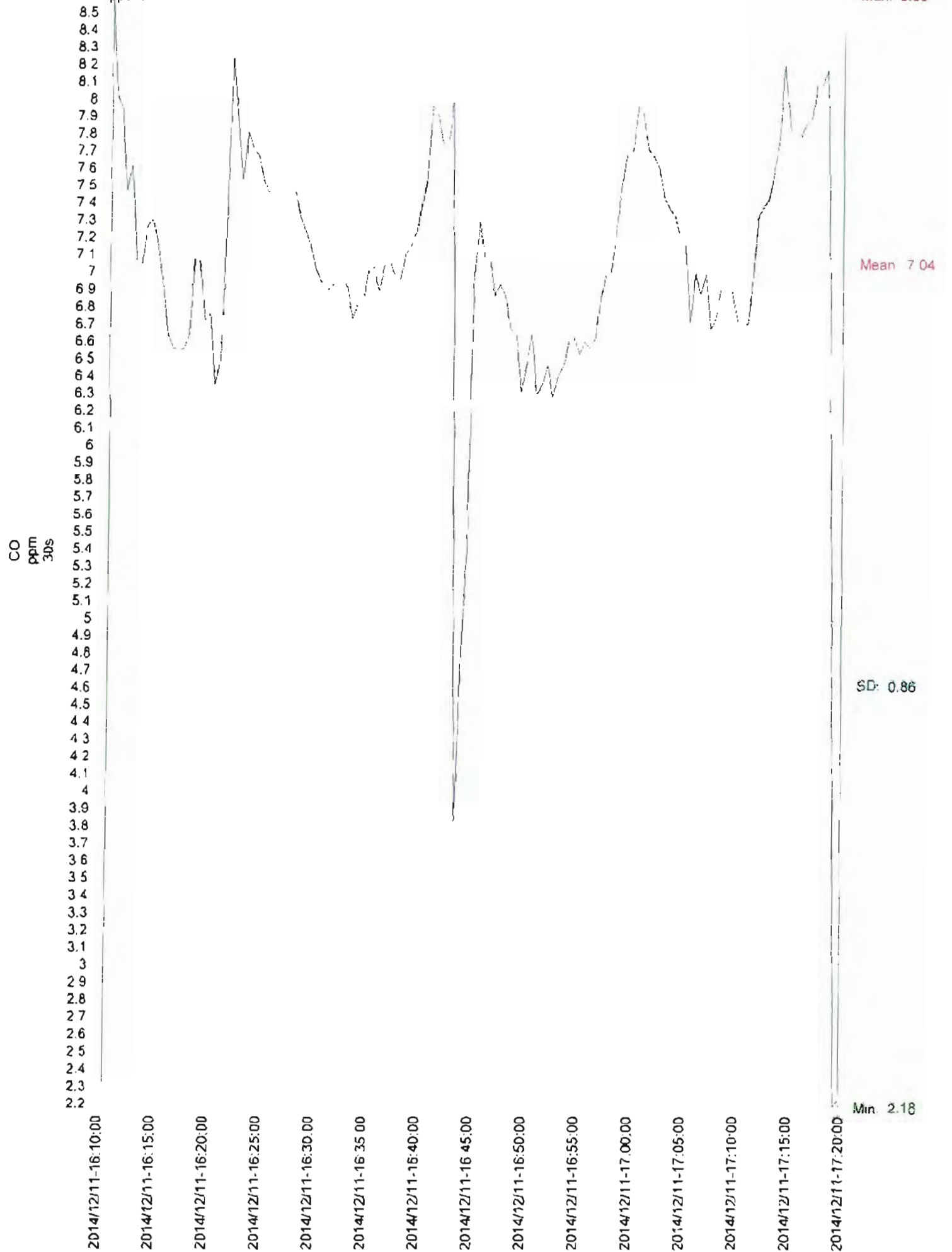
Mean: 5.32

Min: 4.24



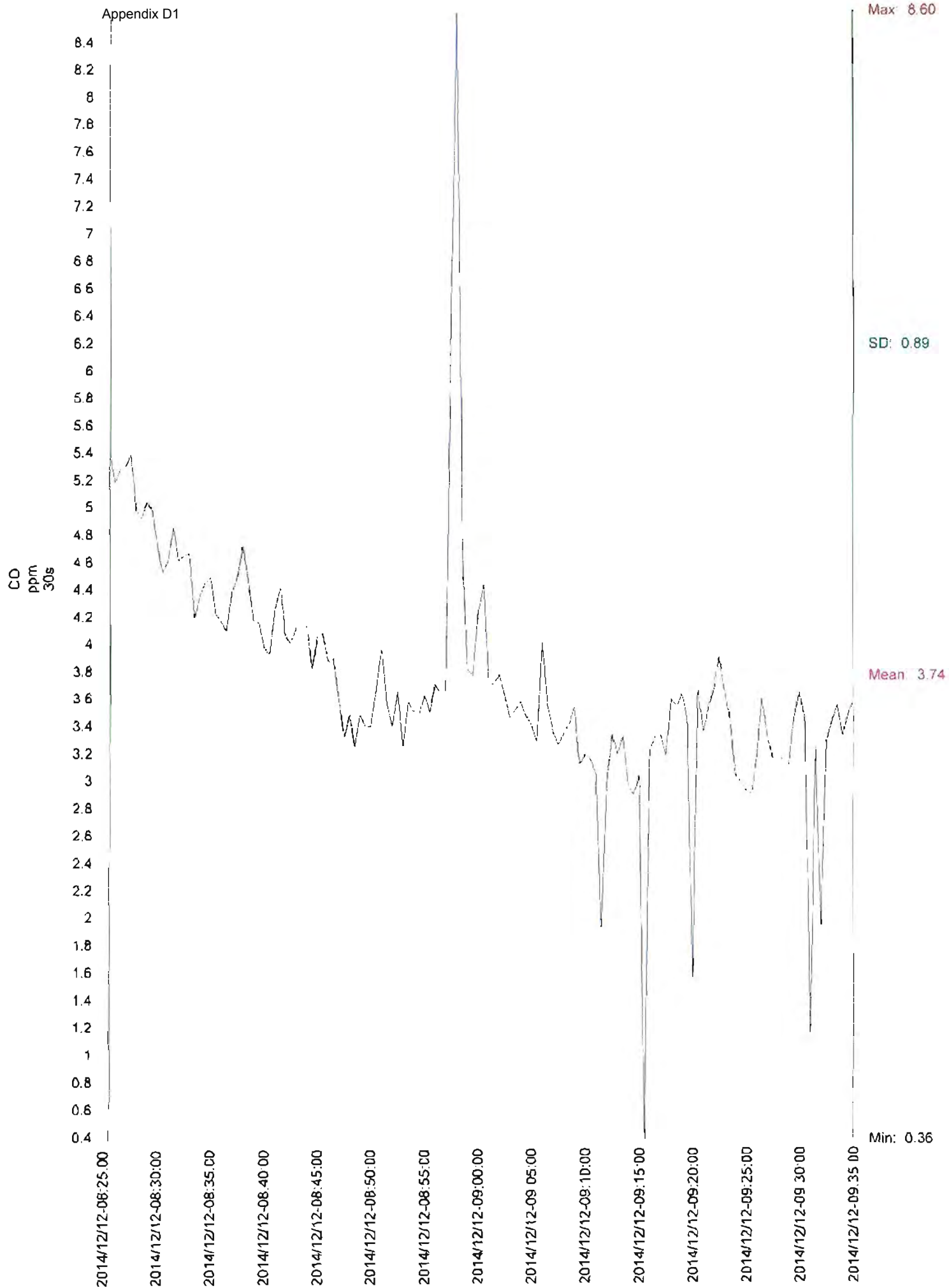


Appendix D1

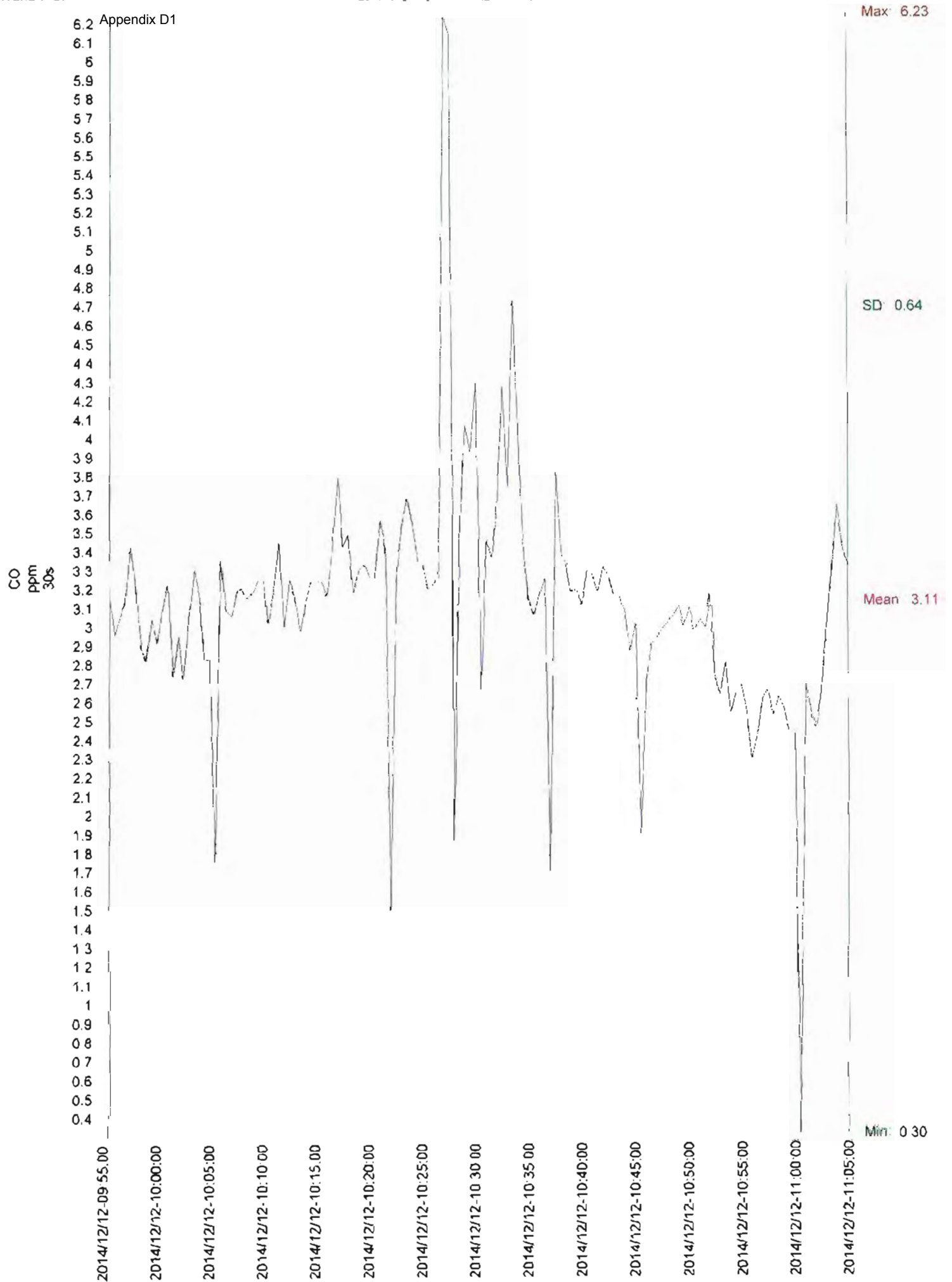




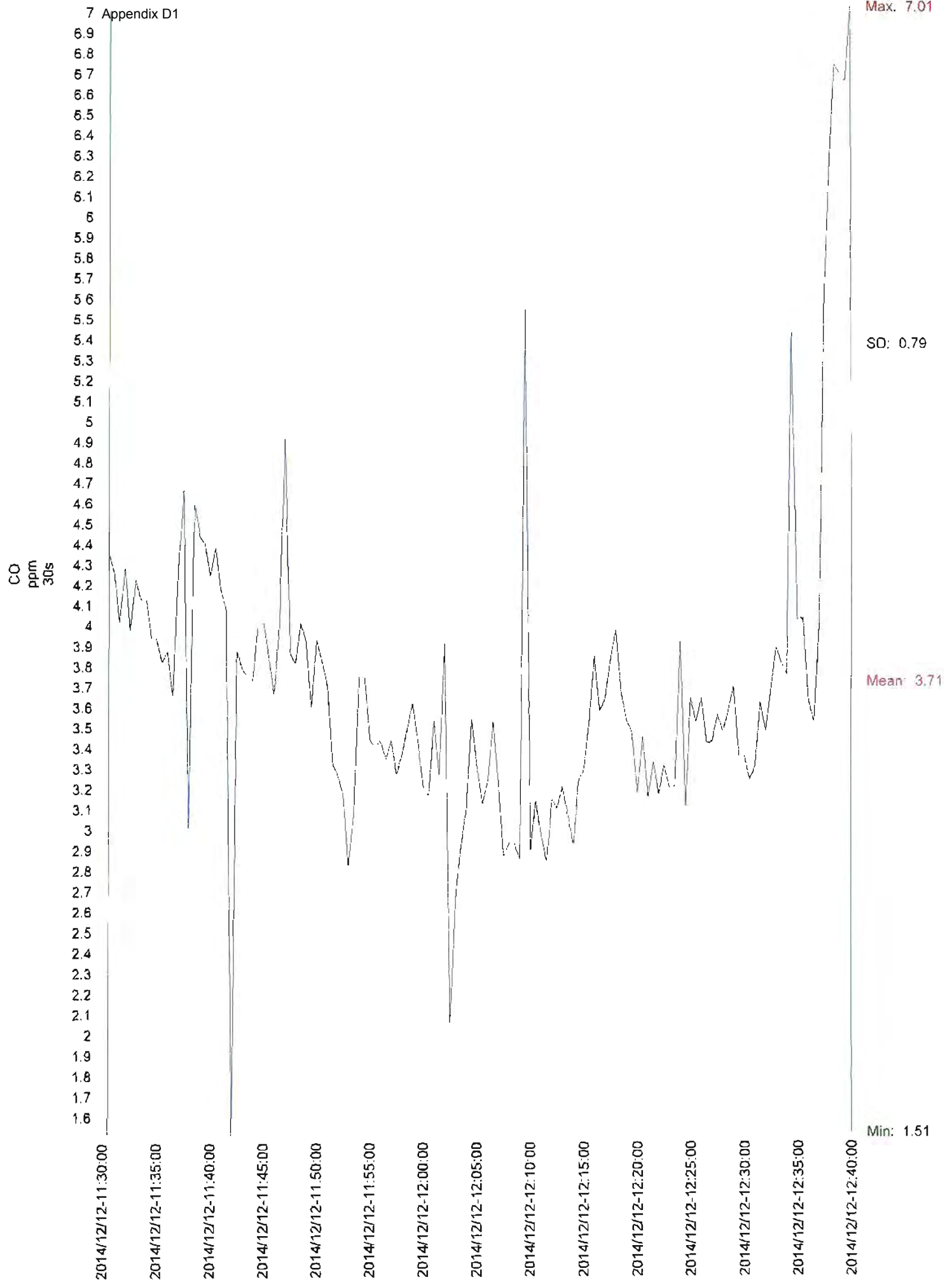
Appendix D1



Appendix D1



7 Appendix D1



Appendix D1

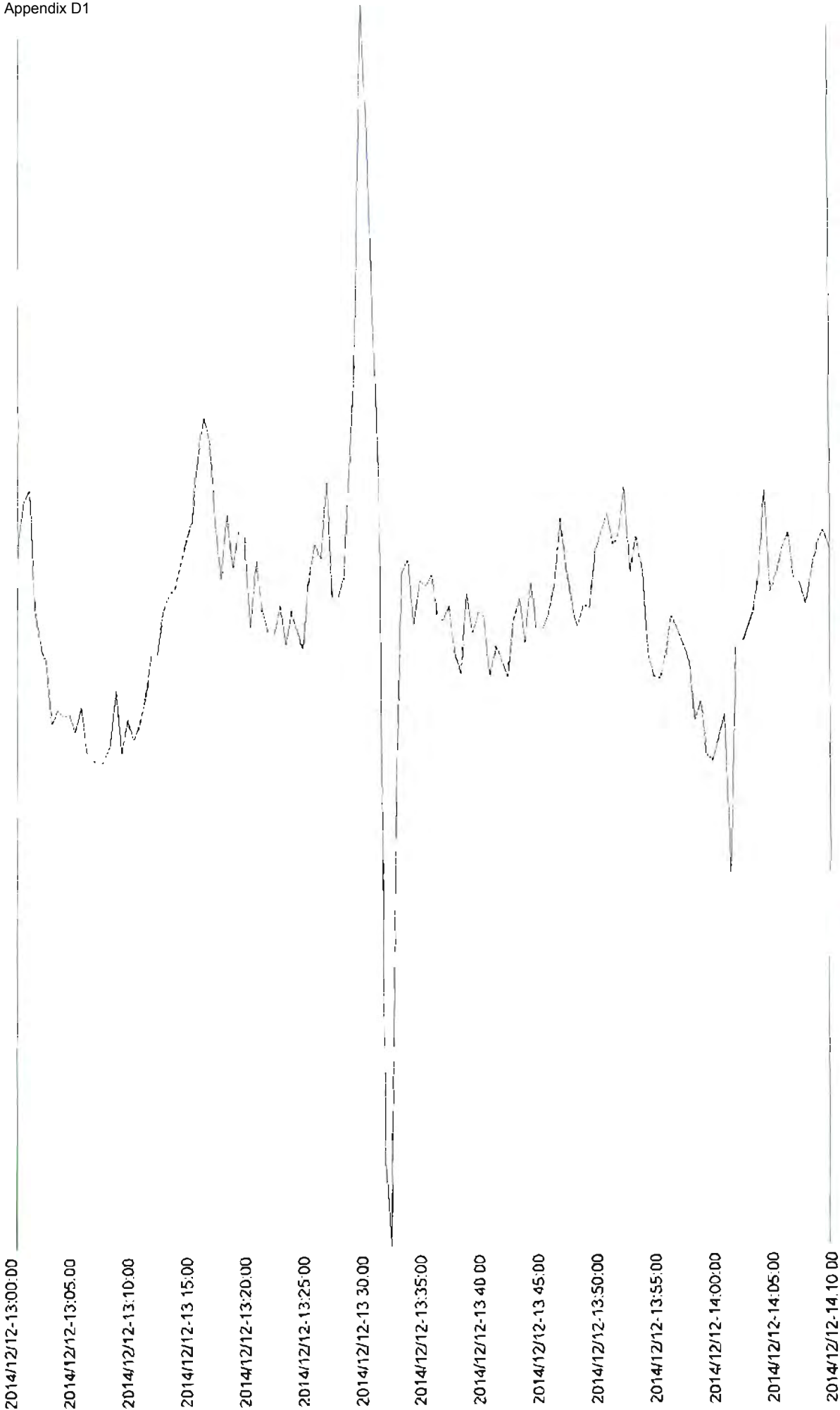
Max 11.58

CO  
ppm  
30s

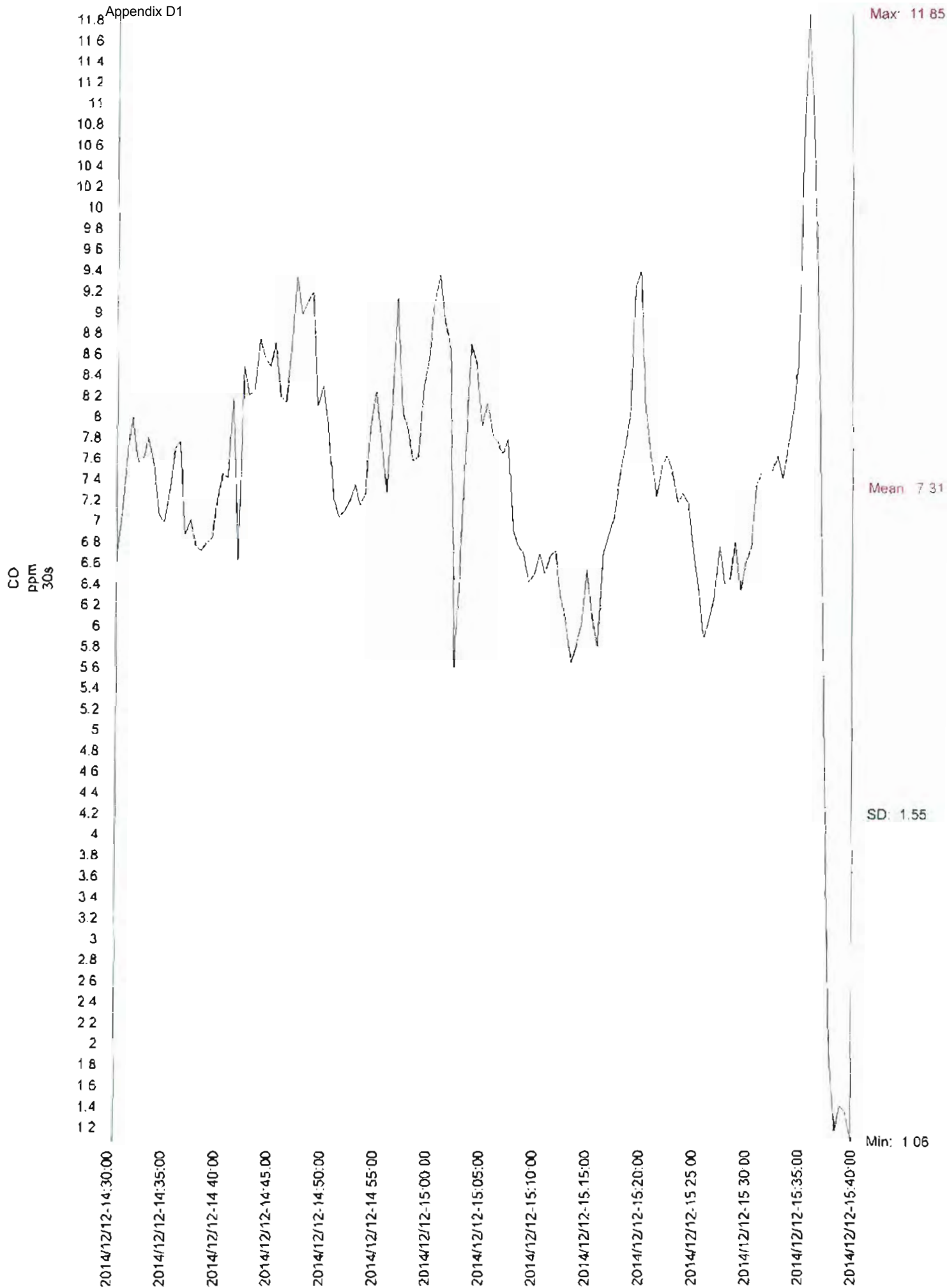
Mean 7.20

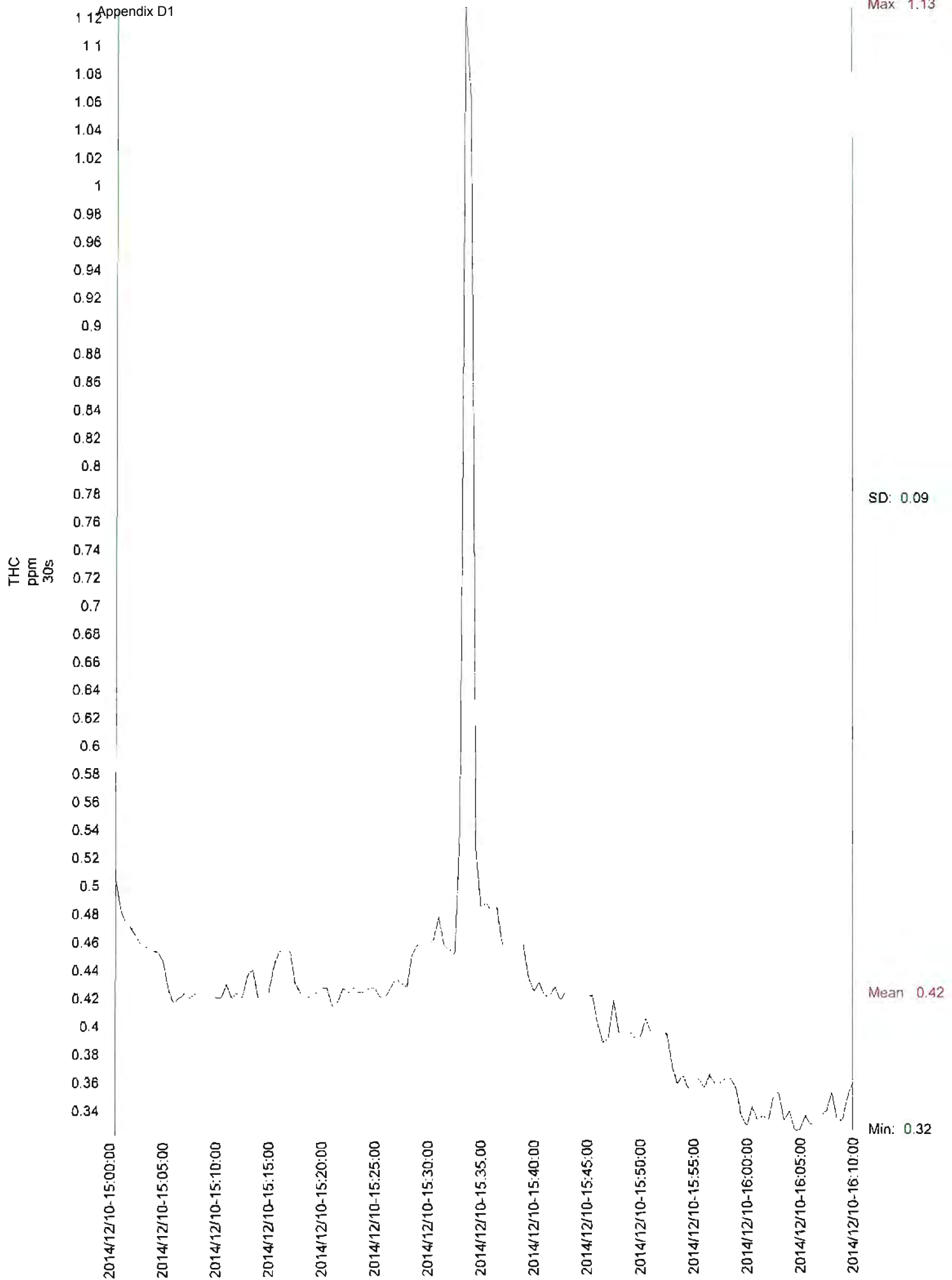
SD: 0.92

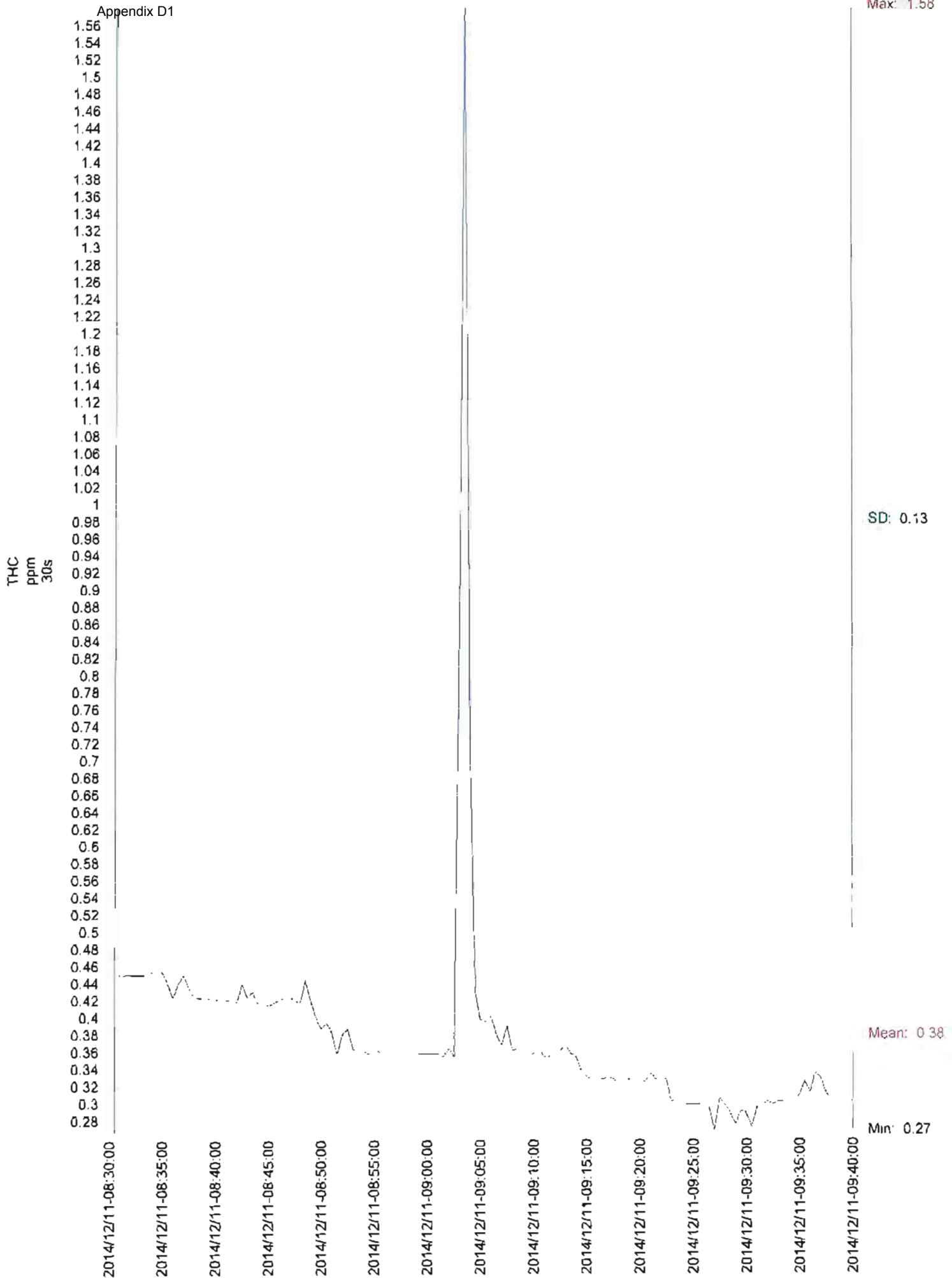
Min 2.63

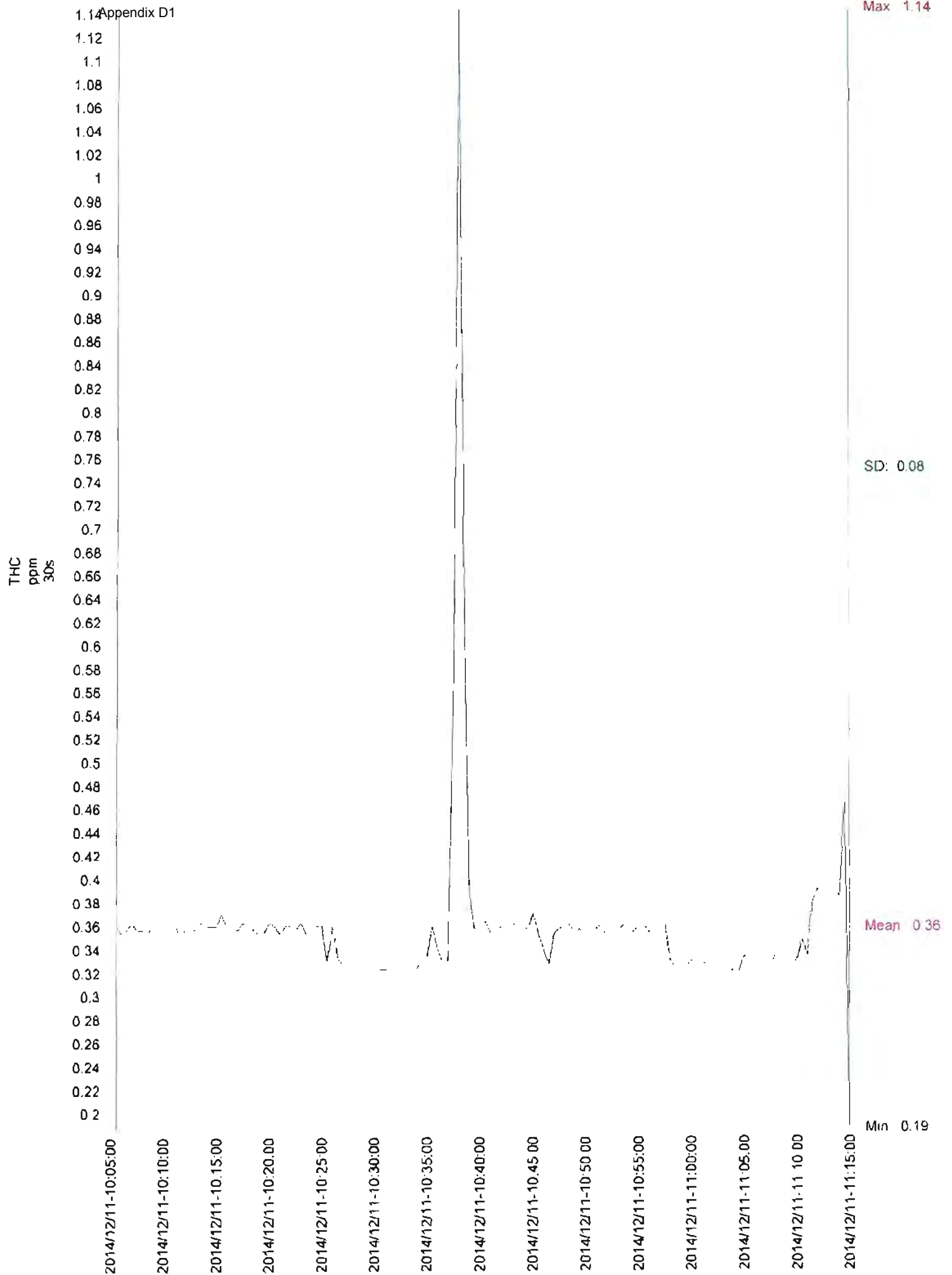


Appendix D1



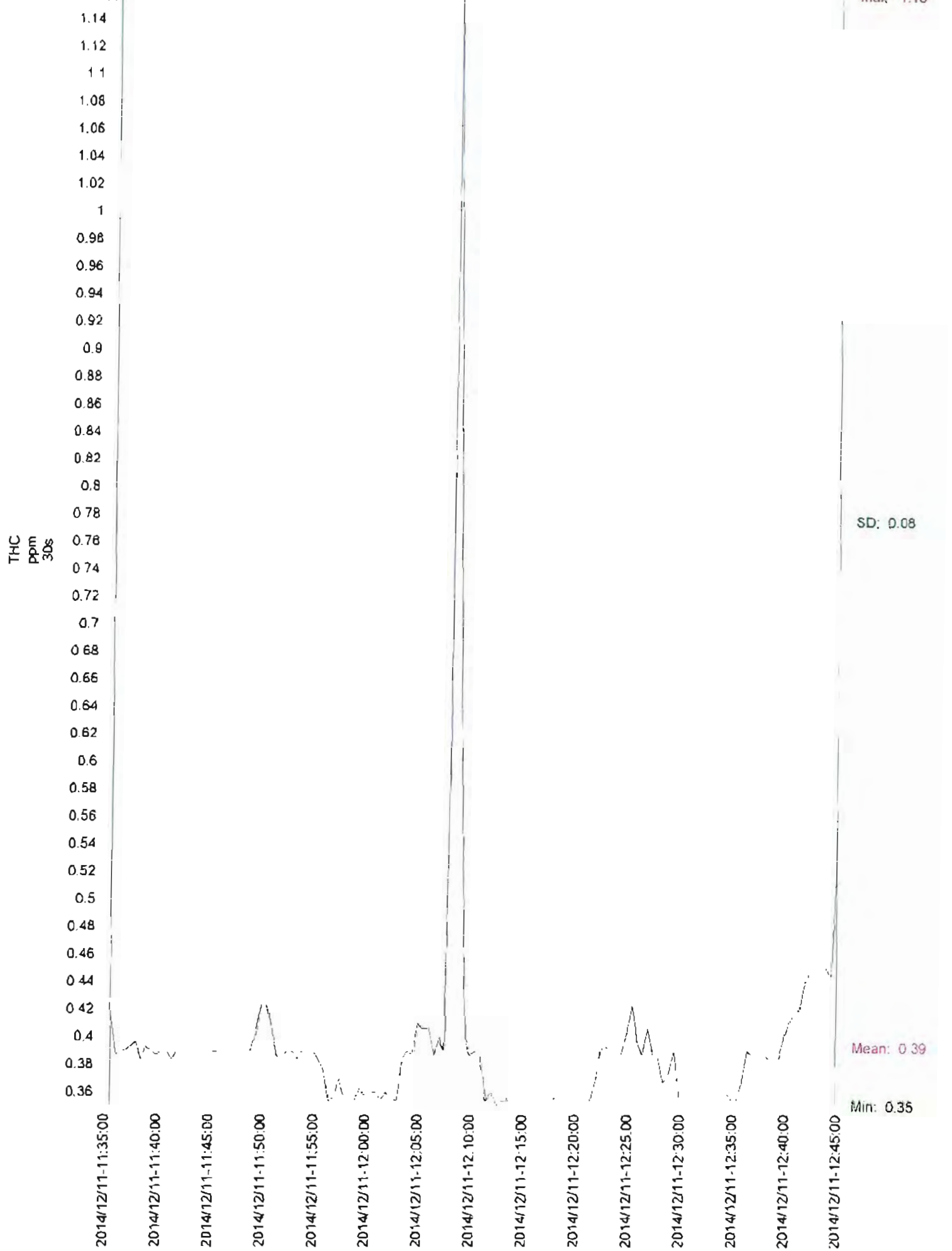


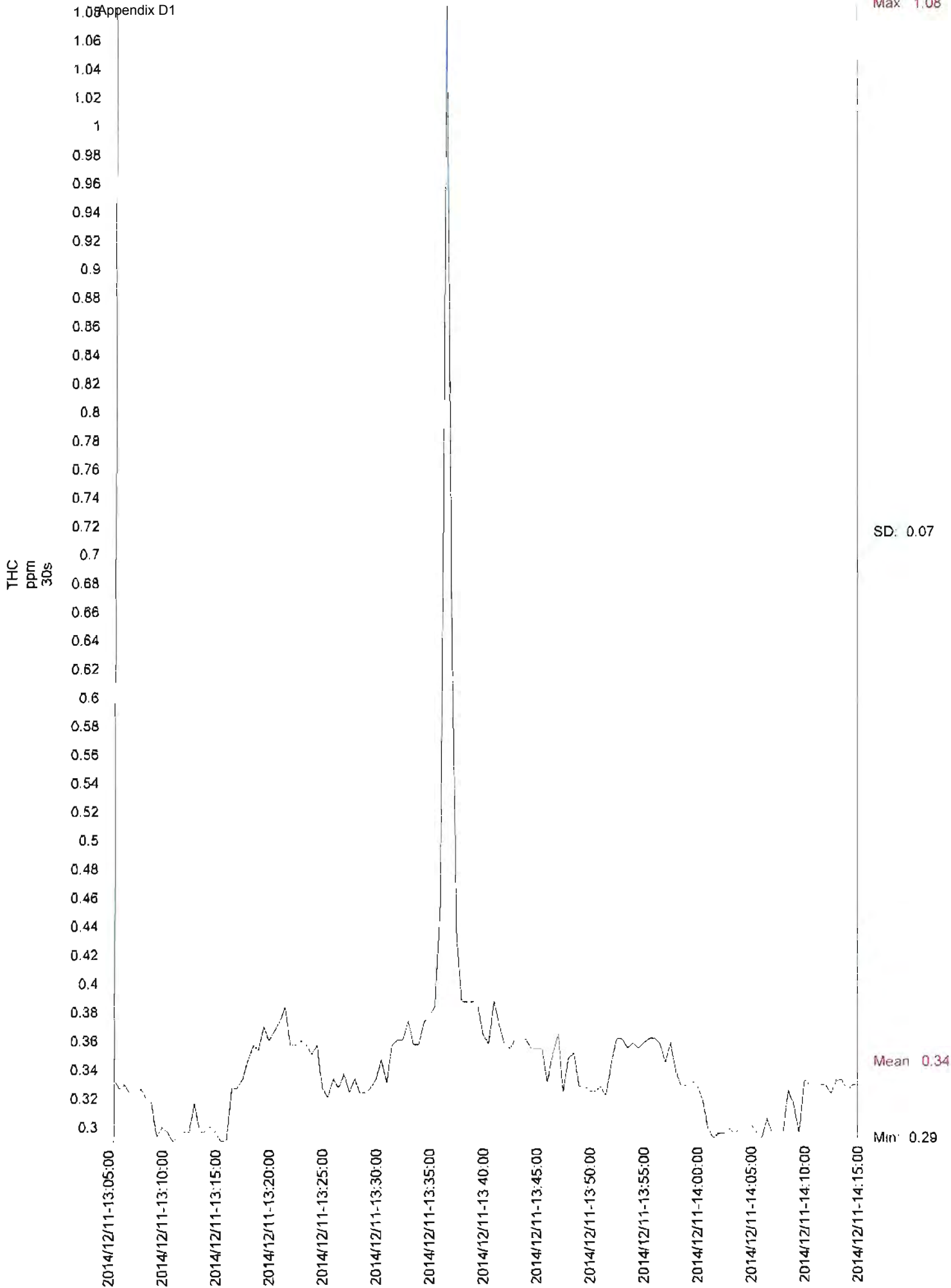


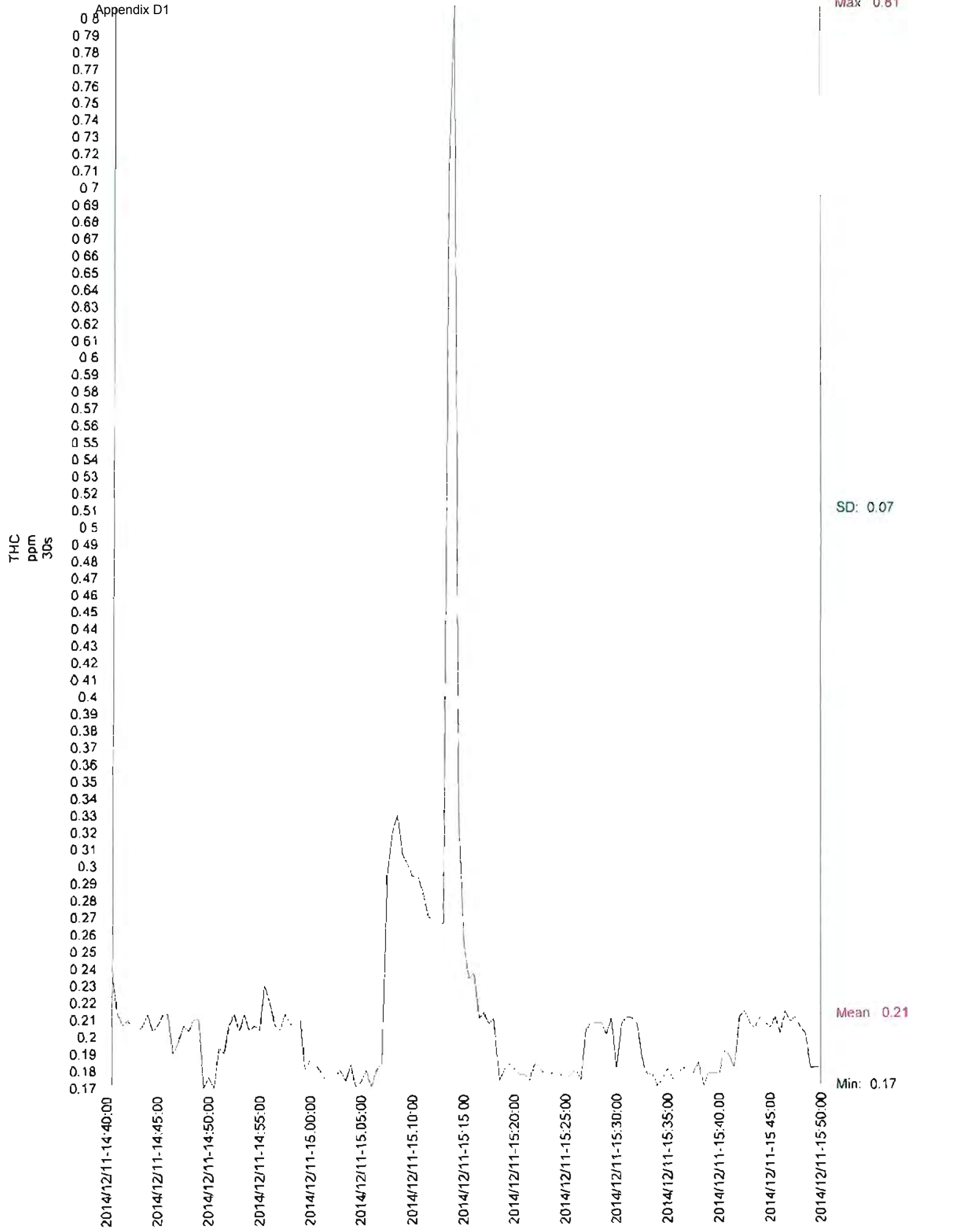




Appendix D1







Appendix D1

THC  
ppm  
30s

Max 2.13

SD: 0.25

Mean 0.25

Min 0.10

2014/12/11-16:10:00  
2014/12/11-16:15:00  
2014/12/11-16:20:00  
2014/12/11-16:25:00  
2014/12/11-16:30:00  
2014/12/11-16:35:00  
2014/12/11-16:40:00  
2014/12/11-16:45:00  
2014/12/11-16:50:00  
2014/12/11-16:55:00  
2014/12/11-17:00:00  
2014/12/11-17:05:00  
2014/12/11-17:10:00  
2014/12/11-17:15:00  
2014/12/11-17:20:00

Appendix D1

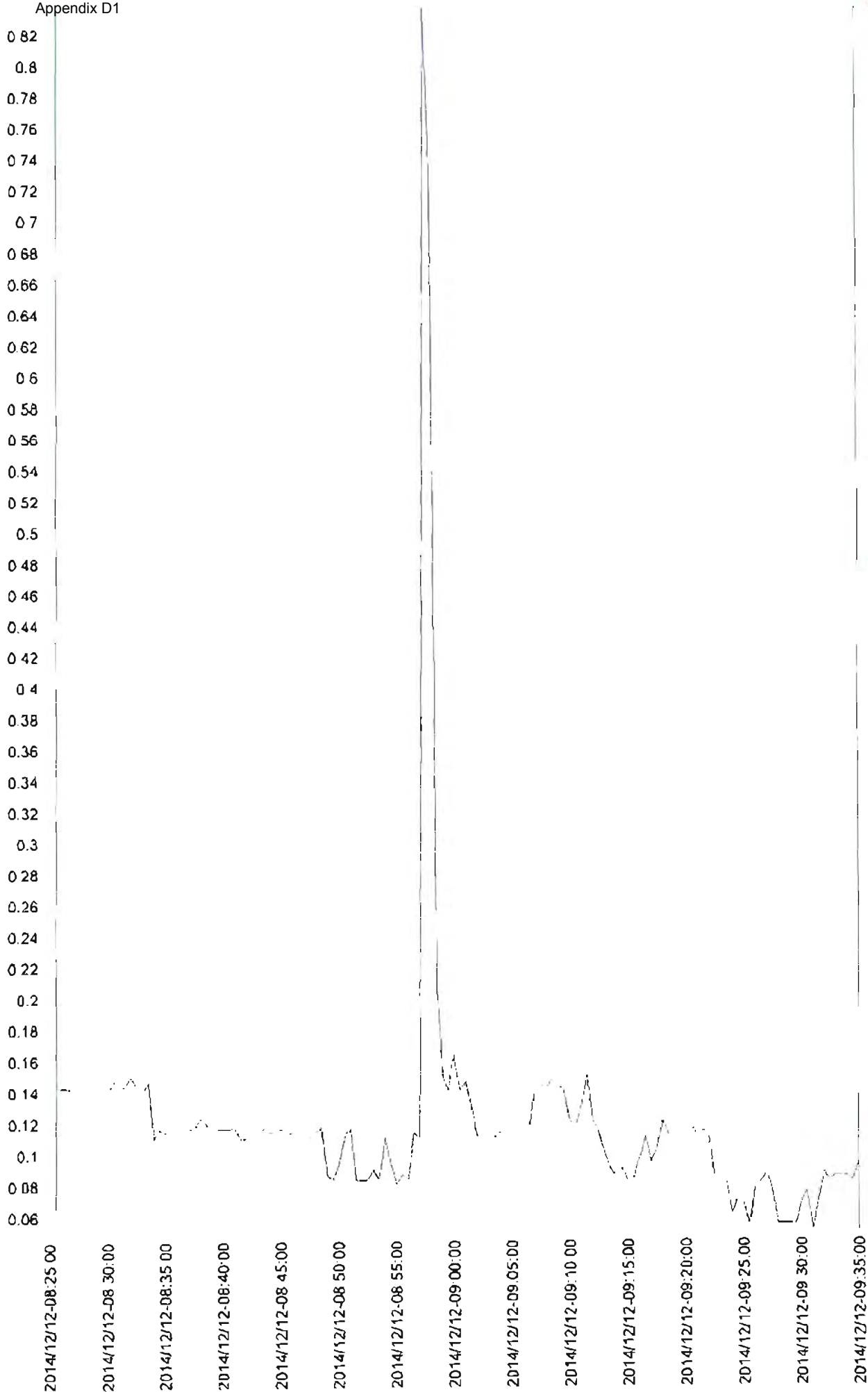
THC  
ppm  
30s

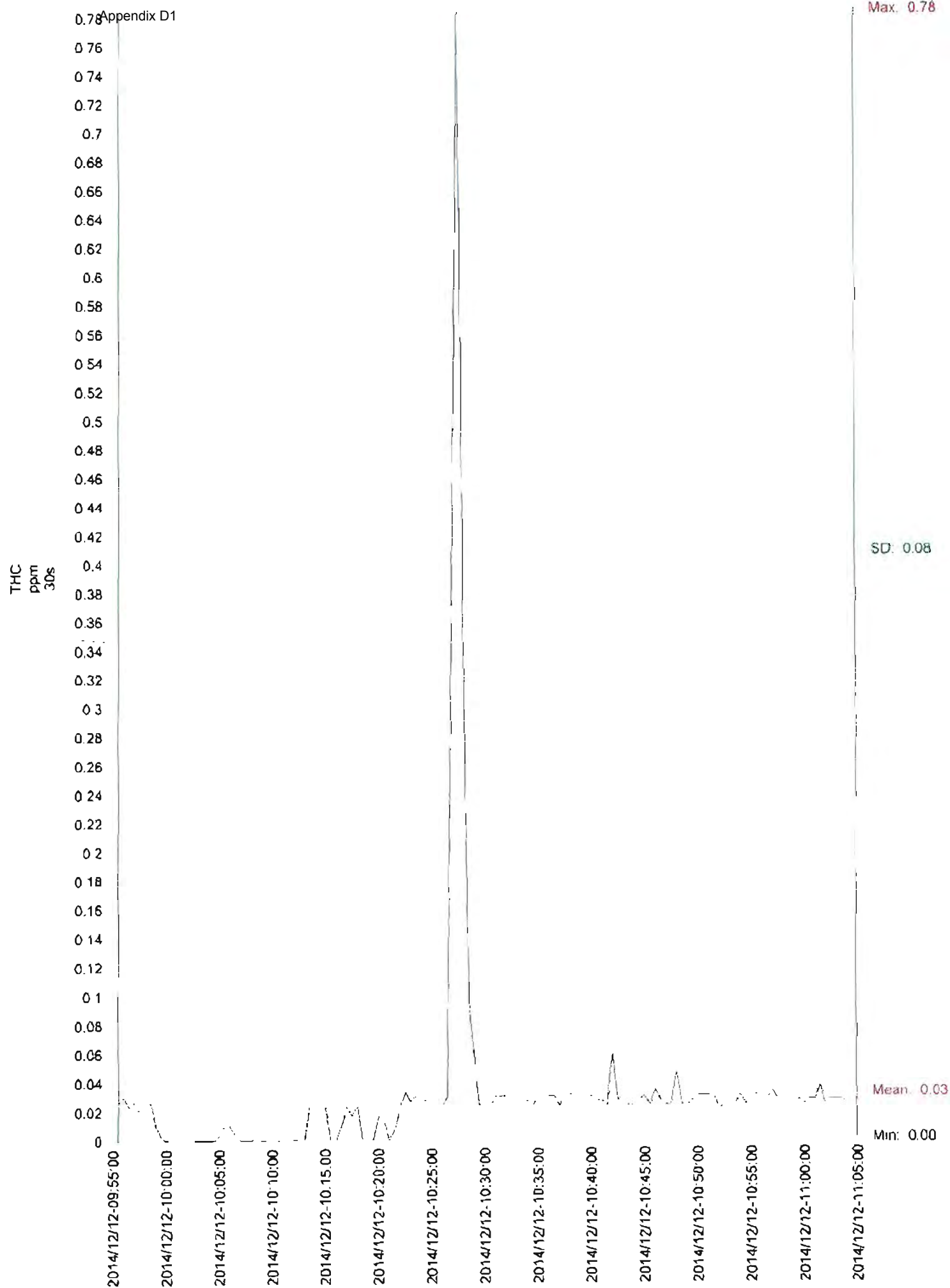
Max: 0.84

SD: 0.08

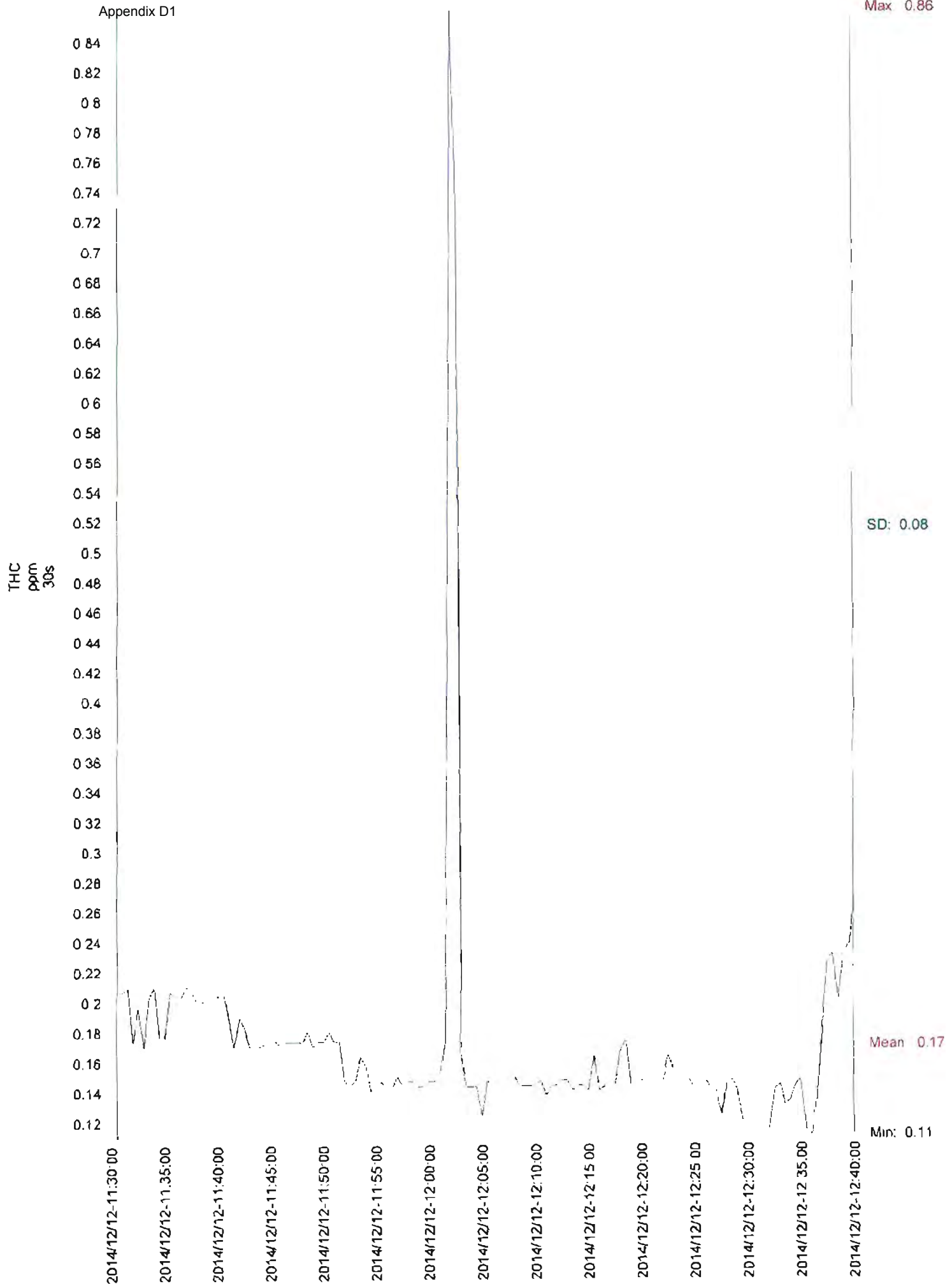
Mean: 0.12

Min: 0.05





Appendix D1



Appendix D1

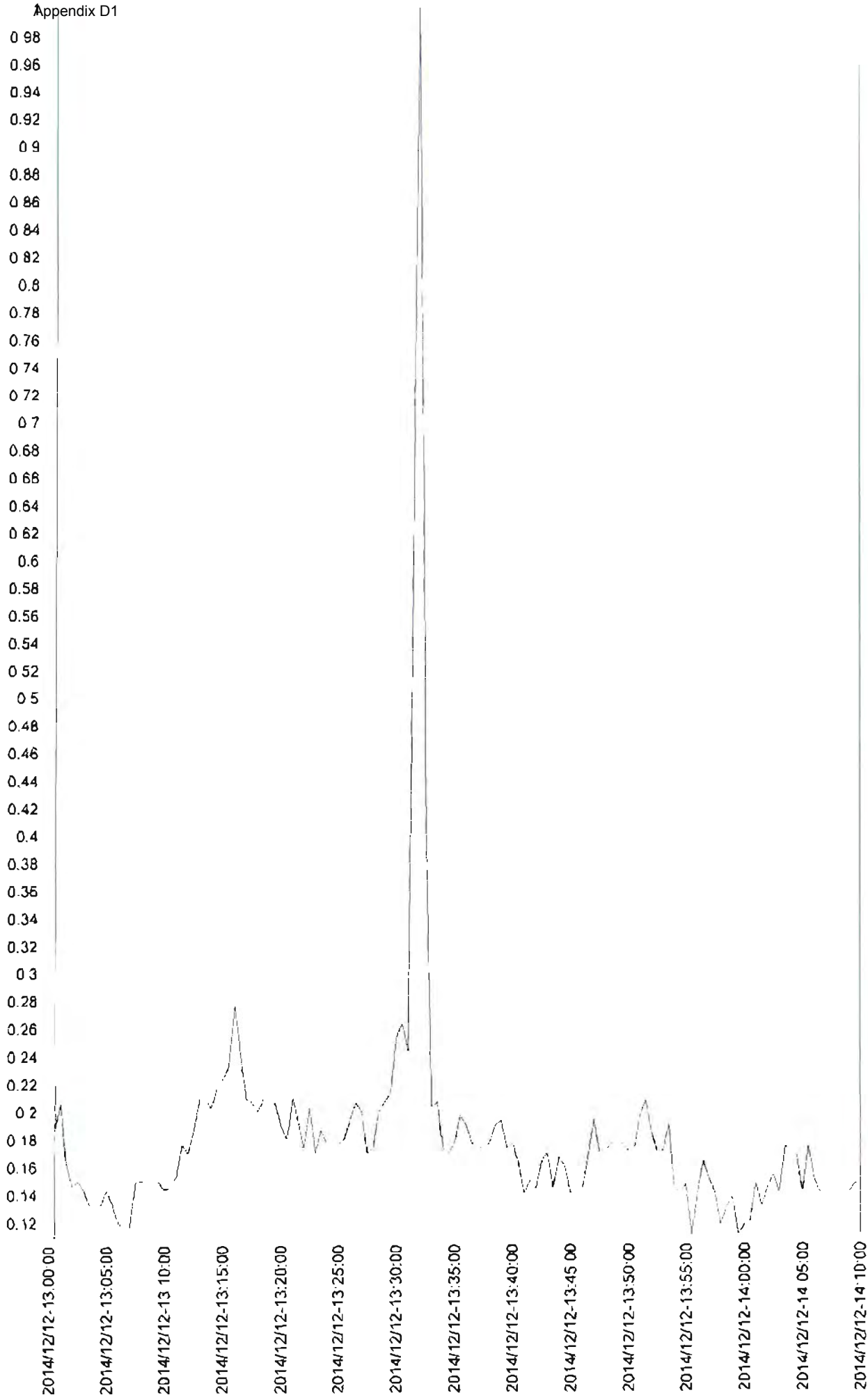
THC  
ppm  
30s

Max 1.00

SD: 0.09

Mean 0.18

Min 0.11





Appendix D1

THC  
ppm  
30s

1.06  
1.04  
1.02  
1  
0.98  
0.96  
0.94  
0.92  
0.9  
0.88  
0.86  
0.84  
0.82  
0.8  
0.78  
0.76  
0.74  
0.72  
0.7  
0.68  
0.66  
0.64  
0.62  
0.6  
0.58  
0.56  
0.54  
0.52  
0.5  
0.48  
0.46  
0.44  
0.42  
0.4  
0.38  
0.36  
0.34  
0.32  
0.3  
0.28  
0.26  
0.24  
0.22  
0.2  
0.18  
0.16  
0.14  
0.12  
0.1

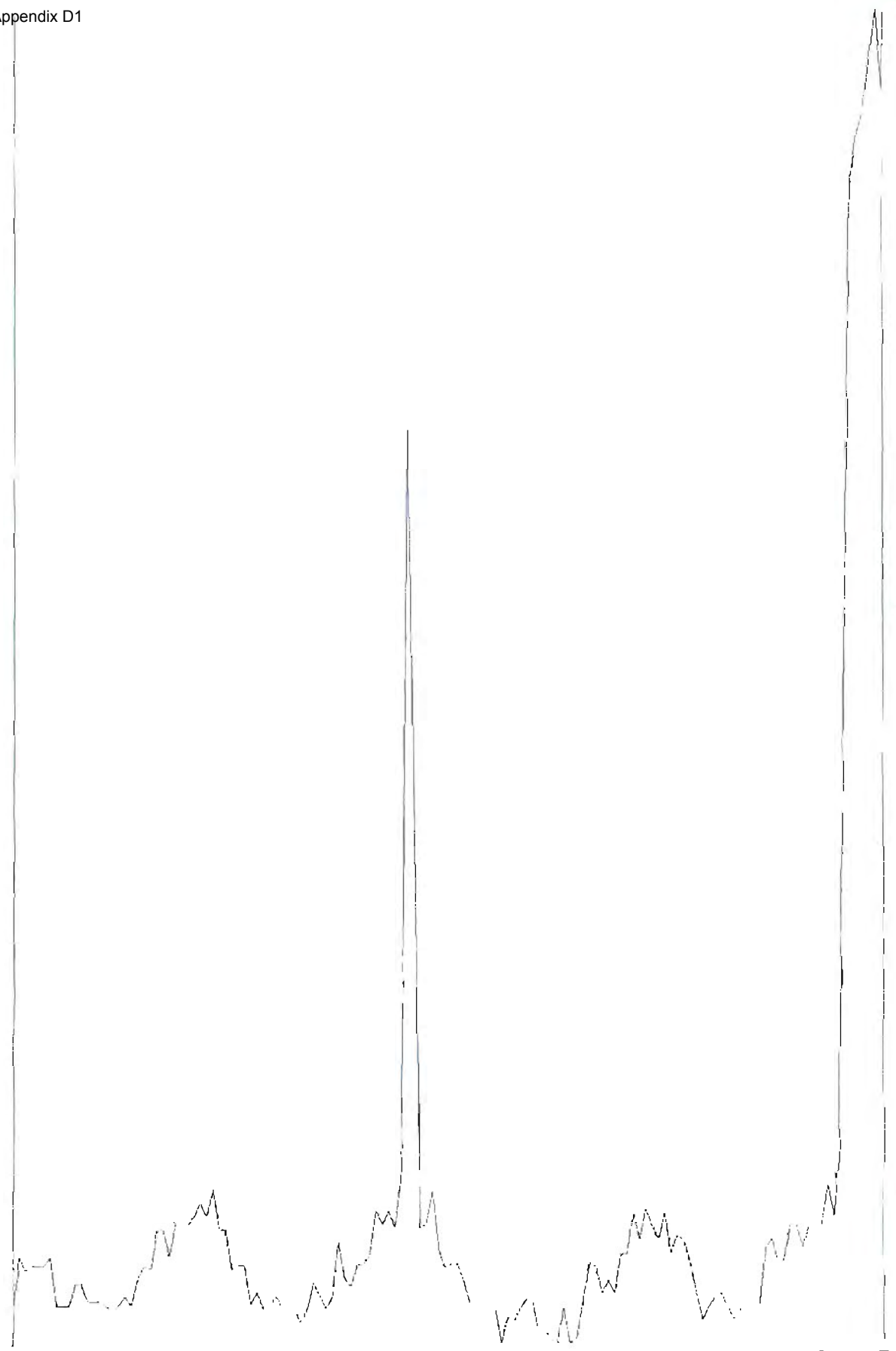
2014/12/12-14:30:00  
2014/12/12-14:35:00  
2014/12/12-14:40:00  
2014/12/12-14:45:00  
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2014/12/12-14:55:00  
2014/12/12-15:00:00  
2014/12/12-15:05:00  
2014/12/12-15:10:00  
2014/12/12-15:15:00  
2014/12/12-15:20:00  
2014/12/12-15:25:00  
2014/12/12-15:30:00  
2014/12/12-15:35:00  
2014/12/12-15:40:00

Max: 1.08

SD: 0.19

Mean: 0.19

Min: 0.08



## **Appendix IV**

### **Field Data Sheets**

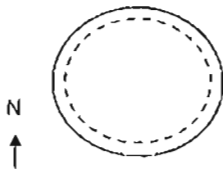
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: Spartan	Location: Calgary	Stack Static Pressure: <del>0.012</del> - 0.012
Contact Name:	Source: Incinerator	Absorbing Solution: DF H <sub>2</sub> O
Date(Y/M/D): 2014/12/10	Test #: One	Initial Volume of Abs.Sol. (ml): 200
Sampled by: JW	Team Leader: AT	Final Volume of Abs. Sol. (ml): 216
Fluke Temp. Meter ID #: #3		Volume Condensed (ml): 16
Cyclonic Flow ? Yes/No: No	Average Null Angle from Vertical =	Pre Silica Weight (g): 316
B.P. (in. Hg): 29.80	Ambient Temperature (°C): 8	Post Silica Weight (g): 327
Pitot ID#: FT SEDm	Pitot Factor: 0.803	H <sub>2</sub> O in Silica Condensed: 7
Meter #: AATA 313	Meter Factor: 1.0204	Total Volume H <sub>2</sub> O Condensed (ml): 23
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume ( $\text{m}^3$ )	Vacuum (in. Hg.)	Meter Temp( $^{\circ}\text{F}$ )	Impinger Temp( $^{\circ}\text{F}$ )	Leak Check Data			
						Initial: $\text{m}^3$	Final: $\text{m}^3$	In Hg.	In Hg.
0	1500	171.33	13	18	8	0.00	0.00	21	21
10						FYRITE TESTS			
20						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
30						1530	13.5	5.5	
40									
50									
60	1610	140.82	13	19	12				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

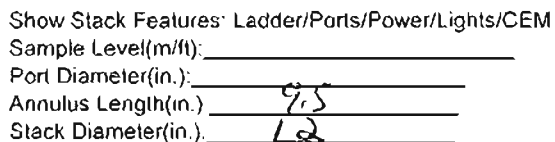
Port Diameter(in.) 2

Annulus Length(in.): 9.3

Stack Diameter(in ): 1.5

[illegible]

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C)	Impinger Temp (°C)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	0830	191.004	13	20	8	Initial: 0.000	Final: 0.000	21	21
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						0838	13	5.5	
40									
50									
60	0940	211.216	13	20	10				



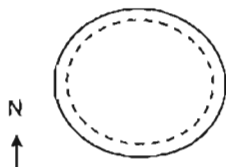
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.011</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>08/14/2011</u>	Test #: <u>Three</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>GC</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/No	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>325</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>338</u>
Pitot ID#: <u>PTSEPM</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA33</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

Point	Time	Port #1	(E-W)	Port #2	(N-S)	Port #3	( )	Port #4	( )
#	(24 Hrs)	Temp(c/f)	ΔP	Temp(c/f)	ΔP	Temp(c/f)	ΔP	Temp(c/f)	ΔP
6	1006	546	0.013	573	0.015				
5		571	0.011	577	0.013				
4		581	0.011	570	0.011				
3		536	0.012	510	0.003				
2		515	0.010	493	0.007				
1	1106	490	0.004	480	0.002				

## ABSORPTION DATA

Min.	Time	Volume	Vacuum	Meter	Impinger	Leak Check Data			
	(24Hrs)	(m <sup>3</sup> /m <sup>3</sup> )	(in. Hg)	Temp(°F)	Temp(°F)	Initial:			
0	1005	0.005	13	20	8	0.000 m <sup>3</sup>	21	in Hg.	
10						Final: 0.000 m <sup>3</sup>	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1020	13.5	6.0	
50									
60	1115	0.002	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in) 9.5Stack Diameter(in) 12

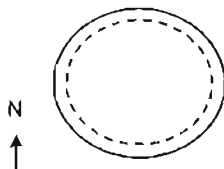
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.012</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/01/11</u>	Test #: <u>Flow</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JLW</u>	Team Leader: <u>KS</u>	Final Volume of Abs. Sol. (ml): <u>212</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>12</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>328</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>331</u>
Pitot ID#: <u>PTS Edm</u>	Pitot Factor: <u>0.303</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>15</u>
Comments:		Rinse Volume (ml):

Point #	Time (24 Hrs)	Port #1 Temp(°F)	(E-W) ΔP	Port #2 Temp(°F)	(N-S) ΔP	Port #3 Temp(°F)	ΔP	Port #4 Temp(°F)	ΔP
6	1138	541	0.013	517	0.012				
5		554	0.012	539	0.010				
4		524	0.010	530	0.010				
3		449	0.007	500	0.012				
2		514	0.002	492	0.005				
1	1241	501	0.002	481	0.003				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume ft <sup>3</sup> /m <sup>3</sup>	Vacuum (in. Hg)	Meter Temp(°F)	Impinger Temp(°F)	Leak Check Data			
0	1135	230.991	13	20	8	Initial: 0.0000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						Final: 0.0000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1200	14	5	
50									
60	1248	251.443	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5Stack Diameter(in.): 12

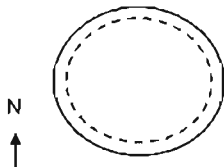
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.011</u>
Contact Name: _____	Source: <u>Incinerator</u>	Absorbing Solution: <u>DI H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Five</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>WR</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#13</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical= _____	Pre Silica Weight (g): <u>331</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>334</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>ATA 38</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>19</u>
Comments: _____		Rinse Volume (ml): _____

Point	Time	Port #1	(E-W)	Port #2	(N-S)	Port #3	( )	Port #4	( )
#	(24 Hrs)	Temp(°f)	ΔP	Temp(°f)	ΔP	Temp(c/f)	ΔP	Temp(c/f)	ΔP
6	1308	531	0.014	538	0.014				
5		556	0.013	547	0.013				
4		544	0.012	527	0.012				
3		520	0.012	480	0.010				
2		510	0.011	493	0.009				
1	1411	490	0.003	491	0.003				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(°f)	Impinger Temp(°f)	Leak Check Data			
0	1305	28.630	13	30	8	Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1530	13.5	5.5	
50									
60	1415	27.848	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 9.5Annulus Length(in.): 12Stack Diameter(in.): 12

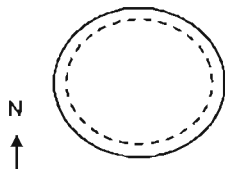
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.01</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>ATH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Six</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>LR</u>	Final Volume of Abs. Sol. (ml): <u>212</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>12</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>297</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>302</u>
Pitot ID#: <u>PTSEAm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>5</u>
Meter #: <u>RATN 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

Point #	Time (24 Hrs)	Port #1 Temp(°F)	(FV) ΔP	Port #2 Temp(°F)	(WS) ΔP	Port #3 Temp(c/f)	( ) ΔP	Port #4 Temp(c/f)	( ) ΔP
6	1444	550	0.014	537	0.014				
5		559	0.014	543	0.012				
4		522	0.013	540	0.012				
3		486	0.011	499	0.014				
2		481	0.008	484	0.012				
1	1547	472	0.007	466	0.003				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (m³)	Vacuum (in. Hg)	Meter Temp(c/f)	Impinger Temp (c/f)	Leak Check Data			
0	1440	272.036	13	20	8	Initial: 0.000 m³	31	in Hg.	
10						Final: 0.000 m³	31	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1500	14	5	
50									
60	1550	283.112	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 9.5Annulus Length(in.): 12Stack Diameter(in.): 12





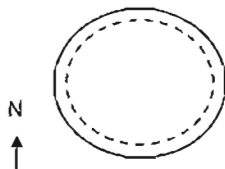
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.067</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DI H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/10/12</u>	Test #: <u>Eight</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>AK</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/No <u>Yes</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>306</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (°F): <u>6</u>	Post Silica Weight (g): <u>311</u>
Pitot ID#: <u>PT5Edm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>5</u>
Meter #: <u>RATA 36</u>	Meter Factor: <u>1.0241</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

Point #	Time (24 Hrs)	Port #1 Temp(°C)	Port #1 ΔP	Port #2 Temp(°C)	Port #2 ΔP	Port #3 Temp(°C)	Port #3 ΔP	Port #4 Temp(°C)	Port #4 ΔP
6	0828	549	0.013	556	0.008				
5		557	0.012	563	0.008				
4		554	0.009	573	0.008				
3		482	0.007	546	0.005				
2		447	0.006	511	0.006				
1	0933	439	0.002	501	0.002				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(°F)	Impinger Temp (°F)	Leak Check Data			
0	0825	310.832	13	13	8	Initial: (0.000 ft <sup>3</sup> )	21	in Hg.	
10						Final: (0.000 ft <sup>3</sup> )	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						0900	13	5.5	
50									
60	0935	330.817	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5Stack Diameter(in.): 12

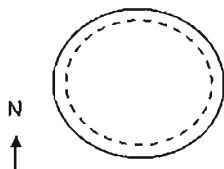
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Nine</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SLW</u>	Team Leader: <u>AK</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>311</u>
B.P. (in. Hg): <u>29.59</u>	Ambient Temperature (°F): <u>6</u>	Post Silica Weight (g): <u>313</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>2</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>18</u>
Comments:		Rinse Volume (ml):

Point #	Time (24 Hrs)	Port #1 Temp(°F)	Port #1 ΔP	Port #2 Temp(°F)	Port #2 ΔP	Port #3 Temp(°F)	Port #3 ΔP	Port #4 Temp(°F)	Port #4 ΔP
6	0958	570	0.009	573	0.012				
5		577	0.009	577	0.010				
4		581	0.010	572	0.008				
3		511	0.011	518	0.007				
3		473	0.008	483	0.006				
1	1103	466	0.007	417	0.002				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(°F)	Impinger Temp(°F)	Leak Check Data			
0	0955	333.010	13	20	8	Initial: 0.000 (ft <sup>3</sup> /m <sup>3</sup> )	21	in Hg.	
10						Final: 0.000 (ft <sup>3</sup> /m <sup>3</sup> )	31	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1030	13	6	
50									
60	1105	352.431	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

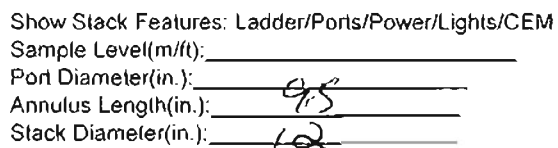
Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5Stack Diameter(in.): 12

[illegible]

Min.	Time (24Hrs)	Volume (ft) <sup>3</sup> /m <sup>3</sup>	Vacuum (in. Hg.)	Meter Temp(°F)	Impinger Temp (°F)	Leak Check Data			
						Initial: 0.00 ft <sup>3</sup> /m <sup>3</sup>		in Hg.	
0	1130	553.128	13	20	8	Final: 0.00 ft <sup>3</sup> /m <sup>3</sup>		in Hg.	
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1200	13	5.5	
40									
60									
60	1240	573.328	13	20	10				



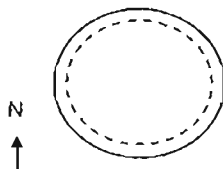
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name: _____	Source: <u>tailwater</u>	Absorbing Solution: <u>DJH2O</u>
Date(Y/M/D): <u>204/12/12</u>	Test #: <u>ELWH</u>	Initial Volume of Abs.Sol. (ml): <u>208</u>
Sampled by: <u>SW</u>	Team Leader: <u>LP</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/No _____	Average Null Angle from Vertical= _____	Pre Silica Weight (g): <u>317</u>
B.P. (In. Hg): <u>29.52</u>	Ambient Temperature (C/F): <u>8</u>	Post Silica Weight (g): <u>320</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 38</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>17</u>
Comments: _____		Rinse Volume (ml): _____

Point #	Time (24 Hrs)	Port #1 Temp(C/F)	Port #1 ΔP	Port #2 Temp(C/F)	Port #2 ΔP	Port #3 Temp(C/F)	Port #3 ΔP	Port #4 Temp(C/F)	Port #4 ΔP
6	1303	513	0.008	507	0.010				
5		520	0.006	514	0.009				
4		509	0.007	499	0.008				
3		451	0.006	453	0.006				
2		440	0.005	429	0.003				
1	1406	427	0.002	430	0.004				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(C/F)	Impinger Temp(C/F)	Leak Check Data			
0	1300	373.507	13	20	8	Initial: <u>0.000</u> (ft <sup>3</sup> /m <sup>3</sup> )	21	in Hg.	
10						Final: <u>0.000</u> (ft <sup>3</sup> /m <sup>3</sup> )	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O2	%CO2	(%/ppm) CO
40							<u>14.5</u>	<u>4.5</u>	
50									
60	1410	393.438	13	20	10				



Show Stack Features. Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in) \_\_\_\_\_

Annulus Length(in.) \_\_\_\_\_

Stack Diameter(in.): \_\_\_\_\_

## AGAT VELOCITY/ ABSORPTION DATA SHEET

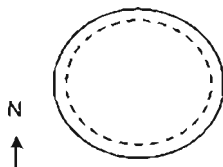
Company: <u>Spartan</u>		Location: <u>Calgary</u>		Stack Static Pressure: <u>-0.006</u>	
Contact Name:		Source: <u>Incinerator</u>		Absorbing Solution: <u>D2H2O</u>	
Date(Y/M/D): <u>2014/12/12</u>		Test #: <u>Twelve</u>		Initial Volume of Abs. Sol. (ml): <u>200</u>	
Sampled by: <u>SW</u>		Team Leader: <u>MC</u>		Final Volume of Abs. Sol. (ml): <u>216</u>	
Fluke Temp. Meter ID #: <u>683</u>				Volume Condensed (ml): <u>16</u>	
Cyclonic Flow ? Yes/No <u>Yes</u>		Average Null Angle from Vertical=		Pre Silica Weight (g): <u>320</u>	
B.P. (In. Hg): <u>29.52</u>		Ambient Temperature (°F): <u>8</u>		Post Silica Weight (g): <u>322</u>	
Pitot ID#: <u>PT5Edn</u>		Pitot Factor: <u>0.805</u>		H2O in Silica Condensed: <u>2</u>	
Meter #: <u>RATA3B</u>		Meter Factor: <u>1.0209</u>		Total Volume H2O Condensed (ml): <u>18</u>	
Comments:				Rinse Volume (ml):	

Point #	Time (24 Hrs)	Port #1 Temp (c/f)	Port #1 ΔP	Port #2 Temp (c/f)	Port #2 ΔP	Port #3 Temp (c/f)	Port #3 ΔP	Port #4 Temp (c/f)	Port #4 ΔP
6	1433	501	0.009	519	0.008				
5		522	0.001	526	0.007				
4		508	0.007	504	0.008				
3		461	0.006	490	0.009				
2		429	0.005	444	0.007				
1	1537	420	0.004	430	0.002				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft³)	Vacuum (in. Hg)	Meter Temp (c/f)	Impinger Temp (c/f)	Leak Check Data			
0	1430	393.625	13	20	8	Initial: 0.000 ft³	21	in Hg.	
10						Final: 0.000 ft³	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O2	%CO2	(%/ppm) CO
40						1500	14.5	5	
50									
60	1540	413.735	13	20	10				



Show Slack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.) \_\_\_\_\_

Annulus Length(in.): \_\_\_\_\_

Stack Diameter(in.): \_\_\_\_\_

---

## **SUMMARY OF OBSERVATIONS**

The following observations were conducted on the test dates of December 10-12, 2014 at the Spartan Controls Ltd – REM Technology Inc. Incinerator Stack. Through the twelve source emission survey tests, it was found that no visible emissions were observed.

Test 1

Appendix D1

FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

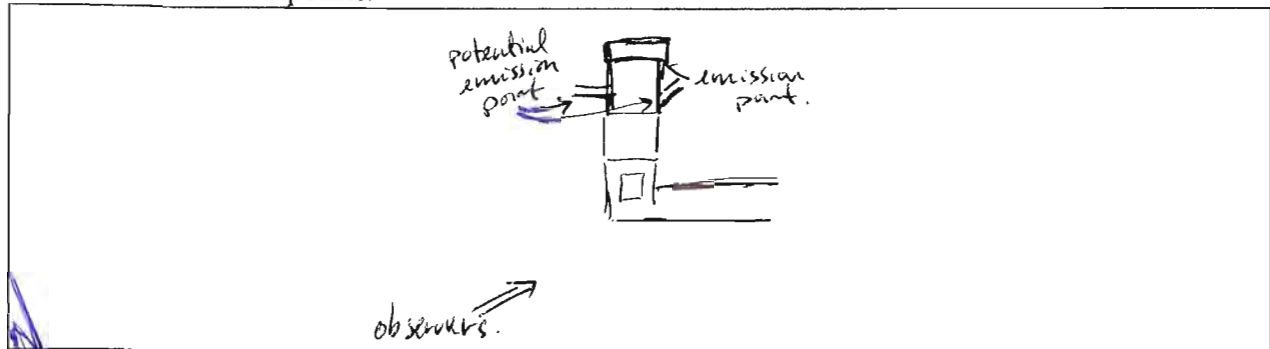
Company <u>REM technology limited</u>	Observer <u>Nitin/Alex</u>
Location <u>9815 48 St SE Calgary</u>	Affiliation <u>AGAT labs.</u>
Company Rep. <u>Greg/Howard.</u>	Date <u>Dec 10/14</u>
Precipitation <u>None.</u>	Wind Speed <u>140 km/h S</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) light overhead (more SW)

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>15:00</u>	<u>14.5 S / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>15:25</u>	<u>170 km/h S / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>15:45</u>	<u>140 km/h S / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>15:51</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>16:05</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
• the final clock time.	<u>16:10</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
For more details on recording this data and taking breaks, see #7 and #10 above.	<u>Accumulated Observation: 1 hr 10 min</u>		
End Observation			





Test 2

~~1/15/2014~~

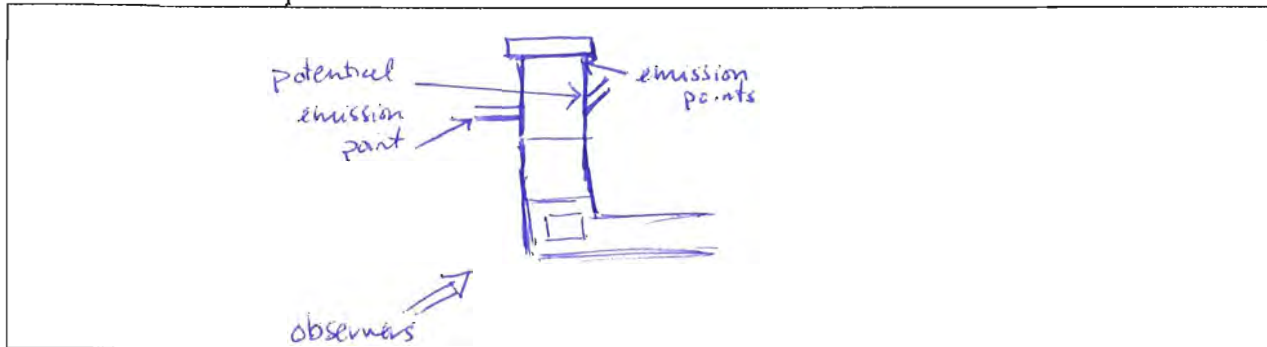
Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company <u>REM Technology Limited</u>	Observer <u>Nitin / Alex.</u>
Location <u>9815 48 St. SE. Calgary.</u>	Affiliation <u>AGAT Labs</u>
Company Rep. <u>Greg / Howard</u>	Date <u>Dec. 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>16 km/h W.</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural  
 Light location (overhead, behind observer, etc.) SE  
 Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>8:30</u>	<u>16 km/h W / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>8:50</u>	<u>20 km/h SW / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>9:10</u>	<u>20 km/h SW / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>9:30</u>	<u>5 km/h SW / clear skies</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>9:40</u>	<u>5 km/h SW / clear skies</u>	<u>                    </u>
• the final clock time.			
	<u>Accumulated Observation: 1hr 10min</u>		
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





Test 3

Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48 St SE Calgary  
Company Rep. Greg/Howard

Observer Nitin/Alex  
Affiliation AGAT Labs  
Date Dec 11/2014

Precipitation None

Wind Speed 5.0 km/h SW

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

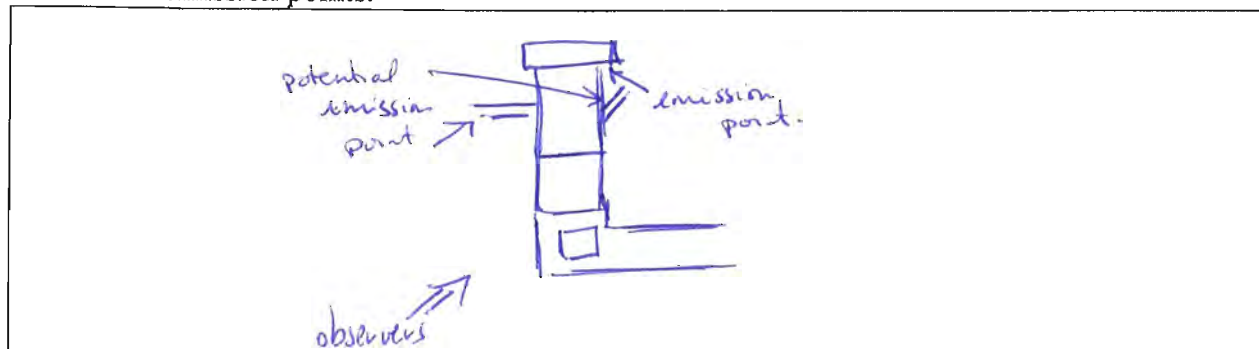
natural

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
--	------------	--	--

Begin

Observation

To complete this form, record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

10:05

6 km/h SE / clear skies

\_\_\_\_\_

10:30

5 km/h SE / variable clouds

\_\_\_\_\_

10:50

5 km/h SE / variable clouds

\_\_\_\_\_

11:10

6.1 km/h SSE / variable clouds

\_\_\_\_\_

11:35

6.1 km/h SSE / variable clouds

\_\_\_\_\_

Accumulated observation: thr 10 min

For more details on recording this data and taking breaks, see #7 and #10 above.

End

Observation



T2  
FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

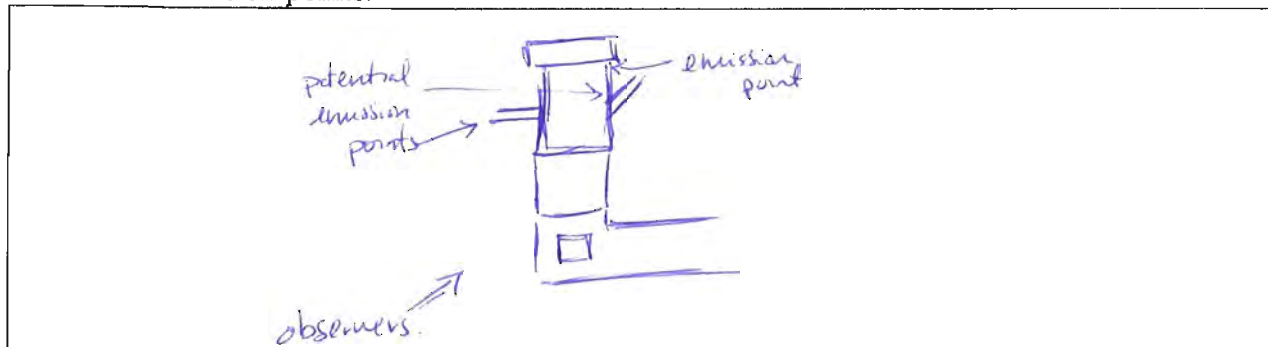
Company <u>REM Technology Limited</u> Location <u>9815 48st SE Calgary</u> Company Rep. <u>Greg/Howard</u>	Observer <u>Nitin / Alex.</u> Affiliation <u>AGAT Labs</u> Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u> Industry _____	Wind Speed <u>5.4 km/h SE</u> Process Unit _____

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>11:35</u>	<u>5.4 km/h SE / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>11:55</u>	<u>12.2 km/h SE / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>12:15</u>	<u>12.2 km/h SE / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>12:35</u>	<u>2.9 km/h SE / overcast.</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>Accumulated observation = the 10 min</u>		
• the final clock time.			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





Test 5

Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48<sup>th</sup> SE Calgary  
Company Rep. Greg Howard

Observer Alex Nitin  
Affiliation AGAT Labs  
Date Dec 11/2014

Precipitation None

Wind Speed

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

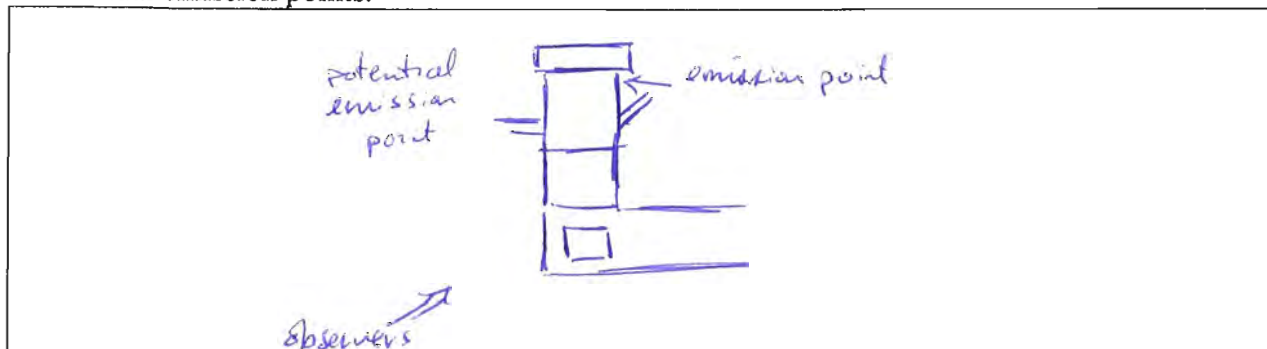
natural

Light location (overhead, behind observer, etc.)

overhead

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

<u>13:05</u>	<u>3.4 km/h W/S / overcast</u>	<u>                    </u>
<u>13:20</u>	<u>5.8 km/h SE / overcast</u>	<u>                    </u>
<u>13:40</u>	<u>9.36 km/h SSE / overcast</u>	<u>                    </u>
<u>14:00</u>	<u>4.0 km/h SE / overcast</u>	<u>                    </u>
<u>14:15</u>	<u>4.0 km/h SE / overcast</u>	<u>                    </u>
<u>Accumulated Observation - the 10 min.</u>		

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation





Test 8

Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48 St. SE Calgary  
Company Rep. Greg Howard

Observer Alex Altin  
Affiliation AGAT Labs  
Date Dec 11/2014

Precipitation None

Wind Speed

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

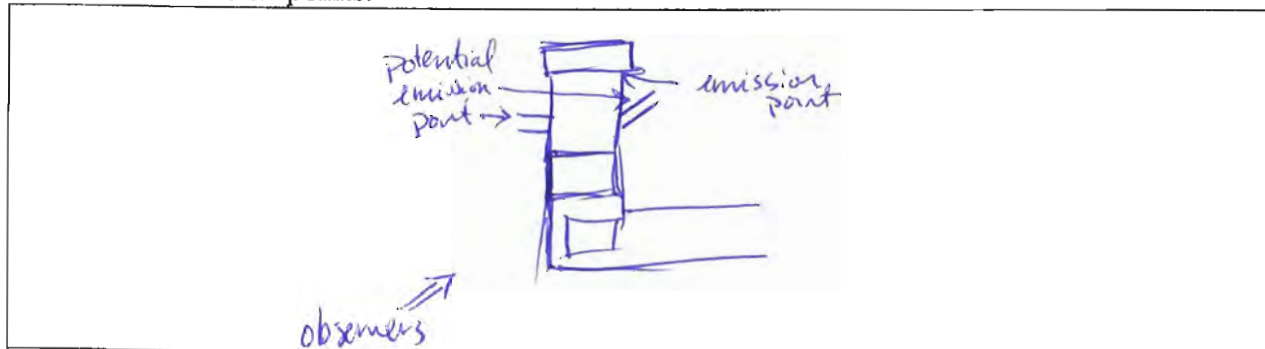
natural

Light location (overhead, behind observer, etc.)

overhead

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	<u>14:40</u>	<u>5.0 km/h SE / overcast.</u>	<u>                    </u>
To complete this form, record the following:	<u>15:00</u>	<u>13.0 km/h / overcast</u>	<u>                    </u>
• the initial clock time	<u>15:20</u>	<u>10.1 km/h overcast.</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>15:40</u>	<u>9.8 km/h overcast.</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>15:50</u>	<u>9.7 km/h / overcast</u>	<u>                    </u>
• the final clock time.	<u>Accumulated Observation: 1hr 10min</u>		
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





Test 3

Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48st SE Calgary  
Company Rep. Greg / Howard

Observer Alex / Nita  
Affiliation AGAT Labs  
Date Dec 1/2014

Precipitation None

Wind Speed 2.1 km/h SE

Industry

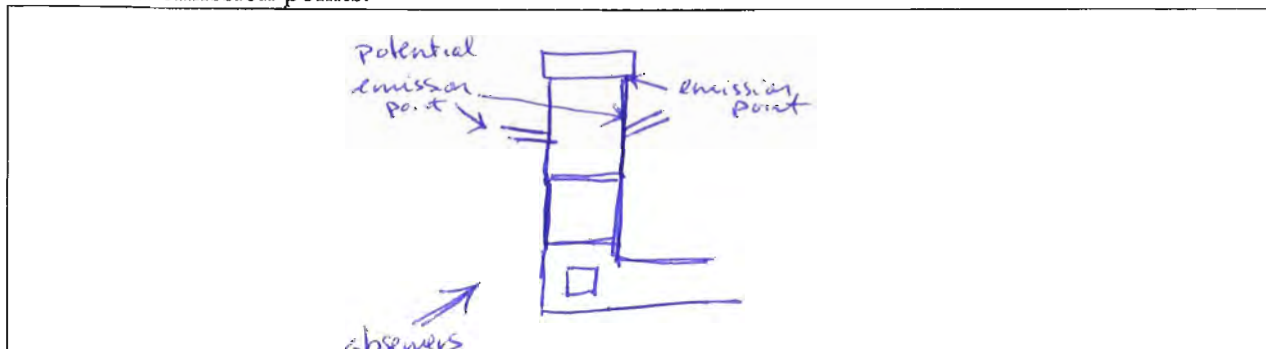
Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) overhead

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

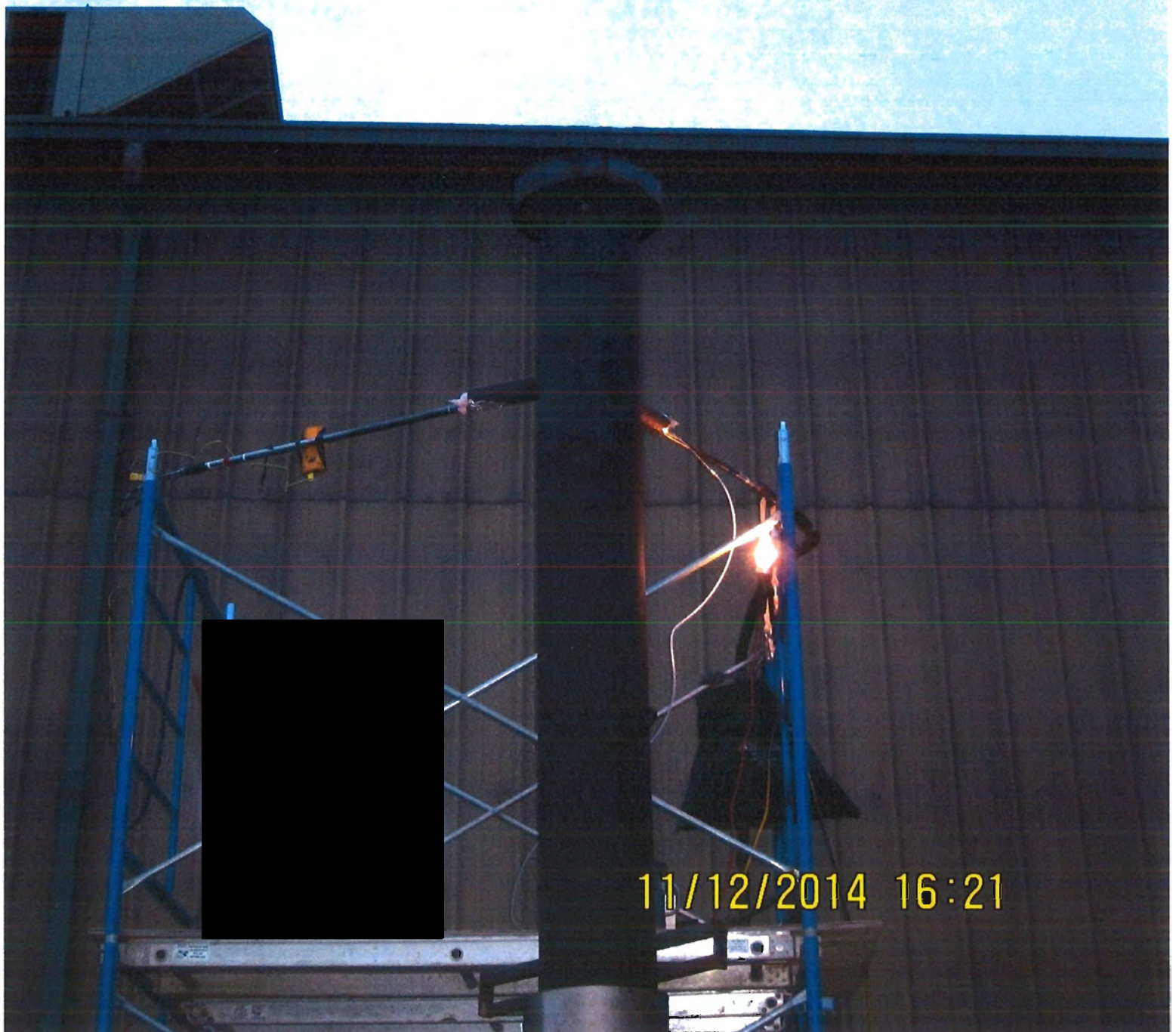
To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

<u>16:00</u>	<u>2.1 km/h SE / overcast</u>	<u>                    </u>
<u>16:20</u>	<u>2.0 km/h SE / overcast</u>	<u>                    </u>
<u>16:40</u>	<u>4.2 km/h SE / overcast</u>	<u>                    </u>
<u>17:00</u>	<u>4.3 km/h SE / overcast</u>	<u>                    </u>
<u>17:20</u>	<u>4.1 km/h SE / overcast</u>	<u>                    </u>
<u>Accumulated Observation: thr 20 min</u>		

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation





Test 8

Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited.  
Location 9815 48 St. SE Calgary  
Company Rep. Greg/Howard

Observer Nitin/Howard  
Affiliation AGAT Labs./REM Tech  
Date Dec 12/2014

Precipitation None

Wind Speed 5.0 km/h SW

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

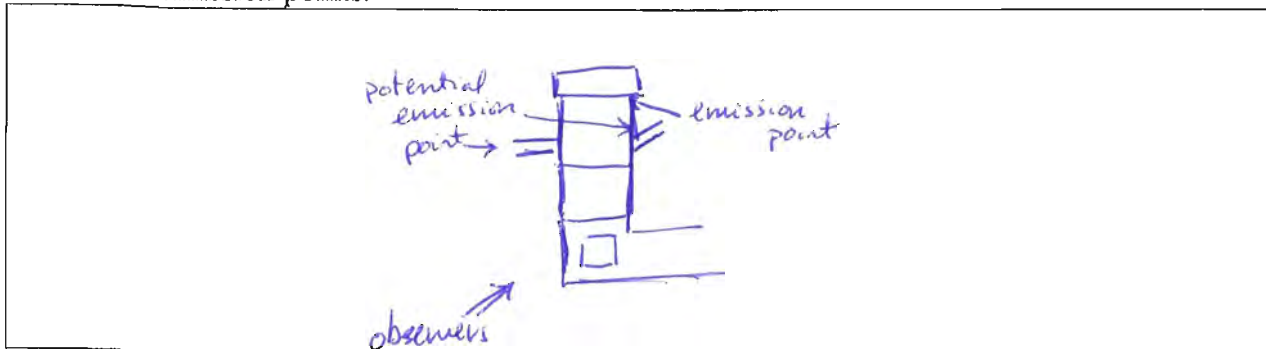
natural

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

8:25

5.0 km/h SW/overcast.

8:50

1.8 km/h SW/overcast.

9:10

2.1 km/h SE/overcast

9:35

2.0 km/h SE/overcast

Accumulated Observation - 1hr 10min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation

12/12/2014 09:34



Test 9

Appendix D1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology limited  
Location 9815 48st. #8E calgary  
Company Rep. Greg/Howard

Observer Nitin/Howard  
Affiliation AGAT Laboratories./REM Tech.  
Date Dec 12/2014

Precipitation None.

Wind Speed 2.5 km/h S

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

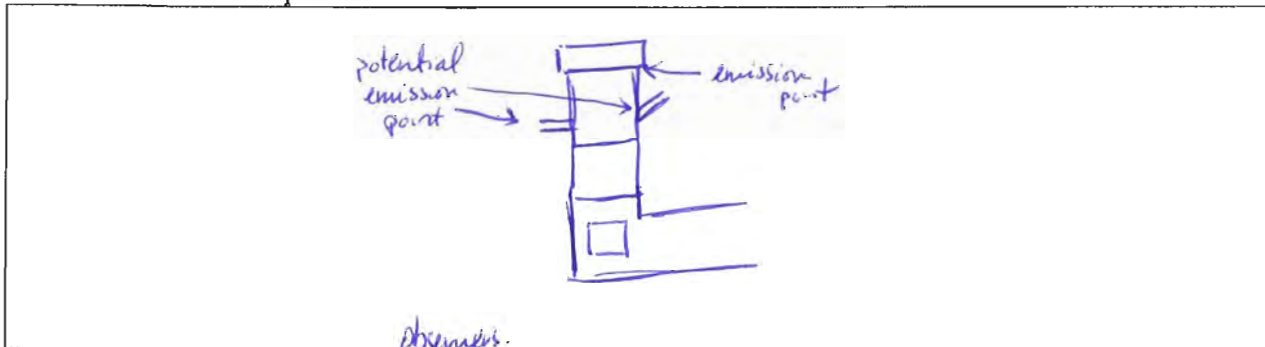
natural.

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin

Observation

To complete this form, record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

09:55

~~10:00~~

10:15

~~10:20~~

10:35

10:05

2.5 km/h / S

1.4 km/h / S

1.1 km/h / S

4.7 km/h SE

variable clouds

variable clouds

variable clouds

variable clouds

variable clouds

Accumulated Observation: thr 10 min

For more details on recording this data and taking breaks, see #7 and #10 above.

End

Observation





FUGITIVE OR SMOKE EMISSION INSPECTION OUTDOOR LOCATION	
Company <i>REM Technology limited</i>	Observer <i>Nitin / Howard.</i>
Location <i>9815 48 St- SE Calgary</i>	Affiliation <i>AGAT Laboratories / REM Tech.</i>
Company Rep. <i>Greg/Howard.</i>	Date <i>Dec 12/2014</i>
Sky Conditions <i>variable clouds.</i>	Wind Direction <i><del>SE</del> NW</i>
Precipitation <i>None.</i>	Wind Speed <i>5.4 km/h NW</i>
Industry	Process Unit

A hand-drawn diagram of a vertical structure, possibly a chimney or a column, with a small square at the bottom. Arrows point from the top of the structure to the labels "potential emission point" and "emission point". An arrow points from the bottom of the structure to the label "observers".

## Begin Observation

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

End  
Observation

Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
11:30	5.4 km/h NW / variable clouds	_____
11:50	2.9 km/h SE / variable clouds	_____
12:10	3.2 km/h SE / variable clouds	_____
12:40	2.5 km/h SE / variable clouds	_____
Accumulated Observation: thr 10 min		





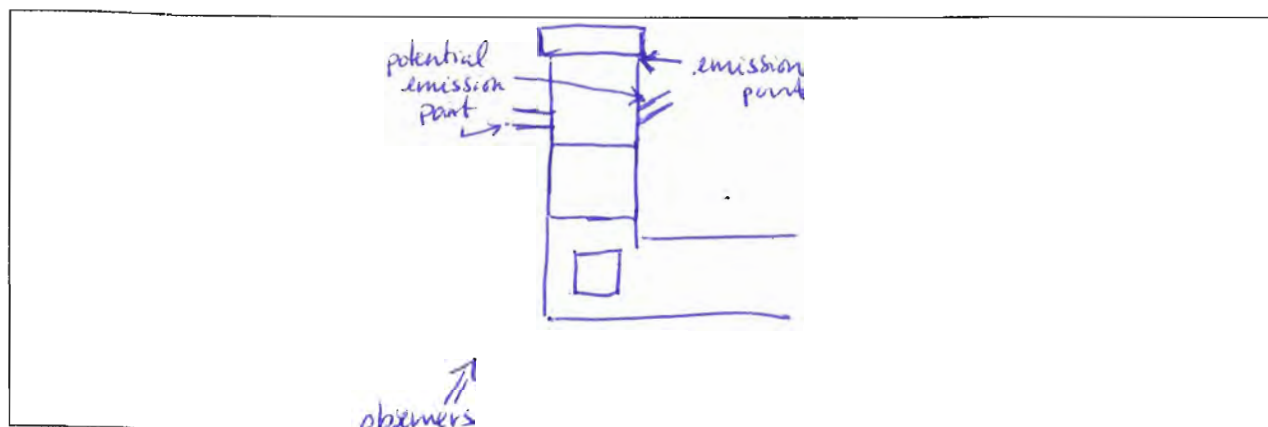
Test 11

# FUGITIVE OR SMOKE EMISSION INSPECTION

## OUTDOOR LOCATION

Company	REM Technology limited.	Observer	Nitin / Alex Scott
Location	9815 48 St. SE Calgary.	Affiliation	AGAT Labs. / Spartan Controls
Company Rep.	Greg / Howard.	Date	Dec 10 / 2014.
Sky Conditions	variable clouds.	Wind Direction	S
Precipitation	none.	Wind Speed	2.5 km/h
Industry		Process Unit	

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	13:00	2.5 km/h S / variable clouds.	
	13:20	2.2 km/h S / variable clouds.	
	13:40	0.0 km/h / variable clouds.	
	14:10	1.1 km/h / variable clouds.	
	<del>14:00</del>		
Accumulated Observation: the 10 min			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			



12/12/14 14:04

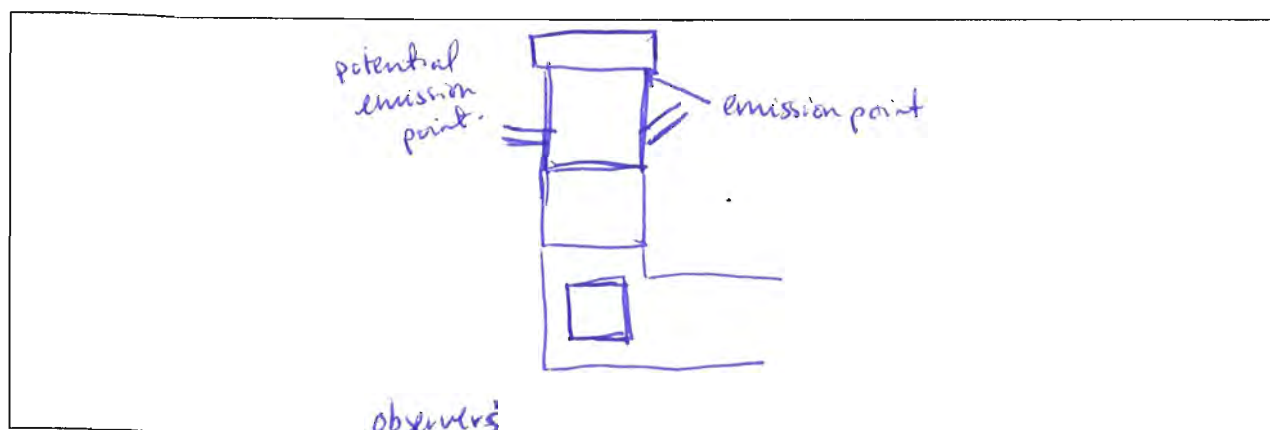


Test 12

FUGITIVE OR SMOKE EMISSION INSPECTION  
OUTDOOR LOCATION

Company	REM Technology Limited	Observer	Nitin / Alex Scott
Location	9815 48 St. SE Calgary.	Affiliation	AGAT Labs. / Spartan Controls
Company Rep.	Greg / Howard	Date	Dec 10 / 2014
Sky Conditions	variable clouds	Wind Direction	<del>SW</del> NW
Precipitation	None.	Wind Speed	1.8 km/h
Industry		Process Unit	

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	14:30	1.8 km/h NW / variable clouds	
To complete this form, record the following:	14:50	2.1 km/h NW / variable clouds	
• the initial clock time	15:10	1.8 km/h NW / variable clouds	
• the total time of the observation (from SW1)	15:40	0.0 km/h / variable clouds	
• the total time of emissions (from SW2), and	Accumulated observation - the 10 min		
• the final clock time.			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			



12/12/2015 5:38



## **Appendix V**

### **AGAT Calibration Data**



## ANALYZER CALIBRATION FORM

Parameter

CO

On-Site to Probe

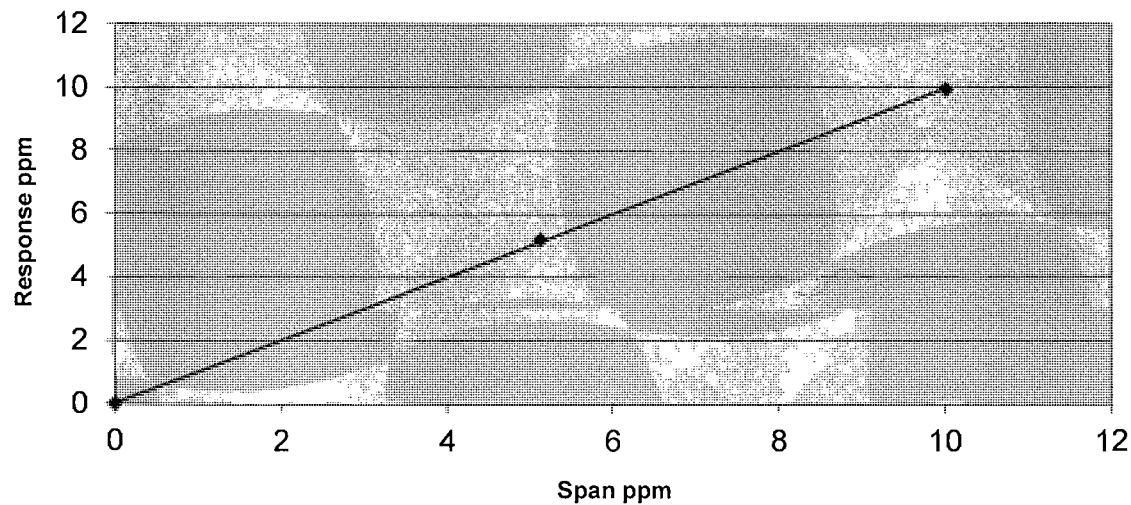
**Company:** Spartan Controls      **Location:** Calgary  
**Staff:** CR/JW/AS/NM      **Parameter:** Pre -Test Linearity  
**Date:** 2014/12/10-12      **Time:** 8:00-8:22  
**Analyzer:** \_\_\_\_\_      **S/N:** \_\_\_\_\_  
**Data System:** ICIS 3      **Dilution:** 1:1

Calibration Standard	Gas	ID Number	Concentration
Compressed Cylinders	CO	0	0 ppm
- Balance Nitrogen	CO	CC258434	5.13 ppm
	CO	CC119196	10.01 ppm
Zero Air	N2	N/A	100 %

Analyzer Span: 10.01 \_\_\_\_\_ 110 seconds

Calibration Data					
Set Point	Required PPM	Dilution Factor	Actual PPM	D.A.S. Response	Percent Difference
1	-0.2002 - 0.2002	100	0		0.000
2	-0.2002 - 0.2002	100	0	0	0.000
3	4.9298 - 5.3302	100	5.13	5.19	-0.599
4	9.8098 - 10.2102	100	10.01	9.94	0.699
5	-0.2002 - 0.2002	100	0	0	0.0000

Linearity      **Slope:** 0.9949      **Y-Intercept:** 0.0169      **Correlation:** 0.99995



**AGAT Laboratories**  
**Source Testing Services, Calgary, Alberta**

**RESPONSE TIME TESTS**

**Test Date :** 2014/12/10-12  
**Analyzer Type :**   
**Operator:** CR  
**Client:** Spartan Controls

**Span Gas Concentration:** 5.13 ppm  
**Analyzer Span Setting:** 10.01 ppm

**Upscale:**

1	<u>110</u>	Seconds
2	<u>110</u>	Seconds
3	<u>110</u>	Seconds
Average:	<u><b>110</b></u>	Seconds

**Downscale**

1	<u>110</u>	Seconds
2	<u>110</u>	Seconds
3	<u>110</u>	Seconds
Average:	<u><b>110</b></u>	Seconds

The system average response time is equivalent to the slower of the  
 upscale and downscale response times, which is: **110**

## Appendix D1

ANALYZER DRIFT  
AGAT Laboratories

Company: Spartan Controls Location: Calgary Staff: CR/JW/AS/NM  
 Date: 2014/12/10-12 Test Type: RATA Condition: Normal  
 Span: CO 10.01 ppm

Test #:	One		Time:		15:00	--	16:10	2014/12/10-12			
	Initial		Final		% Drift		Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS			SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00		10.01	4.45	10.01	4.44	0.10

Test #:	Two		Time:		08:30	--	09:40	2014/12/10-12			
	Initial ZERO      DAS		Final ZERO      DAS		% Drift		Initial SPAN      DAS		Final SPAN      DAS		% Drift
CO	0	0	0	0	0.00		10.01	5.18	10.01	5.56	-3.80

Test #:	Three		Time:		10:05	--	11:15	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	5.56	10.01	5.81	-2.50

Test #:	Four		Time:		11:35	--	12:45	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	5.81	10.01	5.63	1.80

Test #:	Five		Time:		13:05	--	14:15	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	5.63	10.01	5.41	2.20

Test #:	Six	Time:	14.40	--	15.50	2014/12/10-12				
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	5.41	10.01	5.39	0.20

Test #:	Seven		Time:		16:10	--	17:20	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	5.39	10.01	5.55	-1.60

Test #:	Eight		Time:		08:25	--	09:35	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	4.95	10.01	4.77	1.80

Test #:	Nine		Time:		09:55	--	11:05	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	4.77	10.01	4.84	-0.70

Test #:	Ten		Time:		11:30	--	12:40	2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	10.01	4.84	10.01	5.21	-3.70

Test #:	Eleven		Time:		13:00	--	14:10	2014/12/10-12			
	Initial		Final		% Drift		Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS			SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0		10.01	5.21	10.01	5.10	1.10

Test #:	Twelve		Time: 14:30		--	15:40		2014/12/10-12		
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0	10.01	5.10	10.01	4.84	2.60

## ANALYZER CALIBRATION FORM

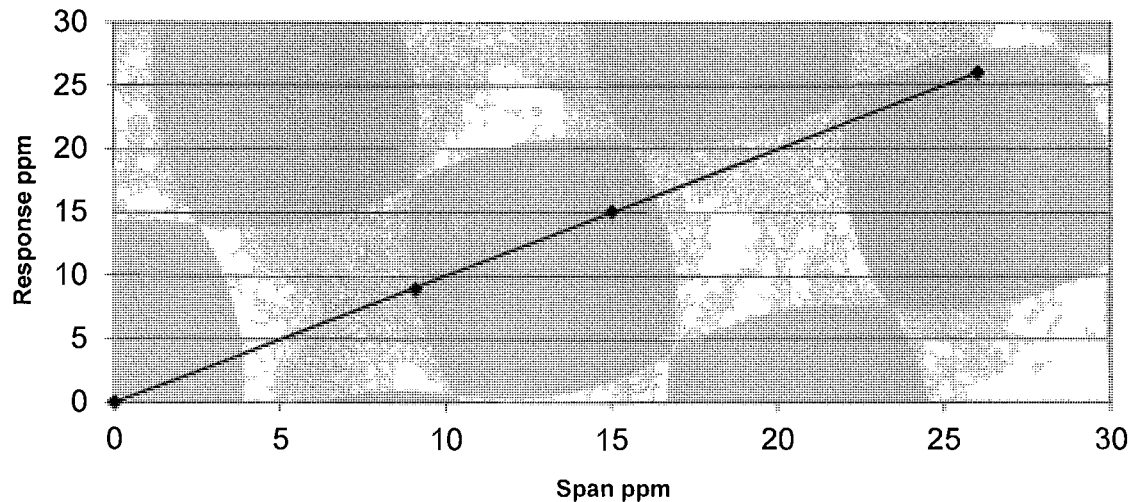
<b>Parameter</b>	THC	On-Site to Probe
<b>Company:</b>	Spartan	<b>Location:</b> Calgary
<b>Staff:</b>	CR/JW/AS/NM	<b>Parameter:</b> Pre -Test Linearity
<b>Date:</b>	2014/12/10-12	<b>Time:</b> 8:15-8:45
<b>Analyzer:</b>		<b>S/N:</b>
<b>Data System:</b>	ICIS 3	<b>Dilution:</b> 1:1

Calibration Standard	Gas	ID Number	Concentration
Compressed Cylinders - Balance Nitrogen	THC	CC140651	9.09 ppm
	THC	CSA15547	15 ppm
	THC	CC107358	26 ppm
Zero Air	N2	N/A	100 %

Analyzer Span: 26 120 seconds

Calibration Data					
Set Point	Required PPM	Dilution Factor	Actual PPM	D.A.S. Response	Percent Difference
1	-0.52 - 0.52	100	0	0	0.000
2	8.57 - 9.61	100	9.09	8.93	0.615
3	14.48 - 15.52	100	15	15.07	-0.269
4	25.48 - 26.52	100	26	26.01	-0.038
5	-0.52 - 0.52	100	0	0	0.0000

Linearity **Slope:** 1.0014 **Y-Intercept:** -0.0297 **Correlation:** 0.99997



**AGAT Laboratories**  
**Source Testing Services, Calgary, Alberta**

**RESPONSE TIME TESTS**

**Test Date :** 2014/12/10-12  
**Analyzer Type :** \_\_\_\_\_  
**Operator:** CR  
**Client:** Spartan

Span Gas Concentration: 9.09 ppm  
 Analyzer Span Setting: 26.0 ppm

**Upscale:**

1	<u>120</u>	Seconds
2	<u>120</u>	Seconds
3	<u>120</u>	Seconds
Average:	<u>120</u>	Seconds

**Downscale**

1	<u>120</u>	Seconds
2	<u>120</u>	Seconds
3	<u>120</u>	Seconds
Average:	<u>120</u>	Seconds

The system average response time is equivalent to the slower of the  
 upscale and downscale response times, which is: **120**

## Appendix D1

ANALYZER DRIFT  
AGAT Laboratories

Company: Spartan Location: Calgary Staff: CRJW/AS/NM  
 Date: 2014/12/10-12 Test Type: RATA Condition: Normal

Span: THC 26 ppm

Test #:	One	Time:	1500	--	1610	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.13	26	8.56	-1.65

Test #:	Two	Time:	0830	--	0940	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.56	26	8.24	1.23

Test #:	Three	Time:	1005	--	1115	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.24	26	8.86	-2.38

Test #:	Four	Time:	1135	--	1245	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.86	26	8.76	0.38

Test #:	Five	Time:	1305	--	1415	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.76	26	8.70	0.23

Test #:	Six	Time:	1440	--	1550	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.70	26	7.88	3.15

Test #:	Seven	Time:	1610	--	1720	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	7.88	26	8.54	-2.54

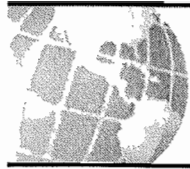
Test #:	Eight	Time:	0825	--	0935	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.93	26	8.20	2.81

Test #:	Nine	Time:	0955	--	1105	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	8.20	26	9.20	-3.85

Test #:	Ten	Time:	1130	--	1240	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
THC	0	0	0	0	0.00	26	9.20	26	8.23	3.73

Test #:	Eleven	Time:	13:00	--	14:10	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
CO	0	0	0	0	0.00	26	8.23	26	7.43	3.08

Test #:	Twelve	Time:	14:30	--	15:40	2014/12/10-12				
	Initial		Final		% Drift	SPAN	Initial	Final	% Drift	
	ZERO	DAS	ZERO	DAS			DAS	DAS		
CO	0	0	0	0	0.00	26	7.43	26	7.38	0.19



# AGAT Laboratories

## S-TYPE PITOT TUBE CALIBRATION

**Calibration Device/Location:** SAIT Wind Tunnel/standard Pit.

**Pitot Tube Number:** PT 5 EDM

**Technician:** TN

**Calibration Date (D/M/Y):** 23-Jan-14

**Date Last Calibrated (D/M/Y):** 24-Jan-13

**Previous Factor:** \_\_\_\_\_

Approx. Velocity	Reference	S-Type		Pitot Factor	Error
ft/sec	$\Delta Pr$	$\Delta Ps$	$(Ref/S-type)^{0.5}$		$\pm 0.01$ from the new factor
10	0.0245	0.0380	0.803	0.795	-0.01
10	0.0240	0.0360	0.816	0.808	0.00
20	0.0670	0.102	0.810	0.802	0.00
20	0.0680	0.103	0.813	0.804	0.00
40	0.312	0.473	0.812	0.804	0.00
40	0.312	0.472	0.813	0.805	0.00
60	0.731	1.106	0.813	0.805	0.00
60	0.731	1.109	0.812	0.804	0.00

**Standard Pitot Tube Factor:** 0.990      **New Factor:** **0.803**

**Calibration Notes:** Pitot Tube tips are in good shape, clean, with no deformations or damage.  
 Calibrated with thermocouples in place.

# Dry Gas Meter Calibration

**Meter:** Sensus 01  $V_{Tr} = \frac{536.7}{29.92} \times \frac{(BP + Dp)}{(Tm + 460)} \times \text{Volume Reference}$   
**Technician:** TN

**Date:** Jan.21,2014  
**B.P:** 26.49 in.Hg.  $V_{DGr} = \frac{536.7}{29.92} \times \frac{(BP + Dp)}{(Tm + 460)} \times \text{Volume Dry Gas Meter}$   
**Old Factor:** 0.9098  
**Ref. Factor** 1.0000

Reference Temperature is 77°F

Reference Pressure is 29.92 in.Hg

	<u><b>Trial 1</b></u>	<u><b>Trial 2</b></u>	<u><b>Trial 3</b></u>	
<b>Test Meter</b>				
Qw Volume :	10.00	10.00	10.00	cubic feet
Temp Meter :	76.0	76.0	74.5	°F
Pressure Meter:	3.15	3.15	3.20	in.H2O
Ref Vol:	8.947	8.947	8.974	Ft.3 @ REF
<b>Dry Gas Meter</b>				
Qd Volume :	9.853	9.880	9.895	cubic feet
Temp Meter :	75.5	76.0	75.5	°F
Pressure Meter:	0.31	0.31	0.31	in.H2O
Ref Vol:	8.755	8.771	8.792	Ft.3 @ REF

Meter Factor:	1.0220	1.0201	1.0206
---------------	--------	--------	--------

**New Factor:** **1.0209**

**Signature:** 

% Change: 12.2113

Notes: \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_





Calibrations | Traceable to NRC and NIST | Installation | Maintenance

Page 1 of 1

Report Number: AL-110714-01

### Certificate of Calibration Hand Held Temp Indicator

**Company:** Agat Laboratories Ltd.  
**Address:** 2910 12 Street N.E.  
Calgary, Alberta. T2P 7P7

**Date:** July 11, 2014  
**Due:** July 11, 2015  
**Tech:** Brandon McKay

**Make:** Fluke  
**Model** 51 Series II  
**Range** Various

**Location:** Lab  
**Serial #:** 88170074

### Calibration Data Type K

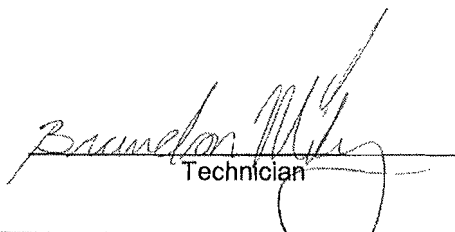
Test Point ( °C )	As Found ( °C )	As Left ( °C )	Error ( °C )	Allowable Error ( °C )
1200.00	1200	1200	0.0	±1.1
800.00	799.9	799.9	-0.1	±0.9
400.00	400.0	400.0	0.0	±0.7
0.00	0.0	0.0	0.0	±0.5
-200.00	-199.8	-199.8	-0.2	±0.9

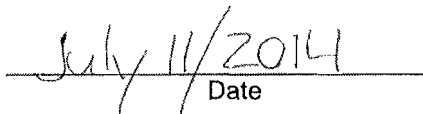
**Comments:** Thermometer is within  $\pm 0.05\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) above  $100^{\circ}\text{C}$  for J,K,E, and T types or  $\pm 0.2\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) below  $100^{\circ}\text{C}$  for J, K, and E types.  $\pm 0.5\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) Below  $100^{\circ}\text{C}$  for T type.

The test accuracy ratio of this calibration is at least 4:1 unless otherwise indicated. This unit has been calibrated using equipment and standards traceable to the National Research Council of Canada (NRC), the National Institute of Standards and Technology (NIST), or derived from accepted values of natural physical constants. This calibration certificate applies only to the item described and shall not be reproduced, other than in full, without approval from Reding Instrument Services Ltd.

### Calibration Standard(s) Used

Asset Used	Model Number	Serial Number	Asset Due Date
Fluke	5520A	8979001	April 17, 2015

  
Technician

  
Date

Reding Instrument Services Ltd.

1-3600, 21st Street NE Calgary, Alberta T2E 6V6

Tel: 403.250.7430 Fax: 403.291.0976 Email: calibration@redinginstruments.com www.redinginstruments.com

**Praxair**

5700 South Alameda Street

Los Angeles, CA 90058

Tel: (323) 585-2154 Fax: (714) 542-6689

PGVPID: F22014

DocNumber: 000073270

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

**Customer & Order Information:**

AGAT LAB \*G\*MS\*

2420 42 AVE NE

CALGARY

AB T1Y 7H

Praxair Order Number: 21876395

Customer P. O. Number: 75785

Customer Reference Number:

Fill Date: 10/27/2014

Part Number: EV NICOR1E-AS

Lot Number: 109430004

Cylinder Style &amp; Outlet: AS CGA 350

Cylinder Pressure &amp; Volume: 2000 psig 140 cu. ft.

**Certified Concentration:**

Expiration Date:	11/4/2022	NIST Traceable
Cylinder Number:	CC258434	Analytical Uncertainty:
5.13 ppm	CARBON MONOXIDE	± 0.9 %
Balance	NITROGEN	

**Certification Information:** Certification Date: 11/4/2014 Term: 96 Months Expiration Date: 11/4/2022

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: 5 ppm  
 Certified Concentration: 5.13 ppm  
 Instrument Used: Horiba VIA-510 S/N 576876015  
 Analytical Method: NDIR  
 Last Multipoint Calibration: 10/20/2014

Reference Standard Type: GMIS  
 Ref. Std. Cylinder #: CC130822  
 Ref. Std. Conc: 10.15 ppm  
 Ref. Std. Traceable to SRM #: 1677c  
 SRM Sample #: 5-J-42  
 SRM Cylinder #: CAL015337

First Analysis Data:				Date:	11/4/2014
Z:	0	R:	83.8	C:	42.4
R:	84.2	Z:	0	C:	42.4
Z:	0	C:	42.5	R:	84
UOM:	ppm	Mean Test Assay:	5.127 ppm		

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

Analyzed by:

Ying Yu

Certified by:

Jack Fu



**Praxair**  
 5700 South Alameda Street  
 Los Angeles, CA 90058  
 Tel: (323) 585-2154 Fax: (714) 542-6689  
 PGVPID: F22014

DocNumber: 000073271

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
 2420 42 AVE NE  
 CALGARY AB T1Y 7H

Praxair Order Number: 21876395  
 Customer P. O. Number: 75785  
 Customer Reference Number:

Fill Date: 10/27/2014  
 Part Number: EV NICOR1E-AS  
 Lot Number: 109430005  
 Cylinder Style & Outlet: AS CGA 350  
 Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	11/4/2022	NIST Traceable
Cylinder Number:	CC119196	Analytical Uncertainty:
10.01 ppm	CARBON MONOXIDE	± 0.8 %
Balance	NITROGEN	

**Certification Information:** Certification Date: 11/4/2014 Term: 96 Months Expiration Date: 11/4/2022

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: 10 ppm  
 Certified Concentration: 10.01 ppm  
 Instrument Used: Horiba VIA-510 S/N 576876015  
 Analytical Method: NDIR  
 Last Multipoint Calibration: 10/20/2014

Reference Standard Type: GMIS  
 Ref. Std. Cylinder #: CC130322  
 Ref. Std. Conc: 10.15 ppm  
 Ref. Std. Traceable to SRM #: 1677c  
 SRM Sample #: 5-J-42  
 SRM Cylinder #: CAL015337

First Analysis Data:				Date:	11/4/2014		
Z:	0	R:	84.2	C:	82.8	Conc:	10.009
R:	83.9	Z:	0	C:	82.9	Conc:	10.021
Z:	0	C:	82.6	R:	83.8	Conc:	9.985
UOM:	ppm	Mean Test Assay:				10.005 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:			0 ppm

Analyzed by:

Ying Yu

Certified by:

Jack Fu



**Praxair**  
 5700 South Alameda Street  
 Los Angeles, CA 90058  
 Tel: (323) 585-2154 Fax: (714) 542-6689  
 PGVPID: F22014

DocNumber: 000072845

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
 2420 42 AVE NE  
 CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
 Customer P. O. Number: 75786  
 Customer Reference Number:

Fill Date: 10/14/2014  
 Part Number: NI PR9ME-AS  
 Lot Number: 109428713  
 Cylinder Style & Outlet: AS CGA 350  
 Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	CC140651	Analytical Uncertainty:
9.09 ppm	PROPANE	± 1 %
Balance	NITROGEN	

**Certification Information:** Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 9 ppm  
 Certified Concentration: 9.09 ppm  
 Instrument Used: HORIBA, FIA-510, 051135122  
 Analytical Method: Flame Ionization  
 Last Multipoint Calibration: 10/11/2014

Reference Standard Type: GMIS  
 Ref. Std. Cylinder #: CC147258  
 Ref. Std. Conc: 9.900 ppm  
 Ref. Std. Traceable to SRM #: 1668b  
 SRM Sample #: 84-K-35  
 SRM Cylinder #: FF10676

**First Analysis Data:** Date: 10/21/2014

Z:	0	R:	23.28	C:	21.36	Conc:	9.1
R:	23.18	Z:	0	C:	21.31	Conc:	9.079
Z:	0	C:	21.31	R:	23.25	Conc:	9.079

UOM: ppm Mean Test Assay: 9.086 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: 0 ppm

Analyzed by:

Ying Yu

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072846

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR15ME-AS  
Lot Number: 109428712  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	SA15547	Analytical Uncertainty:
15.0 ppm	PROPANE	± 1 %
Balance	NITROGEN	

**Certification Information:** Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 15 ppm  
Certified Concentration: 15.0 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

**First Analysis Data:** Date: 10/21/2014  
Z: 0 R: 23.28 C: 35.27 Conc: 15.027  
R: 23.18 Z: 0 C: 35.27 Conc: 15.027  
Z: 0 C: 35.27 R: 23.25 Conc: 15.027  
UOM: ppm Mean Test Assay: 15.027 ppm

Analyzed by:

Ying Yu

Reference Standard Type: GMS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1666b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

**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: 0 ppm

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072847

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR26ME-AS  
Lot Number: 109428711  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	CC107358	Analytical Uncertainty:
26.0 ppm	PROPANE	± 1 %
Balance	NITROGEN	

**Certification Information:** Certification Date: 10/21/2014 Term: 93 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 26 ppm  
Certified Concentration: 26.0 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

First Analysis Date: Date: 10/21/2014

Z: 0	R: 23.2	C: 60.9	Conc: 25.913
R: 23.3	Z: 0	C: 61.1	Conc: 25.998
Z: 0	C: 61.1	R: 23.3	Conc: 25.998

UOM: ppm Mean Test Assay: 25.97 ppm

Analyzed by:

Ying Yu

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1666b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

Second Analysis Date: 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: 0 ppm

Certified by:

Jack Fu

**-END OF DOCUMENT-**

## Appendix D2 – Stack Gas Emissions Report – Graphs

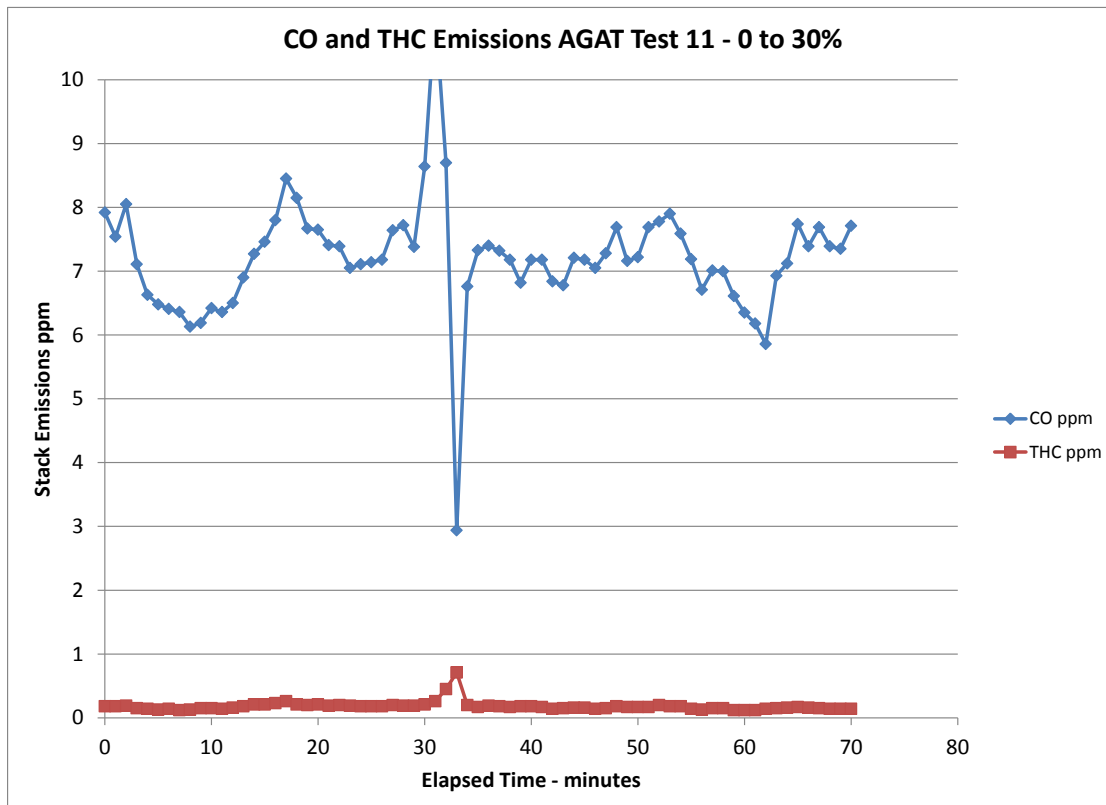
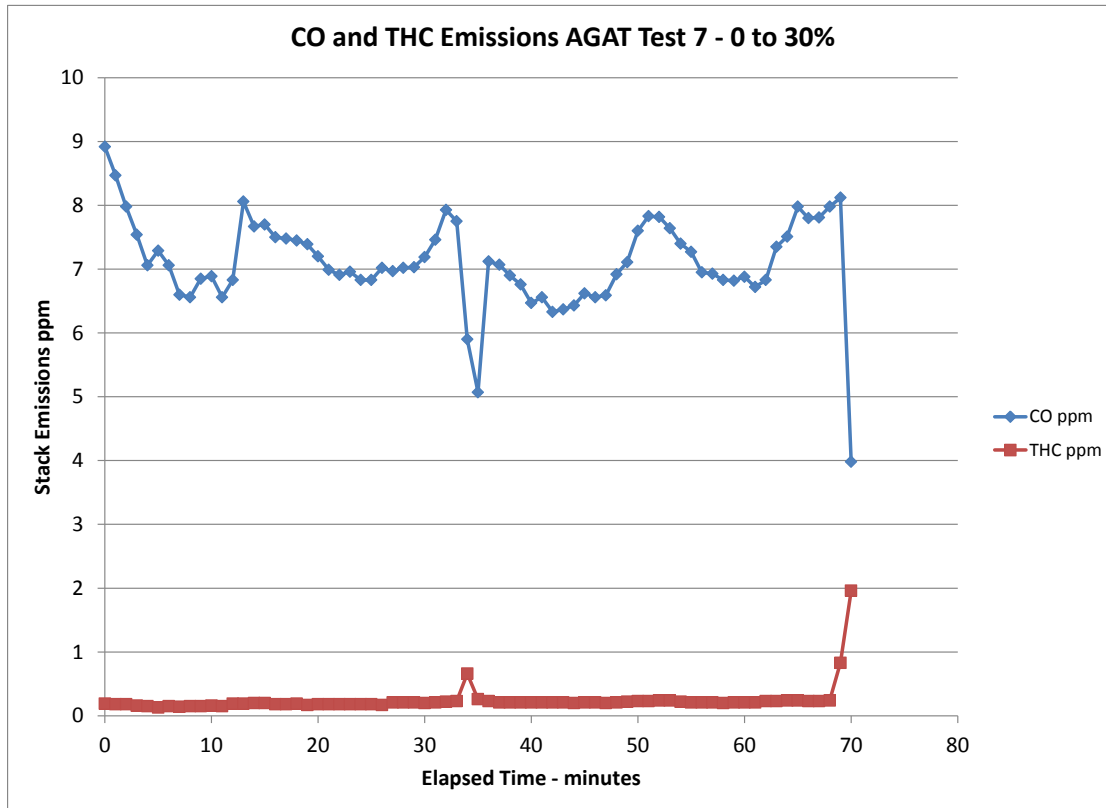
The graphs from Appendix D1 have been re-plotted to a single scale.

Run No.	Fuel Flow Rate	AGAT Test No.
1A	0 to 30%	7
1B	0 to 30%	11
1C	0 to 30%	12
2A	30 to 70%	4
2B	30 to 70%	5
2C	30 to 70%	6
3A	70 to 100%	1
3B	70 to 100%	2
3C	70 to 100%	3
4A	90 to 100%	8
4B	90 to 100%	9
4C	90 to 100%	10

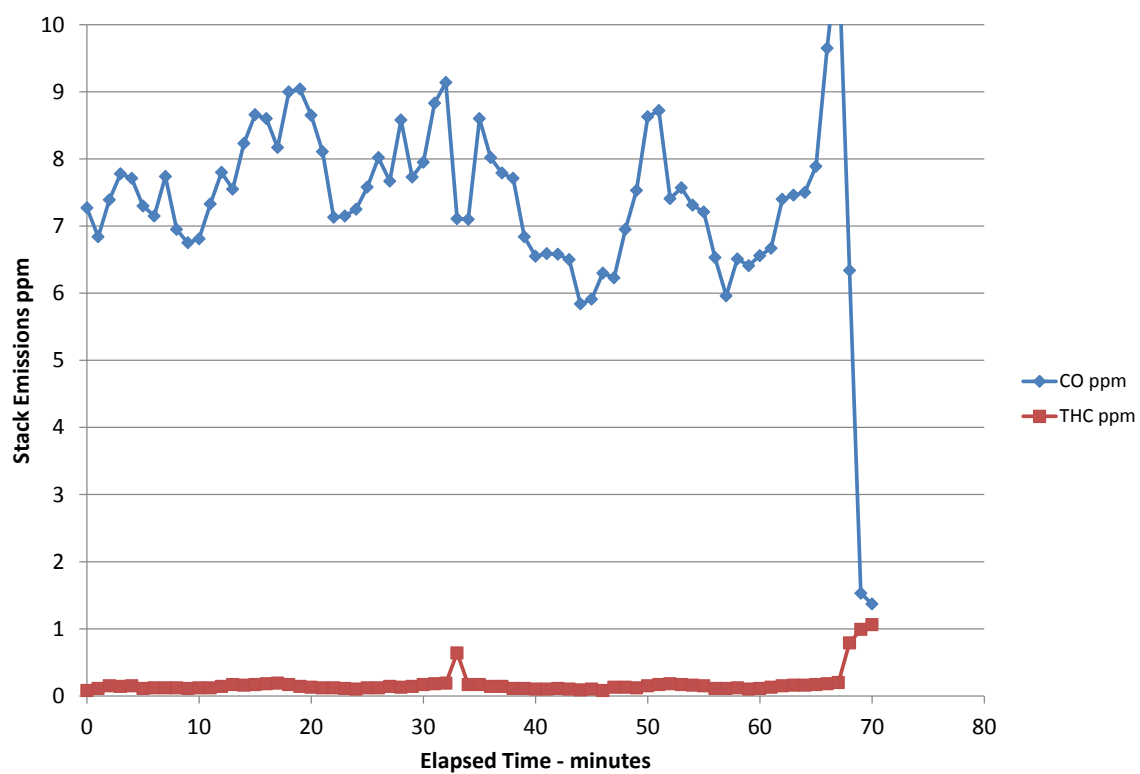


Runs 1A, 1B, 1C

0 to 30% Fuel Flow rate

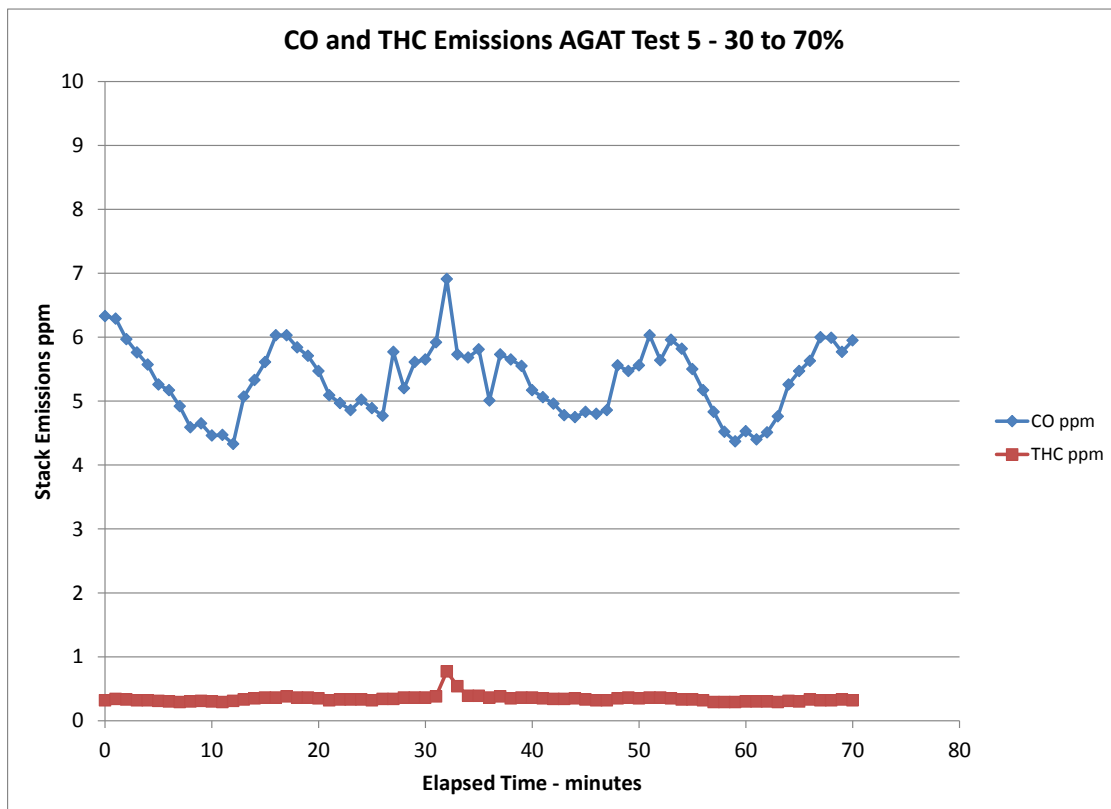
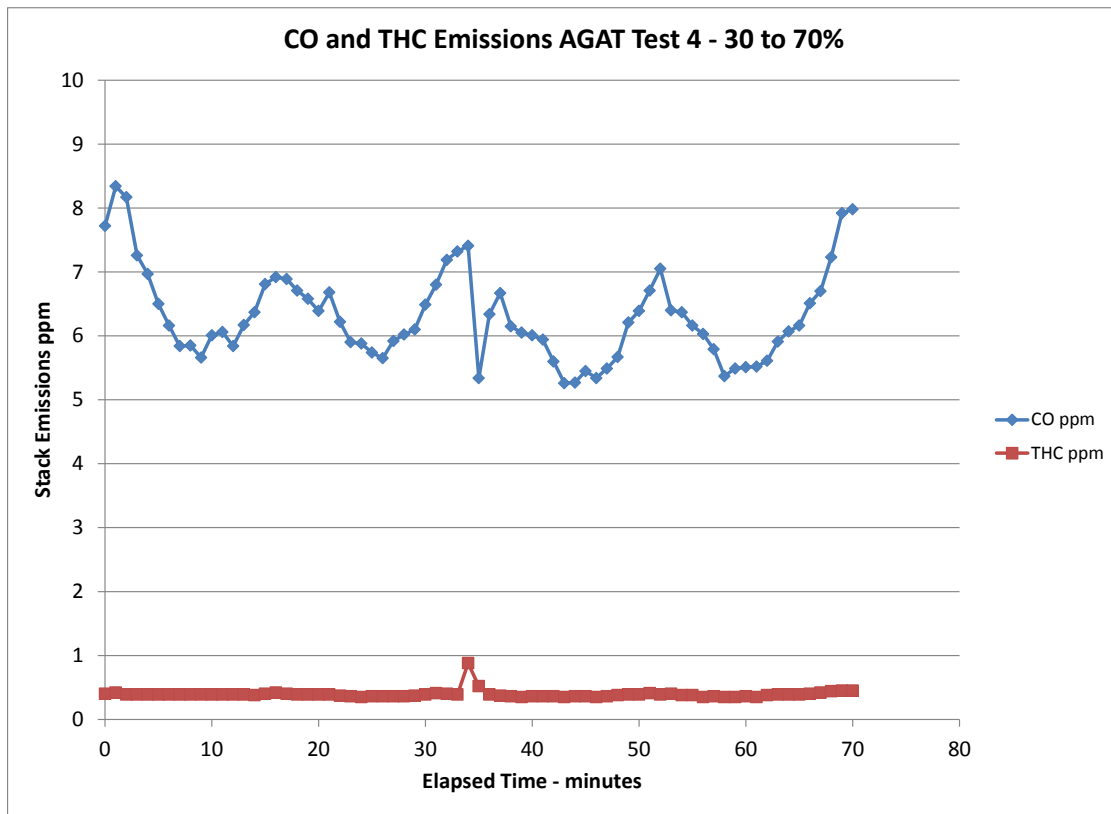


CO and THC Emissions AGAT Test 12 - 0 to 30%

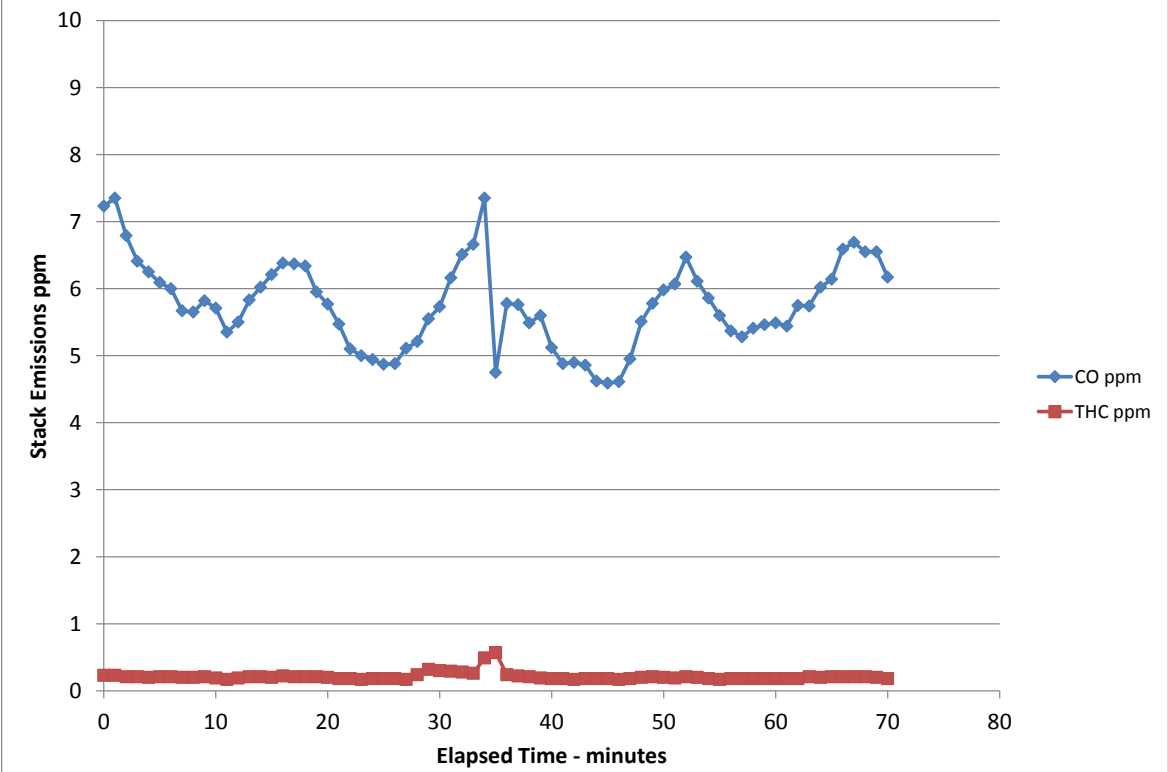


Runs 2A, 2B, 2C

30 to 70% Fuel Flow rate

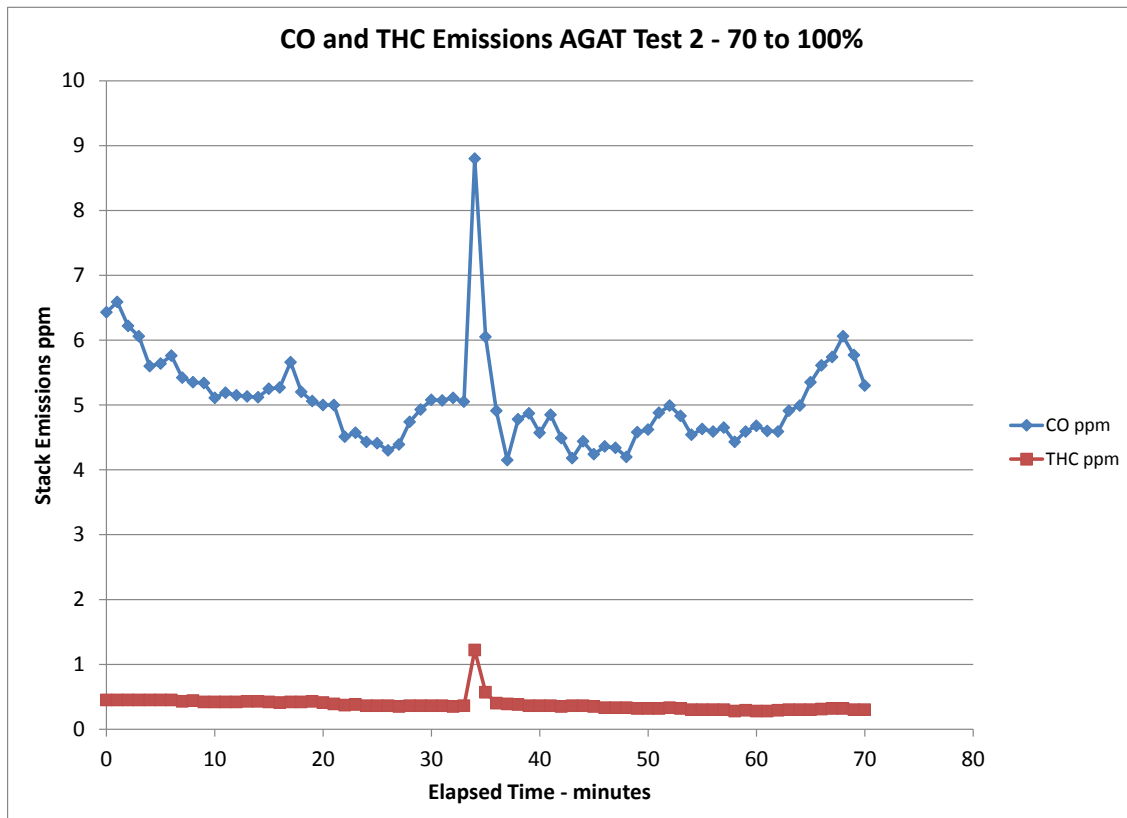
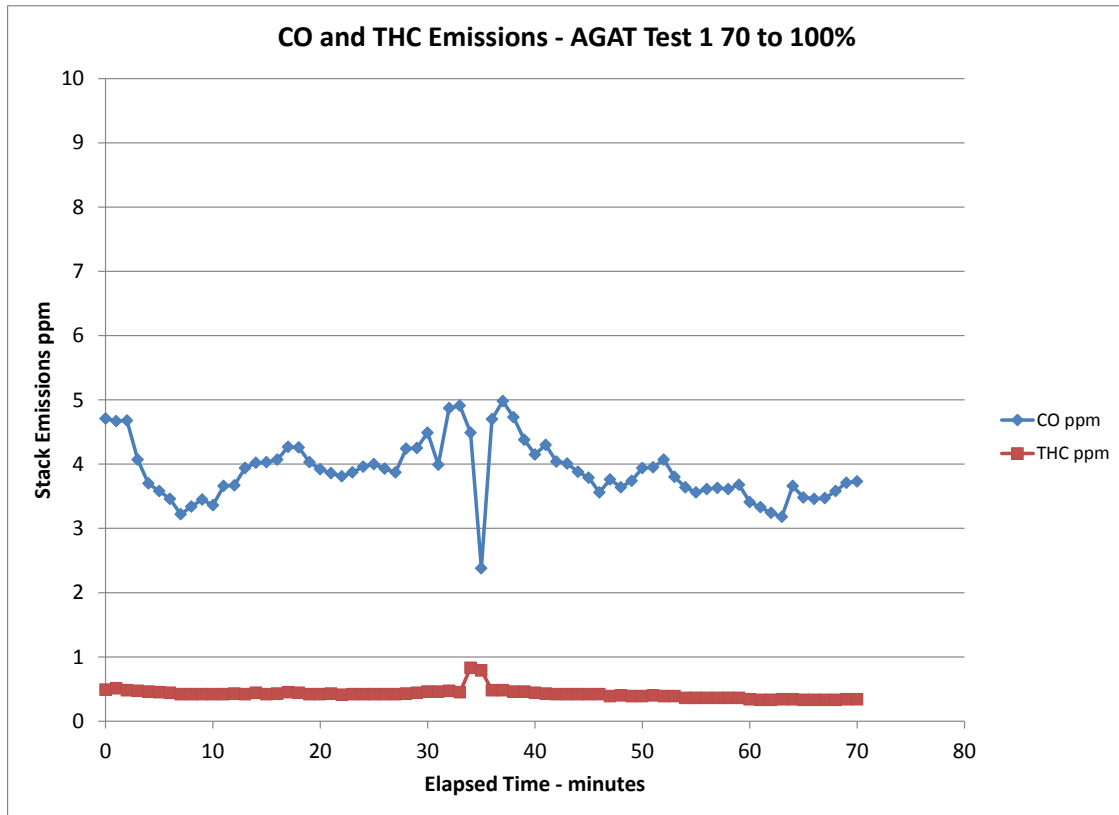


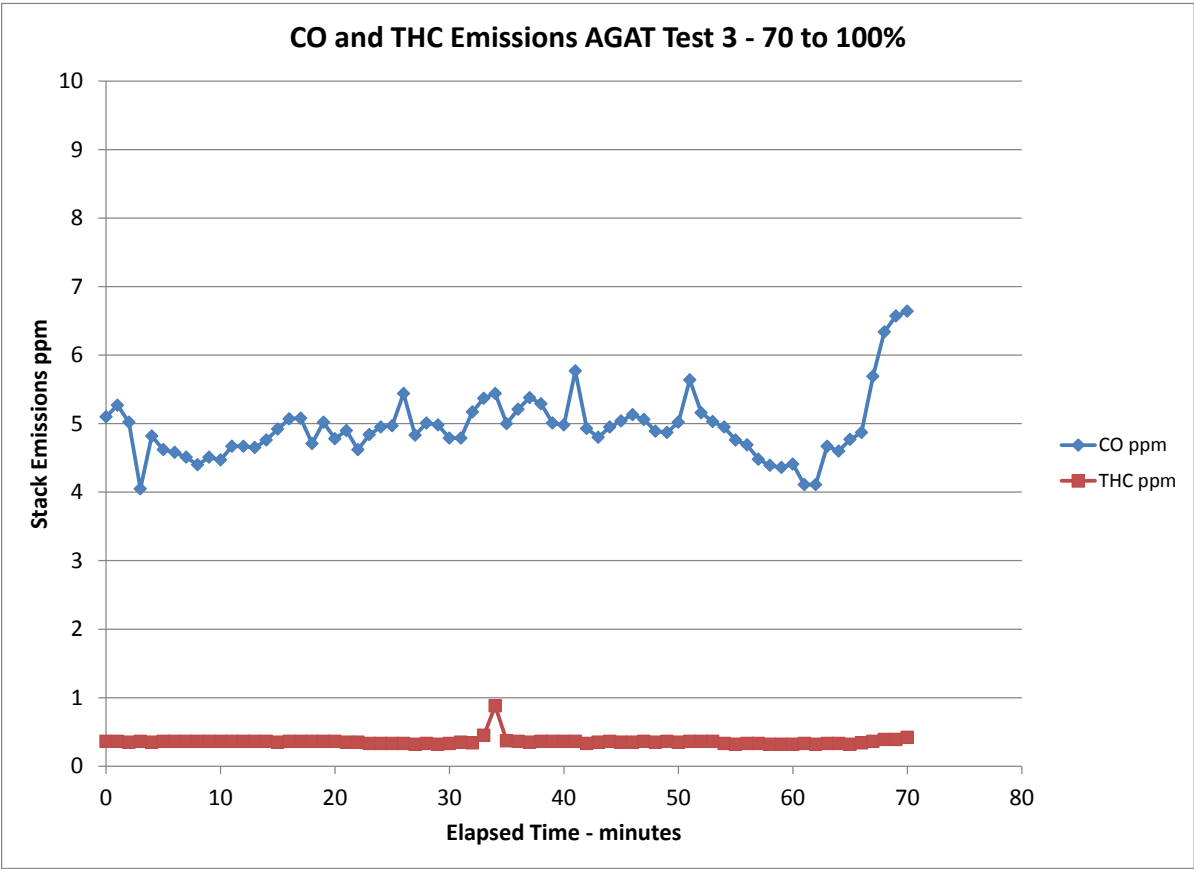
CO and THC Emissions AGAT Test 6 - 30 to 70%



Runs 3A, 3B, 3C

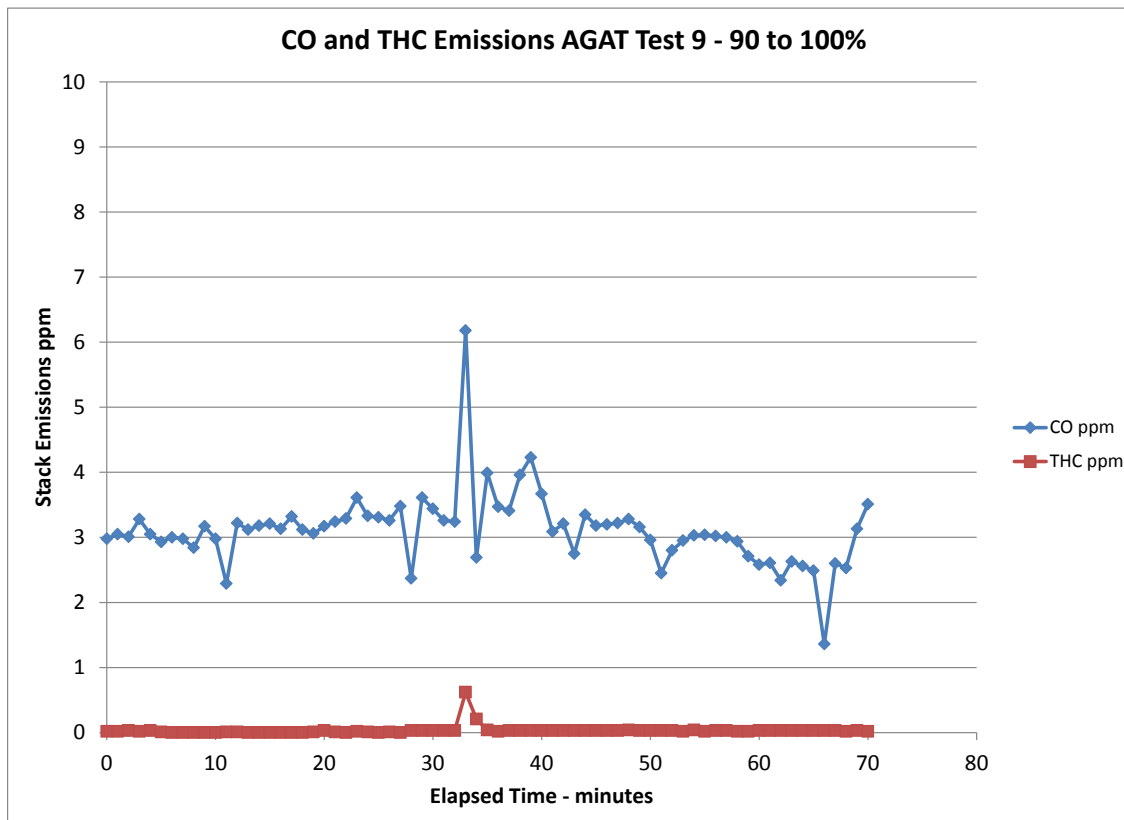
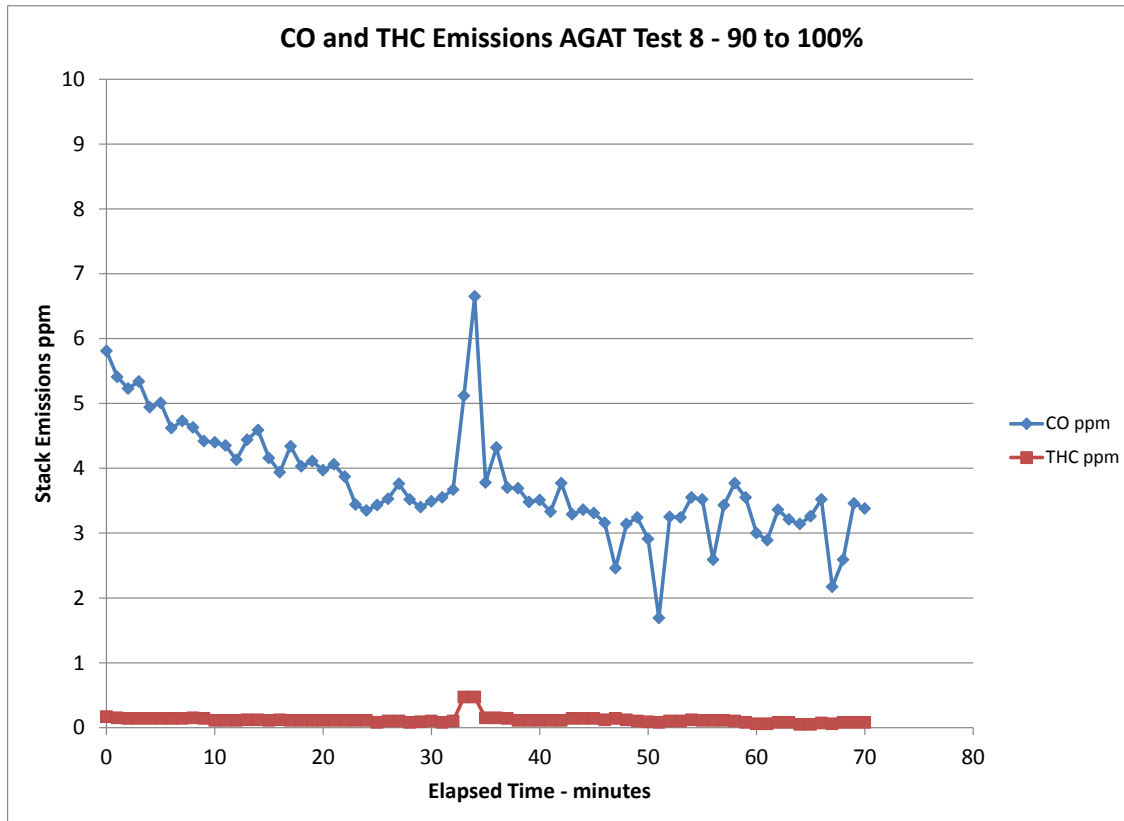
70 to 100% Fuel Flow rate



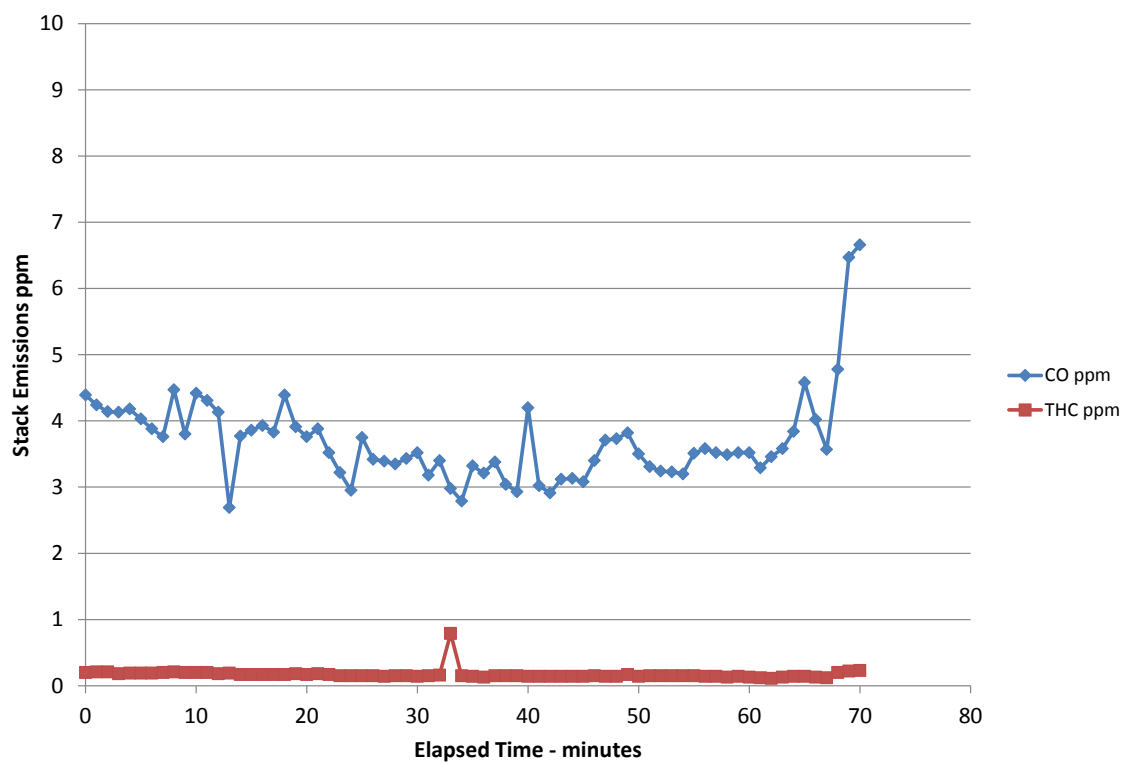


Runs 4A, 4B, 4C

90 to 100% Fuel Flow rate



CO and THC Emissions AGAT Test 10 - 90 to 100%





## Appendix E – Tedlar Bag Stack Gas Analysis Report – Maxxam

Run No.	Fuel Flow Rate	Maxxam Reference
1A	0 to 30%	T9B1A, T9B1B
1B	0 to 30%	T13B1A, T13B1B
1C	0 to 30%	T14B1A, T14B1B
2A	30 to 70%	T6B1A, T6B1B
2B	30 to 70%	T7B1A, T7B1B
2C	30 to 70%	T8B1A, T8B1B
3A	70 to 100%	T3B1A, T3B1B
3B	70 to 100%	T4B1A, T4B1B
3C	70 to 100%	T5B1A, T5B1B
4A	90 to 100%	T10B1A, T10B1B
4B	90 to 100%	T11B1A, T11B1B
4C	90 to 100%	T12B1A, T12B1B

**REVISION 1**

**SPECIALTY TEST SURVEY  
SPARTAN CONTROLS - REM TECHNOLOGY  
CALGARY, ALBERTA**

**Project # 35118**

**December 10 - 12, 2014**

Prepared for:  
**SPARTAN CONTROLS - REM TECHNOLOGY**  
305 27 ST SE  
CALGARY, ALBERTA  
T2A 7V2

**Attention: HOWARD MALM**

Report Date: February 12, 2015

This report supersedes all previous reports with the same Maxxam project number.

Prepared by:



Julia Walz, B.Sc., M.Sc.

Quality Assurance Coordinator, Source Testing, Maxxam Analytics

Reviewed by:



Dennis Skwarchuk, B.A., C.E.T.

Technical Supervisor, Source Testing, Maxxam Analytics

## **SUMMARY**

Maxxam Analytics completed a fixed gas and THC analysis for Spartan Controls - REM Technology, Calgary, Alberta. Sampling was completed on December 10 - 12, 2014. In addition to analytical results, this report includes molecular weight and THC results at 3 % CO<sub>2</sub> correction.

All analysis, and QA/QC for this project was performed by Maxxam Analytics and complies with the applicable protocols (Alberta Stack Sampling Code, Alberta Methods for Chemical Analysis of Atmospheric Pollutants and the Alberta Air Monitoring Directive). The results are therefore considered to be representative of the source during the testing period.

Any deviations or modifications made to the analytical methods are outlined in Section 1.0 Discussion. On this basis, Maxxam is issuing this completed report to Spartan Controls - REM Technology, Calgary, Alberta.

We trust that this report meets your requirements. If you have any questions regarding this project, please contact us at 780-408-5302 or toll-free at 1-800-386-7247.

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<b>2.0 Quality Assurance/Quality Control</b>	<b>3</b>
<b>3.0 Methods and Procedures</b>	<b>3</b>
<b>Appendix I</b>	<b>Summary of Analytical Results</b>
<b>Appendix II</b>	<b>Analytical Results</b>
<b>Appendix III</b>	<b>Sample Custody</b>

## **1.0 Discussion**

A total of 24 samples were analyzed. Results of these 24 samples (T3B1A - T14B1B) are presented in this report.

There were no analytical problems encountered during the sample analysis.

New standard gases were ordered well in advance to replace the expired gas standards. Due to certification problems encountered by the supplier, these were not received in time for the work performed for REM. As with any standard gases Maxxam have in use that are questionable in validity of the stated concentration values or that require recertification, Maxxam laboratory either have the manufacturer recertify the mix or verify the concentration using comparable gases that have not expired to confirm the stated concentrations. The procedure followed is : EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards - EPA/600/R-12/531, May 2012. This was the procedure used to verify the gases that had expired certificates. The results are what was included in the report. To add assurance to the validity of the expired gases used, two new standards were used in this comparison which is more than what is required in the EPA certification protocol.

## **2.0 Quality Assurance/Quality Control**

### ***Maxxam Analytical Departments***

Maxxam's analytical departments QA/QC protocols include, but are not limited to the following:

- i - Canadian Association for Laboratory Accreditation (CALA) performance evaluation samples every six months
- ii - Canadian Association for Laboratory Accreditation (CALA) laboratory audits every two years
- iii - Analytical instrument calibration curves based on five (5) varying standards.

### 3.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

#### **40 C.F.R. 60.5413(d)(6)**

- (ii) Molecular weight and excess air must be determined as specified in paragraph (d)(7) of this
- (iii) Carbon monoxide must be determined as specified in paragraph (d)(8) of this section.
- (iv) THC must be determined as specified in paragraph (d)(9) of this section.
- (v) Visible emissions must be determined as specified in paragraph (d)(10) of this section.

#### **40 C.F.R. 60.5413(d)(7) Molecular weight and excess air determination must be performed as**

(i) An integrated bag sample must be collected during the Method 4, 40 CFR part 60, appendix A-3, moisture test following the procedure specified in (d)(7)(i)(A) through (B) of this section. Analyze the bag sample using a gas chromatograph-thermal conductivity detector (GC-TCD) analysis meeting the criteria in paragraphs (d)(7)(i)(C) through (D) of this section

(A) Collect the integrated sample throughout the entire test, and collect representative volumes from each traverse location.

(B) Purge the sampling line with stack gas before opening the valve and beginning to fill the bag. Clearly label each bag and record sample information on a chain of custody form.

(C) The bag contents must be vigorously mixed prior to the gas chromatograph analysis.

(D) The GC-TCD calibration procedure in Method 3C, 40 CFR part 60, appendix A, must be modified by using EPA Alt-045 as follows: For the initial calibration, triplicate injections of any single concentration must agree within 5 percent of their mean to be valid. The calibration response factor for a single concentration re-check must be within 10 percent of the original calibration response factor for that concentration. If this criterion is not met, repeat the initial calibration using at least three concentration levels.

(ii) Calculate and report the molecular weight of oxygen, carbon dioxide, methane, and nitrogen in the integrated bag sample and include in the test report specified in paragraph (d)(12) of this section. Moisture must be determined using Method 4, 40 CFR part 60, appendix A-3. Traverse both ports with the Method 4, 40 CFR part 60, appendix A-3, sampling train during each test run. Ambient air must not be introduced into the Method 3C, 40 CFR part 60, appendix A-2, integrated bag sample during the port change.

(iii) Excess air must be determined using resultant data from the EPA Method 3C tests and EPA Method 3B, 40 CFR part 60, appendix A, equation 3B-1.

#### **Method 4 moisture test**

Method 4, 40 C.F.R. part 60, appendix A-3. Traverse both ports with the Method 4, 40 CFR part 60, appendix A-3, sampling train during each test run.

#### **Method 3C test**

Collect the integrated bag samples co-incident with the traverse of the Method 4 sample train, switching ports half way through the test and using care not to introduce dilution air to the bag sample during the port change. For each of the integrated bag samples taken during the twelve test runs, use the lab results and report the in-stack concentration of oxygen, carbon dioxide, methane, and nitrogen in the integrated bag sample. Use the in-stack concentrations of these analytes to calculate the molecular weight of the flue gas, excess air of combustion, and oxygen correction of the CO and THC results. Include this information in a chart in the test report.

***APPENDIX I***  
***SUMMARY OF ANALYTICAL RESULTS***

**SUMMARY OF ANALYTICAL RESULTS - FIXED GAS ANALYSIS**

Date/Time Sampled	T381A			T381B			T481A			T481B			T581A		
	10-Dec-14 15:00		Average	10-Dec-14 15:30		Average	11-Dec-14 8:30		Average	11-Dec-14 9:05		Average	11-Dec-14 10:05		Average
Fixed Gas Analysis	Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	13.29	13.32	13.31	13.22	13.28	13.25	13.34	13.39	13.37	12.95	13.01	12.98	13.10	13.13	13.12
	80.32	80.39	80.36	80.34	80.37	80.36	80.30	80.33	80.32	80.40	80.41	80.41	80.36	80.40	80.38
Molecular Weight Gas	5.43	5.33	5.38	5.48	5.39	5.44	5.41	5.32	5.37	5.68	5.62	5.65	5.58	5.50	5.54
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	29.53	29.52	29.52	29.54	29.52	29.53	29.53	29.52	29.53	29.55	29.55	29.55	29.55	29.53	29.54
	Molecular Weight Gas														

Date/Time Sampled	T581B			T681A			T681B			T781A			T781B		
	11-Dec-14 10:40		Average	11-Dec-14 11:35		Average	11-Dec-14 12:10		Average	11-Dec-14 13:05		Average	11-Dec-14 13:40		Average
Fixed Gas Analysis	Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	13.30	13.35	13.33	14.12	14.11	14.12	13.82	13.83	13.83	13.61	13.61	13.61	14.02	14.04	14.03
	80.31	80.33	80.32	80.07	80.12	80.10	80.21	80.21	80.21	80.26	80.26	80.26	80.13	80.13	80.13
Molecular Weight Gas	5.42	5.36	5.39	4.85	4.81	4.83	5.02	5.00	5.01	5.17	5.17	5.17	4.90	4.87	4.89
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	29.53	29.52	29.52	29.47	29.46	29.47	29.49	29.48	29.49	29.50	29.50	29.50	29.48	29.47	29.48
	Molecular Weight Gas														

Date/Time Sampled	T881A			T881B			T981A			T981B			T1081A		
	11-Dec-14 14:40		Average	11-Dec-14 15:15		Average	11-Dec-14 16:10		Average	11-Dec-14 16:45		Average	12-Dec-14 8:25		Average
Fixed Gas Analysis	Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2	
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
	13.97	13.97	13.97	13.79	13.78	13.79	14.47	14.46	14.47	14.69	14.70	14.70	13.36	13.36	13.36
	80.13	80.16	80.15	80.19	80.21	80.20	80.04	80.03	80.04	79.94	79.94	79.94	80.30	80.32	80.31
Molecular Weight Gas	4.94	4.91	4.93	5.07	5.05	5.06	4.54	4.55	4.55	4.41	4.40	4.41	5.38	5.36	5.37
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	29.48	29.48	29.48	29.50	29.49	29.49	29.44	29.44	29.44	29.42	29.42	29.42	29.53	29.52	29.52
	Molecular Weight Gas														

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)



**SUMMARY OF ANALYTICAL RESULTS - FIXED GAS ANALYSIS**

Date/Time Sampled	T10B1B			T11B1A			T11B1B			T12B1A			T12B1B		
	12-Dec-14 9:05		Average	12-Dec-14 9:55		Average	12-Dec-14 10:40		Average	12-Dec-14 11:30		Average	12-Dec-14 12:05		Average
Fixed Gas Analysis	Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2	
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	12.96	12.95	12.96	13.14	13.12	13.13	13.19	13.19	13.19	13.26	13.26	13.26	13.06	13.05	13.06
N2 - mole % dry basis	80.39	80.43	80.41	80.36	80.35	80.36	80.34	80.35	80.35	80.32	80.33	80.33	80.38	80.40	80.39
CO2 - mole % dry basis	5.69	5.65	5.67	5.54	5.56	5.55	5.51	5.50	5.51	5.46	5.45	5.46	5.60	5.59	5.60
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.56	29.55	29.55	29.54	29.54	29.54	29.54	29.54	29.54	29.53	29.53	29.53	29.55	29.55	29.55

Date/Time Sampled	T13B1A			T13B1B			T14B1A			T14B1B		
	12-Dec-14 13:00		Average	12-Dec-14 13:35		Average	12-Dec-14 14:30		Average	12-Dec-14 15:05		Average
Fixed Gas Analysis	Run 1	Run 2		Run 1	Run 2		Run 1	Run 2		Run 1	Run 2	
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	14.48	14.48	14.48	14.55	14.55	14.55	14.52	14.51	14.52	14.38	14.38	14.38
N2 - mole % dry basis	80.06	80.06	80.06	80.03	80.03	80.03	79.97	79.99	79.98	80.08	80.08	80.08
CO2 - mole % dry basis	4.51	4.51	4.51	4.46	4.47	4.47	4.56	4.54	4.55	4.58	4.58	4.58
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.43	29.43	29.43	29.43	29.43	29.43	29.44	29.44	29.44	29.44	29.44	29.44

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

***APPENDIX II***  
***ANALYTICAL RESULTS***

# GAS CHROMATOGRAPHIC ANALYSES

Company: <b>Spartan Controls - REM Technology</b>		Sample Date: 2014-12-10 to 11	
Location: <b>Calgary, Alberta</b>		Analytical Date: 2014-12-11	
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18			
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114		Analyst: BW	

Sample ID:	T3B1A	T3B1B	T4B1A
	2014-12-10	2014-12-10	2014-12-11

Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73306		73307		73308	
Time:	15:00		15:30		08:30	

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	13.29	13.32	13.22	13.28	13.34	13.39
N <sub>2</sub>	80.32	80.39	80.34	80.37	80.30	80.33
CO <sub>2</sub>	5.43	5.33	5.48	5.39	5.41	5.32
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT


THC as CH <sub>4</sub>	7.8	6.9	8.8	8.2	8.9	9.6
Average	7.4		8.5		9.2	

### Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0053	98.5
2	span0062	100.6
Average		99.6
True Value		100.0
% Recovery		99.6

Reviewed By:  Bill Wong

Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: <b>Spartan Controls - REM Technology</b>		Sample Date: 2014-12-11	
Location: <b>Calgary, Alberta</b>		Analytical Date: 2014-12-11 to 13	
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18			
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114		Analyst: BW	

Sample ID:	T4B1B	T5B1A	T5B1B
	2014-12-11	2014-12-11	2014-12-11
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73309	73310	73311
Time:	09:05	10:05	10:40

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	12.95	13.01	13.10	13.13	13.30	13.35
N <sub>2</sub>	80.40	80.41	80.36	80.40	80.31	80.33
CO <sub>2</sub>	5.68	5.62	5.58	5.50	5.42	5.36
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.7	11.6	12.4	13.9	16.2	15.4
Average	12.2		13.2		15.8	

### Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0004	101.3
2	span0013	98.5
Average		99.9
True Value		100.0
% Recovery		99.9

Reviewed By: Bill Wong

Validated By: Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: <b>Spartan Controls - REM Technology</b>		Sample Date: 2014-12-11	
Location: <b>Calgary, Alberta</b>		Analytical Date: 2014-12-13	
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18			
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114		Analyst: BW	

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Sample ID:	T6B1A	T6B1B	T7B1A
	2014-12-11	2014-12-11	2014-12-11

Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73325		73326		73327	
Time:	11:35		12:10		13:05	

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.12	14.11	13.82	13.83	13.61	13.61
N <sub>2</sub>	80.07	80.12	80.21	80.21	80.26	80.26
CO <sub>2</sub>	4.85	4.81	5.02	5.00	5.17	5.17
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00




## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.0	11.5	12.3	13.8	14.5	12.4
Average	11.8		13.0		13.5	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0067	101.2
2	span0074	100.4
Average		100.8
True Value		100.0
% Recovery		100.8

Reviewed By:  Bill Wong  
Validated By:   Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-11  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T7B1B 2014-12-11		T8B1A 2014-12-11		T8B1B 2014-12-11	
Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73328		73329		73330	
Time:	13:40		14:40		15:15	

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.02	14.04	13.97	13.97	13.79	13.78
N <sub>2</sub>	80.13	80.13	80.13	80.16	80.19	80.21
CO <sub>2</sub>	4.90	4.87	4.94	4.91	5.07	5.05
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	10.6	11.6	13.6	14.3	16.1	15.2
Average	11.1		13.9		15.6	

### Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0074	100.4
2	span0082	99.1
	Average	99.8
	True Value	100.0
	% Recovery	99.8

Reviewed By:  Bill Wong

Validated By:  for: Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-11 to 12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T9B1A	T9B1B	T10B1A
	2014-12-11	2014-12-11	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73331	73332	73333
Time:	16:10	16:45	08:25

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.47	14.46	14.69	14.70	13.36	13.36
N <sub>2</sub>	80.04	80.03	79.94	79.94	80.30	80.32
CO <sub>2</sub>	4.54	4.55	4.41	4.40	5.38	5.36
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.0	11.5	11.9	11.1	12.6	11.2
Average	11.8		11.5		11.9	

### Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0082	99.1
2	span0090	98.2
	Average	98.7
	True Value	100.0
	% Recovery	98.7

Reviewed By: Sw Bill Wong  
Validated By: gw fori Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

GAS CHROMATOGRAPHIC ANALYSES

Company:	Spartan Controls - REM Technology			Sample Date:	2014-12-12	
Location:	Calgary, Alberta			Analytical Date:	2014-12-13	
Method Reference:	AENV Method 3 / EPA Method 3C and AENV Method 18					
Laboratory Reference:	AIR SOP-00112 & AIR SOP-00114			Analyst:	BW	

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Sample ID:	T10B1B		T11B1A	T11B1B		
	2014-12-12		2014-12-12	2014-12-12		
Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73334		73335		73336	
Time:	09:05		09:55		10:40	

FIXED GAS ANALYSIS

(Mole % - Dry Basis)

COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	12.96	12.95	13.14	13.12	13.19	13.19
N <sub>2</sub>	80.39	80.43	80.36	80.35	80.34	80.35
CO <sub>2</sub>	5.69	5.65	5.54	5.56	5.51	5.50
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)


COMPONENT

THC as CH <sub>4</sub>	12.6	10.5	10.2	11.1	10.3	11.0
Average	11.5		10.6		10.7	

Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0019	100.0
2	span0027	99.5
Average		99.8
True Value		100.0
% Recovery		99.8

Reviewed By:  Bill Wong

Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.



# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T12B1A	T12B1B	T13B1A
	2014-12-12	2014-12-12	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73337	73338	73339
Time:	11:30	12:05	13:00

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	13.26	13.26	13.06	13.05	14.48	14.48
N <sub>2</sub>	80.32	80.33	80.38	80.40	80.06	80.06
CO <sub>2</sub>	5.46	5.45	5.60	5.59	4.51	4.51
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	11.7	12.8	11.5	13.1	12.8	11.7
Average	12.2		12.3		12.2	

### Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0027	99.5
2	span0034	99.2

Average 99.4  
True Value 100.0  
% Recovery 99.4

Reviewed By: SW Bill Wong

Validated By: JW for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T13B1B	T14B1A	T14B1B
	2014-12-12	2014-12-12	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73340	73341	73342
Time:	13:35	14:30	15:05

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.55	14.55	14.52	14.51	14.38	14.38
N <sub>2</sub>	80.03	80.03	79.97	79.99	80.08	80.08
CO <sub>2</sub>	4.46	4.47	4.56	4.54	4.58	4.58
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	9.9	10.3	13.8	14.0	12.9	14.4
Average	10.1		13.9		13.6	

Second Source Standard

ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0010	98.4
2	span0010	98.4
	Average	98.4
	True Value	100.0
	% Recovery	98.4

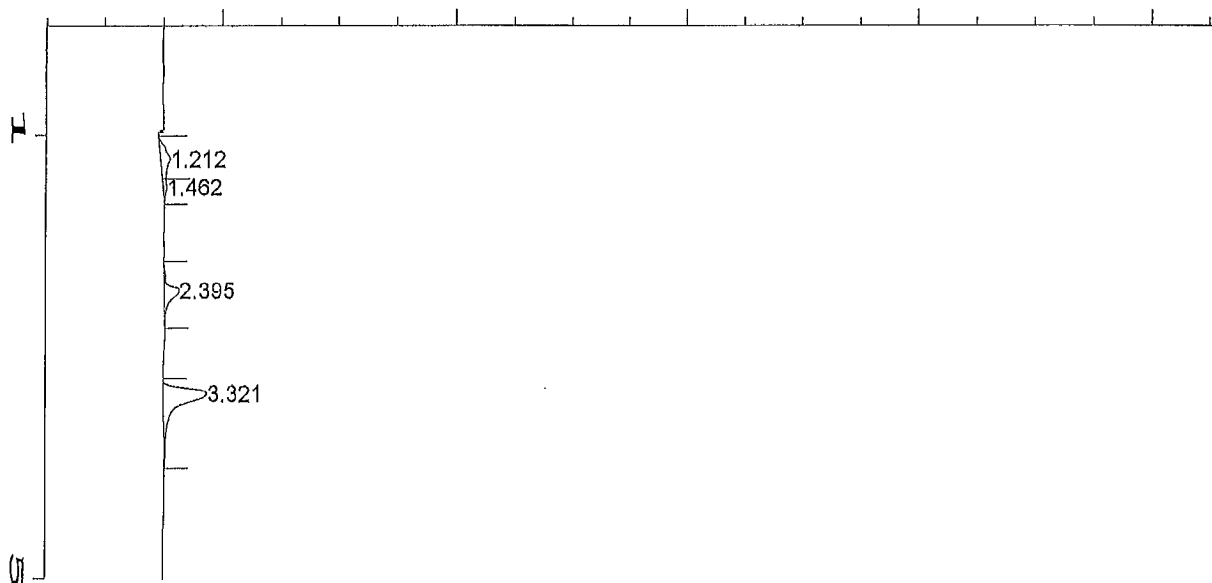
Reviewed By: Bill Wong

Validated By: Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# Total Hydrocarbon Chromatograms

Sample Analysis  
Calibration



=====  
 External Standard Report  
 =====

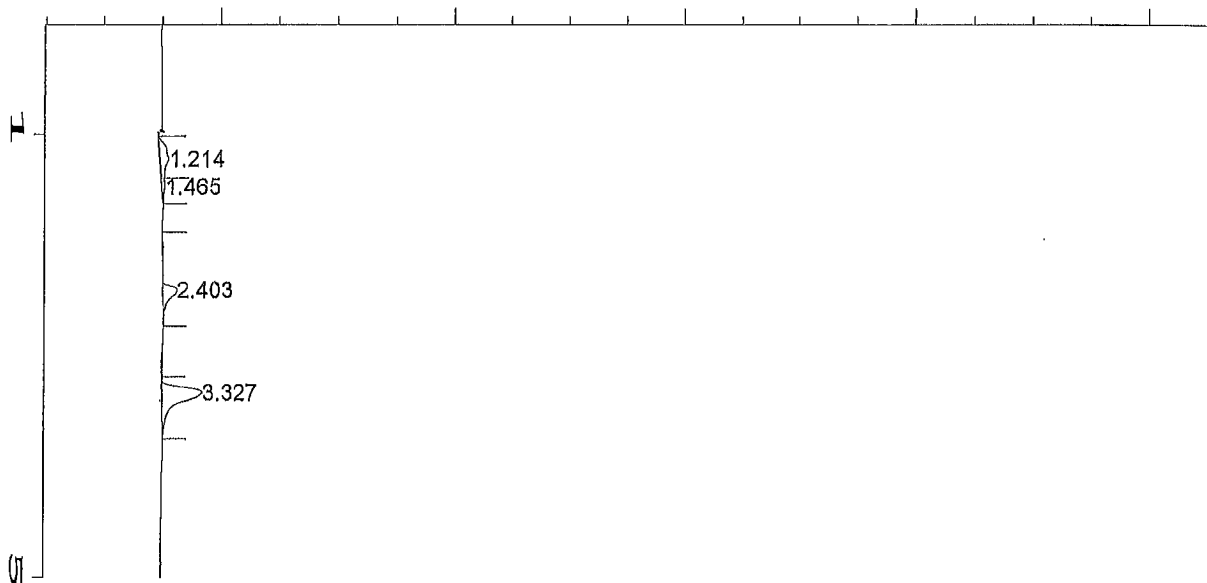
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1A055.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1A 73306 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:01 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:06 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1A - Tr#73306 - 15:00 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1A055.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.212	1032	BV	0.158		1.306	* uncalibrated *
1.462	249	VB	0.108		0.316	* uncalibrated *
2.395	1128	BB	0.130		1.428	* uncalibrated *
3.321	3763	BB	0.154		4.761	* uncalibrated *

Not all calibrated peaks were found

=====



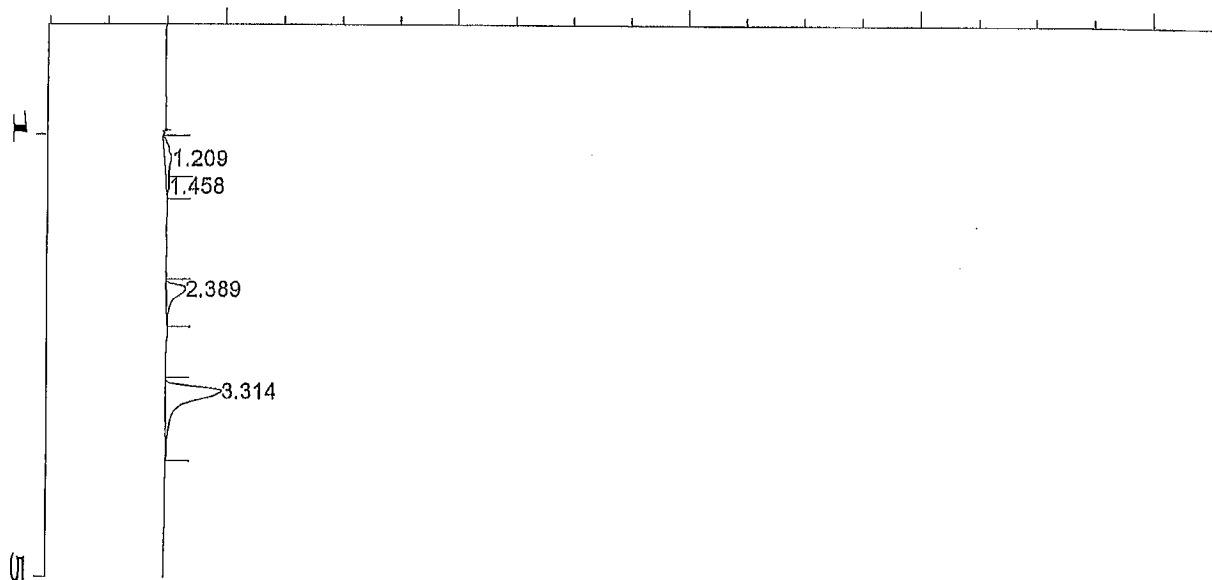
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1A056.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1A 73306 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:10 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:15 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1A - Tr#73306 - 15:00 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1A056.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.214	1035 BV	0.174			1.310	* uncalibrated *
1.465	214 VB	0.112			0.271	* uncalibrated *
2.403	1037 BB	0.130			1.312	* uncalibrated *
3.327	3151 BB	0.145			3.988	* uncalibrated *

Not all calibrated peaks were found



=====  
 External Standard Report  
 =====

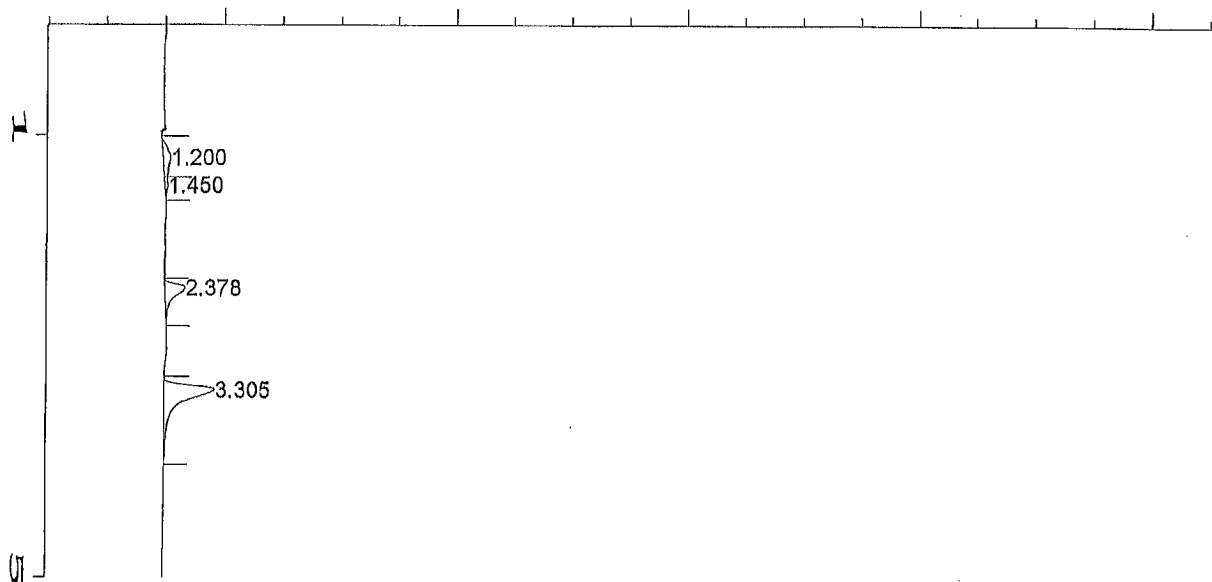
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1B057.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1B 73307 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:20 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:25 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1B - Tr#73307 - 15:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1B057.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.209	840	BV	0.165		1.062	* uncalibrated *
1.458	180	VB	0.101		0.228	* uncalibrated *
2.389	1310	BB	0.124		1.658	* uncalibrated *
3.314	4631	BB	0.149		5.860	* uncalibrated *

Not all calibrated peaks were found

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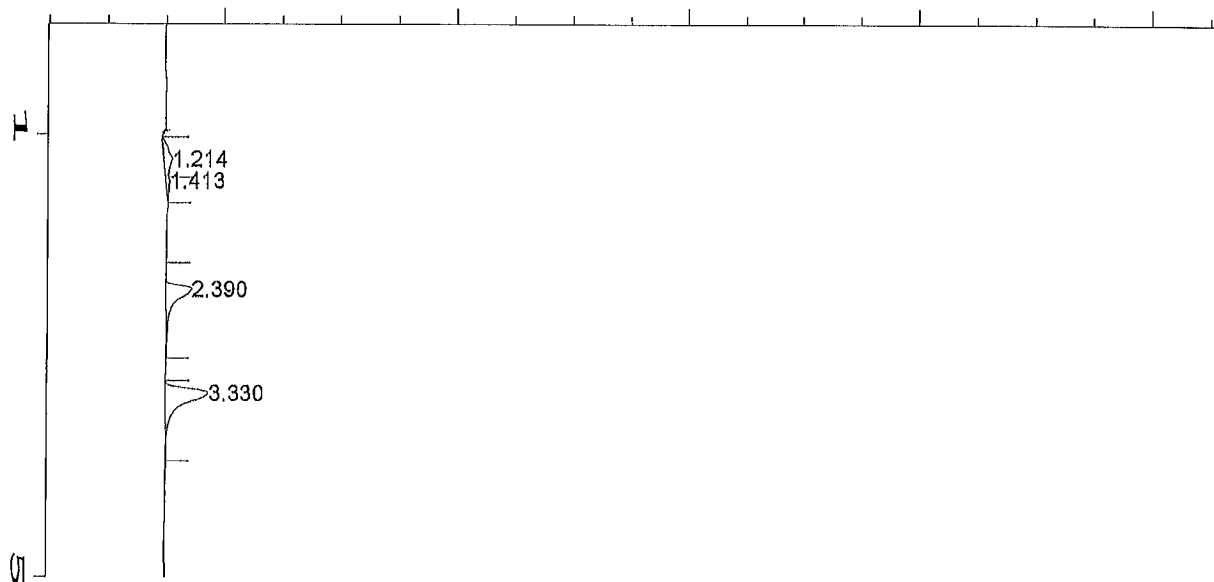
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1B058.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1B 73307 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:25 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:30 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1B - Tr#73307 - 15:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1B058.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.200	872	BV	0.167		1.103	* uncalibrated *
1.450	188	VB	0.127		0.238	* uncalibrated *
2.378	1332	BB	0.121		1.686	* uncalibrated *
3.305	4112	BB	0.147		5.204	* uncalibrated *

Not all calibrated peaks were found



# External Standard Report

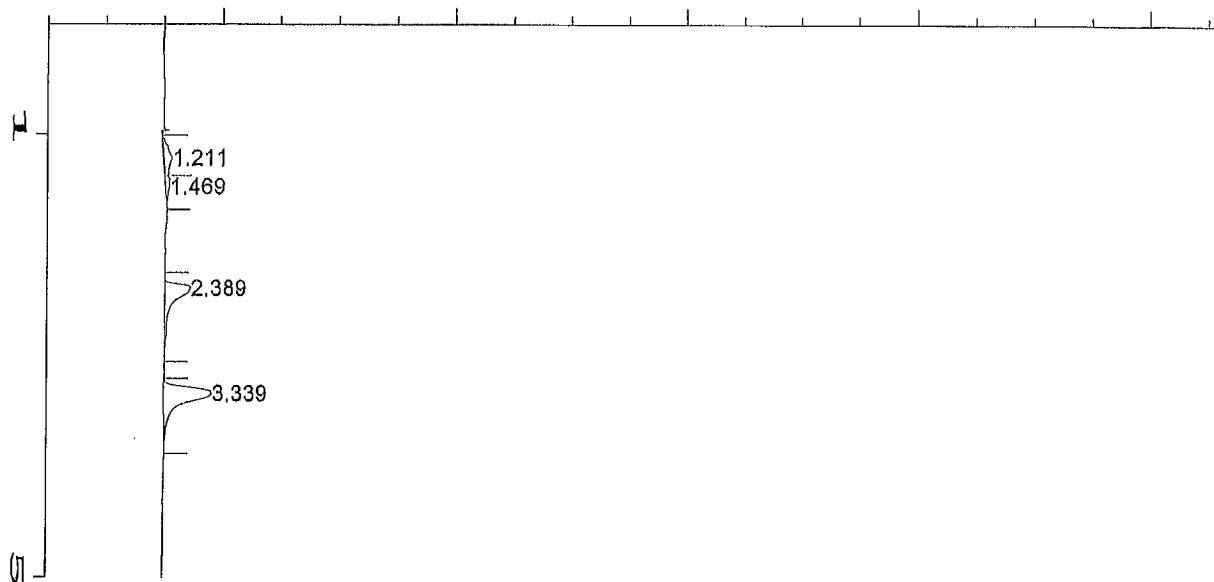
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T4B1A059.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T4B1A 73308 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:38 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1A - Tr#73308 - 08:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T4B1A059.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.214	929 BV	0.160			1.175	* uncalibrated *
1.413	274 VB	0.133			0.346	* uncalibrated *
2.390	2249 BB	0.136			2.846	* uncalibrated *
3.330	3590 BB	0.149			4.542	* uncalibrated *

Not all calibrated peaks were found





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 External Standard Report  
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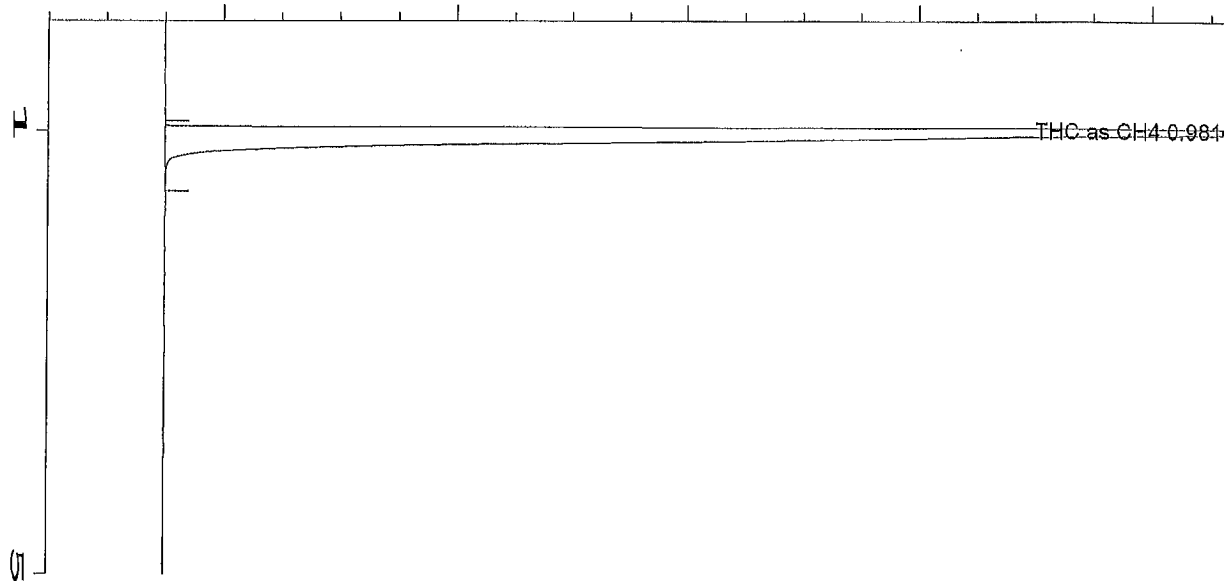
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T4B1A061.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T4B1A 73308 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:47 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:52 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1A - Tr#73308 - 08:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T4B1A061.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.211	946 BV	0.163			1.197	* uncalibrated *
1.469	361 VB	0.164			0.457	* uncalibrated *
2.389	2376 BB	0.157			3.006	* uncalibrated *
3.339	3870 BB	0.147			4.898	* uncalibrated *

Not all calibrated peaks were found

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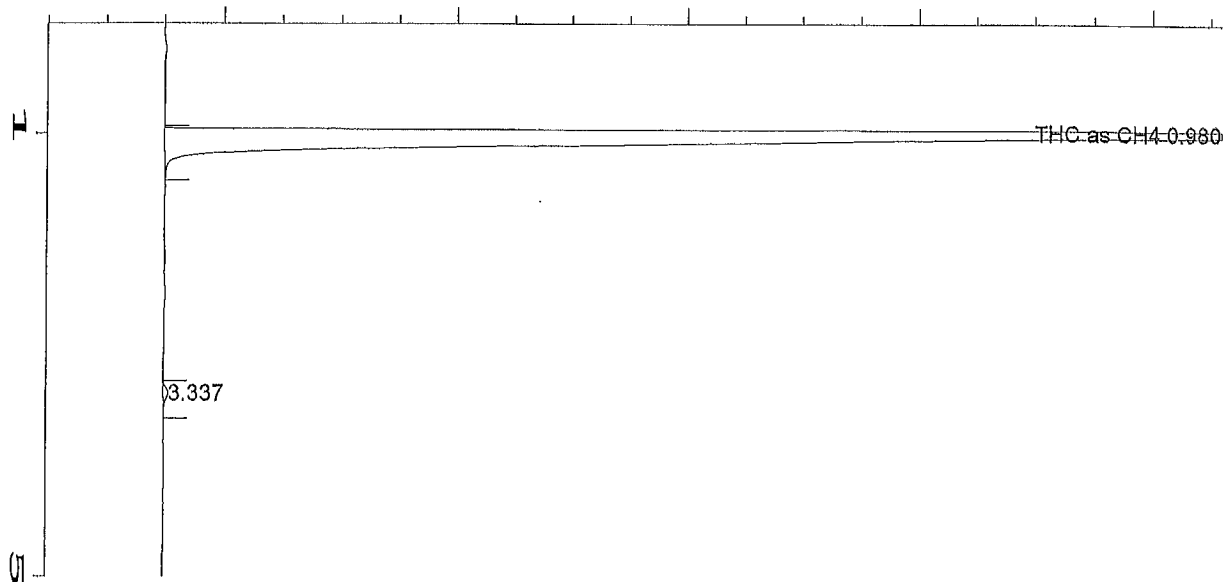
# External Standard Report

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Data File Name      : C:\HPCHEM\1\DATA\2014\20141211\SPAN0053.D
Operator            : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument          : GC ID4284                      Vial Number        :
Sample Name        : Span 0.5 cc                     Injection Number   :
Run Time Bar Code  :                               Sequence Line     :
Acquired on       : 11 Dec 14 02:44 PM               Instrument Method : M18-DB1.MTH
Report Created on : 11 Dec 14 02:49 PM               Analysis Method  : M18-DB1.MTH
Last Recalib on  : 11 Dec 14 02:38 PM               Sample Amount    : 0
Multiplier        : 1                               ISTD Amount      :
Sample Info       : Span check - ID# 11-11-01-26 - 0.5 cc injection
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0053.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.981	78269	BB	0.099	1	98.517	THC as CH4

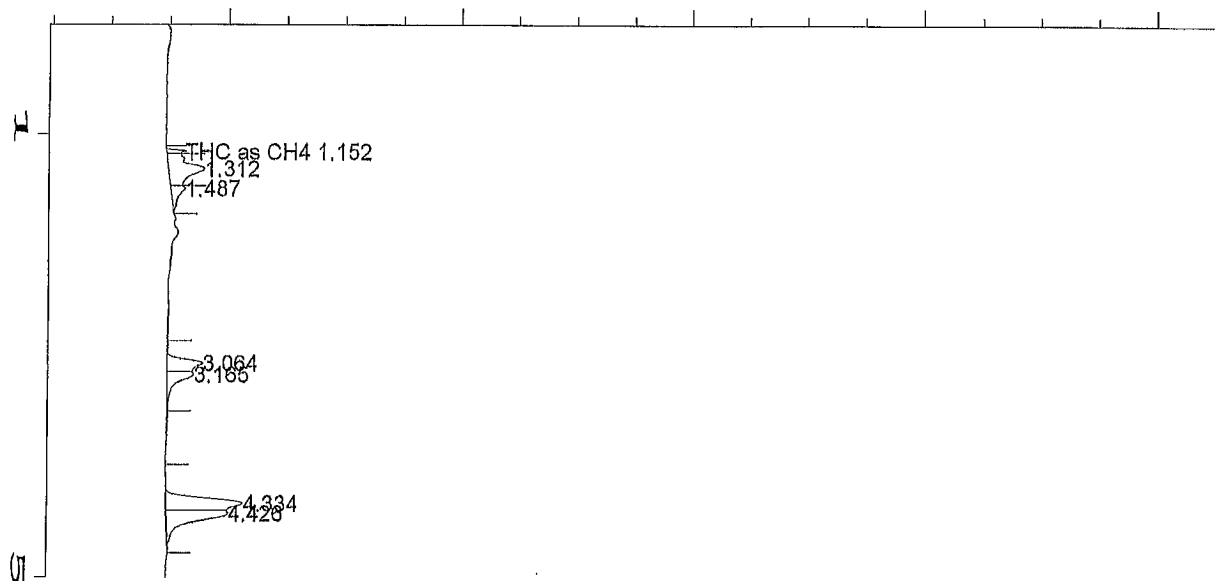


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0062.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:53 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:58 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0062.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.980	79936	BV	0.093	1	100.631	THC as CH4
3.337	309	BB	0.119		0.391	* uncalibrated *

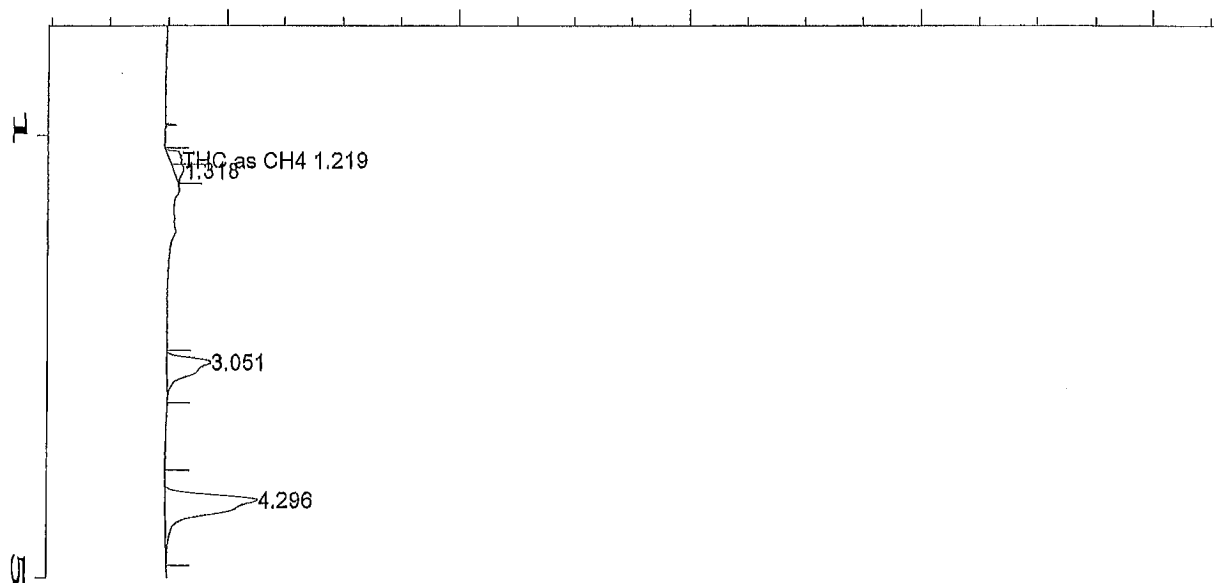


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T4B1B005.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T4B1B 73309 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:55 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:00 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1B - Tr#73309 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T4B1B005.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.152	248	BV	0.029	1	0.203	THC as CH4
1.312	3067	VV	0.139		2.586	* uncalibrated *
1.487	786	VV	0.087		0.662	* uncalibrated *
3.064	1822	BV	0.089		1.536	* uncalibrated *
3.165	1389	VB	0.104		1.172	* uncalibrated *
4.334	4247	FV	0.097		3.581	* uncalibrated *
4.426	3517	VB	0.099		2.966	* uncalibrated *



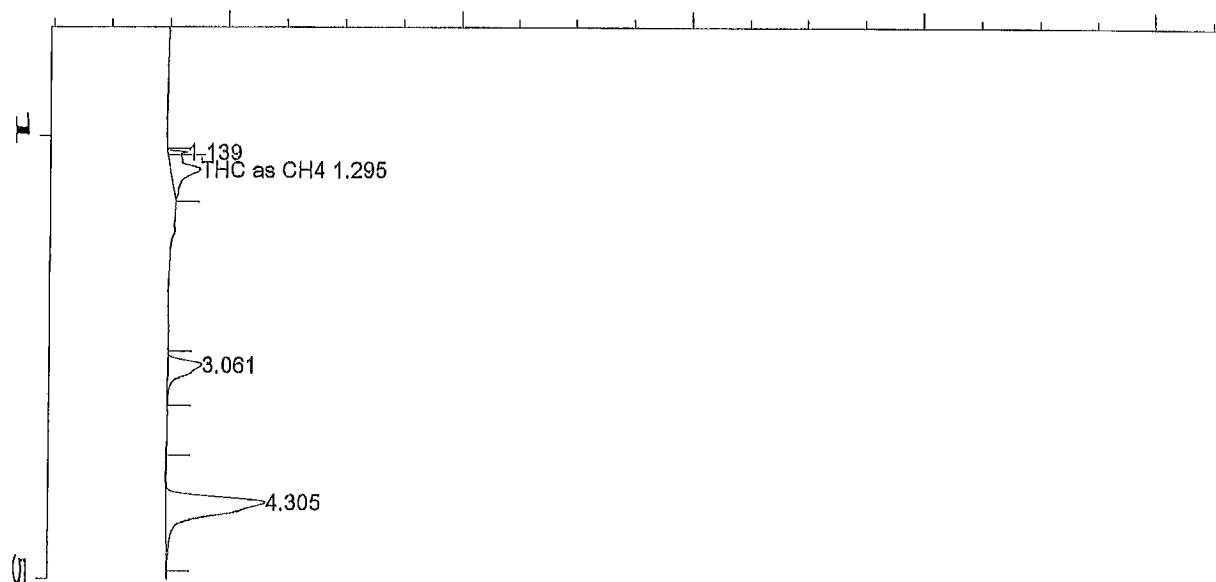
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T4B1B007.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T4B1B 73309 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:11 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:16 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1B - Tr#73309 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T4B1B007.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.219	717	BV	0.101	1	0.588	THC as CH4
1.318	605	VB	0.102		0.510	* uncalibrated *
3.051	3691	BB	0.135		3.113	* uncalibrated *
4.296	8810	BB	0.152		7.429	* uncalibrated *

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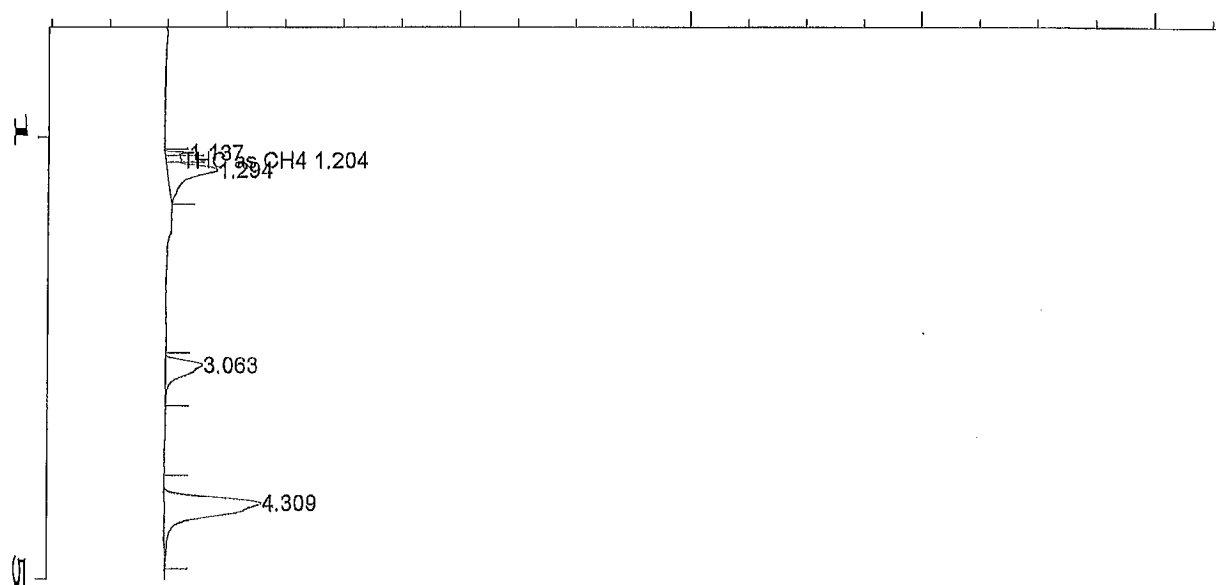


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1A008.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1A 73310 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:20 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:25 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1A - Tr#73310 - 10:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1A008.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.295	2605	VB	0.141	1	2.135	THC as CH4
1.139	283	BV	0.031		0.239	* uncalibrated *
3.061	2585	BV	0.122		2.180	* uncalibrated *
4.305	9323	BB	0.152		7.861	* uncalibrated *



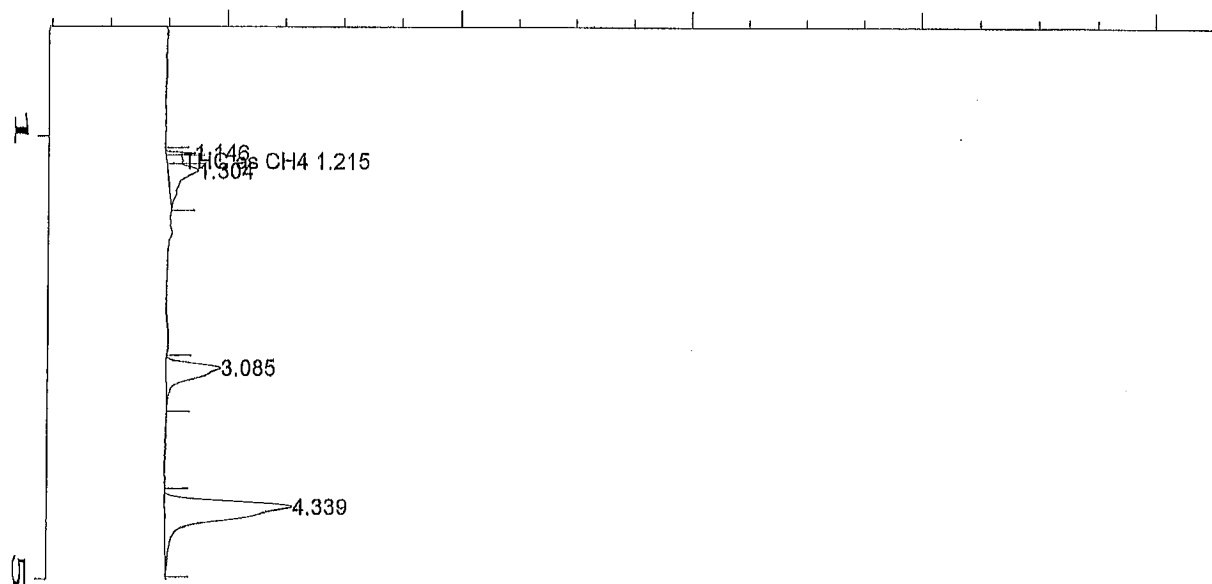
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1A009.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1A 73310 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:26 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:31 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1A - Tr#73310 - 10:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1A009.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.204	463	VV	0.057	1	0.379	THC as CH4
1.137	330	BV	0.031		0.278	* uncalibrated *
1.294	3589	VB	0.120		3.026	* uncalibrated *
3.063	2849	BB	0.124		2.402	* uncalibrated *
4.309	9260	BB	0.151		7.809	* uncalibrated *

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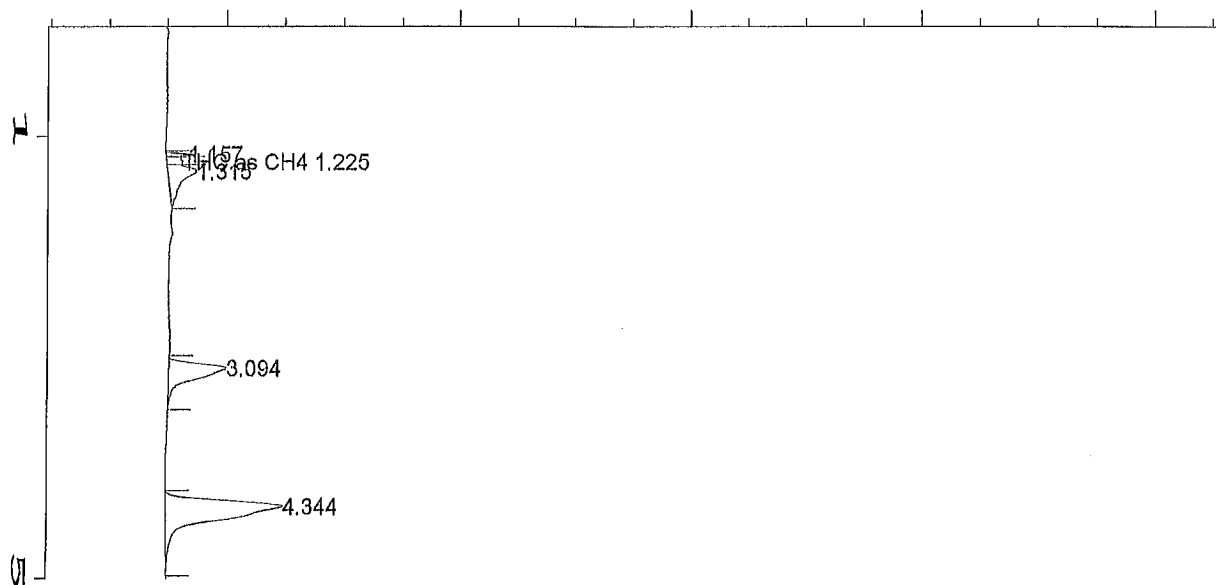
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1B010.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1B 73311 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1B - Tr#73311 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1B010.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.215	585	VV	0.068	1	0.479	THC as CH4
1.146	338	BV	0.028		0.285	* uncalibrated *
1.304	2539	VB	0.134		2.141	* uncalibrated *
3.085	4086	BB	0.122		3.445	* uncalibrated *
4.339	11655	BBA	0.147		9.828	* uncalibrated *



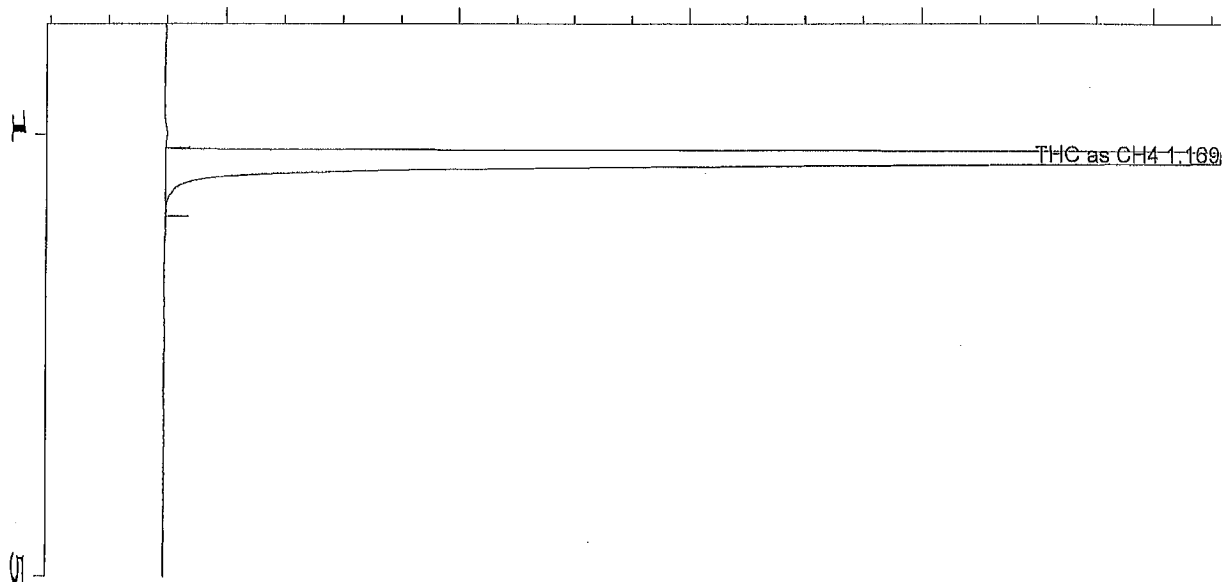


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1B011.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1B 73311 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:40 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:45 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1B - Tr#73311 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1B011.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.225	560	VV	0.069	1	0.459	THC as CH4
1.157	296	BV	0.030		0.250	* uncalibrated *
1.315	2388	VB	0.132		2.013	* uncalibrated *
3.094	4288	BB	0.121		3.615	* uncalibrated *
4.344	10744	BBA	0.149		9.060	* uncalibrated *



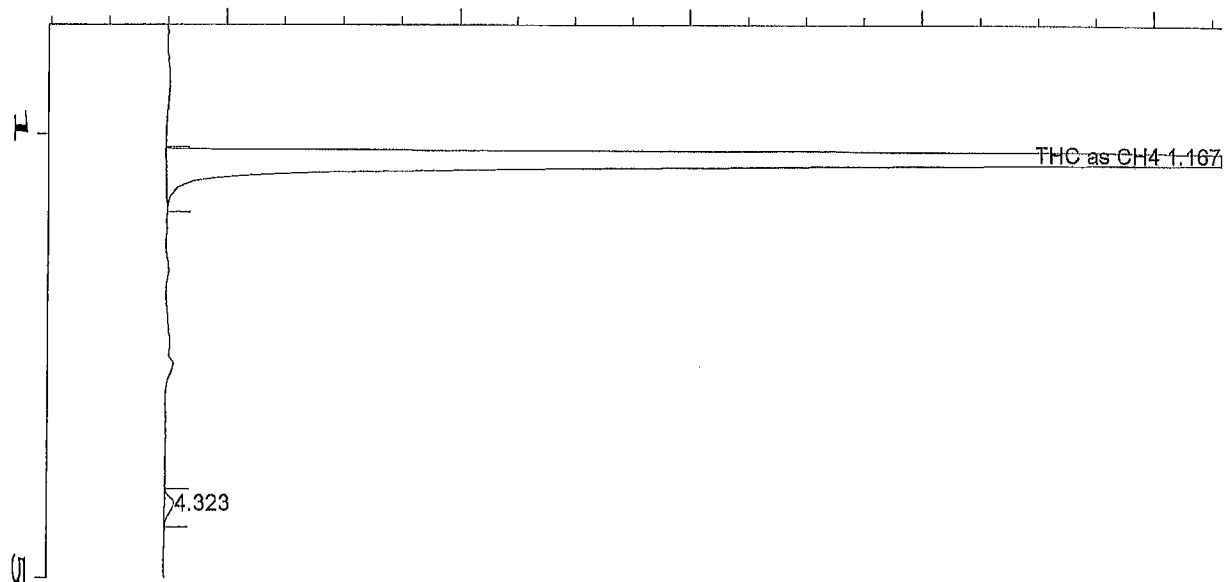
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0004.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:49 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0004.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	120170	BB	0.098	1	101.283	THC as CH4

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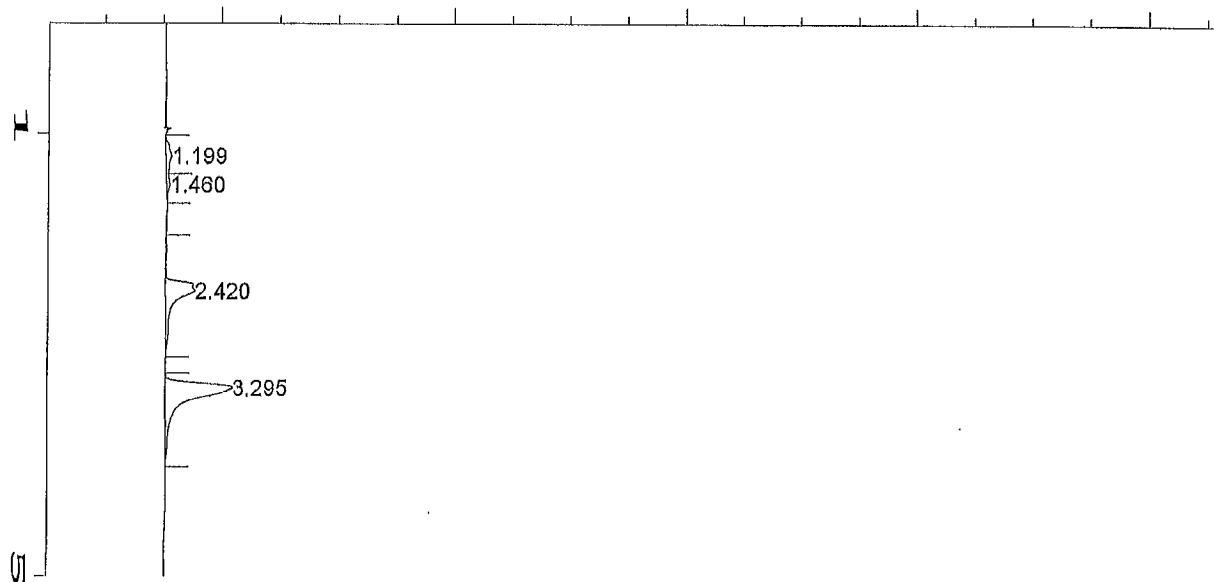
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0013.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:54 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:59 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0013.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	116880	BB	0.098	1	98.507	THC as CH4
4.323	775	BB	0.122		0.653	* uncalibrated *

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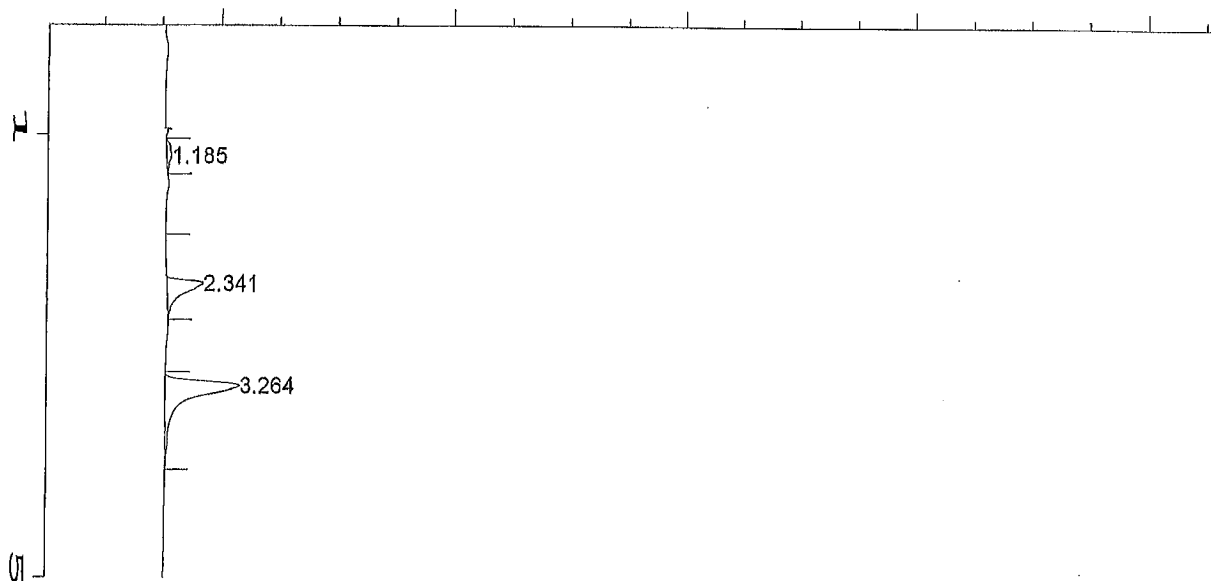
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1A068.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1A 73325 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:19 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:24 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1A -  
 Tr#73325 - 13:00 - 0.5 cc injection  
 11:35 *Sw*

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1A068.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.199	555	PV	0.152		0.699	* uncalibrated *
1.460	226	VB	0.132		0.285	* uncalibrated *
2.420	2976	BB	0.155		3.750	* uncalibrated *
3.295	5802	BB	0.153		7.310	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
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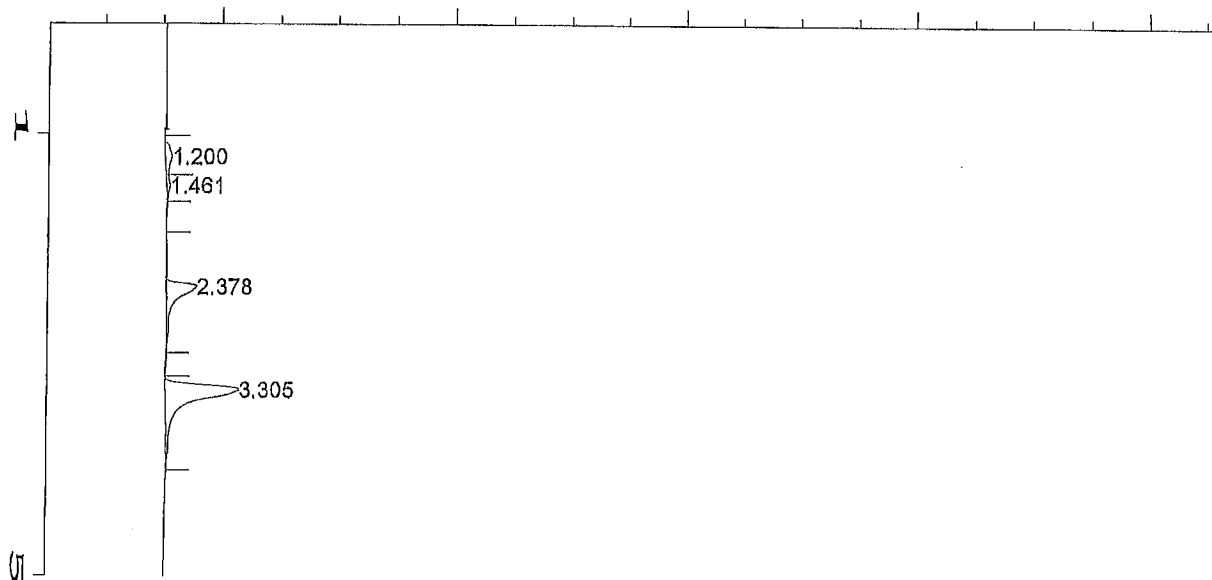
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1A069.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1A 73325 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:32 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1A -  
 Tr#73325 - 11:35 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1A069.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.185	400	FV	0.135		0.504	* uncalibrated *
2.341	2339	BB	0.109		2.948	* uncalibrated *
3.264	6383	BB	0.153		8.042	* uncalibrated *

Not all calibrated peaks were found

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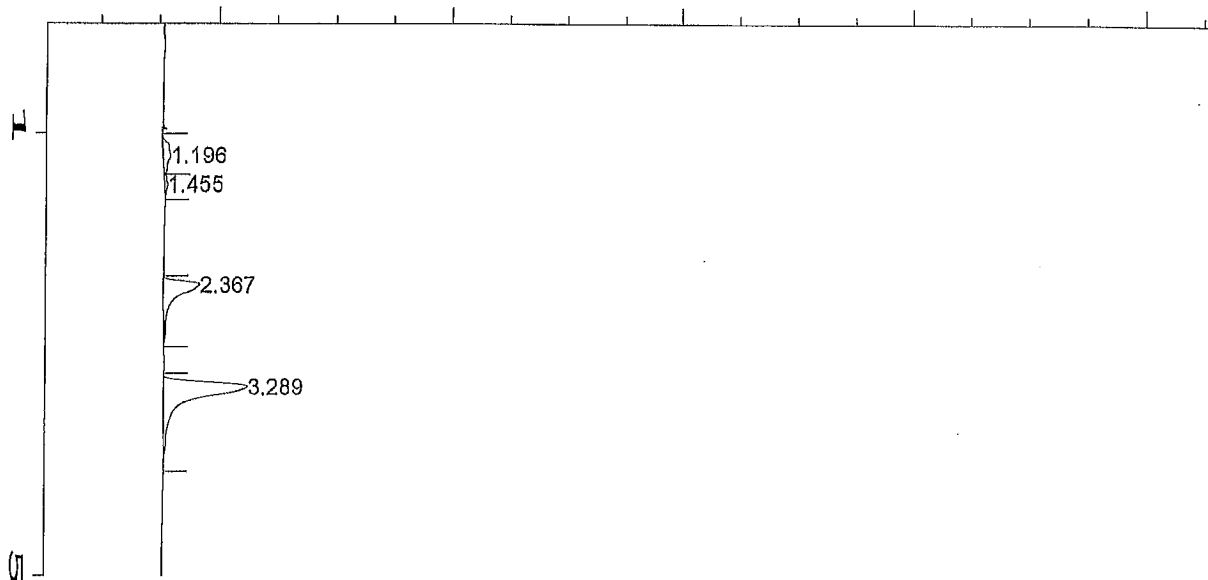
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1B070.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1B 73326 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:41 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:46 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1B -  
 Tr#73326 - 12:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1B070.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.200	679	BV	0.156		0.855	* uncalibrated *
1.461	228	VB	0.110		0.287	* uncalibrated *
2.378	2559	BB	0.131		3.225	* uncalibrated *
3.305	6318	BB	0.154		7.960	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
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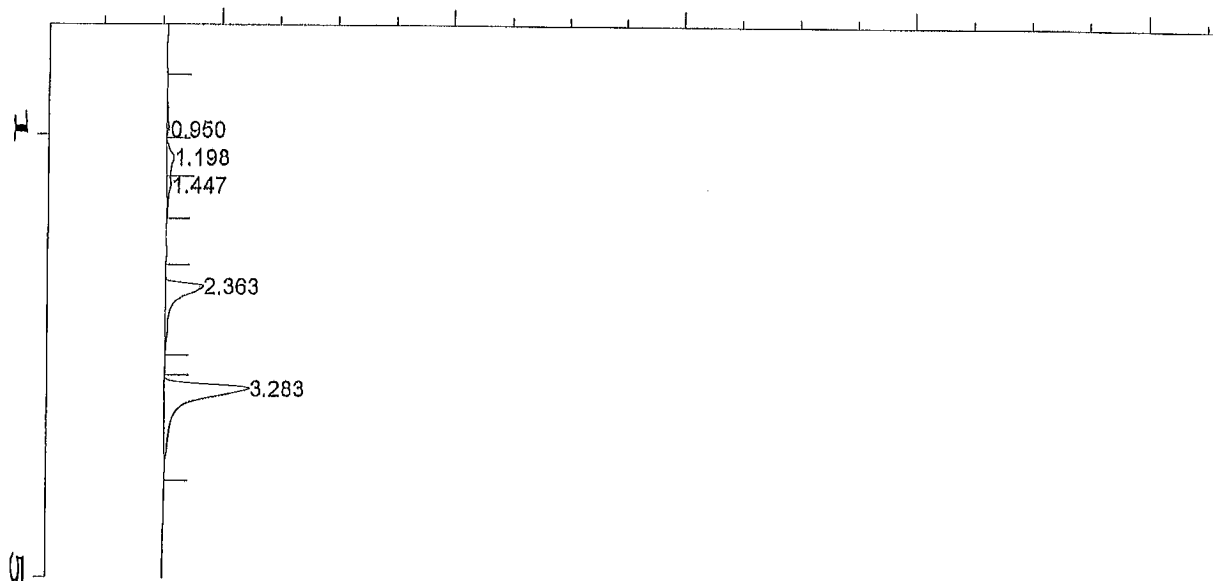
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1B071.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1B 73326 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:46 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:51 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1B -  
 Tr#73326 - 12:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1B071.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.196	812	BV	0.168		1.023	* uncalibrated *
1.455	199	VB	0.116		0.251	* uncalibrated *
2.367	2795	BB	0.138		3.522	* uncalibrated *
3.289	7117	PB	0.152		8.967	* uncalibrated *

Not all calibrated peaks were found

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 External Standard Report  
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Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1A072.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1A 73327 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:55 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:00 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1A -  
 Tr#73327 - 13:05 - 0.5 cc injection

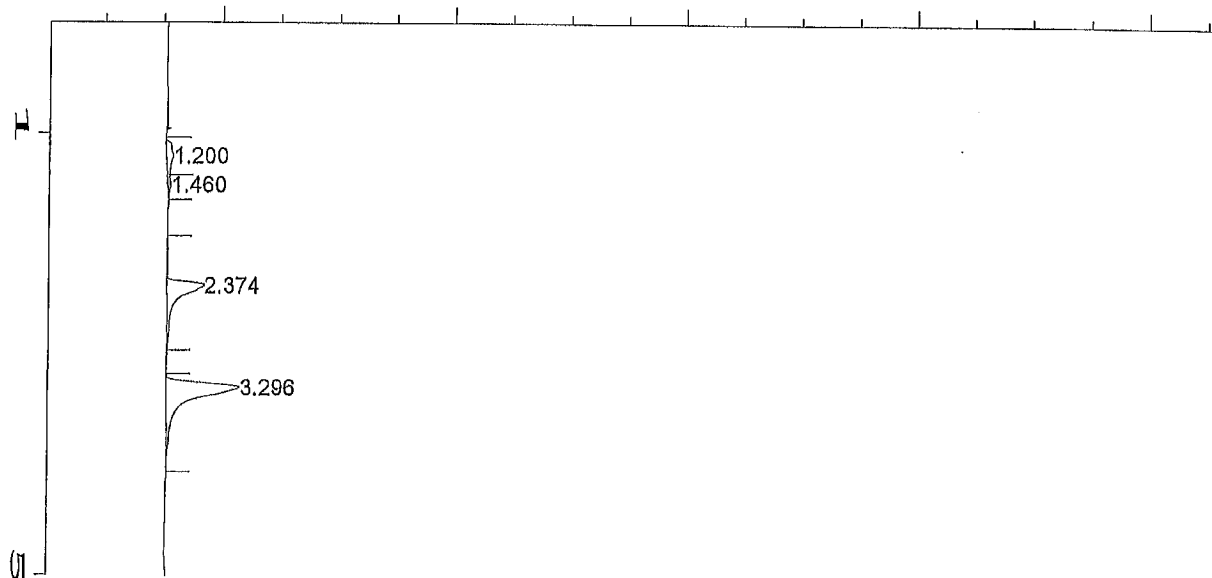
Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1A072.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
0.950	306	BV	0.114		0.386	* uncalibrated *
1.198	738	FV	0.149		0.929	* uncalibrated *
1.447	386	VB	0.133		0.486	* uncalibrated *
2.363	2963	BB	0.138		3.733	* uncalibrated *
3.283	7102	BB	0.134		8.947	* uncalibrated *

Not all calibrated peaks were found

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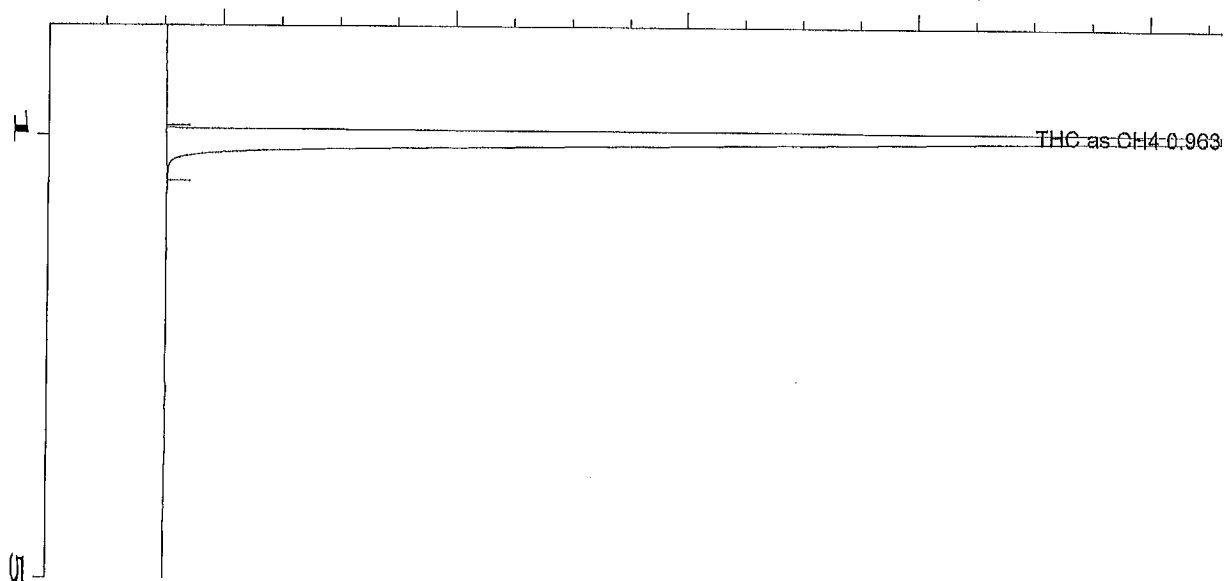
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1A073.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1A 73327 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:07 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:12 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1A -  
 Tr#73327 - 13:05 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1A073.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.200	794	BV	0.170		1.00	* uncalibrated *
1.460	200	VB	0.102		0.252	* uncalibrated *
2.374	2842	BB	0.124		3.580	* uncalibrated *
3.296	6043	BB	0.133		7.613	* uncalibrated *

Not all calibrated peaks were found



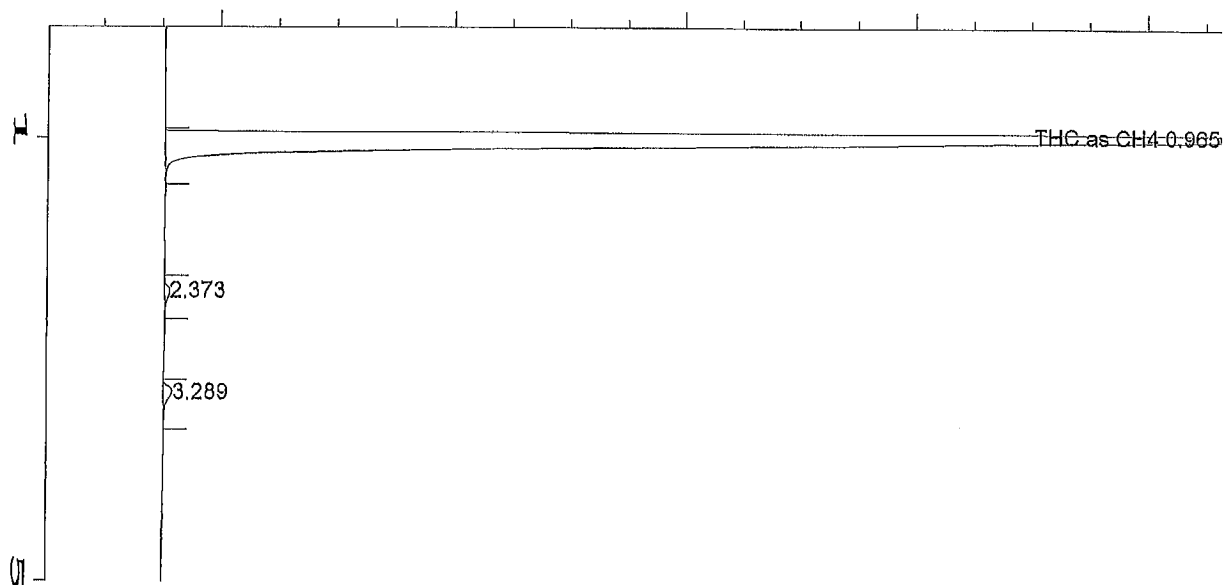
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0067.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:05 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:11 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0067.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.963	80767	BV	0.097	1	101.171	THC as CH4

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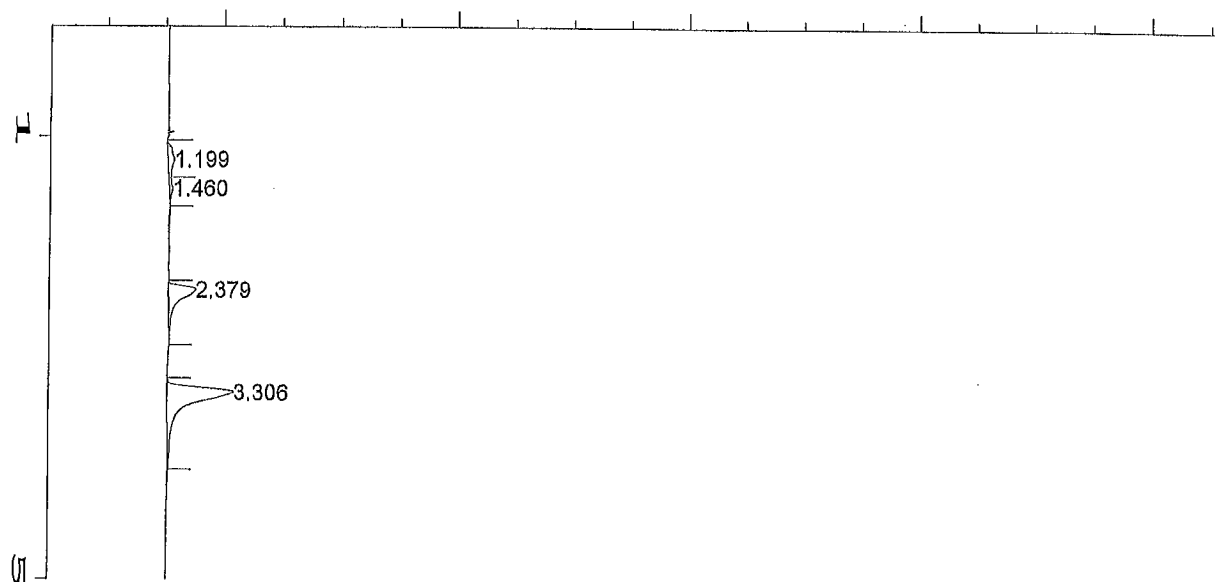


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:17 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:22 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	80186	BV	0.096	1	100.433	THC as CH4
2.373	366	BB	0.119		0.461	* uncalibrated *
3.289	638	BB	0.135		0.803	* uncalibrated *



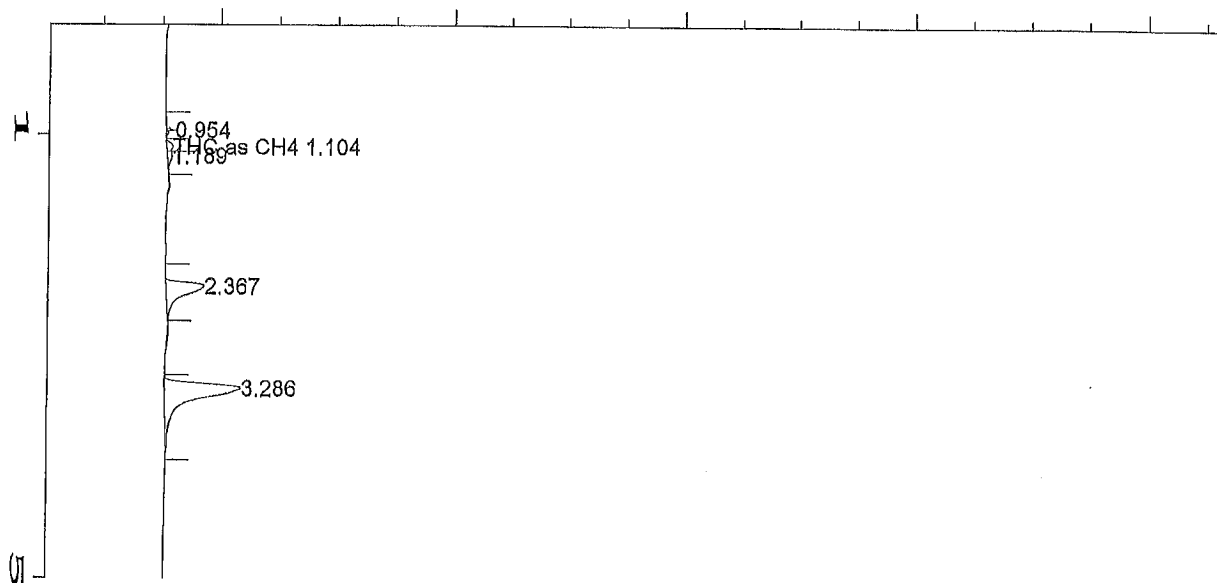
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B075.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:32 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B075.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.199	662	BV	0.156		0.834	* uncalibrated *
1.460	250	VB	0.109		0.315	* uncalibrated *
2.379	2059	BB	0.133		2.594	* uncalibrated *
3.306	5430	BB	0.148		6.841	* uncalibrated *

Not all calibrated peaks were found

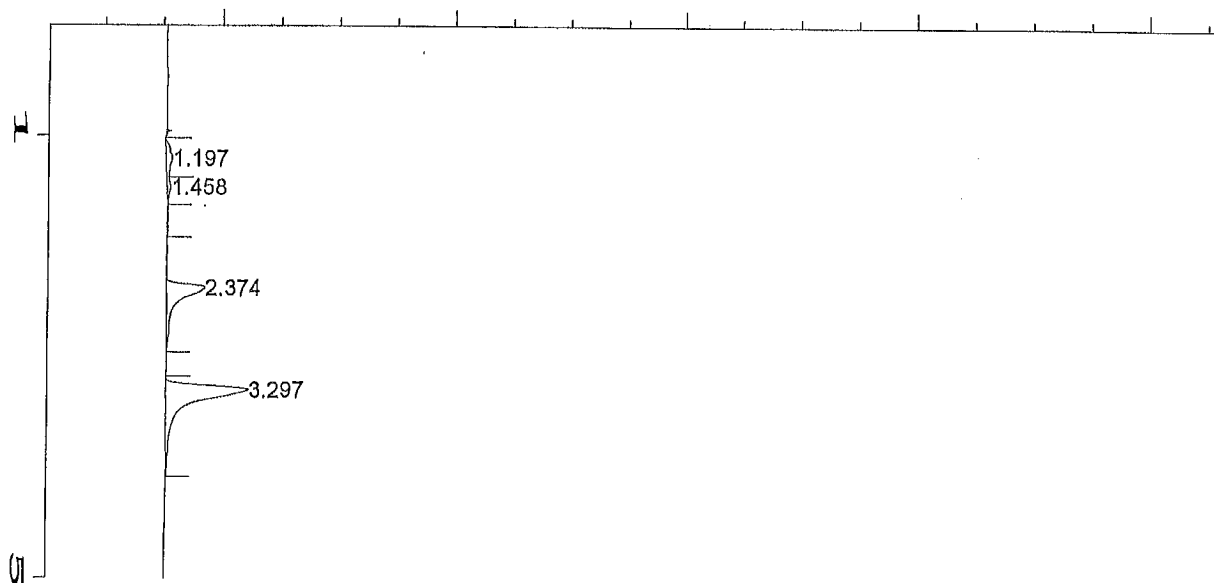


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B077.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:39 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:44 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B077.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.104	237	PV	0.071	1	0.230	THC as CH4
0.954	115	BV	0.028		0.144	* uncalibrated *
1.189	256	VB	0.092		0.322	* uncalibrated *
2.367	2523	BV	0.121		3.179	* uncalibrated *
3.286	6147	BB	0.144		7.744	* uncalibrated *



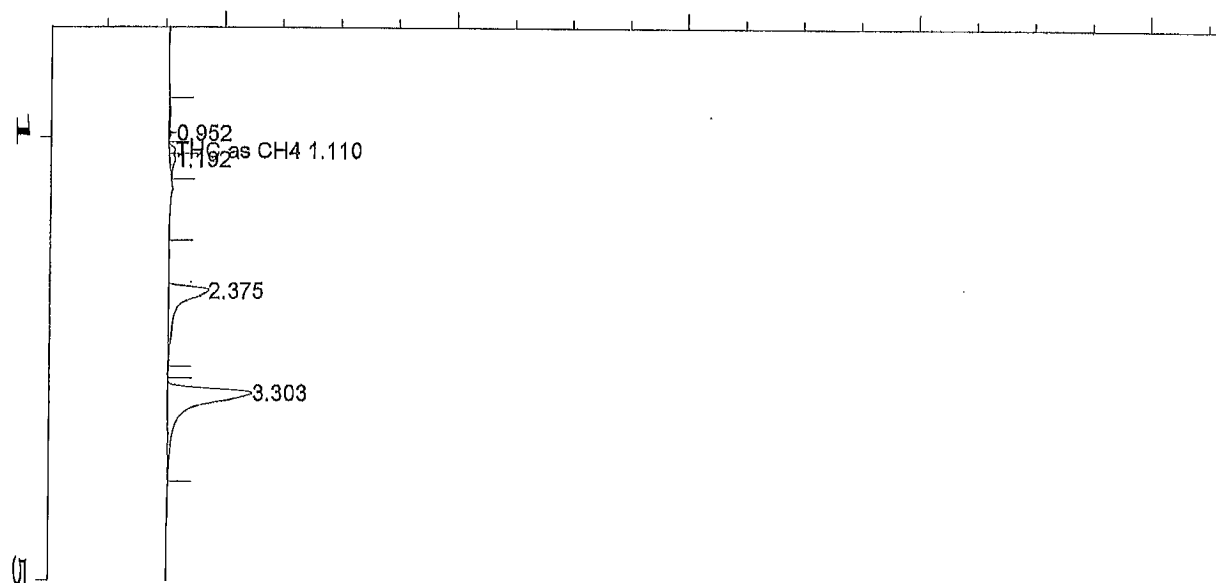
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B076.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 *g Sw* Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:38 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount : *8 Sw*  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - *9 Sw 4* 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B076.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.197	683 BV	0.158			0.861	* uncalibrated *
1.458	233 VB	0.099			0.294	* uncalibrated *
2.374	3042 BB	0.141			3.832	* uncalibrated *
3.297	6828 BB	0.147			8.602	* uncalibrated *

Not all calibrated peaks were found

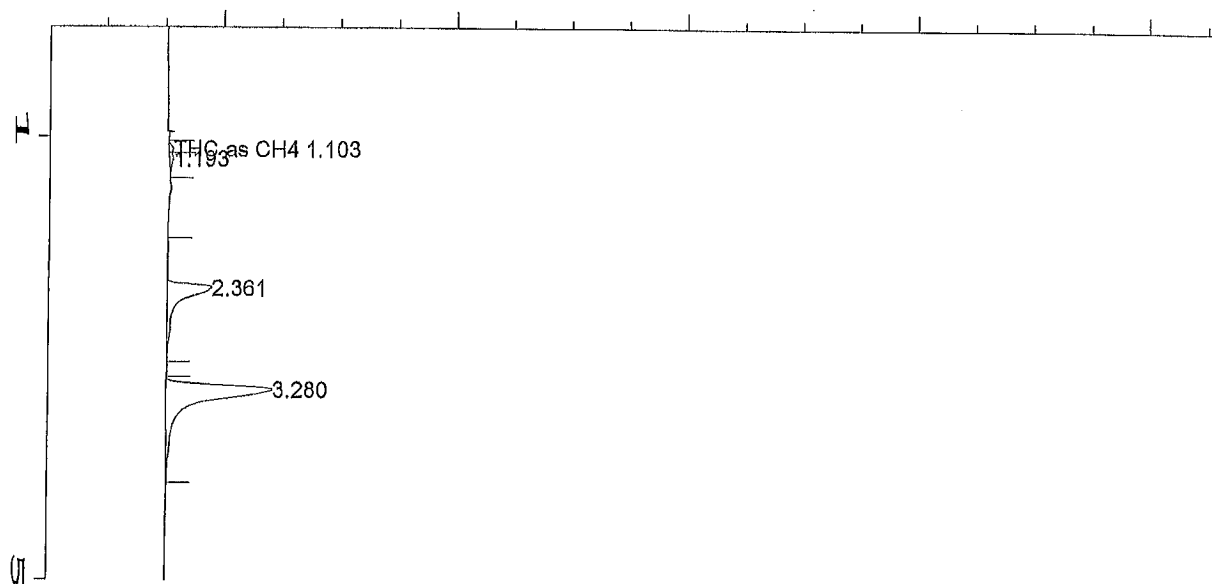


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1A079.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1A 73329 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:51 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:56 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1A -  
 Tr#73329 - 14:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1A079.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.110	205	PV	0.064	1	0.199	THC as CH4
0.952	218	BV	0.058		0.275	* uncalibrated *
1.192	345	VB	0.106		0.434	* uncalibrated *
2.375	3425	BB	0.149		4.315	* uncalibrated *
3.303	7192	BB	0.152		9.061	* uncalibrated *



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 External Standard Report  
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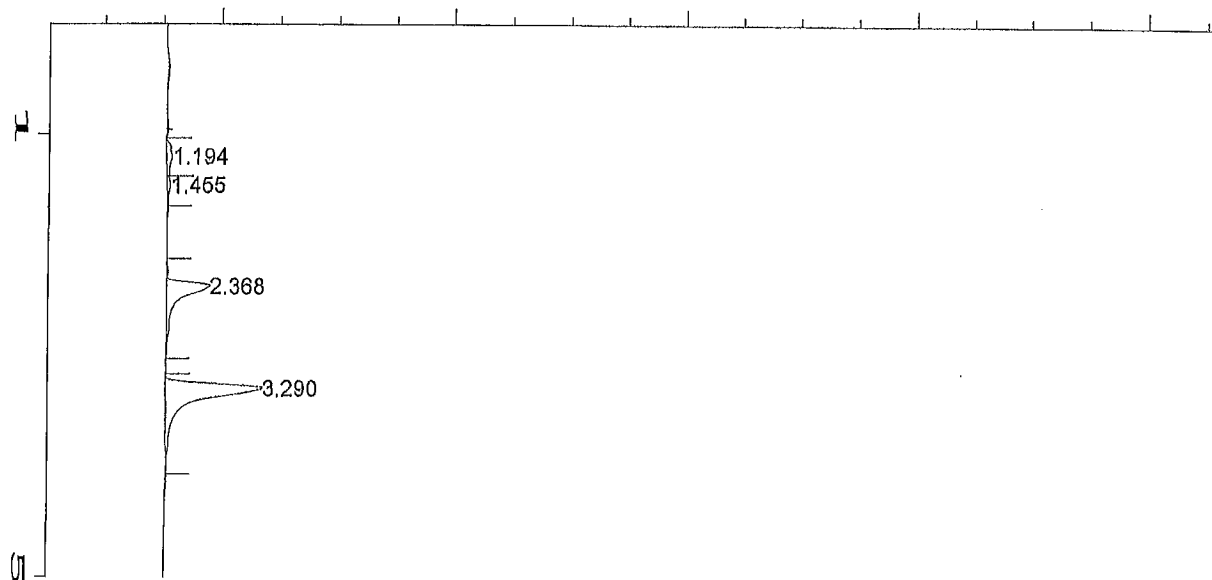
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1B080.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1B 73330 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:02 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:08 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1B -  
 Tr#73330 - 15:15 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1B080.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.103	153	BV	0.064	1	0.149	THC as CH4
1.193	249	VV	0.096		0.313	* uncalibrated *
2.361	3543	BB	0.139		4.464	* uncalibrated *
3.280	8857	BB	0.148		11.159	* uncalibrated *

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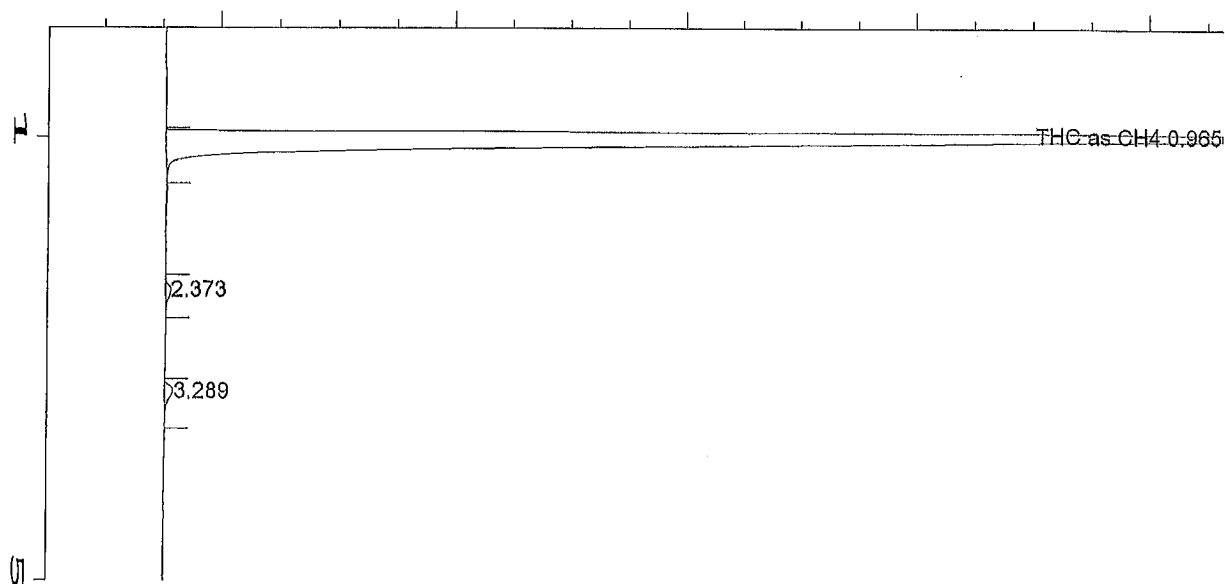
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1B081.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1B 73330 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:09 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:14 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1B -  
 Tr#73330 - 15:15 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1B081.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.194	615	BV	0.162		0.775	* uncalibrated *
1.455	215	VB	0.113		0.270	* uncalibrated *
2.368	3392	BB	0.137		4.274	* uncalibrated *
3.290	7837	BB	0.144		9.874	* uncalibrated *

Not all calibrated peaks were found

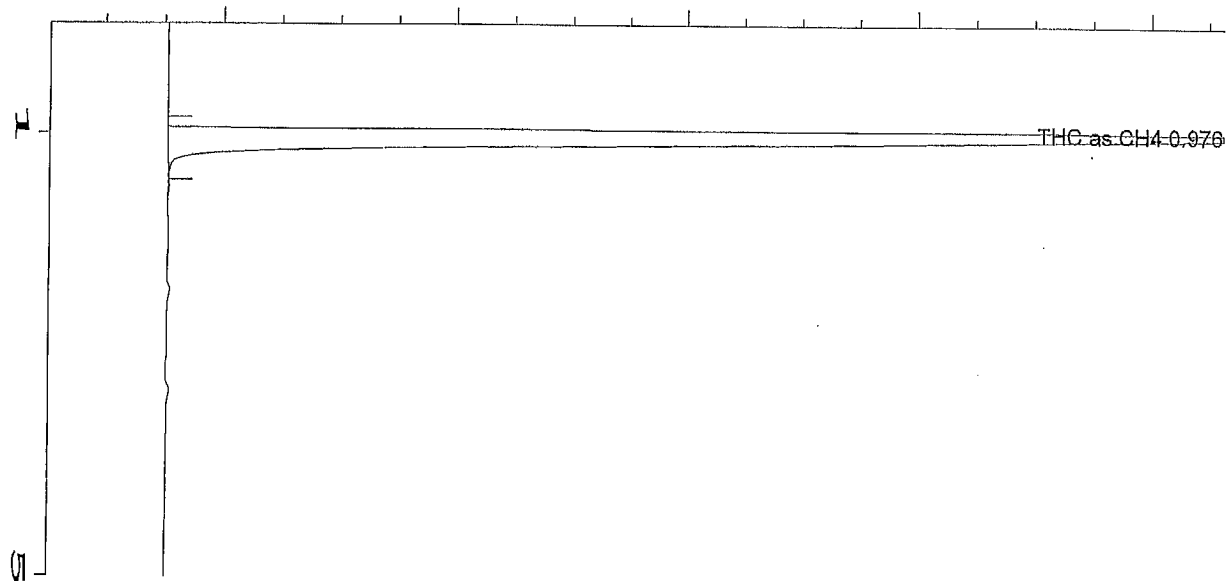


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:17 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	80186	BV	0.096	1	100.433	THC as CH4
2.373	366	BB	0.119		0.461	* uncalibrated *
3.289	638	BB	0.135		0.803	* uncalibrated *



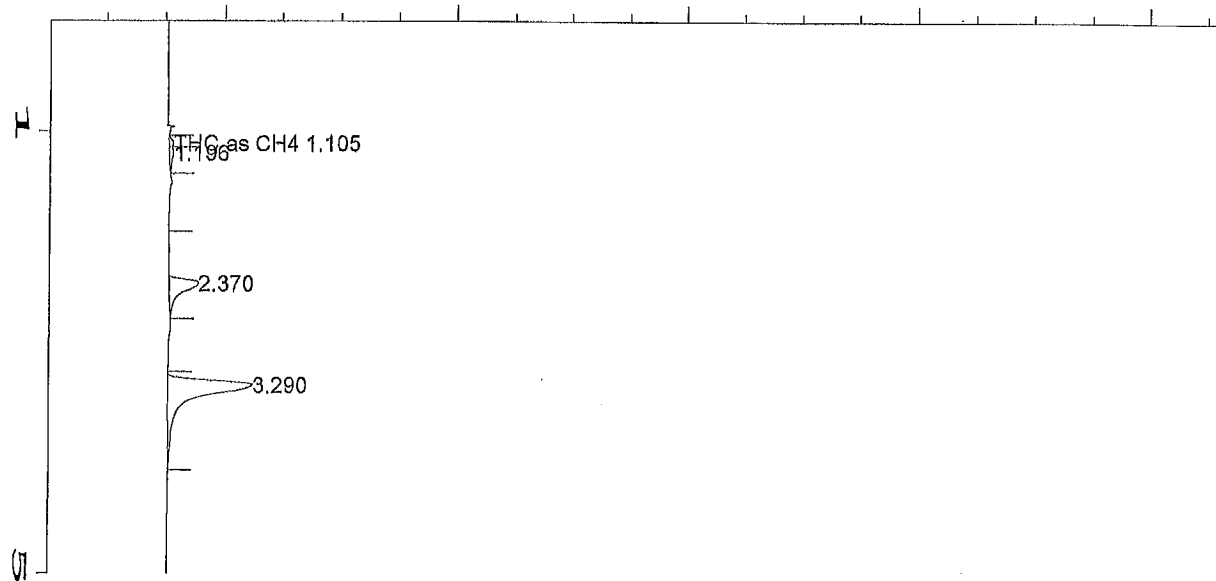
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:18 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:23 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.976	79107	BV	0.105	1	99.060	THC as CH4

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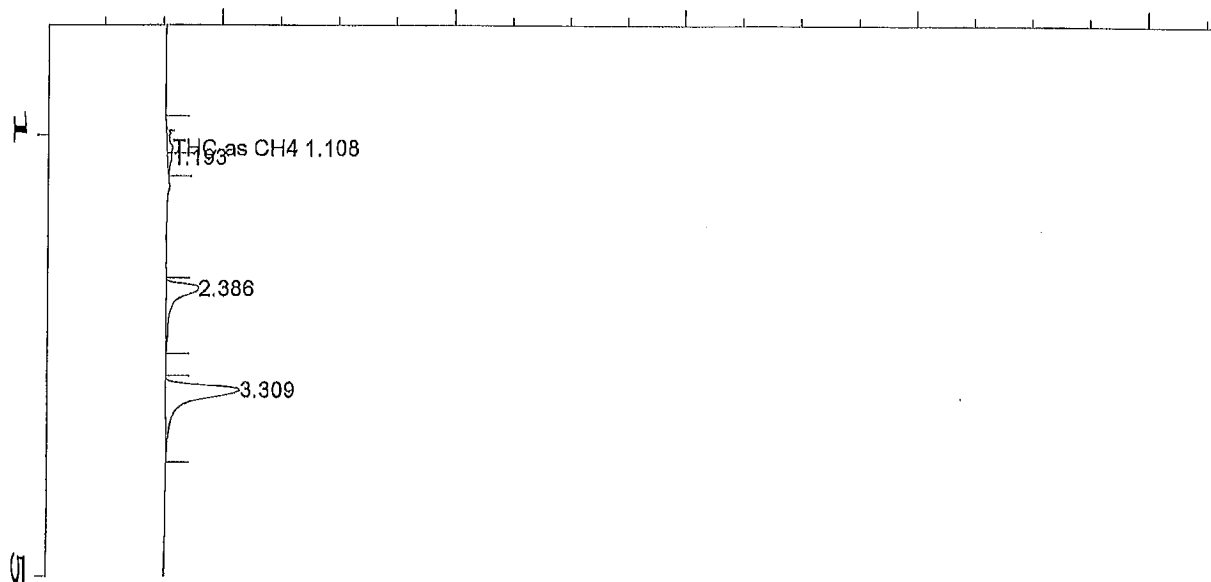
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1A083.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1A 73331 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:30 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:35 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1A -  
 Tr#73331 - 16:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1A083.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.105	174	VV	0.071	1	0.169	THC as CH4
1.196	261	VB	0.096		0.328	* uncalibrated *
2.370	1976	BB	0.123		2.489	* uncalibrated *
3.290	7188	BB	0.150		9.057	* uncalibrated *

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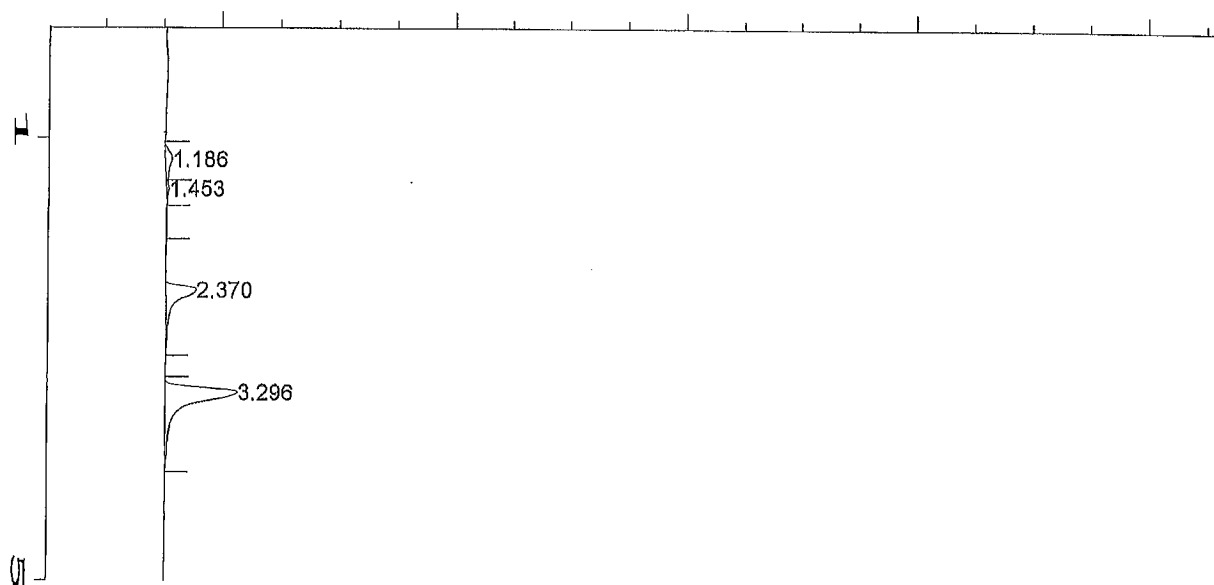
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1A084.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1A 73331 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:37 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:42 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1A -  
 Tr#73331 - 16:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1A084.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.108	399	BV	0.142	1	0.388	THC as CH4
1.193	240	VB	0.096		0.302	* uncalibrated *
2.386	2609	BB	0.140		3.287	* uncalibrated *
3.309	5999	BB	0.144		7.559	* uncalibrated *

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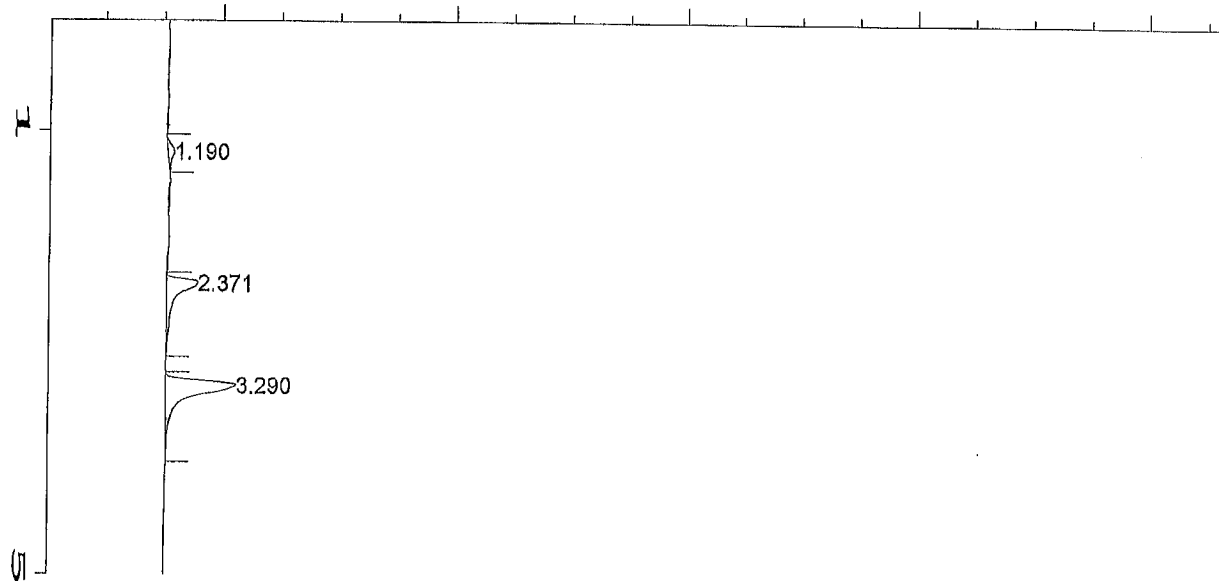
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1B085.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1B 73332 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:47 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:52 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1B -  
 Tr#73332 - 16:45 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1B085.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.186	712	BV	0.156		0.897	* uncalibrated *
1.453	168	VB	0.096		0.212	* uncalibrated *
2.370	2520	BB	0.142		3.175	* uncalibrated *
3.296	6059	BB	0.149		7.633	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
 =====

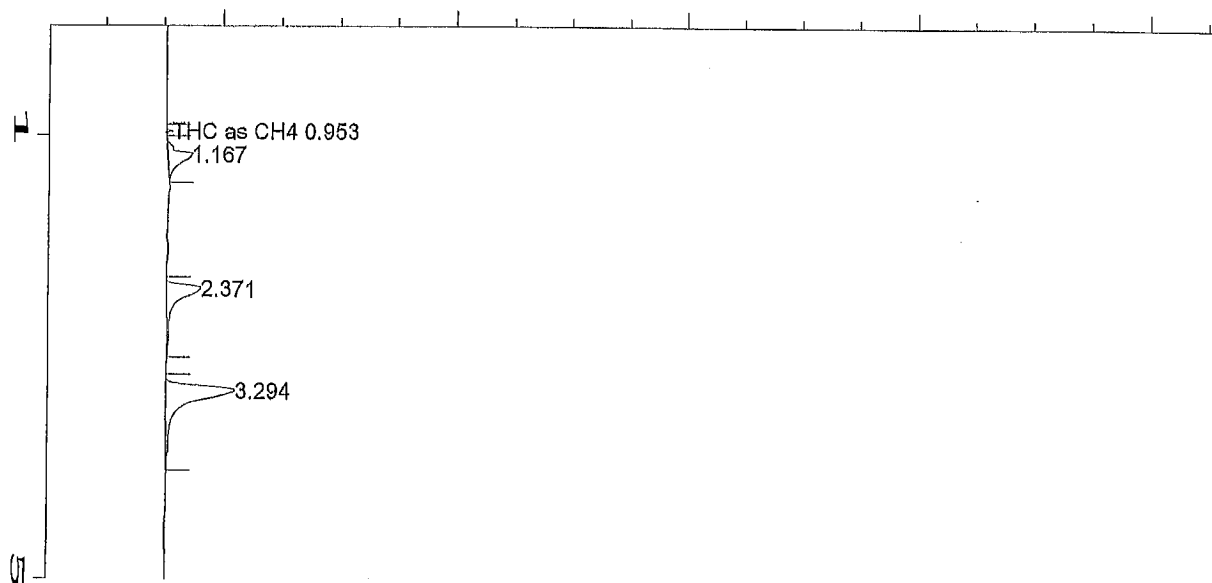
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1B086.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1B 73332 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:53 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:58 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1B -  
 Tr#73332 - 16:45 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1B086.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.190	482	PV	0.123		0.607	* uncalibrated *
2.371	2614	BB	0.147		3.293	* uncalibrated *
3.290	5724	BB	0.145		7.212	* uncalibrated *

Not all calibrated peaks were found

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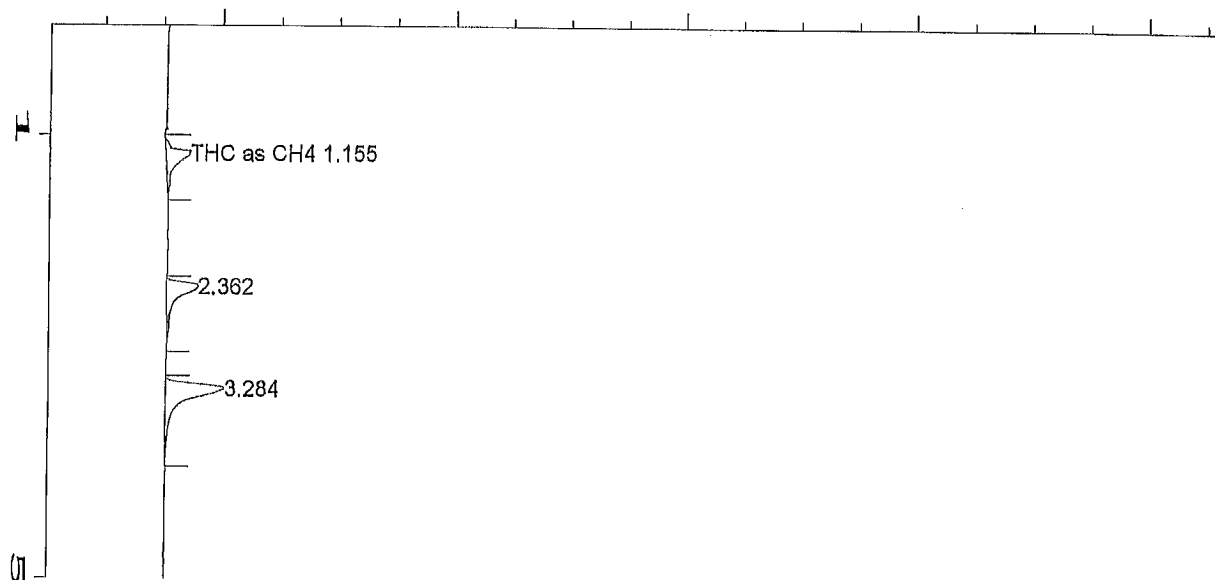
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A87.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:09 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:14 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A87.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.953	28	BV	0.023	1	0.0273	THC as CH4
1.167	1643	PV	0.117		2.070	* uncalibrated *
2.371	2694	BB	0.139		3.394	* uncalibrated *
3.294	5604	BB	0.147		7.061	* uncalibrated *



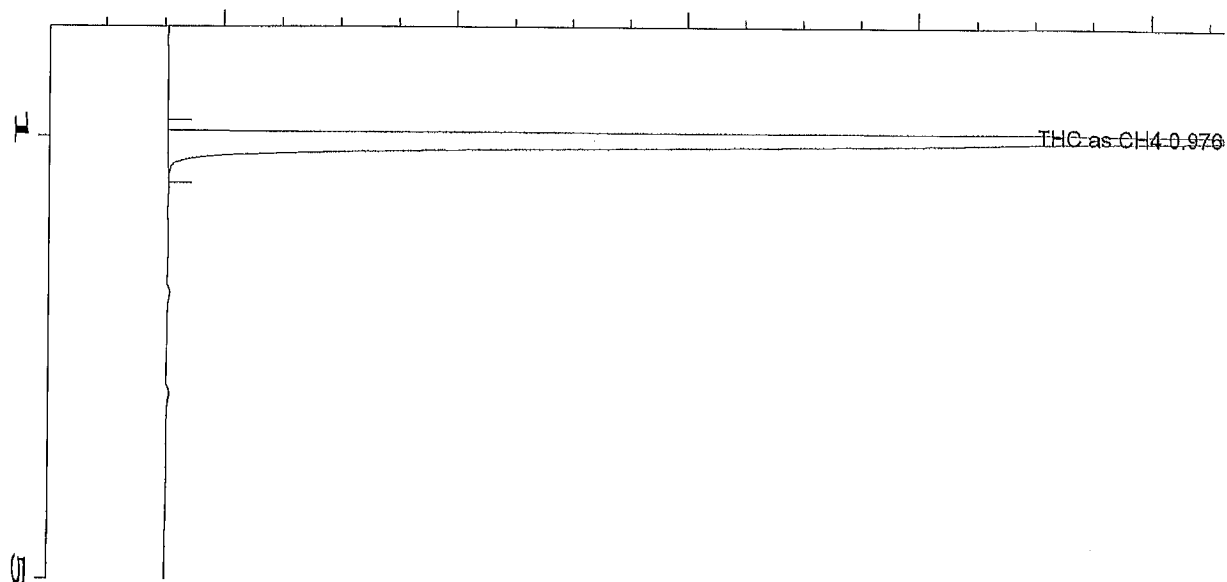


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A89.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:22 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:27 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A89.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.155	2035	BB	0.136	1	1.977	THC as CH4
2.362	2537	BB	0.141		3.196	* uncalibrated *
3.284	4780	BB	0.146		6.022	* uncalibrated *



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 External Standard Report  
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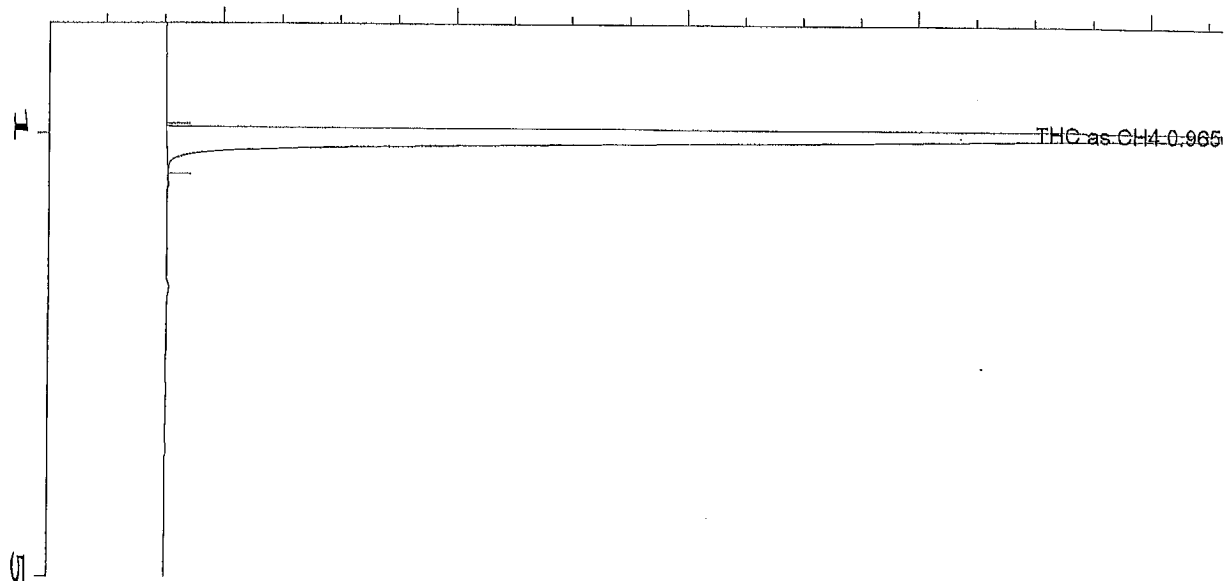
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Data File Name   : C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D
Operator        : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument       : GC ID4284                    Vial Number          :
Sample Name     : Span 0.5c                     Injection Number     :
Run Time Bar Code:                               Sequence Line        :
Acquired on     : 13 Dec 14  02:18 PM            Instrument Method    : M18-DB1.MTH
Report Created on: 13 Dec 14  02:25 PM            Analysis Method     : M18-DB1.MTH
Last Recalib on : 13 Dec 14  11:53 AM            Sample Amount       : 0
Multiplier      : 1                               ISTD Amount         :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.976	79107	BV	0.105	1	99.060	THC as CH4

=====

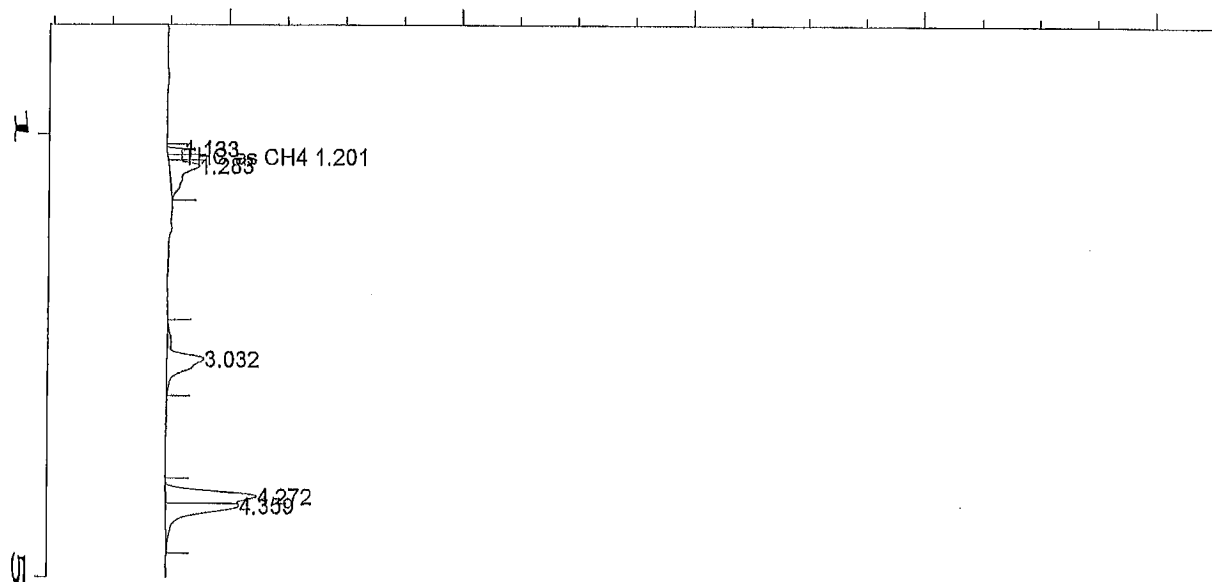


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A90.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:43 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:48 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A90.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	78410	BV	0.105	1	98.174	THC as CH4

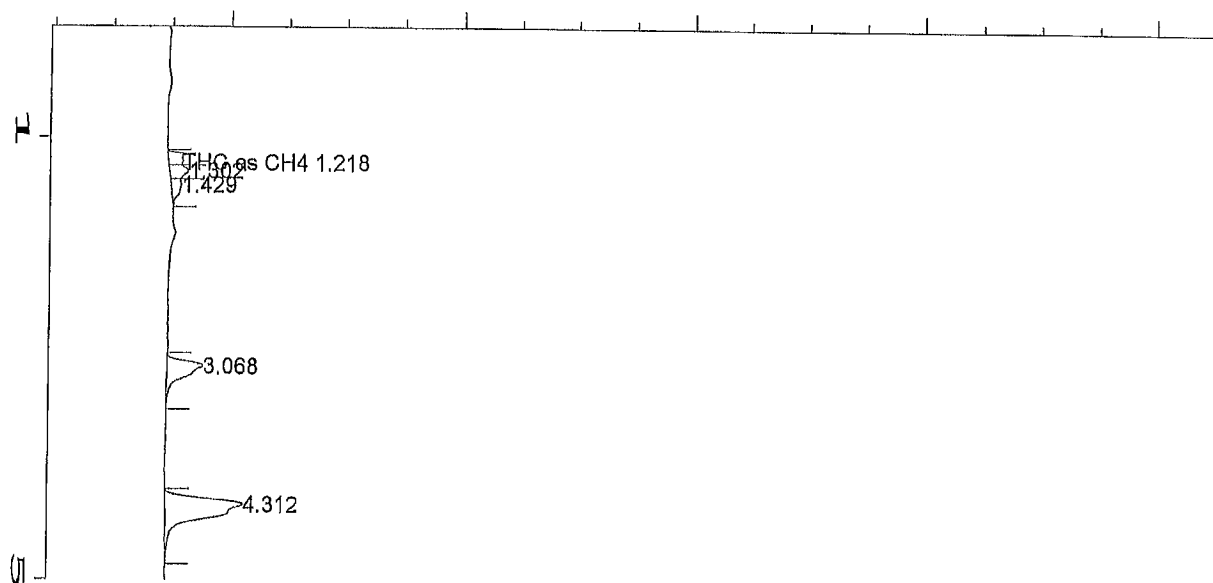


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T10B1B21.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T10B1B 73334 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:28 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:33 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1B -  
 Tr#73334 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T10B1B21.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.201	359	VV	0.048	1	0.268	THC as CH4
1.133	446	BV	0.046		0.364	* uncalibrated *
1.283	2349	VB	0.123		1.919	* uncalibrated *
3.032	3223	BB	0.137		2.633	* uncalibrated *
4.272	4933	BV	0.095		4.029	* uncalibrated *
4.359	4119	VB	0.093		3.364	* uncalibrated *

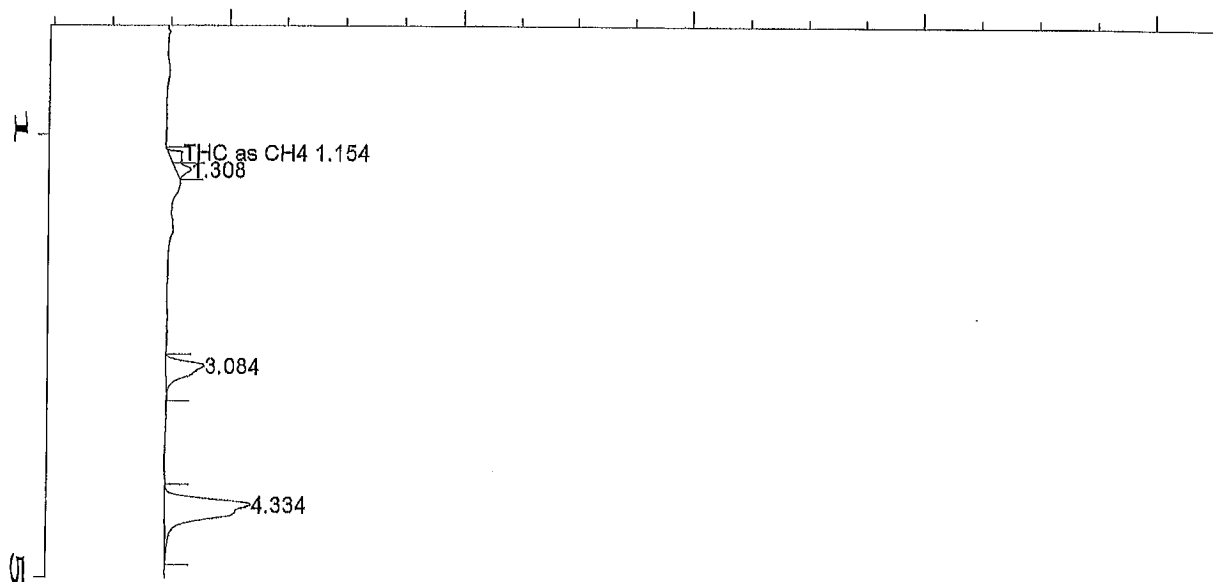


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T10B1B22.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T10B1B 73334 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1B -  
 Tr#73334 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T10B1B22.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.218	828	BV	0.113	1	0.618	THC as CH4
1.302	989	VV	0.083		0.808	* uncalibrated *
1.429	783	VB	0.113		0.639	* uncalibrated *
3.068	2708	BB	0.124		2.212	* uncalibrated *
4.312	7585	BB	0.156		6.195	* uncalibrated *



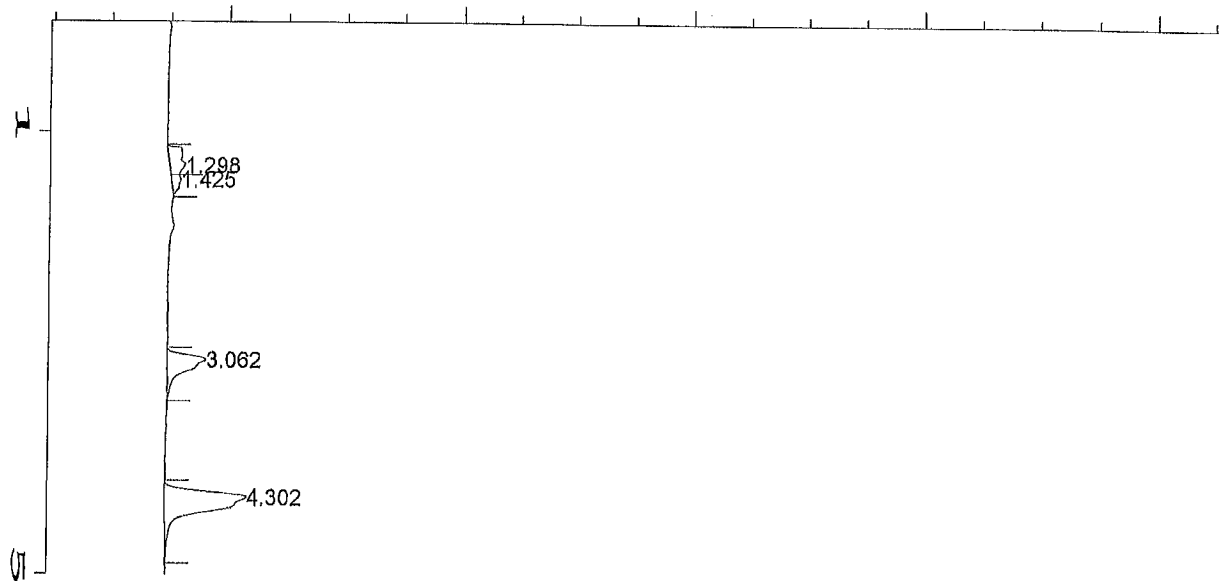
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1A23.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1A 73335 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:41 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:46 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1A -  
 Tr#73335 - 09:55 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1A23.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.154	635	BV	0.085	1	0.474	THC as CH4
1.308	695	VB	0.081		0.567	* uncalibrated *
3.084	2884	BB	0.122		2.356	* uncalibrated *
4.334	8289	BB	0.152		6.770	* uncalibrated *

=====



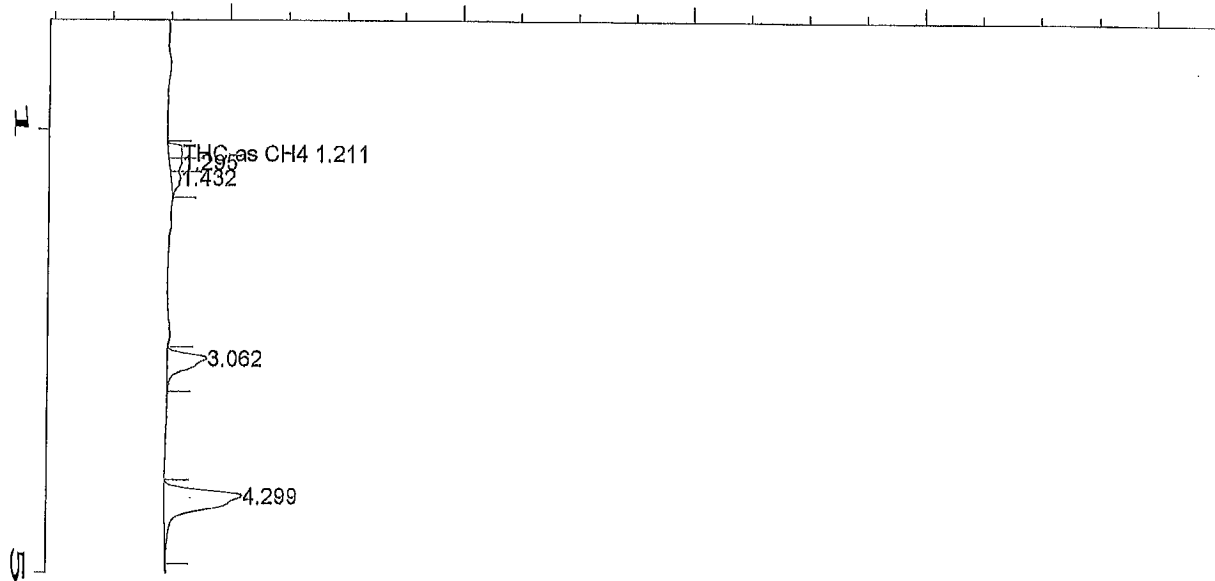
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1A24.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1A 73335 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:47 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:52 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1A -  
 Tr#73335 - 09:55 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1A24.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	* not found *			1		THC as CH4
1.298	1665	BV	0.158		1.360	* uncalibrated *
1.425	640	VB	0.109		0.522	* uncalibrated *
3.062	3164	BB	0.133		2.584	* uncalibrated *
4.302	8104	BV	0.160		6.619	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
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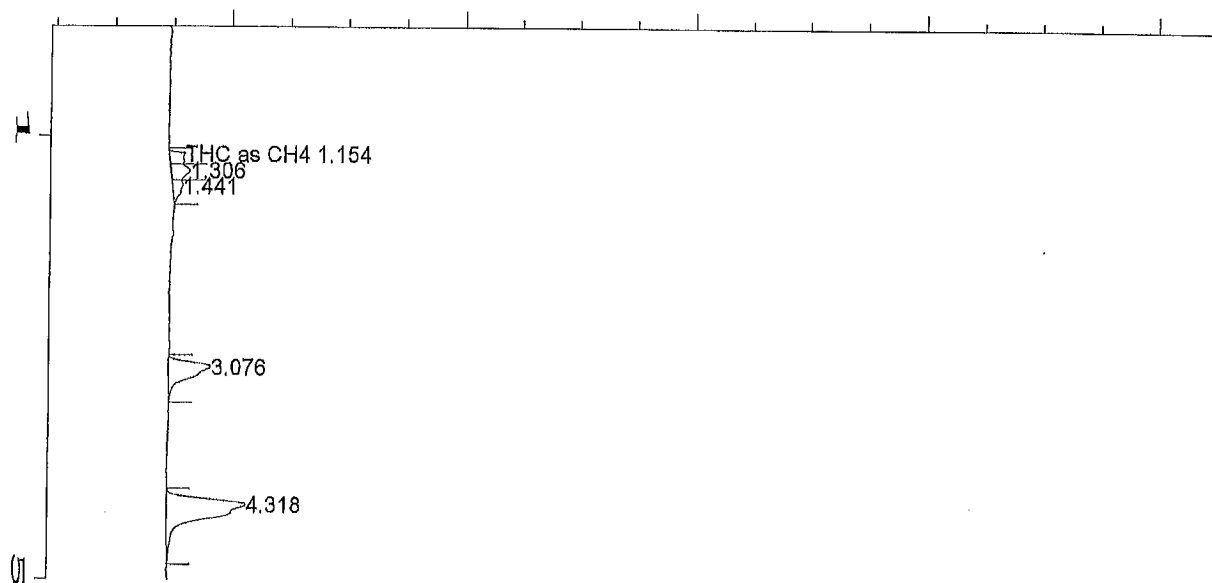
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1B25.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1B 73336 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:55 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:00 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1B -  
 Tr#73336 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1B25.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.211	866	BV	0.099	1	0.646	THC as CH4
1.295	656	VV	0.085		0.536	* uncalibrated *
1.432	695	VB	0.118		0.568	* uncalibrated *
3.062	2925	BB	0.121		2.389	* uncalibrated *
4.299	7520	BB	0.155		6.142	* uncalibrated *

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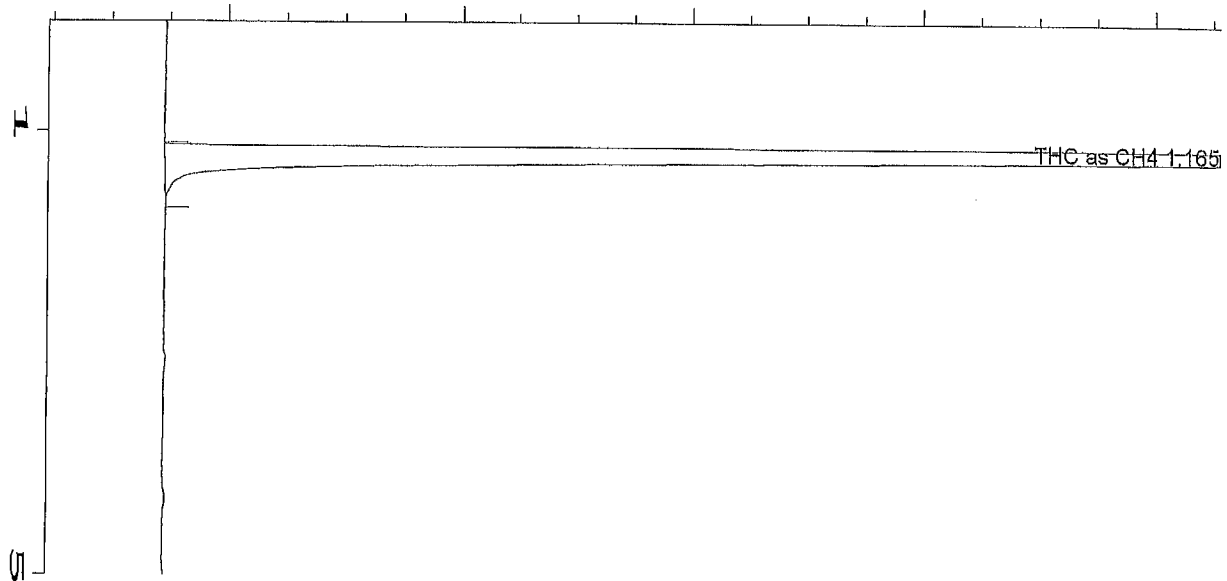


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1B26.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1B 73336 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:08 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:13 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1B -  
 Tr#73336 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1B26.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.154	791	BV	0.095	1	0.590	THC as CH4
1.306	1115	VV	0.092		0.911	* uncalibrated *
1.441	714	VB	0.113		0.583	* uncalibrated *
3.076	3191	BB	0.121		2.606	* uncalibrated *
4.318	7751	BB	0.157		6.331	* uncalibrated *



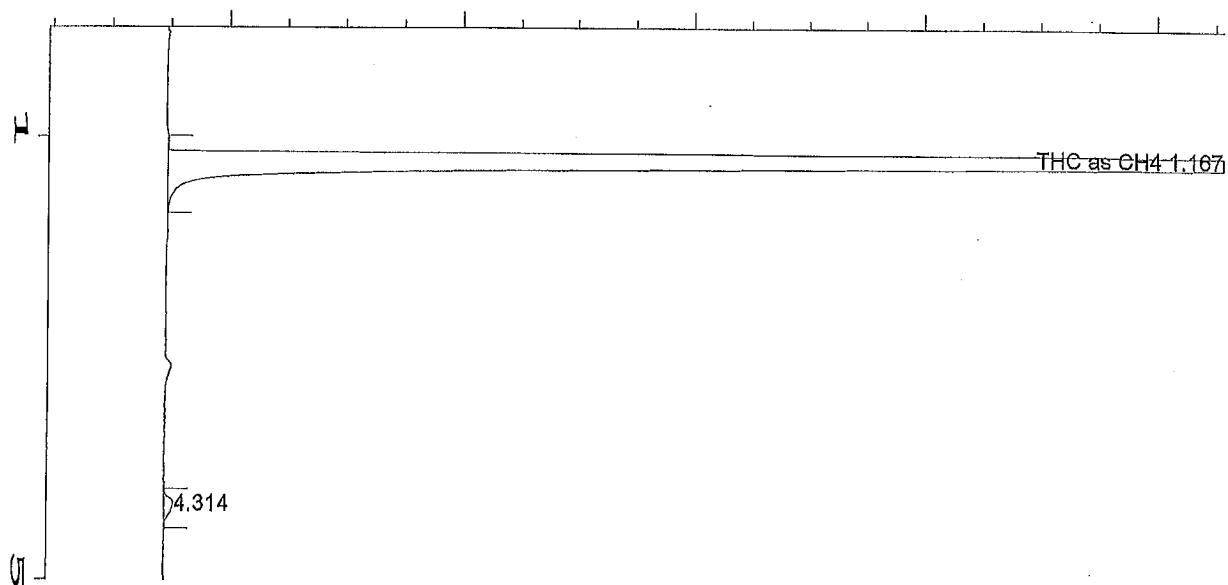
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0019.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:06 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:11 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0019.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	122101	BB	0.094	1	99.962	THC as CH4

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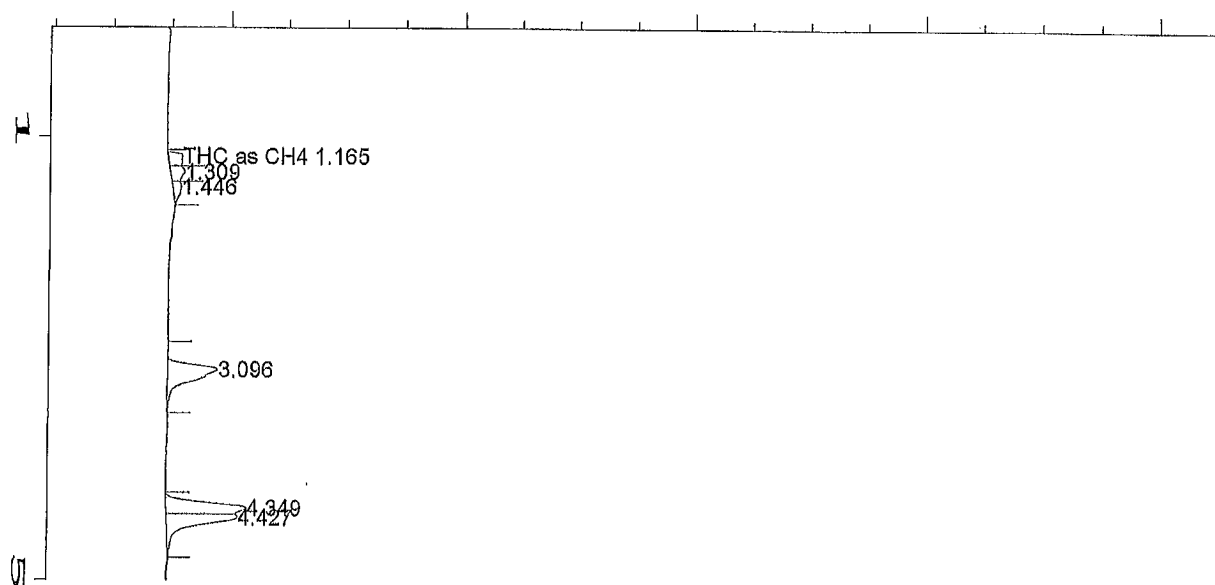
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:18 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	121584	BB	0.092	1	99.537	THC as CH4
4.314	762	BB	0.122		0.622	* uncalibrated *

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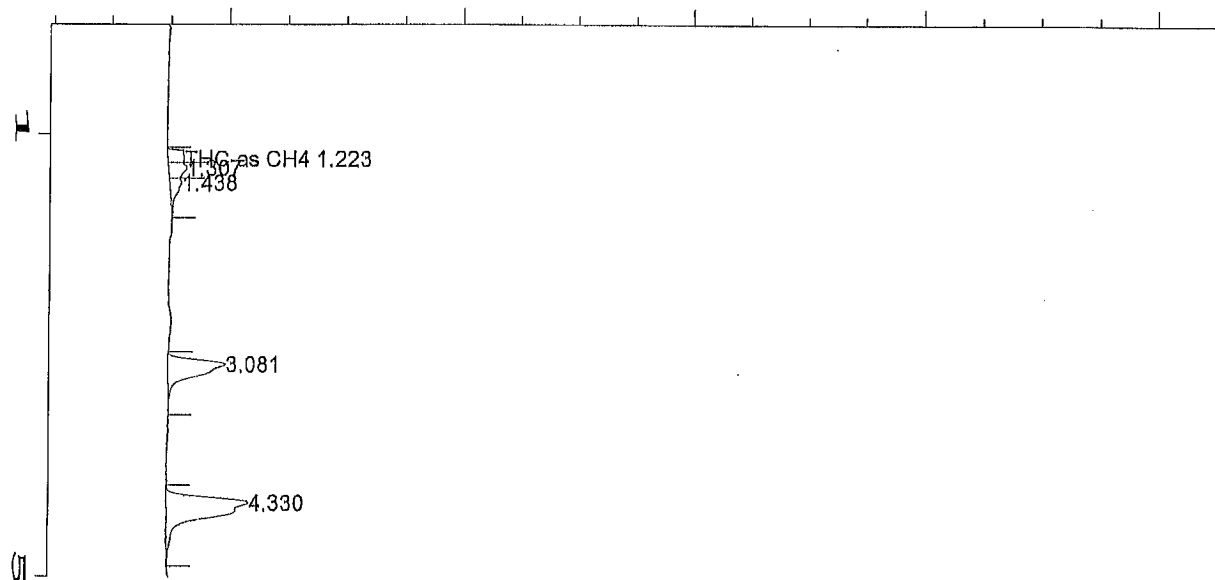
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1A28.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1A 73337 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:27 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:33 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1A -  
 Tr#73337 - 11:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1A28.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	773	BV	0.093	1	0.577	THC as CH4
1.309	824	VV	0.099		0.673	* uncalibrated *
1.446	576	VB	0.110		0.471	* uncalibrated *
3.096	3969	BV	0.131		3.241	* uncalibrated *
4.349	4252	BV	0.092		3.473	* uncalibrated *
4.427	3956	VB	0.094		3.231	* uncalibrated *

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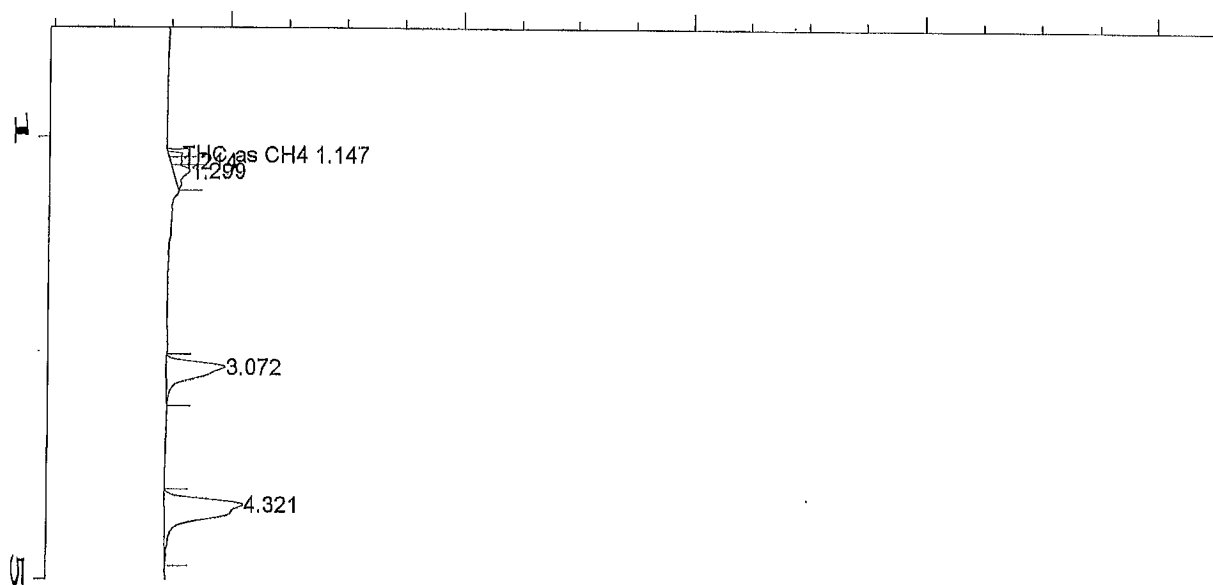


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1A29.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1A 73337 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1A -  
 Tr#73337 - 11:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1A29.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.223	925	BV	0.110	1	0.690	THC as CH4
1.307	1099	VV	0.105		0.898	* uncalibrated *
1.438	968	VB	0.119		0.791	* uncalibrated *
3.081	4475	BB	0.127		3.655	* uncalibrated *
4.330	8311	BB	0.161		6.788	* uncalibrated *

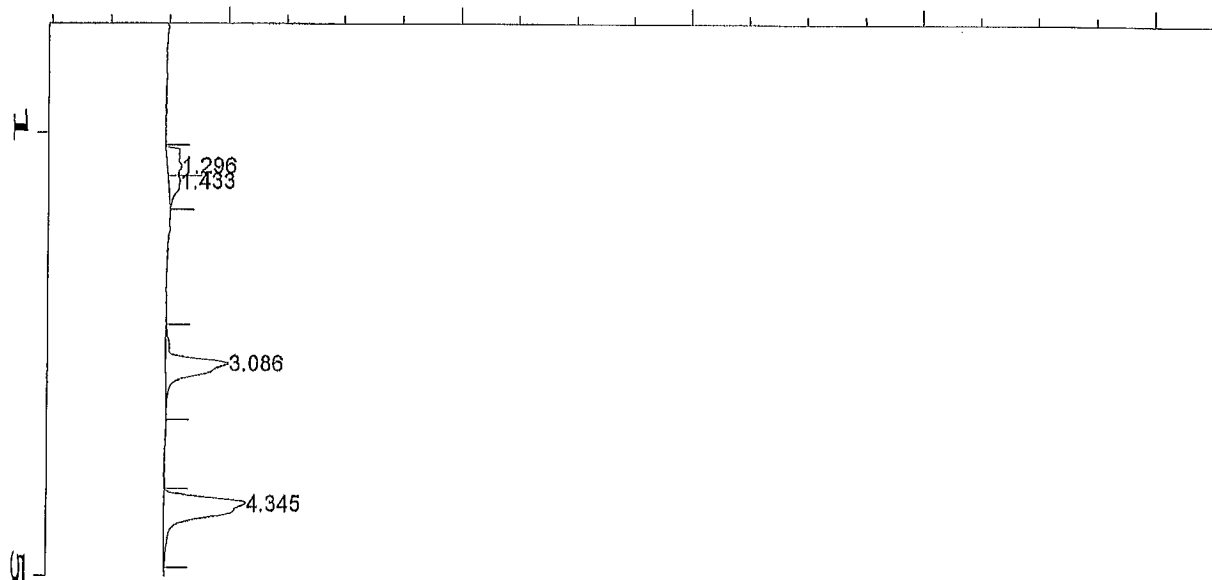


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1B30.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1B 73338 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:46 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:51 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1B -  
 Tr#73338 - 12:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1B30.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.147	260	BV	0.034	1	0.194	THC as CH4
1.214	425	VV	0.071		0.347	* uncalibrated *
1.299	1020	VB	0.096		0.833	* uncalibrated *
3.072	4528	BB	0.125		3.698	* uncalibrated *
4.321	7905	BB	0.158		6.456	* uncalibrated *



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 External Standard Report  
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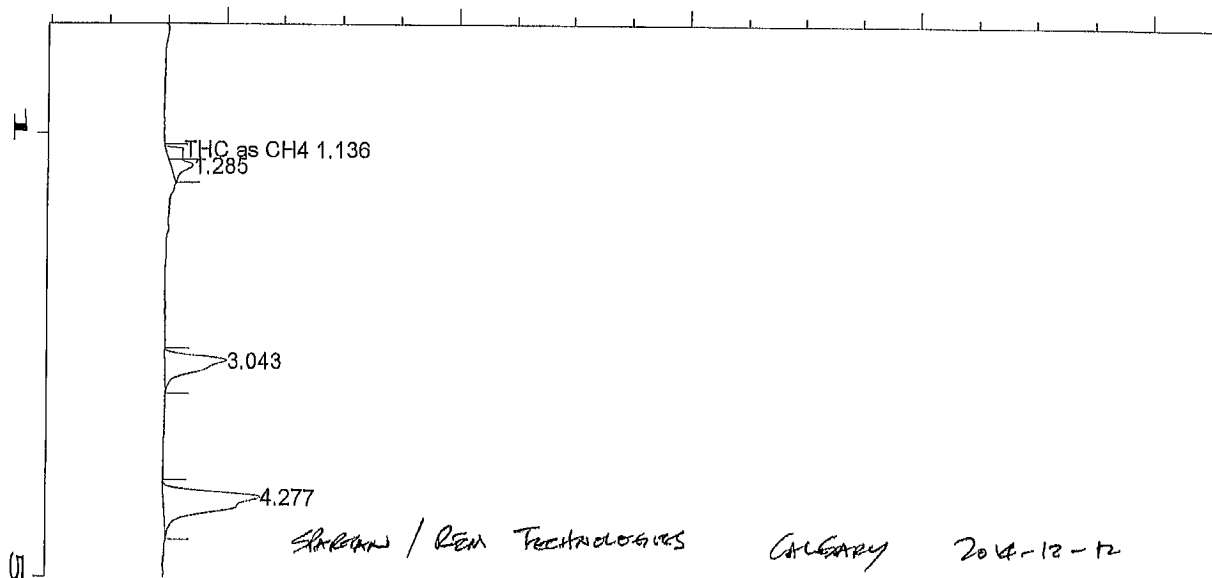
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1B31.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1B 73338 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:52 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:57 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1B -  
 Tr#73338 - 12:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1B31.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	* not found *			1		THC as CH4
1.296	1607	BV	0.175			1.313 * uncalibrated *
1.433	1035	VB	0.135			0.845 * uncalibrated *
3.086	5331	BB	0.136			4.354 * uncalibrated *
4.345	8114	BV	0.159			6.627 * uncalibrated *

Not all calibrated peaks were found

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Shaw / Ren Technologies

Calgary 2014-12-12

T13B1A Test 73339

13:00 0.5cc 10J.

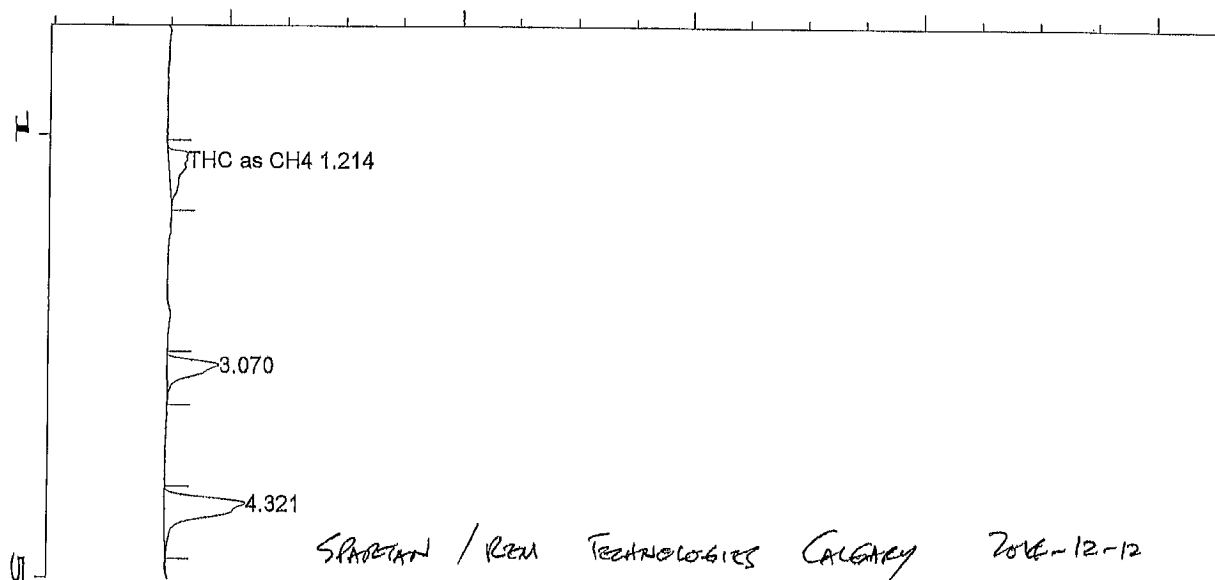
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1A32.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1A 73339 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:03 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:07 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1A32.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.136	892	BV	0.097	1	0.666	THC as CH4
1.285	1177	VB	0.090		0.962	* uncalibrated *
3.043	4660	BB	0.122		3.806	* uncalibrated *
4.277	9045	BB	0.149		7.388	* uncalibrated *





SPARTAN / REM TECHNOLOGIES CALGARY 2014-12-12  
 T13B1A TR# 73339 B:00 0.5cc 10J.

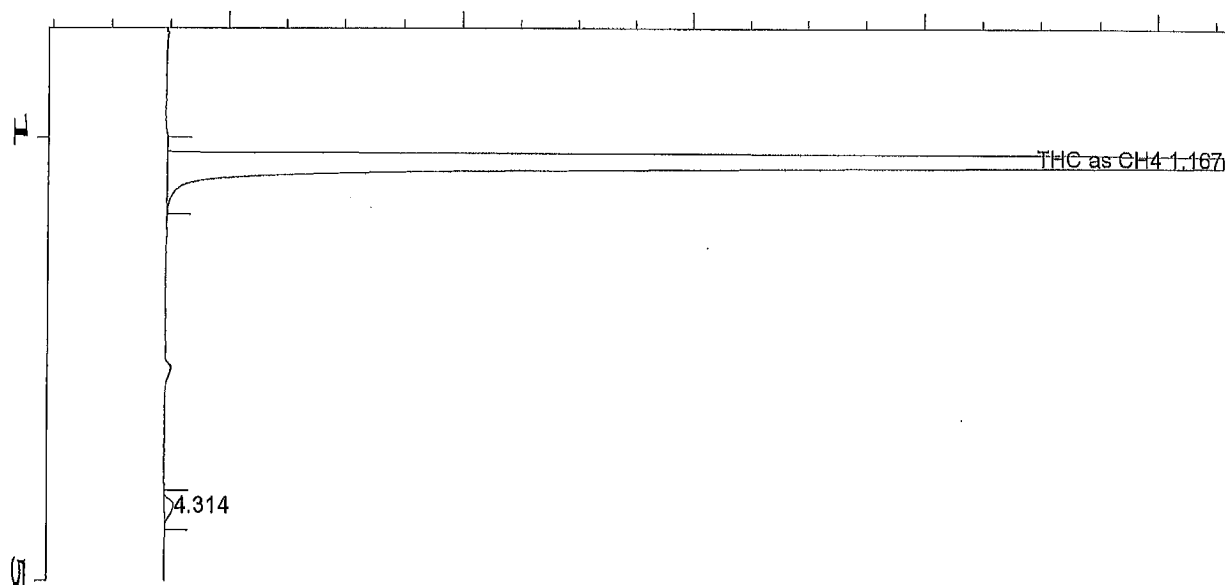
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1A33.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1A 73339 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:09 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:16 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1A33.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.214	2759	BB	0.226	1	2.059	THC as CH4
3.070	3878	BB	0.124		3.168	* uncalibrated *
4.321	7868	BB	0.156		6.426	* uncalibrated *

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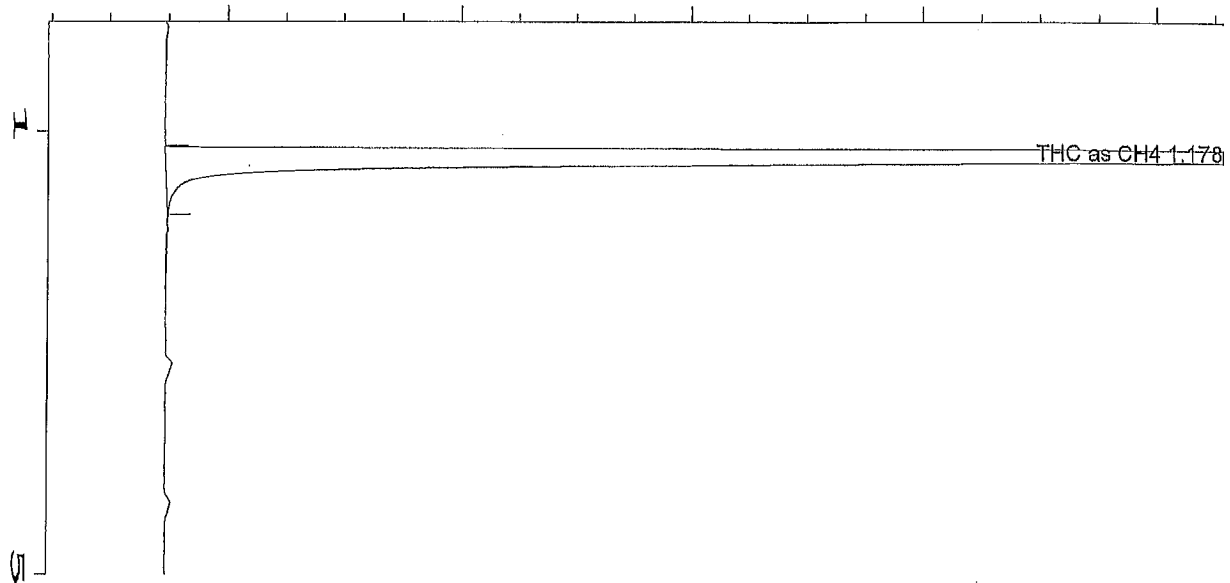


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:18 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	121584	BB	0.092	1	99.537	THC as CH4
4.314	762	BB	0.122		0.622	* uncalibrated *



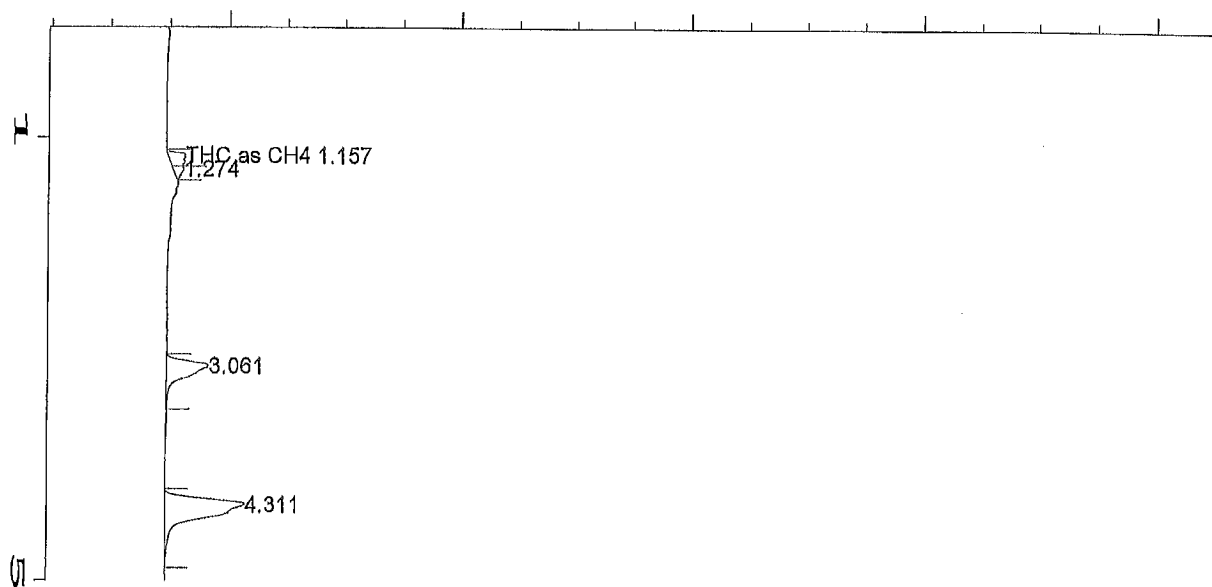
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:19 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:24 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.178	121222	BB	0.098	1	99.239	THC as CH4

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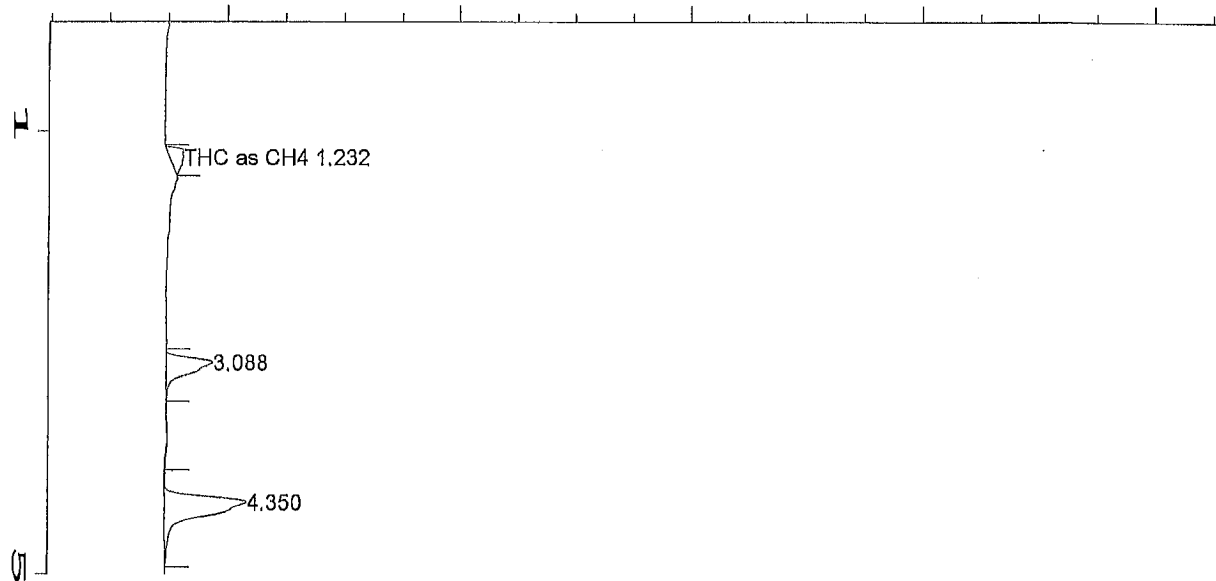
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1B35.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1B 73340 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:30 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:35 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13B1B -  
 Tr#73340 - 13:35 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1B35.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.157	899	BV	0.104	1	0.671	THC as CH4
1.274	427	VV	0.067		0.348	* uncalibrated *
3.061	3181	BB	0.124		2.598	* uncalibrated *
4.311	7637	BB	0.153		6.237	* uncalibrated *

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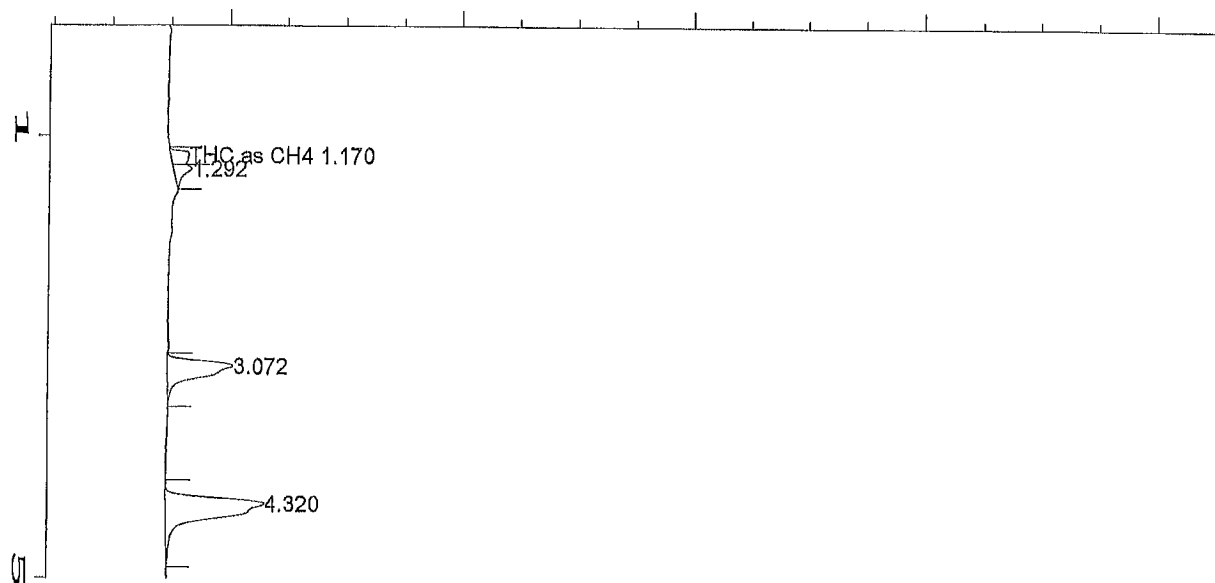


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1B36.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1B 73340 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:38 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:43 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13B1B -  
 Tr#73340 - 13:35 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1B36.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.232	1276	BB	0.134	1	0.953	THC as CH4
3.088	3580	BB	0.126		2.924	* uncalibrated *
4.350	7872	BB	0.152		6.429	* uncalibrated *



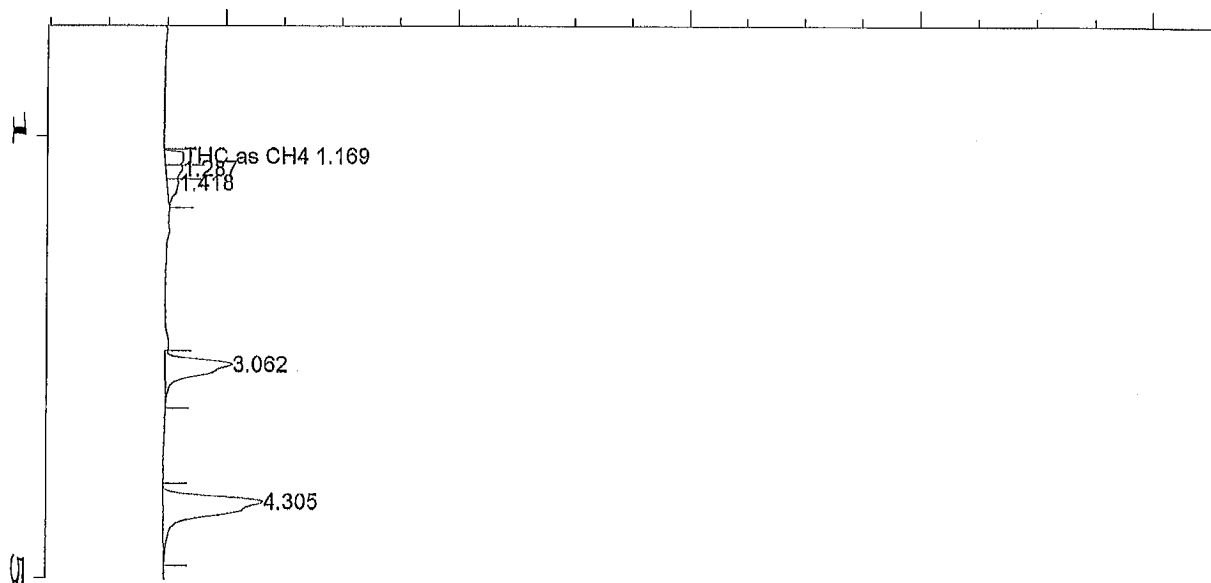
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1A37.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1A 73341 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:48 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:53 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1A -  
 Tr#73341 - 14:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1A37.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.170	1061	BV	0.088	1	0.792	THC as CH4
1.292	1003	VB	0.092		0.820	* uncalibrated *
3.072	5202	BB	0.127		4.249	* uncalibrated *
4.320	9766	BB	0.157		7.977	* uncalibrated *

=====

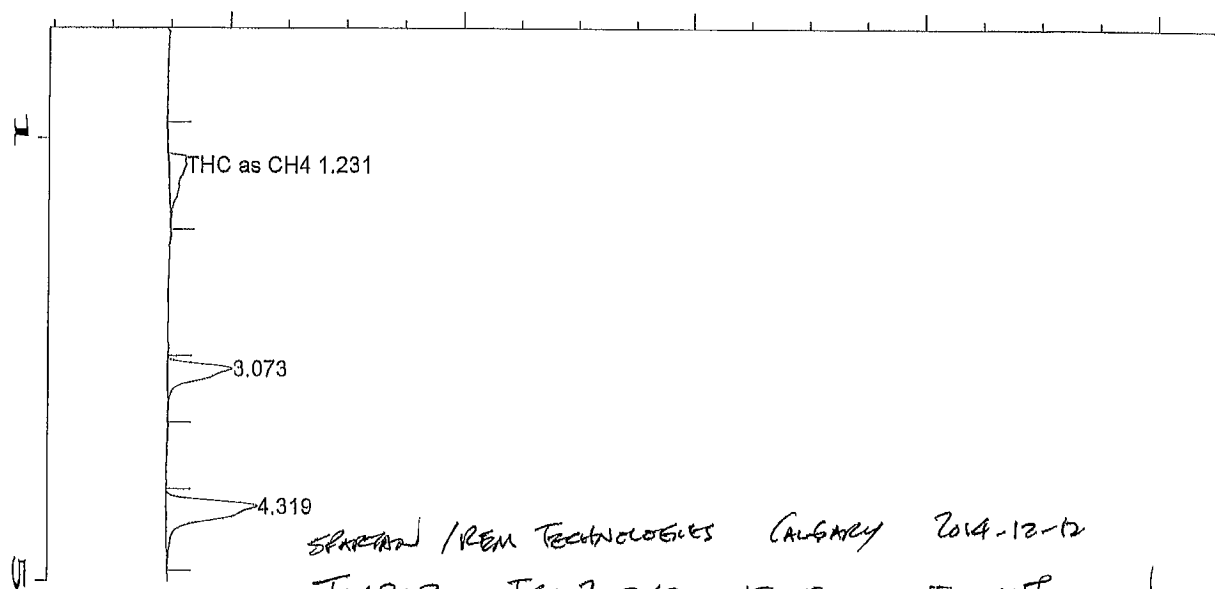


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1A38.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1A 73341 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:54 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:59 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1A -  
 Tr#73341 - 14:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1A38.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	1097	BV	0.100	1	0.819	THC as CH4
1.287	941	VV	0.089		0.769	* uncalibrated *
1.418	838	VB	0.111		0.684	* uncalibrated *
3.062	5240	VB	0.128		4.280	* uncalibrated *
4.305	9478	BB	0.152		7.741	* uncalibrated *



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 External Standard Report  
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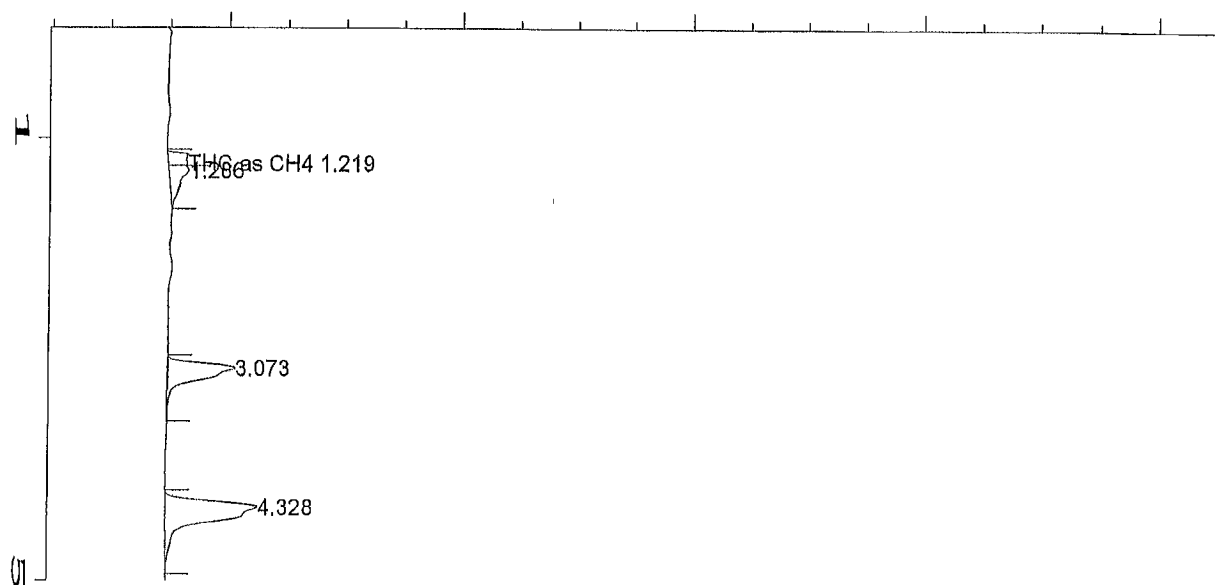
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B39.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:10 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:15 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B39.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.231	2648	PB	0.248	1	1.976	THC as CH4
3.073	4891	VB	0.134		3.995	* uncalibrated *
4.319	8505	BV	0.151		6.946	* uncalibrated *

=====



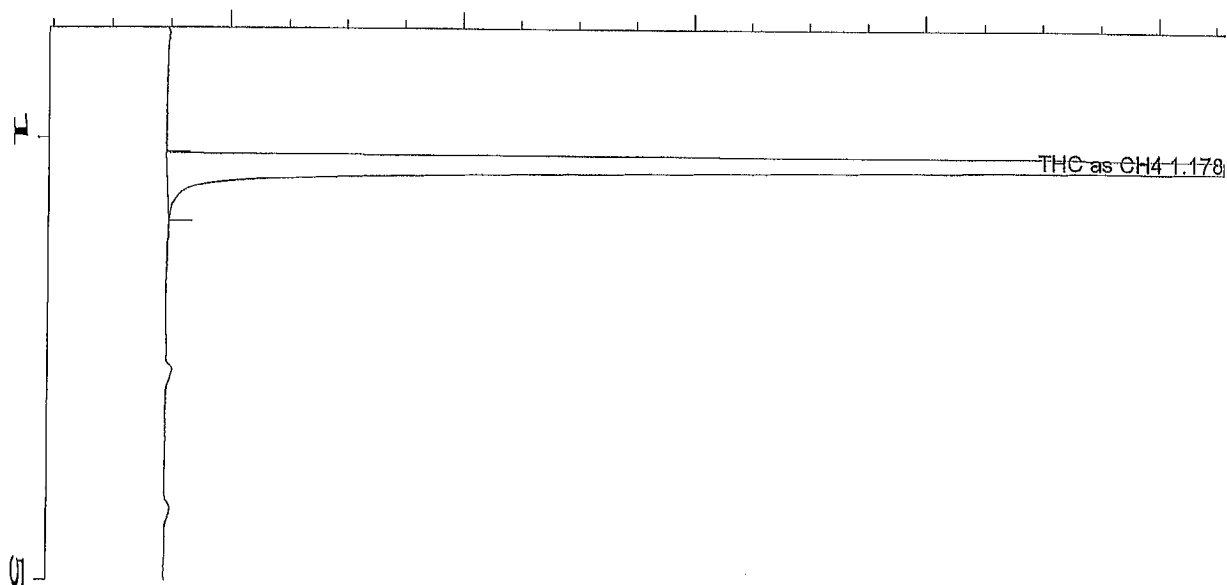


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B41.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:22 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:27 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1B -  
 Tr#73342 - 15:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B41.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.219	1094	BV	0.114	1	0.817	THC as CH4
1.286	1835	VB	0.143		1.499	* uncalibrated *
3.073	5311	BB	0.129		4.338	* uncalibrated *
4.328	9458	BV	0.163		7.725	* uncalibrated *



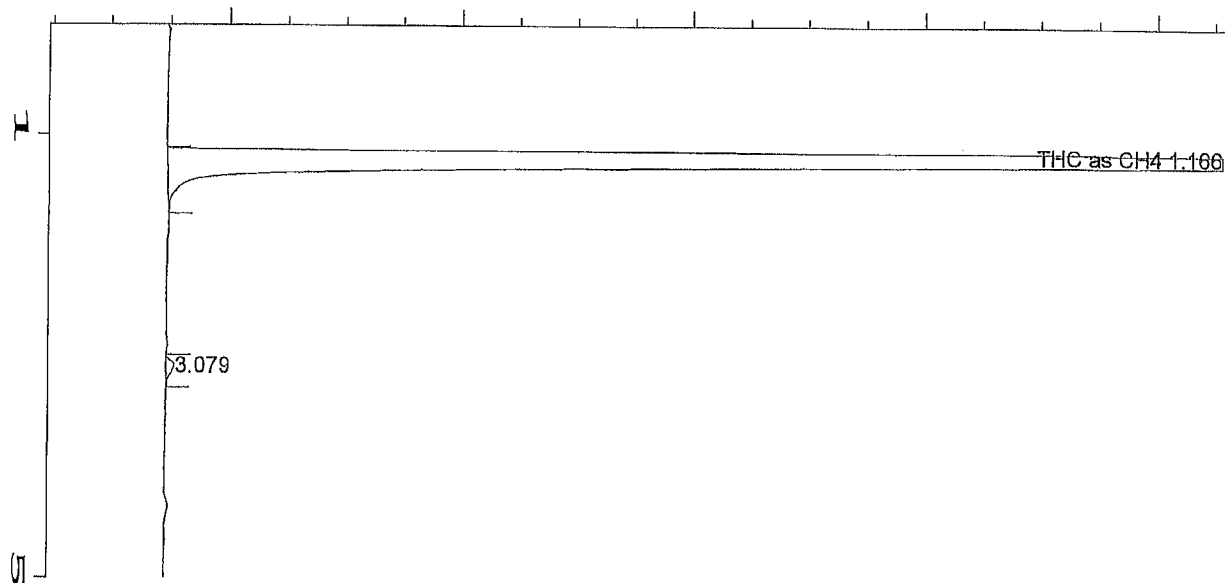
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:19 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:25 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.178	121222	BB	0.098	1	99.239	THC as CH4

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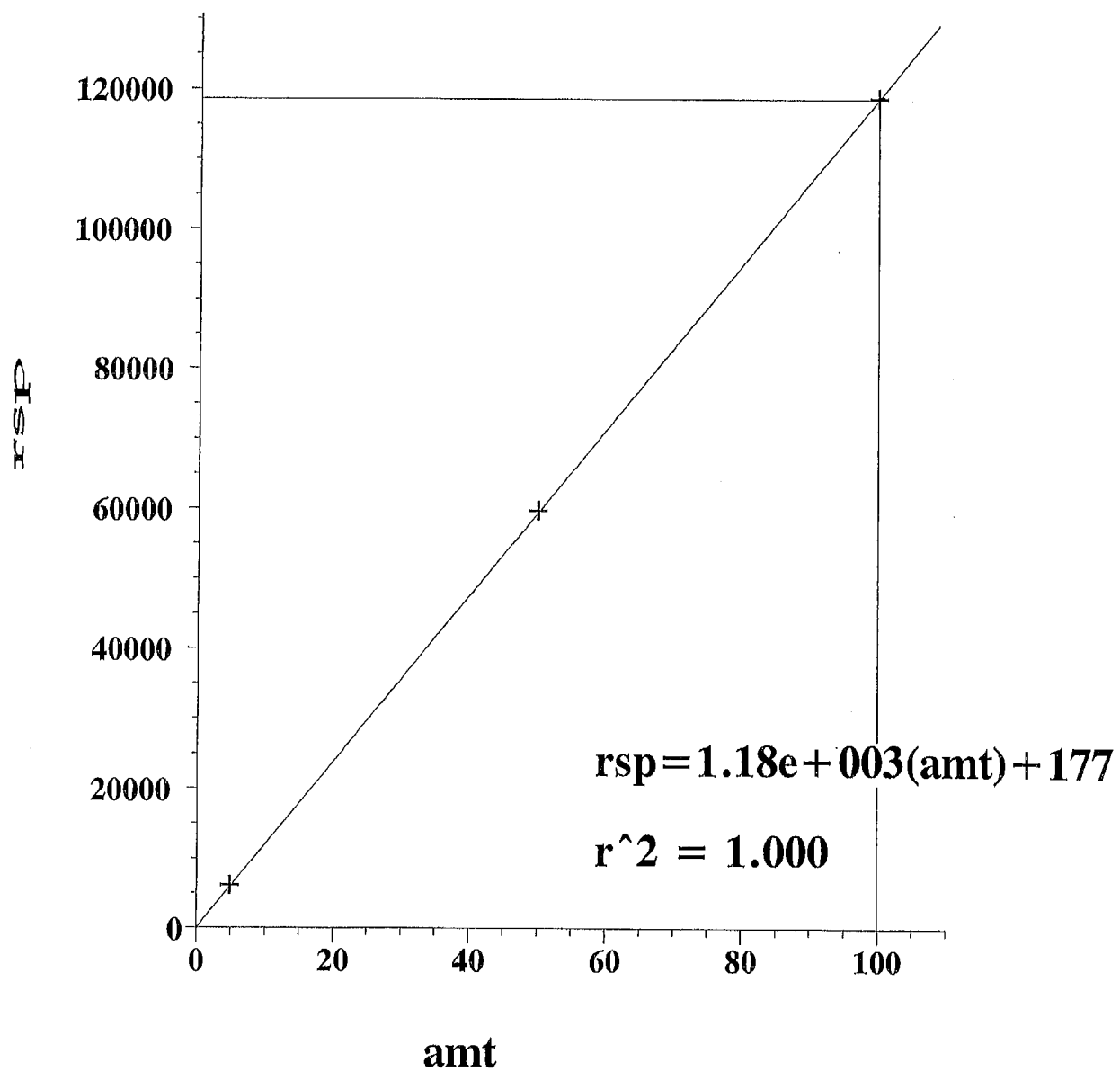
# External Standard Report

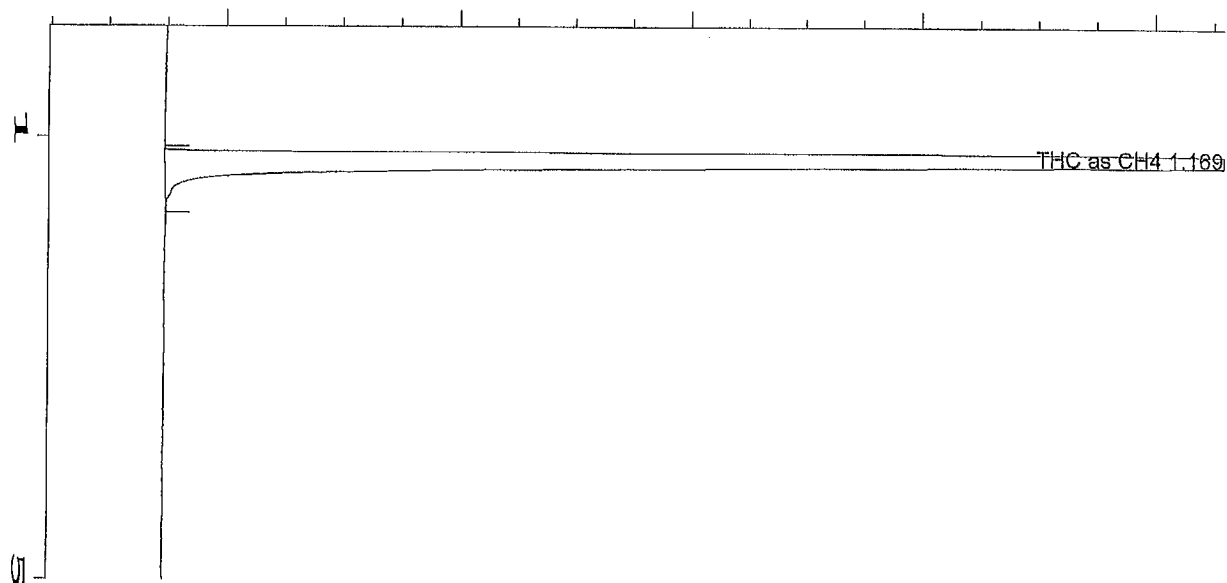
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B42.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:49 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1B -  
 Tr#73342 - 15:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B42.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.166	121230	BB	0.095	1	99.245	THC as CH4
3.079	569	BB	0.109		0.464	* uncalibrated *

## THC as CH4





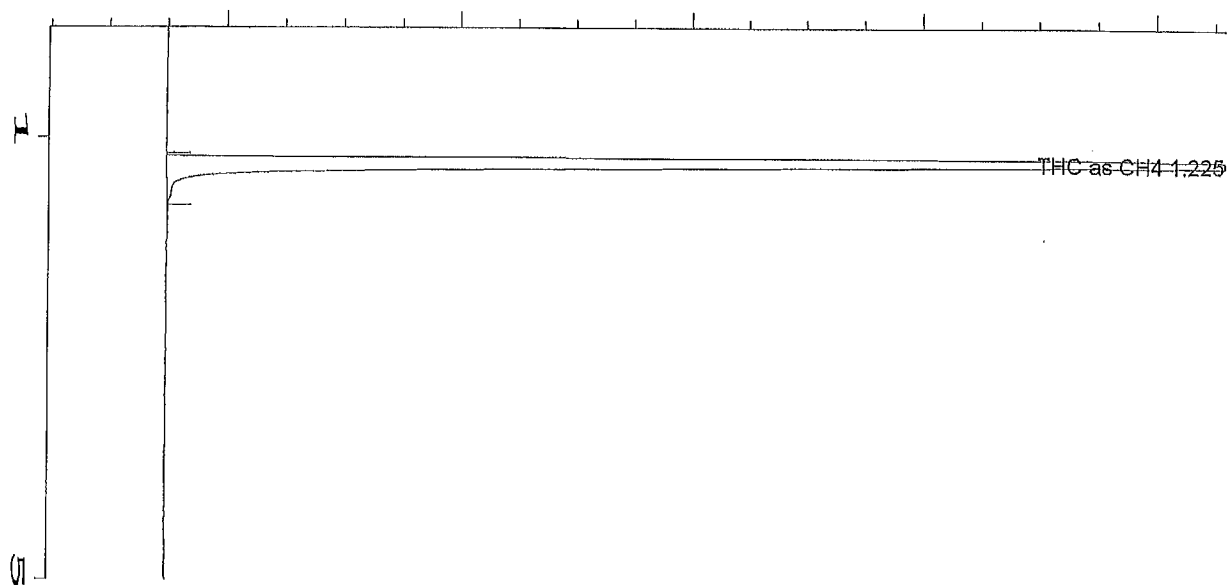
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\1CAL0001.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 1 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:15 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:42 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\1CAL0001.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	118589	BB	0.097	1	99.948	THC as CH4

=====



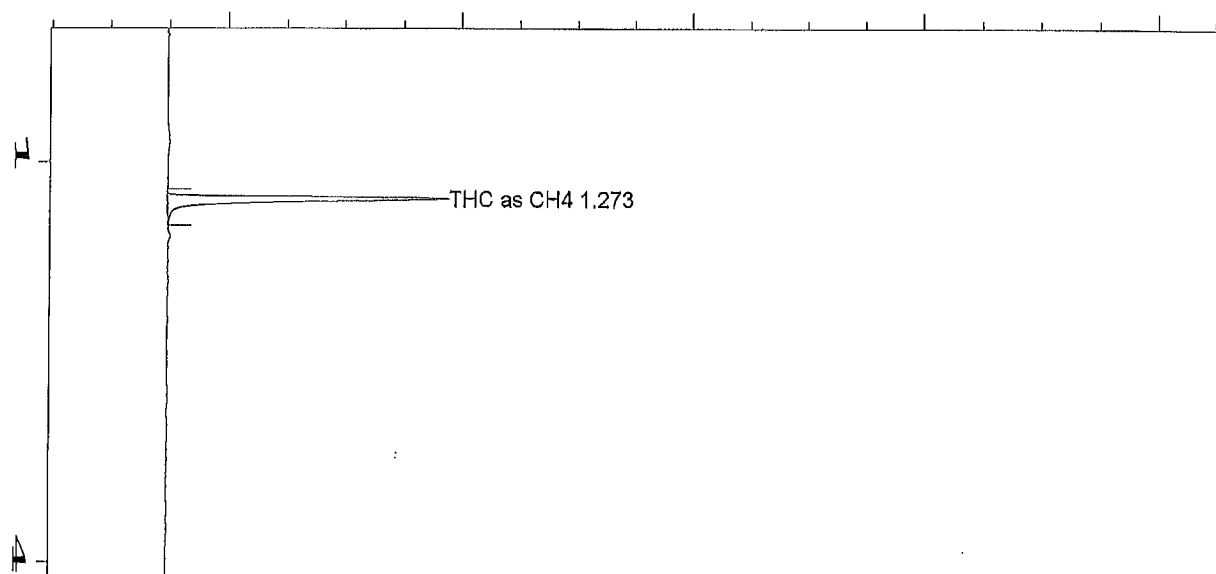
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\2CAL0002.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:27 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:42 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\2CAL0002.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.225	59543	BB	0.071	1	50.109	THC as CH4

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 External Standard Report  
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Data File Name   : C:\HPCHEM\2\DATA\2014\20141211\3CAL0003.D
Operator        : Maxxam - GC ID#4130 - BW      Page Number       : 1
Instrument       : GC ID4130                    Vial Number          :
Sample Name      : Cal 3  0.025 cc               Injection Number     :
Run Time Bar Code:                               Sequence Line        :
Acquired on      : 11 Dec 14  02:34 PM           Instrument Method    : M18-DB-L.MTH
Report Created on: 11 Dec 14  02:42 PM           Analysis Method      : M18-DB-L.MTH
Last Recalib on  : 11 Dec 14  02:41 PM           Sample Amount        : 0
Multiplier       : 1                             ISTD Amount          :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\3CAL0003.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.273	6033	BB	0.038	1	4.944	THC as CH4

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### Method Information

FID - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data aquisition, Range=0, Attn=0. Oven 200 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-10-27-23 for calibration, 11-11-01-26 for span check.

### Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.060	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-1	INITIAL

### Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.225	1	100.0	8.4325e-004	1	THC as CH4
		2	50.0	8.3973e-004		
		3	5.0	8.2877e-004		

### Calibration Settings

Title:  
THC Calibration as CH4 - 2014-12-11

Reference window:	50.000 %
Non-reference window:	50.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	8.4325e-004
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

### Sample ISTD Information

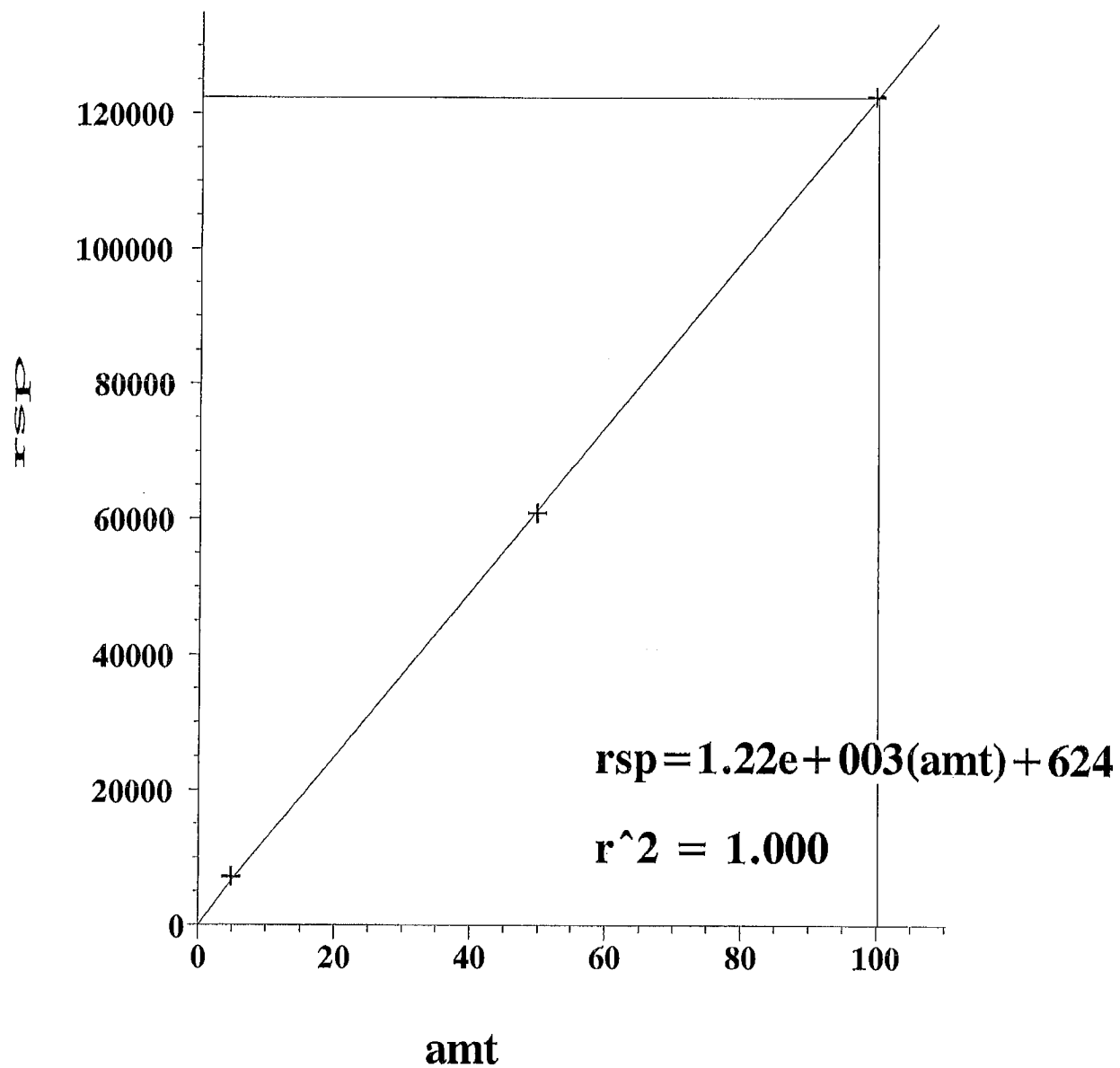
No Sample ISTD Amounts

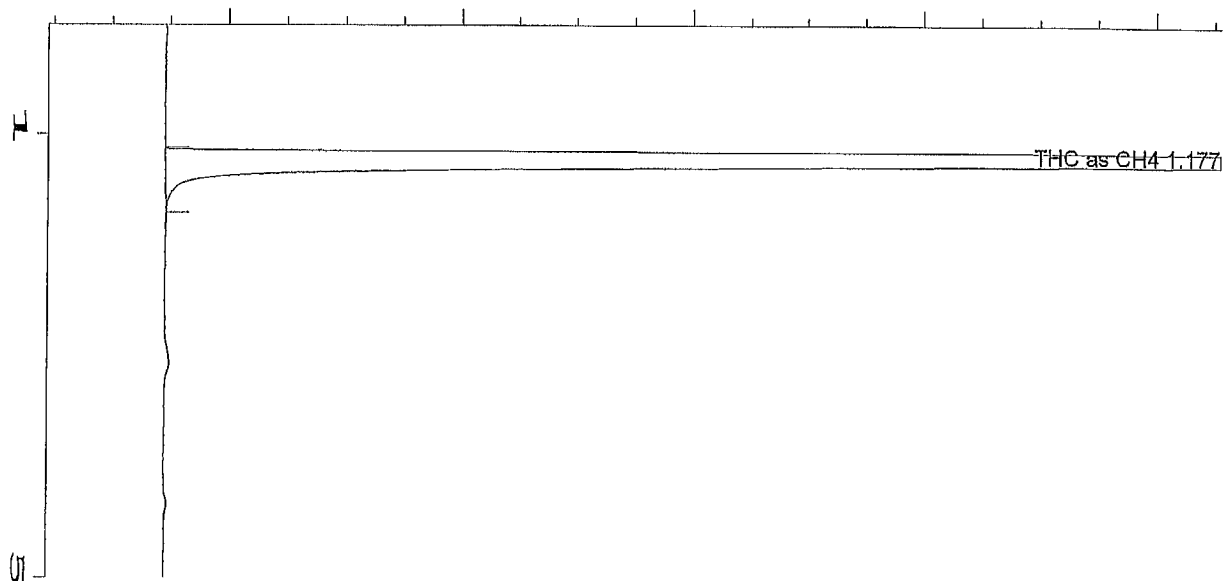
### Multilevel Information

Fit: Linear  
Origin: Force



## THC as CH4





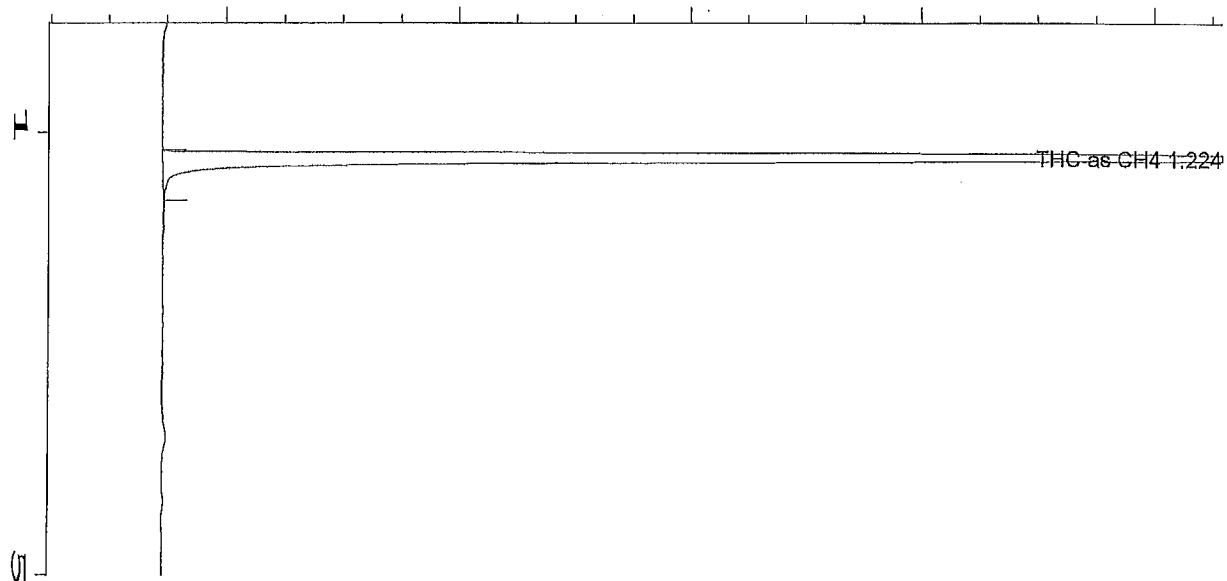
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\1CAL0015.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 1 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:29 AM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:03 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\1CAL0015.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	122435	BB	0.100	1	100.236	THC as CH4

=====



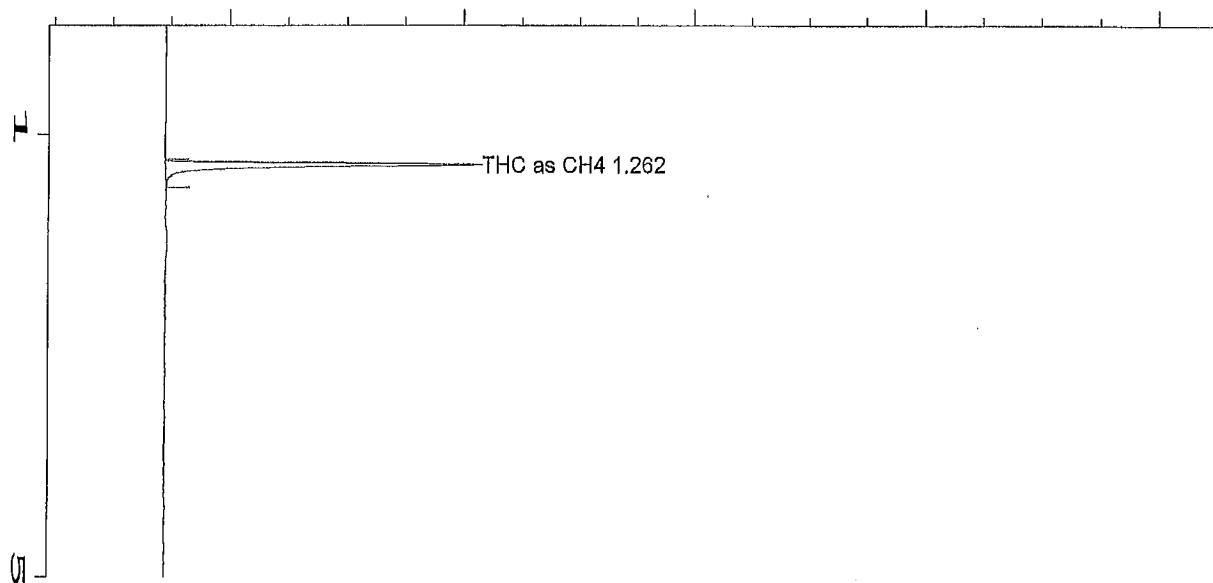
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\2CAL0016.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:37 AM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:04 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\2CAL0016.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.224	60779	BB	0.070	1	49.501	THC as CH4

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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\3CAL0018.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 2 0.025 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:46 AM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:04 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\3CAL0018.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.262	7020	BB	0.040	1	5.263	THC as CH4

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Method: C:\HPCHEM\2\METHODS\M18-DB-L.MTH

## Method Information

FID - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data aquisition, Range=0, Attn=0. Oven 200 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.060	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-1	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.177	1	100.0	8.1676e-004	1	THC as CH4
		2	50.0	8.2265e-004		
		3	5.0	7.123e-004		

## Calibration Settings

## Title:

THC Calibration as CH4 - 2014-12-13

Reference window:	20.000 %
Non-reference window:	20.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	8.1676e-004
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

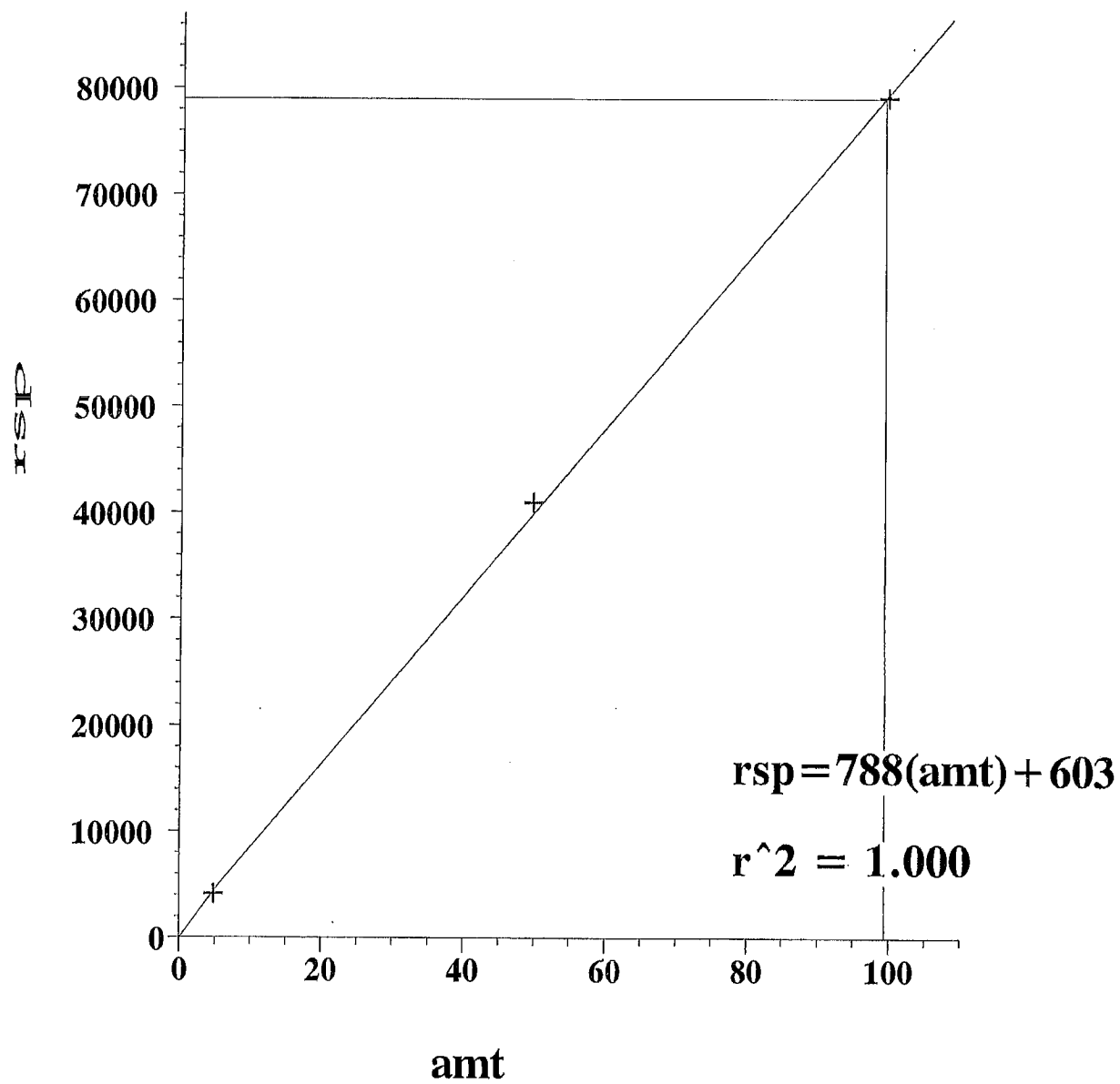
## Sample ISTD Information

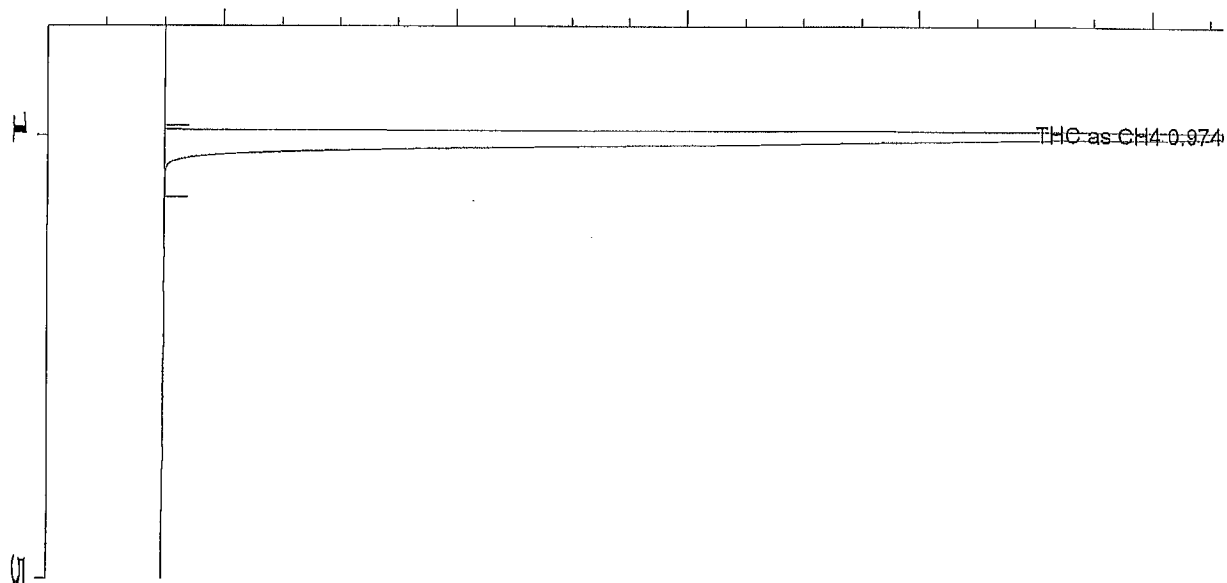
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

## THC as CH4





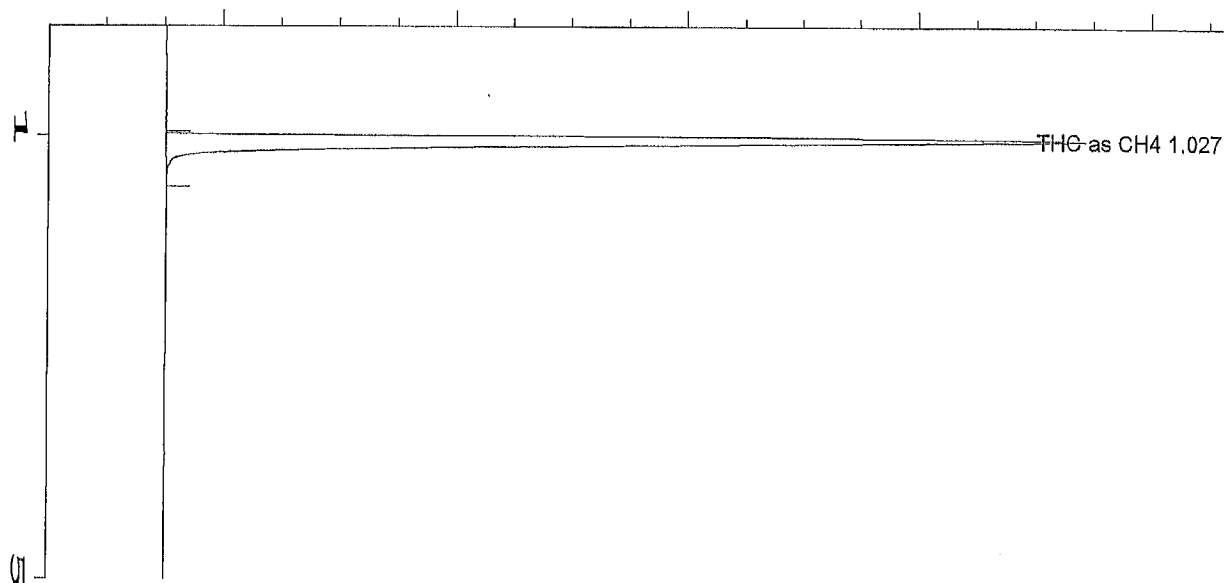
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\1CAL0050.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 1 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:14 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 02:39 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\1CAL0050.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.974	79025	BB	0.098	1	99.475	THC as CH4

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 External Standard Report  
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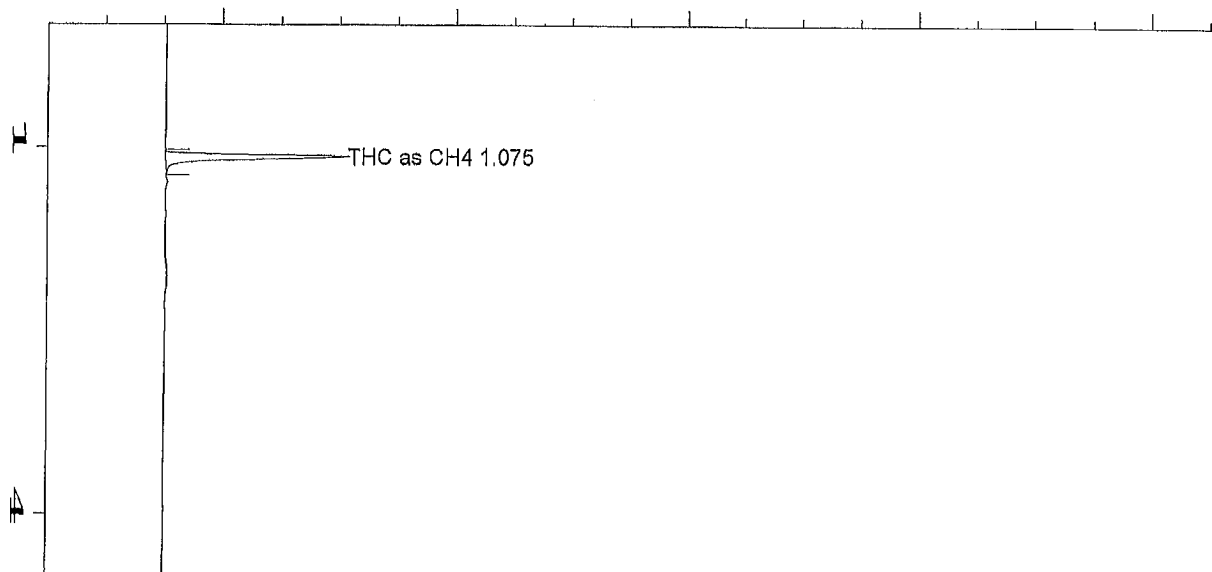
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 02:39 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	40894	BB	0.080	1	51.107	THC as CH4

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External Standard Report

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Data File Name : C:\HPCHEM\1\DATA\2014\20141211\3CAL0052.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 3 0.025 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 02:39 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\3CAL0052.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.075	4086	BV	0.042	1	4.494	THC as CH4

=====

Method: C:\HPCHEM\1\METHODS\M18-DB1.MTH

## Method Information

FID - DB-1 30 meter x 0.53 mm ID x 5 u film. Flow at 5 cc/min, makeup to 30 ml. H2 @ 30 ml. Air @ 300 ml. Packed injection port. Flow = 10

mls. Measured with Humonics Electronic Flowmeter. Signal 1A data aquisition, Range=0, Attn=0. Oven 150 isothermal. Inj @ 150, Det @ 225. 0.5 cc injection size. 100 ppm CH4 Std. Maxxam Internal Lot# 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.100	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-2	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.027	1	100.0	1.2654e-003	1	THC as CH4
		2	50.0	1.2227e-003		
		3	5.0	1.2238e-003		

## Calibration Settings

## Title:

THC as CH4 - 2014-12-11

Reference window:	30.000 %
Non-reference window:	30.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	1.2654e-003
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

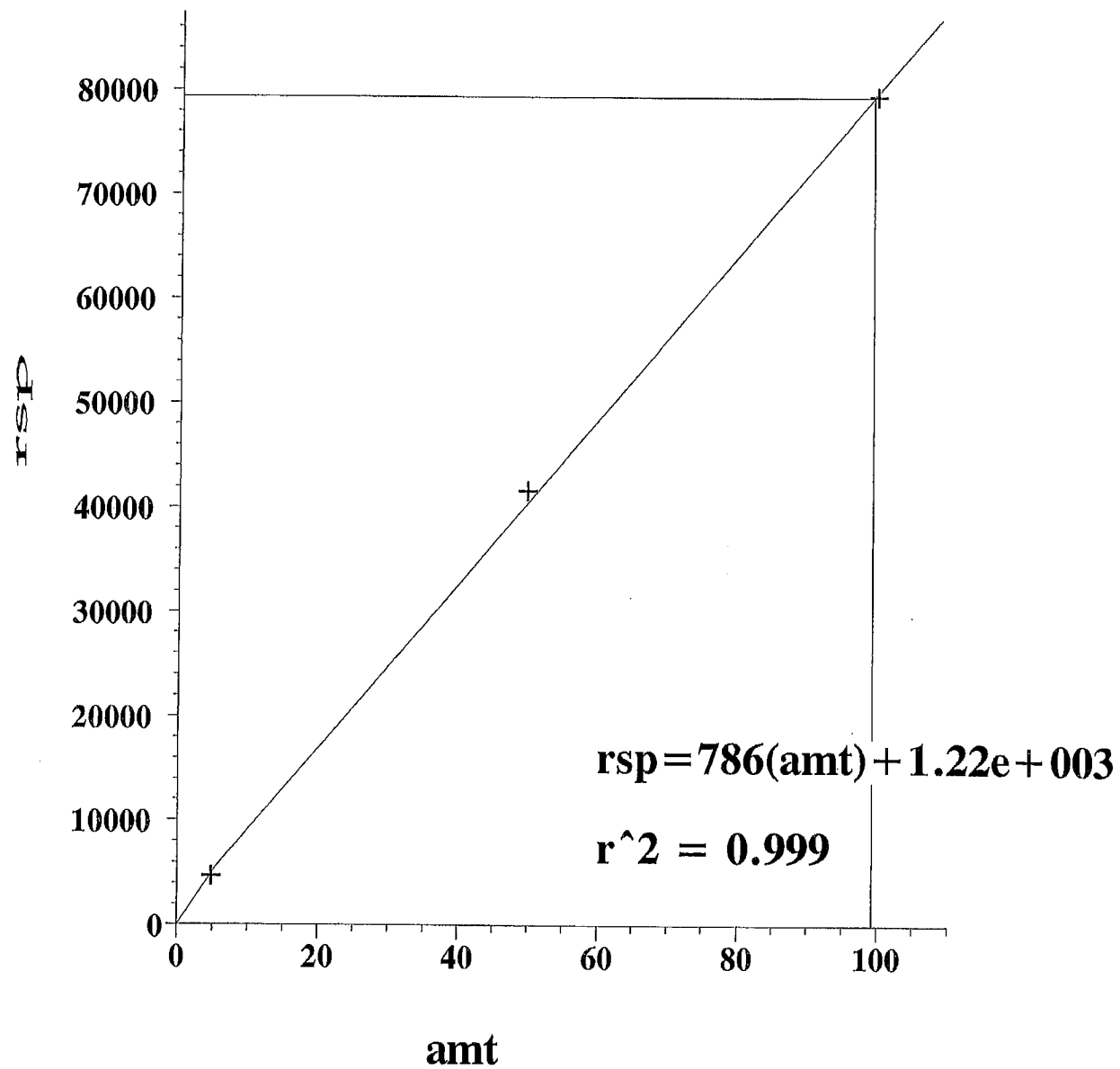
## Sample ISTD Information

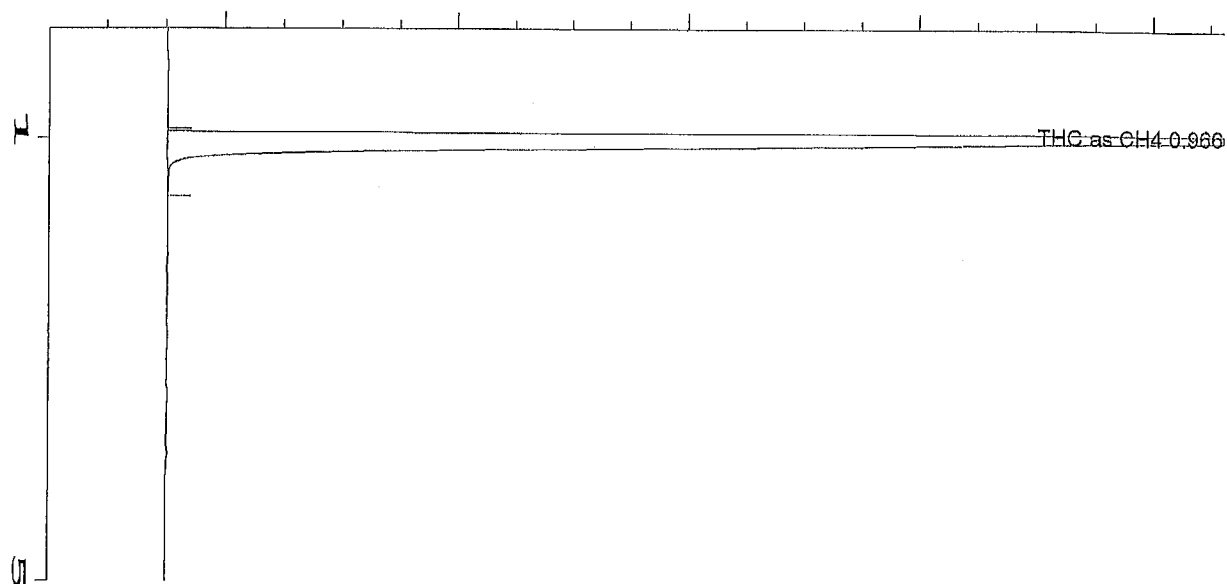
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

## THC as CH4





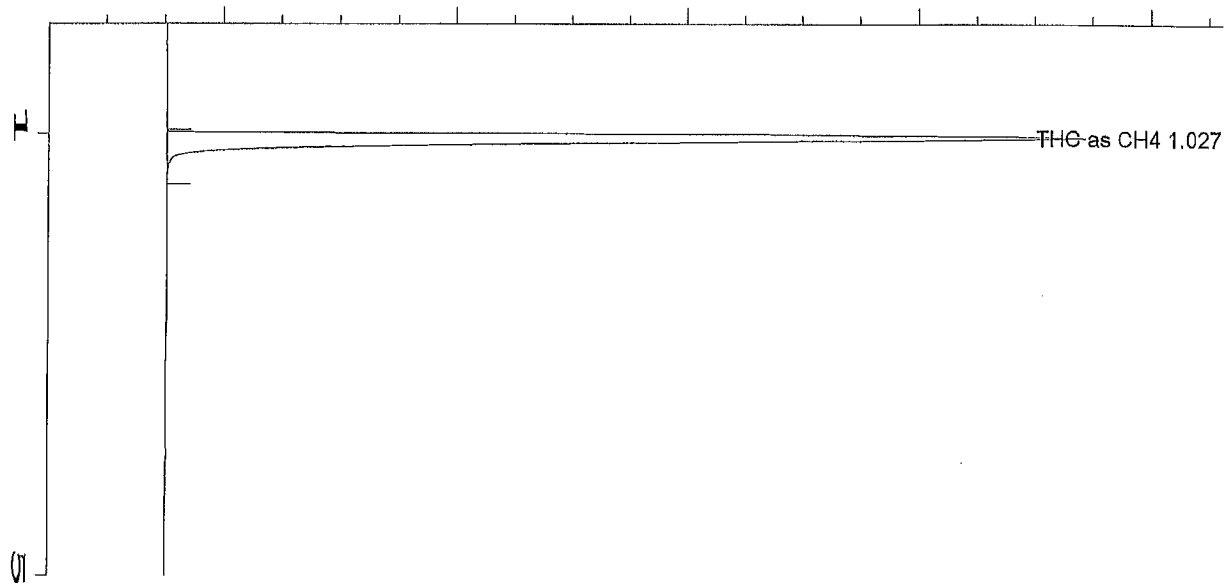
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\1CAL0064.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 1 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:29 AM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 11:54 AM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\1CAL0064.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.966	79370	BB	0.120	1	99.395	THC as CH4

=====



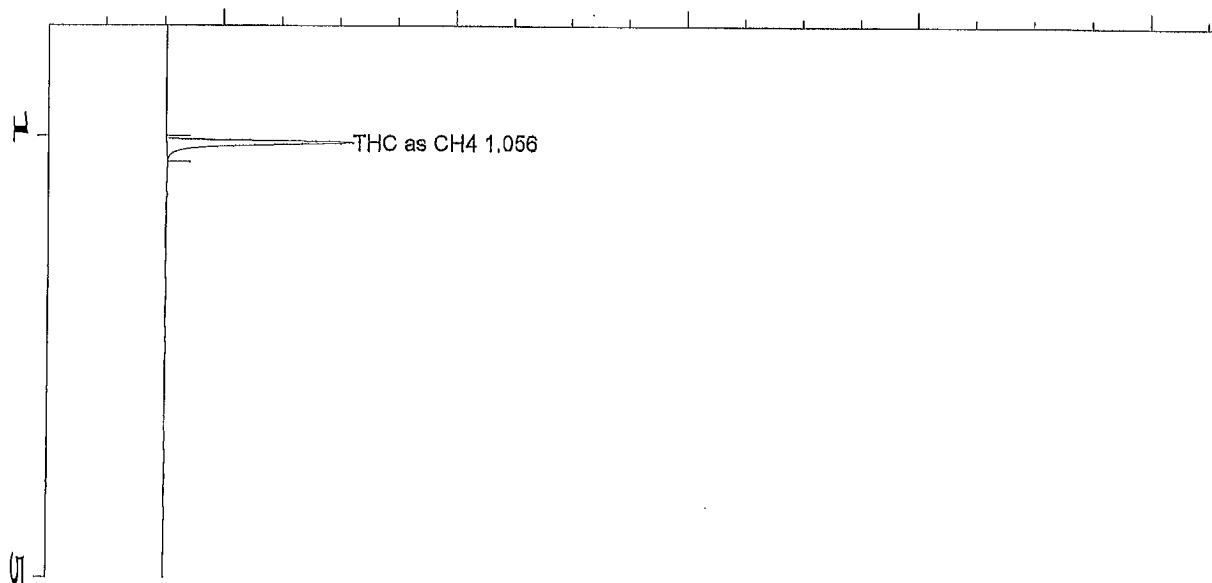
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 11:54 AM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	40894	BB	0.080	1	50.462	THC as CH4

=====



=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\3CAL0066.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 3 0.025cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:46 AM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 11:54 AM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\3CAL0066.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	4619	BV	0.045	1	4.487	THC as CH4

=====

Method: C:\HPCHEM\1\METHODS\M18-DB1.MTH

## Method Information

FID - DB-1 30 meter x 0.53 mm ID x 5 u film. Flow at 5 cc/min, makeup to 30 ml. H2 @ 30 ml. Air @ 300 ml. Packed injection port. Flow = 10 mls. Measured with Humonics Electronic Flowmeter. Signal 1A data aquisition, Range=0, Attn=0. Oven 150 isothermal. Inj @ 150, Det @ 225. 0.5 cc injection size. 100 ppm CH4 Std. Maxxam Internal Lot# 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.100	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-2	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.056	1	100.0	1.2599e-003	1	THC as CH4
		2	50.0	1.2038e-003		
		3	5.0	1.0825e-003		

## Calibration Settings

## Title:

THC as CH4 - 2014-12-13

Reference window:	30.000 %
Non-reference window:	30.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	1.2599e-003
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

## Sample ISTD Information

No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

# Total Hydrocarbon Gas Standards

## Standard Verification



## **CERTIFICATE of ANALYSIS**

### **Customer**

Maxxam Analytics  
Air Services Group

### **Address**

#1 2080 39<sup>th</sup> Avenue NE  
Calgary, Ab  
T2E 6P7

### **ANALYZED CYLINDER**

Manufacturer Praxair  
Identification **11-11-01-26**  
Cylinder Number **CC211407 / Z582116010**  
Cylinder Pressure 1500 psig  
Mixture Type Primary Mix

Certification Date June 21, 2011  
Expiration Date June 21, 2014

Component Methane  
Balance Gas Nitrogen

### **Certified Concentration in ppmv**

Methane **99.9**  
Analytical Uncertainty +/- 1%

### **REFERENCE STANDARDS**

Manufacturer Praxair  
Cylinder Number **Z582436501**  
Certification Date December 31, 2014  
Expiration Date December 31, 2017

Components Methane  
Accuracy +/- 1%

### **INSTRUMENTATION**

Instrument HP 5890A SERIES II GC  
Instrument ID# 4130  
Last Date Calibrated January 19, 2015  
Analytical Principal Flame Ionization

### **ANALYTICAL RESULTS**

Replicate Concentrations (ppmv) - mean values

<u>Test #</u>	<u>1</u>	<u>2</u>	<u>3</u>
Run 1	100.3	100.8	100.5
Run 2	<u>100.8</u>	<u>100.3</u>	<u>100.4</u>
Average	100.6	100.6	100.5
Verified Value (ppmv)	<b>100.5</b>		
Certified Value (ppmv)	<b>99.9</b>		
Relative % Difference	<b>0.6</b>		

ANALYST: Bill Wong  
DATE: January 19, 2015

**Maxxam Analytics - Air Services Group, Calgary, Ab.**





Praxair Canada Inc.  
41 Consolidated Drive  
Paris, Ontario N3L 3G2  
Tel: 519-442-6373  
Fax: 519-442-1540

12/23/2014

PRAXAIR EDMONTON PLANT  
9501 34 ST  
(449-0778)  
EDMONTON, AB T6B 2X6  
Attention: MAXXAM ANALYTICS

Work Order No. **22426033**  
Customer Reference No.

Product Lot/Batch No. **Y787435306**  
Product Part No. **NI CO100M1P-AS**

## CERTIFICATE OF ANALYSIS

### Primary Standard

<u>Component</u>	<u>Requested Concentration</u>	<u>Certified Concentration</u>	<u>Analytical Principle</u>	<u>Analytical Accuracy</u>
Methane	100 ppm	101 ppm	V	±1ppm
Carbon monoxide	100 ppm	101 ppm	V	±1ppm
Nitrogen	balance	balance		

Analytical Instruments: **Gravimetric Analysis~~~**


Cylinder Style: **AS**  
Cylinder Pressure @70F: **2000 psig**  
Cylinder Volume: **4.011 M3**  
Valve Outlet Connection: **CGA-350**

Filling Method: **Gravimetric**  
Date of Fill: **12/19/2014**

Cylinder No(s): **DT0006735**

Comments: **This mixture was filled gravimetrically on a scale calibrated using NCR traceable weights - certificate # 1345865, M13-0352, 1345613.**

Analyst:  **Jamie Roach**

QA Reviewer:  **Courtney Edwards**

The gas calibration cylinder standard prepared by Praxair Canada Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Canada 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.

#### Key to Analytical Techniques:

A Flame Ionization with Methanizer	B Gas Chromatography with Discharge Ionization Detector	C Gas Chromatography with Electrolytic Conductivity Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Helium Ionization Detector	G Gas Chromatography with Methanizer Carbonizer	H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer	J Gas Chromatography with Thermal Conductivity Detector	K Binary Gas Analyzer with Thermal Conductivity Detector	L Infrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
Q Total Hydrocarbon Analyzer	R Wet Chemical	S Detector Tube	T Odor
U Chemiluminescence	V Gravimetric Methods	W Electrolytic Cell/Electrochemical	

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Canada 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 Canada Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.



Praxair Canada, Inc.  
9501-34th Street  
Edmonton, AB T6B 2X6  
Tel: 780 449 0778  
Fax: 780 449 5302

01/09/2015

**PRAXAIR CALGARY DIST CTR**  
**8009 42 ST SE (2366511)**  
**CALGARY, AB T2C 2T4**

Work Order No. **22051297**  
Customer Reference No.

Product Lot/Batch No. **Z582436501**  
Product Part No. **NI CO100M1P-AS**


## **CERTIFICATE OF ANALYSIS**

### **Primary Standard**

<u>Component</u>	<u>Requested Concentration</u>	<u>Certified Concentration</u>	<u>Analytical Principle</u>	<u>Analytical Accuracy</u>
<b>Carbon monoxide</b>	<b>100 ppm</b>	<b>100 ppm</b>	<b>U</b>	<b>±1% rel</b>
<b>Methane</b>	<b>100 ppm</b>	<b>99.6 ppm</b>	<b>U</b>	<b>±1% rel</b>
<b>Nitrogen</b>	<b>balance</b>	<b>balance</b>		

Analytical Instruments: **Mettler-Toledo Analytical Balance~ID2sx/USA~~**  
Cylinder Style: **AS**  
Cylinder Pressure @70F: **2000 psig**  
Cylinder Volume: **141.71 ft3**  
Valve Outlet Connection: **CGA-350**  
Cylinder No(s): **CC248430**

Filling Method: **Gravimetric**  
Date of Fill: **12/31/2014**  
Expiration Date: **12/31/2017**

Analyst:   
**Pascal Visentin**

The gas calibration cylinder standard prepared by Praxair Canada, Inc. is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair Canada, 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.

Key to Analytical Techniques:			
A	Flame Ionization with Methanizer	B	Gas Chromatography with Discharge Ionization Detector
E	Gas Chromatography with Flame Photometric Detector	F	Gas Chromatography with Helium Ionization Detector
I	Gas Chromatography with Reduction Gas Analyzer	J	Gas Chromatography with Thermal Conductivity Detector
M	Mass Spectrometry - MS or GC/MS	N	By Difference of Typical Impurities
Q	Total Hydrocarbon Analyzer	R	Wet Chemical
U	Gravimetric Methods	V	Electrochemical
		C	Gas Chromatography with Electrolytic Conductivity Detector
		G	Gas Chromatography with Methanizer Carbonizer
		K	Binary Gas Analyzer with Thermal Conductivity Detector
		O	Paramagnetic
		S	Detector Tube
		W	Gas Chromatography with Chemiluminescence Detector
		D	Gas Chromatography with Flame Ionization Detector
		H	Gas Chromatography with Photoionization Detector
		L	Infrared - FTIR or NDIR
		P	Specific Water Analyzer
		T	Odor

#### **IMPORTANT**

The information contained herein has been prepared at your request by personnel within Praxair Canada, 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 Canada, Inc. arising out of the use of the information contained herein exceed the fee established for providing such information.

Method: C:\HPCHEM\2\METHODS\M18-DB-L.MTH

## Method Information

FID - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 150 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-11-01-26 for calibration, Lot# Y787435306 & Z582436501 for reference.

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.096	1	100.0	8.3299e-004	1	THC as CH4
		2	50.0	8.4261e-004		
		3	5.0	7.7592e-004		

## Calibration Settings

## Title:

THC Calibration as CH4 - 2015-01-19

Reference window: 20.000 %  
Non-reference window: 20.000 %  
Units of amount: ppmv  
Multiplier: 1.0  
RF uncal peaks: 8.3299e-004  
ISTD# to adjust uncal peaks: 0  
Sample Amount: 0.0

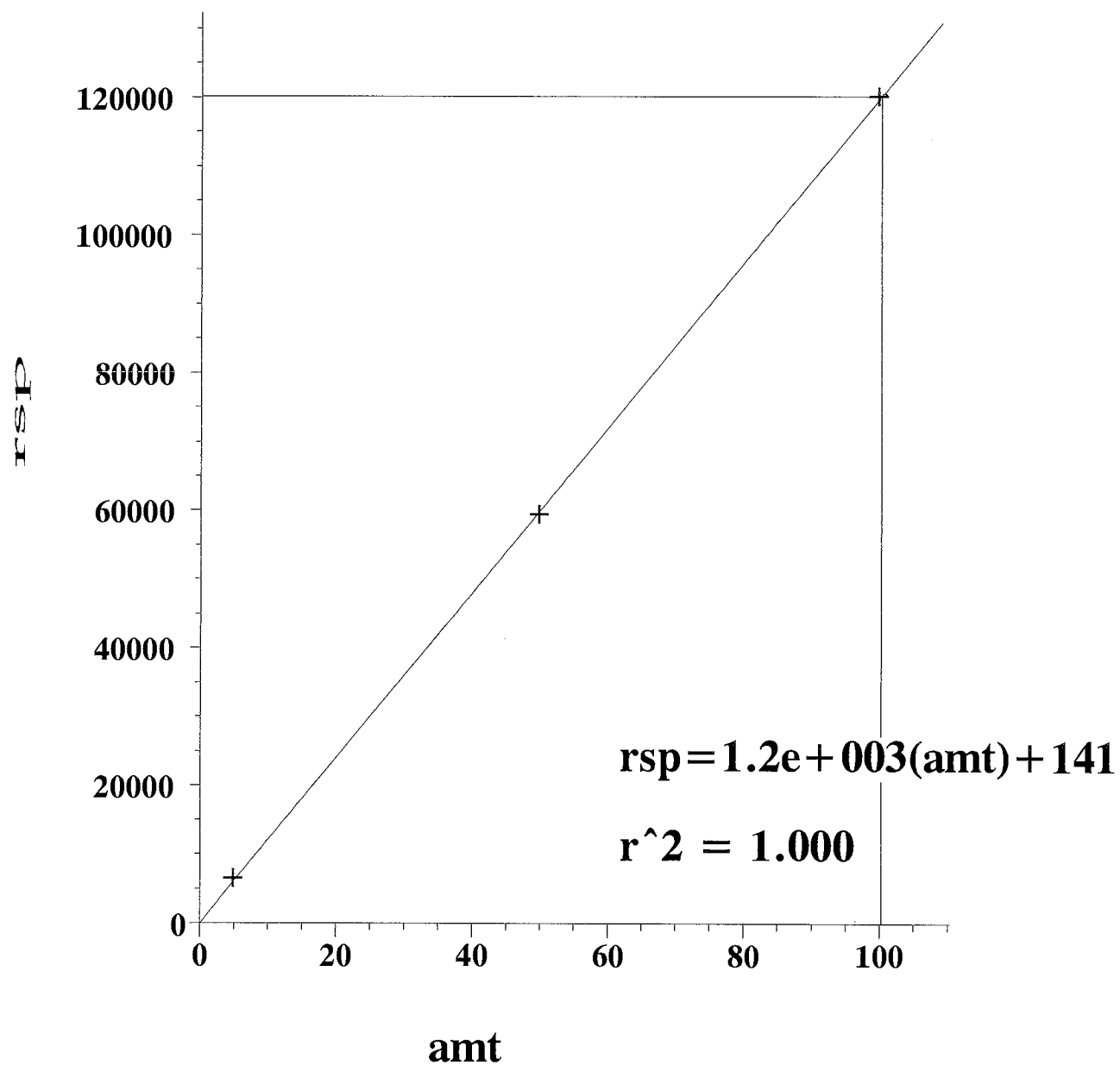
## Sample ISTD Information

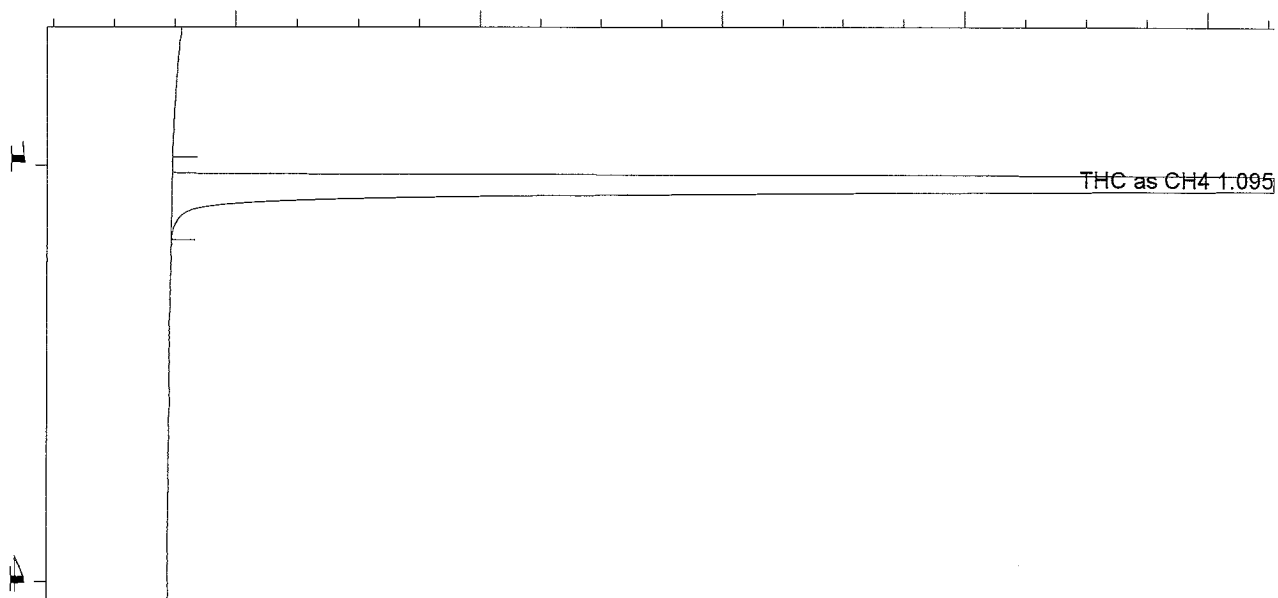
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

## THC as CH4





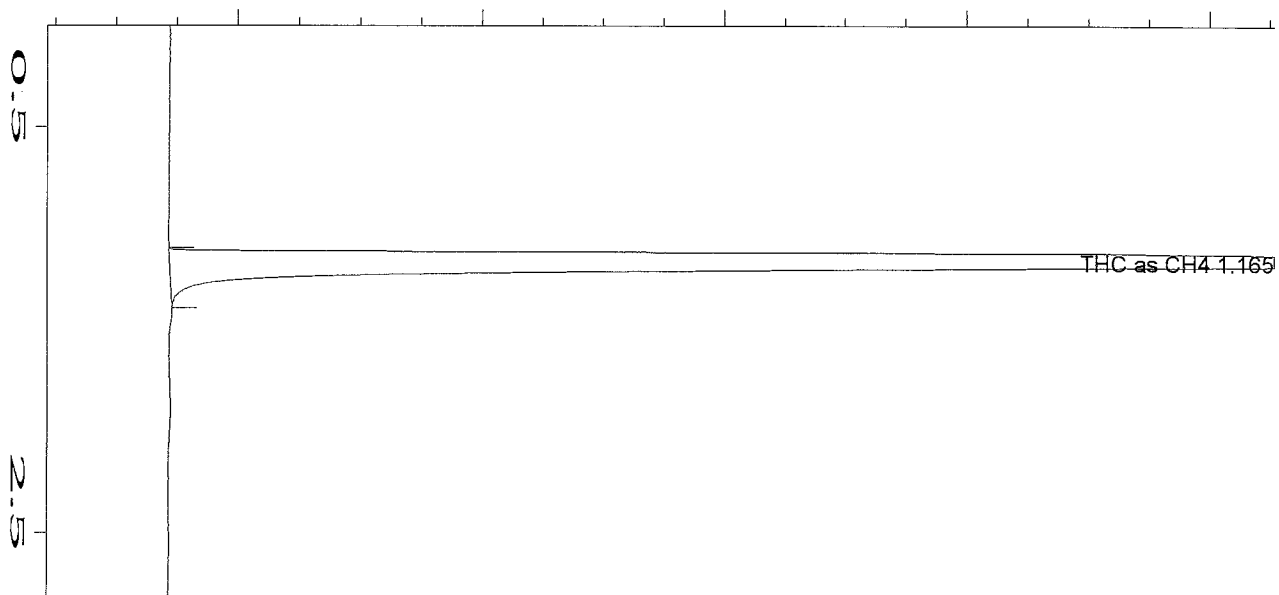
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 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\2\DATA\2014\20150119\1CAL0001.D	
Operator	: Maxxam - GC ID#4130 - BW	Page Number : 1
Instrument	: GC ID4130	Vial Number :
Sample Name	: Cal 1 0.5 inj	Injection Number :
Run Time Bar Code:		Sequence Line :
Acquired on	: 19 Jan 15 10:08 PM	Instrument Method: M18-DB-L.MTH
Report Created on:	: 19 Jan 15 11:51 AM	Analysis Method : M18-DB-L.MTH
Last Recalib on	: 19 JAN 15 10:21 PM	Sample Amount : 0
Multiplier	: 1	ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\1CAL0001.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.095	120002	BV	0.088	1	100.202	THC as CH4

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=====  
 External Standard Report  
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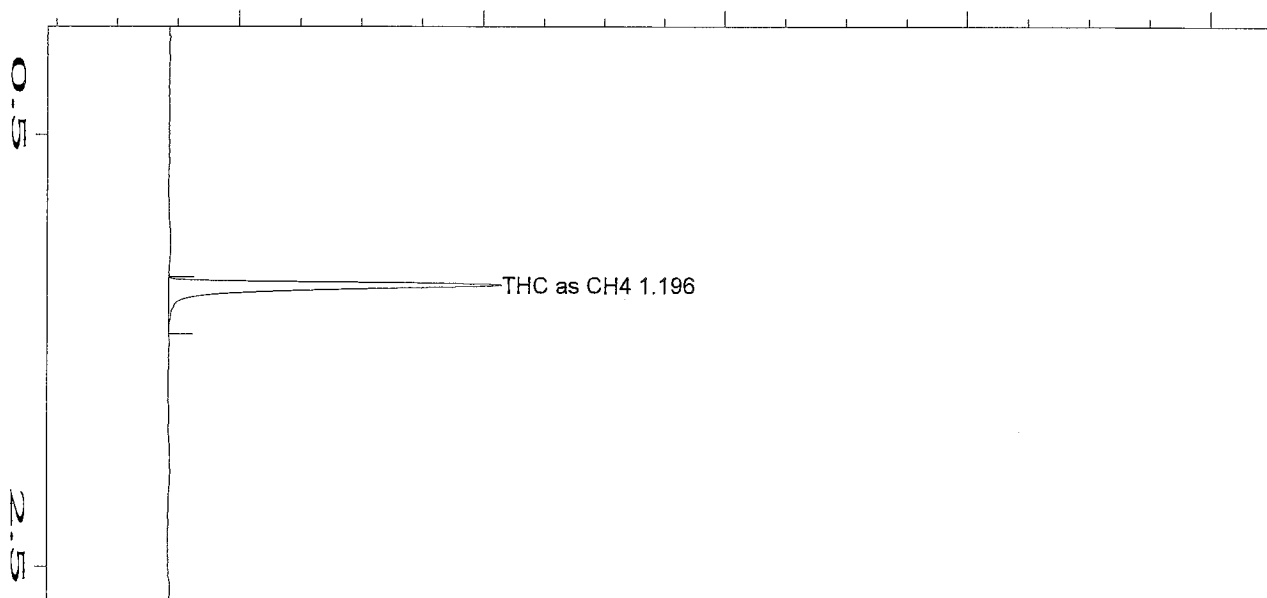
Data File Name	: C:\HPCHEM\2\DATA\2014\20150119\2CAL0002.D	Page Number	: 1
Operator	: Maxxam - GC ID#4130 - BW	Vial Number	:
Instrument	: GC ID4130	Injection Number	:
Sample Name	: Cal 2 0.25 inj	Sequence Line	:
Run Time Bar Code:		Instrument Method:	M18-DB-L.MTH
Acquired on	: 19 Jan 15 10:13 PM	Analysis Method	: M18-DB-L.MTH
Report Created on:	19 Jan 15 11:51 AM	Sample Amount	: 0
Last Recalib on	: 19 JAN 15 10:21 PM	ISTD Amount	:
Multiplier	: 1		

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\2CAL0002.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	59009	BV	0.068	1	49.213	THC as CH4

=====





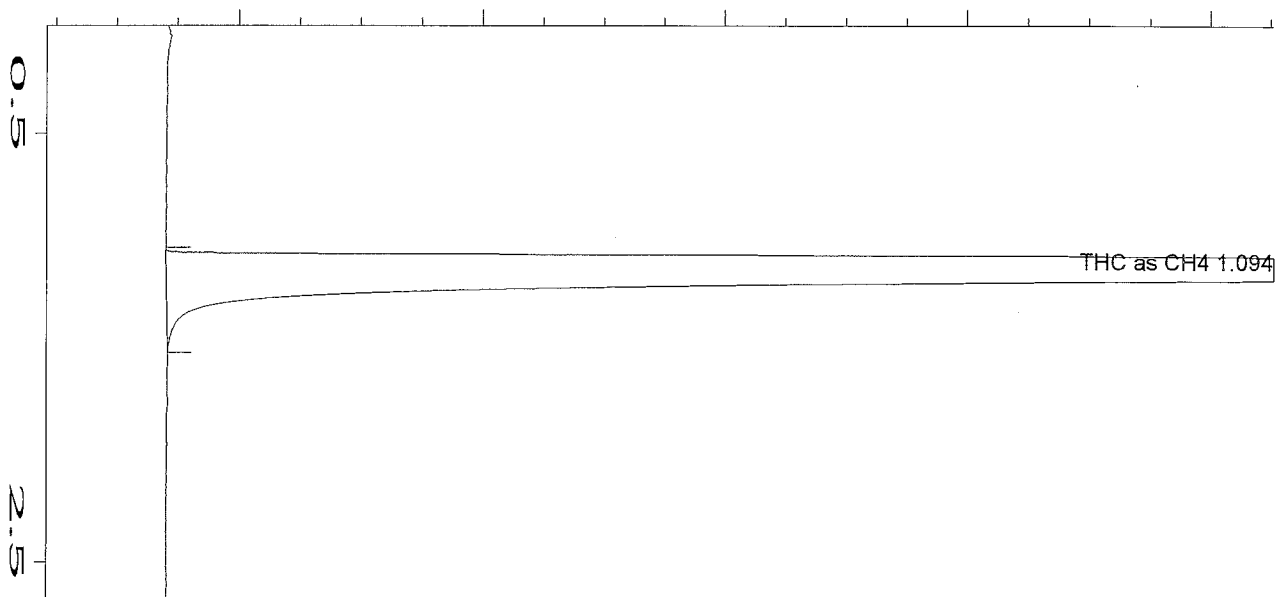
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 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\2\DATA\2014\20150119\3CAL0003.D	
Operator	: Maxxam - GC ID#4130 - BW	Page Number : 1
Instrument	: GC ID4130	Vial Number :
Sample Name	: Cal 3 0.025 inj	Injection Number :
Run Time Bar Code:		Sequence Line :
Acquired on	: 19 Jan 15 10:17 PM	Instrument Method: M18-DB-L.MTH
Report Created on:	: 19 Jan 15 11:51 AM	Analysis Method : M18-DB-L.MTH
Last Recalib on	: 19 JAN 15 10:21 PM	Sample Amount : 0
Multiplier	: 1	ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\3CAL0003.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.196	6458	BV	0.036	1	5.281	THC as CH4

=====



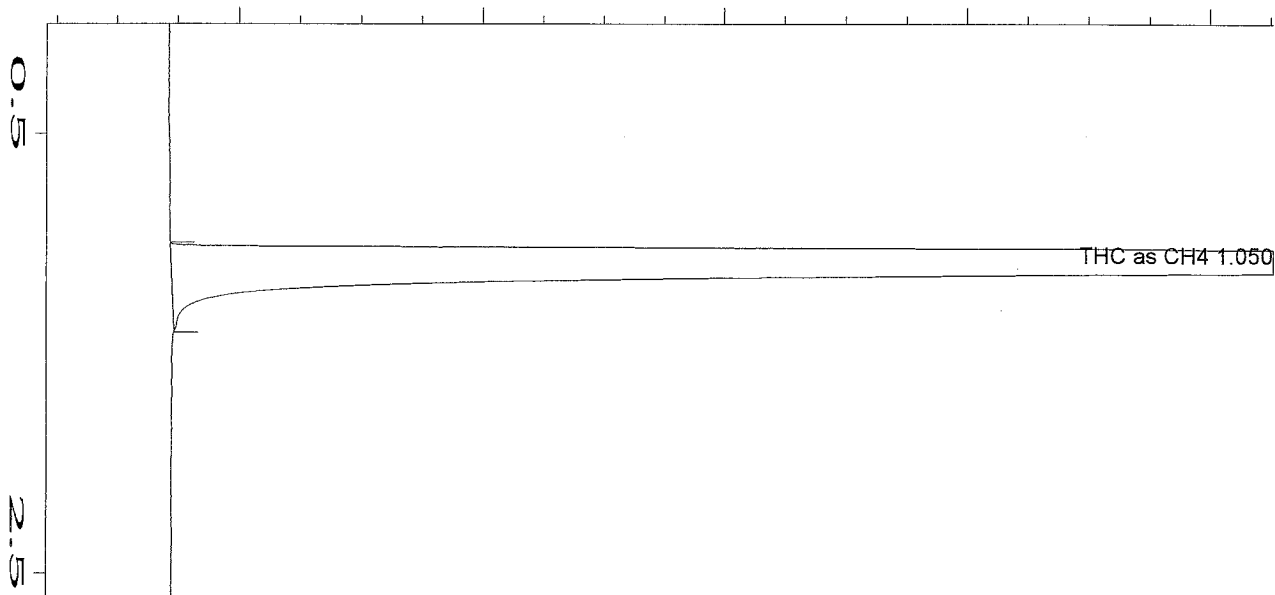
Internal Lot # 11-11-01-26

# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0010.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 11:22 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 11:52 AM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0010.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.094	120158	PV	0.091	1	100.333	THC as CH4



INTERVAL LOT# 11-11-01-26

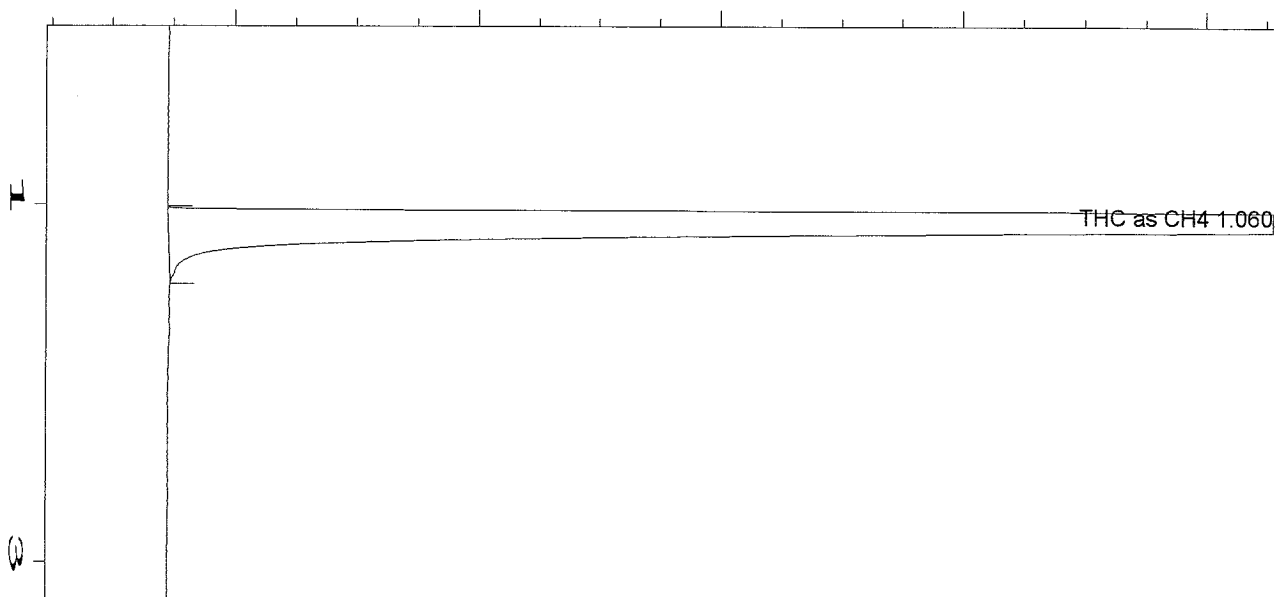
External Standard Report

```

Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0011.D
Operator            : Maxxam - GC ID#4130 - BW
Instrument           : GC ID4130
Sample Name         : Span 0.5 inj
Run Time Bar Code   :
Acquired on         : 19 Jan 15 11:58 AM
Report Created on   : 19 Jan 15 12:03 PM
Last Recalib on    : 19 JAN 15 10:21 PM
Multiplier          : 1
Page Number         : 1
Vial Number         :
Injection Number    :
Sequence Line       :
Instrument Method    : M18-DB-L.MTH
Analysis Method     : M18-DB-L.MTH
Sample Amount       : 0
ISTD Amount         :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0011.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.050	120737	BB	0.086	1	100.816	THC as CH4



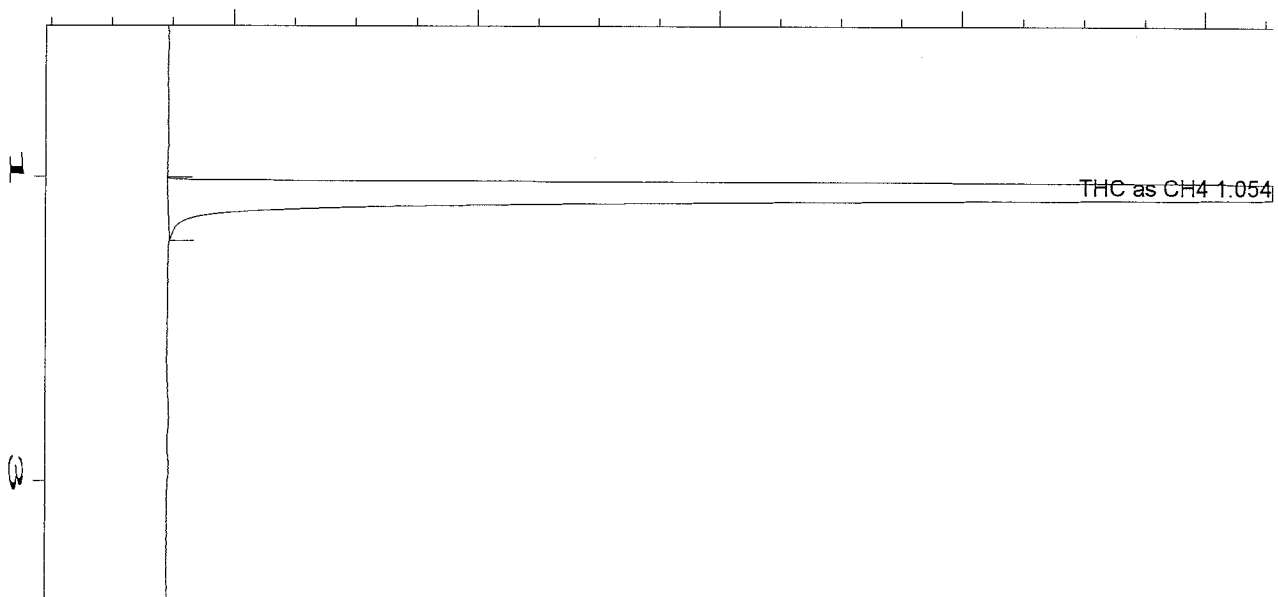
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0014.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 12:19 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 12:22 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # Z582436501 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0014.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.060	119394	BB	0.088	1	99.694	THC as CH4

=====



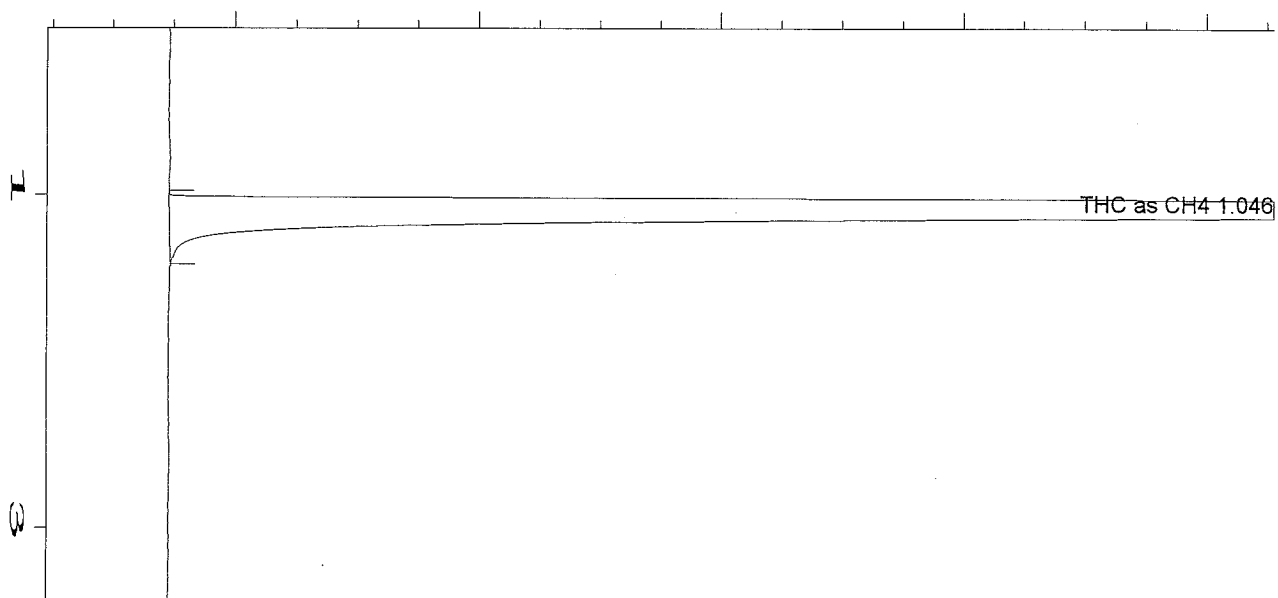
=====  
 External Standard Report  
 =====

```

Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0016.D
Operator           : Maxxam - GC ID#4130 - BW      Page Number       : 1
Instrument          : GC ID4130                   Vial Number        :
Sample Name        : Span 0.5 inj                 Injection Number   :
Run Time Bar Code  :                               Sequence Line     :
Acquired on        : 19 Jan 15 12:26 PM           Instrument Method  : M18-DB-L.MTH
Report Created on  : 19 Jan 15 12:30 PM           Analysis Method   : M18-DB-L.MTH
Last Recalib on   : 19 JAN 15 10:21 PM           Sample Amount     : 0
Multiplier         : 1                           ISTD Amount       :
Sample Info        : Lot # Z582436501 - 0.5 cc inj.
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0016.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.054	119163	BB	0.086	1	99.500	THC as CH4



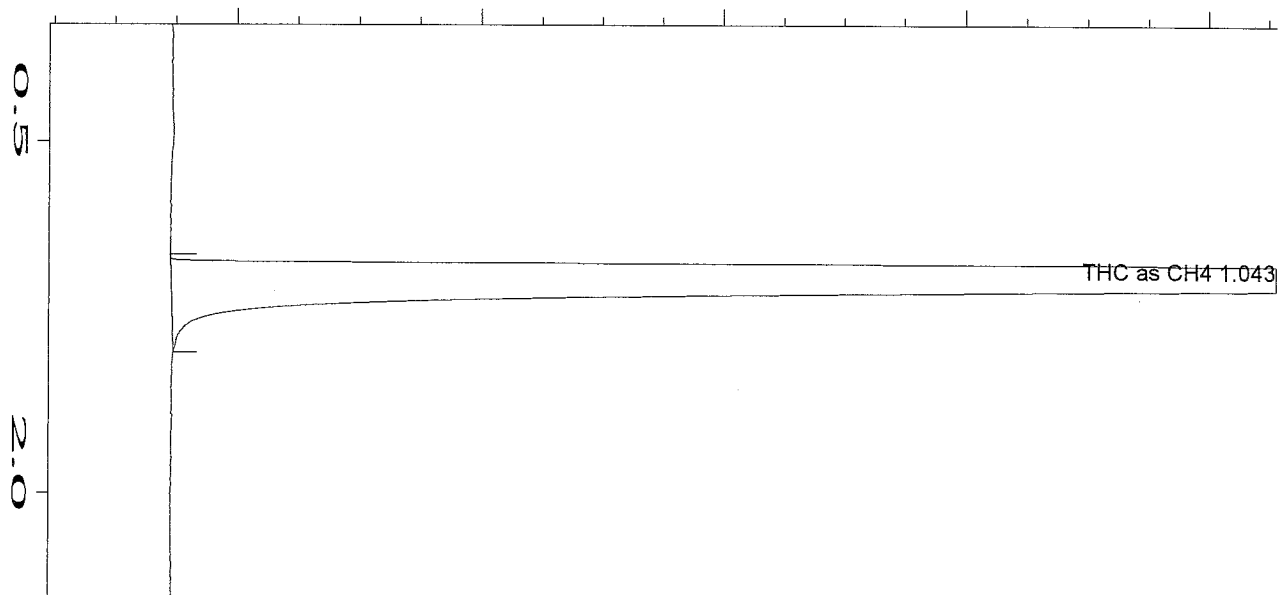
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0017.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 12:32 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 12:35 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # 11-11-01-26 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0017.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.046	120736	BB	0.087	1	100.816	THC as CH4

=====



External Standard Report

```

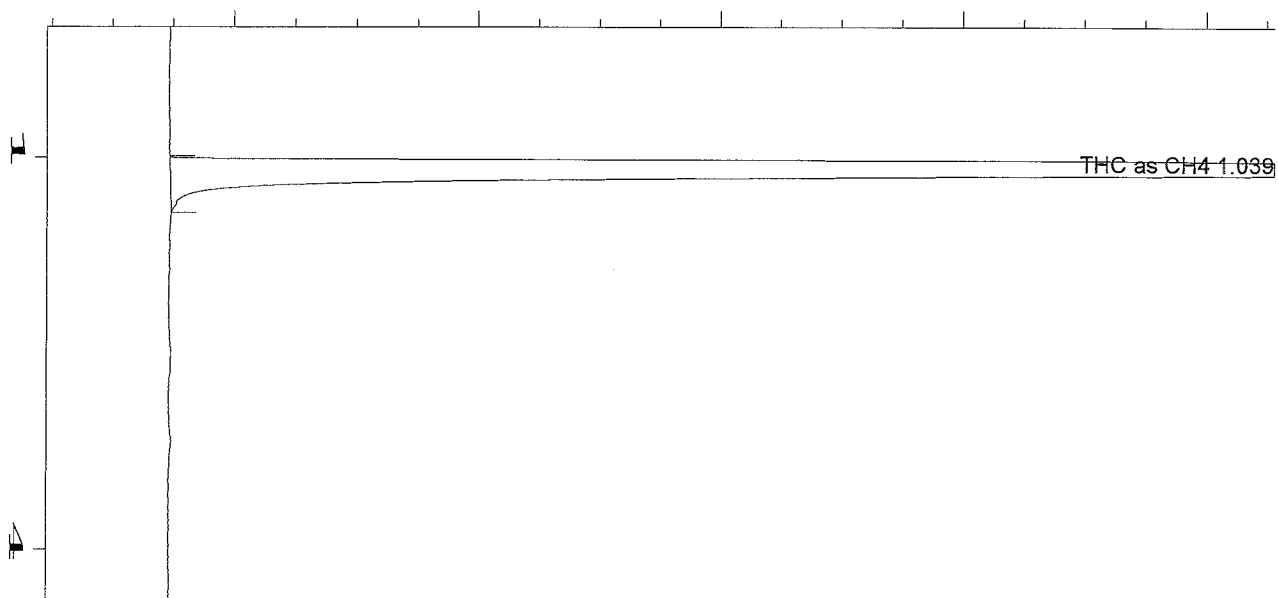
Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0018.D
Operator           : Maxxam - GC ID#4130 - BW
Instrument          : GC ID4130
Sample Name        : Span 0.5 inj
Run Time Bar Code  :
Acquired on        : 19 Jan 15 12:36 PM
Report Created on  : 19 Jan 15 12:38 PM
Last Recalib on   : 19 JAN 15 10:21 PM
Multiplier         : 1
Sample Info        : Lot # 11-11-01-26 - 0.5 cc inj.

Page Number        : 1
Vial Number        :
Injection Number   :
Sequence Line      :
Instrument Method   : M18-DB-L.MTH
Analysis Method    : M18-DB-L.MTH
Sample Amount      : 0
ISTD Amount        :

```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0018.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.043	120156	BB	0.085	1	100.330	THC as CH4



External Standard Report

```

Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0019.D
Operator           : Maxxam - GC ID#4130 - BW
Instrument          : GC ID4130
Sample Name        : Span 0.5 inj
Run Time Bar Code  :
Acquired on        : 19 Jan 15 12:39 PM
Report Created on  : 19 Jan 15 12:44 PM
Last Recalib on   : 19 JAN 15 10:21 PM
Multiplier         : 1
Sample Info        : Lot # Y787435306 - 0.5 cc inj.

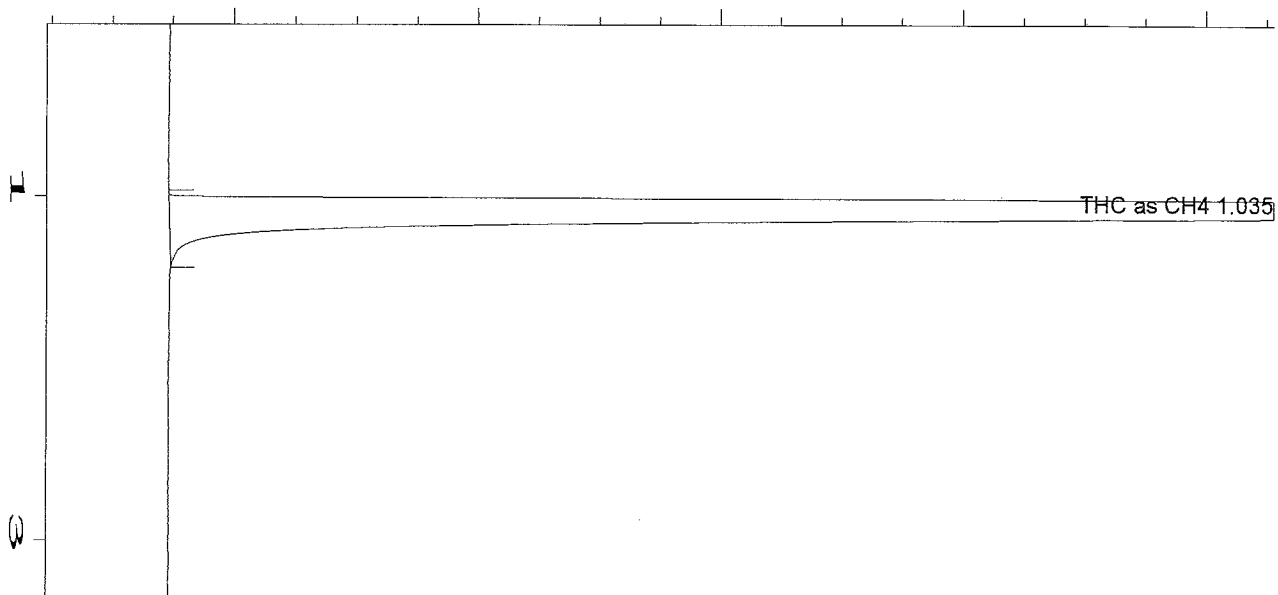
Page Number        : 1
Vial Number        :
Injection Number   :
Sequence Line      :
Instrument Method   : M18-DB-L.MTH
Analysis Method    : M18-DB-L.MTH
Sample Amount      : 0
ISTD Amount        :

```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0019.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.039	121677	BB	0.088	1	101.602	THC as CH4



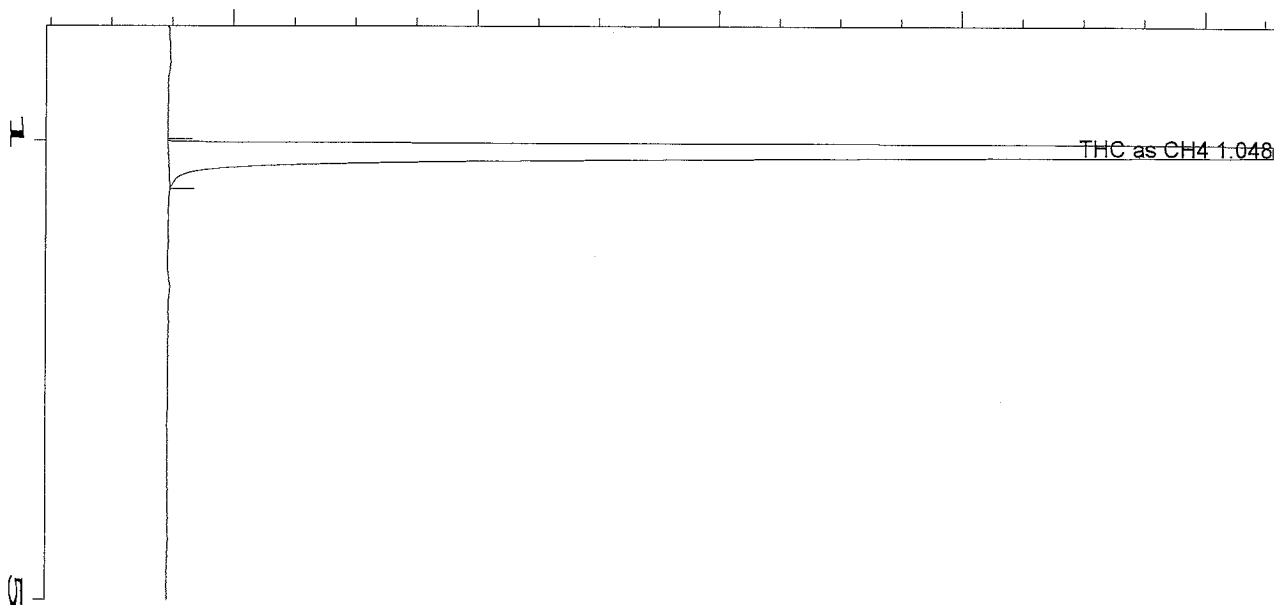


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0020.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 12:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 12:48 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # Y787435306 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0020.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.035	121088	BB	0.085	1	101.110	THC as CH4



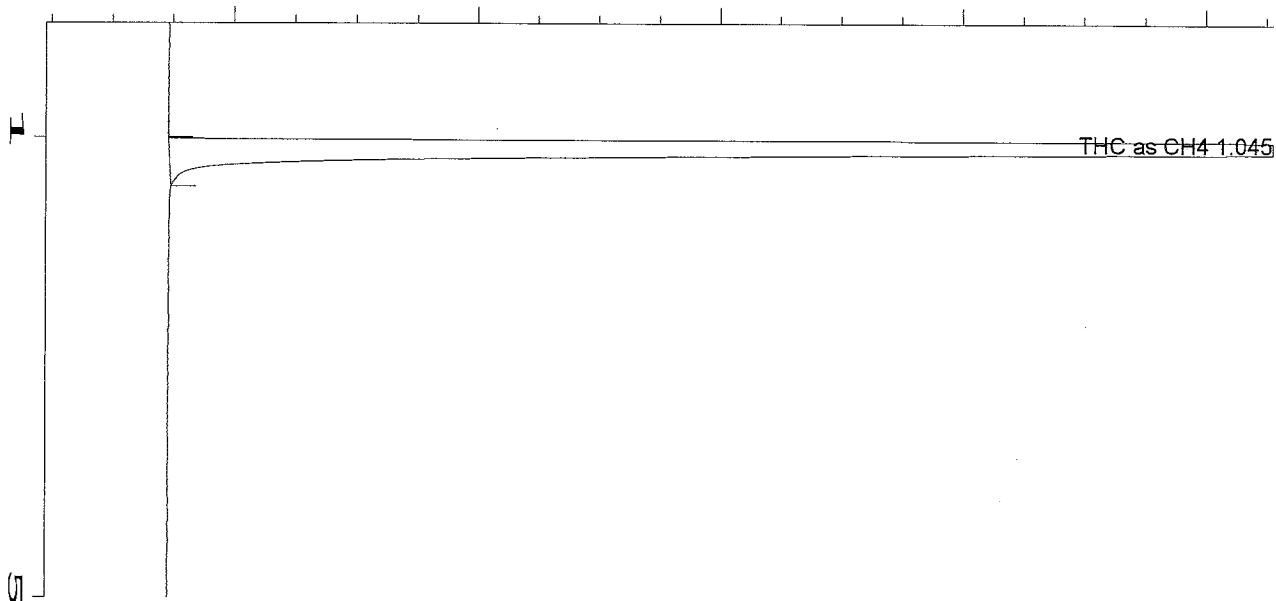
=====  
 External Standard Report  
 =====

```

Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0021.D
Operator           : Maxxam - GC ID#4130 - BW      Page Number       : 1
Instrument          : GC ID4130                    Vial Number        :
Sample Name        : Span 0.5 inj                  Injection Number   :
Run Time Bar Code  :                               Sequence Line     :
Acquired on        : 19 Jan 15 12:49 PM             Instrument Method  : M18-DB-L.MTH
Report Created on   : 19 Jan 15 12:54 PM             Analysis Method   : M18-DB-L.MTH
Last Recalib on    : 19 JAN 15 10:21 PM             Sample Amount     : 0
Multiplier         : 1                             ISTD Amount       :
Sample Info        : Lot # Z582436501 - 0.5 cc inj.
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0021.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.048	119088	BB	0.087	1	99.438	THC as CH4



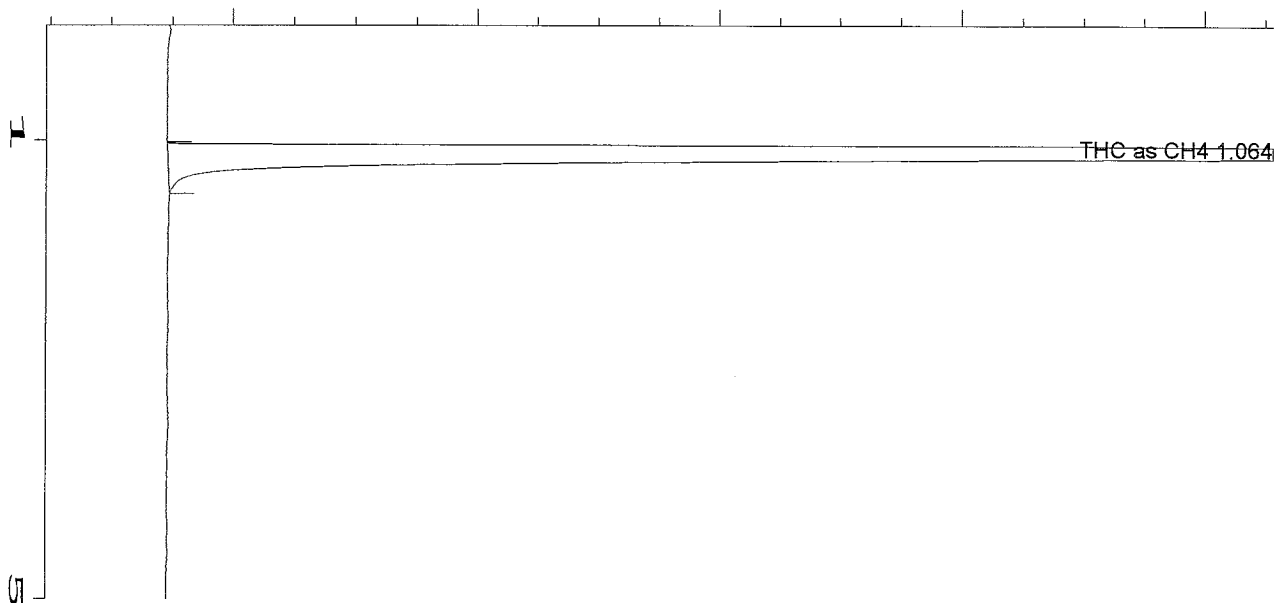
=====  
 External Standard Report  
 =====

```

Data File Name   : C:\HPCHEM\2\DATA\2014\20150119\SPAN0022.D
Operator        : Maxxam - GC ID#4130 - BW      Page Number       : 1
Instrument       : GC ID4130                    Vial Number          :
Sample Name     : Span 0.5 inj                  Injection Number     :
Run Time Bar Code:                             Sequence Line        :
Acquired on    : 19 Jan 15 01:07 PM             Instrument Method: M18-DB-L.MTH
Report Created on: 19 Jan 15 01:12 PM           Analysis Method  : M18-DB-L.MTH
Last Recalib on : 19 JAN 15 10:21 PM            Sample Amount      : 0
Multiplier     : 1                             ISTD Amount        :
Sample Info    : Lot # Z582436501 - 0.5 cc inj.
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0022.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.045	119480	BB	0.086	1	99.766	THC as CH4



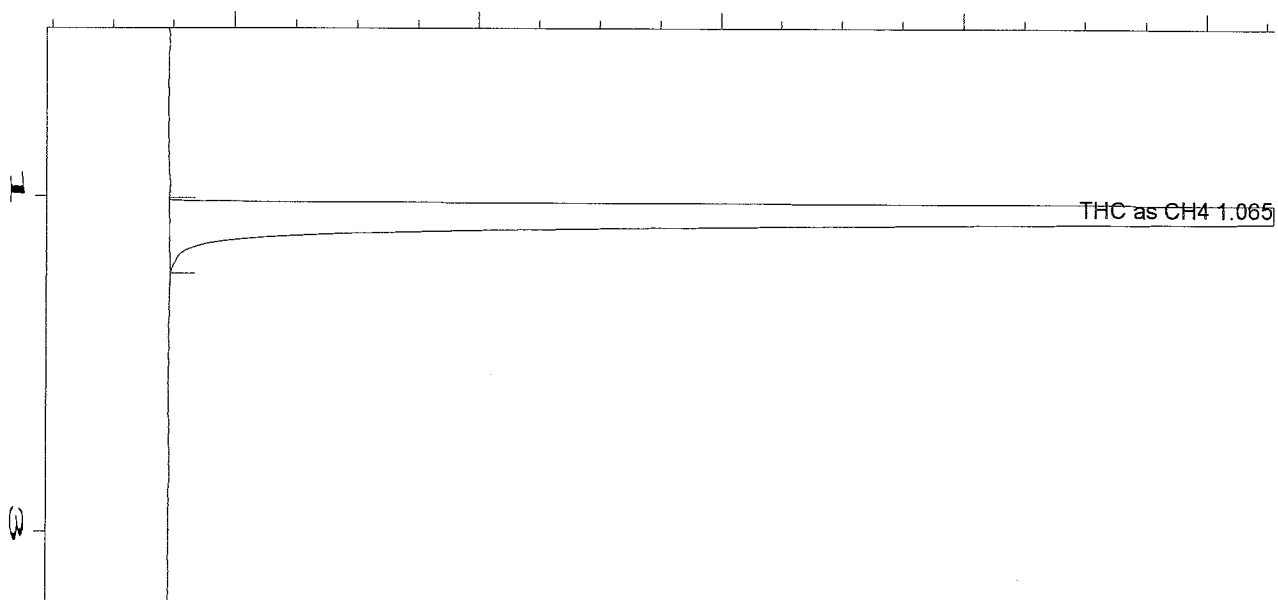
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0023.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 01:14 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 01:19 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # 11-11-01-26 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0023.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.064	120399	BB	0.090	1	100.534	THC as CH4

=====



=====  
 External Standard Report  
 =====

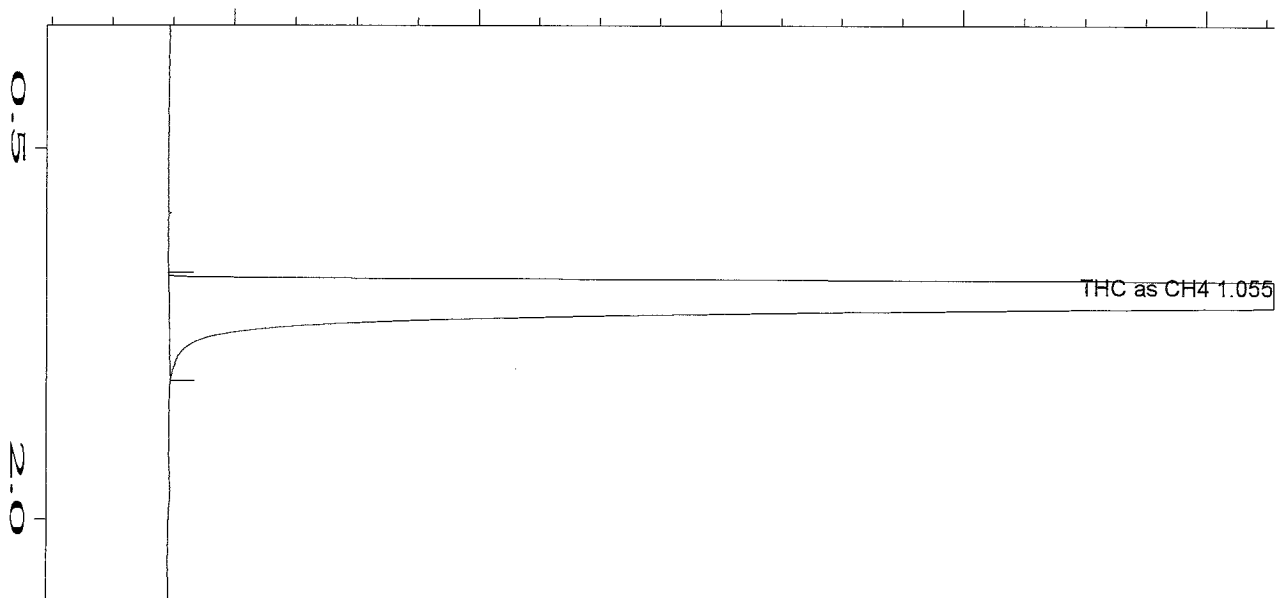
```

Data File Name   : C:\HPCHEM\2\DATA\2014\20150119\SPAN0024.D
Operator        : Maxxam - GC ID#4130 - BW
Instrument       : GC ID4130
Sample Name     : Span 0.5 inj
Run Time Bar Code:
Acquired on    : 19 Jan 15 01:20 PM
Report Created on: 19 Jan 15 01:23 PM
Last Recalib on : 19 JAN 15 10:21 PM
Multiplier     : 1
Sample Info    : Lot # 11-11-01-26 - 0.5 cc inj.

Page Number      : 1
Vial Number     :
Injection Number :
Sequence Line   :
Instrument Method: M18-DB-L.MTH
Analysis Method : M18-DB-L.MTH
Sample Amount   : 0
ISTD Amount     :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0024.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.065	120278	BB	0.089	1	100.433	THC as CH4



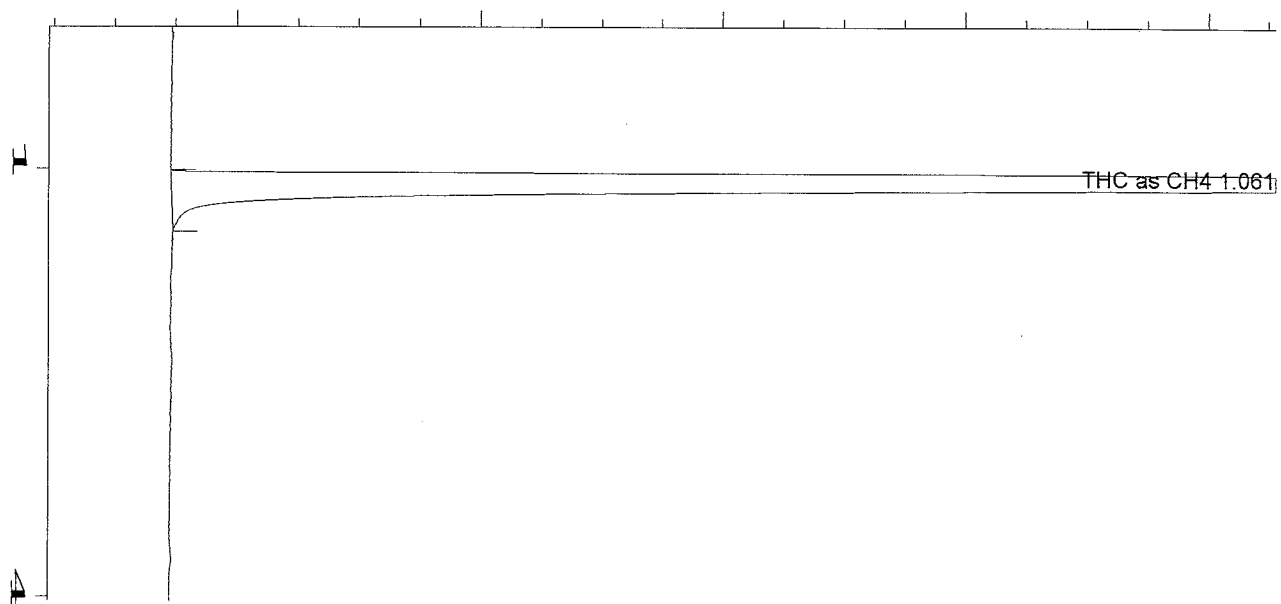
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0025.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 01:24 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 01:27 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # Y787435306 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0025.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.055	121213	BB	0.087	1	101.214	THC as CH4

=====



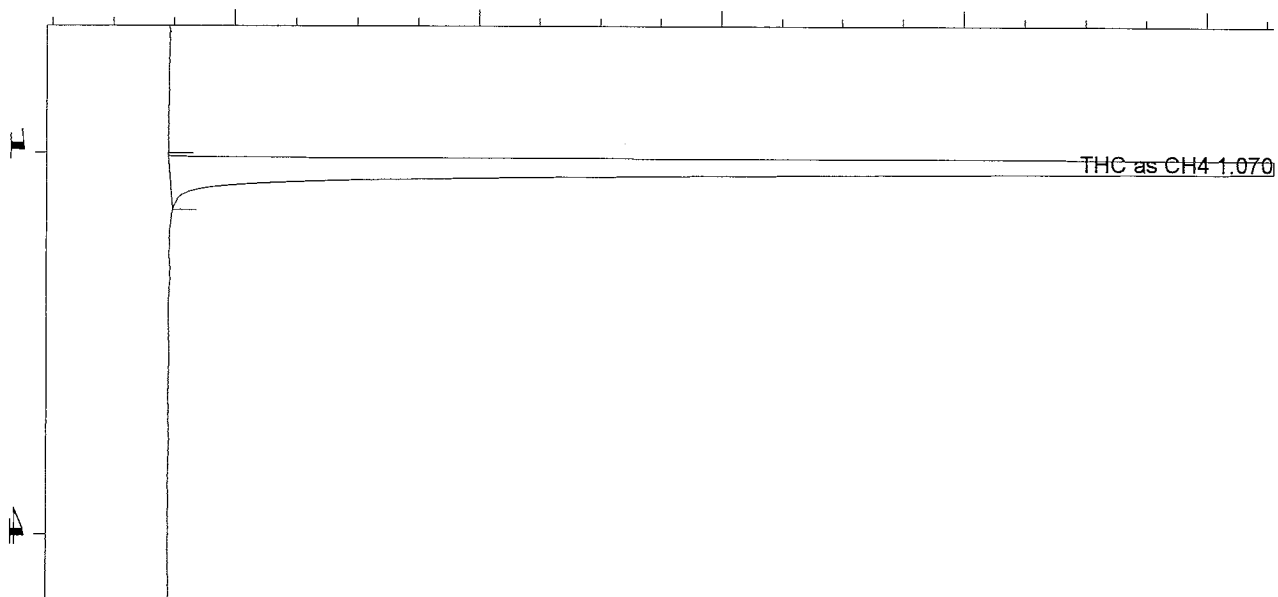
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0026.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 01:27 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 01:31 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # Y787435306 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0026.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.061	120728	BB	0.086	1	100.809	THC as CH4

=====



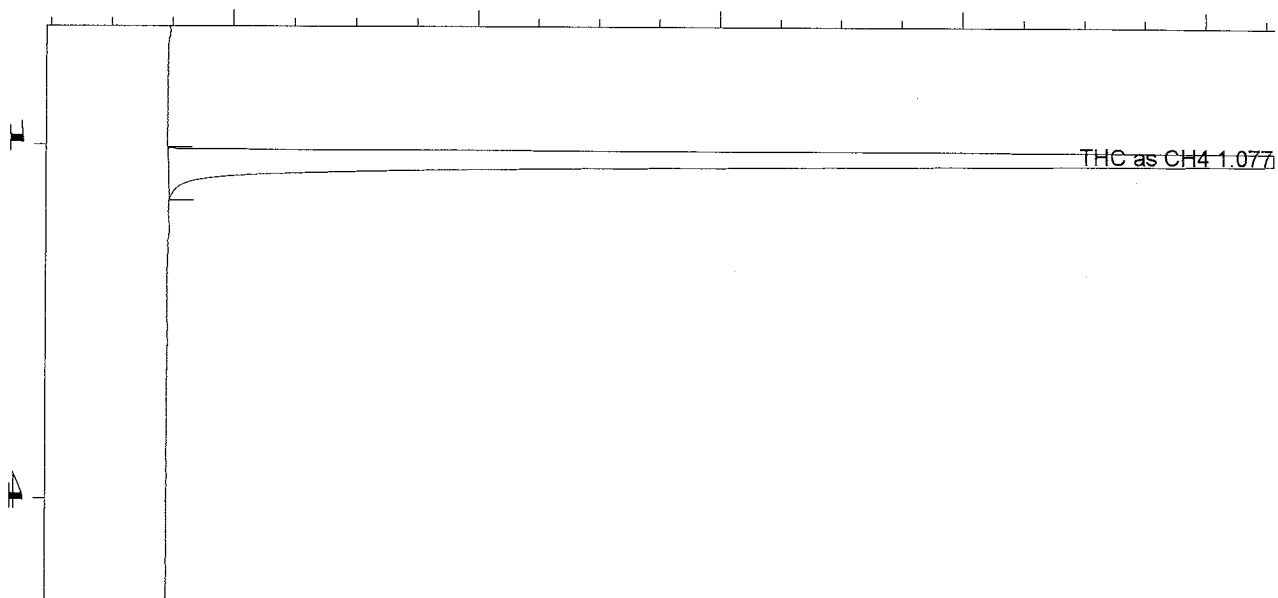
External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 01:32 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 01:37 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # Z582436501 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.070	119319	BB	0.088	1	99.631	THC as CH4





=====  
 External Standard Report  
 =====

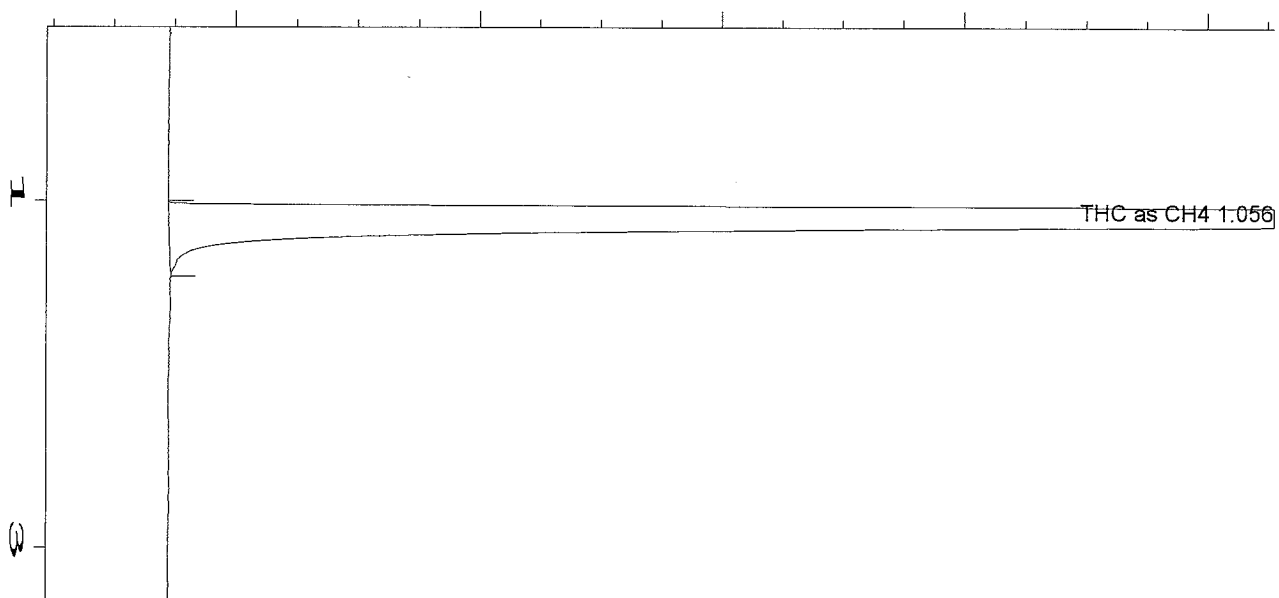
```

Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0028.D
Operator           : Maxxam - GC ID#4130 - BW      Page Number       : 1
Instrument          : GC ID4130                    Vial Number        :
Sample Name        : Span 0.5 inj                  Injection Number   :
Run Time Bar Code  :                               Sequence Line     :
Acquired on        : 19 Jan 15  01:38 PM           Instrument Method  : M18-DB-L.MTH
Report Created on  : 19 Jan 15  01:42 PM           Analysis Method   : M18-DB-L.MTH
Last Recalib on   : 19 JAN 15 10:21 PM             Sample Amount     : 0
Multiplier        : 1                             ISTD Amount       :
Sample Info        : Lot # Z582436501 - 0.5 cc inj.
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0028.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.077	119010	BB	0.089	1	99.373	THC as CH4

=====

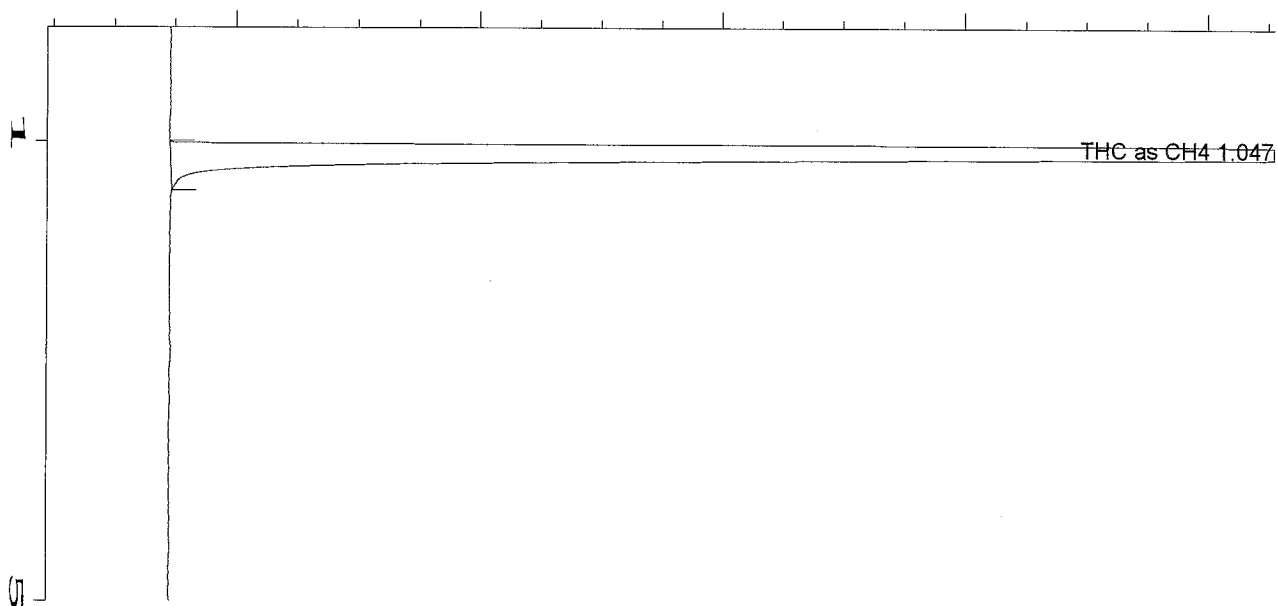


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20150119\SPAN0012.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 inj Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 19 Jan 15 12:06 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 19 Jan 15 12:10 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 19 JAN 15 10:21 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Lot # Y787435306 - 0.5 cc inj.

Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0012.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	121179	BB	0.088	1	101.186	THC as CH4



=====  
 External Standard Report  
 =====

```

Data File Name      : C:\HPCHEM\2\DATA\2014\20150119\SPAN0013.D
Operator           : Maxxam - GC ID#4130 - BW      Page Number       : 1
Instrument          : GC ID4130                   Vial Number          :
Sample Name         : Span 0.5 inj                 Injection Number     :
Run Time Bar Code   :                               Sequence Line        :
Acquired on         : 19 Jan 15 12:10 PM           Instrument Method    : M18-DB-L.MTH
Report Created on   : 19 Jan 15 12:15 PM           Analysis Method      : M18-DB-L.MTH
Last Recalib on    : 19 JAN 15 10:21 PM            Sample Amount        : 0
Multiplier          : 1                           ISTD Amount          :
Sample Info         : Lot # Y787435306 - 0.5 cc inj.
  
```

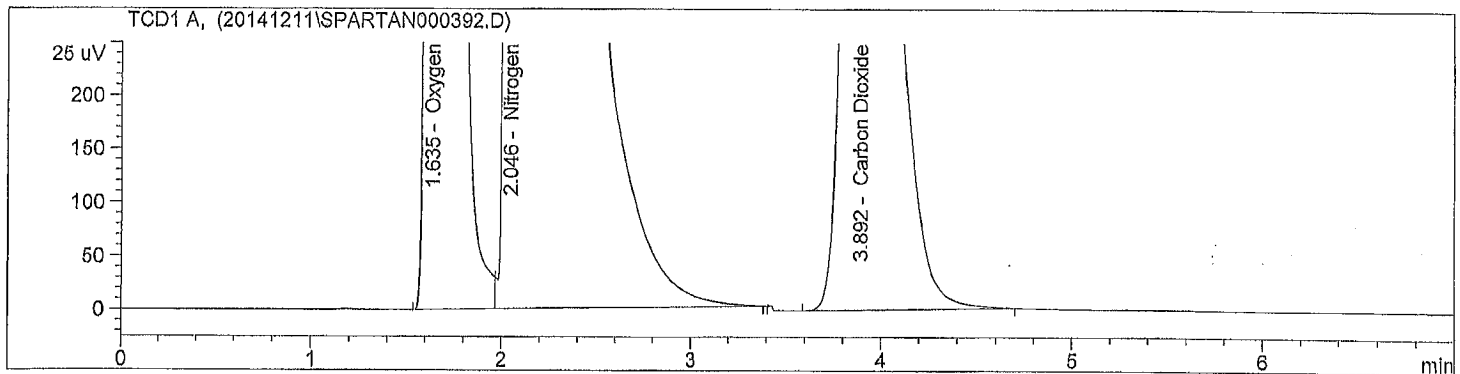
Sig. 2 in C:\HPCHEM\2\DATA\2014\20150119\SPAN0013.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.047	121204	BB	0.088	1	101.207	THC as CH4

# Fixed Gas Chromatograms

## Sample Analysis Calibration

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 11-Dec-14, 14:50:37 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:47:24 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:57:44 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - Tes  
t 3B1A - Tr#73306 - 15:00 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325		-	-	-		Hydrogen
1.635	BV	3.51202e4	3.93153e-4	14.252043		Oxygen
2.046	VBAS	1.97450e5	3.94073e-4	80.314297		Nitrogen
3.892	BBA	1.57490e4	3.34257e-4	5.433660		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

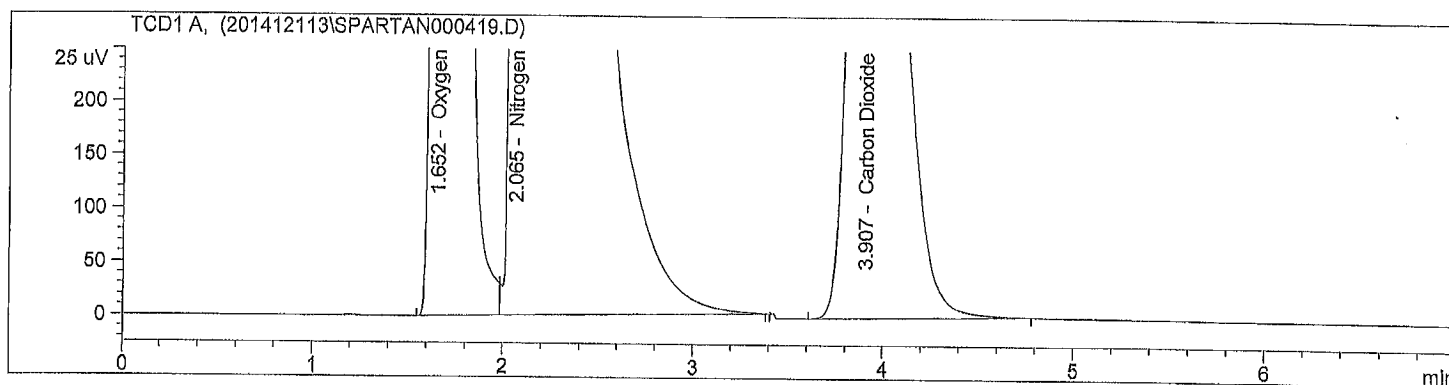
Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 15:44:25 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 3:41:00 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 3:51:32 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B  
1A - Tr#73306 - 15:00 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.652	BV	3.56264e4	3.93152e-4	14.283924	-	Oxygen
2.065	VBAS	2.00012e5	3.94086e-4	80.382619	-	Nitrogen
3.907	BBA	1.56463e4	3.34258e-4	5.333457	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*

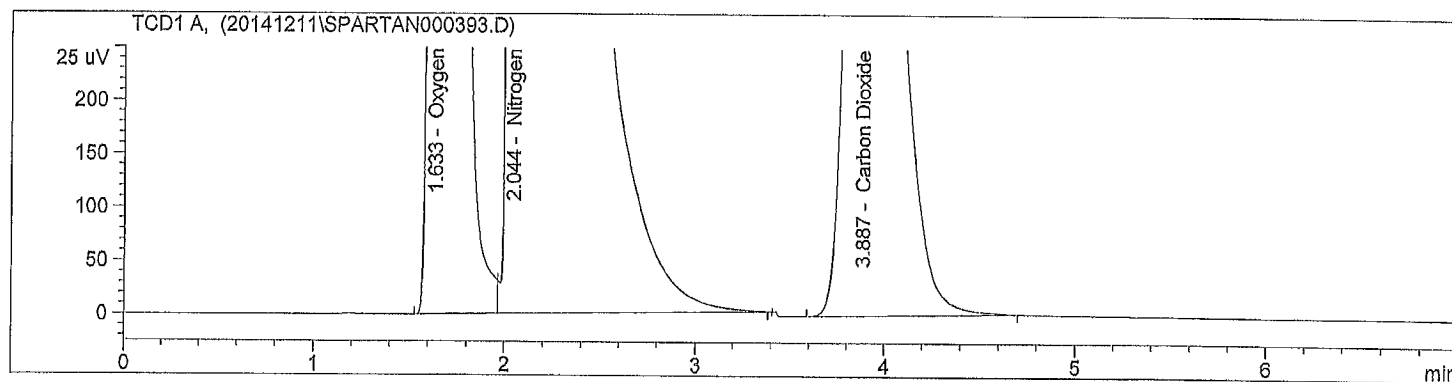
Sample Name: T3B1B Tr#73307 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 15:01:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 2:57:55 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:08:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B
                1B - Tr#73307 - 15:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.633	BV	3.46669e4	3.93155e-4	14.180886	-	Oxygen
2.044	VBAS	1.95951e5	3.94065e-4	80.341579	-	Nitrogen
3.887	BBA	1.57500e4	3.34257e-4	5.477535	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

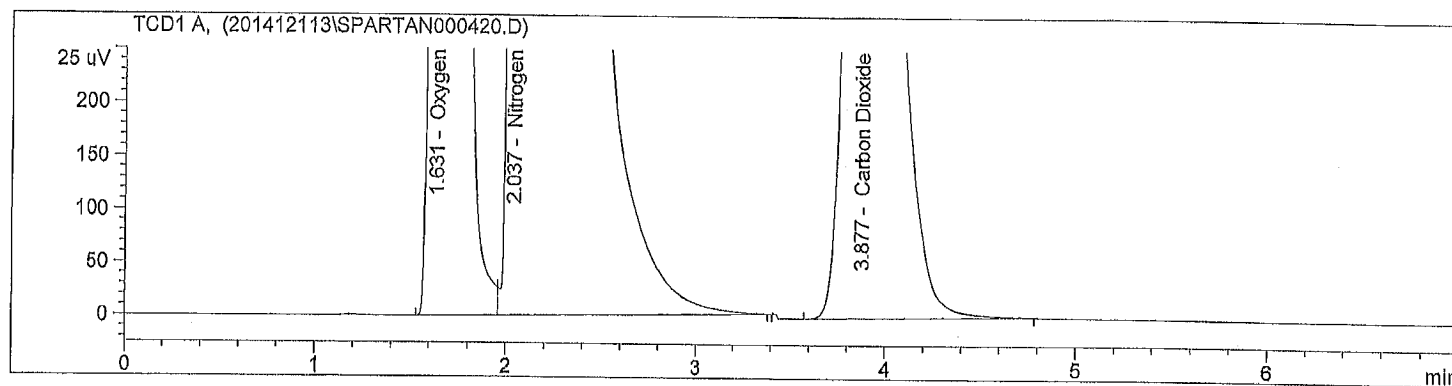
Sample Name: T3B1B Tr#73307 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 15:55:23
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 3:51:42 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:02:30 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B
                1B - Tr#73307 - 15:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.631	BV	3.57662e4	3.93152e-4	14.244248		Oxygen
2.037	VBAS	2.01309e5	3.94093e-4	80.365252		Nitrogen
3.877	BBA	1.59201e4	3.34254e-4	5.390500		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```



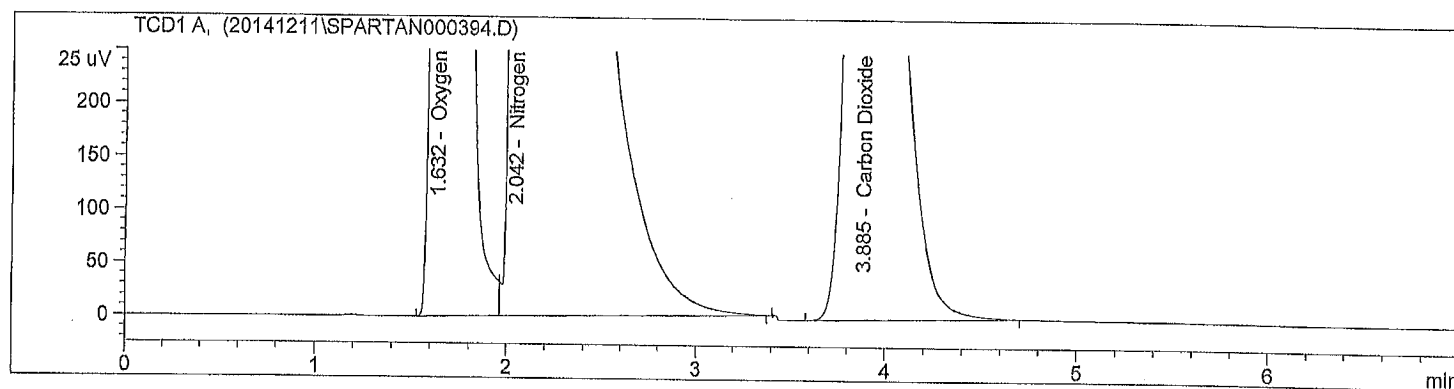
Sample Name: T4B1A Tr#73308 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 11-Dec-14, 15:14:42              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:09:08 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:21:49 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                  1A - Tr#73308 - 08:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.632	BV	3.50873e4	3.93154e-4	14.300138	-	Oxygen
2.042	VBAS	1.96554e5	3.94068e-4	80.293665	-	Nitrogen
3.885	BBA	1.56020e4	3.34259e-4	5.406196	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals :                               100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

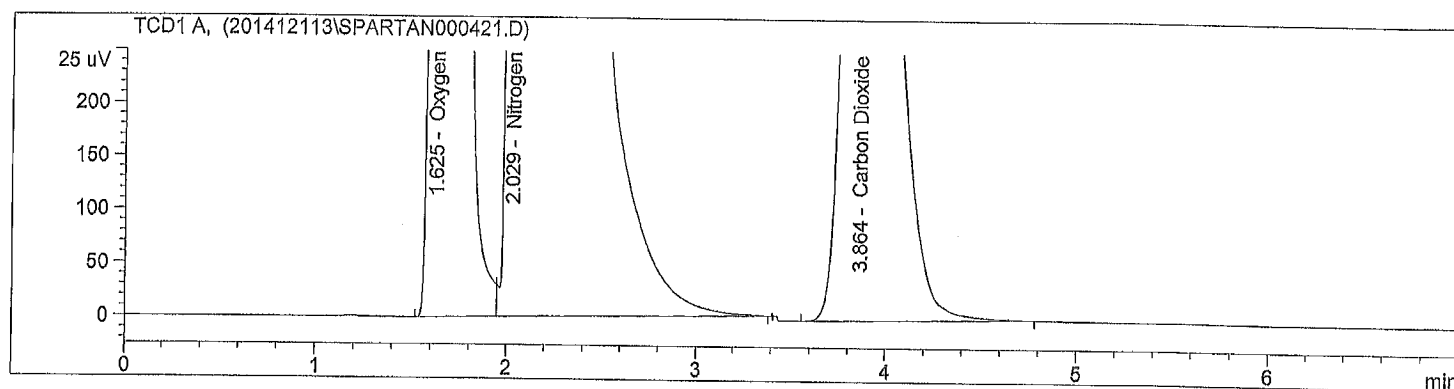
Sample Name: T4B1A Tr#73308 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:05:23
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:02:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:12:30 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1A - Tr#73308 - 08:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.625	BV	3.59375e4	3.93151e-4	14.351923	-	Oxygen
2.029	VBAS	2.00660e5	3.94089e-4	80.326213	-	Nitrogen
3.864	BBA	1.56740e4	3.34258e-4	5.321864	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

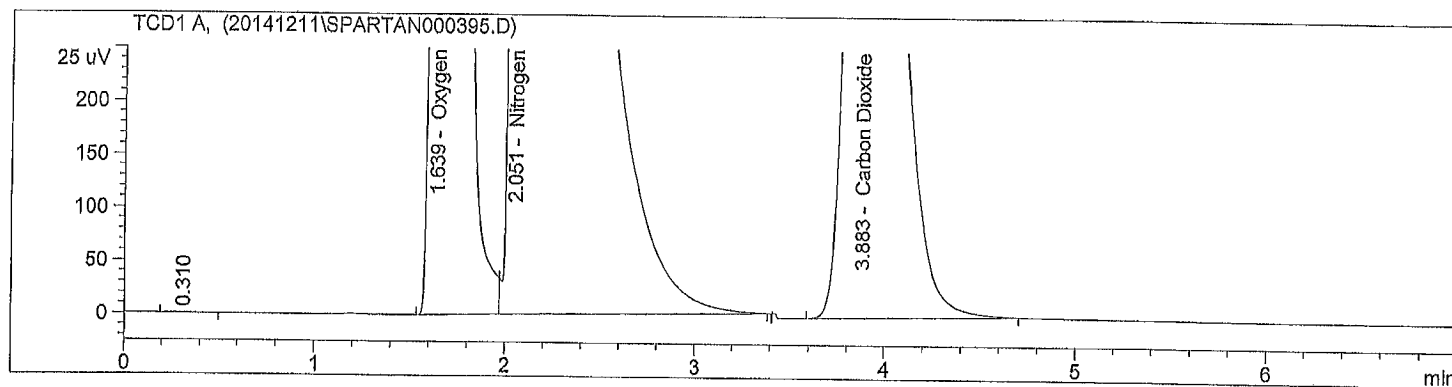
Sample Name: T4B1B Tr#73309 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 15:23:50
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:21:59 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:30:57 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1B - Tr#73309 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.639	BV	3.39189e4	3.93157e-4	13.916811	-	Oxygen
2.051	VBAS	1.95505e5	3.94063e-4	80.399981	-	Nitrogen
3.883	BBA	1.62927e4	3.34248e-4	5.683209	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

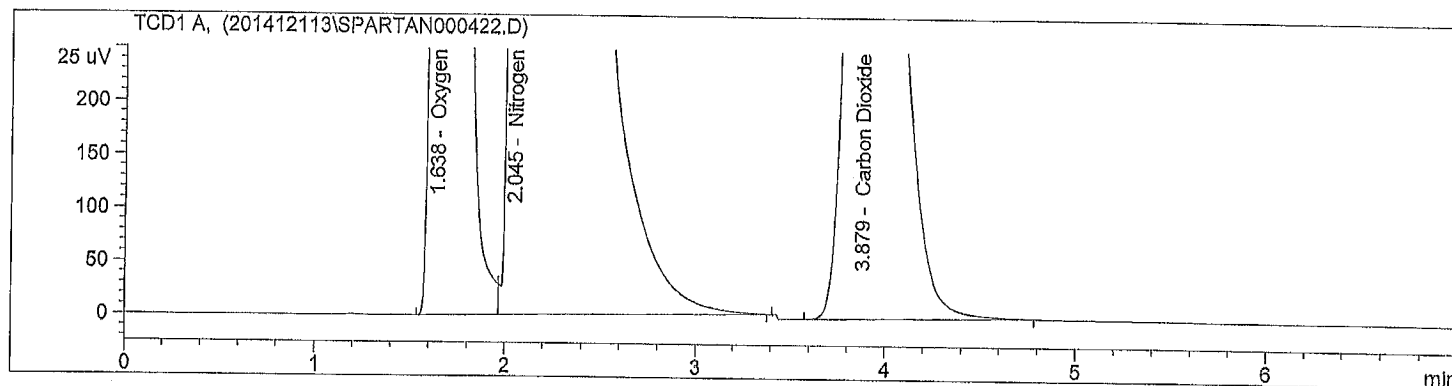
Sample Name: T4B1B Tr#73309 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:15:03
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:12:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:22:10 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1B - Tr#73309 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.638	BV	3.46772e4	3.93155e-4	13.972656		Oxygen
2.045	VBAS	1.99080e5	3.94081e-4	80.405218		Nitrogen
3.879	BBA	1.64120e4	3.34247e-4	5.622126		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

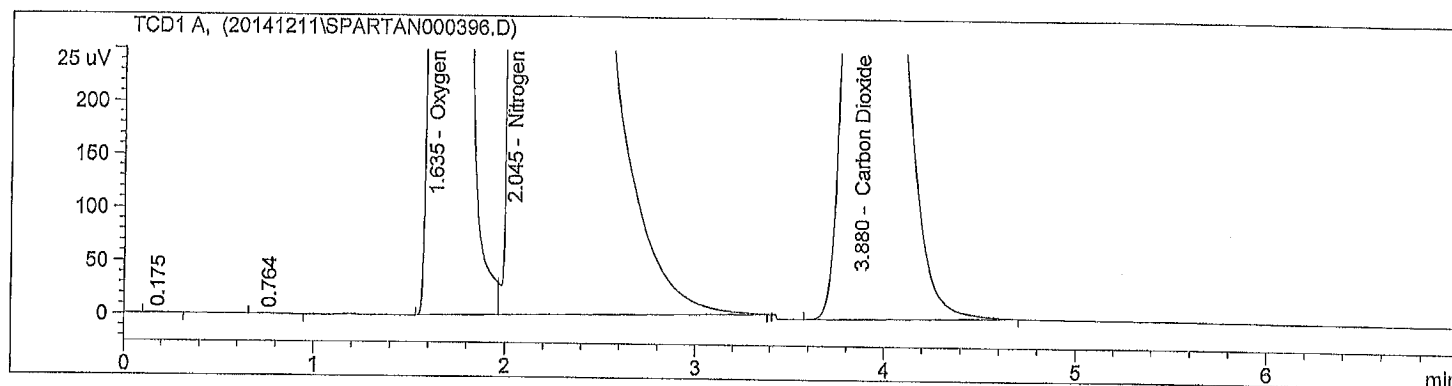
Sample Name: T5B1A Tr#73310 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 11-Dec-14, 15:32:31              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:31:08 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:39:38 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                  1A - Tr#73310 - 10:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.635	BV	3.43879e4	3.93156e-4	14.059841	-	Oxygen
2.045	VBAS	1.96084e5	3.94066e-4	80.356370	-	Nitrogen
3.880	BBA	1.60637e4	3.34252e-4	5.583788	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

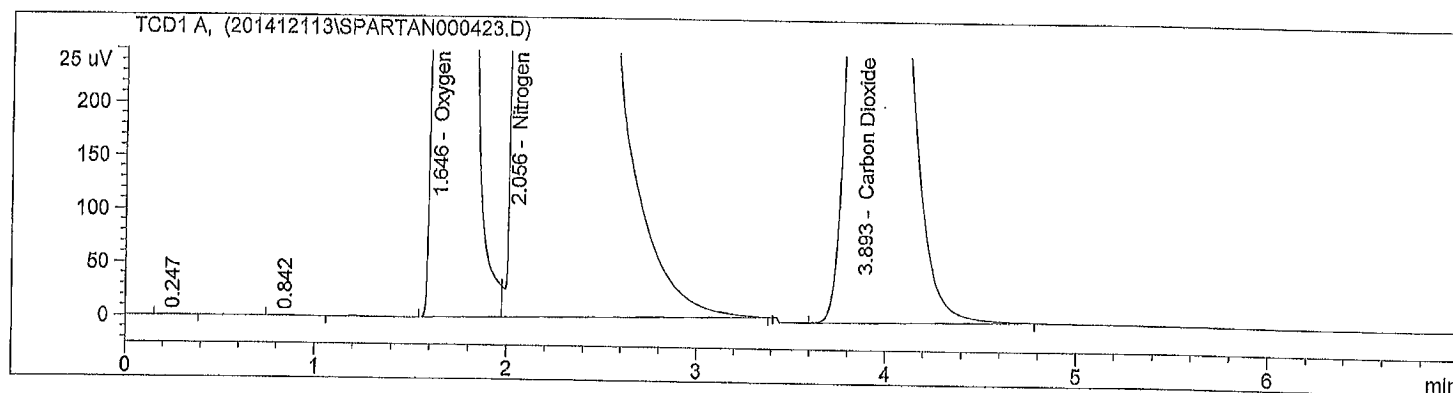
Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 16:23:40 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 4:22:20 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 4:30:47 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B  
1A - Tr#73310 - 10:05 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.646	BV	3.53111e4	3.93153e-4	14.098912	-	Oxygen
2.056	VBAS	2.00880e5	3.94090e-4	80.397902	-	Nitrogen
3.893	BBA	1.62118e4	3.34250e-4	5.503186	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*

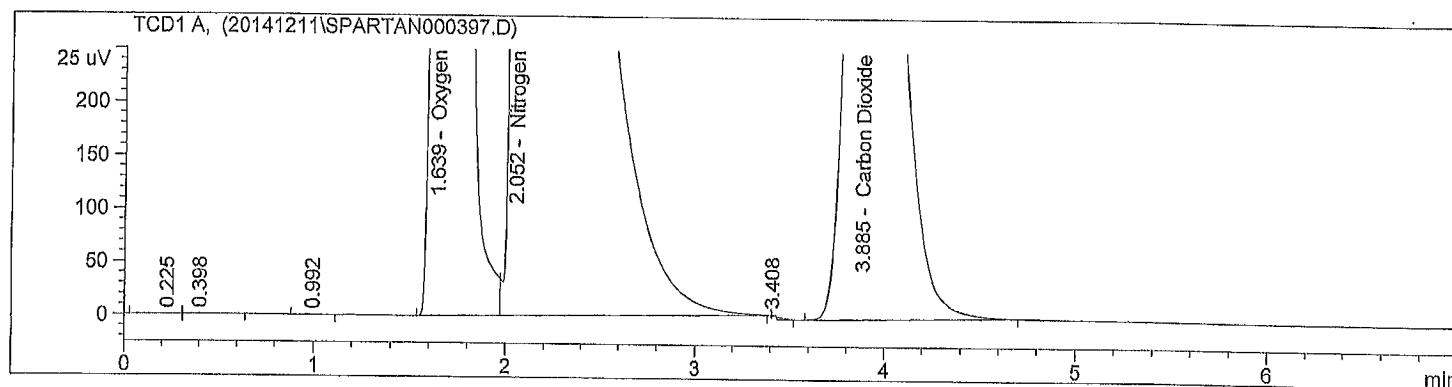
Sample Name: T5B1B Tr#73311 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 15:40:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:39:48 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:48:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                1B - Tr#73311 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.639	BV	3.45241e4	3.93155e-4	14.267644	-	Oxygen
2.052	VBAS	1.93883e5	3.94054e-4	80.308618	-	Nitrogen
3.885	BBA	1.54364e4	3.34262e-4	5.423738	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

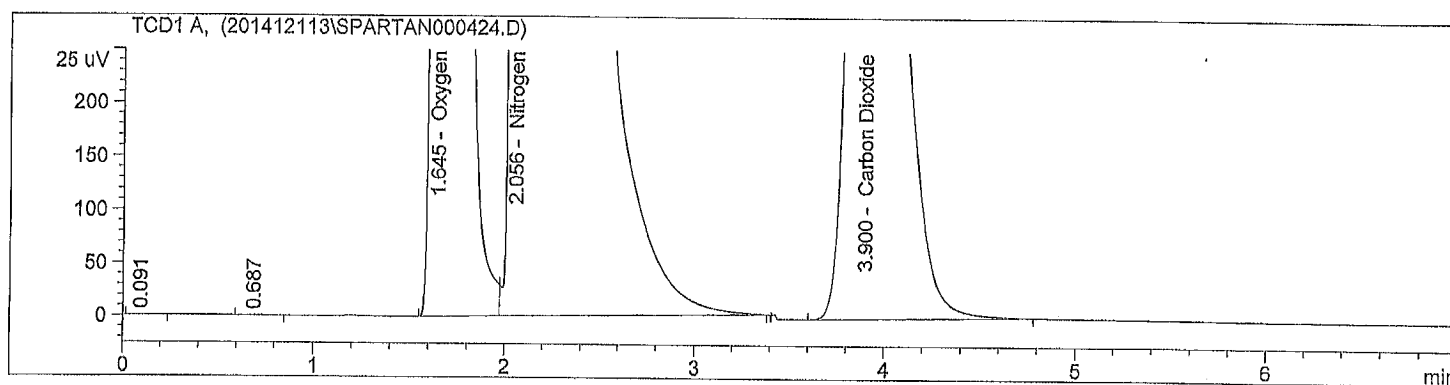
Sample Name: T5B1B Tr#73311 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:32:27
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:30:57 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:39:34 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                1B - Tr#73311 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.645	BV	3.58574e4	3.93152e-4	14.311728		Oxygen
2.056	VBAS	2.00765e5	3.94090e-4	80.322505		Nitrogen
3.900	BBA	1.58125e4	3.34256e-4	5.365767		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

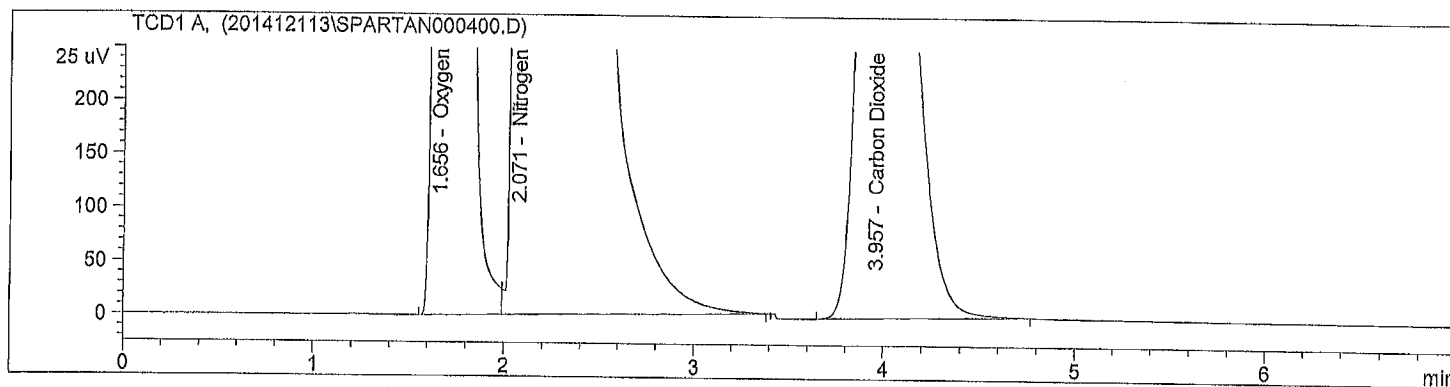


=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 11:39:00	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 11:31:43 AM by Maxxam - ID# 6538 - BW  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 11:46:00 AM by Maxxam - ID# 6538 - BW  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B  
1A - Tr#73325 - ~~13:00~~ 11:35 - 1 cc injection

*6 Sew*



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.656	BV	3.75849e4	3.93147e-4	15.077657	-	Oxygen
2.071	VBAS	1.99116e5	3.94082e-4	80.067842	-	Nitrogen
3.957	BBA	1.42320e4	3.34283e-4	4.854500	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

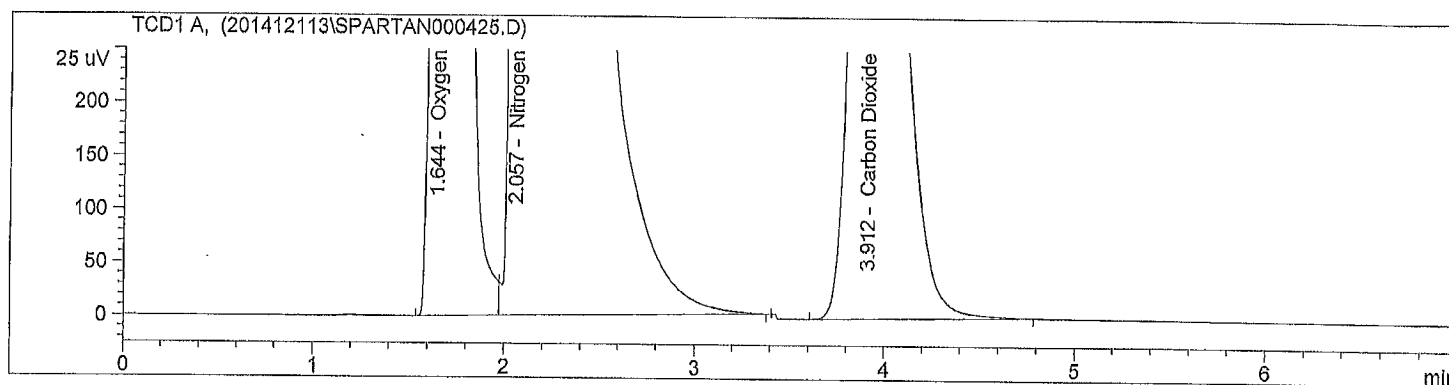
Sample Name: T6B1A Tr#73325 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:42:59
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:39:44 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:50:06 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B
                1A - Tr#73325 - 11:35 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.77631e4	3.93147e-4	15.071963	-	Oxygen
2.057	VBAS	2.00252e5	3.94087e-4	80.115548	-	Nitrogen
3.912	BBA	1.41810e4	3.34284e-4	4.812489	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

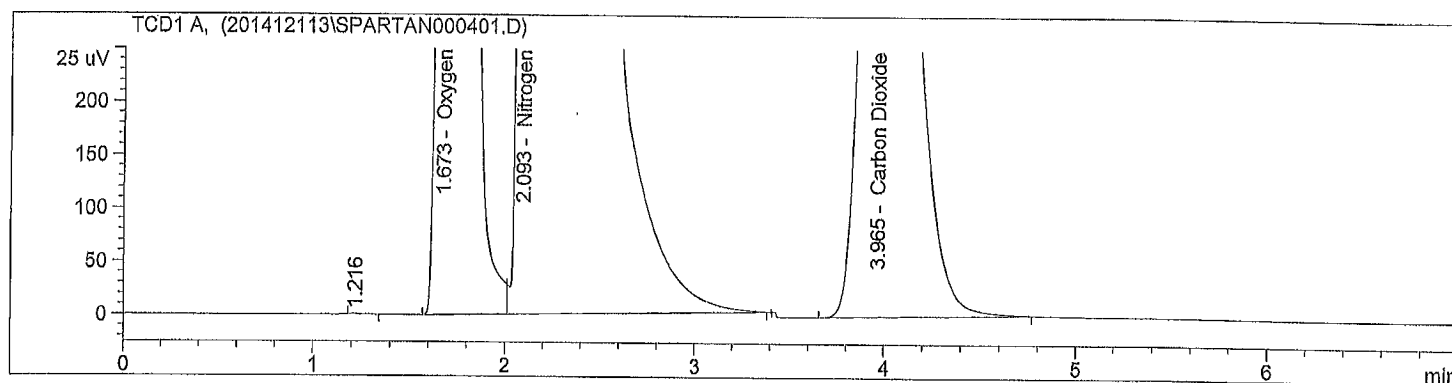
Sample Name: T6B1B Tr#73326 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 11:51:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 11:46:15 AM by Maxxam - ID# 6538 - BW
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:01:17 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - TAB
                1B - Tr#73326 - 13-35 - 1 cc injection
                (2:10 BW)

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:01:17 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.673	BV	3.68061e4	3.93149e-4	14.779464	-	Oxygen
2.093	VBAS	1.99260e5	3.94082e-4	80.202555	-	Nitrogen
3.965	BBA	1.46975e4	3.34274e-4	5.017980	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

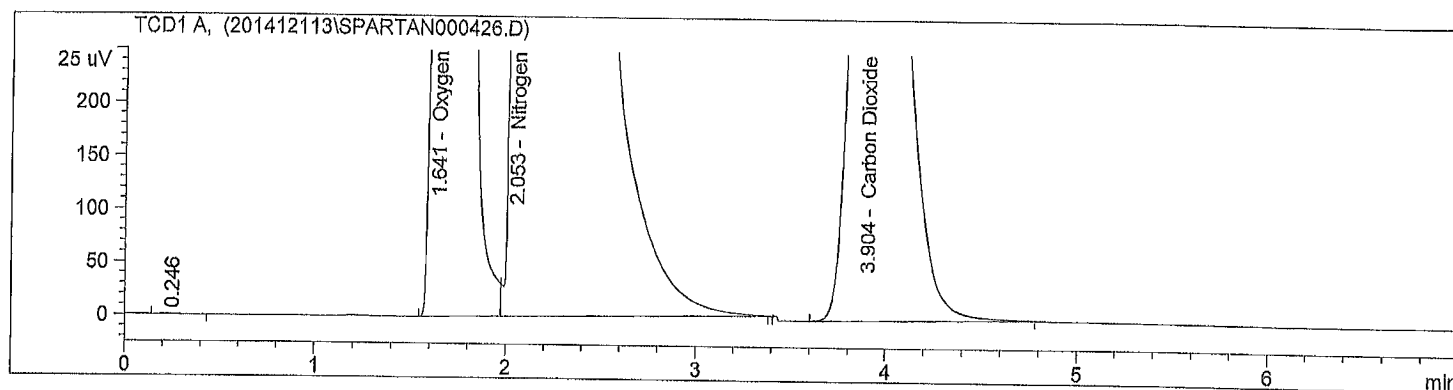
Sample Name: T6B1B Tr#73326 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:52:12
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:50:16 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:59:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B
                1B - Tr#73326 - 12:10 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.71464e4	3.93148e-4	14.793015	-	Oxygen
2.053	VBAS	2.00913e5	3.94091e-4	80.202516	-	Nitrogen
3.904	BBA	1.47800e4	3.34273e-4	5.004470	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

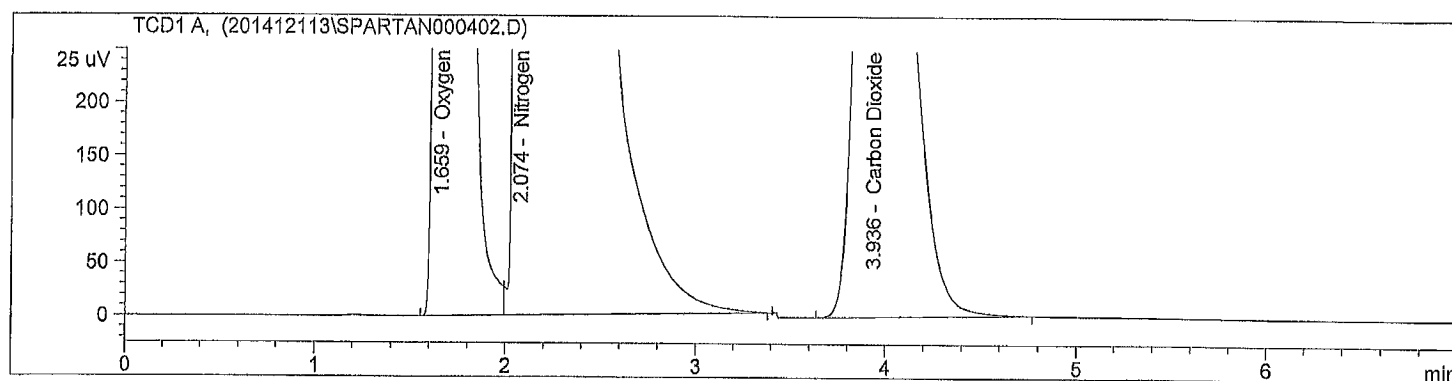
Sample Name: T7B1A Tr#73327 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:04:15
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:01:17 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:11:22 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                  1A - Tr#73327 - 14:30 - 1 cc injection
                  12:05 BW
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:01:17 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.659	BV	3.61436e4	3.93151e-4	14.572023	-	Oxygen
2.074	VBAS	1.98592e5	3.94079e-4	80.255580	-	Nitrogen
3.936	BBA	1.50893e4	3.34267e-4	5.172397	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

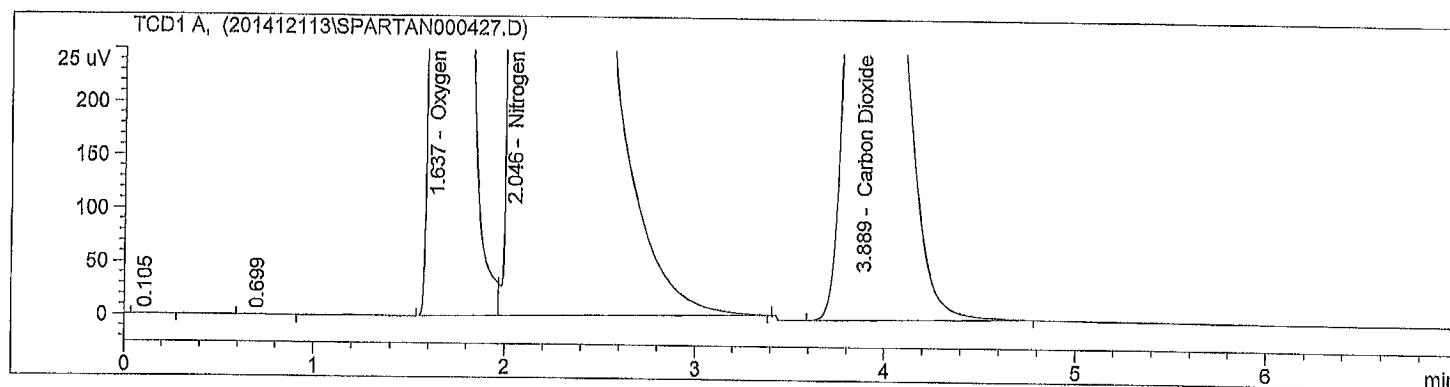
Sample Name: T7B1A Tr#73327 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:00:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:59:29 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:08:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1A - Tr#73327 - 13:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.637	BV	3.64309e4	3.93150e-4	14.577224		Oxygen
2.046	VBAS	2.00098e5	3.94087e-4	80.256618		Nitrogen
3.889	BBA	1.51855e4	3.34266e-4	5.166158		Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

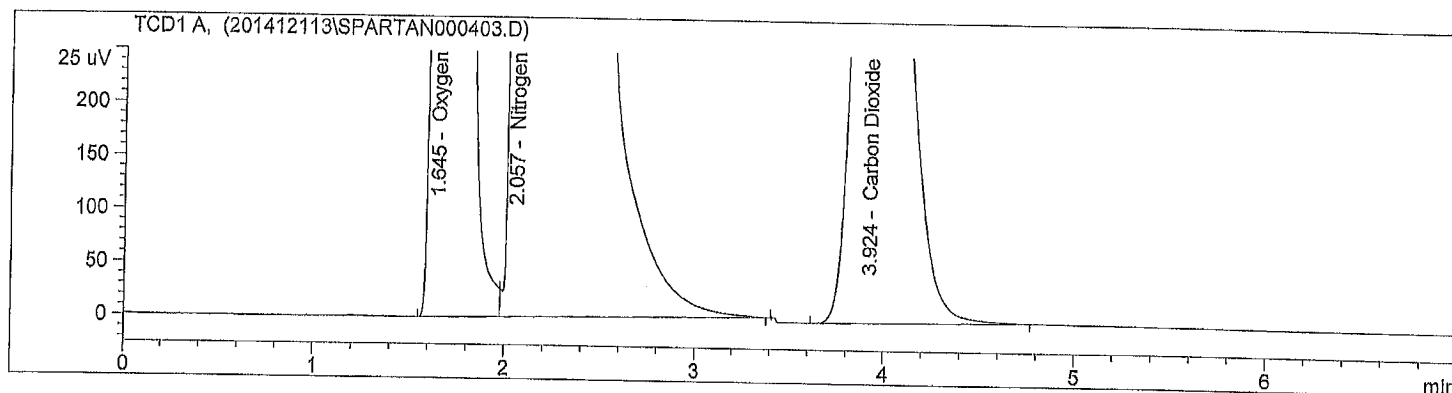
```

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 12:13:43	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:11:32 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:27:28 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B  
1B - Tr#73328 - 15.05 - 1 cc injection

13:40 SW



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.645	BV	3.74293e4	3.93148e-4	14.976146		Oxygen
2.057	VBAS	1.99774e5	3.94085e-4	80.123857		Nitrogen
3.924	BBA	1.44030e4	3.34280e-4	4.899997		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

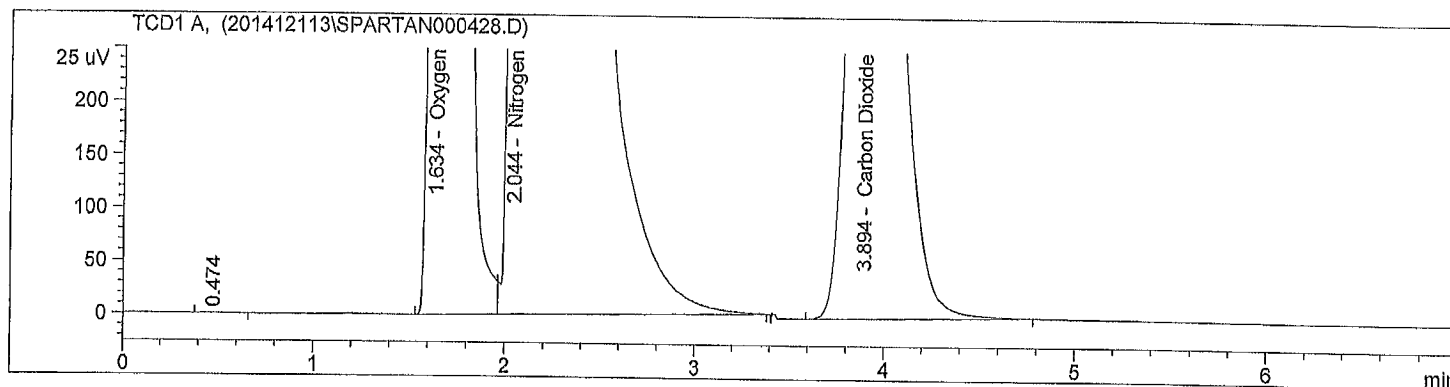
Sample Name: T7B1B Tr#73328 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:09:57
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:08:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:17:04 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1B - Tr#73328 - 13:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.634	BV	3.74772e4	3.93147e-4	14.998602	-	Oxygen
2.044	VBAS	1.99745e5	3.94085e-4	80.129646	-	Nitrogen
3.894	BBA	1.43168e4	3.34281e-4	4.871752	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```



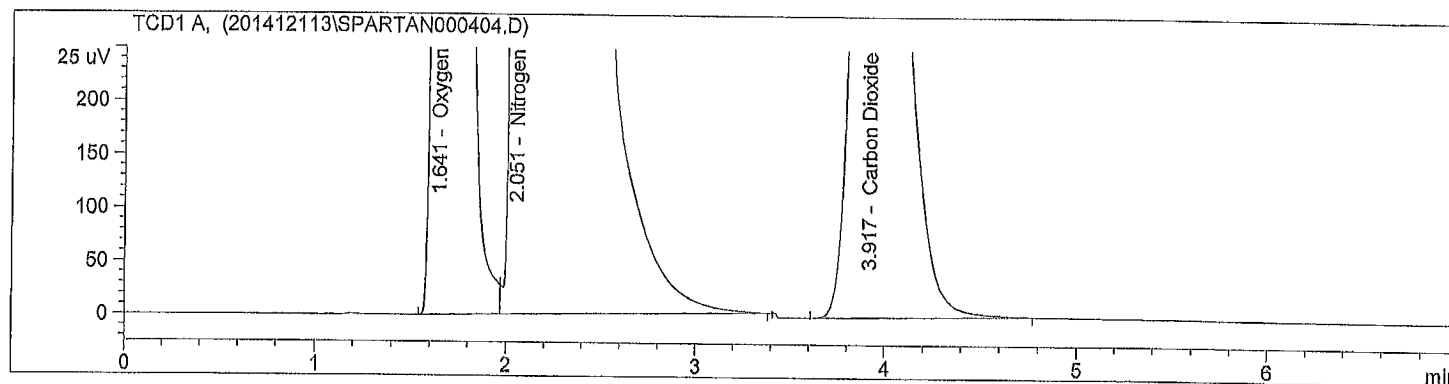
Sample Name: T8B1A Tr#73329 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:29:28
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:27:28 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:36:35 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                1A - Tr#73329 - 14:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.70739e4	3.93148e-4	14.934592	-	Oxygen
2.051	VBAS	1.98443e5	3.94078e-4	80.128397	-	Nitrogen
3.917	BBA	1.44140e4	3.34280e-4	4.937010	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

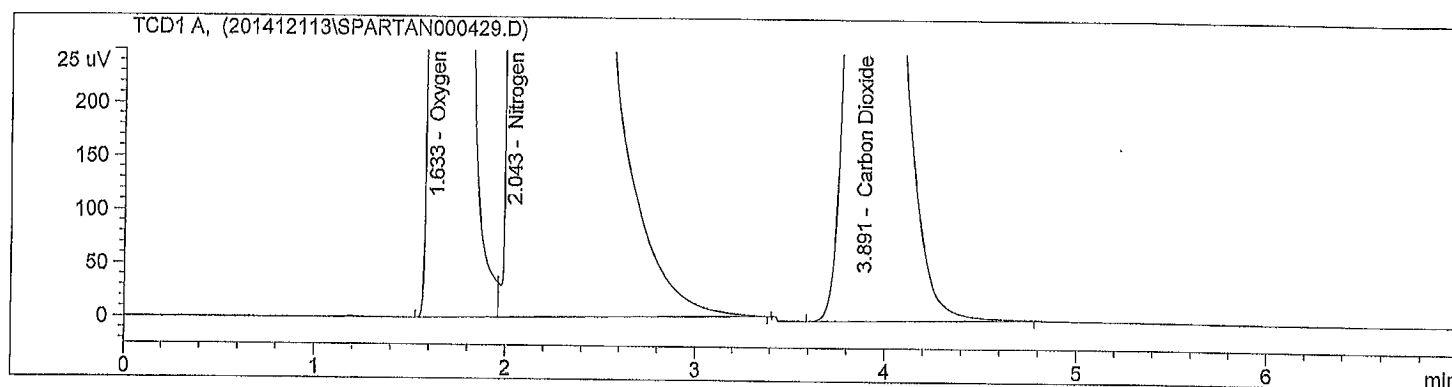
Sample Name: T8B1A Tr#73329 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location :   -
Injection Date  : 13-Dec-14, 17:19:57         Inj       :    1
                                           Inj Volume: Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 5:17:14 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 5:27:05 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                  1A - Tr#73329 - 14:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By           :      Signal
Calib. Data Modified :      12/13/2014 12:27:28 PM
Multiplier          :      1.0000
Dilution            :      1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.633	BV	3.73907e4	3.93148e-4	14.931972		Oxygen
2.043	VBAS	2.00243e5	3.94087e-4	80.158246		Nitrogen
3.891	BBA	1.44596e4	3.34279e-4	4.909782		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals :                               100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

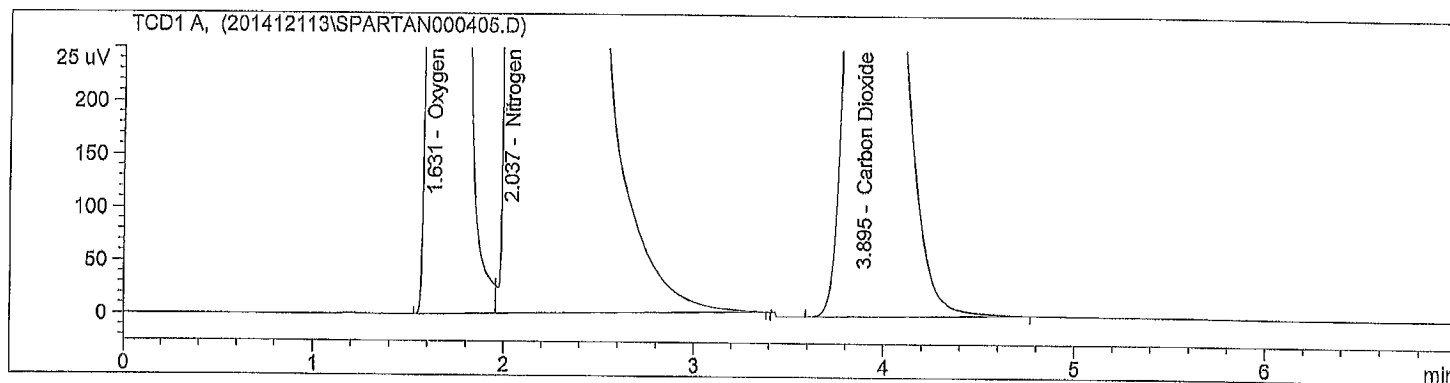
Sample Name: T8B1B Tr#73330 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:40:38
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:36:45 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:47:45 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                1B - Tr#73330 - 15:15 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.631	BV	3.67733e4	3.93149e-4	14.750073		Oxygen
2.037	VBAS	1.99428e5	3.94083e-4	80.182205		Nitrogen
3.895	BBA	1.48597e4	3.34271e-4	5.067721		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

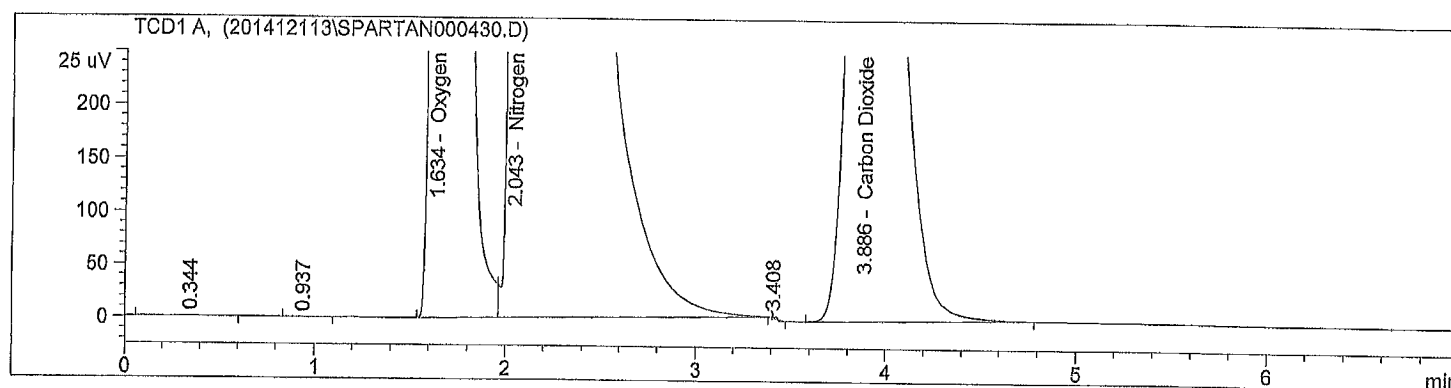
Sample Name: T8B1B Tr#73330 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:28:28
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:27:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:35:35 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                1B - Tr#73330 - 15:15 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.634	BV	3.67586e4	3.93149e-4	14.742918	-	Oxygen
2.043	VBAS	1.99503e5	3.94084e-4	80.205760	-	Nitrogen
3.886	BBA	1.48128e4	3.34272e-4	5.051322	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

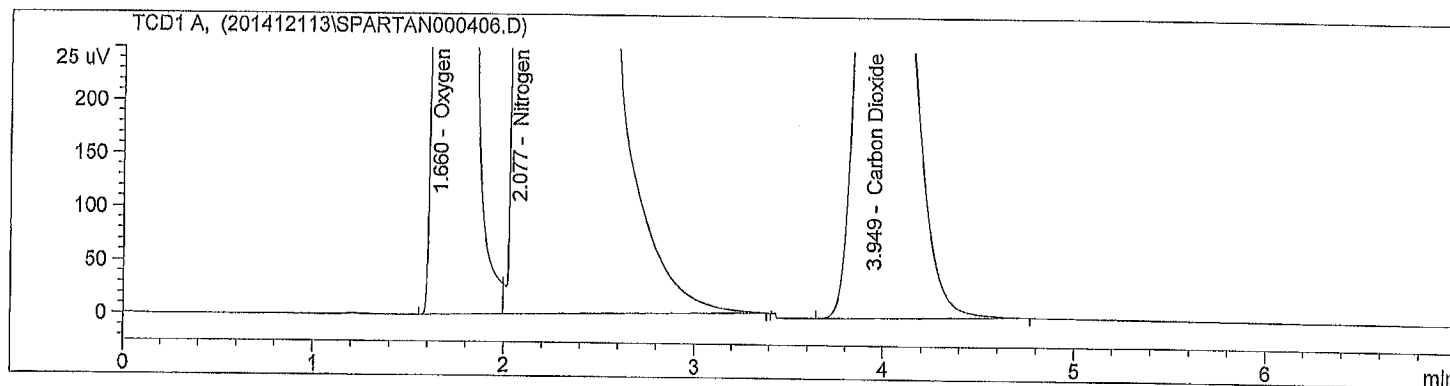
=====
*** End of Report ***
=====

```

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 12:50:07	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:47:55 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:57:14 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B  
1A - Tr#73331 - 16:10 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.660	BV	3.86333e4	3.93145e-4	15.425678	-	Oxygen
2.077	VBAS	1.99967e5	3.94086e-4	80.034680	-	Nitrogen
3.949	BBA	1.33707e4	3.34301e-4	4.539642	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

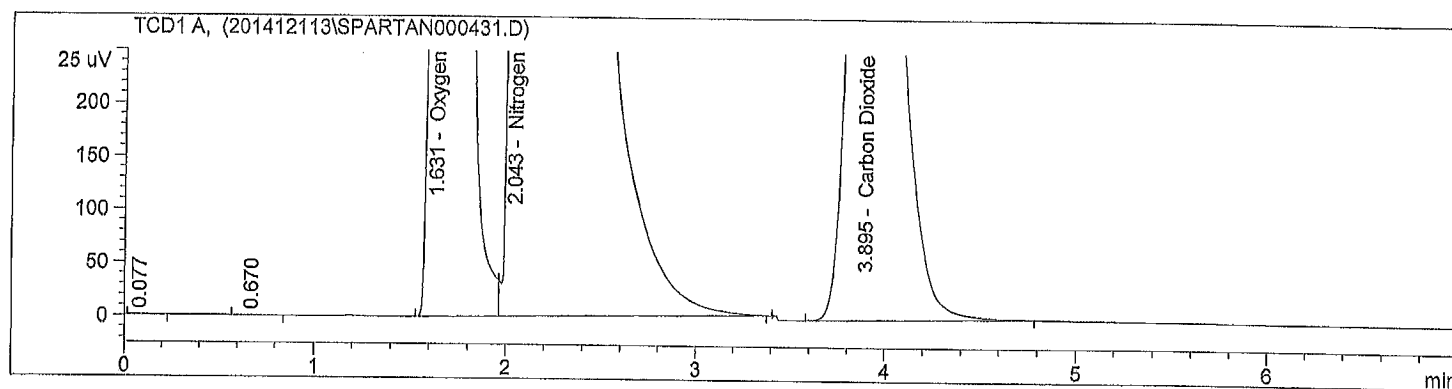
Sample Name: T9B1A Tr#73331 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:37:15
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:35:46 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:44:22 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                1A - Tr#73331 - 16:10 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.631	BV	3.86016e4	3.93145e-4	15.414385	-	Oxygen
2.043	VBAS	1.99939e5	3.94086e-4	80.030773	-	Nitrogen
3.895	BBA	1.34143e4	3.34300e-4	4.554841	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

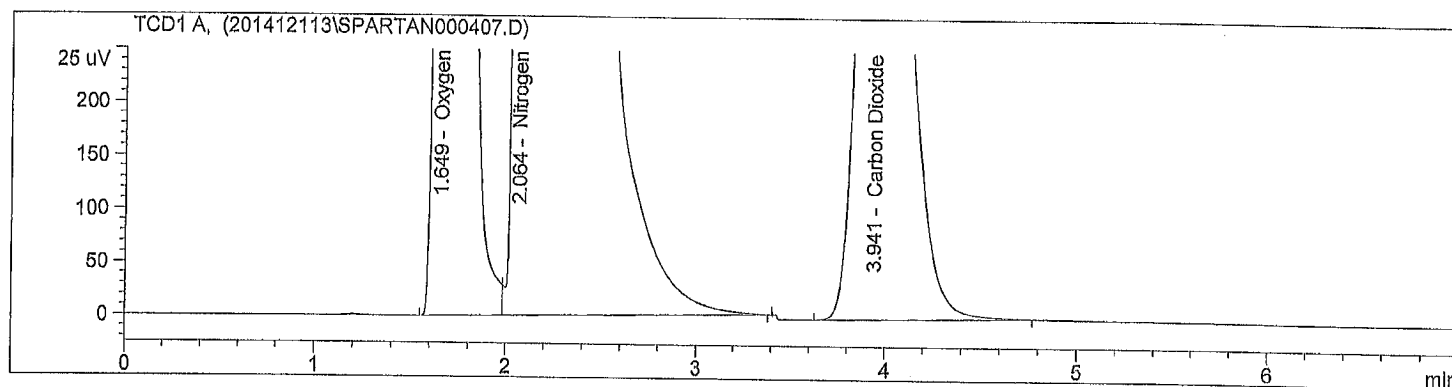
Sample Name: T9B1B Tr#73332 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:01:24
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:57:24 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:08:31 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                1B - Tr#73332 - 16:45 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.649	BV	3.89435e4	3.93144e-4	15.642914		Oxygen
2.064	VBAS	1.98546e5	3.94079e-4	79.942179		Nitrogen
3.941	BBA	1.29253e4	3.34311e-4	4.414907		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

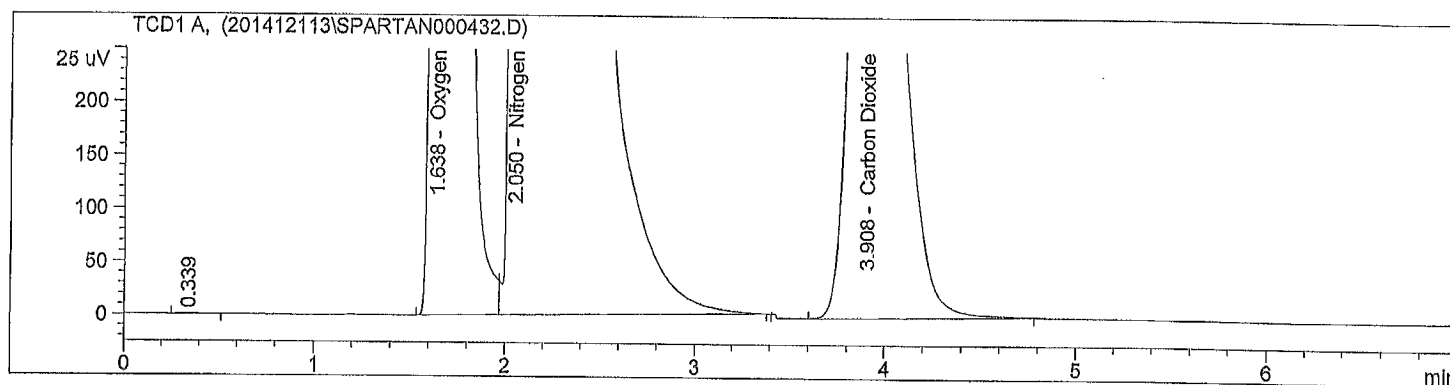
Sample Name: T9B1B Tr#73332 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:46:22
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:44:33 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:53:30 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                1B - Tr#73332 - 16:45 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.638	BV	3.92800e4	3.93143e-4	15.657882	-	Oxygen
2.050	VBAS	2.00053e5	3.94086e-4	79.937040	-	Nitrogen
3.908	BBA	1.29956e4	3.34309e-4	4.405079	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

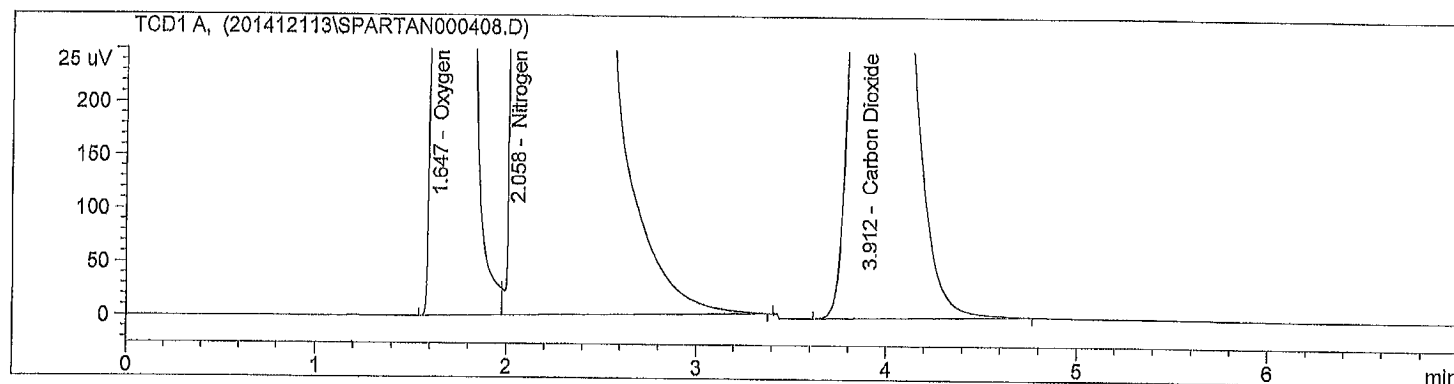
```



=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 13:14:16	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:08:41 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:21:23 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10  
B1A - Tr#73333 - 08:25 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.647	BV	3.56009e4	3.93152e-4	14.320501	-	Oxygen
2.058	VBAS	1.99147e5	3.94082e-4	80.296274	-	Nitrogen
3.912	BBA	1.57408e4	3.34257e-4	5.383224	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

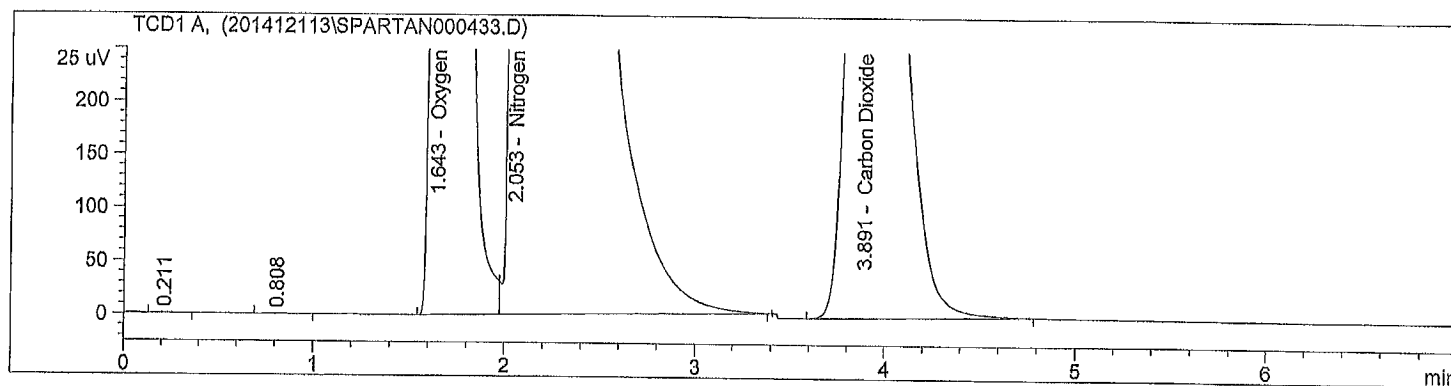
Sample Name: T10B1A Tr#73333 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:55:02
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:53:39 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:02:09 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                B1A - Tr#73333 - 08:25 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.643	BV	3.60246e4	3.93151e-4	14.322703	-	Oxygen
2.053	VBAS	2.01529e5	3.94094e-4	80.316412	-	Nitrogen
3.891	BBA	1.58596e4	3.34255e-4	5.360885	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

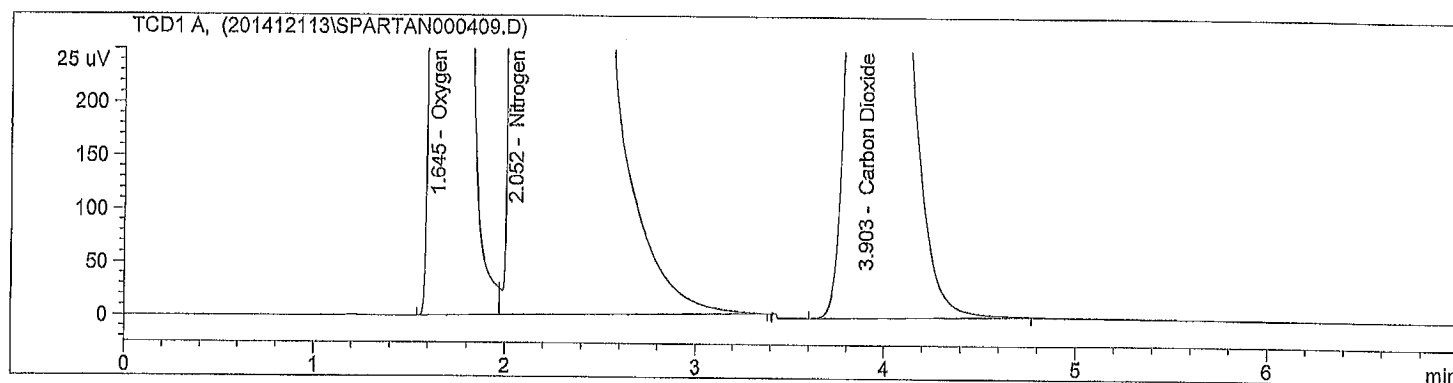
Sample Name: T10B1B Tr#73334 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:23:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:21:33 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:31:02 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                B1B - Tr#73334 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.645	BV	3.45542e4	3.93155e-4	13.924563		Oxygen
2.052	VBAS	1.99010e5	3.94081e-4	80.385387		Nitrogen
3.903	BBA	1.66087e4	3.34244e-4	5.690050		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

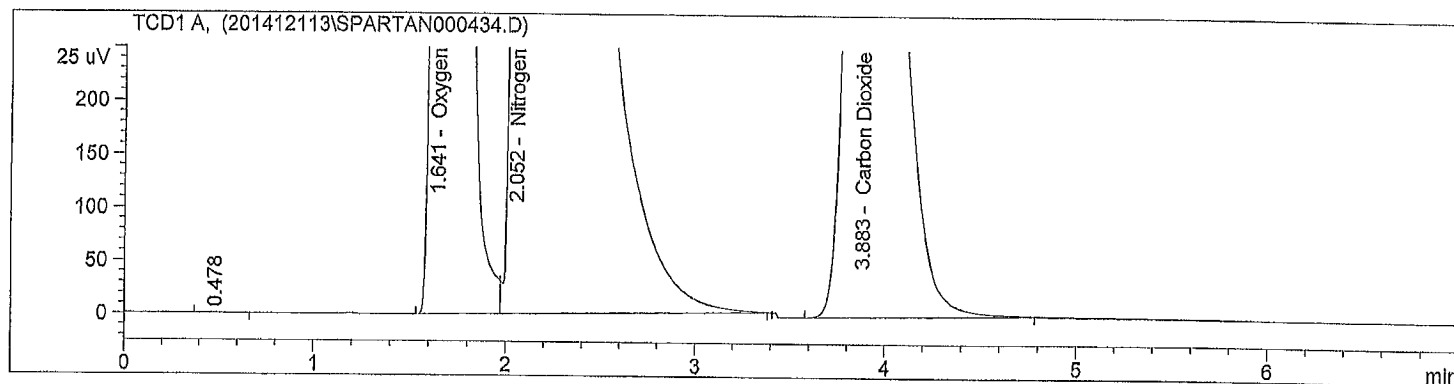
=====
*** End of Report ***
=====

```

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	
Acq. Instrument	: Instrument 1	Location : -
Injection Date	: 13-Dec-14, 18:04:01	Inj : 1
		Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:02:19 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:11:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10  
B1B - Tr#73334 - 09:05 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.48761e4	3.93154e-4	13.919748		Oxygen
2.052	VBAS	2.01031e5	3.94091e-4	80.426722		Nitrogen
3.883	BBA	1.66616e4	3.34243e-4	5.653530		Carbon Dioxide
5.038	-	-	-	-		Methane
6.085	-	-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

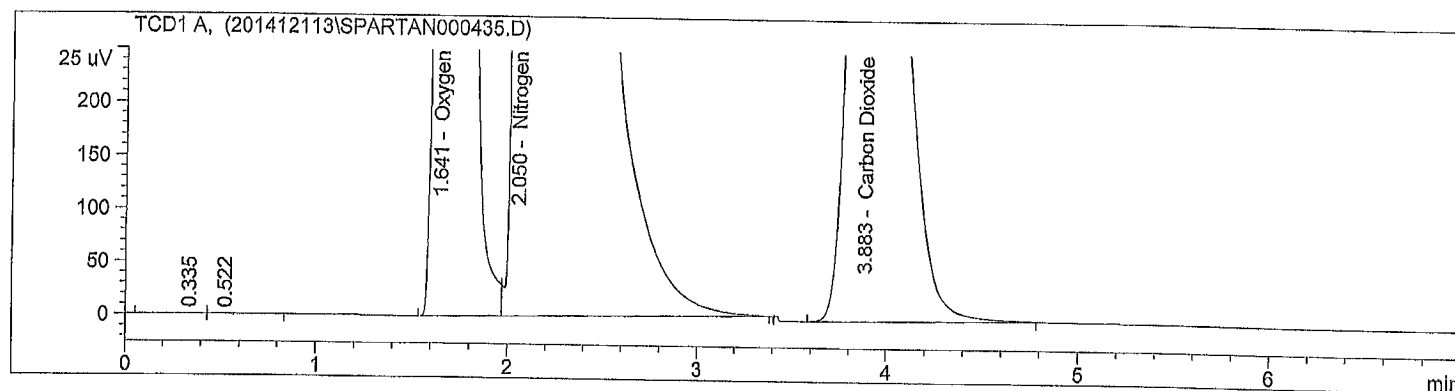
Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:12:21
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:11:18 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:19:28 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1A - Tr#73335 - 09:55 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.55167e4	3.93152e-4	14.107470	-	Oxygen
2.050	VBAS	2.01806e5	3.94095e-4	80.350639	-	Nitrogen
3.883	BBA	1.64110e4	3.34247e-4	5.541891	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

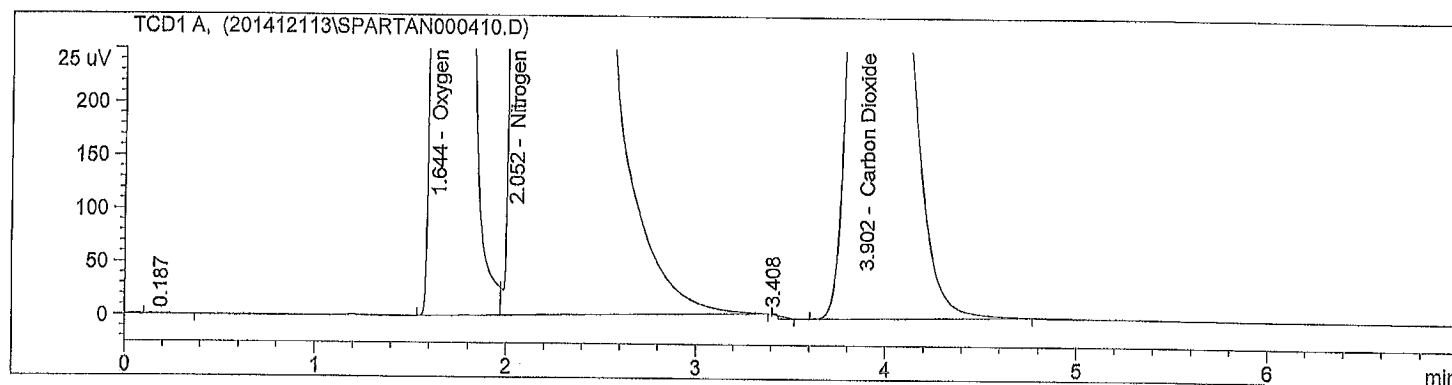
Sample Name: T11B1A Tr#73335 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:33:12
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:31:12 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:40:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1A - Tr#73335 - 09:55 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.50528e4	3.93154e-4	14.088072	-	Oxygen
2.052	VBAS	1.99442e5	3.94083e-4	80.347443	-	Nitrogen
3.902	BBA	1.62850e4	3.34249e-4	5.564486	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

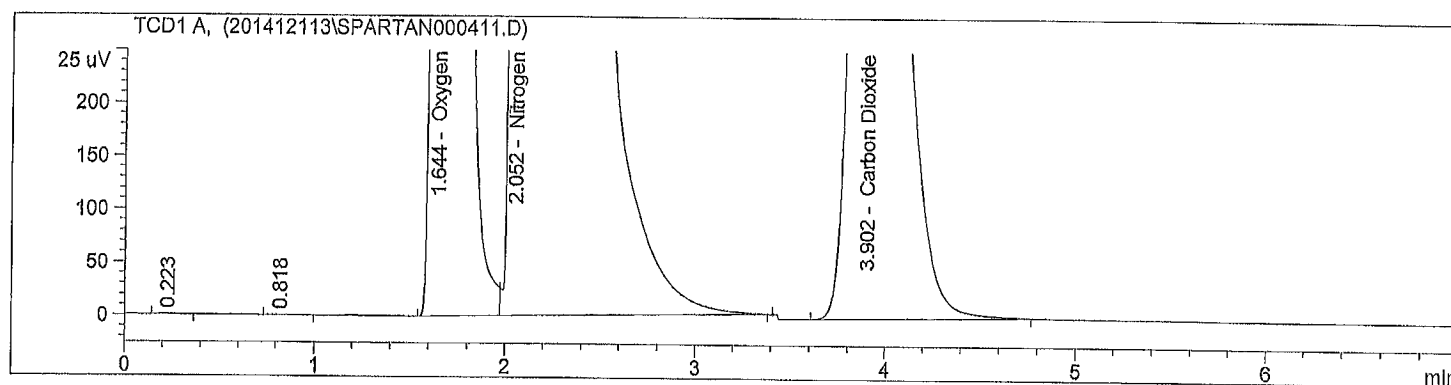
Sample Name: T11B1B Tr#73336 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:41:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:40:29 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:48:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1B - Tr#73336 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.54348e4	3.93153e-4	14.149885	-	Oxygen
2.052	VBAS	2.00705e5	3.94090e-4	80.336850	-	Nitrogen
3.902	BBA	1.62396e4	3.34249e-4	5.513266	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

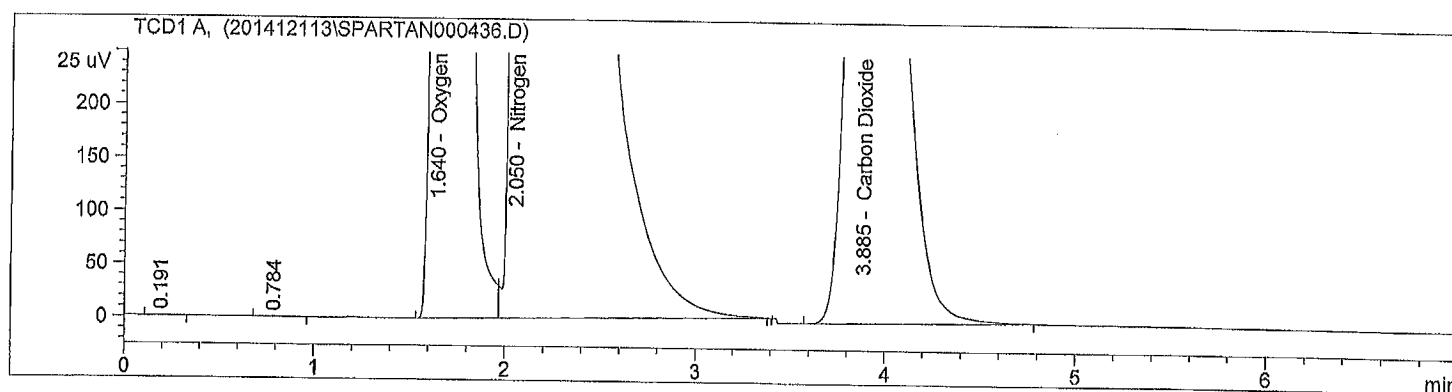
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 18:21:02 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:19:38 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:28:09 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11  
B1B - Tr#73336 - 10:40 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.640	BV	3.55673e4	3.93152e-4	14.153537	-	Oxygen
2.050	VBAS	2.01436e5	3.94093e-4	80.350585	-	Nitrogen
3.885	BBA	1.62448e4	3.34249e-4	5.495878	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

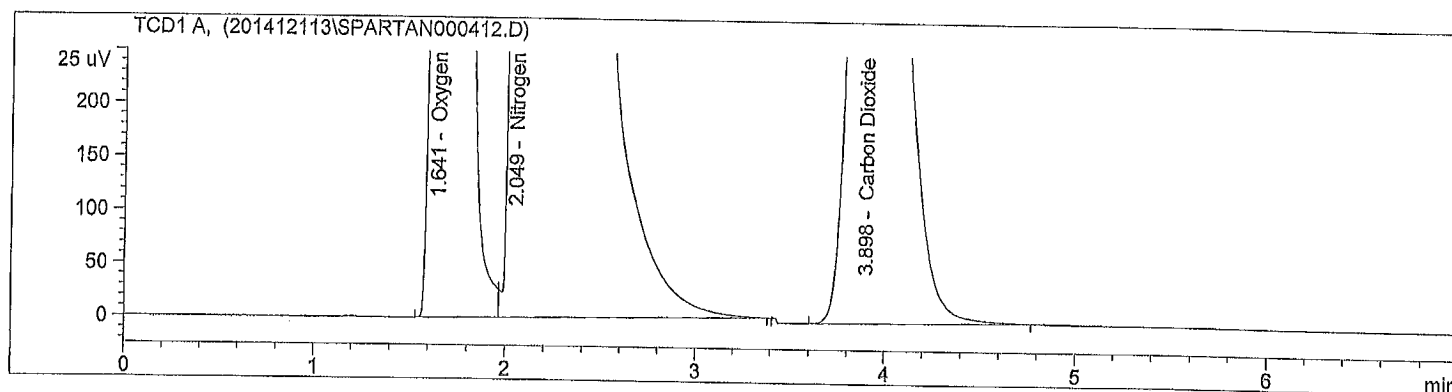
Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*



=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 13:51:45 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:49:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:58:52 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12  
B1A - Tr#73337 - 11:30 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.54625e4	3.93153e-4	14.223440		Oxygen
2.049	VBAS	1.99767e5	3.94085e-4	80.313218		Nitrogen
3.898	BBA	1.60217e4	3.34252e-4	5.463342		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*

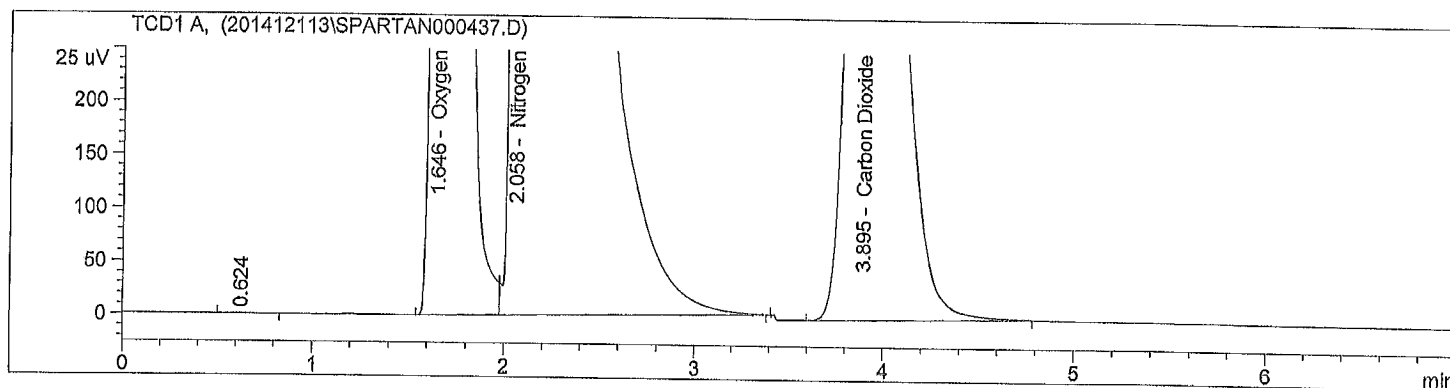
Sample Name: T12B1A Tr#73337 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:29:52
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:28:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:36:59 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                B1A - Tr#73337 - 11:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.646	BV	3.55005e4	3.93152e-4	14.220822		Oxygen
2.058	VBAS	2.00058e5	3.94086e-4	80.329728		Nitrogen
3.895	BBA	1.60011e4	3.34253e-4	5.449449		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

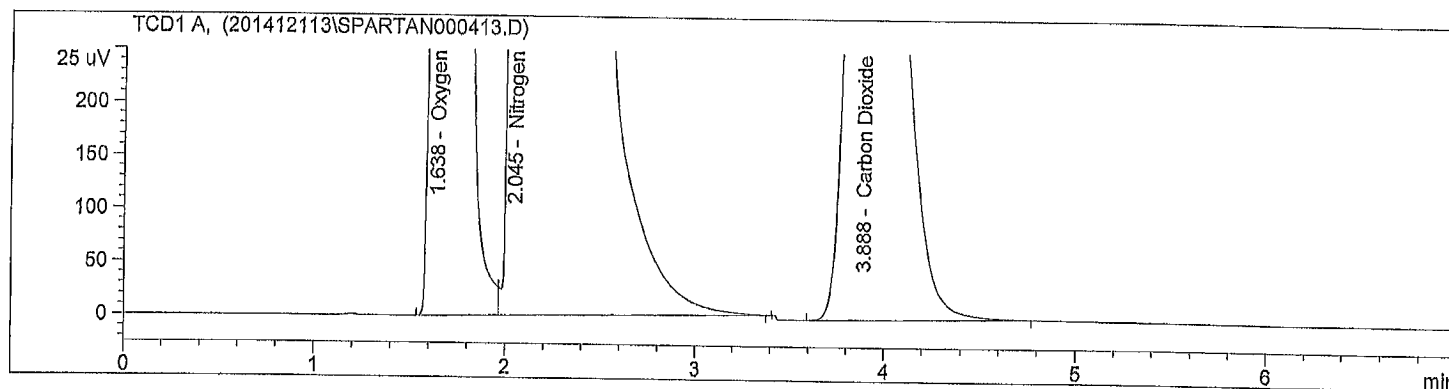
=====
*** End of Report ***

```

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 14:08:55	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:59:02 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 2:16:02 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12  
B1B - Tr#73338 - 12:05 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.638	BV	3.52385e4	3.93153e-4	14.029007		Oxygen
2.045	VBAS	2.01397e5	3.94093e-4	80.370934		Nitrogen
3.888	BBA	1.65455e4	3.34245e-4	5.600059		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

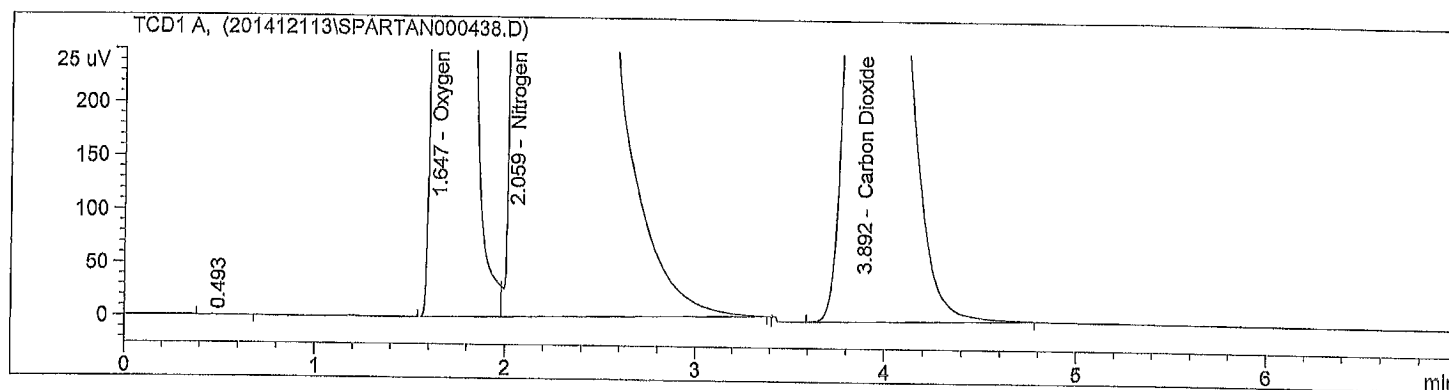
=====

\*\*\* End of Report \*\*\*

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 18:38:51	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:37:09 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:45:58 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12  
B1B - Tr#73338 - 12:05 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.647	BV	3.50068e4	3.93154e-4	14.018034	-	Oxygen
2.059	VBAS	2.00287e5	3.94088e-4	80.392815	-	Nitrogen
3.892	BBA	1.64175e4	3.34247e-4	5.589151	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

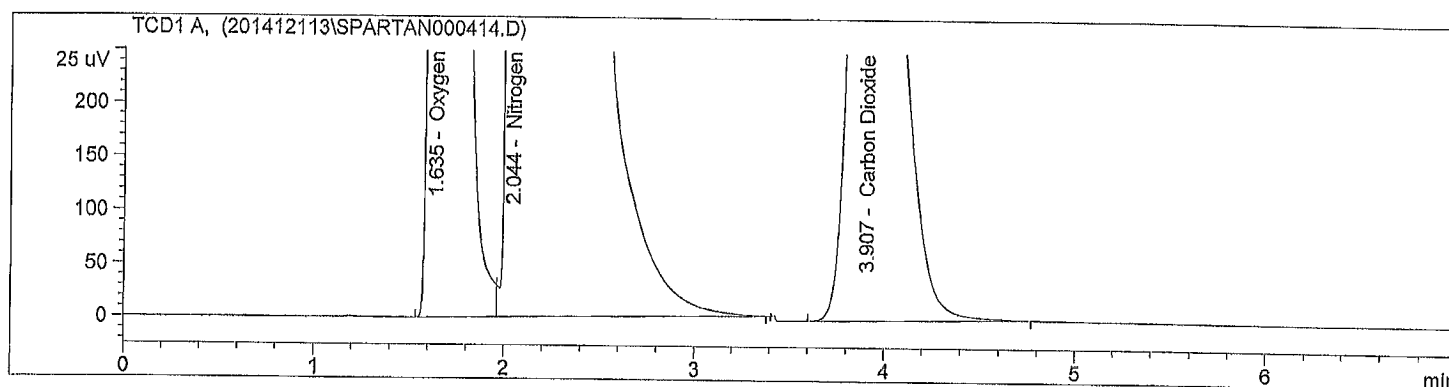
Sample Name: T13B1A Tr#73339 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:18:30
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:16:12 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:25:37 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T13
                B1A - Tr#73339 - 13:00 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.635	BV	3.86394e4	3.93145e-4	15.457051		Oxygen
2.044	VBAS	1.99469e5	3.94083e-4	79.984714		Nitrogen
3.907	BBA	1.34004e4	3.34300e-4	4.558235		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

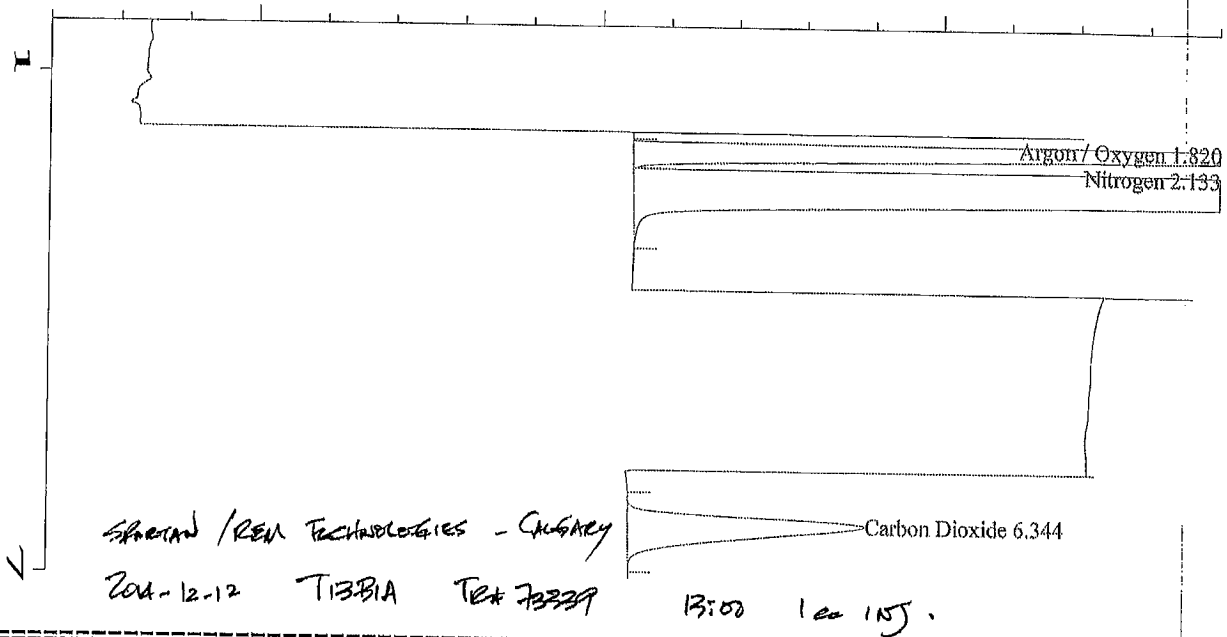
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```



# Normalized Percent Report

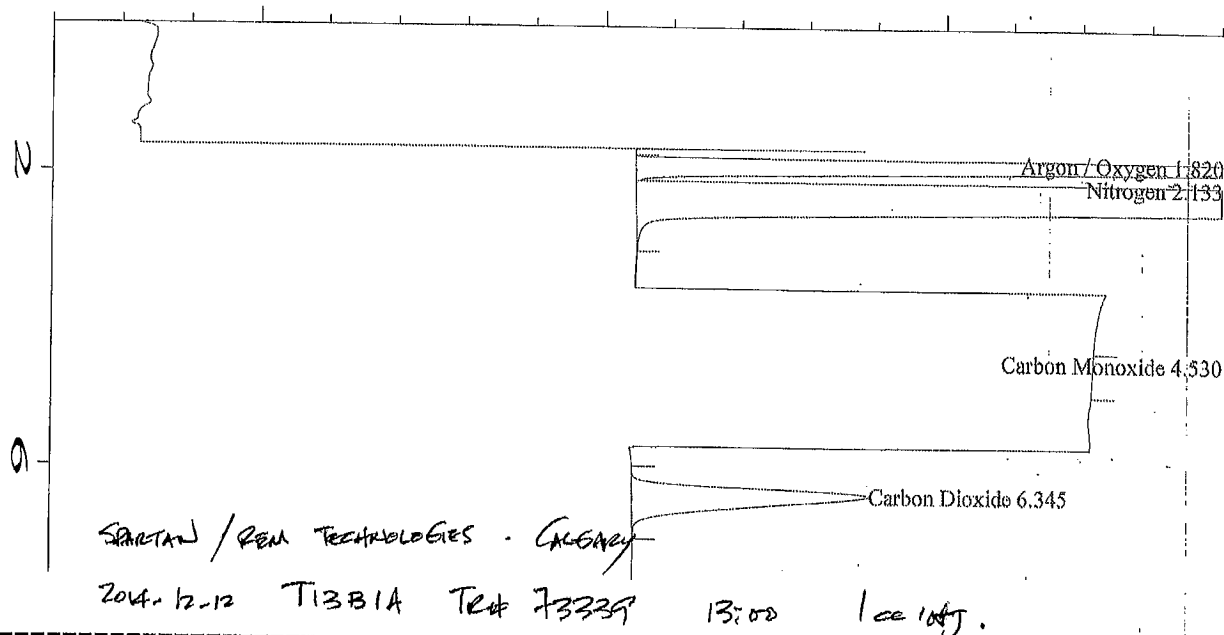
Data File Name : C:\HPCHEM\...\TRS-TCID\HPCHEM~1\2014\REM-SP~1\REM\T13B1A-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:33:58 Instrument Method:  
 Report Created on: 15 Dec 14 10:57 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...\2014\REM-SP~1\REM\T13B1A-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	333085	BV	0.122	1	15.427	Argon / Oxygen
2.133	1670841	VBA	0.192	1	80.056	Nitrogen
3.913	* not found *	1				Methane
4.559	* not found *	1				Carbon Monoxide
6.344	112833	BV	0.254	1	4.517	Carbon Dioxide

Total amount = 99.0285

Not all calibrated peaks were found



# Normalized Percent Report

Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T13B1A-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:44:28 Instrument Method:  
 Report Created on: 15 Dec 14 10:59 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...\2014\REM-SP~1\REM\T13B1A-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	332968	BV	0.122	1	15.429	Argon / Oxygen
2.133	1670092	VBA	0.192	1	80.056	Nitrogen
3.913	* not found *	1				Methane
4.530	96	BBA	0.082	1	0.000141	Carbon Monoxide
6.345	112755	BV	0.255	1	4.516	Carbon Dioxide

Total amount = 98.9839

Not all calibrated peaks were found

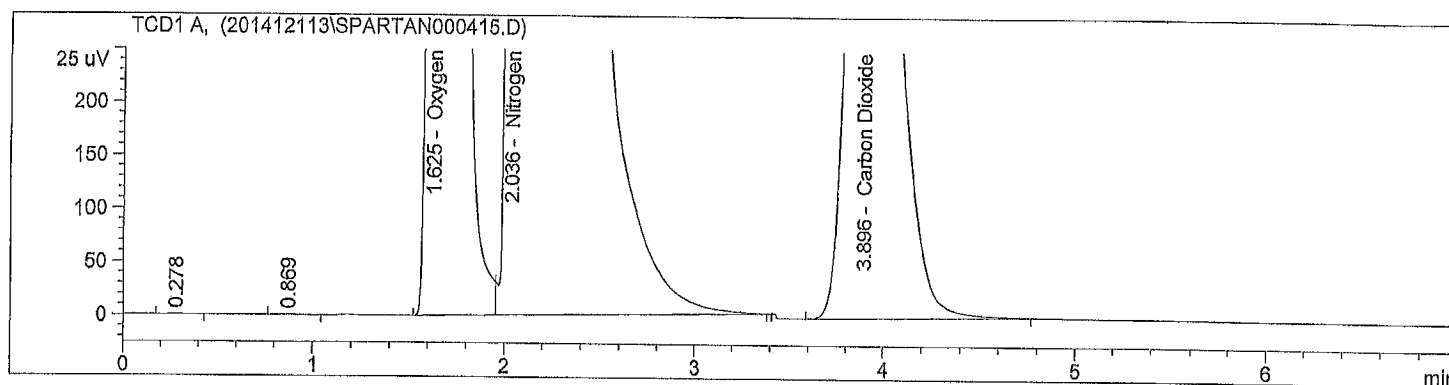
Sample Name: T13B1B Tr#73340 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:36:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:35:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:44:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T13
                B1B - Tr#73340 - 13:35 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.625	BV	3.85337e4	3.93145e-4	15.527256	-	Oxygen
2.036	VBAS	1.97964e5	3.94076e-4	79.958974	-	Nitrogen
3.896	BBA	1.31733e4	3.34305e-4	4.513770	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

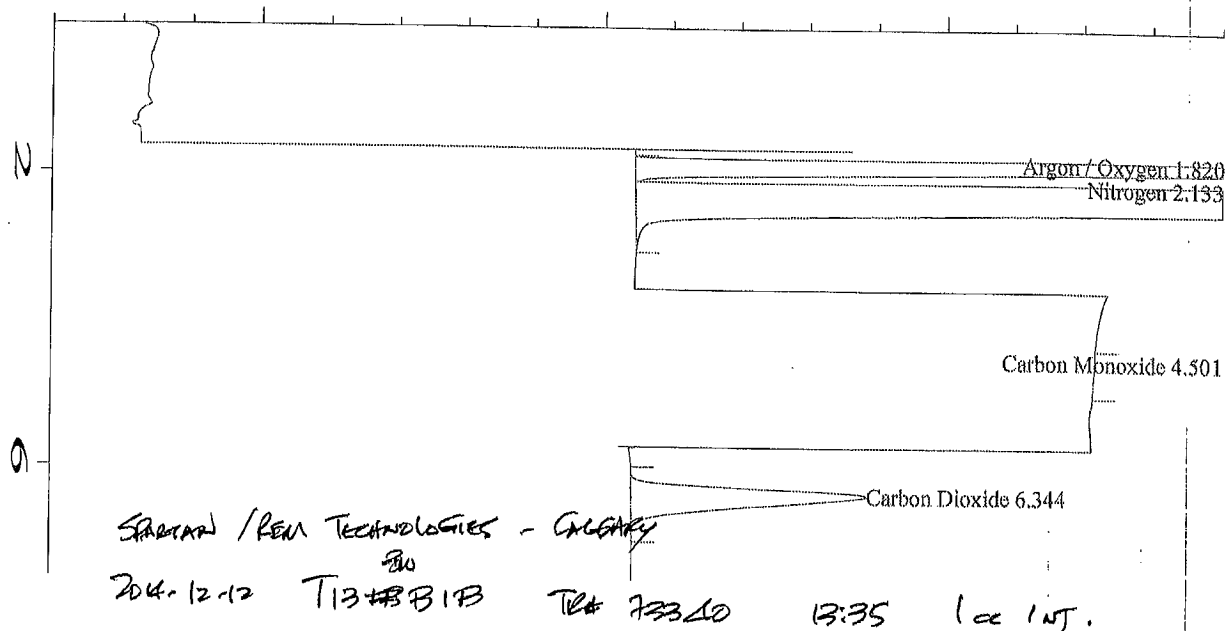
Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```





# Normalized Percent Report

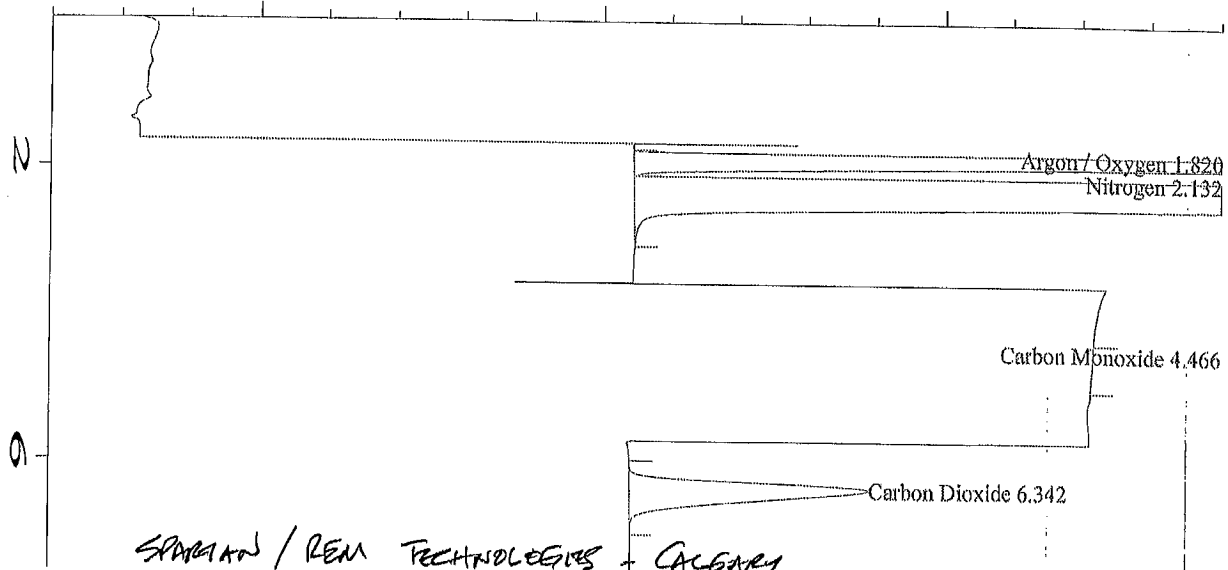
Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T13B1B-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:54:47 Instrument Method:  
 Report Created on: 15 Dec 14 11:00 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\T13B1B-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	333945	BV	0.122	1	15.499	Argon / Oxygen
2.133	1666980	VBA	0.192	1	80.030	Nitrogen
3.913	* not found *	1				Methane
4.501	130	BBA	0.121	1	0.000191	Carbon Monoxide
6.344	111490	BV	0.255	1	4.471	Carbon Dioxide

Total amount = 98.8272

Not all calibrated peaks were found



# Normalized Percent Report

Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T13B1B-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:06:19 Instrument Method:  
 Report Created on: 15 Dec 14 11:01 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

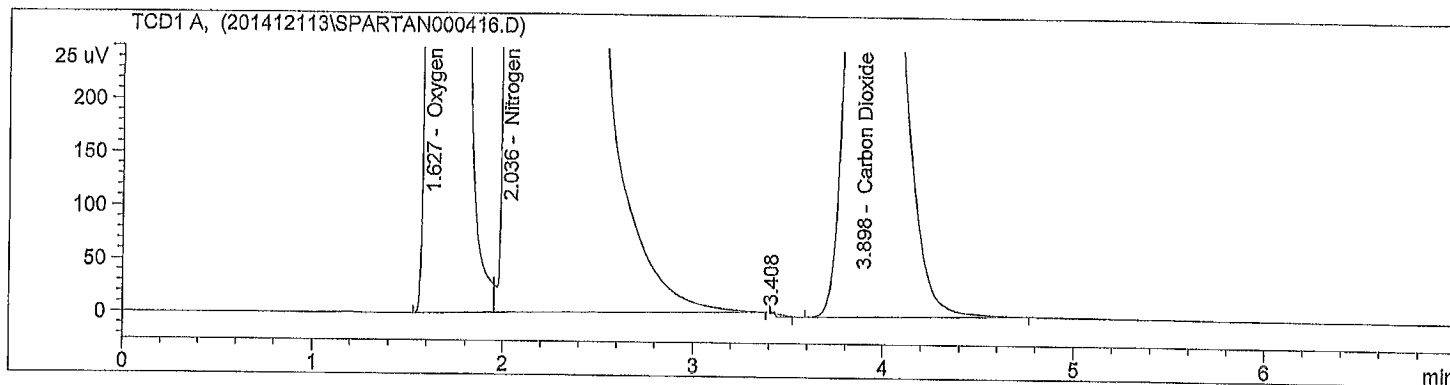
Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\T13B1B-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	335519	BV	0.122	1	15.499	Argon / Oxygen
2.132	1674636	VBA	0.192	1	80.027	Nitrogen
3.913	* not found *	1				Methane
4.466	131	BBA	0.438	1	0.000192	Carbon Monoxide
6.342	112095	BV	0.251	1	4.475	Carbon Dioxide

Total amount = 99.2941

Not all calibrated peaks were found

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 14:48:54 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 2:44:15 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 2:56:02 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14  
B1A - Tr#73341 - 14:30 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.627	BV	3.88828e4	3.93144e-4	15.474906		Oxygen
2.036	VBAS	2.00447e5	3.94088e-4	79.967244		Nitrogen
3.898	BBA	1.34681e4	3.34298e-4	4.557850		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*

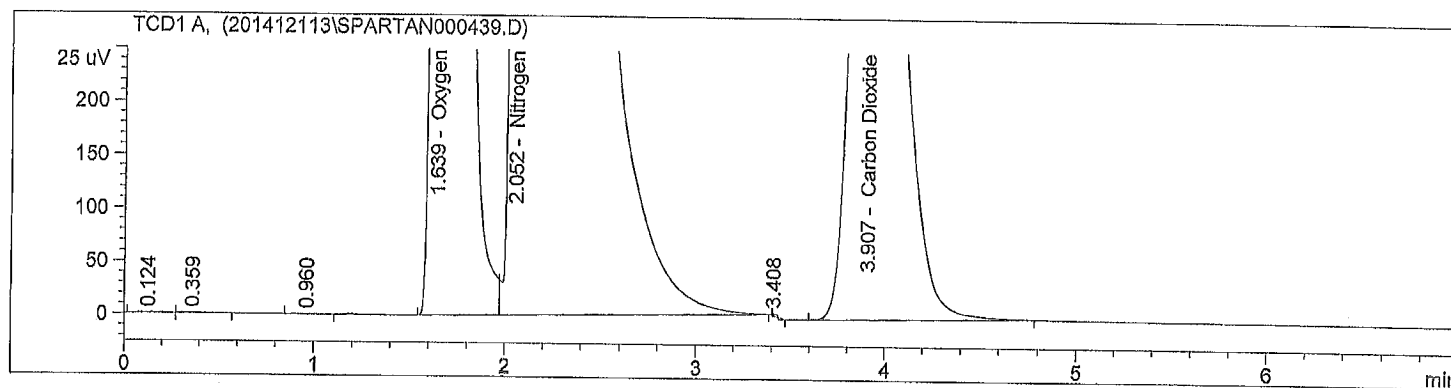
Sample Name: T14B1A Tr#73341 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:47:21
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:46:08 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:54:28 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T14
                B1A - Tr#73341 - 14:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.639	BV	3.90190e4	3.93144e-4	15.463890	-	Oxygen
2.052	VBAS	2.01351e5	3.94093e-4	79.991345	-	Nitrogen
3.907	BBA	1.34861e4	3.34298e-4	4.544765	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

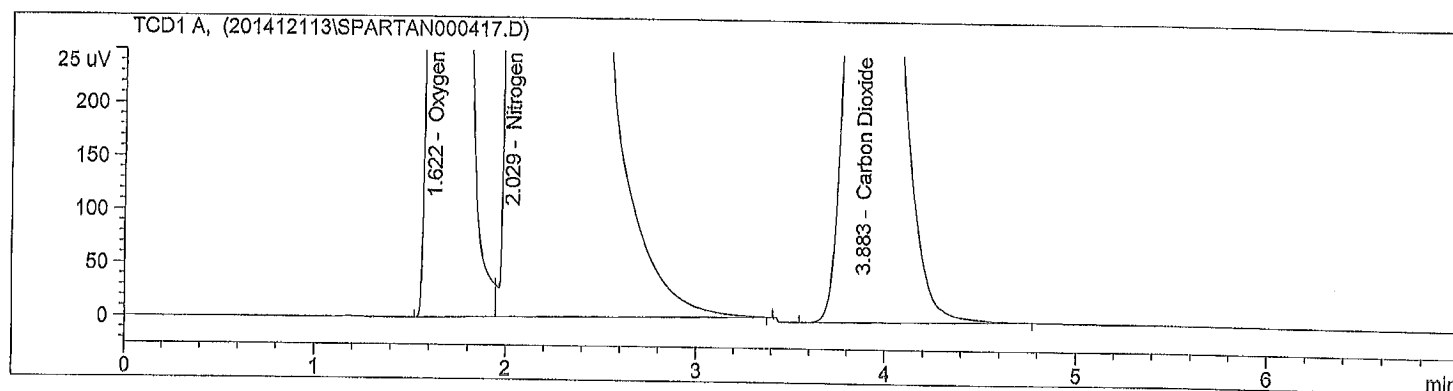
Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 14:59:59 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 2:56:12 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 3:07:06 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14  
B1B - Tr#73342 - 15:05 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

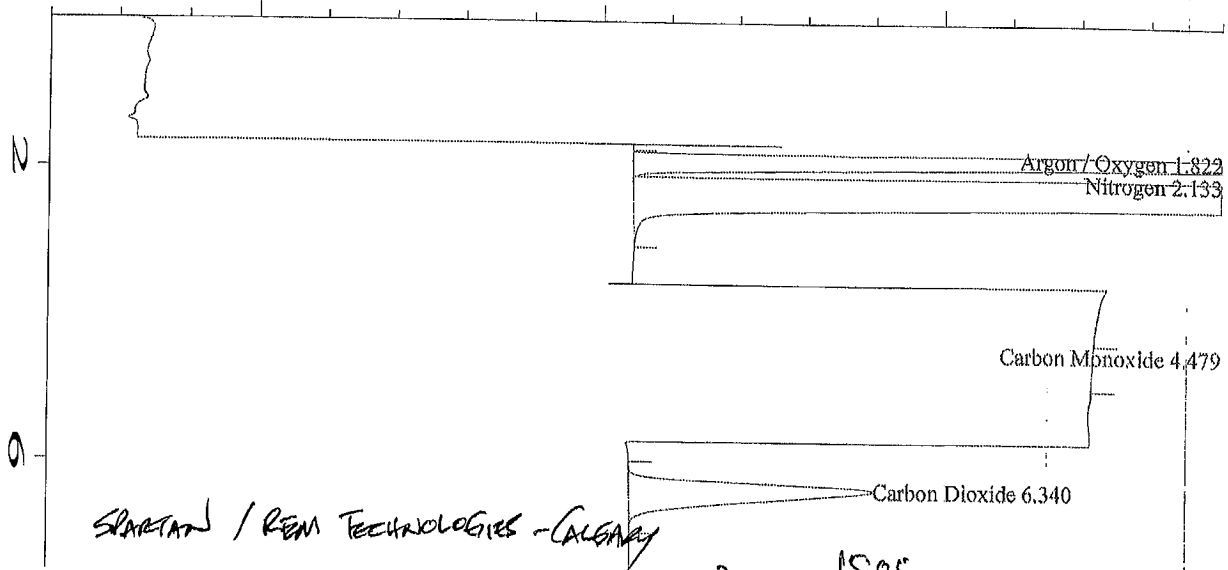
RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.622	BV	3.84951e4	3.93145e-4	15.350323		Oxygen
2.029	VBAS	2.00192e5	3.94087e-4	80.020010		Nitrogen
3.883	BBA	1.36540e4	3.34295e-4	4.629667		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*



SPARTAN / REM TECHNOLOGIES - CALGARY  
 2014-12-12 TUB 14B TR# 73343 2 15:05 14:30 1 cc 10J.

Normalized Percent Report

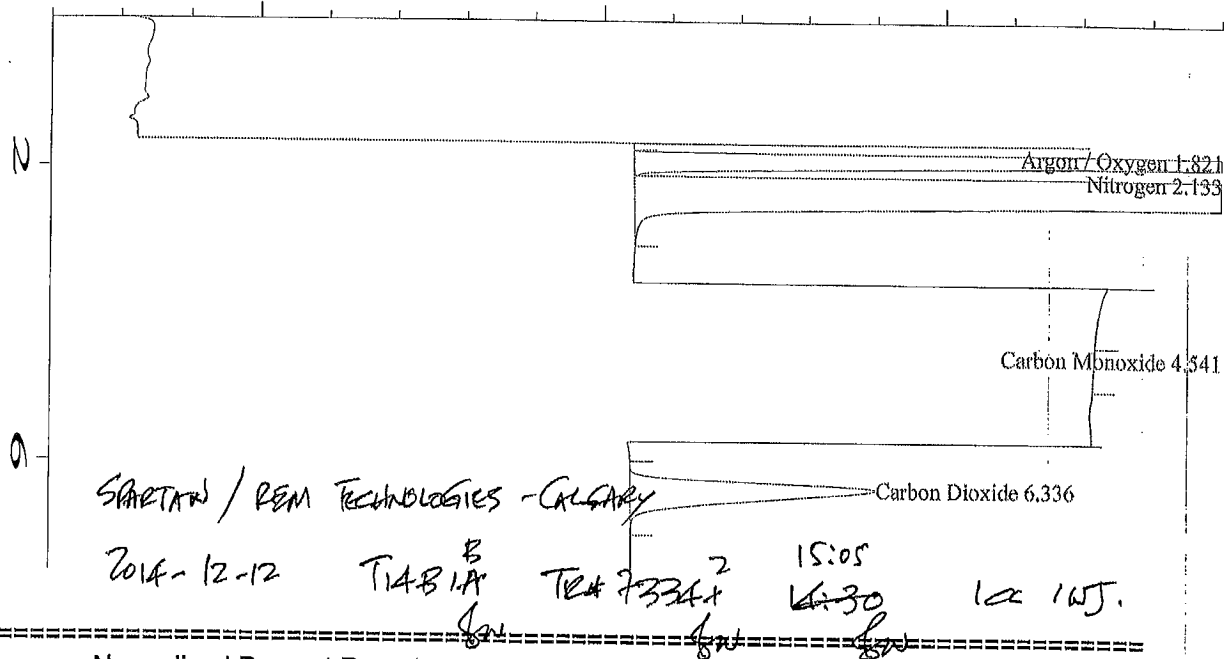
Data File Name : C:\HPCHEM\...\TRS-TCID\HPCHEM~1\2014\REM-SP~1\REM\T14B1B-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:16:31 Instrument Method:  
 Report Created on: 15 Dec 14 11:01 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\T14B1B-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.822	330679	BV	0.121	1	15.328	Argon / Oxygen
2.133	1669905	VBA	0.192	1	80.078	Nitrogen
3.913	* not found *	1				Methane
4.479	186	BV	0.453	1	0.000274	Carbon Monoxide
6.340	114611	BV	0.251	1	4.593	Carbon Dioxide

Total amount = 98.9449

Not all calibrated peaks were found



# Normalized Percent Report

Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T14B1B-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:26:43 Instrument Method:  
 Report Created on: 15 Dec 14 11:02 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\T14B1B-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *			1		Hydrogen
1.821	328801	BV	0.122	1	15.328	Argon / Oxygen
2.133	1660620	VBA	0.191	1	80.080	Nitrogen
3.913	* not found *			1		Methane
4.541	111	BBA	0.374	1	0.000165	Carbon Monoxide
6.336	113914	BV	0.249	1	4.591	Carbon Dioxide

Total amount = 98.3814

Not all calibrated peaks were found

=====

Calibration Table

=====

Calib. Data Modified : 11/20/2014 11:10:56 AM

Calculate : Normalized Percent

Based on : Peak Area

Rel. Reference Window : 3.000 %

Abs. Reference Window : 0.300 min

Rel. Non-ref. Window : 3.000 %

Abs. Non-ref. Window : 0.300 min

Do not use Multiplier & Dilution Factor with ISTDs

Uncalibrated Peaks : not reported

Partial Calibration : Yes, identified peaks are recalibrated

Correct All Ret. Times: No, only for identified peaks

Curve Type : Linear

Origin : Included

Weight : Equal

Recalibration Settings:

Average Response : Average all calibrations

Average Retention Time: Floating Average New 75%

G.C. ID# 6538

2014-11-19

## Calibration Report Options :

Printout of recalibrations within a sequence:

Calibration Table after Recalibration

Normal Report after Recalibration

If the sequence is done with bracketing:

Results of first cycle (ending previous bracket)

Signal 1: TCD1 A,

RetTime	Lvl	Amount	Area	Amt/Area	Ref Grp Name
[min]	Sig	[Mole %]			
1.325	1	3 1.00000e-1	7.96014e-1	1.25626e-1	Hydrogen
		2 5.00000e-1	3.70561	1.34930e-1	
		1 1.00000	6.92623	1.44379e-1	
1.787	1	3 6.00000e-1	1559.54932	3.84727e-4	Oxygen
		2 3.00000	7531.69385	3.98317e-4	
		1 6.00000	1.52983e4	3.92201e-4	
2.250	1	3 8.08000	2.14924e4	3.75947e-4	Nitrogen
		2 40.40000	1.02827e5	3.92894e-4	
		1 80.80000	2.04934e5	3.94273e-4	
4.025	1	3 1.20000	3644.35571	3.29276e-4	Carbon Dioxide
		2 6.00000	1.78148e4	3.36800e-4	
		1 12.00000	3.59777e4	3.33540e-4	
5.038	1	3 1.00000e-2	21.17078	4.72349e-4	Methane
		2 5.00000e-2	95.72540	5.22327e-4	
		1 1.00000e-1	201.92026	4.95245e-4	
6.085	1	3 1.00000e-2	21.98953	4.54762e-4	Carbon Monoxide
		2 5.00000e-2	122.41664	4.08441e-4	
		1 1.00000e-1	253.91801	3.93828e-4	

=====

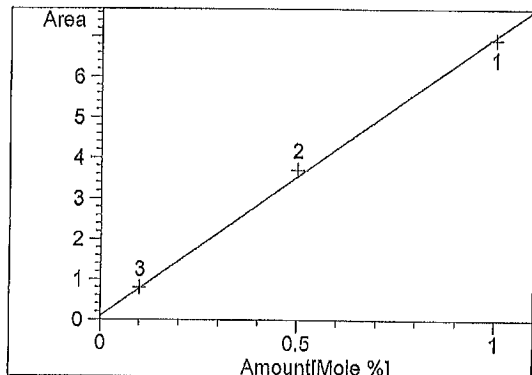
Peak Sum Table

=====

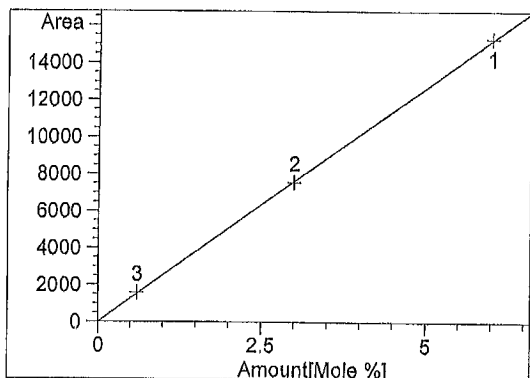


\*\*\*No Entries in table\*\*\*

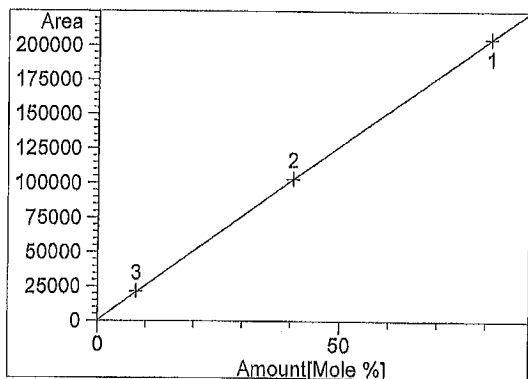
### Calibration Curves



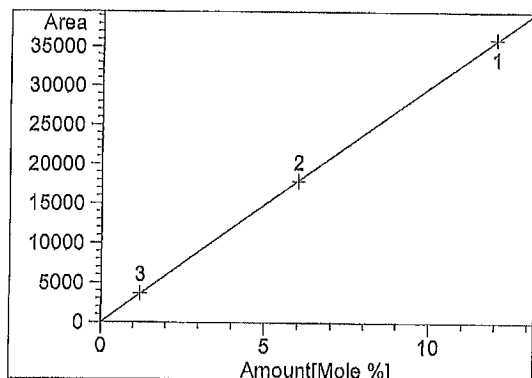
Hydrogen at exp. RT: 1.325  
TCD1 A,  
Correlation: 0.99933  
Residual Std. Dev.: 0.14056  
Formula:  $y = mx + b$   
m: 6.91531  
b: 9.08385e-2  
x: Amount  
y: Height



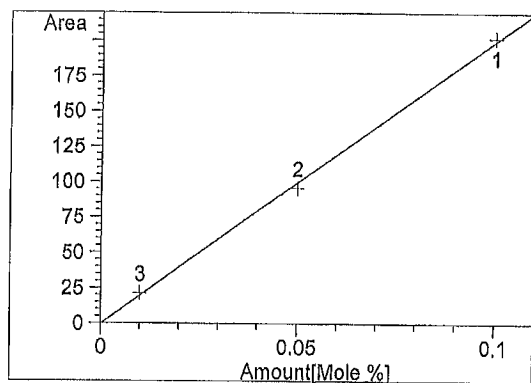
Oxygen at exp. RT: 1.787  
TCD1 A,  
Correlation: 0.99996  
Residual Std. Dev.: 77.66686  
Formula:  $y = mx + b$   
m: 2544.15882  
b: -8.60112  
x: Amount  
y: Height



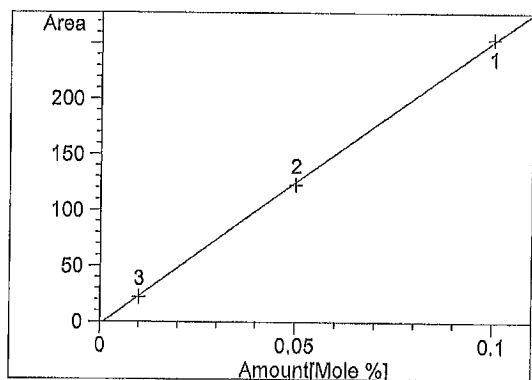
Nitrogen at exp. RT: 2.250  
TCD1 A,  
Correlation: 0.99999  
Residual Std. Dev.: 526.14425  
Formula:  $y = mx + b$   
m: 2531.04840  
b: 509.82082  
x: Amount  
y: Height



Carbon Dioxide at exp. RT: 4.025  
TCD1 A,  
Correlation: 0.99998  
Residual Std. Dev.: 115.80990  
Formula:  $y = mx + b$   
m: 2993.92133  
b: -11.62622  
x: Amount  
y: Height



Methane at exp. RT: 5.038  
TCD1 A,  
Correlation: 0.99954  
Residual Std. Dev.: 3.37306  
Formula:  $y = mx + b$   
m: 2006.02358  
b: -5.36834e-1  
x: Amount  
y: Height

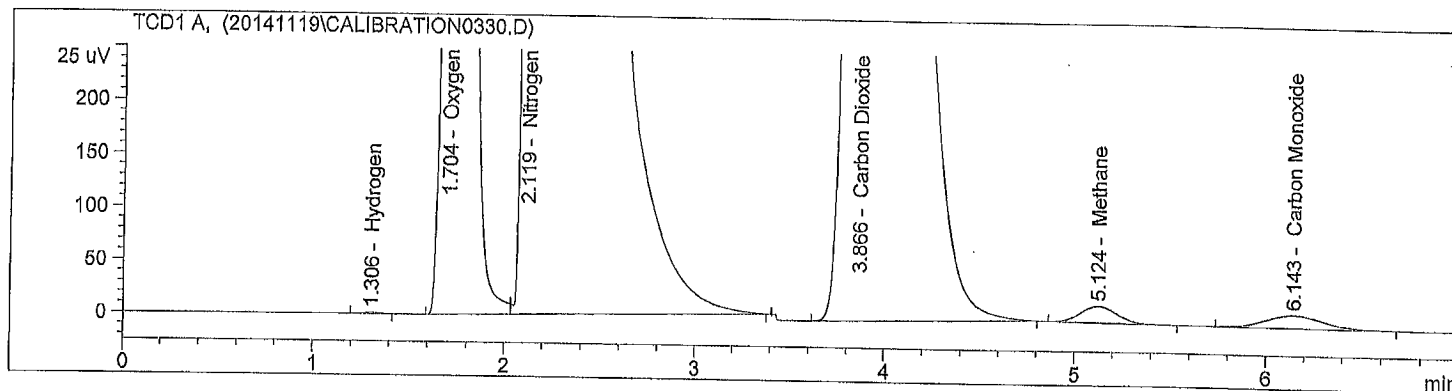


Carbon Monoxide at exp. RT: 6.085  
TCD1 A,  
Correlation: 0.99980  
Residual Std. Dev.: 2.82061  
Formula:  $y = mx + b$   
m: 2548.31630  
b: -2.35161  
x: Amount  
y: Height

=====

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 19-Nov-14, 13:51:55	Inj Volume	: Manually
Acq. Method	: C:\CHEM32\1\METHODS\TCD.M		
Last changed	: 11/19/2014 1:49:29 PM by Maxxam - ID# 6538 - BW		
Analysis Method	: C:\CHEM32\1\METHODS\TCD.M		
Last changed	: 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW		
	(modified after loading)		
Sample Info	: Calibration - Level 1 - run 1 - ID# 11-10-27-22 - 1 cc injection		



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:10:56 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.306	BBA	6.95264	1.42717e-1	0.986598		Hydrogen
1.704	BV	1.54031e4	3.93277e-4	6.023090		Oxygen
2.119	VBAS	2.06180e5	3.94116e-4	80.794853		Nitrogen
3.866	BBA	3.61016e4	3.34118e-4	11.993334		Carbon Dioxide
5.124	BBA	205.76920	4.99799e-4	0.102256		Methane
6.143	BBA	253.60886	3.96055e-4	0.099870		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

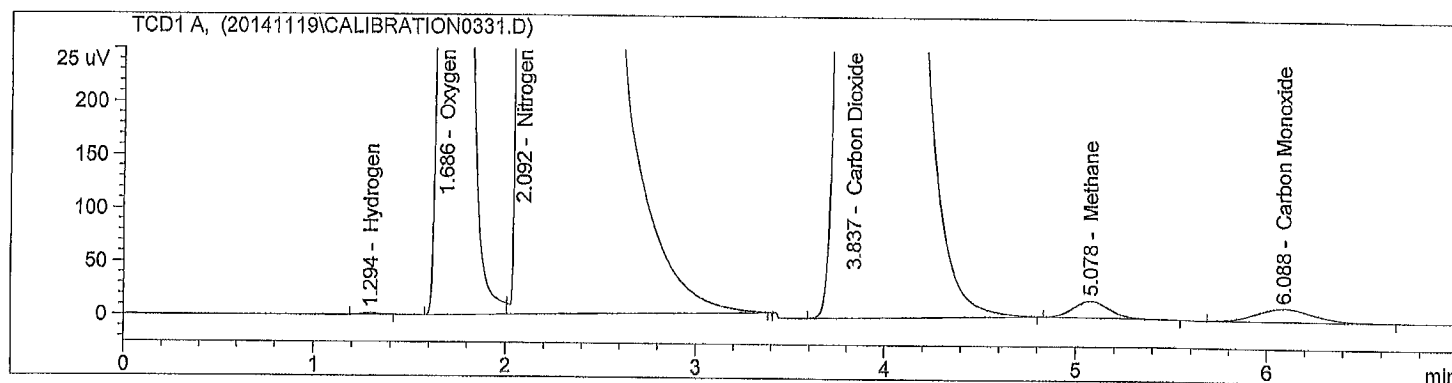
Sample Name: Level 1 - run 2 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:05:16
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:03:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 1 - run 2 - ID# 11-10-27-22 - 1 cc
                injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.294	BBA	6.88176	1.42698e-1	0.980902		Hydrogen
1.686	BV	1.53162e4	3.93278e-4	6.016701		Oxygen
2.092	VBAS	2.05130e5	3.94111e-4	80.752692		Nitrogen
3.837	BBA	3.60992e4	3.34118e-4	12.047740		Carbon Dioxide
5.078	BBA	202.26636	4.99822e-4	0.100983		Methane
6.088	BBA	255.27438	3.96031e-4	0.100982		Carbon Monoxide

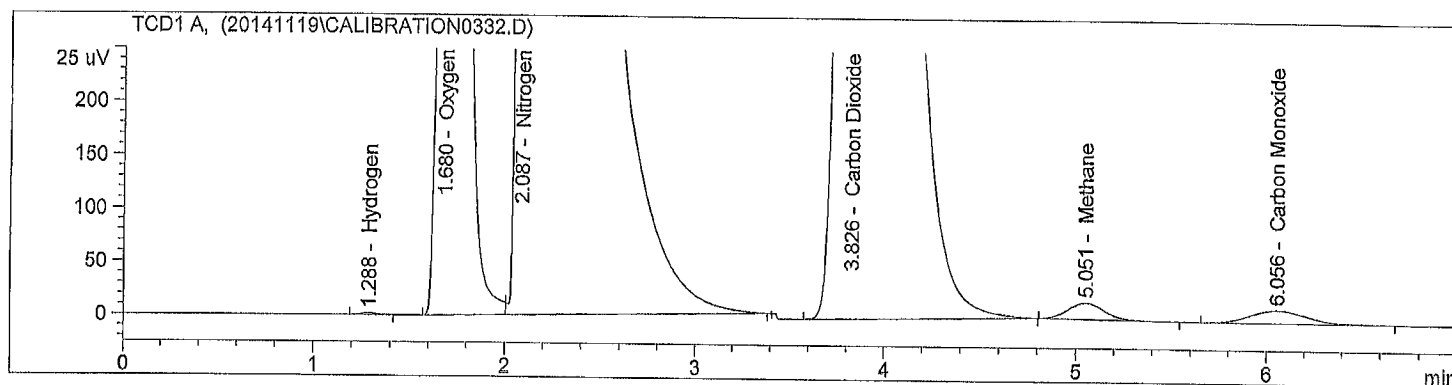
Totals : 100.000000

```

=====
*** End of Report ***
=====

```

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 19-Nov-14, 14:18:22 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 11/19/2014 2:16:41 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Calibration - Level 1 - run 3 - ID# 11-10-27-22 - 1 cc  
injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:10:56 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.288	BBA	6.94429	1.42715e-1	0.998099		Hydrogen
1.680	BV	1.51756e4	3.93280e-4	6.010682		Oxygen
2.087	VBAS	2.03492e5	3.94103e-4	80.767144		Nitrogen
3.826	BBA	3.57322e4	3.34119e-4	12.023674		Carbon Dioxide
5.051	BBA	197.72522	4.99852e-4	0.099536		Methane
6.056	BBA	252.87079	3.96065e-4	0.100865		Carbon Monoxide

Totals : 100.000000

=====  
\*\*\* End of Report \*\*\*

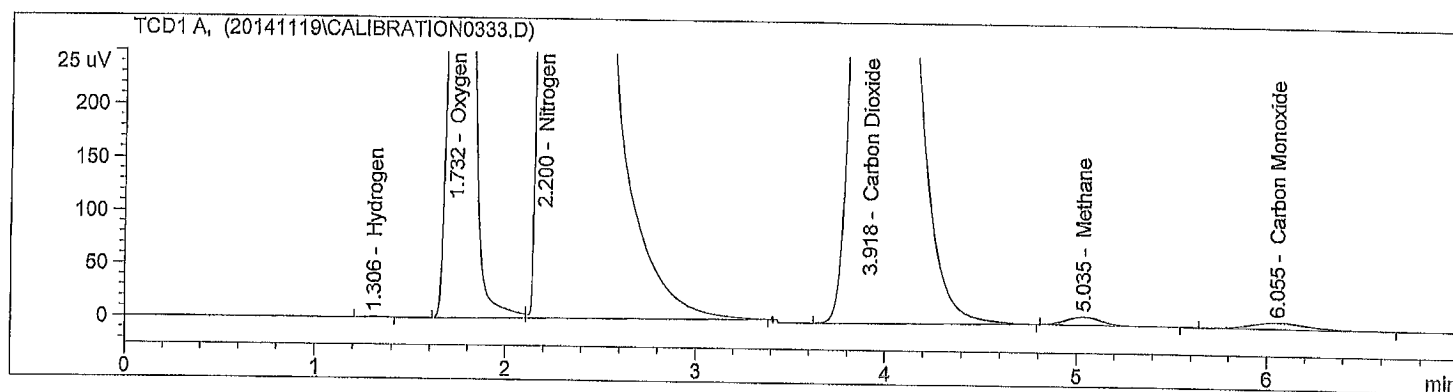
Sample Name: Level 2 - run 1 0.5 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:38:37
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:36:49 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Calibration - Level 2 - run 1 - ID# 11-10-27-22 - 0.5
                  cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.306	BBA	3.66942	1.41027e-1	1.036414		Hydrogen
1.732	BV	7525.45117	3.93506e-4	5.930871		Oxygen
2.200	VBAS	1.02771e5	3.93133e-4	80.918075		Nitrogen
3.918	BBA	1.78080e4	3.34228e-4	11.920423		Carbon Dioxide
5.035	BBA	96.20104	5.01280e-4	0.096582		Methane
6.055	BBA	121.87815	3.99988e-4	0.097635		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

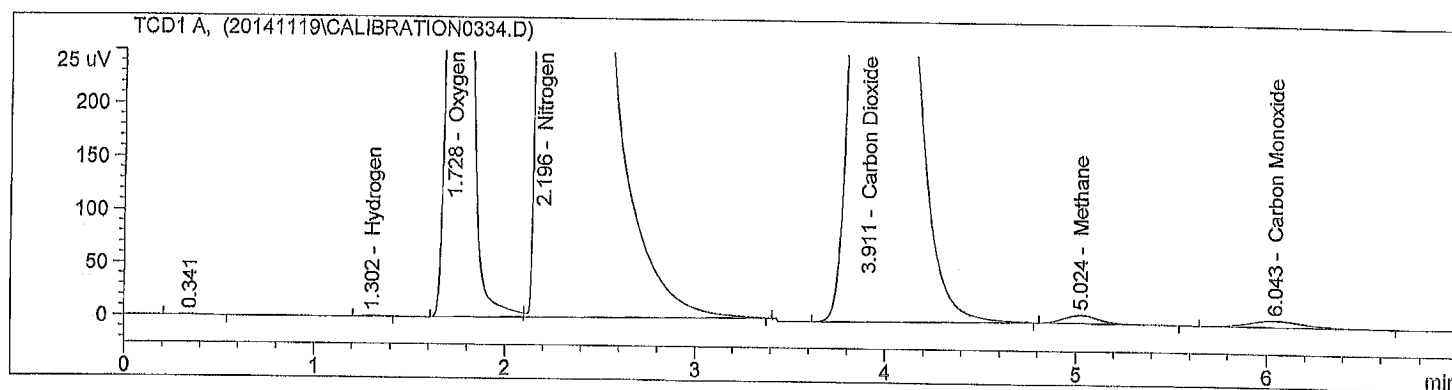
Sample Name: Level 2 - run 2 0.5 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:47:46
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:45:54 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Calibration - Level 2 - run 2 - ID# 11-10-27-22 - 0.5
                  cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.302	BBA	3.74180	1.41096e-1	1.056029		Hydrogen
1.728	BV	7537.93652	3.93506e-4	5.933126		Oxygen
2.196	VBAS	1.02882e5	3.93135e-4	80.902696		Nitrogen
3.911	BBA	1.78215e4	3.34228e-4	11.914282		Carbon Dioxide
5.024	BBA	95.24976	5.01308e-4	0.095510		Methane
6.043	BBA	122.95512	3.99921e-4	0.098356		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

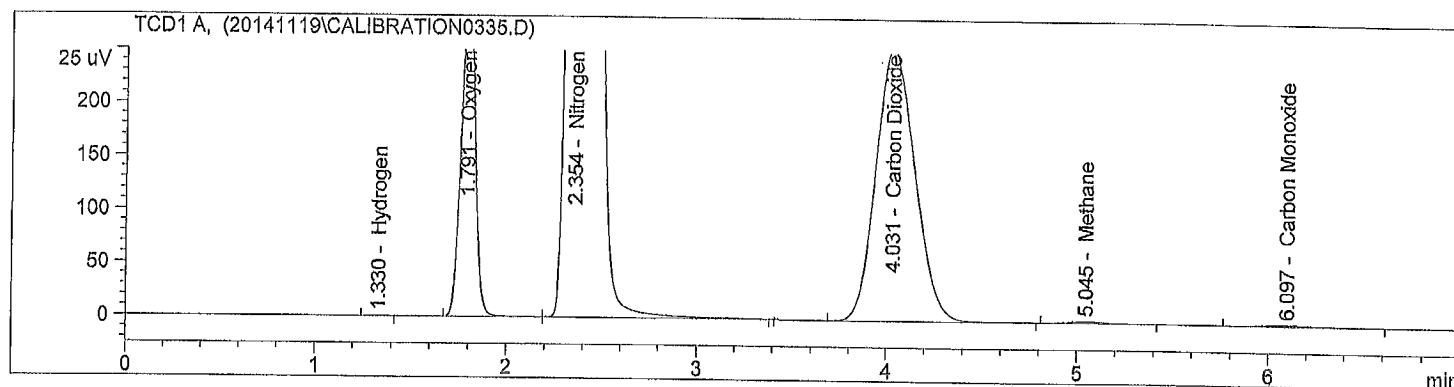
Sample Name: Level 3 - run 1 0.1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:58:21
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:55:04 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 3 - run 1 - ID# 11-10-27-22 - 0.1
                cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.330	BBA	7.91850e-1	1.28018e-1	0.992228		Hydrogen
1.791	BV	1553.33228	3.95234e-4	6.009202		Oxygen
2.354	VBA	2.14240e4	3.85691e-4	80.879747		Nitrogen
4.031	BBA	3634.52686	3.35079e-4	11.920459		Carbon Dioxide
5.045	BB	21.13526	5.11160e-4	0.105746		Methane
6.097	BB	21.76138	4.34822e-4	0.092618		Carbon Monoxide

Totals : 100.000000

```

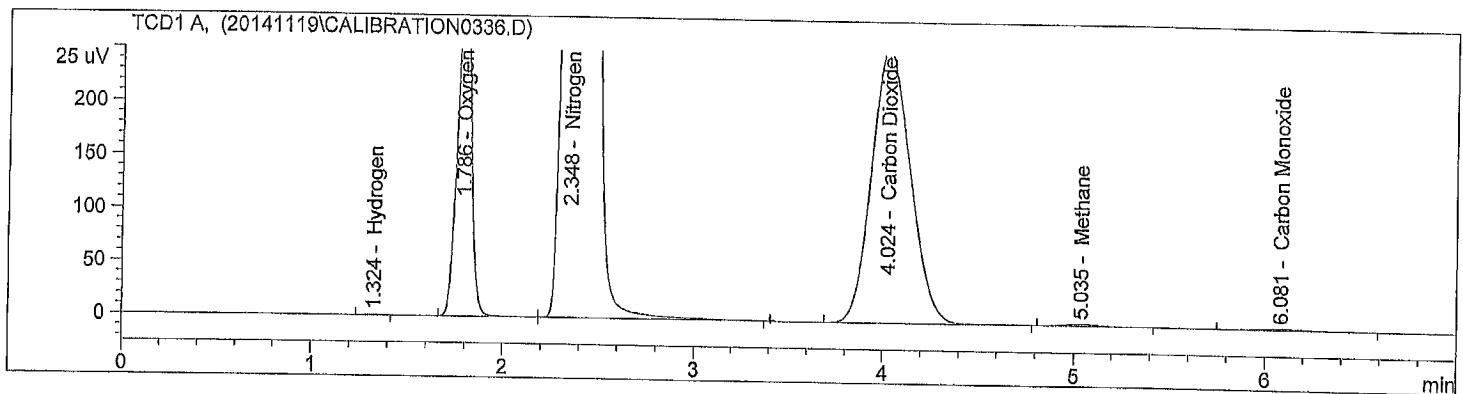
=====
*** End of Report ***
=====

```



=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 19-Nov-14, 15:08:13	Inj Volume	: Manually
Acq. Method	: C:\CHEM32\1\METHODS\TCD.M		
Last changed	: 11/19/2014 3:07:10 PM by Maxxam - ID# 6538 - BW (modified after loading)		
Analysis Method	: C:\CHEM32\1\METHODS\TCD.M		
Last changed	: 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW (modified after loading)		
Sample Info	: Calibration - Level 3 - run 2 - ID# 11-10-27-22 - 0.1 cc injection		



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:10:56 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.324	BBA	8.00179e-1	1.28190e-1	0.997489		Hydrogen
1.786	BV	1565.76636	3.95216e-4	6.017657		Oxygen
2.348	VBA	2.15607e4	3.85751e-4	80.878889		Nitrogen
4.024	BBA	3654.18457	3.35073e-4	11.906805		Carbon Dioxide
5.035	BB	21.20629	5.11118e-4	0.105403		Methane
6.081	BB	22.21768	4.33951e-4	0.093757		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

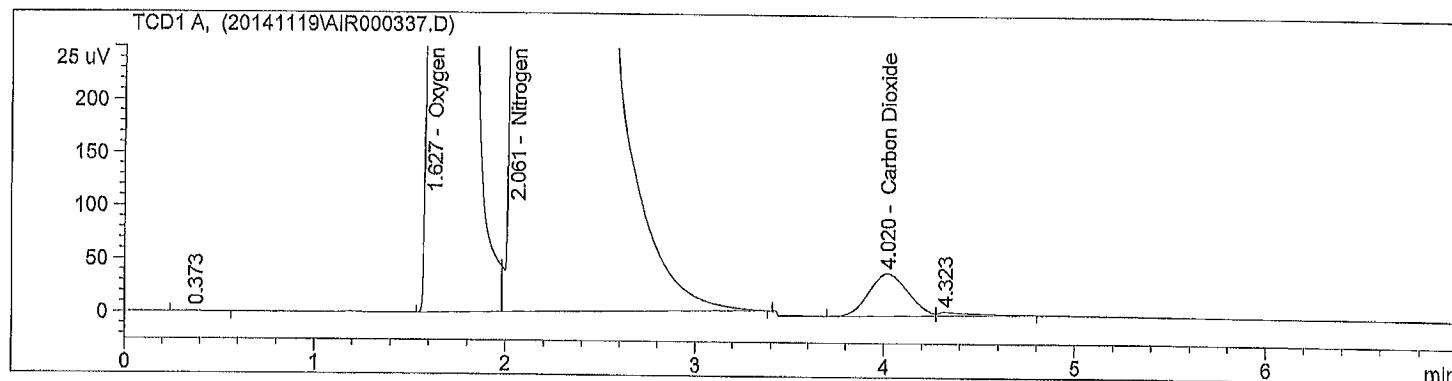
Sample Name: Air 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 15:17:19
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 3:15:30 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:16:02 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Air - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:15:08 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.627	BV S	5.39117e4	3.93120e-4	21.422795	-	Oxygen
2.061	VBAS	1.96779e5	3.94070e-4	78.382674	-	Nitrogen
4.020	BV	564.56024	3.40889e-4	0.194532	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

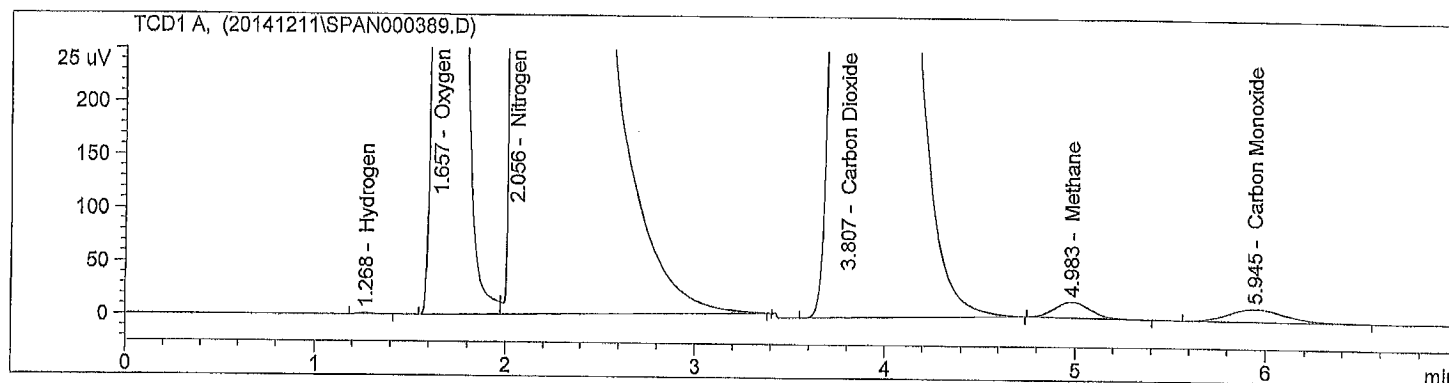
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 14:09:43
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/26/2014 2:03:01 PM by Maxxam - ID# 6538 - BW
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 2:24:34 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.268	BBA	5.94273	1.42396e-1	0.867649		Hydrogen
1.657	BV	1.49409e4	3.93283e-4	6.024776		Oxygen
2.056	VBAS	2.00089e5	3.94087e-4	80.849146		Nitrogen
3.807	BBA	3.51987e4	3.34120e-4	12.058402		Carbon Dioxide
4.983	BBA	193.17958	4.99884e-4	0.099013		Methane
5.945	BBA	248.70967	3.96126e-4	0.101015		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

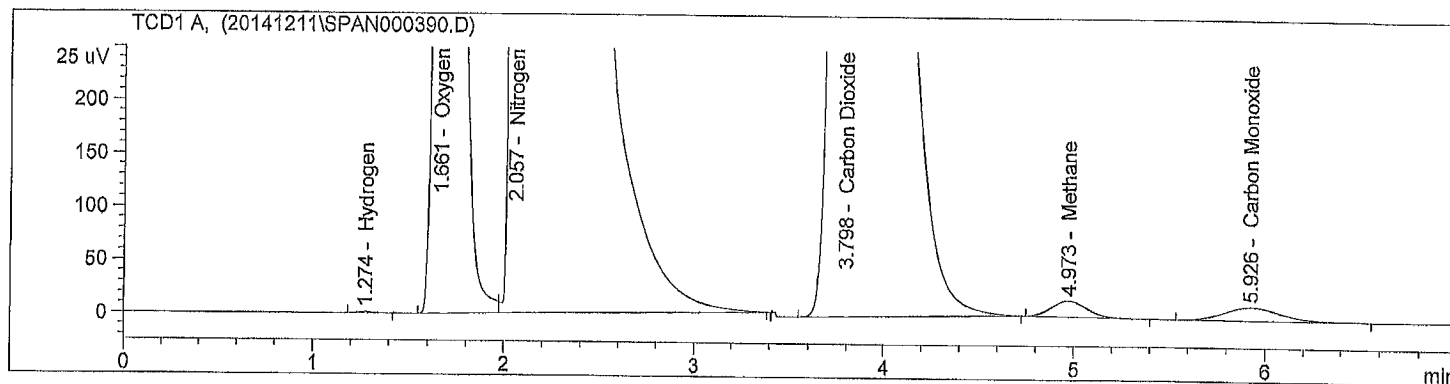
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 14:25:30
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 2:24:34 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 2:32:37 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.274	BBA	5.84992	1.42361e-1	0.858268		Hydrogen
1.661	BV	1.48660e4	3.93285e-4	6.025345		Oxygen
2.057	VBAS	1.99137e5	3.94082e-4	80.876270		Nitrogen
3.798	BBA	3.49651e4	3.34121e-4	12.039830		Carbon Dioxide
4.973	BBA	191.44820	4.99896e-4	0.098631		Methane
5.926	BBA	249.01297	3.96122e-4	0.101656		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

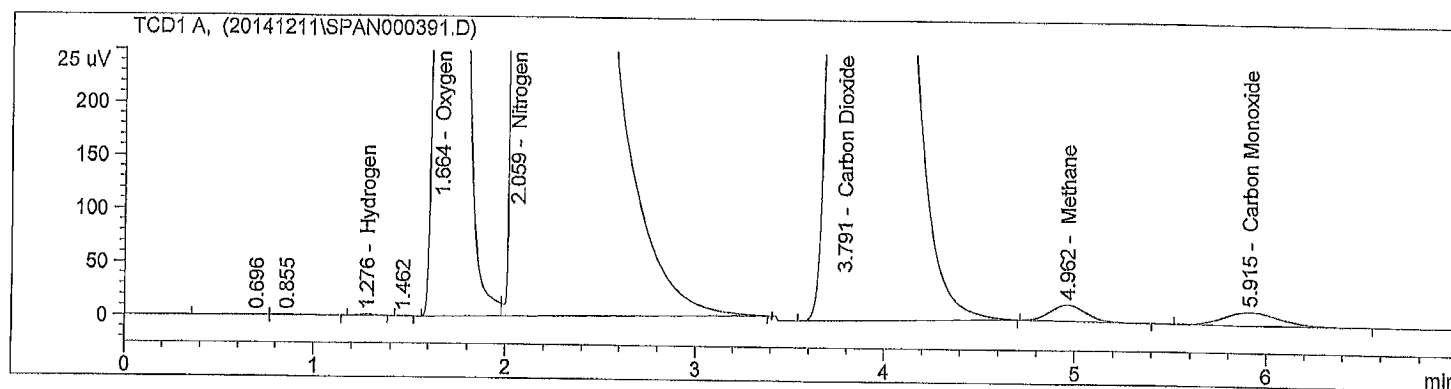
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 14:33:29
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 2:32:47 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 2:47:24 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.276	BV	6.21625	1.42493e-1	0.913639		Hydrogen
1.664	BV	1.48556e4	3.93285e-4	6.026265		Oxygen
2.059	VBAS	1.98890e5	3.94080e-4	80.844069		Nitrogen
3.791	BBA	3.48630e4	3.34121e-4	12.014899		Carbon Dioxide
4.962	BBA	193.45824	4.99882e-4	0.099748		Methane
5.915	BBA	248.11813	3.96135e-4	0.101380		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

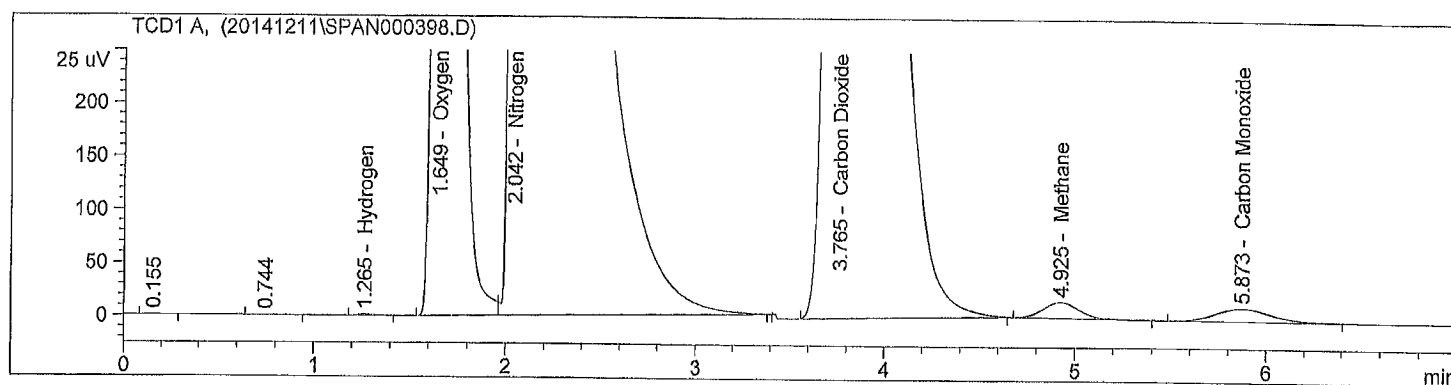
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:49:40        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:48:15 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:59:25 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.265	BBA	5.67366	1.42291e-1	0.835041		Hydrogen
1.649	BV	1.48336e4	3.93285e-4	6.034194		Oxygen
2.042	VBAS	1.98546e5	3.94079e-4	80.930284		Nitrogen
3.765	BBA	3.47237e4	3.34122e-4	12.000443		Carbon Dioxide
4.925	BBA	191.79823	4.99894e-4	0.099172		Methane
5.873	BBA	246.15312	3.96165e-4	0.100867		Carbon Monoxide

```
Totals :                               100.000000
```

```

=====
*** End of Report ***
=====

```

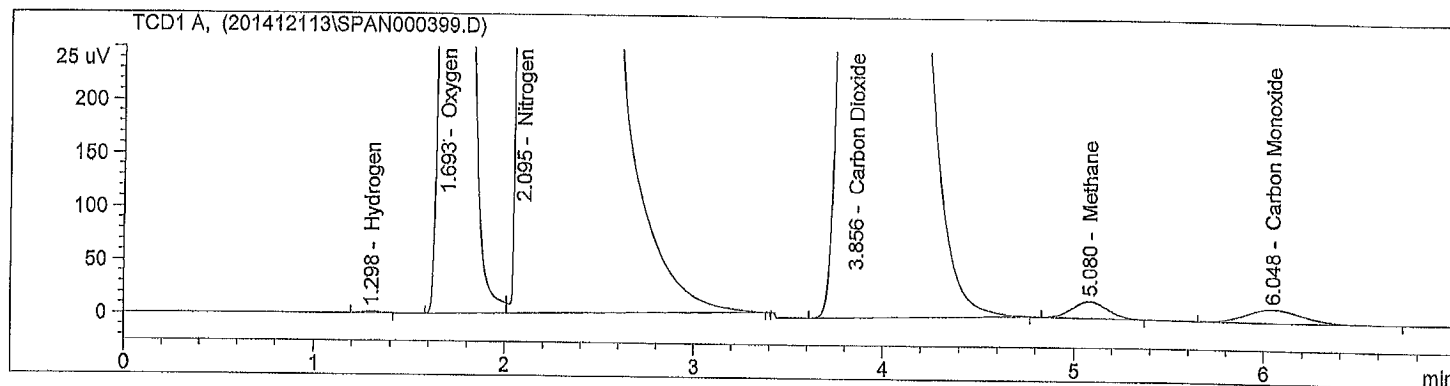
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 11:24:27
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/26/2014 2:03:01 PM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 11:31:27 AM by Maxxam - ID# 6538 - BW
Sample Info    : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.298	BBA	6.97662	1.42724e-1	0.993227		Hydrogen
1.693	BV	1.53576e4	3.93277e-4	6.024606		Oxygen
2.095	VBAS	2.05441e5	3.94113e-4	80.763405		Nitrogen
3.856	BBA	3.60542e4	3.34118e-4	12.016069		Carbon Dioxide
5.080	BBA	204.12659	4.99810e-4	0.101768		Methane
6.048	BBA	255.48210	3.96028e-4	0.100924		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

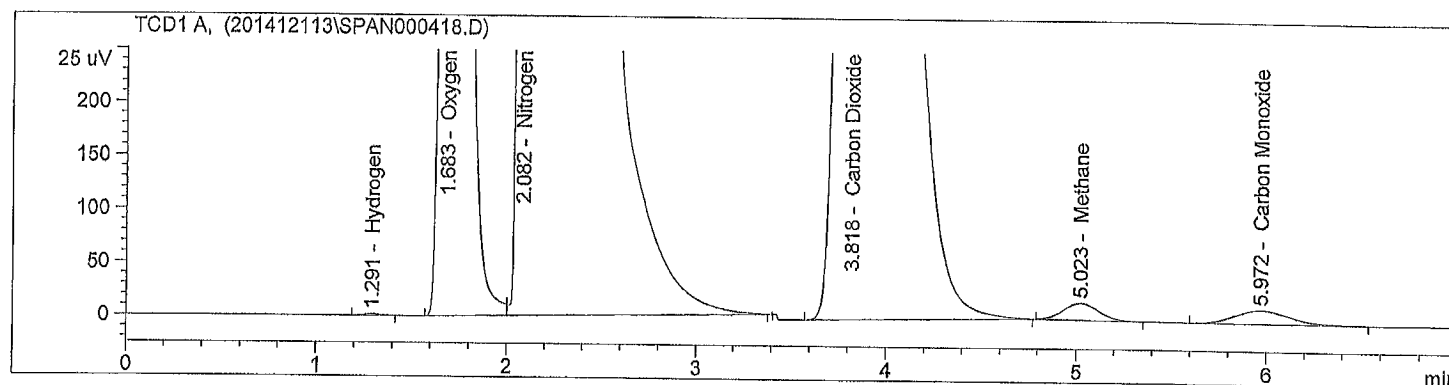
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 13-Dec-14, 15:23:04              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:07:16 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:41:00 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.291	BBA	6.84476	1.42687e-1	0.990908		Hydrogen
1.683	BV	1.51029e4	3.93281e-4	6.026322		Oxygen
2.082	VBAS	2.02190e5	3.94097e-4	80.844724		Nitrogen
3.818	BBA	3.52096e4	3.34120e-4	11.935842		Carbon Dioxide
5.023	BBA	199.69040	4.99839e-4	0.101269		Methane
5.972	BBA	251.16362	3.96090e-4	0.100935		Carbon Monoxide

```
Totals :                               100.000000
```

```

=====
*** End of Report ***
=====

```



### Calibration Table

Pk#	RT	Lvl	Mole %	Amt/Area	Ref Istd I#	Name
1	1.457	1	1.0	5.997e-004	1	Hydrogen
	2		0.5	6.6957e-004		
	3		0.1	7.9221e-004		
2	1.895	1	6.0	4.5687e-005	1	Argon / Oxygen
	2		3.0	4.5461e-005		
	3		0.6	4.3221e-005		
3	2.241	1	80.8	4.7623e-005	1	Nitrogen
	2		40.4	4.5948e-005		
	3		8.08	4.237e-005		
4	3.913	1	0.1	1.8827e-006	1	Methane
	2		0.05	1.8635e-006		
	3		0.01	1.7607e-006		
5	4.559	1	0.1	1.492e-006	1	Carbon Monoxide
	2		0.05	1.4927e-006		
	3		0.01	1.4498e-006		
6	6.316	1	12.0	4.0229e-005	1	Carbon Dioxide
	2		6.0	3.9701e-005		
	3		1.2	3.782e-005		

### Calibration Settings

Title:

Calibration 2014-12-13

Reference window: 15.000 %  
Non-reference window: 15.000 %  
Units of amount: Mole %  
Multiplier: 1.0  
RF uncal peaks: 0.0  
ISTD# to adjust uncal peaks: 0  
Sample Amount: 0.0

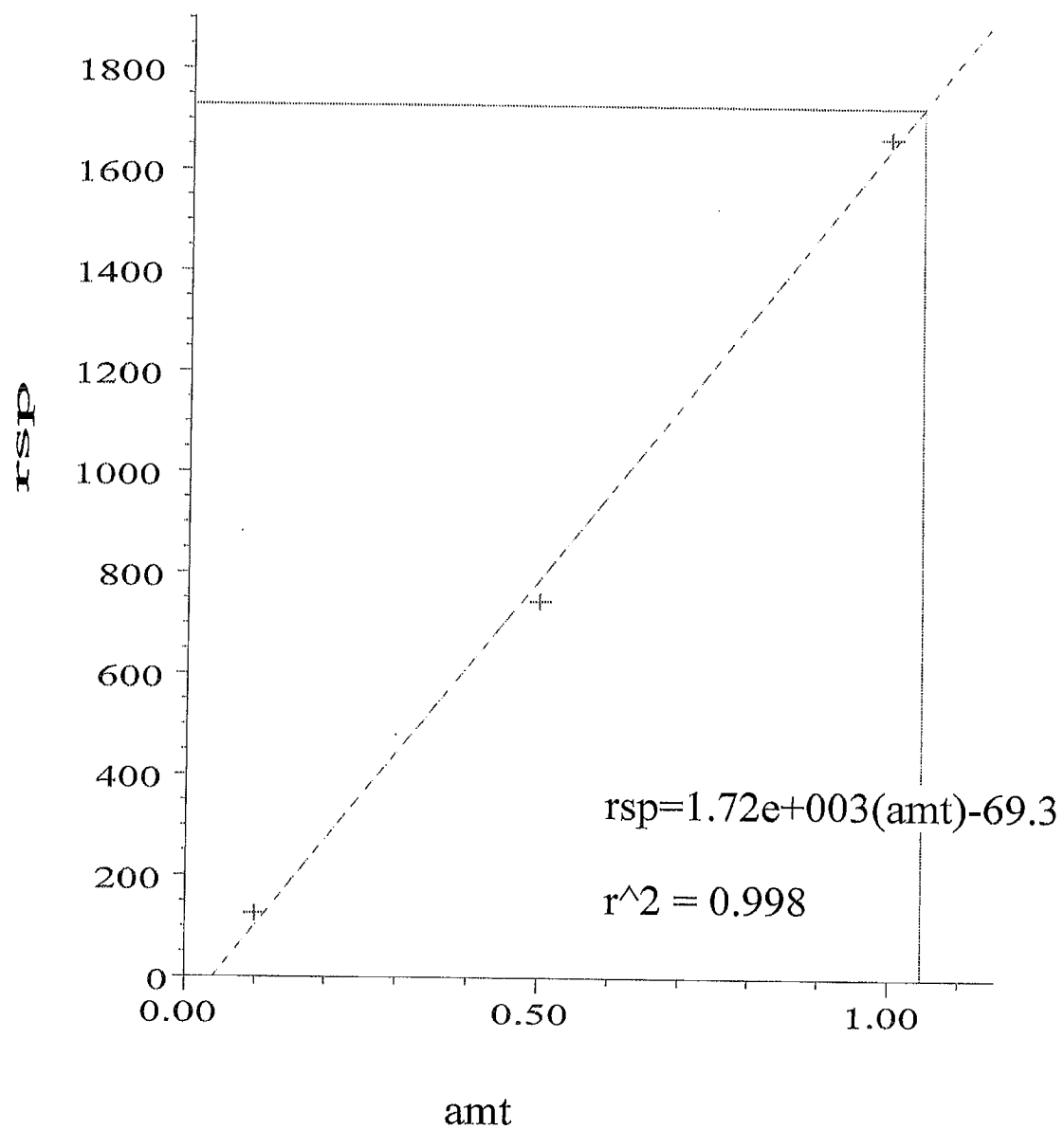
### Sample ISTD Information

No Sample ISTD Amounts

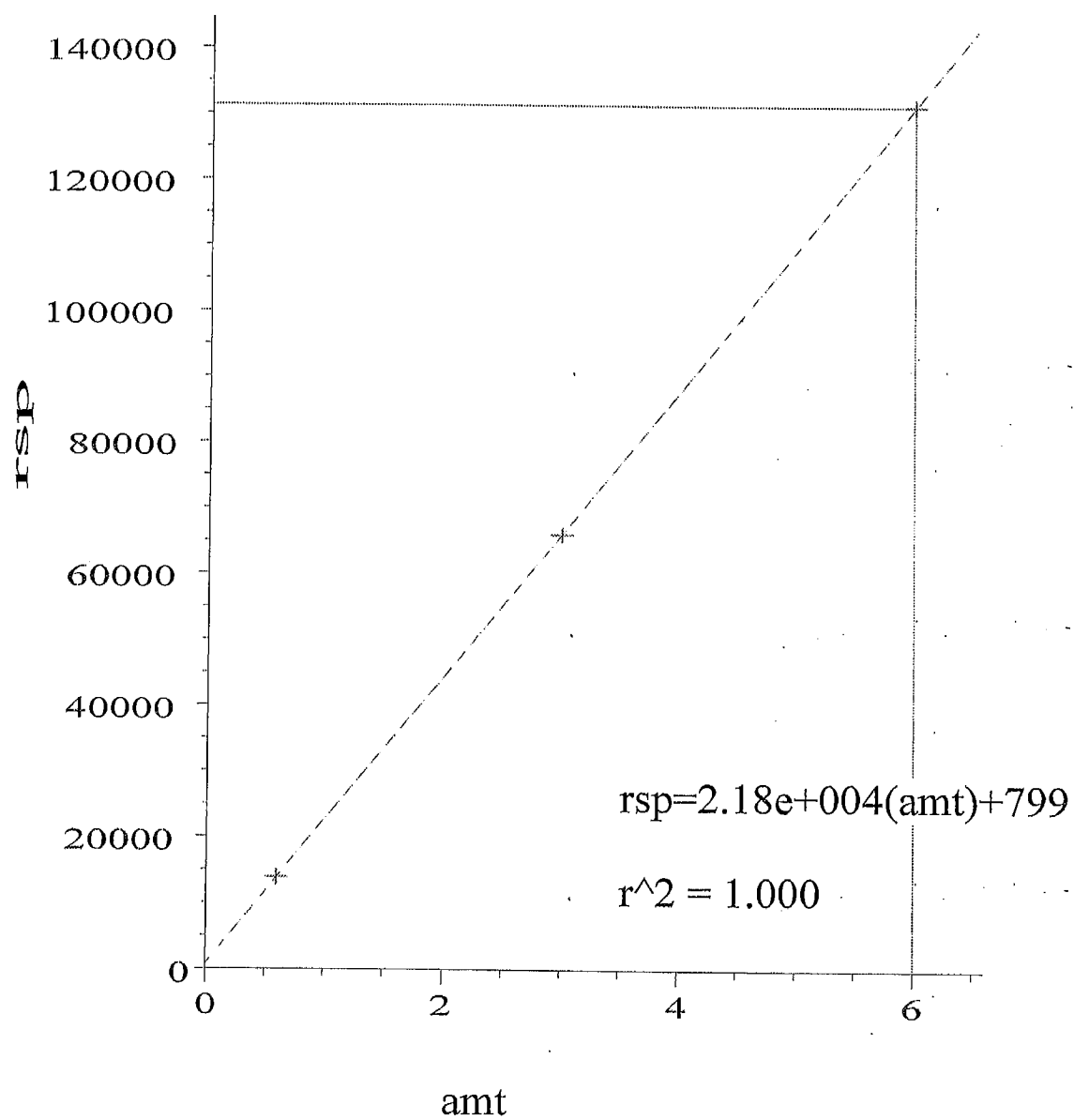
### Multilevel Information

Fit: Linear  
Origin: Force

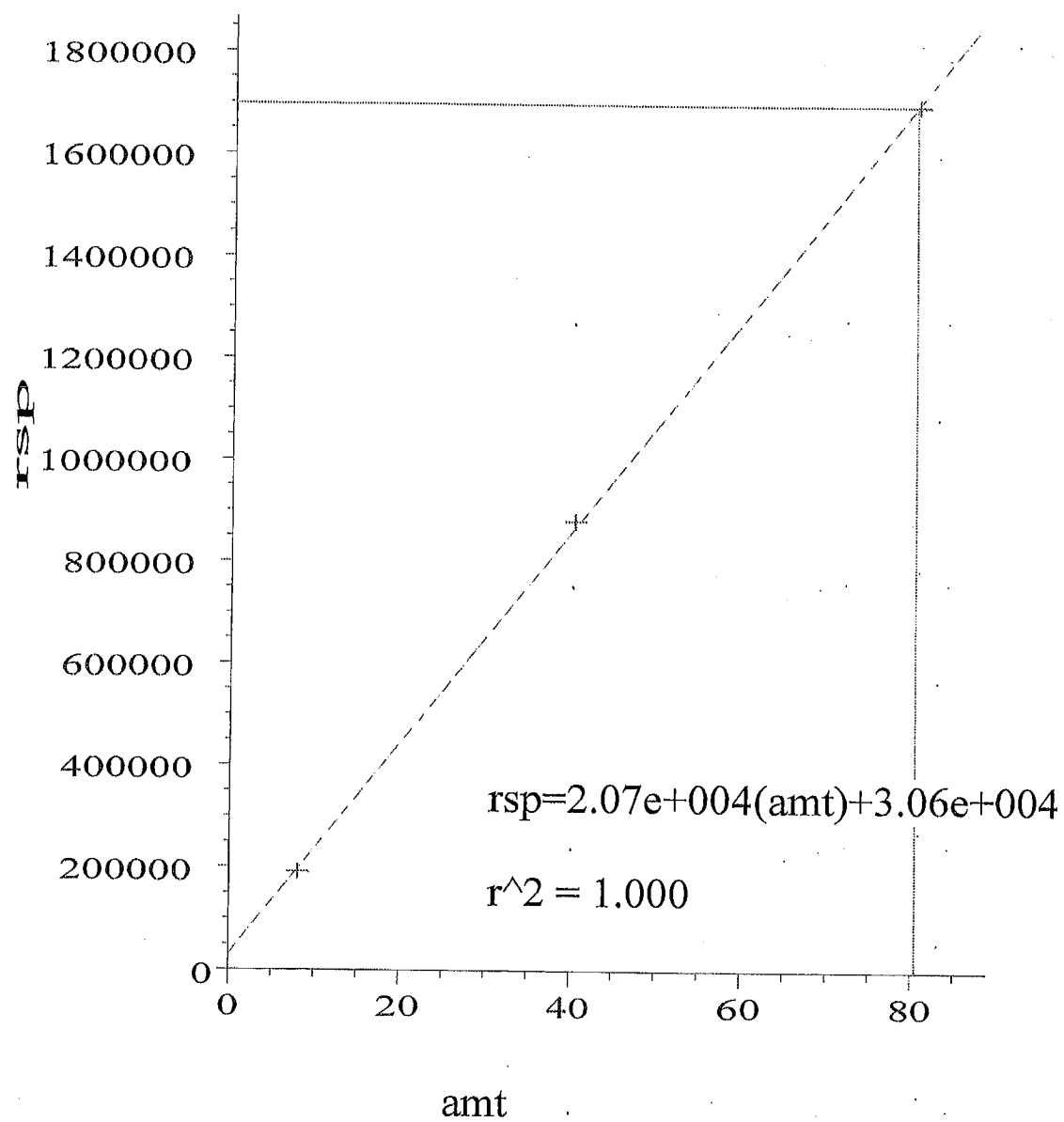
# Hydrogen



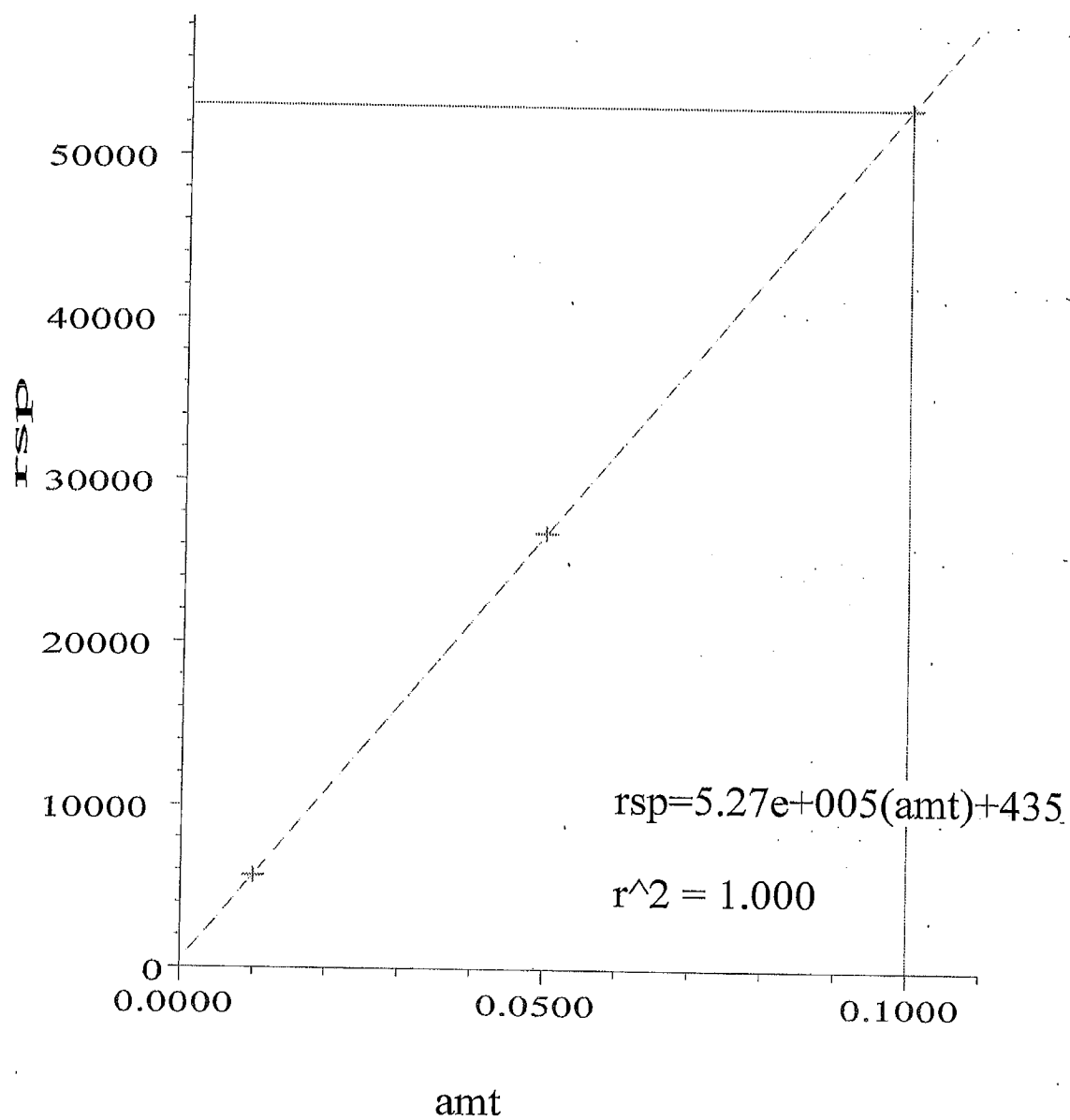
# Argon / Oxygen



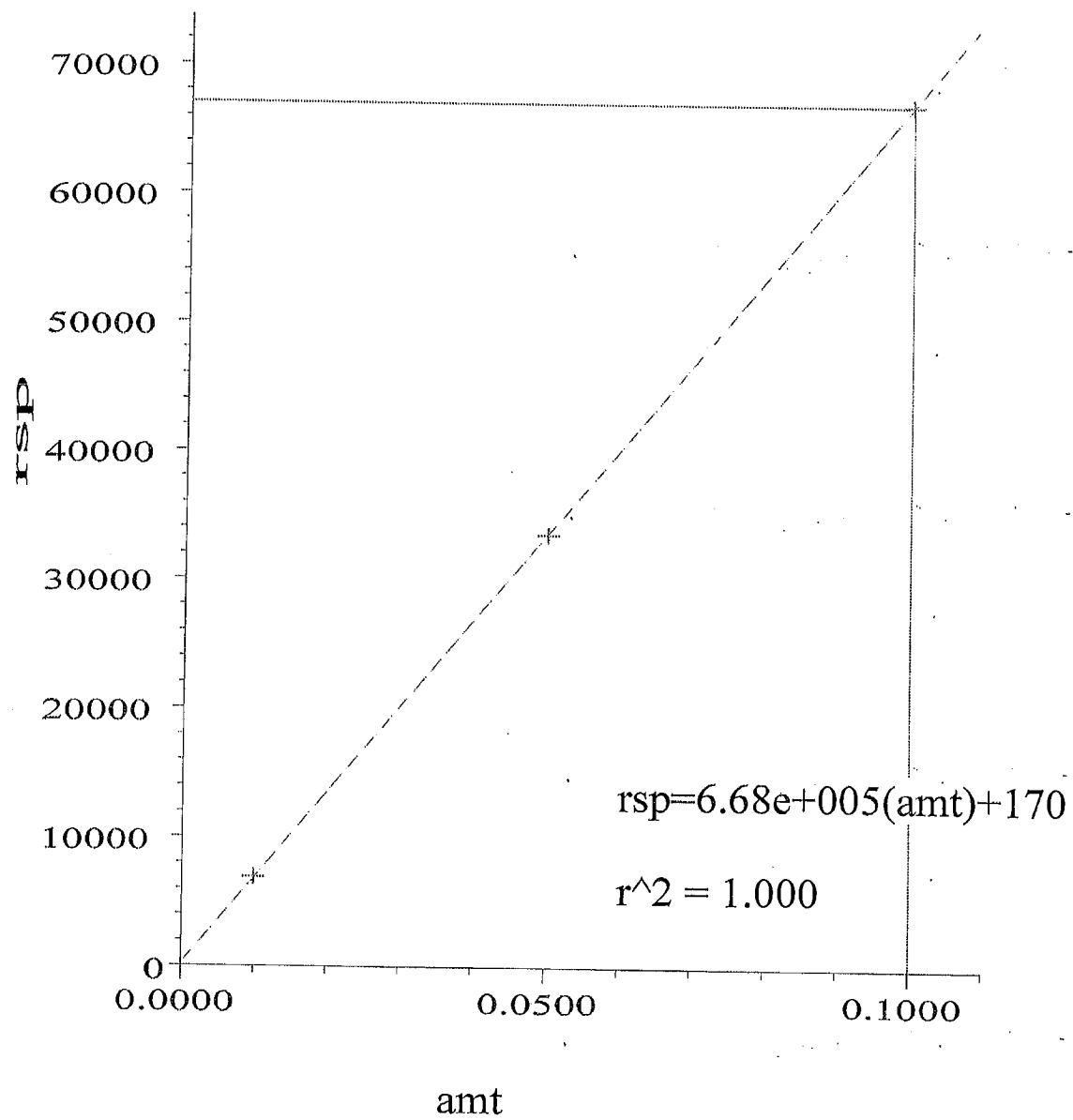
# Nitrogen



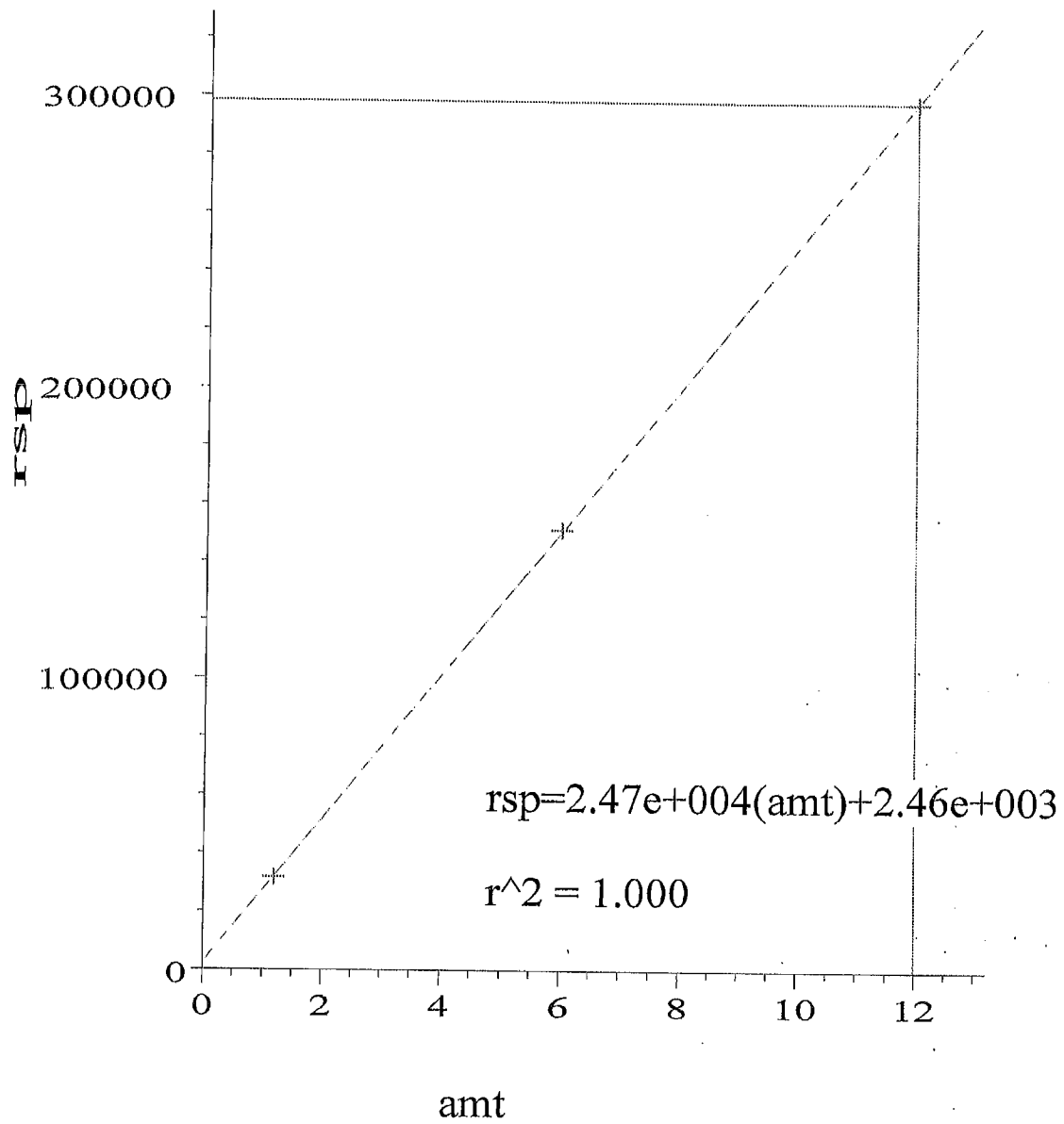
# Methane

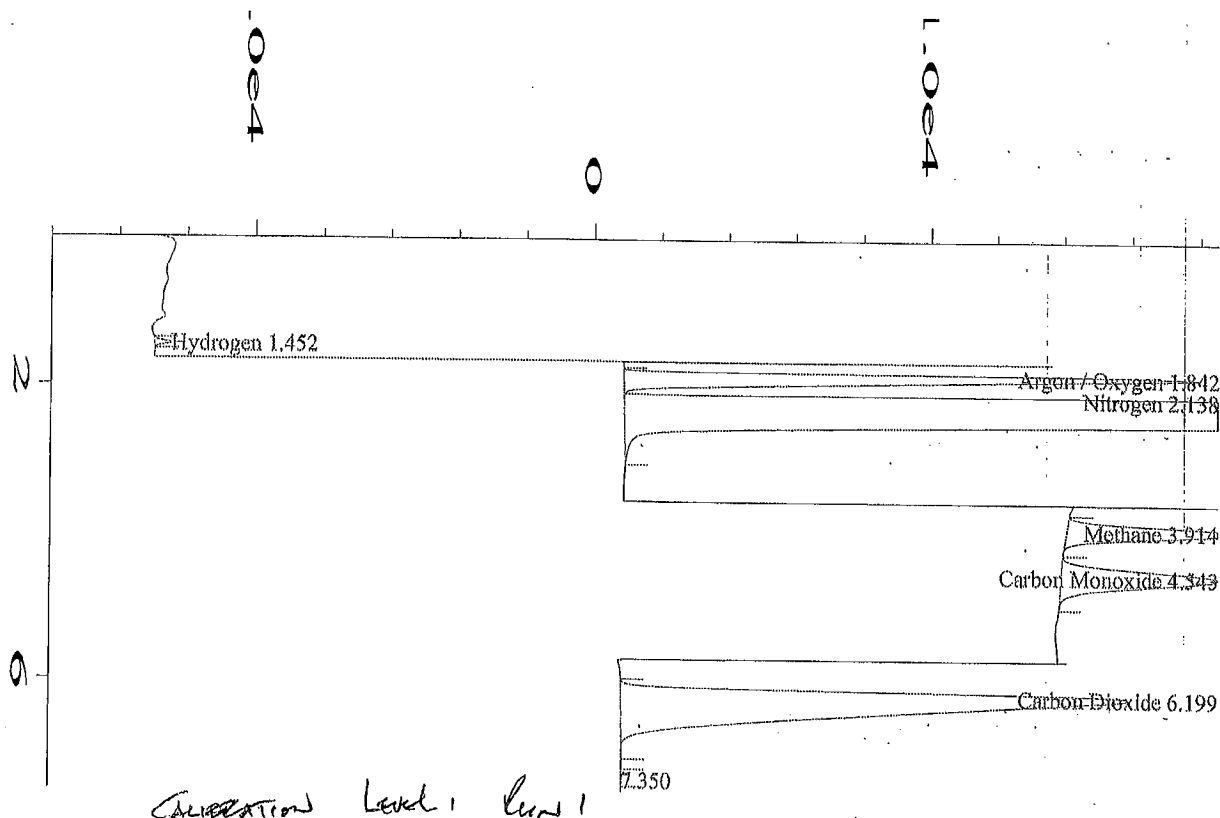


# Carbon Monoxide



# Carbon Dioxide





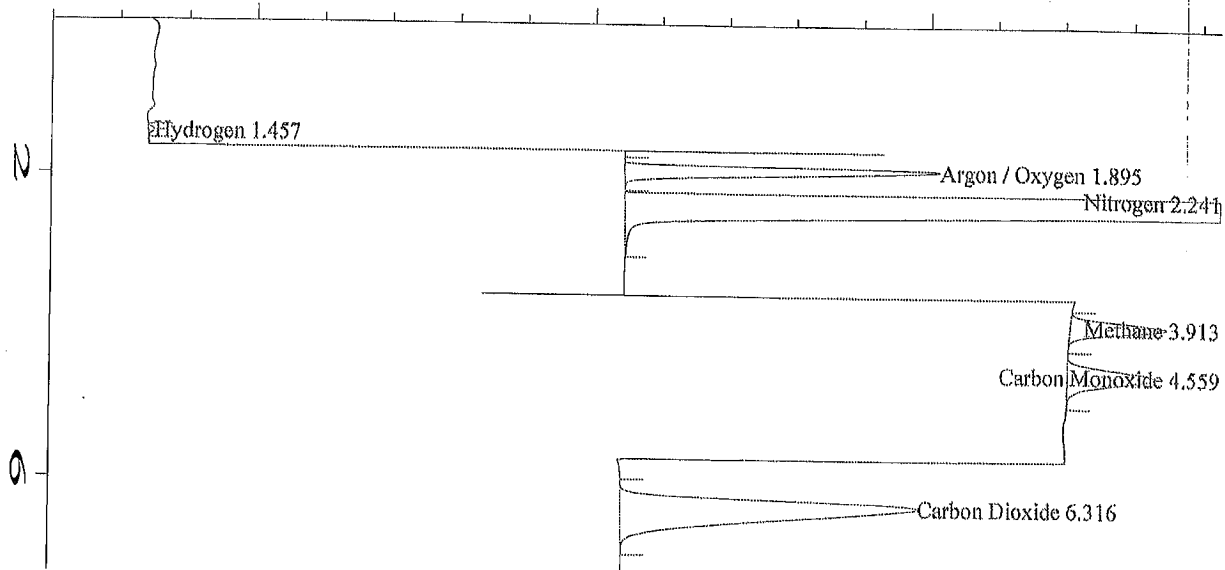
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REMICAL1-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 1914 15:44:05 Instrument Method:  
 Report Created on: 15 Dec 14 10:54 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REMICAL1-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.452	1636	BBA	0.054	1	0.993	Hydrogen
1.842	131328	BV	0.118	1	6.001	Argon / Oxygen
2.138	1696645	VBA	0.192	1	80.525	Nitrogen
3.914	53114	BBA	0.156	1	0.100	Methane
4.543	67022	BBA	0.224	1	0.100	Carbon Monoxide
6.199	298291	BBA	0.304	1	11.989	Carbon Dioxide





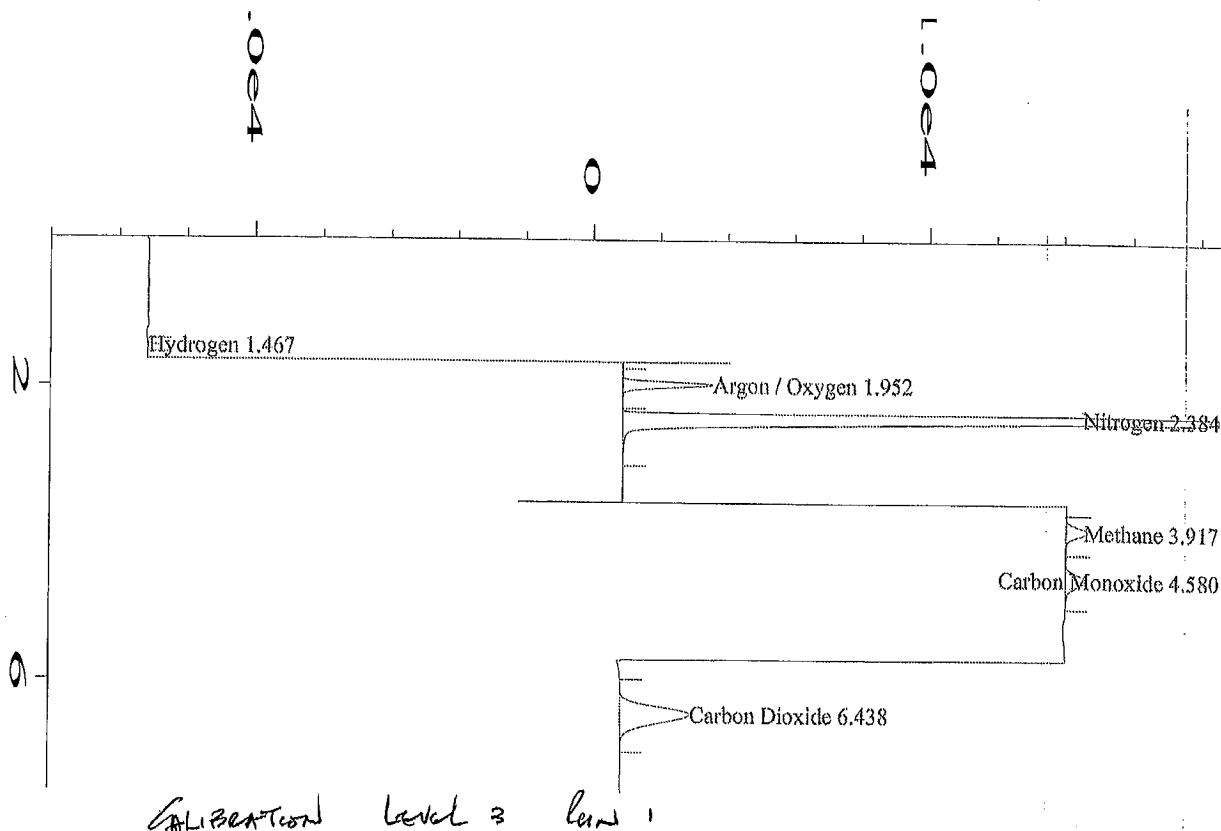
Concentration level 2 run 1

# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL2-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 16:08:58 Instrument Method:  
 Report Created on: 15 Dec 14 10:51 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\CAL2-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.457	747	BBA	0.068	1	0.475	Hydrogen
1.895	65991	BV	0.117	1	2.997	Argon / Oxygen
2.241	879257	PBA	0.151	1	41.018	Nitrogen
3.913	26832	BBA	0.152	1	0.0501	Methane
4.559	33496	BBA	0.207	1	0.0499	Carbon Monoxide
6.316	151130	BV	0.267	1	6.025	Carbon Dioxide

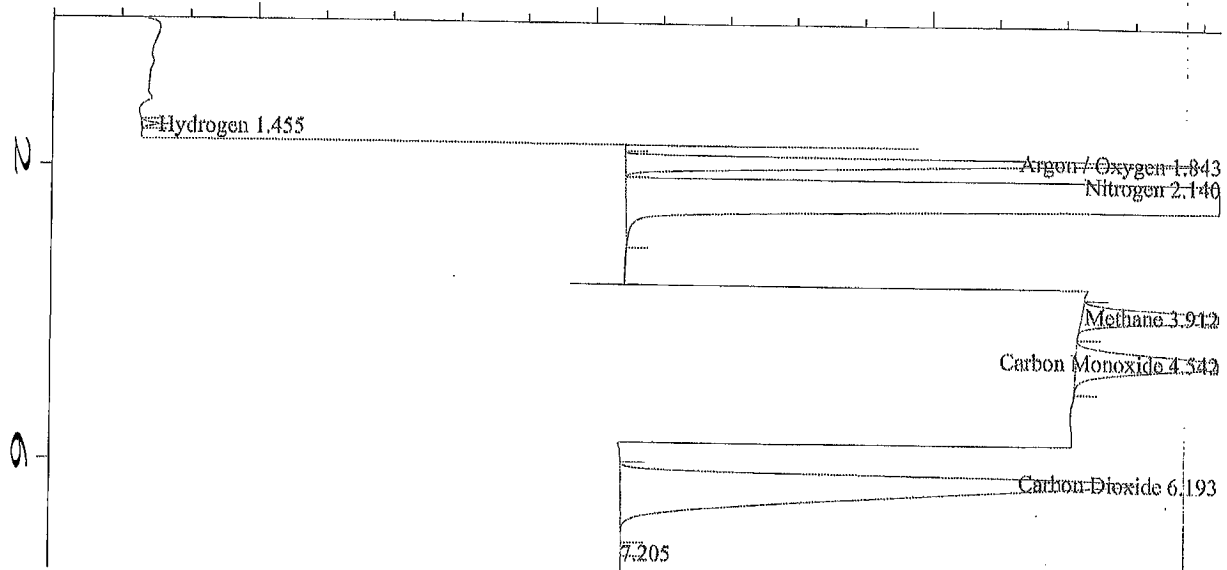


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL3-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 16:19:48 Instrument Method:  
 Report Created on: 15 Dec 14 10:56 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\2014\REM-SP~1\REM\CAL3-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.467	126	BBA	0.075	1	0.114	Hydrogen
1.952	13882	BV	0.083	1	0.602	Argon / Oxygen
2.384	190702	PBA	0.098	1	7.737	Nitrogen
3.917	5679	BBA	0.144	1	0.00995	Methane
4.580	6898	BBA	0.191	1	0.0101	Carbon Monoxide
6.438	31729	BV	0.241	1	1.186	Carbon Dioxide



Standard check - Run 1 11-10-27-27

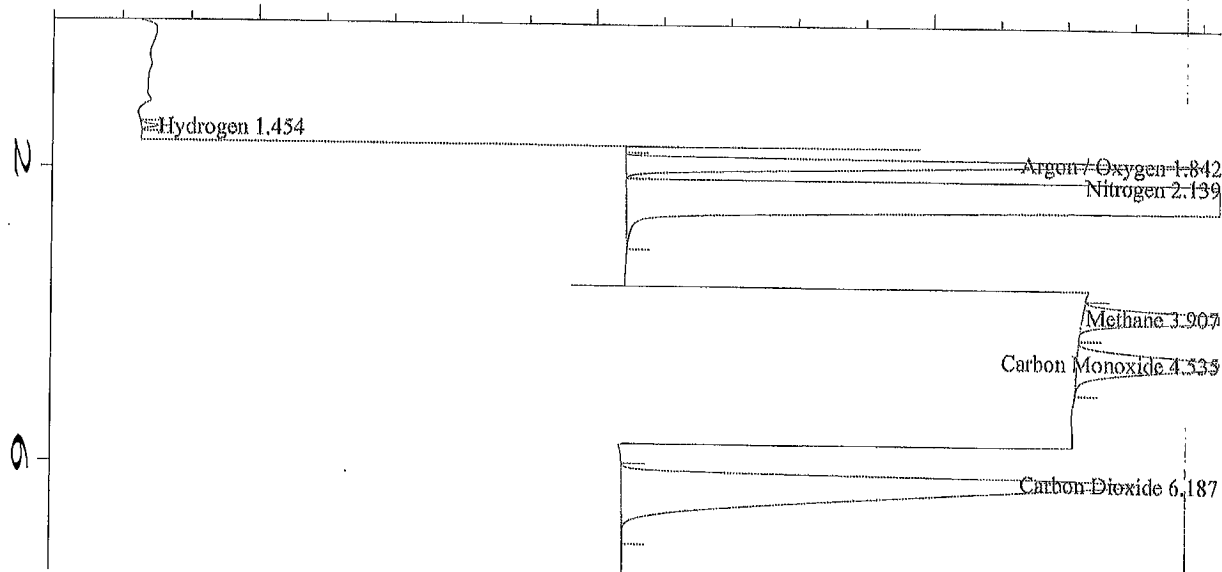
# Normalized Percent Report

Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:00:41 Instrument Method:  
 Report Created on: 15 Dec 14 10:49 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\... \2014\REM-SP~1\REM\SPAN1-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.455	1663	BBA	0.054	1	1.008	Hydrogen
1.843	131956	BV	0.118	1	6.025	Argon / Oxygen
2.140	1703043	VBA	0.192	1	80.762	Nitrogen
3.912	53408	BBA	0.159	1	0.100	Methane
4.542	67369	BBA	0.226	1	0.100	Carbon Monoxide
6.193	298942	BBA	0.302	1	12.005	Carbon Dioxide

Total amount = 100.09



Span Check - Run #2 10# 11-10-27-22

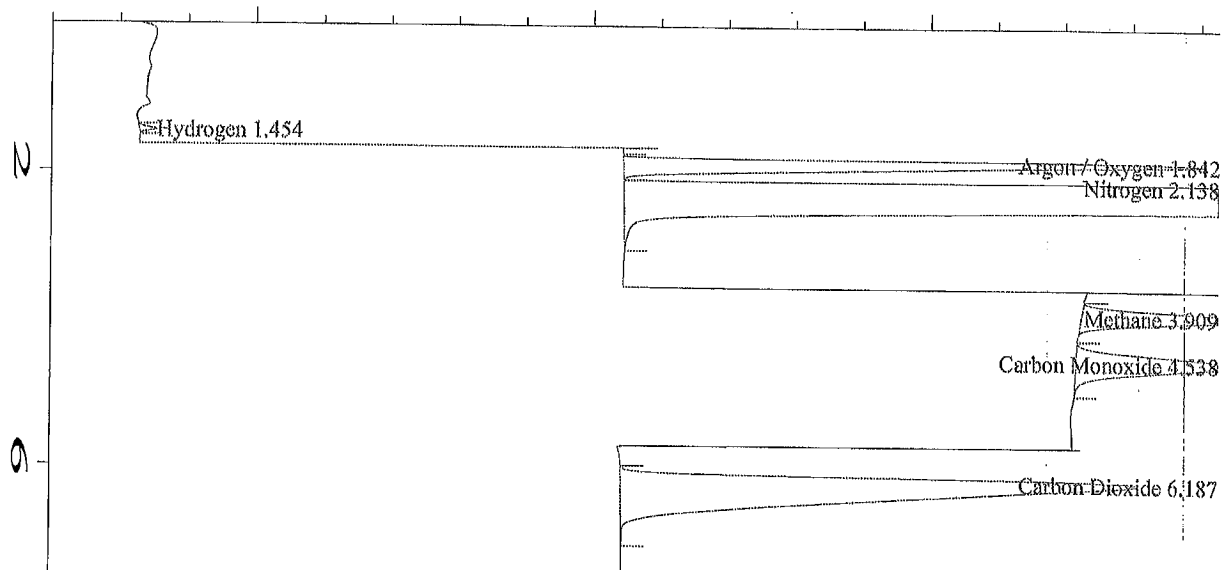
# Normalized Percent Report

Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:10:46 Instrument Method:  
 Report Created on: 15 Dec 14 10:49 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\SPAN1-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.454	1652	BBA	0.054	1	1.007	Hydrogen
1.842	131103	BV	0.118	1	6.024	Argon / Oxygen
2.139	1692608	VBA	0.191	1	80.773	Nitrogen
3.907	52989	BBA	0.158	1	0.100	Methane
4.535	67035	BBA	0.226	1	0.101	Carbon Monoxide
6.187	296833	BBA	0.298	1	11.995	Carbon Dioxide

Total amount = 99.4526



Span Check - Run # 3 ID# 11-10-27-22

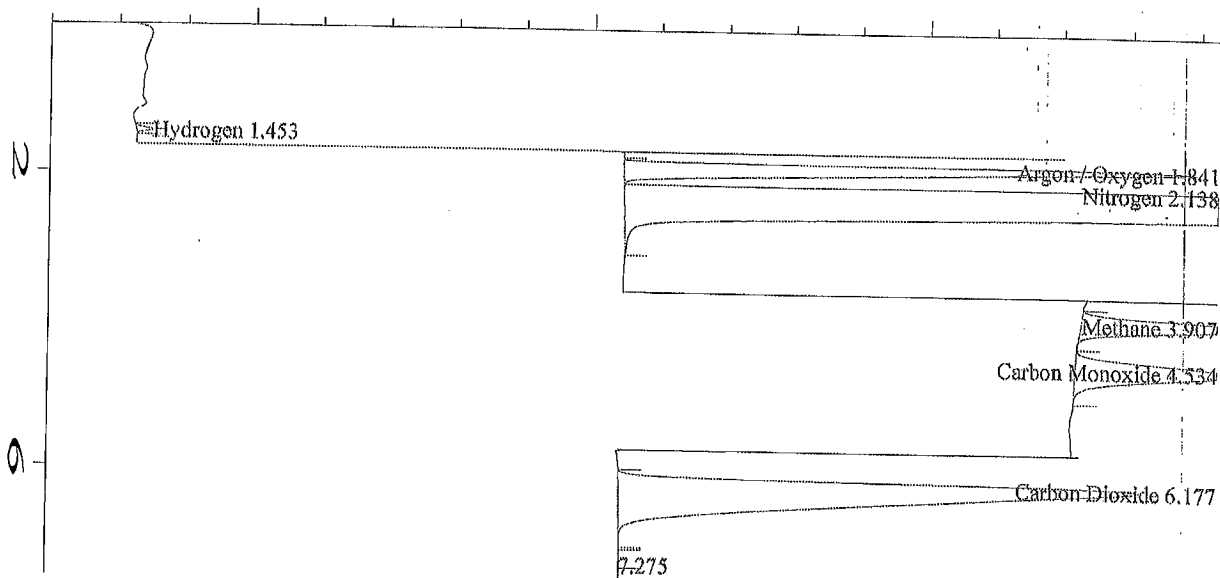
# Normalized Percent Report

Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-3.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:22:45 Instrument Method:  
 Report Created on: 15 Dec 14 10:50 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\SPAN1-3.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.454	1662	BBA	0.054	1	1.010	Hydrogen
1.842	131492	BV	0.118	1	6.023	Argon / Oxygen
2.138	1697737	VBA	0.192	1	80.766	Nitrogen
3.909	53310	BBA	0.158	1	0.101	Methane
4.538	67294	BBA	0.226	1	0.101	Carbon Monoxide
6.187	297864	BBA	0.296	1	11.999	Carbon Dioxide

Total amount = 99.7675



*RM Check*

*11-10-27-22*

### Normalized Percent Report

Data File Name : C:\HPCHEM\...\TRS-TCID\HPCHEM~1\2014\REM-SP~1\REM\SPAN2-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:36:35 Instrument Method:  
 Report Created on: 15 Dec 14 10:50 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...\2014\REM-SP~1\REM\SPAN2-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.453	1621	BBA	0.054	1	0.994	Hydrogen
1.841	130613	BV	0.119	1	6.026	Argon / Oxygen
2.138	1686834	VBA	0.191	1	80.829	Nitrogen
3.907	52816	BBA	0.156	1	0.100	Methane
4.534	66706	BBA	0.226	1	0.101	Carbon Monoxide
6.177	294510	BV	0.293	1	11.951	Carbon Dioxide

Total amount = 99.0383



Praxair Distribution Inc  
9501 - 34 Street  
Edmonton, AB T6B 2X6  
Tel.: (780) 449-0778  
Fax.: (780) 449-5302

Issue Date: December 4, 2014

To: PX Calgary  
8009 - 42 Street SE  
Calgary, AB T2C 2T4

Praxair Order Number: 22051297  
Customer Order Number:

Product Lot Number: Z582 4 322 02  
Product Part Number: NI CD12CX2P-AS

## CERTIFICATE OF ANALYSIS

### Primary Standard

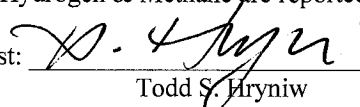
Cylinder S/N	Components	Requested Concentration	Certified Concentration	Analytical Principle*/Instrument	Analytical Uncertainty
CC83741	Hydrogen	1.00%	1.016%	J*/HP 6890	±2% rel
	Oxygen	6.00%	6.004%	L*/Grav	±0.02%
	Methane	1000ppm	965.9ppm	J*/HP 6890	±2% rel
	Carbon Monoxide	1000ppm	1010ppm	L*/Grav	±1% rel
	Carbon Dioxide	12.00%	12.00%	L*/Grav	±0.02%
	Nitrogen	Balance	Balance		

Cylinder Style: AS  
Cylinder Pressure @70°F (21°C): 2000 psig  
Cylinder Volume: 148.9 cu ft

Valve Outlet Connection: CGA 590  
Filling Method: Gravimetric  
Filling Date: 11/18/2014  
Expiry Date: 11/18/2017

Note: Hydrogen & Methane are reported with laboratory analytical values. All other components are reported by grav.

Analyst:

  
Todd S. Hryniw

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair 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

\*Key to Analytical Principle:

- |   |  |                                    |                               |
|---|--|------------------------------------|-------------------------------|
| A. Flame Ionization with Methanizer                           | F. Gas Chromatography with Helium Ionization Detector    | K. Thermal Conductivity Analyzer   | P. Electrochemical            |
| B. Gas Chromatography with Discharge Ionization Detector      | G. Gas Chromatography with Methanizer Carbonizer         | L. Gravimetric Methods             | Q. Total Hydrocarbon Analyzer |
| C. Gas Chromatography with Electrolytic Conductivity Detector | H. Gas Chromatography with Photoionization Detector      | M. Infrared - FTIR or NDIR         | R. Microfuel Cell             |
| D. Gas Chromatography with Flame Ionization Detector          | I. Gas Chromatography with Reduction Gas Analyzer        | N. Mass Spectrometry - MS or GC/MS | S. Detector Tube              |
| E. Gas Chromatography with Flame Photometric Detector         | J. Gas Chromatography with Thermal Conductivity Detector | O. Paramagnetic                    | T. Odor                       |

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 arising out of the use of the information contained herein exceed the fee established for providing such information.

**SUMMARY OF ANALYTICAL RESULTS - THC as CH4 ANALYSIS**

Date/Time Sampled	T381A			T381B			T481A			T481B			T581A		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	7.80	6.90	7.40	8.80	8.20	8.50	8.90	9.60	9.25	12.70	11.60	12.15	12.40	13.90	13.15
THC-ppmv @3% CO2	4.28	3.86	4.07	4.79	4.54	4.66	4.91	5.38	5.14	6.67	6.15	6.41	6.63	7.54	7.08

Date/Time Sampled	T581B			T681A			T681B			T781A			T781B		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	16.20	15.40	15.80	12.00	11.50	11.75	12.30	13.80	13.05	14.50	12.40	13.45	10.60	11.60	11.10
THC-ppmv @3% CO2	8.91	8.57	8.74	7.38	7.14	7.26	7.31	8.24	7.77	8.37	7.15	7.76	6.46	7.11	6.78

Date/Time Sampled	T881A			T881B			T981A			T981B			T1081A		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	13.60	14.30	13.95	16.10	15.20	15.65	12.00	11.50	11.75	11.90	11.10	11.50	12.60	11.20	11.90
THC-ppmv @3% CO2	8.22	8.69	8.45	9.47	8.98	9.23	7.89	7.55	7.72	8.06	7.54	7.80	6.98	6.23	6.61

Date/Time Sampled	T1081B			T1181A			T1181B			T1281A			T1281B		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	12.60	10.50	11.55	10.20	11.10	10.65	10.30	11.00	10.65	11.70	12.80	12.25	11.50	13.10	12.30
THC-ppmv @3% CO2	6.60	5.54	6.07	5.49	5.95	5.72	5.57	5.96	5.77	6.39	7.00	6.70	6.12	6.99	6.55

Date/Time Sampled	T1381A			T1381B			T1481A			T1481B		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	12.80	11.70	12.25	9.90	10.30	10.10	13.80	14.00	13.90	12.90	14.40	13.65
THC-ppmv @3% CO2	8.48	7.75	8.11	6.63	6.88	6.76	9.04	9.21	9.12	8.41	9.39	8.90

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)



***APPENDIX III***  
***SAMPLE CUSTODY***



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Company: Maxam Analytics

Email Howard.Malm@rem-technology.com

Contact: Bill Wong

Project #: 35118

Purchase Order: 672130-08

Date: \_\_\_\_\_

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

## SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: Dec 18/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)	Lab Test
Spartan T1B1A	Dec 10/2014 10:25	AGFT LABS	Hold as backup	✓	73302
Spartan T1B1B	12/10/14 11:00		Hold as backup	✓	73303
Spartan T2B1A	12:10		Hold as backup	✓	73304
Spartan T2B1B	12:45		Hold as backup	✓	73305
Spartan T3B1A	✓ 15:00	✓	Oxygen, CO <sub>2</sub> , CH <sub>4</sub> , H <sub>2</sub> O, moisture	✓	73306
Spartan T3B1B	15:30			✓	73307

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Charles Adeltz	Howard Malm Bill Wong	12/10/14
		2014-12-11 12:50

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Pages 1 of 2



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Email Howard.Malm@remtechnology.com

Project #: 35118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: \_\_\_\_\_

Send Additional Copy to:

Name Greg Brown

Email brown-greg@spartancontrols.com

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: Dec 18/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)	Lab Tick#
Spartan T4B1A	12/11/14 0830	AGAT Labs	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , moisture	✓	73308
Spartan T4B1B	0905	✓	"	✓	73309
Spartan T5B1A	1005	✓	"	✓	73310
Spartan T5B1B	1040	✓	"	✓	73311
—	—	—	—	—	—
—	—	—	—	—	—

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Bidelt <u>Claude</u>	Howard Malm, H. Malm	12/11/14
	Bill Wong	2014-12-11 12:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Company: Moxian Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: Dec 12/14

## SERVICE REQUESTED:

Standard: (5-7 working days)

Rush: Next Day ☐

Rush: Same Day ☐

Project #: 35118

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Spartan T6B1A	11/12/14 1135	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> wafered	
" T6B1B	" 1210	AGAT		

Lab T24  
73325  
73326

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Frellet	H. MALM	12/12/14 13:10
H. MALM	Bill Wong	12/12/14 14:00
H. MALM	Bill Wong	

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malin

Email howard@remtechnology.com

Project #: 35118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-OP

Date: Dec 12/14

## SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Spartan T7B1A	11/12/14 1305	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , water	
T7B1B	1340			
T8B1A	1440			
T8B1B	1515			
T9B1A	1610			
T9B1B	1645			

LAB ID#  
73327  
73328  
73329  
73330  
73331  
73332

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Kibbett	H. MALIN	12/12/14 13:10
Howard Malin	BILL WONG	12/12/14 14:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Company: Martian Analytics

Contact: Bill Wong

Purchase Order: 672130-OP

Date: Dec 12/14

Email Howard.Malm@renttechnology.com

Project #: 35118

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

## SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: \_\_\_\_\_

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
SPARTAN T10B1A	12/12/14 08:25	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , water	
SPARTAN T10B1B	12/12/14 905			
SPARTAN T11B1A	955			
SPARTAN T11B1B	1040			
SPARTAN T12B1A	1730			
SPARTAN T12B1B	✓ 1205	✓	✓	

LAB ID#  
73323  
73334  
73335  
73336  
73337  
73338

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Pichette	H. MALM	12/12/14 13:10
H. MALM	BILL WONG	12/12/14 14:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Email Howard.Malm@rentechtechnology.com

Project #: 3S118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: \_\_\_\_\_

## SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☐ Rush: Next Day

☒ Rush: Same Day

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: December 19, 2014

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
SPARTAN T13B1A	12/12/14 13:00	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , Water	LAB TEST
SPARTAN T13B1B	12/12/14 13:35	AGAT		73339
SPARTAN T14B1A	12/12/14 14:30	AGAT		73340
SPARTAN T14B1B	12/12/14 15:05	AGAT		73341
				73342

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
JOE WEAVER	Gregory Brown	12/12/14 16:10
Gregory Brown	Bill Wong	12/13/14 09:50

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

## **Appendix F – Instrument Calibration Reports**

**Fox FT2-075P Mass Flow Transmitter**

**Rosemount Pressure Transmitter**

**RTD Probe**

**FloBoss Controller**

**Fluke Calibrator**

**Kestral Weather Tracker**





399 Reservation Road, Marina, California 93933 (831) 384-4300

## CALIBRATION CERTIFICATE

Serial #:	12572	Dia. =	8.240E-01	in
Model #:	FT2-075P	Area =	3.440E-04	M^2
Fluid Type:	Propylene			
Density:	1.877 kg/m^3 @ 0 C, 760 mm HG	IDTag:	-	<div>4 mA = 0.000E+00 kg/hr</div> <div>20 ma = 1.000E+01 kg/hr</div>
#	Input Volts	NMPH at 0 C 760 mmHg	kg/hr	
1	0.2457	0.00	0.00	
2	0.2716	178.43	0.121	
3	0.3010	450.12	0.305	
4	0.3304	893.88	0.605	
5	0.3532	1368.29	0.926	
6	0.3734	1933.14	1.308	
7	0.3993	2887.70	1.954	
8	0.4233	4054.57	2.744	
9	0.4428	5172.40	3.500	
10	0.4666	6783.70	4.591	
11	0.4910	8849.89	5.989	
12	0.5116	10901.16	7.377	
13	0.5298	12969.28	8.777	
14	0.5517	15902.56	10.762	
15	0.5824	21039.63	14.238	
16	0.6622	38562.76	26.097	
<p>This calibration is traceable to the National Institute of Standards and Technology to an uncertainty of +/- 1% of reading          +/- .2% of full scale using measurements traceable to NIST Standards in accordance with Mil-Std-45662A.</p>				
Prepared By:	John Moorhead	Cal. Equip. No:	3443	
Date:	November 21, 2014			

November 6, 2014

Emerson Process Management  
4112 - 91A Street  
Edmonton, AB T6E 5V2



### Calibration Data Sheet - Consistent with ISO 10474 3.1B or EN 10201 3.1

#### Customer Information

Name: Spartan Controls  
PO: 679331 OD  
End Customer Name:  
End Customer PO:

#### Manufacturer Information

Order Number: N/A  
Line: N/A

#### Device information

Device type: Pressure Transmitter  
Device No:  
Model No: 2088G1S22A1C6  
Serial No: 440043  
Module Serial No: 10691556  
Output: Linear 4-20 ma / Hart

#### Calibration Information

Factory: Edmonton, AB, CAN  
Station Name:  
Operator ID: Damien  
Calibration Date: November 5, 2014

#### Attached Models


#### Equipment Used

EqNumber:	EqName:	CalDueDate:
IVSR-035	DMM	4/8/2015
IVSR-067	PPC2 Digital Calibrator	7/25/2016
ES-01382	Load Box	11/8/2014

#### Calibration Data

Range: -1 To 2 PSI

% of Range	Applied Pressure (PSI)	Requested Applied Pressure (PSI)	Analog Output (mA)	% Span Error	Pass/Fail
100.000	2.000	2.000	20.00674	0.04213	PASS
80.000	1.400	1.400	16.80006	0.00037	PASS
60.000	0.800	0.800	13.59990	-0.00062	PASS
40.000	0.200	0.200	10.39330	-0.04188	PASS
20.000	-0.400	-0.400	7.19778	-0.01388	PASS
0.000	-1.000	-1.000	3.99386	-0.03837	PASS

### Certification

This is to certify that the listed product meets the applicable Rosemount Specifications. Measuring and test equipment used in the manufacture, inspection and calibration of the listed product are traceable to the National Institute of Standards and Technology or to the National Research Council of Canada. The calibration system was designed to meet the intent of ANSI Z540-1-1994

  
Technician

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## Calibration Certificate

**Customer:** *Spartan Controls*

**Certificate:** 48162-00-1

### UNIT IDENTIFICATION

Manufacturer: **Metalogic**

Serial: **ITM2060**

Model: **M02-R2D1**

ID: **NA**

Description: **RTD Probe**

### CALIBRATION DATE

Calibration Date: 2014-Dec-01

Due Date: 2015-Dec-01

### CALIBRATION CONDITIONS

Temperature: **21.7 °C**

Humidity: **15 %**

Barometric Pressure: **N/A**

### GENERAL INFORMATION

Procedure: **PROBE rtd 100 OHM °C : /1502** Rev: **1.1**

As Received: **Within Specifications**

As Returned: **Within Specifications**

Data Type: **As Found-As Left** Adjusted: **No**

Remark: **Fluke 725 used as probe readout.**

### STANDARDS USED

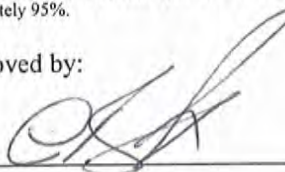
<u>ID</u>	<u>Manufacturer</u>	<u>Model</u>	<u>Cal Date</u>	<u>Due Date</u>
0124	Hart Scientific	1502A	2014-Mar-19	2015-Mar-19
0125	Burns Engineering	12001	2011-Dec-21	2014-Dec-21
0166	Fluke	725	2014-Apr-17	2015-Apr-17

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted intrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of  $k=2$  corresponding to a confidence level of approximately 95%.

Calibrated by: Andrew Atton



Approved by:



Certificate: 48162-00-1  
Asset: ITM2060 M02-R2D1

Calibration Certificate  
Data Type: As Found-As Left

Page 1 of 2





Appendix F

ITM INSTRUMENTS INC.

## TORONTO

16975 Leslie Street  
Newmarket, ON L3Y 9A1  
Tel: (905) 952-3750  
Fax: (905) 952-3751

## MONTREAL

20800 Boul. Industriel  
Ste-Anne-de-Bellevue, QC H9X 0A1  
Tel: (514) 457-7280  
Fax: (514) 457-4329

## CALGARY

#209, 4615 112 Ave SE  
Calgary, AB T2C 5J3  
Tel: (403) 272-9332  
Fax: (403) 248-5194

[www.itm.com](http://www.itm.com) - [information@itm.com](mailto:information@itm.com)

### Test Results

<u>Test Description</u>	<u>True Value</u>	<u>Reading</u>	<u>Lower limit</u>	<u>Upper limit</u>	<u>Units</u>	<u>Test Status</u>	<u>Exp Uncert</u>
21.6000 °C		21.676	21.100	22.100	°C	Pass	3.5e-002 °C
0.6250 °C		0.600	0.125	1.125	°C	Pass	3.5e-002 °C
95.6280 °C		95.600	95.128	96.128	°C	Pass	3.5e-002 °C

Certificate: 48162-00-1  
Asset: ITM2060\_M02-R2D1

Calibration Certificate  
Data Type: As Found-As Left

Page 2 of 2

This calibration certificate may not be reproduced, except in full, unless with the permission of ITM Instruments Inc.  
Ce certificat ne peut être reproduit autrement qu'en totalité, sauf avec l'autorisation de ITM Instruments Inc.

<b>itn</b> Calibration Certificate Certificat de Calibration 1 800 561 8187 www.itn.com	
Cert. : 48162-00-1	
S/N: ITM2060	
ID: NA	
Date: 2014-Dec-01	APA
Due: 2015-Dec-01	

ITM2060 00-00-01

**FloBoss Analog Input Configuration**

The detailed configuration information is shown on the following pages. The table below shows the key input information.

Device	Tag ID	Point Number	Units
RTD	TE-1019	1	Degrees F
Pressure Transmitter	PT-1103	2	Ounces
Mass Flow Transmitter	FT-1200	3	Pounds per hour

**Configuration: A10G2 - SS-GTS v1.3.0****Uploaded: 01/21/2015 10:00:08 Operator: LOI****Point Type : Analog Inputs**

0	Point Tag ID	TE-1019
2	Scan Period	1
4	Adjusted A/D 0%	9627
6	Low Reading EU	-40.0
8	Low Alarm EU	-40.0
10	Low Low Alarm EU	-40.0
12	Rate Alarm EU	5.0
14	Filtered EU Value	23.1016
16	Alarm Code	0
18	Actual Scan Time	20
20	Zero Raw	9627
22	Mid Point Raw #2	28140
24	Span Raw	28140
26	Mid Point EU #1	752.0
28	Mid Point EU #3	752.0
30	Offset (Zero Shift)	0.0
32	Manual Value	752.6845
34	Calibration Mode	0

**Point Number : 1**

1	Units	Degrees F
3	Filter	3
5	Adjusted A/D 100%	28140
7	High Reading EU	752.0
9	High Alarm EU	752.0
11	Hi Hi Alarm EU	752.0
13	Alarm Deadband	2.0
15	Mode	0
17	Raw A/D Input	11102
19	Fault Value	0.0
21	Mid Point Raw #1	28140
23	Mid Point Raw #3	28140
25	Zero EU	-40.0
27	Mid Point EU #2	752.0
29	Span EU	752.0
31	Set Value	752.0
33	Calibration Timer	35963
35	Calibration Type	0

**Point Type : Analog Inputs**

0	Point Tag ID	PT-1103
2	Scan Period	0.1
4	Adjusted A/D 0%	646
6	Low Reading EU	-16.0
8	Low Alarm EU	0.0
10	Low Low Alarm EU	0.0
12	Rate Alarm EU	5.0
14	Filtered EU Value	-1.670808
16	Alarm Code	3
18	Actual Scan Time	2
20	Zero Raw	646
22	Mid Point Raw #2	3222
24	Span Raw	3222
26	Mid Point EU #1	32.0
28	Mid Point EU #3	32.0
30	Offset (Zero Shift)	0.0
32	Manual Value	32.01863
34	Calibration Mode	0

**Point Number : 2**

1	Units	Ounce
3	Filter	3
5	Adjusted A/D 100%	3222
7	High Reading EU	32.0
9	High Alarm EU	100.0
11	Hi Hi Alarm EU	100.0
13	Alarm Deadband	2.0
15	Mode	17
17	Raw A/D Input	1415
19	Fault Value	12.0
21	Mid Point Raw #1	3222
23	Mid Point Raw #3	3222
25	Zero EU	-16.0
27	Mid Point EU #2	32.0
29	Span EU	32.0
31	Set Value	32.0
33	Calibration Timer	35957
35	Calibration Type	0

**Configuration: A10G2 - SS-GTS v1.3.0****Uploaded: 01/21/2015 10:00:08 Operator: LOI****Point Type : Analog Inputs**

0	Point Tag ID	FT-1200
2	Scan Period	0.1
4	Adjusted A/D 0%	647
6	Low Reading EU	0.0
8	Low Alarm EU	0.0
10	Low Low Alarm EU	0.0
12	Rate Alarm EU	10.0
14	Filtered EU Value	-0.0170543
16	Alarm Code	0
18	Actual Scan Time	2
20	Zero Raw	647
22	Mid Point Raw #2	3227
24	Span Raw	3227
26	Mid Point EU #1	22.0
28	Mid Point EU #3	22.0
30	Offset (Zero Shift)	0.0
32	Manual Value	22.02558
34	Calibration Mode	0

**Point Number : 3**

1	Units	lb/hr
3	Filter	3
5	Adjusted A/D 100%	3227
7	High Reading EU	22.0
9	High Alarm EU	100.0
11	Hi Hi Alarm EU	100.0
13	Alarm Deadband	2.0
15	Mode	0
17	Raw A/D Input	645
19	Fault Value	0.0
21	Mid Point Raw #1	3227
23	Mid Point Raw #3	3227
25	Zero EU	0.0
27	Mid Point EU #2	22.0
29	Span EU	22.0
31	Set Value	0.0
33	Calibration Timer	0
35	Calibration Type	0



## Calibration Data Sheet

### Customer Information

Name: REM Technology Inc.
Contact: Les Keast

### Device Information

### Calibration Information

Device Type: FloBoss 107	Technician: Ryan Tuck
Model No: 107-2036-9102	Calibration Date: December 8, 2014
Serial No: 2061108	

### Equipment Used

Model No	Serial Number	Description	Calibration Due Date
Fluke 725	1196161	Multifunction Process Calibrator	November 14, 2015

### Calibration Data

I/O Card Slot / Model No / Serial No: 0 / W40159X0042 / Not Available

Channel: RTD-1 / TE-1019

Range: -40 to 752 °F

Percent of Range [%]	Actual Reading [°F]	Expected Reading [°F]	Deviation [°F]	Error [%]
0	-40.000	-40.000	0.000	0.0000
25	157.818	158.000	-0.182	-0.0230
50	356.235	356.000	0.235	0.0297
75	554.909	554.000	0.909	0.1148
100	752.727	752.000	0.727	0.0918

December 8, 2014

Spartan Controls  
305 – 27 Street SE  
Calgary, Alberta T2A 7V2

I/O Card Slot / Model No / Serial No: 0 / W40159X0042 / Not Available

Channel: AI-1 / PT-1103

Range: -16 to 32 Oz/in

Percent of Range [%]	Actual Reading [Oz./in]	Expected Reading [Oz./in]	Deviation [Oz./in]	Error [%]
0	-16.019	-16.000	-0.019	-0.0396
25	-4.000	-4.000	0.000	0.0000
50	8.000	8.000	0.000	0.0000
75	20.019	20.000	0.019	0.0396
100	32.037	32.000	0.037	0.0771

I/O Card Slot / Model No / Serial No: 0 / W40159X0042 / Not Available

Channel: AI-2 / FT-1200

Range: 0 to 22 lb/hr

Percent of Range [%]	Actual Reading [lb/hr]	Expected Reading [lb/hr]	Deviation [lb/hr]	Error [%]
0	0.000	0.000	0.000	0.0000
25	5.500	5.500	0.000	0.0000
50	11.009	11.000	0.009	0.0409
75	16.500	16.500	0.000	0.0000
100	22.009	22.000	0.009	0.0409

  
\_\_\_\_\_  
Technician



8505 Argyll Road  
Edmonton AB T6B 4B2  
Phone: (780) 434-0509 Fax: (780) 988-5177  
cal.lab@bhd.ca www.bhd.ca

## Certificate of Calibration

<b>Asset Number:</b>	FLU-725-017	<b>Customer:</b>	BHD Instrumentation Rentals
<b>Manufacturer:</b>	FLUKE		8505 Argyll Road
<b>Model Number:</b>	725		Edmonton, AB T6C 4B2
<b>Serial Number:</b>	1196161		
<b>Customer Asset</b>			

<b>Calibration Date:</b>	14-November-2014	<b>Temperature:</b>	23.0 °C
<b>Calibration Due:</b>	14-November-2015	<b>Relative Humidity:</b>	20 %
<b>Condition as Received / Returned:</b> In Tolerance As Found / As Left (Pass)			

**Procedure Name:** Fluke 725: (1 year) CAL VER RS-232 / 5520,8508

- BHD Calibration Laboratories Ltd. certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes.

- The quality system is registered to ISO 9001:2008.

- This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

- The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma ( $k=2$ ) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

- This calibration certificate shall not be reproduced except in full without the written approval of BHD Calibration Laboratories Ltd. .

### Standards Used

Cal Standard	Model	Serial Number	Description	Cal Due
CL506	8508A	212765313	Multimeter	11/17/2014
CL901	5520A	8885010	Calibrator	08/09/2015

A handwritten signature in blue ink, appearing to read 'Dale Rauhala', is written over a horizontal line.

Dale Rauhala



## **Kestrel® 4500 Pocket Weather Tracker Certificate of Conformity**

*This certifies that the enclosed Kestrel 4500 Pocket Weather Tracker was manufactured by*

**Nielsen-Kellerman Co.**

*at its facilities located at*

**21 Creek Circle, Boothwyn, PA 19061 USA**

*This instrument was produced under rigorous factory production control and documented standard procedures. It was individually inspected and tested for display, backlight, button and software functionality and its measurement performance was individually calibrated and tested against standards traceable to the National Institute of Standards and Technology ("NIST") or calibrated intermediary standards. This unit is certified to have performed at the time of manufacture in compliance with the specifications printed on the reverse.*

### **Methods Used in Calibration and Testing**

**Wind Speed /Air Velocity:** The Kestrel impeller installed in this unit was individually tested in a subsonic wind tunnel operating at approximately 1200 fpm (6.1 m/s) monitored by a Gill Instruments Model 1350 ultrasonic time-of-flight anemometer. The low-speed functionality of this impeller was further verified following wind tunnel testing. The Gill 1350 is calibrated at low and high speeds by NIST with a maximum relative expanded uncertainty of  $\pm 0.60\%$  within the airspeed range 591 to 7874 fpm (3.0 to 40.0 m/s) and further verified on a regular schedule by NK's internal measurement assurance program.

**Temperature:** The temperature response of this unit was verified in comparison with a Eutechnics 4600 Precision Thermometer or a standard Kestrel 4000 Pocket Weather Tracker calibrated weekly with the Eutechnics 4600. The Eutechnics 4600 is calibrated annually and is traceable to NIST with a maximum relative expanded uncertainty of  $\pm 0.020^{\circ}\text{C}$ .

**Relative Humidity:** This unit received a two-point RH calibration in humidity and temperature controlled chambers at 75.5% RH and 32.5% RH at  $25^{\circ}\text{C}$ . The calibration chambers were monitored with an Edgetech Model 2002 DewPrime II Standard Chilled Mirror Hygrometer. Following calibration, the performance of this instrument was further verified at an RH of approximately 43% against the Edgetech Hygrometer. The Edgetech Hygrometer is calibrated annually and is traceable to NIST with a maximum relative expanded uncertainty of  $\pm 0.5\% \text{RH}$ .

**Barometric Pressure:** The pressure response of this unit was verified at multiple pressures ( $\sim 1000 \text{ hPa}$ ,  $900 \text{ hPa}$  and  $500 \text{ hPa}$ ) against a Mensor Series 6000 Digital Barometer or a standard Kestrel 4000 Pocket Weather Tracker calibrated weekly with the Mensor Barometer. The Mensor Barometer is calibrated annually and is traceable to NIST with a maximum relative expanded uncertainty of  $\pm 0.2 \text{ hPa}$ .

**Direction:** The performance of the magnetic compass sensor of this unit was verified at the component level as well as after assembly by

Inspected By:



## Appendix F

Kestrel 4500 Pocket Weather Tracker Specifications

Measurement Response Time	Units	Operational Range	Resolution	Accuracy (+/-)	Specification Range
Wind Speed 1 second	m/s	0.4 to 60.0 m/s	0.1	Larger of 3% of reading or least significant digit	0.4 to 40.0 m/s
	ft/min	59 to 11,948 ft/min	1		59 to 7877 ft/min
	km/h	1.0 to 218.0 km/h	0.1		1.0 to 144.0 km/h
	mph	0.8 to 135.0 mph	1		0.8 to 89.0 mph
	knots	0.6 to 118.3 kt	0.1		0.6 to 78.0 kt
	Beaufort	0 to 12 B	0.1		0 to 12 B
1 inch diameter impeller with precision axle and sapphire bearings. Off-axis accuracy -1% @ 5° off-axis, -2% @ 10°, -3% @ 15°. Calibration drift < 1% after 100 hours use at 16 MPH / 7 m/s. Sustained operation above 60 MPH / 27 m/s will wear impeller rapidly and may cause destruction of impeller. Replacement impeller (NK PN-0601) may be field-installed without tools (US Patent 5,783,753).					
Wind Direction / Forward Heading 1 second	°	360°	1	5°	0 to 360°
	Cardinal Points	360°	16 Points	5°	0 to 360°
2-axis solid-state magnetoresistive sensor mounted perpendicular to unit plane to permit operation while measuring wind speed. Declination/variation adjustable for True North readout. Accuracy of measurements dependent upon unit's vertical position. Self-calibration routine eliminates magnetic error from batteries or unit and must be run after every full power-down (battery removal or change).					
Temperature 1 second	°F	-49.0 to 257.0 °F	0.1	1.8 °F	-20.0 to 158.0 °F
	°C	-45.0 to 125.0 °C	0.1	1.0 °C	-29.0 to 70.0 °C
Measures air, water and snow temperature. Thermally isolated, hermetically sealed, precision thermistor mounted externally (US Patent 5,939,645). Calibration drift negligible.					
Relative Humidity 1 minute	%RH	0.0 to 100.0 %	0.1	3.0 %RH	5.0 to 95.0 % non-condensing
Polymer capacitive humidity sensor mounted in thin-walled chamber external to case for rapid, accurate response (US Patent 6,257,074). (To achieve stated relative humidity accuracy, unit must be permitted to equilibrate to external temperature when exposed to large, rapid temperature changes and must be kept out of direct sunlight.) Calibration drift +/- 2% over 24 months. Relative humidity may be recalibrated at factory or in field using Kestrel Humidity Calibration Kit (NK PN-0802).					
Pressure 1 second	inHg	0.3 to 32.5 inHg	0.01	0.05 inHg	At 77.0 °F, 22.1 to 32.5 inHg
	hPa / mb	10.0 to 1100.0 hPa / mb	0.1	1.5 hPa / mb	At 25.0 °C, 750 to 1100hPa / mb
	PSI	0.15 to 16.0 PSI	0.01	0.02 PSI	At 77.0 °F, 10.9 to 16.0 PSI
Monolithic silicon piezoresistive pressure sensor with second-order temperature correction. Maximum error over temperature range 32 to 158 °F (0 to 70 °C), +/- 0.06 inHg / +/-2.0 hPa. Calibration drift typically -0.03 inHg / -1.0 hPa per year. Pressure sensor may be recalibrated at factory or in field.					
Altitude 1 second	ft	-6000 to 30000 ft	1	50 ft	At 77.0 °F, <19,700 ft. Max error +/- 98 ft
	m	-2000 to 9000 m	1	15 m	At 25.0 °C, <6,000 m. Max error +/- 30 m
Temperature compensated pressure (barometric) altimeter.					
Crosswind Headwind, Tailwind 1 second	mph	0.8 to 135.0 mph	1	5%	8.5 to 89.0 mph
	ft/min	59 to 11,880 ft/min	1	5%	750 to 7832 ft/min
	km/h	1.0 to 217.3 km/h	0.1	5%	13.7 to 143.2 km/h
	m/s	0.4 to 60.0 m/s	0.1	5%	3.8 to 40.0 m/s
	knots	0.6 to 117.3 kt	0.1	5%	7.4 to 77.0 kt
Calculated from the primary measurements of wind speed, wind direction and target heading. Auto-switching headwind/tailwind indication. Ranges expressed refer to primary wind speed.					
Wind Chill 1 second	°F	0.7 to 135.0 MPH, -49.0 to 257.0 °F	0.1	1.8 °F	1.8 to 89.0 mph, -50.0 to 50.0 °F
	°C	0.4 to 60.0 m/s, -45.0 to 125.0 °C	0.1	1.0 °C	0.4 to 40 m/s, -45.6 to 10.0 °C
Calculated from the primary measurements of wind speed and temperature. Utilizes the NWS Wind Chill Temperature (WCT) Index, revised 2001, with wind speed adjusted by a factor of 1.5 to yield equivalent results to wind speed measured at 10 m above ground. (Specification temperature limits established by WCT Tables.)					
Heat Index 1 minute	°F	0.0 to 100.0 %RH, -49.0 to 257.0 °F	0.1	3.6 °F	70.0 to 130.0 °F, 0 to 100% RH
	°C	0.0 to 100.0 %RH, -45.0 to 125.0 °C	0.1	2.0 °C	21.1 to 54.4 °C, 0 to 100 %RH
Calculated from the primary measurements of temperature and relative humidity. Utilizes the NWS Heat Index (HI) tables. (Specification temperature limits established by HI tables.)					
Dewpoint 1 minute	°F	0.0 to 100.0 %RH, -49.0 to 257.0 °F	0.1	3.6 °F	-20.0 to 158.0 °F, 20.0 to 95.0% RH
	°C	0.0 to 100.0 %RH, -45.0 to 125.0 °C	0.1	2.0 °C	-29.0 to 70.0 °C, 20.0 to 95.0 %RH
Calculated from the primary measurements of temperature and relative humidity. Temperature to which the air would need to be cooled at a constant pressure to become saturated.					
Wet Bulb Temperature 1 minute	°F	-49.0 to 257.0 °F, 0.0 to 100.0 %RH, 8.86 to 32.48 inHg	0.1	3.6 °F	32.0 to 100.0 °F, 5.0 to 95.0% RH, 8.86 to 32.48 inHg, <19700 ft
	°C	-45.0 to 125.0 °C, 0.0 to 100.0 %RH, 300.0 to 1100.0 hPa	0.1	2.0 °C	0.0 to 37.8 °C, 5.0 to 95.0 %RH, -2000.0 to 9000.0 hPa, <6000 m
Calculated from the primary measurements of temperature, relative humidity and pressure. Temperature indicated by a wet bulb psychrometer.					
Density Altitude 1 second	ft	-49.0 to 257.0 °F, 0.0 to 100.0 % RH, 8.86 to 32.48 inHg	1	246	32.0 to 100.0 °F, 5.0 to 95.0 %RH, 8.86 to 32.48 inHg, <19700 ft
	m	-45.0 to 125.0 °C, 0.0 to 100.0 %RH, 300.0 to 1100.0 hPa	1	75	0.0 to 37.8 °C, 5.0 to 95.0 %RH, -2000 to 9000 hPa, <6000 m
Calculated from the primary measurements of temperature, relative humidity and pressure. Air density converted to equivalent sea level elevation at the International Standard Atmosphere.					
Max/Avg Wind Speed, Crosswind, Headwind/Tailwind	One-button clear and restart of Max Wind Gust and Average Wind measurement.				
Data Storage / Display	Minimum, maximum, average and logged history stored and displayed for every measured value. 1400-point data logger with graphical display. Auto data storage; interval settable from 2 seconds to 12 hours. Manual data capture.				
Data Upload	Requires optional PC interface (NK PN-0630) and provided software. RS-232 connection with USB adapter available.				
Display	Multifunction, multi-digit programmable dot-matrix display.				
Display Update	1 second				
Display Backlight	Choice of aviation green or visible red electroluminescent backlight. Automatic or manual activation.				
Clock / Calendar	Real-time hours:minutes:seconds clock, calendar, automatic leap-year adjustment.				
Operational Temperature Range (LCD and Batteries)	The operational temperature range of the liquid crystal display and batteries is 14° F to 131° F / -10 °C to 55 °C. Beyond the limits of the operational temperature range, the unit must be maintained within range and exposed for minimum time necessary to take reading.				
Storage Temperature	-22 °F to 140 °F / -30 °C to 60 °C.				
Auto Shutdown	User-selectable: 15 or 60 minutes with no key presses or disabled.				
Languages	English, French, German, Italian, Spanish.				
Certifications	CE certified. Individually tested to NIST-traceable standards (written certificate of tests available at additional charge).				
Batteries	AAA Alkaline, two, included. Average life, 400 hours of use, +/- depending on backlight use.				
Environmental	Waterproof (IP67 standard). Drop-tested (MIL-STD-810F, unit only. Substantial impact may damage replaceable impeller).				
Dimensions	Unit 5.0 x 1.8 x 1.1 in / 12.7 x 4.5 x 2.8 cm.				
Weight	Unit 3.6 oz / 102 g.				

## **Appendix H – Miscellaneous Information**

- Email from R. Segall re Calibration Gas
- Letter from Steffan Johnson re flow measurement



Email from Robin R. Segall, Senior Environmental Scientist, Measurement Technology Group (E143-02), Office of Air Quality Planning & Standards, US Environmental Protection Agency to Patty Centofanti, Senior Consultant, Trinity Consultants.

**From:** Segall, Robin [<mailto:Segall.Robin@epa.gov>]  
**Sent:** Monday, December 08, 2014 6:07 PM  
**To:** Patty Centofanti  
**Cc:** Johnson, Steffan; Christi Wilson  
**Subject:** RE: REM Technology Testing - Propane in Nitrogen

Patty,

Thank you for supplying this additional information via email. In the case that your test plan and this email describes, we would consider the use of Propane in Nitrogen for the Method 25A testing in lieu of Propane in Air to be a minor change to testing which will not affect the results of the Manufacturers Test program under 40 CFR 60, Subpart OOOO. Please be sure that the modification is properly reported in the test report and that a copy of this email is included.

Thank you,

Robin

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**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
 RESEARCH TRIANGLE PARK, NC 27711

**MAR 26 2014**

OFFICE OF  
 AIR QUALITY PLANNING  
 AND STANDARDS

Ms. Christi Wilson, Managing Consultant  
 Trinity Consultants  
 4500 Brooktree Road, Suite 103  
 Wexford, PA 15090

Dear Ms. Wilson,

Thank you for your letter dated January 14, 2014, to the EPA's Region III requesting the Environmental Protection Agency (EPA) review and issue a determination on a number of modifications/alternatives to test methods. Your request was forwarded to the Office of Air Quality Planning and Standards, the delegated authority that determines any major alternative to test methods and procedures required under 40 CFR part 60, 61, 63, or 65 as applicable. As we understand it, Trinity Consultants (Trinity) has submitted this request on behalf of REM Technology Inc. as Trinity will soon be performing the manufacturer's performance test for an enclosed combustion device for REM Technology according to 40 CFR part 60, Subpart OOOO, Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution, section 60.5413(d).

As part of the test plan describing this work, you requested the following alternatives/modifications to a number of the requirements of section 60.5413(d). We approve the following alternatives for use during manufacturer's performance testing of the REM Technology SlipStream GTS system according to 40 CFR part 60, Subpart OOOO:

1) Use of fuel input (in scfm) to define firing rate and use of lowest point on operating range in lieu of 0% design rate. In your test plan, you explain that the REM Technology SlipStream GTS system to be tested is designed such that the burner only ignites at a certain sufficient pressure of fuel gas, 4 oz/in<sup>2</sup>, which generally corresponds to a fuel flow of 1.5 scfm. The top of the system operation range is 10 oz/in<sup>2</sup>, which corresponds to a fuel flow of 2.7 scfm. You then propose that, for testing of the REM Technology combustor, the firing rate percentages set forth in 60.5413(d)(2) of Subpart OOOO be applied to the combustor operating range as follows:

<b>Specifications (%)</b>	<b>Firing Rate (scfm)</b>
90-100	2.5-27
70-100-70	2.3-2.7-2.3
30-70-30	1.9-2.3-1.9
0-30-30	1.5-1.9-1.5



2) Use of a mass flow meter in lieu of a volumetric flow meter in conducting Method 2A. In *specific*, you propose use of an in-line mass flow meter calibrated by the supplier specifically for propylene gas. This meter measures both gas flow and temperature. Please ensure that the supplier's calibration documentation is included in the test report.

The remaining requested alternatives/modifications are not approved for the reasons detailed.

3) Use of Method 3A in lieu of Method 3C for measurement of oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>). You propose use of a continuous instrumental measurement as opposed to an integrated bag sample analyzed by gas chromatography for O<sub>2</sub> and CO<sub>2</sub>. We are not approving use of Method 3A in lieu of Method 3C. Subpart OOOO specifically did not provide Method 3A as an option for measurement of O<sub>2</sub> and CO<sub>2</sub> to avoid potential for adjustment of the process operating conditions based on the real time O<sub>2</sub>/CO<sub>2</sub> data.

4) For Method 10, use of a span of 0 to 100 ppm CO in lieu of the recommended span of 0 to 10 ppm CO. For Method 10, we cannot approve use of a span of 0 to 100 ppm CO. Subpart OOOO 'recommends' a span of 0 to 10 ppm CO leaving some leeway for alternative spans to be used; however, a span an order of magnitude greater is inappropriate, particularly in light of the performance criterion specified for CO of 10 ppm. Data collected for demonstrating compliance should be mostly between 20 - 80 percent of the instrument range, making a 0-100 ppm CO span too high for such purposes.

5) For Method 25A to determine total hydrocarbon, use of methane for calibration in lieu of propane as required by section 60.5413(d)(9). You propose that the THC results measured based on a methane calibration would then be divided by a factor of 3 to yield THC results as propane. We see no compelling reason for and, therefore, disapprove the use of methane for calibration instead of propane in conducting the total hydrocarbon testing using Method 25A.

If you have any questions regarding this alternative method approval, you may contact Robin Segall of my staff at (919) 541-0893 or [segall.robin@epa.gov](mailto:segall.robin@epa.gov), or me at (919) 541-4790 or [johnson.steffan@epa.gov](mailto:johnson.steffan@epa.gov).

Sincerely,



Steffan Johnson, Acting Group Leader  
Measurement Technology Group

cc: Chris Frantz, OAQPS/SPPD  
James Hagedorn, Region 3  
Marcia Mia, OECA  
Bruce Moore, OAQPS/SPPD

## Appendix I – Wind Velocity, Direction and Atmospheric Pressure

Recorded by the Kestral 4500 Weather Tracker

### Wind and Pressure data

Magnetic declination	14	Deg
Altitude	1037	m

Test 9 - 0% to 30%				
Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa
12/11/2014	16:10	119	1.2	87.88
12/11/2014	16:11	114	0.6	87.88
12/11/2014	16:12	119	0.7	87.88
12/11/2014	16:13	126	0.6	87.88
12/11/2014	16:14	113	0.7	87.88
12/11/2014	16:15	125	0.7	87.87
12/11/2014	16:16	128	0.6	87.88
12/11/2014	16:17	126	0	87.87
12/11/2014	16:18	127	0	87.87
12/11/2014	16:19	143	0.5	87.86
12/11/2014	16:20	141	0	87.86
12/11/2014	16:21	143	0	87.85
12/11/2014	16:22	137	0.8	87.85
12/11/2014	16:23	150	0.7	87.85
12/11/2014	16:24	142	0.7	87.85
12/11/2014	16:25	130	0.9	87.85
12/11/2014	16:26	133	0.8	87.85
12/11/2014	16:27	134	0.9	87.85
12/11/2014	16:28	129	1.5	87.85
12/11/2014	16:29	129	1.1	87.86
12/11/2014	16:30	132	1.2	87.86
12/11/2014	16:31	148	1.1	87.85
12/11/2014	16:32	154	1.2	87.85
12/11/2014	16:33	147	0.9	87.86
12/11/2014	16:34	134	1.4	87.86
12/11/2014	16:35	130	0.8	87.86
12/11/2014	16:36	130	0.6	87.86
12/11/2014	16:37	133	1.2	87.86
12/11/2014	16:38	130	1.2	87.86
12/11/2014	16:39	138	1.1	87.86
12/11/2014	16:40	145	1.4	87.86
12/11/2014	16:41	111	1.2	87.86
12/11/2014	16:42	129	1.7	87.87
12/11/2014	16:43	135	2.6	87.87
12/11/2014	16:44	130	1.6	87.88
12/11/2014	16:45	145	1.7	87.87
12/11/2014	16:46	132	2.1	87.87
12/11/2014	16:47	154	1.4	87.88
12/11/2014	16:48	134	1.8	87.88
12/11/2014	16:49	138	1.4	87.88
12/11/2014	16:50	135	1	87.88
12/11/2014	16:51	130	1.2	87.88
12/11/2014	16:52	141	1.8	87.88
12/11/2014	16:53	132	1.6	87.88
12/11/2014	16:54	132	1.2	87.88
12/11/2014	16:55	133	2.6	87.88
12/11/2014	16:56	172	0.8	87.89
12/11/2014	16:57	158	0.9	87.89
12/11/2014	16:58	153	1.2	87.88
12/11/2014	16:59	158	1.6	87.88
12/11/2014	17:00	133	1.3	87.88
12/11/2014	17:01	149	1.4	87.88
12/11/2014	17:02	136	1.3	87.87
12/11/2014	17:03	135	0.9	87.87
12/11/2014	17:04	141	1.1	87.85
12/11/2014	17:05	137	1.4	87.86
12/11/2014	17:06	137	0.6	87.86
12/11/2014	17:07	139	1.4	87.87
12/11/2014	17:08	167	1.2	87.86
12/11/2014	17:09	133	0.9	87.86
12/11/2014	17:10	133	0.8	87.86
12/11/2014	17:11	134	0	87.85
12/11/2014	17:12	132	0.9	87.86
12/11/2014	17:13	132	0	87.86
12/11/2014	17:14	132	0.5	87.86
12/11/2014	17:15	131	0.6	87.86
12/11/2014	17:16	147	0.7	87.86
Average				87.87

## Appendix I

Test 13 - 0% to 30%					Test 14 - 0% to 30%				
Date	Time	Wind Dir	Wind Vel	Pressure	Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa		hh:mm	Deg (True)	m/s	kPa
12/12/2014	13:00	186	0.6	88.08	12/12/2014	14:30	371	0.8	88.07
12/12/2014	13:01	168	0.8	88.07	12/12/2014	14:31	363	1.1	88.06
12/12/2014	13:02	167	0	88.1	12/12/2014	14:32	358	1.1	88.07
12/12/2014	13:03	131	0.9	88.1	12/12/2014	14:33	14	1	88.08
12/12/2014	13:04	169	1	88.09	12/12/2014	14:34	345	1.4	88.07
12/12/2014	13:05	168	1.2	88.09	12/12/2014	14:35	361	0.6	88.09
12/12/2014	13:06	161	1.3	88.09	12/12/2014	14:36	20	0.7	88.09
12/12/2014	13:07	182	1.7	88.08	12/12/2014	14:37	367	1	88.09
12/12/2014	13:08	144	1	88.08	12/12/2014	14:38	355	1.2	88.08
12/12/2014	13:09	168	1.2	88.07	12/12/2014	14:39	358	0.9	88.08
12/12/2014	13:10	150	1.1	88.08	12/12/2014	14:40	356	1	88.09
12/12/2014	13:11	132	1.1	88.09	12/12/2014	14:41	352	1.1	88.11
12/12/2014	13:12	160	1.3	88.09	12/12/2014	14:42	360	0.9	88.12
12/12/2014	13:13	133	1.1	88.09	12/12/2014	14:43	364	1.2	88.13
12/12/2014	13:14	185	1	88.08	12/12/2014	14:44	18	0.9	88.13
12/12/2014	13:15	125	1.4	88.09	12/12/2014	14:45	368	0.7	88.13
12/12/2014	13:16	119	0.6	88.08	12/12/2014	14:46	360	1	88.14
12/12/2014	13:17	184	0.8	88.08	12/12/2014	14:47	361	1.5	88.13
12/12/2014	13:18	180	1.5	88.07	12/12/2014	14:48	15	1	88.12
12/12/2014	13:19	167	0.9	88.08	12/12/2014	14:49	24	1.2	88.13
12/12/2014	13:20	163	0.6	88.07	12/12/2014	14:50	19	1.4	88.12
12/12/2014	13:21	175	1.7	88.08	12/12/2014	14:51	367	0.7	88.11
12/12/2014	13:22	183	0.8	88.07	12/12/2014	14:52	332	1.1	88.11
12/12/2014	13:23	205	1.3	88.08	12/12/2014	14:53	366	0.9	88.12
12/12/2014	13:24	178	1	88.08	12/12/2014	14:54	346	0.9	88.11
12/12/2014	13:25	204	0	88.09	12/12/2014	14:55	346	1	88.12
12/12/2014	13:26	207	0.6	88.08	12/12/2014	14:56	334	0.8	88.12
12/12/2014	13:27	174	0	88.09	12/12/2014	14:57	352	0.6	88.11
12/12/2014	13:28	176	0.5	88.09	12/12/2014	14:58	345	1.3	88.12
12/12/2014	13:29	171	0	88.08	12/12/2014	14:59	358	0.8	88.12
12/12/2014	13:30	171	0.8	88.08	12/12/2014	15:00	337	0.6	88.12
12/12/2014	13:31	128	0.9	88.09	12/12/2014	15:01	272	0.6	88.12
12/12/2014	13:32	137	1.3	88.08	12/12/2014	15:02	359	0.3	88.13
12/12/2014	13:33	144	1.1	88.09	12/12/2014	15:03	360	0	88.14
12/12/2014	13:34	130	0	88.08	12/12/2014	15:04	357	0.6	88.14
12/12/2014	13:35	172	0.8	88.07	12/12/2014	15:05	14	0	88.14
12/12/2014	13:36	145	0	88.1	12/12/2014	15:06	366	1	88.12
12/12/2014	13:37	150	0.9	88.09	12/12/2014	15:07	372	0.7	88.13
12/12/2014	13:38	172	0	88.05	12/12/2014	15:08	366	0.5	88.13
12/12/2014	13:39	172	0	88.06	12/12/2014	15:09	21	0.7	88.14
12/12/2014	13:40	126	0.9	88.1	12/12/2014	15:10	28	0.5	88.15
12/12/2014	13:41	160	0	88.08	12/12/2014	15:11	41	0	88.14
12/12/2014	13:42	167	0	88.06	12/12/2014	15:12	363	0	88.13
12/12/2014	13:43	172	0.5	88.08	12/12/2014	15:13	369	0	88.13
12/12/2014	13:44	174	0	88.08	12/12/2014	15:14	368	0	88.13
12/12/2014	13:45	174	0	88.07	12/12/2014	15:15	367	0	88.13
12/12/2014	13:46	174	0.4	88.08	12/12/2014	15:16	369	0	88.14
12/12/2014	13:47	171	0	88.08	12/12/2014	15:17	369	0	88.14
12/12/2014	13:48	172	0	88.08	12/12/2014	15:18	370	0	88.13
12/12/2014	13:49	167	0	88.08	12/12/2014	15:19	370	0	88.13
12/12/2014	13:50	174	0.5	88.09	12/12/2014	15:20	369	0	88.14
12/12/2014	13:51	172	0	88.08	12/12/2014	15:21	368	0	88.14
12/12/2014	13:52	173	0	88.07	12/12/2014	15:22	369	0	88.13
12/12/2014	13:53	183	0	88.02	12/12/2014	15:23	368	0	88.14
12/12/2014	13:54	183	0	88.01	12/12/2014	15:24	368	0	88.14
12/12/2014	13:55	164	0	88.08	12/12/2014	15:25	363	0	88.13
12/12/2014	13:56	163	0.8	88.08	12/12/2014	15:26	135	0.8	88.13
12/12/2014	13:57	157	0.5	88.09	12/12/2014	15:27	121	0.3	88.15
12/12/2014	13:58	209	0.7	87.98	12/12/2014	15:28	140	0.7	88.15
12/12/2014	13:59	159	0	88.09	12/12/2014	15:29	159	0	88.15
12/12/2014	14:00	173	0.6	88.08	12/12/2014	15:30	177	0	88.14
12/12/2014	14:01	325	1.5	88.09	12/12/2014	15:31	233	0	88.02
12/12/2014	14:02	257	0.7	88.09	12/12/2014	15:32	233	0	88.01
12/12/2014	14:03	217	0	88.09	12/12/2014	15:33	198	0	88.03
12/12/2014	14:04	160	0	88.1	12/12/2014	15:34	128	0.6	88.13
12/12/2014	14:05	125	0.6	88.11	12/12/2014	15:35	149	0.8	88.14
Average				88.08					88.12



## Appendix I

Test 6 - 30% to 70%					Test 7 - 30% to 70%				
Date	Time	Wind Dir	Wind Vel	Pressure	Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa		hh:mm	Deg (True)	m/s	kPa
12/11/2014	11:35	184	0	87.89	12/11/2014	13:05	134	2.8	87.95
12/11/2014	11:36	161	1.5	87.89	12/11/2014	13:06	136	2	87.95
12/11/2014	11:37	137	1.6	87.9	12/11/2014	13:07	152	1.8	87.94
12/11/2014	11:38	150	1.3	87.96	12/11/2014	13:08	139	3.7	87.94
12/11/2014	11:39	122	0.7	87.91	12/11/2014	13:09	139	2.5	87.93
12/11/2014	11:40	129	1	87.9	12/11/2014	13:10	145	1.6	87.93
12/11/2014	11:41	128	0.9	87.9	12/11/2014	13:11	148	1.1	87.91
12/11/2014	11:42	159	1.2	87.9	12/11/2014	13:12	140	3.1	87.92
12/11/2014	11:43	192	1.7	87.89	12/11/2014	13:13	144	3.4	87.91
12/11/2014	11:44	170	0.5	87.9	12/11/2014	13:14	140	2.2	87.91
12/11/2014	11:45	130	0.4	87.92	12/11/2014	13:15	130	2.2	87.9
12/11/2014	11:46	193	1	87.89	12/11/2014	13:16	140	2	87.9
12/11/2014	11:47	155	0.5	87.88	12/11/2014	13:17	161	1.8	87.91
12/11/2014	11:48	184	0	87.87	12/11/2014	13:18	172	2.2	87.91
12/11/2014	11:49	157	0.6	87.92	12/11/2014	13:19	142	0.7	87.91
12/11/2014	11:50	181	1.5	87.88	12/11/2014	13:20	145	1.7	87.91
12/11/2014	11:51	172	0.7	87.86	12/11/2014	13:21	136	2.5	87.91
12/11/2014	11:52	160	3.2	87.92	12/11/2014	13:22	160	1.6	87.91
12/11/2014	11:53	125	1.6	87.95	12/11/2014	13:23	142	1.6	87.91
12/11/2014	11:54	154	4.2	87.94	12/11/2014	13:24	142	1.5	87.92
12/11/2014	11:55	151	2.9	87.93	12/11/2014	13:25	132	1.6	87.93
12/11/2014	11:56	167	2.6	87.9	12/11/2014	13:26	139	1.8	87.94
12/11/2014	11:57	163	1.9	87.91	12/11/2014	13:27	153	0.8	87.93
12/11/2014	11:58	163	2	87.9	12/11/2014	13:28	141	2.4	87.94
12/11/2014	11:59	172	3	87.88	12/11/2014	13:29	130	1.4	87.94
12/11/2014	12:00	200	1	87.87	12/11/2014	13:30	146	1.8	87.93
12/11/2014	12:01	216	1.3	87.88	12/11/2014	13:31	139	2.7	87.93
12/11/2014	12:02	327	0.6	87.89	12/11/2014	13:32	128	1.7	87.93
12/11/2014	12:03	341	1.8	87.88	12/11/2014	13:33	142	1.9	87.93
12/11/2014	12:04	318	1.1	87.89	12/11/2014	13:34	138	2.2	87.93
12/11/2014	12:05	303	2.1	87.88	12/11/2014	13:35	133	2	87.93
12/11/2014	12:06	338	1.5	87.88	12/11/2014	13:36	130	1.8	87.91
12/11/2014	12:07	22	1.5	87.89	12/11/2014	13:37	137	1.6	87.93
12/11/2014	12:08	333	1	87.88	12/11/2014	13:38	129	1	87.93
12/11/2014	12:09	328	1	87.89	12/11/2014	13:39	131	1.8	87.93
12/11/2014	12:10	324	0	87.9	12/11/2014	13:40	137	2.5	87.94
12/11/2014	12:11	147	0.5	87.92	12/11/2014	13:41	138	2.1	87.93
12/11/2014	12:12	124	0.9	87.93	12/11/2014	13:42	116	1.2	87.93
12/11/2014	12:13	129	1.4	87.93	12/11/2014	13:43	131	2.6	87.94
12/11/2014	12:14	143	1.3	87.93	12/11/2014	13:44	140	1.3	87.93
12/11/2014	12:15	127	1.1	87.95	12/11/2014	13:45	138	1.9	87.94
12/11/2014	12:16	141	2.3	87.95	12/11/2014	13:46	129	1.9	87.94
12/11/2014	12:17	114	1	87.96	12/11/2014	13:47	132	1.9	87.95
12/11/2014	12:18	143	2.6	87.97	12/11/2014	13:48	123	1.8	87.96
12/11/2014	12:19	118	1.8	87.97	12/11/2014	13:49	150	1.6	87.95
12/11/2014	12:20	137	2.4	87.96	12/11/2014	13:50	131	2	87.95
12/11/2014	12:21	143	2	87.98	12/11/2014	13:51	131	1.9	87.95
12/11/2014	12:22	137	1	87.97	12/11/2014	13:52	138	1.5	87.95
12/11/2014	12:23	147	1.5	87.96	12/11/2014	13:53	132	2.2	87.94
12/11/2014	12:24	208	0.7	87.95	12/11/2014	13:54	133	1.6	87.94
12/11/2014	12:25	132	0.7	87.94	12/11/2014	13:55	135	1.7	87.94
12/11/2014	12:26	120	0	87.94	12/11/2014	13:56	144	1.8	87.95
12/11/2014	12:27	103	0	87.92	12/11/2014	13:57	136	1.1	87.94
12/11/2014	12:28	104	0	87.91	12/11/2014	13:58	137	1.7	87.94
12/11/2014	12:29	104	0	87.92	12/11/2014	13:59	154	1.3	87.94
12/11/2014	12:30	104	0	87.93	12/11/2014	14:00	135	0.7	87.93
12/11/2014	12:31	165	0	87.92	12/11/2014	14:01	121	1	87.93
12/11/2014	12:32	147	0.9	87.93	12/11/2014	14:02	132	1.4	87.93
12/11/2014	12:33	151	0.8	87.93	12/11/2014	14:03	143	1.6	87.92
12/11/2014	12:34	151	1.6	87.93	12/11/2014	14:04	138	2.1	87.92
12/11/2014	12:35	132	2.1	87.94	12/11/2014	14:05	149	1.6	87.91
12/11/2014	12:36	143	1.9	87.95	12/11/2014	14:06	135	1.8	87.91
12/11/2014	12:37	136	2.3	87.95	12/11/2014	14:07	130	0.9	87.9
12/11/2014	12:38	155	2.6	87.93	12/11/2014	14:08	146	1.4	87.9
12/11/2014	12:39	129	1.4	87.95	12/11/2014	14:09	143	1.1	87.9
12/11/2014	12:40	148	2.1	87.94	12/11/2014	14:10	127	0.8	87.9
12/11/2014	12:41	135	1.3	87.95					
Average				87.92					87.93

Test 8 - 30% to 70%				
Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa
12/11/2014	14:40	106	0.8	87.95
12/11/2014	14:41	131	0.8	87.93
12/11/2014	14:42	141	0.8	87.93
12/11/2014	14:43	136	1.7	87.94
12/11/2014	14:44	138	1	87.94
12/11/2014	14:45	137	1.6	87.93
12/11/2014	14:46	140	1.4	87.93
12/11/2014	14:47	131	1.8	87.93
12/11/2014	14:48	136	1.6	87.92
12/11/2014	14:49	133	1.7	87.92
12/11/2014	14:50	133	1.7	87.91
12/11/2014	14:51	134	1.5	87.9
12/11/2014	14:52	135	1.4	87.9
12/11/2014	14:53	130	2.1	87.89
12/11/2014	14:54	133	1.6	87.89
12/11/2014	14:55	119	0.6	87.88
12/11/2014	14:56	134	1.6	87.88
12/11/2014	14:57	142	1.7	87.88
12/11/2014	14:58	133	1.6	87.88
12/11/2014	14:59	133	1.7	87.88
12/11/2014	15:00	123	2.1	87.88
12/11/2014	15:01	136	1.9	87.87
12/11/2014	15:02	128	1	87.87
12/11/2014	15:03	133	2.1	87.87
12/11/2014	15:04	128	2.5	87.87
12/11/2014	15:05	125	1.8	87.87
12/11/2014	15:06	124	1.9	87.86
12/11/2014	15:07	133	1.8	87.86
12/11/2014	15:08	130	2	87.86
12/11/2014	15:09	130	1.6	87.86
12/11/2014	15:10	134	1.1	87.86
12/11/2014	15:11	166	1.3	87.86
12/11/2014	15:12	132	1.3	87.87
12/11/2014	15:13	127	1.2	87.87
12/11/2014	15:14	133	1.9	87.88
12/11/2014	15:15	128	1.8	87.88
12/11/2014	15:16	125	2.2	87.88
12/11/2014	15:17	138	1.5	87.88
12/11/2014	15:18	134	1.8	87.87
12/11/2014	15:19	142	1.5	87.87
12/11/2014	15:20	128	2	87.87
12/11/2014	15:21	141	2.1	87.87
12/11/2014	15:22	140	2.2	87.87
12/11/2014	15:23	149	2.5	87.88
12/11/2014	15:24	140	1.4	87.87
12/11/2014	15:25	136	1.3	87.87
12/11/2014	15:26	152	2.1	87.88
12/11/2014	15:27	125	2.2	87.88
12/11/2014	15:28	131	1.5	87.88
12/11/2014	15:29	125	1.1	87.88
12/11/2014	15:30	139	1.3	87.88
12/11/2014	15:31	130	1	87.88
12/11/2014	15:32	129	1.1	87.88
12/11/2014	15:33	128	0.8	87.88
12/11/2014	15:34	132	0.9	87.88
12/11/2014	15:35	137	1	87.88
12/11/2014	15:36	139	1.8	87.88
12/11/2014	15:37	133	1.2	87.88
12/11/2014	15:38	129	1.7	87.88
12/11/2014	15:39	131	0.9	87.88
12/11/2014	15:40	140	0.9	87.88
12/11/2014	15:41	132	1.4	87.88
12/11/2014	15:42	140	1.7	87.89
12/11/2014	15:43	133	1.8	87.89
12/11/2014	15:44	139	1.8	87.89
12/11/2014	15:45	136	1.2	87.9
12/11/2014	15:46	156	1.5	87.9
Average				87.89

## Appendix I

Test 3 - 70% to 100%				
Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa
12/10/2014	15:00	169	3.1	88.08
12/10/2014	15:01	363	1.1	88.08
12/10/2014	15:02	163	2.8	88.08
12/10/2014	15:03	158	2.9	88.07
12/10/2014	15:04	152	3	88.06
12/10/2014	15:05	126	3.4	88.06
12/10/2014	15:06	130	3.4	88.06
12/10/2014	15:07	169	2.9	88.06
12/10/2014	15:08	202	1.3	88.07
12/10/2014	15:09	159	1.8	88.08
12/10/2014	15:10	128	2	88.08
12/10/2014	15:11	136	2.7	88.08
12/10/2014	15:12	267	2.1	88.08
12/10/2014	15:13	143	3.9	88.08
12/10/2014	15:14	132	2.7	88.08
12/10/2014	15:15	142	3	88.07
12/10/2014	15:16	155	2.3	88.08
12/10/2014	15:17	196	2.5	88.08
12/10/2014	15:18	140	2.7	88.07
12/10/2014	15:19	154	3.9	88.08
12/10/2014	15:20	152	2.3	88.08
12/10/2014	15:21	147	2.5	88.08
12/10/2014	15:22	145	3.5	88.08
12/10/2014	15:23	172	3.2	88.07
12/10/2014	15:24	18	1.3	88.06
12/10/2014	15:25	155	2.7	88.07
12/10/2014	15:26	146	3.2	88.08
12/10/2014	15:27	138	3.5	88.08
12/10/2014	15:28	143	4.1	88.09
12/10/2014	15:29	119	1.1	88.08
12/10/2014	15:30	166	2.3	88.08
12/10/2014	15:31	133	2.6	88.08
12/10/2014	15:32	156	1.8	88.09
12/10/2014	15:33	138	3	88.09
12/10/2014	15:34	172	2.3	88.08
12/10/2014	15:35	170	3.9	88.08
12/10/2014	15:36	105	2.6	88.08
12/10/2014	15:37	158	1	88.08
12/10/2014	15:38	144	1.3	88.08
12/10/2014	15:39	111	1	88.08
12/10/2014	15:40	129	2.5	88.09
12/10/2014	15:41	148	1.6	88.09
12/10/2014	15:42	153	3.2	88.09
12/10/2014	15:43	133	4.6	88.09
12/10/2014	15:44	143	2.6	88.08
12/10/2014	15:45	129	2.4	88.08
12/10/2014	15:46	130	3.2	88.08
12/10/2014	15:47	158	4.1	88.08
12/10/2014	15:48	152	3.7	88.08
12/10/2014	15:49	139	3.1	88.07
12/10/2014	15:50	185	3.2	88.08
12/10/2014	15:51	167	3.1	88.07
12/10/2014	15:52	201	2.1	88.08
12/10/2014	15:53	117	3.4	88.08
12/10/2014	15:54	136	4.6	88.08
12/10/2014	15:55	143	2.9	88.07
12/10/2014	15:56	130	4.4	88.08
12/10/2014	15:57	131	6.2	88.08
12/10/2014	15:58	138	4.8	88.08
12/10/2014	15:59	138	6.1	88.08
12/10/2014	16:00	151	4.7	88.09
12/10/2014	16:01	139	5.8	88.1
12/10/2014	16:02	142	4.5	88.1
12/10/2014	16:03	147	6.8	88.12
12/10/2014	16:04	134	5.6	88.13
12/10/2014	16:05	139	8.4	88.14
12/10/2014	16:06	158	5.6	88.14
12/10/2014	16:07	149	3	88.13
12/10/2014	16:08	148	3.9	88.13
12/10/2014	16:09	152	5.4	88.13
12/10/2014	16:10	135	4.4	88.13
Average				88.08



## Appendix I

Wind and Pressure data										
Magnetic declination		14 Deg								
Test 4 - 70% to 100%						Test 5 - 70% to 100%				
Date	Time	Wind Dir	Wind Vel	Pressure		Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa			hh:mm	Deg (True)	m/s	kPa
12/11/2014	8:30	279	3.4	87.86		12/11/2014	10:05	140	2	87.96
12/11/2014	8:31	274	1.6	87.86		12/11/2014	10:06	147	2.5	87.95
12/11/2014	8:32	229	1.4	87.86		12/11/2014	10:07	119	2.3	87.98
12/11/2014	8:33	189	0.9	87.85		12/11/2014	10:08	135	2.5	87.99
12/11/2014	8:34	286	4.4	87.87		12/11/2014	10:09	139	2.3	87.99
12/11/2014	8:35	247	2.8	87.85		12/11/2014	10:10	110	1.8	88
12/11/2014	8:36	324	3.3	87.85		12/11/2014	10:11	126	1.4	87.99
12/11/2014	8:37	331	3	87.86		12/11/2014	10:12	129	2.4	88
12/11/2014	8:38	352	4.2	87.85		12/11/2014	10:13	132	1.9	87.99
12/11/2014	8:39	255	5	87.87		12/11/2014	10:14	120	1.7	88
12/11/2014	8:40	335	3.4	87.86		12/11/2014	10:15	134	1.8	88
12/11/2014	8:41	299	4.2	87.88		12/11/2014	10:16	122	1.8	88.01
12/11/2014	8:42	343	4	87.87		12/11/2014	10:17	110	1.2	88
12/11/2014	8:43	359	2.4	87.88		12/11/2014	10:18	131	2.2	88
12/11/2014	8:44	355	3.2	87.88		12/11/2014	10:19	142	0.8	87.99
12/11/2014	8:45	316	3.1	87.88		12/11/2014	10:20	138	2.1	88
12/11/2014	8:46	278	3.7	87.89		12/11/2014	10:21	115	0.9	87.97
12/11/2014	8:47	299	3.2	87.88		12/11/2014	10:22	82	0	87.98
12/11/2014	8:48	372	2.8	87.9		12/11/2014	10:23	87	0.9	87.96
12/11/2014	8:49	291	3.3	87.89		12/11/2014	10:24	282	1.7	87.96
12/11/2014	8:50	268	3.8	87.89		12/11/2014	10:25	324	3.1	87.98
12/11/2014	8:51	271	1.1	87.91		12/11/2014	10:26	342	2.3	87.95
12/11/2014	8:52	249	2.2	87.88		12/11/2014	10:27	320	1.8	87.95
12/11/2014	8:53	15	1.5	87.89		12/11/2014	10:28	346	1.5	87.94
12/11/2014	8:54	346	4.2	87.89		12/11/2014	10:29	370	0.7	87.94
12/11/2014	8:55	19	2.2	87.88		12/11/2014	10:30	345	1.3	87.95
12/11/2014	8:56	19	3	87.88		12/11/2014	10:31	290	0.5	87.95
12/11/2014	8:57	359	2.5	87.87		12/11/2014	10:32	196	1.3	87.95
12/11/2014	8:58	335	3.1	87.87		12/11/2014	10:33	149	1.1	87.96
12/11/2014	8:59	283	3.4	87.87		12/11/2014	10:34	133	1.8	87.96
12/11/2014	9:00	352	4.4	87.86		12/11/2014	10:35	154	2.2	87.99
12/11/2014	9:01	338	3.2	87.88		12/11/2014	10:36	149	2.3	87.99
12/11/2014	9:02	299	4.9	87.88		12/11/2014	10:37	134	3.5	88
12/11/2014	9:03	333	3.3	87.88		12/11/2014	10:38	129	2.8	88
12/11/2014	9:04	347	3.5	87.89		12/11/2014	10:39	153	2.2	88
12/11/2014	9:05	340	4.5	87.9		12/11/2014	10:40	157	2.7	88
12/11/2014	9:06	365	3.6	87.91		12/11/2014	10:41	137	2.7	88.01
12/11/2014	9:07	324	2.6	87.89		12/11/2014	10:42	168	1.6	88
12/11/2014	9:08	21	2.8	87.92		12/11/2014	10:43	130	1	88.02
12/11/2014	9:09	357	3.8	87.92		12/11/2014	10:44	178	0.5	88
12/11/2014	9:10	257	4.2	87.92		12/11/2014	10:45	137	1.6	88
12/11/2014	9:11	327	3.9	87.92		12/11/2014	10:46	155	0.7	88
12/11/2014	9:12	328	3.5	87.92		12/11/2014	10:47	230	0.9	88
12/11/2014	9:13	304	2.4	87.91		12/11/2014	10:48	339	0	87.99
12/11/2014	9:14	14	1.5	87.91		12/11/2014	10:49	136	0.8	87.99
12/11/2014	9:15	346	3.7	87.91		12/11/2014	10:50	291	1.4	87.97
12/11/2014	9:16	301	2.7	87.91		12/11/2014	10:51	349	0.7	87.97
12/11/2014	9:17	293	2.9	87.91		12/11/2014	10:52	167	0.9	87.94
12/11/2014	9:18	317	4.9	87.92		12/11/2014	10:53	200	1.3	87.95
12/11/2014	9:19	359	1.7	87.91		12/11/2014	10:54	141	1.1	87.98
12/11/2014	9:20	334	2.7	87.92		12/11/2014	10:55	176	1.6	87.97
12/11/2014	9:21	303	2.7	87.91		12/11/2014	10:56	120	2.4	88
12/11/2014	9:22	368	2.4	87.89		12/11/2014	10:57	158	1.8	87.96
12/11/2014	9:23	355	2.7	87.89		12/11/2014	10:58	145	0.9	88.01
12/11/2014	9:24	291	3.3	87.88		12/11/2014	10:59	136	1.6	88.01
12/11/2014	9:25	298	2.6	87.88		12/11/2014	11:00	137	1.3	88.01
12/11/2014	9:26	348	2	87.9		12/11/2014	11:01	148	1.2	88.01
12/11/2014	9:27	351	2.6	87.9		12/11/2014	11:02	202	0.9	87.99
12/11/2014	9:28	342	2	87.9		12/11/2014	11:03	146	0.8	88
12/11/2014	9:29	360	2.7	87.91		12/11/2014	11:04	156	1.8	88
12/11/2014	9:30	371	3.6	87.91		12/11/2014	11:05	157	0.6	88
12/11/2014	9:31	350	2.5	87.91		12/11/2014	11:06	196	0.6	88
12/11/2014	9:32	353	3.9	87.92		12/11/2014	11:07	253	1.2	87.98
12/11/2014	9:33	273	2.6	87.93		12/11/2014	11:08	165	0.9	87.98
12/11/2014	9:34	321	3.6	87.93		12/11/2014	11:09	272	0.7	87.99
12/11/2014	9:35	339	2.6	87.95		12/11/2014	11:10	256	0.6	87.98
12/11/2014	9:36	25	1.2	87.95						
Average				87.89		Average				87.98

## Appendix I

Test 10 - 90% to 100%					Test 11 - 90% to 100%				
Date	Time	Wind Dir	Wind Vel	Pressure	Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa		hh:mm	Deg (True)	m/s	kPa
12/12/2014	8:25	188	2.1	87.86	12/12/2014	9:55	245	0.7	88.02
12/12/2014	8:26	199	1.2	87.87	12/12/2014	9:56	306	0.9	88.03
12/12/2014	8:27	14	1.4	87.86	12/12/2014	9:57	36	0.5	88.03
12/12/2014	8:28	218	0.7	87.86	12/12/2014	9:58	190	0.7	88.03
12/12/2014	8:29	193	1	87.87	12/12/2014	9:59	177	1	88.03
12/12/2014	8:30	157	0.6	87.85	12/12/2014	10:00	230	0.3	88.03
12/12/2014	8:31	219	1.4	87.86	12/12/2014	10:01	331	0.4	88.03
12/12/2014	8:32	272	1.1	87.87	12/12/2014	10:02	16	2.5	88.03
12/12/2014	8:33	180	0.8	87.87	12/12/2014	10:03	300	1.6	88.03
12/12/2014	8:34	346	1.1	87.88	12/12/2014	10:04	243	2	88.04
12/12/2014	8:35	188	0.6	87.88	12/12/2014	10:05	351	1.6	88.03
12/12/2014	8:36	351	1	87.88	12/12/2014	10:06	324	1.2	88.03
12/12/2014	8:37	222	1.2	87.87	12/12/2014	10:07	343	1.6	88.03
12/12/2014	8:38	167	1.5	87.89	12/12/2014	10:08	344	0.6	88.03
12/12/2014	8:39	158	1.4	87.88	12/12/2014	10:09	332	0.6	88.03
12/12/2014	8:40	183	0.8	87.89	12/12/2014	10:10	31	0.5	88.04
12/12/2014	8:41	164	1.3	87.89	12/12/2014	10:11	200	0	88.02
12/12/2014	8:42	290	0.8	87.89	12/12/2014	10:12	173	1.2	87.99
12/12/2014	8:43	174	1	87.88	12/12/2014	10:13	131	1.6	88.03
12/12/2014	8:44	137	0.5	87.89	12/12/2014	10:14	141	2.6	88
12/12/2014	8:45	340	0.4	87.88	12/12/2014	10:15	129	2.9	88.03
12/12/2014	8:46	240	2.4	87.89	12/12/2014	10:16	130	2.7	88.04
12/12/2014	8:47	205	1.7	87.89	12/12/2014	10:17	129	2.2	88.04
12/12/2014	8:48	42	1.9	87.89	12/12/2014	10:18	135	1.9	88.02
12/12/2014	8:49	344	0.7	87.89	12/12/2014	10:19	177	1.1	88
12/12/2014	8:50	268	2	87.89	12/12/2014	10:20	123	1.6	88.04
12/12/2014	8:51	128	0.9	87.89	12/12/2014	10:21	178	0.5	87.99
12/12/2014	8:52	194	2.6	87.9	12/12/2014	10:22	168	0.7	87.93
12/12/2014	8:53	189	3	87.91	12/12/2014	10:23	174	0.7	87.98
12/12/2014	8:54	193	3	87.91	12/12/2014	10:24	161	1.2	87.85
12/12/2014	8:55	310	2.2	87.9	12/12/2014	10:25	182	0.9	88.04
12/12/2014	8:56	350	0.7	87.91	12/12/2014	10:26	196	0.6	88.04
12/12/2014	8:57	196	2.3	87.91	12/12/2014	10:27	166	0.5	88.03
12/12/2014	8:58	323	3.5	87.92	12/12/2014	10:28	168	1.5	88.05
12/12/2014	8:59	225	2.2	87.91	12/12/2014	10:29	172	0	88.03
12/12/2014	9:00	174	0.7	87.92	12/12/2014	10:30	195	0.3	88.04
12/12/2014	9:01	166	0.6	87.92	12/12/2014	10:31	50	0	88.04
12/12/2014	9:02	344	2.3	87.93	12/12/2014	10:32	55	0	88.05
12/12/2014	9:03	229	0.5	87.95	12/12/2014	10:33	57	0	88.05
12/12/2014	9:04	207	2.3	87.95	12/12/2014	10:34	58	0	88.05
12/12/2014	9:05	321	1	87.94	12/12/2014	10:35	57	0	88.06
12/12/2014	9:06	241	1.3	87.95	12/12/2014	10:36	57	0	88.06
12/12/2014	9:07	233	0.5	87.94	12/12/2014	10:37	38	0	88.06
12/12/2014	9:08	188	2	87.93	12/12/2014	10:38	42	0.5	88.07
12/12/2014	9:09	15	0.4	87.93	12/12/2014	10:39	151	0.5	88.05
12/12/2014	9:10	179	1.6	87.93	12/12/2014	10:40	124	1.1	88.05
12/12/2014	9:11	150	1.5	87.94	12/12/2014	10:41	130	1.1	88.05
12/12/2014	9:12	295	1.2	87.94	12/12/2014	10:42	129	1.4	88.05
12/12/2014	9:13	137	2.4	87.95	12/12/2014	10:43	126	2.1	88.04
12/12/2014	9:14	138	1.5	87.95	12/12/2014	10:44	133	2.3	88.03
12/12/2014	9:15	120	1.1	87.95	12/12/2014	10:45	138	1.8	88.03
12/12/2014	9:16	133	1.3	87.94	12/12/2014	10:46	144	1.8	88.02
12/12/2014	9:17	127	0.8	87.94	12/12/2014	10:47	137	1.9	88.04
12/12/2014	9:18	132	0.7	87.94	12/12/2014	10:48	132	0.9	88.04
12/12/2014	9:19	144	0.6	87.93	12/12/2014	10:49	156	0.6	87.97
12/12/2014	9:20	125	0.6	87.94	12/12/2014	10:50	144	1.7	88.02
12/12/2014	9:21	142	1	87.94	12/12/2014	10:51	148	1.4	88.02
12/12/2014	9:22	138	1.2	87.95	12/12/2014	10:52	145	1.7	88.03
12/12/2014	9:23	142	0.6	87.94	12/12/2014	10:53	139	2.4	88.03
12/12/2014	9:24	127	0.5	87.95	12/12/2014	10:54	140	2	88.03
12/12/2014	9:25	133	0.4	87.95	12/12/2014	10:55	139	1.8	88.04
12/12/2014	9:26	117	1	87.96	12/12/2014	10:56	139	1.8	88.04
12/12/2014	9:27	130	0.7	87.97	12/12/2014	10:57	134	1.5	88
12/12/2014	9:28	126	1.2	87.97	12/12/2014	10:58	140	1.6	88.02
12/12/2014	9:29	130	1.3	87.97	12/12/2014	10:59	135	2.7	88.03
12/12/2014	9:30	124	1	87.98	12/12/2014	11:00	143	0.6	88.03
12/12/2014	9:31	143	1	87.98	12/12/2014	11:01	148	1.8	87.98
Average				87.91					88.03

## Appendix I

Test 12 - 90% to 100%				
Date	Time	Wind Dir	Wind Vel	Pressure
	hh:mm	Deg (True)	m/s	kPa
12/12/2014	11:30	234	1.2	88.02
12/12/2014	11:31	248	1.7	88.02
12/12/2014	11:32	346	1.1	88.02
12/12/2014	11:33	245	2.9	88.03
12/12/2014	11:34	215	1.5	88
12/12/2014	11:35	348	1.1	88.01
12/12/2014	11:36	210	1.6	88
12/12/2014	11:37	274	1.4	88
12/12/2014	11:38	339	2	88
12/12/2014	11:39	199	2	88
12/12/2014	11:40	363	2.1	88
12/12/2014	11:41	202	1.3	88
12/12/2014	11:42	326	1.8	88.01
12/12/2014	11:43	319	1.8	88.01
12/12/2014	11:44	336	1	87.99
12/12/2014	11:45	331	1.4	88
12/12/2014	11:46	349	1.2	88.01
12/12/2014	11:47	336	0	88.02
12/12/2014	11:48	309	0	88.03
12/12/2014	11:49	281	1.1	88.02
12/12/2014	11:50	359	0	88.02
12/12/2014	11:51	203	1	88.02
12/12/2014	11:52	189	0.9	88.02
12/12/2014	11:53	142	0.8	88.03
12/12/2014	11:54	128	1	88.03
12/12/2014	11:55	129	1.1	88.04
12/12/2014	11:56	128	1.2	88.04
12/12/2014	11:57	141	1.8	88.04
12/12/2014	11:58	135	2.1	88.04
12/12/2014	11:59	138	2.1	88.04
12/12/2014	12:00	137	1.2	88.04
12/12/2014	12:01	142	1.5	88.05
12/12/2014	12:02	133	1.7	88.06
12/12/2014	12:03	133	1.5	88.06
12/12/2014	12:04	138	1.5	88.06
12/12/2014	12:05	135	2.2	88.06
12/12/2014	12:06	133	2	88.05
12/12/2014	12:07	134	1.5	88.05
12/12/2014	12:08	137	1.6	88.06
12/12/2014	12:09	136	1.1	88.05
12/12/2014	12:10	118	2.1	88.06
12/12/2014	12:11	134	2.1	88.05
12/12/2014	12:12	137	0.7	88.05
12/12/2014	12:13	180	0.9	87.96
12/12/2014	12:14	195	0.9	88
12/12/2014	12:15	180	1.4	88
12/12/2014	12:16	359	0.5	88.06
12/12/2014	12:17	249	0.8	88.03
12/12/2014	12:18	194	1.2	88.02
12/12/2014	12:19	207	0.8	88.03
12/12/2014	12:20	166	2.2	88.04
12/12/2014	12:21	184	0.9	88.04
12/12/2014	12:22	194	1	88.03
12/12/2014	12:23	137	0.4	88.05
12/12/2014	12:24	191	1.5	88.04
12/12/2014	12:25	181	0.6	88.04
12/12/2014	12:26	167	1.1	88.05
12/12/2014	12:27	343	0	88.06
12/12/2014	12:28	167	0.9	88.06
12/12/2014	12:29	166	0.5	88.07
12/12/2014	12:30	134	0.8	88.06
12/12/2014	12:31	191	0	88.01
12/12/2014	12:32	27	0	88.06
12/12/2014	12:33	310	0.9	88.06
12/12/2014	12:34	160	0.8	88.06
12/12/2014	12:35	206	0.6	88.06
12/12/2014	12:36	149	0.8	88.06
Average				88.03224

**From:** [Howard Malm](#)  
**To:** [Mia, Marcia](#); [Patty Centofanti](#)  
**Cc:** [Garwood, Gerri](#); [Jason Huckaby](#)  
**Subject:** RE: Initial Review of Spartan Slipstream Combustor  
**Date:** Wednesday, September 30, 2015 1:13:58 PM  
**Attachments:** [Chain of Custody-ORTECH.pdf](#)  
[Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2.pdf](#)  
[AGAT Letter Sep 2015.pdf](#)

---

Marcia:

I am pleased to provide the requested information as follows:

1. The missing gas custody form is attached in file "Chain of Custody-ORTECH"
2. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows that the GC-TDC calibration procedure was modified using EPA Alt-045. Please see page 3 of the revised report.
3. The traverse locations for the sample locations are specified by the letter and diagram in the attached document "AGAT Letter Sep 2015".
4. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows a revised table in Appendix 1 (page 9 of the document) entitled "Summary of Analytical Results – THC as Propane Analysis" where the THC is reported as propane.

I trust the attached material will fully answer the points raised.

Yours truly

Howard Malm Ph.D. P.Eng.  
Chief Technical Officer  
REM Technology Inc.  
403-695-2373 (off)  
604-562-9438 (cell)

---

**From:** Mia, Marcia [mailto:[Mia.Marcia@epa.gov](mailto:Mia.Marcia@epa.gov)]  
**Sent:** Wednesday, September 09, 2015 2:08 PM  
**To:** Howard Malm; Patty Centofanti  
**Cc:** Garwood, Gerri; Jason Huckaby  
**Subject:** Initial Review of Spartan Slipstream Combustor

We have completed our initial review of the performance test that you submitted under NSPS OOOO and MACT HH/HHH on 02/16/15.

We need additional detail on the following items:

1. Missing Inlet Gas Sampling Chain of Custody forms - Section 60.5413(d)(5)(i)(A)-(C) requires certain sampling and chain of custody (COC) protocols are followed. Please provide the missing COC forms.

2. We are unable to determine if the GC-TCD calibration procedure was modified using EPA Alt-045 – Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 3C must be modified using EPA Alt-045. Please confirm. An affirmative statement is sufficient.
3. The narrative regarding the traverse locations for THC and CO is unclear and there is no traverse point diagram– Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 10/25A is conducted using a three point traverse. Please provide a diagram of the traverse and confirm that the Method 10/25A was conducted using a three point traverse.
4. Is THC reported as propane? - Section 60.5413(d)(9)(v)-(vi) requires that THC is measured as propane. The information on page 473 is presented as methane. Please confirm that THC is measured as propane.

You may provide the information in response to this email. We may elect to have a follow-up call after we receive the information. If you would like to have a conference call in any event, please let me know and I will schedule something. Thanks for your time in providing this information.

Marcia B Mia  
Office of Compliance/Air Branch  
2227A WJCS  
U.S. Environmental Protection Agency  
202-564-7042



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malin

Email Howard.Malin@renttechnology.com

Project #: 35118

### SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☒ Rush: Next Day

☐ Rush: Same Day

Company: DRTECH Environmental

Contact: Eugene Sherehevsky

Purchase Order: 68082200

Date: December 12, 2014

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19, 2014

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Test 1A,B,C-14714	12/12/14	Les Yeast	C1-C6 + Benzene (ASTM D1415-03) H2, CO, CO2, H2O (ASTM D1415-03) and higher heating value (ASTM D3588-08) or ASTM D4891-89 for all samples	
Test 2A,B,C-5634	12/11/14	Les Yeast		
Test 3A,B,C-14717	12/11/14	Les Yeast		
Test 4A,B,C-17124	12/12/14	Les Yeast		

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Leslie Keast <u>[Signature]</u>	Chris Gilbert <u>[Signature]</u>	Dec 12/14
Chris Gilbert <u>[Signature]</u>	Chris Gilbert <u>[Signature]</u>	Dec 12/14
		Dec 12/14

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

EUGENE SHEREHEVSKY [Signature] Dec 15/2014

**REVISION 2**

**SPECIALTY TEST SURVEY  
SPARTAN CONTROLS - REM TECHNOLOGY  
CALGARY, ALBERTA**

**Project # 35118**

**December 10 - 12, 2014**

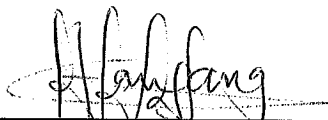
Prepared for:  
**SPARTAN CONTROLS - REM TECHNOLOGY**  
305 27 ST SE  
CALGARY, ALBERTA  
T2A 7V2

**Attention: HOWARD MALM**

Report Date: September 14, 2015

This report supersedes all previous reports with the same Maxxam project number.

Prepared by:



Ernestine Tangang, B.Sc., M.Sc.

Team Lead, Air Services, Maxxam Analytics

Reviewed by:



Dennis Skwarchuk, B.A., C.E.T.

Technical Supervisor, Source Testing, Maxxam Analytics

## **SUMMARY**

Maxxam Analytics completed a fixed gas and THC analysis for Spartan Controls - REM Technology, Calgary, Alberta. Sampling was completed on December 10 - 12, 2014. In addition to analytical results, this report includes molecular weight and THC results at 3 % CO2 correction.

All analysis, and QA/QC for this project was performed by Maxxam Analytics and complies with the applicable protocols (Alberta Stack Sampling Code, Alberta Methods for Chemical Analysis of Atmospheric Pollutants and the Alberta Air Monitoring Directive). The results are therefore considered to be representative of the source during the testing period.

Any deviations or modifications made to the analytical methods are outlined in Section 1.0 Discussion. On this basis, Maxxam is issuing this completed report to Spartan Controls - REM Technology, Calgary, Alberta.

We trust that this report meets your requirements. If you have any questions regarding this project, please contact us at 780-408-5302 or toll-free at 1-800-386-7247.



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Appendix II	Analytical Results
Appendix III	Sample Custody

## **1.0 Discussion**

A total of 24 samples were analyzed. Results of these 24 samples (T3B1A - T14B1B) are presented in this report.

The GC-TCD calibration procedure in Method 3CD, 40 CFR part 60, appendix A was modified using EPA Alt-045. The analytical traces are included in the Appendices.

There were no analytical problems encountered during the sample analysis.

New standard gases were ordered well in advance to replace the expired gas standards. Due to certification problems encountered by the supplier, these were not received in time for the work performed for REM. As with any standard gases Maxxam have in use that are questionable in validity of the stated concentration values or that require recertification, Maxxam laboratory either have the manufacturer recertify the mix or verify the concentration using comparable gases that have not expired to confirm the stated concentrations. The procedure followed is : EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards - EPA/600/R-12/531, May 2012. This was the procedure used to verify the gases that had expired certificates. The results are what was included in the report. To add assurance to the validity of the expired gases used, two new standards were used in this comparison which is more than what is required in the EPA certification protocol.

## **2.0 Quality Assurance/Quality Control**

### ***Maxxam Analytical Departments***

Maxxam's analytical departments QA/QC protocols include, but are not limited to the following:

- i - Canadian Association for Laboratory Accreditation (CALA) performance evaluation samples every six months
- ii - Canadian Association for Laboratory Accreditation (CALA) laboratory audits every two years
- iii - Analytical instrument calibration curves based on five (5) varying standards.

### 3.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

#### **40 C.F.R. 60.5413(d)(6)**

- (ii) Molecular weight and excess air must be determined as specified in paragraph (d)(7) of this section.
- (iii) Carbon monoxide must be determined as specified in paragraph (d)(8) of this section.
- (iv) THC must be determined as specified in paragraph (d)(9) of this section.
- (v) Visible emissions must be determined as specified in paragraph (d)(10) of this section.

#### **40 C.F.R. 60.5413(d)(7) Molecular weight and excess air determination must be performed as**

(i) An integrated bag sample must be collected during the Method 4, 40 CFR part 60, appendix A-3, moisture test following the procedure specified in (d)(7)(i)(A) through (B) of this section. Analyze the bag sample using a gas chromatograph-thermal conductivity detector (GC-TCD) analysis meeting the criteria in paragraphs (d)(7)(i)(C) through (D) of this section

(A) Collect the integrated sample throughout the entire test, and collect representative volumes from each traverse location.

(B) Purge the sampling line with stack gas before opening the valve and beginning to fill the bag. Clearly label each bag and record sample information on a chain of custody form.

(C) The bag contents must be vigorously mixed prior to the gas chromatograph analysis.

(D) The GC-TCD calibration procedure in Method 3C, 40 CFR part 60, appendix A, must be modified by using EPA Alt-045 as follows: For the initial calibration, triplicate injections of any single concentration must agree within 5 percent of their mean to be valid. The calibration response factor for a single concentration re-check must be within 10 percent of the original calibration response factor for that concentration. If this criterion is not met, repeat the initial calibration using at least three concentration levels.

(ii) Calculate and report the molecular weight of oxygen, carbon dioxide, methane, and nitrogen in the integrated bag sample and include in the test report specified in paragraph (d)(12) of this section. Moisture must be determined using Method 4, 40 CFR part 60, appendix A-3. Traverse both ports with the Method 4, 40 CFR part 60, appendix A-3, sampling train during each test run. Ambient air must not be introduced into the Method 3C, 40 CFR part 60, appendix A-2, integrated bag sample during the port change.

(iii) Excess air must be determined using resultant data from the EPA Method 3C tests and EPA Method 3B, 40 CFR part 60, appendix A, equation 3B-1.

#### **Method 4 moisture test**

Method 4, 40 C.F.R. part 60, appendix A-3. Traverse both ports with the Method 4, 40 CFR part 60, appendix A-3, sampling train during each test run.

#### **Method 3C test**

Collect the integrated bag samples co-incident with the traverse of the Method 4 sample train, switching ports half way through the test and using care not to introduce dilution air to the bag sample during the port change. For each of the integrated bag samples taken during the twelve test runs, use the lab results and report the in-stack concentration of oxygen, carbon dioxide, methane, and nitrogen in the integrated bag sample. Use the in-stack concentrations of these analytes to calculate the molecular weight of the flue gas, excess air of combustion, and oxygen correction of the CO and THC results. Include this information in a chart in the test report.

***APPENDIX I***  
***SUMMARY OF ANALYTICAL RESULTS***

SUMMARY OF ANALYTICAL RESULTS - FIXED GAS ANALYSIS

Date/Time Sampled	T3B1A 10-Dec-14 15:00			T3B1B 10-Dec-14 15:30			T4B1A 11-Dec-14 8:30			T4B1B 11-Dec-14 9:05			T5B1A 11-Dec-14 10:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	13.29	13.32	13.31	13.22	13.28	13.25	13.34	13.39	13.37	12.95	13.01	12.98	13.10	13.13	13.12
N2 - mole % dry basis	80.32	80.39	80.36	80.34	80.37	80.36	80.30	80.33	80.32	80.40	80.41	80.41	80.36	80.40	80.38
CO2 - mole % dry basis	5.43	5.33	5.38	5.48	5.39	5.44	5.41	5.32	5.37	5.68	5.62	5.65	5.58	5.50	5.54
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.53	29.52	29.52	29.54	29.52	29.53	29.53	29.52	29.53	29.55	29.55	29.55	29.55	29.53	29.54

Date/Time Sampled	T5B1B 11-Dec-14 10:40			T6B1A 11-Dec-14 11:35			T6B1B 11-Dec-14 12:10			T7B1A 11-Dec-14 13:05			T7B1B 11-Dec-14 13:40		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	13.30	13.35	13.33	14.12	14.11	14.12	13.82	13.83	13.83	13.61	13.61	13.61	14.02	14.04	14.03
N2 - mole % dry basis	80.31	80.33	80.32	80.07	80.12	80.10	80.21	80.21	80.21	80.26	80.26	80.26	80.13	80.13	80.13
CO2 - mole % dry basis	5.42	5.36	5.39	4.85	4.81	4.83	5.02	5.00	5.01	5.17	5.17	5.17	4.90	4.87	4.89
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.53	29.52	29.52	29.47	29.46	29.47	29.49	29.48	29.49	29.50	29.50	29.50	29.48	29.47	29.48

Date/Time Sampled	T8B1A 11-Dec-14 14:40			T8B1B 11-Dec-14 15:15			T9B1A 11-Dec-14 16:10			T9B1B 11-Dec-14 16:45			T10B1A 12-Dec-14 8:25		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	13.97	13.97	13.97	13.79	13.78	13.79	14.47	14.46	14.47	14.69	14.70	14.70	13.36	13.36	13.36
N2 - mole % dry basis	80.13	80.16	80.15	80.19	80.21	80.20	80.04	80.03	80.04	79.94	79.94	79.94	80.30	80.32	80.31
CO2 - mole % dry basis	4.94	4.91	4.93	5.07	5.05	5.06	4.54	4.55	4.55	4.41	4.40	4.41	5.38	5.36	5.37
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.48	29.48	29.48	29.50	29.49	29.49	29.44	29.44	29.44	29.42	29.42	29.42	29.53	29.52	29.52

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

SUMMARY OF ANALYTICAL RESULTS - FIXED GAS ANALYSIS

Date/Time Sampled	T10B1B			T11B1A			T11B1B			T12B1A			T12B1B		
	12-Dec-14 9:05			12-Dec-14 9:55			12-Dec-14 10:40			12-Dec-14 11:30			12-Dec-14 12:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	12.96	12.95	12.96	13.14	13.12	13.13	13.19	13.19	13.19	13.26	13.26	13.26	13.06	13.05	13.06
N2 - mole % dry basis	80.39	80.43	80.41	80.36	80.35	80.36	80.34	80.35	80.35	80.32	80.33	80.33	80.38	80.40	80.39
CO2 - mole % dry basis	5.69	5.65	5.67	5.54	5.56	5.55	5.51	5.50	5.51	5.46	5.45	5.46	5.60	5.59	5.60
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.56	29.55	29.55	29.54	29.54	29.54	29.54	29.54	29.54	29.53	29.53	29.53	29.55	29.55	29.55

Date/Time Sampled	T13B1A			T13B1B			T14B1A			T14B1B		
	12-Dec-14 13:00			12-Dec-14 13:35			12-Dec-14 14:30			12-Dec-14 15:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis												
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	14.48	14.48	14.48	14.55	14.55	14.55	14.52	14.51	14.52	14.38	14.38	14.38
N2 - mole % dry basis	80.06	80.06	80.06	80.03	80.03	80.03	79.97	79.99	79.98	80.08	80.08	80.08
CO2 - mole % dry basis	4.51	4.51	4.51	4.46	4.47	4.47	4.56	4.54	4.55	4.58	4.58	4.58
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.43	29.43	29.43	29.43	29.43	29.43	29.44	29.44	29.44	29.44	29.44	29.44

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

**SUMMARY OF ANALYTICAL RESULTS - THC as PROPANE ANALYSIS**

Date/Time Sampled	T3B1A 10-Dec-14 15:00			T3B1B 10-Dec-14 15:30			T4B1A 11-Dec-14 8:30			T4B1B 11-Dec-14 9:05			T5B1A 11-Dec-14 10:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	7.80	6.90	7.40	8.80	8.20	8.50	8.90	9.60	9.25	12.70	11.60	12.15	12.40	13.90	13.15
THC-ppmv @3% CO2	4.28	3.86	4.07	4.79	4.54	4.66	4.91	5.38	5.14	6.67	6.15	6.41	6.63	7.54	7.08
THC as C3 analysis	2.60	2.30	2.47	2.93	2.73	2.83	2.97	3.20	3.08	4.23	3.87	4.05	4.13	4.63	4.38
C3-ppmv @3% CO2	1.43	1.29	1.36	1.60	1.51	1.55	1.64	1.79	1.71	2.22	2.05	2.14	2.21	2.51	2.36

Date/Time Sampled	T5B1B 11-Dec-14 10:40			T6B1A 11-Dec-14 11:35			T6B1B 11-Dec-14 12:10			T7B1A 11-Dec-14 13:05			T7B1B 11-Dec-14 13:40		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	16.20	15.40	15.80	12.00	11.50	11.75	12.30	13.80	13.05	14.50	12.40	13.45	10.60	11.60	11.10
THC-ppmv @3% CO2	8.91	8.57	8.74	7.38	7.14	7.26	7.31	8.24	7.77	8.37	7.15	7.76	6.46	7.11	6.78
THC as C3 analysis	5.40	5.13	5.27	4.00	3.83	3.92	4.10	4.60	4.35	4.83	4.13	4.48	3.53	3.87	3.70
C3-ppmv @3% CO2	2.97	2.86	2.91	2.46	2.38	2.42	2.44	2.75	2.59	2.79	2.38	2.59	2.15	2.37	2.26

Date/Time Sampled	T8B1A 11-Dec-14 14:40			T8B1B 11-Dec-14 15:15			T9B1A 11-Dec-14 16:10			T9B1B 11-Dec-14 16:45			T10B1A 12-Dec-14 8:25		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	13.60	14.30	13.95	16.10	15.20	15.65	12.00	11.50	11.75	11.90	11.10	11.50	12.60	11.20	11.90
THC-ppmv @3% CO2	8.22	8.69	8.45	9.47	8.98	9.23	7.89	7.55	7.72	8.06	7.54	7.80	6.98	6.23	6.61
THC as C3 analysis	4.53	4.77	4.65	5.37	5.07	5.22	4.00	3.83	3.92	3.97	3.70	3.83	4.20	3.73	3.97
C3-ppmv @3% CO2	2.74	2.90	2.82	3.16	2.99	3.08	2.63	2.52	2.57	2.69	2.51	2.60	2.33	2.08	2.20

Date/Time Sampled	T10B1B 12-Dec-14 9:05			T11B1A 12-Dec-14 9:55			T11B1B 12-Dec-14 10:40			T12B1A 12-Dec-14 11:30			T12B1B 12-Dec-14 12:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	12.60	10.50	11.55	10.20	11.10	10.65	10.30	11.00	10.65	11.70	12.80	12.25	11.50	13.10	12.30
THC-ppmv @3% CO2	6.60	5.54	6.07	5.49	5.95	5.72	5.57	5.96	5.77	6.39	7.00	6.70	6.12	6.99	6.55
THC as C3 analysis	4.20	3.50	3.85	3.40	3.70	3.55	3.43	3.67	3.55	3.90	4.27	4.08	3.83	4.37	4.10
C3-ppmv @3% CO2	2.20	1.85	2.02	1.83	1.98	1.91	1.86	1.99	1.92	2.13	2.33	2.23	2.04	2.33	2.18

Date/Time Sampled	T13B1A 12-Dec-14 13:00			T13B1B 12-Dec-14 13:35			T14B1A 12-Dec-14 14:30			T14B1B 12-Dec-14 15:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	12.80	11.70	12.25	9.90	10.30	10.10	13.80	14.00	13.90	12.90	14.40	13.65
THC-ppmv @3% CO2	8.48	7.75	8.11	6.63	6.88	6.76	9.04	9.21	9.12	8.41	9.39	8.90
THC as C3 analysis	4.27	3.90	4.08	3.30	3.43	3.37	4.60	4.67	4.63	4.30	4.80	4.55
C3-ppmv @3% CO2	2.83	2.58	2.70	2.21	2.29	2.25	3.01	3.07	3.04	2.80	3.13	2.97

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

***APPENDIX II***  
***ANALYTICAL RESULTS***



# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology  
Location: Calgary, Alberta  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114  
Sample Date: 2014-12-10 to 11  
Analytical Date: 2014-12-11  
Analyst: BW

Sample ID:	T3B1A	T3B1B	T4B1A
	2014-12-10	2014-12-10	2014-12-11
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73306	73307	73308
Time:	15:00	15:30	08:30

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	13.29	13.32	13.22	13.28	13.34	13.39
N <sub>2</sub>	80.32	80.39	80.34	80.37	80.30	80.33
CO <sub>2</sub>	5.43	5.33	5.48	5.39	5.41	5.32
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	7.8	6.9	8.8	8.2	8.9	9.6
Average	7.4		8.5		9.2	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0053	98.5
2	span0062	100.6
Average		99.6
True Value		100.0
% Recovery		99.6

Reviewed By: BW Bill Wong  
Validated By: EW Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology  
Location: Calgary, Alberta  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114  
Sample Date: 2014-12-11  
Analytical Date: 2014-12-11 to 13  
Analyst: BW

Sample ID:	T4B1B	T5B1A	T5B1B
	2014-12-11	2014-12-11	2014-12-11
Run #:	Run #1	Run #1	Run #1
Lab ID#:	73309	73310	73311
Time:	09:05	10:05	10:40

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	12.95	13.01	13.10	13.13	13.30	13.35
N <sub>2</sub>	80.40	80.41	80.36	80.40	80.31	80.33
CO <sub>2</sub>	5.68	5.62	5.58	5.50	5.42	5.36
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis



(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.7	11.6	12.4	13.9	16.2	15.4
Average	12.2		13.2		15.8	

### Second Source Standard ID# 14-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0004	101.3
2	span0013	98.5
	Average	99.9
	True Value	100.0
	% Recovery	99.9

Reviewed By:  Bill Wong  
Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology  
Location: Calgary, Alberta  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114  
Sample Date: 2014-12-11  
Analytical Date: 2014-12-13  
Analyst: BW

Sample ID:	T6B1A	T6B1B	T7B1A
	2014-12-11	2014-12-11	2014-12-11
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73325	73326	73327
Time:	11:35	12:10	13:05

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.12	14.11	13.82	13.83	13.61	13.61
N <sub>2</sub>	80.07	80.12	80.21	80.21	80.26	80.26
CO <sub>2</sub>	4.85	4.81	5.02	5.00	5.17	5.17
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.0	11.5	12.3	13.8	14.5	12.4
Average	11.8		13.0		13.5	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0067	101.2
2	span0074	100.4
	Average	100.8
	True Value	100.0
	% Recovery	100.8

Reviewed By: SW Bill Wong  
Validated By: JW for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology		Sample Date: 2014-12-11	
Location: Calgary, Alberta		Analytical Date: 2014-12-13	
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18			
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114		Analyst: BW	

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Sample ID:	T7B1B	T8B1A	T8B1B
	2014-12-11	2014-12-11	2014-12-11

Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73328		73329		73330	
Time:	13:40		14:40		15:15	

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.02	14.04	13.97	13.97	13.79	13.78
N <sub>2</sub>	80.13	80.13	80.13	80.16	80.19	80.21
CO <sub>2</sub>	4.90	4.87	4.94	4.91	5.07	5.05
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT THC as CH<sub>4</sub> Average

10.6	11.6	13.6	14.3	16.1	15.2
11.1		13.9		15.6	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0074	100.4
2	span0082	99.1
	Average	99.8
	True Value	100.0
	% Recovery	99.8

Reviewed By: BW Bill Wong  
Validated By: JW Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-11 to 12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T9B1A	T9B1B	T10B1A
	2014-12-11	2014-12-11	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73331	73332	73333
Time:	16:10	16:45	08:25

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.47	14.46	14.69	14.70	13.36	13.36
N <sub>2</sub>	80.04	80.03	79.94	79.94	80.30	80.32
CO <sub>2</sub>	4.54	4.55	4.41	4.40	5.38	5.36
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.0	11.5	11.9	11.1	12.6	11.2
Average	11.8		11.5		11.9	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0082	99.1
2	span0090	98.2
	Average	98.7
	True Value	100.0
	% Recovery	98.7

Reviewed By: BW Bill Wong  
Validated By: JW fori Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company:	Spartan Controls - REM Technology			Sample Date:	2014-12-12	
Location:	Calgary, Alberta			Analytical Date:	2014-12-13	
Method Reference:	AENV Method 3 / EPA Method 3C and AENV Method 18					
Laboratory Reference:	AIR SOP-00112 & AIR SOP-00114			Analyst:	BW	

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Sample ID:	T10B1B		T11B1A		T11B1B	
	2014-12-12		2014-12-12		2014-12-12	

Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73334		73335		73336	
Time:	09:05		09:55		10:40	

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	12.96	12.95	13.14	13.12	13.19	13.19
N <sub>2</sub>	80.39	80.43	80.36	80.35	80.34	80.35
CO <sub>2</sub>	5.69	5.65	5.54	5.56	5.51	5.50
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.6	10.5	10.2	11.1	10.3	11.0
Average	11.5		10.6		10.7	

### Second Source Standard


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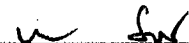
CH<sub>4</sub>

### QA/QC Runs

Run #	(ppmv)
1 span0019	100.0
2 span0027	99.5

Average	99.8
True Value	100.0
% Recovery	99.8

Reviewed By:  Bill Wong

Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: DW

Sample ID:	T12B1A	T12B1B	T13B1A
	2014-12-12	2014-12-12	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73337	73338	73339
Time:	11:30	12:05	13:00

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	13.26	13.26	13.06	13.05	14.48	14.48
N <sub>2</sub>	80.32	80.33	80.38	80.40	80.06	80.06
CO <sub>2</sub>	5.46	5.45	5.60	5.59	4.51	4.51
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	11.7	12.8	11.5	13.1	12.8	11.7
Average	12.2		12.3		12.2	

Second Source Standard  
ID# 11-11-01-26

### QA/QC Runs

Run #	CH <sub>4</sub> (ppmv)
1	span0027 99.5
2	span0034 99.2
Average	99.4
True Value	100.0
% Recovery	99.4

Reviewed By: SW Bill Wong

Validated By: JW for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T13B1B	T14B1A	T14B1B
	2014-12-12	2014-12-12	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73340	73341	73342
Time:	13:35	14:30	15:05

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.55	14.55	14.52	14.51	14.38	14.38
N <sub>2</sub>	80.03	80.03	79.97	79.99	80.08	80.08
CO <sub>2</sub>	4.46	4.47	4.56	4.54	4.58	4.58
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT THC as CH<sub>4</sub> Average

9.9	10.1	10.3	13.8	13.9	14.0	12.9	13.6	14.4
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### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0010	98.4
2	span0010	98.4
	Average	98.4
	True Value	100.0
	% Recovery	98.4

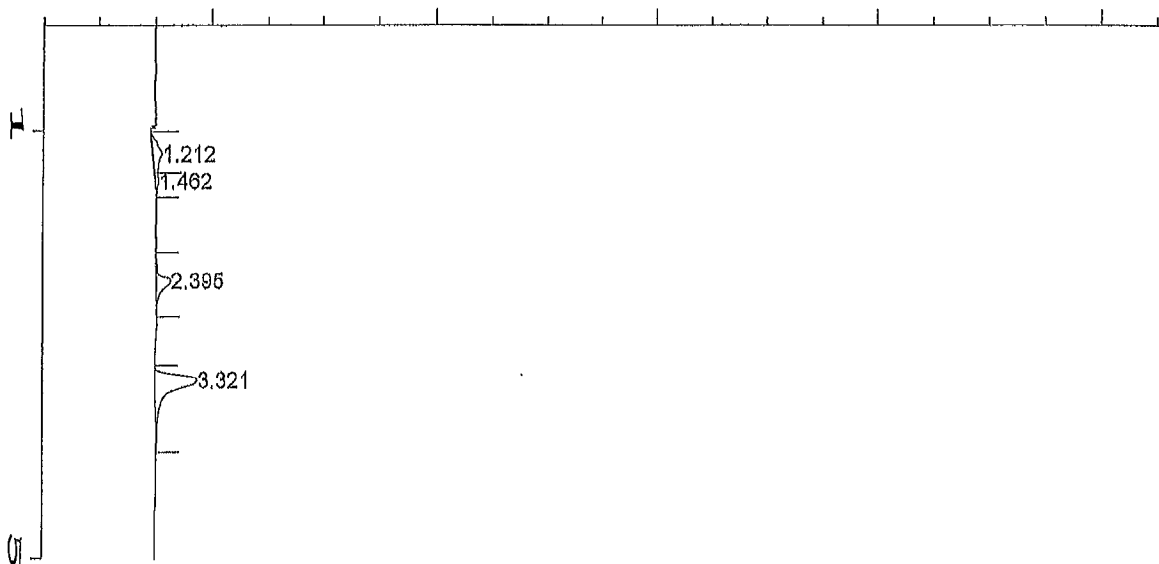
Reviewed By: BW Bill Wong  
Validated By: JW for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.



# Total Hydrocarbon Chromatograms

## Sample Analysis Calibration



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 External Standard Report  
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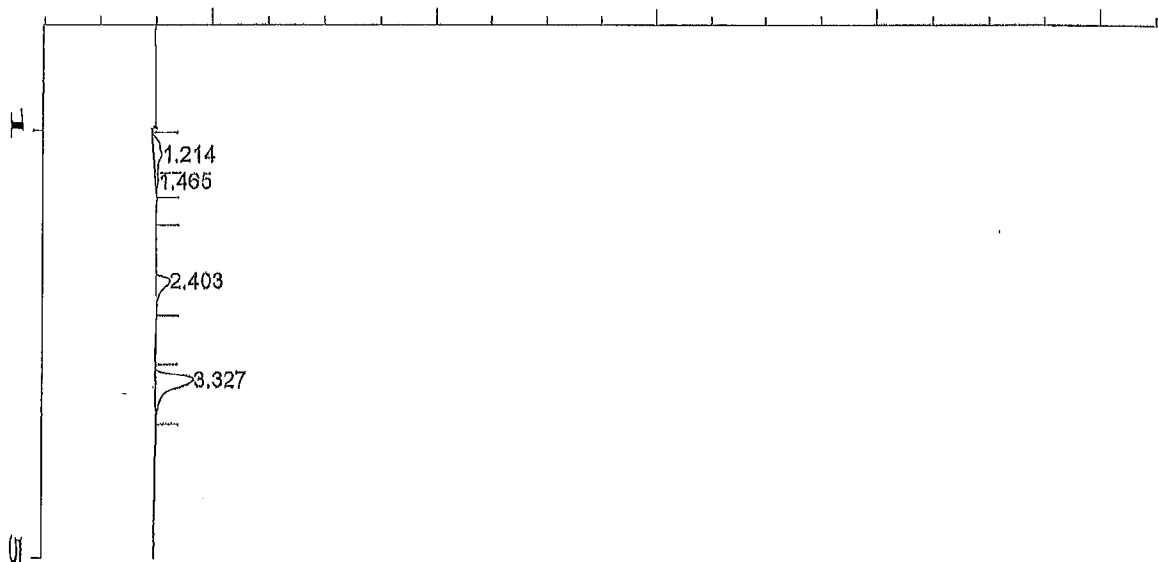
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1A055.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1A 73306 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:01 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:06 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1A - Tr#73306 - 15:00 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1A055.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.212	1032	BV	0.158		1.306	* uncalibrated *
1.462	249	VB	0.108		0.316	* uncalibrated *
2.395	1128	BB	0.130		1.428	* uncalibrated *
3.321	3763	BB	0.154		4.761	* uncalibrated *

Not all calibrated peaks were found

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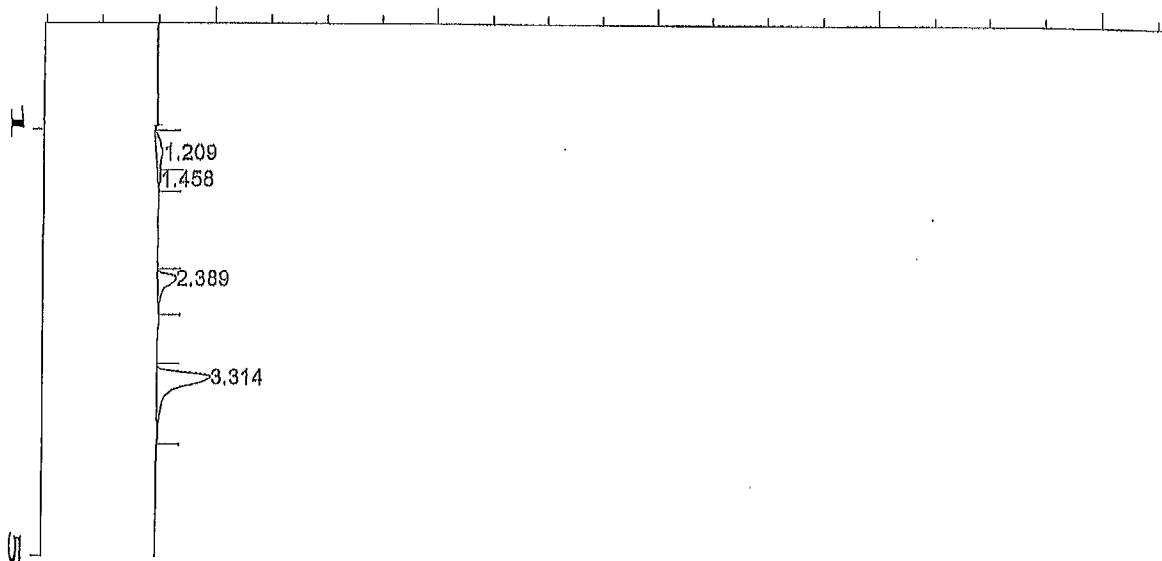
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1A056.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1A 73306 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:10 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:15 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1A - Tr#73306 - 15:00 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1A056.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.214	1035	BV	0.174			1.310 * uncalibrated *
1.465	214	VB	0.112			0.271 * uncalibrated *
2.403	1037	BB	0.130			1.312 * uncalibrated *
3.327	3151	BB	0.145			3.988 * uncalibrated *

Not all calibrated peaks were found



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External Standard Report

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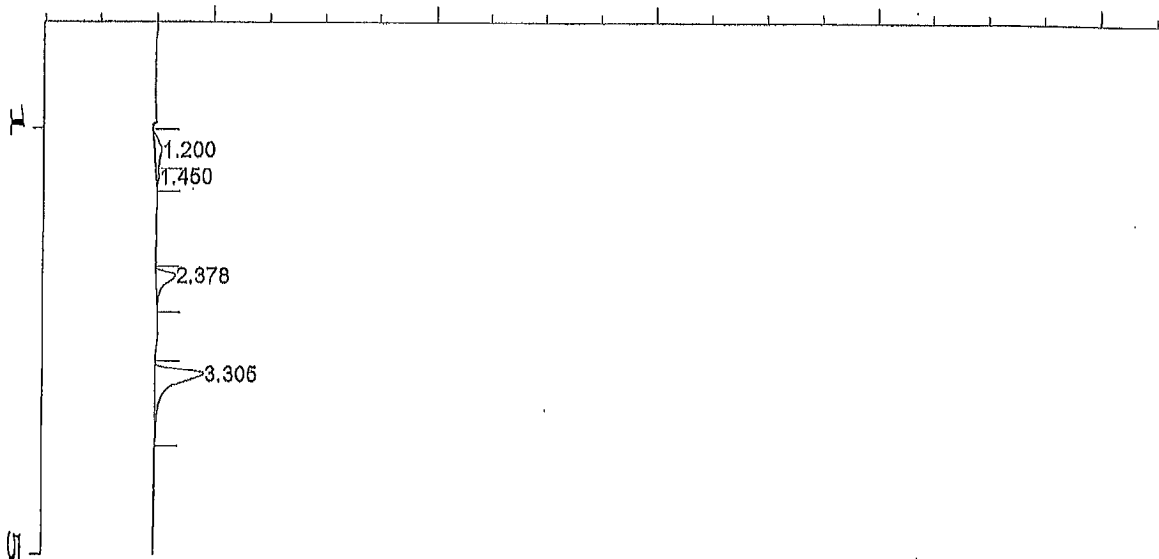
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1B057.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1B 73307 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:20 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:25 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1B - Tr#73307 - 15:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1B057.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.209	840	BV	0.165		1.062	* uncalibrated *
1.458	180	VB	0.101		0.228	* uncalibrated *
2.389	1310	BB	0.124		1.658	* uncalibrated *
3.314	4631	BB	0.149		5.860	* uncalibrated *

Not all calibrated peaks were found

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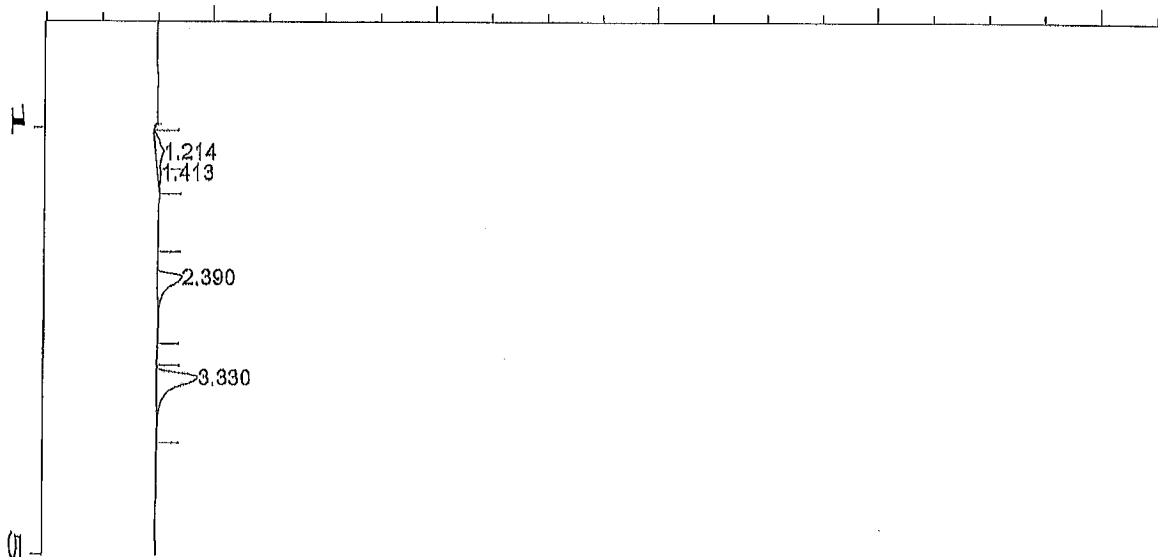
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1B058.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1B 73307 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:25 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:30 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1B - Tr#73307 - 15:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1B058.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.200	872	BV	0.167		1.103	* uncalibrated *
1.450	188	VB	0.127		0.238	* uncalibrated *
2.378	1332	BB	0.121		1.686	* uncalibrated *
3.305	4112	BB	0.147		5.204	* uncalibrated *

Not all calibrated peaks were found



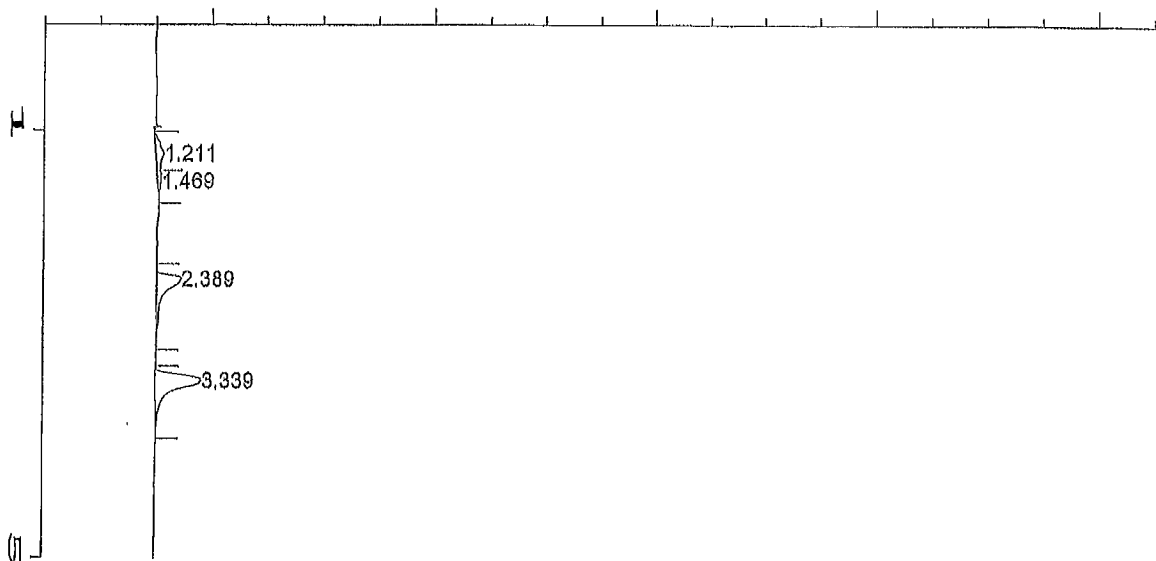
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T4B1A059.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T4B1A 73308 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:38 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1A - Tr#73308 - 08:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T4B1A059.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.214	929	BV	0.160		1.175	* uncalibrated *
1.413	274	VB	0.133		0.346	* uncalibrated *
2.390	2249	BB	0.136		2.846	* uncalibrated *
3.330	3590	BB	0.149		4.542	* uncalibrated *

Not all calibrated peaks were found



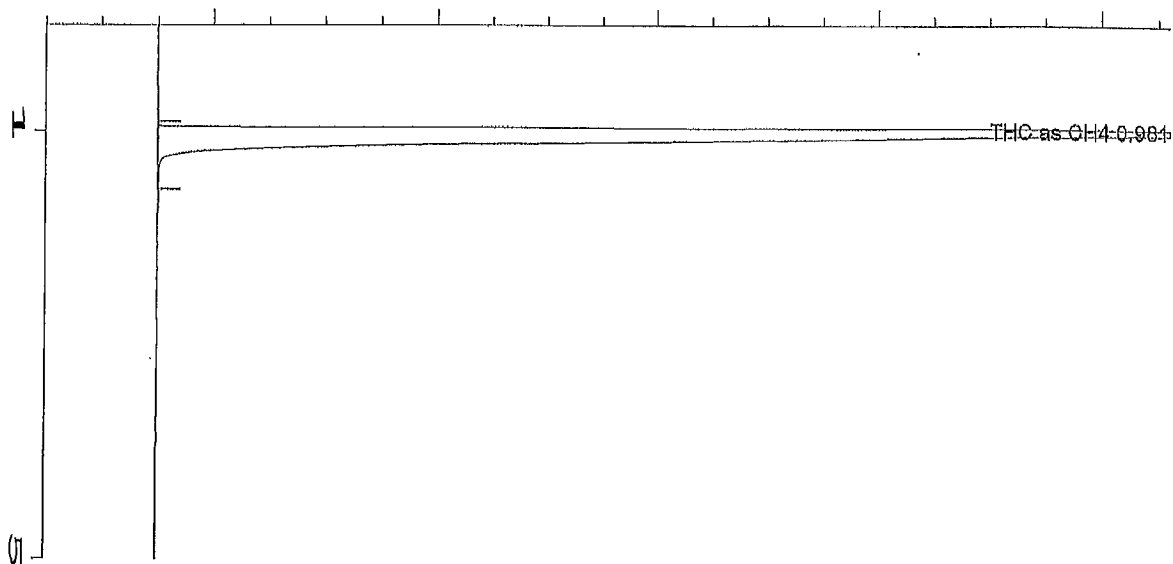
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T4B1A061.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T4B1A 73308 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:47 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:52 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1A - Tr#73308 - 08:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T4B1A061.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.211	946 BV	0.163			1.197	* uncalibrated *
1.469	361 VB	0.164			0.457	* uncalibrated *
2.389	2376 BB	0.157			3.006	* uncalibrated *
3.339	3870 BB	0.147			4.898	* uncalibrated *

Not all calibrated peaks were found



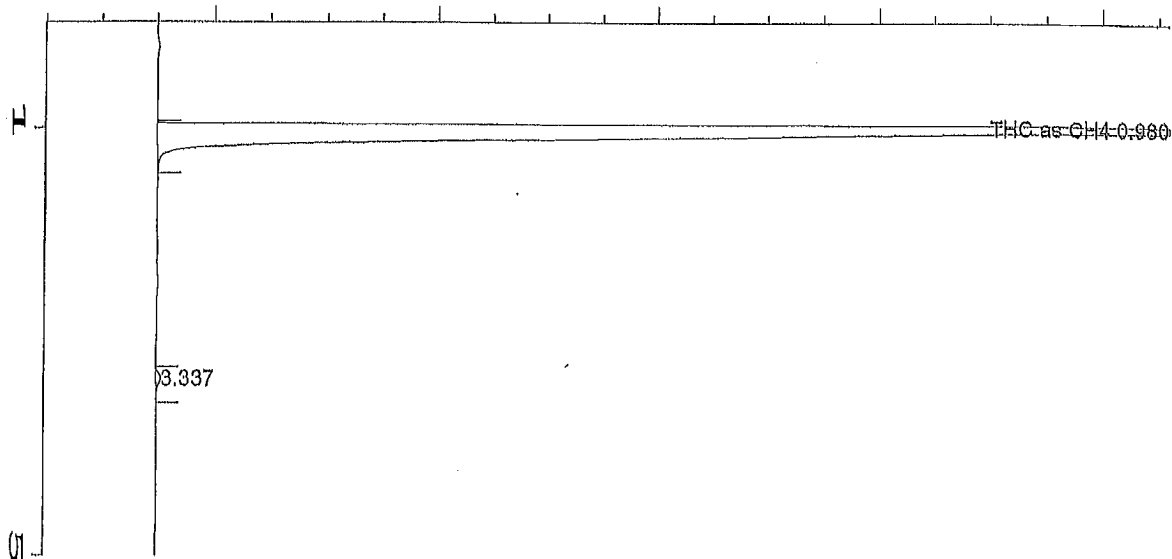
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0053.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:44 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 02:49 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0053.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.981	78269	BB	0.099	1	98.517	THC as CH4



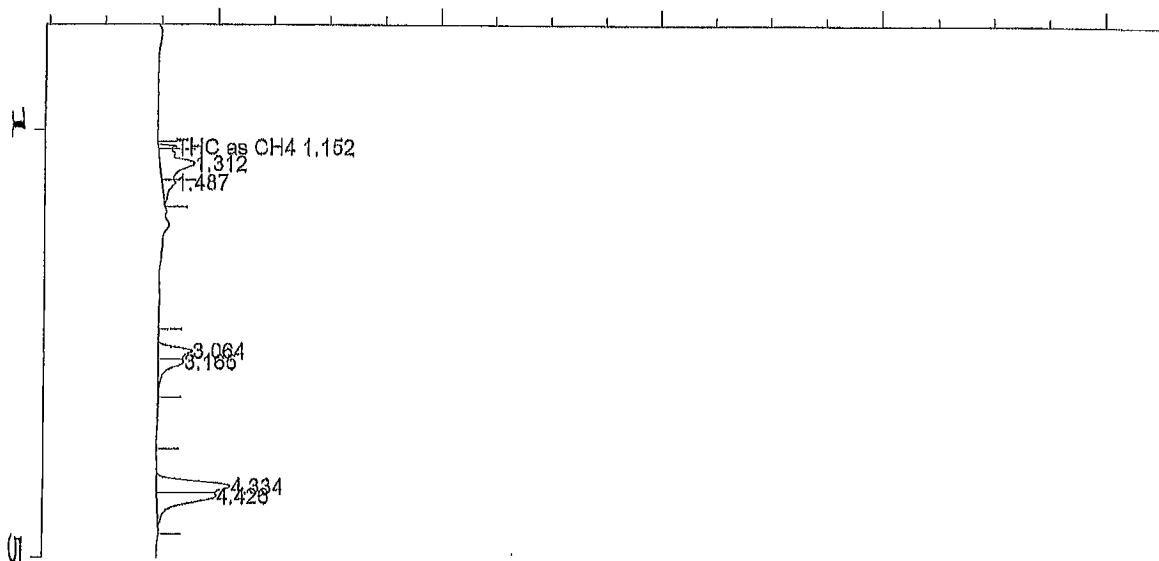


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0062.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:53 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:58 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0062.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.980	79936	BV	0.093	1	100.631	THC as CH4
3.337	309	BB	0.119		0.391	* uncalibrated *

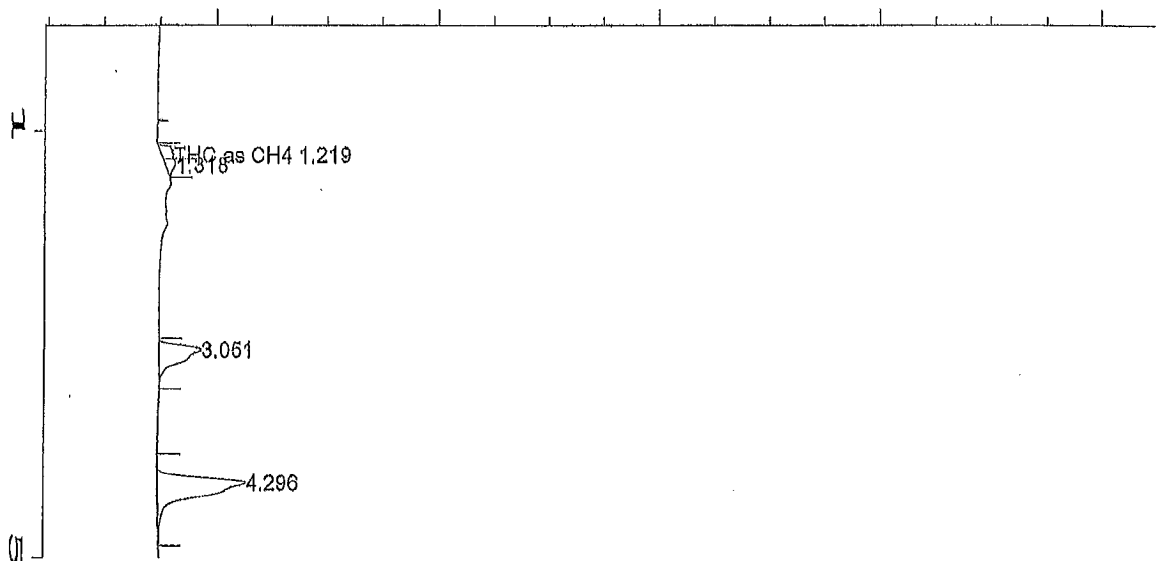


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T4B1B005.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T4B1B 73309 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:55 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:00 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1B - Tr#73309 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T4B1B005.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.152	248	BV	0.029	1	0.203	THC as CH4
1.312	3067	VV	0.139		2.586	* uncalibrated *
1.487	786	VV	0.087		0.662	* uncalibrated *
3.064	1822	BV	0.089		1.536	* uncalibrated *
3.165	1389	VB	0.104		1.172	* uncalibrated *
4.334	4247	PV	0.097		3.581	* uncalibrated *
4.426	3517	VB	0.099		2.966	* uncalibrated *



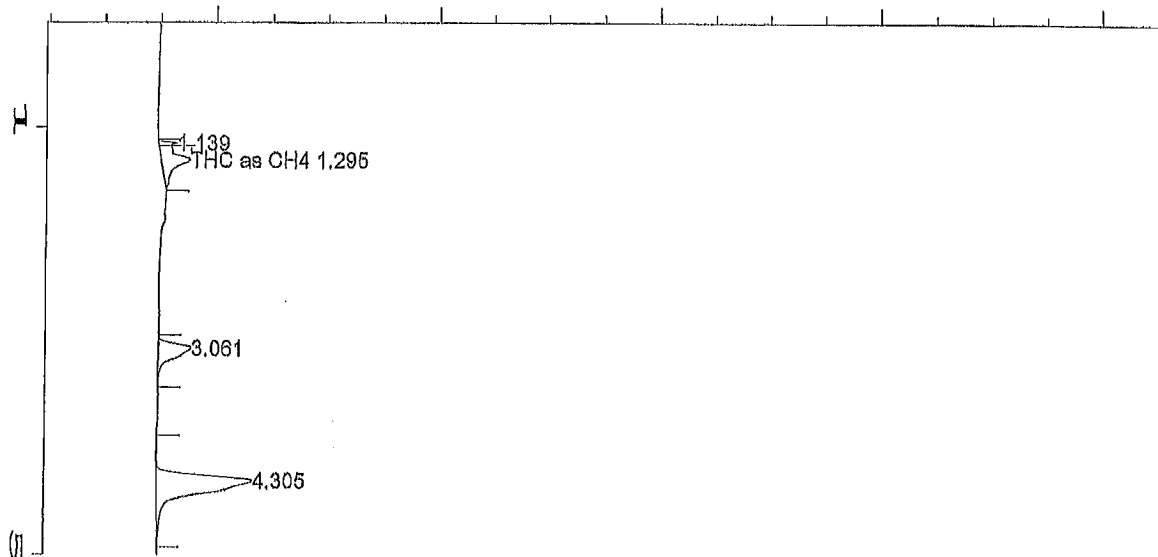
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T4B1B007.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T4B1B 73309 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:11 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:16 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1B - Tr#73309 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T4B1B007.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.219	717	BV	0.101	1	0.588	THC as CH4
1.318	605	VB	0.102		0.510	* uncalibrated *
3.051	3691	BB	0.135		3.113	* uncalibrated *
4.296	8810	BB	0.152		7.429	* uncalibrated *

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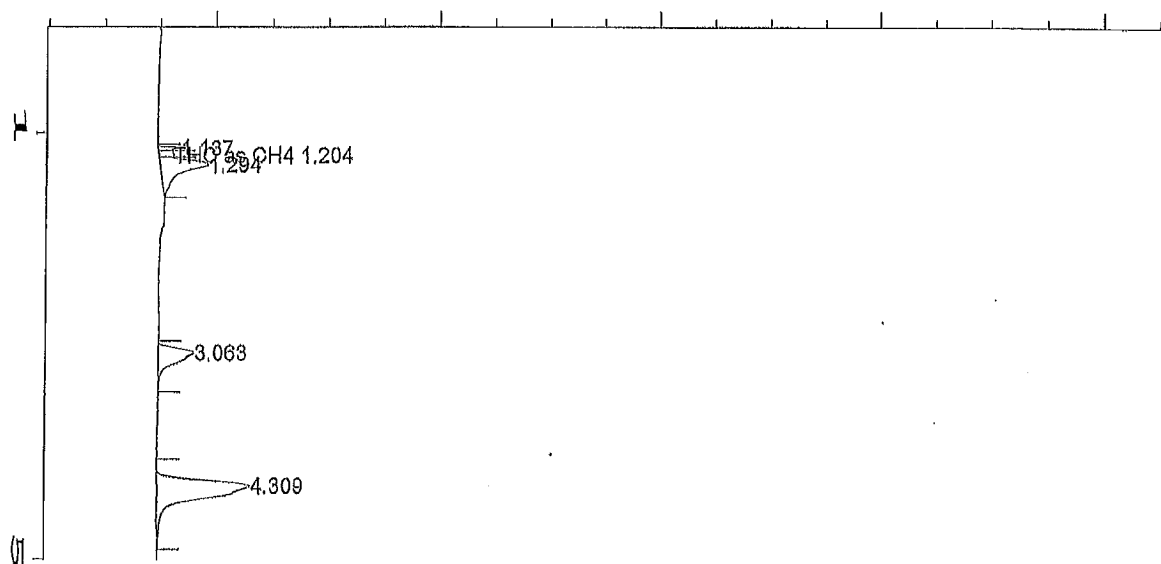


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1A008.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1A 73310 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:20 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:25 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1A - Tr#73310 - 10:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1A008.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.295	2605	VB	0.141	1	2.135	THC as CH4
1.139	283	BV	0.031		0.239	* uncalibrated *
3.061	2585	BV	0.122		2.180	* uncalibrated *
4.305	9323	BB	0.152		7.861	* uncalibrated *

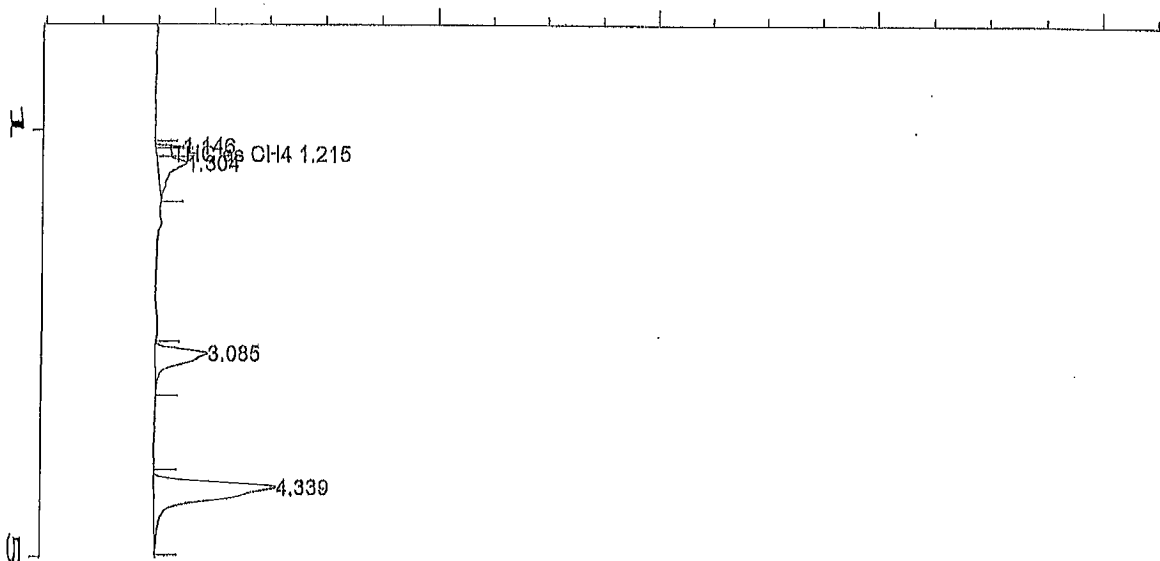


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1A009.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1A 73310 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:26 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:31 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1A - Tr#73310 - 10:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1A009.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.204	463	VV	0.057	1	0.379	THC as CH4
1.137	330	BV	0.031		0.278	* uncalibrated *
1.294	3589	VB	0.120		3.026	* uncalibrated *
3.063	2849	BB	0.124		2.402	* uncalibrated *
4.309	9260	BB	0.151		7.809	* uncalibrated *

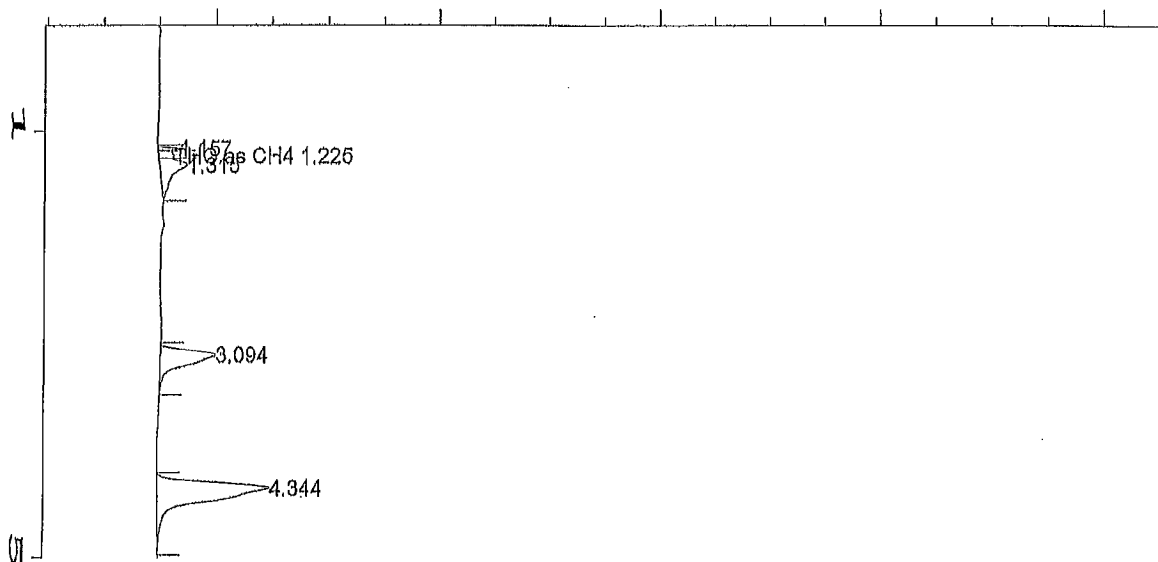


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1B010.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1B 73311 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1B - Tr#73311 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1B010.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.215	585	VV	0.068	1	0.479	THC as CH4
1.146	338	BV	0.028		0.285	* uncalibrated *
1.304	2539	VB	0.134		2.141	* uncalibrated *
3.085	4086	BB	0.122		3.445	* uncalibrated *
4.339	11655	BBA	0.147		9.828	* uncalibrated *

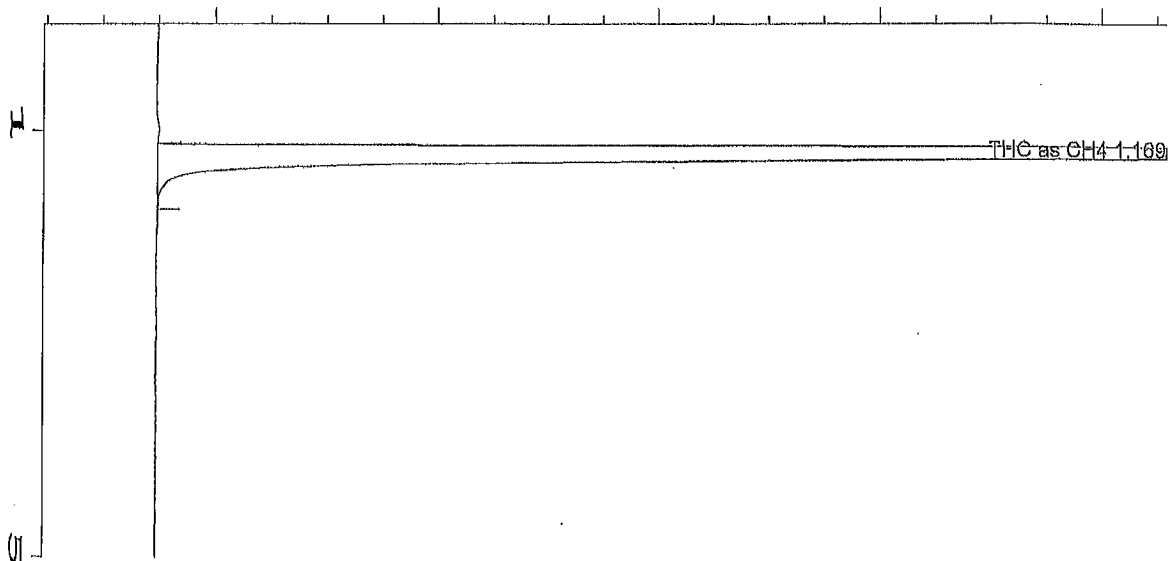


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1B011.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1B 73311 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:40 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:45 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1B - Tr#73311 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1B011.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.225	560	VV	0.069	1	0.459	THC as CH4
1.157	296	BV	0.030		0.250	* uncalibrated *
1.315	2388	VB	0.132		2.013	* uncalibrated *
3.094	4288	BB	0.121		3.615	* uncalibrated *
4.344	10744	BBA	0.149		9.060	* uncalibrated *



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 External Standard Report  
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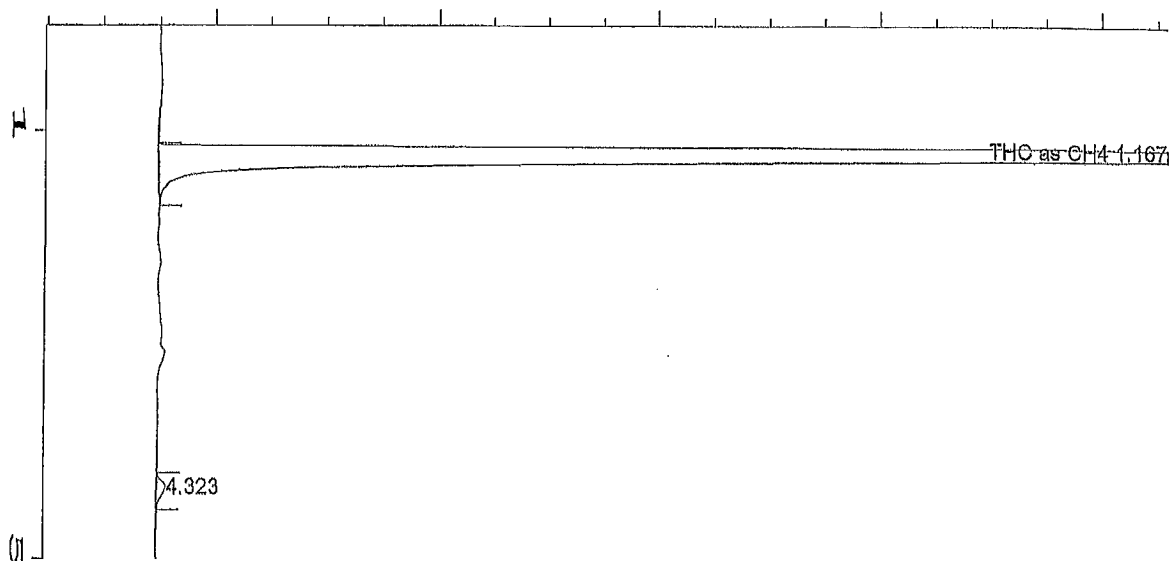
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0004.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:49 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0004.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	120170	BB	0.098	1	101.283	THC as CH4

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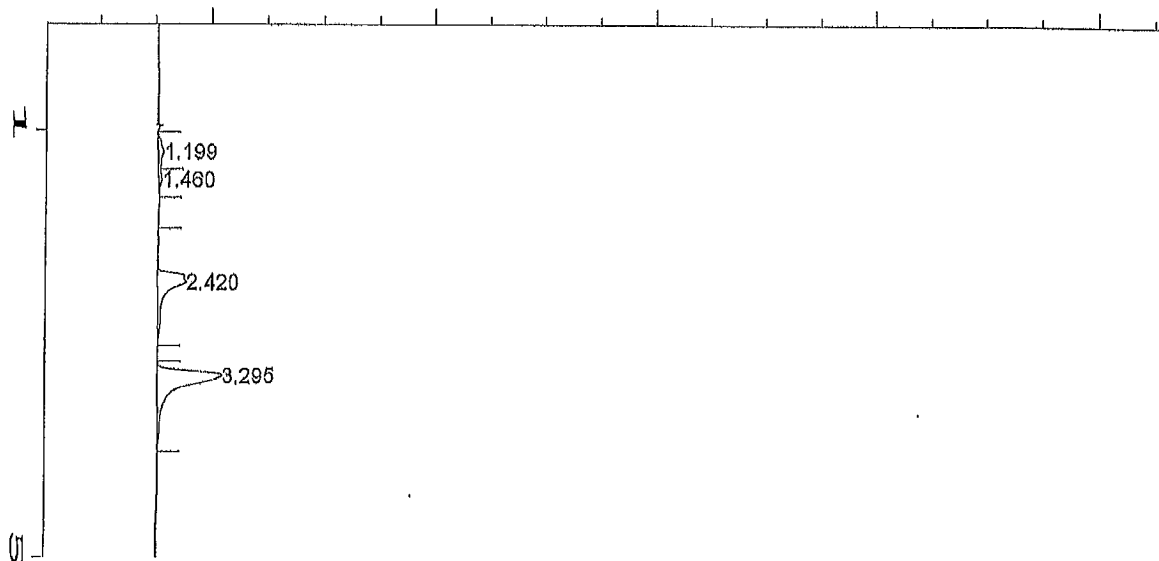


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0013.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:54 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:59 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0013.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	116880	BB	0.098	1	98.507	THC as CH4
4.323	775	BB	0.122		0.653	* uncalibrated *



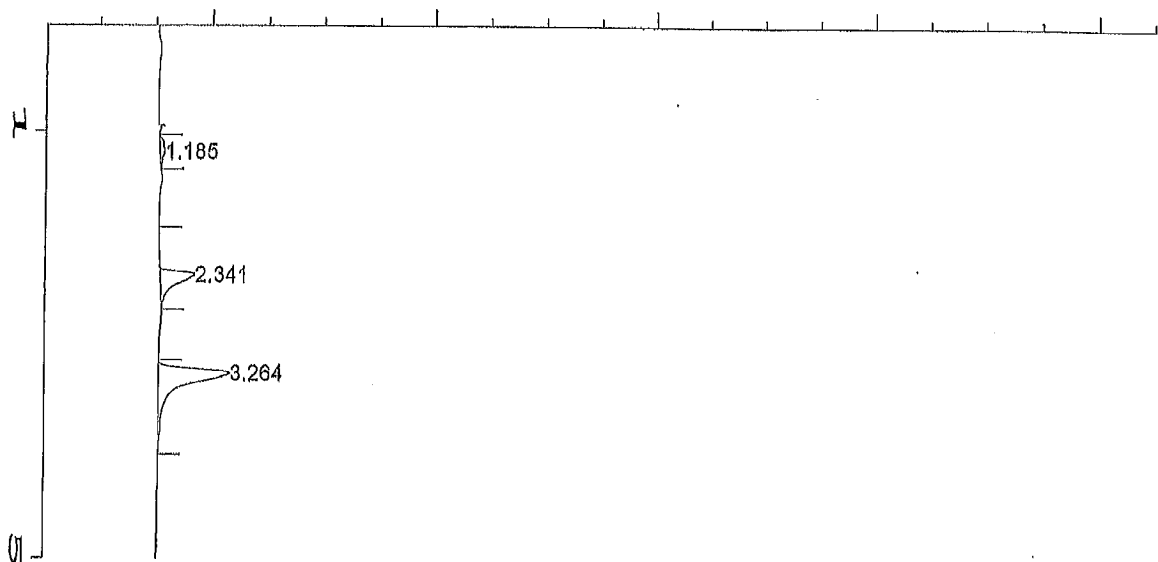
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1A068.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1A 73325 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:19 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:24 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1A -  
 Tr#73325 - 13:00 - 0.5 cc injection  
 11:35 *SW*

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1A068.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.199	555	FV	0.152		0.699	* uncalibrated *
1.460	226	VB	0.132		0.285	* uncalibrated *
2.420	2976	BB	0.155		3.750	* uncalibrated *
3.295	5802	BB	0.153		7.310	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
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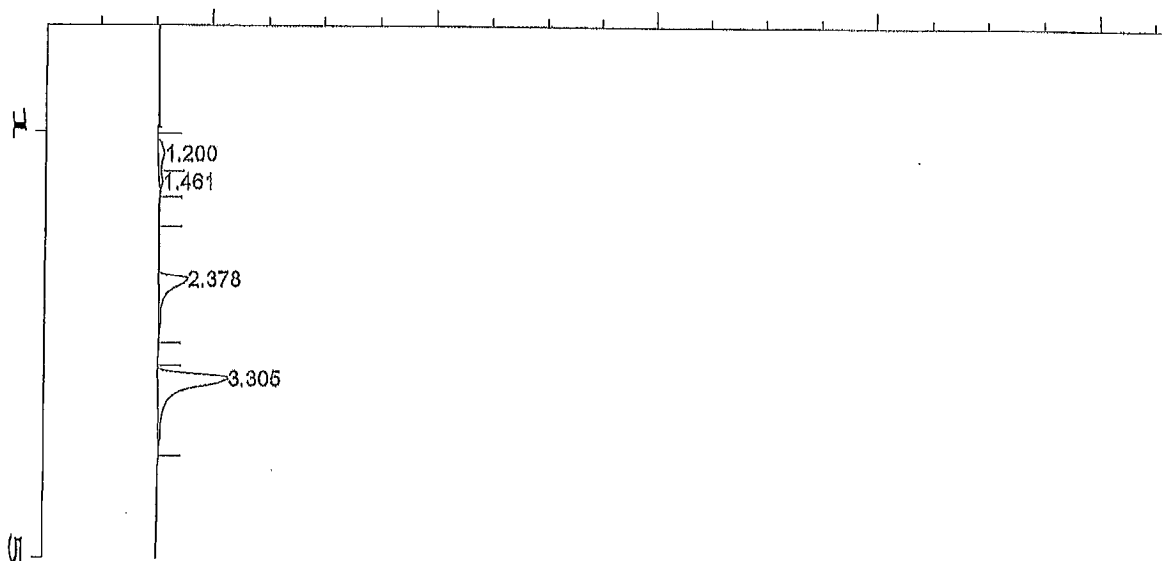
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1A069.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1A 73325 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:32 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1A -  
 Tr#73325 - 11:35 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1A069.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.185	400	PV	0.135		0.504	* uncalibrated *
2.341	2339	BB	0.109		2.948	* uncalibrated *
3.264	6383	BB	0.153		8.042	* uncalibrated *

Not all calibrated peaks were found

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 External Standard Report  
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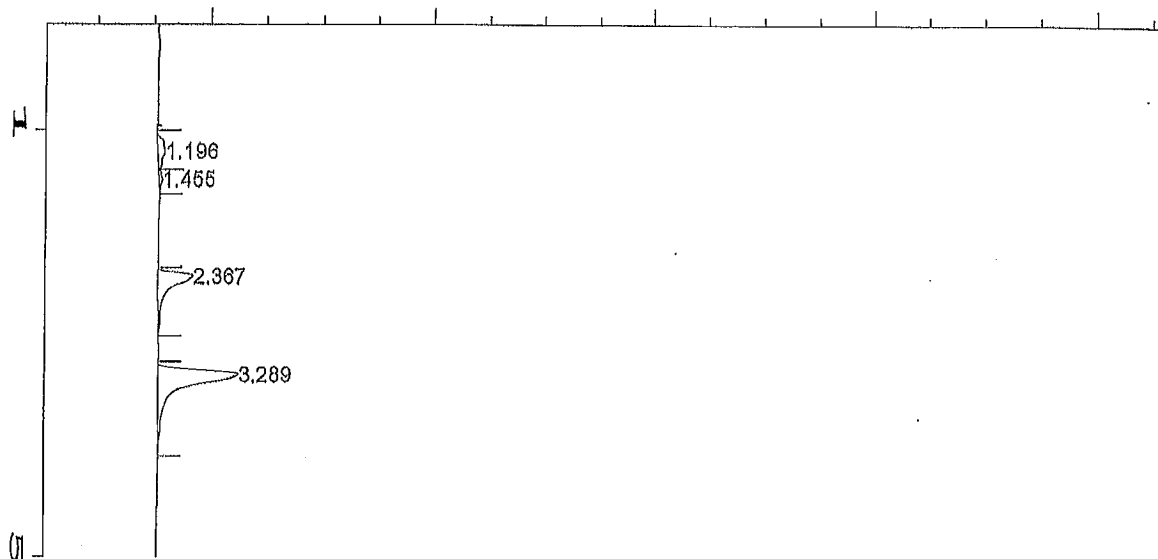
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1B070.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1B 73326 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:41 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:46 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1B -  
 Tr#73326 - 12:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1B070.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.200	679	BV	0.156		0.855	* uncalibrated *
1.461	228	VB	0.110		0.287	* uncalibrated *
2.378	2559	BB	0.131		3.225	* uncalibrated *
3.305	6318	BB	0.154		7.960	* uncalibrated *

Not all calibrated peaks were found

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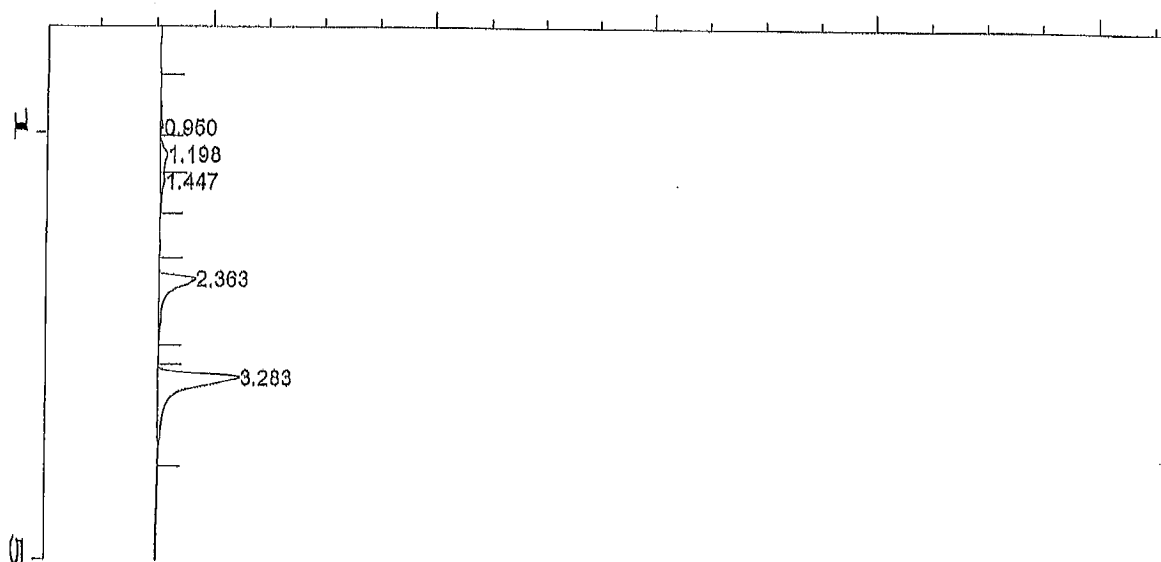
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1B071.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1B 73326 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:46 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:51 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1B -  
 Tr#73326 - 12:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1B071.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.196	812 BV	0.168			1.023	* uncalibrated *
1.455	199 VB	0.116			0.251	* uncalibrated *
2.367	2795 BB	0.138			3.522	* uncalibrated *
3.289	7117 PB	0.152			8.967	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
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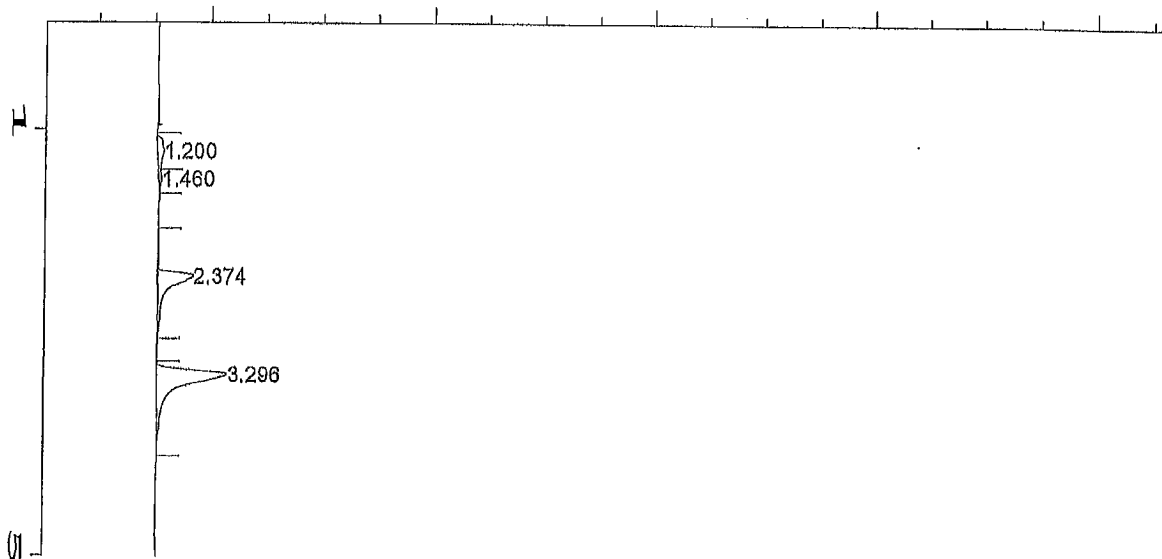
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1A072.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1A 73327 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:55 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:00 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1A -  
 Tr#73327 - 13:05 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1A072.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
0.950	306	BV	0.114		0.386	* uncalibrated *
1.198	738	PV	0.149		0.929	* uncalibrated *
1.447	386	VB	0.133		0.486	* uncalibrated *
2.363	2963	BB	0.138		3.733	* uncalibrated *
3.283	7102	BB	0.134		8.947	* uncalibrated *

Not all calibrated peaks were found

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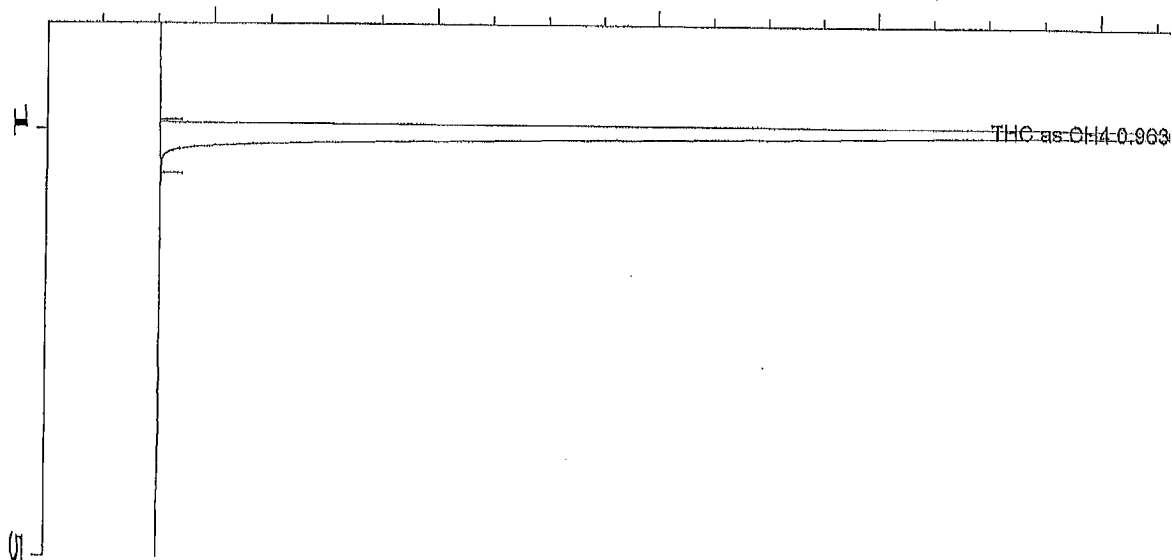
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1A073.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1A 73327 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:07 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:12 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1A -  
 Tr#73327 - 13:05 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1A073.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.200	794	BV	0.170		1.00	* uncalibrated *
1.460	200	VB	0.102		0.252	* uncalibrated *
2.374	2842	BB	0.124		3.580	* uncalibrated *
3.296	6043	BB	0.133		7.613	* uncalibrated *

Not all calibrated peaks were found



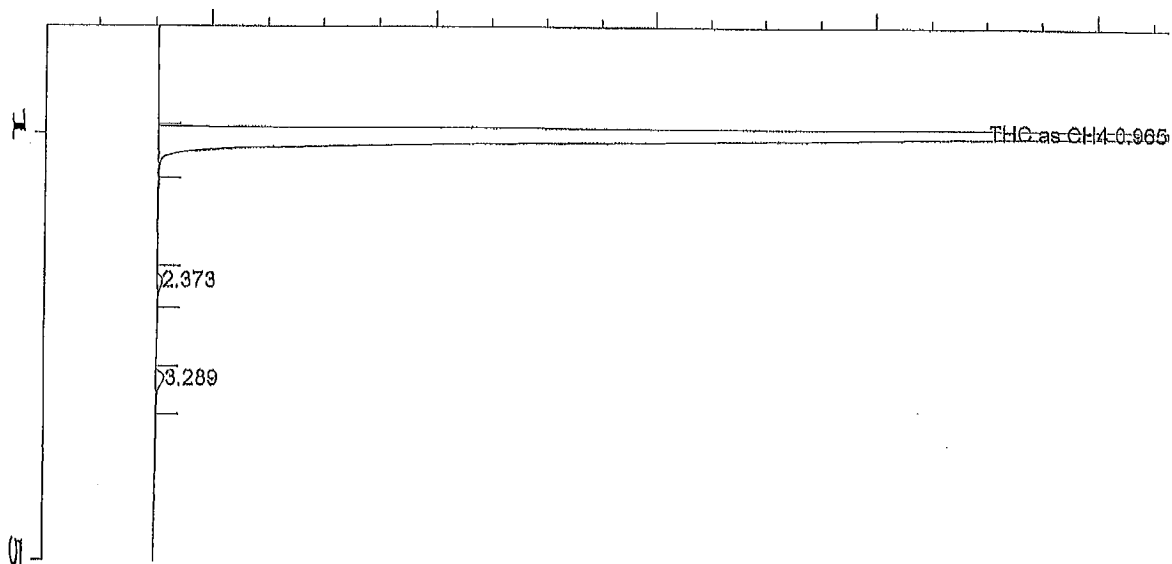
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0067.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:05 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:11 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0067.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.963	80767	BV	0.097	1	101.171	THC as CH4



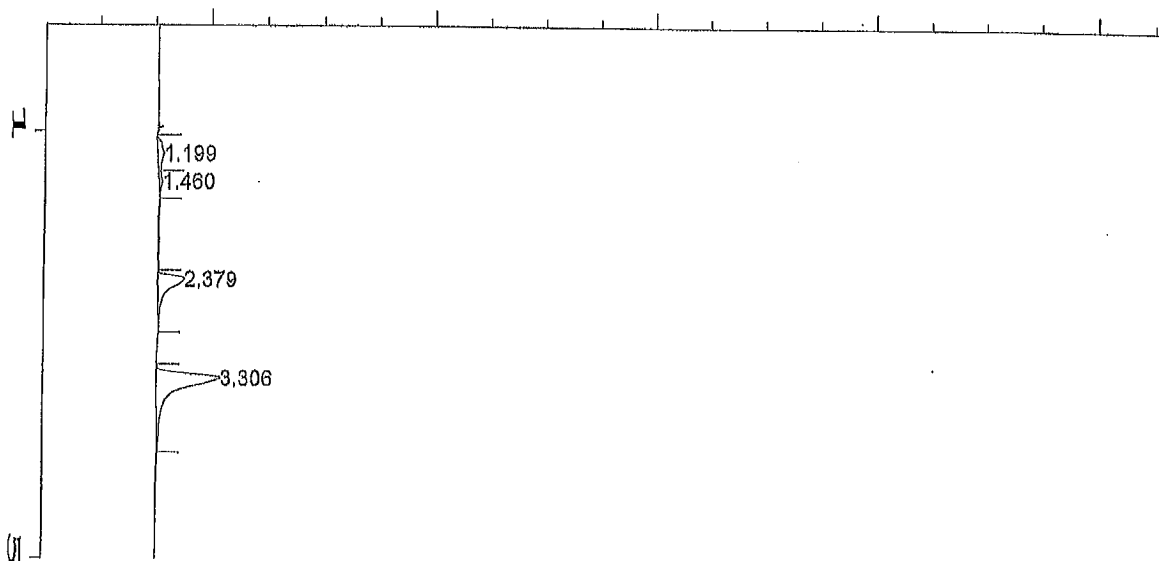


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:17 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:22 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	80186	BV	0.096	1	100.433	THC as CH4
2.373	366	BB	0.119		0.461	* uncalibrated *
3.289	638	BB	0.135		0.803	* uncalibrated *



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External Standard Report

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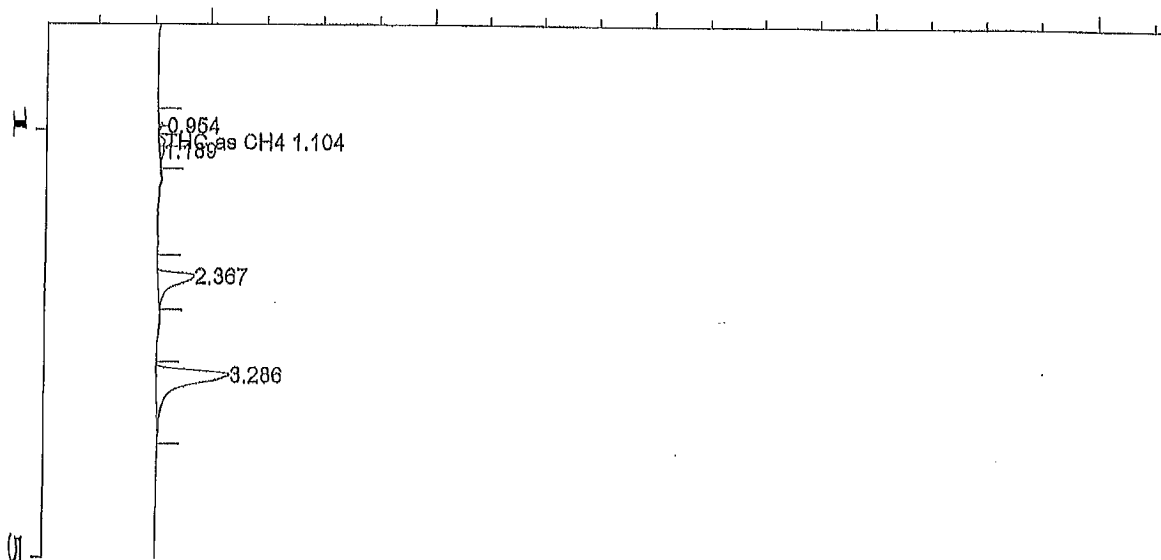
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B075.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:32 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B075.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.199	662	BV	0.156		0.834	* uncalibrated *
1.460	250	VB	0.109		0.315	* uncalibrated *
2.379	2059	BB	0.133		2.594	* uncalibrated *
3.306	5430	BB	0.148		6.841	* uncalibrated *

Not all calibrated peaks were found

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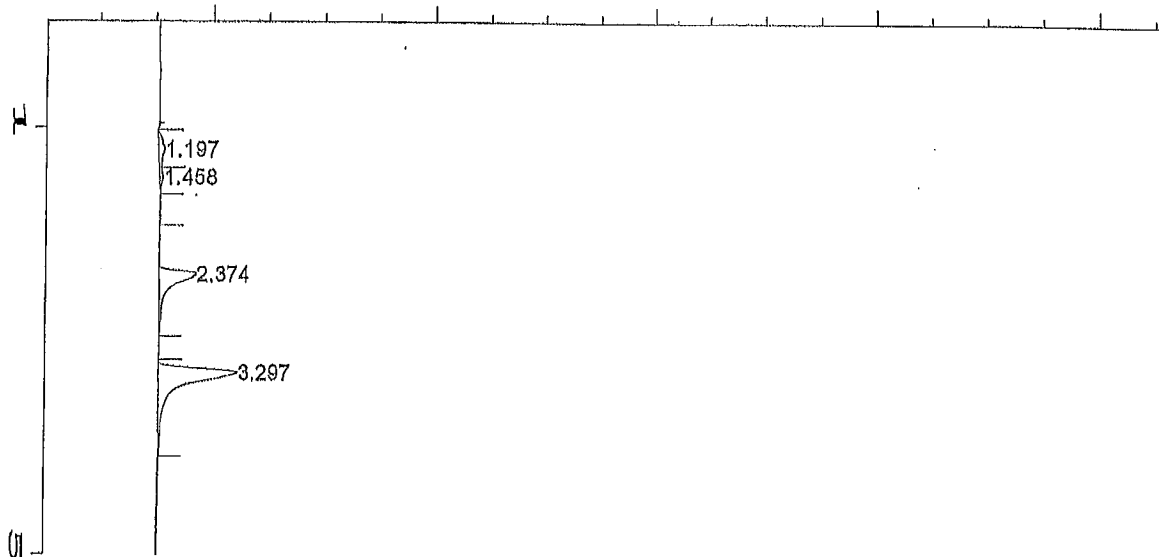


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B077.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:39 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:44 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B077.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.104	237	PV	0.071	1	0.230	THC as CH4
0.954	115	BV	0.028		0.144	* uncalibrated *
1.189	256	VB	0.092		0.322	* uncalibrated *
2.367	2523	BV	0.121		3.179	* uncalibrated *
3.286	6147	BB	0.144		7.744	* uncalibrated *



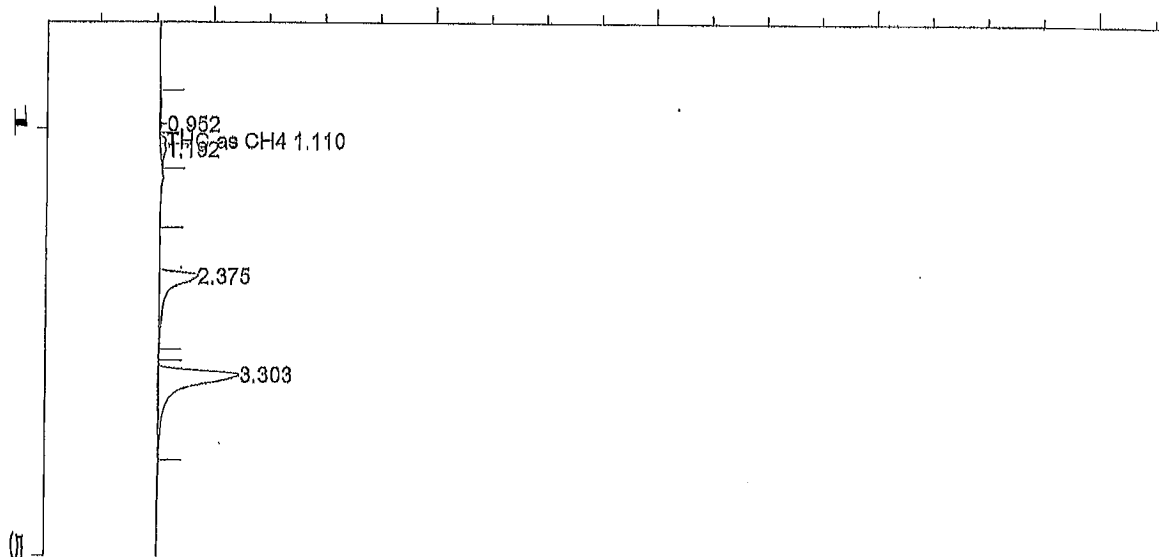
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B076.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 *g Sw* Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:38 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount : *g Sw*  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 18:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B076.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.197	683	BV	0.158		0.861	* uncalibrated *
1.458	233	VB	0.099		0.294	* uncalibrated *
2.374	3042	BB	0.141		3.832	* uncalibrated *
3.297	6828	BB	0.147		8.602	* uncalibrated *

Not all calibrated peaks were found

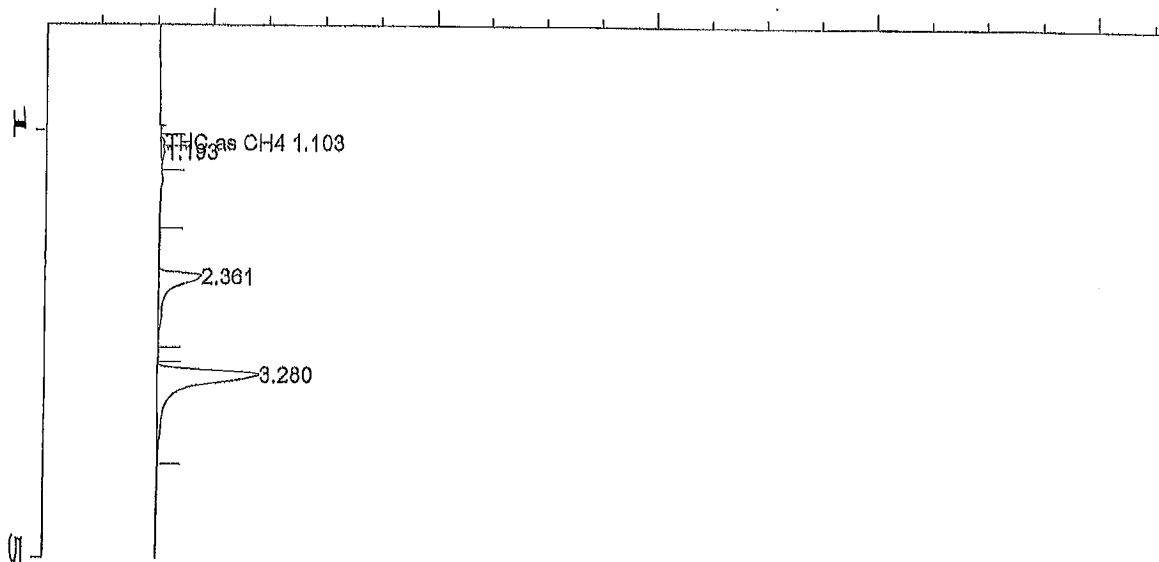


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1A079.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1A 73329 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:51 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:56 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1A -  
 Tr#73329 - 14:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1A079.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.110	205	FV	0.064	1	0.199	THC as CH4
0.952	218	BV	0.058		0.275	* uncalibrated *
1.192	345	VB	0.106		0.434	* uncalibrated *
2.375	3425	BB	0.149		4.315	* uncalibrated *
3.303	7192	BB	0.152		9.061	* uncalibrated *



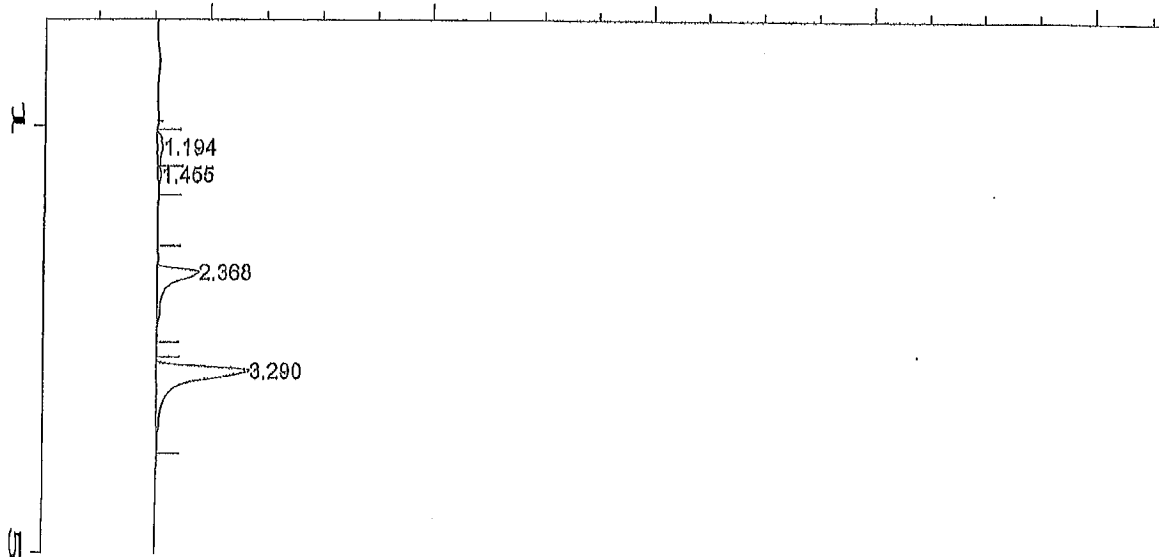
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 External Standard Report  
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Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1B080.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1B 73330 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:02 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:08 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1B -  
 Tr#73330 - 15:15 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1B080.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.103	153	BV	0.064	1	0.149	THC as CH4
1.193	249	VV	0.096		0.313	* uncalibrated *
2.361	3543	BB	0.139		4.464	* uncalibrated *
3.280	8857	BB	0.148		11.159	* uncalibrated *

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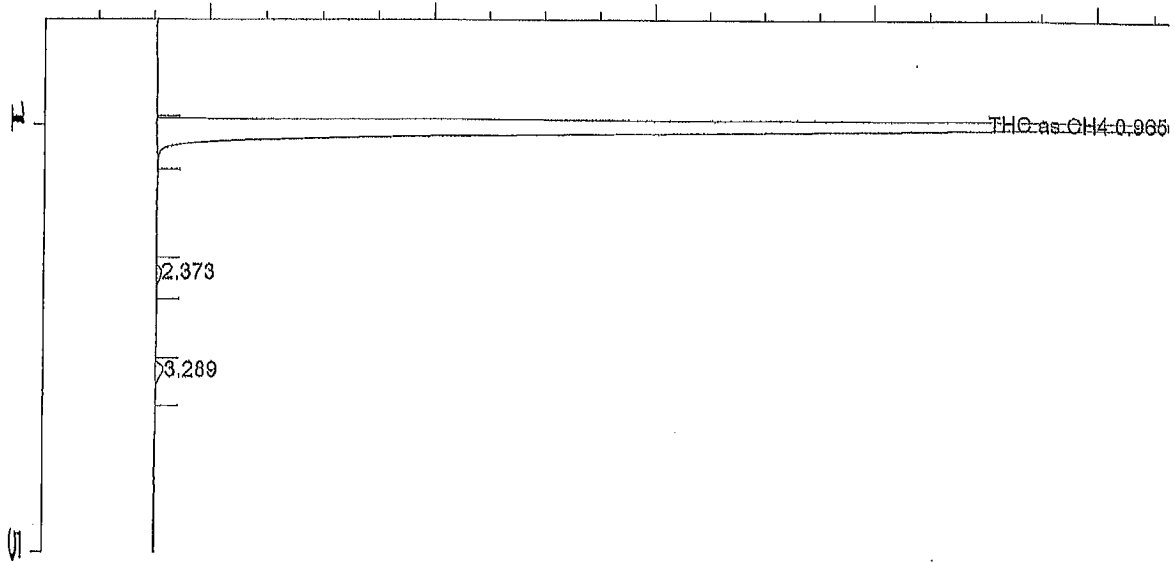
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1B081.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1B 73330 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:09 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:14 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1B -  
 Tr#73330 - 15:15 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1B081.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.194	615	BV	0.162		0.775	* uncalibrated *
1.455	215	VB	0.113		0.270	* uncalibrated *
2.368	3392	BB	0.137		4.274	* uncalibrated *
3.290	7837	BB	0.144		9.874	* uncalibrated *

Not all calibrated peaks were found



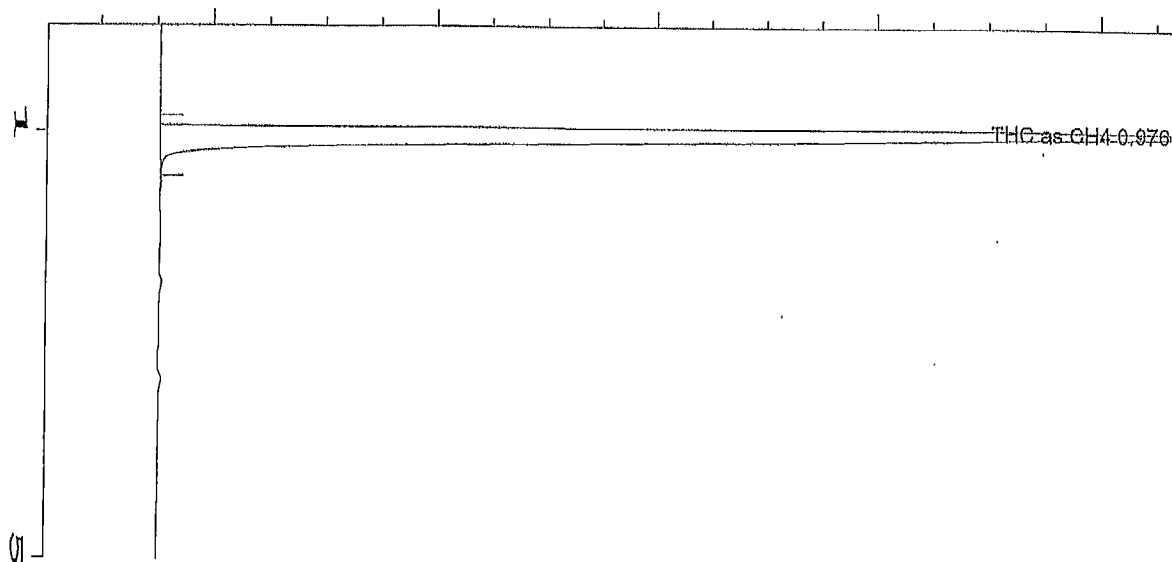
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:17 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	80186	BV	0.096	1	100.433	THC as CH4
2.373	366	BB	0.119		0.461	* uncalibrated *
3.289	638	BB	0.135		0.803	* uncalibrated *





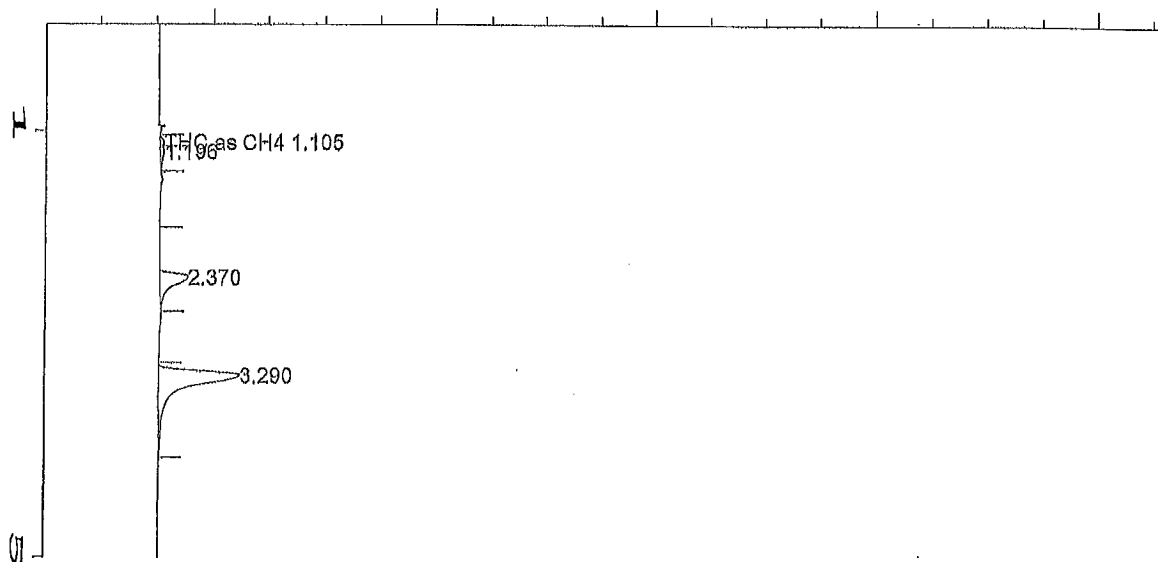
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 External Standard Report  
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Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:18 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:23 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.976	79107	BV	0.105	1	99.060	THC as CH4

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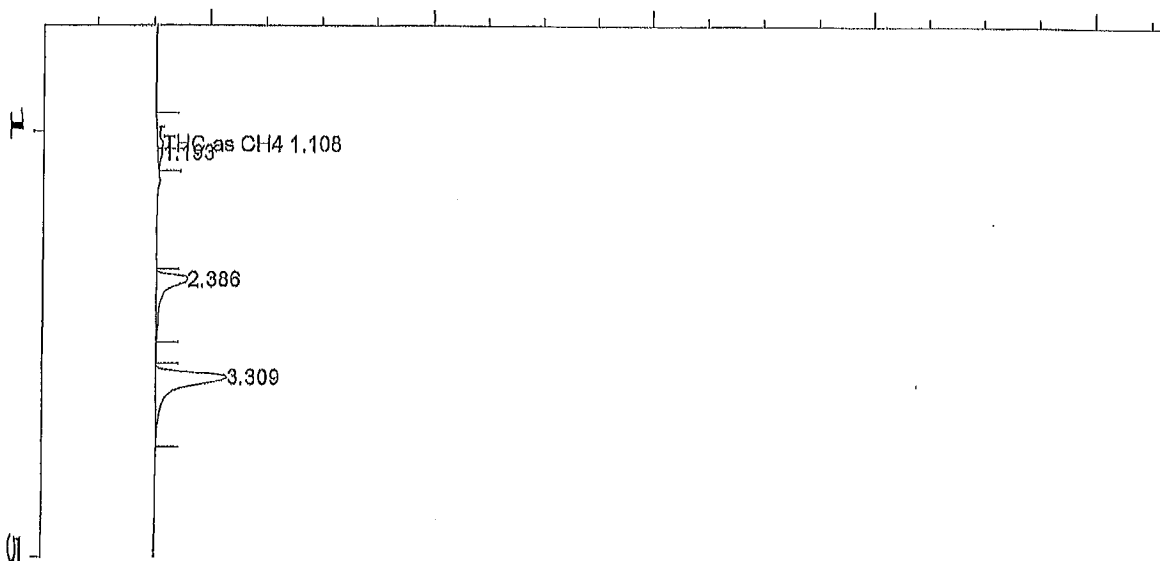


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1A083.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1A 73331 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:30 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:35 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1A -  
 Tr#73331 - 16:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1A083.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.105	174	VV	0.071	1	0.169	THC as CH4
1.196	261	VB	0.096		0.328	* uncalibrated *
2.370	1976	BB	0.123		2.489	* uncalibrated *
3.290	7188	BB	0.150		9.057	* uncalibrated *

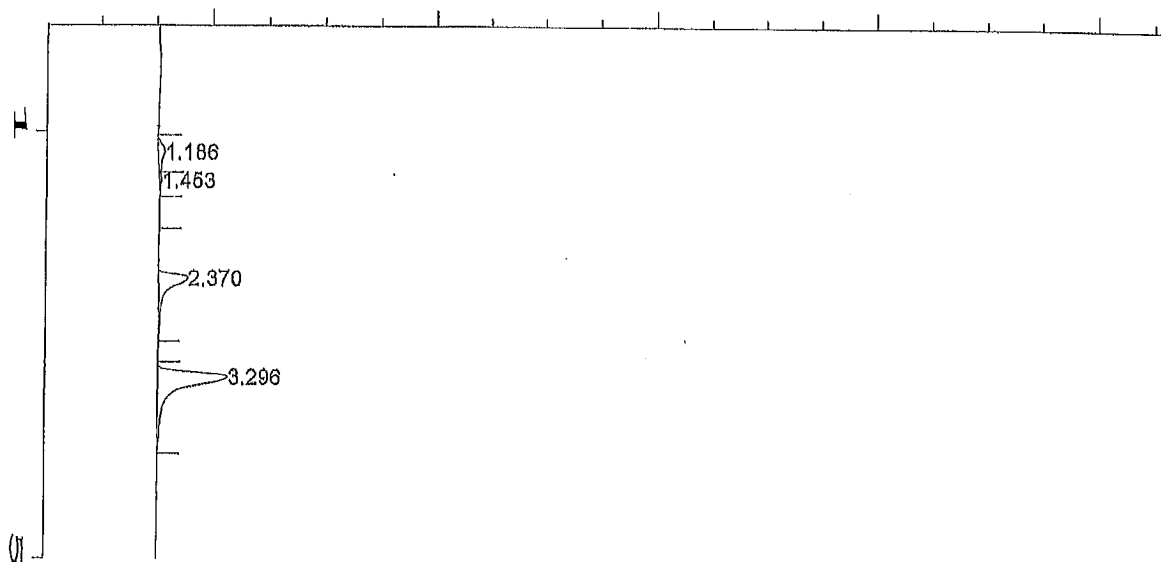


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1A084.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1A 73331 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:37 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:42 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1A -  
 Tr#73331 - 16:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1A084.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.108	399	BV	0.142	1	0.388	THC as CH4
1.193	240	VB	0.096		0.302	* uncalibrated *
2.386	2609	BB	0.140		3.287	* uncalibrated *
3.309	5999	BB	0.144		7.559	* uncalibrated *



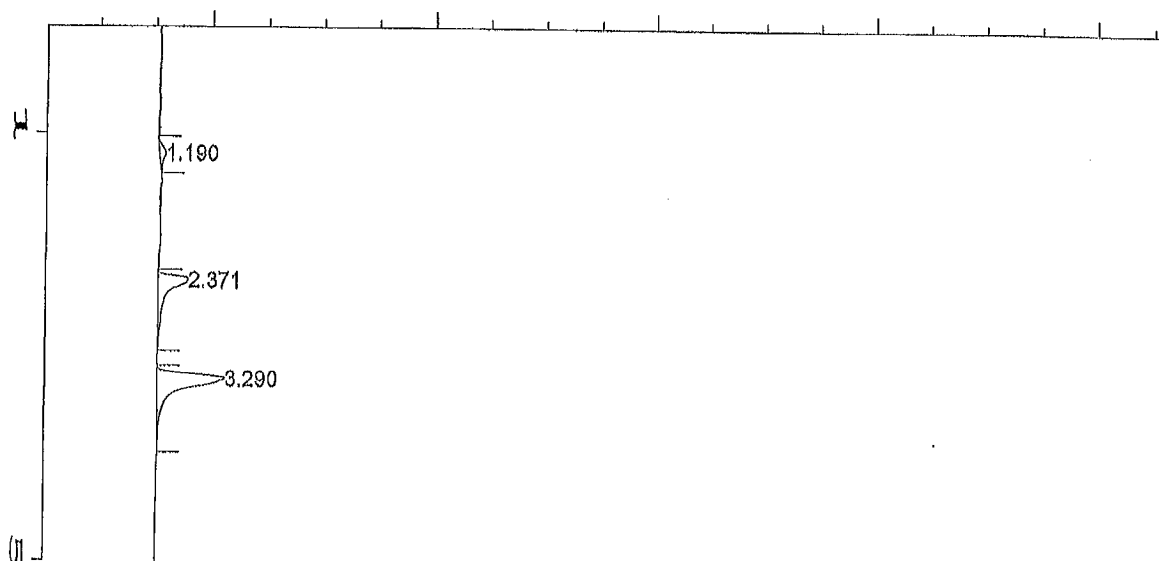
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1B085.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1B 73332 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:47 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:52 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1B -  
 Tr#73332 - 16:45 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1B085.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.186	712	BV	0.156		0.897	* uncalibrated *
1.453	168	VB	0.096		0.212	* uncalibrated *
2.370	2520	BB	0.142		3.175	* uncalibrated *
3.296	6059	BB	0.149		7.633	* uncalibrated *

Not all calibrated peaks were found



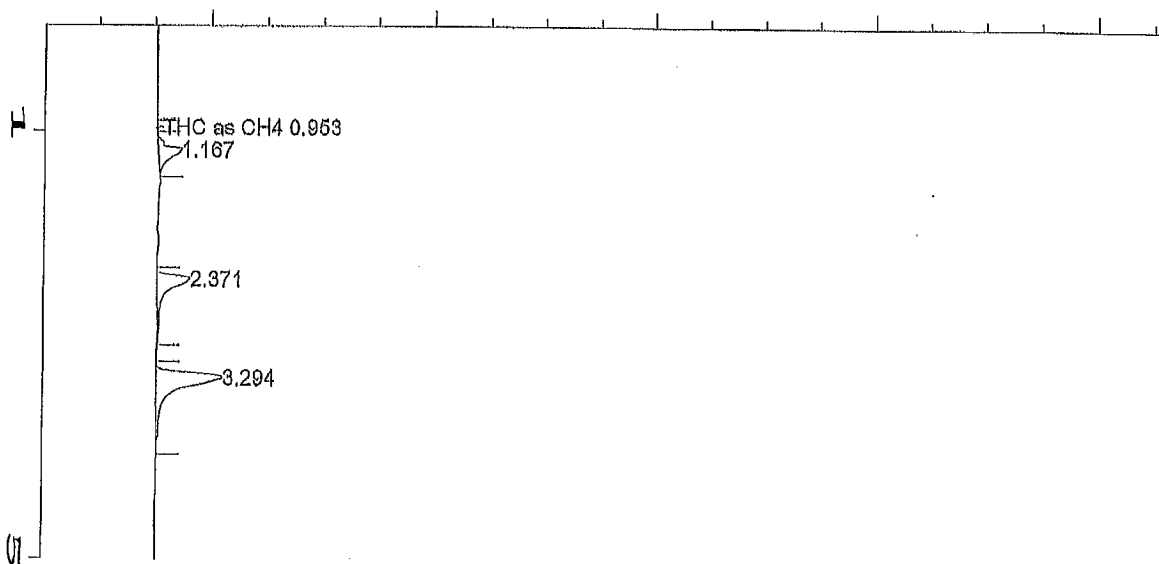
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1B086.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1B 73332 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:53 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:58 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1B -  
 Tr#73332 - 16:45 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1B086.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.190	482	FV	0.123		0.607	* uncalibrated *
2.371	2614	BB	0.147		3.293	* uncalibrated *
3.290	5724	BB	0.145		7.212	* uncalibrated *

Not all calibrated peaks were found

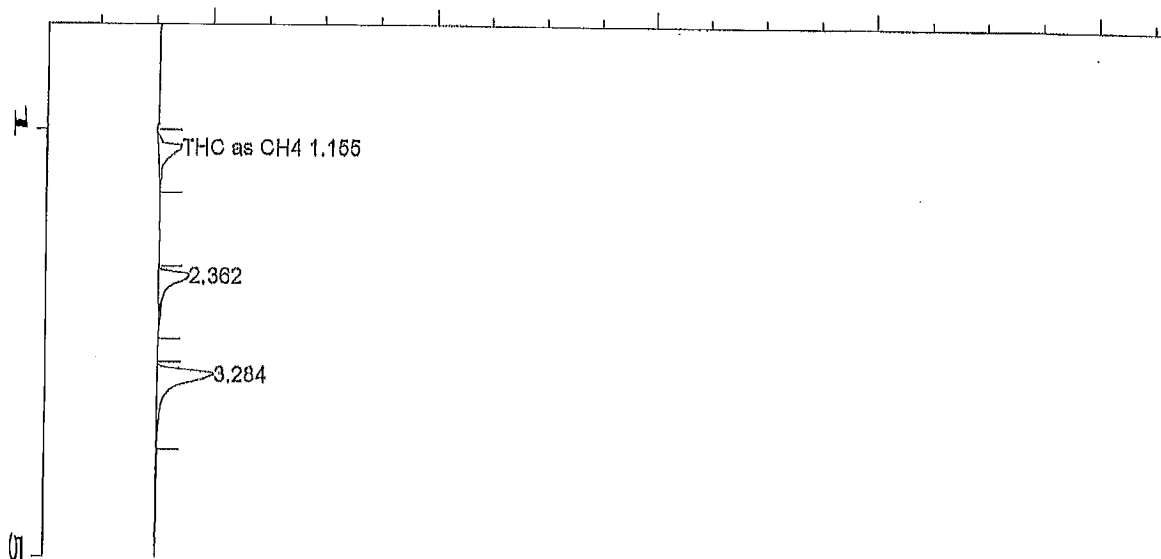


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A87.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:09 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:14 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A87.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.953	28	BV	0.023	1	0.0273	THC as CH4
1.167	1643	FV	0.117		2.070	* uncalibrated *
2.371	2694	BB	0.139		3.394	* uncalibrated *
3.294	5604	BB	0.147		7.061	* uncalibrated *

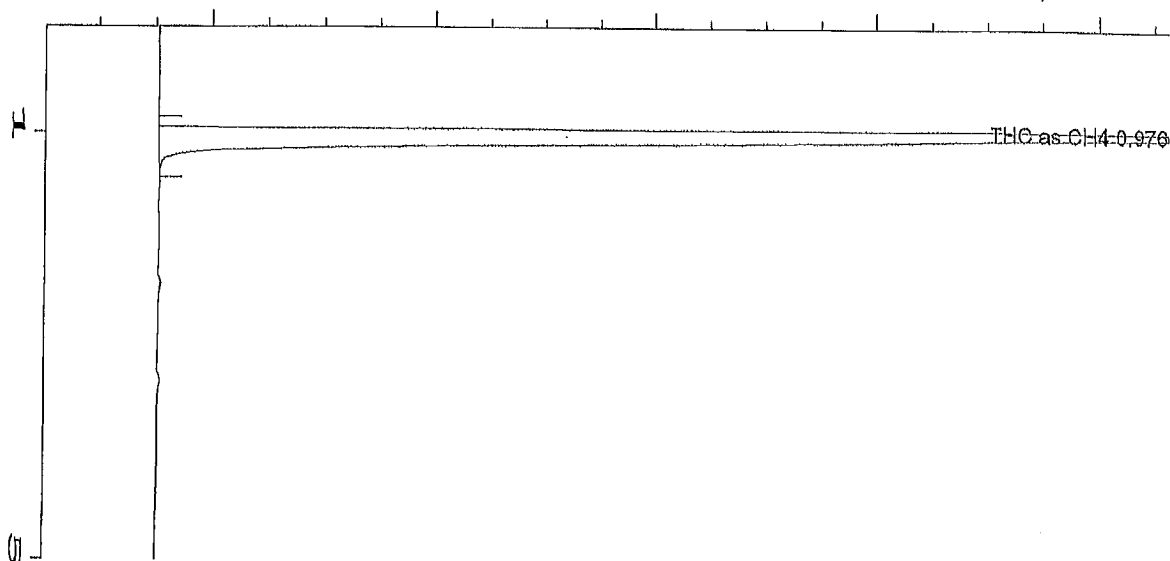


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A89.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:22 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:27 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A89.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.155	2035	BB	0.136	1	1.977	THC as CH4
2.362	2537	BB	0.141		3.196	* uncalibrated *
3.284	4780	BB	0.146		6.022	* uncalibrated *



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 External Standard Report  
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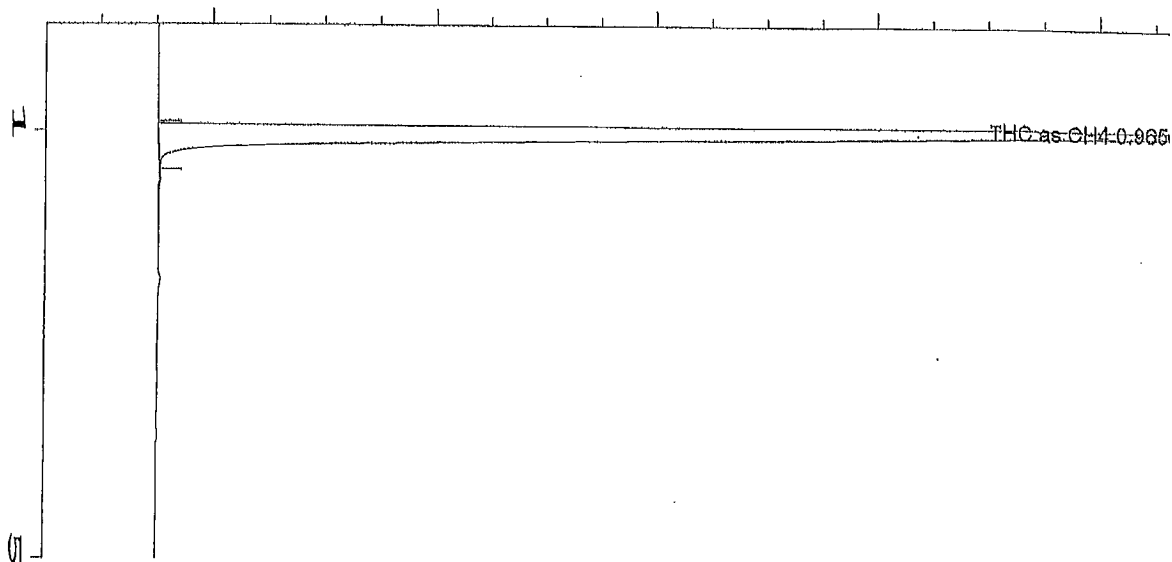
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:18 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:25 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.976	79107	BV	0.105	1	99.060	THC as CH4

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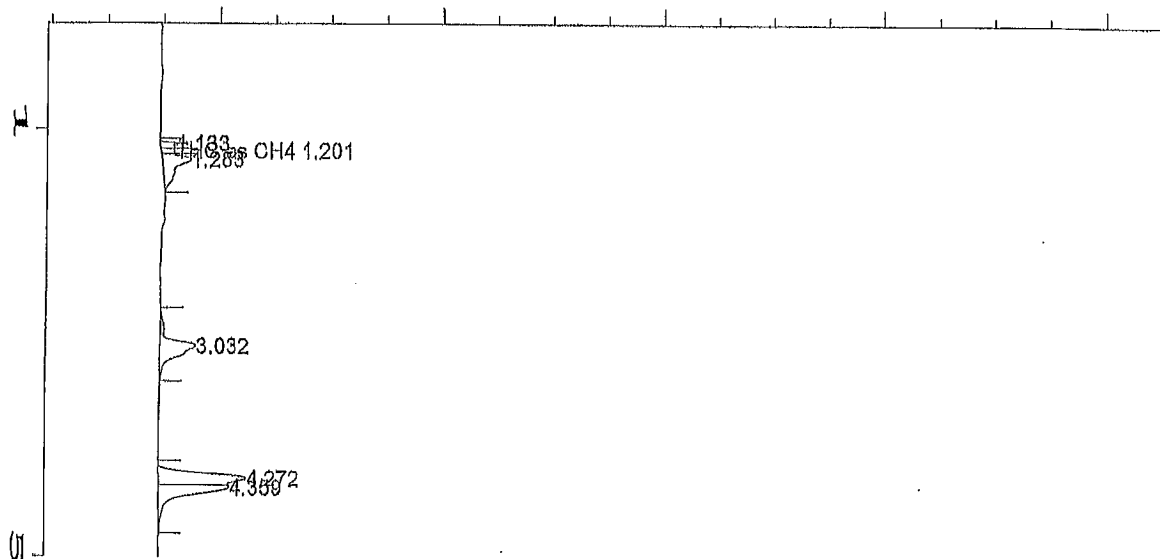
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A90.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:43 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:48 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A90.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	78410	BV	0.105	1	98.174	THC as CH4

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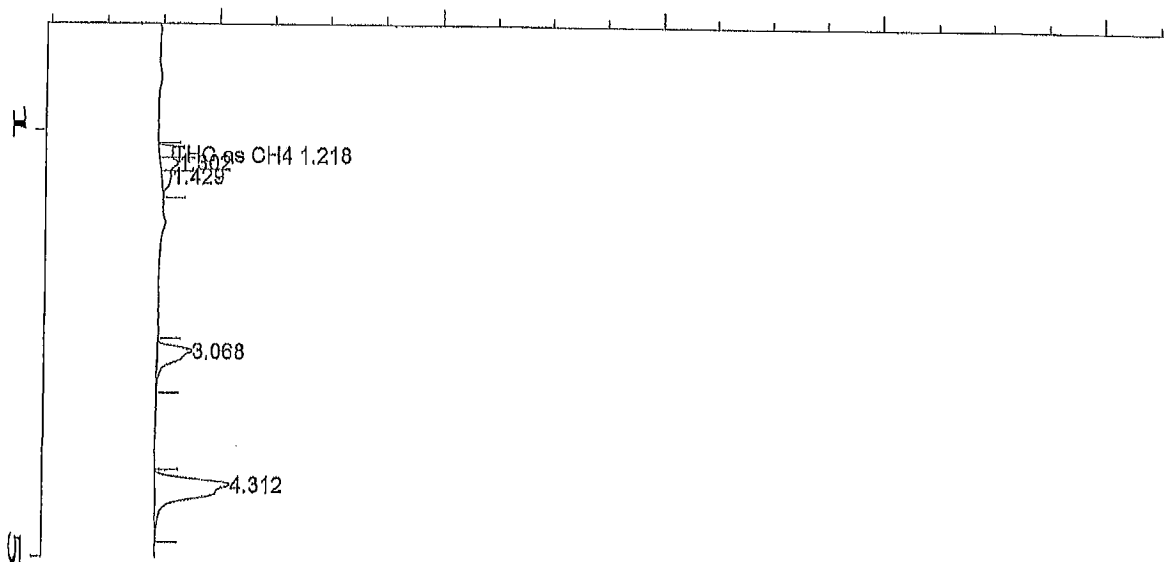


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T10B1B21.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T10B1B 73334 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:28 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:33 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1B -  
 Tr#73334 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T10B1B21.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.201	359	VV	0.048	1	0.268	THC as CH4
1.133	446	BV	0.046		0.364	* uncalibrated *
1.283	2349	VB	0.123		1.919	* uncalibrated *
3.032	3223	BB	0.137		2.633	* uncalibrated *
4.272	4933	BV	0.095		4.029	* uncalibrated *
4.359	4119	VB	0.093		3.364	* uncalibrated *

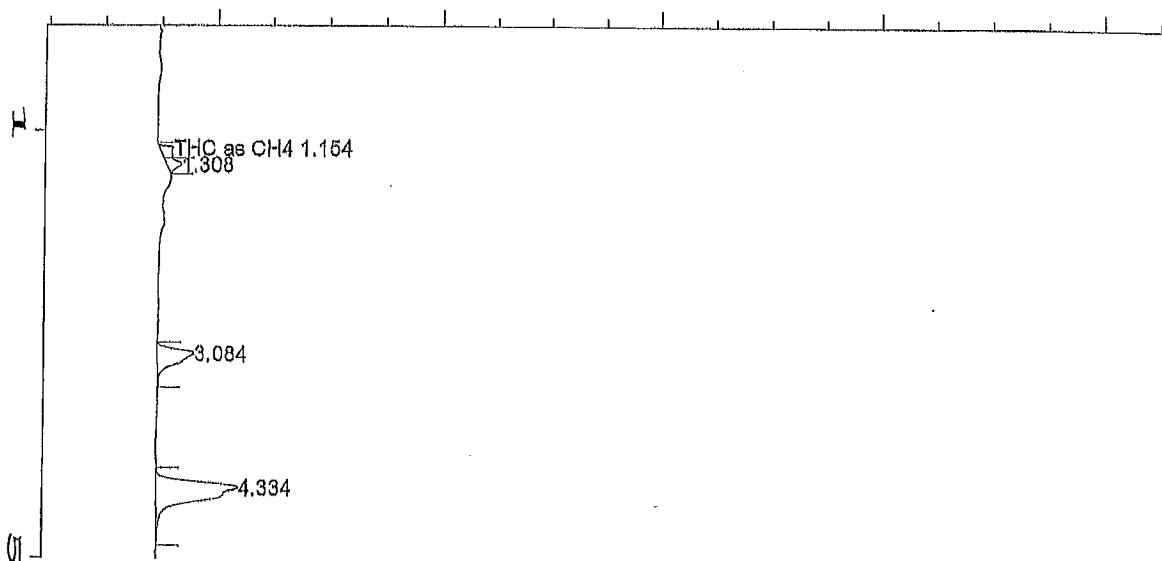


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T10B1B22.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T10B1B 73334 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1B -  
 Tr#73334 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T10B1B22.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.218	828	BV	0.113	1	0.618	THC as CH4
1.302	989	VV	0.083		0.808	* uncalibrated *
1.429	783	VB	0.113		0.639	* uncalibrated *
3.068	2708	BB	0.124		2.212	* uncalibrated *
4.312	7585	BB	0.156		6.195	* uncalibrated *

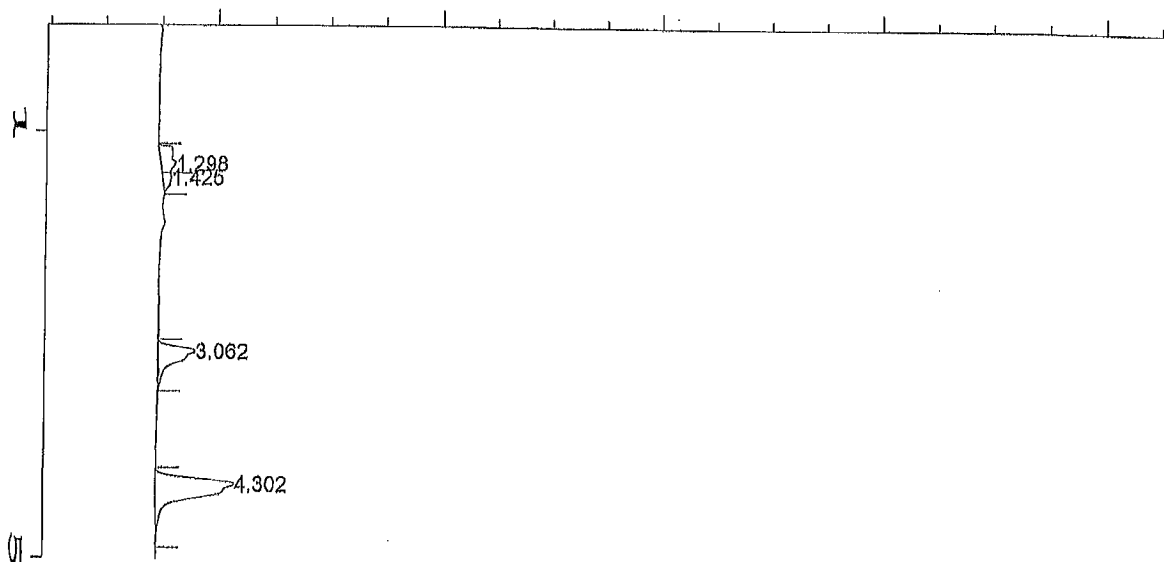


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1A23.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1A 73335 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:41 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:46 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1A -  
 Tr#73335 - 09:55 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1A23.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.154	635	BV	0.085	1	0.474	THC as CH4
1.308	695	VB	0.081		0.567	* uncalibrated *
3.084	2884	BB	0.122		2.356	* uncalibrated *
4.334	8289	BB	0.152		6.770	* uncalibrated *



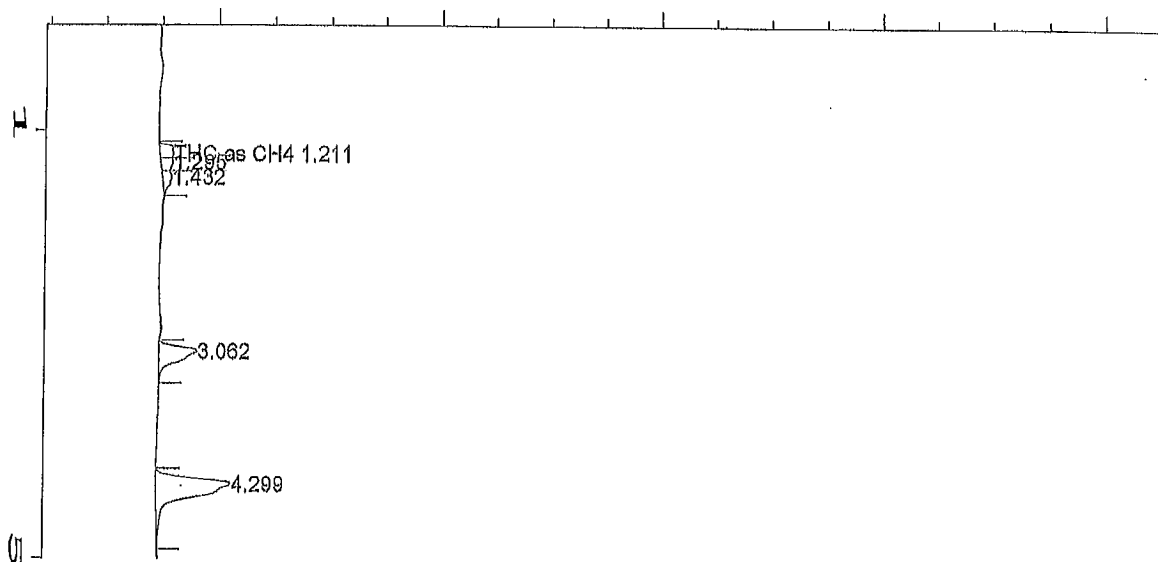
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1A24.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1A 73335 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:47 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:52 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1A -  
 Tr#73335 - 09:55 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1A24.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	* not found *			1		THC as CH4
1.298	1665	BV	0.158		1.360	* uncalibrated *
1.425	640	VB	0.109		0.522	* uncalibrated *
3.062	3164	BB	0.133		2.584	* uncalibrated *
4.302	8104	BV	0.160		6.619	* uncalibrated *

Not all calibrated peaks were found

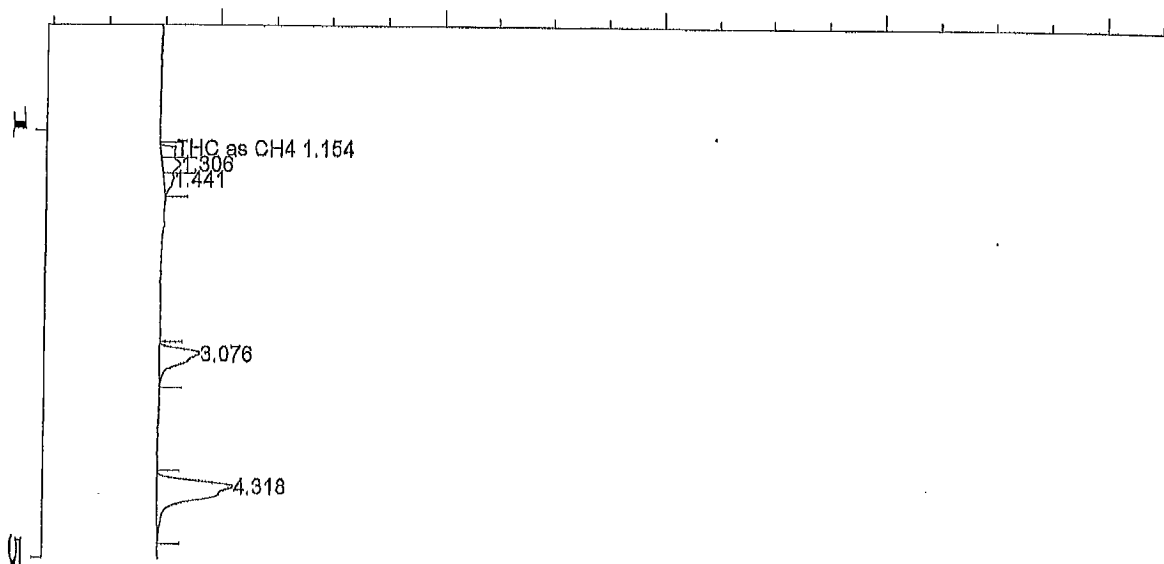


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1B25.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1B 73336 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:55 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:00 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1B -  
 Tr#73336 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1B25.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.211	866	BV	0.099	1	0.646	THC as CH4
1.295	656	VV	0.085		0.536	* uncalibrated *
1.432	695	VB	0.118		0.568	* uncalibrated *
3.062	2925	BB	0.121		2.389	* uncalibrated *
4.299	7520	BB	0.155		6.142	* uncalibrated *

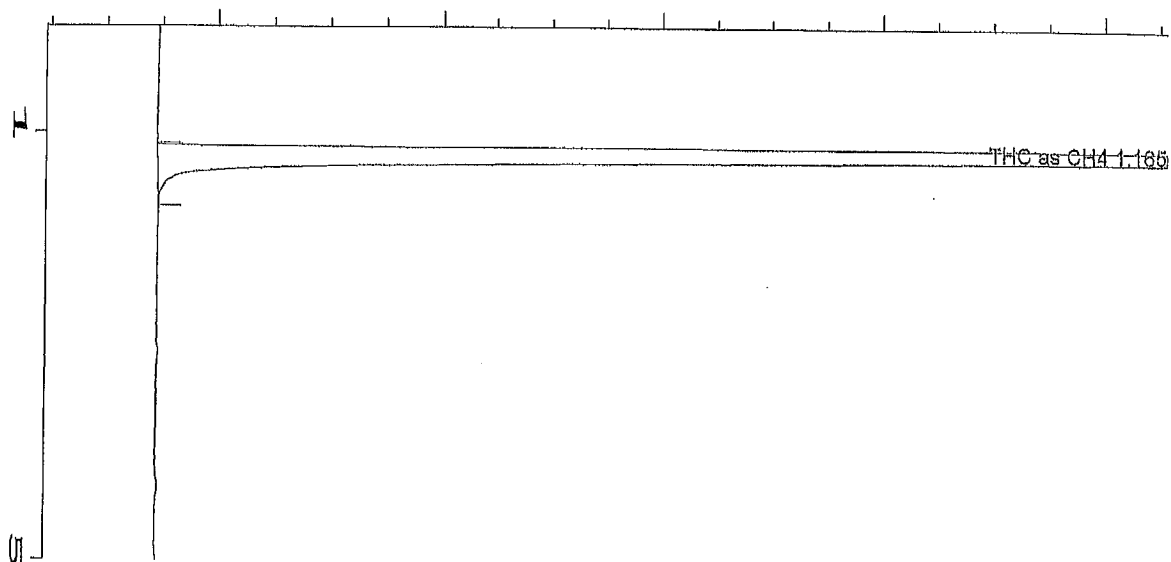


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1B26.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1B 73336 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:08 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:13 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1B -  
 Tr#73336 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1B26.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.154	791	BV	0.095	1	0.590	THC as CH4
1.306	1115	VV	0.092		0.911	* uncalibrated *
1.441	714	VB	0.113		0.583	* uncalibrated *
3.076	3191	BB	0.121		2.606	* uncalibrated *
4.318	7751	BB	0.157		6.331	* uncalibrated *



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 External Standard Report  
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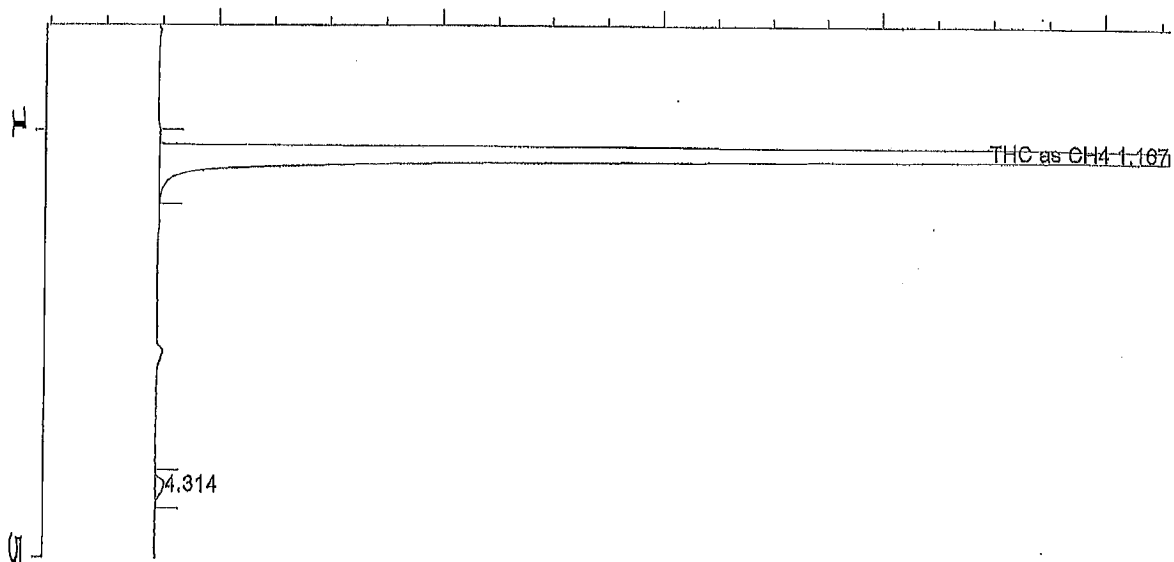
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0019.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:06 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:11 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0019.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	122101	BB	0.094	1	99.962	THC as CH4

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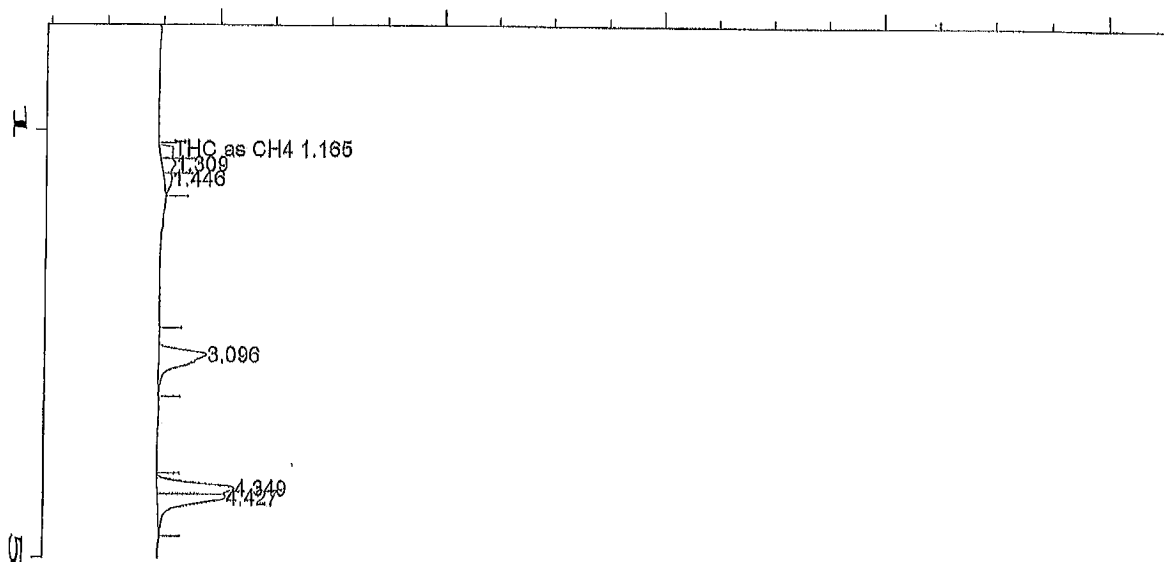


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:18 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	121584	BB	0.092	1	99.537	THC as CH4
4.314	762	BB	0.122		0.622	* uncalibrated *

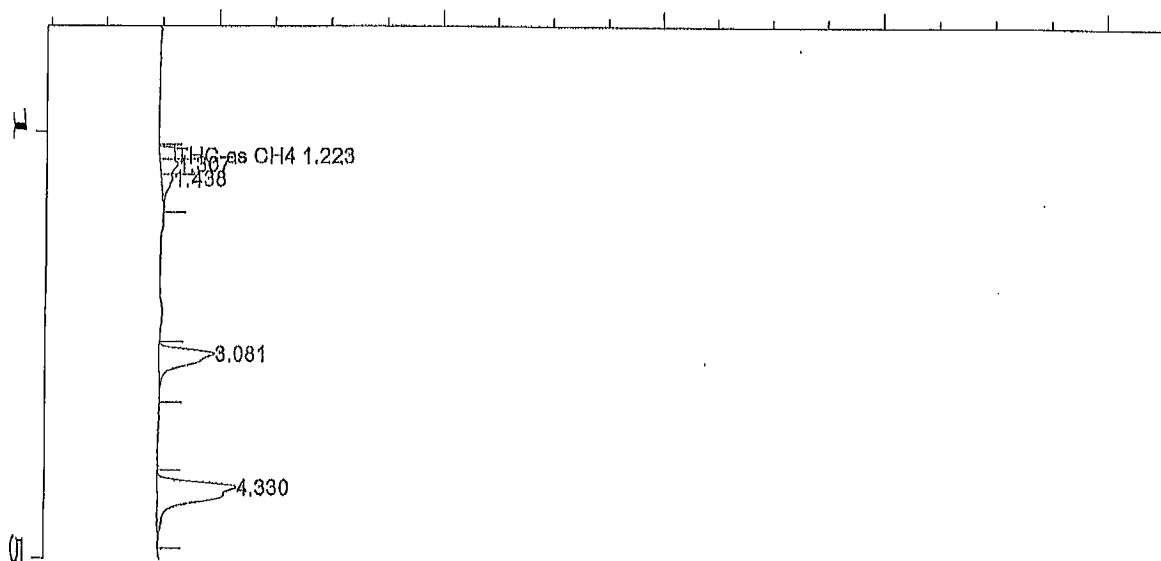


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1A28.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1A 73337 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:27 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:33 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1A -  
 Tr#73337 - 11:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1A28.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	773	BV	0.093	1	0.577	THC as CH4
1.309	824	VV	0.099		0.673	* uncalibrated *
1.446	576	VB	0.110		0.471	* uncalibrated *
3.096	3969	BV	0.131		3.241	* uncalibrated *
4.349	4252	BV	0.092		3.473	* uncalibrated *
4.427	3956	VB	0.094		3.231	* uncalibrated *

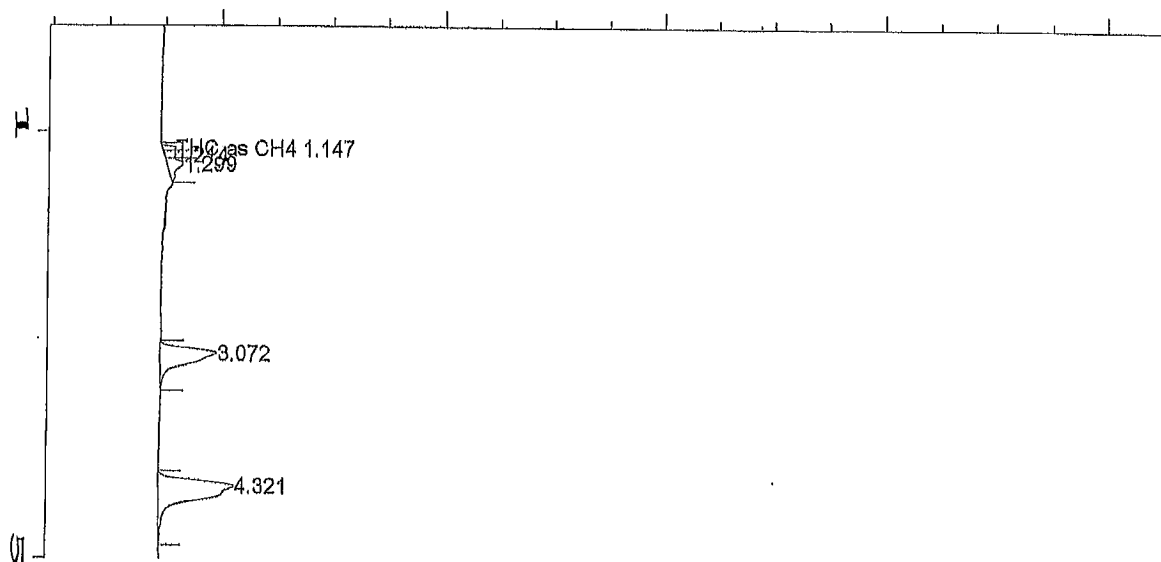


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1A29.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1A 73337 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1A -  
 Tr#73337 - 11:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1A29.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.223	925	BV	0.110	1	0.690	THC as CH4
1.307	1099	VV	0.105		0.898	* uncalibrated *
1.438	968	VB	0.119		0.791	* uncalibrated *
3.081	4475	BB	0.127		3.655	* uncalibrated *
4.330	8311	BB	0.161		6.788	* uncalibrated *

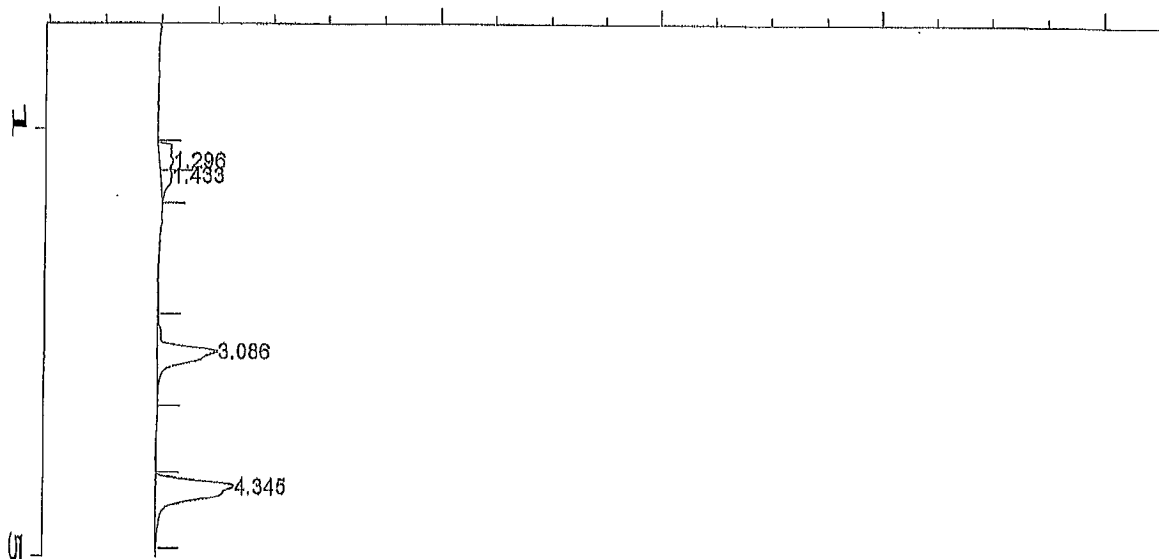


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1B30.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1B 73338 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:46 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:51 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1B -  
 Tr#73338 - 12:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1B30.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.147	260	BV	0.034	1	0.194	THC as CH4
1.214	425	VV	0.071		0.347	* uncalibrated *
1.299	1020	VB	0.096		0.833	* uncalibrated *
3.072	4528	BB	0.125		3.698	* uncalibrated *
4.321	7905	BB	0.158		6.456	* uncalibrated *



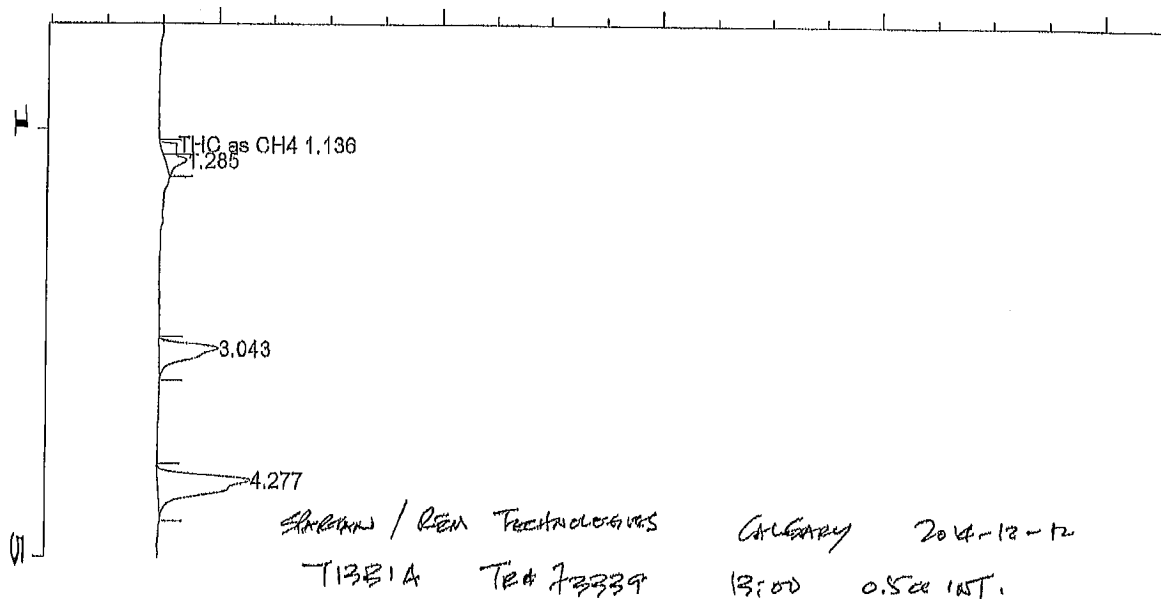
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1B31.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1B 73338 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:52 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:57 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1B -  
 Tr#73338 - 12:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1B31.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	* not found *			1		THC as CH4
1.296	1607	BV	0.175		1.313	* uncalibrated *
1.433	1035	VB	0.135		0.845	* uncalibrated *
3.086	5331	BB	0.136		4.354	* uncalibrated *
4.345	8114	BV	0.159		6.627	* uncalibrated *

Not all calibrated peaks were found

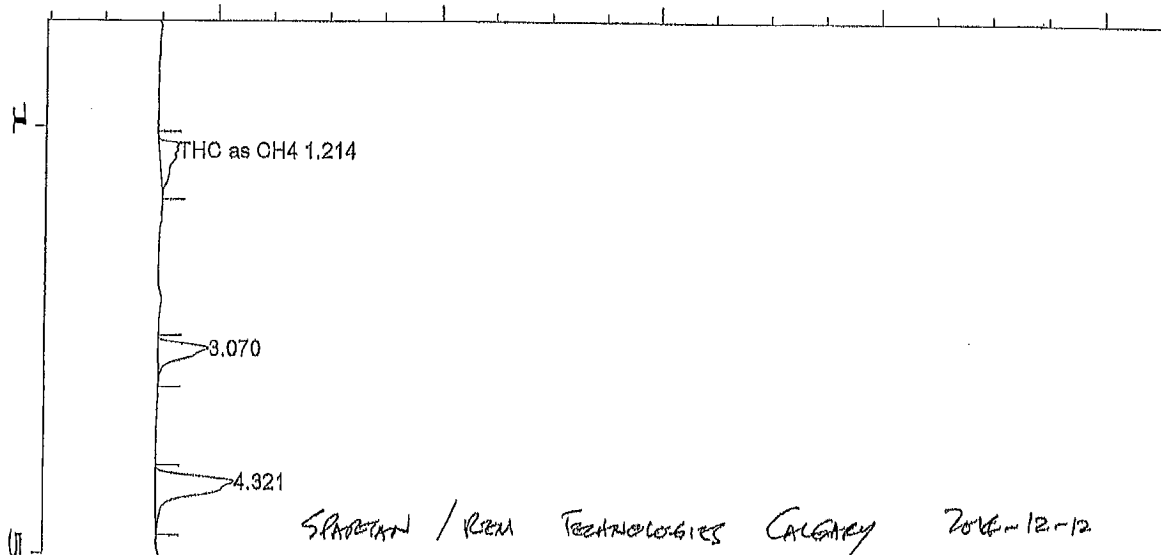


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1A32.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1A 73339 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:03 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:07 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1A32.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.136	892	BV	0.097	1	0.666	THC as CH4
1.285	1177	VB	0.090		0.962	* uncalibrated *
3.043	4660	BB	0.122		3.806	* uncalibrated *
4.277	9045	BB	0.149		7.388	* uncalibrated *



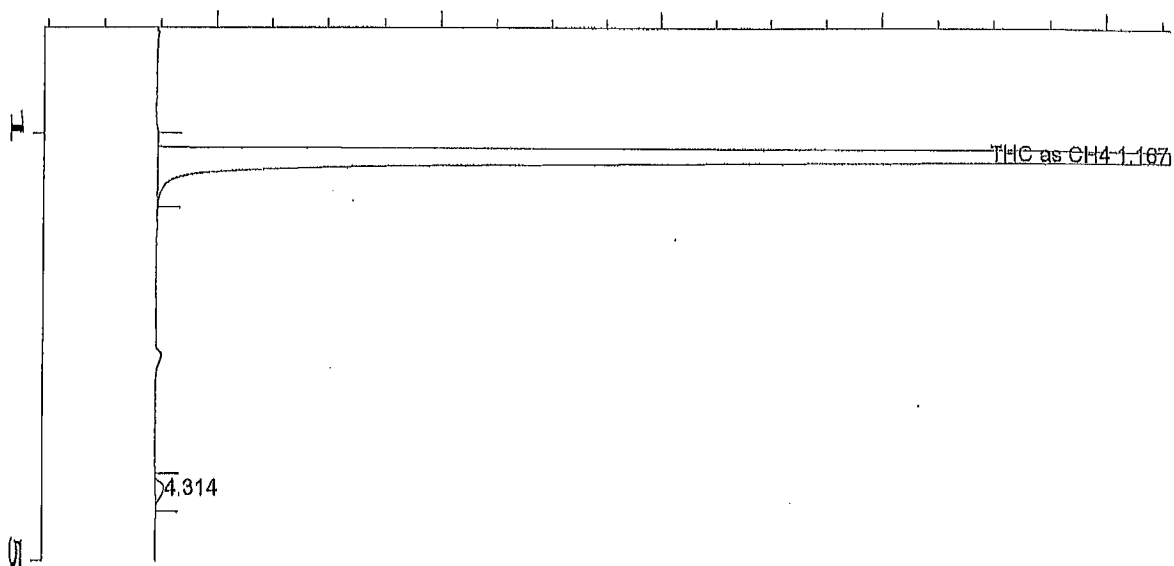
SPRINT / REM TECHNOLOGIES CALGARY 2014-12-12  
 T13B1A Test 73339 Bio 0.5cc (0.5)

External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1A33.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1A 73339 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:09 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:16 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1A33.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.214	2759	BB	0.226	1	2.059	THC as CH4
3.070	3878	BB	0.124		3.168	* uncalibrated *
4.321	7868	BB	0.156		6.426	* uncalibrated *



=====  
 External Standard Report  
 =====

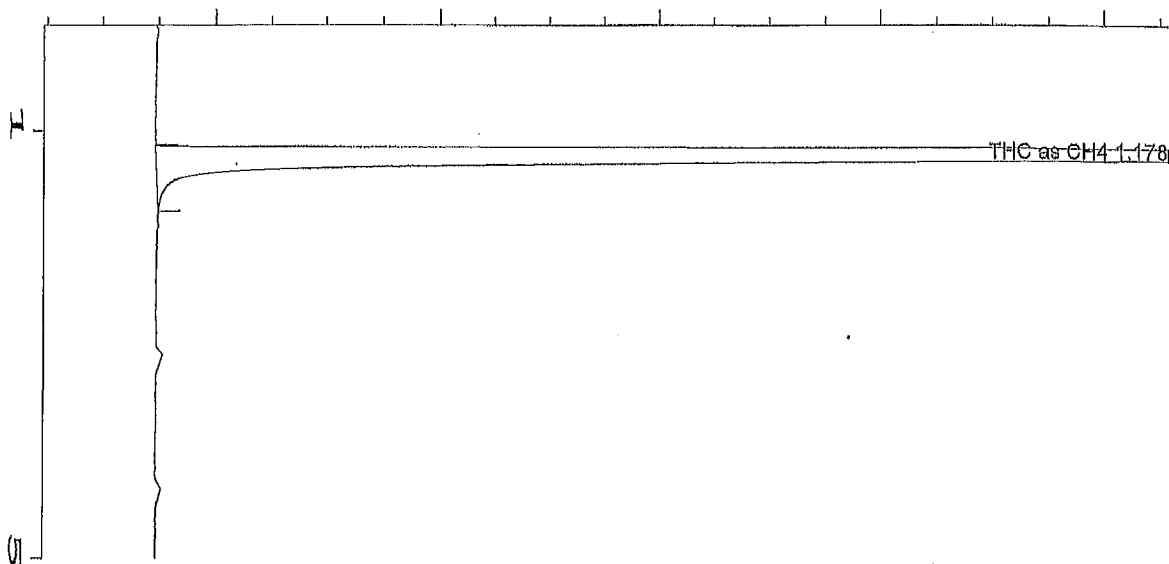
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:18 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	121584	BB	0.092	1	99.537	THC as CH4
4.314	762	BB	0.122		0.622	* uncalibrated *

=====



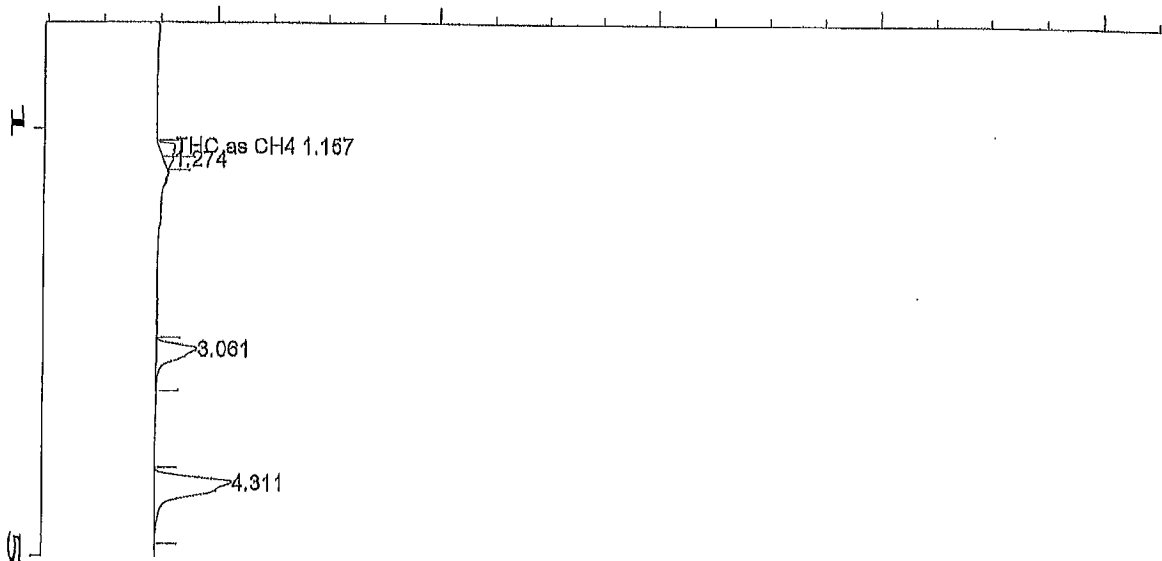


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:19 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:24 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.178	121222	BB	0.098	1	99.239	THC as CH4

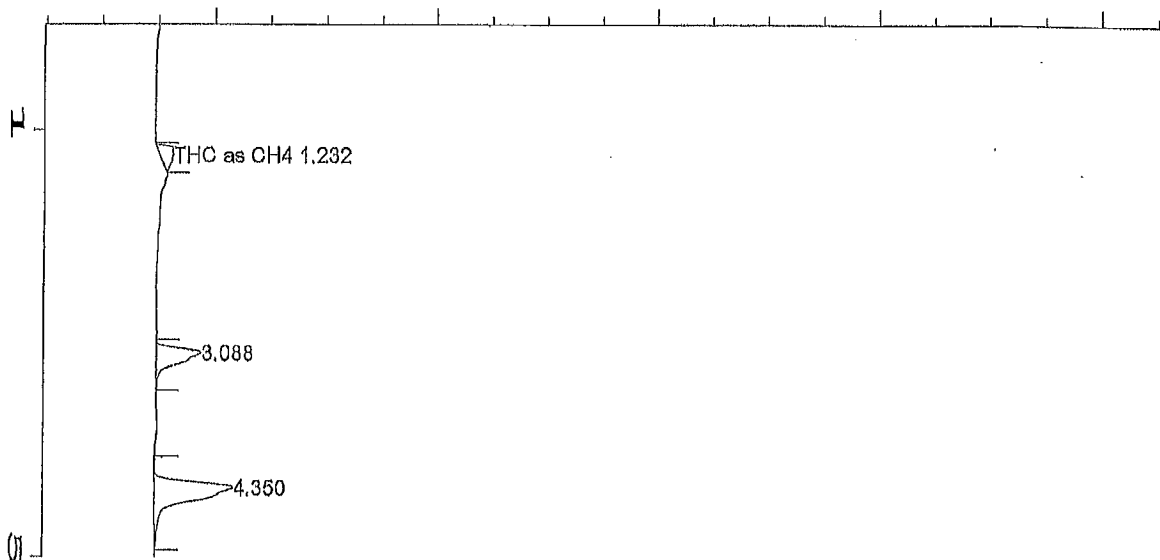


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1B35.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1B 73340 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:30 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:35 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13B1B -  
 Tr#73340 - 13:35 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1B35.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.157	899	BV	0.104	1	0.671	THC as CH4
1.274	427	VV	0.067		0.348	* uncalibrated *
3.061	3181	BB	0.124		2.598	* uncalibrated *
4.311	7637	BB	0.153		6.237	* uncalibrated *

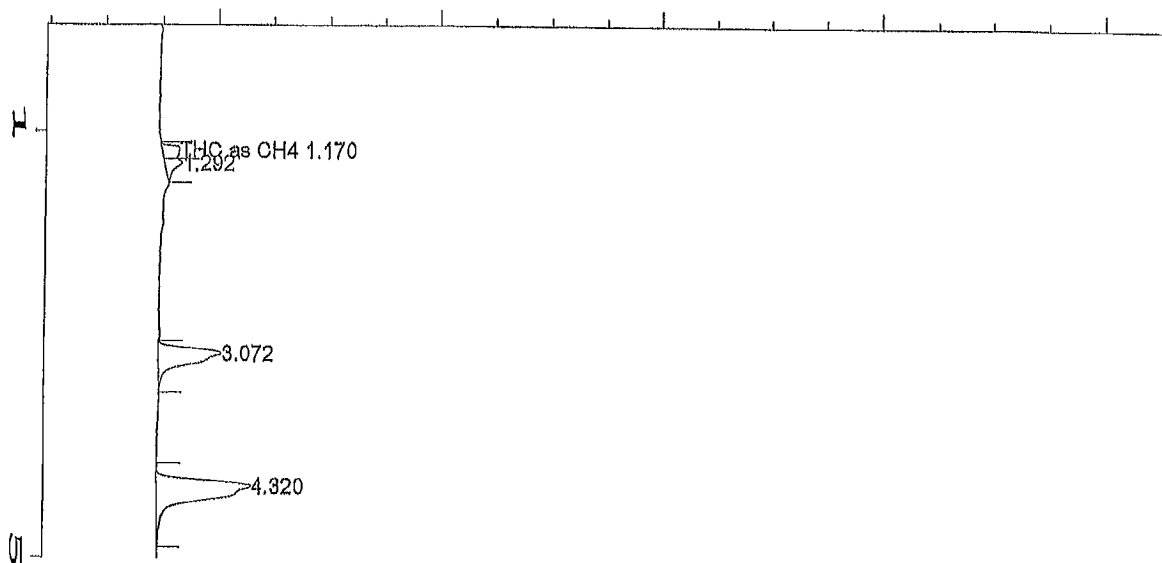


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1B36.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1B 73340 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:38 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:43 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13B1B -  
 Tr#73340 - 13:35 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1B36.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.232	1276	BB	0.134	1	0.953	THC as CH4
3.088	3580	BB	0.126		2.924	* uncalibrated *
4.350	7872	BB	0.152		6.429	* uncalibrated *

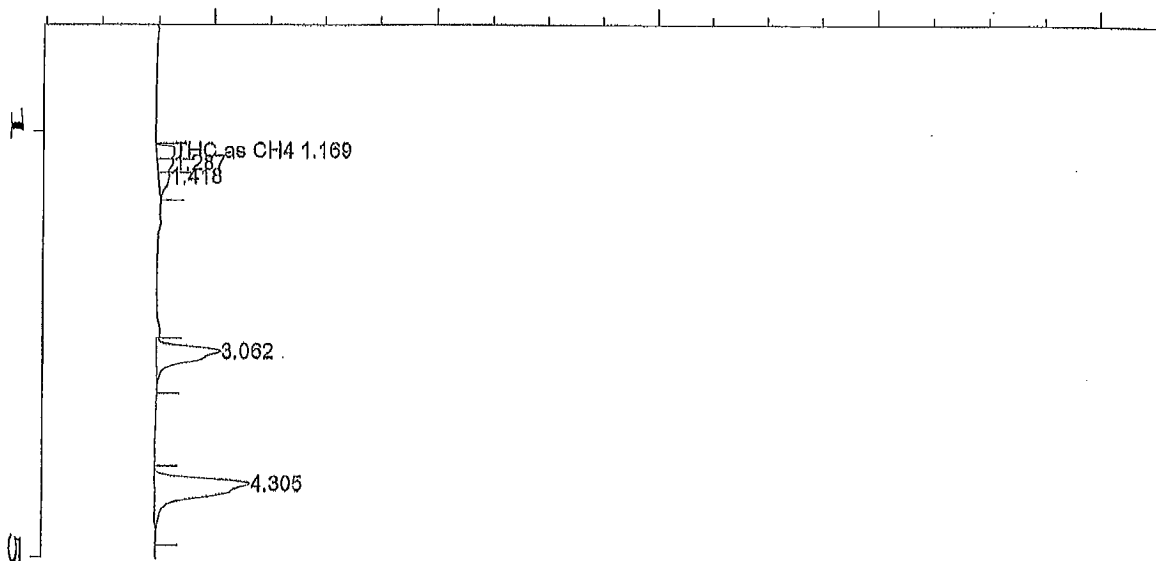


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1A37.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1A 73341 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:48 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:53 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1A -  
 Tr#73341 - 14:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1A37.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.170	1061	BV	0.088	1	0.792	THC as CH4
1.292	1003	VB	0.092		0.820	* uncalibrated *
3.072	5202	BB	0.127		4.249	* uncalibrated *
4.320	9766	BB	0.157		7.977	* uncalibrated *

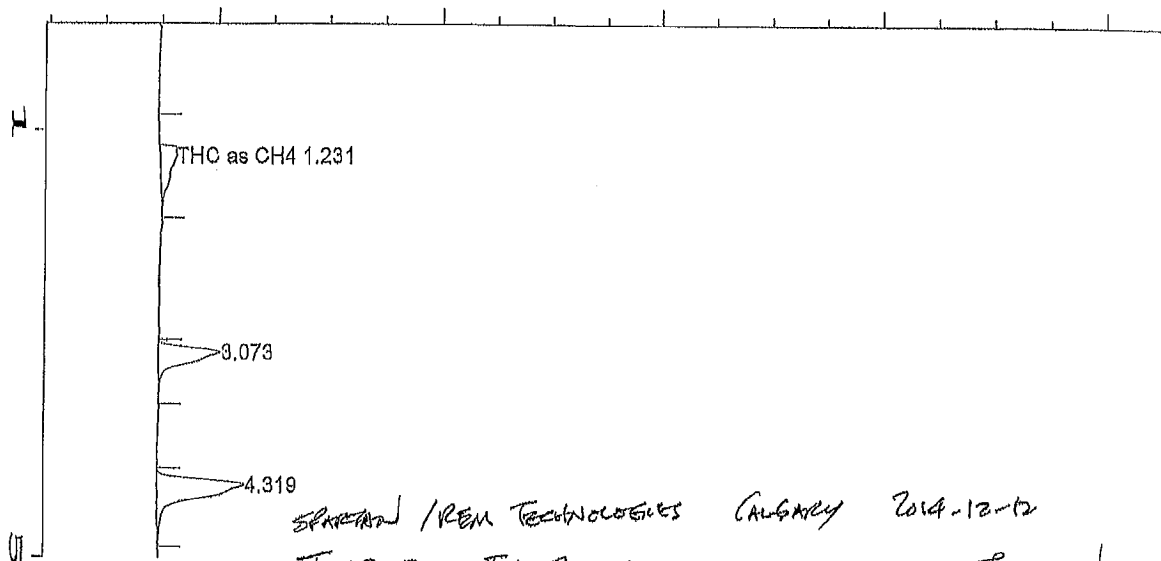


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1A38.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1A 73341 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:54 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:59 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1A -  
 Tr#73341 - 14:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1A38.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	1097	BV	0.100	1	0.819	THC as CH4
1.287	941	VV	0.089		0.769	* uncalibrated *
1.418	838	VB	0.111		0.684	* uncalibrated *
3.062	5240	VB	0.128		4.280	* uncalibrated *
4.305	9478	BB	0.152		7.741	* uncalibrated *



SPRINT / REM TECHNOLOGIES CALGARY 2014-12-12  
 T14B1B TR# 73342 15:05 0.5cc Injection

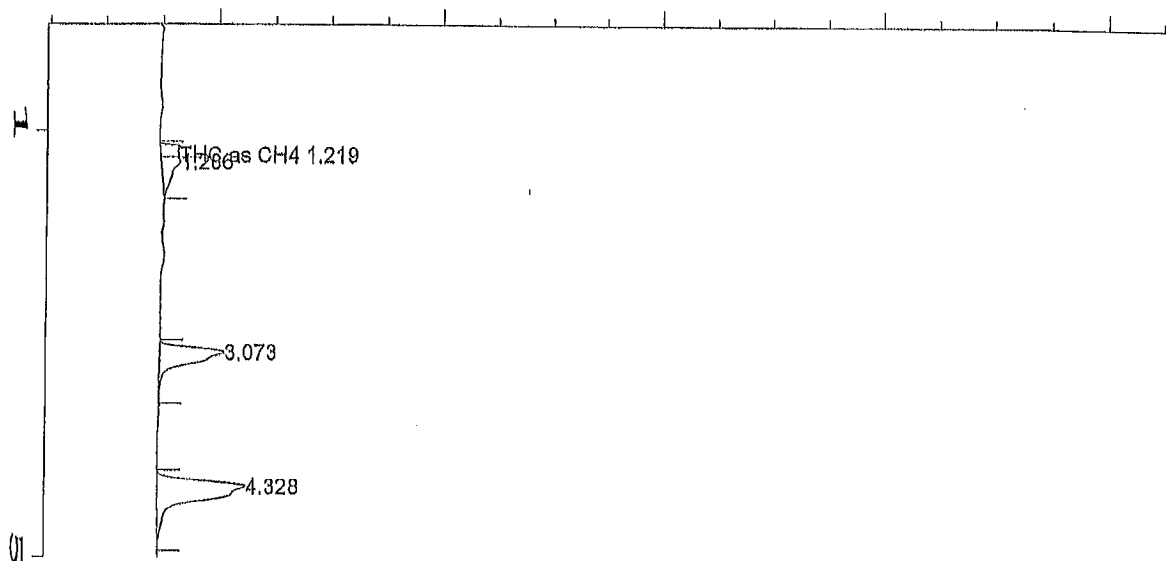
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B39.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:10 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:15 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B39.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.231	2648	PB	0.248	1	1.976	THC as CH4
3.073	4891	VB	0.134		3.995	* uncalibrated *
4.319	8505	BV	0.151		6.946	* uncalibrated *

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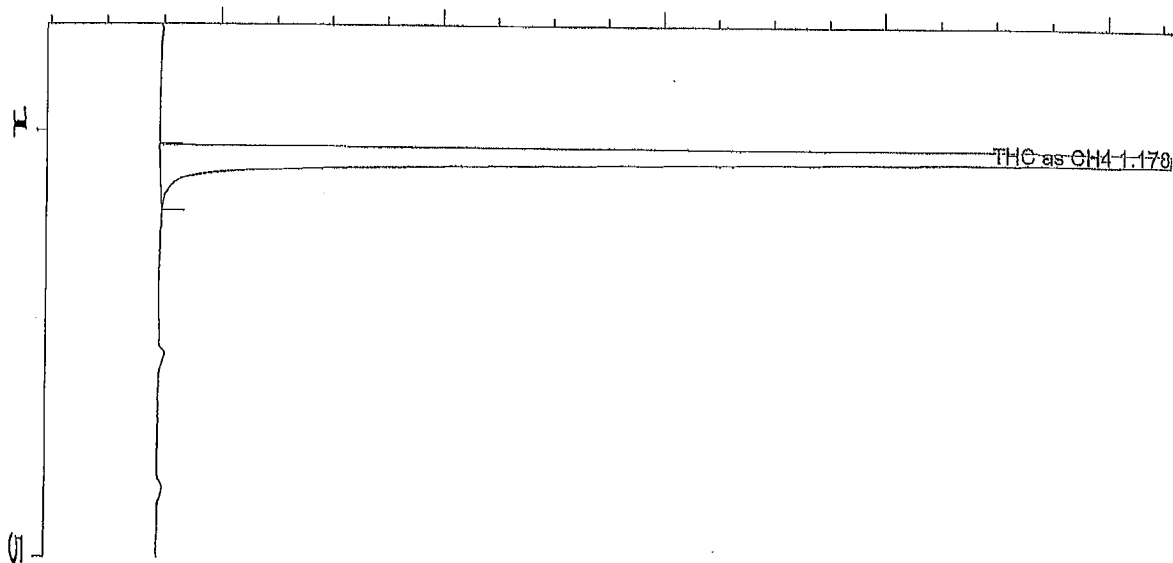


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B41.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:22 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:27 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1B -  
 Tr#73342 - 15:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B41.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.219	1094	BV	0.114	1	0.817	THC as CH4
1.286	1835	VB	0.143		1.499	* uncalibrated *
3.073	5311	BB	0.129		4.338	* uncalibrated *
4.328	9458	BV	0.163		7.725	* uncalibrated *



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 External Standard Report  
 =====

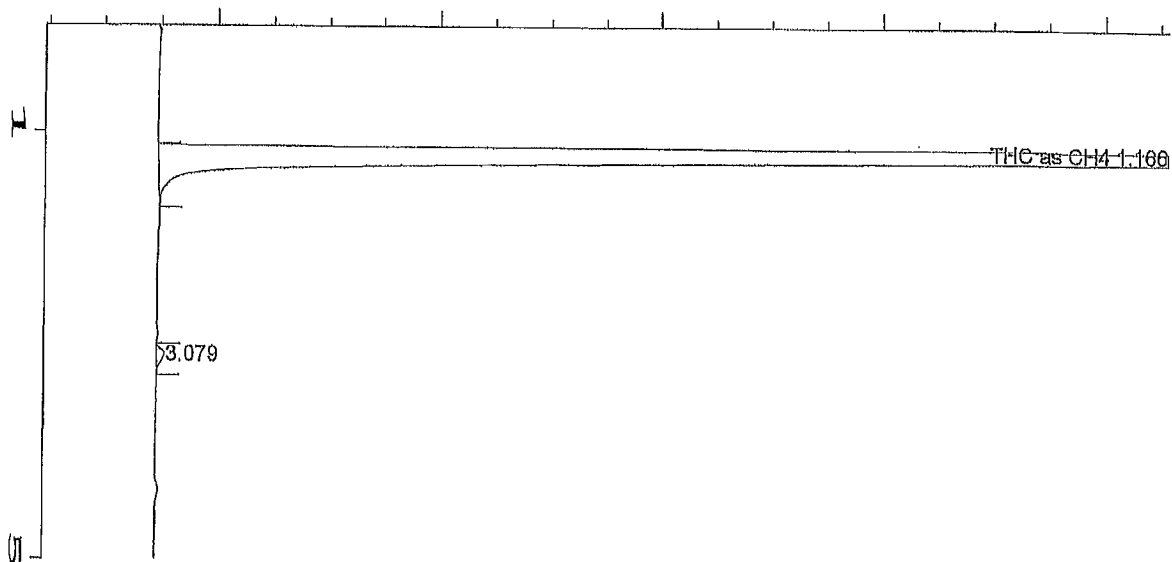
Data File Name	: C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D	
Operator	: Maxxam - GC ID#4130 - BW	Page Number : 1
Instrument	: GC ID4130	Vial Number :
Sample Name	: Span 0.5	Injection Number :
Run Time Bar Code:		Sequence Line :
Acquired on	: 13 Dec 14 02:19 PM	Instrument Method: M18-DB-L.MTH
Report Created on:	13 Dec 14 02:25 PM	Analysis Method : M18-DB-L.MTH
Last Recalib on	: 13 Dec 14 12:01 PM	Sample Amount : 0
Multiplier	: 1	ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.178	121222	BB	0.098	1	99.239	THC as CH4

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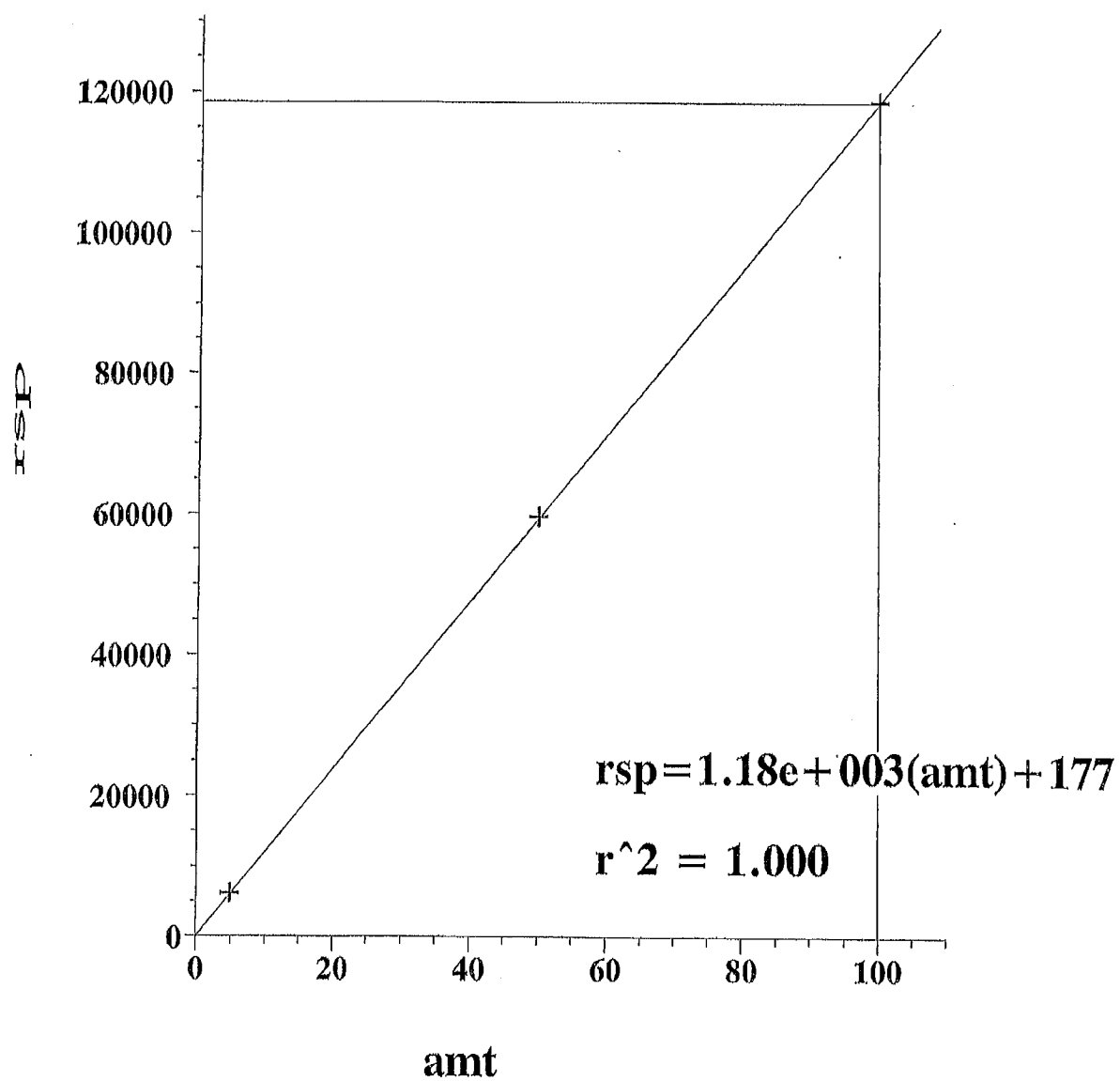
# External Standard Report

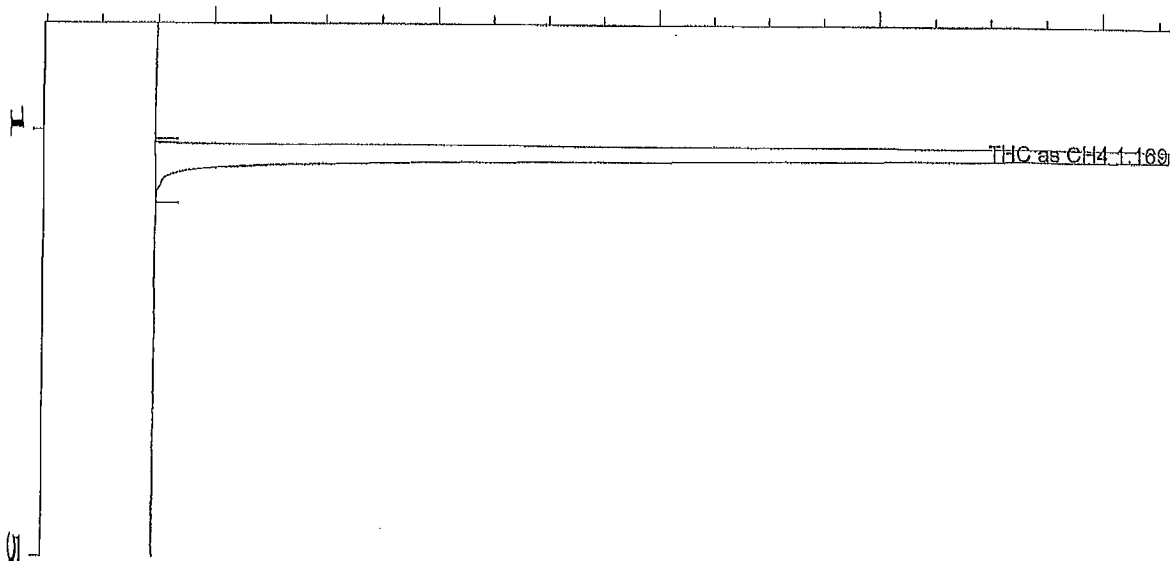
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B42.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:49 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1B -  
 Tr#73342 - 15:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B42.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.166	121230	BB	0.095	1	99.245	THC as CH4
3.079	569	BB	0.109		0.464	* uncalibrated *

# THC as CH4





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 External Standard Report  
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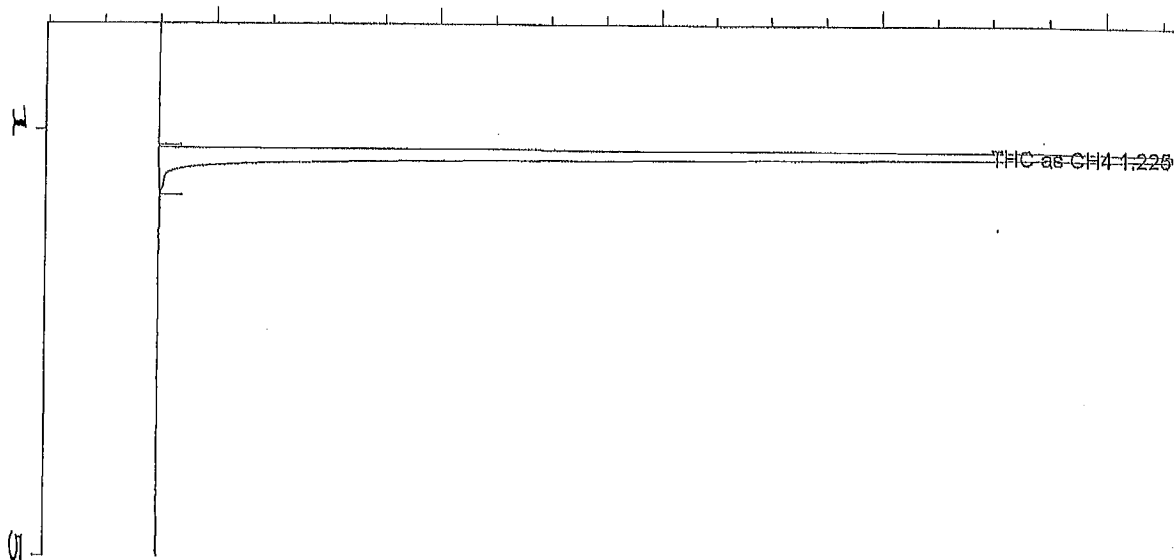
```

Data File Name   : C:\HPCHEM\2\DATA\2014\20141211\1CAL0001.D
Operator        : Maxxam - GC ID#4130 - BW
Instrument       : GC ID4130
Sample Name     : Cal 1 0.5 cc
Run Time Bar Code:
Acquired on    : 11 Dec 14 02:15 PM
Report Created on: 11 Dec 14 02:42 PM
Last Recalib on : 11 Dec 14 02:41 PM
Multiplier     : 1
Page Number    : 1
Vial Number    :
Injection Number:
Sequence Line  :
Instrument Method: M18-DB-L.MTH
Analysis Method : M18-DB-L.MTH
Sample Amount  : 0
ISTD Amount    :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\1CAL0001.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	118589	BB	0.097	1	99.948	THC as CH4

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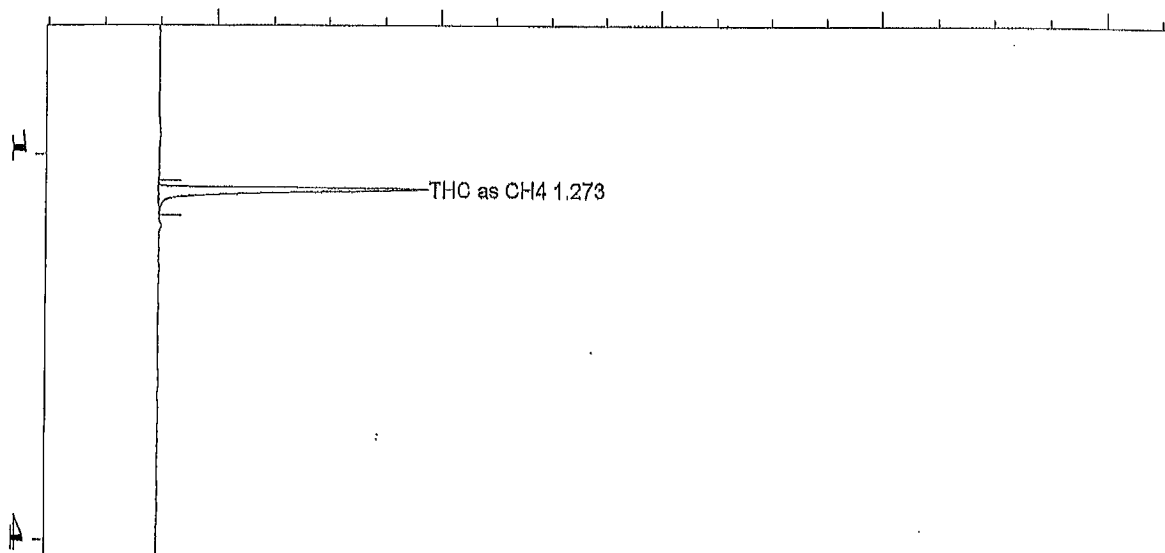
External Standard Report

```

Data File Name   : C:\HPCHEM\2\DATA\2014\20141211\2CAL0002.D
Operator        : Maxxam - GC ID#4130 - BW
Instrument       : GC ID4130
Sample Name     : Cal 2 0.25 cc
Run Time Bar Code:
Acquired on    : 11 Dec 14 02:27 PM
Report Created on: 11 Dec 14 02:42 PM
Last Recalib on : 11 Dec 14 02:41 PM
Multiplier     : 1
Page Number    : 1
Vial Number    :
Injection Number:
Sequence Line :
Instrument Method: M18-DB-L.MTH
Analysis Method : M18-DB-L.MTH
Sample Amount  : 0
ISTD Amount    :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\2CAL0002.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.225	59543	BB	0.071	1	50.109	THC as CH4



=====  
 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\2\DATA\2014\20141211\3CAL0003.D	Page Number	: 1
Operator	: Maxxam - GC ID#4130 - BW	Vial Number	:
Instrument	: GC ID4130	Injection Number	:
Sample Name	: Cal 3 0.025 cc	Sequence Line	:
Run Time Bar Code:		Instrument Method	: M18-DB-L.MTH
Acquired on	: 11 Dec 14 02:34 PM	Analysis Method	: M18-DB-L.MTH
Report Created on:	11 Dec 14 02:42 PM	Sample Amount	: 0
Last Recalib on	: 11 Dec 14 02:41 PM	ISTD Amount	:
Multiplier	: 1		

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\3CAL0003.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.273	6033	BB	0.038	1	4.944	THC as CH4

=====

# Method Information

FID - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 200 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.060	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-1	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.225	1	100.0	8.4325e-004	1	THC as CH4
		2	50.0	8.3973e-004		
		3	5.0	8.2877e-004		

## Calibration Settings

### Title:

THC Calibration as CH4 - 2014-12-11

Reference window:	50.000 %
Non-reference window:	50.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	8.4325e-004
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

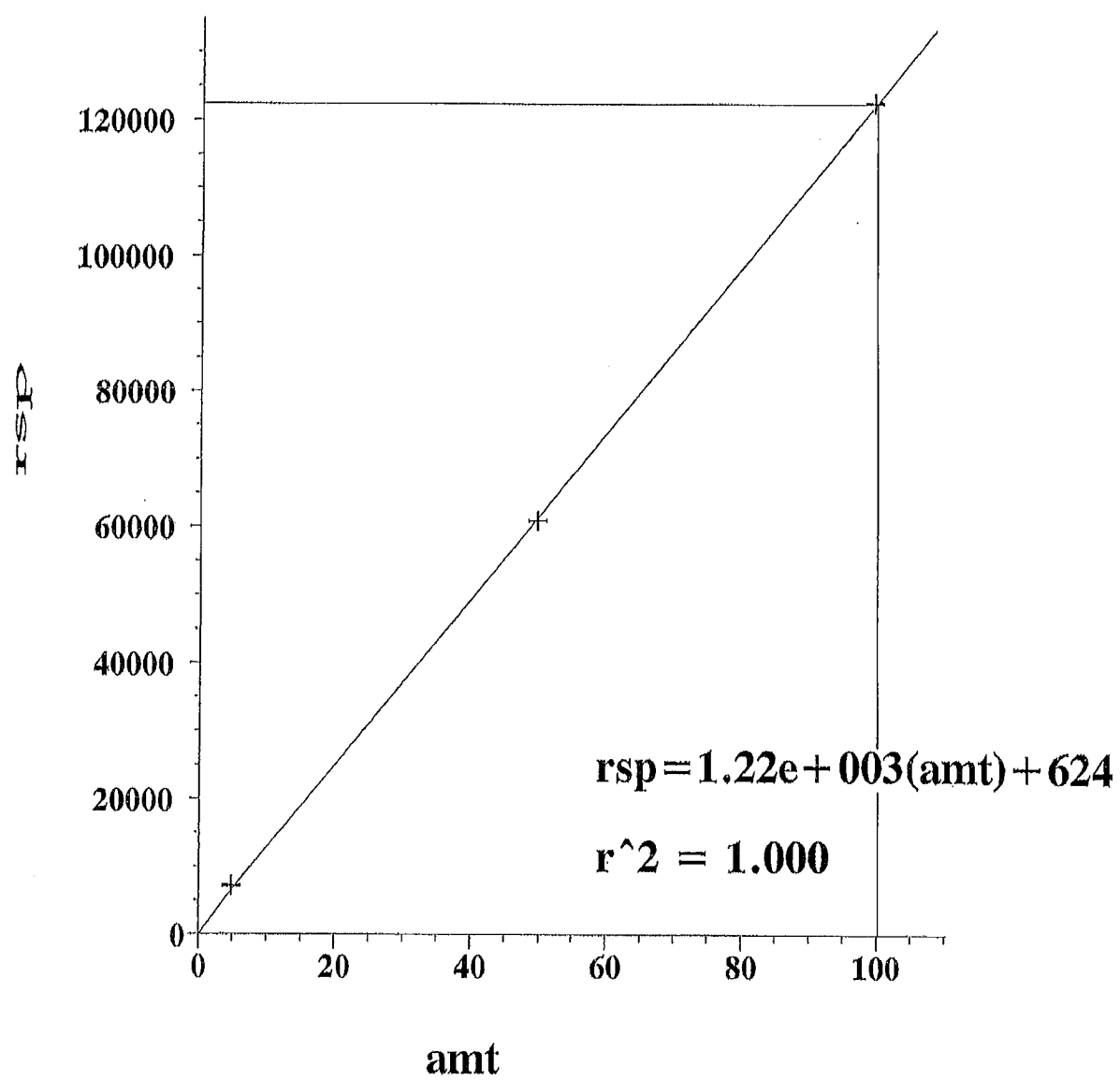
## Sample ISTD Information

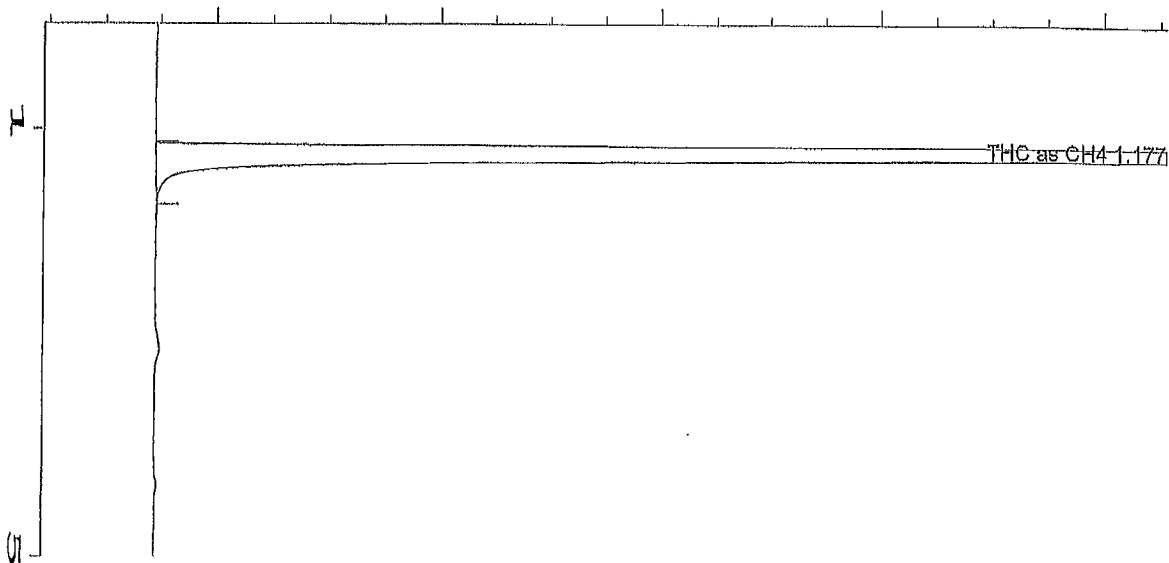
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

# THC as CH4





# External Standard Report

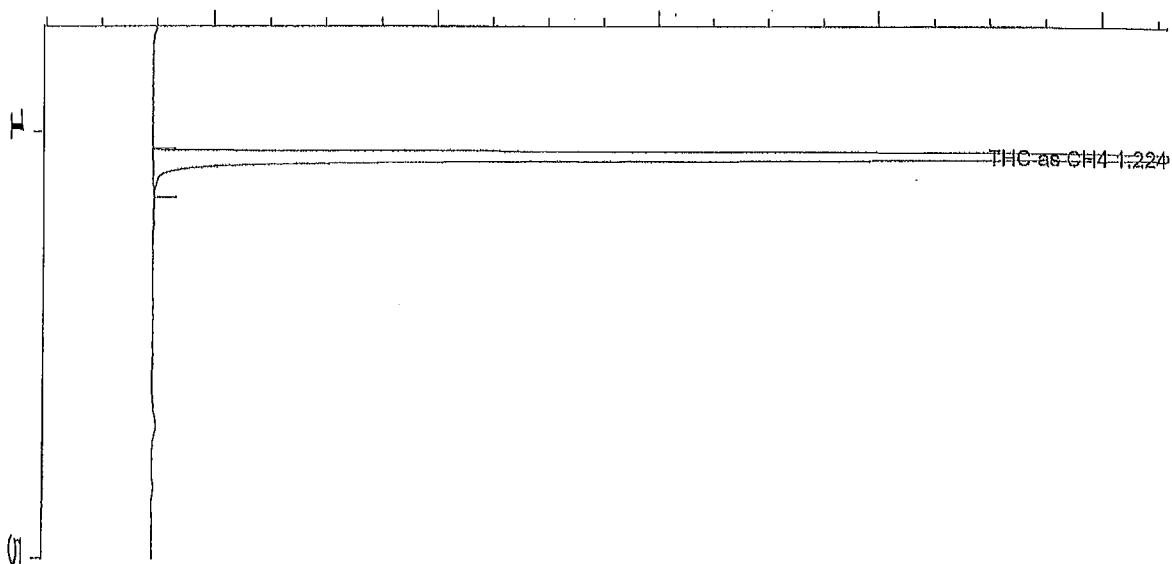
```

Data File Name   : C:\HPCHEM\2\DATA\2014\20141211\1CAL0015.D
Operator        : Maxxam - GC ID#4130 - BW
Instrument       : GC ID4130
Sample Name     : Cal 1 0.5 cc
Run Time Bar Code :
Acquired on    : 13 Dec 14 11:29 AM
Report Created on: 13 Dec 14 12:03 PM
Last Recalib on : 13 Dec 14 12:01 PM
Multiplier     : 1
Page Number    : 1
Vial Number    :
Injection Number :
Sequence Line  :
Instrument Method: M18-DB-L.MTH
Analysis Method : M18-DB-L.MTH
Sample Amount   : 0
ISTD Amount     :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\1CAL0015.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	122435	BB	0.100	1	100.236	THC as CH4





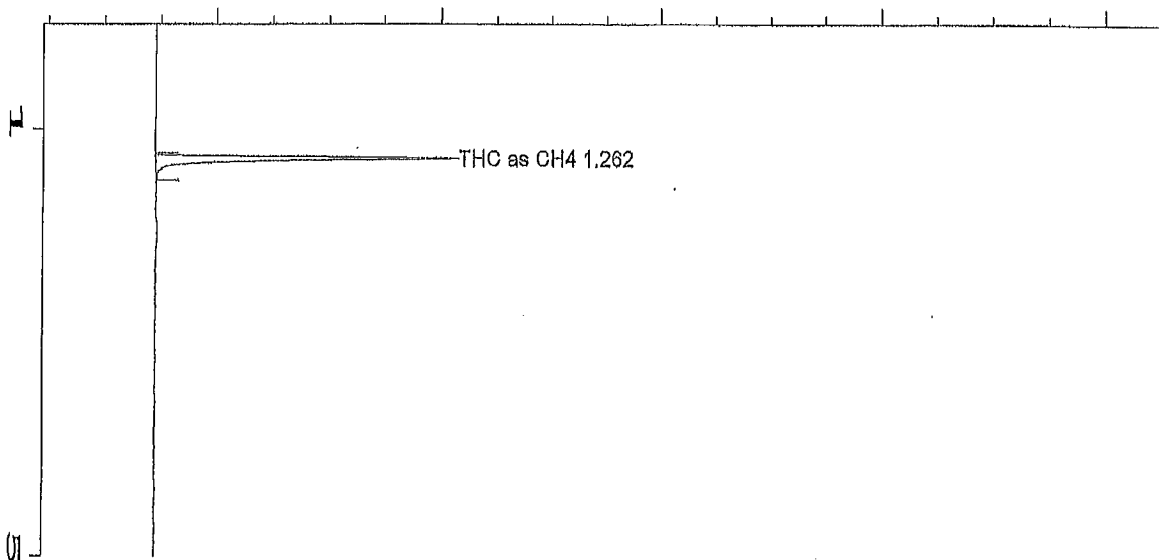
# External Standard Report

```

Data File Name      : C:\HPCHEM\2\DATA\2014\20141211\2CAL0016.D
Operator           : Maxxam - GC ID#4130 - BW      Page Number      : 1
Instrument          : GC ID4130                   Vial Number       :
Sample Name        : Cal 2 0.25 cc                Injection Number  :
Run Time Bar Code  :                               Sequence Line    :
Acquired on        : 13 Dec 14 11:37 AM           Instrument Method: M18-DB-L.MTH
Report Created on  : 13 Dec 14 12:04 PM           Analysis Method  : M18-DB-L.MTH
Last Recalib on   : 13 Dec 14 12:01 PM           Sample Amount    : 0
Multiplier         : 1                           ISTD Amount      :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\2CAL0016.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.224	60779	BB	0.070	1	49.501	THC as CH4



=====  
 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\2\DATA\2014\20141211\3CAL0018.D	
Operator	: Maxxam - GC ID#4130 - BW	Page Number : 1
Instrument	: GC ID4130	Vial Number :
Sample Name	: Cal 2 0.025 cc	Injection Number :
Run Time Bar Code:		Sequence Line :
Acquired on	: 13 Dec 14 11:46 AM	Instrument Method: M18-DB-L.MTH
Report Created on:	13 Dec 14 12:04 PM	Analysis Method : M18-DB-L.MTH
Last Recalib on	: 13 Dec 14 12:01 PM	Sample Amount : 0
Multiplier	: 1	ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\3CAL0018.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.262	7020	BB	0.040	1	5.263	THC as CH4

=====

Method: C:\HPCHEM\2\METHODS\M18-DB-L.MTH

## Method Information

FTD - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 200 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.060	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-1	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.177	1	100.0	8.1676e-004	1	THC as CH4
		2	50.0	8.2265e-004		
		3	5.0	7.123e-004		

## Calibration Settings

## Title:

THC Calibration as CH4 - 2014-12-13

Reference window:	20.000 %
Non-reference window:	20.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	8.1676e-004
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

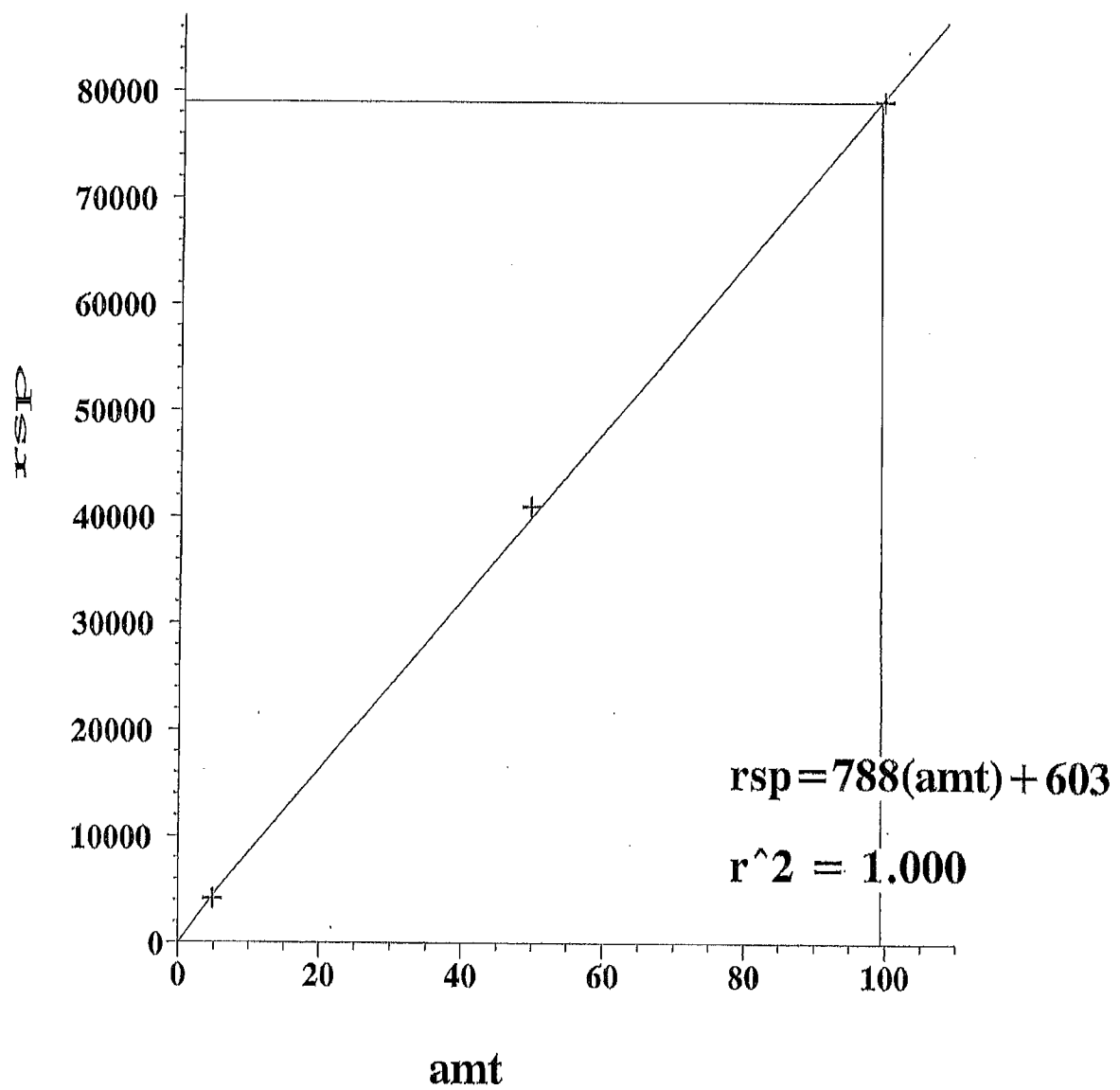
## Sample ISTD Information

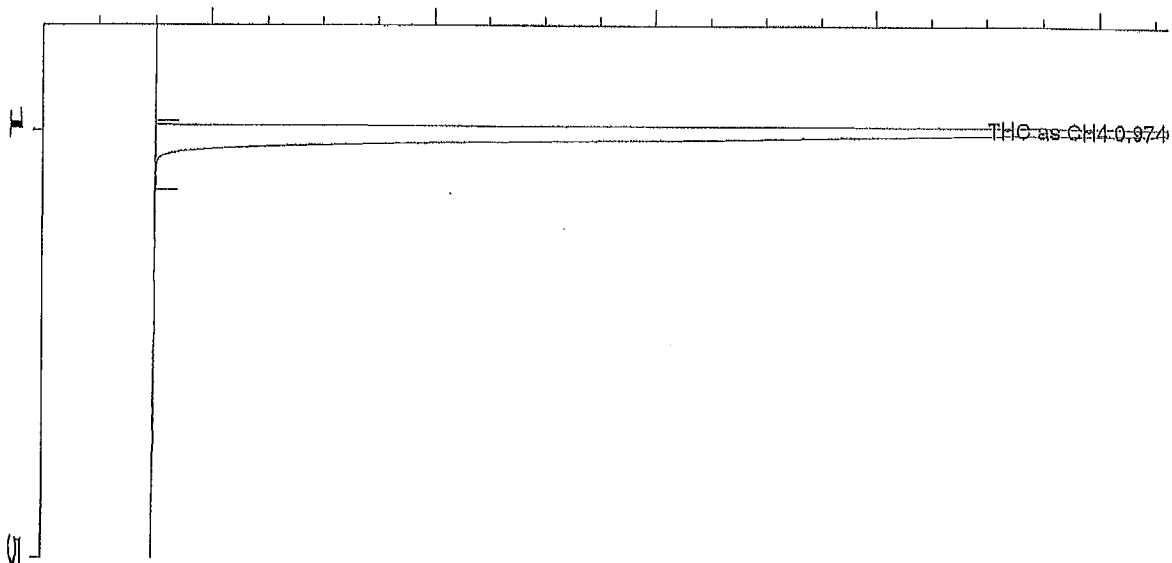
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

# THC as CH4





=====  
 External Standard Report  
 =====

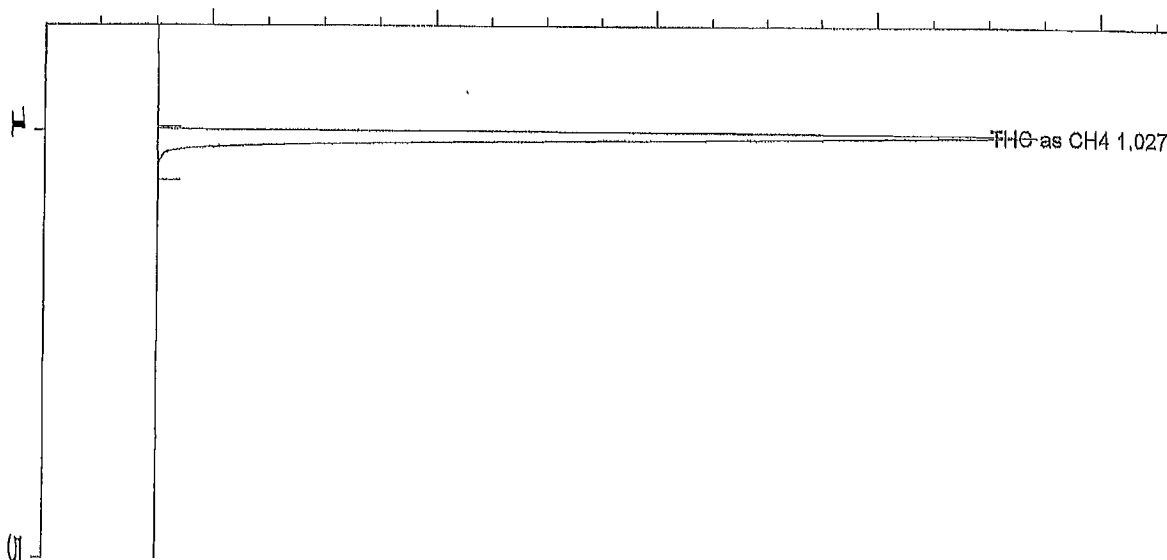
```

Data File Name   : C:\HPCHEM\1\DATA\2014\20141211\1CAL0050.D
Operator        : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument       : GC ID4284                     Vial Number            :
Sample Name      : Cal 1 0.5 cc                   Injection Number       :
Run Time Bar Code:                               Sequence Line          :
Acquired on      : 11 Dec 14 02:14 PM              Instrument Method: M18-DB1.MTH
Report Created on: 11 Dec 14 02:39 PM              Analysis Method  : M18-DB1.MTH
Last Recalib on  : 11 Dec 14 02:38 PM              Sample Amount         : 0
Multiplier       : 1                               ISTD Amount           :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\1CAL0050.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.974	79025	BB	0.098	1	99.475	THC as CH4

=====



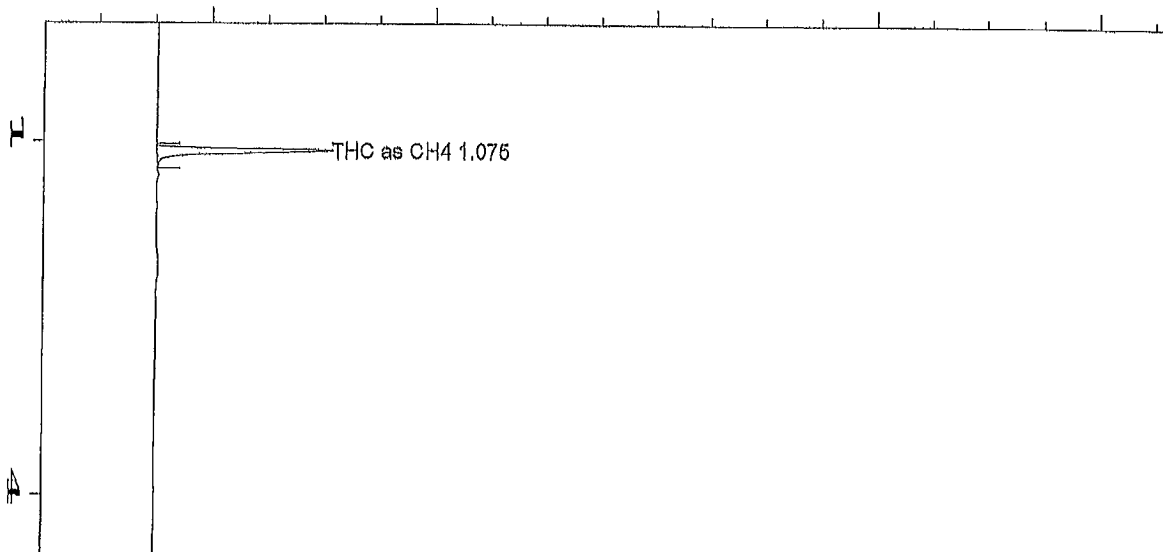
# External Standard Report

```

Data File Name       : C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D
Operator            : Maxxam - GC 1D# 4284 - BW
Instrument          : GC ID4284
Sample Name         : Cal 2 0.25 cc
Run Time Bar Code   :
Acquired on         : 11 Dec 14 02:27 PM
Report Created on   : 11 Dec 14 02:39 PM
Last Recalib on    : 11 Dec 14 02:38 PM
Multiplier          : 1
Page Number         : 1
Vial Number         :
Injection Number    :
Sequence Line       :
Instrument Method    : M18-DB1.MTH
Analysis Method     : M18-DB1.MTH
Sample Amount       : 0
ISTD Amount         :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	40894	BB	0.080	1	51.107	THC as CH4



=====  
 External Standard Report  
 =====

```

Data File Name   : C:\HPCHEM\1\DATA\2014\20141211\3CAL0052.D
Operator        : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument       : GC ID4284                     Vial Number            :
Sample Name      : Cal 3 0.025 cc                 Injection Number       :
Run Time Bar Code:                               Sequence Line         :
Acquired on      : 11 Dec 14   02:33 PM           Instrument Method: M18-DB1.MTH
Report Created on: 11 Dec 14   02:39 PM           Analysis Method  : M18-DB1.MTH
Last Recalib on  : 11 Dec 14   02:38 PM           Sample Amount       : 0
Multiplier       : 1                             ISTD Amount          :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\3CAL0052.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.075	4086	BV	0.042	1	4.494	THC as CH4

=====

# Method Information

FID -- DB-1 30 meter x 0.53 mm ID x 5 u film. Flow at 5 cc/min, makeup to 30 ml. H2 @ 30 ml. Air @ 300 ml. Packed injection port. Flow = 10  
mls. Measured with Humonics Electronic Flowmeter. Signal 1A  
data acquisition, Range=0, Attn=0. Oven 150 isothermal. Inj @ 150,  
Det @ 225. 0.5 cc injection size. 100 ppm CH4 Std. Maxxam Internal  
Lot# 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.100	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-2	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.027	1	100.0	1.2654e-003	1	THC as CH4
		2	50.0	1.2227e-003		
		3	5.0	1.2238e-003		

## Calibration Settings

Title:  
THC as CH4 - 2014-12-11

Reference window:	30.000 %
Non-reference window:	30.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	1.2654e-003
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

## Sample ISTD Information

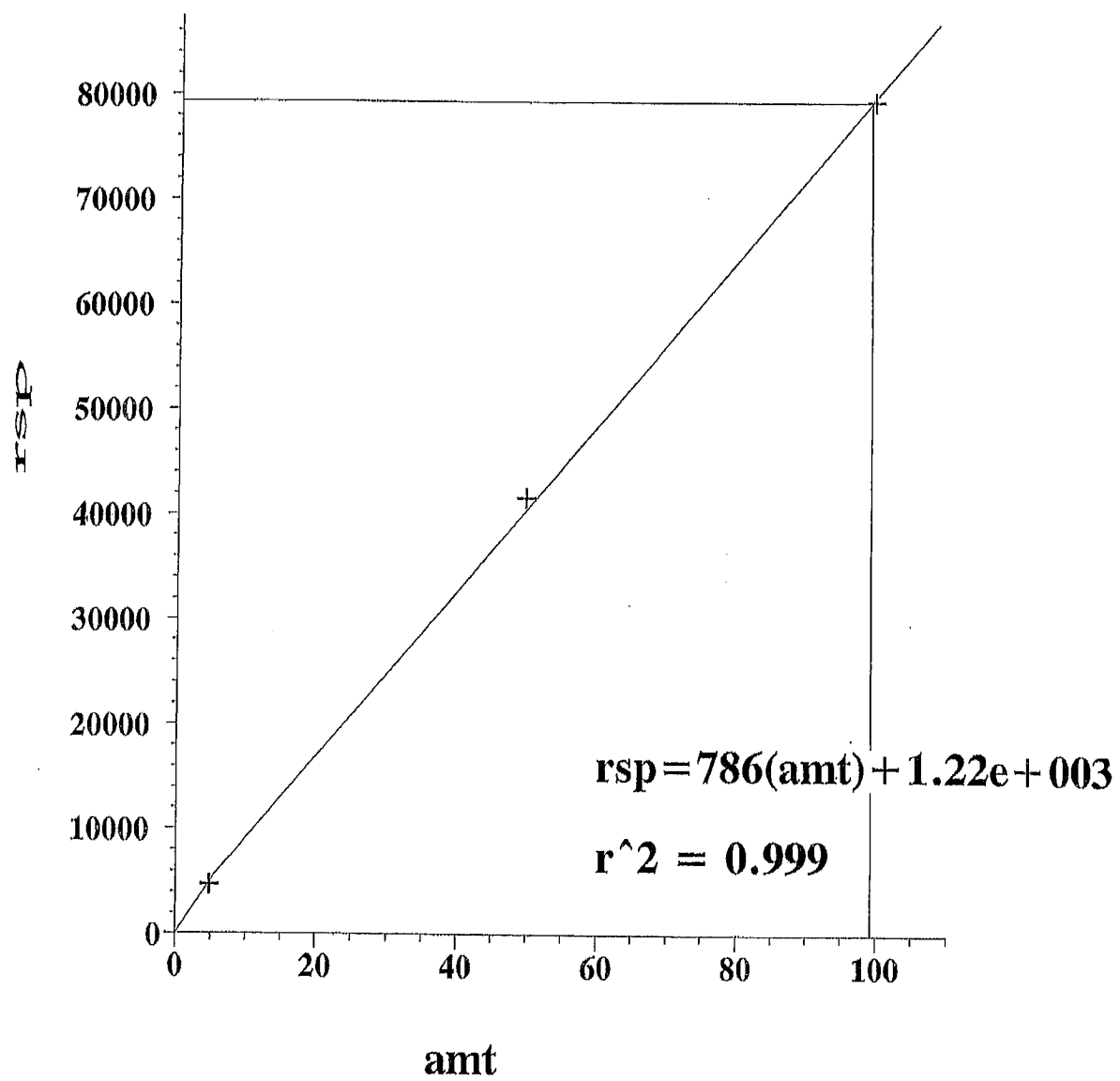
No Sample ISTD Amounts

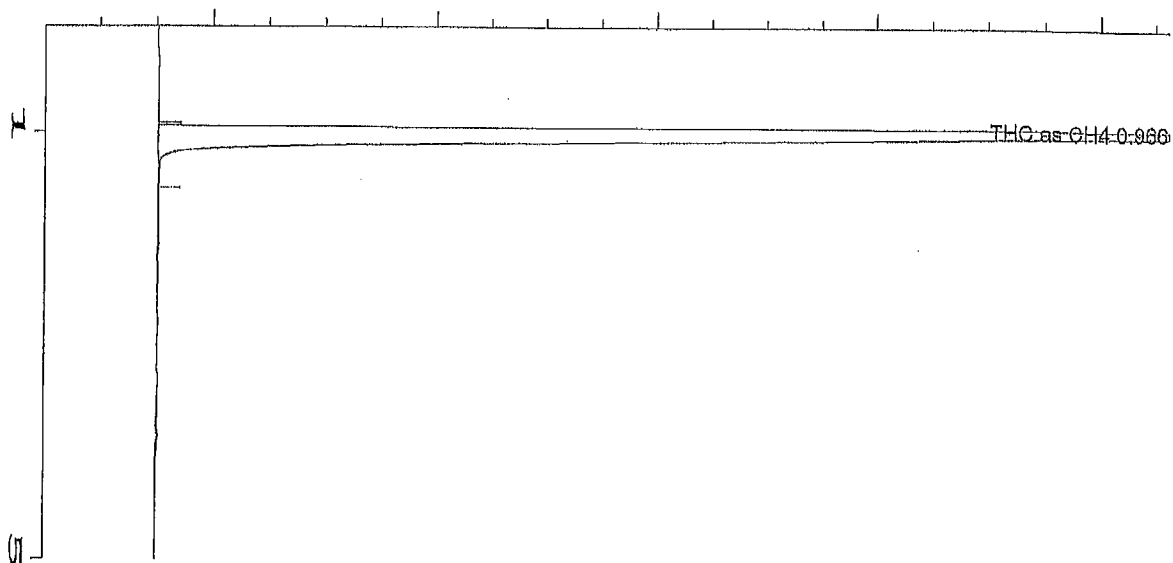
## Multilevel Information

Fit: Linear  
Origin: Force



# THC as CH4





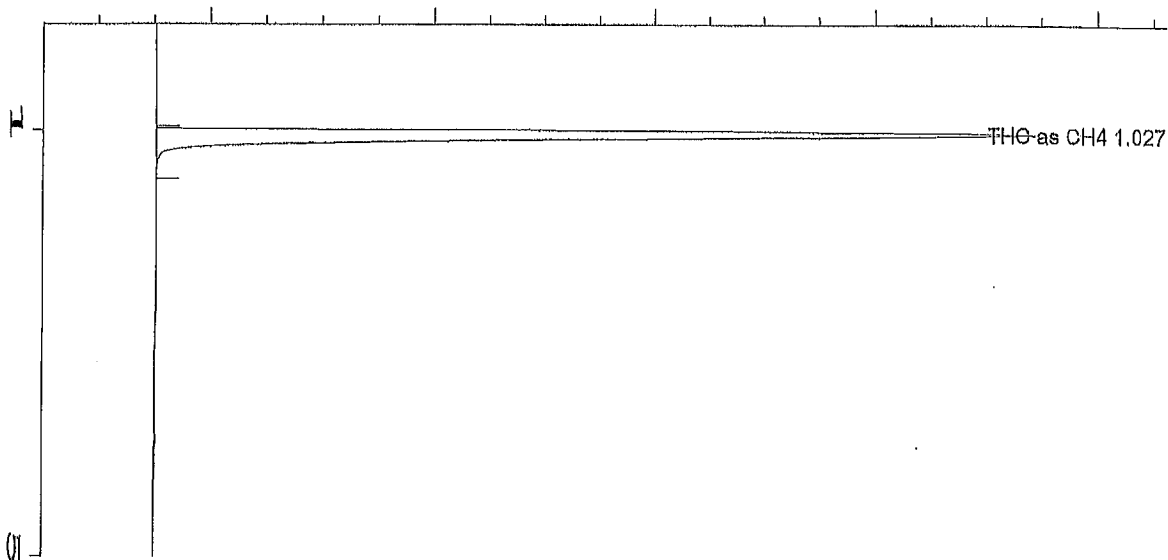
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\1CAL0064.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 1 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:29 AM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 11:54 AM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\1CAL0064.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.966	79370	BB	0.120	1	99.395	THC as CH4

=====



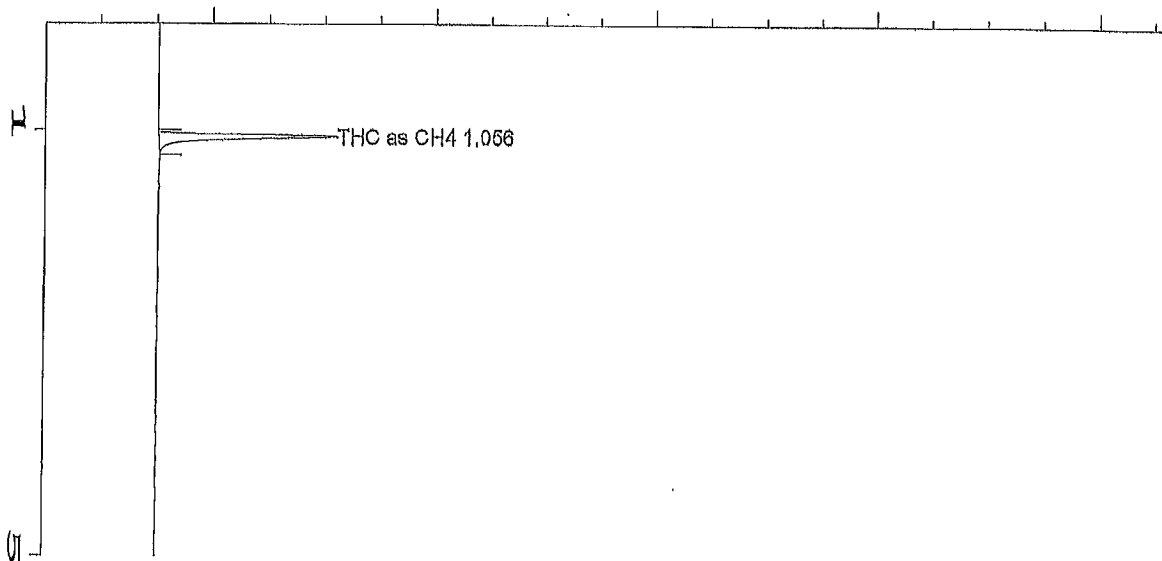
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 11:54 AM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	40894	BB	0.080	1	50.462	THC as CH4

=====



=====  
 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\1\DATA\2014\20141211\3CAL0066.D	Page Number	: 1
Operator	: Maxxam - GC 1D# 4284 - BW	Vial Number	:
Instrument	: GC ID4284	Injection Number	:
Sample Name	: Cal 3 0.025cc	Sequence Line	:
Run Time Bar Code:		Instrument Method:	M18-DB1.MTH
Acquired on	: 13 Dec 14 11:46 AM	Analysis Method	: M18-DB1.MTH
Report Created on:	13 Dec 14 11:54 AM	Sample Amount	: 0
Last Recalib on	: 13 Dec 14 11:53 AM	ISTD Amount	:
Multiplier	: 1		

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\3CAL0066.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	4619	BV	0.045	1	4.487	THC as CH4

=====

Method: C:\HPCHEM\1\METHODS\M18-DB1.MTH

## Method Information

FID - DB-1 30 meter x 0.53 mm ID x 5 u film. Flow at 5 cc/min, makeup to 30 ml. H2 @ 30 ml. Air @ 300 ml. Packed injection port. Flow = 10

mls. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 150 isothermal. Inj @ 150, Det @ 225. 0.5 cc injection size. 100 ppm CH4 Std. Maxxam Internal Lot# 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.100	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-2	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.056	1	100.0	1.2599e-003	1	THC as CH4
		2	50.0	1.2038e-003		
		3	5.0	1.0825e-003		

## Calibration Settings

## Title:

THC as CH4 - 2014-12-13

Reference window:	30.000 %
Non-reference window:	30.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	1.2599e-003
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

## Sample ISTD Information

No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force



Praxair Distribution, Inc.  
9601-34th Street  
Edmonton, AB T6B 2X6  
Tel: 780-449-0778  
Fax: 780-449-6302

10/13/2011

PRAXAIR CALGARY DIST CTR  
8009 42 ST SE (236-6511)  
CALGARY, AB T2C 2T4  
Attention: REPORT PRINTER 360 PICK TICKET PRINTER 361

Praxair Order No. **14043294**  
Customer Reference No. **02171899**

Product Lot/Batch No. **Z582128602**  
Praxair Part No. **NI CO100M1P-AS**

## CERTIFICATE OF ANALYSIS

### Primary Standard

Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Carbon monoxide	100 ppm	102 ppm	U	± 1% rel
Methane	100 ppm	100 ppm	U	± 1% rel
Nitrogen	Balance	Balance		

Analytical Instruments: **Horiba~VIA 510~~**

**Chandler Engineering~Carle Series 400 AGC~~**

Cylinder Style: **AS**  
Cylinder Pressure @70F: **13,790 kPa**  
Cylinder Volume: **4.013 M3**  
Valve Outlet Connection: **CGA-350**  
Cylinder No(s): **CC79386**

Filling Method: **Gravimetric**  
Date of Fill: **10/12/2011**  
Expiration Date: **10/13/2014**

Analyst: **Alex Auty**

Received 2011-10-27 *[Signature]*  
opened 2011-10-27 *[Signature]*  
INTERNAL TRACKING # 11-10-27-23

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

#### Key to Analytical Techniques:

A Flame Ionization with Methanizer	B Gas Chromatography with Discharge Ionization Detector	C Gas Chromatography with Electrolytic Conductivity Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Helium Ionization Detector	G Gas Chromatography with Methanizer Carbonizer	H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer	J Gas Chromatography with Thermal Conductivity Detector	K Binary Gas Analyzer with Thermal Conductivity Detector	L Infrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
Q Total Hydrocarbon Analyzer	R Wet Chemical	S Detector Tube	T Odor
U Gravimetric Methods	V Electrochemical	W Gas Chromatography with Chemiluminescence Detector	

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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.



Praxair Distribution Inc  
9501 - 34 Street  
Edmonton, AB T6B 2X6  
Tel.: (780) 449-0778  
Fax.: (780) 449-5302

Issue Date: June 21, 2011

To: Praxair Calgary Dist. Ctr.  
8009 - 42 St. S.E.  
Calgary AB T2C2T4

Praxair Order Number: 12864348  
Customer Order Number: 02045158

Product Lot Number: Z582116010  
Product Part Number: NI CO100M1P-AS

## CERTIFICATE OF ANALYSIS

### Primary Standard

Cylinder Serial Number	Components	Requested Concentration	Certified Concentration	Analytical Principle*/ Instrument	Analytical Uncertainty
CC211407	Methane	100ppm	99.9ppm	Gravimetric	+/- 1% Relative
	Carbon Monoxide	100ppm	101ppm	Gravimetric	+/- 1% Relative
	Nitrogen	Balance	Balance	By Difference	N/A

Cylinder Style: AS  
Cylinder Pressure @70°F (21°C): 2000 psig  
Cylinder Volume: 141.5 cu ft

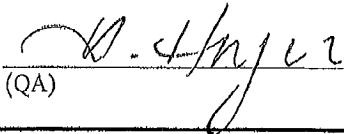
Valve Outlet Connection: CGA 580  
Filling Method: Gravimetric  
Filling Date: June 21, 2011  
Expiry Date: June 21, 2014

Rec'd 2011-06-23 ELO

Checked 2011-06-23 ELO

INTERNAL LOT# 11-11-01-26

Approved Signer:

  
(QA)

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair 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

#### \*Key to Analytical Principle:

A. Flame Ionization with Methanol	F. Gas Chromatography with Helium Ionization Detector	K. Thermal Conductivity Analyzer	P. Electrochemical
B. Gas Chromatography with Discharge Ionization Detector	G. Gas Chromatography with Methanol Carbonizer	L. Gravimetric Methods	Q. Total Hydrocarbon Analyzer
C. Gas Chromatography with Electrolyte Conductivity Detector	H. Gas Chromatography with Photoionization Detector	M. Infrared - FTIR or NDIR	R. Microbial Cell
D. Gas Chromatography with Flame Ionization Detector	I. Gas Chromatography with Reduction Gas Analyzer	N. Mass Spectrometry - MS or GC/MS	S. Detector Tube
E. Gas Chromatography with Flame Photometric Detector	J. Gas Chromatography with Thermal Conductivity Detector	O. Paramagnetic	T. Odor

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 arising out of the use of the information contained herein exceed the fee established for providing such information.

# Fixed Gas Chromatograms

Sample Analysis  
Calibration



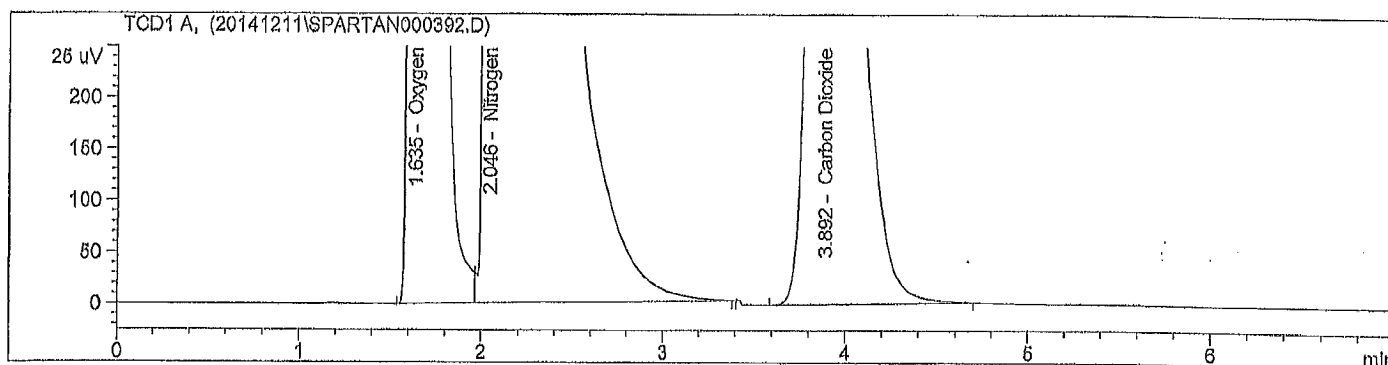
Sample Name: T3B1A Tr#73306 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 14:50:37        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:47:24 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:57:44 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-10 - Tes
                  t 3B1A - Tr#73306 - 15:00 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325		-	-	-		Hydrogen
1.635	BV	3.51202e4	3.93153e-4	14.252043		Oxygen
2.046	VBAS	1.97450e5	3.94073e-4	80.314297		Nitrogen
3.892	BBA	1.57490e4	3.34257e-4	5.433660		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

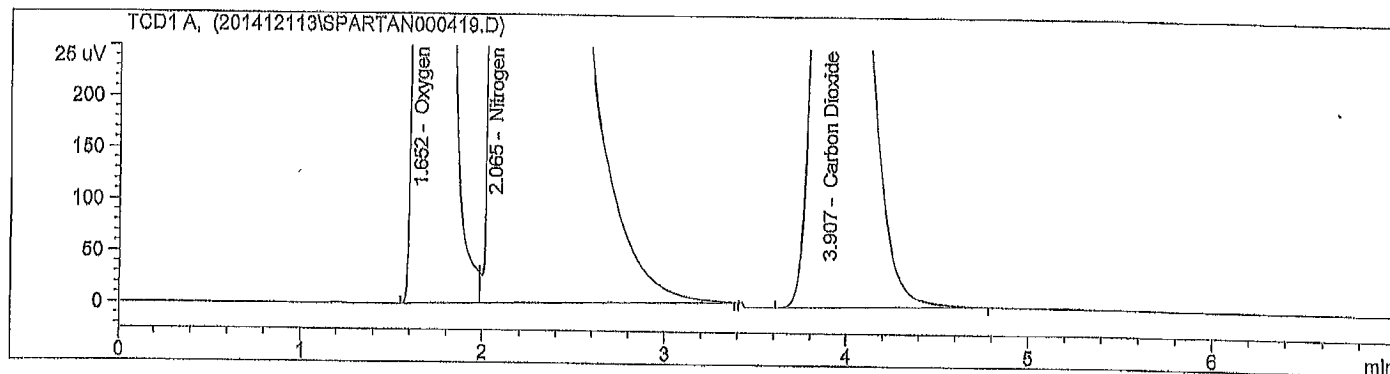
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 15:44:25
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 3:41:00 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 3:51:32 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B
                1A - Tr#73306 - 15:00 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.652	BV	3.56264e4	3.93152e-4	14.283924		Oxygen
2.065	VBAS	2.00012e5	3.94086e-4	80.382619		Nitrogen
3.907	BBA	1.56463e4	3.34258e-4	5.333457		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

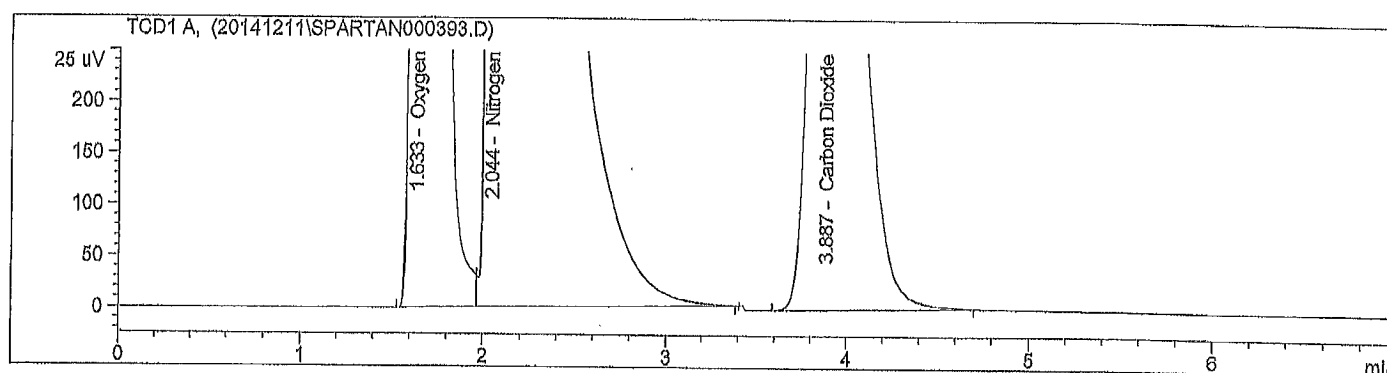
\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\20141211\SPARTAN000393.D  
Sample Name: T3B1B Tr#73307 1 cc inj

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 11-Dec-14, 15:01:51	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:57:55 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 3:08:58 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B  
1B - Tr#73307 - 15:30 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.633	BV	3.46669e4	3.93155e-4	14.180886	-	Oxygen
2.044	VBAS	1.95951e5	3.94065e-4	80.341579	-	Nitrogen
3.887	BBA	1.57500e4	3.34257e-4	5.477535	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

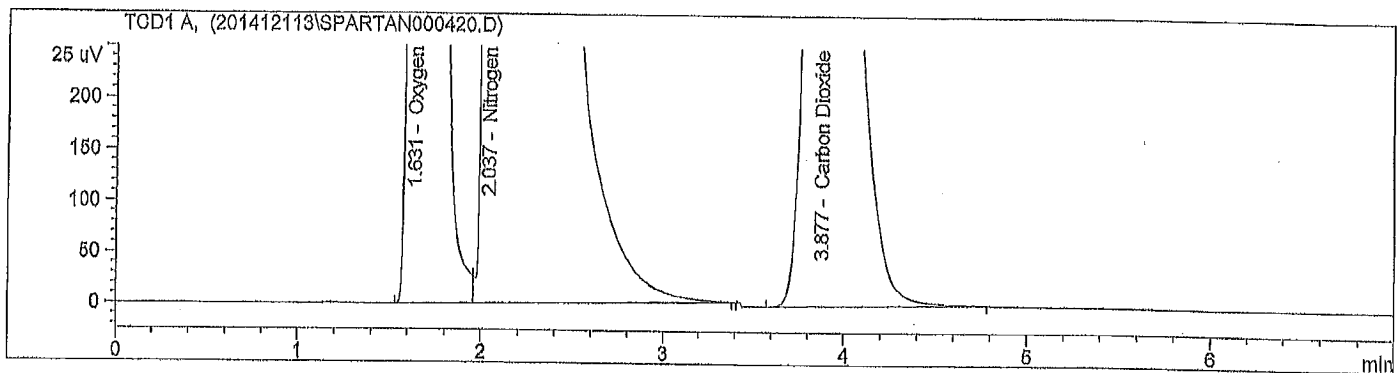
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 15:55:23 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 3:51:42 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 4:02:30 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B  
1B - Tr#73307 - 15:30 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.631	BV	3.57662e4	3.93152e-4	14.244248		Oxygen
2.037	VBAS	2.01309e5	3.94093e-4	80.365252		Nitrogen
3.877	BBA	1.59201e4	3.34254e-4	5.390500		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

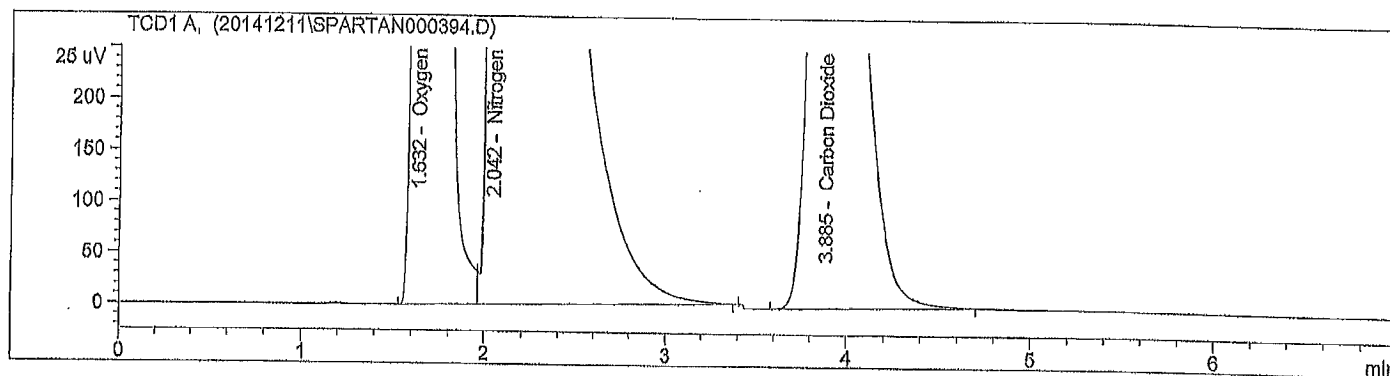
Sample Name: T4B1A Tr#73308 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:14:42        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:09:08 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:21:49 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                  1A - Tr#73308 - 08:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By           : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier          : 1.0000
Dilution            : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.632	BV	3.50873e4	3.93154e-4	14.300138	-	Oxygen
2.042	VBAS	1.96554e5	3.94068e-4	80.293665	-	Nitrogen
3.885	BBA	1.56020e4	3.34259e-4	5.406196	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

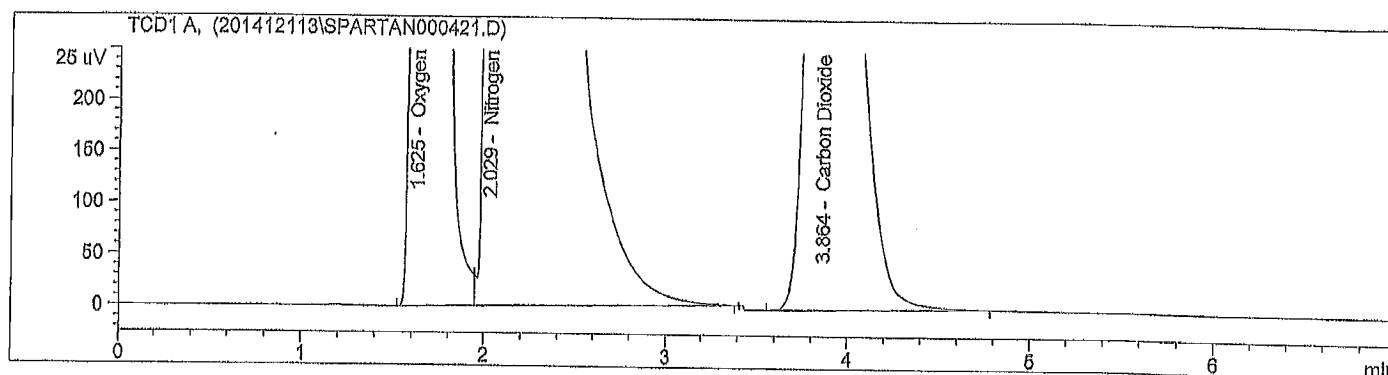
Sample Name: T4B1A Tr#73308 1 cc Inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:05:23
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:02:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:12:30 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1A - Tr#73308 - 08:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.625	BV	3.59375e4	3.93151e-4	14.351923		Oxygen
2.029	VBAS	2.00660e5	3.94089e-4	80.326213		Nitrogen
3.864	BBA	1.56740e4	3.34258e-4	5.321864		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

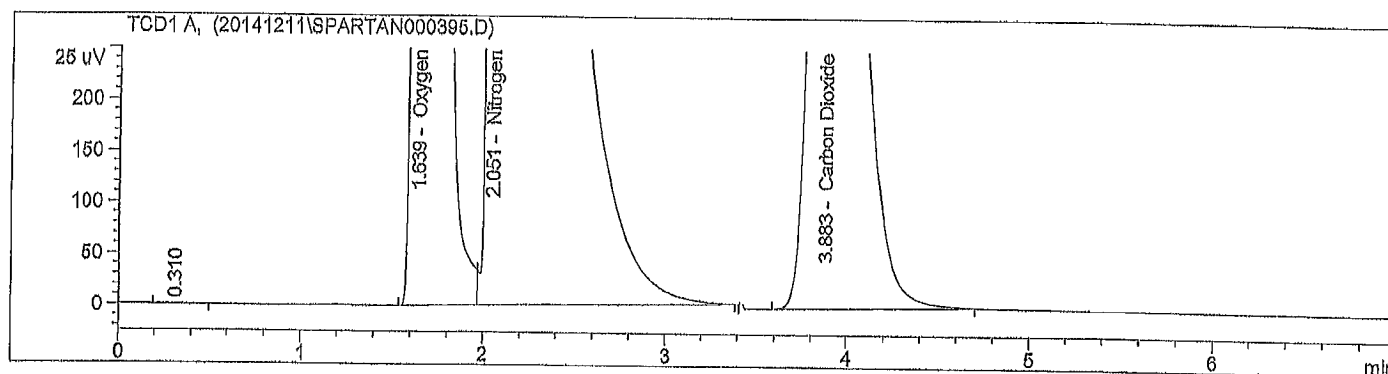
Sample Name: T4B1B Tr#73309 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 15:23:50
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:21:59 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:30:57 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1B - Tr#73309 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.639	BV	3.39189e4	3.93157e-4	13.916811	-	Oxygen
2.051	VBAS	1.95505e5	3.94063e-4	80.399981	-	Nitrogen
3.883	BBA	1.62927e4	3.34248e-4	5.683209	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

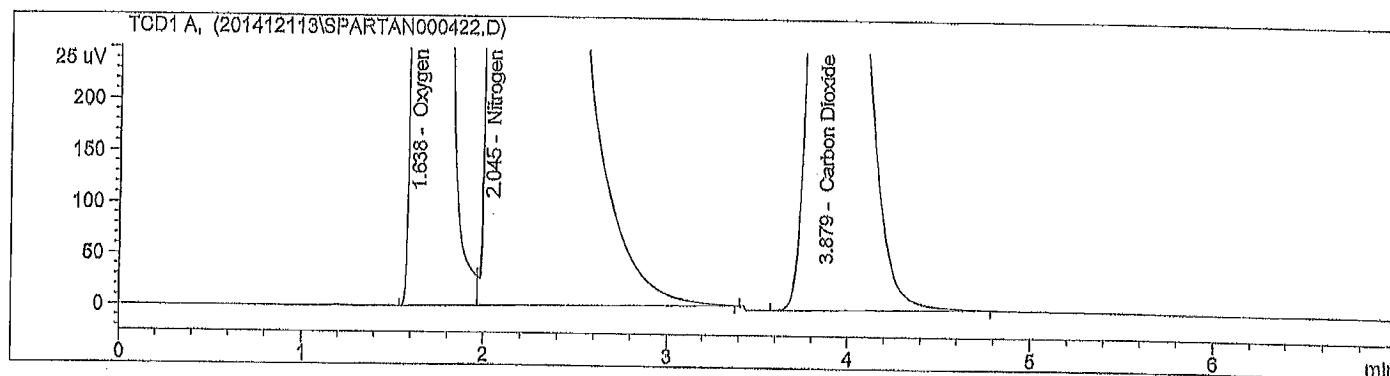
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:15:03
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:12:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:22:10 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1B - Tr#73309 - 09:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.638	BV	3.46772e4	3.93155e-4	13.972656	-	Oxygen
2.045	VBAS	1.99080e5	3.94081e-4	80.405218	-	Nitrogen
3.879	BBA	1.64120e4	3.34247e-4	5.622126	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



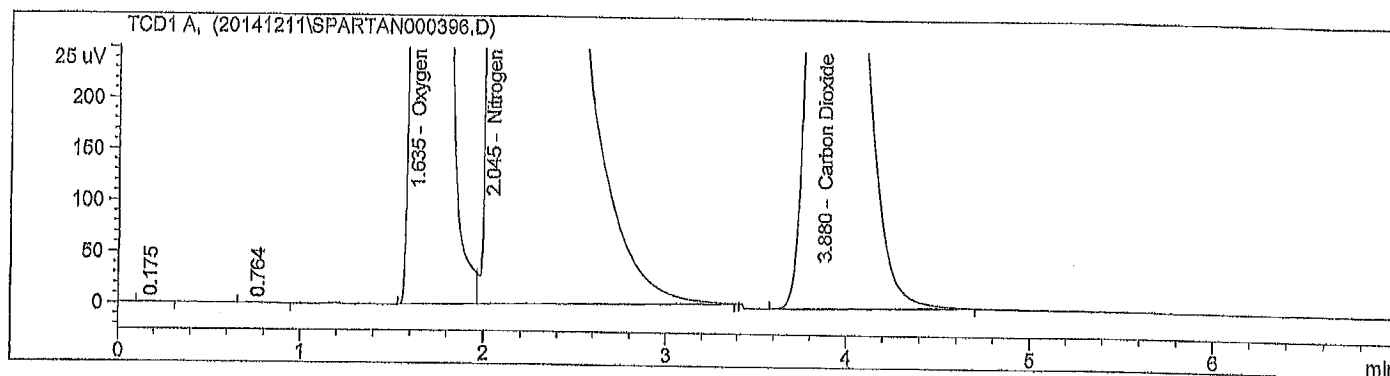
Sample Name: T5B1A Tr#73310 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:32:31        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:31:08 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:39:38 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                  1A - Tr#73310 - 10:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325		-	-	-		Hydrogen
1.635	BV	3.43879e4	3.93156e-4	14.059841		Oxygen
2.045	VBAS	1.96084e5	3.94066e-4	80.356370		Nitrogen
3.880	BBA	1.60637e4	3.34252e-4	5.583788		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

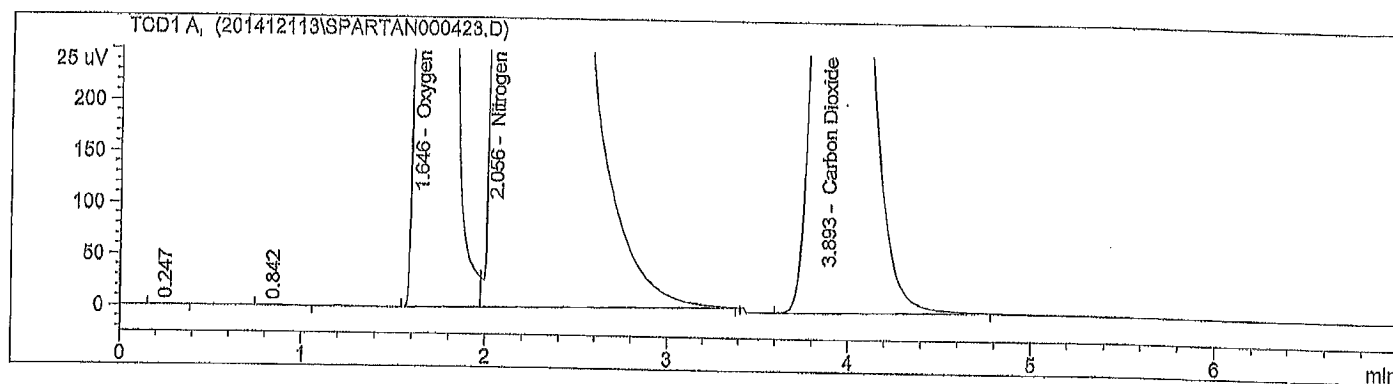
```

=====
*** End of Report ***

```

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:23:40
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:22:20 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:30:47 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                1A - Tr#73310 - 10:05 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.646	BV	3.53111e4	3.93153e-4	14.098912	-	Oxygen
2.056	VBAS	2.00880e5	3.94090e-4	80.397902	-	Nitrogen
3.893	BBA	1.62118e4	3.34250e-4	5.503186	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

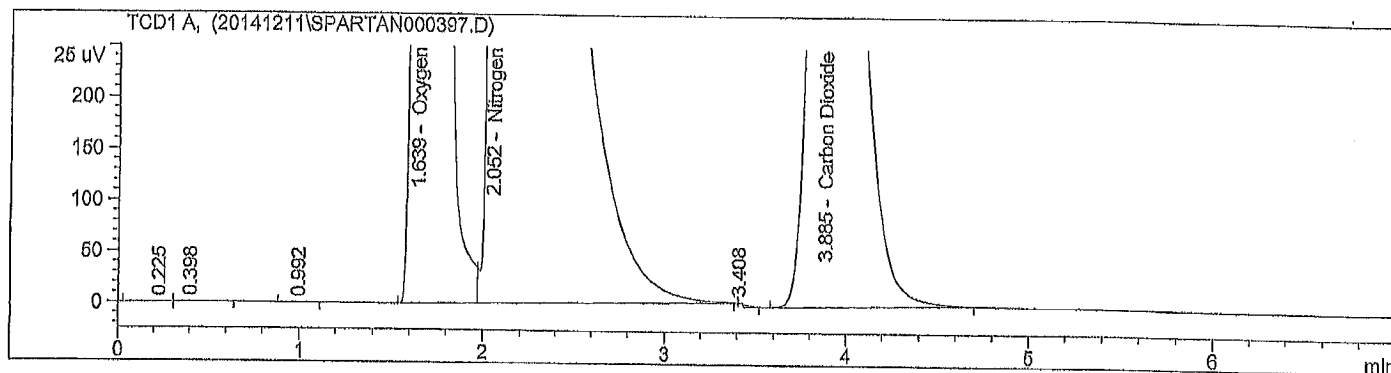
Sample Name: T5B1B Tr#73311 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 11-Dec-14, 15:40:58              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:39:48 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:48:05 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                  1B - Tr#73311 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.639	BV	3.45241e4	3.93155e-4	14.267644	-	Oxygen
2.052	VBAS	1.93883e5	3.94054e-4	80.308618	-	Nitrogen
3.885	BBA	1.54364e4	3.34262e-4	5.423738	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

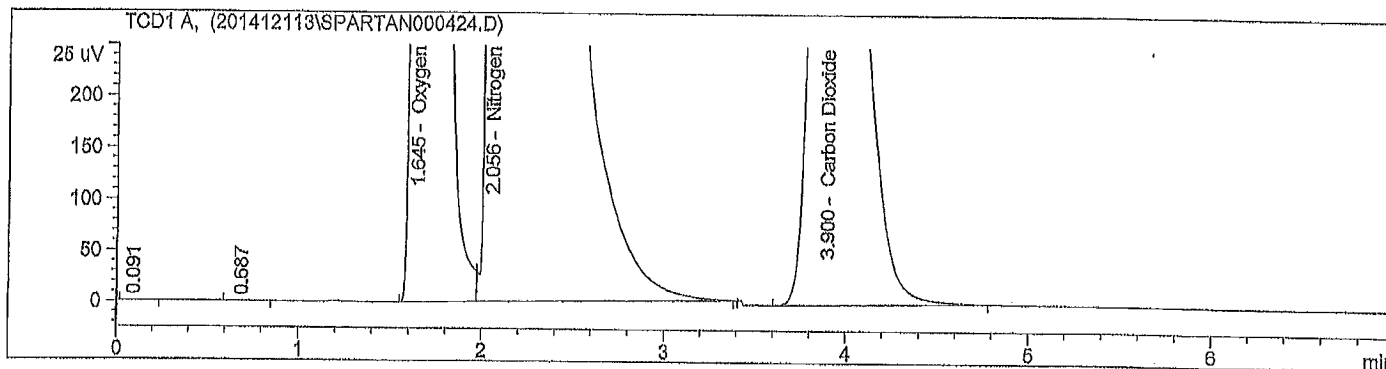
Sample Name: T5B1B Tr#73311 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 16:32:27        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 4:30:57 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 4:39:34 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                  1B - Tr#73311 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.645	BV	3.58574e4	3.93152e-4	14.311728	-	Oxygen
2.056	VBAS	2.00765e5	3.94090e-4	80.322505	-	Nitrogen
3.900	BBA	1.58125e4	3.34256e-4	5.365767	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

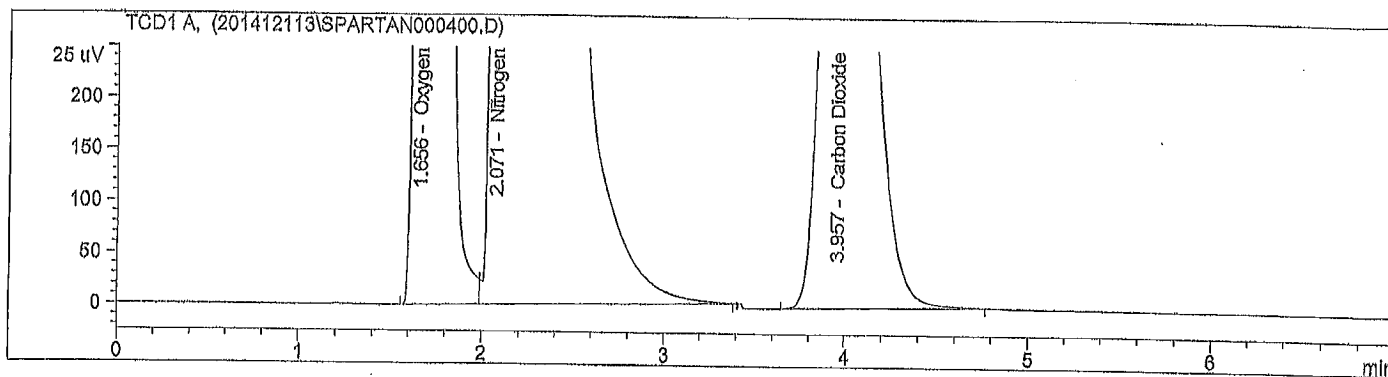
```

=====
*** End of Report ***

```

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 11:39:00
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 11:31:43 AM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 11:46:00 AM by Maxxam - ID# 6538 - BW
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                  1A - Tr#73325 - 13+00 - 1 cc injection
                  11:35 BW
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325		-	-	-		Hydrogen
1.656	BV	3.75849e4	3.93147e-4	15.077657		Oxygen
2.071	VBAS	1.99116e5	3.94082e-4	80.067842		Nitrogen
3.957	BBA	1.42320e4	3.34283e-4	4.854500		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

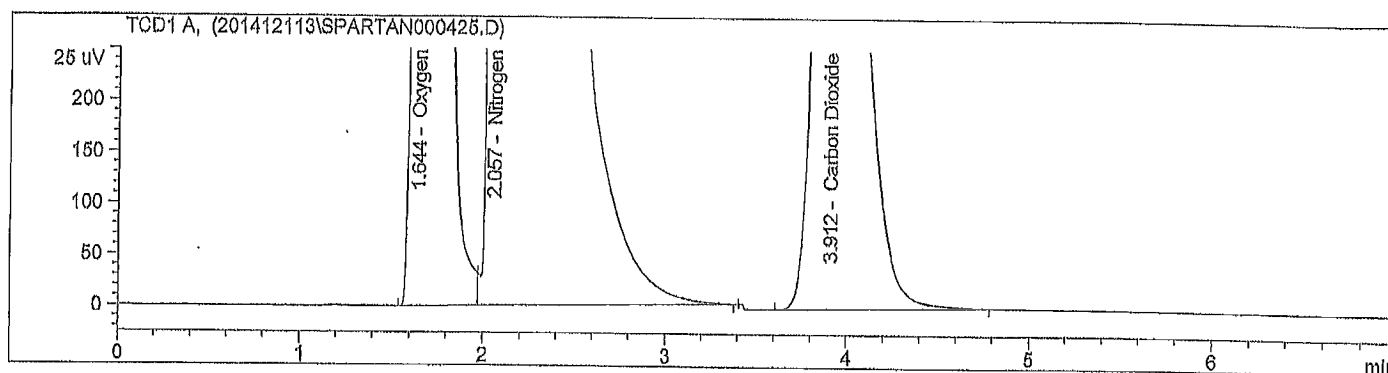
Sample Name: T6B1A Tr#73325 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:42:59
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:39:44 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:50:06 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B
                1A - Tr#73325 - 11:35 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.77631e4	3.93147e-4	15.071963	-	Oxygen
2.057	VBAS	2.00252e5	3.94087e-4	80.115548	-	Nitrogen
3.912	BBA	1.41810e4	3.34284e-4	4.812489	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

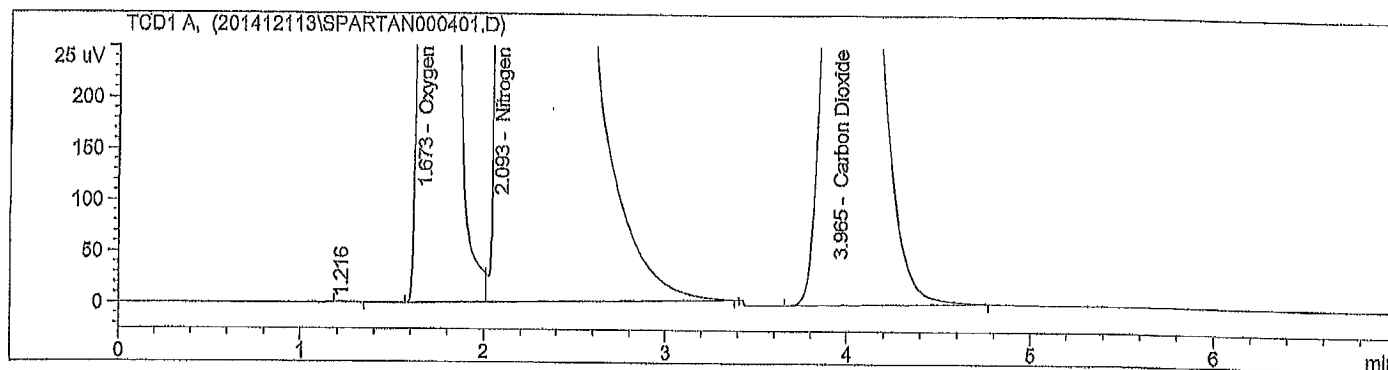
Sample Name: T6B1B Tr#73326 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 11:51:51        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 11:46:15 AM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:01:17 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - TAB
                  1B - Tr#73326 - 13-25 - 1 cc injection
                  (2:10 BW)

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By           : Signal
Calib. Data Modified : 12/13/2014 12:01:17 PM
Multiplier          : 1.0000
Dilution            : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.673	BV	3.68061e4	3.93149e-4	14.779464	-	Oxygen
2.093	VBAS	1.99260e5	3.94082e-4	80.202555	-	Nitrogen
3.965	BBA	1.46975e4	3.34274e-4	5.017980	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

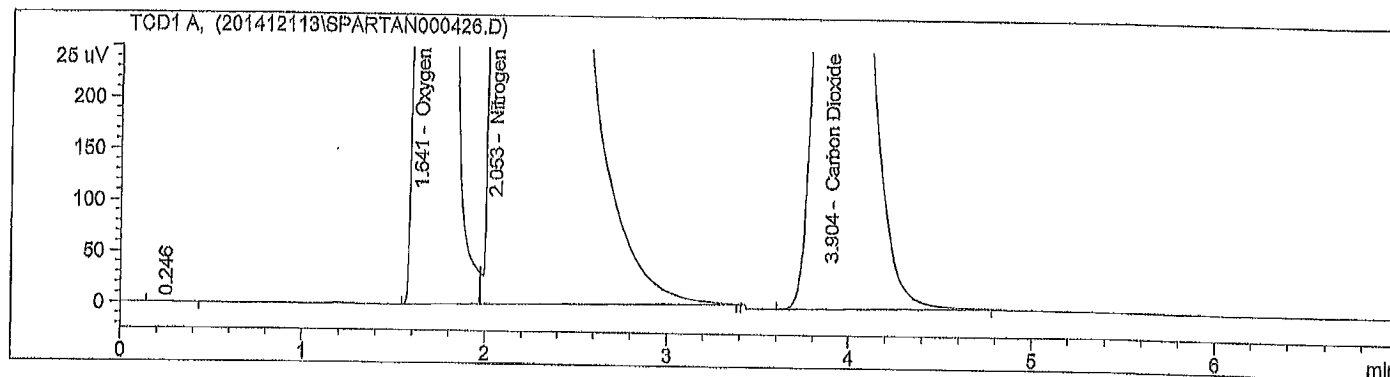
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:52:12
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:50:16 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:59:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B
                1B - Tr#73326 - 12:10 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.71464e4	3.93148e-4	14.793015		Oxygen
2.053	VBAS	2.00913e5	3.94091e-4	80.202516		Nitrogen
3.904	BBA	1.47800e4	3.34273e-4	5.004470		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



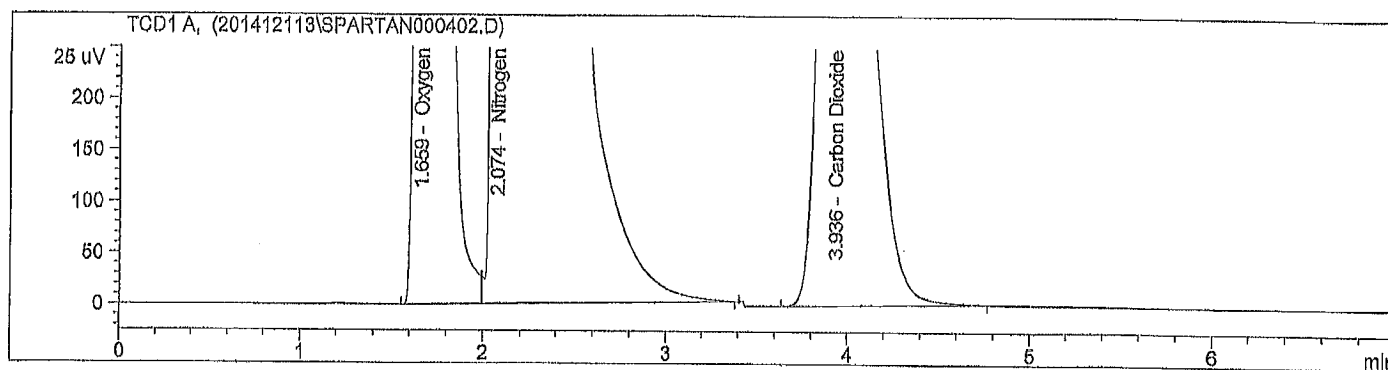
Sample Name: T7B1A Tr#73327 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:04:15
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:01:17 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:11:22 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1A - Tr#73327 - 14:30 - 1 cc injection
                B:05 BW
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:01:17 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.659	BV	3.61436e4	3.93151e-4	14.572023		Oxygen
2.074	VBAS	1.98592e5	3.94079e-4	80.255580		Nitrogen
3.936	BBA	1.50893e4	3.34267e-4	5.172397		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

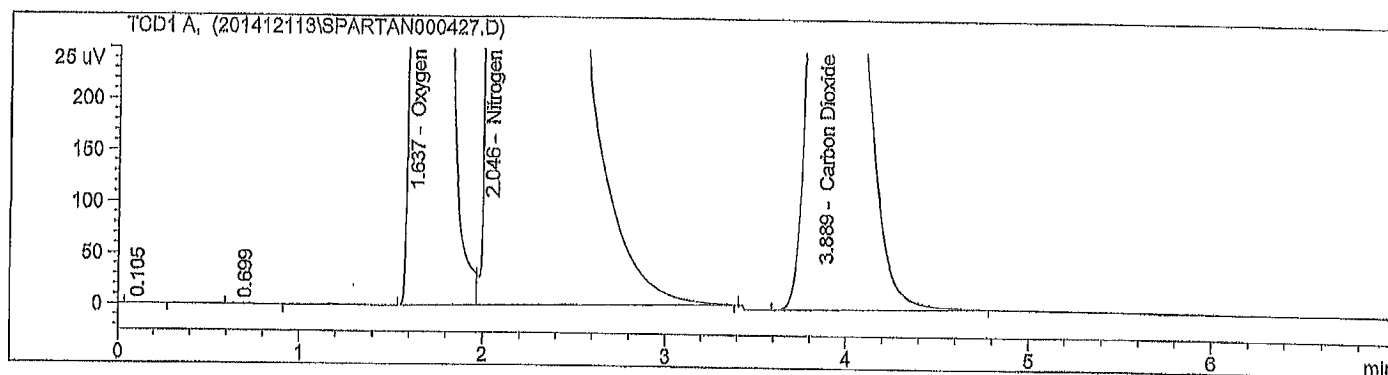
Sample Name: T7B1A Tr#73327 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:00:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:59:29 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:08:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1A - Tr#73327 - 13:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.637	BV	3.64309e4	3.93150e-4	14.577224		Oxygen
2.046	VBAS	2.00098e5	3.94087e-4	80.256618		Nitrogen
3.889	BBA	1.51855e4	3.34266e-4	5.166158		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

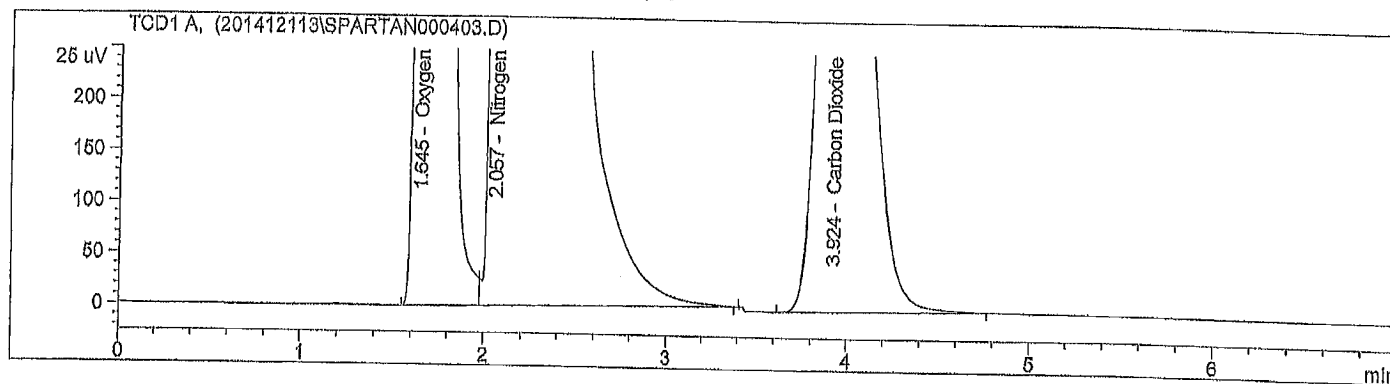
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 12:13:43 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:11:32 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:27:28 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B  
1B - Tr#73328 - 15.05 - 1 cc injection  
13:40 SW



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.645	BV	3.74293e4	3.93148e-4	14.976146	-	Oxygen
2.057	VBAS	1.99774e5	3.94085e-4	80.123857	-	Nitrogen
3.924	BBA	1.44030e4	3.34280e-4	4.899997	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals ; 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

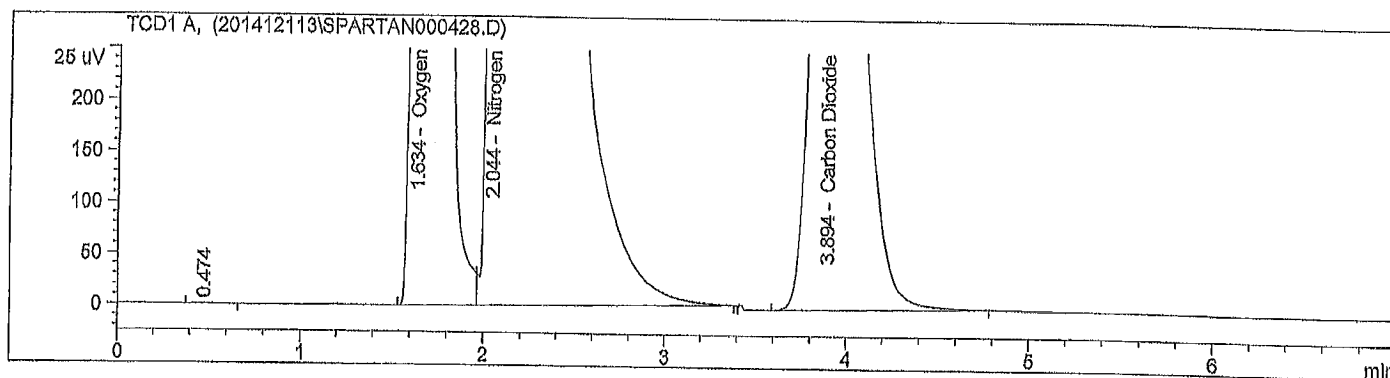
\*\*\* End of Report \*\*\*

Sample Name: T7B1B Tr#73328 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:09:57
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:08:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:17:04 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1B - Tr#73328 - 13:40 - 1 cc injection
=====
    
```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
    
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.634	BV	3.74772e4	3.93147e-4	14.998602	-	Oxygen
2.044	VBAS	1.99745e5	3.94085e-4	80.129646	-	Nitrogen
3.894	BBA	1.43168e4	3.34281e-4	4.871752	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

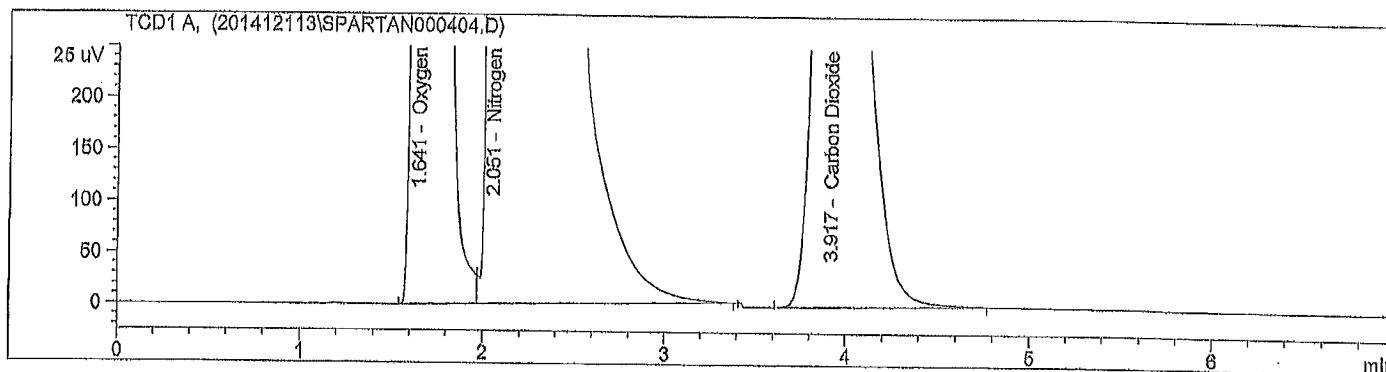
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 12:29:28        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:27:28 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:36:35 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                  1A - Tr#73329 - 14:40 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.70739e4	3.93148e-4	14.934592	-	Oxygen
2.051	VBAS	1.98443e5	3.94078e-4	80.128397	-	Nitrogen
3.917	BBA	1.44140e4	3.34280e-4	4.937010	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

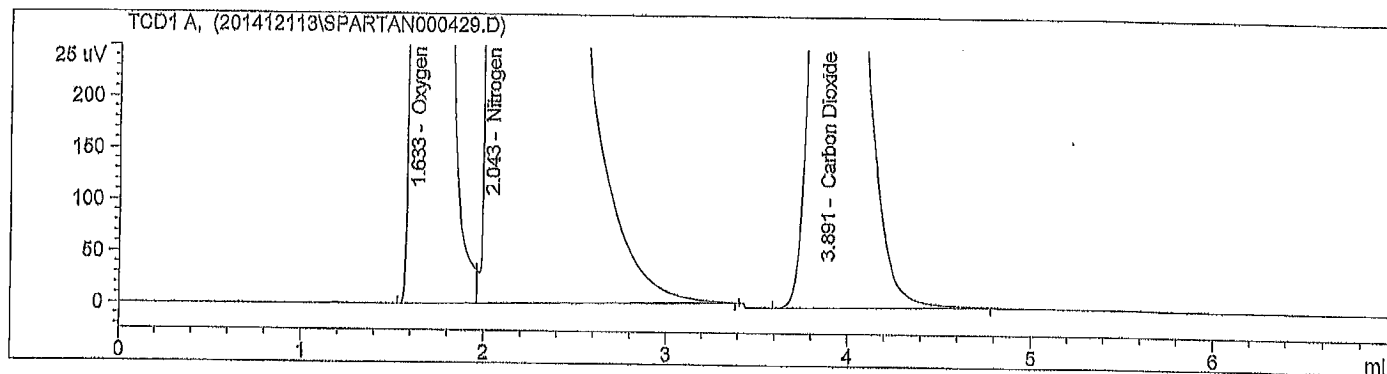
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 17:19:57	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:17:14 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:27:05 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B  
1A - Tr#73329 - 14:40 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.633	BV	3.73907e4	3.93148e-4	14.931972		Oxygen
2.043	VBAS	2.00243e5	3.94087e-4	80.158246		Nitrogen
3.891	BBA	1.44596e4	3.34279e-4	4.909782		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

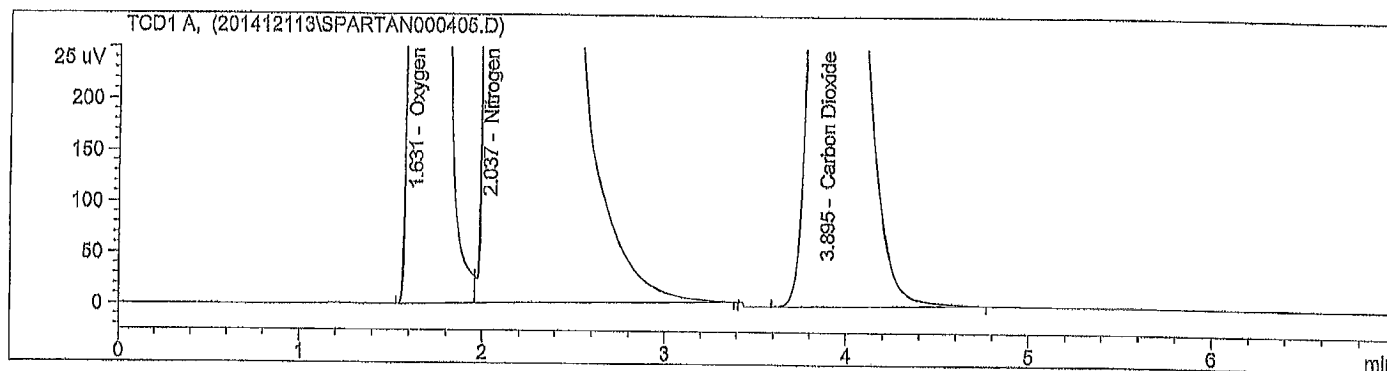
Sample Name: T8B1B Tr#73330 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:40:38
Location       : -
Inj           : 1
Inj Volume    : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:36:45 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:47:45 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                  1B - Tr#73330 - 15:15 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.631	BV	3.67733e4	3.93149e-4	14.750073		Oxygen
2.037	VBA5	1.99428e5	3.94083e-4	80.182205		Nitrogen
3.895	BBA	1.48597e4	3.34271e-4	5.067721		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

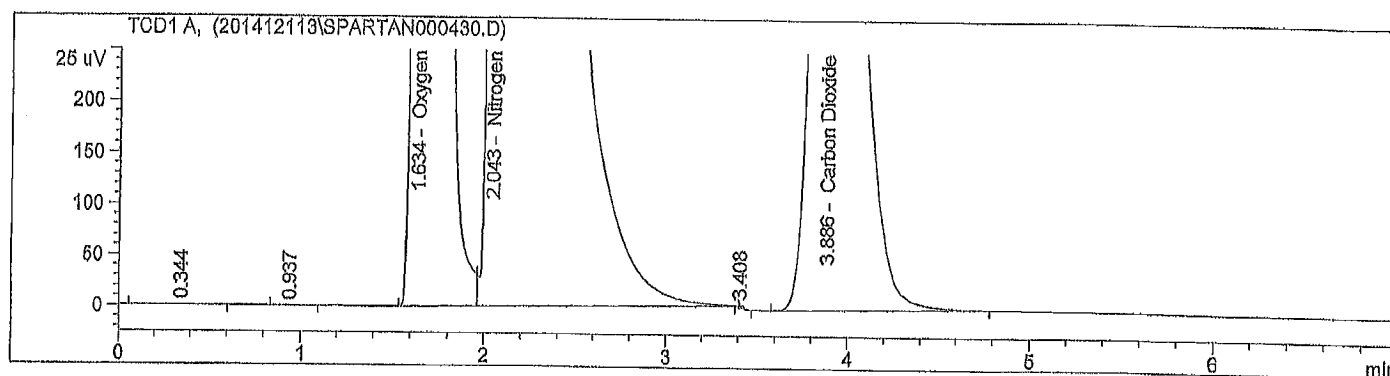
Sample Name: T8B1B Tr#73330 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:28:28
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:27:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:35:35 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                1B - Tr#73330 - 15:15 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.634	BV	3.67586e4	3.93149e-4	14.742918		Oxygen
2.043	VBAS	1.99503e5	3.94084e-4	80.205760		Nitrogen
3.886	BBA	1.48128e4	3.34272e-4	5.051322		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```



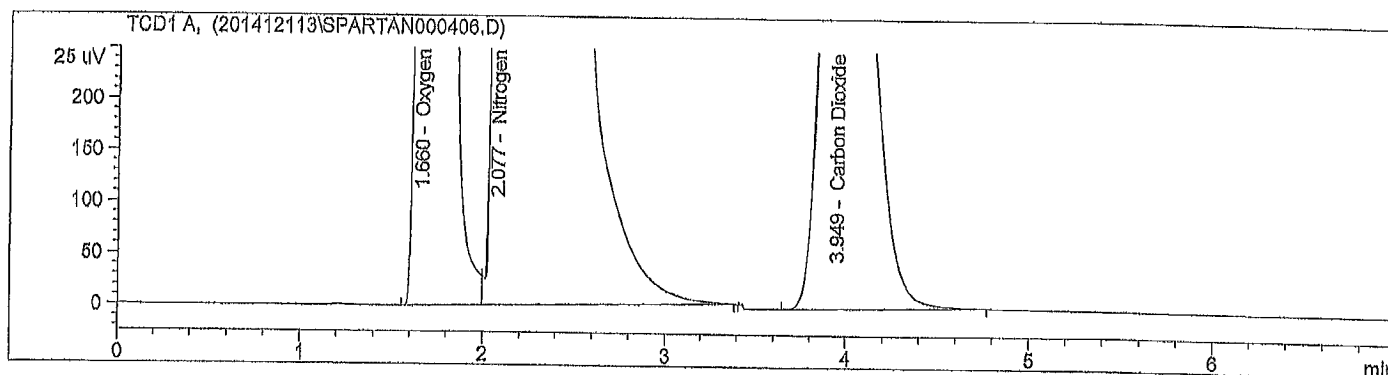
Data File C:\CHEM32\1\DATA\201412113\SPARTAN000406.D  
Sample Name: T9B1A Tr#73331 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:50:07
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:47:55 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:57:14 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                1A - Tr#73331 - 16:10 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.660	BV	3.86333e4	3.93145e-4	15.425678		Oxygen
2.077	VBAS	1.99967e5	3.94086e-4	80.034680		Nitrogen
3.949	BBA	1.33707e4	3.34301e-4	4.539642		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

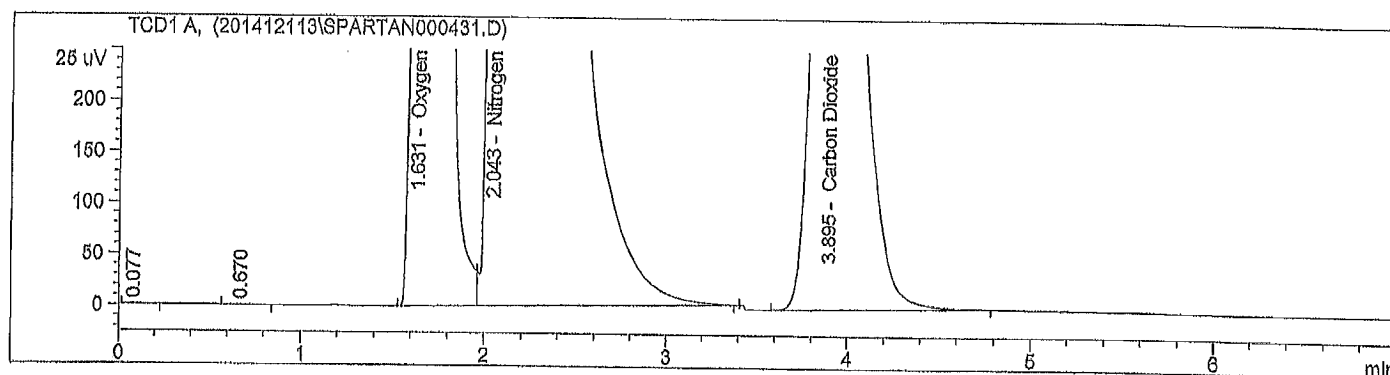
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 17:37:15	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:35:46 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:44:22 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B  
1A - Tr#73331 - 16:10 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.631	BV	3.86016e4	3.93145e-4	15.414385	-	Oxygen
2.043	VBAS	1.99939e5	3.94086e-4	80.030773	-	Nitrogen
3.895	BBA	1.34143e4	3.34300e-4	4.554841	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

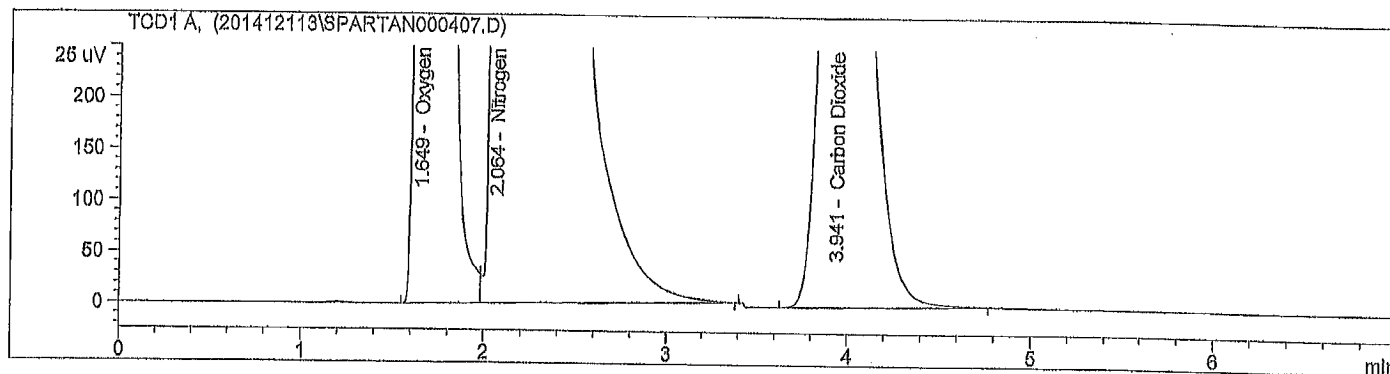
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:01:24
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:57:24 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:08:31 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                  1B - Tr#73332 - 16:45 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with TSTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.649	BV	3.89435e4	3.93144e-4	15.642914		Oxygen
2.064	VBAS	1.98546e5	3.94079e-4	79.942179		Nitrogen
3.941	BBA	1.29253e4	3.34311e-4	4.414907		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

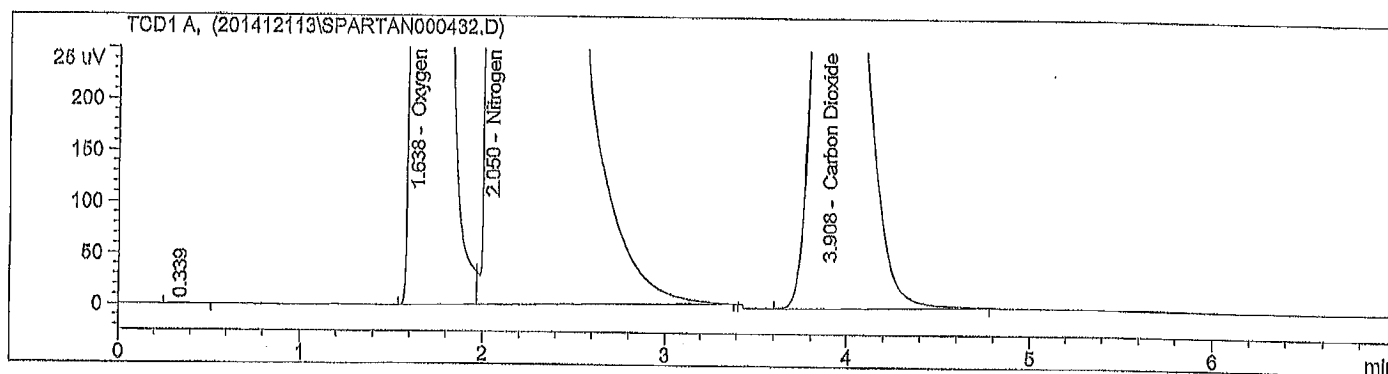
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 17:46:22	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:44:33 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:53:30 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B  
1B - Tr#73332 - 16:45 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.638	BV	3.92800e4	3.93143e-4	15.657882	-	Oxygen
2.050	VBAS	2.00053e5	3.94086e-4	79.937040	-	Nitrogen
3.908	BBA	1.29956e4	3.34309e-4	4.405079	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

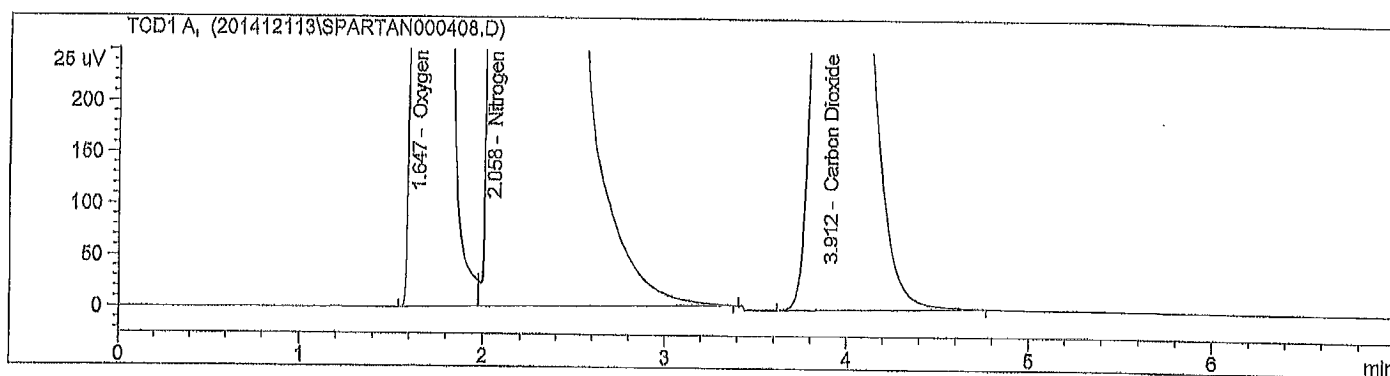
=====

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\201412113\SPARTAN000408.D  
Sample Name: T10B1A Tr#73333 1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:14:16
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 1:08:41 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 1:21:23 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                  B1A - Tr#73333 - 08:25 - 1 cc injection
=====
```



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.647	BV	3.56009e4	3.93152e-4	14.320501	-	Oxygen
2.058	VBAS	1.99147e5	3.94082e-4	80.296274	-	Nitrogen
3.912	BBA	1.57408e4	3.34257e-4	5.383224	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

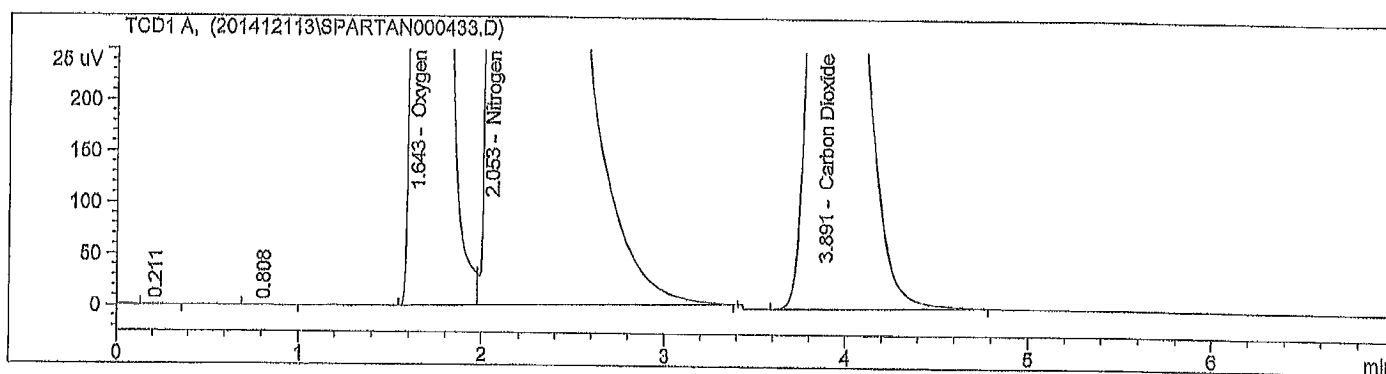
\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\201412113\SPARTAN000433.D  
Sample Name: T10B1A Tr#73333 1 cc inj

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 17:55:02	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:53:39 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:02:09 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10  
B1A - Tr#73333 - 08:25 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.643	BV	3.60246e4	3.93151e-4	14.322703	-	Oxygen
2.053	VBAS	2.01529e5	3.94094e-4	80.316412	-	Nitrogen
3.891	BBA	1.58596e4	3.34255e-4	5.360885	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

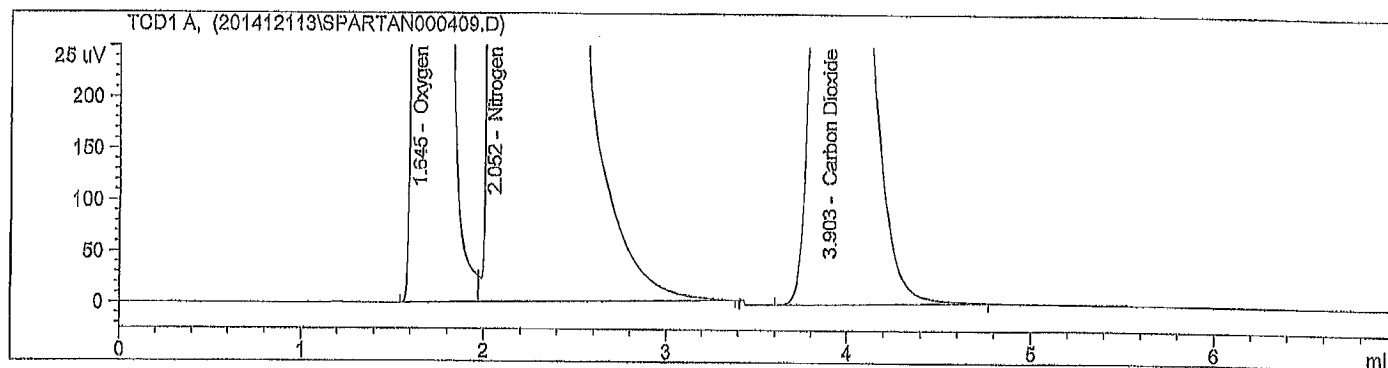
Sample Name: T10B1B Tr#73334 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:23:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:21:33 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:31:02 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                B1B - Tr#73334 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355						Hydrogen
1.645	BV	3.45542e4	3.93155e-4	13.924563		Oxygen
2.052	VBAS	1.99010e5	3.94081e-4	80.385387		Nitrogen
3.903	BBA	1.66087e4	3.34244e-4	5.690050		Carbon Dioxide
5.038						Methane
6.085						Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

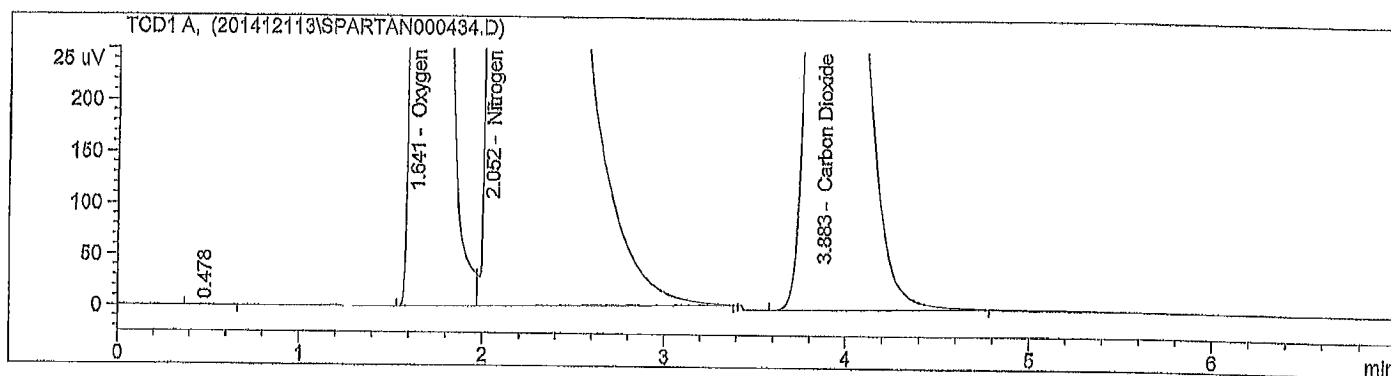
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 18:04:01 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:02:19 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:11:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10  
B1B - Tr#73334 - 09:05 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.48761e4	3.93154e-4	13.919748	-	Oxygen
2.052	VBAS	2.01031e5	3.94091e-4	80.426722	-	Nitrogen
3.883	BBA	1.66616e4	3.34243e-4	5.653530	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

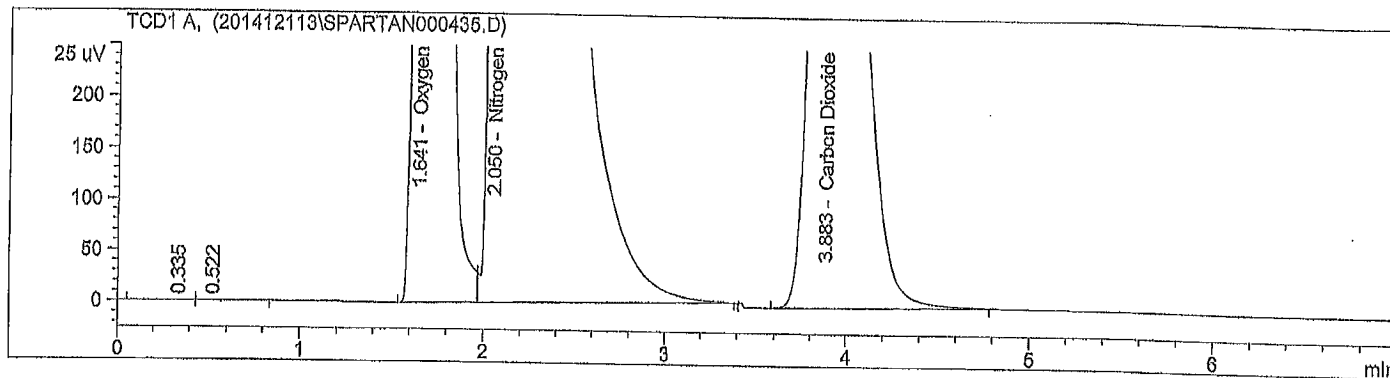
=====

\*\*\* End of Report \*\*\*



```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 18:12:21        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 6:11:18 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 6:19:28 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                  B1A - Tr#73335 - 09:55 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.55167e4	3.93152e-4	14.107470		Oxygen
2.050	VBAS	2.01806e5	3.94095e-4	80.350639		Nitrogen
3.883	BBA	1.64110e4	3.34247e-4	5.541891		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

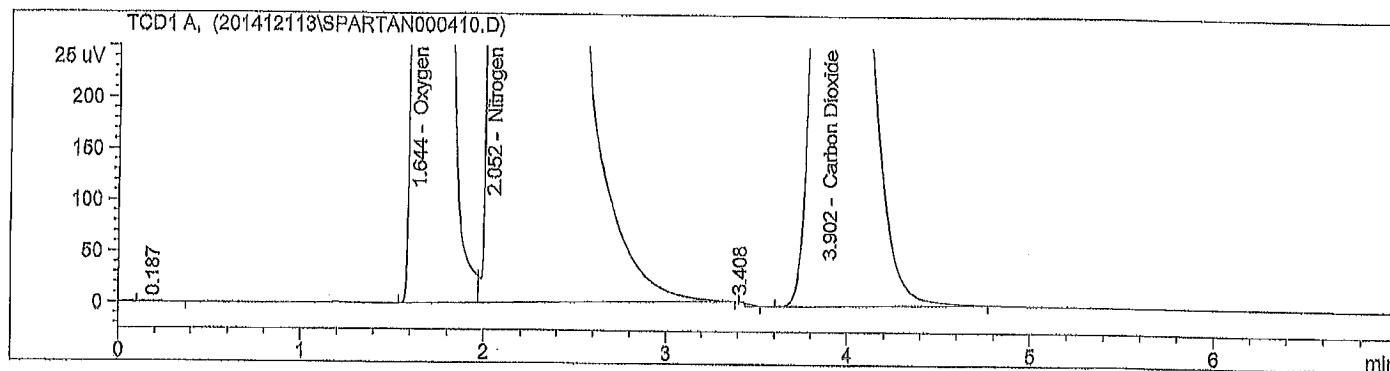
Sample Name: T11B1A Tr#73335 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:33:12
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:31:12 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:40:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1A - Tr#73335 - 09:55 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By           : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier          : 1.0000
Dilution            : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.644	BV	3.50528e4	3.93154e-4	14.088072		Oxygen
2.052	VBAS	1.99442e5	3.94083e-4	80.347443		Nitrogen
3.902	BBA	1.62850e4	3.34249e-4	5.564486		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

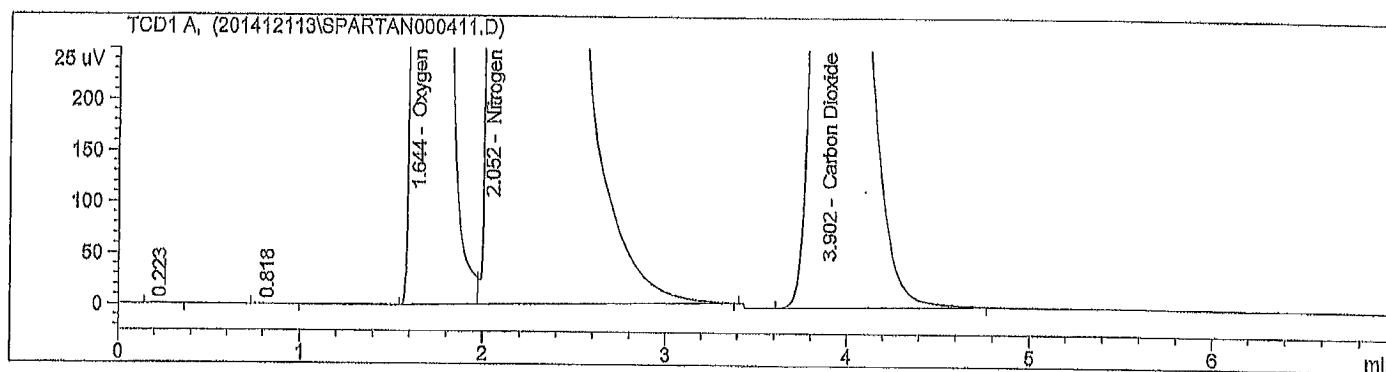
Sample Name: T11B1B Tr#73336 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:41:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:40:29 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:48:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1B - Tr#73336 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.54348e4	3.93153e-4	14.149885	-	Oxygen
2.052	VBAS	2.00705e5	3.94090e-4	80.336850	-	Nitrogen
3.902	BBA	1.62396e4	3.34249e-4	5.513266	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

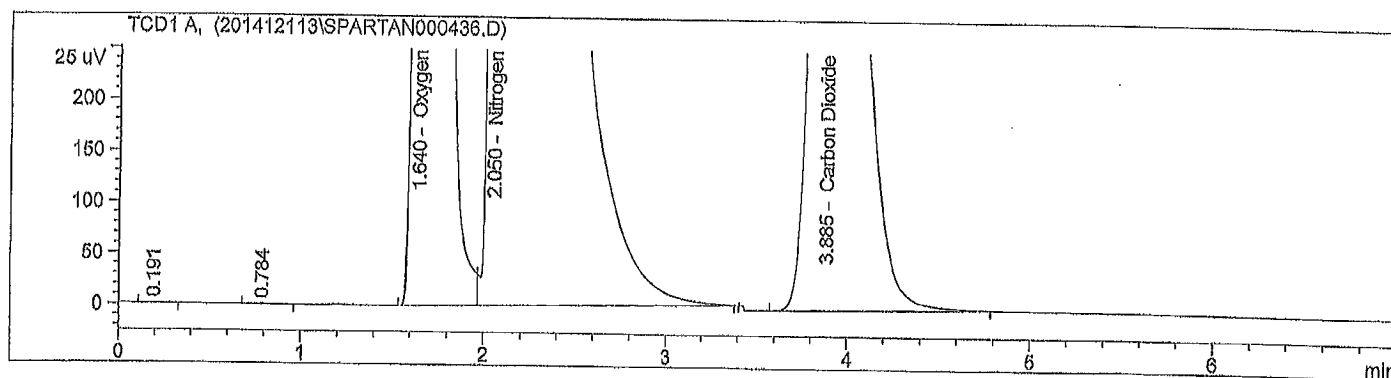
```

Sample Name: T11B1B Tr#73336 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:21:02
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:19:38 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:28:09 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1B - Tr#73336 - 10:40 - 1 cc injection
=====
    
```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
    
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.640	BV	3.55673e4	3.93152e-4	14.153537	-	Oxygen
2.050	VBAS	2.01436e5	3.94093e-4	80.350585	-	Nitrogen
3.885	BBA	1.62448e4	3.34249e-4	5.495878	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

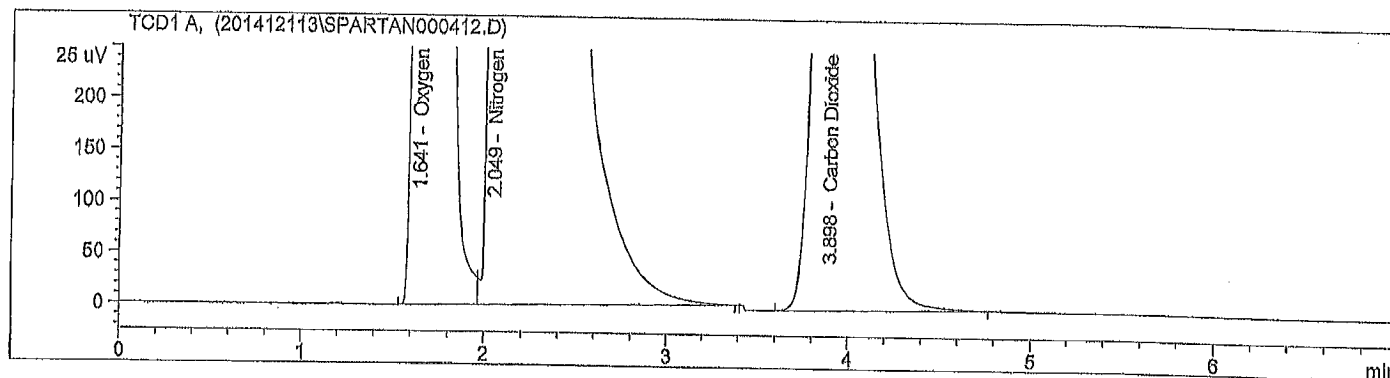
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\201412113\SPARTAN000412.D  
Sample Name: T12B1A Tr#73337 1 cc inj

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 13:51:45 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:49:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:58:52 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12  
B1A - Tr#73337 - 11:30 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.54625e4	3.93153e-4	14.223440		Oxygen
2.049	VBAS	1.99767e5	3.94085e-4	80.313218		Nitrogen
3.898	BBA	1.60217e4	3.34252e-4	5.463342		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

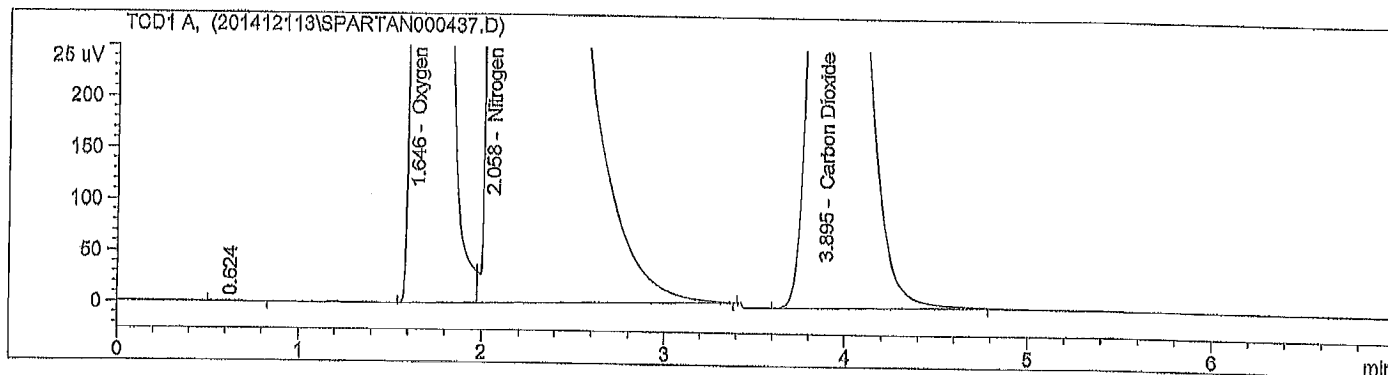
=====  
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:29:52
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:28:19 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:36:59 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                  B1A - Tr#73337 - 11:30 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.646	BV	3.55005e4	3.93152e-4	14.220822	-	Oxygen
2.058	VBAS	2.00058e5	3.94086e-4	80.329728	-	Nitrogen
3.895	BBA	1.60011e4	3.34253e-4	5.449449	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

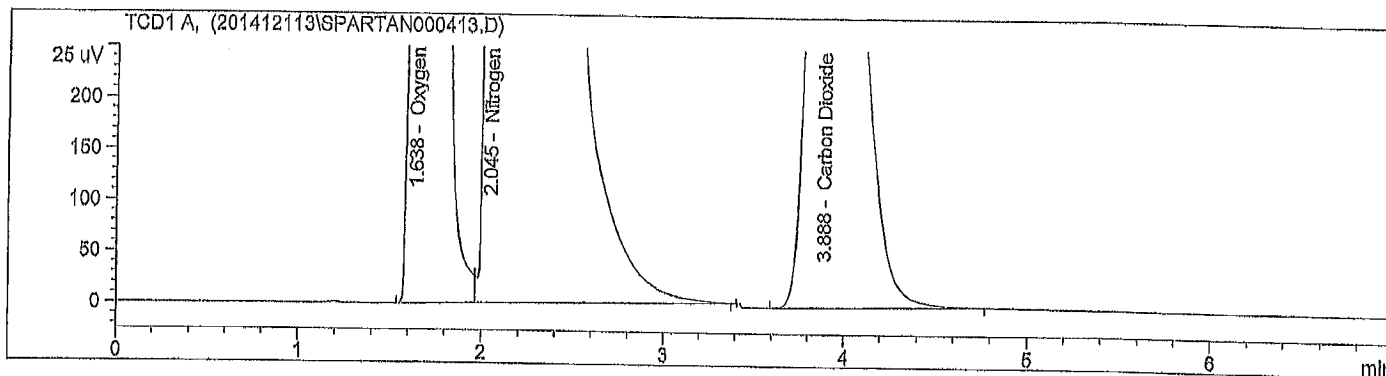
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:08:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:59:02 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:16:02 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                  B1B - Tr#73338 - 12:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.638	BV	3.52385e4	3.93153e-4	14.029007		Oxygen
2.045	VBAS	2.01397e5	3.94093e-4	80.370934		Nitrogen
3.888	BBA	1.65455e4	3.34245e-4	5.600059		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

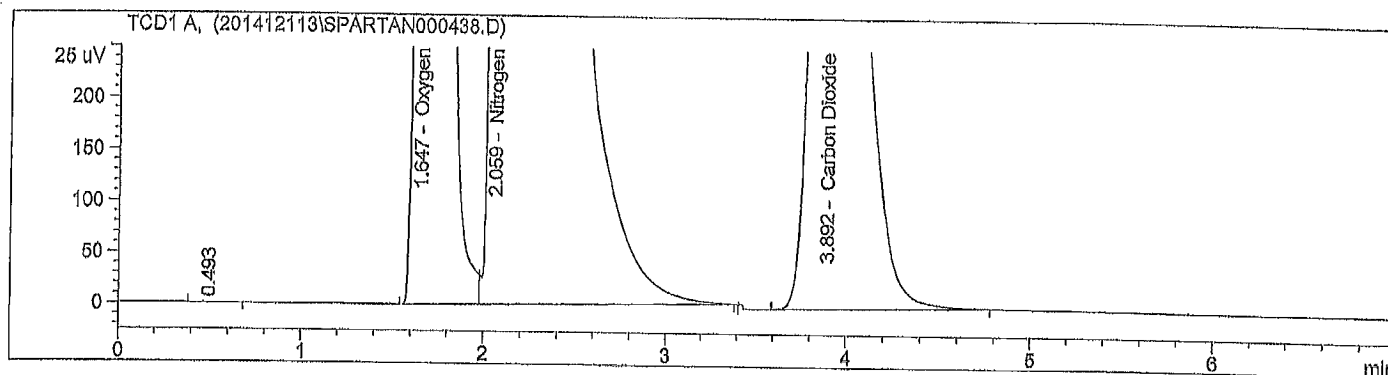
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:38:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:37:09 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:45:58 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                  B1B - Tr#73338 - 12:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.647	BV	3.50068e4	3.93154e-4	14.018034		Oxygen
2.059	VBAS	2.00287e5	3.94088e-4	80.392815		Nitrogen
3.892	BBA	1.64175e4	3.34247e-4	5.589151		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

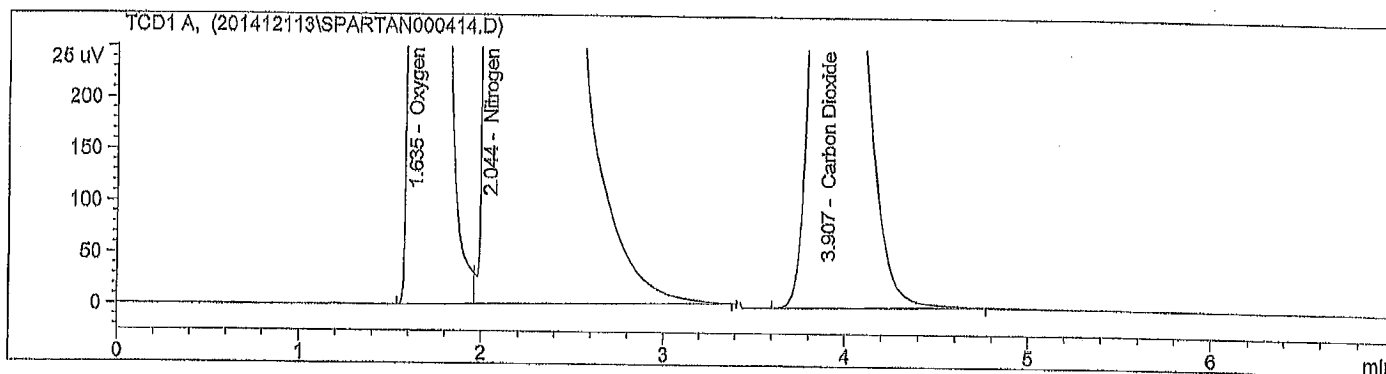
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 14:18:30        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 2:16:12 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 2:25:37 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T13
                  B1A - Tr#73339 - 13:00 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

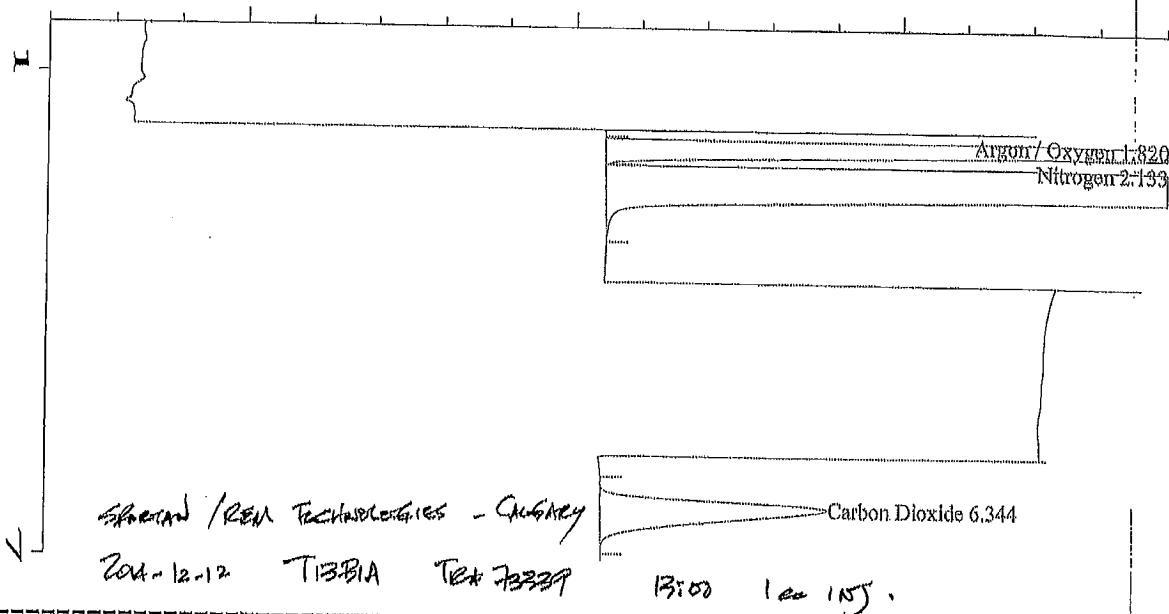
RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.635	BV	3.86394e4	3.93145e-4	15.457051	-	Oxygen
2.044	VBAS	1.99469e5	3.94083e-4	79.984714	-	Nitrogen
3.907	BBA	1.34004e4	3.34300e-4	4.558235	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



Normalized Percent Report

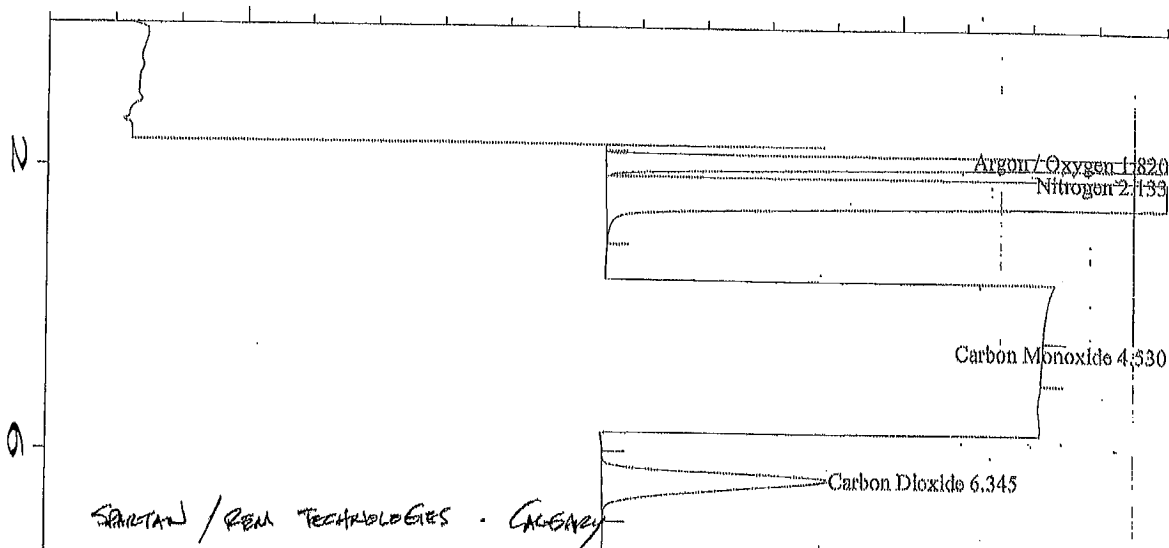
Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REMT13B1A-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:33:58 Instrument Method:  
 Report Created on: 15 Dec 14 10:57 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...\2014\REM-SP~1\REMT13B1A-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *			1		Hydrogen
1.820	333085 BV	0.122	1		15.427	Argon / Oxygen
2.133	1670841 VBA	0.192	1		80.056	Nitrogen
3.913	* not found *			1		Methane
4.559	* not found *			1		Carbon Monoxide
6.344	112833 BV	0.254	1		4.517	Carbon Dioxide

Total amount = 99.0285

Not all calibrated peaks were found



2014-12-12 T13B1A TR# 73339 13:00 1cc inj.

# Normalized Percent Report

Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REMT13B1A-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:44:28 Instrument Method:  
 Report Created on: 15 Dec 14 10:59 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\... \2014\REM-SP~1\REMT13B1A-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	332968	BV	0.122	1	15.429	Argon / Oxygen
2.133	1670092	VBA	0.192	1	80.056	Nitrogen
3.913	* not found *	1				Methane
4.530	96	BBA	0.082	1	0.000141	Carbon Monoxide
6.345	112755	BV	0.255	1	4.516	Carbon Dioxide

Total amount = 98.9839

Not all calibrated peaks were found

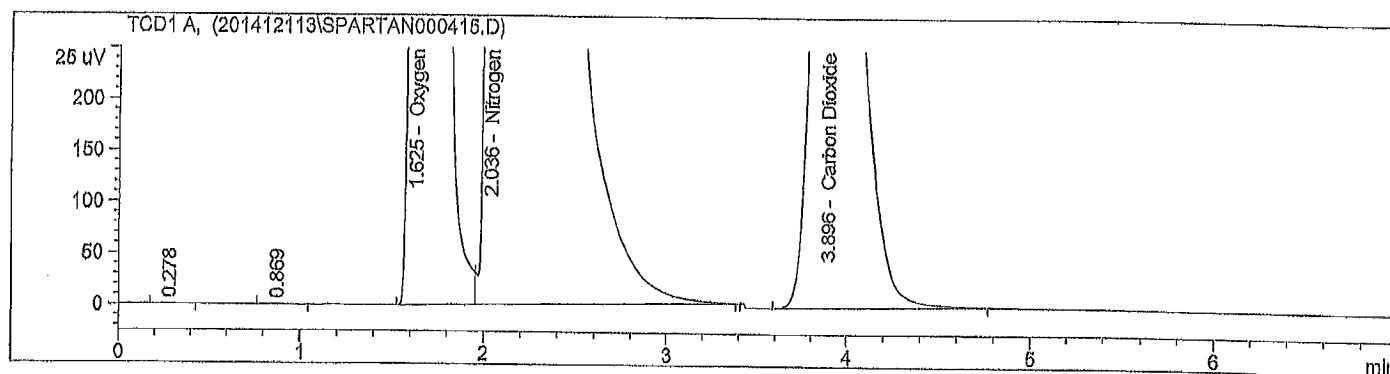
Sample Name: T13B1B Tr#73340 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:36:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:35:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:44:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T13
                B1B - Tr#73340 - 13:35 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.625	BV	3.85337e4	3.93145e-4	15.527256	-	Oxygen
2.036	VBAS	1.97964e5	3.94076e-4	79.958974	-	Nitrogen
3.896	BBA	1.31733e4	3.34305e-4	4.513770	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

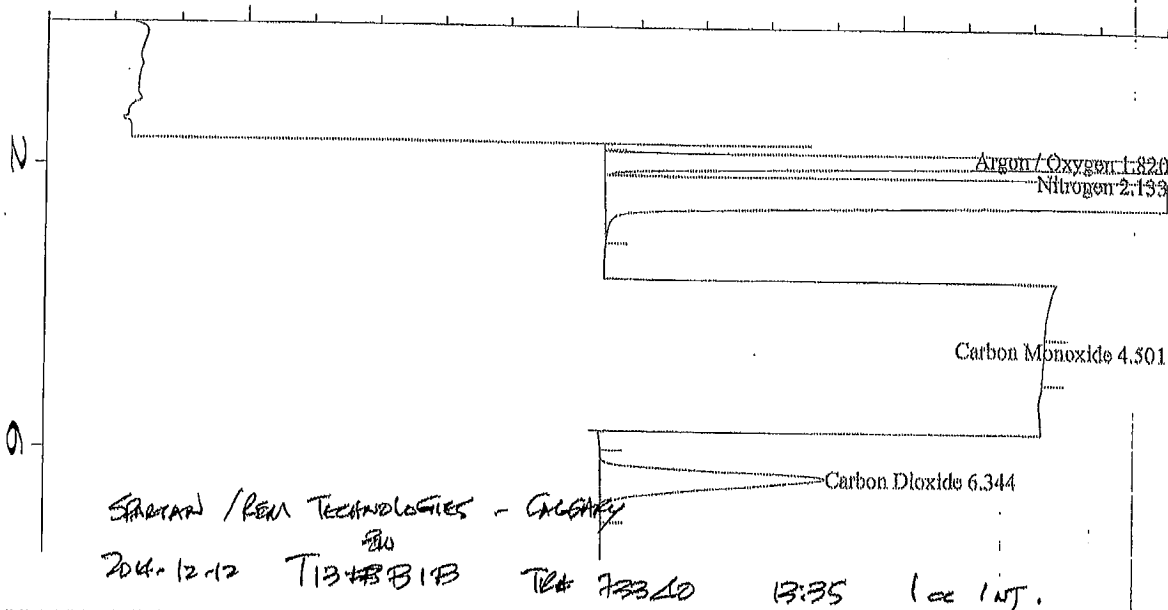
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```



# Normalized Percent Report

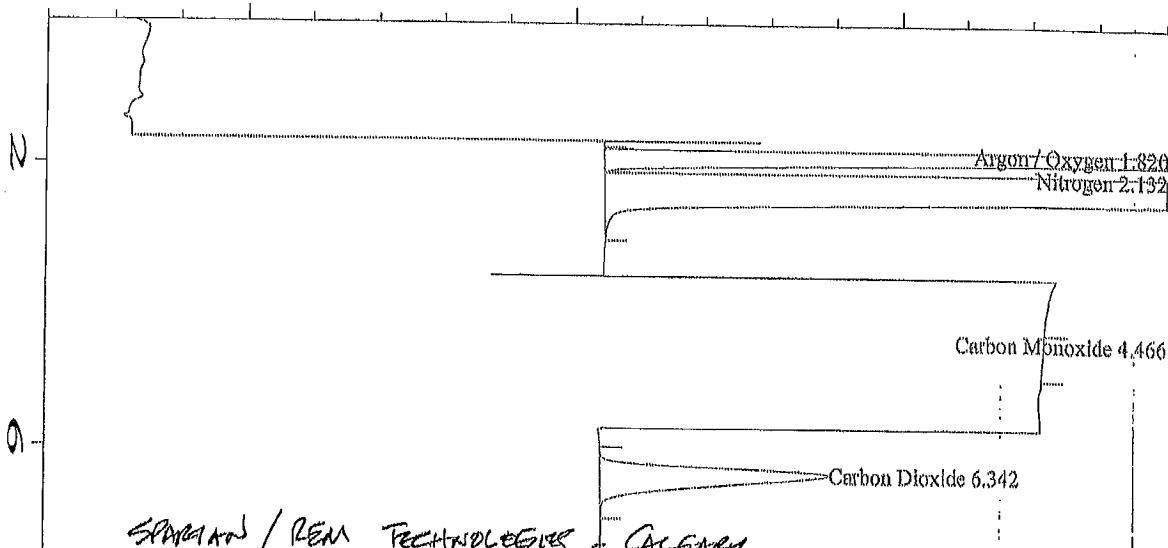
Data File Name : C:\HPCHEM\...ITRS-TCID\HPCHEM~1\2014\REM-SP~1\REMT13B1B-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:54:47 Instrument Method:  
 Report Created on: 15 Dec 14 11:00 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REMT13B1B-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *		1			Hydrogen
1.820	333945 BV	0.122	1		15.499	Argon / Oxygen
2.133	1666980 VBA	0.192	1		80.030	Nitrogen
3.913	* not found *		1			Methane
4.501	130 BBA	0.121	1		0.000191	Carbon Monoxide
6.344	111490 BV	0.255	1		4.471	Carbon Dioxide

Total amount = 98.8272

Not all calibrated peaks were found



SPRINT / REM TECHNOLOGIES - CALGARY

2014-12-12 T13B1B TR# 73340 13:35 1cc 10J.

# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T13B1B-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:06:19 Instrument Method:  
 Report Created on: 15 Dec 14 11:01 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on: 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\T13B1B-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	335519	BV	0.122	1	15.499	Argon / Oxygen
2.132	1674636	VBA	0.192	1	80.027	Nitrogen
3.913	* not found *	1				Methane
4.466	131	BBA	0.438	1	0.000192	Carbon Monoxide
6.342	112095	BV	0.251	1	4.475	Carbon Dioxide

Total amount = 99.2941

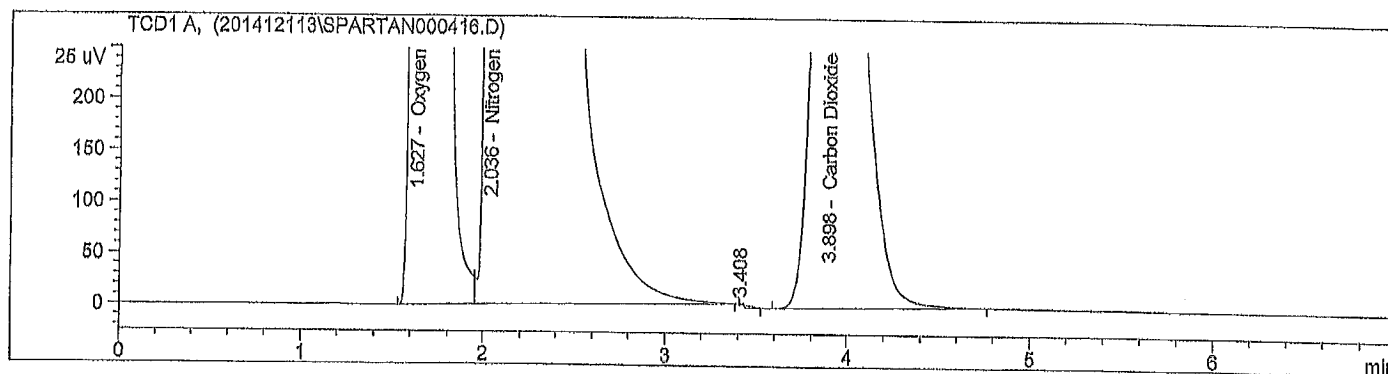
Not all calibrated peaks were found

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:48:54
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:44:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:56:02 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T14
                B1A - Tr#73341 - 14:30 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.627	EV	3.88828e4	3.93144e-4	15.474906		Oxygen
2.036	VBAS	2.00447e5	3.94088e-4	79.967244		Nitrogen
3.898	BBA	1.34681e4	3.34298e-4	4.557850		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

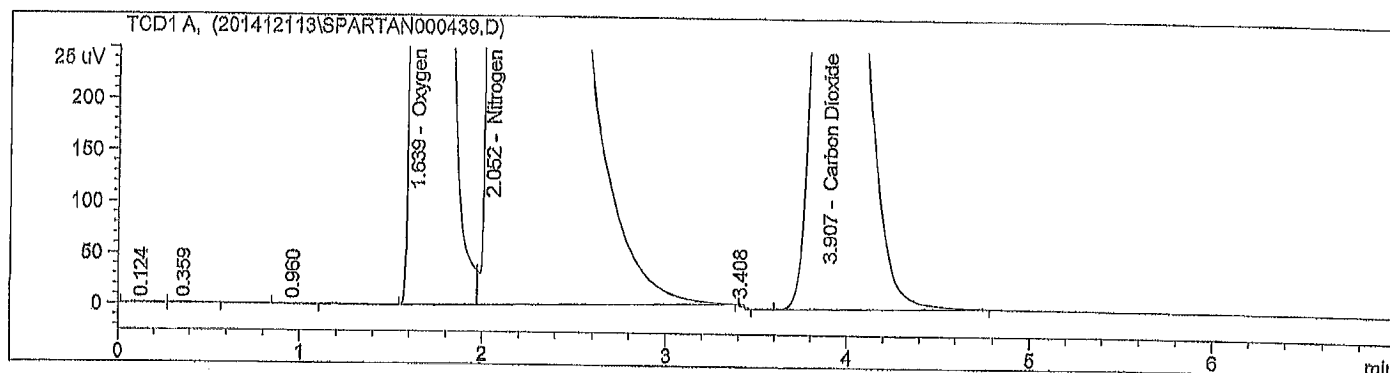
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 18:47:21	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:46:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:54:28 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14  
B1A - Tr#73341 - 14:30 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.639	BV	3.90190e4	3.93144e-4	15.463890	-	Oxygen
2.052	VBAS	2.01351e5	3.94093e-4	79.991345	-	Nitrogen
3.907	BBA	1.34861e4	3.34298e-4	4.544765	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*



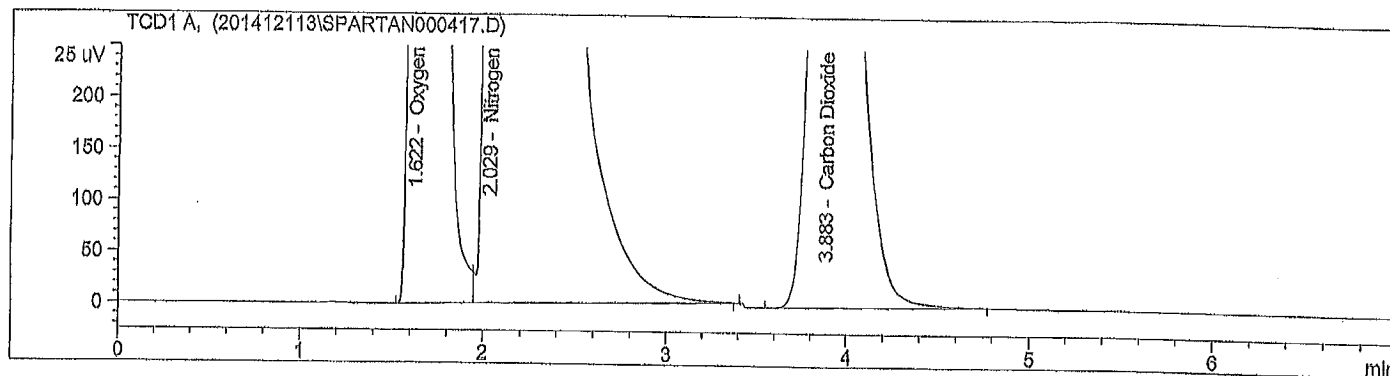
Data File C:\CHEM32\1\DATA\201412113\SPARTAN000417.D  
Sample Name: T14B1B Tr#73342 1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 13-Dec-14, 14:59:59              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 2:56:12 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:07:06 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)

Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T14
                  B1B - Tr#73342 - 15:05 - 1 cc injection
=====
```



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.622	BV	3.84951e4	3.93145e-4	15.350323		Oxygen
2.029	VBAS	2.00192e5	3.94087e-4	80.020010		Nitrogen
3.883	BBA	1.36540e4	3.34295e-4	4.629667		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

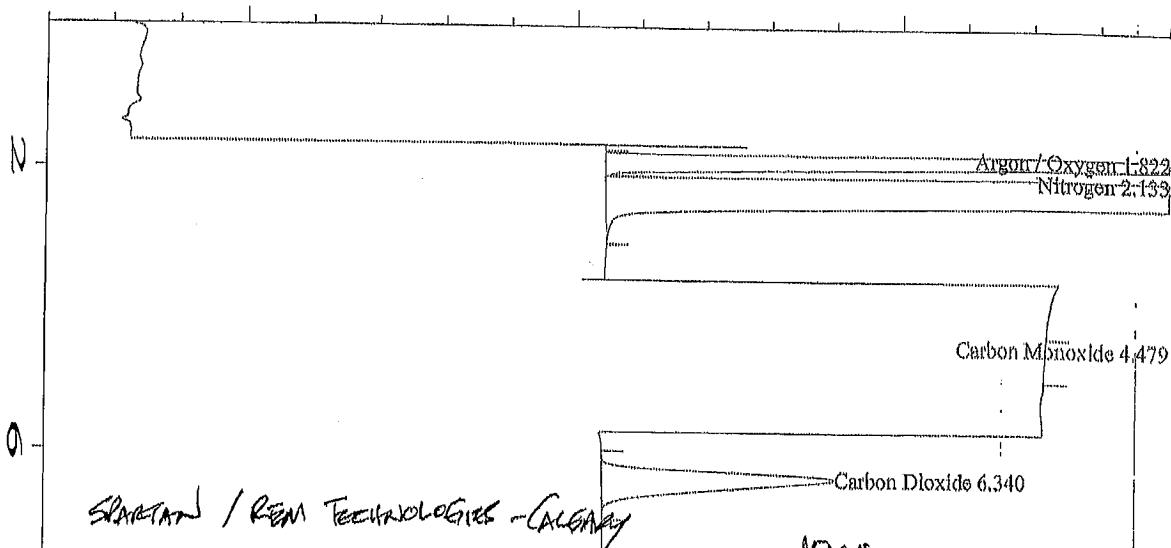
Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*



Normalized Percent Report

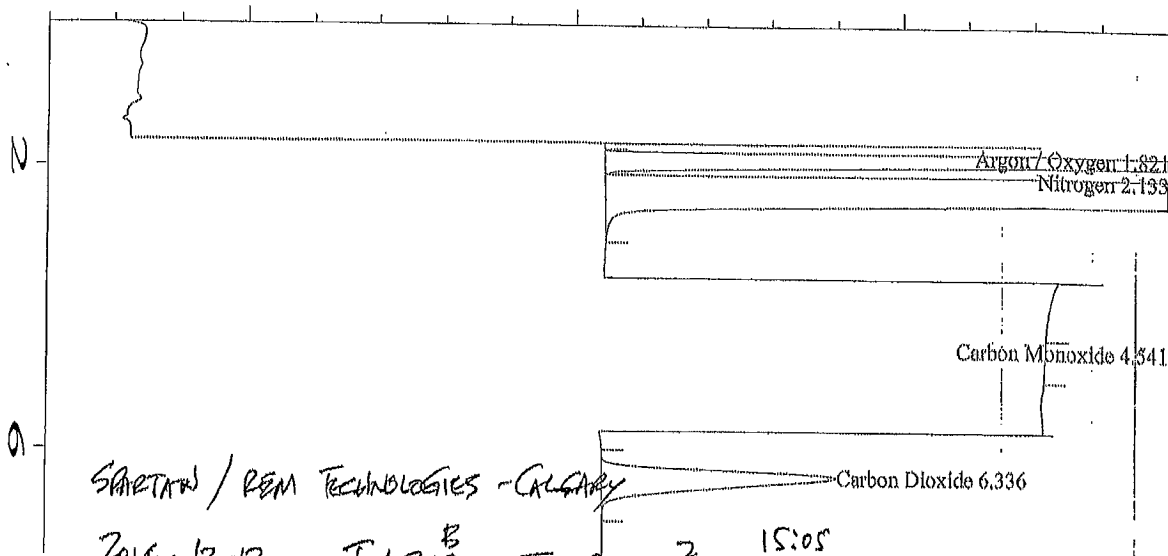
Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T14B1B-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:16:31 Instrument Method:  
 Report Created on: 15 Dec 14 11:01 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\... \2014\REM-SP~1\REM\T14B1B-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.822	330679	BV	0.121	1	15.328	Argon / Oxygen
2.133	1669905	VBA	0.192	1	80.078	Nitrogen
3.913	* not found *	1				Methane
4.479	186	BV	0.453	1	0.000274	Carbon Monoxide
6.340	114611	BV	0.251	1	4.593	Carbon Dioxide

Total amount = 98.9449

Not all calibrated peaks were found



Normalized Percent Report

Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T14B1B-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:26:43 Instrument Method:  
 Report Created on: 15 Dec 14 11:02 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Slg. 1 In C:\HPCHEM\... \2014\REM-SP~1\REM\T14B1B-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.821	328801 BV	0.122	1		15.328	Argon / Oxygen
2.133	1660620 VBA	0.191	1		80.080	Nitrogen
3.913	* not found *	1				Methane
4.541	111 BBA	0.374	1		0.000165	Carbon Monoxide
6.336	113914 BV	0.249	1		4.591	Carbon Dioxide

Total amount = 98.3814

Not all calibrated peaks were found

=====

Calibration Table

=====

Calib. Data Modified : 11/20/2014 11:10:56 AM

G.C. ID# 6538

Calculate : Normalized Percent  
Based on : Peak Area

2014-11-19

Rel. Reference Window : 3.000 %  
Abs. Reference Window : 0.300 min  
Rel. Non-ref. Window : 3.000 %  
Abs. Non-ref. Window : 0.300 min  
Do not use Multiplier & Dilution Factor with ISTDs  
Uncalibrated Peaks : not reported  
Partial Calibration : Yes, identified peaks are recalibrated  
Correct All Ret. Times: No, only for identified peaks

Curve Type : Linear  
Origin : Included  
Weight : Equal

Recalibration Settings:  
Average Response : Average all calibrations  
Average Retention Time: Floating Average New 75%

Calibration Report Options :

Printout of recalibrations within a sequence:

Calibration Table after Recalibration

Normal Report after Recalibration

If the sequence is done with bracketing:

Results of first cycle (ending previous bracket)

Signal 1: TCD1 A,

RetTime [min]	Lvl Sig	Amount [Mole %]	Area	Amt/Area	Ref Grp Name
1.325	1 3	1.00000e-1	7.96014e-1	1.25626e-1	Hydrogen
	2	5.00000e-1	3.70561	1.34930e-1	
	1	1.00000	6.92623	1.44379e-1	
1.787	1 3	6.00000e-1	1559.54932	3.84727e-4	Oxygen
	2	3.00000	7531.69385	3.98317e-4	
	1	6.00000	1.52983e4	3.92201e-4	
2.250	1 3	8.08000	2.14924e4	3.75947e-4	Nitrogen
	2	40.40000	1.02827e5	3.92894e-4	
	1	80.80000	2.04934e5	3.94273e-4	
4.025	1 3	1.20000	3644.35571	3.29276e-4	Carbon Dioxide
	2	6.00000	1.78148e4	3.36800e-4	
	1	12.00000	3.59777e4	3.33540e-4	
5.038	1 3	1.00000e-2	21.17078	4.72349e-4	Methane
	2	5.00000e-2	95.72540	5.22327e-4	
	1	1.00000e-1	201.92026	4.95245e-4	
6.085	1 3	1.00000e-2	21.98953	4.54762e-4	Carbon Monoxide
	2	5.00000e-2	122.41664	4.08441e-4	
	1	1.00000e-1	253.91801	3.93828e-4	

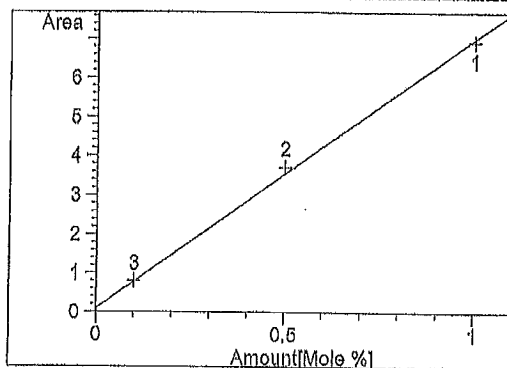
=====

Peak Sum Table

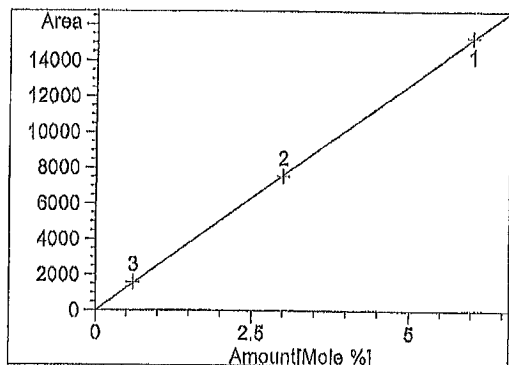
=====

\*\*\*No Entries in table\*\*\*

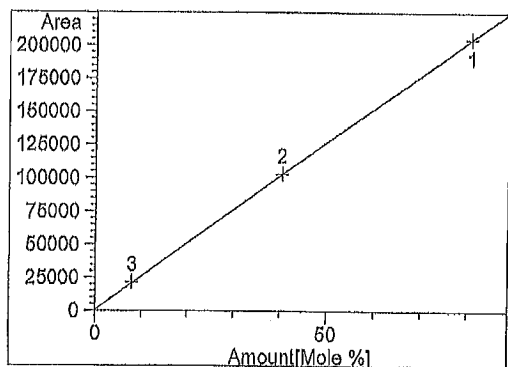
### Calibration Curves



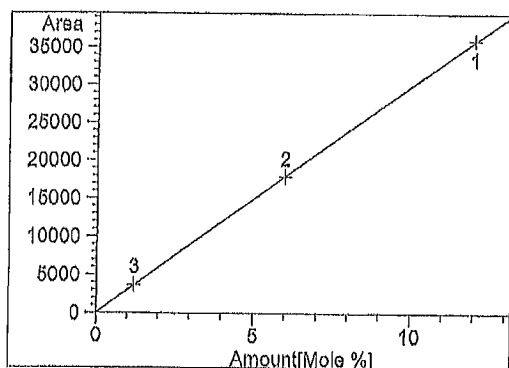
Hydrogen at exp. RT: 1.325  
TCD1 A,  
Correlation: 0.99933  
Residual Std. Dev.: 0.14056  
Formula:  $y = mx + b$   
m: 6.91531  
b: 9.08385e-2  
x: Amount  
y: Height



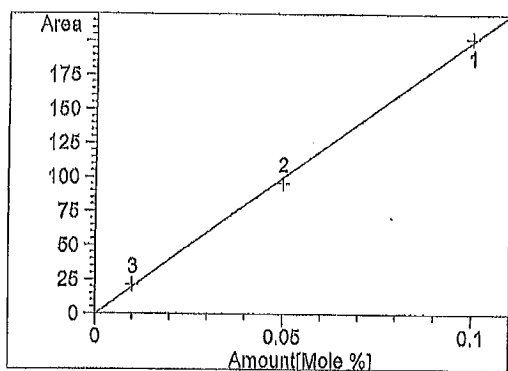
Oxygen at exp. RT: 1.787  
TCD1 A,  
Correlation: 0.99996  
Residual Std. Dev.: 77.66686  
Formula:  $y = mx + b$   
m: 2544.15882  
b: -8.60112  
x: Amount  
y: Height



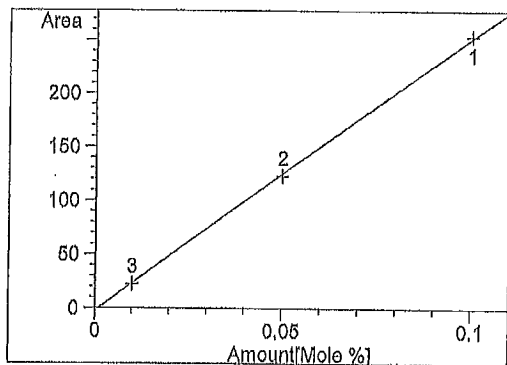
Nitrogen at exp. RT: 2.250  
TCD1 A,  
Correlation: 0.99999  
Residual Std. Dev.: 526.14425  
Formula:  $y = mx + b$   
m: 2531.04840  
b: 509.82082  
x: Amount  
y: Height



Carbon Dioxide at exp. RT: 4.025  
TCD1 A,  
Correlation: 0.99998  
Residual Std. Dev.: 115.80990  
Formula:  $y = mx + b$   
m: 2993.92133  
b: -11.62622  
x: Amount  
y: Height



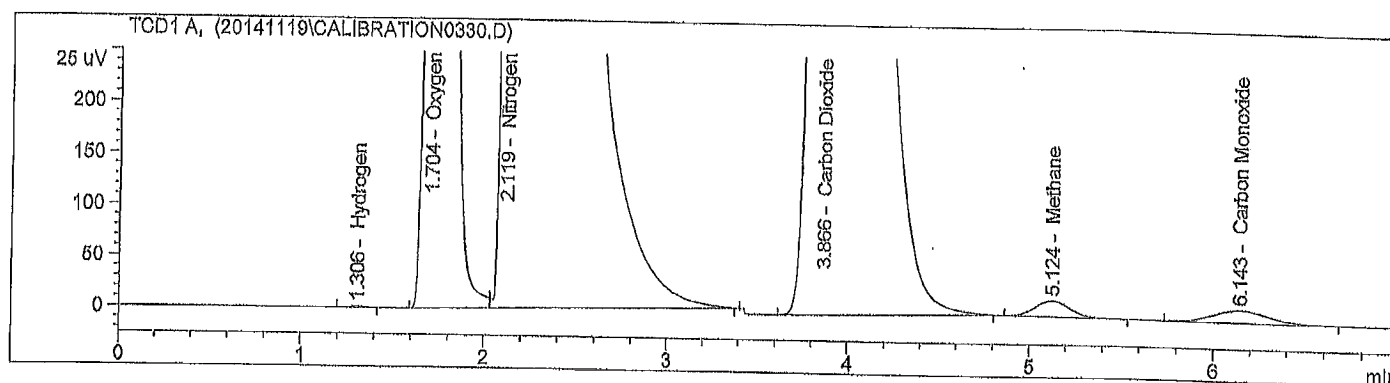
Methane at exp. RT: 5.038  
TCD1 A,  
Correlation: 0.99954  
Residual Std. Dev.: 3.37306  
Formula:  $y = mx + b$   
m: 2006.02358  
b: -5.36834e-1  
x: Amount  
y: Height



Carbon Monoxide at exp. RT: 6.085  
TCD1 A,  
Correlation: 0.99980  
Residual Std. Dev.: 2.82061  
Formula:  $y = mx + b$   
m: 2548.31630  
b: -2.35161  
x: Amount  
y: Height

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 13:51:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 1:49:29 PM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 1 - run 1 - ID# 11-10-27-22 - 1 cc
                injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

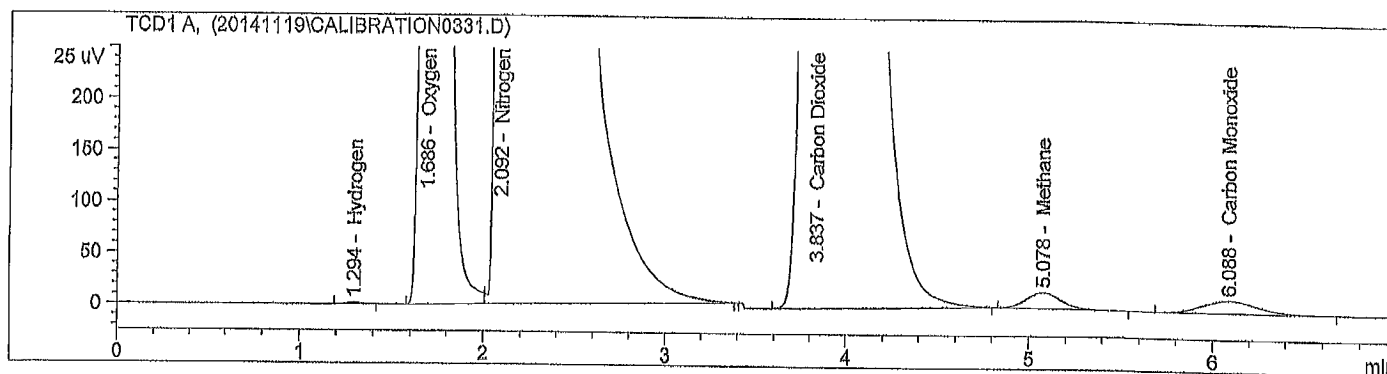
RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.306	BBA	6.95264	1.42717e-1	0.986598		Hydrogen
1.704	BV	1.54031e4	3.93277e-4	6.023090		Oxygen
2.119	VBAS	2.06180e5	3.94116e-4	80.794853		Nitrogen
3.866	BBA	3.61016e4	3.34118e-4	11.993334		Carbon Dioxide
5.124	BBA	205.76920	4.99799e-4	0.102256		Methane
6.143	BBA	253.60886	3.96055e-4	0.099870		Carbon Monoxide

Totals : 100.000000

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:05:16
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:03:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 1 - run 2 - ID# 11-10-27-22 - 1 cc
                injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.294	BBA	6.88176	1.42698e-1	0.980902		Hydrogen
1.686	BV	1.53162e4	3.93278e-4	6.016701		Oxygen
2.092	VBAS	2.05130e5	3.94111e-4	80.752692		Nitrogen
3.837	BBA	3.60992e4	3.34118e-4	12.047740		Carbon Dioxide
5.078	BBA	202.26636	4.99822e-4	0.100983		Methane
6.088	BBA	255.27438	3.96031e-4	0.100982		Carbon Monoxide

Totals : 100.000000

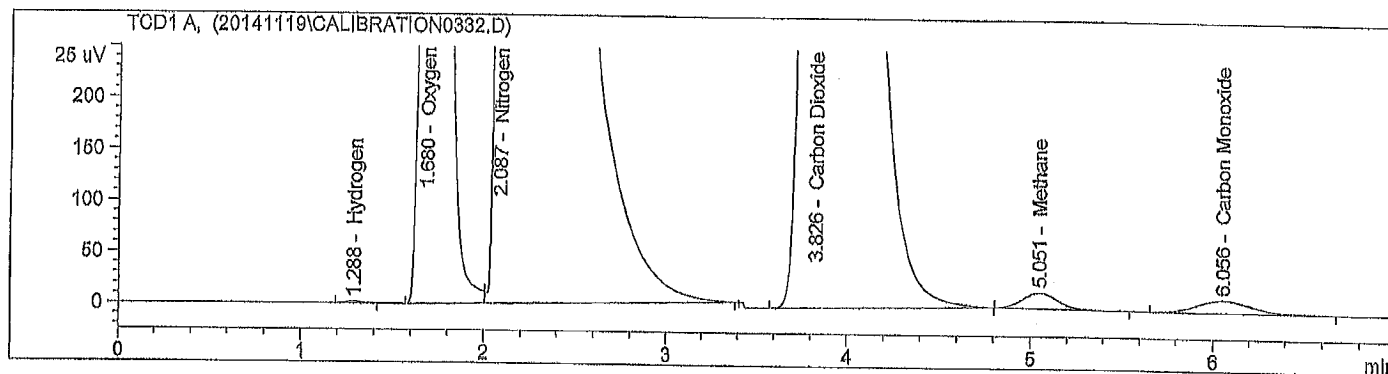
\*\*\* End of Report \*\*\*



=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 19-Nov-14, 14:18:22	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 11/19/2014 2:16:41 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Calibration - Level 1 - run 3 - ID# 11-10-27-22 - 1 cc  
injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:10:56 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.288	BBA	6.94429	1.42715e-1	0.998099		Hydrogen
1.680	BV	1.51756e4	3.93280e-4	6.010682		Oxygen
2.087	VBAS	2.03492e5	3.94103e-4	80.767144		Nitrogen
3.826	BBA	3.57322e4	3.34119e-4	12.023674		Carbon Dioxide
5.051	BBA	197.72522	4.99852e-4	0.099536		Methane
6.056	BBA	252.87079	3.96065e-4	0.100865		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

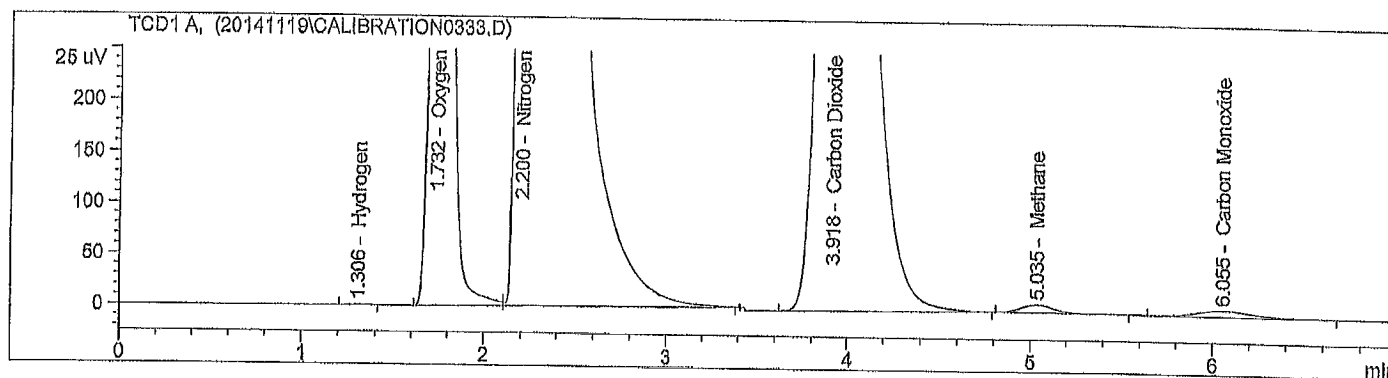
Sample Name: Level 2 - run 1 0.5 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:38:37
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:36:49 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 2 - run 1 - ID# 11-10-27-22 - 0.5
                cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.306	BBA	3.66942	1.41027e-1	1.036414		Hydrogen
1.732	BV	7525.45117	3.93506e-4	5.930871		Oxygen
2.200	VBAS	1.02771e5	3.93133e-4	80.918075		Nitrogen
3.918	BBA	1.78080e4	3.34228e-4	11.920423		Carbon Dioxide
5.035	BBA	96.20104	5.01280e-4	0.096582		Methane
6.055	BBA	121.87815	3.99988e-4	0.097635		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

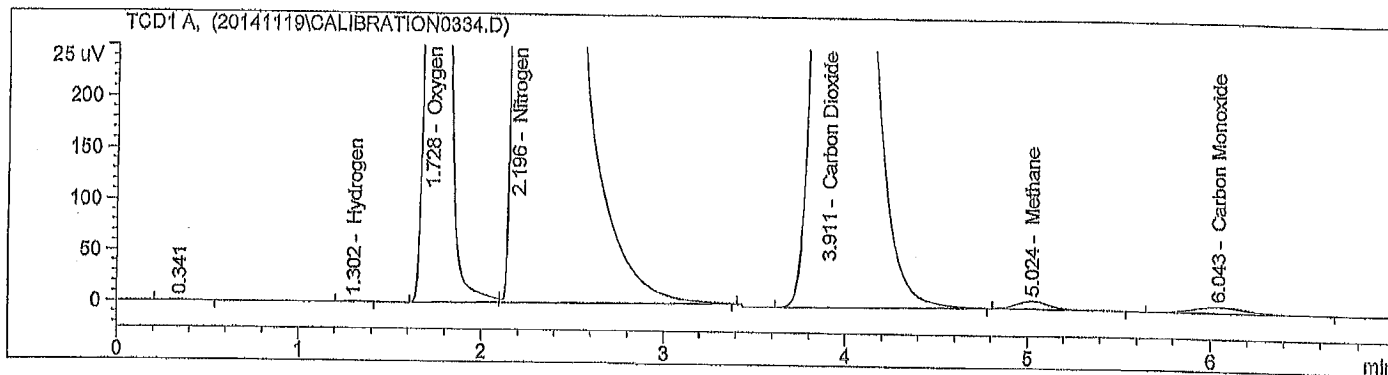
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:47:46
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:45:54 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 2 - run 2 - ID# 11-10-27-22 - 0.5
                cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.302	BBA	3.74180	1.41096e-1	1.056029		Hydrogen
1.728	BV	7537.93652	3.93506e-4	5.933126		Oxygen
2.196	VBAS	1.02882e5	3.93135e-4	80.902696		Nitrogen
3.911	BBA	1.78215e4	3.34228e-4	11.914282		Carbon Dioxide
5.024	BBA	95.24976	5.01308e-4	0.095510		Methane
6.043	BBA	122.95512	3.99921e-4	0.098356		Carbon Monoxide

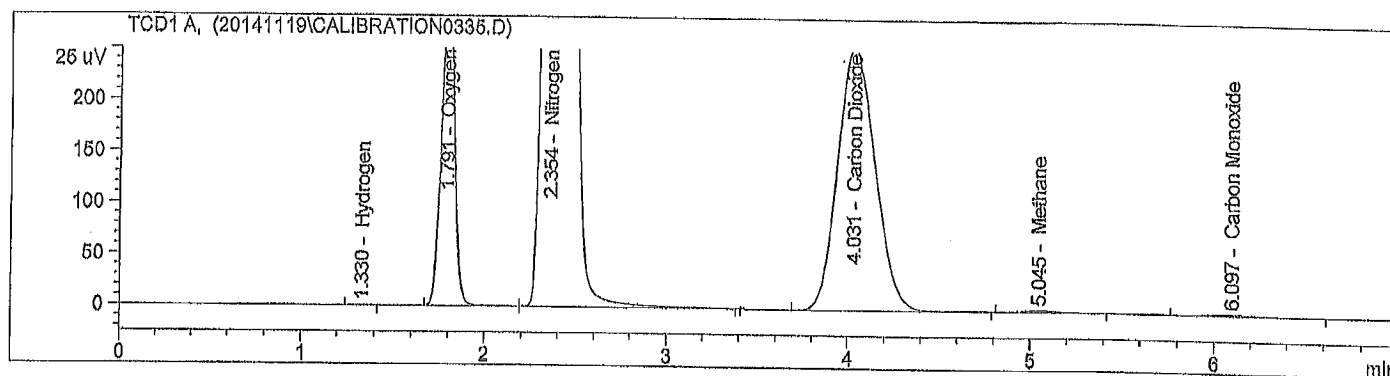
Totals : 100.000000

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\20141119\CALIBRATION0335.D  
Sample Name: Level 3 - run 1 0.1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:58:21
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:55:04 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Calibration - Level 3 - run 1 - ID# 11-10-27-22 - 0.1
                  cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

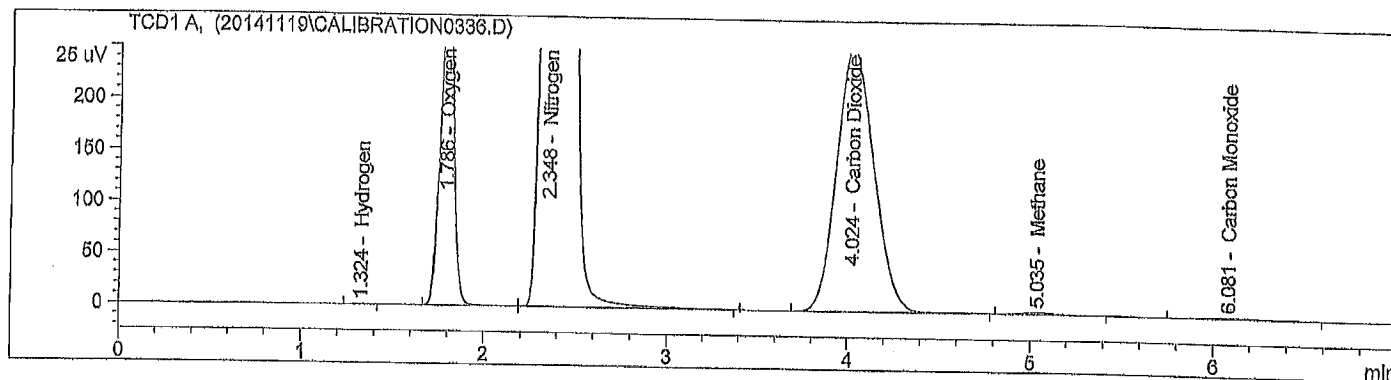
RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.330	BBA	7.91850e-1	1.28018e-1	0.992228		Hydrogen
1.791	BV	1553.33228	3.95234e-4	6.009202		Oxygen
2.354	VBA	2.14240e4	3.85691e-4	80.879747		Nitrogen
4.031	BBA	3634.52686	3.35079e-4	11.920459		Carbon Dioxide
5.045	BB	21.13526	5.11160e-4	0.105746		Methane
6.097	BB	21.76138	4.34822e-4	0.092618		Carbon Monoxide

Totals : 100.000000

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 15:08:13
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 3:07:10 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 3 - run 2 - ID# 11-10-27-22 - 0.1
                cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.324	BBA	8.00179e-1	1.28190e-1	0.997489		Hydrogen
1.786	BV	1565.76636	3.95216e-4	6.017657		Oxygen
2.348	VBA	2.15607e4	3.85751e-4	80.878889		Nitrogen
4.024	BBA	3654.18457	3.35073e-4	11.906805		Carbon Dioxide
5.035	BB	21.20629	5.11118e-4	0.105403		Methane
6.081	BB	22.21768	4.33951e-4	0.093757		Carbon Monoxide

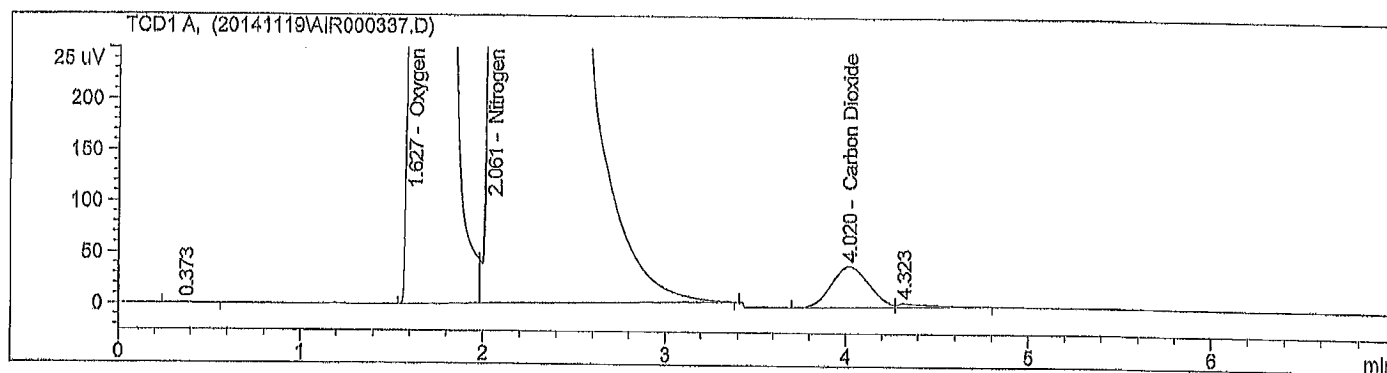
Totals : 100.000000

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\20141119\AIR000337.D  
Sample Name: Air 1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 19-Nov-14, 15:17:19              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 11/19/2014 3:15:30 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 11/20/2014 11:16:02 AM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Air - 1 cc injection
=====
```



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:15:08 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.627	BV S	5.39117e4	3.93120e-4	21.422795	-	Oxygen
2.061	VBAS	1.96779e5	3.94070e-4	78.382674	-	Nitrogen
4.020	BV	564.56024	3.40889e-4	0.194532	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

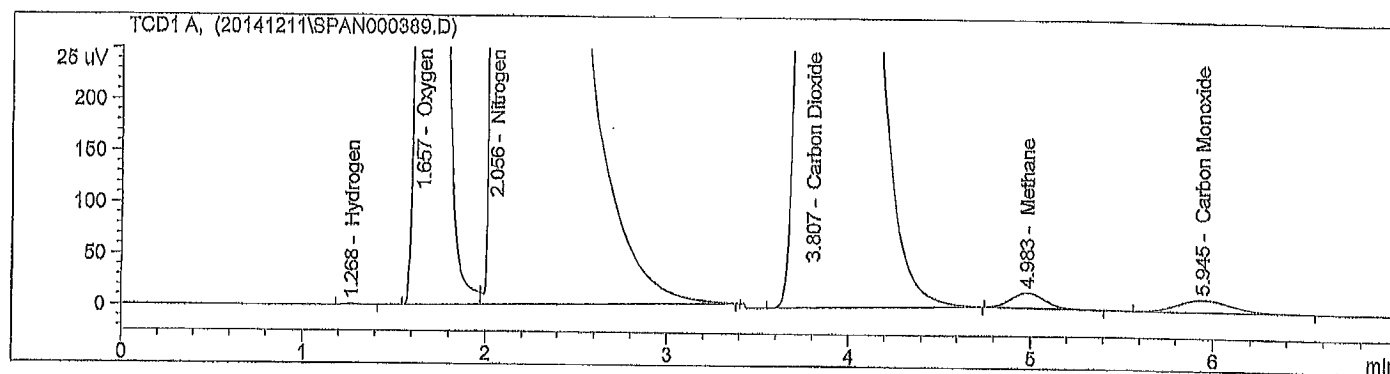
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1              Location : -
Injection Date  : 11-Dec-14, 14:09:43      Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 11/26/2014 2:03:01 PM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:24:34 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



=====

Normalized Percent Report

=====

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

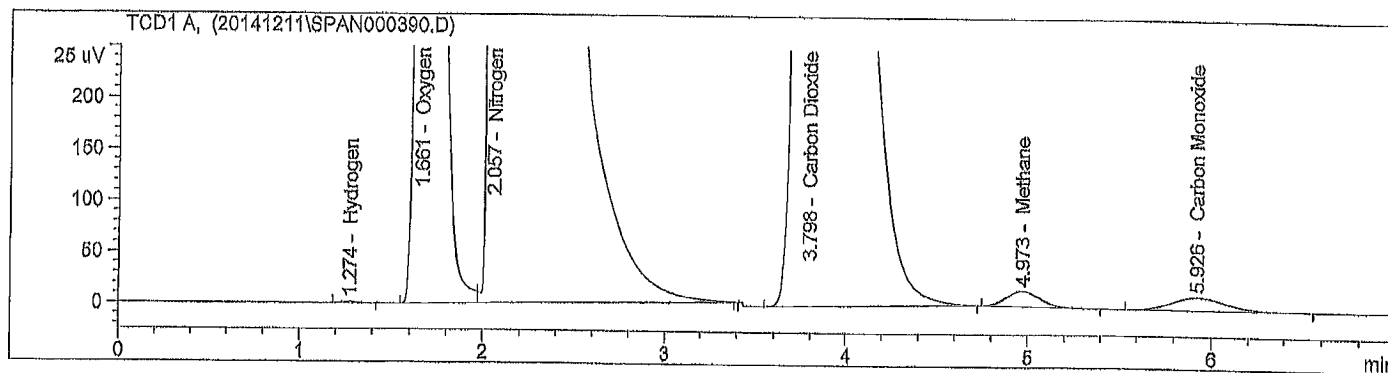
RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.268	BBA	5.94273	1.42396e-1	0.867649		Hydrogen
1.657	BV	1.49409e4	3.93283e-4	6.024776		Oxygen
2.056	VBAS	2.00089e5	3.94087e-4	80.849146		Nitrogen
3.807	BBA	3.51987e4	3.34120e-4	12.058402		Carbon Dioxide
4.983	BBA	193.17958	4.99884e-4	0.099013		Methane
5.945	BBA	248.70967	3.96126e-4	0.101015		Carbon Monoxide

Totals : 100.000000

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 14:25:30        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:24:34 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:32:37 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====
```



=====

Normalized Percent Report

=====

```
Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.274	BBA	5.84992	1.42361e-1	0.858268		Hydrogen
1.661	BV	1.48660e4	3.93285e-4	6.025345		Oxygen
2.057	VBAS	1.99137e5	3.94082e-4	80.876270		Nitrogen
3.798	BBA	3.49651e4	3.34121e-4	12.039830		Carbon Dioxide
4.973	BBA	191.44820	4.99896e-4	0.098631		Methane
5.926	BBA	249.01297	3.96122e-4	0.101656		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*



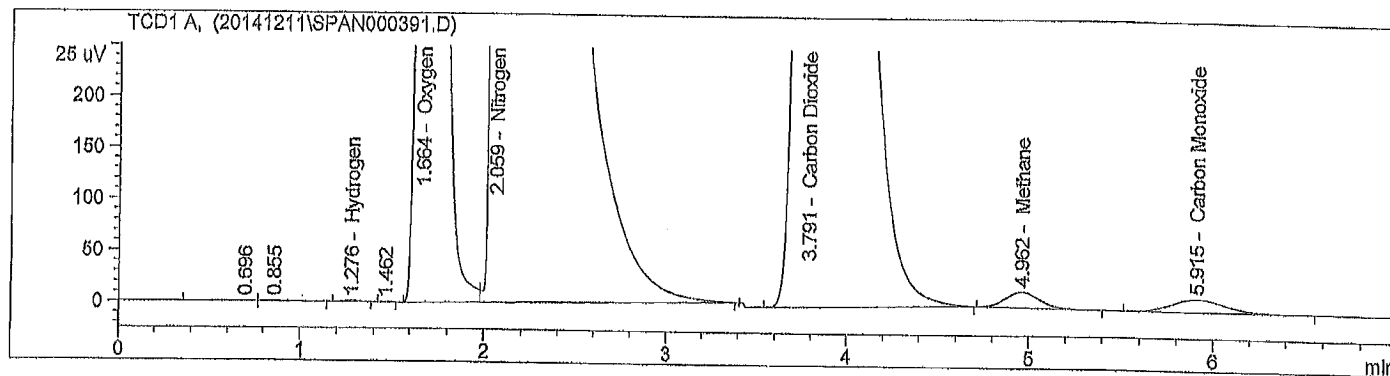
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 14:33:29        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:32:47 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:47:24 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.276	BV	6.21625	1.42493e-1	0.913639		Hydrogen
1.664	BV	1.48556e4	3.93285e-4	6.026265		Oxygen
2.059	VBAS	1.98890e5	3.94080e-4	80.844069		Nitrogen
3.791	BBA	3.48630e4	3.34121e-4	12.014899		Carbon Dioxide
4.962	BBA	193.45824	4.99882e-4	0.099748		Methane
5.915	BBA	248.11813	3.96135e-4	0.101380		Carbon Monoxide

Totals : 100.000000

```

=====
*** End of Report ***
=====

```

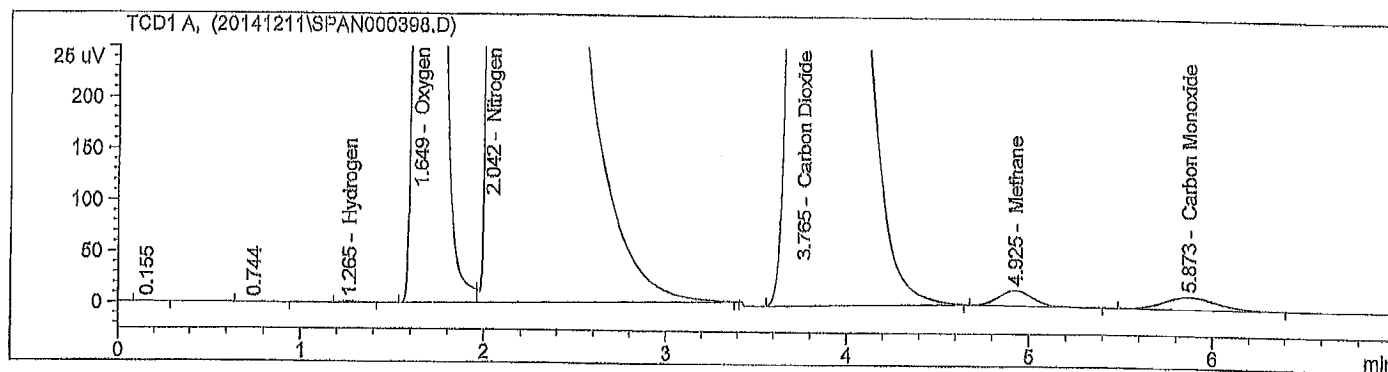
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:49:40        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:48:15 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:59:25 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.265	BBA	5.67366	1.42291e-1	0.835041		Hydrogen
1.649	BV	1.48336e4	3.93285e-4	6.034194		Oxygen
2.042	VBAS	1.98546e5	3.94079e-4	80.930284		Nitrogen
3.765	BBA	3.47237e4	3.34122e-4	12.000443		Carbon Dioxide
4.925	BBA	191.79823	4.99894e-4	0.099172		Methane
5.873	BBA	246.15312	3.96165e-4	0.100867		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

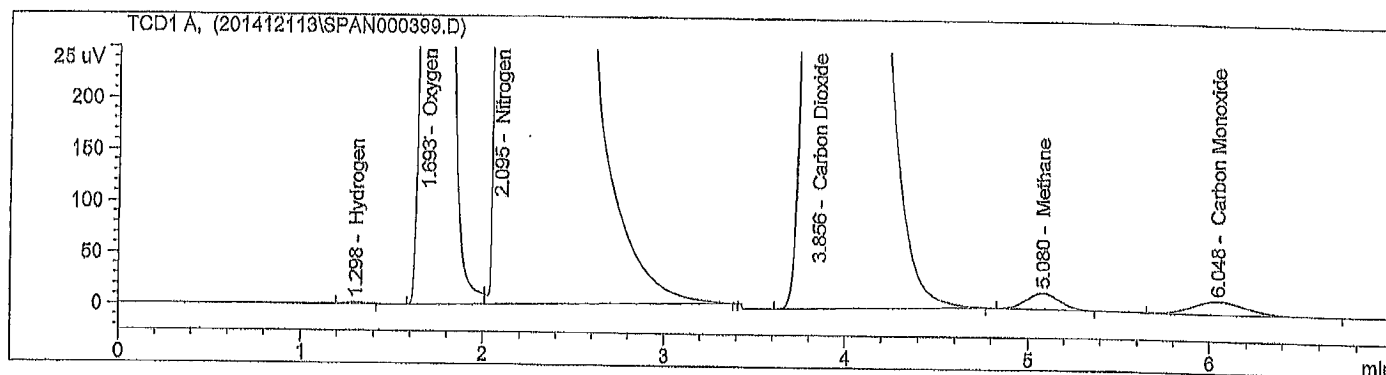
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 11:24:27
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/26/2014 2:03:01 PM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 11:31:27 AM by Maxxam - ID# 6538 - BW
Sample Info    : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



=====

Normalized Percent Report

=====

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.298	BBA	6.97662	1.42724e-1	0.993227		Hydrogen
1.693	BV	1.53576e4	3.93277e-4	6.024606		Oxygen
2.095	VBAS	2.05441e5	3.94113e-4	80.763405		Nitrogen
3.856	BBA	3.60542e4	3.34118e-4	12.016069		Carbon Dioxide
5.080	BBA	204.12659	4.99810e-4	0.101768		Methane
6.048	BBA	255.48210	3.96028e-4	0.100924		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

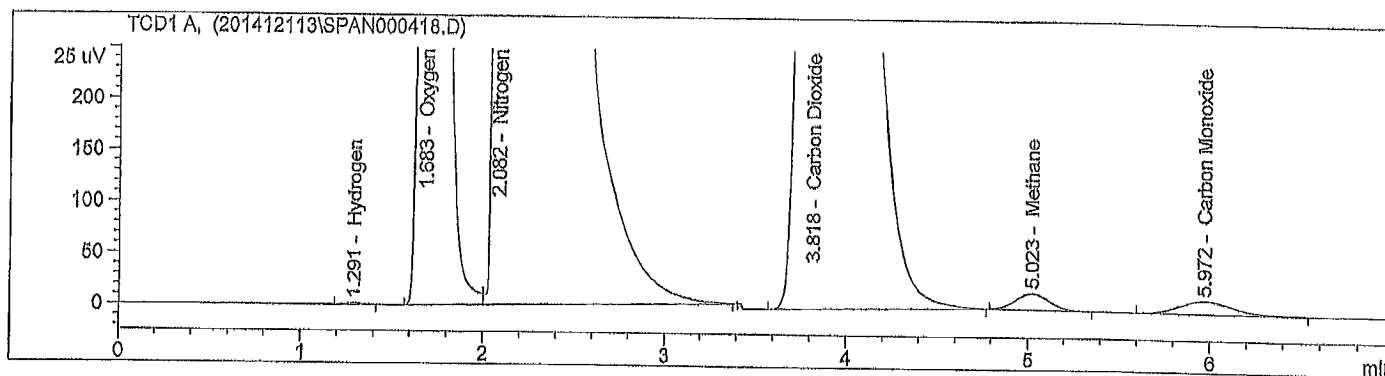
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 15:23:04        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:07:16 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:41:00 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc Injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.291	BBA	6.84476	1.42687e-1	0.990908		Hydrogen
1.683	BV	1.51029e4	3.93281e-4	6.026322		Oxygen
2.082	VBAS	2.02190e5	3.94097e-4	80.844724		Nitrogen
3.818	BBA	3.52096e4	3.34120e-4	11.935842		Carbon Dioxide
5.023	BBA	199.69040	4.99839e-4	0.101269		Methane
5.972	BBA	251.16362	3.96090e-4	0.100935		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

```

### Calibration Table

Pk#	RT	Lvl	Mole %	Amt/Area	Ref Istd I#	Name
1	1.457	1	1.0	5.997e-004	1	Hydrogen
	2		0.5	6.6957e-004		
	3		0.1	7.9221e-004		
2	1.895	1	6.0	4.5687e-005	1	Argon / Oxygen
	2		3.0	4.5461e-005		
	3		0.6	4.3221e-005		
3	2.241	1	80.8	4.7623e-005	1	Nitrogen
	2		40.4	4.5948e-005		
	3		8.08	4.237e-005		
4	3.913	1	0.1	1.8827e-006	1	Methane
	2		0.05	1.8635e-006		
	3		0.01	1.7607e-006		
5	4.559	1	0.1	1.492e-006	1	Carbon Monoxide
	2		0.05	1.4927e-006		
	3		0.01	1.4498e-006		
6	6.316	1	12.0	4.0229e-005	1	Carbon Dioxide
	2		6.0	3.9701e-005		
	3		1.2	3.782e-005		

### Calibration Settings

Title:

Calibration 2014-12-13

Reference window: 15.000 %  
Non-reference window: 15.000 %  
Units of amount: Mole %  
Multiplier: 1.0  
RF uncal peaks: 0.0  
ISTD# to adjust uncal peaks: 0  
Sample Amount: 0.0

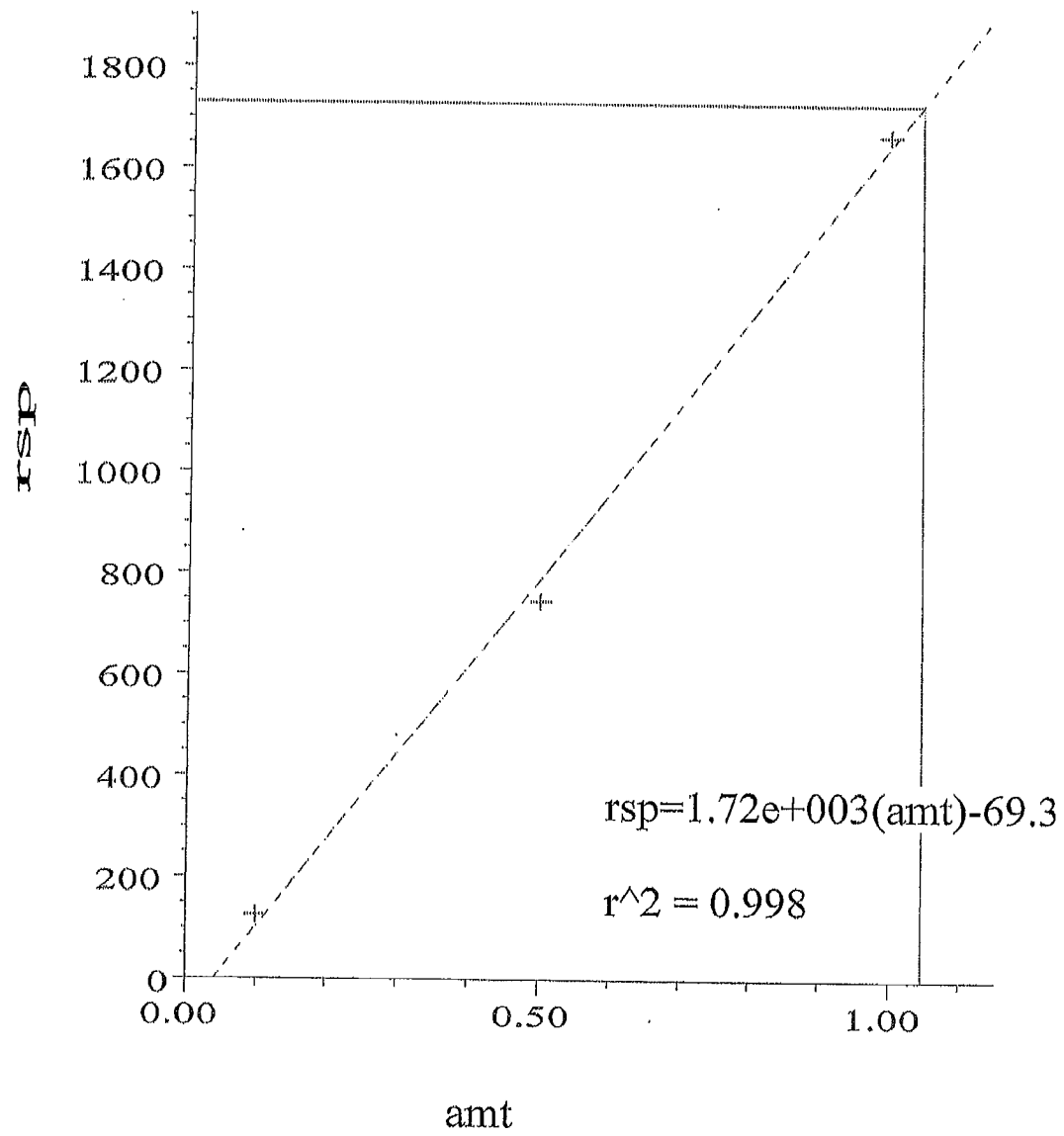
### Sample ISTD Information

No Sample ISTD Amounts

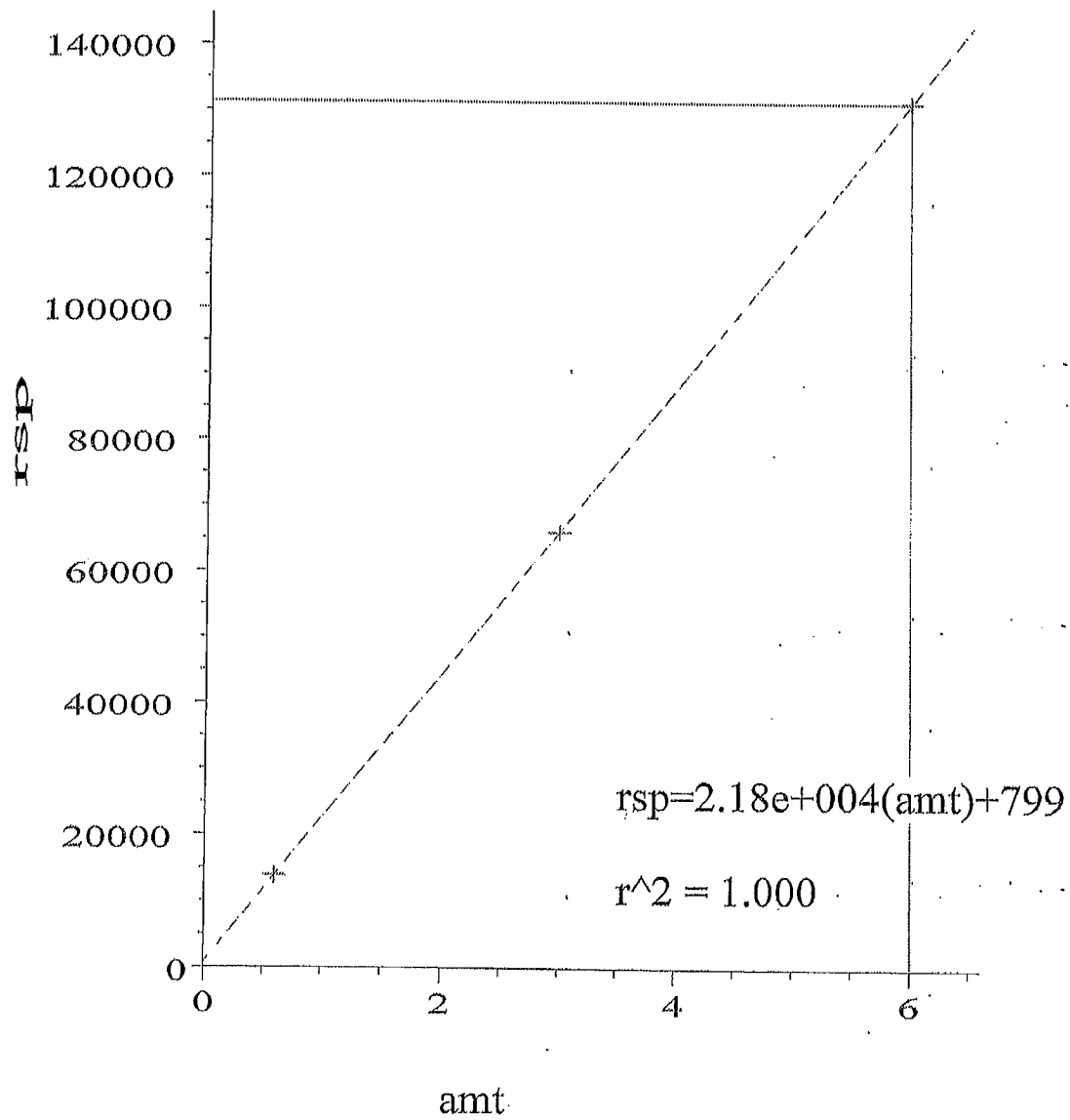
### Multilevel Information

Fit: Linear  
Origin: Force

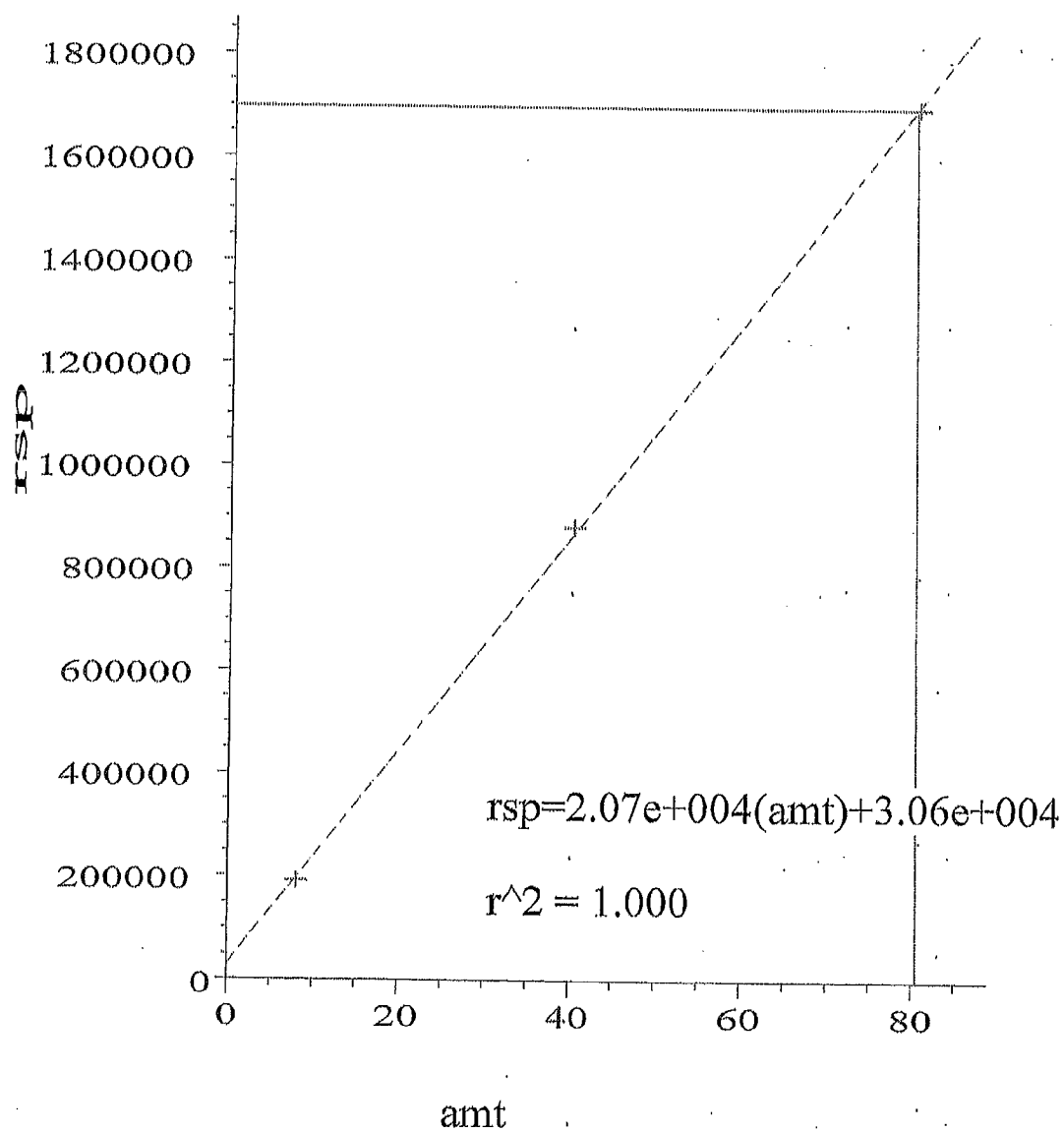
# Hydrogen



# Argon / Oxygen

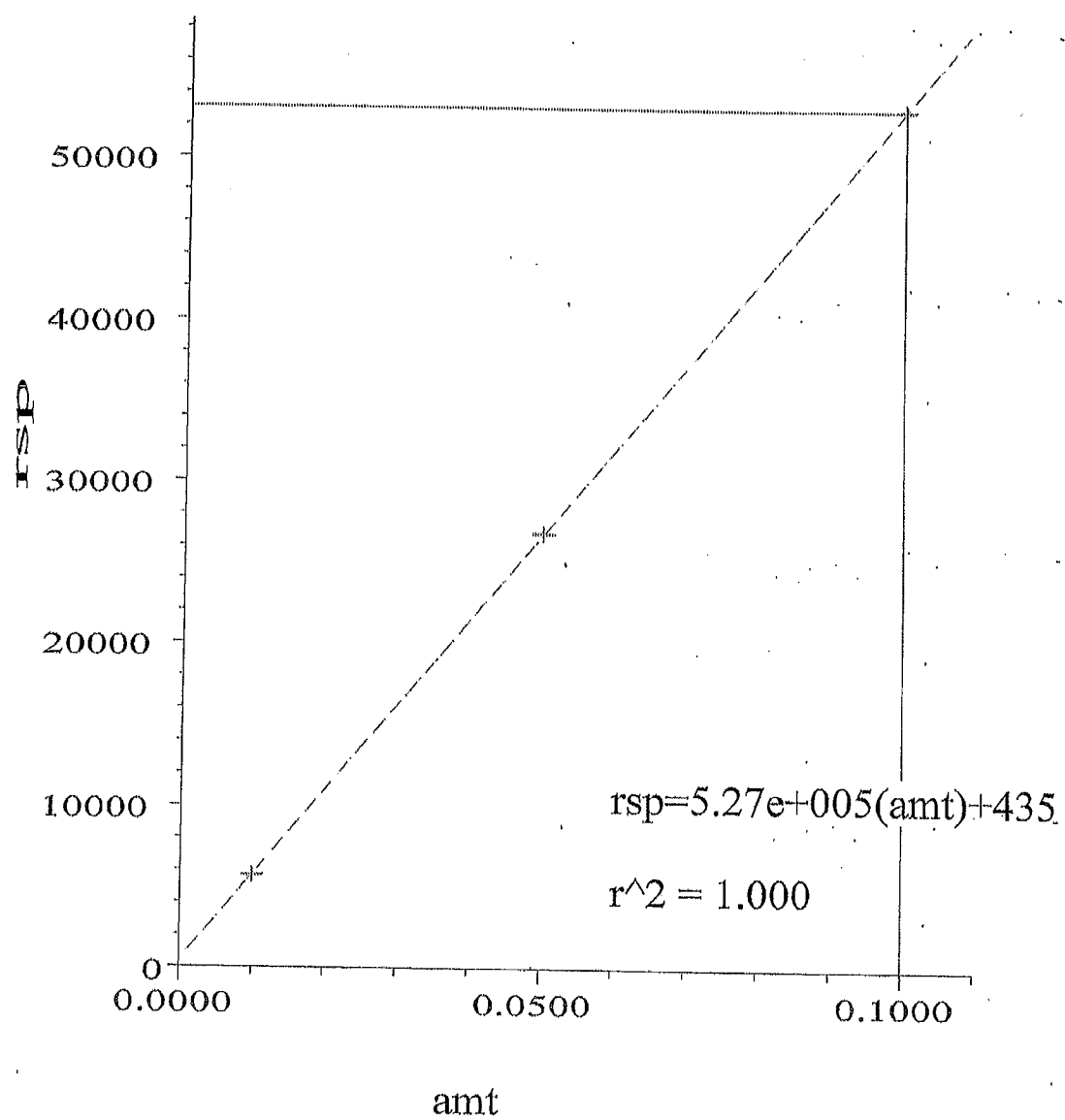


# Nitrogen

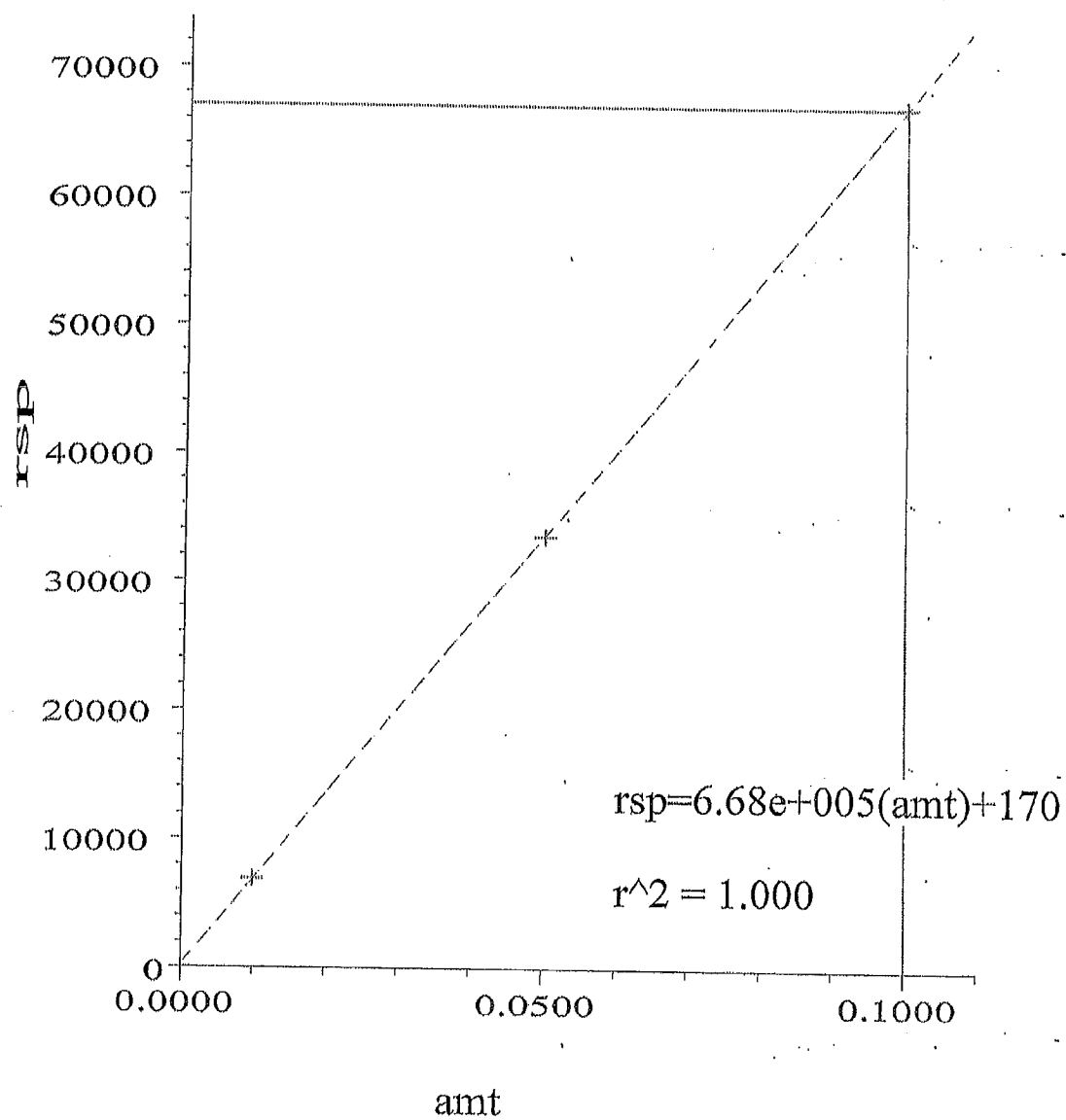




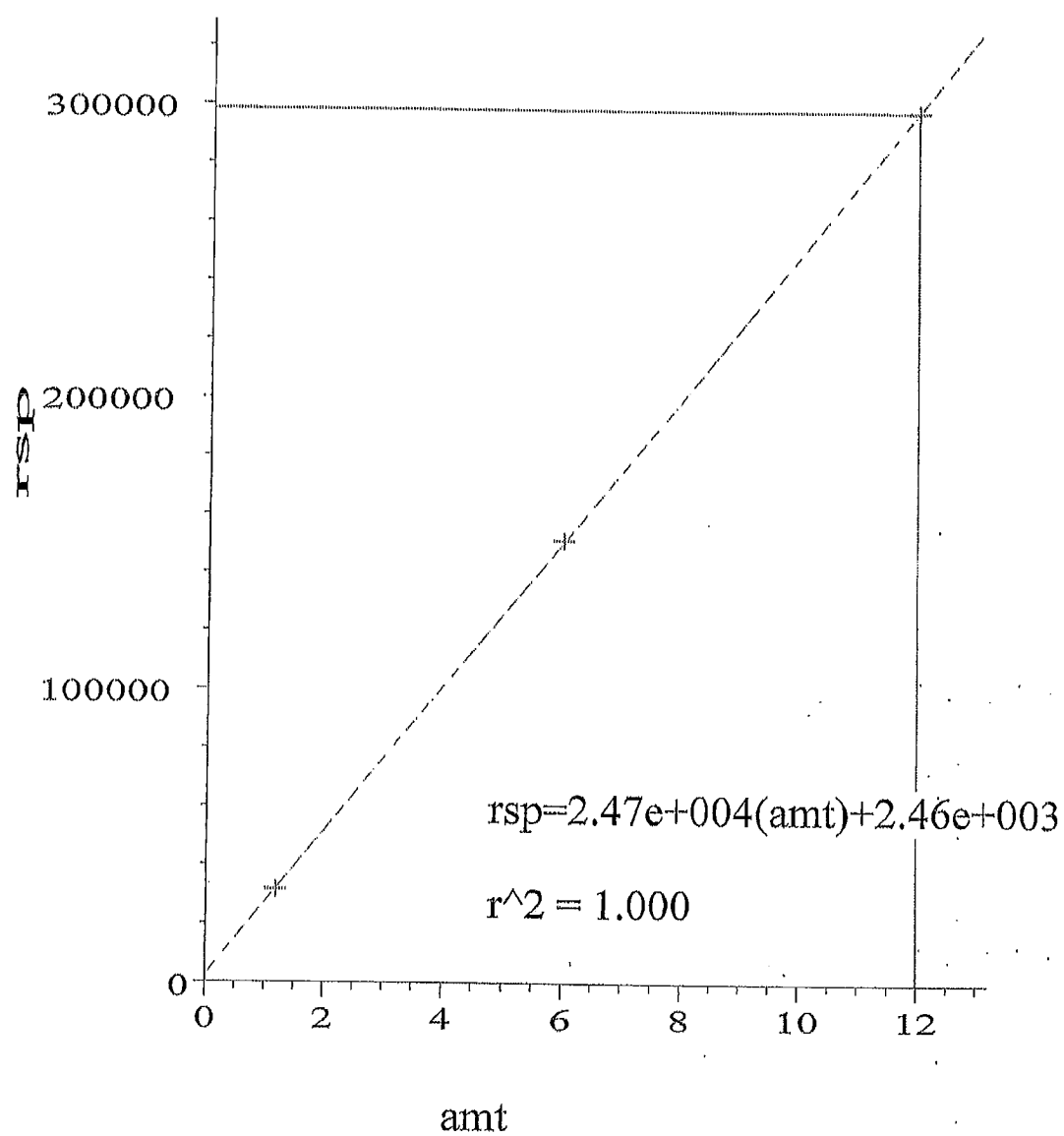
# Methane

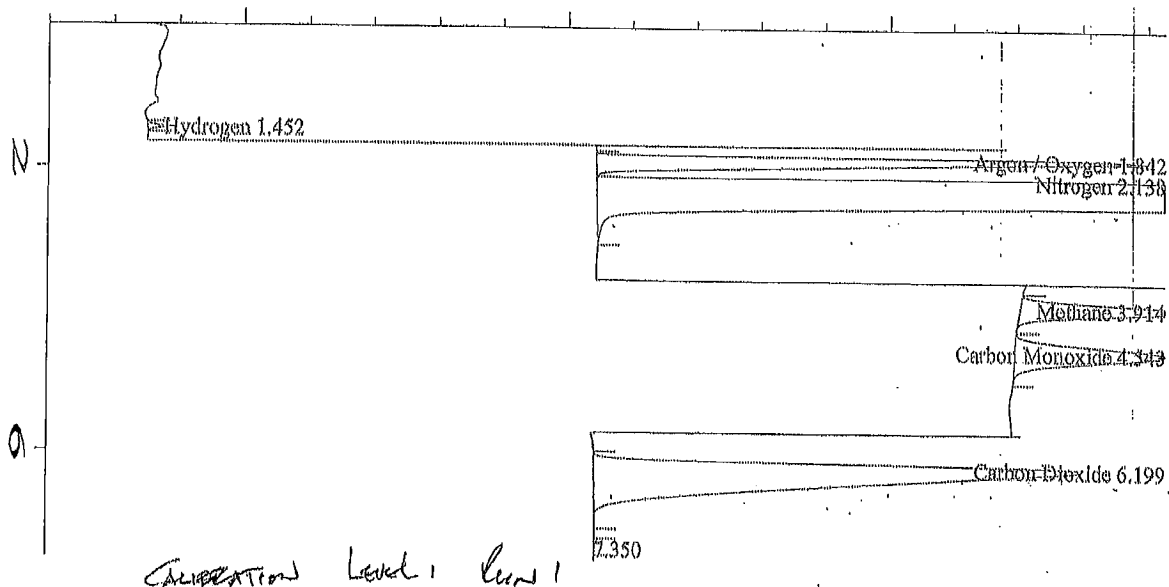


# Carbon Monoxide



# Carbon Dioxide



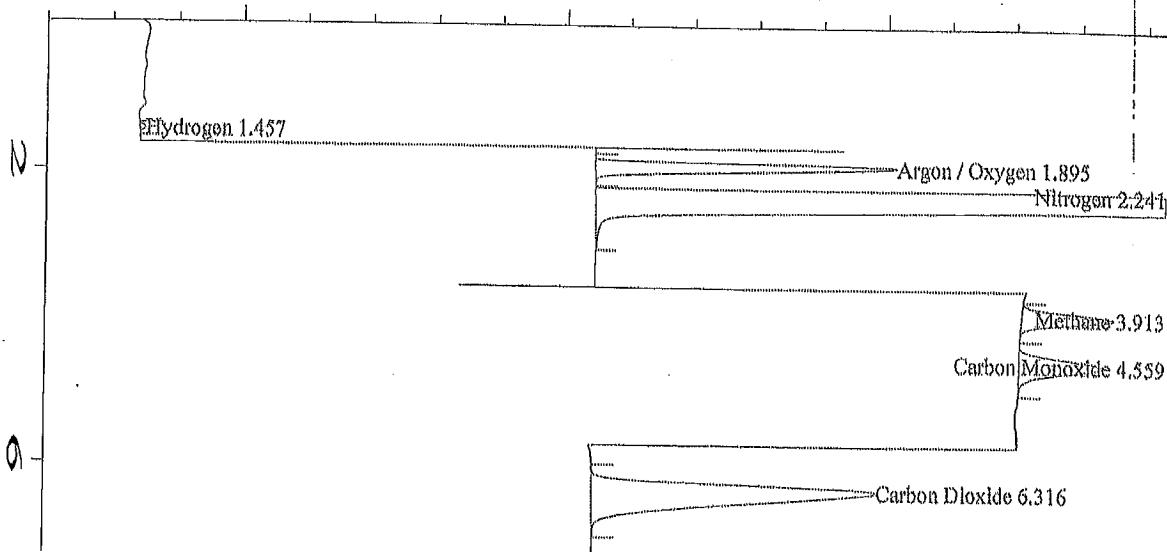


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL1-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 1914 15:44:05 Instrument Method:  
 Report Created on: 15 Dec 14 10:54 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\CAL1-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.452	1636	BBA	0.054	1	0.993	Hydrogen
1.842	131328	BV	0.118	1	6.001	Argon / Oxygen
2.138	1696645	VBA	0.192	1	80.525	Nitrogen
3.914	53114	BBA	0.156	1	0.100	Methane
4.543	67022	BBA	0.224	1	0.100	Carbon Monoxide
6.199	298291	BBA	0.304	1	11.989	Carbon Dioxide



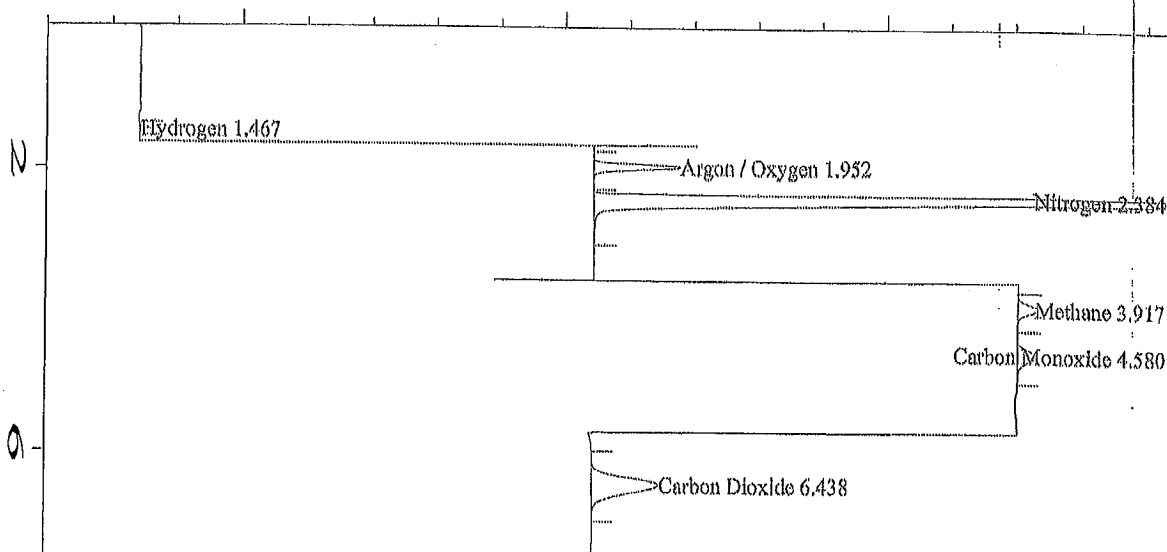
*Combustion level 2 Run 1*

# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL2-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 16:08:58 Instrument Method:  
 Report Created on: 15 Dec 14 10:51 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\CAL2-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.457	747	BBA	0.068	1	0.475	Hydrogen
1.895	65991	BV	0.117	1	2.997	Argon / Oxygen
2.241	879257	PBA	0.151	1	41.018	Nitrogen
3.913	26832	BBA	0.152	1	0.0501	Methane
4.559	33496	BBA	0.207	1	0.0499	Carbon Monoxide
6.316	151130	BV	0.267	1	6.025	Carbon Dioxide



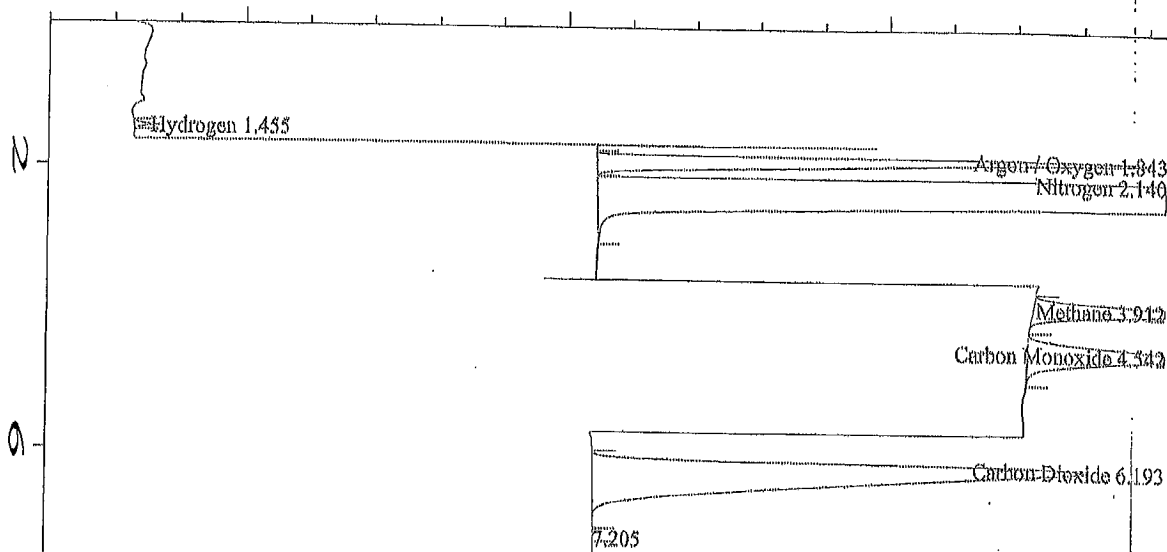
Calibration level 3 run 1

# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL3-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 16:19:48 Instrument Method:  
 Report Created on: 15 Dec 14 10:56 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\2014\REM-SP~1\REM\CAL3-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.467	126	BBA	0.075	1	0.114	Hydrogen
1.952	13882	BV	0.083	1	0.602	Argon / Oxygen
2.384	190702	PBA	0.098	1	7.737	Nitrogen
3.917	5679	BBA	0.144	1	0.00995	Methane
4.580	6898	BBA	0.191	1	0.0101	Carbon Monoxide
6.438	31729	BV	0.241	1	1.186	Carbon Dioxide



Shut check - run 1 11-10-27-27

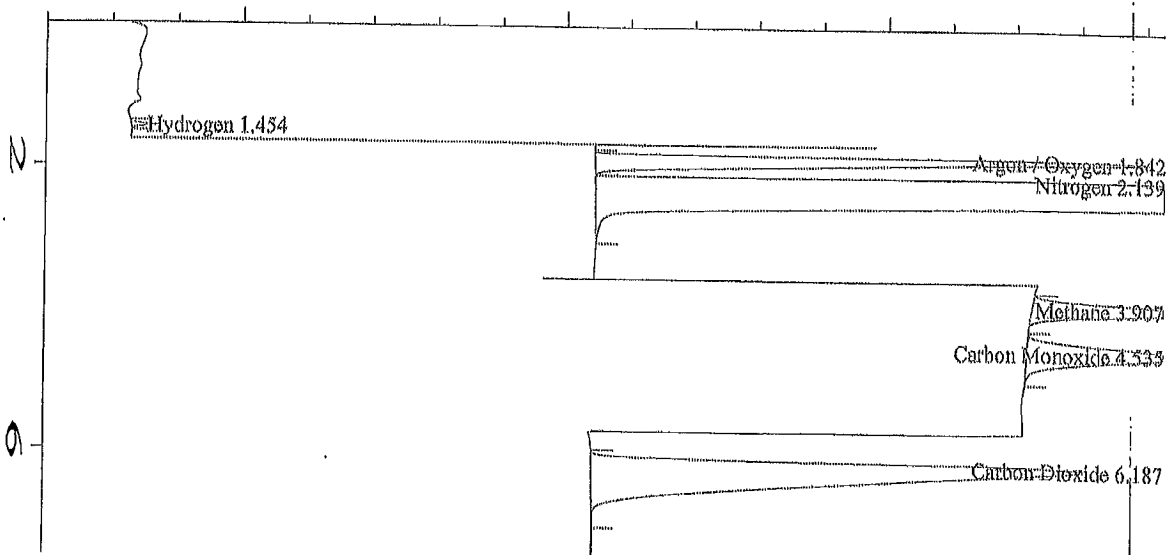
# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:00:41 Instrument Method:  
 Report Created on: 15 Dec 14 10:49 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\SPAN1-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.455	1663	BBA	0.054	1	1.008	Hydrogen
1.843	131956	BV	0.118	1	6.025	Argon / Oxygen
2.140	1703043	VBA	0.192	1	80.762	Nitrogen
3.912	53408	BBA	0.159	1	0.100	Methane
4.542	67369	BBA	0.226	1	0.100	Carbon Monoxide
6.193	298942	BBA	0.302	1	12.005	Carbon Dioxide

Total amount = 100.09



Span Check - Run #2 ID# 11-10-27-22

# Normalized Percent Report

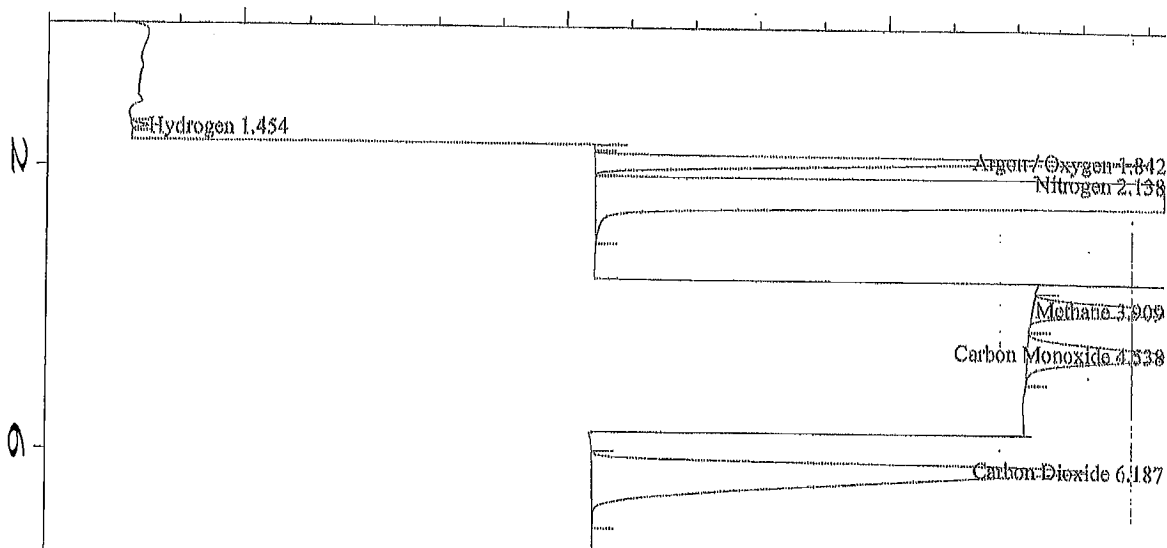
Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:10:46 Instrument Method:  
 Report Created on: 15 Dec 14 10:49 AM Analysis Method : TCDHS1.MTH  
 Last Recallb on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\SPAN1-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.454	1652	BBA	0.054	1	1.007	Hydrogen
1.842	131103	BV	0.118	1	6.024	Argon / Oxygen
2.139	1692608	VBA	0.191	1	80.773	Nitrogen
3.907	52989	BBA	0.158	1	0.100	Methane
4.535	67035	BBA	0.226	1	0.101	Carbon Monoxide
6.187	296833	BBA	0.298	1	11.995	Carbon Dioxide

Total amount = 99.4526





span check - Run #3 11-10-27-22

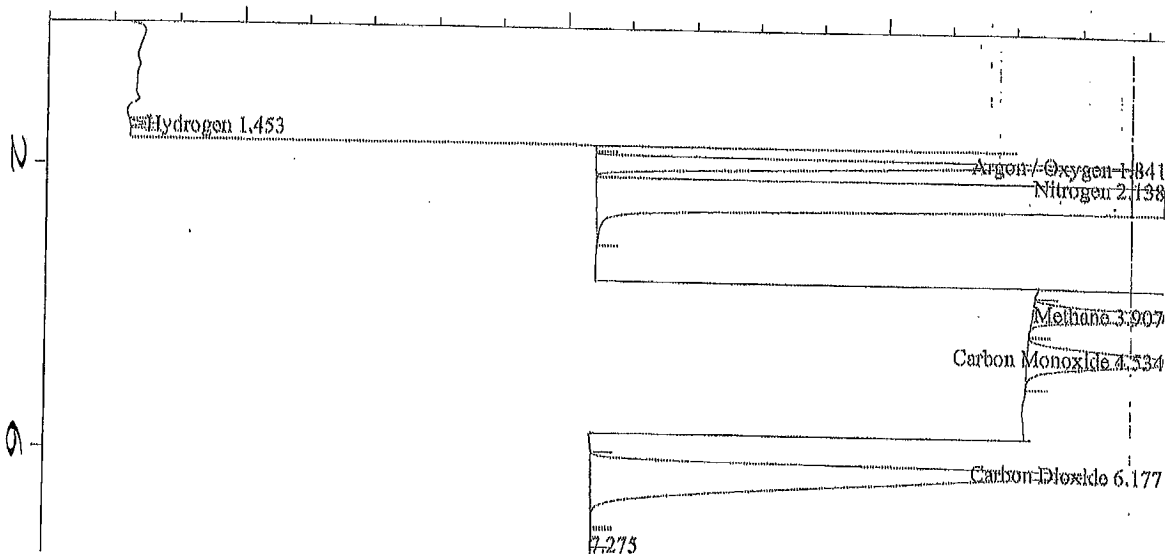
# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-3.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:22:45 Instrument Method:  
 Report Created on: 15 Dec 14 10:50 AM Analysis Method : TCDHS1.MTH  
 Last Recallb on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\SPAN1-3.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.454	1662	BBA	0.054	1	1.010	Hydrogen
1.842	131492	BV	0.118	1	6.023	Argon / Oxygen
2.138	1697737	VBA	0.192	1	80.766	Nitrogen
3.909	53310	BBA	0.158	1	0.101	Methane
4.538	67294	BBA	0.226	1	0.101	Carbon Monoxide
6.187	297864	BBA	0.296	1	11.999	Carbon Dioxide

Total amount = 99.7675



*Run Check*

*12-10-27-22*

=====  
 Normalized Percent Report  
 =====

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN2-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:36:35 Instrument Method:  
 Report Created on: 15 Dec 14 10:50 AM Analysis Method : TCDHS1.MTH  
 Last Recallb on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\SPAN2-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.453	1621	BBA	0.054	1	0.994	Hydrogen
1.841	130613	BV	0.119	1	6.026	Argon / Oxygen
2.138	1686834	VBA	0.191	1	80.829	Nitrogen
3.907	52816	BBA	0.156	1	0.100	Methane
4.534	66706	BBA	0.226	1	0.101	Carbon Monoxide
6.177	294510	BV	0.293	1	11.951	Carbon Dioxide

Total amount = 99.0383

=====



Praxair Distribution, Inc.  
9501-34th Street  
Edmonton, AB T6B 2X6  
Tel: 780-449-0778  
Fax: 780-449-6302

10/14/2011

PRAXAIR CALGARY DIST CTR  
8009 42 ST SE (236-6511)  
CALGARY, AB T2C 2T4  
Attention: REPORT PRINTER 360 PICK TICKET PRINTER 361

Praxair Order No. **14043294**  
Customer Reference No. **02171899**

Product Lot/Batch No. **Z582128701**  
Praxair Part No. **NI CD12CX2P-AS**

## CERTIFICATE OF ANALYSIS

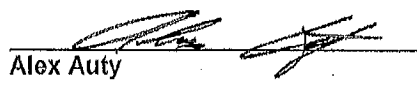
### Primary Standard



Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Carbon dioxide	12%	12.04%	L	±.02%abs
Carbon monoxide	1000 ppm	1001 ppm	U	± 1% rel
Hydrogen	1%	1.00%	U	± 1%rel
Methane	1000 ppm	999 ppm	U	± 1% rel
Oxygen	6%	6.00%	U	±.02%abs
Nitrogen	Balance	Balance		

Analytical Instruments: Horiba~VIA 510~~  
Hewlett-Packard (Agilent)~6890~~  
Chandler Engineering~Carle Series 400 AGC~~  
Servomex~244A~~

Cylinder Style: AS  
Cylinder Pressure @70F: 13,790 kPa  
Cylinder Volume: 4.216 M3  
Valve Outlet Connection: CGA-590  
Cylinder No(s): SA21434

Filling Method: Gravimetric  
Date of Fill: 10/13/2011  
Expiration Date: 10/14/2014

Analyst:   
Alex Auty

Received 2011-10-27   
Opened 2011-10-27   
INTERNAL TRACKING # 11-10-27-22

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

Key to Analytical Techniques:

A Flame Ionization with Methanizer	B Gas Chromatography with Discharge Ionization Detector	O Gas Chromatography with Electrolytic Conductivity Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Helium Ionization Detector	G Gas Chromatography with Methanizer Carbonizer	H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer	J Gas Chromatography with Thermal Conductivity Detector	K Binary Gas Analyzer with Thermal Conductivity Detector	L Infrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
Q Total Hydrocarbon Analyzer	R Wet Chemical	S Detector Tube	T Other
U Gravimetric Methods	V Biochemical	W Gas Chromatography with Chemiluminescence Detector	

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 availability 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.



Praxair Distribution Inc  
9501 - 34 Street  
Edmonton, AB T6B 2X6  
Tel.: (780) 449-0778  
Fax.: (780) 449-5302

Issue Date: June 21, 2011

To: Praxair Calgary  
8009 42 St SE  
Calgary, AB  
For: Maxxam 12864240

Praxair Order Number: 12864348  
Customer Order Number: 00045158

Product Lot Number: Z582117202  
Product Part Number: NI CD12CX2P-AS

## CERTIFICATE OF ANALYSIS

### Primary Standard

Cylinder Serial Number	Components	Requested Concentration	Certified Concentration	Analytical Principle*/ Instrument	Analytical Uncertainty
CC246723	Carbon Dioxide	12 %	12.00 %	L*	+/- 0.02% Absolute
	Carbon Monoxide	0.1 %	0.10 %	L*	+/- 1% Relative
	Hydrogen	1 %	1.00 %	L*	+/- 1% Relative
	Methane	0.1 %	0.10 %	L*	+/- 1% Relative
	Oxygen	6 %	6.00 %	L*	+/- 0.02% Absolute
	Nitrogen	Balance	Balance	By Difference	N/A

Cylinder Style: AS  
Cylinder Pressure @70°F (21°C): 13790 kPa  
Cylinder Volume: 3.81 m<sup>3</sup>

Valve Outlet Connection: CGA 590  
Filling Method: Gravimetric  
Fill Date: June 7, 2011  
Expiry Date: June 21, 2014

Approved Signer: Michelle Pearce  
QA

Rec'd 2011-06-23 BW  
Open'd 2011-06-23 BW  
INTERNAL TR# 11-11-01-25

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair 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

\*Key to Analytical Principles:

A. Flame Ionization with Methanizer	F. Gas Chromatography with Helium Ionization Detector	K. Gas Chromatography with Ultrasonic Detector	P. Specific Water Analyzer
B. Gas Chromatography with Discharge Ionization Detector	G. Gas Chromatography with Methanizer Carbonizer	L. Gravimetric Methods	Q. Total Hydrocarbon Analyzer
C. Gas Chromatography with Electrolyte Conductivity Detector	H. Gas Chromatography with Photoionization Detector	M. Infrared - FTIR or NDIR	R. Wet Chemical
D. Gas Chromatography with Flame Ionization Detector	I. Gas Chromatography with Reduction Gas Analyzer	N. Mass Spectrometry - MS or GC/MS	S. Detector Tube
E. Gas Chromatography with Flame Photometric Detector	J. Gas Chromatography with Thermal Conductivity Detector	O. Paramagnetic	T. Odor

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 arising out of the use of the information contained herein exceed the fee established for providing such information.

***APPENDIX III***  
***SAMPLE CUSTODY***



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Email Howard.Malm@semtechnology.com

Project #: 35118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: \_\_\_\_\_

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: Dec 18/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)	LAB Test
Spartan T1B1A	<u>Dec 10/2014 10:25</u>	<u>AGFT LABS</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73302</u>
Spartan T1B1B	<u>12/10/14 11:00</u>	<u>✓</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73303</u>
Spartan T2B1A	<u>12:10</u>	<u>✓</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73304</u>
Spartan T2B1B	<u>12:45</u>	<u>✓</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73305</u>
Spartan T3B1A	<u>✓ 15:00</u>	<u>✓</u>	<u>Oxygen, CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>O, Moisture</u>	<u>✓</u>	<u>73306</u>
Spartan T3B1B	<u>15:30</u>	<u>✓</u>	<u>"</u>	<u>✓</u>	<u>73307</u>

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
<u>Charles Adelsky</u>	<u>Howard Malm</u>	<u>12/10/14</u>
	<u>Bill Wong</u>	<u>2014-12-11 12:00</u>

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Pages 1 of 2



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm  
Email Howard.Malm@remtechnology.com  
Project #: 35118

Company: Maxxam Analytics  
Contact: Bill Wong  
Purchase Order: 672130-08  
Date: \_\_\_\_\_

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)  
☐ Rush: Next Day  
☐ Rush: Same Day

Date Required: Dec 18/14

Send Additional Copy to:  
Name Greg Brown  
Email brown-greg@spartancontrols.com

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)	Lab TC #
Spartan T4B1A	12/11/14 0830	AG-AT Labs	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , Moisture	✓	73308
Spartan T4B1B	0905	✓	"	✓	73309
Spartan T5B1A	1005	✓	"	✓	73310
Spartan T5B1B	1040	✓	"	✓	73311
—	—	—	—	—	—
—	—	—	—	—	—

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
<u>Charles Buckle</u>	<u>Howard Malm, Jr. Malm</u>	12/11/14
	<u>Bill Wong</u>	2014-12-11 12:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Company: Maxxan Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: Dec 12/14

### SERVICE REQUESTED:

Standard: (5-7 working days) ☒

Rush: Next Day ☐

Rush: Same Day ☐

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Spartan T6B1A	12/12/14	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , water	100% TC
" T6B1B	"	AGAT		73225
				73226

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Frellicks	H. Malm	12/12/14 13:10
H. Malm	Bill Wong	12/12/14 14:00
H. Malm	Gov.	

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.





305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malin

Email howard@remtechnology.com

Project #: 35118

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19/14

Company: Maxxon Analytics

Contact: Bill Wong

Purchase Order: 672130-OP

Date: Dec 12/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Spartan T7B1A	11/12/14 1305	AG-AT	O <sub>2</sub> CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> water	
T7B1B	1340			
T8B1A	1440			
T8B1B	1515			
T9B1A	1610			
T9B1B	1645			

14870#  
73327  
73328  
73329  
73330  
73331  
73332

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Clayde Ridder	H. Malin	12/12/14 13:10
Howard Malin	Bill Wong	12/12/14 14:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malin

Email Howard.Malin@rentedtechnology.com

Project #: 35118

Send Additional Copy to:

Name Greg Brown

Email brown-greg@spartancontrols.com

### SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: \_\_\_\_\_

Company: Martian Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: Dec 12/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
SPARTAN T10B1A	12/12/14 08:25	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , water	
SPARTAN T10B1B	12/12/14 905			
SPARTAN T11B1A	955			
SPARTAN T11B1B	1040			
SPARTAN T12B1A	1130			
SPARTAN T12B1B	1205	✓	✓	

Lab ID#  
73323  
73324  
73325  
73326  
73327  
73328

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Pickett	H. Malin	12/12/14 13:10
H. Malin	Bill Wong	12/12/14 14:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Pages 1 of 3



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Email Howard.Malm@renttechnology.com

Project #: 35118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: \_\_\_\_\_

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

## SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☐ Rush: Next Day

☒ Rush: Same Day

Date Required: December 19, 2014

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
SPARTAN T13B1A	12/12/14 13:00	ACAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , Water	<u>Lab Test</u>
SPARTAN T13B1B	12/12/14 13:35	ACAT	}	<u>73339</u>
SPARTAN T14B1A	12/12/14 14:30	ACAT	}	<u>73340</u>
SPARTAN T14B1B	12/12/14 15:05	ACAT	}	<u>73341</u>
				<u>73342</u>

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
<u>JOE WEHLEBE</u> Gregory Brown	Gregory Brown Bill Wong	12/12/14 16:10
		12/12/14 09:50

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Steve Millar  
Source Testing Manager – Air Quality Monitoring Division  
AGAT Laboratories Ltd.  
2420 – 42<sup>nd</sup> Avenue N.E.  
Calgary, Alberta  
T2E 7T6

September 28, 2015

Howard Malm  
REM Technology  
305 27<sup>th</sup> St. S.E  
Calgary, Alberta  
T2A 7V6

Dear Howard,

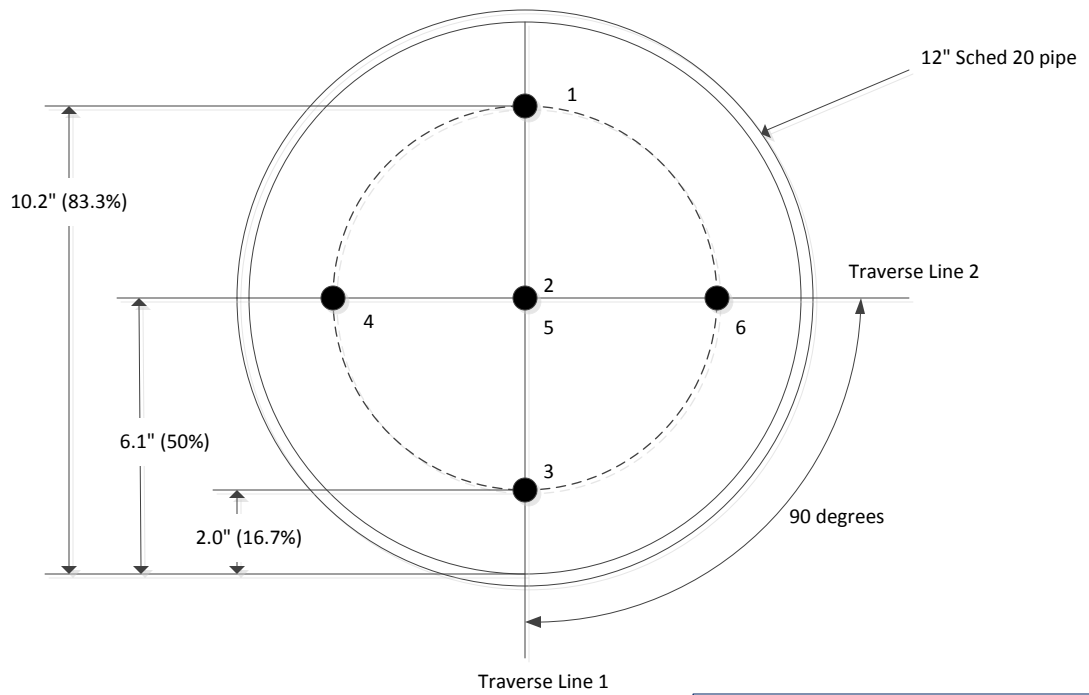
This letter is to inform that the traverse locations for the sampling of THC and CO using Method 10/24A, which is indicated on the traverse point diagram, were completed in accordance with sections 60.5413(d)(8) and (d)(9)(i)-(ii).

Regards,

Steve Millar



# Stack Sample Locations GTS-12



Traverse Line	Point	% of distance
1	1	83.3
1	2	50
1	3	16.7
2	4	83.3
2	5	50
2	6	16.7

**From:** [Greg Brown](#)  
**To:** [Mia Marcia](#)  
**Cc:** [Patty Centofanti](#); [Garwood, Gerri](#); [Jason Huckaby](#); [Howard Malm](#); [Cam Dowler](#); [Charlie Bischoff](#)  
**Subject:** RE: Initial Review of Spartan Slipstream Combustor  
**Date:** Friday, October 09, 2015 7:46:51 PM  
**Attachments:** [Spartan Controls REM Technologies December 2014 Source Emission Survey u....pdf](#)

---

Hi Marcia,

On behalf of Howard Malm, I have forwarded a revised statement, please see Page (1) of the attached document, from AGAT Laboratories Ltd. confirming that the M25A THC results presented in the AGAT report (starting on page 111 in the original "EPA Burner Report – Rev-0.pdf" file) are reported as propane, per 40 CFR 60.5413(d)(9)(v).

Please let us know if this meets with your requirements.

Best regards,

Greg Brown

**Greg Brown** | Research & Development Engineer | ASC-PIC Project Services

**Spartan Controls** | 305 - 27 Street S.E. | Calgary | AB | T2A 7V2 | Canada

T+1 (403) 695-2312 | M+1 (403) 589-2779 | F+1 (403) 207-0874

[Brown.Greg@spartancontrols.com](mailto:Brown.Greg@spartancontrols.com)

An Emerson Process Management Local Business Partner

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**From:** Mia, Marcia [<mailto:Mia.Marcia@epa.gov>]

**Sent:** Monday, October 05, 2015 3:25 PM

**To:** Howard Malm <[Howard.Malm@remtechnology.com](mailto:Howard.Malm@remtechnology.com)>; Patty Centofanti <[PCentofanti@trinityconsultants.com](mailto:PCentofanti@trinityconsultants.com)>

**Cc:** Garwood, Gerri <[Garwood.Gerri@epa.gov](mailto:Garwood.Gerri@epa.gov)>; Jason Huckaby <[Jason.Huckaby@erg.com](mailto:Jason.Huckaby@erg.com)>

**Subject:** RE: Initial Review of Spartan Slipstream Combustor

Thank you Howard.

We need a confirmatory statement, if applicable, that the M25A THC results presented in the AGAT report (starting on page 111 in the original "EPA Burner Report – Rev-0.pdf" file) are reported as propane, per 40 CFR 60.5413(d)(9)(v).

If you are able to make this statement and get it to us, I think that will wrap things up on our end. I am out of the office until October 14, 2015 and will look for your response upon my return.

Marcia B Mia

Office of Compliance/Air Branch

2227A WJCS

U.S. Environmental Protection Agency

202-564-7042

**From:** Howard Malm [<mailto:Howard.Malm@remtechnology.com>]

**Sent:** Wednesday, September 30, 2015 1:12 PM

**To:** Mia, Marcia; Patty Centofanti

**Cc:** Garwood, Gerri; Jason Huckaby

**Subject:** RE: Initial Review of Spartan Slipstream Combustor

Marcia:

I am pleased to provide the requested information as follows:

1. The missing gas custody form is attached in file "Chain of Custody-ORTECH"
2. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows that the GC-TDC calibration procedure was modified using EPA Alt-045. Please see page 3 of the revised report.
3. The traverse locations for the sample locations are specified by the letter and diagram in the attached document "AGAT Letter Sep 2015".
4. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows a revised table in Appendix 1 (page 9 of the document) entitled "Summary of Analytical Results – THC as Propane Analysis" where the THC is reported as propane.

I trust the attached material will fully answer the points raised.

Yours truly

Howard Malm Ph.D. P.Eng.

Chief Technical Officer

REM Technology Inc.

403-695-2373 (off)

604-562-9438 (cell)

**From:** Mia, Marcia [<mailto:Mia.Marcia@epa.gov>]

**Sent:** Wednesday, September 09, 2015 2:08 PM

**To:** Howard Malm; Patty Centofanti

**Cc:** Garwood, Gerri; Jason Huckaby

**Subject:** Initial Review of Spartan Slipstream Combustor

We have completed our initial review of the performance test that you submitted under NSPS OOOO and MACT HH/HHH on 02/16/15.

We need additional detail on the following items:

1. Missing Inlet Gas Sampling Chain of Custody forms - Section 60.5413(d)(5)(i)(A)-(C) requires certain sampling and chain of custody (COC) protocols are followed. Please provide the

missing COC forms.

2. We are unable to determine if the GC-TCD calibration procedure was modified using EPA Alt-045 – Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 3C must be modified using EPA Alt-045. Please confirm. An affirmative statement is sufficient.
3. The narrative regarding the traverse locations for THC and CO is unclear and there is no traverse point diagram– Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 10/25A is conducted using a three point traverse. Please provide a diagram of the traverse and confirm that the Method 10/25A was conducted using a three point traverse.
4. Is THC reported as propane? - Section 60.5413(d)(9)(v)-(vi) requires that THC is measured as propane. The information on page 473 is presented as methane. Please confirm that THC is measured as propane.

You may provide the information in response to this email. We may elect to have a follow-up call after we receive the information. If you would like to have a conference call in any event, please let me know and I will schedule something. Thanks for your time in providing this information.

Marcia B Mia  
Office of Compliance/Air Branch  
2227A WJCS  
U.S. Environmental Protection Agency  
202-564-7042



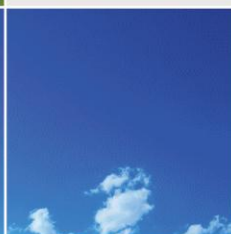


## SOURCE EMISSION SURVEY

### Spartan Controls Ltd.

REM Technology Inc.

14C914464



Spartan Controls Ltd.

REM Technology Inc.

305 - 27 St. SE

Calgary, Alberta

T2A 7V2

Attention: Dr. Howard Malm

December 10-12, 2014

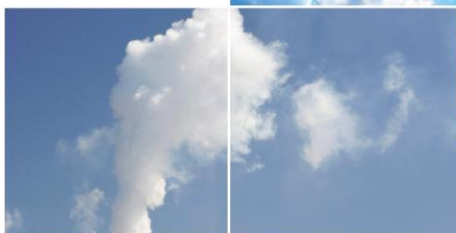
Submitted By:

AGAT Laboratories Ltd.

2420 42<sup>nd</sup> Avenue NE

Calgary, Alberta T2E 7T6

Phone: 403.736.5300



#### Canadian Technology in Action:

Accredited by:

- The Canadian Association for Laboratory Accreditation (CALA)
- The Standards Council of Canada (SCC) for ISO 17025:2005 Certification

(Accreditation is limited to specific laboratory locations and registered tests)  
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# AGAT Laboratories

Service Beyond Analysis ■ [www.agatlabs.com](http://www.agatlabs.com)



# AGAT Laboratories

January 07, 2015

Spartan Controls Ltd  
REM Technology Inc.  
305 – 27 St. SE  
Calgary, Alberta  
T2A 7V2

---

Attention: Dr. Howard Malm

Subject: REM Technology Inc. – December 2014 Source Emission Survey

---

AGAT Laboratories' Source Testing Services Group is pleased to submit the following Source Emission report. The test program was conducted for Spartan Controls Ltd. – REM Technology Inc. on December 10-12, 2014. Parameters tested were Carbon Monoxide, Total Hydrocarbons (reported as propane), Flow, and Sample Level Temperature.

If you have any questions or concerns regarding this report, please contact Mr. Steve Millar at (403) 736-5304 or via E-mail at [millar@agatlabs.com](mailto:millar@agatlabs.com). Alternatively, please contact Mr. Nitin Monteiro at (403) 736-5305, or via E-mail at [monteiro@agatlabs.com](mailto:monteiro@agatlabs.com). Thank you for your patronage, and we look forward to being of service to you in the future.

Yours truly,

**AGAT Laboratories**

Steve Millar  
Source Testing Manager

Nitin Monteiro, B.Sc., EPt.  
Client Project Manager

## SUMMARY

**Table 1: Summary of Results for Process Condition of 0 to 30%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>6.88</b>
CO Emission Rate	t/d	<b>0.0000420</b>
	kg/hr	<b>0.00175</b>
Total Hydrocarbons	ppmvd	<b>0.195</b>
THC Emission Rate	t/d	<b>0.000000667</b>
	kg/hr	<b>0.0000278</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.15</b>
	lb/hr	<b>561</b>
	ft <sup>3</sup> /hr	<b>7,573</b>
	m <sup>3</sup> /sec	<b>0.0596</b>
Stack Temperature	°C	<b>476</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 2: Summary of Results for Process Condition of 30 to 70%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>5.12</b>
CO Emission Rate	t/d	<b>0.0000356</b>
	kg/hr	<b>0.00148</b>
Total Hydrocarbons	ppmvd	<b>0.318</b>
THC Emission Rate	t/d	<b>0.00000120</b>
	kg/hr	<b>0.0000500</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.83</b>
	lb/hr	<b>633</b>
	ft <sup>3</sup> /hr	<b>8,583</b>
	m <sup>3</sup> /sec	<b>0.0675</b>
Stack Temperature	°C	<b>514</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 3: Summary of Results for Process Condition of 70 to 100%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>4.36</b>
CO Emission Rate	t/d	<b>0.0000291</b>
	kg/hr	<b>0.00121</b>
Total Hydrocarbons	ppmvd	<b>0.403</b>
THC Emission Rate	t/d	<b>0.00000146</b>
	kg/hr	<b>0.0000608</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.54</b>
	lb/hr	<b>602</b>
	ft <sup>3</sup> /hr	<b>8,157</b>
	m <sup>3</sup> /sec	<b>0.0642</b>
Stack Temperature	°C	<b>541</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 4: Summary of Results for Process Condition of 90 to 100%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>3.45</b>
CO Emission Rate	t/d	<b>0.0000207</b>
	kg/hr	<b>0.000862</b>
Total Hydrocarbons	ppmvd	<b>0.102</b>
THC Emission Rate	t/d	<b>0.000000325</b>
	kg/hr	<b>0.0000135</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.01</b>
	lb/hr	<b>543</b>
	ft <sup>3</sup> /hr	<b>7,367</b>
	m <sup>3</sup> /sec	<b>0.0579</b>
Stack Temperature	°C	<b>530</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

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## **Part 1 – INTRODUCTION**

### **1.1 Background Information**

AGAT Laboratories' Source Testing Services Group was retained by Dr. Howard Malm of Spartan Controls Ltd. – REM Technology Inc. to perform a Source Emission Survey. These tests were conducted from December 10-12, 2014.

### **1.2 Key Personnel**

Mr. Claude Ricketts was the AGAT project manager with Dr. Howard Malm acting as the client contact and coordinator. Mr. Claude Ricketts, Mr. Joseph Woehleke, Mr. Alexander Sanguino and Mr. Nitin Monteiro performed the on-site sampling program. Mr. Nitin Monteiro performed the data reduction and produced the final report.

### **1.3 Project Scope**

Project scope included Source Emission Survey tests for Carbon Monoxide, Total Hydrocarbons (reported as propane), Volumetric Flow, and Sample Level Temperature.



## Part 2 – TEST PROCEDURE

### 2.1 Standard Methods

**Table 5: Standard Methods**

PARAMETER	METHOD
Velocity Traverse	Method 1 – Sample and Velocity Traverses for Stationary Sources, U.S. EPA
Stack Gas Velocity and Volumetric Flow Rate	Method 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate (type S pitot tube), U.S. EPA
Stack Gas Molecular Weight	Method 3A/3C – Gas Analysis for the Determination of Dry Molecular Weight, U.S. EPA
Moisture Content	Method 4 – Determination of Moisture Content in Stack Gases, U.S. EPA
Carbon Monoxide	Method 10 - Determination of Carbon Monoxide Emissions from Stationary Sources, U.S. EPA
Total Hydrocarbons	Method 25A – Determination of Total Hydrocarbons Emissions from Stationary Sources, USEPA
Fugitive Opacity	Method 22 – Determination of Fugitive Opacity from Stationary Sources, U.S. EPA

In the determination of percent CO<sub>2</sub> and percent O<sub>2</sub> content of the exhaust gas, an integrated bag sampling procedure was used as a grab-sample of the exhaust gas over the course of each test. One 10L bag was filled during every half hour, which amounted to two 10L bags for each test run. The exhaust gas was sampled at a constant rate of 0.30 L/min for five minutes at each traverse point and this was done simultaneously with flow measurements.

### Gaseous Sampling System

Stack gas was withdrawn via an out-of-stack probe system with a 1:1 ratio that ensures the gas delivered to the analyzer is what is drawn out of the stack. The gas is delivered to a manifold through an inert teflon line. Test gas is passed through the manifold to a gas filter where it is analyzed for CO by a broad band infrared light. Additionally, the sample gas is also delivered through the manifold of a second analyzer for analysis of Total Hydrocarbons by a flame ionization detector. The sample gas is passed through the analyzer at a precise rate of flow and pressure to maintain sample integrity.

## **Volumetric Flow Measurements**

Stack gas velocity was determined from moisture content of the stack gas as well as differential pressure and temperature readings collected at six points along two diameters of the stack. Pressure differentials are measured by calibrated S-type Pitot tube and inclined oil manometer. Temperature measurements are made with a calibrated K-type thermocouple. Velocity, when multiplied by the cross sectional area of the stack equates to the volumetric flow.

## **2.2 Quality Assurance / Quality Control**

AGAT Laboratories is accredited by Canadian Association for Laboratory Accreditation (CALA), the Standards Council of Canada (SCC), and is an ISO 17025:2005 registered company. AGAT Laboratories is also ISO 9001:2008 registered company.

- Regular maintenance and calibration of all field-sampling equipment as per the applicable sampling protocols.
- Linearity and response time checks are conducted on all analyzers prior to use.
- Calibration drift is checked between all tests to assure instruments are performing within allowable limits.
- QA/QC on all final lab analysis and final written reports.

## **PART 3 – DISCUSSION**

The source emission survey for Spartan Controls Ltd. – REM Technology Inc. was conducted through four different process conditions (0-30%, 30-70%, 70-100% and 90-100%) comprising of a total of twelve tests.

At each traverse point of the stack at which the probe was placed, five (5) minutes of data were collected throughout each of the sixty (60) minute test runs. Therefore twelve (12) traverse points were measured during each of the one (1) hour test runs.

During the determination of fugitive opacity, two observers were used, alternating every 20 minutes, for the continuous observation period for each of the twelve (12) tests and it was determined that zero emissions were observed during each of the twelve (12) tests.

The survey was conducted over a span of three days and the test results are an accurate representation of emission characteristics for the process conditions maintained on the Spartan Controls Ltd. – REM Technology Inc. Incinerator Stack on the test dates of December 10-12, 2014.

## Part 4 – RESULTS

**Table 6: Parameter Results for Process Condition of 0 to 30%**

REM Technology Inc.					
Parameter	Units	Test 7	Test 11	Test 12	Average
Date and Time	14/12/11-12	16:10-17:20	13:00-14:10	14:30-15:40	
Flow Rate	%	0-30%	0-30%	0-30%	
Carbon Monoxide	ppmvw	6.47	6.82	7.34	6.88
CO Emission Rate	t/d	0.0000471	0.0000384	0.0000406	0.0000420
	kg/hr	0.00196	0.00160	0.00169	0.00175
Total Hydrocarbons	ppmvd	0.221	0.197	0.166	0.195
THC Emission Rate	t/d	0.000000889	0.000000610	0.000000501	0.000000667
	kg/hr	0.0000370	0.0000254	0.0000209	0.0000278
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	6.12	4.71	4.61	5.15
	lb/hr	673	510	500	561
	ft <sup>3</sup> /hr	9,005	6,931	6,783	7,573
	m <sup>3</sup> /sec	0.0708	0.0545	0.0534	0.0596
Stack Temperature	°C	475	474	480	476

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 7: Parameter Results for Process Condition of 30 to 70%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 4</b>	<b>Test 5</b>	<b>Test 6</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/11</b>	<b>11:35-12:45</b>	<b>13:05-14:15</b>	<b>14:40-15:50</b>	
<b>Flow Rate</b>	<b>%</b>	<b>30-70%</b>	<b>30-70%</b>	<b>30-70%</b>	
Carbon Monoxide	ppmvw	<b>5.40</b>	<b>4.72</b>	<b>5.24</b>	<b>5.12</b>
CO Emission Rate	t/d	<b>0.0000332</b>	<b>0.0000347</b>	<b>0.0000388</b>	<b>0.0000356</b>
	kg/hr	<b>0.00139</b>	<b>0.00145</b>	<b>0.00162</b>	<b>0.00148</b>
Total Hydrocarbons	ppmvd	<b>0.392</b>	<b>0.344</b>	<b>0.219</b>	<b>0.318</b>
THC Emission Rate	t/d	<b>0.00000133</b>	<b>0.00000138</b>	<b>0.000000893</b>	<b>0.00000120</b>
	kg/hr	<b>0.0000554</b>	<b>0.0000575</b>	<b>0.0000372</b>	<b>0.0000500</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.17</b>	<b>6.12</b>	<b>6.21</b>	<b>5.83</b>
	lb/hr	<b>562</b>	<b>664</b>	<b>673</b>	<b>633</b>
	ft <sup>3</sup> /hr	<b>7,607</b>	<b>9,005</b>	<b>9,138</b>	<b>8,583</b>
	m <sup>3</sup> /sec	<b>0.0598</b>	<b>0.0708</b>	<b>0.0719</b>	<b>0.0675</b>
Stack Temperature	°C	<b>511</b>	<b>519</b>	<b>512</b>	<b>514</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 8: Parameter Results for Process Condition of 70 to 100%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Test 3</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/10/11</b>	<b>15:00-16:10</b>	<b>08:30-09:40</b>	<b>10:05-11:15</b>	
<b>Flow Rate</b>	<b>%</b>	<b>70-100%</b>	<b>70-100%</b>	<b>70-100%</b>	
Carbon Monoxide	ppmvw	<b>4.24</b>	<b>4.59</b>	<b>4.27</b>	<b>4.36</b>
CO Emission Rate	t/d	<b>0.0000265</b>	<b>0.0000319</b>	<b>0.0000288</b>	<b>0.0000291</b>
	kg/hr	<b>0.00110</b>	<b>0.00133</b>	<b>0.00120</b>	<b>0.00121</b>
Total Hydrocarbons	ppmvd	<b>0.447</b>	<b>0.390</b>	<b>0.372</b>	<b>0.403</b>
THC Emission Rate	t/d	<b>0.00000151</b>	<b>0.00000149</b>	<b>0.00000138</b>	<b>0.00000146</b>
	kg/hr	<b>0.0000629</b>	<b>0.0000622</b>	<b>0.0000574</b>	<b>0.0000608</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.15</b>	<b>5.84</b>	<b>5.64</b>	<b>5.54</b>
	lb/hr	<b>556</b>	<b>635</b>	<b>614</b>	<b>602</b>
	ft <sup>3</sup> /hr	<b>7,578</b>	<b>8,593</b>	<b>8,299</b>	<b>8,157</b>
	m <sup>3</sup> /sec	<b>0.0596</b>	<b>0.0676</b>	<b>0.0653</b>	<b>0.0642</b>
Stack Temperature	°C	<b>558</b>	<b>527</b>	<b>537</b>	<b>541</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 9: Parameter Results for Process Condition of 90 to 100%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 8</b>	<b>Test 9</b>	<b>Test 10</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/12</b>	<b>08:25-09:35</b>	<b>09:55-11:05</b>	<b>11:30-12:40</b>	
<b>Flow Rate</b>	<b>%</b>	<b>90-100%</b>	<b>90-100%</b>	<b>90-100%</b>	
Carbon Monoxide	ppmvw	<b>3.73</b>	<b>3.12</b>	<b>3.49</b>	<b>3.45</b>
CO Emission Rate	t/d	<b>0.0000225</b>	<b>0.0000198</b>	<b>0.0000198</b>	<b>0.0000207</b>
	kg/hr	<b>0.000938</b>	<b>0.000823</b>	<b>0.000825</b>	<b>0.000862</b>
Total Hydrocarbons	ppmvd	<b>0.117</b>	<b>0.0209</b>	<b>0.167</b>	<b>0.102</b>
THC Emission Rate	t/d	<b>0.000000384</b>	<b>0.0000000724</b>	<b>0.000000517</b>	<b>0.000000325</b>
	kg/hr	<b>0.0000160</b>	<b>0.00000302</b>	<b>0.0000215</b>	<b>0.0000135</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.02</b>	<b>5.28</b>	<b>4.72</b>	<b>5.01</b>
	lb/hr	<b>543</b>	<b>574</b>	<b>511</b>	<b>543</b>
	ft <sup>3</sup> /hr	<b>7,387</b>	<b>7,769</b>	<b>6,945</b>	<b>7,367</b>
	m <sup>3</sup> /sec	<b>0.0581</b>	<b>0.0611</b>	<b>0.0546</b>	<b>0.0579</b>
Stack Temperature	°C	<b>523</b>	<b>527</b>	<b>539</b>	<b>530</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

## **Appendix I**

### **Emission Data and Calculations**



	<b>Company:</b>	Spartan Controls										
	<b>Date:</b>	2014/12/10-12										
Actual Span Gas Conc	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13
Pre Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Pre Test Span	4.45	5.18	5.56	5.81	5.63	5.41	5.39	4.95	4.77	4.84	5.21	5.10
RATA Test #	1	2	3	4	5	6	7	8	9	10	11	12
Process Condition	70-100%	70-100%	70-100%	30-70%	30-70%	30-70%	0-30%	90-100%	90-100%	90-100%	0-30%	0-30%
PPM Dry to Wet	4.235	4.589	4.270	5.404	4.718	5.238	6.467	3.729	3.118	3.491	6.817	7.341
CO PPM drift corrected	4.495	4.772	4.467	5.614	4.953	5.463	6.715	3.916	3.267	3.665	7.125	7.690
Reference ppm, dry	3.895	4.995	4.950	6.260	5.330	5.750	7.160	3.710	3.060	3.590	7.160	7.450
mg/m3,wet	5.15	5.46	5.11	6.43	5.67	6.25	7.69	4.48	3.74	4.20	8.16	8.80
Reference Flow (E'M <sup>3</sup> /Day)	5.15	5.84	5.64	5.17	6.12	6.21	6.12	5.02	5.28	4.72	4.71	4.61
CO kg/h	0.001104	0.001329	0.001202	0.001385	0.001446	0.001618	0.001960	0.000938	0.000823	0.000825	0.001601	0.001691
CO t/d	0.00002651	0.00003191	0.00002884	0.00003323	0.00003471	0.00003884	0.00004705	0.00002251	0.00001975	0.00001981	0.00003842	0.00004059
Ref Temp °C All Points	558.4	526.7	536.8	511.4	518.9	511.6	475.3	523.2	526.5	539.3	474.3	479.5
Velocity (m/sec)	2.590	2.862	2.800	2.485	2.970	2.983	2.804	2.441	2.581	2.342	2.153	2.122
Stack Gas Moisture	0.0580	0.0383	0.0440	0.0375	0.0475	0.0411	0.0370	0.0478	0.0457	0.0475	0.0432	0.0453
CO Test Time start	15:00	08:30	10:05	11:35	13:05	14:40	16:10	08:25	09:55	11:30	13:00	14:30
End	16:10	09:40	11:15	12:45	14:15	15:50	17:20	09:35	11:05	12:40	14:10	15:40
Velocity Test Times Start	15:56	08:34	10:06	11:38	13:08	14:44	16:14	08:28	09:58	11:33	13:03	14:33
End	16:06	09:38	11:06	12:41	14:11	15:47	17:16	09:33	11:03	12:37	14:06	15:37
Post Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Post Test Span	4.44	5.56	5.81	5.63	5.41	5.39	5.55	4.77	4.84	5.21	5.10	4.84

	Company: Date:		Spartan 2014/12/10-12 RATA Table									
Actual Span Gas Conc	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09
Pre Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Pre Test Span	8.13	8.56	8.24	8.86	8.76	8.70	7.88	8.93	8.20	9.20	8.23	7.43
RATA Test #	1	2	3	4	5	6	7	8	9	10	11	12
Process Condition	70-100%	70-100%	70-100%	30-70%	30-70%	30-70%	0-30%	90-100%	90-100%	90-100%	0-30%	0-30%
THC PPM drift corrected	0.447	0.390	0.372	0.392	0.344	0.219	0.221	0.117	0.0209	0.167	0.197	0.166
Reference ppm, wet	0.410	0.360	0.350	0.380	0.330	0.200	0.200	0.110	0.0200	0.160	0.170	0.135
mg/m3,wet	0.293	0.256	0.244	0.257	0.225	0.144	0.145	0.077	0.0137	0.109	0.129	0.109
Reference Flow (E <sup>3</sup> M <sup>3</sup> /Day)	5.15	5.84	5.64	5.17	6.12	6.21	6.12	5.02	5.28	4.72	4.71	4.61
THC kg/h	0.0000629	0.0000622	0.0000574	0.0000554	0.0000575	0.0000372	0.0000370	0.0000160	0.00000302	0.0000215	0.0000254	0.0000209
THC t/d	0.00000151	0.00000149	0.00000138	0.00000133	0.00000138	0.000000893	0.000000889	0.000000384	0.0000000724	0.000000517	0.000000610	0.000000501
Ref Temp °C All Points	558.4	526.7	536.8	511.4	518.9	511.6	475.3	523.2	526.5	539.3	474.3	479.5
Velocity (m/sec)	2.590	2.862	2.800	2.485	2.970	2.983	2.804	2.441	2.581	2.342	2.153	2.122
Stack Gas Moisture	0.0580	0.0383	0.0440	0.0375	0.0475	0.0411	0.0370	0.0478	0.0457	0.0475	0.0432	0.0453
THC Test Time start	1500	0830	1005	1135	1305	1440	1610	0825	0955	1130	1300	1430
End	1610	0940	1115	1245	1415	1550	1720	0935	1105	1240	1410	1540
Velocity Test Times Start	1556	0834	1006	1138	1308	1444	1614	0828	0958	1133	1303	1433
End	1606	0938	1106	1241	1411	1547	1716	0933	1103	1237	1406	1537
Post Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Post Test Span	8.56	8.24	8.86	8.76	8.70	7.88	8.54	8.20	9.20	8.23	7.43	7.38

Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/10  
Test# 1

Source Incinerator Test # 1 Date 2014/12/10

Start Time 15:56 End Time 16:06

Summary

Average Stack Gas Velocity 2.59 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 202 std m3/hour  
Wet 215 std m3/hour  
Dry 0.0562 std m3/sec  
Wet 0.0596 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 238 kg/hour  
Wet 252 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 558 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.8 kg/kg-mol

Molar Fraction Water Vapor 0.058

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.5	5.5	81.0	#N/A
Wet	12.7	5.2	76.3	#N/A

### Data and Calculations

Source Incinerator Test # 1 Date 2014/12/10

Start Time 15:56 End Time 16:06

Average Stack Gas Velocity. **2.590 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

214.60 std m3/hour

5.15 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 252.25 \text{ kg/hour}$$

Dry Molecular Wt. **29.42 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.76 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 5.8012142 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0580**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0217 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5066 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0095 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	558.4	Temperature Stack C
$\_T_s$	831.6	Absolute stack temperature K
$\_B_p$	668.6	Barometric Pressure mmHg
$\_P_{st}$	-0.3048	Static Pressure mmH2O
$\_P_s$	668.56	Absolute stack pressure mm Hg
$\_M_s$	28.76	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$	298.15	Standard absolute temperature K
$\_P_{std}$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.56328	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	18.50	Temperature meter Celsius
_Tm	291.7	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	9.20	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/11  
Test# 2

Source Incinerator Test # 2 Date 2014/12/11

Start Time 8:34 End Time 9:38

Summary

Average Stack Gas Velocity 2.86 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 234 std m3/hour  
Wet 243 std m3/hour  
Dry 0.065 std m3/sec  
Wet 0.0676 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 277 kg/hour  
Wet 288 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 527 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.0383

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.5	5.3	78.4	#N/A

## Data and Calculations

Source Incinerator Test # 2 Date 2014/12/11

Start Time 8:34 End Time 9:38

Average Stack Gas Velocity. **2.862 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
243.41 std m3/hour  
5.84 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 288.17 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.96 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.8263946 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0383**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0176 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5111 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0027 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	526.7	Temperature Stack C
$\_T_s$	799.8	Absolute stack temperature K
$\_B_p$	660.2	Barometric Pressure mmHg
$\_P_{st}$	-0.3302	Static Pressure mmH2O
$\_P_s$	660.17	Absolute stack pressure mm Hg
$\_M_s$	28.96	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$	298.15	Standard absolute temperature K
$\_P_{std}$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	13.0	Final Weight of water in grams
_V	0.57852	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm



Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/11  
Test# 3

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Source Incinerator Test # 3 Date 2014/12/11

Start Time 10:06 End Time 11:06

Summary

Average Stack Gas Velocity 2.8 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 225 std m3/hour  
Wet 235 std m3/hour  
Dry 0.0625 std m3/sec  
Wet 0.0653 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 266 kg/hour  
Wet 279 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 537 Celsius

Dry Molecular Weight 29.5 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.044

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.5	6.0	80.5	#N/A
Wet	12.9	5.7	77.0	#N/A

### Data and Calculations

Source Incinerator Test # 3 Date 2014/12/11

Start Time 10:06 End Time 11:06

Average Stack Gas Velocity. **2.800 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
235.18 std m3/hour  
5.64 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 278.71 \text{ kg/hour}$$

Dry Molecular Wt. **29.5 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.99 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.402453 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0440**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.019 \_Vw(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5005 \_Vm(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0041 \_Vsg(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

\_Kp 34.9219 Pitot tube constant  
\_Cp 0.803 Pitot tube coefficient  
\_NP 12 Number of traverse points  
\_Dts 536.8 Temperature Stack C  
\_Ts 810.0 Absolute stack temperature K  
\_Bp 660.2 Barometric Pressure mmHg  
\_Pst -0.2794 Static Pressure mmH2O  
\_Ps 660.18 Absolute stack pressure mm Hg  
\_Ms 28.99 Molecular weight of stack gas, wet basis g/g-mole  
\_A 0.0730 Area Square Meters 0.3048 Diameter Meters

\_Tstd 298.15 Standard absolute temperature K  
\_Pstd 760 Standard absolute pressure

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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.56652	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	6	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	80.5	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/11  
Test# 4

Source Incinerator Test # 4 Date 2014/12/11

Start Time 11:38 End Time 12:41

Summary

Average Stack Gas Velocity 2.49 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 207 std m3/hour  
Wet 216 std m3/hour  
Dry 0.0576 std m3/sec  
Wet 0.0599 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 245 kg/hour  
Wet 255 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 511 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0375

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.0	5.0	81.0	#N/A
Wet	13.5	4.8	78.0	#N/A

### Data and Calculations

Source Incinerator Test # 4 Date 2014/12/11

Start Time 11:38 End Time 12:41

Average Stack Gas Velocity. **2.485 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**  
215.50 std m3/hour  
5.17 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 254.87 \text{ kg/hour}$$

Dry Molecular Wt. **29.36 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.93 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.7478721 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0375**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0163 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5224 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	511.4	Temperature Stack C
_Ts	784.6	Absolute stack temperature K
_Bp	660.2	Barometric Pressure mmHg
_Pst	-0.2794	Static Pressure mmH2O
_Ps	660.18	Absolute stack pressure mm Hg
_Ms	28.93	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
		0.3048 Diameter Meters

\_Tstd 298.15 Standard absolute temperature K

\_Pstd 760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	12.0	Final Weight of water in grams
_V	0.59124	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/11  
Test# 5

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Source Incinerator Test # 5 Date 2014/12/11  
Start Time 13:08 End Time 14:11

Summary

Average Stack Gas Velocity 2.97 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 243 std m3/hour  
Wet 255 std m3/hour  
Dry 0.0675 std m3/sec  
Wet 0.0709 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 287 kg/hour  
Wet 301 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 519 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0475

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.5	5.5	81.0	#N/A
Wet	12.9	5.2	77.2	#N/A

### Data and Calculations

Source Incinerator Test # 5 Date 2014/12/11

Start Time 13:08 End Time 14:11

Average Stack Gas Velocity. **2.970 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

255.11 std m3/hour

6.12 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437$$

301.12 kg/hour

Dry Molecular Wt. **29.42 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.88 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7515786 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0475**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0217 \_Vw(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5164 \_Vm(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0041 \_Vsg(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	518.9	Temperature Stack C
$\_Ts$	792.1	Absolute stack temperature K
$\_Bp$	660.2	Barometric Pressure mmHg
$\_Pst$	-0.2794	Static Pressure mmH2O
$\_Ps$	660.18	Absolute stack pressure mm Hg
$\_Ms$	28.88	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K

$\_Pstd$  760 Standard absolute pressure



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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.58447	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/11  
Test# 6

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Source Incinerator Test # 6 Date 2014/12/11

Start Time 14:44 End Time 15:47

Summary

Average Stack Gas Velocity 2.98 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 248 std m3/hour  
Wet 259 std m3/hour  
Dry 0.0689 std m3/sec  
Wet 0.0718 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 293 kg/hour  
Wet 305 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 512 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0411

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.0	5.0	81.0	#N/A
Wet	13.4	4.8	77.7	#N/A

## Data and Calculations

Source Incinerator Test # 6 Date 2014/12/11

Start Time 14:44 End Time 15:47

Average Stack Gas Velocity. **2.983 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
258.60 std m3/hour  
6.21 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 305.40 \text{ kg/hour}$$

Dry Molecular Wt. **29.36 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.89 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.1075717 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0411**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0163 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5383 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0068 \_V_{sg}(\text{std})$$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	511.6	Temperature Stack C
$\_T_s$	784.7	Absolute stack temperature K
$\_B_p$	660.2	Barometric Pressure mmHg
$\_P_{st}$	-0.2794	Static Pressure mmH2O
$\_P_s$	660.18	Absolute stack pressure mm Hg
$\_M_s$	28.89	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	12.0	Final Weight of water in grams
_V	0.60928	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Source Incinerator Test # 7 Date 2014/12/11

Start Time 16:14 End Time 17:16

Summary

Average Stack Gas Velocity 2.8 m/s

Average Stack Gas Volumetric Flow Rate Dry 245 std m3/hour  
Wet 255 std m3/hour  
Dry 0.0682 std m3/sec  
Wet 0.0708 std m3/sec

Average Stack Gas Mass Flow Rate Dry 290 kg/hour  
Wet 301 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 475 Celsius

Dry Molecular Weight 29.3 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.037

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	4.5	81.0	#N/A
Wet	14.0	4.3	78.0	#N/A

### Data and Calculations

Source Incinerator Test # 7 Date 2014/12/11

Start Time 16:14 End Time 17:16

Average Stack Gas Velocity. **2.804 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

254.85 std m3/hour

6.12 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 300.85 \text{ kg/hour}$$

Dry Molecular Wt. **29.3 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.88 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.7042476 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0370**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0136 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.4936 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0054 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	475.3	Temperature Stack C
$\_Ts$	748.4	Absolute stack temperature K
$\_Bp$	660.2	Barometric Pressure mmHg
$\_Pst$	-0.254	Static Pressure mmH2O
$\_Ps$	660.18	Absolute stack pressure mm Hg
$\_Ms$	28.88	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$	298.15	Standard absolute temperature K
$\_Pstd$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	10.0	Final Weight of water in grams
_V	0.55872	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	4.5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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2014/12/12  
Test# 8

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Source Incinerator Test # 8 Date 2014/12/12

Start Time 8:28 End Time 9:33

Summary

Average Stack Gas Velocity 2.44 m/s

Average Stack Gas Volumetric Flow Rate Dry 199 std m3/hour  
Wet 209 std m3/hour  
Dry 0.0553 std m3/sec  
Wet 0.058 std m3/sec

Average Stack Gas Mass Flow Rate Dry 235 kg/hour  
Wet 246 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 523 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0478

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.4	5.2	77.6	#N/A



### Data and Calculations

Source Incinerator Test # 8 Date 2014/12/12

Start Time 8:28 End Time 9:33

Average Stack Gas Velocity. **2.441 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

208.96 std m3/hour

5.02 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 246.45 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.85 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7813766 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0478**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5132 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0068 \_V_{sg}(\text{std})$$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	523.2	Temperature Stack C
_Ts	796.3	Absolute stack temperature K
_Bp	661.5	Barometric Pressure mmHg
_Pst	-0.1778	Static Pressure mmH2O
_Ps	661.45	Absolute stack pressure mm Hg
_Ms	28.85	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
		0.3048 Diameter Meters

_Tstd	298.15	Standard absolute temperature K
_Pstd	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.57774	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	19.00	Temperature meter Celsius
_Tm	292.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 9 Date 2014/12/12

Start Time 9:58 End Time 11:03

Summary

Average Stack Gas Velocity 2.58 m/s

Average Stack Gas Volumetric Flow Rate Dry 210 std m3/hour  
Wet 220 std m3/hour  
Dry 0.0583 std m3/sec  
Wet 0.0611 std m3/sec

Average Stack Gas Mass Flow Rate Dry 248 kg/hour  
Wet 260 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 527 Celsius

Dry Molecular Weight 29.5 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.0457

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	6.0	81.0	#N/A
Wet	12.4	5.7	77.3	#N/A

## Data and Calculations

Source Incinerator Test # 9 Date 2014/12/12

Start Time 9:58 End Time 11:03

Average Stack Gas Velocity. **2.581 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

220.01 std m3/hour

5.28 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437$$

260.39 kg/hour

Dry Molecular Wt. **29.48 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.96 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.5679914 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0457**

$$V_w(\text{std}) = K (W_f - W_i)$$

Volume Water vapor at s.t.p. M<sup>3</sup>

0.0217  $\_V_w(\text{std})$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m)$$

Volume meter gas at s.t.p. M<sup>3</sup>

0.5098  $\_V_m(\text{std})$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i)$$

Water Water in silica s.t.p. M<sup>3</sup>

0.0027  $\_V_{sg}(\text{std})$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	526.5	Temperature Stack C
$\_Ts$	799.7	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.96	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K

$\_Pstd$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.57589	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	6	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/12  
Test# 10

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Source Incinerator Test # 10 Date 2014/12/12  
Start Time 11:33 End Time 12:37

Summary

Average Stack Gas Velocity 2.34 m/s

Average Stack Gas Volumetric Flow Rate Dry 187 std m3/hour  
Wet 197 std m3/hour  
Dry 0.052 std m3/sec  
Wet 0.0546 std m3/sec

Average Stack Gas Mass Flow Rate Dry 221 kg/hour  
Wet 232 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 539 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0475

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.4	5.2	77.6	#N/A

## Data and Calculations

Source Incinerator Test # 10 Date 2014/12/12

Start Time 11:33 End Time 12:37

Average Stack Gas Velocity. **2.342 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

196.51 std m3/hour

4.72 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 231.80 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.86 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7487394 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0475**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0203 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5168 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0054 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	539.3	Temperature Stack C
$\_T_s$	812.4	Absolute stack temperature K
$\_B_p$	661.5	Barometric Pressure mmHg
$\_P_{st}$	-0.1524	Static Pressure mmH2O
$\_P_s$	661.46	Absolute stack pressure mm Hg
$\_M_s$	28.86	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	15.0	Final Weight of water in grams
_V	0.58381	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm



---

Source Incinerator Test # 11 Date 2014/12/12

Start Time 13:00 End Time 14:06

Summary

Average Stack Gas Velocity 2.15 m/s

Average Stack Gas Volumetric Flow Rate Dry 188 std m3/hour  
Wet 196 std m3/hour  
Dry 0.0522 std m3/sec  
Wet 0.0545 std m3/sec

Average Stack Gas Mass Flow Rate Dry 221 kg/hour  
Wet 231 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 474 Celsius

Dry Molecular Weight 29.3 kg/kg-mol  
Wet Molecular Weight 28.8 kg/kg-mol

Molar Fraction Water Vapor 0.0432

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	4.5	81.0	#N/A
Wet	13.9	4.3	77.5	#N/A

### Data and Calculations

Source Incinerator Test # 11 Date 2014/12/12

Start Time 13:00 End Time 14:06

Average Stack Gas Velocity. **2.153 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

196.37 std m3/hour

4.71 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 231.25 \text{ kg/hour}$$

Dry Molecular Wt. **29.3 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.81 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.3239159 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0432**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.51 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	474.3	Temperature Stack C
$\_Ts$	747.5	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.81	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$	298.15	Standard absolute temperature K
$\_Pstd$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.57618	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	4.5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 12 Date 2014/12/12

Start Time 14:33 End Time 15:37

Summary

Average Stack Gas Velocity 2.12 m/s

Average Stack Gas Volumetric Flow Rate Dry 183 std m3/hour  
Wet 192 std m3/hour  
Dry 0.051 std m3/sec  
Wet 0.0534 std m3/sec

Average Stack Gas Mass Flow Rate Dry 216 kg/hour  
Wet 227 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 480 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0453

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	5.0	80.5	#N/A
Wet	13.8	4.8	76.9	#N/A

### Data and Calculations

Source Incinerator Test # 12 Date 2014/12/12

Start Time 14:33 End Time 15:37

Average Stack Gas Velocity. **2.122 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

192.15 std m3/hour

4.61 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437$$

226.71 kg/hour

Dry Molecular Wt. **29.38 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.86 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O = 4.5270035 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0453**

$$V_w(\text{std}) = K (W_f - W_i)$$

Volume Water vapor at s.t.p. M<sup>3</sup>

0.0217  $\_V_w(\text{std})$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m)$$

Volume meter gas at s.t.p. M<sup>3</sup>

0.5146  $\_V_m(\text{std})$

$$V_{sg}(\text{std}) = K_2(\text{sg}) (W_f - W_i)$$

Water Water in silica s.t.p. M<sup>3</sup>

0.0027  $\_V_{sg}(\text{std})$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

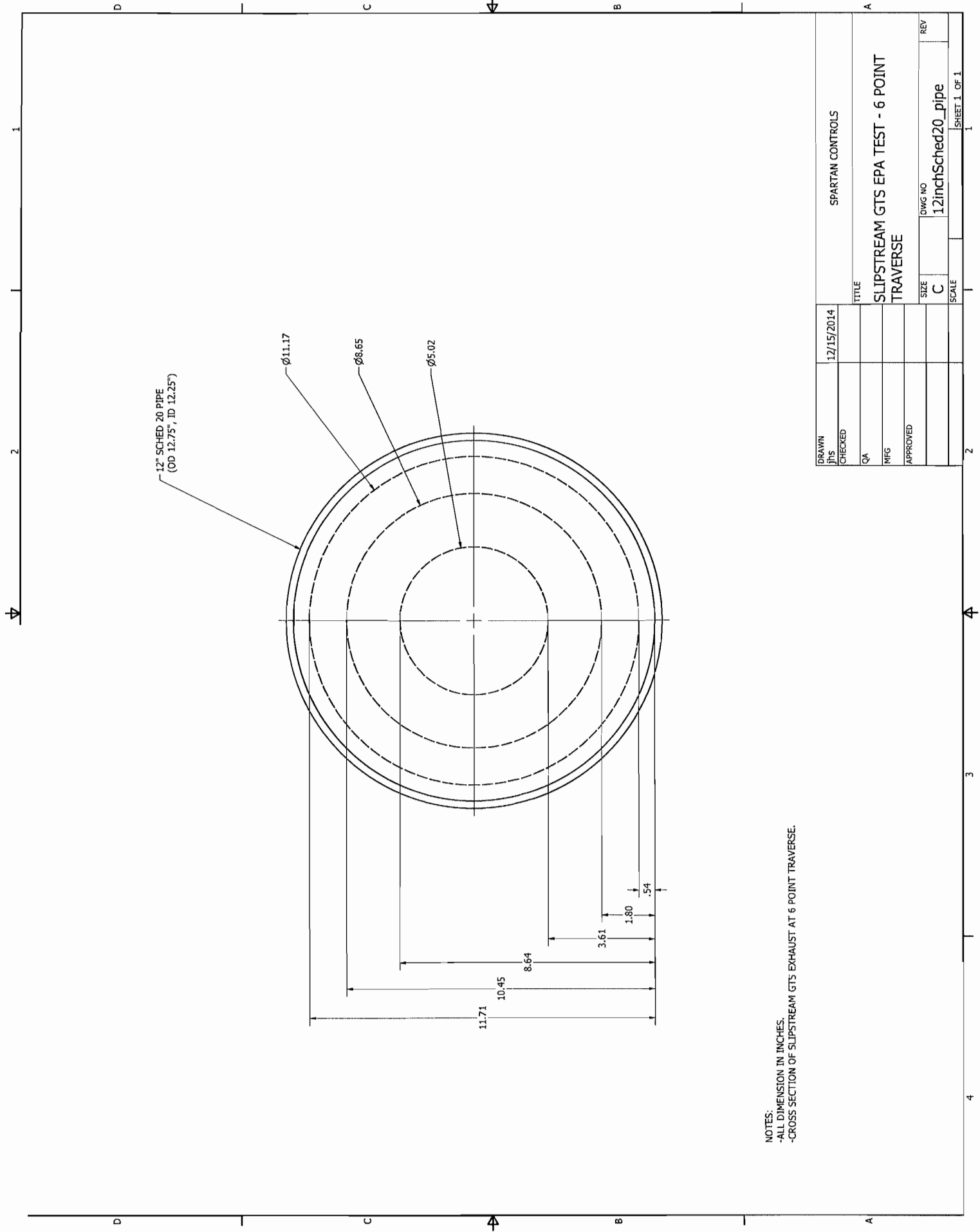
$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	479.5	Temperature Stack C
$\_T_s$	752.7	Absolute stack temperature K
$\_B_p$	661.5	Barometric Pressure mmHg
$\_P_{st}$	-0.1524	Static Pressure mmH2O
$\_P_s$	661.46	Absolute stack pressure mm Hg
$\_M_s$	28.86	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

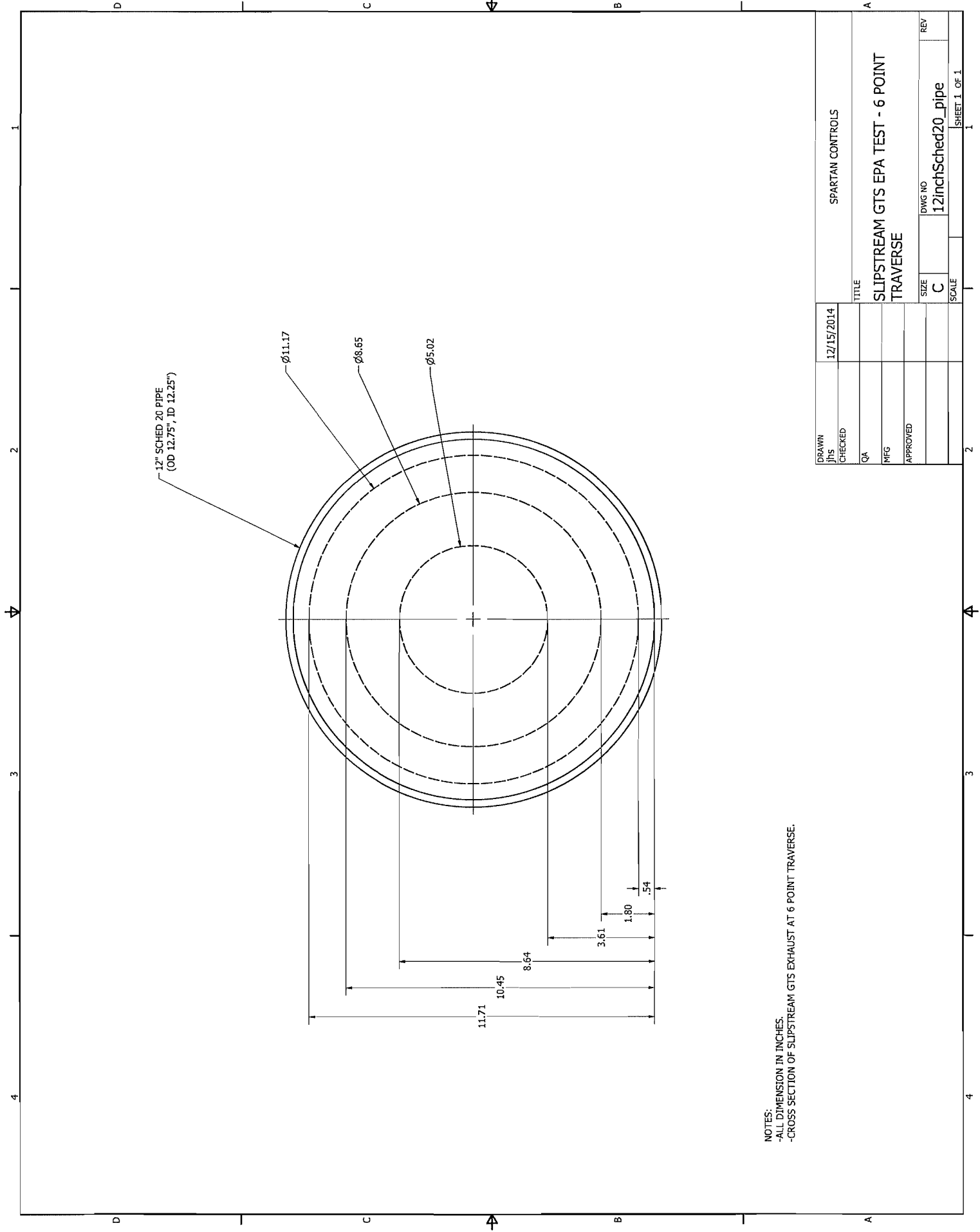
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_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.58135	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	80.5	Molar Percent Nitrogen
_CO	#N/A	ppm



NOTES:  
-ALL DIMENSION IN INCHES.  
-CROSS SECTION OF SLIPSTREAM GTS EXHAUST AT 6 POINT TRAVERSE.

DRAWN	12/15/2014	SPARTAN CONTROLS	
JYS		TITLE	
CHECKED		SLIPSTREAM GTS EPA TEST - 6 POINT TRAVERSE	
QA		SIZE	REV
MFG		C	
APPROVED		DWG NO	12inchSched20_pipe
		SCALE	SHEET 1 OF 1



NOTES:  
-ALL DIMENSION IN INCHES  
-CROSS SECTION OF SLIPSTREAM GTS EXHAUST AT 6 POINT TRAVERSE.

DRAWN JHS	12/15/2014	SPARTAN CONTROLS	
CHECKED		TITLE	
QA		SLIPSTREAM GTS EPA TEST - 6 POINT TRAVERSE	
MFG			
APPROVED			
		SIZE	REV
		C	12inchSched20_pipe
		SCALE	
		SHEET 1 OF 1	

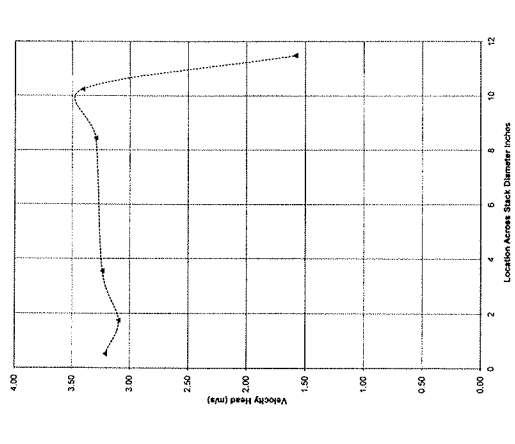


## **Appendix II**

### **Velocity Traverse Profiles**

Project: E1C214664  
2014/12/10  
Test # 1  
Spartan  
Calgary  
Incinerator

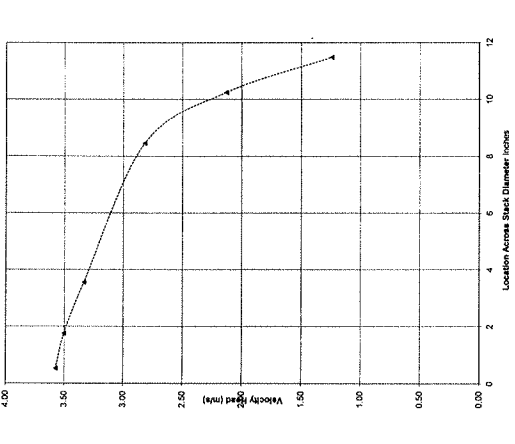
Velocity Profile East to West  
Incinerator Test #1 2014/12/10



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Project: E1C214664  
2014/12/11  
Test # 2  
Spartan  
Calgary  
Incinerator

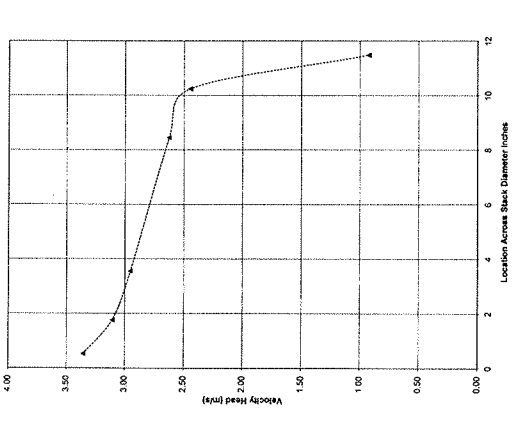
Velocity Profile East to West  
Incinerator Test #2 2014/12/11



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Project: E1C214664  
2014/12/10  
Test # 1  
Spartan  
Calgary  
Incinerator

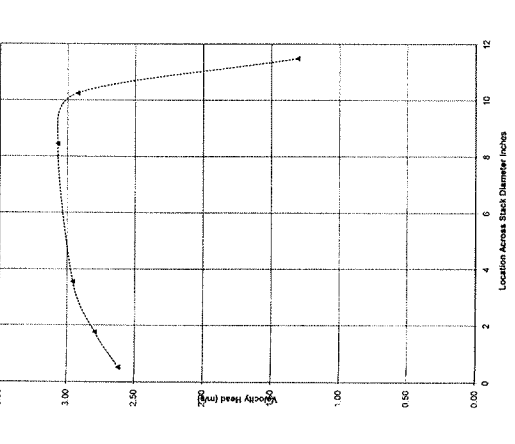
Velocity Profile North to South  
Incinerator Test #1 2014/12/10



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Project: E1C214664  
2014/12/10  
Test # 1  
Spartan  
Calgary  
Incinerator

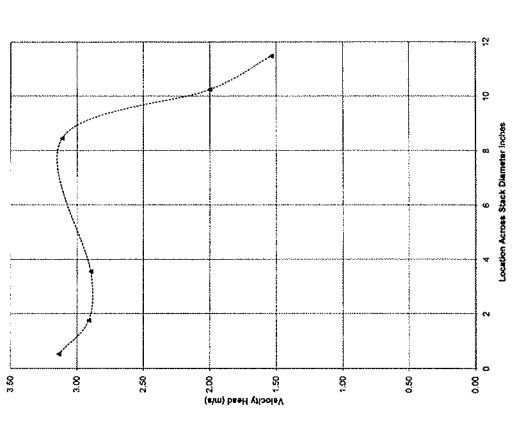
Velocity Profile East to West  
Incinerator Test #1 2014/12/10



AGAT Laboratories

Project: E1C214664  
2014/12/11  
Test # 4  
Spartan  
Calgary  
Incinerator

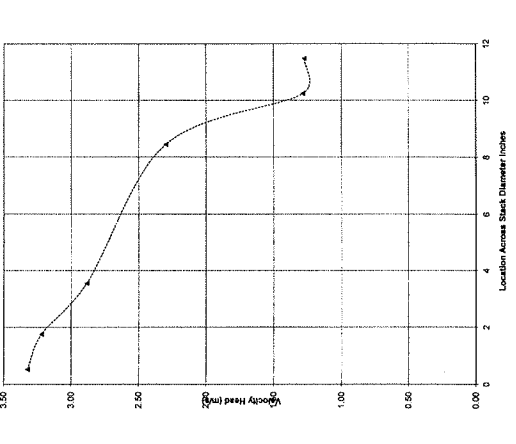
Velocity Profile North to South  
Incinerator Test #4 2014/12/11



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Project: E1C214664  
2014/12/11  
Test # 4  
Spartan  
Calgary  
Incinerator

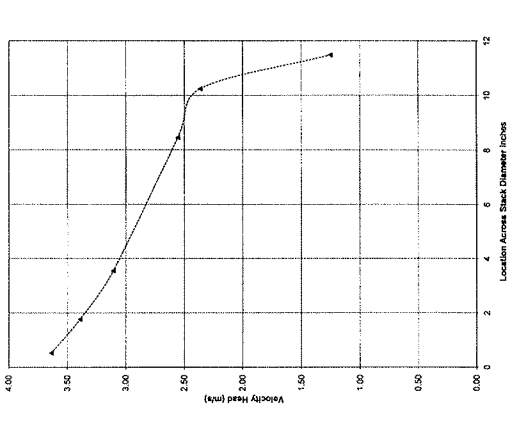
Velocity Profile East to West  
Incinerator Test #4 2014/12/11



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Project: E1C214664  
2014/12/11  
Test # 3  
Spartan  
Calgary  
Incinerator

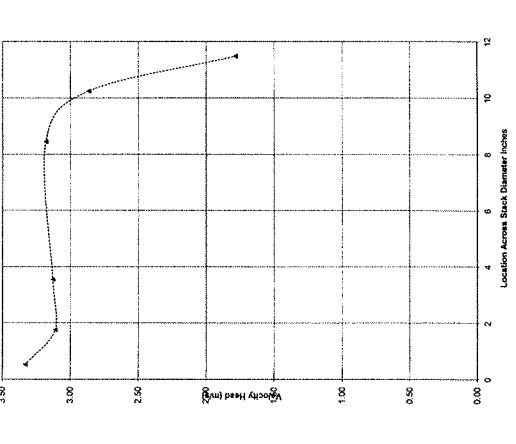
Velocity Profile North to South  
Incinerator Test #3 2014/12/11



AGAT Laboratories

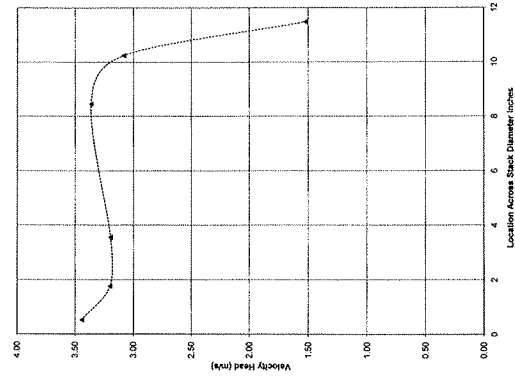
Project: E1C214664  
2014/12/11  
Test # 3  
Spartan  
Calgary  
Incinerator

Velocity Profile East to West  
Incinerator Test #3 2014/12/11

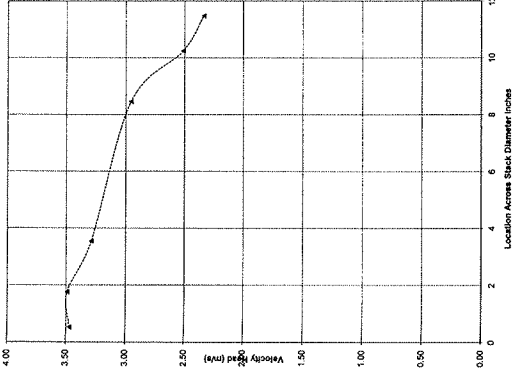


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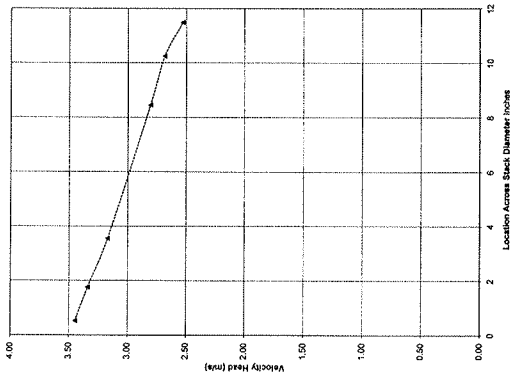
Velocity Profile North to South  
Incinerator Test # 6 2014/12/11



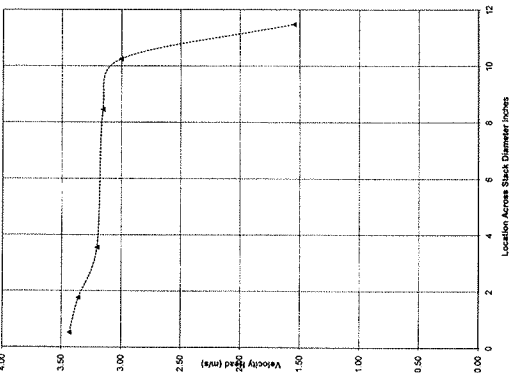
Velocity Profile East to West  
Incinerator Test # 6 2014/12/11



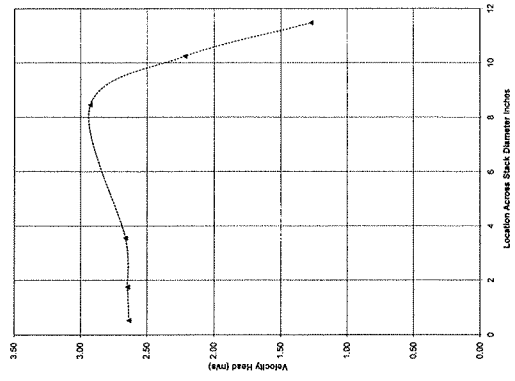
Velocity Profile North to South  
Incinerator Test # 5 2014/12/11



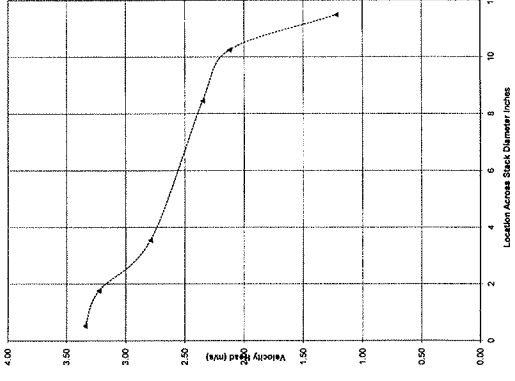
Velocity Profile East to West  
Incinerator Test # 5 2014/12/11



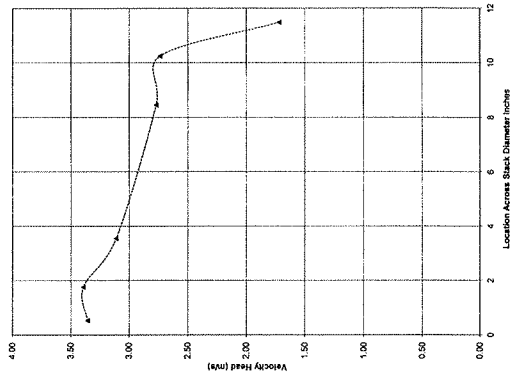
Velocity Profile North to South  
Incinerator Test # 8 2014/12/12



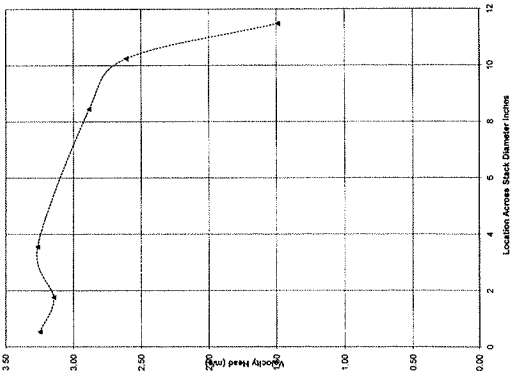
Velocity Profile East to West  
Incinerator Test # 8 2014/12/12



Velocity Profile North to South  
Incinerator Test # 7 2014/12/11



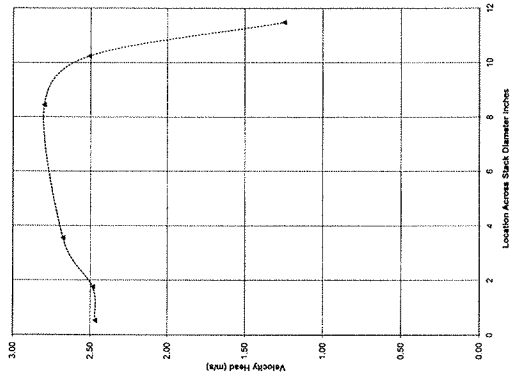
Velocity Profile East to West  
Incinerator Test # 7 2014/12/11



Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 10

Velocity Profile North to South  
Incinerator Test # 10 2014/12/12

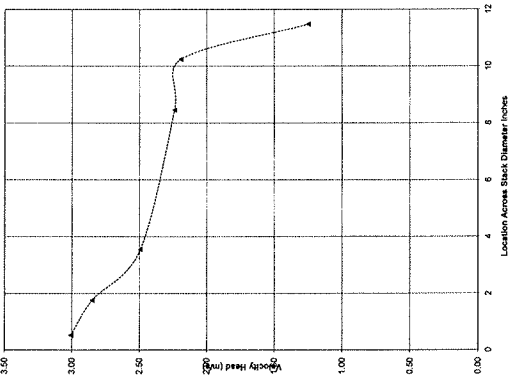


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 10

Velocity Profile East to West  
Incinerator Test # 10 2014/12/12

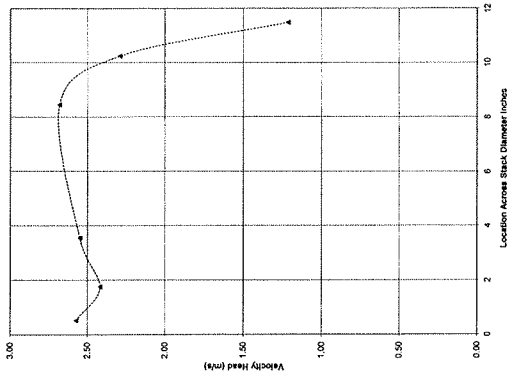


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 12

Velocity Profile North to South  
Incinerator Test # 12 2014/12/12

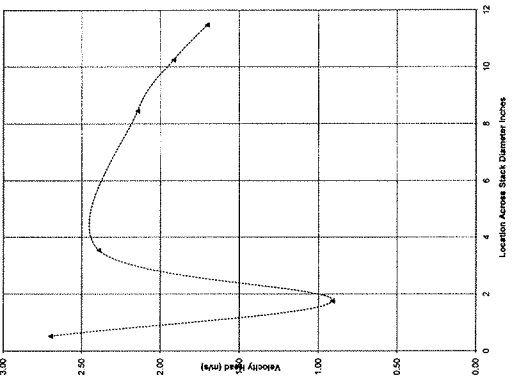


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 12

Velocity Profile East to West  
Incinerator Test # 12 2014/12/12

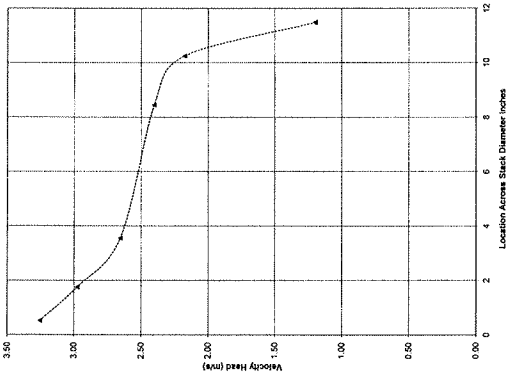


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 9

Velocity Profile North to South  
Incinerator Test # 9 2014/12/12

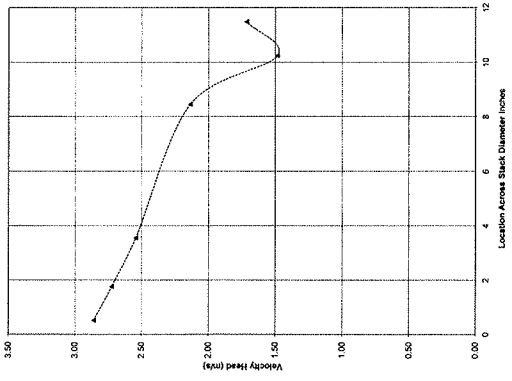


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 11

Velocity Profile North to South  
Incinerator Test # 11 2014/12/12

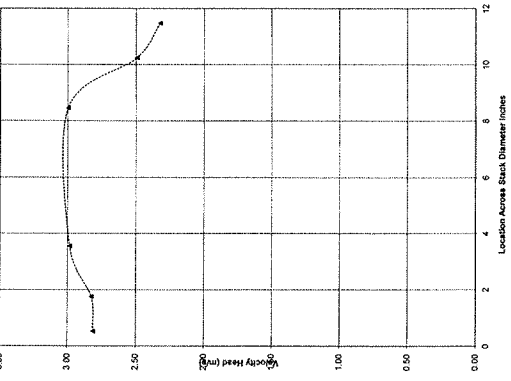


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 9

Velocity Profile East to West  
Incinerator Test # 9 2014/12/12

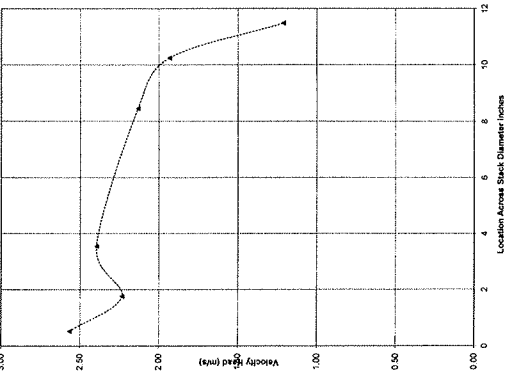


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Station  
Calgary  
Incinerator

Project #40214464  
2014/12/12  
Test # 11

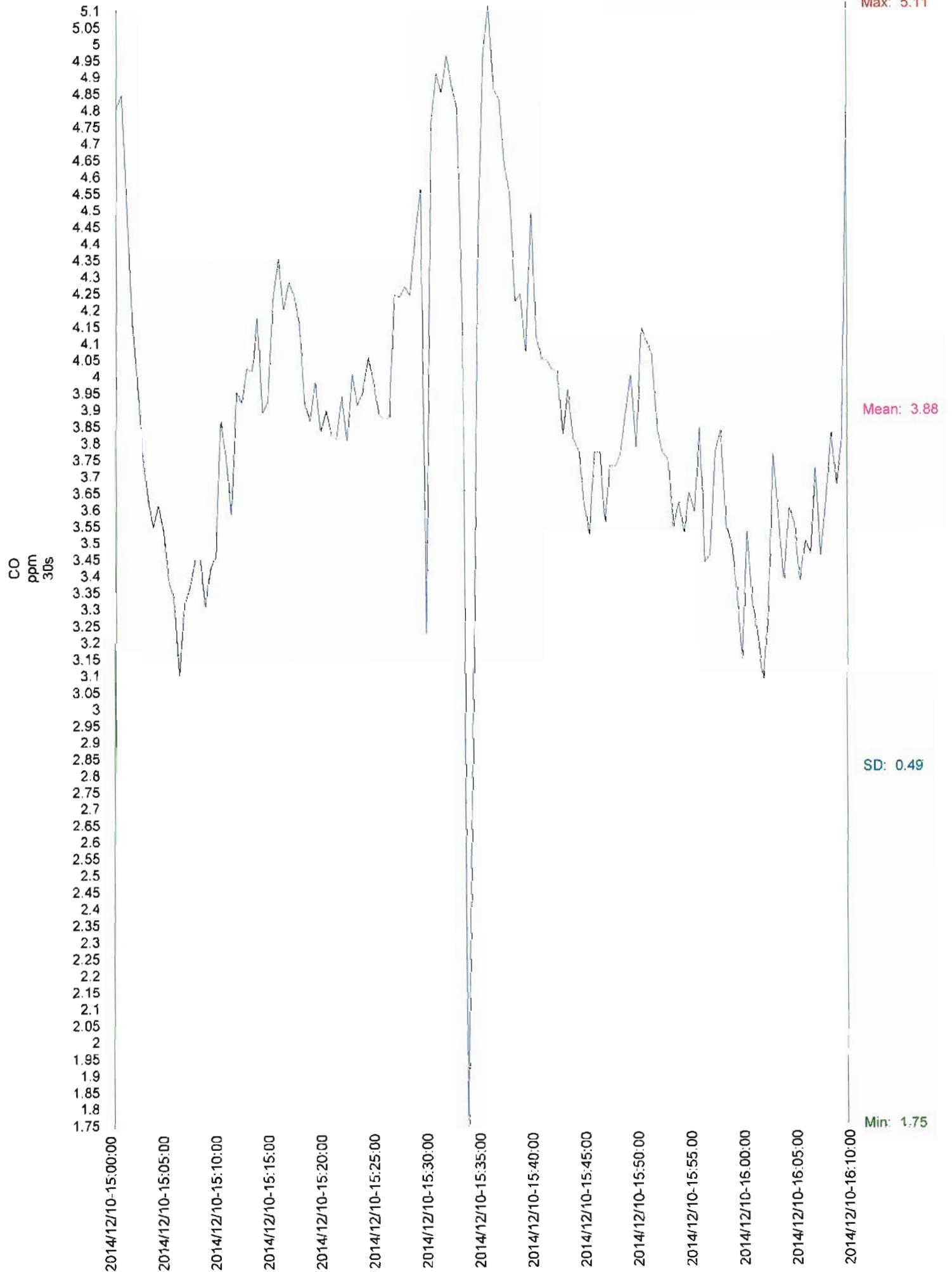
Velocity Profile East to West  
Incinerator Test # 11 2014/12/12

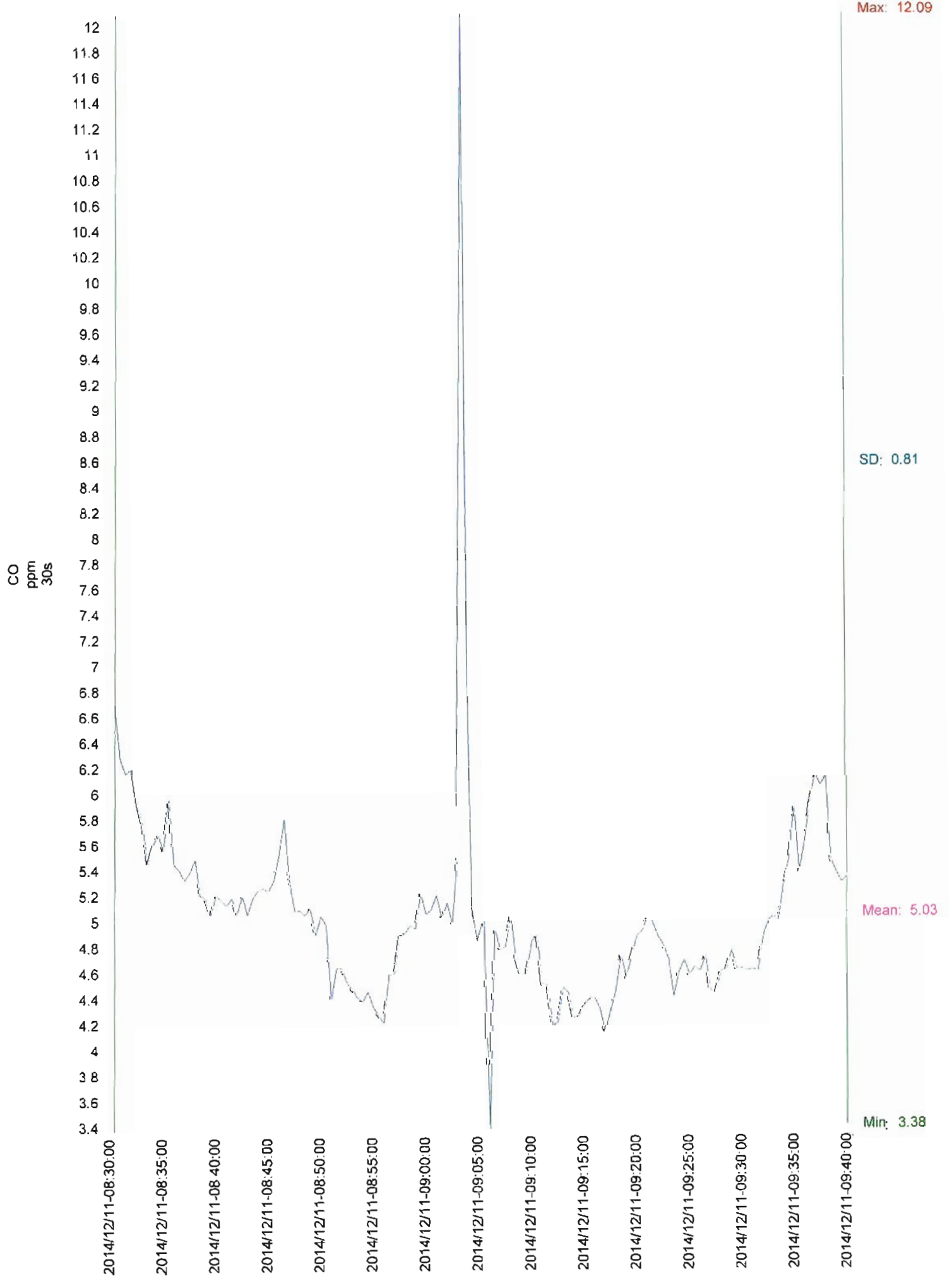


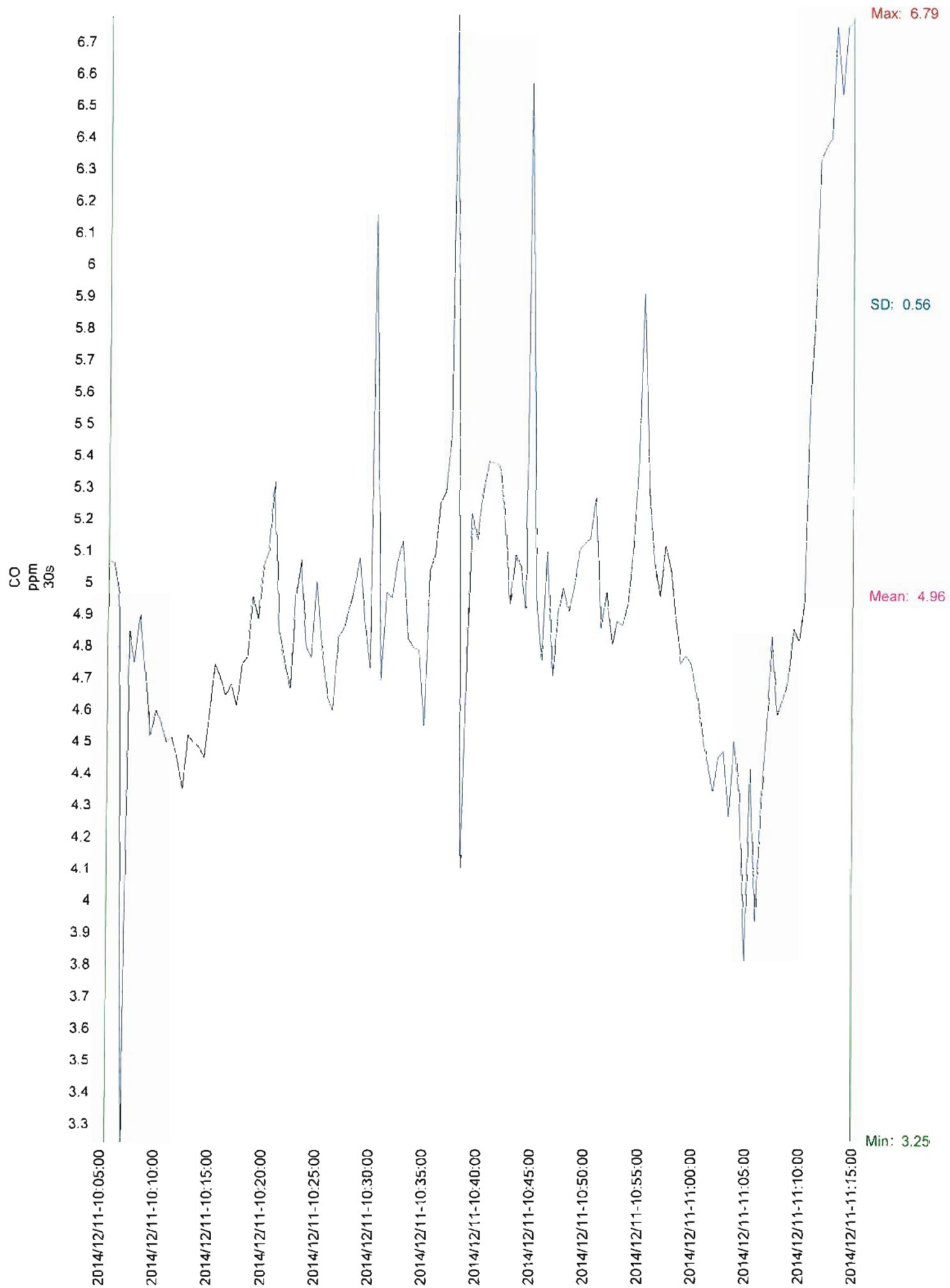
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## **Appendix III**

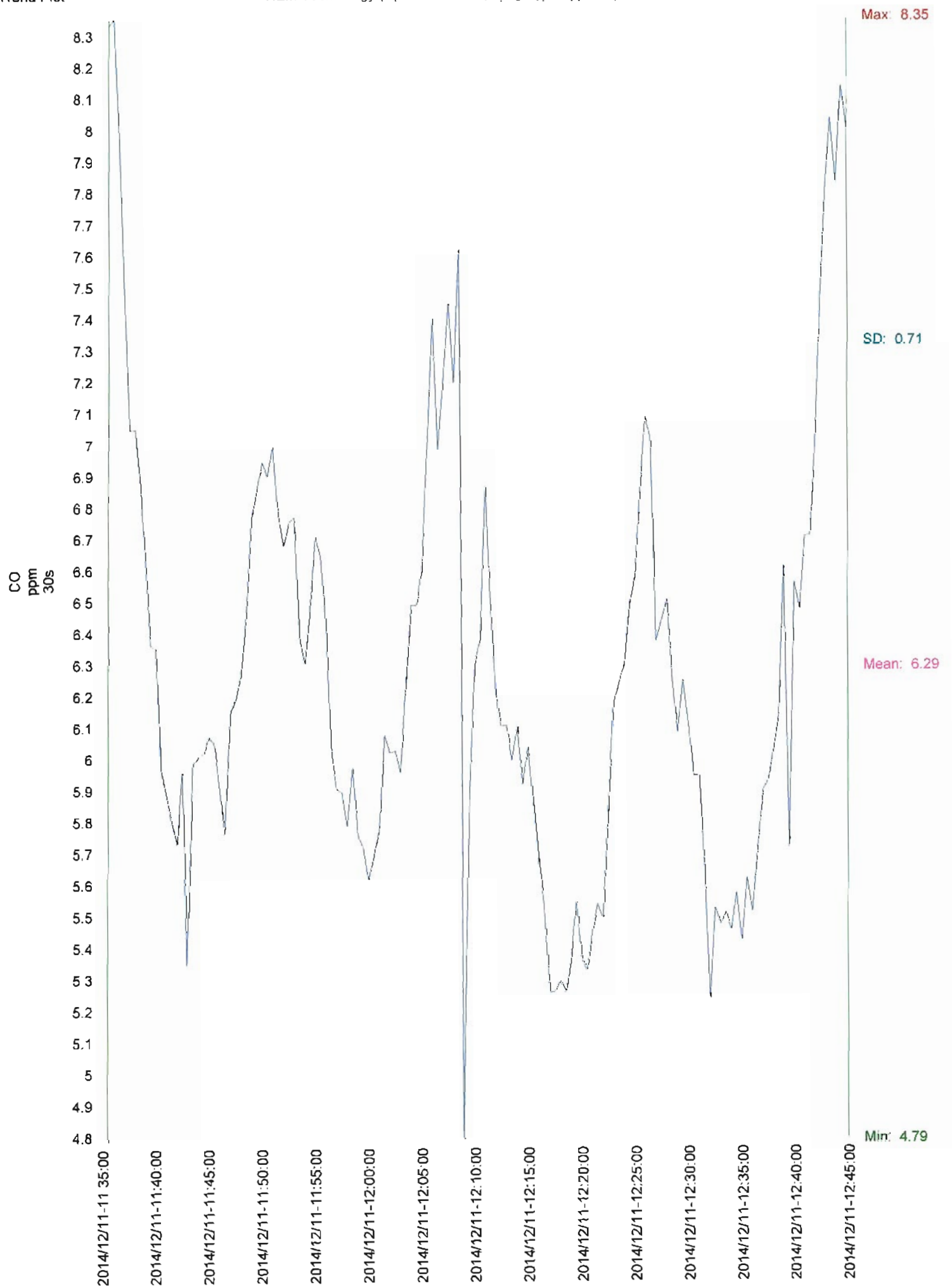
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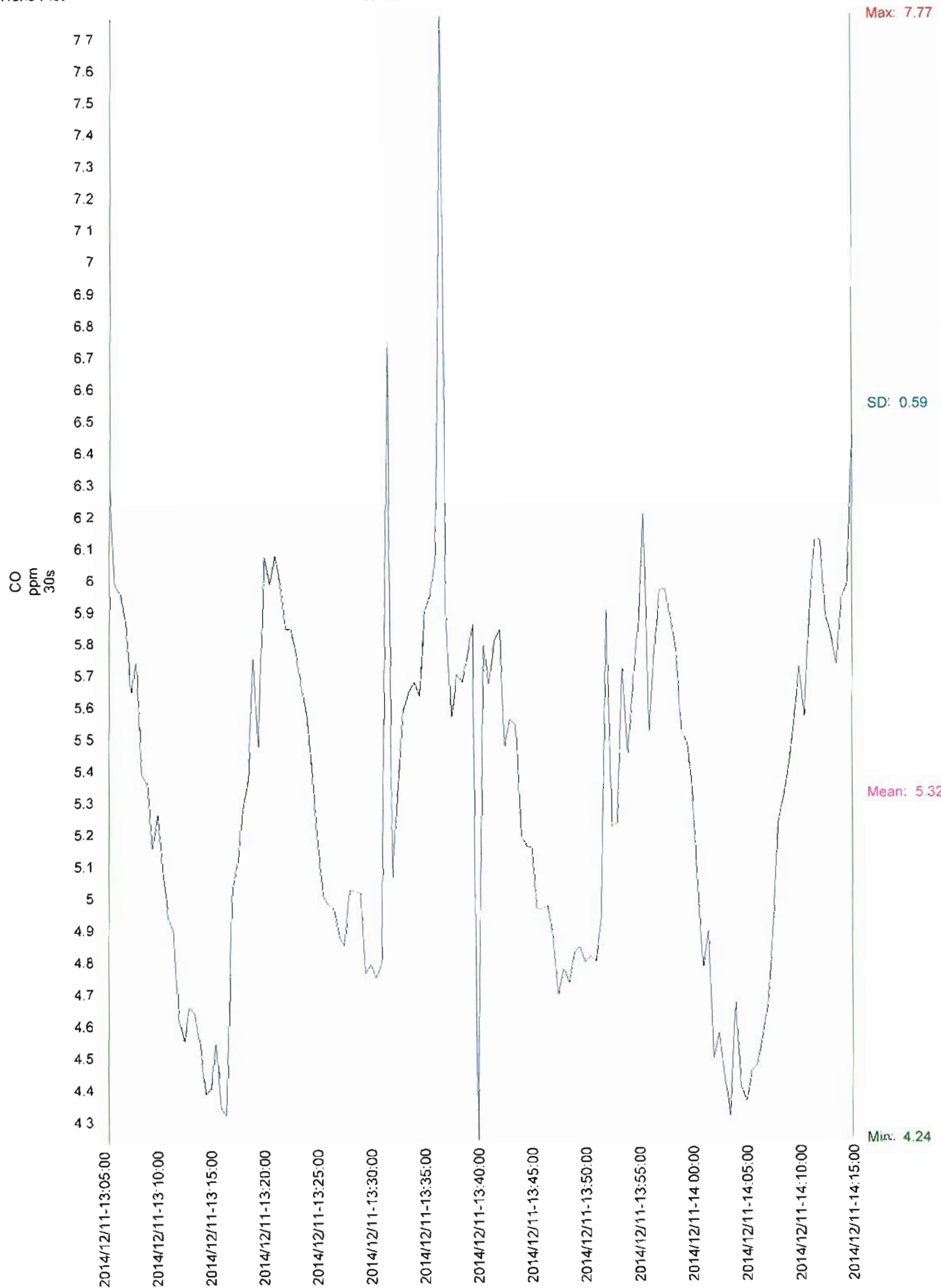


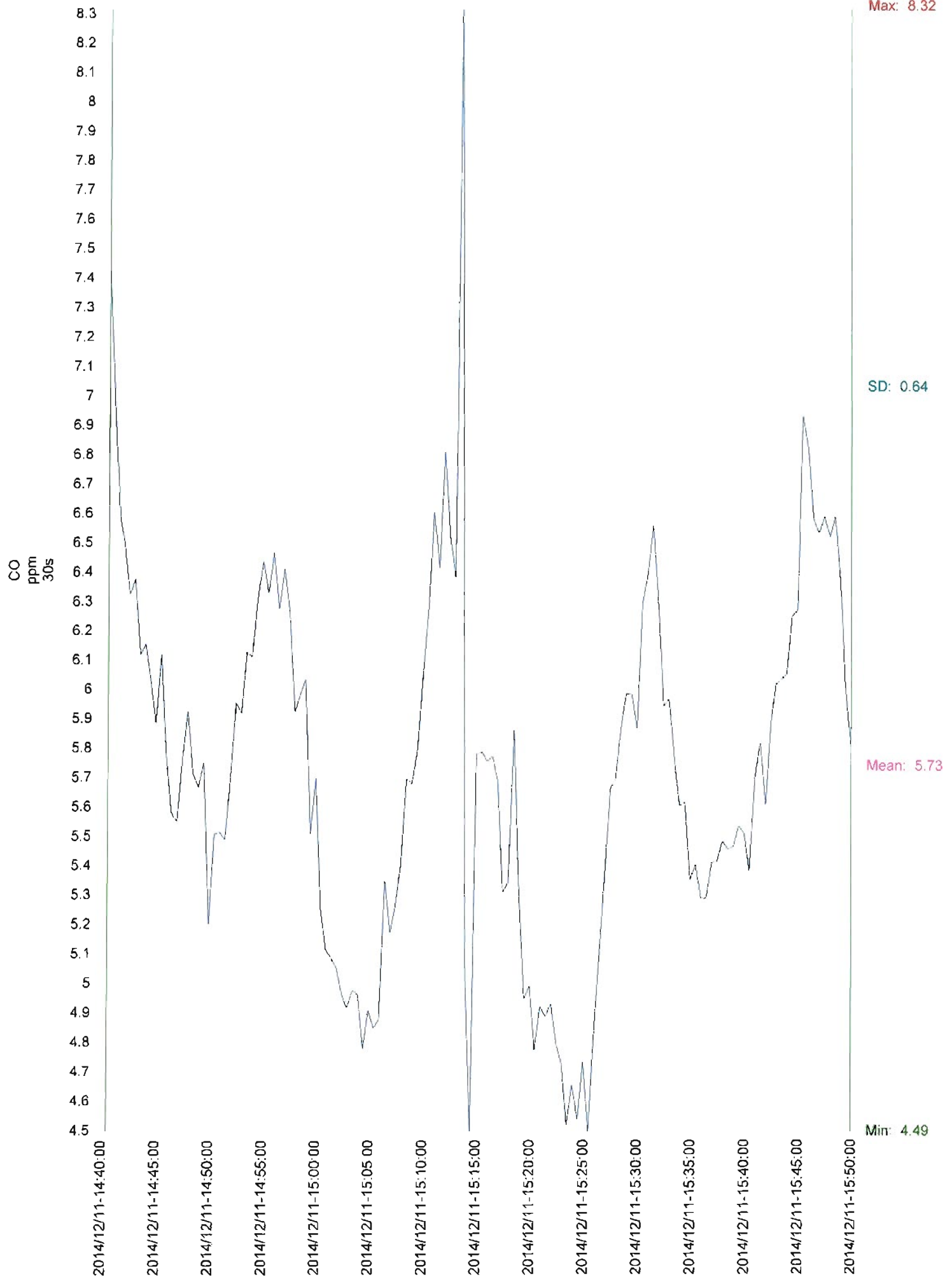


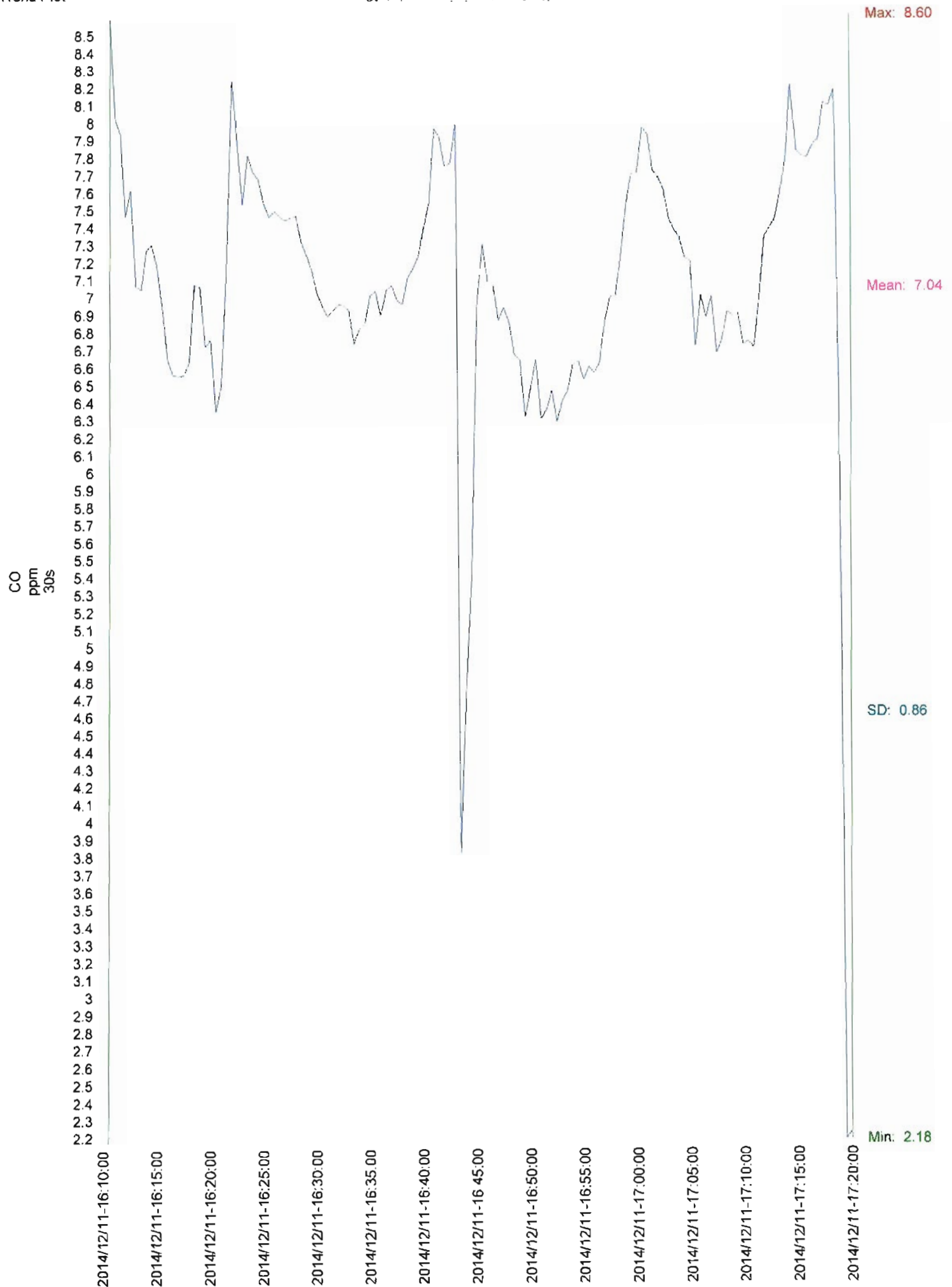


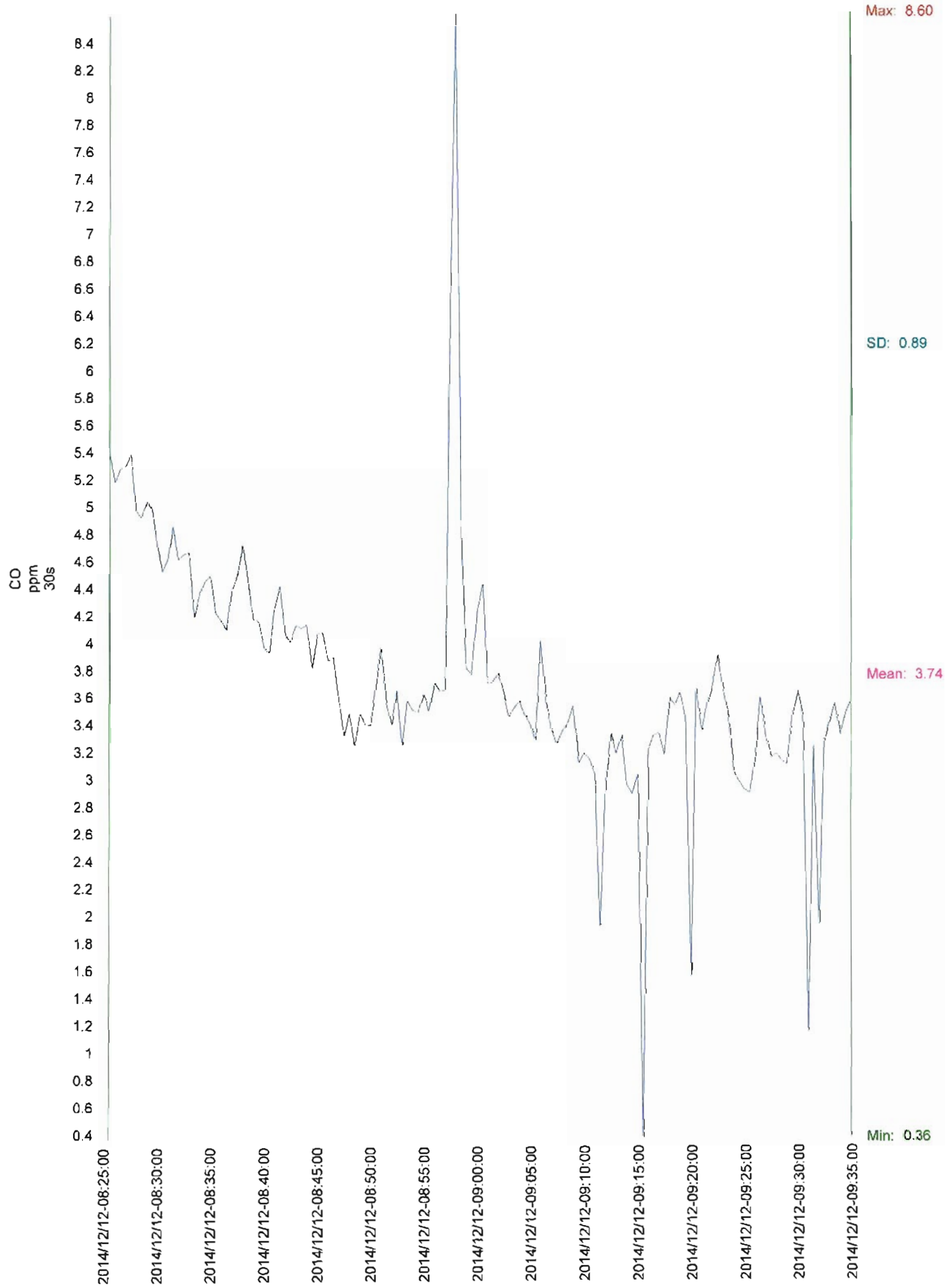


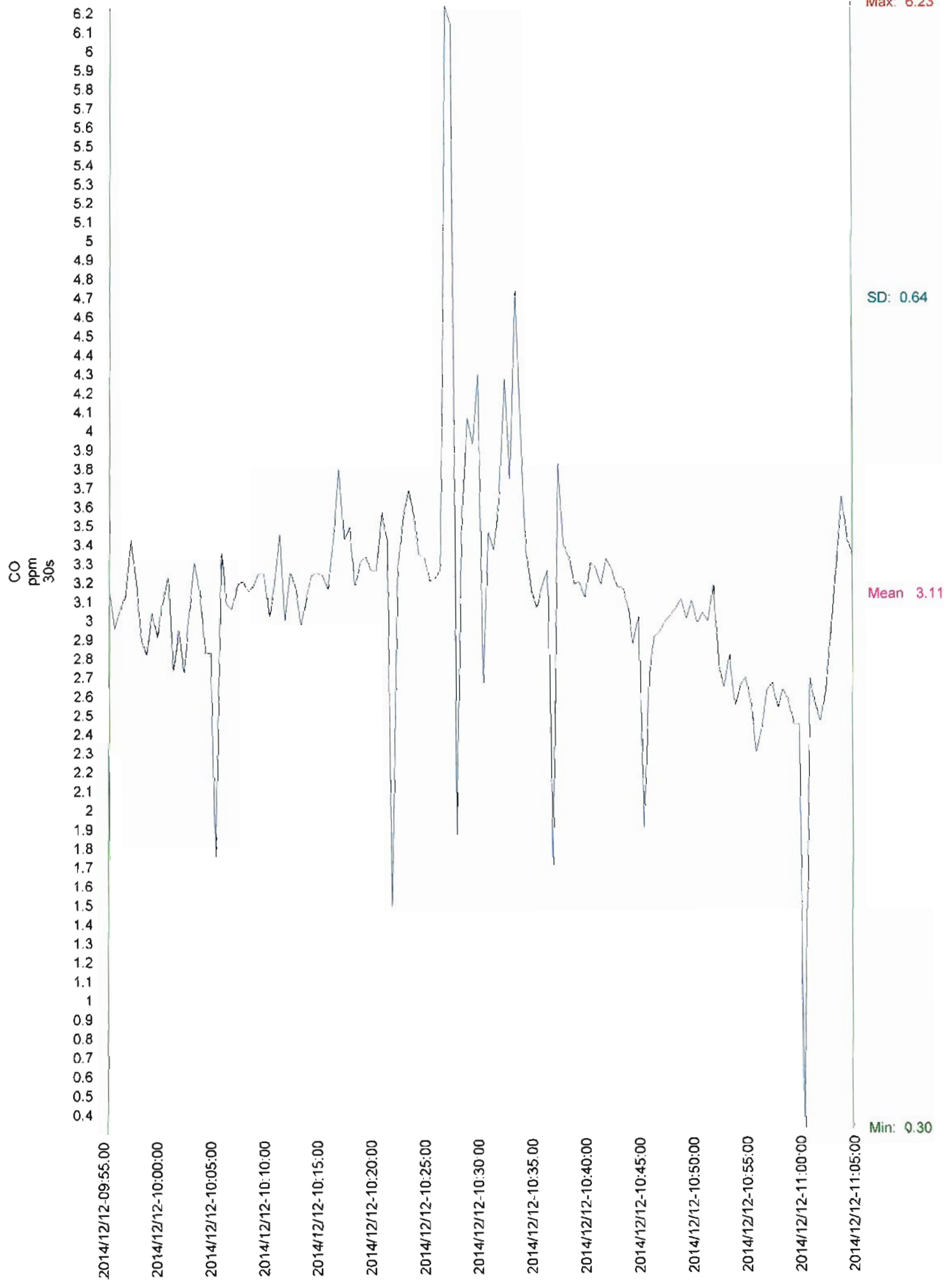


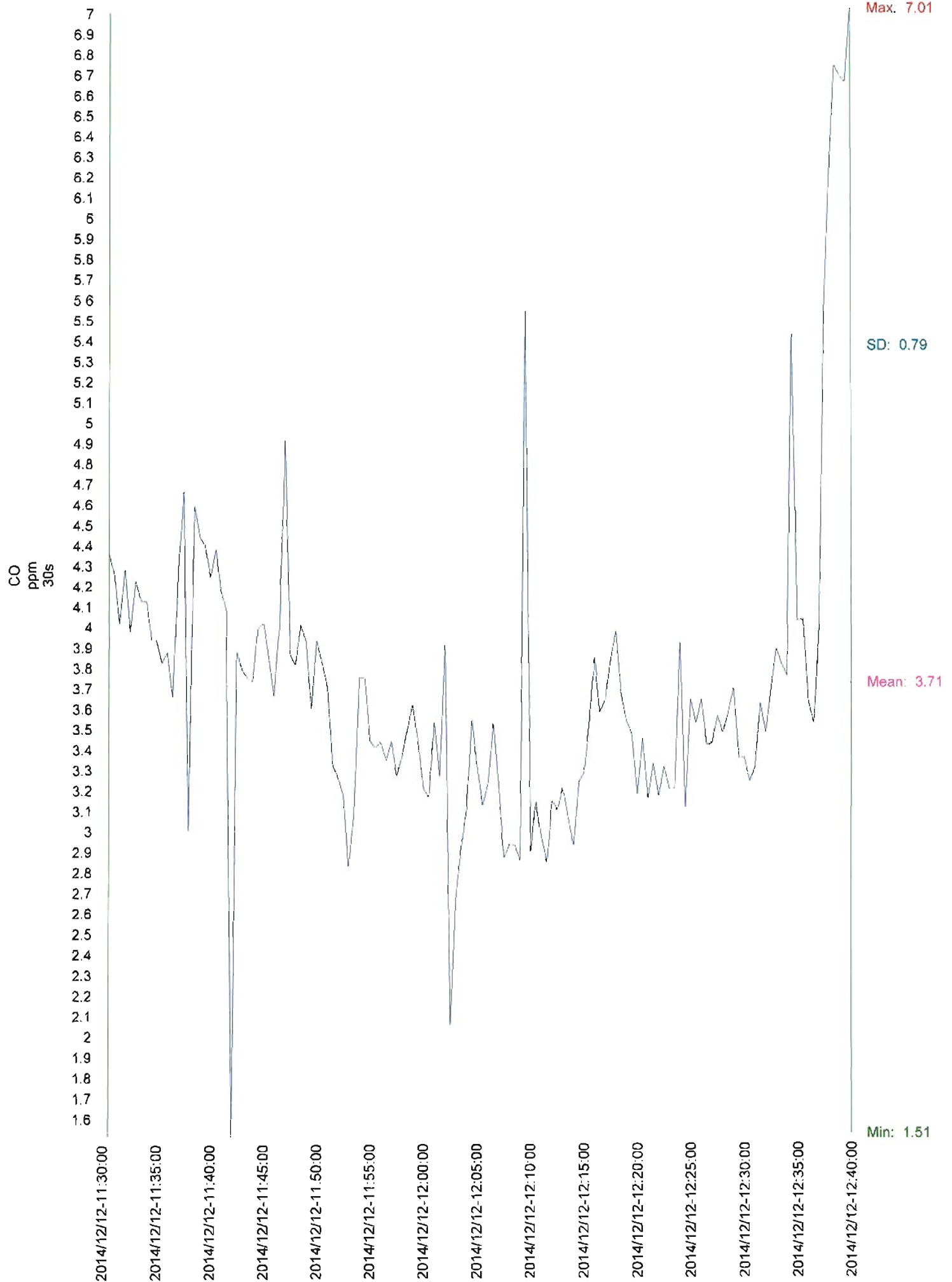


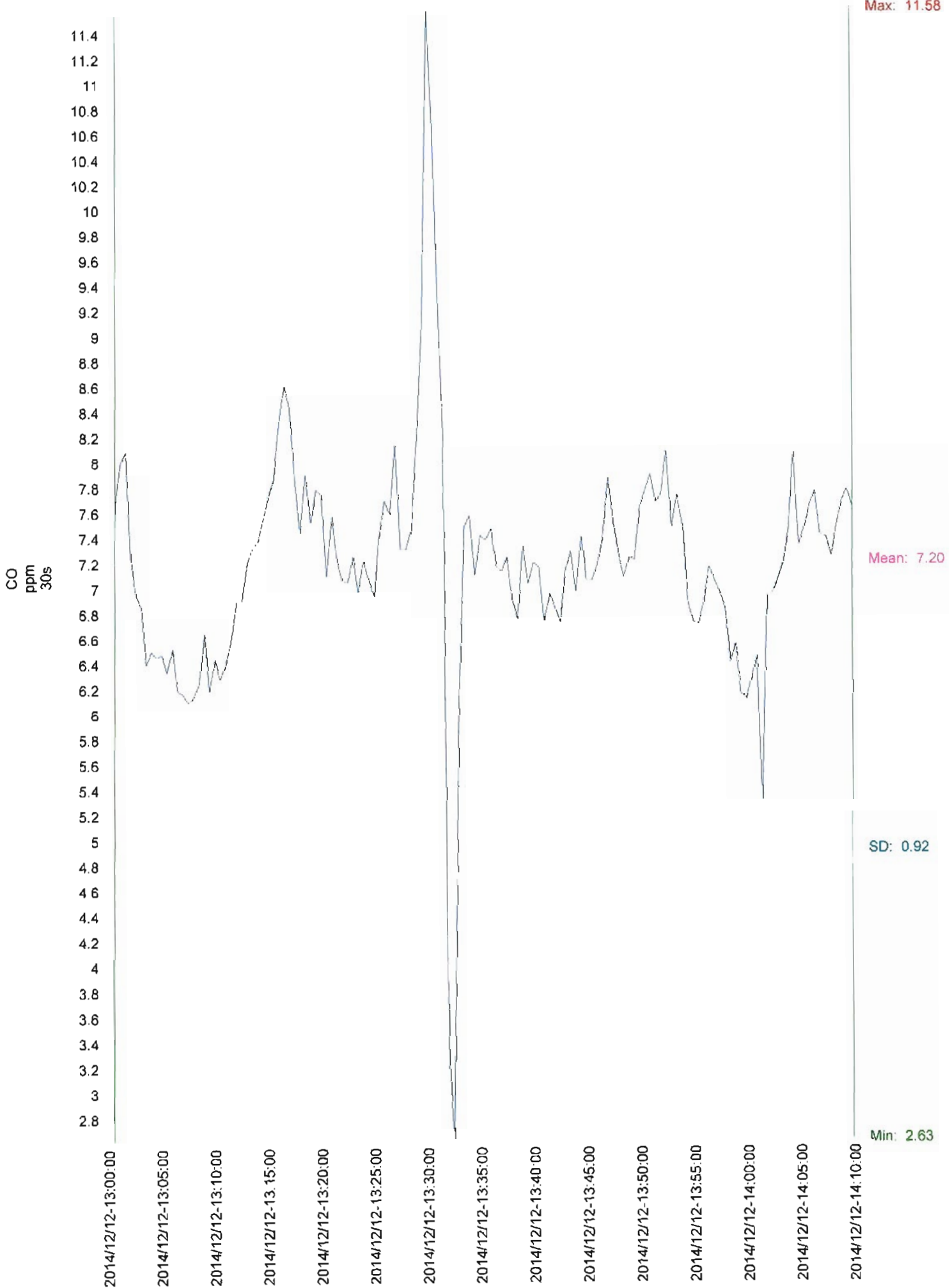




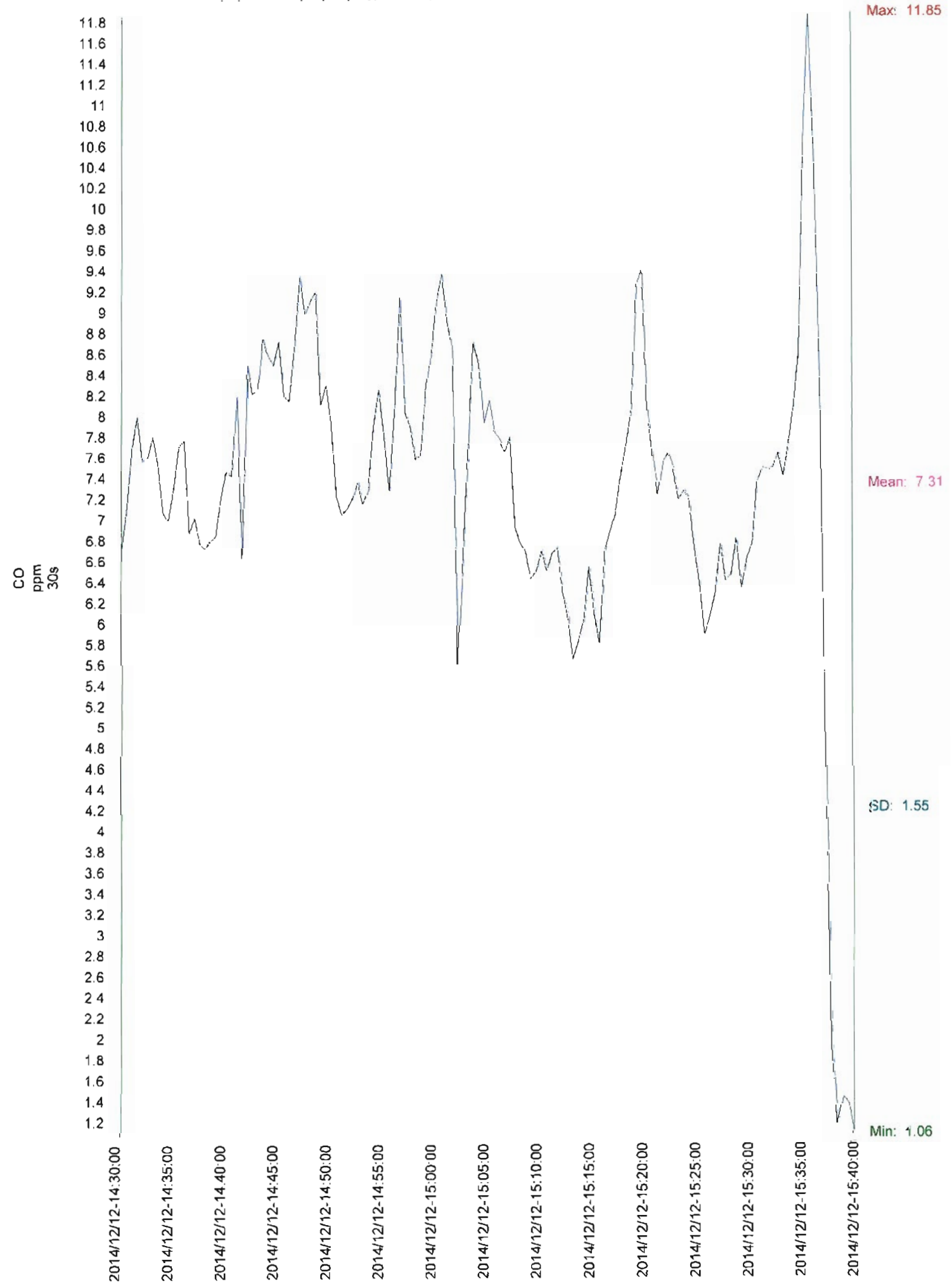


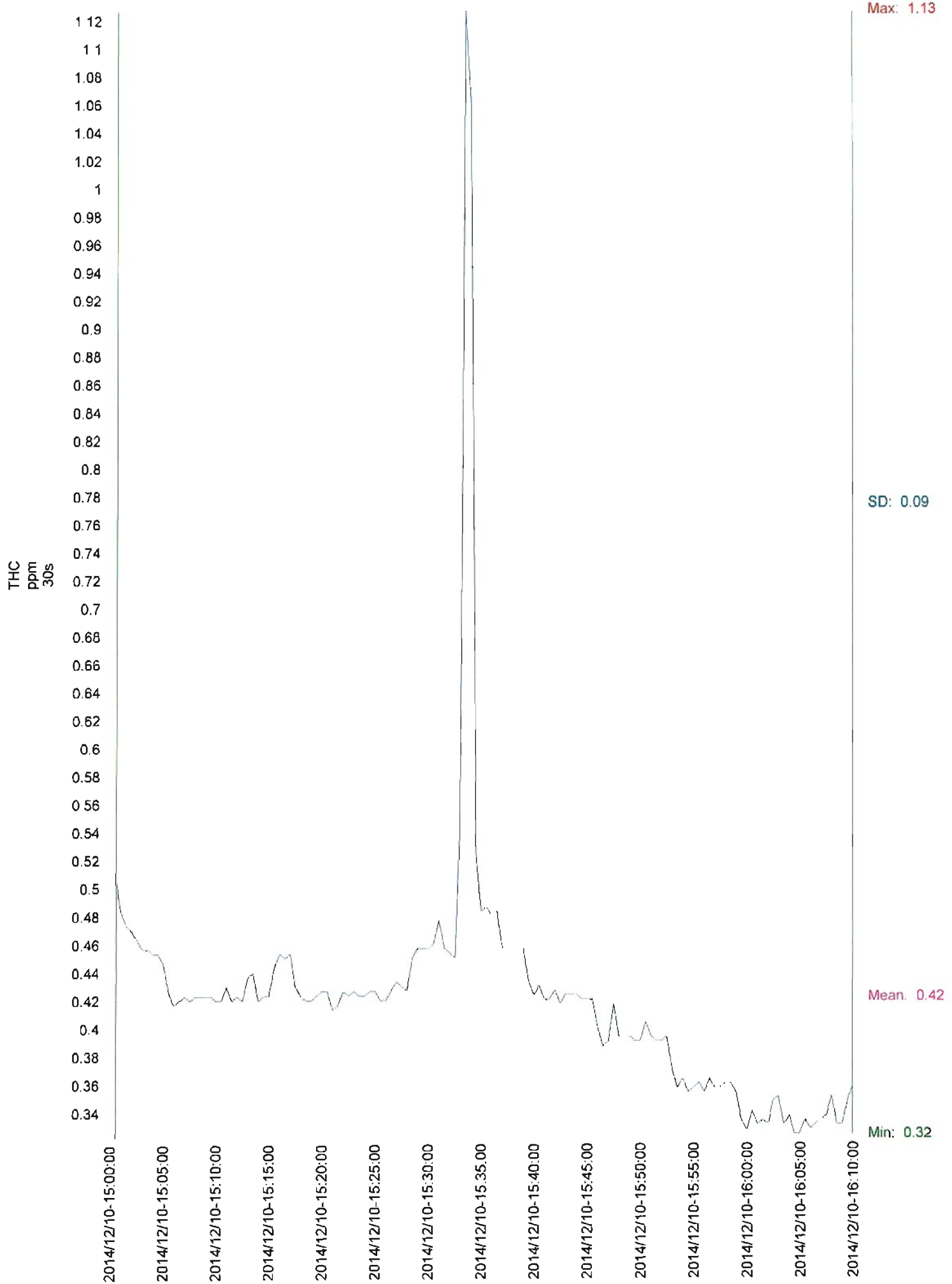












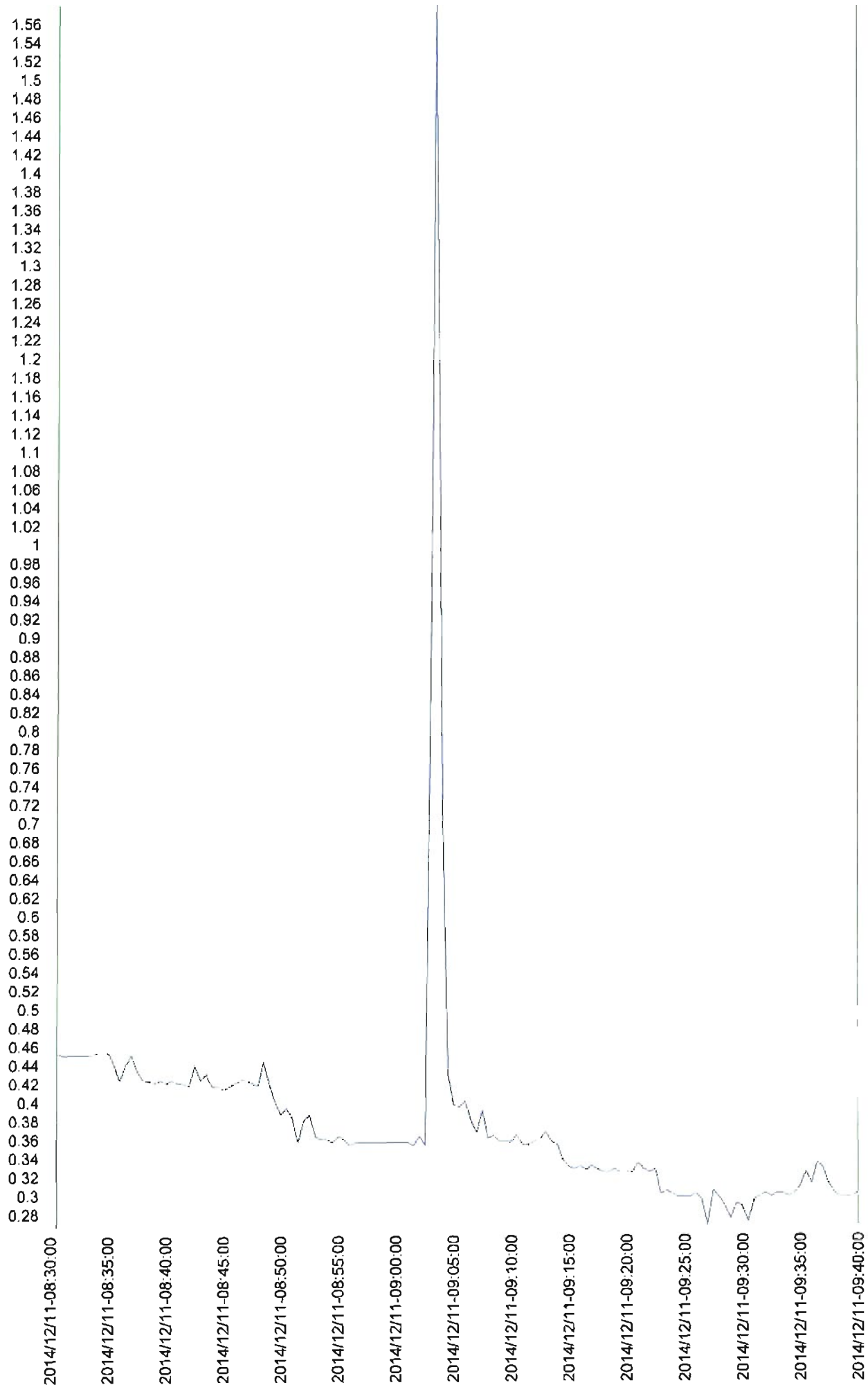
THC  
ppm  
30s

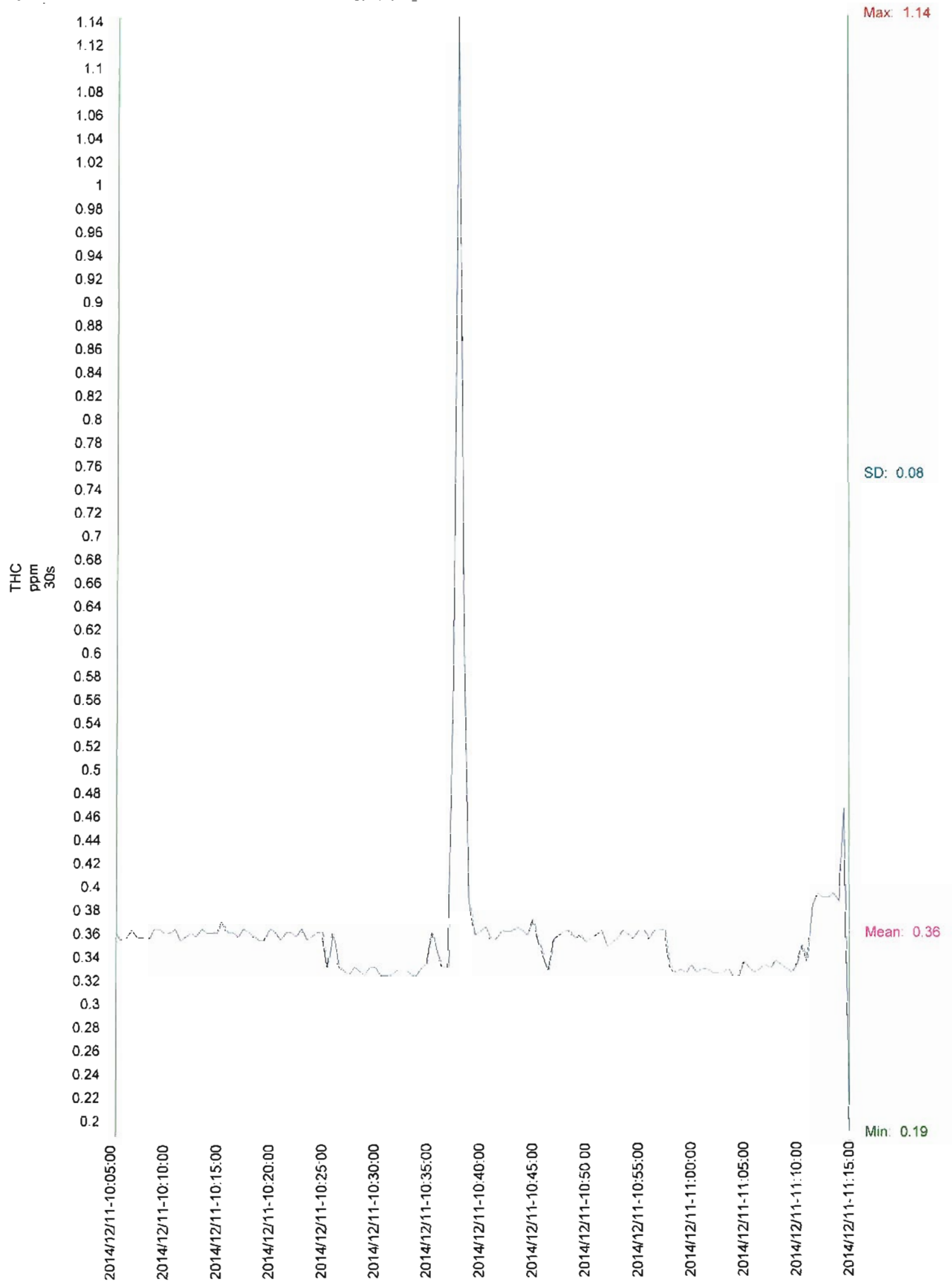
Max: 1.58

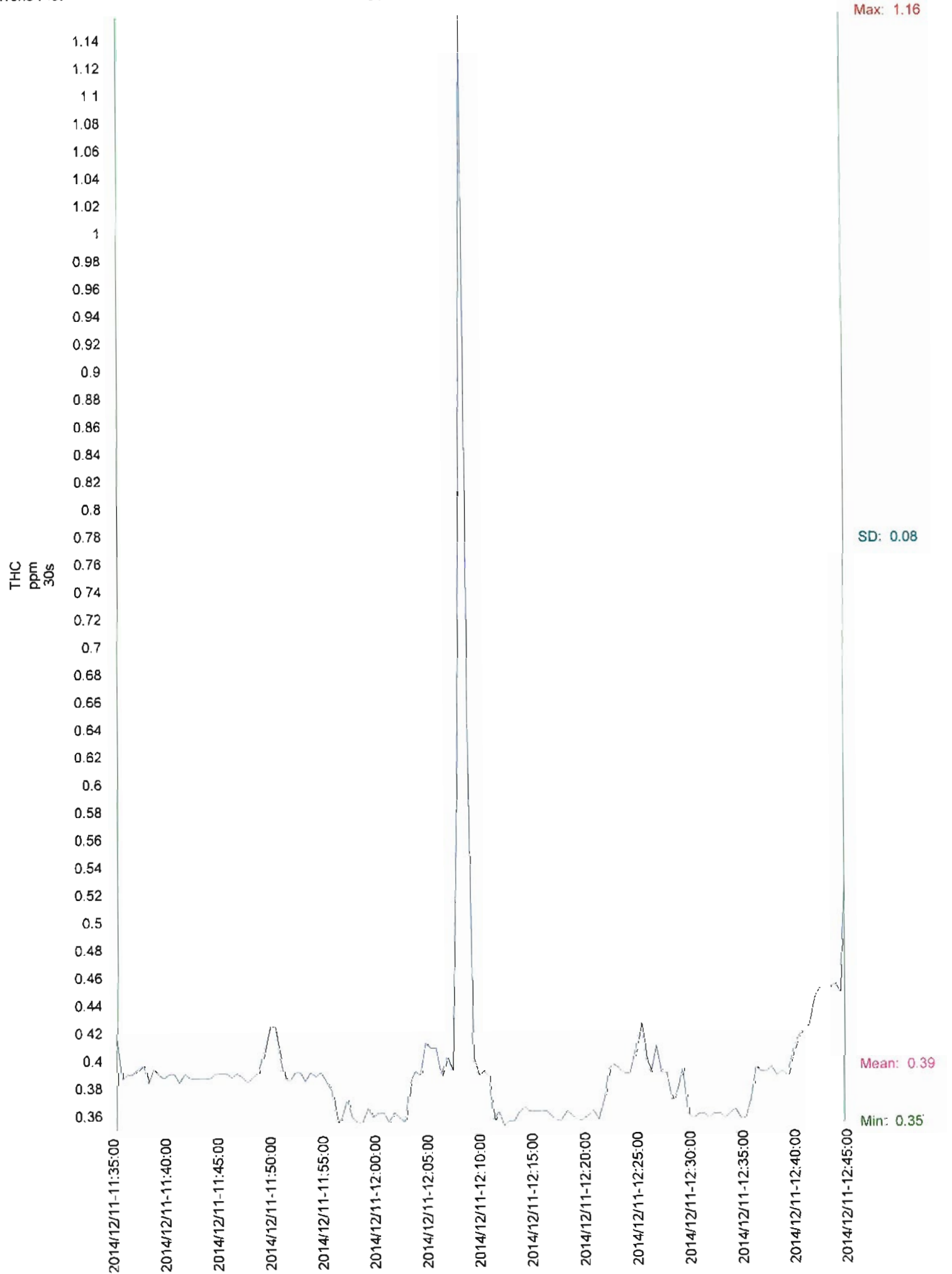
SD: 0.13

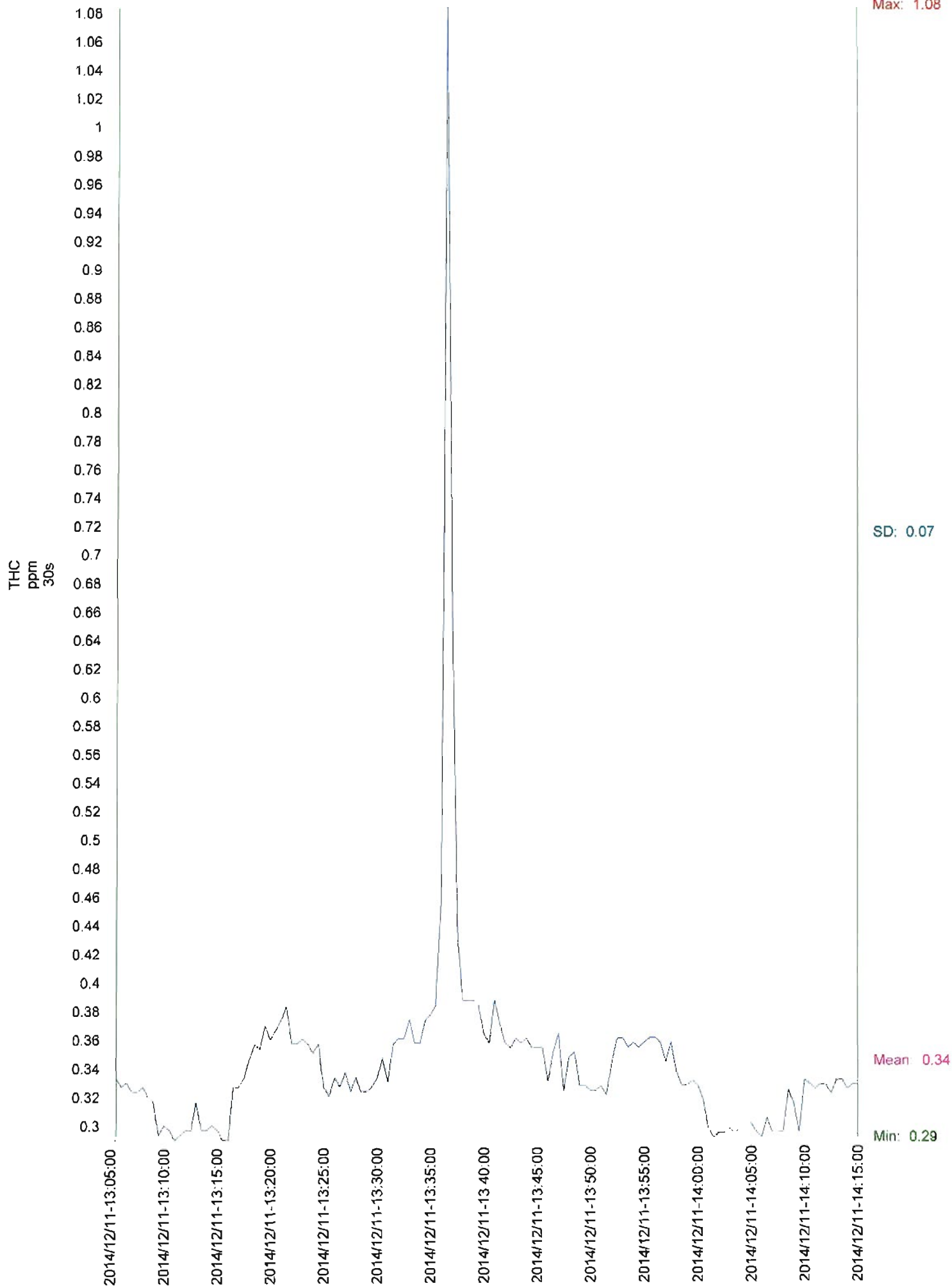
Mean: 0.38

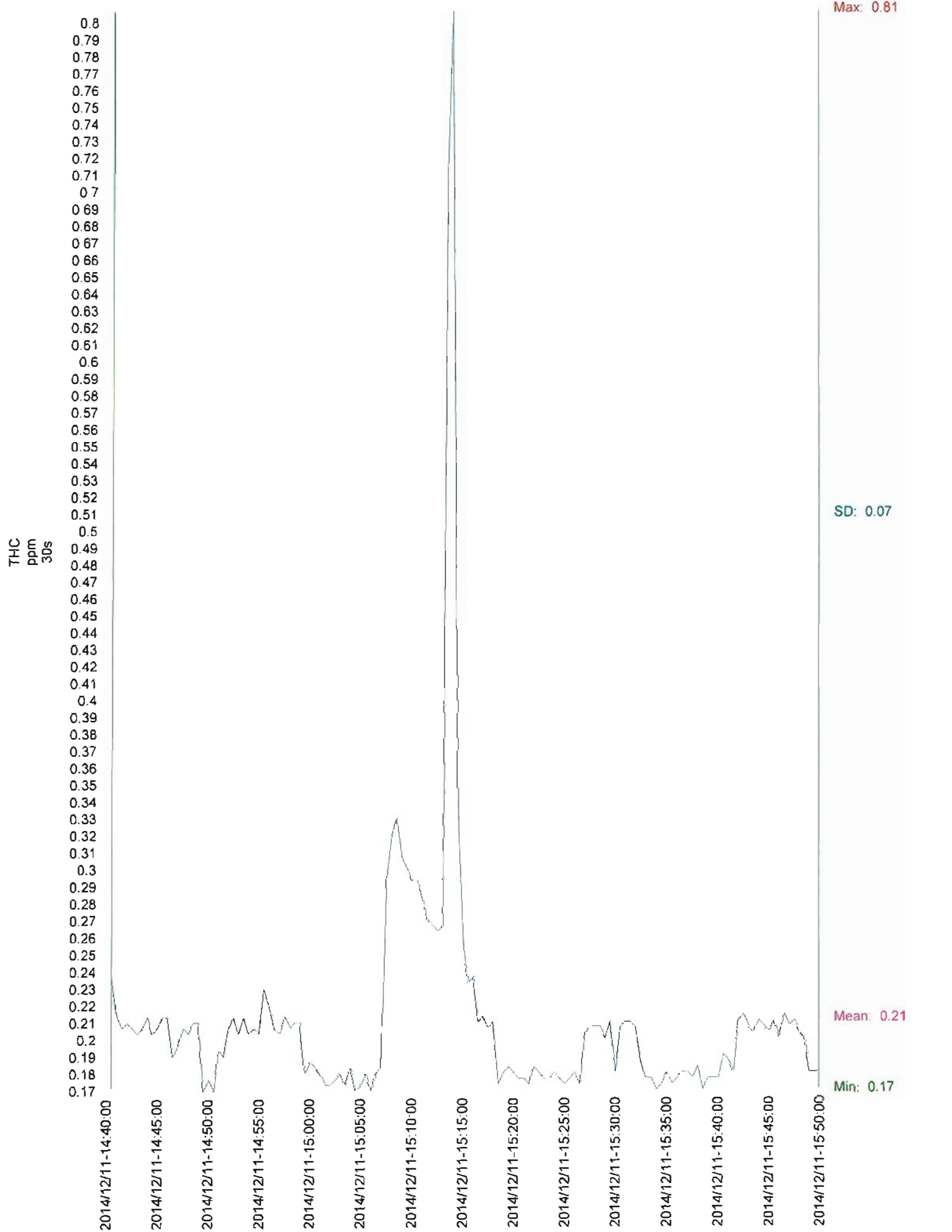
Min: 0.27

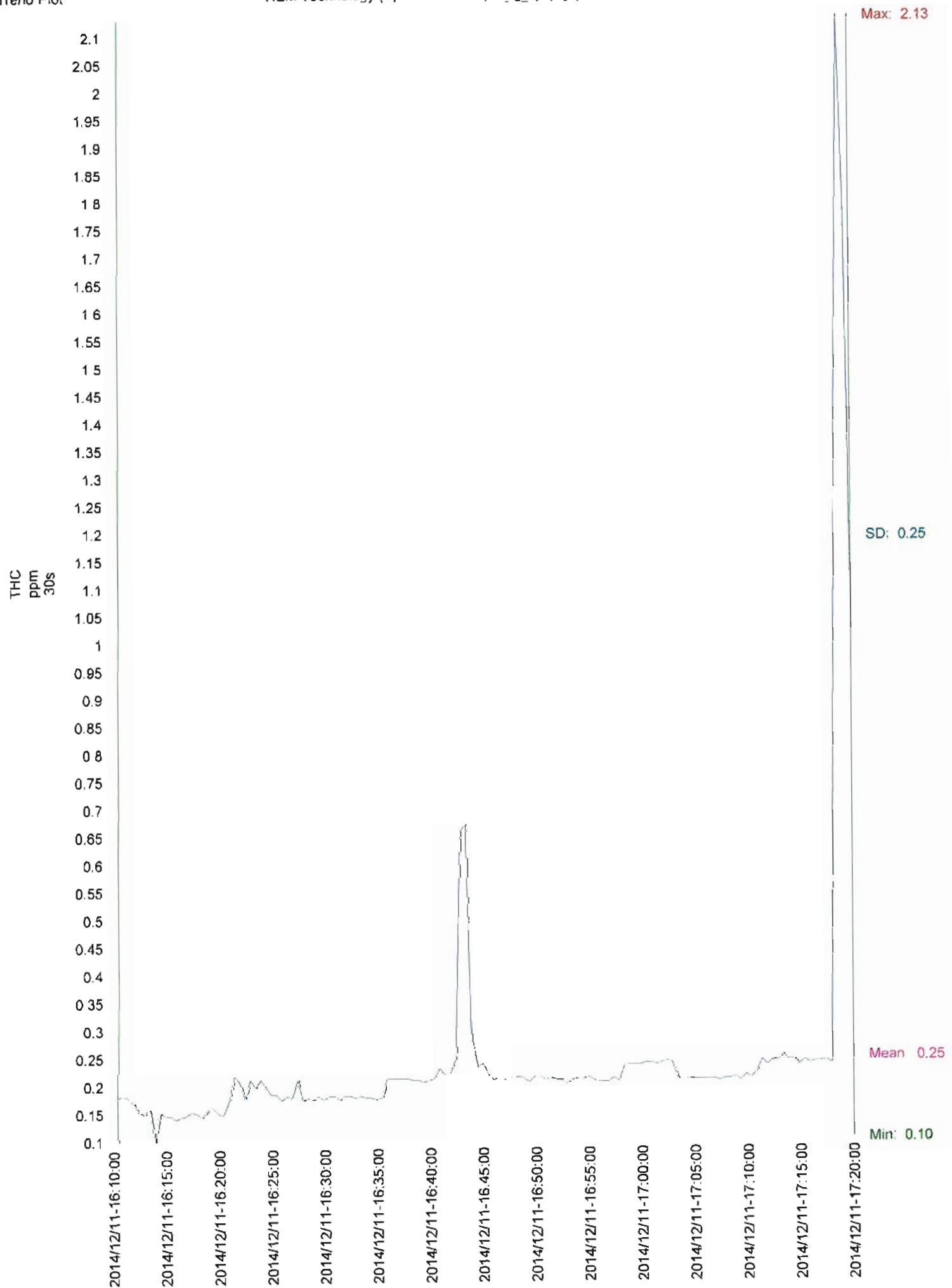




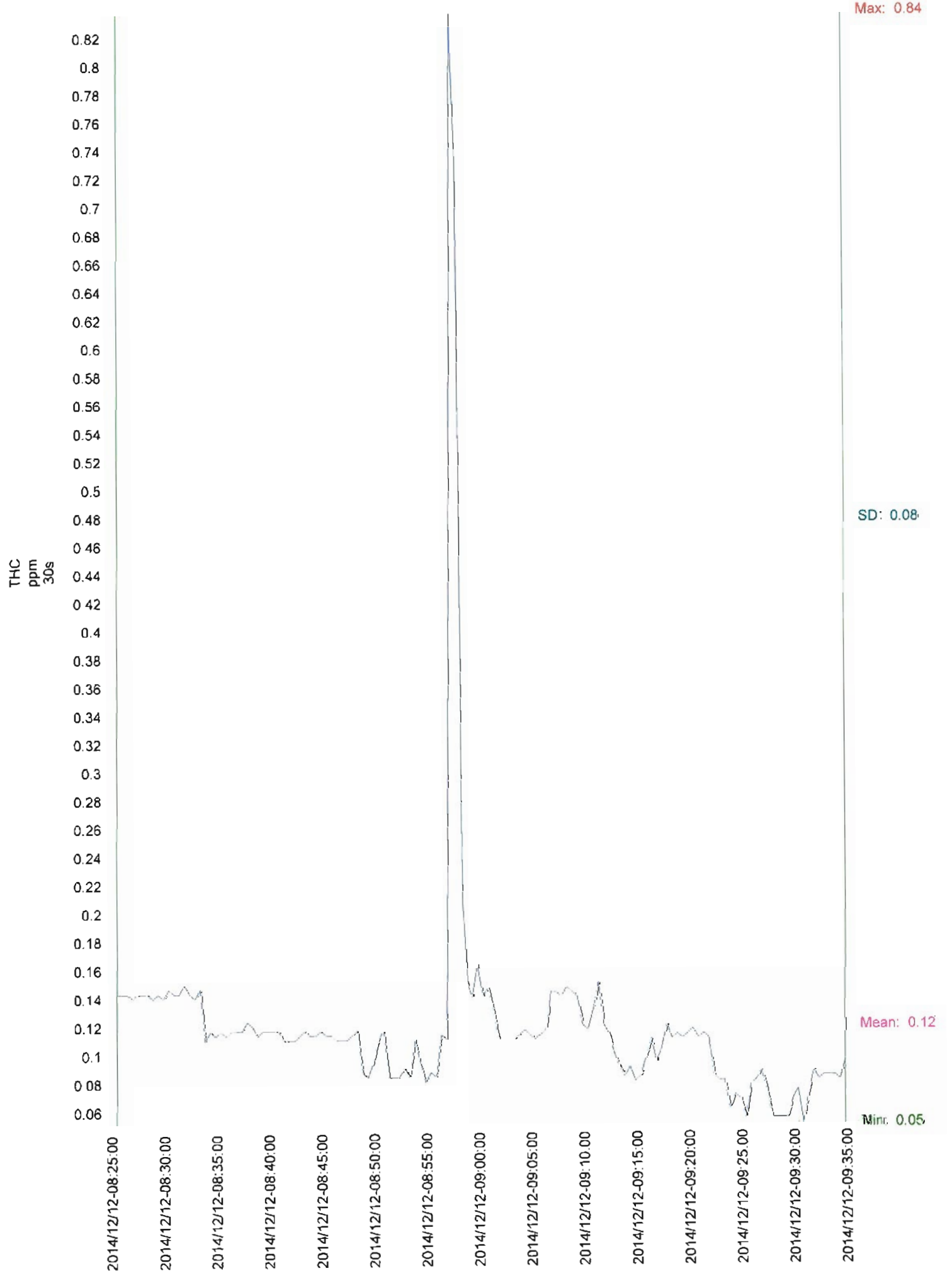


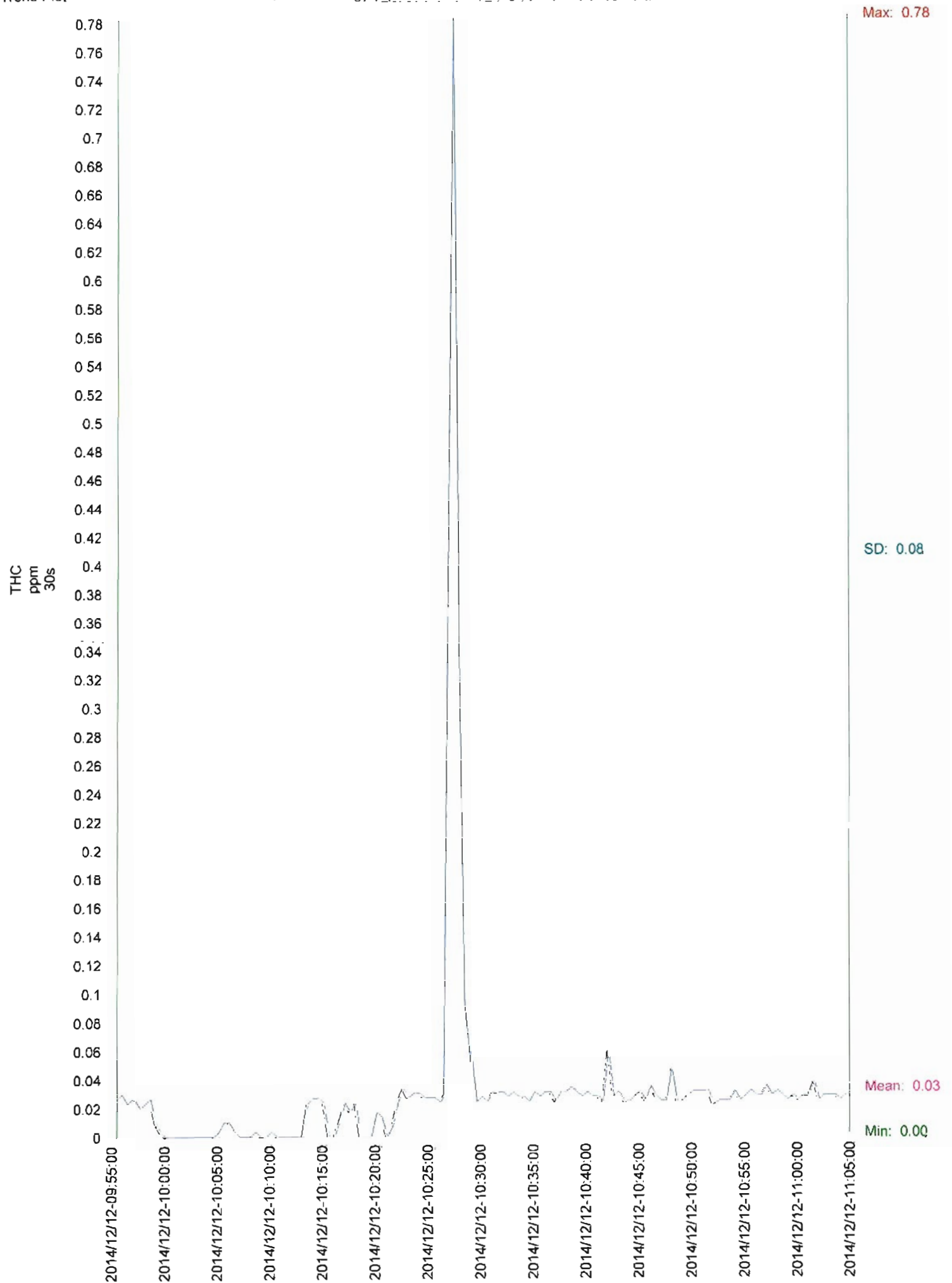


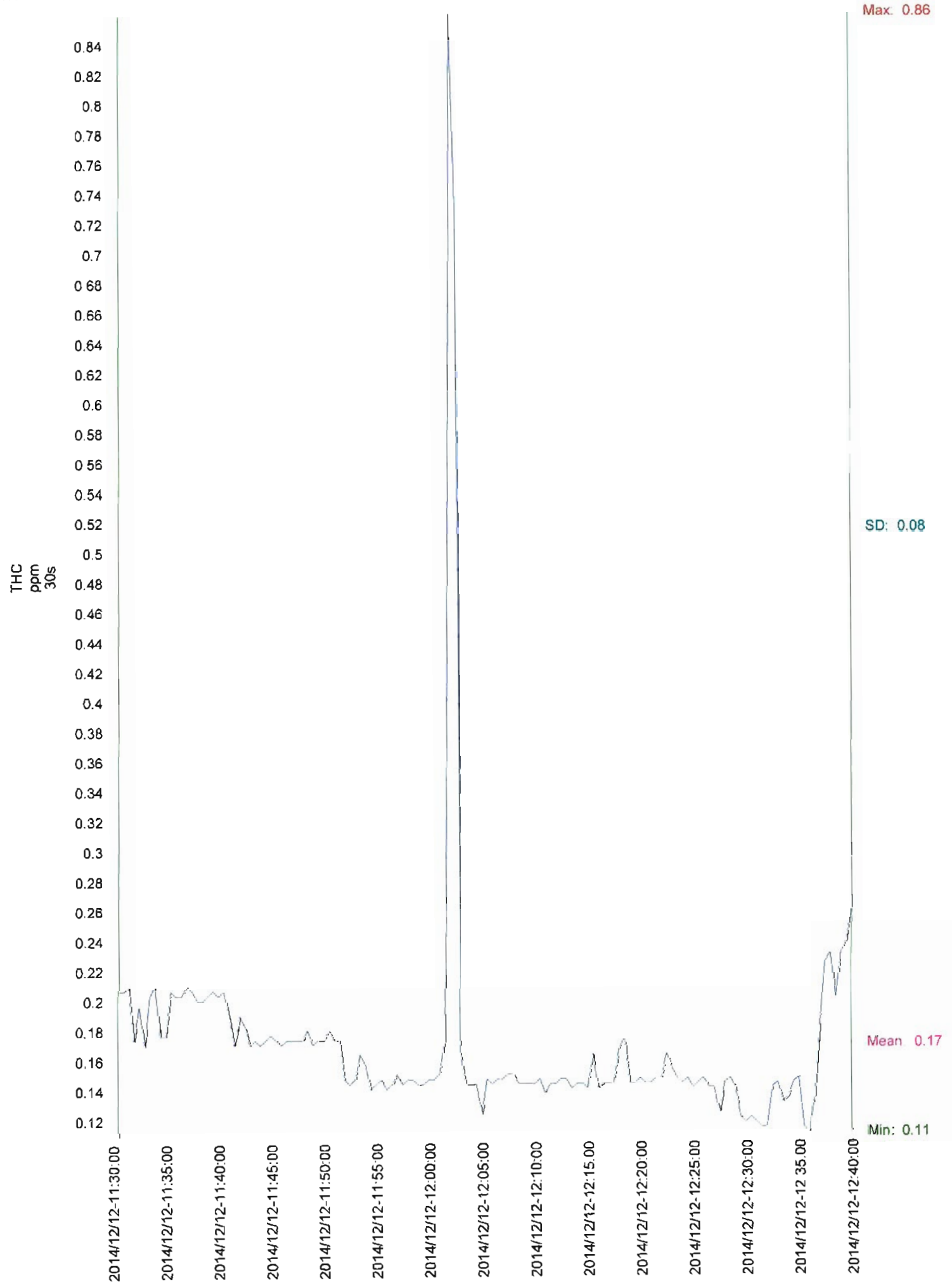


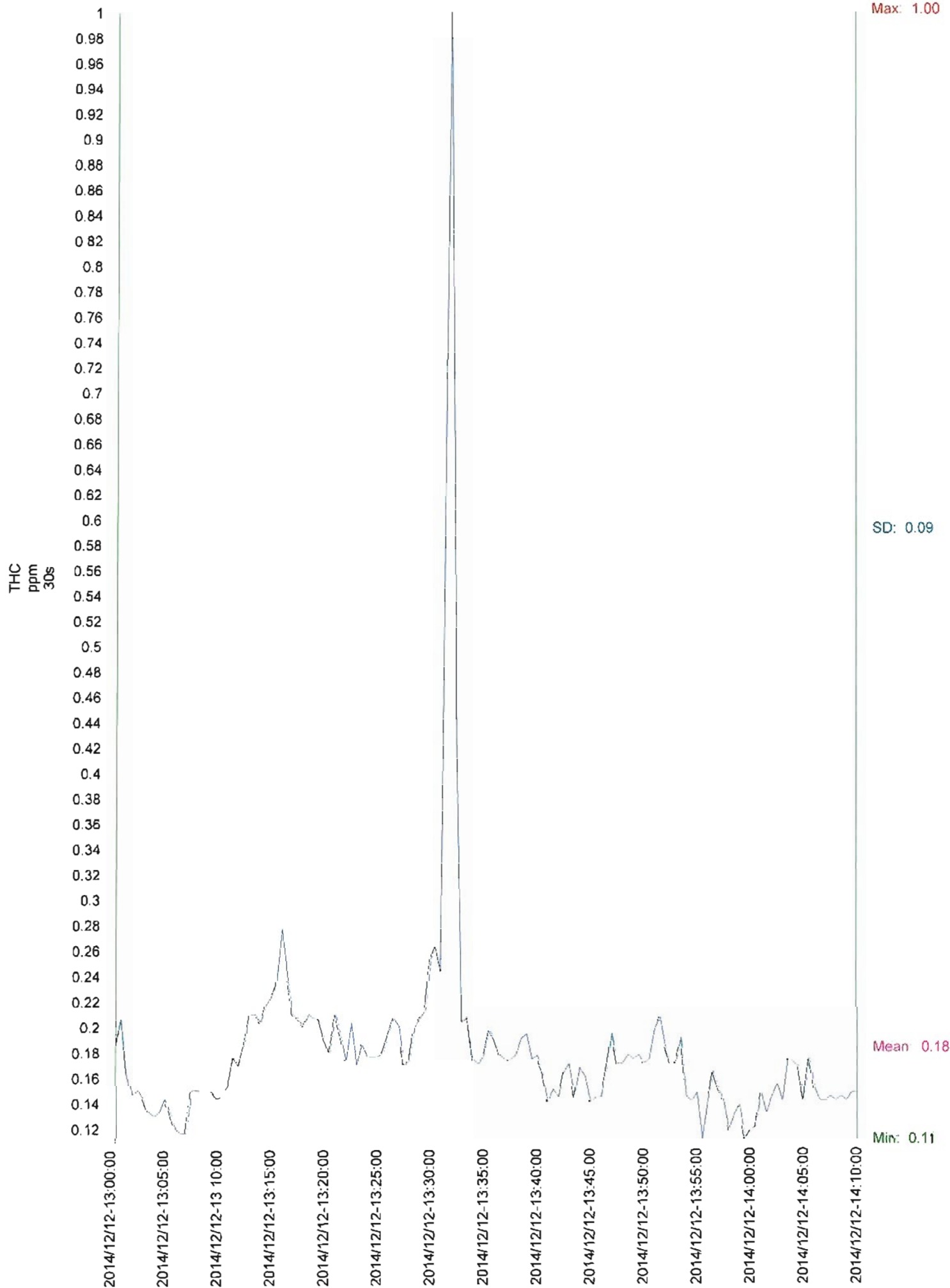


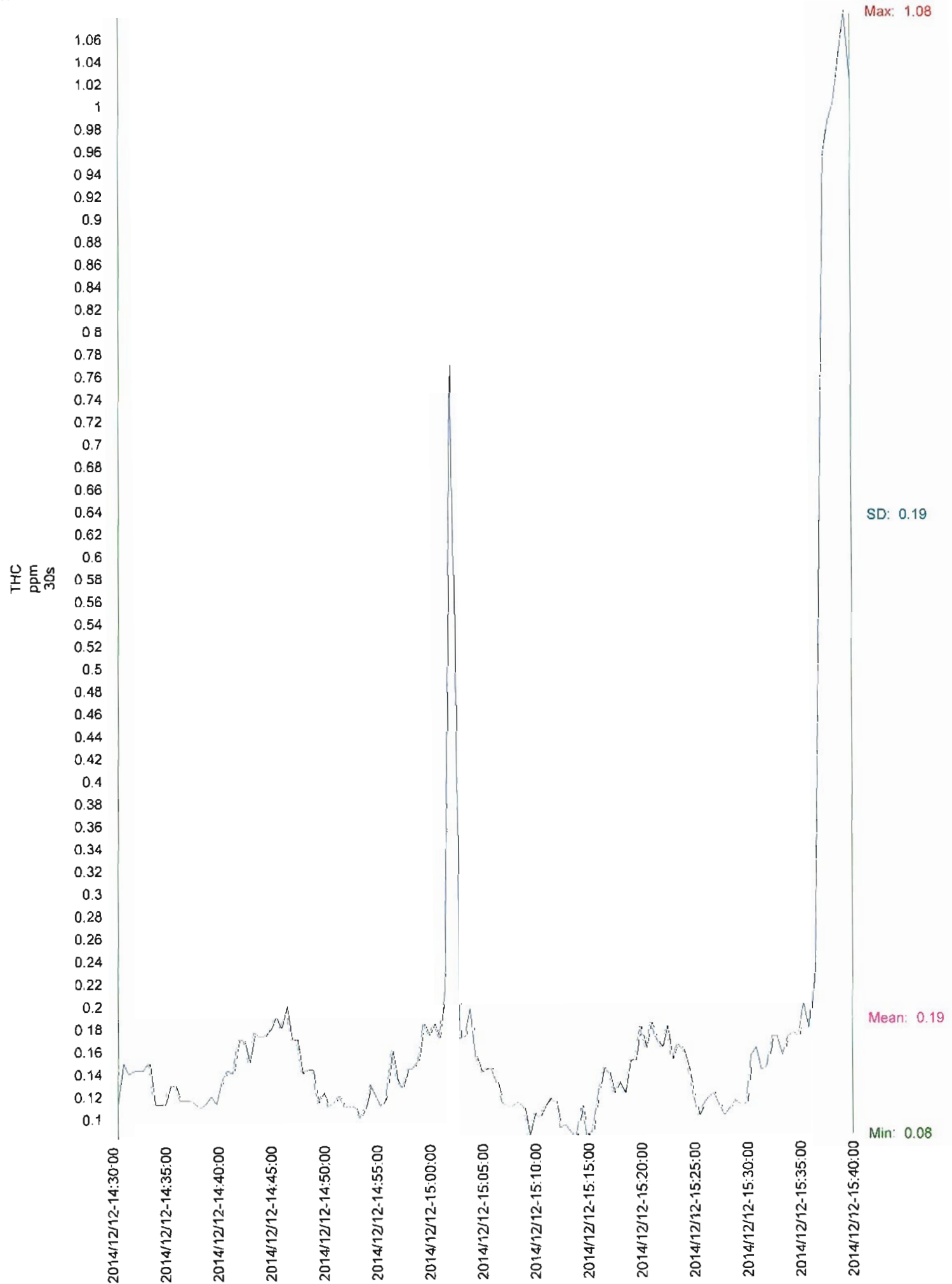












## **Appendix IV**

### **Field Data Sheets**

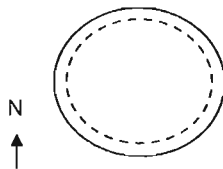
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u><del>0.012</del> -0.012</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DH H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/10</u>	Test #: <u>One</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>HC</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/No: <u>0</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>316</u>
B.P. (in. Hg): <u>29.80</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>327</u>
Pitot ID#: <u>PT5Edm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>7</u>
Meter #: <u>RATA 33</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>23</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (c/f)	Impinger Temp (c/f)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	1500	171.336	13	18	8	Initial: 0.000	Final: 0.000	21	21
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1530	13.5	5.5	
40									
50									
60	1610	190.821	13	19	12				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 1.315

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2

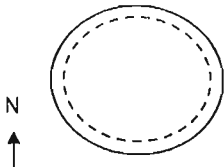
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.013</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DIH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Two</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>Jiw</u>	Team Leader: <u>KS</u>	Final Volume of Abs. Sol. (ml): <u>213</u>
Fluke Temp. Meter ID #: <u>43</u>		Volume Condensed (ml): <u>13</u>
Cyclonic Flow ? Yes(No) <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>323</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (0/f): <u>8</u>	Post Silica Weight (g): <u>325</u>
Pitot ID#: <u>PTSEF<sub>m</sub></u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>2</u>
Meter #: <u>DATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>15</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C)	Impinger Temp (°C)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	0830	196.004	13	20	8	Initial: 0.000	Final: 0.000	21	21
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						0838	13	5.5	
40									
50									
60	0940	211.216	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 4.314

Annulus Length(in.): 9.5

Stack Diameter(in.): 12



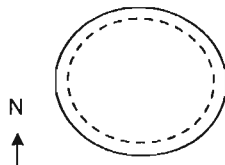
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.01</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Three</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>UC</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>325</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>328</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>3</u>
Meter #: <u>RATA3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C/°F)	Impinger Temp (°C/°F)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	10:05	21.205	13	20	8	Initial: 0.000	Final: 0.000	21	21
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						10:20	13.5	6.0	
40									
50									
60	11:15	230.302	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.):

Annulus Length(in.): 9.5

Stack Diameter(in.): 13

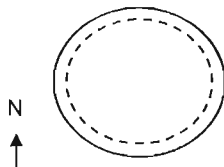
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.012</u>
Contact Name:	Source: <u>Incrustator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Fair</u>	Initial Volume of Abs.Sol. (ml): <u>300</u>
Sampled by: <u>JW</u>	Team Leader: <u>KT</u>	Final Volume of Abs. Sol. (ml): <u>212</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>12</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>328</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>331</u>
Pitot ID#: <u>PTS Edm</u>	Pitot Factor: <u>0.303</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>15</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume ft <sup>3</sup> /m <sup>3</sup>	Vacuum (in. Hg.)	Meter Temp (°F)	Impinger Temp (°F)	Leak Check Data			
						Initial:	ft <sup>3</sup> /m <sup>3</sup>	in Hg.	
0	1135	230.991	13	20	8	Final:	0.0000	ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1200	14	5	
40									
50									
60	1245	231.443	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft):

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2

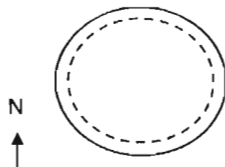
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.011</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/10/11</u>	Test #: <u>Five</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>LS</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/No: <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>331</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>334</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°F)	Impinger Temp (°F)	Leak Check Data				
						Initial:	ft <sup>3</sup> /m <sup>3</sup>	in Hg.		
0	1305	28.630	13	20	8	Final:	0.0008	ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.
10						FYRITE TESTS				
20						Time	%O2	%CO2	(%/ppm) CO	
30						1530	13.5	5.5		
40										
50										
60	1415	27.848	13	20	10					



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 1.5

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2

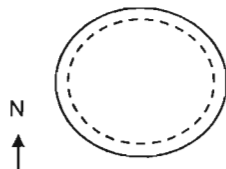
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.01</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DIH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Six</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>GR</u>	Final Volume of Abs. Sol. (ml): <u>212</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>12</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>297</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>302</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>5</u>
Meter #: <u>RATX 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp(c/f)	Impinger Temp (c/f)	Leak Check Data			
						Initial:	Final:	in Hg.	in Hg.
0	1440	272.036	13	20	8	Initial: 0.000	Final: 0.000	21	21
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1500	14	5	
40									
50									
60	1550	293.112	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft):

Port Diameter(in.): 2.5

Annulus Length(in.): 4.5

Stack Diameter(in.): 12

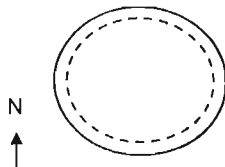
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.010</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DIH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>seven</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>CS</u>	Final Volume of Abs. Sol. (ml): <u>210</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>10</u>
Cyclonic Flow ? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Average Null Angle from Vertical=		Pre Silica Weight (g): <u>302</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>306</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>4</u>
Meter #: <u>RATA 313</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>14</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C/F)	Impinger Temp (°C/F)	Leak Check Data			
						Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.	Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.
0	1610	293.308	13	20	8				
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1700	14.5	4.5	
40									
50									
60	1720	312.68	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 0.6

Annulus Length(in.):

Stack Diameter(in.): 1.2



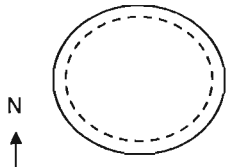
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.007</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DI H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Eight</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>HS</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/ <input checked="" type="checkbox"/> No	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>306</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (C/F): <u>6</u>	Post Silica Weight (g): <u>311</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>5</u>
Meter #: <u>RATA 36</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C/°F)	Impinger Temp (°C/°F)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	0825	310.832	13	18	8	Initial: 0.000	21	in Hg.	
10						Final: 0.000	31	in Hg.	
20						FYRITE TESTS			
30						Time	%O2	%CO2	(%/ppm) CO
40						0900	13	5.5	
50									
60	0935	332.817	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 7.5

Stack Diameter(in.): 12

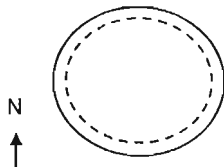
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <i>Spartan</i>	Location: <i>Calgary</i>	Stack Static Pressure: <i>-0.006</i>
Contact Name:	Source: <i>Incinerator</i>	Absorbing Solution: <i>DJH<sub>2</sub>O</i>
Date(Y/M/D): <i>2014/12/12</i>	Test #: <i>Nine</i>	Initial Volume of Abs.Sol. (ml): <i>500</i>
Sampled by: <i>JW</i>	Team Leader: <i>AK</i>	Final Volume of Abs. Sol. (ml): <i>216</i>
Fluke Temp. Meter ID #: <i>#3</i>		Volume Condensed (ml): <i>16</i>
Cyclonic Flow ? Yes/No <i>No</i>	Average Null Angle from Vertical=	Pre Silica Weight (g): <i>311</i>
B.P. (in. Hg): <i>29.52</i>	Ambient Temperature (°F): <i>60</i>	Post Silica Weight (g): <i>313</i>
Pitot ID#: <i>PTSEdm</i>	Pitot Factor: <i>0.803</i>	H <sub>2</sub> O in Silica Condensed: <i>2</i>
Meter #: <i>RATA 3B</i>	Meter Factor: <i>1.0209</i>	Total Volume H <sub>2</sub> O Condensed (ml): <i>18</i>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg )	Meter Temp (°F)	Impinger Temp (°C)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	0955	333.010	13	20	8	Initial: 0.000	21	in Hg.	
10						Final: 0.000	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O2	%CO2	(%/ppm) CO
40						1030	13	6	
50									
60	1105	352.931	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 0.25

Annulus Length(in.): 7.5

Stack Diameter(in.): 12

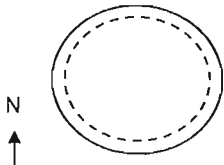
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name:	Source: <u>Inchwater</u>	Absorbing Solution: <u>DI H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Ten</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>GS</u>	Final Volume of Abs. Sol. (ml): <u>215</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>15</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>313</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (°C): <u>8</u>	Post Silica Weight (g): <u>317</u>
Pitot ID#: <u>PT5Edm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>4</u>
Meter #: <u>RATA33</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (C/F)	Impinger Temp (C/F)	Leak Check Data			
						Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
0	1130	53.128	13	20	8	Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1200	13	5.5	
40									
50									
60	1240	573.323	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 0.6

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2



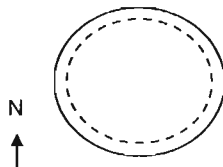
# AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name: _____	Source: <u>Incinerator</u>	Absorbing Solution: <u>D.I.H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>ELWEN</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>ELW</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/No _____	Average Null Angle from Vertical= _____	Pre Silica Weight (g): <u>317</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (C/F): <u>8</u>	Post Silica Weight (g): <u>320</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>17</u>
Comments: _____		Rinse Volume (ml): _____

Point #	Time (24 Hrs)	Port #1 Temp(C/F)	(E-W) ΔP	Port #2 Temp(C/F)	(N-S) ΔP	Port #3 Temp(C/F)	( ) ΔP	Port #4 Temp(C/F)	( ) ΔP
6	1303	513	0.008	507	0.010				
5		520	0.006	514	0.009				
4		509	0.007	499	0.008				
3		451	0.006	453	0.006				
2		440	0.005	429	0.003				
1	1406	427	0.002	430	0.004				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(C/F)	Impinger Temp (C/F)	Leak Check Data			
0	1300	373.507	13	20	8	Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40							14.5	4.8	
50									
60	1410	393.438	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5

Stack Diameter(in.): 12

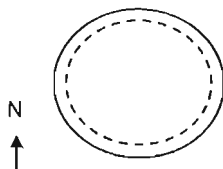
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DTH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Twelve</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>HL</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>6083</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>320</u>
B.P. (in. Hg): <u>29.53</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>322</u>
Pitot ID#: <u>PTSEda</u>	Pitot Factor: <u>0.805</u>	H2O in Silica Condensed: <u>2</u>
Meter #: <u>RATA3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>18</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp(c/f)	Impinger Temp (c/f)	Leak Check Data			
						Initial:	Final:	in Hg.	in Hg.
0	1430	393.625	13	20	8	0.000	0.000	21	21
10									
20									
30									
40									
50									
60	1540	413.735	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.):                     

Annulus Length(in.): 9.5

Stack Diameter(in.): 12

## **SUMMARY OF OBSERVATIONS**

The following observations were conducted on the test dates of December 10-12, 2014 at the Spartan Controls Ltd – REM Technology Inc. Incinerator Stack. Through the twelve source emission survey tests, it was found that no visible emissions were observed.

Test 1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

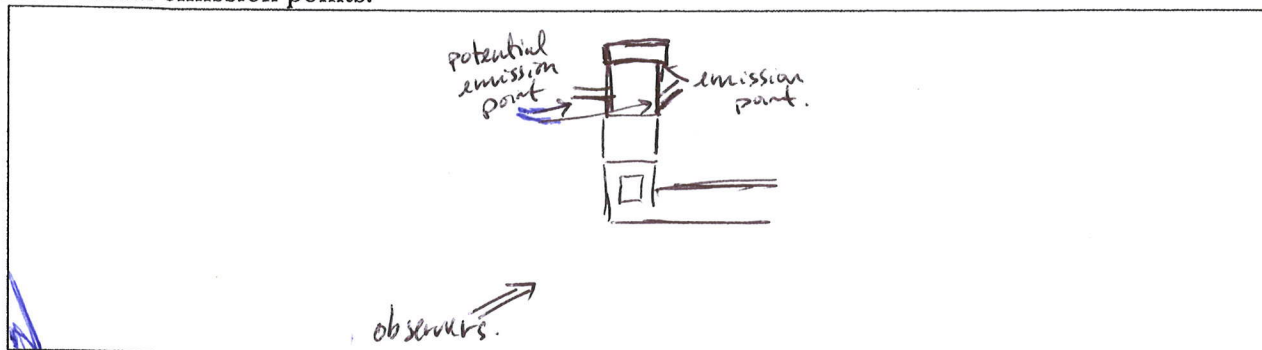
Company <u>REM technology limited</u>	Observer <u>Nitin/Alex</u>
Location <u>9815 48 St SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg/Howard.</u>	Date <u>Dec 10/14</u>
Precipitation <u>None.</u>	Wind Speed <u>14.0 km/h S</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) light overhead (more SW)

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>15:00</u>	<u>14.0 km/h S / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>15:25</u>	<u>17.0 km/h S / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>15:45</u>	<u>14.0 km/h S / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>15:51</u>	<u>19. km/h S / variable clouds</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>16:05</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
• the final clock time.	<u>16:10</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
For more details on recording this data and taking breaks, see #7 and #10 above.	<u>Accumulated Observation: 1 hr 10 min</u>		
End Observation			





10/12/2014 15:01

Test 2

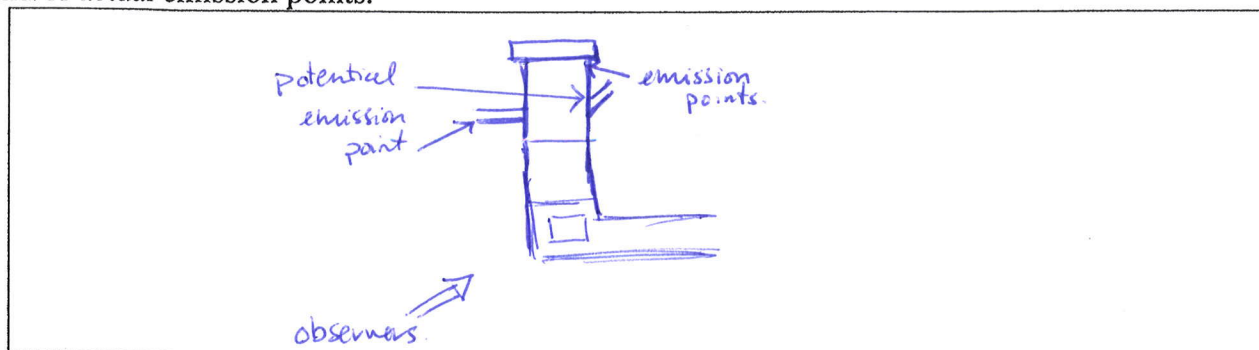
~~XXXXXX~~

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company <u>REM Technology limited</u>	Observer <u>Nitin / Alex.</u>
Location <u>9815 48 St. SE Calgary.</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg / Howard.</u>	Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>16 km/h W.</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural  
 Light location (overhead, behind observer, etc.) SE  
 Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>8:30</u>	<u>16 km/h W / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>8:50</u>	<u>20 km/h SW / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>9:10</u>	<u>20 km/h SW / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>9:30</u>	<u>5 km/h SW / clear skies</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>9:40</u>	<u>5 km/h SW / clear skies</u>	<u>                    </u>
• the final clock time.			
	<u>Accumulated Observation: 1hr 10min</u>		
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





Test 3

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

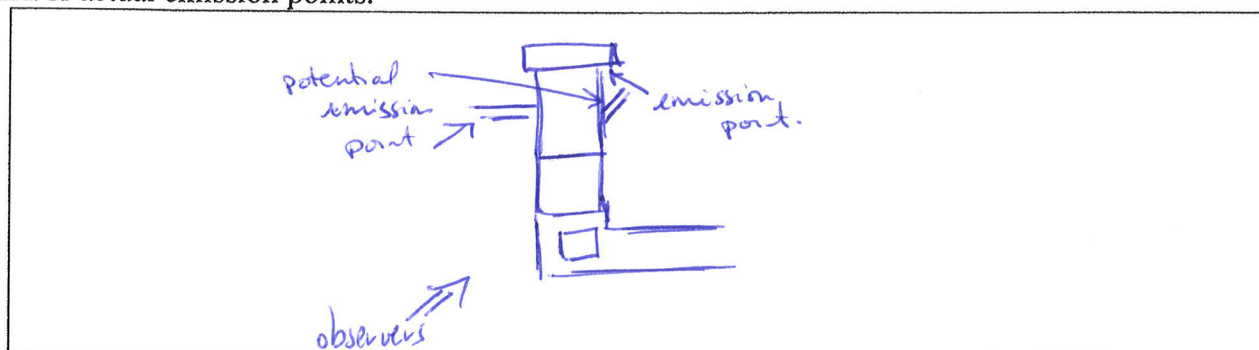
Company <u>REM Technology Limited</u>	Observer <u>Nitin / Alex</u>
Location <u>9815 48 St. SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg / Howard</u>	Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>5.0 km/h SW</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
--	------------	--	--

Begin

Observation

To complete this form, record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

<u>10:10</u>	<u>6 km/h SE / clear SKIES</u>	<u>                    </u>
<u>10:30</u>	<u>5.0 km/h SE / variable clouds</u>	<u>                    </u>
<u>10:50</u>	<u>5 km/h SE / variable clouds</u>	<u>                    </u>
<u>11:10</u>	<u>6.1 km/h SSE / variable clouds.</u>	<u>                    </u>
<u>11:35</u>	<u>6.1 km/h SSE / variable clouds</u>	<u>                    </u>
<u>Accumulated observation: thr 10 min</u>		

For more details on recording this data and taking breaks, see #7 and #10 above.

End

Observation





11/12/2014 10:07

T2

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

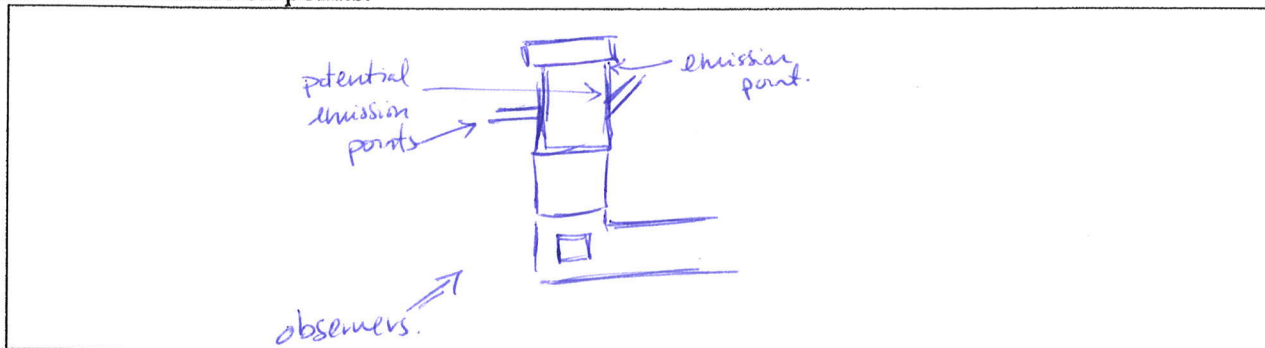
Company <u>REM Technology Limited.</u>	Observer <u>Nitin / Alex.</u>
Location <u>9815 48st. SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg/Howard.</u>	Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>5.4 km/h SE</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

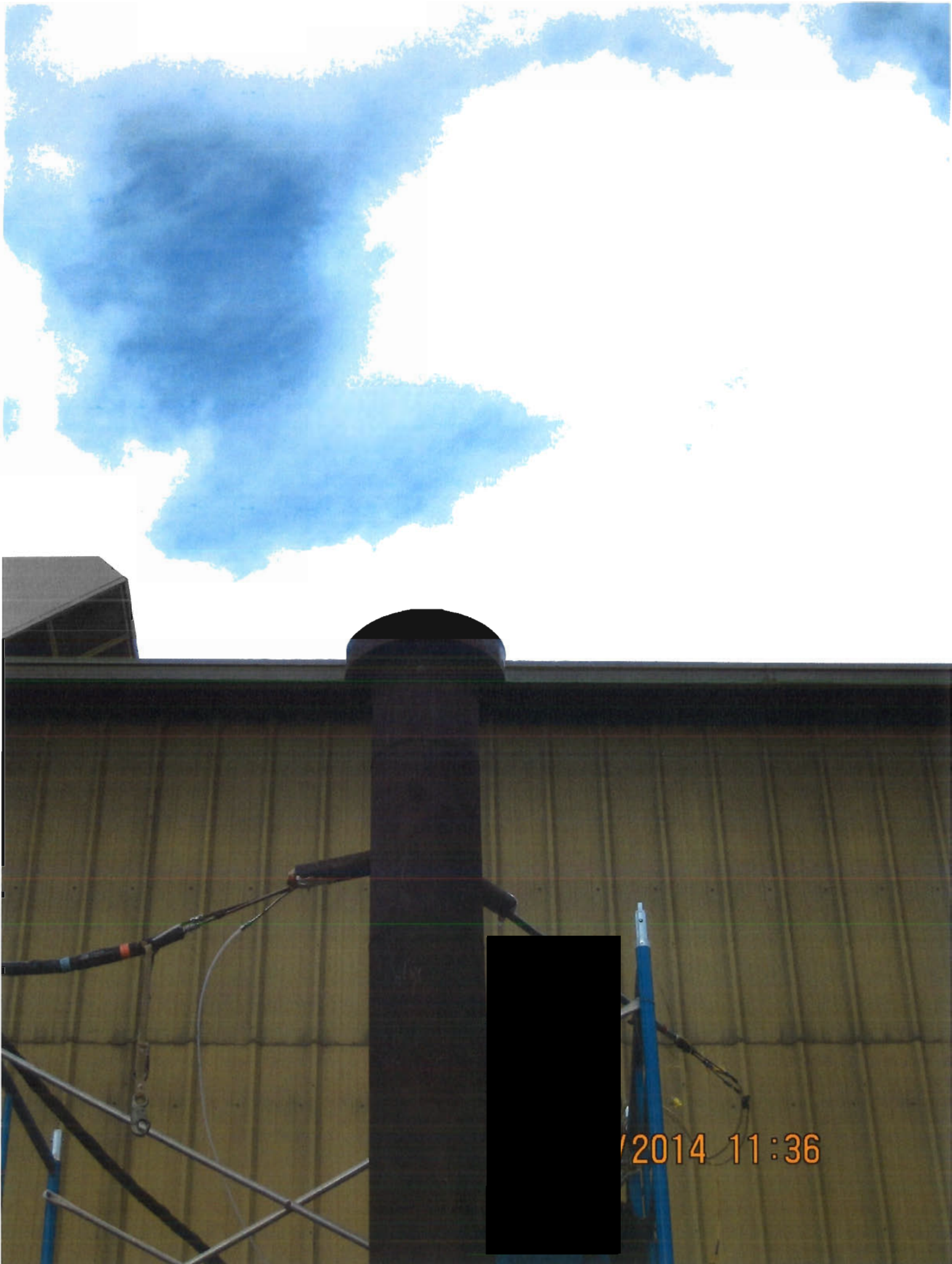
Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>11:35</u>	<u>5.4 km/h SE / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>11:55</u>	<u>12.2 km/h SE / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>12:15</u>	<u>12.2 km/h SE / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>12:35</u>	<u>2.9 km/h SE / overcast.</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>Accumulated observation = the 10 min</u>		
• the final clock time.			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





Test 5

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48<sup>th</sup> SE Calgary  
Company Rep. Greg/Howard

Observer Alex/Nitin  
Affiliation AGAT Labs  
Date Dec 11/2014

Precipitation None

Wind Speed

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

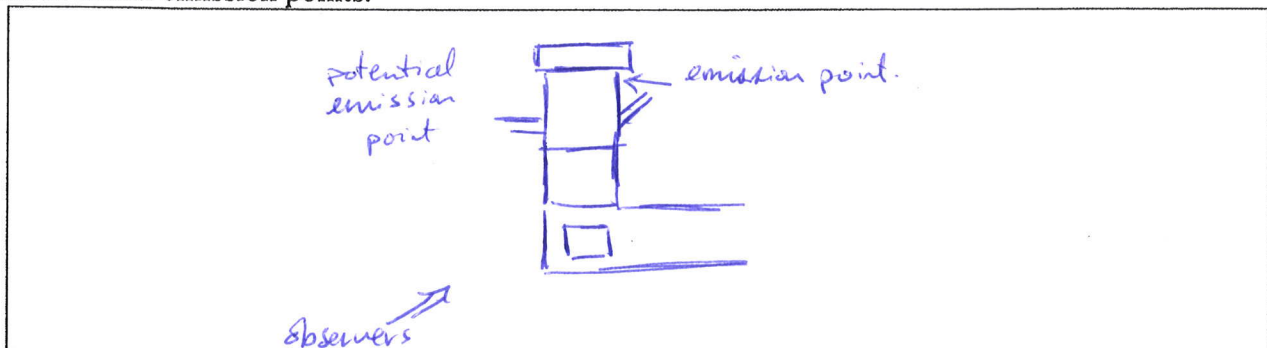
natural

Light location (overhead, behind observer, etc.)

overhead

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

13:05

3.4 km/h W/S / overcast

13:20

5.8 km/h SE / overcast

13:40

9.36 km/h SSE / overcast

14:00

4.0 km/h SE / overcast

14:15

4.0 km/h SE / overcast

Accumulated Observation - the 10 min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation



11/12/2014 14:04



## FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Light type (fluorescent, incandescent, natural)	<i>natural</i>
Light location (overhead, behind observer, etc.)	<i>overhead.</i>
Illuminance (must be greater than or equal to 100 lux or 10 foot candles)	

OBSERVATIONS	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	14:40	5.0 km/h SE / overcast.	
To complete this form, record the following:	15:00	13.0 km/h / overcast	
• the initial clock time	15:20	10.1 km/h / overcast.	
• the total time of the observation (from SW1)	15:40	9.8 km/h / overcast.	
• the total time of emissions (from SW2), and	15:50	9.7 km/h / overcast	
• the final clock time.	Accumulated Observation: 1 hr 10 min		
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





11/12/2014 14:53

Test #

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48st SE Calgary  
Company Rep. Greg / Howard

Observer Alex / Nita  
Affiliation AGAT Labs.  
Date Dec 11/2014

Precipitation None.

Wind Speed 2.1 km/h SE

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

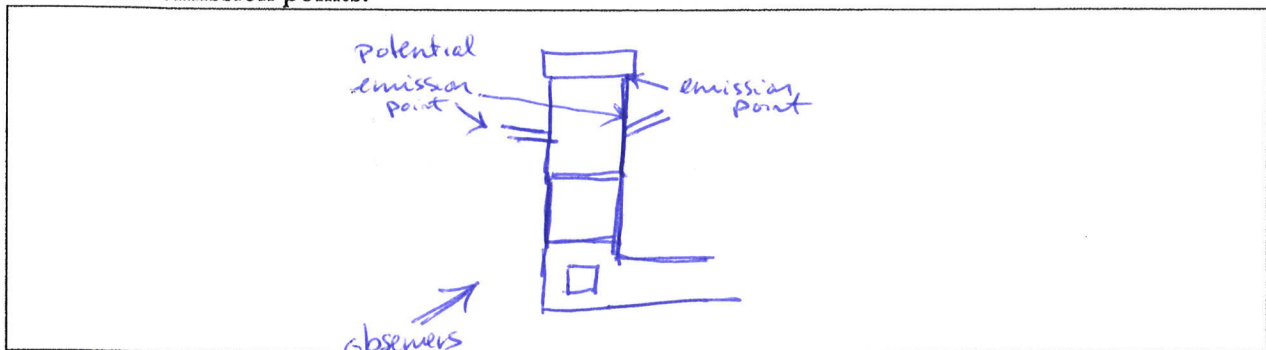
natural

Light location (overhead, behind observer, etc.)

overhead.

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

16:00 2.1 km/h SE / overcast.

16:20 2.0 km/h SE / overcast

16:40 4.7 km/h SE / overcast

17:00 5.3 km/h SE / overcast

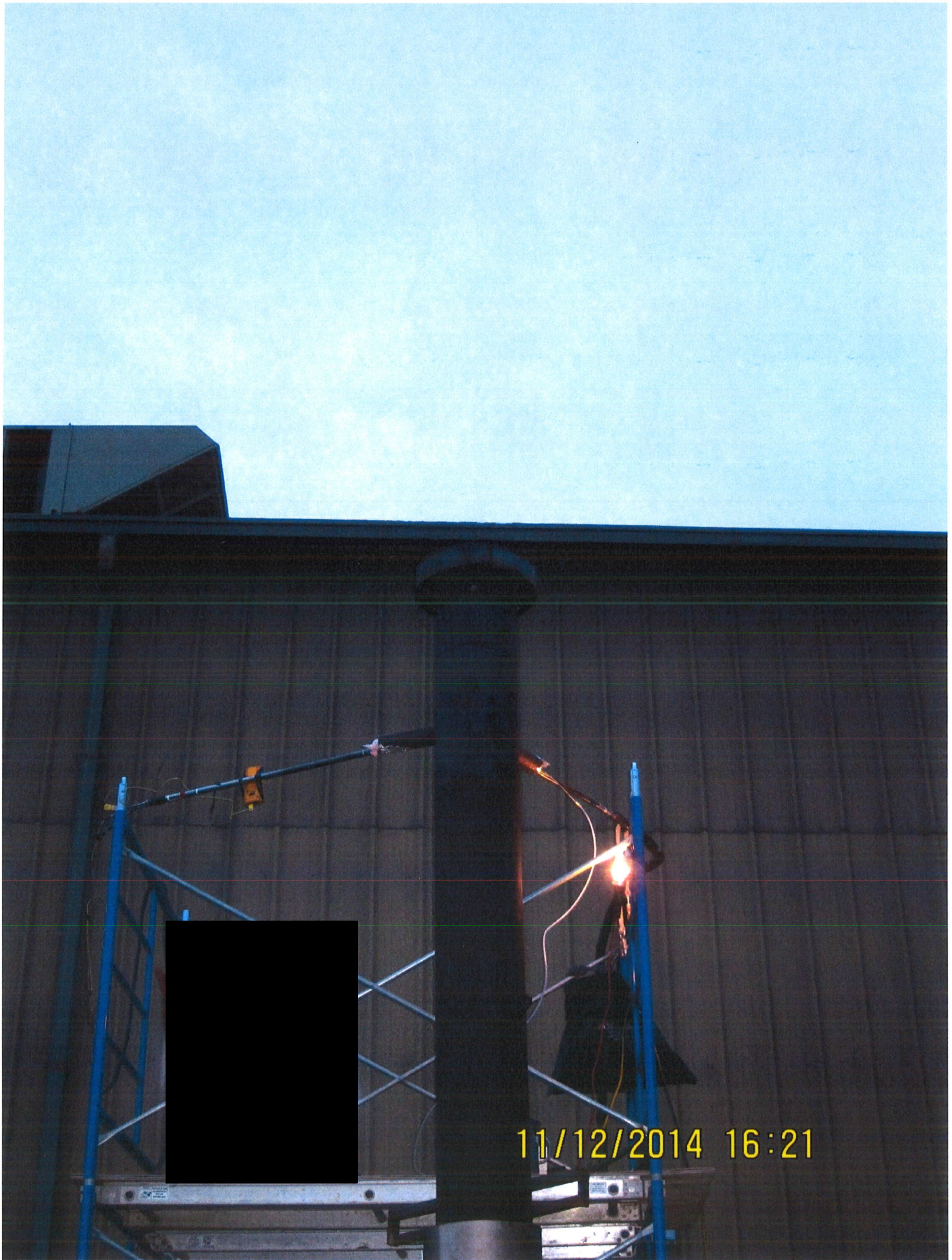
17:20 4.1 km/h SE / overcast

Accumulated Observation: thr 20 min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation





11/12/2014 16:21



Test 8

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited.  
Location 9815 48 St. SE Calgary  
Company Rep. Greg/Howard.

Observer Ntin/Howard  
Affiliation AGAT Labs./REM Tech.  
Date Dec 12/2014

Precipitation None.

Wind Speed 5.0 km/h SW

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

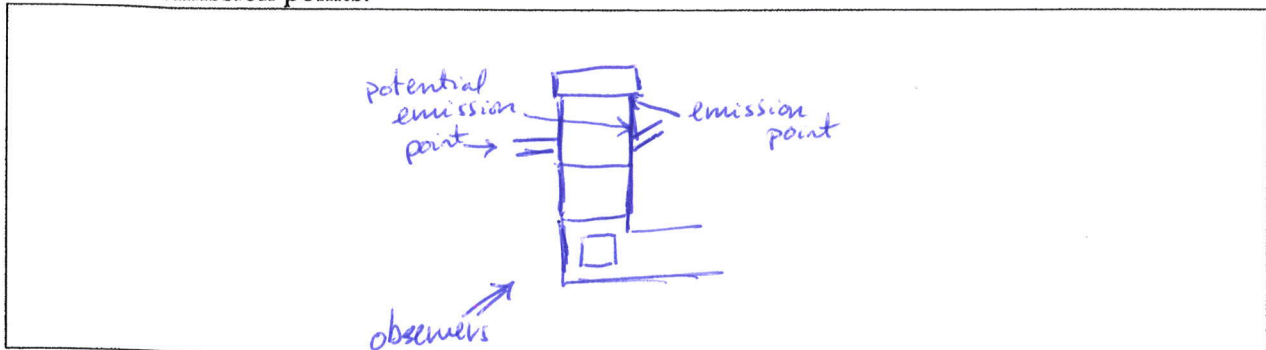
natural

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

8:25

6.0 km/h SW/overcast.

8:50

1.8 km/h SW/overcast.

9:10

2.1 km/h SE/overcast

9:35

2.0 km/h SE/overcast

Accumulated Observation - 1hr 10min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation

12/12/2014 09:34





Test 9

FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

Company REM Technology limited  
Location 9815 48st. #8E calgary  
Company Rep. Greg/Howard.

Observer Nitin/Howard  
Affiliation AGAT Laboratories./REM Tech.  
Date Dec 12/2014

Precipitation None.

Wind Speed 2.5 km/h S

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

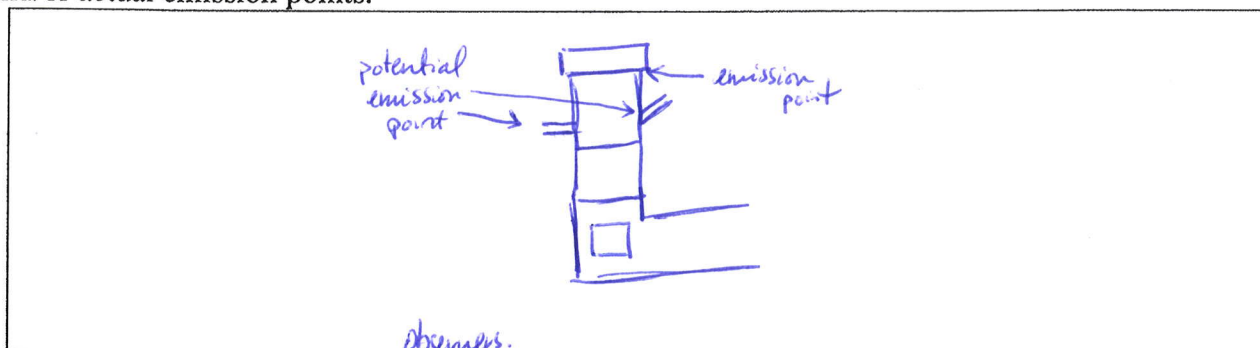
natural.

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

Begin

Observation

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

Clock  
Time

Observation

period  
duration,  
minutes:seconds

Accumulated

emission  
time,  
minutes:seconds

09:55

~~10:00~~

10:15

~~10:20~~

10:35

10:05

2.5 km/h / S variable clouds

1.4 km/h / S variable clouds

1.1 km/h / S variable clouds

4.7 km/h SE variable clouds

Accumulated Observation: thr 10 min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End

Observation



12/12/2014 11:02



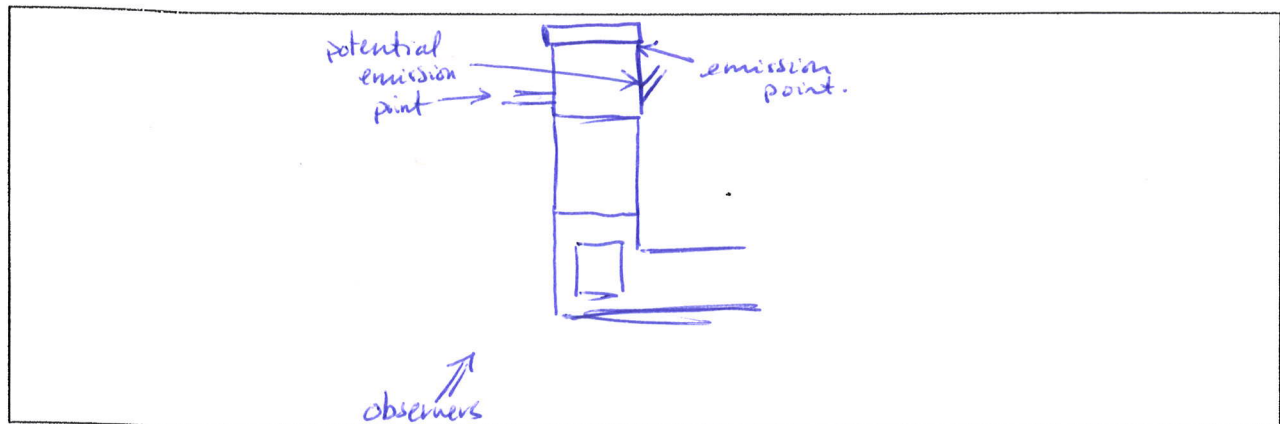


Test 10

# FUGITIVE OR SMOKE EMISSION INSPECTION OUTDOOR LOCATION

Company REM Technology limited	Observer Nitin / Howard.
Location 9815 48 St. SE Calgary	Affiliation AGAT Laboratories / REM Tech.
Company Rep. Greg / Howard.	Date Dec 12 / 2014
Sky Conditions variable clouds.	Wind Direction SE NW
Precipitation None.	Wind Speed 5.4 km/h NW
Industry	Process Unit

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	11:30	5.4 km/h NW / variable clouds	_____
To complete this form, record the following:	11:50	2.9 km/h SE / variable clouds	_____
• the initial clock time	12:10	3.2 km/h SE / variable clouds	_____
• the total time of the observation (from SW1)	12:40	2.5 km/h SE / variable clouds	_____
• the total time of emissions (from SW2), and	Accumulated Observation: the 10 min		
• the final clock time.	_____	_____	_____
For more details on recording this data and taking breaks, see #7 and #10 above.	_____	_____	_____
End Observation	_____	_____	_____





9/17/2014 12:37

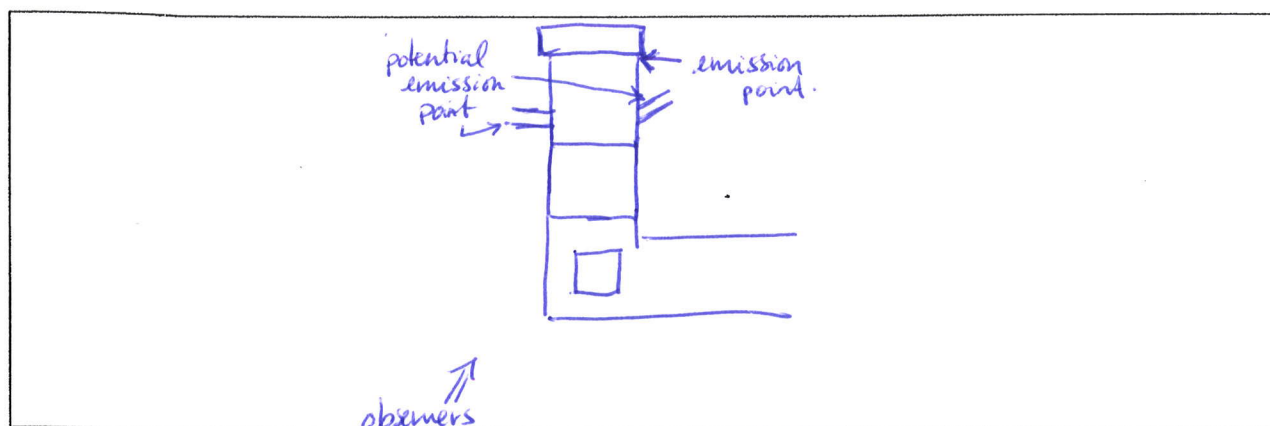


Test 11

FUGITIVE OR SMOKE EMISSION INSPECTION  
OUTDOOR LOCATION

Company <i>REM Technology limited.</i>	Observer <i>Nitin / Alex. Scott</i>
Location <i>9815 48 St. SE Calgary.</i>	Affiliation <i>AGAT Labs. / Spartan Controls</i>
Company Rep. <i>Greg / Howard.</i>	Date <i>Dec 10 / 2014.</i>
Sky Conditions <i>variable clouds.</i>	Wind Direction <i>S</i>
Precipitation <i>none.</i>	Wind Speed <i>2.5 km/h.</i>
Industry	Process Unit

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<i>13:00</i>	<i>2.5 km/h S / variable clouds.</i>	<i>_____</i>
	<i>13:20</i>	<i>2.2 km/h S / variable clouds.</i>	<i>_____</i>
	<i>13:40</i>	<i>0.0 km/h. / variable clouds.</i>	<i>_____</i>
	<i>14:10</i>	<i>1.1 km/h / variable clouds.</i>	<i>_____</i>
	<i>14:05</i>		
	<i>Accumulated Observation: the 10 min</i>		
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
End Observation	_____	_____	_____

- To complete this form, record the following:
- the initial clock time
  - the total time of the observation (from SW1)
  - the total time of emissions (from SW2), and
  - the final clock time.

For more details on recording this data and taking breaks, see #7 and #10 above.



12/12/14 14:04



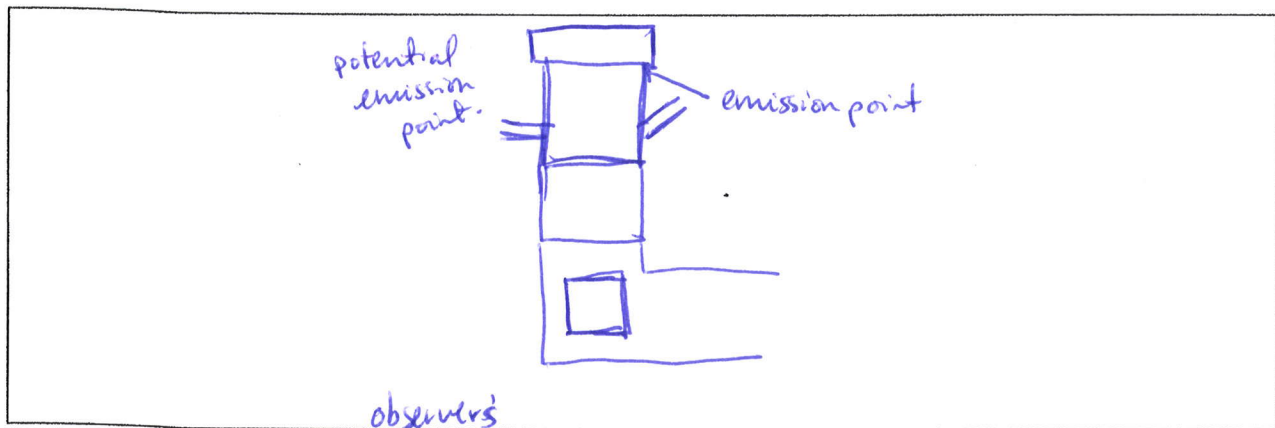


Test 12

FUGITIVE OR SMOKE EMISSION INSPECTION  
OUTDOOR LOCATION

Company	REM Technology Limited	Observer	Nth/Alex Scott
Location	9815 48 St. SE Calgary.	Affiliation	AGAT Labs. / Spartan Controls
Company Rep.	Greg Howard	Date	Dec 10 / 2014
Sky Conditions	variable clouds	Wind Direction	<del>SW</del> NW
Precipitation	None.	Wind Speed	1.8 km/h
Industry		Process Unit	

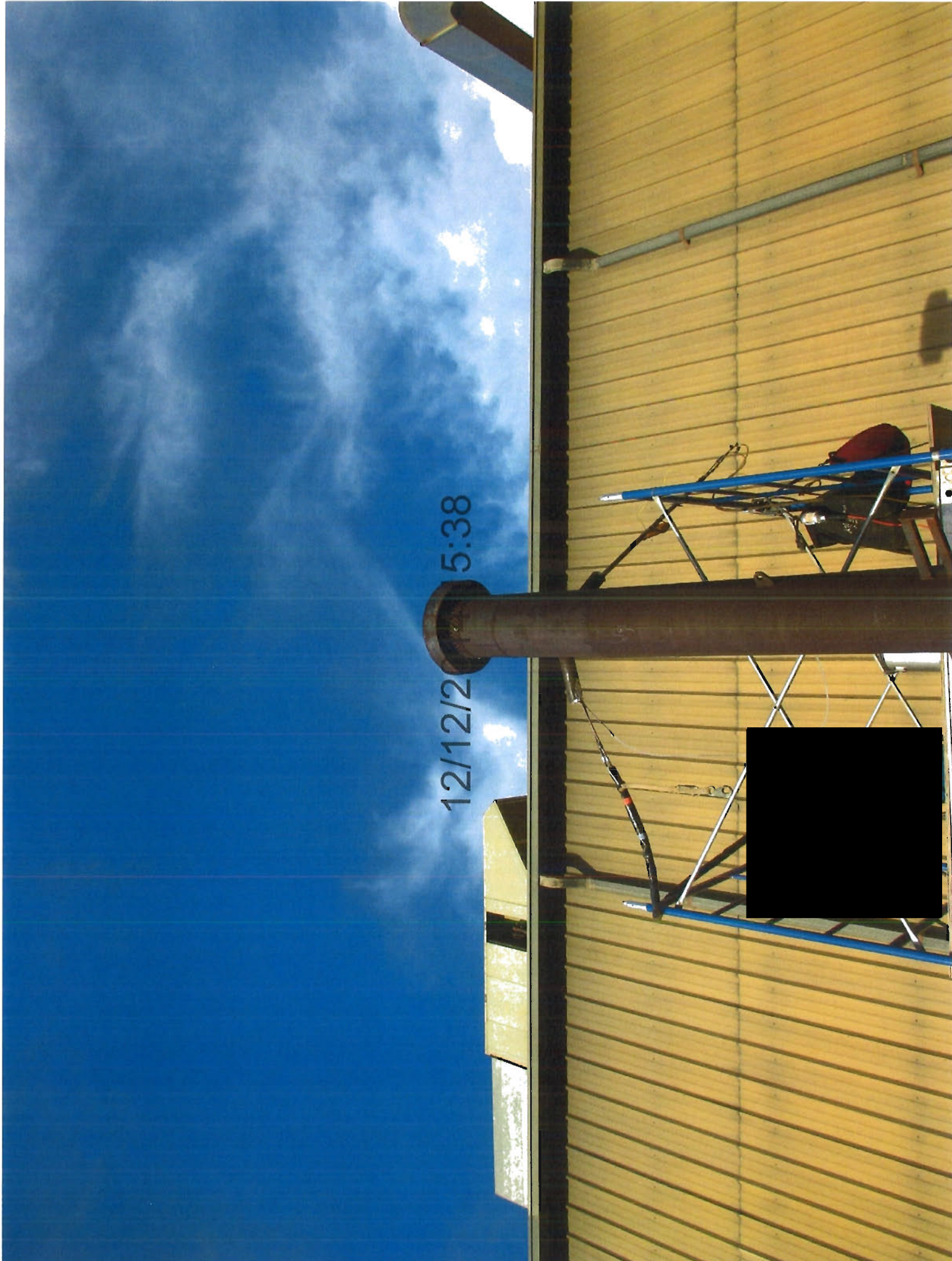
Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	14:30	1.8 km/h NW / variable clouds.	
To complete this form, record the following:	14:50	2.1 km/h NW / variable clouds.	
• the initial clock time	15:10	1.8 km/h NW / variable clouds.	
• the total time of the observation (from SW1)	15:40	0.0 km/h. / variable clouds.	
• the total time of emissions (from SW2), and	Accumulated observation: the 10 min		
• the final clock time.			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			

12/12/2015 5:38



## **Appendix V**

### **AGAT Calibration Data**



# ANALYZER CALIBRATION FORM

Parameter

CO

On-Site to Probe

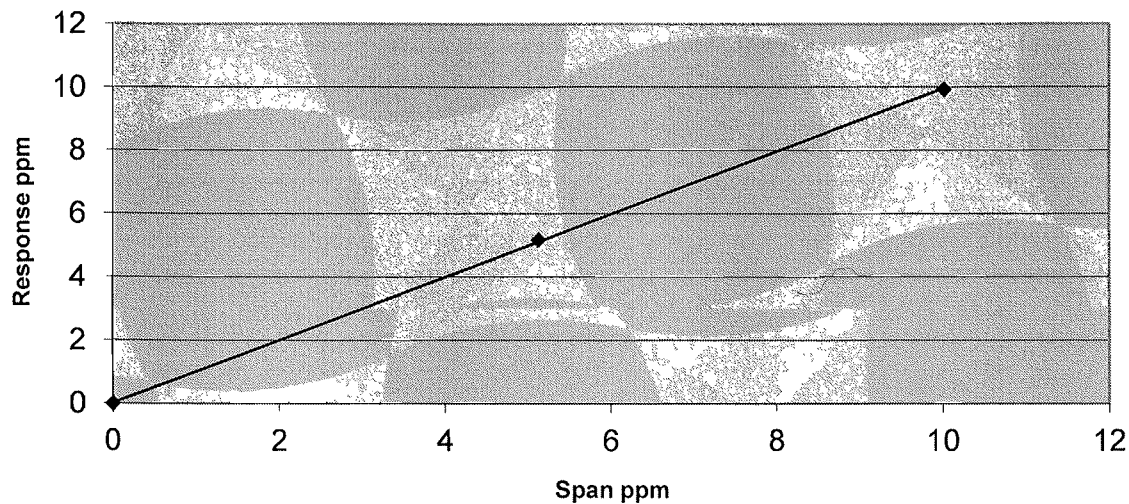
Company: Spartan Controls Location: Calgary  
 Staff: CR/JW/AS/NM Parameter: Pre -Test Linearity  
 Date: 2014/12/10-12 Time: 8:00-8:22  
 Analyzer: \_\_\_\_\_ S/N: \_\_\_\_\_  
 Data System: ICIS 3 Dilution: 1:1

Calibration Standard	Gas	ID Number	Concentration
Compressed Cylinders	CO	0	0 ppm
- Balance Nitrogen	CO	CC258434	5.13 ppm
	CO	CC119196	10.01 ppm
Zero Air	N2	N/A	100 %

Analyzer Span: 10.01 110 seconds

Calibration Data					
Set Point	Required PPM	Dilution Factor	Actual PPM	D.A.S. Response	Percent Difference
1	-0.2002 - 0.2002	100	0		0.000
2	-0.2002 - 0.2002	100	0	0	0.000
3	4.9298 - 5.3302	100	5.13	5.19	-0.599
4	9.8098 - 10.2102	100	10.01	9.94	0.699
5	-0.2002 - 0.2002	100	0	0	0.0000

Linearity Slope: 0.9949 Y-Intercept: 0.0169 Correlation: 0.99995



**AGAT Laboratories**  
**Source Testing Services, Calgary, Alberta**

**RESPONSE TIME TESTS**

**Test Date :** 2014/12/10-12  
**Analyzer Type :**   
**Operator:** CR  
**Client:** Spartan Controls

Span Gas Concentration: 5.13 ppm  
Analyzer Span Setting: 10.01 ppm

**Upscale:**

1	<u>110</u>	Seconds
2	<u>110</u>	Seconds
3	<u>110</u>	Seconds
Average:	<u><b>110</b></u>	Seconds

**Downscale**

1	<u>110</u>	Seconds
2	<u>110</u>	Seconds
3	<u>110</u>	Seconds
Average:	<u><b>110</b></u>	Seconds

The system average response time is equivalent to the slower of the  
upscale and downscale response times, which is: **110**

**ANALYZER DRIFT**  
AGAT Laboratories

Company: Spartan Controls Location: Calgary Staff: CR/JW/AS/NM  
Date: 2014/12/10-12 Test Type: RATA Condition: Normal

Span: CO 10.01 ppm

Test #:	One	Time:	15:00	--	16:10	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 4.45 10.01 4.44 0.10

Test #:	Two	Time:	08:30	--	09:40	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 5.18 10.01 5.56 -3.80

Test #:	Three	Time:	10:05	--	11:15	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 5.56 10.01 5.81 -2.50

Test #:	Four	Time:	11:35	--	12:45	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 5.81 10.01 5.63 1.80

Test #:	Five	Time:	13:05	--	14:15	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 5.63 10.01 5.41 2.20

Test #:	Six	Time:	14:40	--	15:50	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 5.41 10.01 5.39 0.20

Test #:	Seven	Time:	16:10	--	17:20	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 5.39 10.01 5.55 -1.60

Test #:	Eight	Time:	08:25	--	09:35	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 4.95 10.01 4.77 1.80

Test #:	Nine	Time:	09:55	--	11:05	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 4.77 10.01 4.84 -0.70

Test #:	Ten	Time:	11:30	--	12:40	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0.00	10.01 4.84 10.01 5.21 -3.70

Test #:	Eleven	Time:	13:00	--	14:10	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0	10.01 5.21 10.01 5.10 1.10

Test #:	Twelve	Time:	14:30	--	15:40	2014/12/10-12
	Initial		Final		% Drift	
	ZERO	DAS	ZERO	DAS		
CO	0	0	0	0	0	10.01 5.10 10.01 4.84 2.60

# ANALYZER CALIBRATION FORM

Parameter

THC

On-Site to Probe

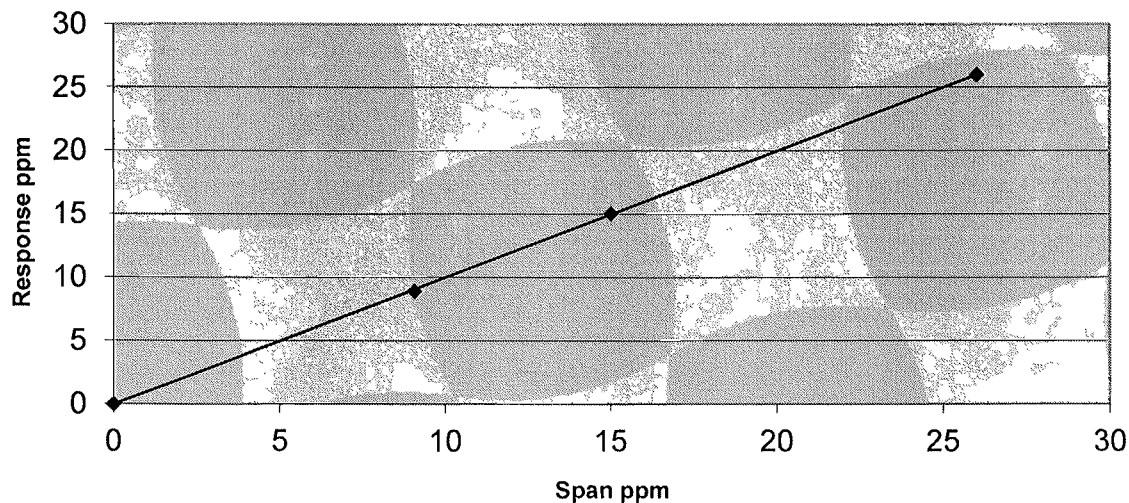
Company: Spartan Location: Calgary  
 Staff: CR/JW/AS/NM Parameter: Pre -Test Linearity  
 Date: 2014/12/10-12 Time: 8:15-8:45  
 Analyzer: \_\_\_\_\_ S/N: \_\_\_\_\_  
 Data System: ICIS 3 Dilution: 1:1

Calibration Standard	Gas	ID Number	Concentration
Compressed Cylinders	THC	CC140651	9.09 ppm
- Balance Nitrogen	THC	CSA15547	15 ppm
	THC	CC107358	26 ppm
Zero Air	N2	N/A	100 %

Analyzer Span: 26 120 seconds

Calibration Data					
Set Point	Required PPM	Dilution Factor	Actual PPM	D.A.S. Response	Percent Difference
1	-0.52 - 0.52	100	0	0	0.000
2	8.57 - 9.61	100	9.09	8.93	0.615
3	14.48 - 15.52	100	15	15.07	-0.269
4	25.48 - 26.52	100	26	26.01	-0.038
5	-0.52 - 0.52	100	0	0	0.0000

Linearity Slope: 1.0014 Y-Intercept: -0.0297 Correlation: 0.99997





**AGAT Laboratories**  
**Source Testing Services, Calgary, Alberta**

**RESPONSE TIME TESTS**

**Test Date :** 2014/12/10-12  
**Analyzer Type :** \_\_\_\_\_  
**Operator:** CR  
**Client:** Spartan

**Span Gas Concentration:** 9.09 ppm  
**Analyzer Span Setting:** 26.0 ppm

**Upscale:**

1	<u>120</u>	Seconds
2	<u>120</u>	Seconds
3	<u>120</u>	Seconds
Average:	<u>120</u>	Seconds

**Downscale**

1	<u>120</u>	Seconds
2	<u>120</u>	Seconds
3	<u>120</u>	Seconds
Average:	<u>120</u>	Seconds

The system average response time is equivalent to the slower of the  
upscale and downscale response times, which is: **120**

**ANALYZER DRIFT**  
AGAT Laboratories

Company: Spartan Location: Calgary Staff: CR/JW/AS/NM  
Date: 2014/12/10-12 Test Type: RATA Condition: Normal

Span: THC 26 ppm  
Test #: One Time: 1500 -- 1610 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.13	26	8.56	-1.65

Test #: Two Time: 0830 -- 0940 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.56	26	8.24	1.23

Test #: Three Time: 1005 -- 1115 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.24	26	8.86	-2.38

Test #: Four Time: 1135 -- 1245 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.86	26	8.76	0.38

Test #: Five Time: 1305 -- 1415 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.76	26	8.70	0.23

Test #: Six Time: 1440 -- 1550 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.70	26	7.88	3.15

Test #: Seven Time: 1610 -- 1720 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	7.88	26	8.54	-2.54

Test #: Eight Time: 0825 -- 0935 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.93	26	8.20	2.81

Test #: Nine Time: 0955 -- 1105 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.20	26	9.20	-3.85

Test #: Ten Time: 1130 -- 1240 2014/12/10-12

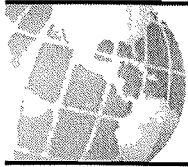
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	9.20	26	8.23	3.73

Test #: Eleven Time: 13:00 -- 14:10 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	26	8.23	26	7.43	3.08

Test #: Twelve Time: 14:30 -- 15:40 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	26	7.43	26	7.38	0.19



# AGAT Laboratories

## S-TYPE PITOT TUBE CALIBRATION

Calibration Device/Location: SAIT Wind Tunnel/standard Pit

Pitot Tube Number: PT 5 EDM

Technician: TN

Calibration Date (D/M/Y): 23-Jan-14

Date Last Calibrated (D/M/Y): 24-Jan-13

Previous Factor: \_\_\_\_\_

Approx. Velocity	Reference	S-Type		Pitot Factor	Error
ft/sec	$\Delta Pr$	$\Delta Ps$	$(Ref/S-type)^{0.5}$		$\pm 0.01$ from the new factor
10	0.0245	0.0380	0.803	0.795	-0.01
10	0.0240	0.0360	0.816	0.808	0.00
20	0.0670	0.102	0.810	0.802	0.00
20	0.0680	0.103	0.813	0.804	0.00
40	0.312	0.473	0.812	0.804	0.00
40	0.312	0.472	0.813	0.805	0.00
60	0.731	1.106	0.813	0.805	0.00
60	0.731	1.109	0.812	0.804	0.00

Standard Pitot Tube Factor: 0.990      New Factor: **0.803**

Calibration Notes: Pitot Tube tips are in good shape, clean, with no deformations or damage.  
Calibrated with thermocouples in place.  
\_\_\_\_\_  
\_\_\_\_\_

# Dry Gas Meter Calibration

**Meter:** Sensus 01  $V_{Tr} = \frac{536.7}{29.92} \times \frac{(BP + Dp)}{(Tm + 460)} \times \text{Volume Reference}$   
**Technician:** TN

**Date:** Jan.21,2014  
**B.P:** 26.49 in.Hg.  $V_{DGr} = \frac{536.7}{29.92} \times \frac{(BP + Dp)}{(Tm + 460)} \times \text{Volume Dry Gas Meter}$   
**Old Factor:** 0.9098  
**Ref. Factor** 1.0000

Reference Temperature is 77°F  
 Reference Pressure is 29.92 in.Hg

	<u><b>Trial 1</b></u>	<u><b>Trial 2</b></u>	<u><b>Trial 3</b></u>	
<b>Test Meter</b>				
Qw Volume :	10.00	10.00	10.00	cubic feet
Temp Meter :	76.0	76.0	74.5	°F
Pressure Meter:	3.15	3.15	3.20	in.H2O
Ref Vol:	8.947	8.947	8.974	Ft.3 @ REF
<b>Dry Gas Meter</b>				
Qd Volume :	9.853	9.880	9.895	cubic feet
Temp Meter :	75.5	76.0	75.5	°F
Pressure Meter:	0.31	0.31	0.31	in.H2O
Ref Vol:	8.755	8.771	8.792	Ft.3 @ REF

Meter Factor: 

1.0220	1.0201	1.0206
--------	--------	--------

**New Factor:** **1.0209**

**Signature:** 

% Change: 12.2113

Notes: \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Certificate of Calibration Hand Held Temp Indicator

**Company:** Agat Laboratories Ltd.  
**Address:** 2910 12 Street N.E.  
Calgary, Alberta. T2P 7P7

**Date:** July 11, 2014  
**Due:** July 11, 2015  
**Tech:** Brandon McKay

**Make:** Fluke  
**Model** 51 Series II  
**Range** Various

**Location:** Lab  
**Serial #:** 88170074

### Calibration Data Type K

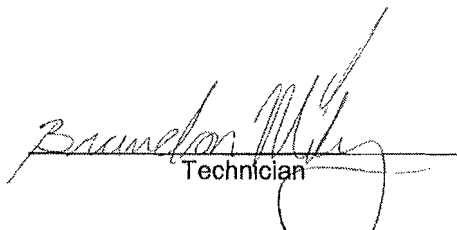
Test Point (°C)	As Found (°C)	As Left (°C)	Error (°C)	Allowable Error (°C)
1200.00	1200	1200	0.0	±1.1
800.00	799.9	799.9	-0.1	±0.9
400.00	400.0	400.0	0.0	±0.7
0.00	0.0	0.0	0.0	±0.5
-200.00	-199.8	-199.8	-0.2	±0.9

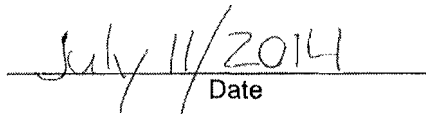
**Comments:** Thermometer is within  $\pm 0.05\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) above  $100^{\circ}\text{C}$  for J,K,E, and T types or  $\pm 0.2\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) below  $100^{\circ}\text{C}$  for J, K, and E types.  $\pm 0.5\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) Below  $100^{\circ}\text{C}$  for T type.

The test accuracy ratio of this calibration is at least 4:1 unless otherwise indicated. This unit has been calibrated using equipment and standards traceable to the National Research Council of Canada (NRC), the National Institute of Standards and Technology (NIST), or derived from accepted values of natural physical constants. This calibration certificate applies only to the item described and shall not be reproduced, other than in full, without approval from Reding Instrument Services Ltd.

### Calibration Standard(s) Used

Asset Used	Model Number	Serial Number	Asset Due Date
Fluke	5520A	8979001	April 17, 2015

  
Technician

  
Date



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000073270

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876395  
Customer P. O. Number: 75785  
Customer Reference Number:

Fill Date: 10/27/2014  
Part Number: EV NICOR1E-AS  
Lot Number: 109430004  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	11/4/2022	NIST Traceable
Cylinder Number:	CC258434	Analytical Uncertainty:
5.13 ppm	CARBON MONOXIDE	± 0.9 %
Balance	NITROGEN	

Certification Information: Certification Date: 11/4/2014 Term: 96 Months Expiration Date: 11/4/2022

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: 5 ppm  
Certified Concentration: 5.13 ppm  
Instrument Used: Horiba VIA-510 S/N 576876015  
Analytical Method: NDIR  
Last Multipoint Calibration: 10/20/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC130322  
Ref. Std. Conc: 10.15 ppm  
Ref. Std. Traceable to SRM #: 1677c  
SRM Sample #: 5-J-42  
SRM Cylinder #: CAL015337

First Analysis Data:				Date:	11/4/2014
Z:	0	R:	83.8	C:	42.4
R:	84.2	Z:	0	C:	42.4
Z:	0	C:	42.5	R:	84
UOM:	ppm	Mean Test Assay:	5.127	ppm	

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

Analyzed by:

Ying Yu

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000073271

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876395  
Customer P. O. Number: 75785  
Customer Reference Number:

Fill Date: 10/27/2014  
Part Number: EV NICOR1E-AS  
Lot Number: 109430005  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	11/4/2022	NIST Traceable
Cylinder Number:	CC119196	Analytical Uncertainty:
10.01 ppm	CARBON MONOXIDE	± 0.8 %
Balance	NITROGEN	

Certification Information: Certification Date: 11/4/2014 Term: 96 Months Expiration Date: 11/4/2022

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: 10 ppm  
Certified Concentration: 10.01 ppm  
Instrument Used: Horiba VIA-510 S/N 576876015  
Analytical Method: NDIR  
Last Multipoint Calibration: 10/20/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC130322  
Ref. Std. Conc: 10.15 ppm  
Ref. Std. Traceable to SRM #: 1677c  
SRM Sample #: 5-J-42  
SRM Cylinder #: CAL015337

First Analysis Data:				Date:	11/4/2014
Z:	0	R:	84.2	C:	82.8
R:	83.9	Z:	0	C:	82.9
Z:	0	C:	82.6	R:	83.8
UOM:	ppm	Mean Test Assay:	10.005 ppm		

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

Analyzed by:

Ying Yu

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072845

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR9ME-A8  
Lot Number: 109428713  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	CC140651	Analytical Uncertainty:
9.09 ppm	PROPANE	± 1 %
Balance	NITROGEN	

Certification Information: Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 9 ppm  
Certified Concentration: 9.09 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1668b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

First Analysis Data: Date: 10/21/2014  
Z: 0 R: 23.28 C: 21.36 Conc: 9.1  
R: 23.18 Z: 0 C: 21.31 Conc: 9.079  
Z: 0 C: 21.31 R: 23.25 Conc: 9.079  
UOM: ppm Mean Test Assay: 9.086 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: 0 ppm

Analyzed by:

Ying Yu

Certified by:

Jack Fu





Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072846

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR15ME-AS  
Lot Number: 109428712  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	SA15547	Analytical Uncertainty:
15.0 ppm PROPANE		± 1 %
Balance NITROGEN		

Certification Information: Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 15 ppm  
Certified Concentration: 15.0 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1666b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

First Analysis Data: Date: 10/21/2014  
Z: 0 R: 23.28 C: 35.27 Conc: 15.027  
R: 23.18 Z: 0 C: 35.27 Conc: 15.027  
Z: 0 C: 35.27 R: 23.25 Conc: 15.027  
UOM: ppm Mean Test Assay: 15.027 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: 0 ppm

Analyzed by:

Ying Yu

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072847

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR26ME-AS  
Lot Number: 109428711  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	CC107358	Analytical Uncertainty:
26.0 ppm PROPANE	± 1 %	
Balance NITROGEN		

Certification Information: Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 26 ppm  
Certified Concentration: 26.0 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

First Analysis Data: Date: 10/21/2014  
Z: 0 R: 23.2 C: 60.9 Conc: 25.913  
R: 23.3 Z: 0 C: 61.1 Conc: 25.998  
Z: 0 C: 61.1 R: 23.3 Conc: 25.998  
UOM: ppm Mean Test Assay: 25.97 ppm

Analyzed by:

Ying Yu

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1666b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

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: 0 ppm

Certified by:

Jack E. [Signature]

**-END OF DOCUMENT-**

**From:** [Howard Malm](#)  
**To:** [Mia, Marcia](#); [Patty Centofanti](#)  
**Cc:** [Garwood, Gerri](#); [Jason Huckaby](#)  
**Subject:** RE: Initial Review of Spartan Slipstream Combustor  
**Date:** Wednesday, September 30, 2015 1:13:58 PM  
**Attachments:** [Chain of Custody-ORTECH.pdf](#)  
[Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2.pdf](#)  
[AGAT Letter Sep 2015.pdf](#)

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Marcia:

I am pleased to provide the requested information as follows:

1. The missing gas custody form is attached in file "Chain of Custody-ORTECH"
2. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows that the GC-TDC calibration procedure was modified using EPA Alt-045. Please see page 3 of the revised report.
3. The traverse locations for the sample locations are specified by the letter and diagram in the attached document "AGAT Letter Sep 2015".
4. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows a revised table in Appendix 1 (page 9 of the document) entitled "Summary of Analytical Results – THC as Propane Analysis" where the THC is reported as propane.

I trust the attached material will fully answer the points raised.

Yours truly

Howard Malm Ph.D. P.Eng.  
Chief Technical Officer  
REM Technology Inc.  
403-695-2373 (off)  
604-562-9438 (cell)

---

**From:** Mia, Marcia [mailto:[Mia.Marcia@epa.gov](mailto:Mia.Marcia@epa.gov)]  
**Sent:** Wednesday, September 09, 2015 2:08 PM  
**To:** Howard Malm; Patty Centofanti  
**Cc:** Garwood, Gerri; Jason Huckaby  
**Subject:** Initial Review of Spartan Slipstream Combustor

We have completed our initial review of the performance test that you submitted under NSPS OOOO and MACT HH/HHH on 02/16/15.

We need additional detail on the following items:

1. Missing Inlet Gas Sampling Chain of Custody forms - Section 60.5413(d)(5)(i)(A)-(C) requires certain sampling and chain of custody (COC) protocols are followed. Please provide the missing COC forms.

2. We are unable to determine if the GC-TCD calibration procedure was modified using EPA Alt-045 – Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 3C must be modified using EPA Alt-045. Please confirm. An affirmative statement is sufficient.
3. The narrative regarding the traverse locations for THC and CO is unclear and there is no traverse point diagram– Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 10/25A is conducted using a three point traverse. Please provide a diagram of the traverse and confirm that the Method 10/25A was conducted using a three point traverse.
4. Is THC reported as propane? - Section 60.5413(d)(9)(v)-(vi) requires that THC is measured as propane. The information on page 473 is presented as methane. Please confirm that THC is measured as propane.

You may provide the information in response to this email. We may elect to have a follow-up call after we receive the information. If you would like to have a conference call in any event, please let me know and I will schedule something. Thanks for your time in providing this information.

Marcia B Mia  
Office of Compliance/Air Branch  
2227A WJCS  
U.S. Environmental Protection Agency  
202-564-7042

**REPORT INFORMATION**

(Please send report to:)

Name Howard Malin

Email Howard.Malin@renttechnology.com

Project #: 35118

**SERVICE REQUESTED:**

☐ Standard: (5-7 working days)

☒ Rush: Next Day

☐ Rush: Same Day

Date Required: Dec 19, 2014

Company: DRTECH Environmental

Contact: Eugene Sherehevsky

Purchase Order: 68082200

Date: December 12, 2014

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Test 1A,B,C-14714	12/12/14	Les Yeast	C1-C6 + Benzene (ASTM D1415-03) H2, CO, CO2, H2O (ASTM D1415-03) and higher heating value (ASTM D3588-08) or ASTM D4891-89 for all samples	
Test 2A,B,C-5634	12/11/14	Les Yeast		
Test 3A,B,C-14717	12/11/14	Les Yeast		
Test 4A,B,C-17124	12/12/14	Les Yeast		

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Leslie Keast <u>[Signature]</u>	Chris Gilbert <u>[Signature]</u>	Dec 12/14
Chris Gilbert <u>[Signature]</u>	Chris Gilbert <u>[Signature]</u>	Dec 12/14
		Dec 12/14

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

EUGENE SHEREHEVSKY [Signature] Dec 15/2014

**REVISION 2**

**SPECIALTY TEST SURVEY  
SPARTAN CONTROLS - REM TECHNOLOGY  
CALGARY, ALBERTA**

**Project # 35118**

**December 10 - 12, 2014**

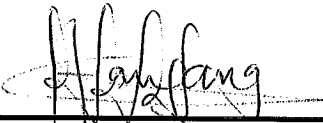
Prepared for:  
**SPARTAN CONTROLS - REM TECHNOLOGY**  
305 27 ST SE  
CALGARY, ALBERTA  
T2A 7V2

**Attention: HOWARD MALM**

Report Date: September 14, 2015

This report supersedes all previous reports with the same Maxxam project number.

Prepared by:



Ernestine Tangang, B.Sc., M.Sc.

Team Lead, Air Services, Maxxam Analytics

Reviewed by:



Dennis Skwarchuk, B.A., C.E.T.

Technical Supervisor, Source Testing, Maxxam Analytics

## **SUMMARY**

Maxxam Analytics completed a fixed gas and THC analysis for Spartan Controls - REM Technology, Calgary, Alberta. Sampling was completed on December 10 - 12, 2014. In addition to analytical results, this report includes molecular weight and THC results at 3 % CO2 correction.

All analysis, and QA/QC for this project was performed by Maxxam Analytics and complies with the applicable protocols (Alberta Stack Sampling Code, Alberta Methods for Chemical Analysis of Atmospheric Pollutants and the Alberta Air Monitoring Directive). The results are therefore considered to be representative of the source during the testing period.

Any deviations or modifications made to the analytical methods are outlined in Section 1.0 Discussion. On this basis, Maxxam is issuing this completed report to Spartan Controls - REM Technology, Calgary, Alberta.

We trust that this report meets your requirements. If you have any questions regarding this project, please contact us at 780-408-5302 or toll-free at 1-800-386-7247.



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3.0 Methods and Procedures	3
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Appendix II	Analytical Results
Appendix III	Sample Custody

## 1.0 Discussion

A total of 24 samples were analyzed. Results of these 24 samples (T3B1A - T14B1B) are presented in this report.

The GC-TCD calibration procedure in Method 3CD, 40 CFR part 60, appendix A was modified using EPA Alt-045. The analytical traces are included in the Appendices.

There were no analytical problems encountered during the sample analysis.

New standard gases were ordered well in advance to replace the expired gas standards. Due to certification problems encountered by the supplier, these were not received in time for the work performed for REM. As with any standard gases Maxxam have in use that are questionable in validity of the stated concentration values or that require recertification, Maxxam laboratory either have the manufacturer recertify the mix or verify the concentration using comparable gases that have not expired to confirm the stated concentrations. The procedure followed is : EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards - EPA/600/R-12/531, May 2012. This was the procedure used to verify the gases that had expired certificates. The results are what was included in the report. To add assurance to the validity of the expired gases used, two new standards were used in this comparison which is more than what is required in the EPA certification protocol.

## 2.0 Quality Assurance/Quality Control

### ***Maxxam Analytical Departments***

Maxxam's analytical departments QA/QC protocols include, but are not limited to the following:

- i - Canadian Association for Laboratory Accreditation (CALA) performance evaluation samples every six months
- ii - Canadian Association for Laboratory Accreditation (CALA) laboratory audits every two years
- iii - Analytical instrument calibration curves based on five (5) varying standards.

### 3.0 Methods and Procedures

The following methods and procedures were used to complete the test program:

#### **40 C.F.R. 60.5413(d)(6)**

- (ii) Molecular weight and excess air must be determined as specified in paragraph (d)(7) of this
- (iii) Carbon monoxide must be determined as specified in paragraph (d)(8) of this section.
- (iv) THC must be determined as specified in paragraph (d)(9) of this section.
- (v) Visible emissions must be determined as specified in paragraph (d)(10) of this section.

#### **40 C.F.R. 60.5413(d)(7) Molecular weight and excess air determination must be performed as**

(i) An integrated bag sample must be collected during the Method 4, 40 CFR part 60, appendix A-3, moisture test following the procedure specified in (d)(7)(i)(A) through (B) of this section. Analyze the bag sample using a gas chromatograph-thermal conductivity detector (GC-TCD) analysis meeting the criteria in paragraphs (d)(7)(i)(C) through (D) of this section

(A) Collect the integrated sample throughout the entire test, and collect representative volumes from each traverse location.

(B) Purge the sampling line with stack gas before opening the valve and beginning to fill the bag. Clearly label each bag and record sample information on a chain of custody form.

(C) The bag contents must be vigorously mixed prior to the gas chromatograph analysis.

(D) The GC-TCD calibration procedure in Method 3C, 40 CFR part 60, appendix A, must be modified by using EPA Alt-045 as follows: For the initial calibration, triplicate injections of any single concentration must agree within 5 percent of their mean to be valid. The calibration response factor for a single concentration re-check must be within 10 percent of the original calibration response factor for that concentration. If this criterion is not met, repeat the initial calibration using at least three concentration levels.

(ii) Calculate and report the molecular weight of oxygen, carbon dioxide, methane, and nitrogen in the integrated bag sample and include in the test report specified in paragraph (d)(12) of this section. Moisture must be determined using Method 4, 40 CFR part 60, appendix A-3. Traverse both ports with the Method 4, 40 CFR part 60, appendix A-3, sampling train during each test run. Ambient air must not be introduced into the Method 3C, 40 CFR part 60, appendix A-2, integrated bag sample during the port change.

(iii) Excess air must be determined using resultant data from the EPA Method 3C tests and EPA Method 3B, 40 CFR part 60, appendix A, equation 3B-1.

#### **Method 4 moisture test**

Method 4, 40 C.F.R. part 60, appendix A-3. Traverse both ports with the Method 4, 40 CFR part 60, appendix A-3, sampling train during each test run.

#### **Method 3C test**

Collect the integrated bag samples co-incident with the traverse of the Method 4 sample train, switching ports half way through the test and using care not to introduce dilution air to the bag sample during the port change. For each of the integrated bag samples taken during the twelve test runs, use the lab results and report the in-stack concentration of oxygen, carbon dioxide, methane, and nitrogen in the integrated bag sample. Use the in-stack concentrations of these analytes to calculate the molecular weight of the flue gas, excess air of combustion, and oxygen correction of the CO and THC results. Include this information in a chart in the test report.

***APPENDIX I***  
***SUMMARY OF ANALYTICAL RESULTS***

SUMMARY OF ANALYTICAL RESULTS - FIXED GAS ANALYSIS

Date/Time Sampled	T3B1A 10-Dec-14 15:00			T3B1B 10-Dec-14 15:30			T4B1A 11-Dec-14 8:30			T4B1B 11-Dec-14 9:05			T5B1A 11-Dec-14 10:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	13.29	13.32	13.31	13.22	13.28	13.25	13.34	13.39	13.37	12.95	13.01	12.98	13.10	13.13	13.12
N2 - mole % dry basis	80.32	80.39	80.36	80.34	80.37	80.36	80.30	80.33	80.32	80.40	80.41	80.41	80.36	80.40	80.38
CO2 - mole % dry basis	5.43	5.33	5.38	5.48	5.39	5.44	5.41	5.32	5.37	5.68	5.62	5.65	5.58	5.50	5.54
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.53	29.52	29.52	29.54	29.52	29.53	29.53	29.52	29.53	29.55	29.55	29.55	29.55	29.53	29.54

Date/Time Sampled	T5B1B 11-Dec-14 10:40			T6B1A 11-Dec-14 11:35			T6B1B 11-Dec-14 12:10			T7B1A 11-Dec-14 13:05			T7B1B 11-Dec-14 13:40		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	13.30	13.35	13.33	14.12	14.11	14.12	13.82	13.83	13.83	13.61	13.61	13.61	14.02	14.04	14.03
N2 - mole % dry basis	80.31	80.33	80.32	80.07	80.12	80.10	80.21	80.21	80.21	80.26	80.26	80.26	80.13	80.13	80.13
CO2 - mole % dry basis	5.42	5.36	5.39	4.85	4.81	4.83	5.02	5.00	5.01	5.17	5.17	5.17	4.90	4.87	4.89
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.53	29.52	29.52	29.47	29.46	29.47	29.49	29.48	29.49	29.50	29.50	29.50	29.48	29.47	29.48

Date/Time Sampled	T8B1A 11-Dec-14 14:40			T8B1B 11-Dec-14 15:15			T9B1A 11-Dec-14 16:10			T9B1B 11-Dec-14 16:45			T10B1A 12-Dec-14 8:25		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	13.97	13.97	13.97	13.79	13.78	13.79	14.47	14.46	14.47	14.69	14.70	14.70	13.36	13.36	13.36
N2 - mole % dry basis	80.13	80.16	80.15	80.19	80.21	80.20	80.04	80.03	80.04	79.94	79.94	79.94	80.30	80.32	80.31
CO2 - mole % dry basis	4.94	4.91	4.93	5.07	5.05	5.06	4.54	4.55	4.55	4.41	4.40	4.41	5.38	5.36	5.37
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.48	29.48	29.48	29.50	29.49	29.49	29.44	29.44	29.44	29.42	29.42	29.42	29.53	29.52	29.52

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

SUMMARY OF ANALYTICAL RESULTS - FIXED GAS ANALYSIS

Date/Time Sampled	T10B1B			T11B1A			T11B1B			T12B1A			T12B1B		
	12-Dec-14 9:05			12-Dec-14 9:55			12-Dec-14 10:40			12-Dec-14 11:30			12-Dec-14 12:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis															
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	12.96	12.95	12.96	13.14	13.12	13.13	13.19	13.19	13.19	13.26	13.26	13.26	13.06	13.05	13.06
N2 - mole % dry basis	80.39	80.43	80.41	80.36	80.35	80.36	80.34	80.35	80.35	80.32	80.33	80.33	80.38	80.40	80.39
CO2 - mole % dry basis	5.69	5.65	5.67	5.54	5.56	5.55	5.51	5.50	5.51	5.46	5.45	5.46	5.60	5.59	5.60
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.56	29.55	29.55	29.54	29.54	29.54	29.54	29.54	29.54	29.53	29.53	29.53	29.55	29.55	29.55

Date/Time Sampled	T13B1A			T13B1B			T14B1A			T14B1B		
	12-Dec-14 13:00			12-Dec-14 13:35			12-Dec-14 14:30			12-Dec-14 15:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
Fixed Gas Analysis												
H2 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ar - mole % dry basis	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
O2 - mole % dry basis	14.48	14.48	14.48	14.55	14.55	14.55	14.52	14.51	14.52	14.38	14.38	14.38
N2 - mole % dry basis	80.06	80.06	80.06	80.03	80.03	80.03	79.97	79.99	79.98	80.08	80.08	80.08
CO2 - mole % dry basis	4.51	4.51	4.51	4.46	4.47	4.47	4.56	4.54	4.55	4.58	4.58	4.58
CO - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 - mole % dry basis	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Molecular Weight Gas	29.43	29.43	29.43	29.43	29.43	29.43	29.44	29.44	29.44	29.44	29.44	29.44

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

SUMMARY OF ANALYTICAL RESULTS - THC as PROPANE ANALYSIS

Date/Time Sampled	T3B1A 10-Dec-14 15:00			T3B1B 10-Dec-14 15:30			T4B1A 11-Dec-14 8:30			T4B1B 11-Dec-14 9:05			T5B1A 11-Dec-14 10:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	7.80	6.90	7.40	8.80	8.20	8.50	8.90	9.60	9.25	12.70	11.60	12.15	12.40	13.90	13.15
THC-ppmv @3% CO2	4.28	3.86	4.07	4.79	4.54	4.66	4.91	5.38	5.14	6.67	6.15	6.41	6.63	7.54	7.08
THC as C3 analysis	2.60	2.30	2.47	2.93	2.73	2.83	2.97	3.20	3.08	4.23	3.87	4.05	4.13	4.63	4.38
C3-ppmv @3% CO2	1.43	1.29	1.36	1.60	1.51	1.55	1.64	1.79	1.71	2.22	2.05	2.14	2.21	2.51	2.36

Date/Time Sampled	T5B1B 11-Dec-14 10:40			T6B1A 11-Dec-14 11:35			T6B1B 11-Dec-14 12:10			T7B1A 11-Dec-14 13:05			T7B1B 11-Dec-14 13:40		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	16.20	15.40	15.80	12.00	11.50	11.75	12.30	13.80	13.05	14.50	12.40	13.45	10.60	11.60	11.10
THC-ppmv @3% CO2	8.91	8.57	8.74	7.38	7.14	7.26	7.31	8.24	7.77	8.37	7.15	7.76	6.46	7.11	6.78
THC as C3 analysis	5.40	5.13	5.27	4.00	3.83	3.92	4.10	4.60	4.35	4.83	4.13	4.48	3.53	3.87	3.70
C3-ppmv @3% CO2	2.97	2.86	2.91	2.46	2.38	2.42	2.44	2.75	2.59	2.79	2.38	2.59	2.15	2.37	2.26

Date/Time Sampled	T8B1A 11-Dec-14 14:40			T8B1B 11-Dec-14 15:15			T9B1A 11-Dec-14 16:10			T9B1B 11-Dec-14 16:45			T10B1A 12-Dec-14 8:25		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	13.60	14.30	13.95	16.10	15.20	15.65	12.00	11.50	11.75	11.90	11.10	11.50	12.60	11.20	11.90
THC-ppmv @3% CO2	8.22	8.69	8.45	9.47	8.98	9.23	7.89	7.55	7.72	8.06	7.54	7.80	6.98	6.23	6.61
THC as C3 analysis	4.53	4.77	4.65	5.37	5.07	5.22	4.00	3.83	3.92	3.97	3.70	3.83	4.20	3.73	3.97
C3-ppmv @3% CO2	2.74	2.90	2.82	3.16	2.99	3.08	2.63	2.52	2.57	2.69	2.51	2.60	2.33	2.08	2.20

Date/Time Sampled	T10B1B 12-Dec-14 9:05			T11B1A 12-Dec-14 9:55			T11B1B 12-Dec-14 10:40			T12B1A 12-Dec-14 11:30			T12B1B 12-Dec-14 12:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	12.60	10.50	11.55	10.20	11.10	10.65	10.30	11.00	10.65	11.70	12.80	12.25	11.50	13.10	12.30
THC-ppmv @3% CO2	6.60	5.54	6.07	5.49	5.95	5.72	5.57	5.96	5.77	6.39	7.00	6.70	6.12	6.99	6.55
THC as C3 analysis	4.20	3.50	3.85	3.40	3.70	3.55	3.43	3.67	3.55	3.90	4.27	4.08	3.83	4.37	4.10
C3-ppmv @3% CO2	2.20	1.85	2.02	1.83	1.98	1.91	1.86	1.99	1.92	2.13	2.33	2.23	2.04	2.33	2.18

Date/Time Sampled	T13B1A 12-Dec-14 13:00			T13B1B 12-Dec-14 13:35			T14B1A 12-Dec-14 14:30			T14B1B 12-Dec-14 15:05		
	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average	Run 1	Run 2	Average
THC as CH4 analysis	12.80	11.70	12.25	9.90	10.30	10.10	13.80	14.00	13.90	12.90	14.40	13.65
THC-ppmv @3% CO2	8.48	7.75	8.11	6.63	6.88	6.76	9.04	9.21	9.12	8.41	9.39	8.90
THC as C3 analysis	4.27	3.90	4.08	3.30	3.43	3.37	4.60	4.67	4.63	4.30	4.80	4.55
C3-ppmv @3% CO2	2.83	2.58	2.70	2.21	2.29	2.25	3.01	3.07	3.04	2.80	3.13	2.97

Where results are less than the Method Detection Limit, zero has been used for calculations (MDL for fixed gases CH4 and CO - 4 ppmv)

***APPENDIX II***  
***ANALYTICAL RESULTS***



# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology  
Location: Calgary, Alberta  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114  
Sample Date: 2014-12-10 to 11  
Analytical Date: 2014-12-11  
Analyst: BW

Sample ID:	T3B1A	T3B1B	T4B1A
	2014-12-10	2014-12-10	2014-12-11
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73306	73307	73308
Time:	15:00	15:30	08:30

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	13.29	13.32	13.22	13.28	13.34	13.39
N <sub>2</sub>	80.32	80.39	80.34	80.37	80.30	80.33
CO <sub>2</sub>	5.43	5.33	5.48	5.39	5.41	5.32
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	7.8	6.9	8.8	8.2	8.9	9.6
Average	7.4		8.5		9.2	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0053	98.5
2	span0062	100.6
Average		99.6
True Value		100.0
% Recovery		99.6

Reviewed By: BW Bill Wong

Validated By: for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology  
Location: Calgary, Alberta  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114  
Sample Date: 2014-12-11  
Analytical Date: 2014-12-11 to 13  
Analyst: BW

Sample ID:	T4B1B	T5B1A	T5B1B
	2014-12-11	2014-12-11	2014-12-11
Run #:	Run #1	Run #1	Run #1
Lab ID#:	73309	73310	73311
Time:	09:05	10:05	10:40

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	12.95	13.01	13.10	13.13	13.30	13.35
N <sub>2</sub>	80.40	80.41	80.36	80.40	80.31	80.33
CO <sub>2</sub>	5.68	5.62	5.58	5.50	5.42	5.36
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis



(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.7	11.6	12.4	13.9	16.2	15.4
Average	12.2		13.2		15.8	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0004	101.3
2	span0013	98.5
	Average	99.9
	True Value	100.0
	% Recovery	99.9

Reviewed By:  Bill Wong  
Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: Spartan Controls - REM Technology  
Location: Calgary, Alberta  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114  
Sample Date: 2014-12-11  
Analytical Date: 2014-12-13  
Analyst: BW

Sample ID:	T6B1A	T6B1B	T7B1A
	2014-12-11	2014-12-11	2014-12-11
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73325	73326	73327
Time:	11:35	12:10	13:05

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.12	14.11	13.82	13.83	13.61	13.61
N <sub>2</sub>	80.07	80.12	80.21	80.21	80.26	80.26
CO <sub>2</sub>	4.85	4.81	5.02	5.00	5.17	5.17
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00



## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT THC as CH<sub>4</sub> Average

12.0	11.5	12.3	13.8	14.5	12.4
11.8		13.0		13.5	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0067	101.2
2	span0074	100.4
	Average	100.8
	True Value	100.0
	% Recovery	100.8

Reviewed By:  Bill Wong  
Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company:	Spartan Controls - REM Technology		Sample Date:	2014-12-11		
Location:	Calgary, Alberta		Analytical Date:	2014-12-13		
Method Reference:	AENV Method 3 / EPA Method 3C and AENV Method 18					
Laboratory Reference:	AIR SOP-00112 & AIR SOP-00114		Analyst:	BW		

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Sample ID:	T7B1B		T8B1A		T8B1B	
	2014-12-11		2014-12-11		2014-12-11	
Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73328		73329		73330	
Time:	13:40		14:40		15:15	

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.02	14.04	13.97	13.97	13.79	13.78
N <sub>2</sub>	80.13	80.13	80.13	80.16	80.19	80.21
CO <sub>2</sub>	4.90	4.87	4.94	4.91	5.07	5.05
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT THC as CH<sub>4</sub> Average

10.6	11.6	13.6	14.3	16.1	15.2
11.1		13.9		15.6	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0074	100.4
2	span0082	99.1
	Average	99.8
	True Value	100.0
	% Recovery	99.8

Reviewed By: BW Bill Wong

Validated By: JW Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-11 to 12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T9B1A	T9B1B	T10B1A
	2014-12-11	2014-12-11	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73331	73332	73333
Time:	16:10	16:45	08:25

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.47	14.46	14.69	14.70	13.36	13.36
N <sub>2</sub>	80.04	80.03	79.94	79.94	80.30	80.32
CO <sub>2</sub>	4.54	4.55	4.41	4.40	5.38	5.36
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.0	11.5	11.9	11.1	12.6	11.2
Average	11.8		11.5		11.9	

### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0082	99.1
2	span0090	98.2
	Average	98.7
	True Value	100.0
	% Recovery	98.7

Reviewed By: EW Bill Wong  
Validated By: JW fori Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: <b>Spartan Controls - REM Technology</b>		Sample Date: 2014-12-12	
Location: <b>Calgary, Alberta</b>		Analytical Date: 2014-12-13	
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18			
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114		Analyst: BW	

Sample ID:	T10B1B	T11B1A	T11B1B
	2014-12-12	2014-12-12	2014-12-12

Run #:	Run #1	Run #2	Run #1	Run #2	Run #1	Run #2
Lab ID#:	73334		73335		73336	
Time:	09:05		09:55		10:40	

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	12.96	12.95	13.14	13.12	13.19	13.19
N <sub>2</sub>	80.39	80.43	80.36	80.35	80.34	80.35
CO <sub>2</sub>	5.69	5.65	5.54	5.56	5.51	5.50
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	12.6	10.5	10.2	11.1	10.3	11.0
Average	11.5		10.6		10.7	

Second Source Standard

ID# 11-11-01-26

CH<sub>4</sub>


### QA/QC Runs

Run #	(ppmv)
1 span0019	100.0
2 span0027	99.5

Average 99.8

True Value 100.0

% Recovery 99.8

Reviewed By:  Bill Wong

Validated By:  Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: DW

Sample ID:	T12B1A	T12B1B	T13B1A
	2014-12-12	2014-12-12	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73337	73338	73339
Time:	11:30	12:05	13:00

## FIXED GAS ANALYSIS

(Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	13.26	13.26	13.06	13.05	14.48	14.48
N <sub>2</sub>	80.32	80.33	80.38	80.40	80.06	80.06
CO <sub>2</sub>	5.46	5.45	5.60	5.59	4.51	4.51
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis

(ppmv - as received)

### COMPONENT

THC as CH <sub>4</sub>	11.7	12.8	11.5	13.1	12.8	11.7
Average	12.2		12.3		12.2	

Second Source Standard  
ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0027	99.5
2	span0034	99.2
	Average	99.4
	True Value	100.0
	% Recovery	99.4

Reviewed By: SW Bill Wong

Validated By: JW for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.

# GAS CHROMATOGRAPHIC ANALYSES

Company: **Spartan Controls - REM Technology** Sample Date: 2014-12-12  
Location: **Calgary, Alberta** Analytical Date: 2014-12-13  
Method Reference: AENV Method 3 / EPA Method 3C and AENV Method 18  
Laboratory Reference: AIR SOP-00112 & AIR SOP-00114 Analyst: BW

Sample ID:	T13B1B	T14B1A	T14B1B
	2014-12-12	2014-12-12	2014-12-12
Run #:	Run #1	Run #2	Run #1
Lab ID#:	73340	73341	73342
Time:	13:35	14:30	15:05

## FIXED GAS ANALYSIS (Mole % - Dry Basis)

### COMPONENT

H <sub>2</sub>	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ar	0.96	0.96	0.96	0.96	0.96	0.96
O <sub>2</sub>	14.55	14.55	14.52	14.51	14.38	14.38
N <sub>2</sub>	80.03	80.03	79.97	79.99	80.08	80.08
CO <sub>2</sub>	4.46	4.47	4.56	4.54	4.58	4.58
CO	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
C <sub>1</sub>	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total	100.00	100.00	100.00	100.00	100.00	100.00

## Total Hydrocarbon (THC) as CH<sub>4</sub> Analysis (ppmv - as received)

### COMPONENT THC as CH<sub>4</sub> Average

9.9	10.1	10.3	13.8	13.9	14.0	12.9	13.6	14.4
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### Second Source Standard ID# 11-11-01-26

QA/QC Runs	Run #	CH <sub>4</sub> (ppmv)
1	span0010	98.4
2	span0010	98.4
	Average	98.4
	True Value	100.0
	% Recovery	98.4

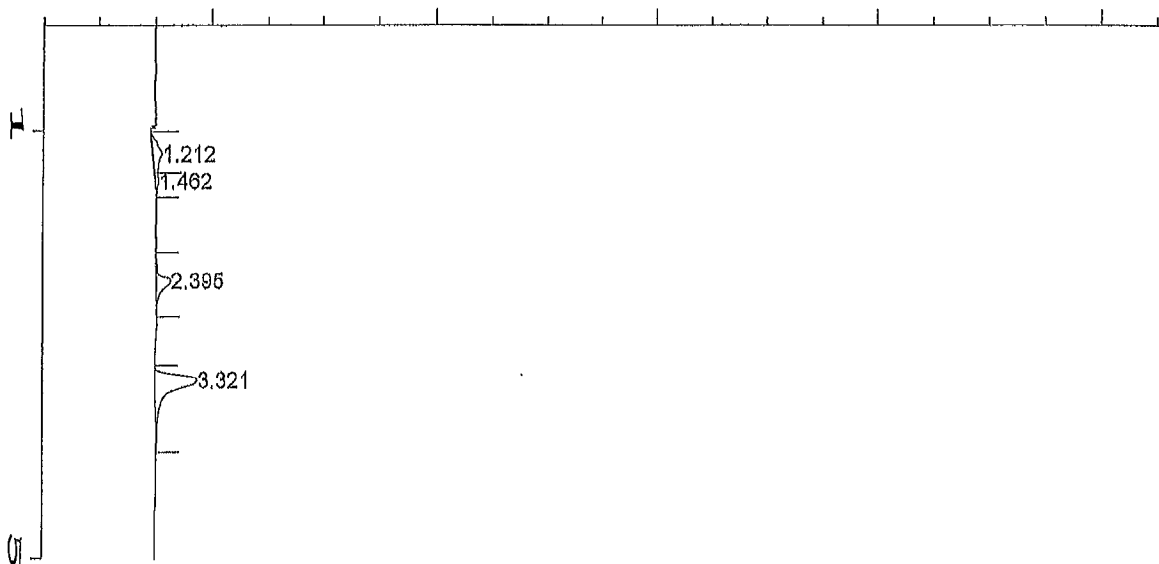
Reviewed By: BW Bill Wong  
Validated By: JW for Ernestine Tangang

MDL for Fixed Gases CH<sub>4</sub> and CO - 4 ppmv  
Minimum detectable limit for THC as CH<sub>4</sub> is 0.2 ppmv.



# Total Hydrocarbon Chromatograms

## Sample Analysis Calibration



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 External Standard Report  
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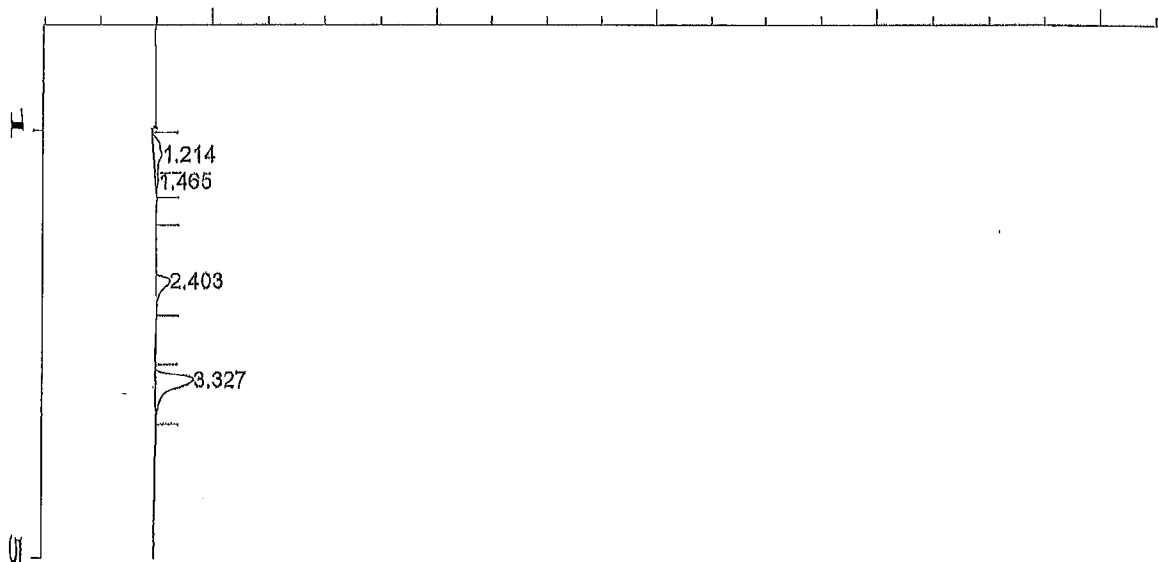
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1A055.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1A 73306 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:01 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:06 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1A - Tr#73306 - 15:00 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1A055.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.212	1032	BV	0.158		1.306	* uncalibrated *
1.462	249	VB	0.108		0.316	* uncalibrated *
2.395	1128	BB	0.130		1.428	* uncalibrated *
3.321	3763	BB	0.154		4.761	* uncalibrated *

Not all calibrated peaks were found

=====



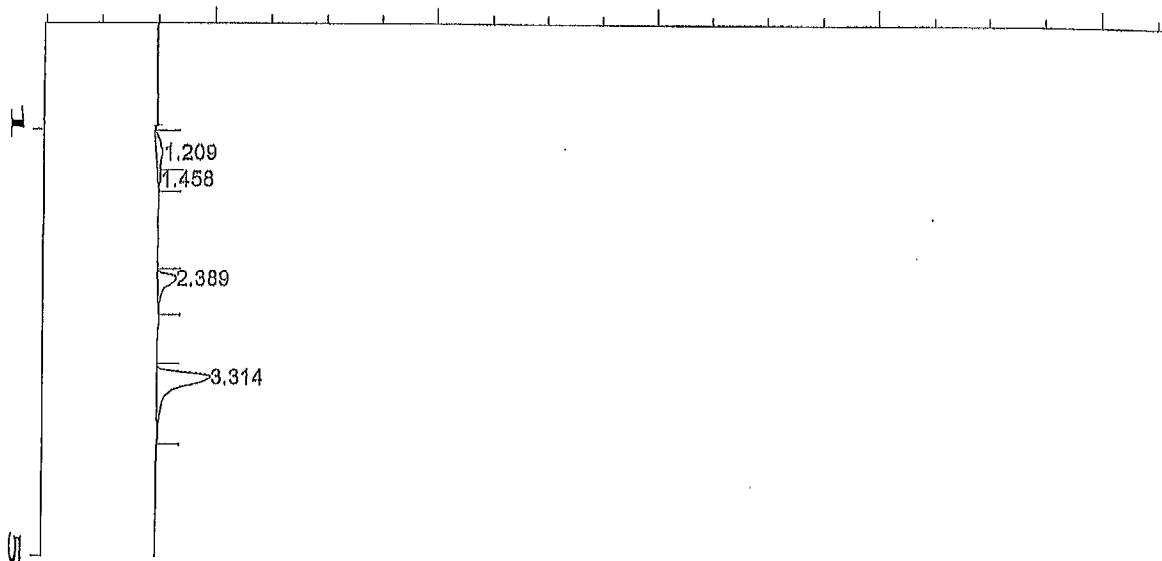
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1A056.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1A 73306 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:10 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:15 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1A - Tr#73306 - 15:00 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1A056.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.214	1035	BV	0.174			1.310 * uncalibrated *
1.465	214	VB	0.112			0.271 * uncalibrated *
2.403	1037	BB	0.130			1.312 * uncalibrated *
3.327	3151	BB	0.145			3.988 * uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
 =====

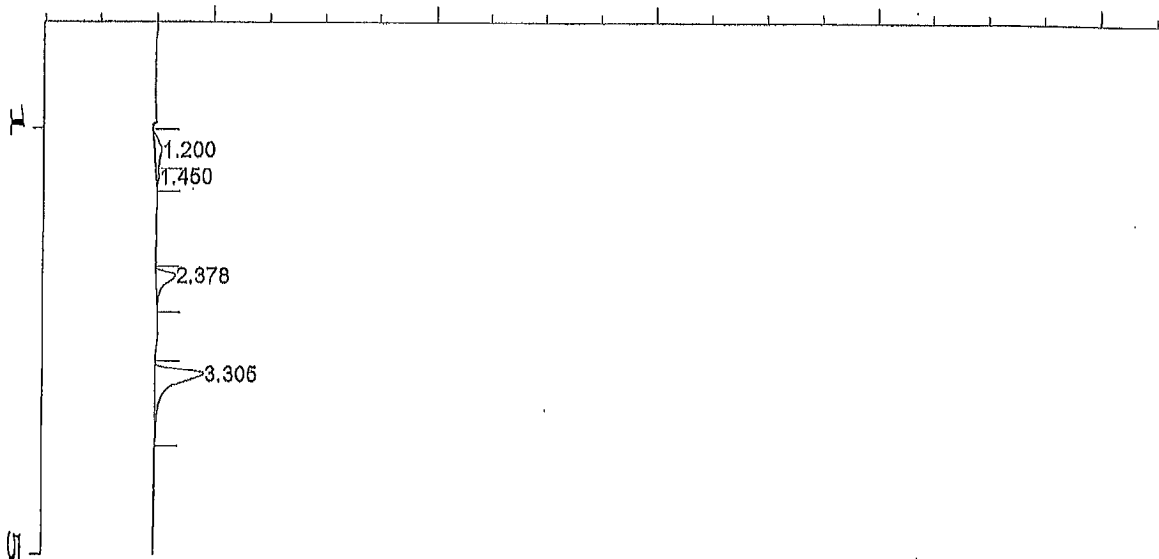
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1B057.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1B 73307 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:20 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:25 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1B - Tr#73307 - 15:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1B057.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.209	840	BV	0.165		1.062	* uncalibrated *
1.458	180	VB	0.101		0.228	* uncalibrated *
2.389	1310	BB	0.124		1.658	* uncalibrated *
3.314	4631	BB	0.149		5.860	* uncalibrated *

Not all calibrated peaks were found

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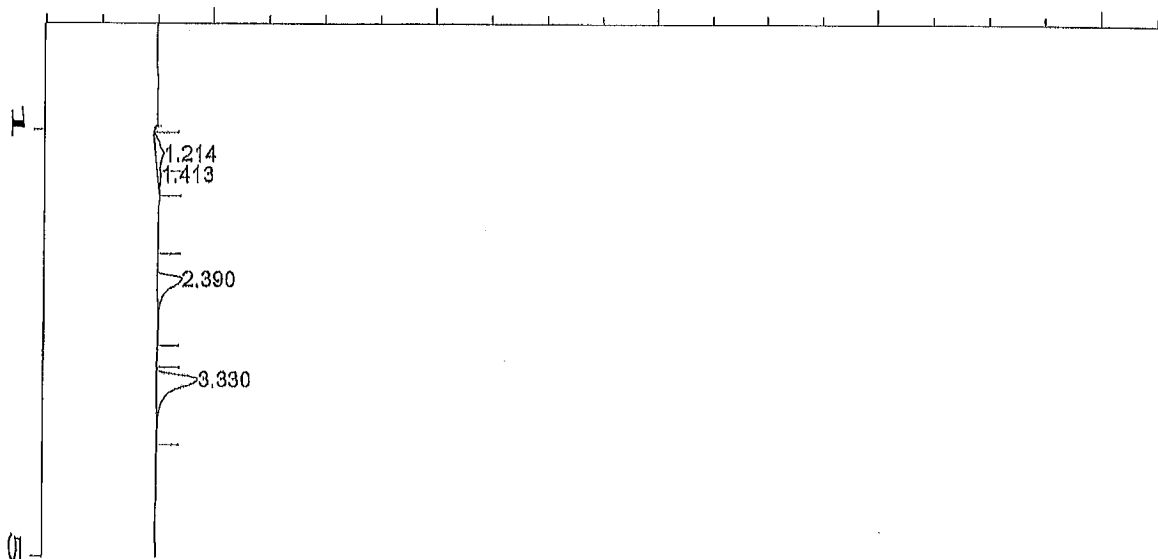
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T3B1B058.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T3B1B 73307 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:25 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:30 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-10 -  
 T3B1B - Tr#73307 - 15:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T3B1B058.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.200	872	BV	0.167		1.103	* uncalibrated *
1.450	188	VB	0.127		0.238	* uncalibrated *
2.378	1332	BB	0.121		1.686	* uncalibrated *
3.305	4112	BB	0.147		5.204	* uncalibrated *

Not all calibrated peaks were found



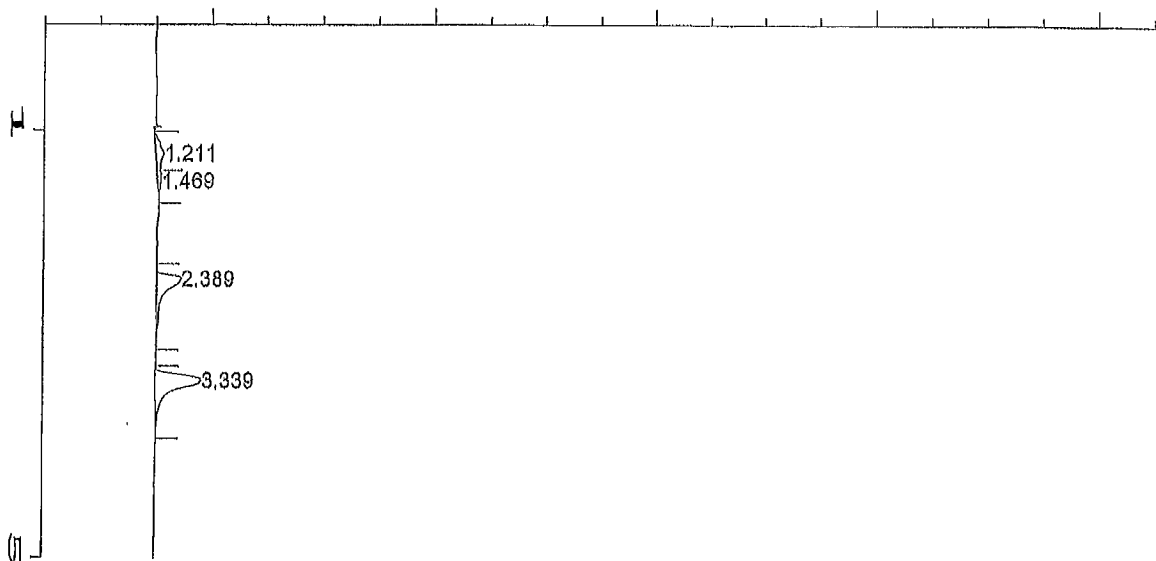
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T4B1A059.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T4B1A 73308 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:38 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1A - Tr#73308 - 08:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T4B1A059.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.214	929	BV	0.160		1.175	* uncalibrated *
1.413	274	VB	0.133		0.346	* uncalibrated *
2.390	2249	BB	0.136		2.846	* uncalibrated *
3.330	3590	BB	0.149		4.542	* uncalibrated *

Not all calibrated peaks were found



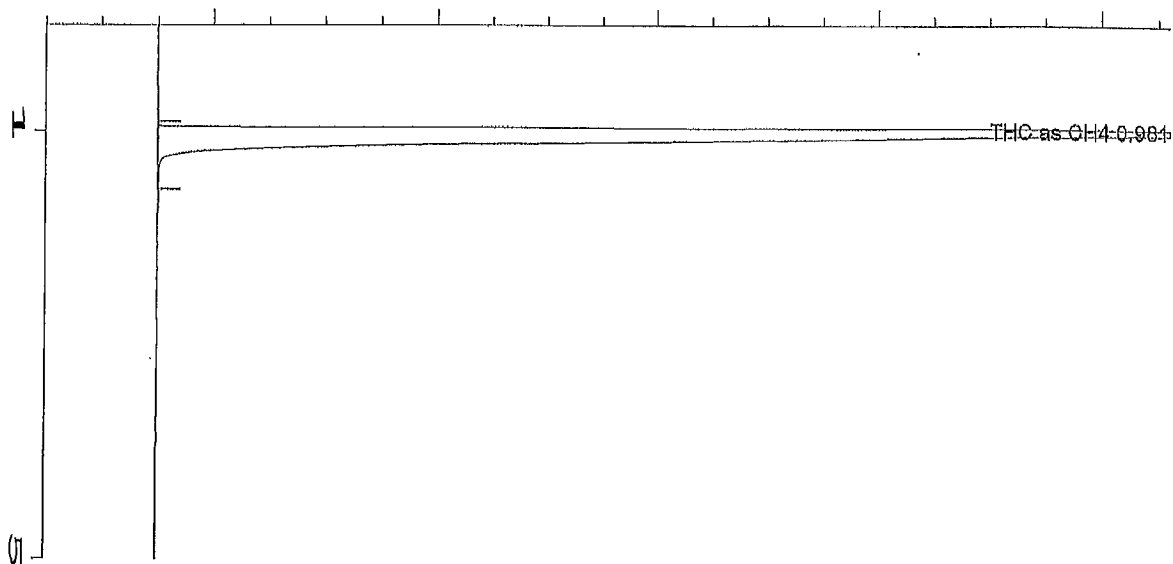
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T4B1A061.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T4B1A 73308 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:47 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:52 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1A - Tr#73308 - 08:30 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T4B1A061.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	* not found *			1		THC as CH4
1.211	946 BV	0.163			1.197	* uncalibrated *
1.469	361 VB	0.164			0.457	* uncalibrated *
2.389	2376 BB	0.157			3.006	* uncalibrated *
3.339	3870 BB	0.147			4.898	* uncalibrated *

Not all calibrated peaks were found



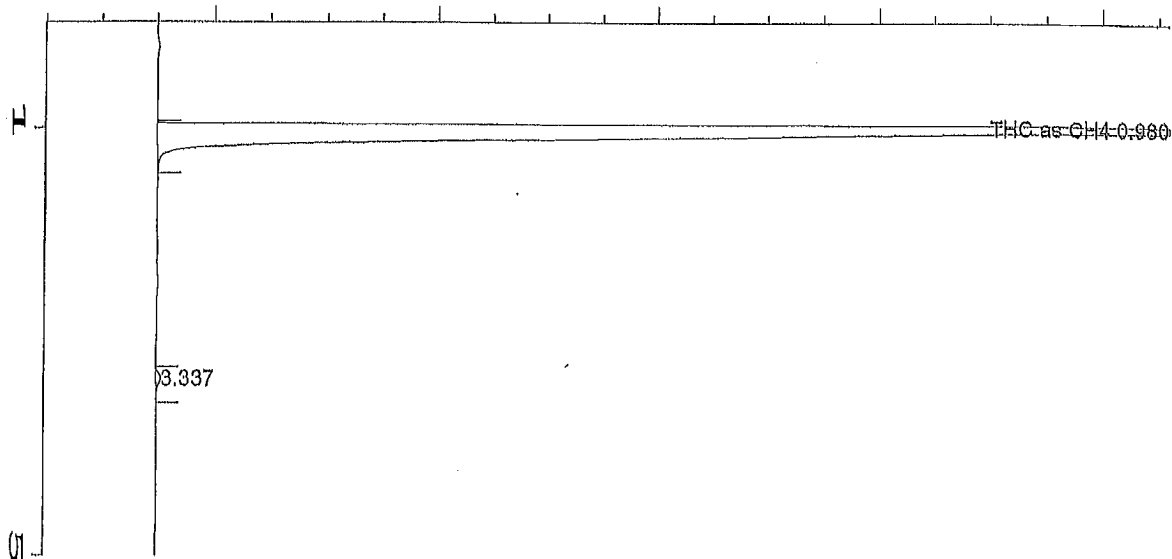
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0053.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:44 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 02:49 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0053.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.981	78269	BB	0.099	1	98.517	THC as CH4



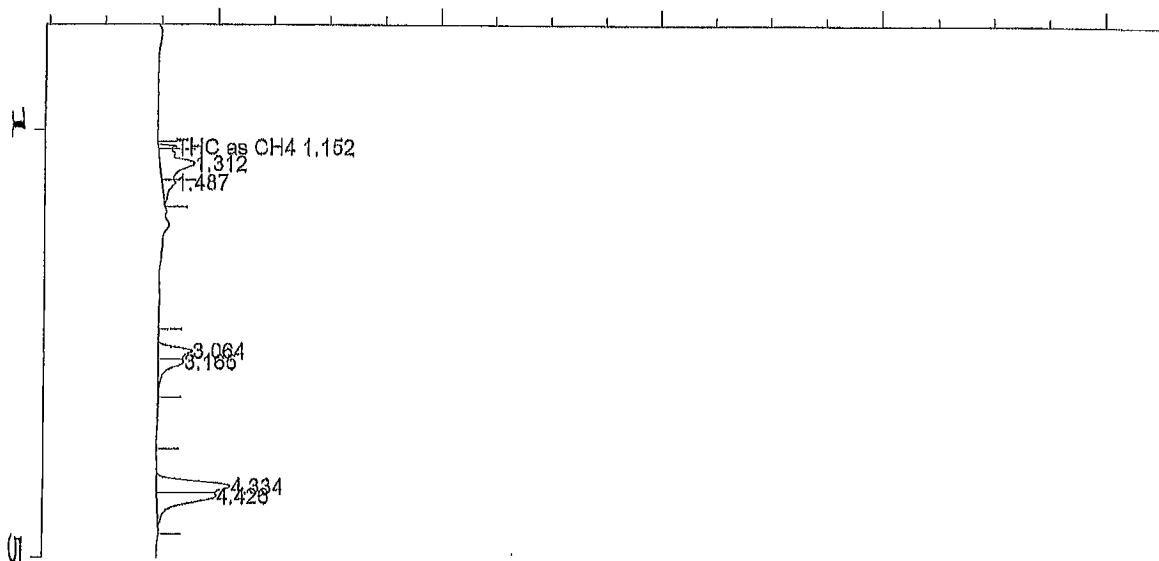


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0062.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:53 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 11 Dec 14 03:58 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 11 Dec 14 02:38 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0062.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.980	79936	BV	0.093	1	100.631	THC as CH4
3.337	309	BB	0.119		0.391	* uncalibrated *

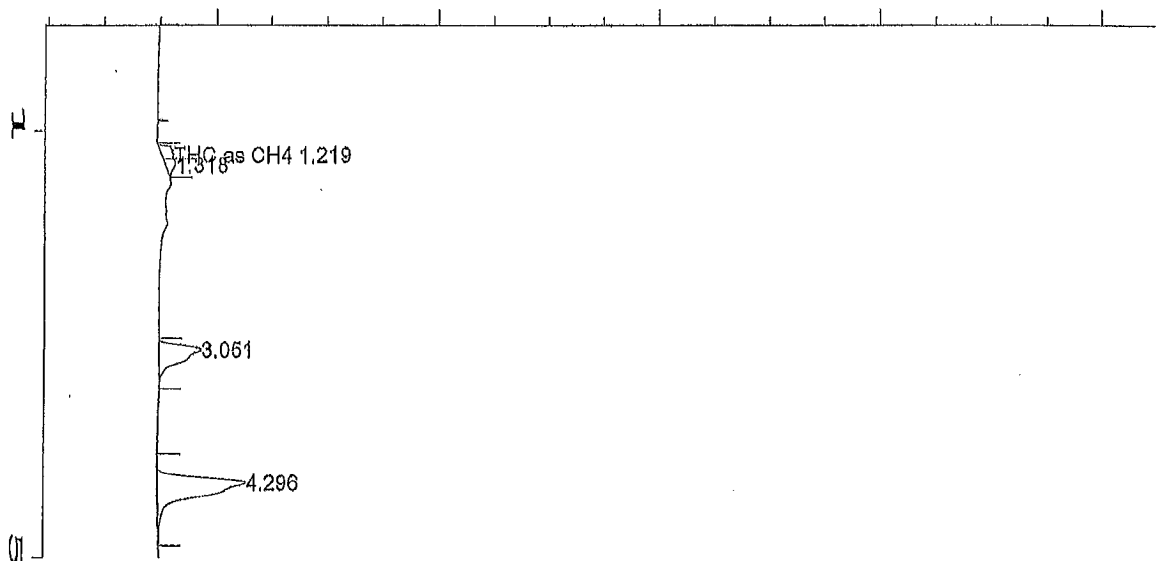


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T4B1B005.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T4B1B 73309 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:55 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:00 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1B - Tr#73309 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T4B1B005.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.152	248	BV	0.029	1	0.203	THC as CH4
1.312	3067	VV	0.139		2.586	* uncalibrated *
1.487	786	VV	0.087		0.662	* uncalibrated *
3.064	1822	BV	0.089		1.536	* uncalibrated *
3.165	1389	VB	0.104		1.172	* uncalibrated *
4.334	4247	PV	0.097		3.581	* uncalibrated *
4.426	3517	VB	0.099		2.966	* uncalibrated *

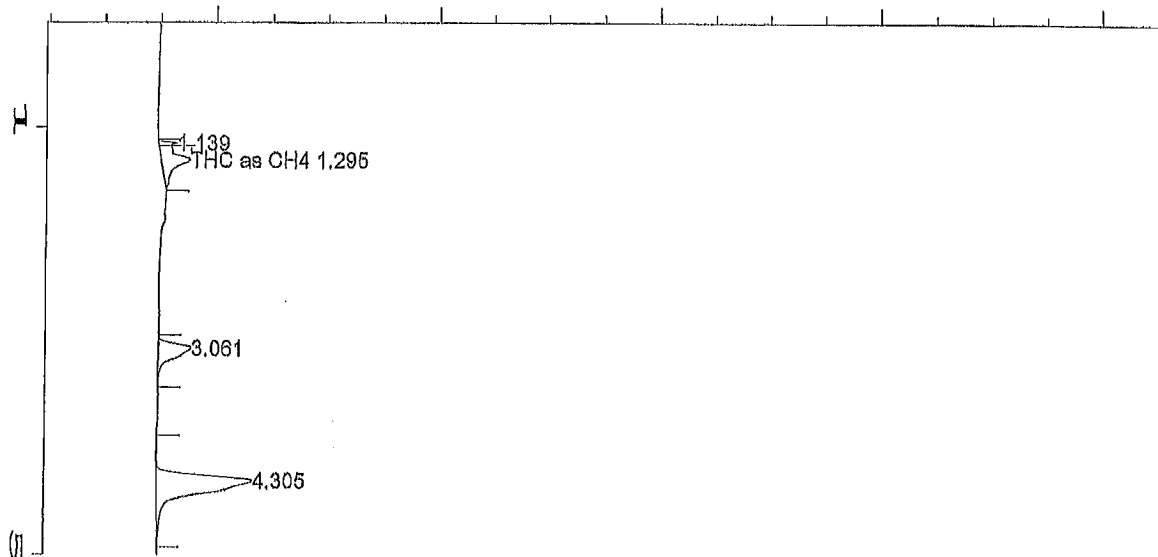


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T4B1B007.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T4B1B 73309 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:11 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:16 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T4B1B - Tr#73309 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T4B1B007.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.219	717	BV	0.101	1	0.588	THC as CH4
1.318	605	VB	0.102		0.510	* uncalibrated *
3.051	3691	BB	0.135		3.113	* uncalibrated *
4.296	8810	BB	0.152		7.429	* uncalibrated *

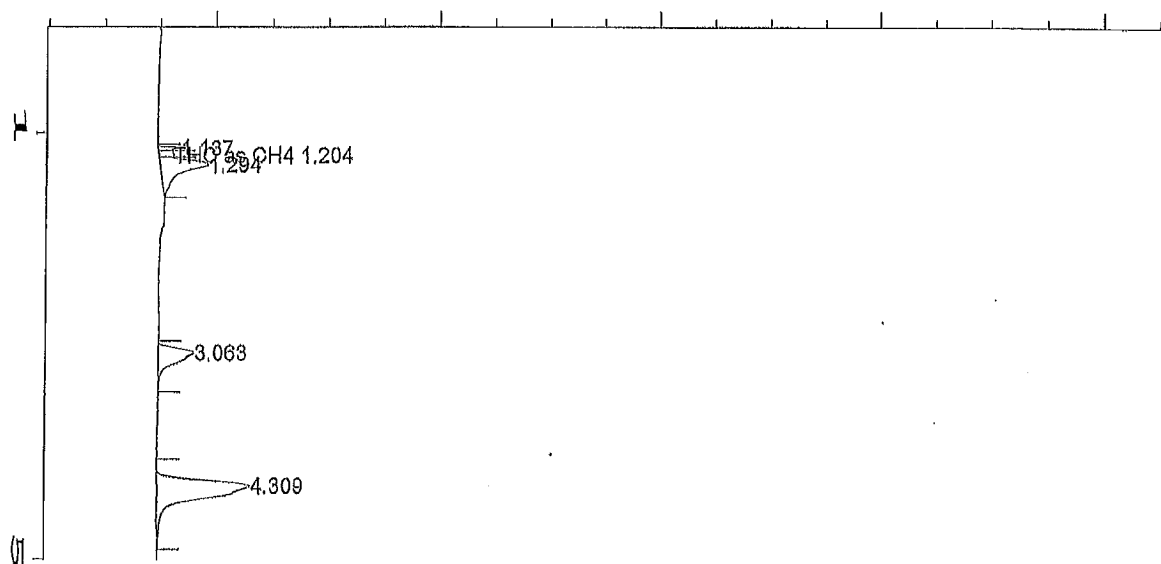


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1A008.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1A 73310 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:20 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:25 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1A - Tr#73310 - 10:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1A008.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.295	2605	VB	0.141	1	2.135	THC as CH4
1.139	283	BV	0.031		0.239	* uncalibrated *
3.061	2585	BV	0.122		2.180	* uncalibrated *
4.305	9323	BB	0.152		7.861	* uncalibrated *

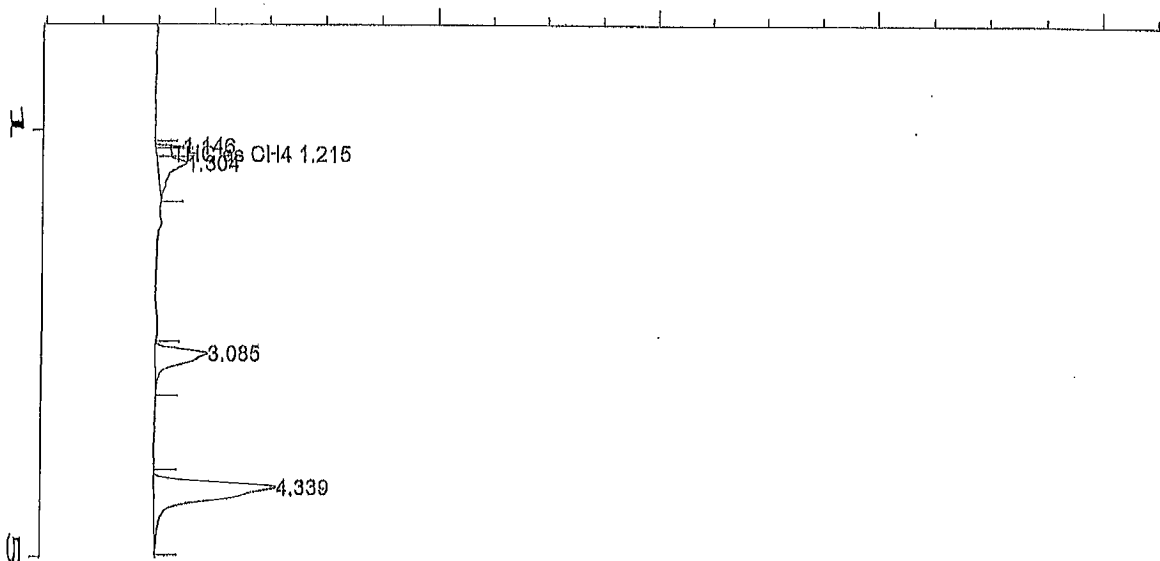


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1A009.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1A 73310 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:26 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:31 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1A - Tr#73310 - 10:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1A009.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.204	463	VV	0.057	1	0.379	THC as CH4
1.137	330	BV	0.031		0.278	* uncalibrated *
1.294	3589	VB	0.120		3.026	* uncalibrated *
3.063	2849	BB	0.124		2.402	* uncalibrated *
4.309	9260	BB	0.151		7.809	* uncalibrated *

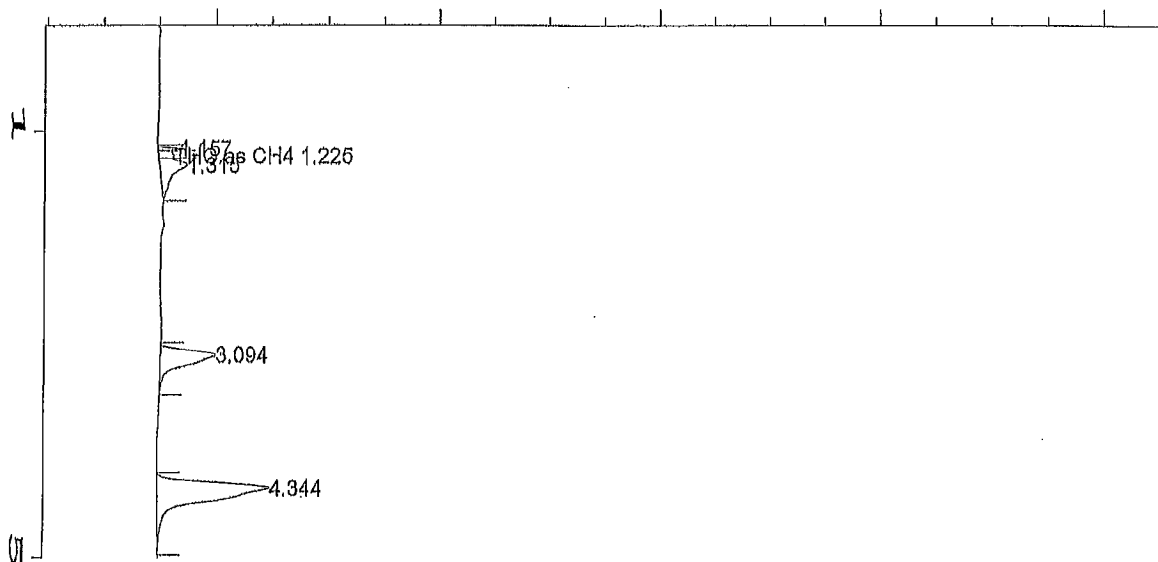


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1B010.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1B 73311 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1B - Tr#73311 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1B010.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.215	585	VV	0.068	1	0.479	THC as CH4
1.146	338	BV	0.028		0.285	* uncalibrated *
1.304	2539	VB	0.134		2.141	* uncalibrated *
3.085	4086	BB	0.122		3.445	* uncalibrated *
4.339	11655	BBA	0.147		9.828	* uncalibrated *

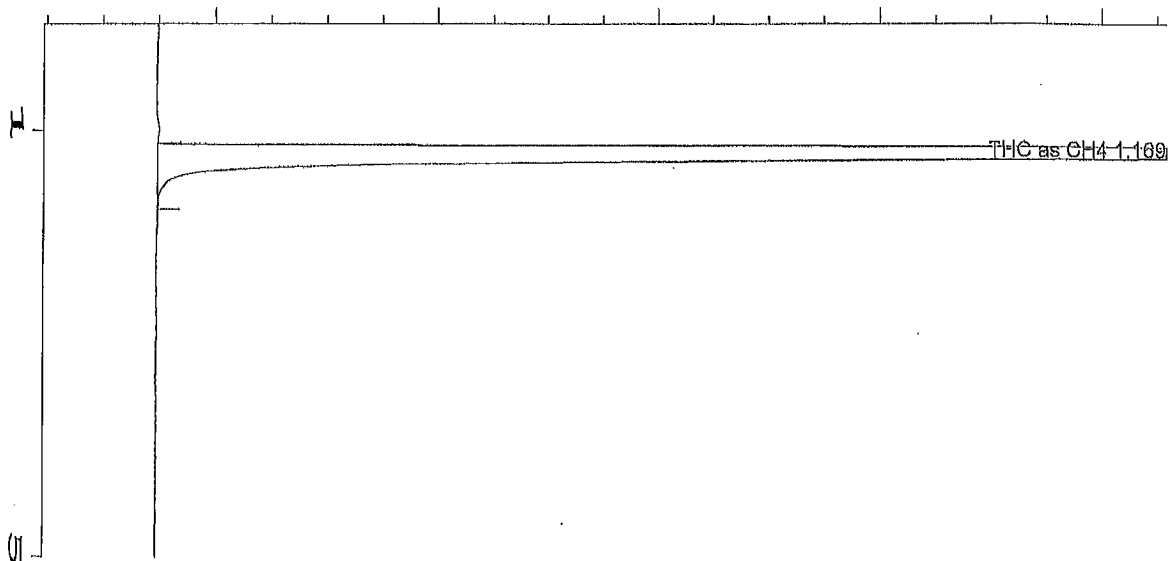


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T5B1B011.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T5B1B 73311 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:40 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:45 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan Controls / REM Technologies - Calgary - 2014-12-11 -  
 T5B1B - Tr#73311 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T5B1B011.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.225	560	VV	0.069	1	0.459	THC as CH4
1.157	296	BV	0.030		0.250	* uncalibrated *
1.315	2388	VB	0.132		2.013	* uncalibrated *
3.094	4288	BB	0.121		3.615	* uncalibrated *
4.344	10744	BBA	0.149		9.060	* uncalibrated *



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 External Standard Report  
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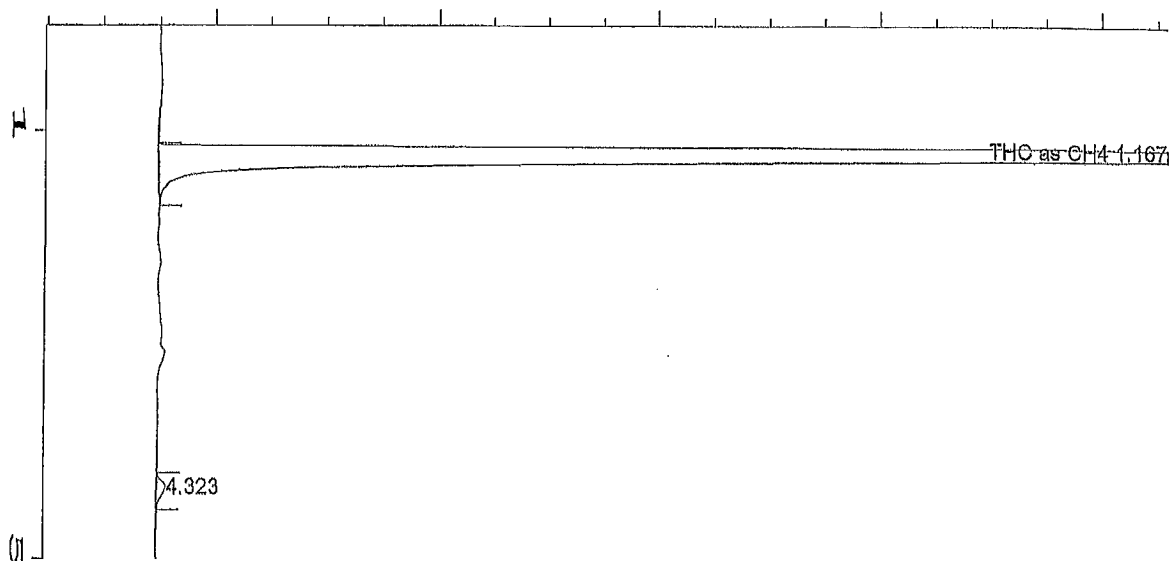
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0004.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:49 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0004.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	120170	BB	0.098	1	101.283	THC as CH4

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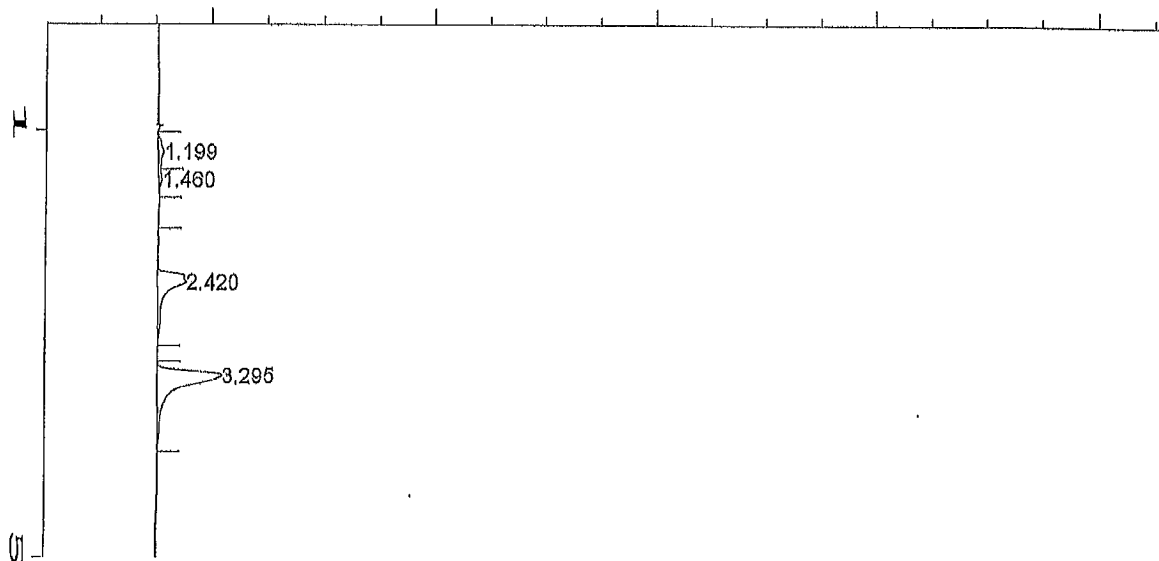


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0013.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 03:54 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 03:59 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0013.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	116880	BB	0.098	1	98.507	THC as CH4
4.323	775	BB	0.122		0.653	* uncalibrated *



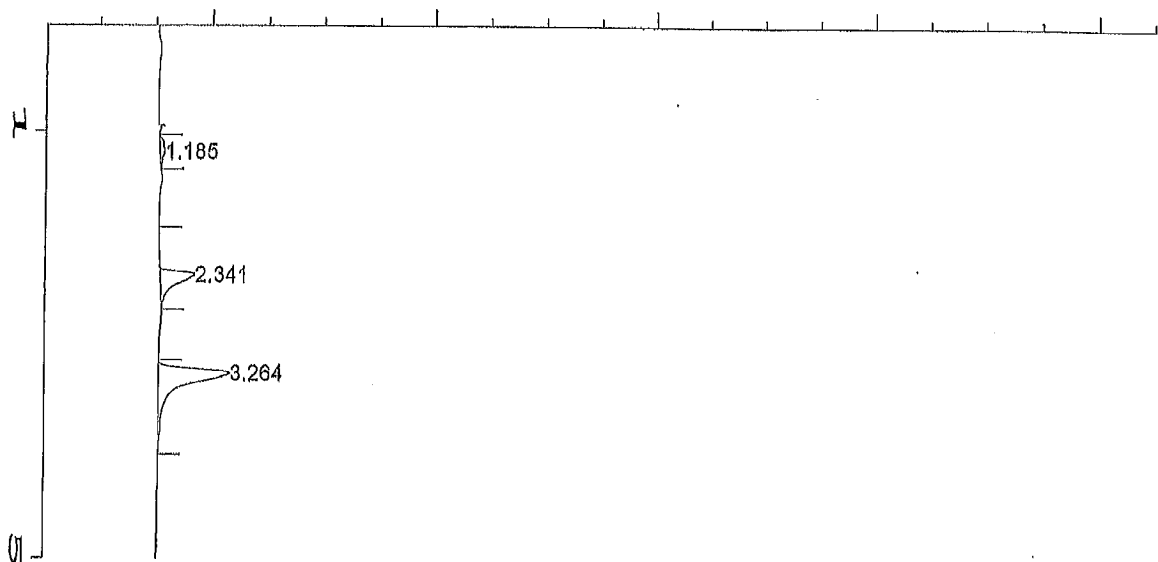
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1A068.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1A 73325 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:19 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:24 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1A -  
 Tr#73325 - 13:00 - 0.5 cc injection  
 11:35 BW

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1A068.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.199	555	FV	0.152		0.699	* uncalibrated *
1.460	226	VB	0.132		0.285	* uncalibrated *
2.420	2976	BB	0.155		3.750	* uncalibrated *
3.295	5802	BB	0.153		7.310	* uncalibrated *

Not all calibrated peaks were found



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 External Standard Report  
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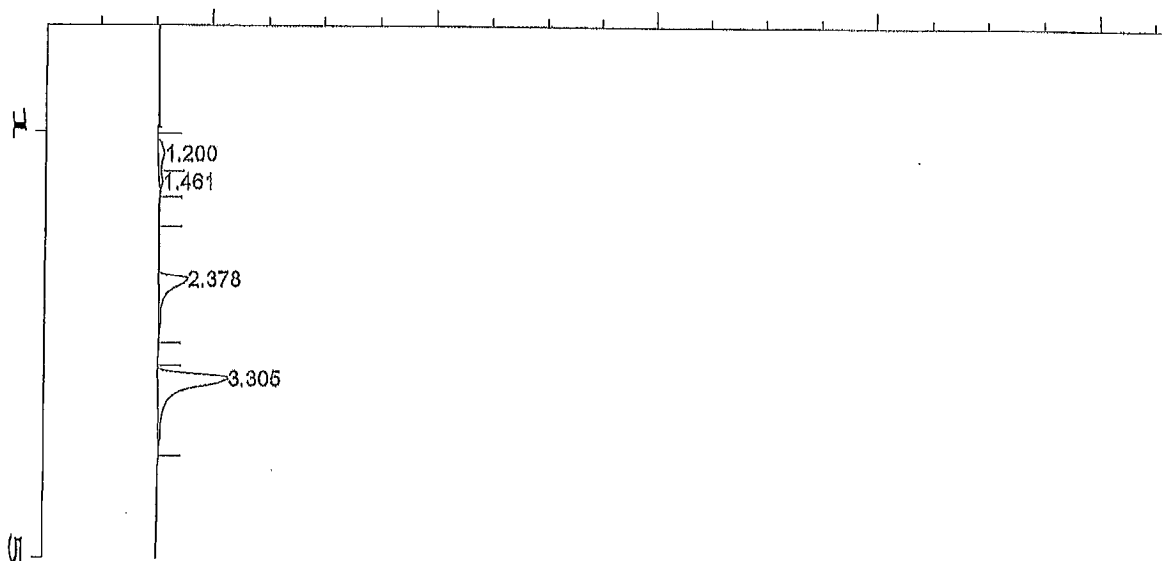
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1A069.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1A 73325 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:32 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1A -  
 Tr#73325 - 11:35 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1A069.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.185	400	PV	0.135		0.504	* uncalibrated *
2.341	2339	BB	0.109		2.948	* uncalibrated *
3.264	6383	BB	0.153		8.042	* uncalibrated *

Not all calibrated peaks were found

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External Standard Report

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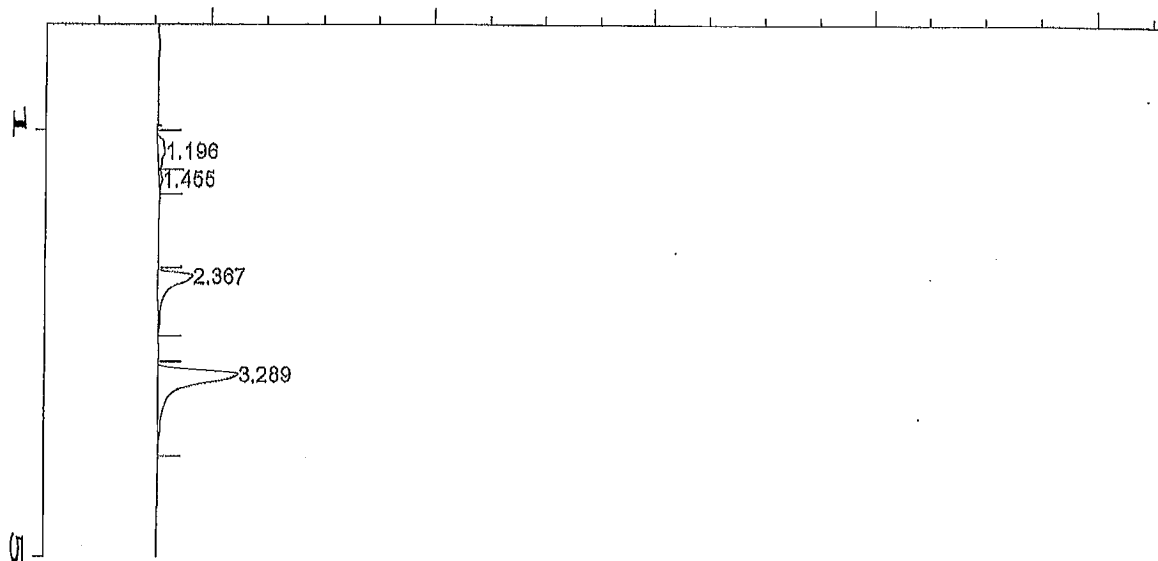
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1B070.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1B 73326 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:41 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:46 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1B -  
 Tr#73326 - 12:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1B070.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.200	679	BV	0.156		0.855	* uncalibrated *
1.461	228	VB	0.110		0.287	* uncalibrated *
2.378	2559	BB	0.131		3.225	* uncalibrated *
3.305	6318	BB	0.154		7.960	* uncalibrated *

Not all calibrated peaks were found

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External Standard Report

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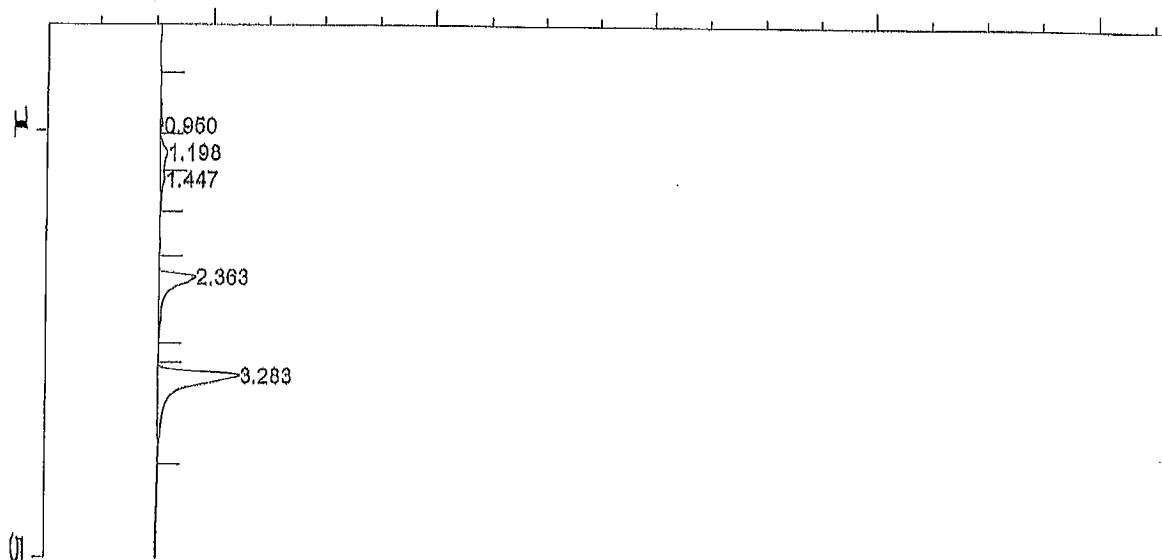
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T6B1B071.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T6B1B 73326 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:46 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:51 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B1B -  
 Tr#73326 - 12:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T6B1B071.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.196	812 BV	0.168			1.023	* uncalibrated *
1.455	199 VB	0.116			0.251	* uncalibrated *
2.367	2795 BB	0.138			3.522	* uncalibrated *
3.289	7117 PB	0.152			8.967	* uncalibrated *

Not all calibrated peaks were found

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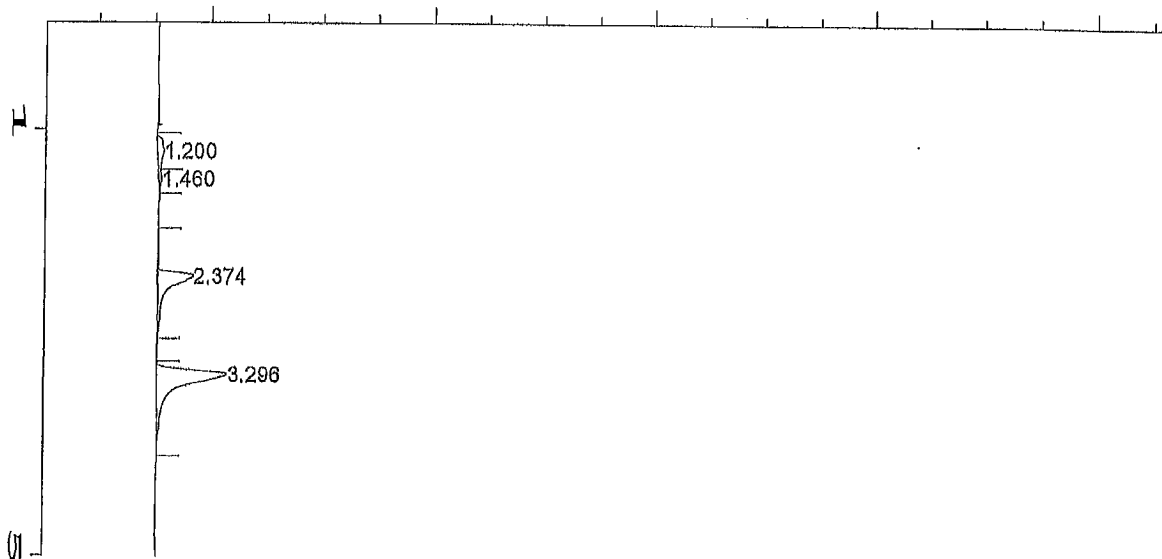
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1A072.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1A 73327 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:55 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:00 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1A -  
 Tr#73327 - 13:05 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1A072.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
0.950	306	BV	0.114		0.386	* uncalibrated *
1.198	738	PV	0.149		0.929	* uncalibrated *
1.447	386	VB	0.133		0.486	* uncalibrated *
2.363	2963	BB	0.138		3.733	* uncalibrated *
3.283	7102	BB	0.134		8.947	* uncalibrated *

Not all calibrated peaks were found



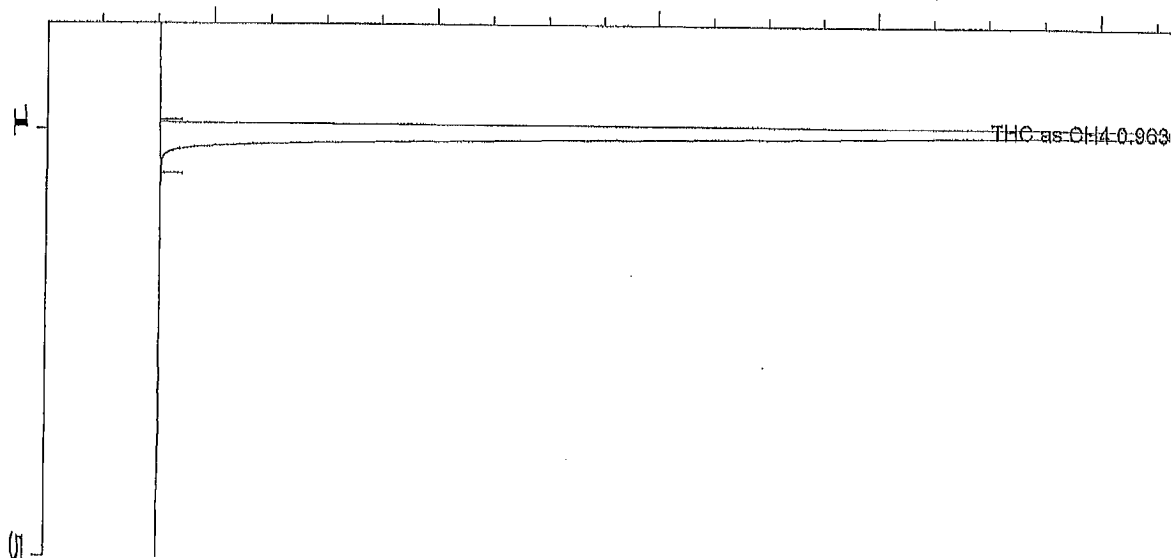
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1A073.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1A 73327 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:07 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:12 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1A -  
 Tr#73327 - 13:05 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1A073.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.200	794	BV	0.170		1.00	* uncalibrated *
1.460	200	VB	0.102		0.252	* uncalibrated *
2.374	2842	BB	0.124		3.580	* uncalibrated *
3.296	6043	BB	0.133		7.613	* uncalibrated *

Not all calibrated peaks were found



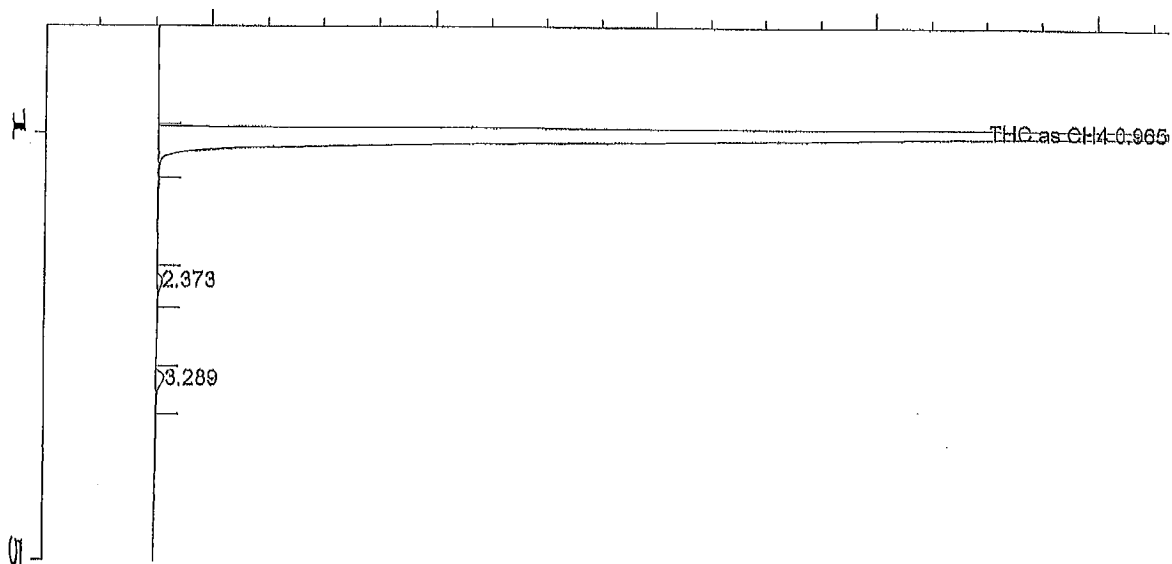
External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0067.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:05 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 12:11 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0067.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.963	80767	BV	0.097	1	101.171	THC as CH4



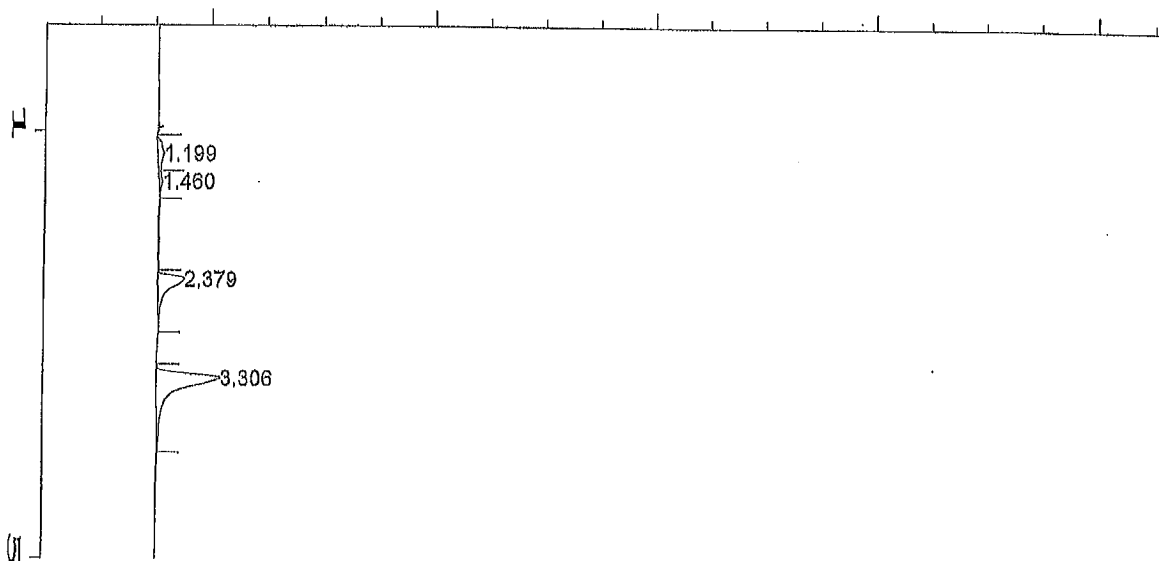


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:17 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:22 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	80186	BV	0.096	1	100.433	THC as CH4
2.373	366	BB	0.119		0.461	* uncalibrated *
3.289	638	BB	0.135		0.803	* uncalibrated *



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External Standard Report

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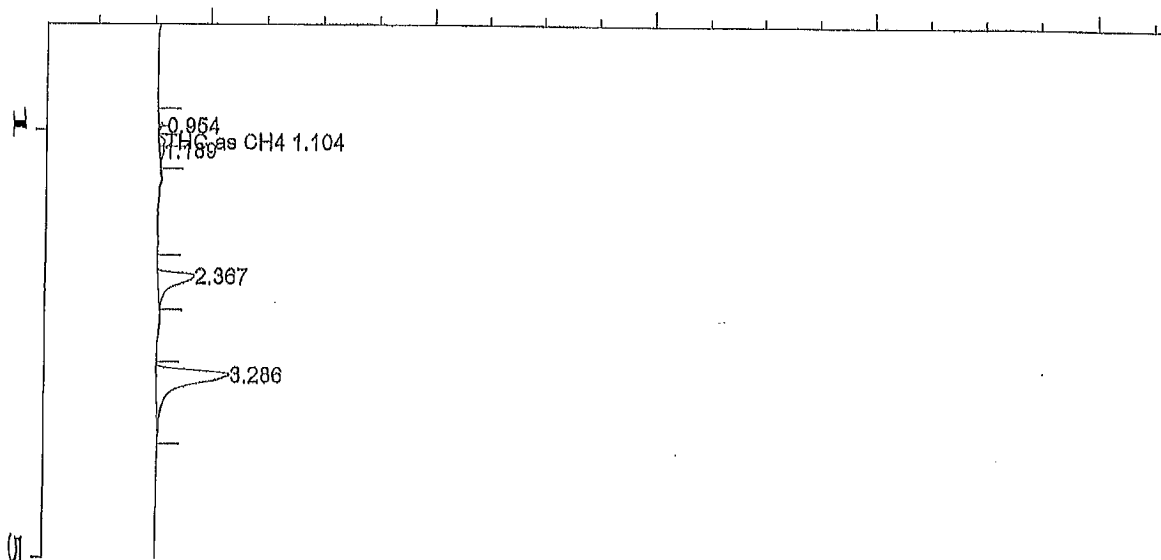
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B075.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:27 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:32 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B075.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.199	662	BV	0.156		0.834	* uncalibrated *
1.460	250	VB	0.109		0.315	* uncalibrated *
2.379	2059	BB	0.133		2.594	* uncalibrated *
3.306	5430	BB	0.148		6.841	* uncalibrated *

Not all calibrated peaks were found

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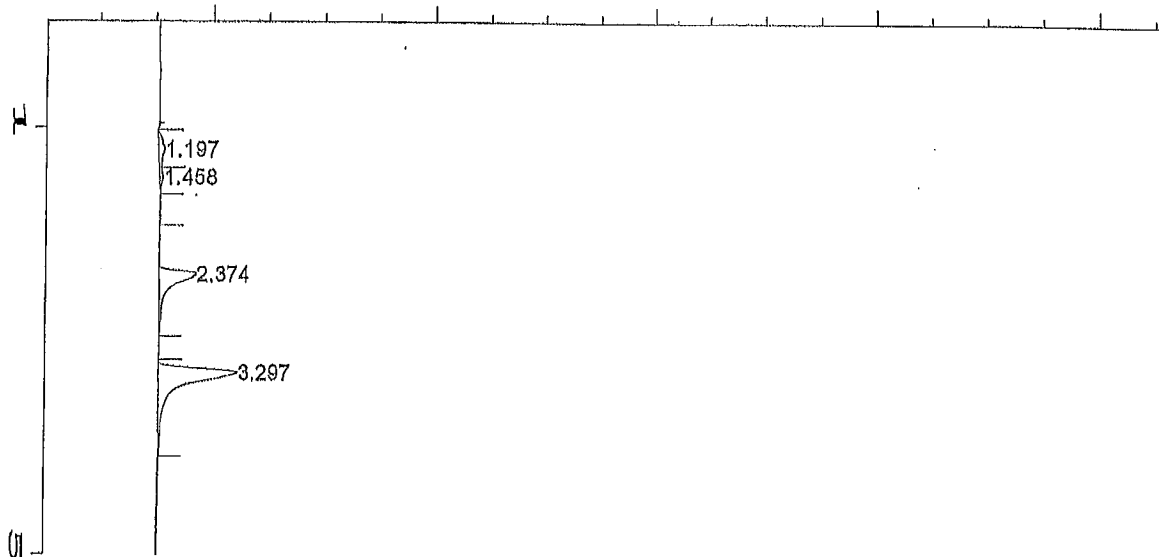


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B077.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:39 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:44 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
 Tr#73328 - 13:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B077.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.104	237	PV	0.071	1	0.230	THC as CH4
0.954	115	BV	0.028		0.144	* uncalibrated *
1.189	256	VB	0.092		0.322	* uncalibrated *
2.367	2523	BV	0.121		3.179	* uncalibrated *
3.286	6147	BB	0.144		7.744	* uncalibrated *



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 External Standard Report  
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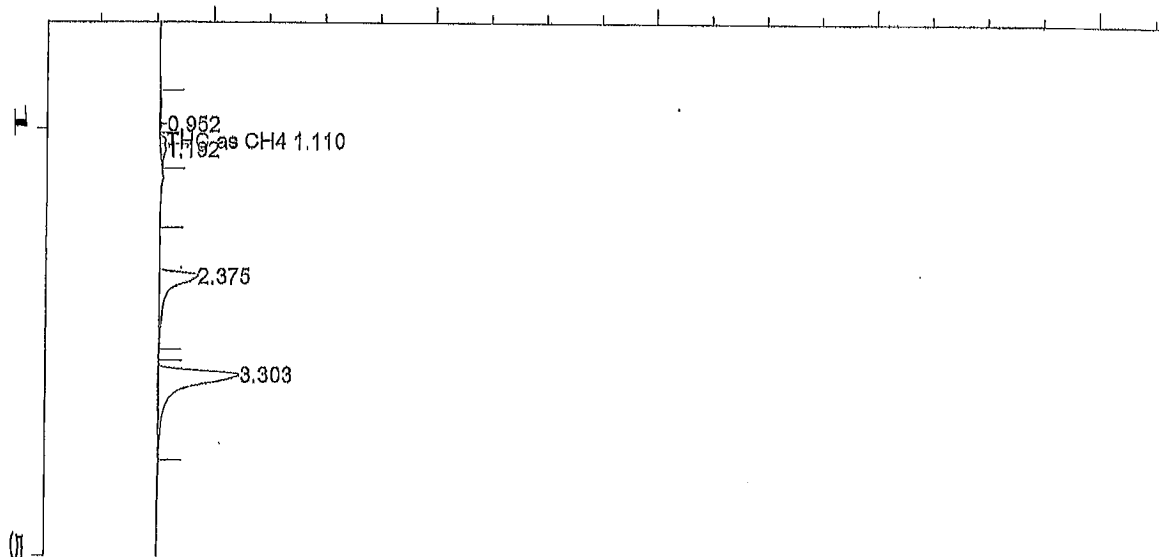
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T7B1B076.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 *g Sw* Vial Number :  
 Sample Name : T7B1B 73328 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:33 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:38 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount : *8 Sw*  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B1B -  
                   Tr#73328 - 12:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T7B1B076.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.197	683	BV	0.158		0.861	* uncalibrated *
1.458	233	VB	0.099		0.294	* uncalibrated *
2.374	3042	BB	0.141		3.832	* uncalibrated *
3.297	6828	BB	0.147		8.602	* uncalibrated *

Not all calibrated peaks were found

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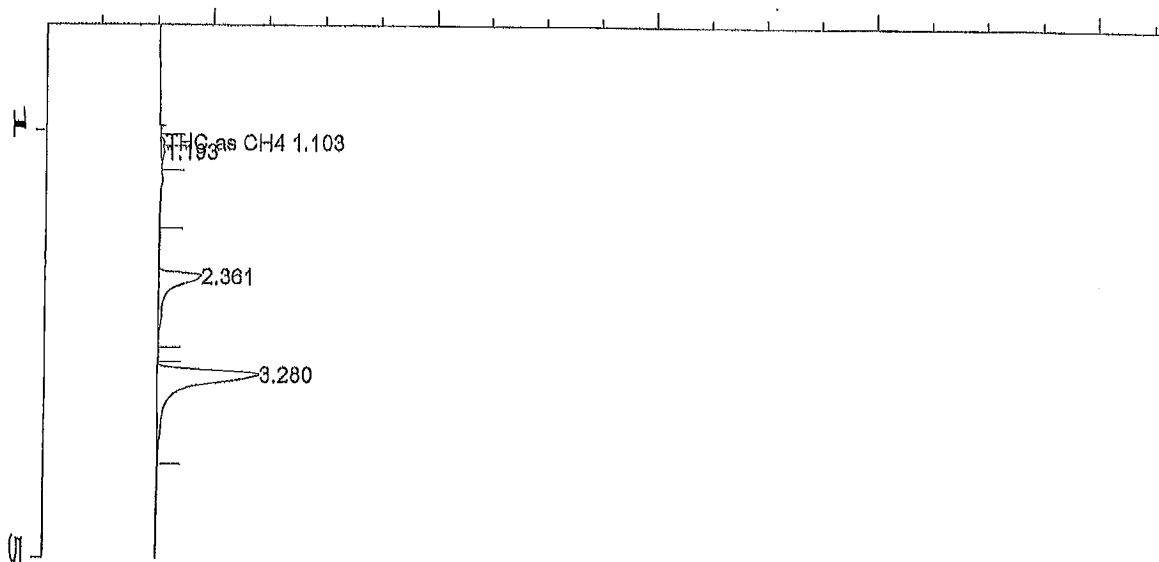


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1A079.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1A 73329 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:51 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:56 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1A -  
 Tr#73329 - 14:40 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1A079.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.110	205	FV	0.064	1	0.199	THC as CH4
0.952	218	BV	0.058		0.275	* uncalibrated *
1.192	345	VB	0.106		0.434	* uncalibrated *
2.375	3425	BB	0.149		4.315	* uncalibrated *
3.303	7192	BB	0.152		9.061	* uncalibrated *



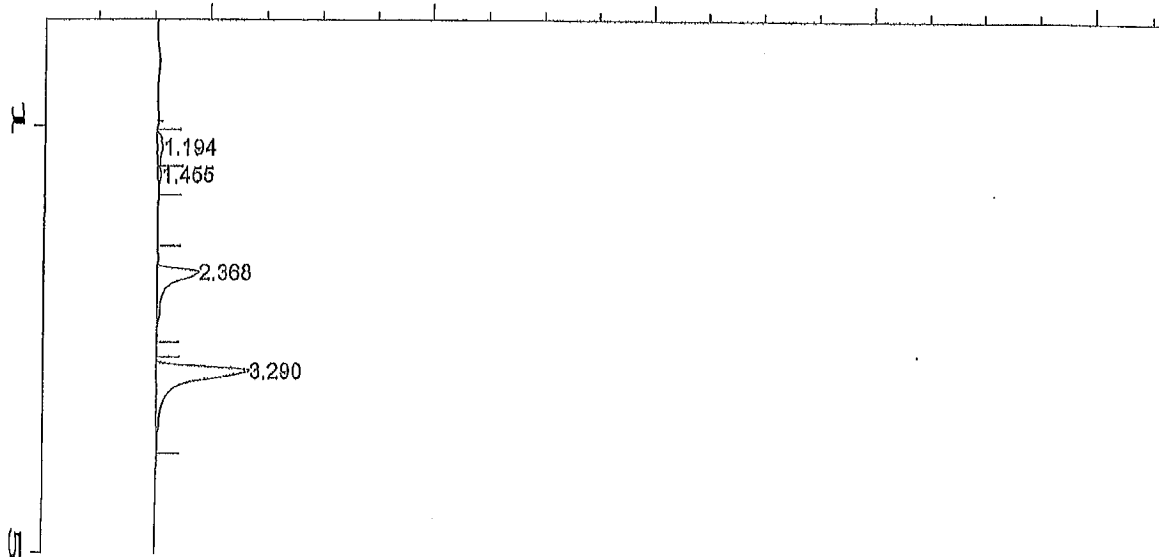
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 External Standard Report  
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Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1B080.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1B 73330 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:02 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:08 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1B -  
 Tr#73330 - 15:15 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1B080.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.103	153	BV	0.064	1	0.149	THC as CH4
1.193	249	VV	0.096		0.313	* uncalibrated *
2.361	3543	BB	0.139		4.464	* uncalibrated *
3.280	8857	BB	0.148		11.159	* uncalibrated *

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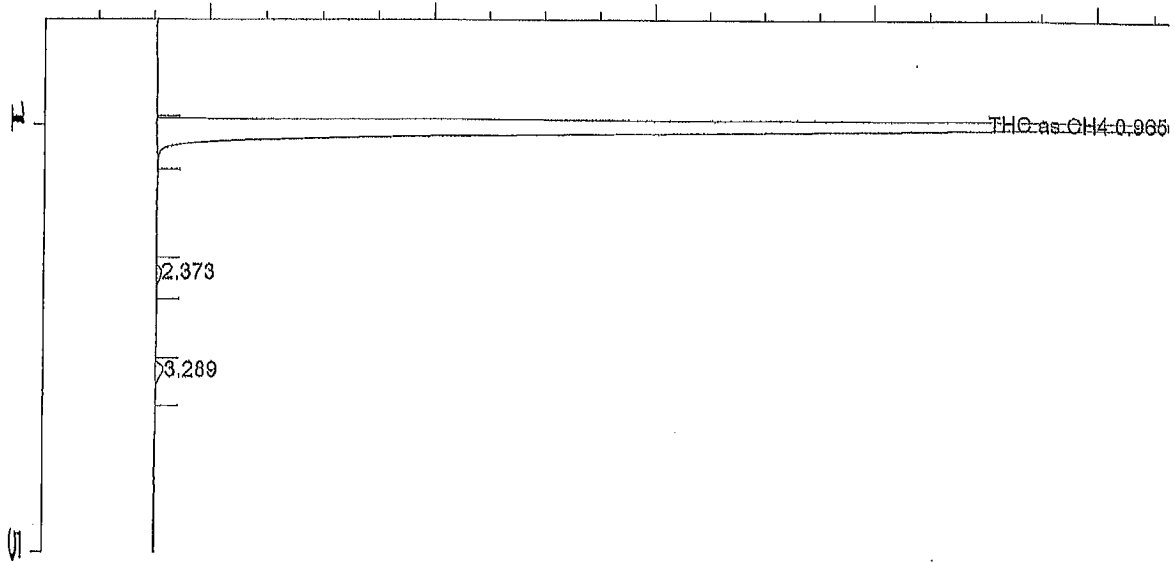
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T8B1B081.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T8B1B 73330 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:09 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:14 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B1B -  
 Tr#73330 - 15:15 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T8B1B081.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.194	615	BV	0.162		0.775	* uncalibrated *
1.455	215	VB	0.113		0.270	* uncalibrated *
2.368	3392	BB	0.137		4.274	* uncalibrated *
3.290	7837	BB	0.144		9.874	* uncalibrated *

Not all calibrated peaks were found



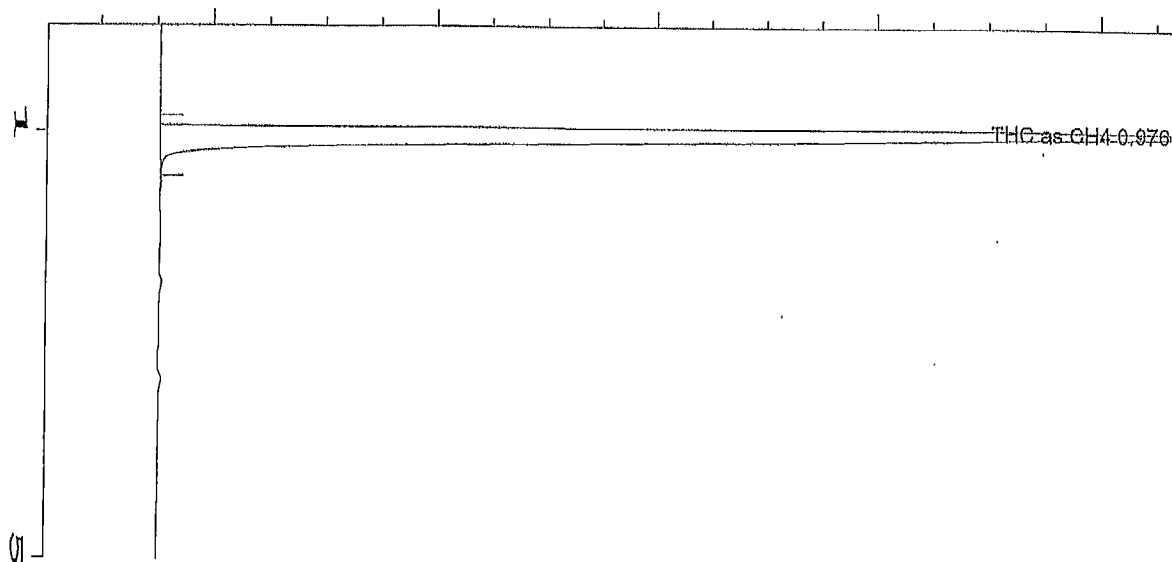
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:17 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0074.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	80186	BV	0.096	1	100.433	THC as CH4
2.373	366	BB	0.119		0.461	* uncalibrated *
3.289	638	BB	0.135		0.803	* uncalibrated *





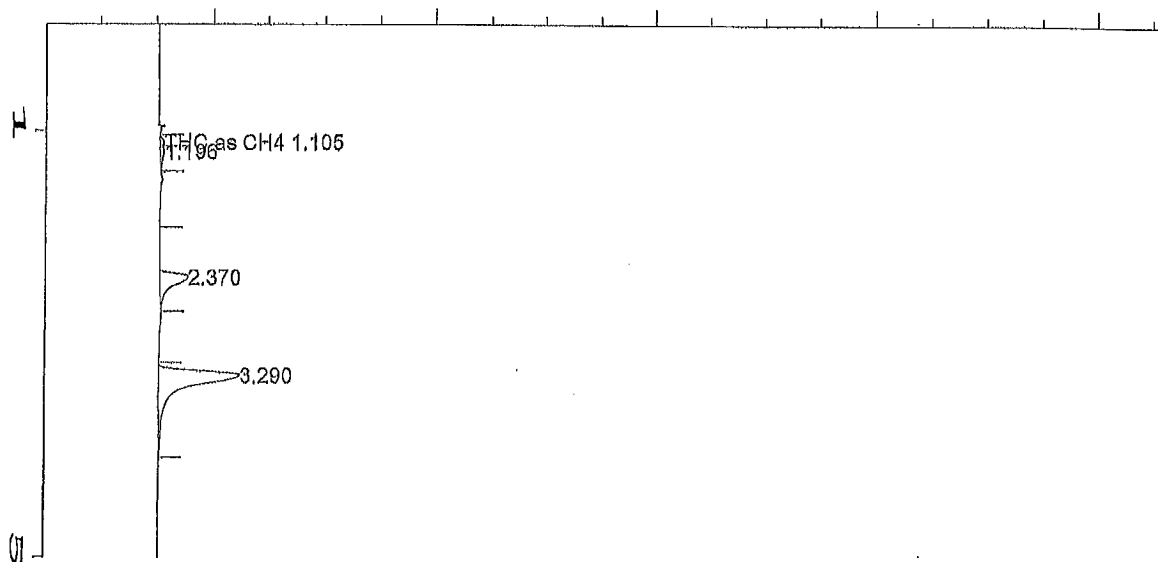
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:18 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:23 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.976	79107	BV	0.105	1	99.060	THC as CH4

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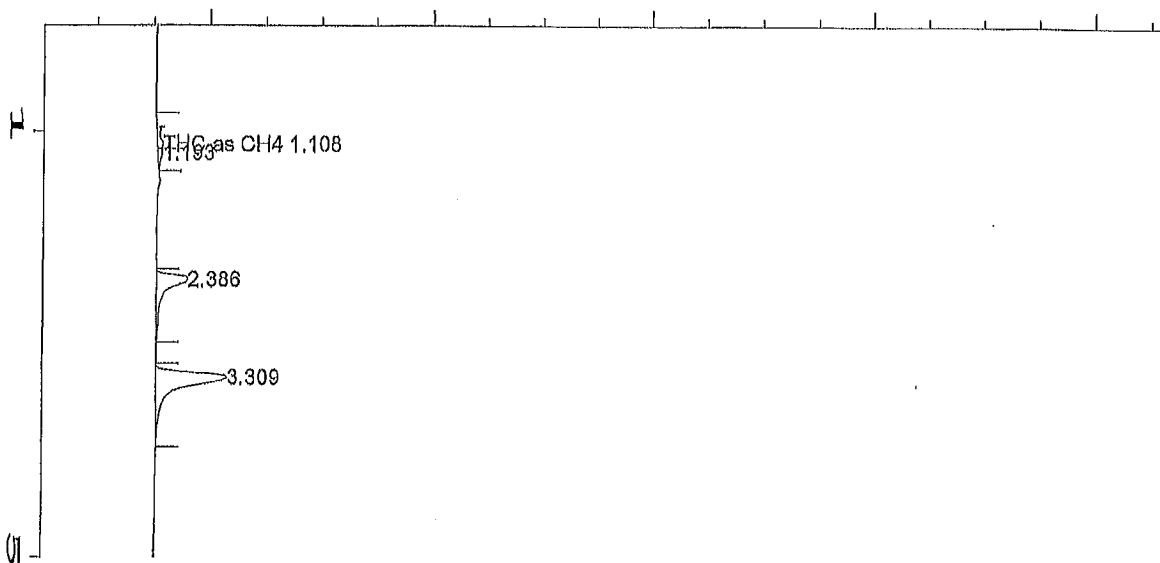


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1A083.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1A 73331 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:30 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:35 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1A -  
 Tr#73331 - 16:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1A083.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.105	174	VV	0.071	1	0.169	THC as CH4
1.196	261	VB	0.096		0.328	* uncalibrated *
2.370	1976	BB	0.123		2.489	* uncalibrated *
3.290	7188	BB	0.150		9.057	* uncalibrated *

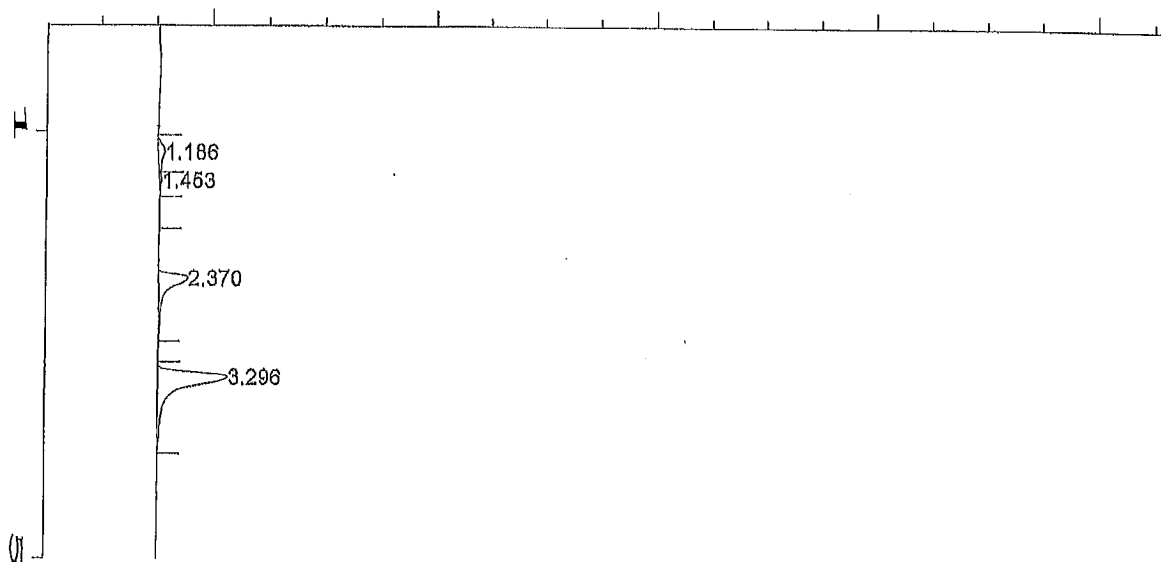


External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1A084.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1A 73331 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:37 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:42 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1A -  
 Tr#73331 - 16:10 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1A084.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.108	399	BV	0.142	1	0.388	THC as CH4
1.193	240	VB	0.096		0.302	* uncalibrated *
2.386	2609	BB	0.140		3.287	* uncalibrated *
3.309	5999	BB	0.144		7.559	* uncalibrated *



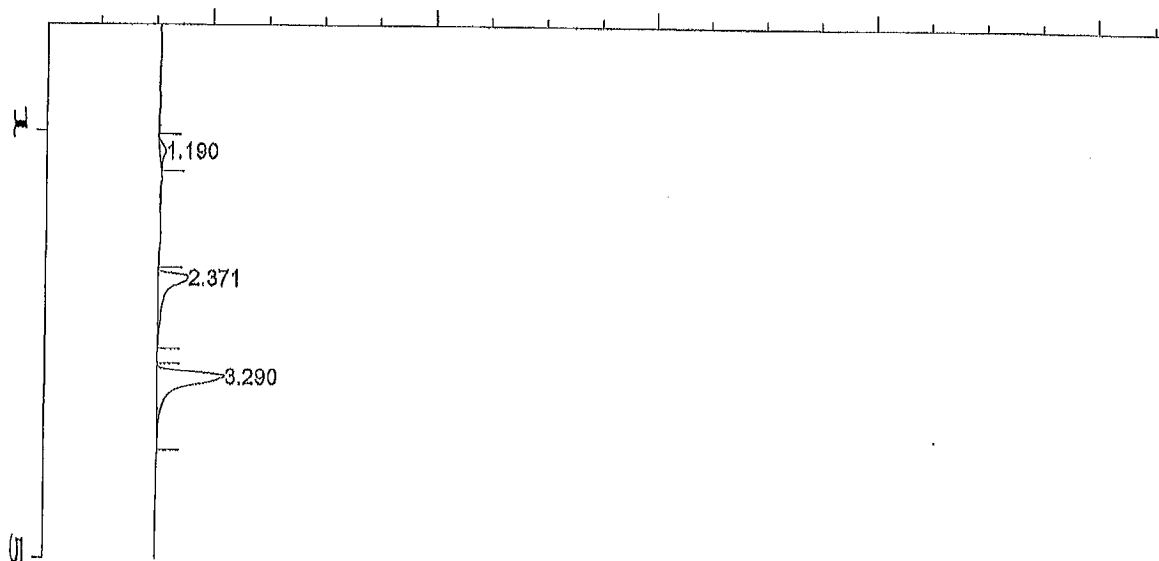
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1B085.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1B 73332 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:47 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:52 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1B -  
 Tr#73332 - 16:45 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1B085.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.186	712	BV	0.156		0.897	* uncalibrated *
1.453	168	VB	0.096		0.212	* uncalibrated *
2.370	2520	BB	0.142		3.175	* uncalibrated *
3.296	6059	BB	0.149		7.633	* uncalibrated *

Not all calibrated peaks were found



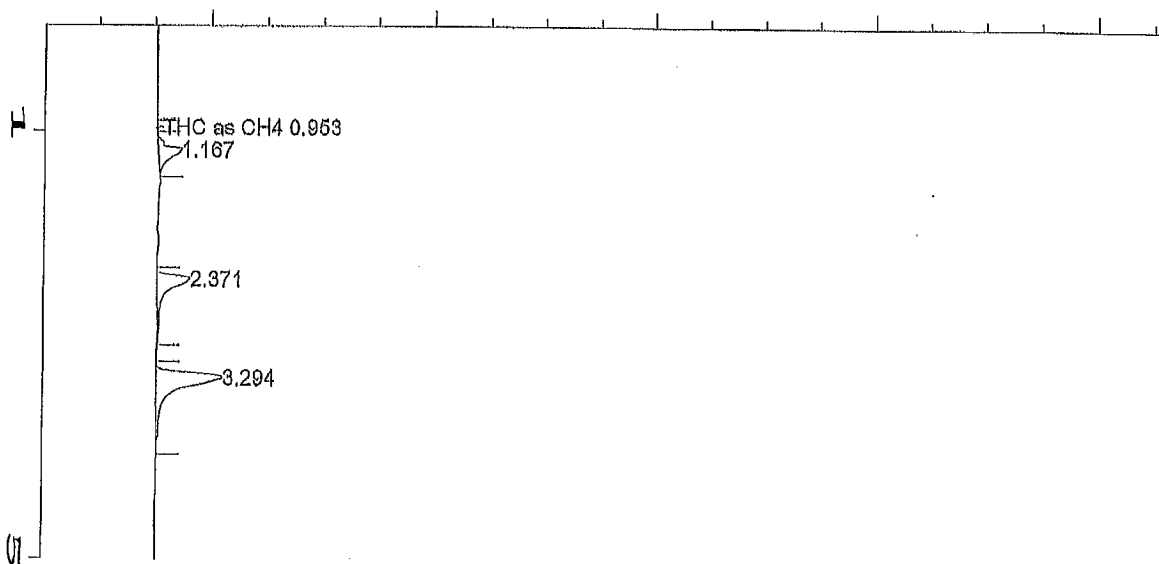
# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T9B1B086.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T9B1B 73332 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:53 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:58 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B1B -  
 Tr#73332 - 16:45 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T9B1B086.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	* not found *			1		THC as CH4
1.190	482	FV	0.123		0.607	* uncalibrated *
2.371	2614	BB	0.147		3.293	* uncalibrated *
3.290	5724	BB	0.145		7.212	* uncalibrated *

Not all calibrated peaks were found

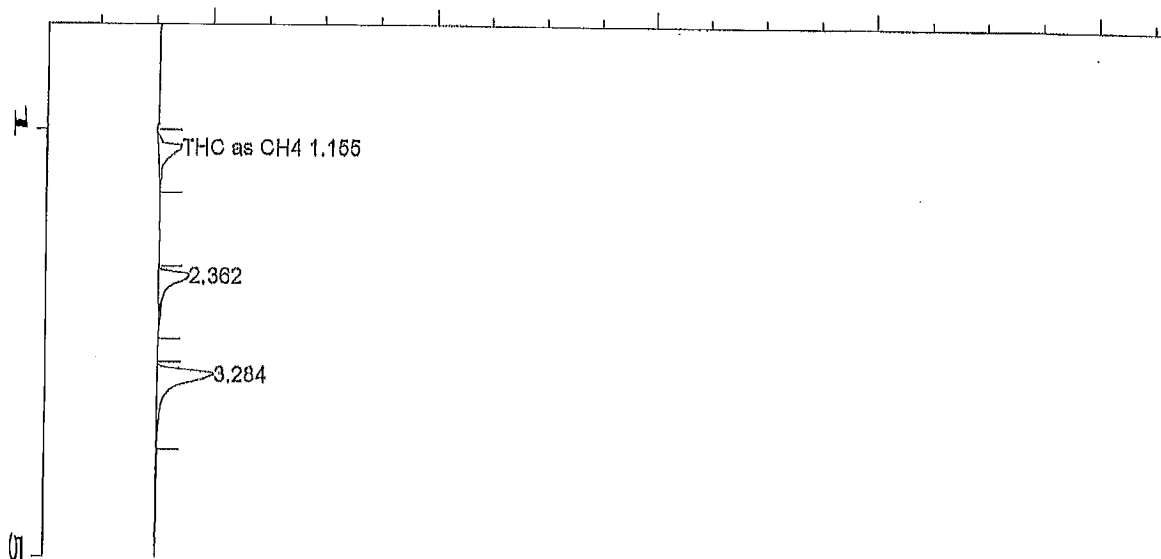


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A87.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:09 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:14 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A87.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.953	28	BV	0.023	1	0.0273	THC as CH4
1.167	1643	FV	0.117		2.070	* uncalibrated *
2.371	2694	BB	0.139		3.394	* uncalibrated *
3.294	5604	BB	0.147		7.061	* uncalibrated *

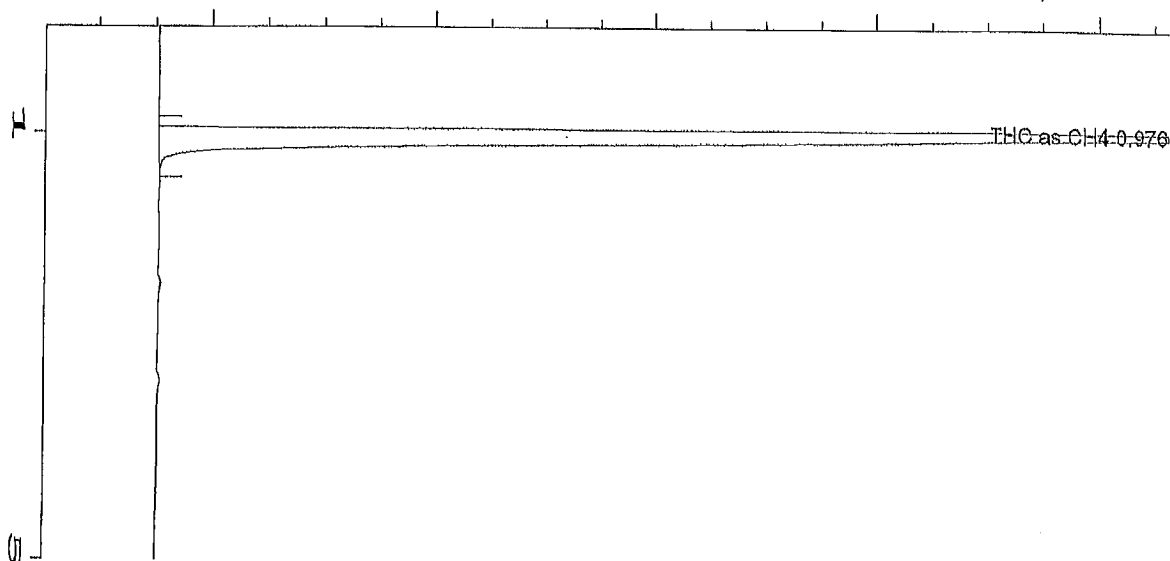


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A89.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:22 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:27 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A89.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.155	2035	BB	0.136	1	1.977	THC as CH4
2.362	2537	BB	0.141		3.196	* uncalibrated *
3.284	4780	BB	0.146		6.022	* uncalibrated *



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 External Standard Report  
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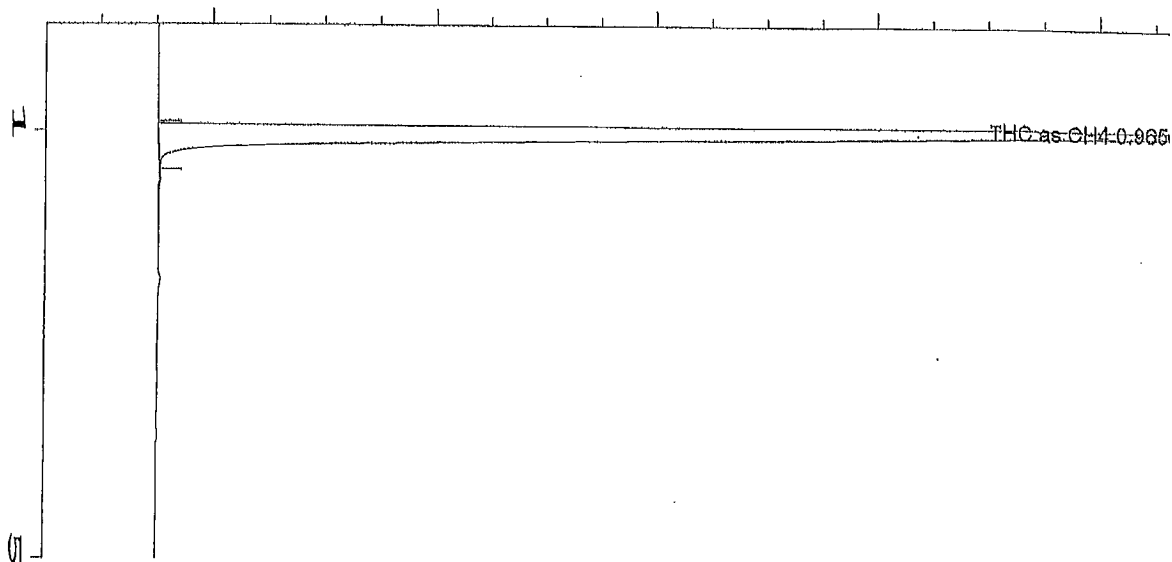
Data File Name : C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Span 0.5c Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:18 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 02:25 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\SPAN0082.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.976	79107	BV	0.105	1	99.060	THC as CH4

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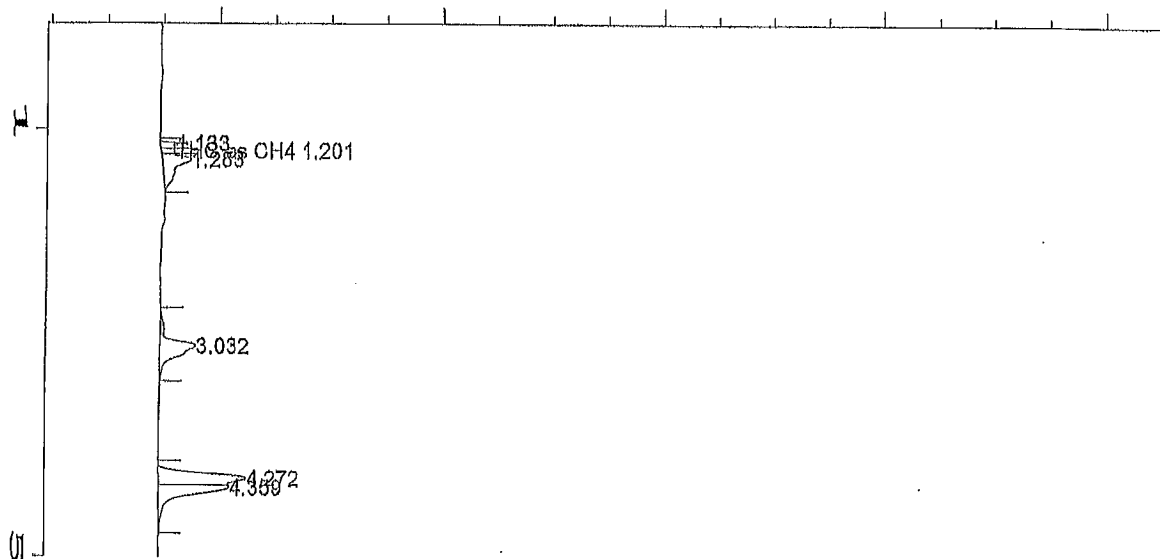
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 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\T10B1A90.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : T10B1A 73333 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:43 PM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 03:48 PM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1A -  
 Tr#73333 - 08:25 - 0.5 cc injection

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\T10B1A90.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.965	78410	BV	0.105	1	98.174	THC as CH4

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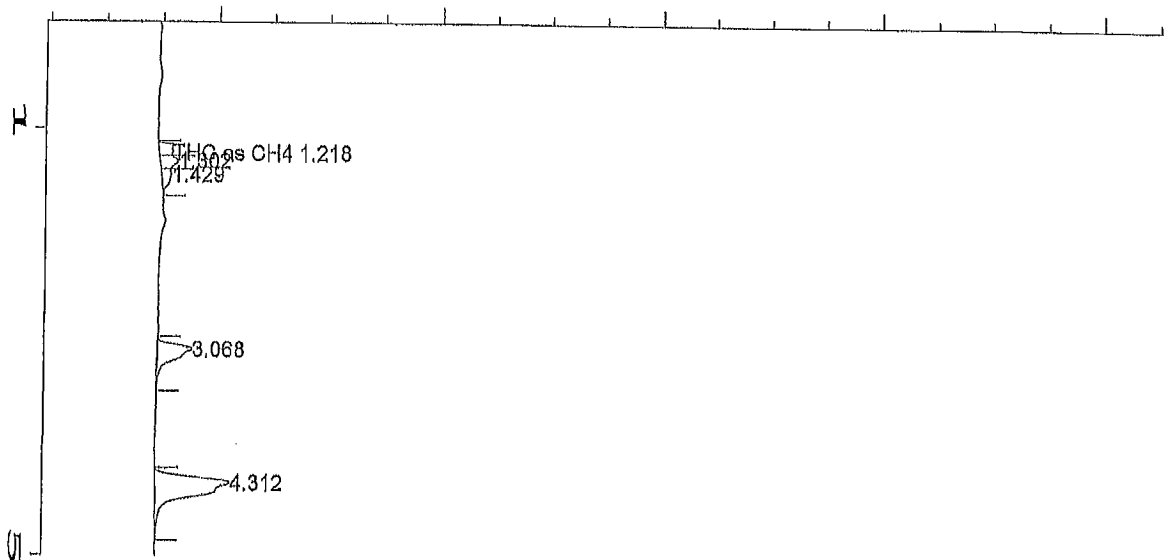


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T10B1B21.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T10B1B 73334 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:28 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:33 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1B -  
 Tr#73334 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T10B1B21.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.201	359	VV	0.048	1	0.268	THC as CH4
1.133	446	BV	0.046		0.364	* uncalibrated *
1.283	2349	VB	0.123		1.919	* uncalibrated *
3.032	3223	BB	0.137		2.633	* uncalibrated *
4.272	4933	BV	0.095		4.029	* uncalibrated *
4.359	4119	VB	0.093		3.364	* uncalibrated *

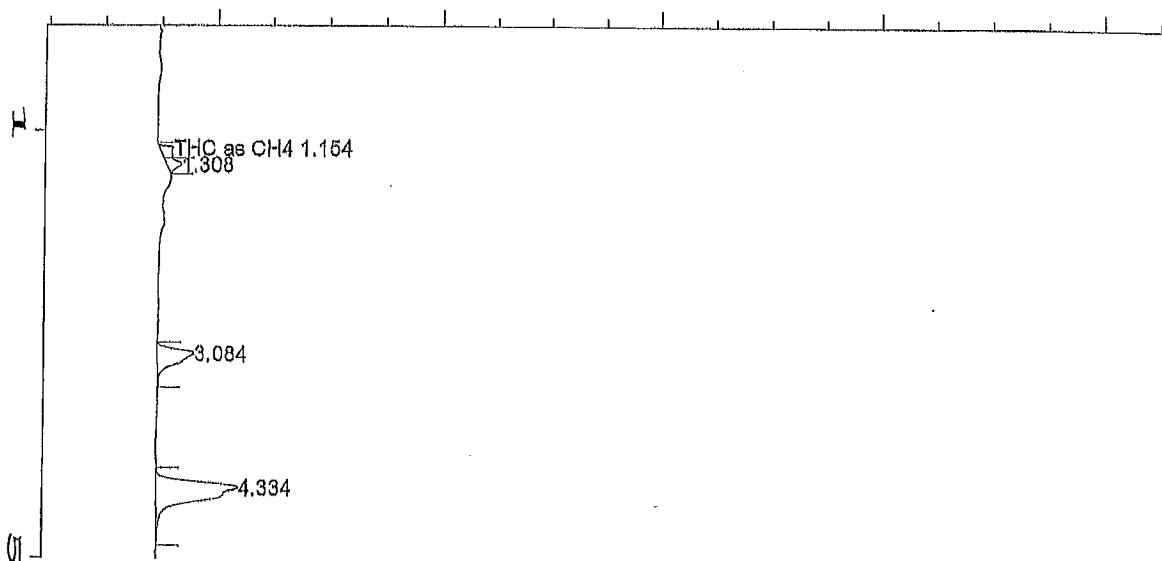


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T10B1B22.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T10B1B 73334 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10B1B -  
 Tr#73334 - 09:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T10B1B22.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.218	828	BV	0.113	1	0.618	THC as CH4
1.302	989	VV	0.083		0.808	* uncalibrated *
1.429	783	VB	0.113		0.639	* uncalibrated *
3.068	2708	BB	0.124		2.212	* uncalibrated *
4.312	7585	BB	0.156		6.195	* uncalibrated *

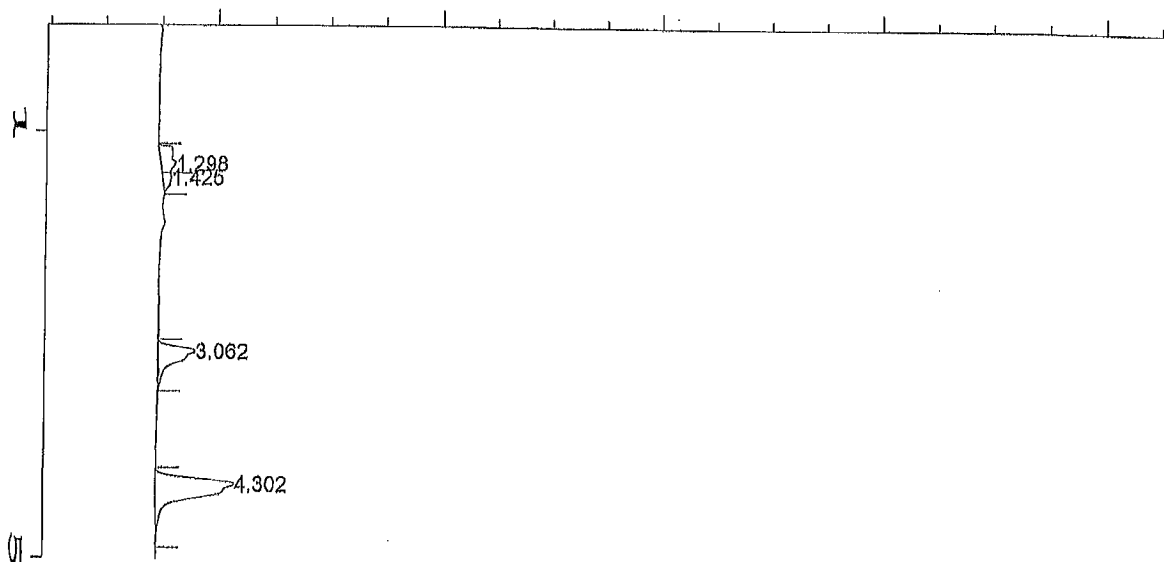


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1A23.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1A 73335 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:41 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:46 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1A -  
 Tr#73335 - 09:55 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1A23.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.154	635	BV	0.085	1	0.474	THC as CH4
1.308	695	VB	0.081		0.567	* uncalibrated *
3.084	2884	BB	0.122		2.356	* uncalibrated *
4.334	8289	BB	0.152		6.770	* uncalibrated *



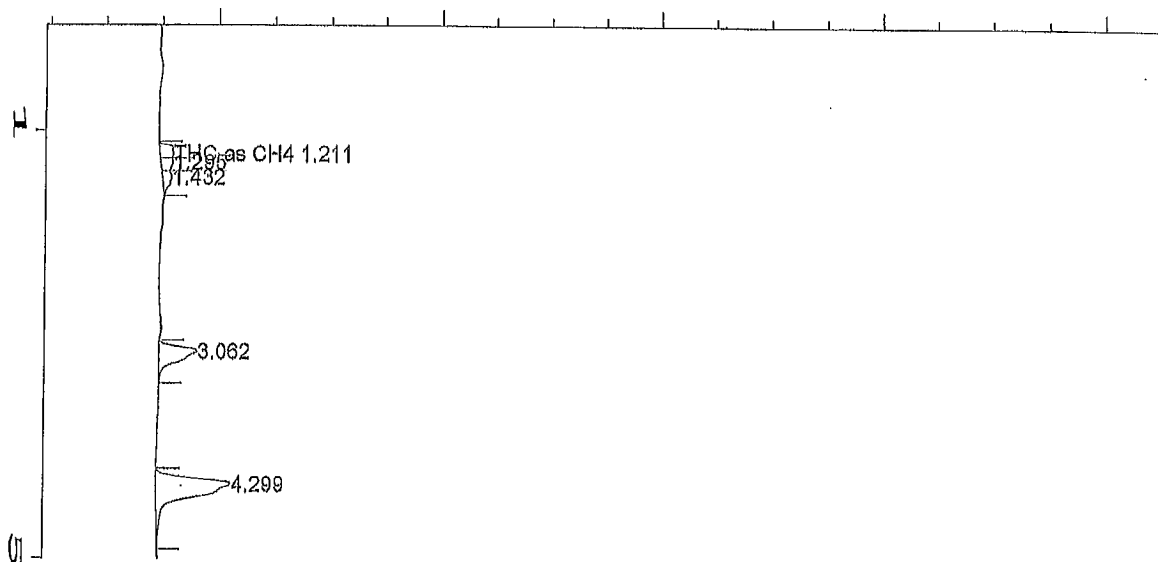
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1A24.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1A 73335 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:47 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:52 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1A -  
 Tr#73335 - 09:55 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1A24.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	* not found *			1		THC as CH4
1.298	1665	BV	0.158		1.360	* uncalibrated *
1.425	640	VB	0.109		0.522	* uncalibrated *
3.062	3164	BB	0.133		2.584	* uncalibrated *
4.302	8104	BV	0.160		6.619	* uncalibrated *

Not all calibrated peaks were found

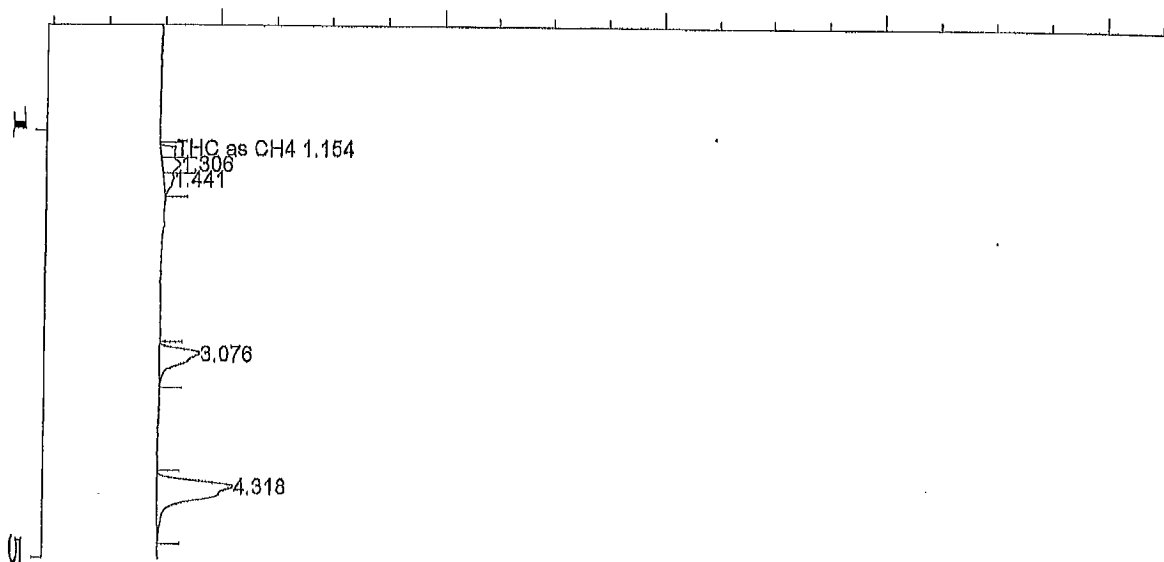


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1B25.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1B 73336 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:55 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:00 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1B -  
 Tr#73336 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1B25.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.211	866	BV	0.099	1	0.646	THC as CH4
1.295	656	VV	0.085		0.536	* uncalibrated *
1.432	695	VB	0.118		0.568	* uncalibrated *
3.062	2925	BB	0.121		2.389	* uncalibrated *
4.299	7520	BB	0.155		6.142	* uncalibrated *

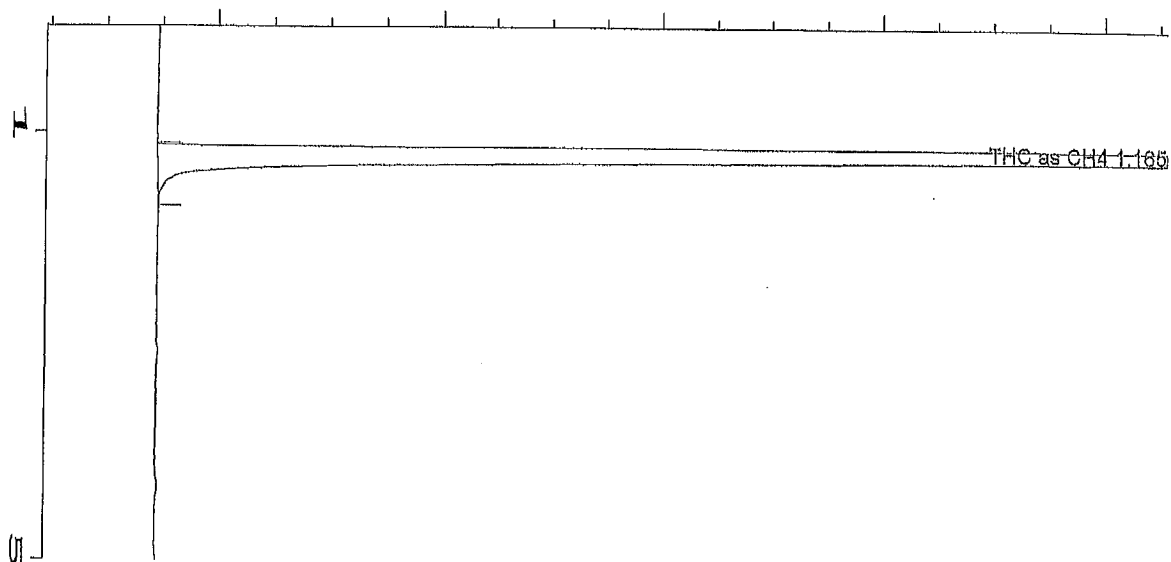


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T11B1B26.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T11B1B 73336 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:08 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:13 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T11B1B -  
 Tr#73336 - 10:40 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T11B1B26.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.154	791	BV	0.095	1	0.590	THC as CH4
1.306	1115	VV	0.092		0.911	* uncalibrated *
1.441	714	VB	0.113		0.583	* uncalibrated *
3.076	3191	BB	0.121		2.606	* uncalibrated *
4.318	7751	BB	0.157		6.331	* uncalibrated *



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 External Standard Report  
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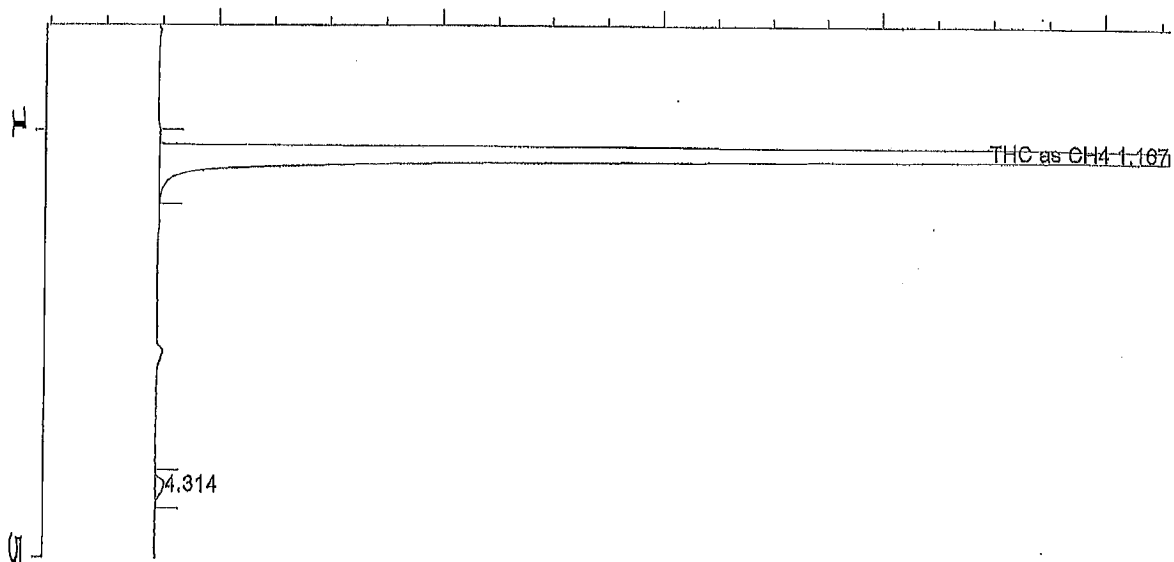
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0019.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 12:06 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:11 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0019.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	122101	BB	0.094	1	99.962	THC as CH4

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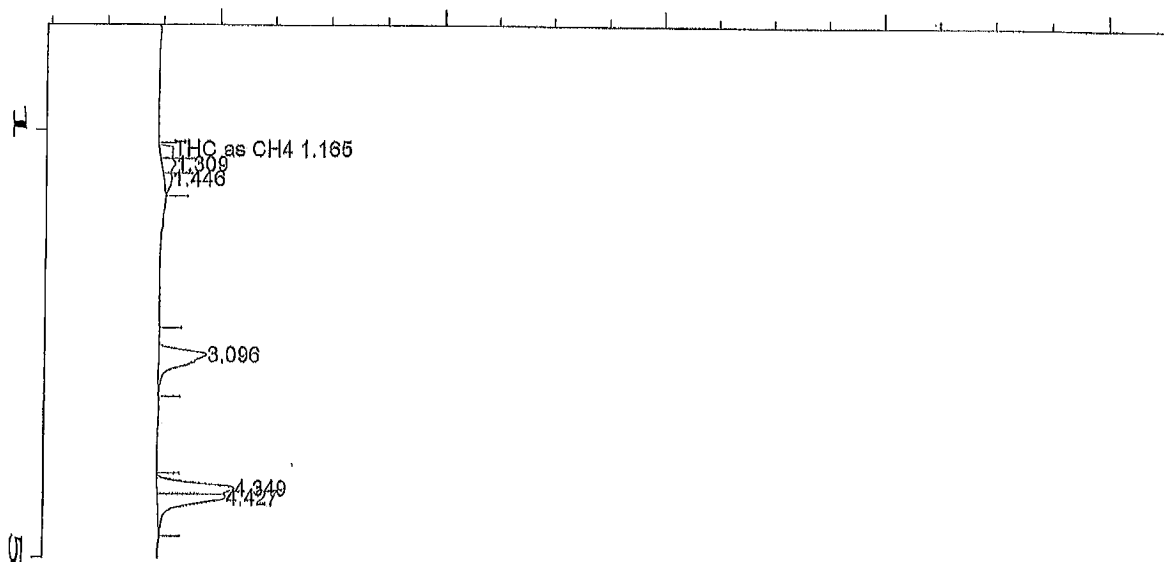


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:18 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	121584	BB	0.092	1	99.537	THC as CH4
4.314	762	BB	0.122		0.622	* uncalibrated *

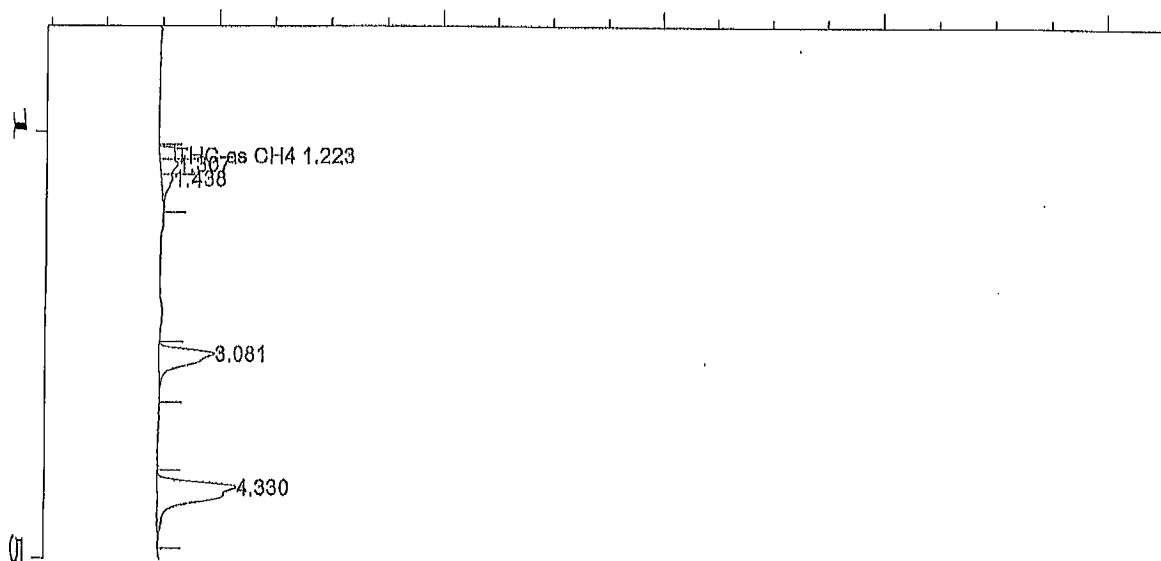


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1A28.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1A 73337 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:27 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:33 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1A -  
 Tr#73337 - 11:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1A28.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.165	773	BV	0.093	1	0.577	THC as CH4
1.309	824	VV	0.099		0.673	* uncalibrated *
1.446	576	VB	0.110		0.471	* uncalibrated *
3.096	3969	BV	0.131		3.241	* uncalibrated *
4.349	4252	BV	0.092		3.473	* uncalibrated *
4.427	3956	VB	0.094		3.231	* uncalibrated *

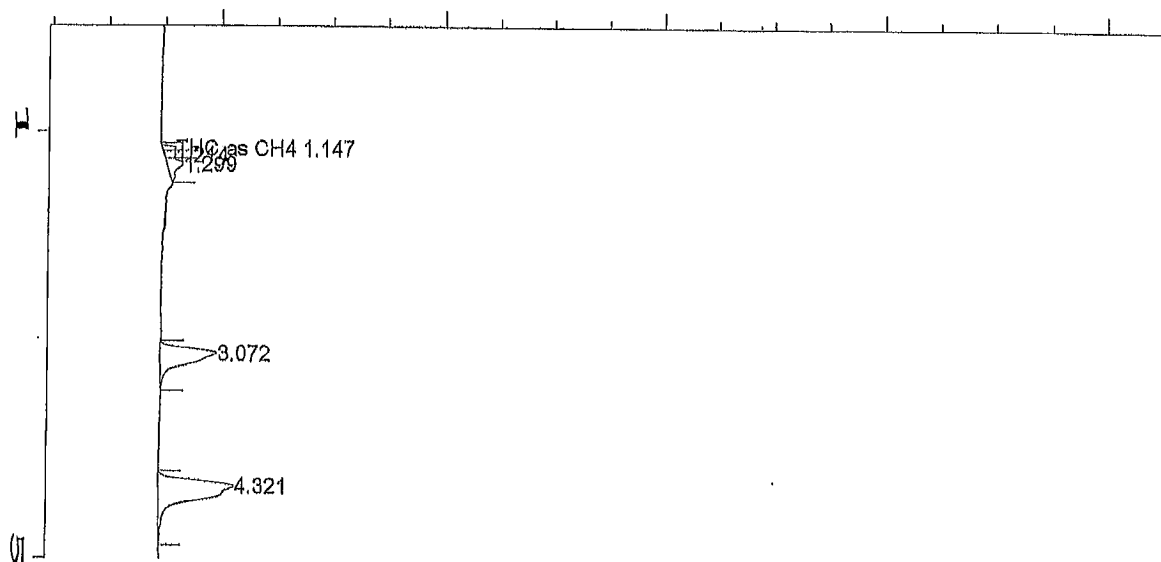


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1A29.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1A 73337 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:34 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:39 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1A -  
 Tr#73337 - 11:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1A29.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.223	925	BV	0.110	1	0.690	THC as CH4
1.307	1099	VV	0.105		0.898	* uncalibrated *
1.438	968	VB	0.119		0.791	* uncalibrated *
3.081	4475	BB	0.127		3.655	* uncalibrated *
4.330	8311	BB	0.161		6.788	* uncalibrated *

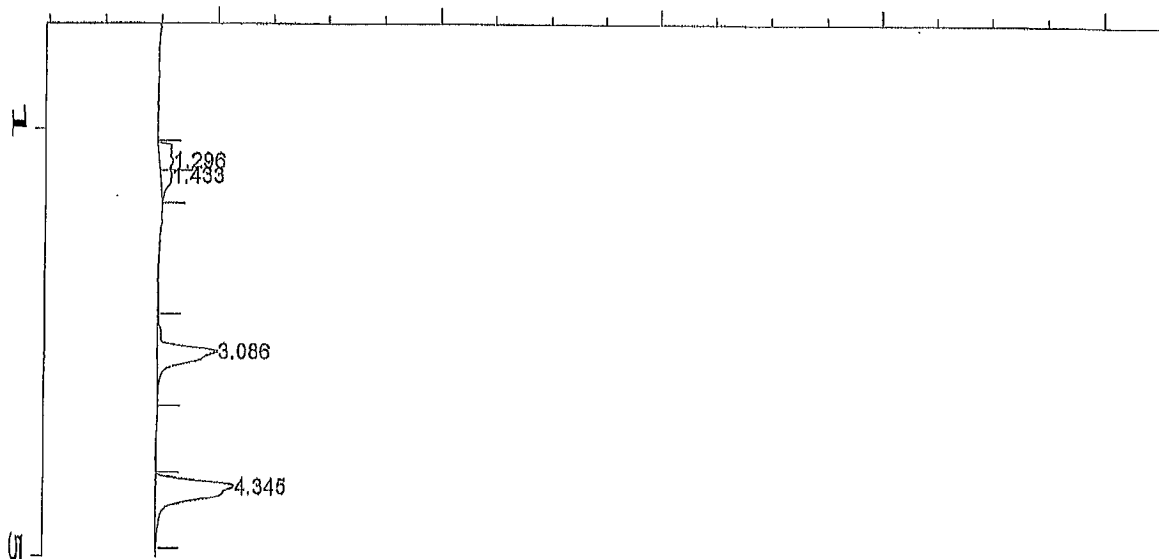


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1B30.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1B 73338 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:46 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:51 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1B -  
 Tr#73338 - 12:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1B30.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.147	260	BV	0.034	1	0.194	THC as CH4
1.214	425	VV	0.071		0.347	* uncalibrated *
1.299	1020	VB	0.096		0.833	* uncalibrated *
3.072	4528	BB	0.125		3.698	* uncalibrated *
4.321	7905	BB	0.158		6.456	* uncalibrated *



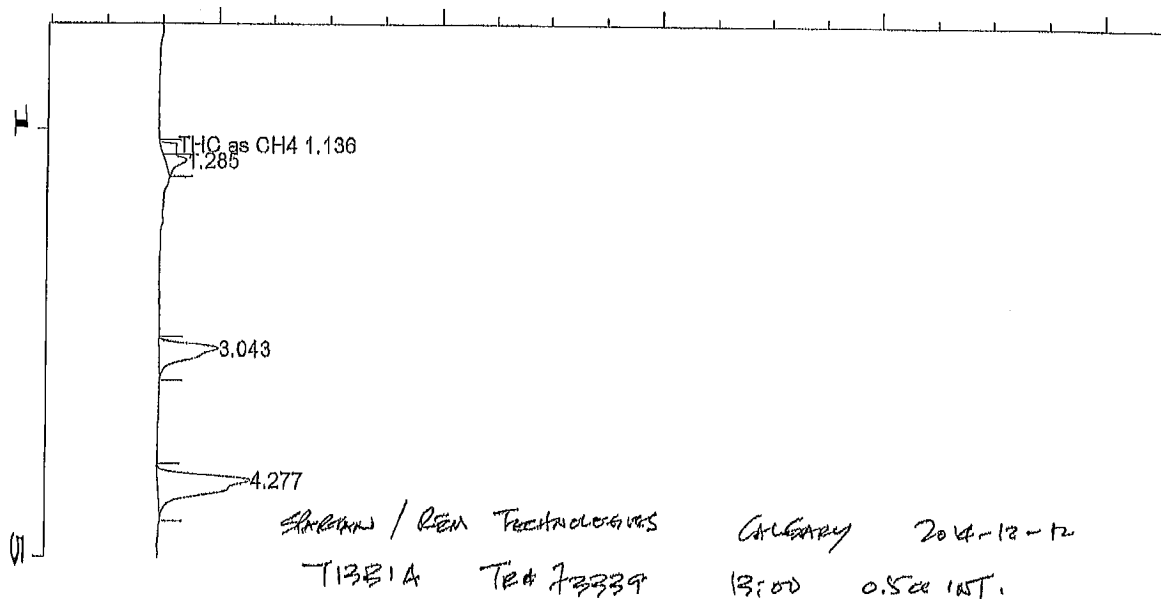
# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T12B1B31.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T12B1B 73338 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:52 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:57 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12B1B -  
 Tr#73338 - 12:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T12B1B31.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	* not found *			1		THC as CH4
1.296	1607	BV	0.175		1.313	* uncalibrated *
1.433	1035	VB	0.135		0.845	* uncalibrated *
3.086	5331	BB	0.136		4.354	* uncalibrated *
4.345	8114	BV	0.159		6.627	* uncalibrated *

Not all calibrated peaks were found

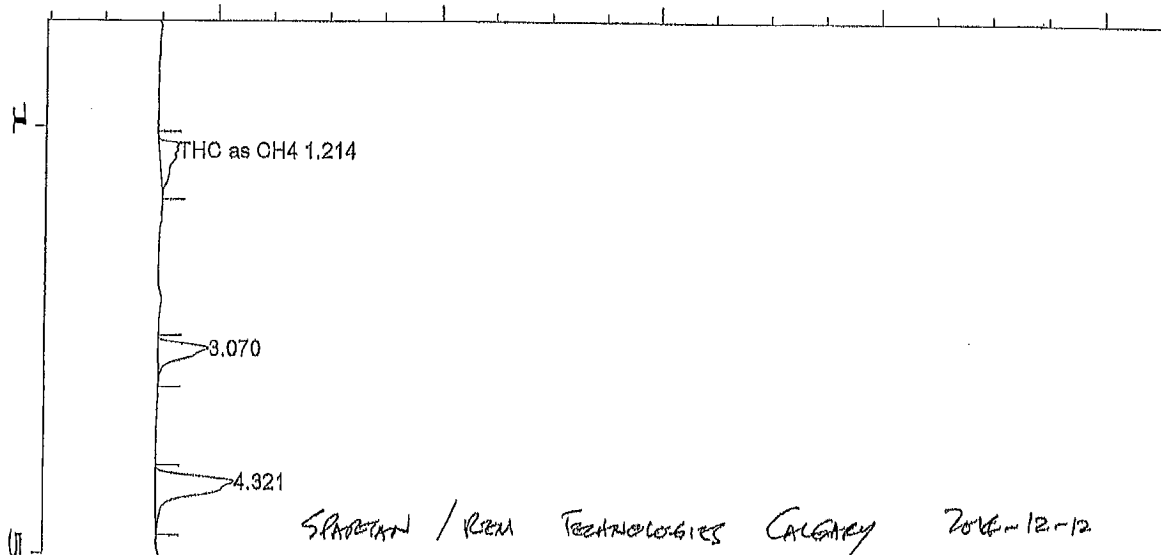


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1A32.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1A 73339 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:03 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:07 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1A32.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.136	892	BV	0.097	1	0.666	THC as CH4
1.285	1177	VB	0.090		0.962	* uncalibrated *
3.043	4660	BB	0.122		3.806	* uncalibrated *
4.277	9045	BB	0.149		7.388	* uncalibrated *



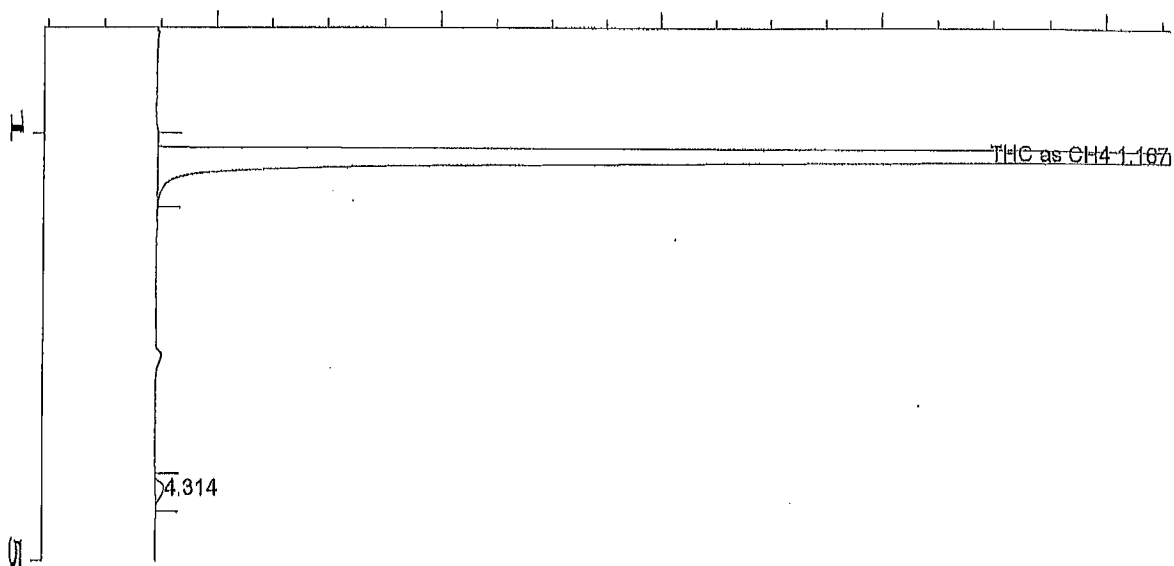
SPRINT / REM TECHNOLOGIES CALGARY 2014-12-12  
 T13B1A Test 73339 Bio 0.5cc (0.5).

External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1A33.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1A 73339 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:09 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:16 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1A33.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.214	2759	BB	0.226	1	2.059	THC as CH4
3.070	3878	BB	0.124		3.168	* uncalibrated *
4.321	7868	BB	0.156		6.426	* uncalibrated *



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 External Standard Report  
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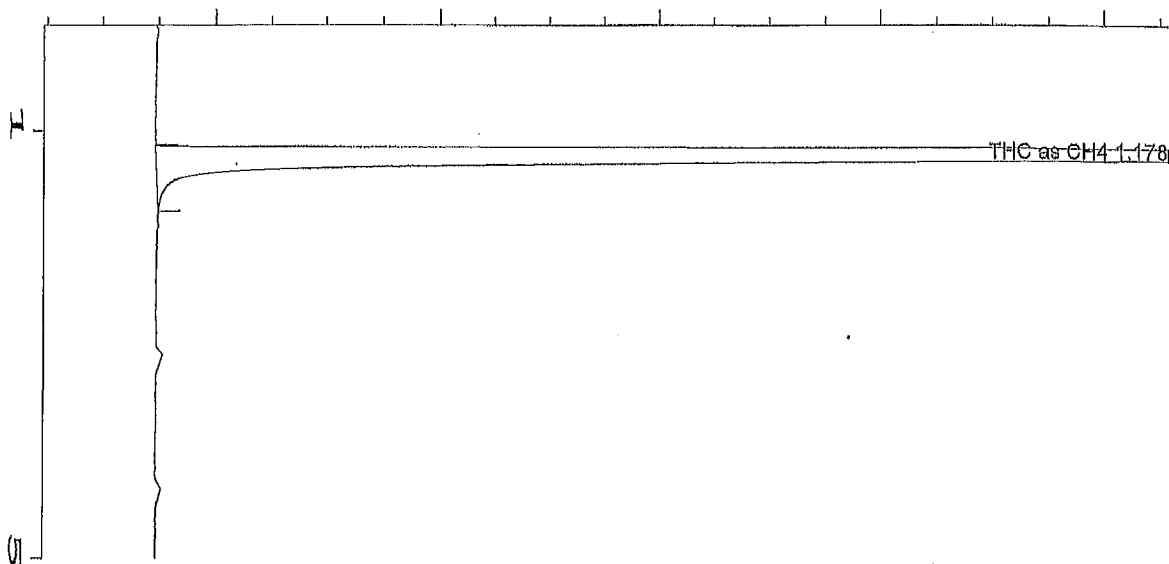
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 01:18 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 01:23 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0027.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.167	121584	BB	0.092	1	99.537	THC as CH4
4.314	762	BB	0.122		0.622	* uncalibrated *

=====



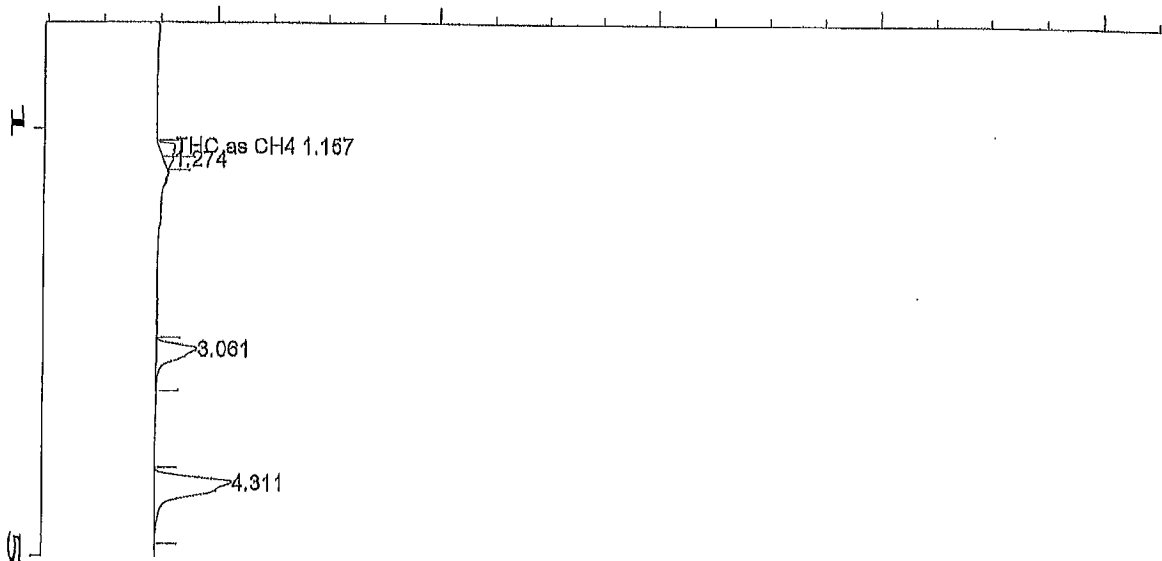


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Span 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:19 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:24 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Span Check - ID# 11-11-01-26 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.178	121222	BB	0.098	1	99.239	THC as CH4

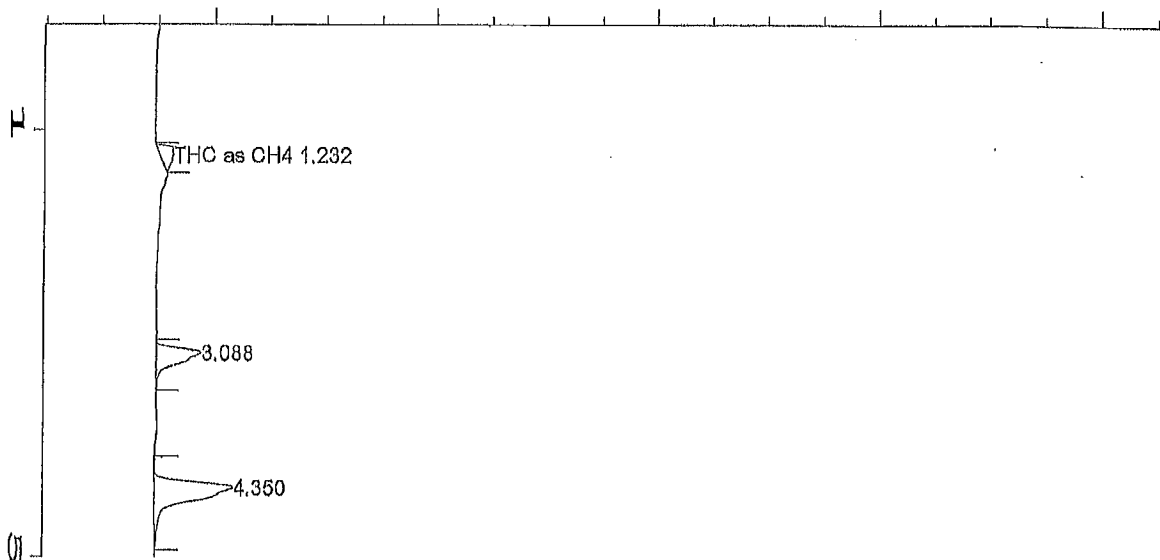


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1B35.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1B 73340 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:30 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:35 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13B1B -  
 Tr#73340 - 13:35 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1B35.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.157	899	BV	0.104	1	0.671	THC as CH4
1.274	427	VV	0.067		0.348	* uncalibrated *
3.061	3181	BB	0.124		2.598	* uncalibrated *
4.311	7637	BB	0.153		6.237	* uncalibrated *

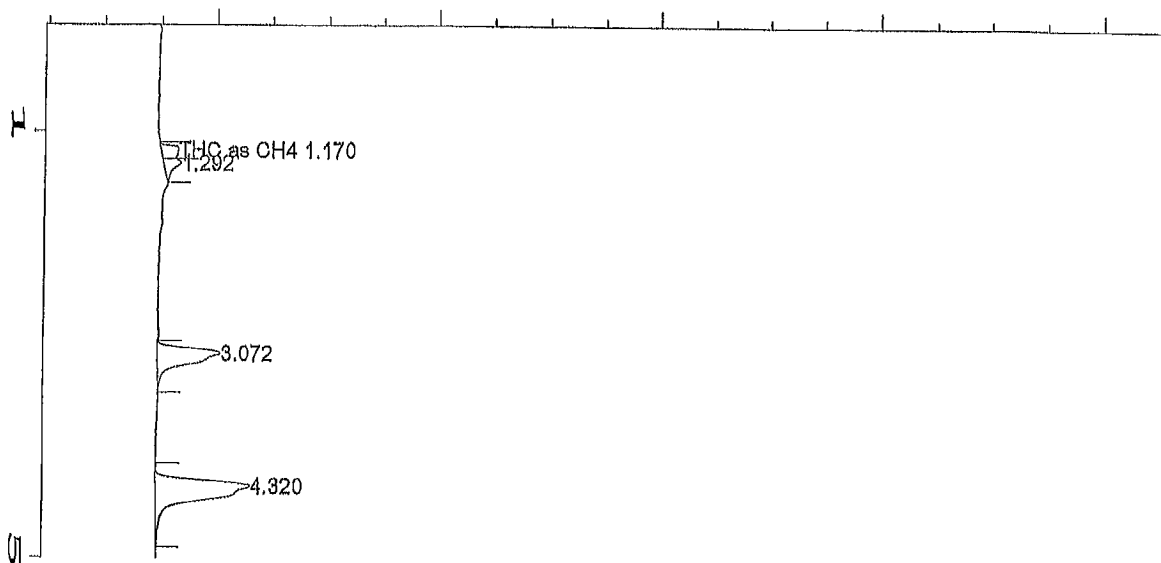


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T13B1B36.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T13B1B 73340 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:38 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:43 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13B1B -  
 Tr#73340 - 13:35 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T13B1B36.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.232	1276	BB	0.134	1	0.953	THC as CH4
3.088	3580	BB	0.126		2.924	* uncalibrated *
4.350	7872	BB	0.152		6.429	* uncalibrated *

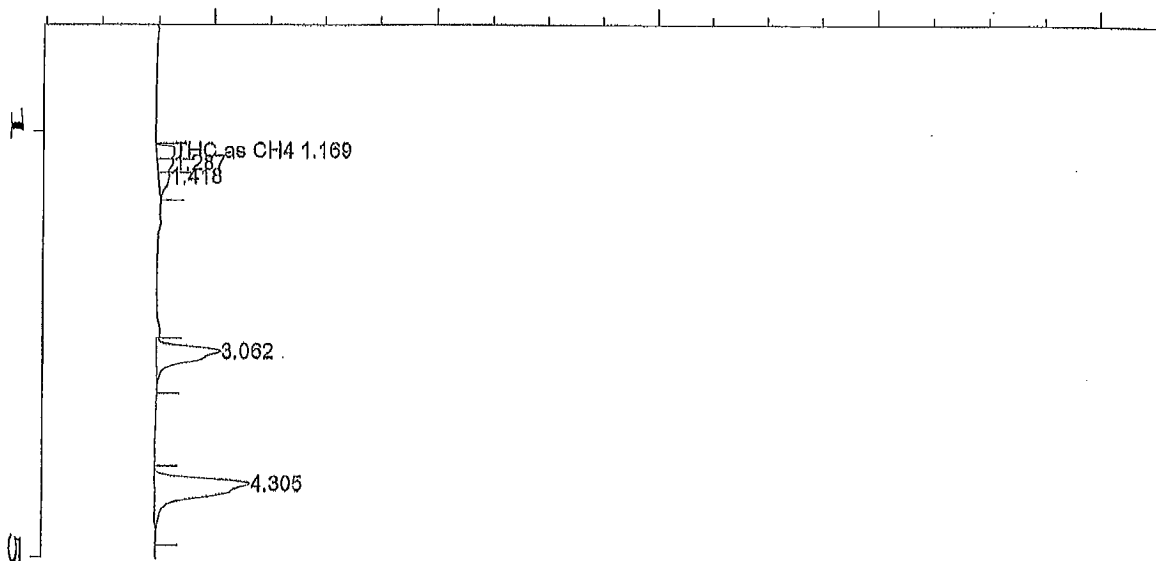


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1A37.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1A 73341 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:48 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:53 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1A -  
 Tr#73341 - 14:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1A37.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.170	1061	BV	0.088	1	0.792	THC as CH4
1.292	1003	VB	0.092		0.820	* uncalibrated *
3.072	5202	BB	0.127		4.249	* uncalibrated *
4.320	9766	BB	0.157		7.977	* uncalibrated *

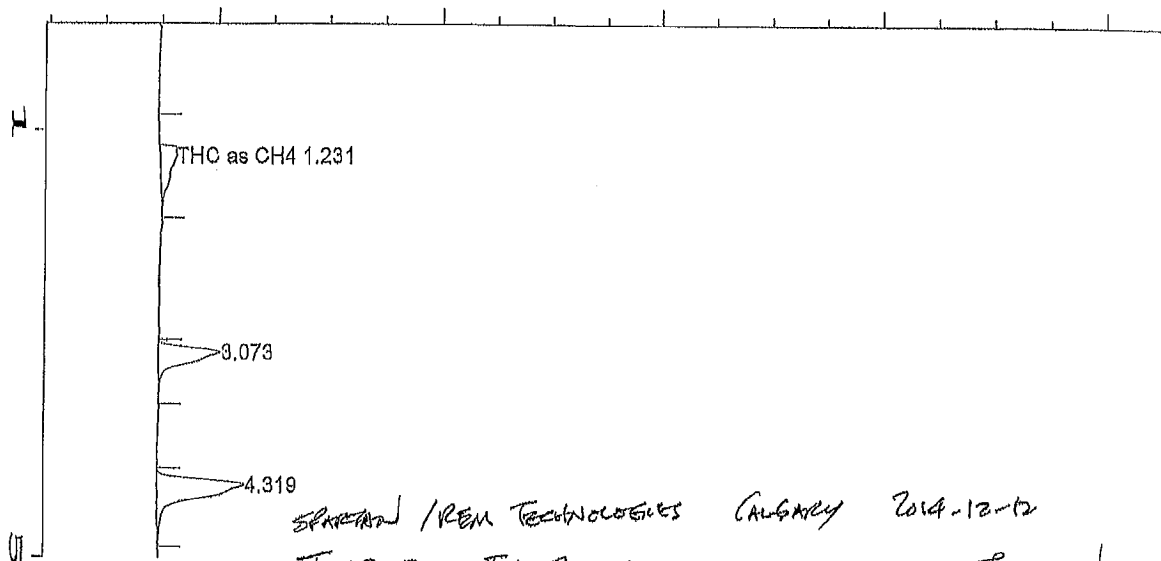


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1A38.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1A 73341 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 02:54 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 02:59 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1A -  
 Tr#73341 - 14:30 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1A38.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	1097	BV	0.100	1	0.819	THC as CH4
1.287	941	VV	0.089		0.769	* uncalibrated *
1.418	838	VB	0.111		0.684	* uncalibrated *
3.062	5240	VB	0.128		4.280	* uncalibrated *
4.305	9478	BB	0.152		7.741	* uncalibrated *



SPRINT / REM TECHNOLOGIES CALGARY 2014-12-12  
 T14B1B TR# 73342 15:05 0.5cc Injection

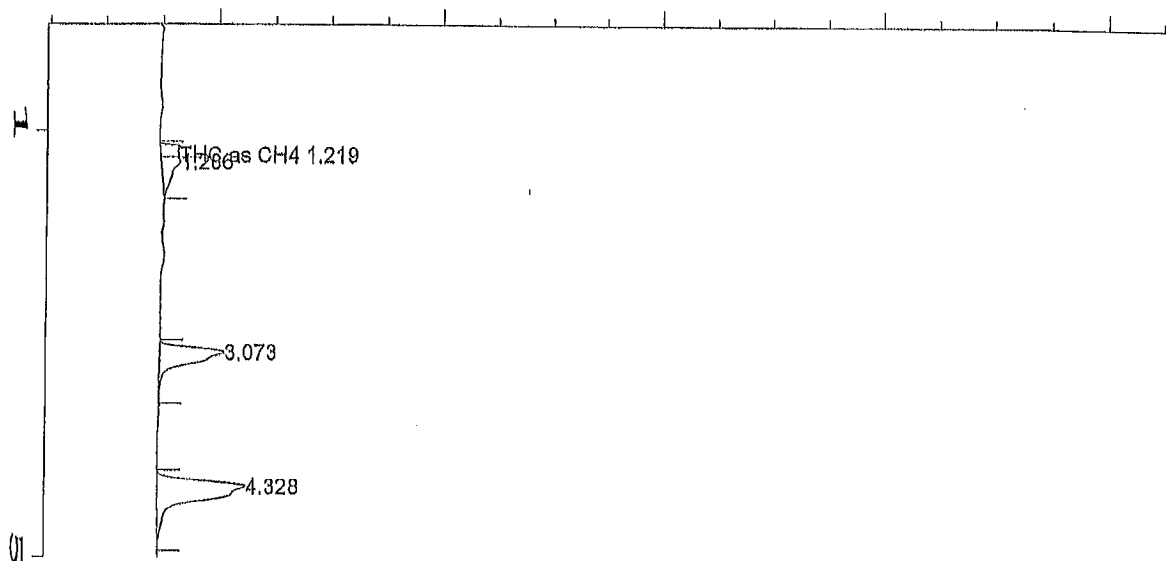
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B39.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:10 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:15 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 DEC 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B39.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.231	2648	PB	0.248	1	1.976	THC as CH4
3.073	4891	VB	0.134		3.995	* uncalibrated *
4.319	8505	BV	0.151		6.946	* uncalibrated *

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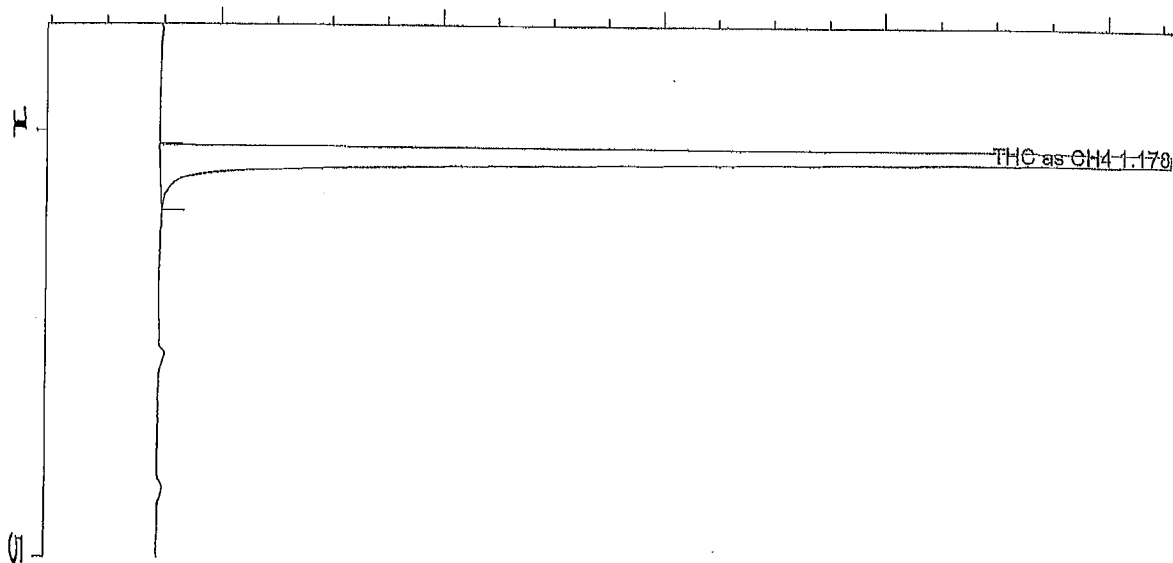


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B41.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:22 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:27 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1B -  
 Tr#73342 - 15:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B41.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.219	1094	BV	0.114	1	0.817	THC as CH4
1.286	1835	VB	0.143		1.499	* uncalibrated *
3.073	5311	BB	0.129		4.338	* uncalibrated *
4.328	9458	BV	0.163		7.725	* uncalibrated *



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 External Standard Report  
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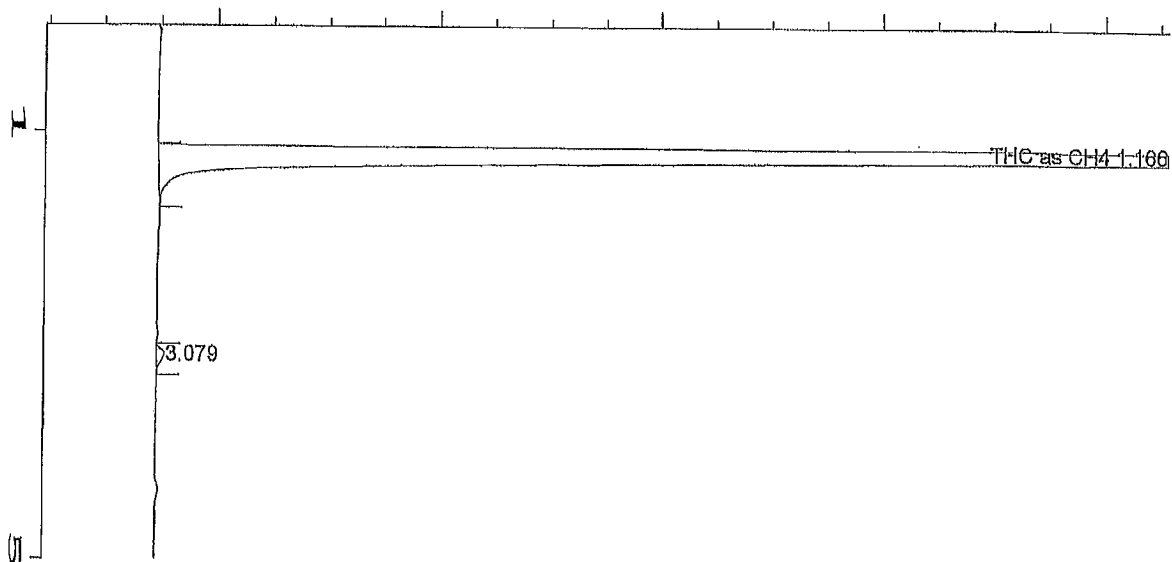
Data File Name	: C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D	
Operator	: Maxxam - GC ID#4130 - BW	Page Number : 1
Instrument	: GC ID4130	Vial Number :
Sample Name	: Span 0.5	Injection Number :
Run Time Bar Code:		Sequence Line :
Acquired on	: 13 Dec 14 02:19 PM	Instrument Method: M18-DB-L.MTH
Report Created on:	13 Dec 14 02:25 PM	Analysis Method : M18-DB-L.MTH
Last Recalib on	: 13 Dec 14 12:01 PM	Sample Amount : 0
Multiplier	: 1	ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\SPAN0034.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.178	121222	BB	0.098	1	99.239	THC as CH4

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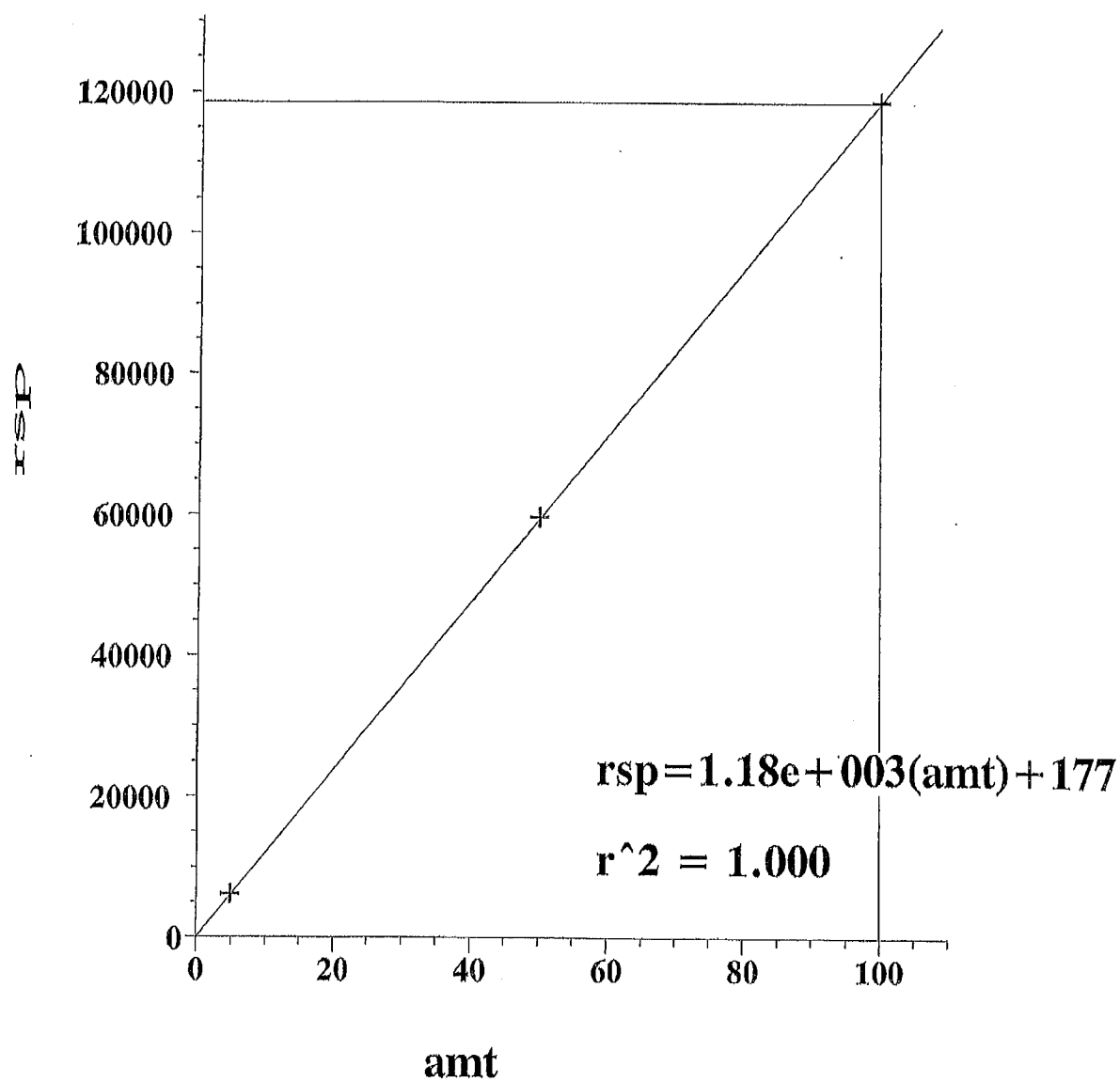
# External Standard Report

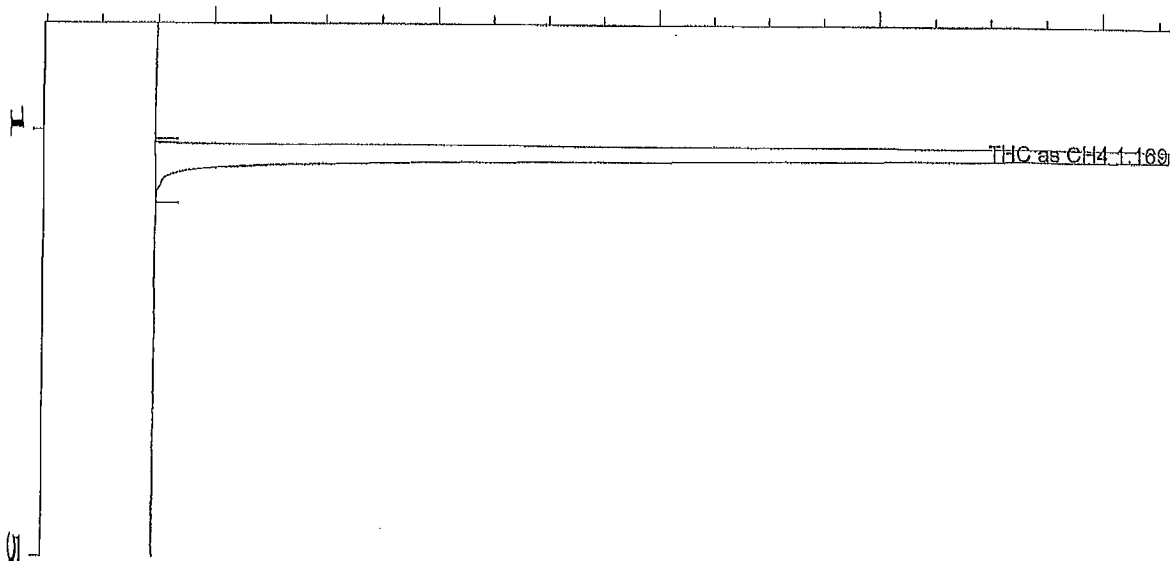
Data File Name : C:\HPCHEM\2\DATA\2014\20141211\T14B1B42.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : T14B1B 73342 0.5 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 03:44 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 03:49 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :  
 Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14B1B -  
 Tr#73342 - 15:05 - 0.5 cc injection

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\T14B1B42.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.166	121230	BB	0.095	1	99.245	THC as CH4
3.079	569	BB	0.109		0.464	* uncalibrated *

# THC as CH4





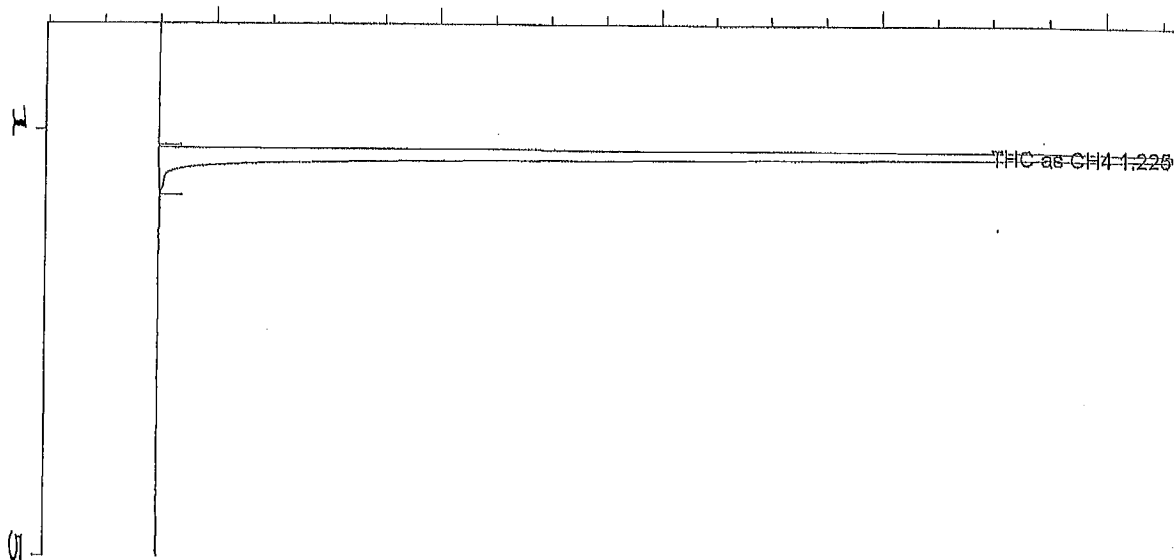
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 External Standard Report  
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Data File Name : C:\HPCHEM\2\DATA\2014\20141211\1CAL0001.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 1 0.5 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:15 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:42 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\1CAL0001.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.169	118589	BB	0.097	1	99.948	THC as CH4

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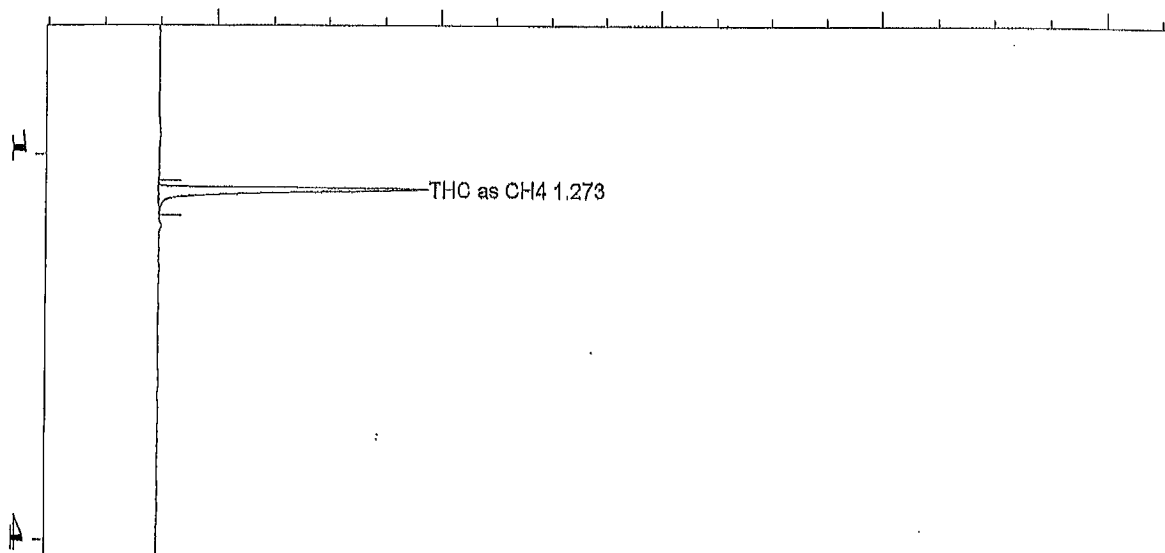


External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\2CAL0002.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 11 Dec 14 02:27 PM Instrument Method: M18-DB-L.MTH  
 Report Created on: 11 Dec 14 02:42 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 11 Dec 14 02:41 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\2CAL0002.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.225	59543	BB	0.071	1	50.109	THC as CH4



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 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\2\DATA\2014\20141211\3CAL0003.D	Page Number	: 1
Operator	: Maxxam - GC ID#4130 - BW	Vial Number	:
Instrument	: GC ID4130	Injection Number	:
Sample Name	: Cal 3 0.025 cc	Sequence Line	:
Run Time Bar Code:		Instrument Method	: M18-DB-L.MTH
Acquired on	: 11 Dec 14 02:34 PM	Analysis Method	: M18-DB-L.MTH
Report Created on:	11 Dec 14 02:42 PM	Sample Amount	: 0
Last Recalib on	: 11 Dec 14 02:41 PM	ISTD Amount	:
Multiplier	: 1		

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\3CAL0003.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.273	6033	BB	0.038	1	4.944	THC as CH4

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# Method Information

FID - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 200 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.060	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-1	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.225	1	100.0	8.4325e-004	1	THC as CH4
		2	50.0	8.3973e-004		
		3	5.0	8.2877e-004		

## Calibration Settings

### Title:

THC Calibration as CH4 - 2014-12-11

Reference window:	50.000 %
Non-reference window:	50.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	8.4325e-004
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

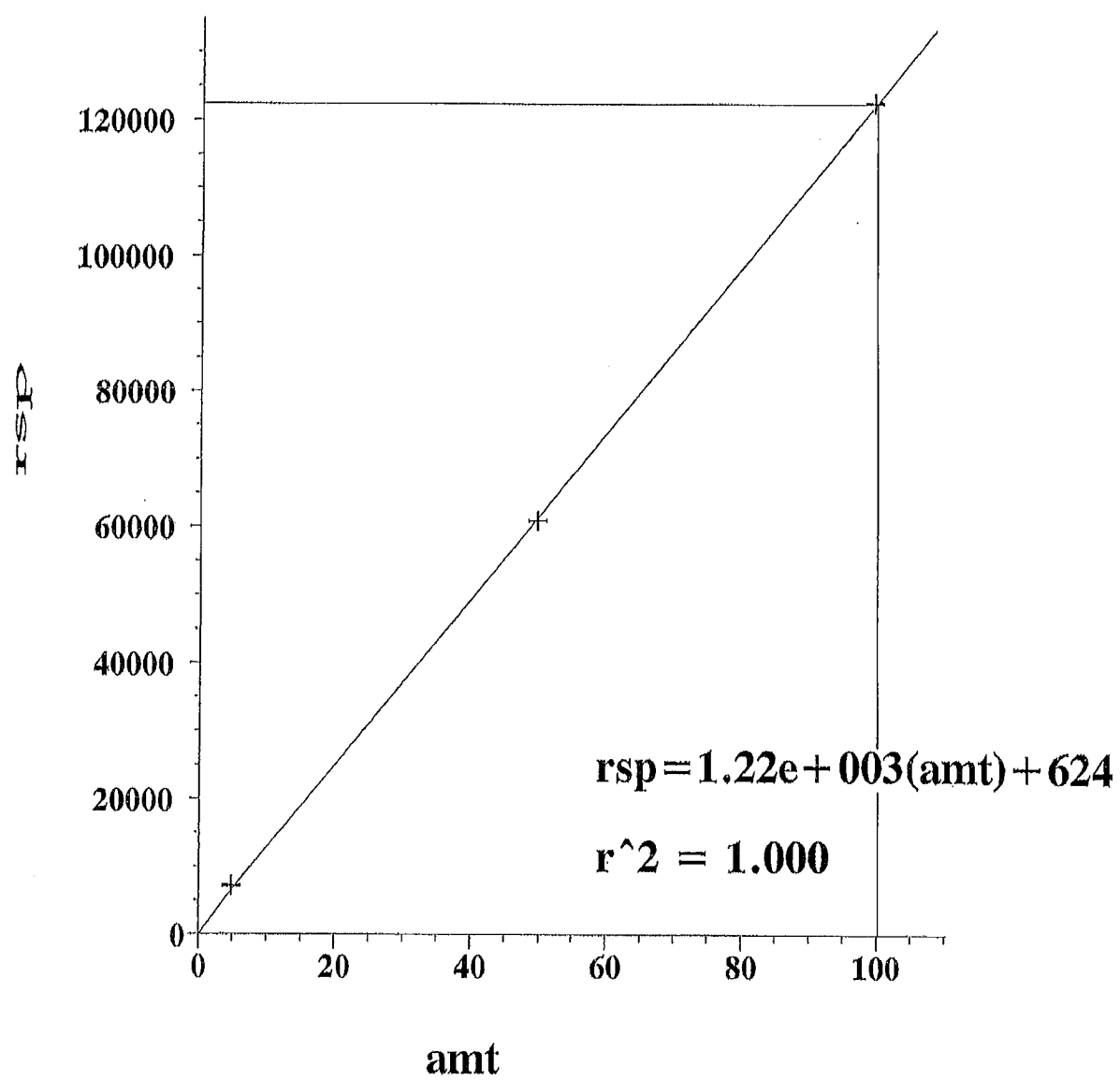
## Sample ISTD Information

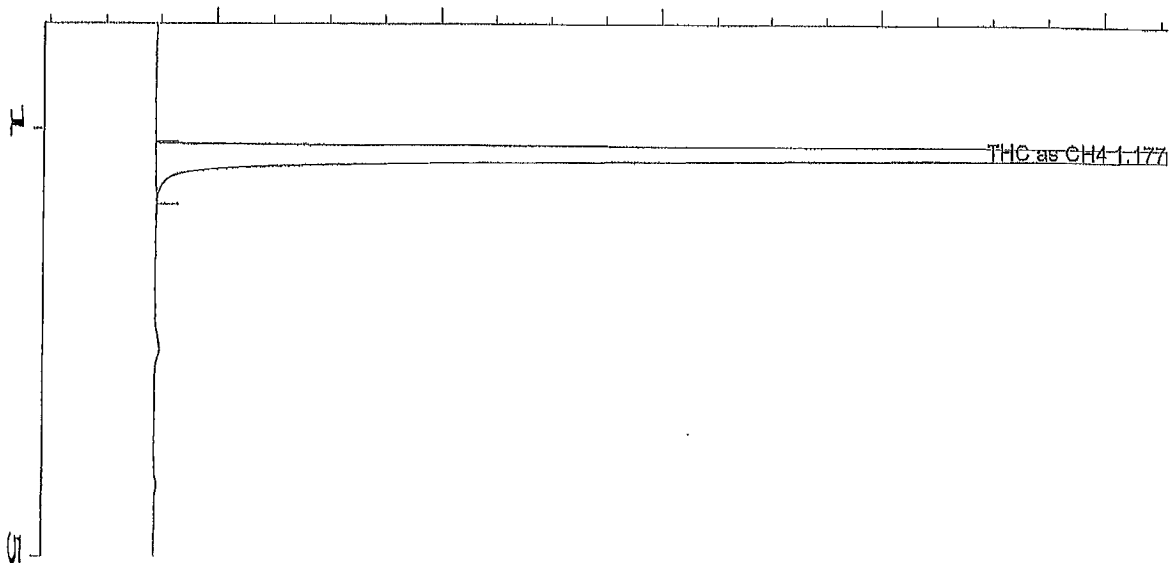
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

# THC as CH4





# External Standard Report

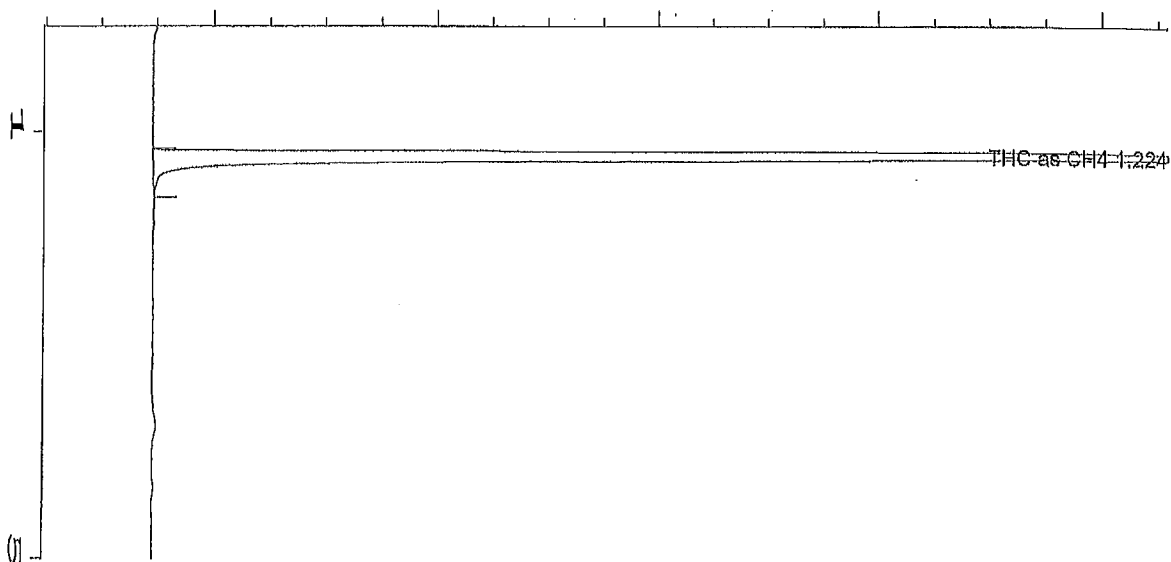
```

Data File Name   : C:\HPCHEM\2\DATA\2014\20141211\1CAL0015.D
Operator        : Maxxam - GC ID#4130 - BW
Instrument       : GC ID4130
Sample Name     : Cal 1 0.5 cc
Run Time Bar Code :
Acquired on    : 13 Dec 14  11:29 AM
Report Created on: 13 Dec 14  12:03 PM
Last Recalib on : 13 Dec 14  12:01 PM
Multiplier     : 1
Page Number    : 1
Vial Number    :
Injection Number :
Sequence Line  :
Instrument Method: M18-DB-L.MTH
Analysis Method : M18-DB-L.MTH
Sample Amount  : 0
ISTD Amount    :
  
```

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\1CAL0015.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.177	122435	BB	0.100	1	100.236	THC as CH4



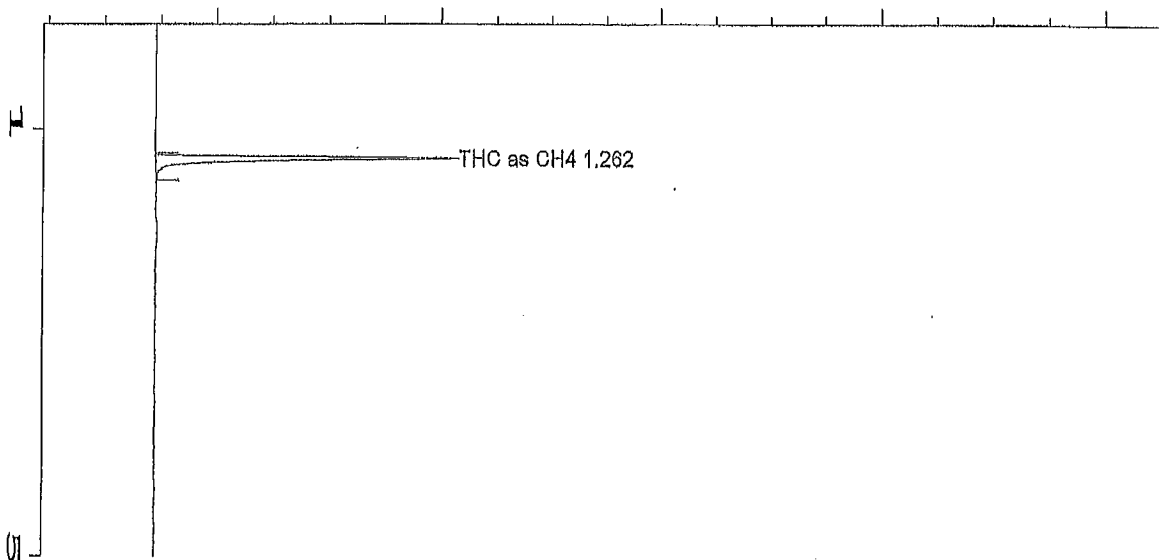


# External Standard Report

Data File Name : C:\HPCHEM\2\DATA\2014\20141211\2CAL0016.D  
 Operator : Maxxam - GC ID#4130 - BW Page Number : 1  
 Instrument : GC ID4130 Vial Number :  
 Sample Name : Cal 2 0.25 cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:37 AM Instrument Method: M18-DB-L.MTH  
 Report Created on: 13 Dec 14 12:04 PM Analysis Method : M18-DB-L.MTH  
 Last Recalib on : 13 Dec 14 12:01 PM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\2CAL0016.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.224	60779	BB	0.070	1	49.501	THC as CH4



=====  
 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\2\DATA\2014\20141211\3CAL0018.D	
Operator	: Maxxam - GC ID#4130 - BW	Page Number : 1
Instrument	: GC ID4130	Vial Number :
Sample Name	: Cal 2 0.025 cc	Injection Number :
Run Time Bar Code:		Sequence Line :
Acquired on	: 13 Dec 14 11:46 AM	Instrument Method: M18-DB-L.MTH
Report Created on:	13 Dec 14 12:04 PM	Analysis Method : M18-DB-L.MTH
Last Recalib on	: 13 Dec 14 12:01 PM	Sample Amount : 0
Multiplier	: 1	ISTD Amount :

Sig. 2 in C:\HPCHEM\2\DATA\2014\20141211\3CAL0018.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.262	7020	BB	0.040	1	5.263	THC as CH4

=====

Method: C:\HPCHEM\2\METHODS\M18-DB-L.MTH

## Method Information

FTD - SGE-BP1 30 meter - SN 12090A04 x 0.53 mm ID x 5 u film. Flow at 5 mls, makeup to 30 ml. H2 @ 35 ml. Air @ 350 ml. Packed injection port. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 200 C isothermal. Inj @ 150, Det @ 200. 0.5 cc injection size. 100 ppmv Methane std used. Maxxam Internal Lot # 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.060	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-1	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.177	1	100.0	8.1676e-004	1	THC as CH4
		2	50.0	8.2265e-004		
		3	5.0	7.123e-004		

## Calibration Settings

## Title:

THC Calibration as CH4 - 2014-12-13

Reference window:	20.000 %
Non-reference window:	20.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	8.1676e-004
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

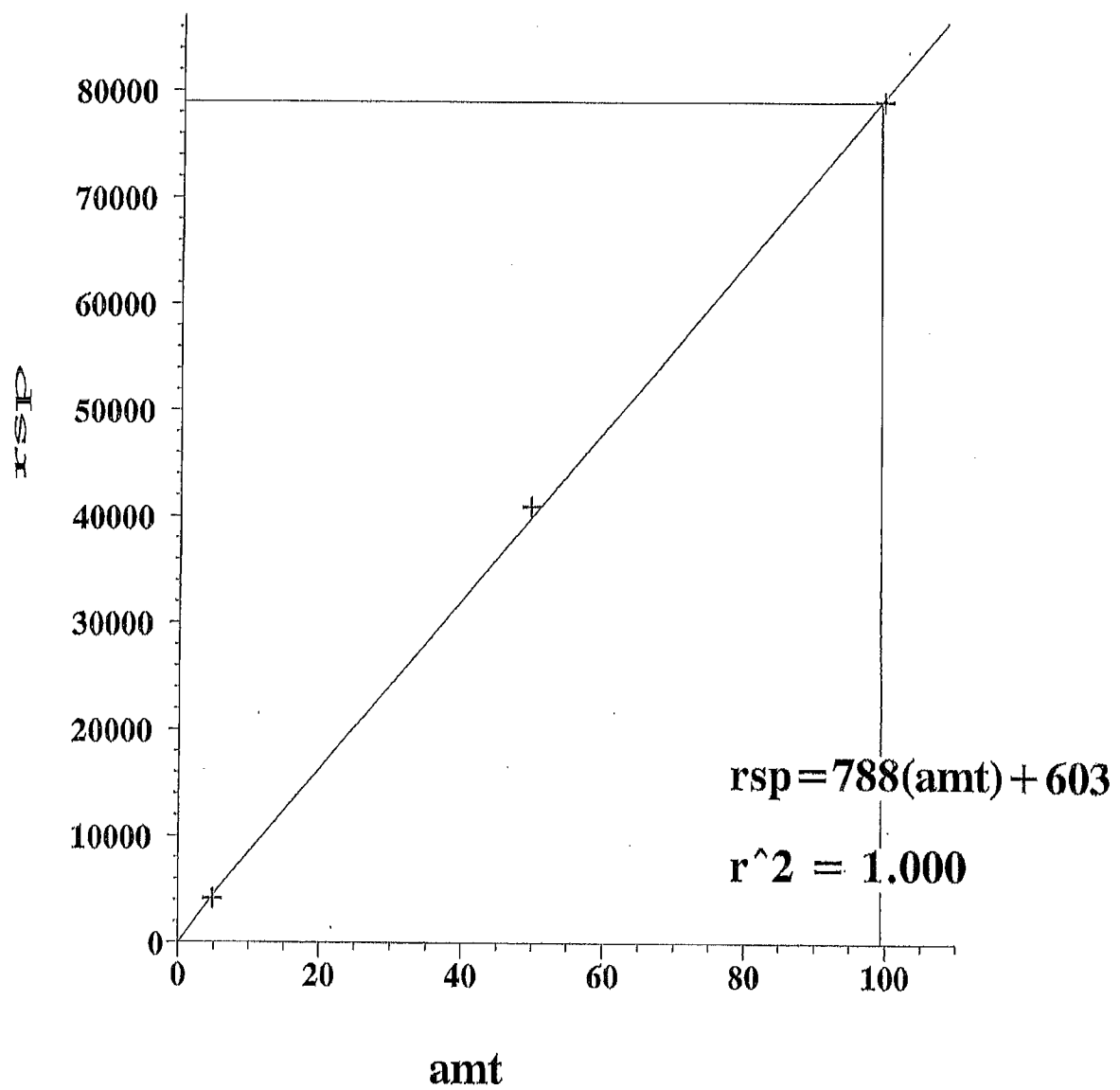
## Sample ISTD Information

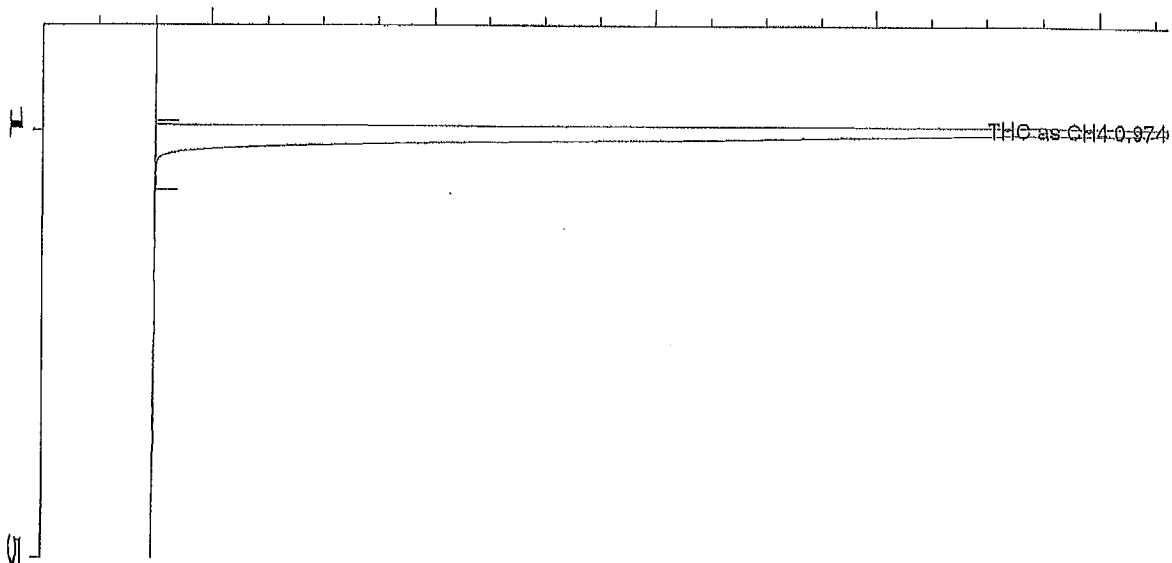
No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force

# THC as CH4





=====  
 External Standard Report  
 =====

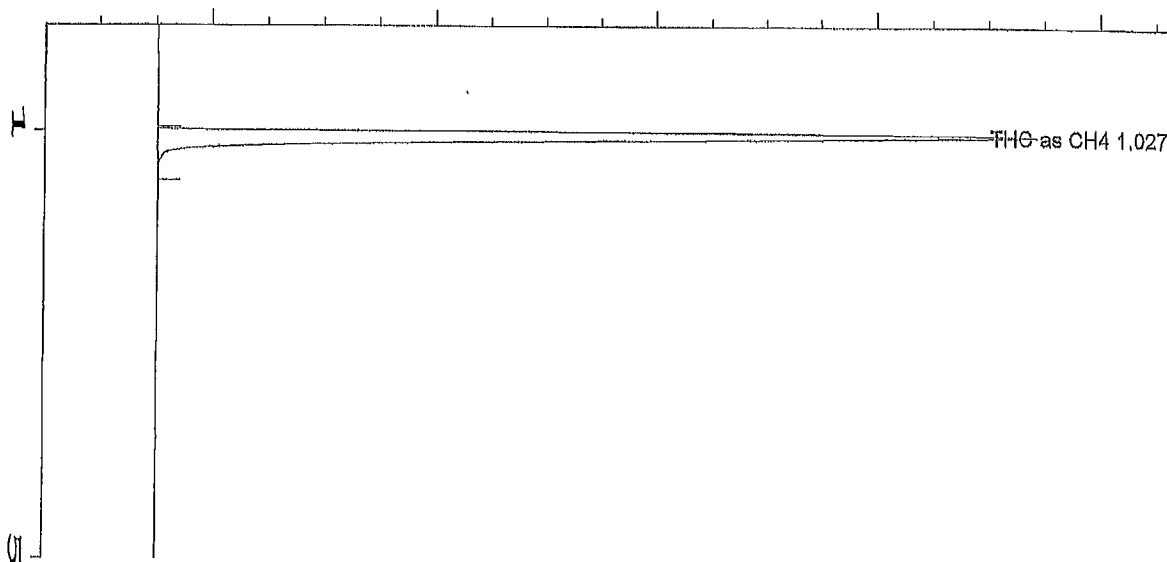
```

Data File Name   : C:\HPCHEM\1\DATA\2014\20141211\1CAL0050.D
Operator        : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument       : GC ID4284                     Vial Number            :
Sample Name     : Cal 1 0.5 cc                   Injection Number       :
Run Time Bar Code:                               Sequence Line          :
Acquired on     : 11 Dec 14  02:14 PM             Instrument Method: M18-DB1.MTH
Report Created on: 11 Dec 14  02:39 PM             Analysis Method  : M18-DB1.MTH
Last Recalib on : 11 Dec 14  02:38 PM             Sample Amount       : 0
Multiplier      : 1                               ISTD Amount          :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\1CAL0050.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.974	79025	BB	0.098	1	99.475	THC as CH4

=====



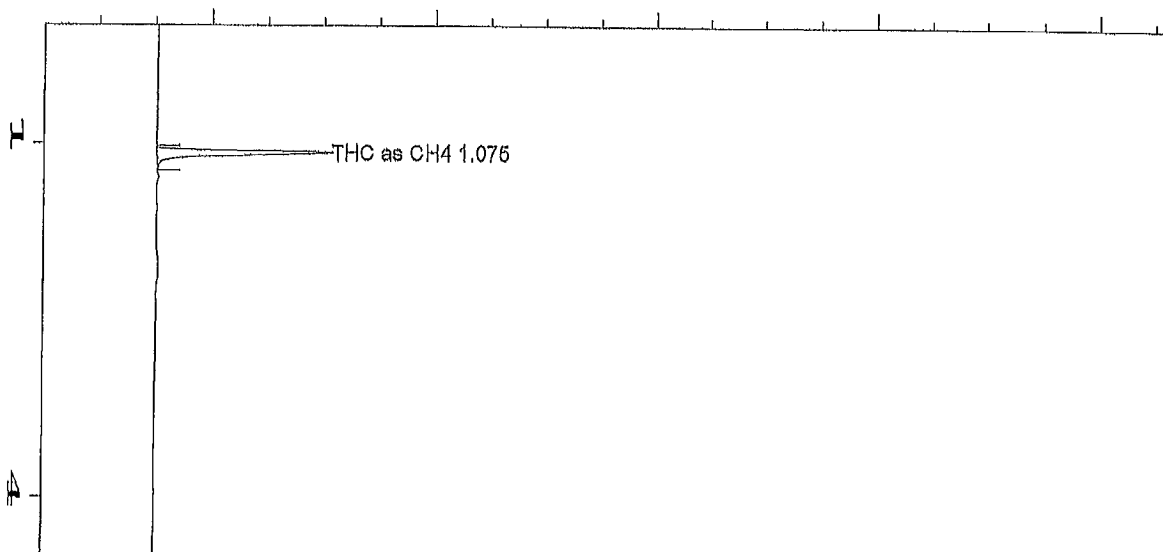
# External Standard Report

```

Data File Name       : C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D
Operator            : Maxxam - GC 1D# 4284 - BW
Instrument          : GC ID4284
Sample Name         : Cal 2 0.25 cc
Run Time Bar Code   :
Acquired on        : 11 Dec 14 02:27 PM
Report Created on   : 11 Dec 14 02:39 PM
Last Recalib on    : 11 Dec 14 02:38 PM
Multiplier         : 1
Page Number        : 1
Vial Number        :
Injection Number    :
Sequence Line      :
Instrument Method   : M18-DB1.MTH
Analysis Method    : M18-DB1.MTH
Sample Amount      : 0
ISTD Amount        :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	40894	BB	0.080	1	51.107	THC as CH4



=====  
 External Standard Report  
 =====

```

Data File Name   : C:\HPCHEM\1\DATA\2014\20141211\3CAL0052.D
Operator        : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument       : GC ID4284                     Vial Number            :
Sample Name     : Cal 3 0.025 cc                 Injection Number       :
Run Time Bar Code:                               Sequence Line          :
Acquired on    : 11 Dec 14  02:33 PM             Instrument Method: M18-DB1.MTH
Report Created on: 11 Dec 14  02:39 PM           Analysis Method  : M18-DB1.MTH
Last Recalib on : 11 Dec 14  02:38 PM           Sample Amount       : 0
Multiplier     : 1                               ISTD Amount          :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\3CAL0052.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.075	4086	BV	0.042	1	4.494	THC as CH4

=====

# Method Information

FID -- DB-1 30 meter x 0.53 mm ID x 5 u film. Flow at 5 cc/min, makeup to 30 ml. H2 @ 30 ml. Air @ 300 ml. Packed injection port. Flow = 10  
mls. Measured with Humonics Electronic Flowmeter. Signal 1A  
data acquisition, Range=0, Attn=0. Oven 150 isothermal. Inj @ 150,  
Det @ 225. 0.5 cc injection size. 100 ppm CH4 Std. Maxxam Internal  
Lot# 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.100	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-2	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.027	1	100.0	1.2654e-003	1	THC as CH4
		2	50.0	1.2227e-003		
		3	5.0	1.2238e-003		

## Calibration Settings

Title:  
THC as CH4 - 2014-12-11

Reference window:	30.000 %
Non-reference window:	30.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	1.2654e-003
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

## Sample ISTD Information

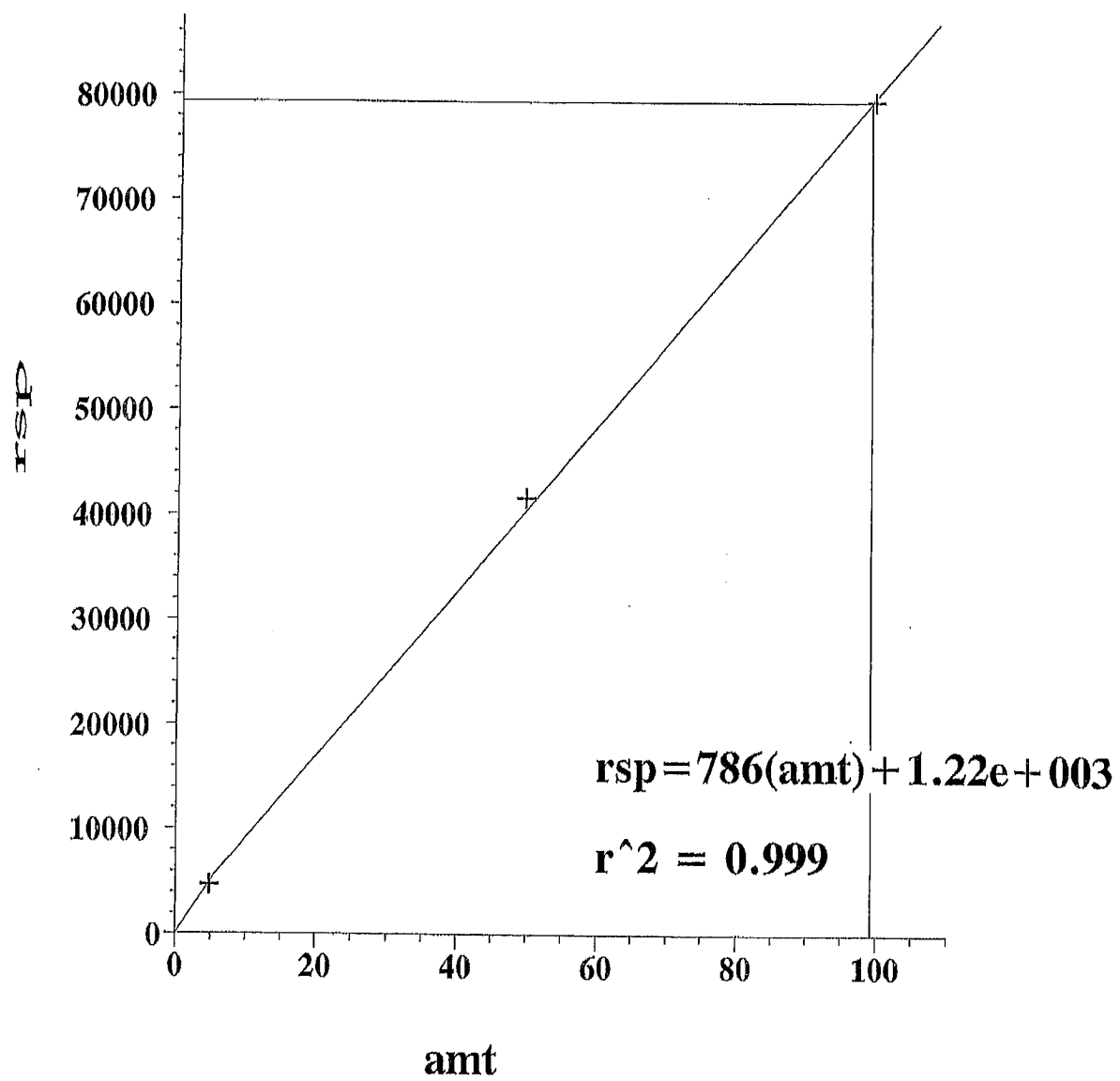
No Sample ISTD Amounts

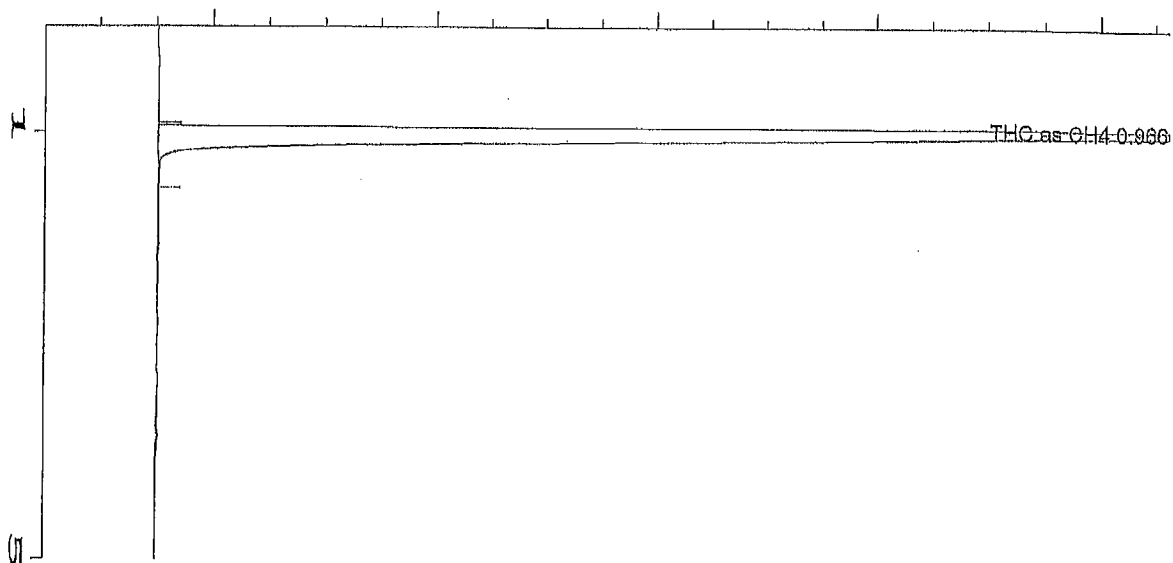
## Multilevel Information

Fit: Linear  
Origin: Force



# THC as CH4





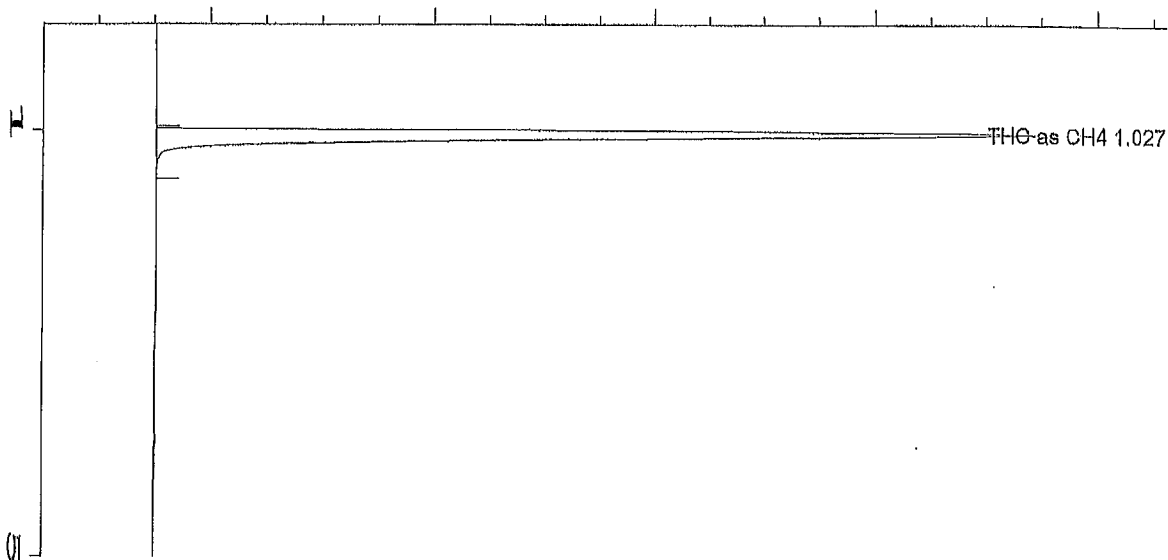
=====  
 External Standard Report  
 =====

Data File Name : C:\HPCHEM\1\DATA\2014\20141211\1CAL0064.D  
 Operator : Maxxam - GC 1D# 4284 - BW Page Number : 1  
 Instrument : GC ID4284 Vial Number :  
 Sample Name : Cal 1 0.5cc Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : 13 Dec 14 11:29 AM Instrument Method: M18-DB1.MTH  
 Report Created on: 13 Dec 14 11:54 AM Analysis Method : M18-DB1.MTH  
 Last Recalib on : 13 Dec 14 11:53 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\1CAL0064.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
0.966	79370	BB	0.120	1	99.395	THC as CH4

=====



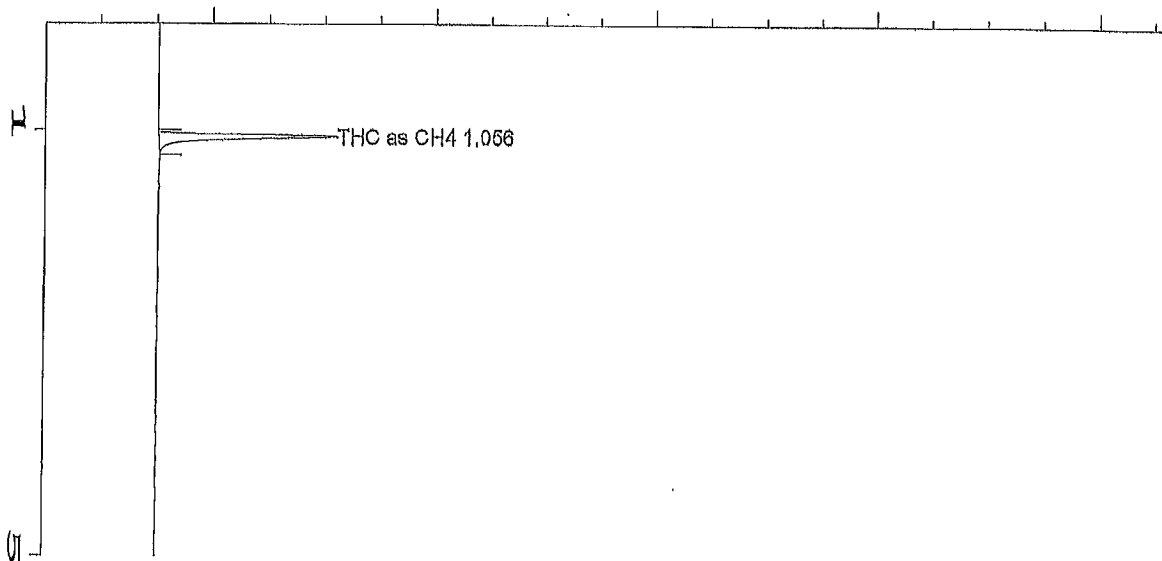
External Standard Report

```

Data File Name   : C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D
Operator        : Maxxam - GC 1D# 4284 - BW      Page Number       : 1
Instrument       : GC ID4284                    Vial Number           :
Sample Name      : Cal 2 0.25 cc                 Injection Number      :
Run Time Bar Code:                               Sequence Line         :
Acquired on      : 11 Dec 14 02:27 PM            Instrument Method     : M18-DB1.MTH
Report Created on: 13 Dec 14 11:54 AM            Analysis Method       : M18-DB1.MTH
Last Recalib on  : 13 Dec 14 11:53 AM            Sample Amount         : 0
Multiplier       : 1                             ISTD Amount           :
  
```

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\2CAL0051.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.027	40894	BB	0.080	1	50.462	THC as CH4



=====  
 External Standard Report  
 =====

Data File Name	: C:\HPCHEM\1\DATA\2014\20141211\3CAL0066.D	Page Number	: 1
Operator	: Maxxam - GC 1D# 4284 - BW	Vial Number	:
Instrument	: GC ID4284	Injection Number	:
Sample Name	: Cal 3 0.025cc	Sequence Line	:
Run Time Bar Code:		Instrument Method	: M18-DB1.MTH
Acquired on	: 13 Dec 14 11:46 AM	Analysis Method	: M18-DB1.MTH
Report Created on:	13 Dec 14 11:54 AM	Sample Amount	: 0
Last Recalib on	: 13 Dec 14 11:53 AM	ISTD Amount	:
Multiplier	: 1		

Sig. 1 in C:\HPCHEM\1\DATA\2014\20141211\3CAL0066.D

Ret Time	Area	Type	Width	Ref#	ppmv	Name
1.056	4619	BV	0.045	1	4.487	THC as CH4

=====

Method: C:\HPCHEM\1\METHODS\M18-DB1.MTH

## Method Information

FID - DB-1 30 meter x 0.53 mm ID x 5 u film. Flow at 5 cc/min, makeup to 30 ml. H2 @ 30 ml. Air @ 300 ml. Packed injection port. Flow = 10

mls. Measured with Humonics Electronic Flowmeter. Signal 1A data acquisition, Range=0, Attn=0. Oven 150 isothermal. Inj @ 150, Det @ 225. 0.5 cc injection size. 100 ppm CH4 Std. Maxxam Internal Lot# 11-10-27-23 for calibration, 11-11-01-26 for span check.

## Integration Events

Events:	Value:	Time:
Initial Area Reject	1	INITIAL
Initial Peak Width	0.100	INITIAL
Shoulder Detection	OFF	INITIAL
Initial Threshold	-2	INITIAL

## Calibration Table

Pk#	RT	Lvl	ppmv	Amt/Area	Ref Istd I#	Name
1	1.056	1	100.0	1.2599e-003	1	THC as CH4
		2	50.0	1.2038e-003		
		3	5.0	1.0825e-003		

## Calibration Settings

Title:

THC as CH4 - 2014-12-13

Reference window:	30.000 %
Non-reference window:	30.000 %
Units of amount:	ppmv
Multiplier:	1.0
RF uncal peaks:	1.2599e-003
ISTD# to adjust uncal peaks:	0
Sample Amount:	0.0

## Sample ISTD Information

No Sample ISTD Amounts

## Multilevel Information

Fit: Linear  
Origin: Force



Praxair Distribution, Inc.  
9601-34th Street  
Edmonton, AB T6B 2X6  
Tel: 780-449-0778  
Fax: 780-449-6302

10/13/2011

PRAXAIR CALGARY DIST CTR  
8009 42 ST SE (236-6511)  
CALGARY, AB T2C 2T4  
Attention: REPORT PRINTER 360 PICK TICKET PRINTER 361

Praxair Order No. **14043294**  
Customer Reference No. **02171899**

Product Lot/Batch No. **Z582128602**  
Praxair Part No. **NI CO100M1P-AS**

### CERTIFICATE OF ANALYSIS

*Primary Standard*

<u>Component</u>	<u>Requested Concentration</u>	<u>Certified Concentration</u>	<u>Analytical Principle</u>	<u>Analytical Accuracy</u>
Carbon monoxide	100 ppm	102 ppm	U	± 1% rel
Methane	100 ppm	100 ppm	U	± 1% rel
Nitrogen	Balance	Balance		

Analytical Instruments: **Horiba~VIA 510~~**  
**Chandler Engineering~Carle Series 400 AGC~~**

Cylinder Style: **AS**  
Cylinder Pressure @70F: **13,790 kPa**  
Cylinder Volume: **4.013 M3**  
Valve Outlet Connection: **CGA-350**  
Cylinder No(s): **CC79386**

Filling Method: **Gravimetric**  
Date of Fill: **10/12/2011**  
Expiration Date: **10/13/2014**

Analyst: **Alex Auty**

Received 2011-10-27 *[Signature]*  
opened 2011-10-27 *[Signature]*  
INTERNAL TRACKING # 11-10-27-23

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

**Key to Analytical Techniques:**

A Flame Ionization with Methanizer	B Gas Chromatography with Discharge Ionization Detector	C Gas Chromatography with Electrolytic Conductivity Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Helium Ionization Detector	G Gas Chromatography with Methanizer Carbonizer	H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer	J Gas Chromatography with Thermal Conductivity Detector	K Binary Gas Analyzer with Thermal Conductivity Detector	L Infrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
Q Total Hydrocarbon Analyzer	R Wet Chemical	S Detector Tube	T Odor
U Gravimetric Methods	V Electrochemical	W Gas Chromatography with Chemiluminescence Detector	

**IMPORTANT**

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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.



Praxair Distribution Inc  
9501 - 34 Street  
Edmonton, AB T6B 2X6  
Tel.: (780) 449-0778  
Fax.: (780) 449-5302

Issue Date: June 21, 2011

To: Praxair Calgary Dist. Ctr.  
8009 - 42 St. S.E.  
Calgary AB T2C2T4

Praxair Order Number: 12864348  
Customer Order Number: 02045158

Product Lot Number: Z582116010  
Product Part Number: NI CO100M1P-AS

## CERTIFICATE OF ANALYSIS

### Primary Standard

Cylinder Serial Number	Components	Requested Concentration	Certified Concentration	Analytical Principle*/ Instrument	Analytical Uncertainty
CC211407	Methane	100ppm	99.9ppm	Gravimetric	+/- 1% Relative
	Carbon Monoxide	100ppm	101ppm	Gravimetric	+/- 1% Relative
	Nitrogen	Balance	Balance	By Difference	N/A

Cylinder Style: AS  
Cylinder Pressure @70°F (21°C): 2000 psig  
Cylinder Volume: 141.5 cu ft

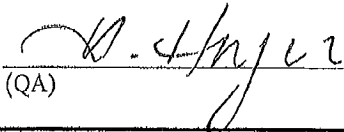
Valve Outlet Connection: CGA 580  
Filling Method: Gravimetric  
Filling Date: June 21, 2011  
Expiry Date: June 21, 2014

Rec'd 2011-06-23 ELO

Checked 2011-06-23 ELO

INTERNAL LOT# 11-11-01-26

Approved Signer:

  
(QA)

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair 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

#### \*Key to Analytical Principle:

A. Flame Ionization with Methanol	F. Gas Chromatography with Helium Ionization Detector	K. Thermal Conductivity Analyzer	P. Electrochemical
B. Gas Chromatography with Discharge Ionization Detector	G. Gas Chromatography with Methanol Carbonizer	L. Gravimetric Methods	Q. Total Hydrocarbon Analyzer
C. Gas Chromatography with Electrolyte Conductivity Detector	H. Gas Chromatography with Photoionization Detector	M. Infrared - FTIR or NDIR	R. Microbial Cell
D. Gas Chromatography with Flame Ionization Detector	I. Gas Chromatography with Reduction Gas Analyzer	N. Mass Spectrometry - MS or GC/MS	S. Detector Tube
E. Gas Chromatography with Flame Photometric Detector	J. Gas Chromatography with Thermal Conductivity Detector	O. Paramagnetic	T. Odor

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 arising out of the use of the information contained herein exceed the fee established for providing such information.

# Fixed Gas Chromatograms

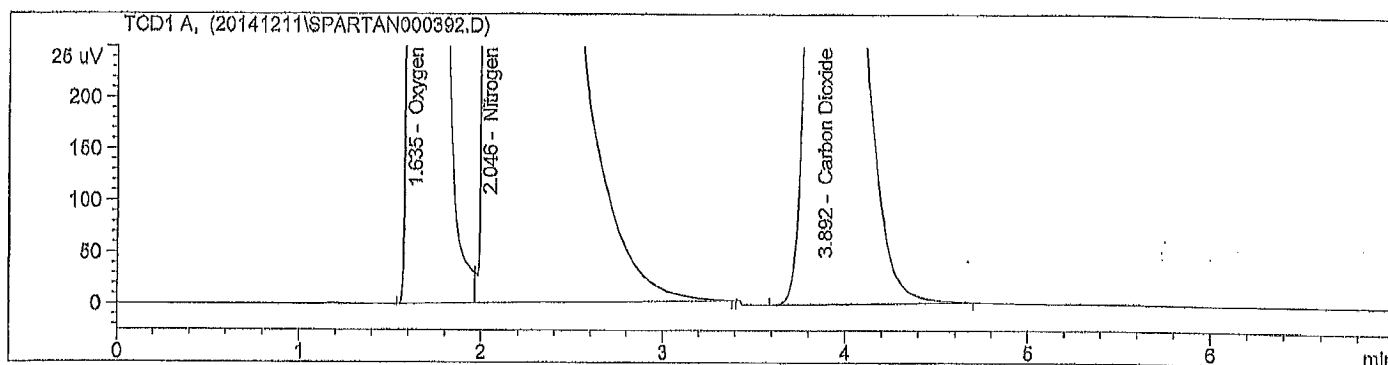
Sample Analysis  
Calibration



=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 11-Dec-14, 14:50:37 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:47:24 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:57:44 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - Tes  
t 3B1A - Tr#73306 - 15:00 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325		-	-	-		Hydrogen
1.635	BV	3.51202e4	3.93153e-4	14.252043		Oxygen
2.046	VBAS	1.97450e5	3.94073e-4	80.314297		Nitrogen
3.892	BBA	1.57490e4	3.34257e-4	5.433660		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

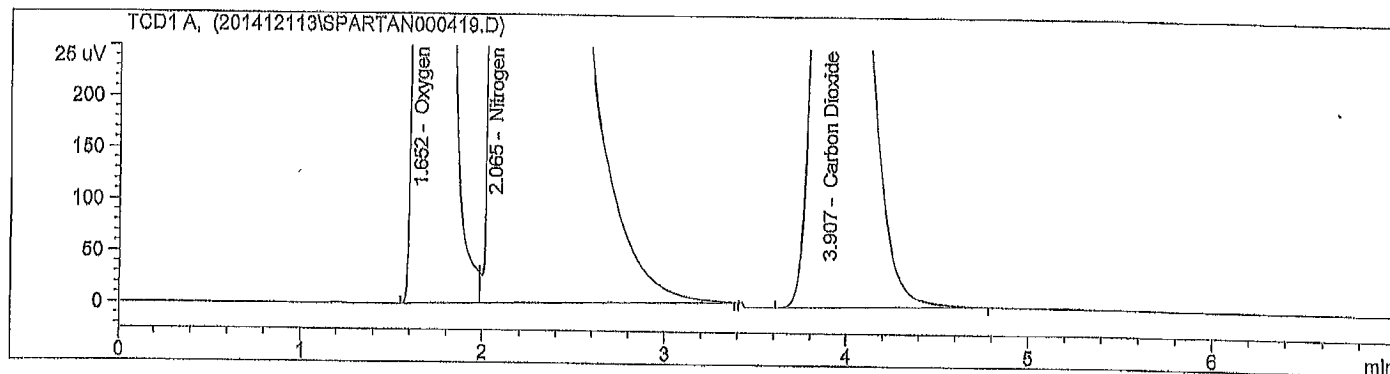
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 15:44:25
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 3:41:00 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 3:51:32 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B
                  1A - Tr#73306 - 15:00 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.652	BV	3.56264e4	3.93152e-4	14.283924		Oxygen
2.065	VBAS	2.00012e5	3.94086e-4	80.382619		Nitrogen
3.907	BBA	1.56463e4	3.34258e-4	5.333457		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

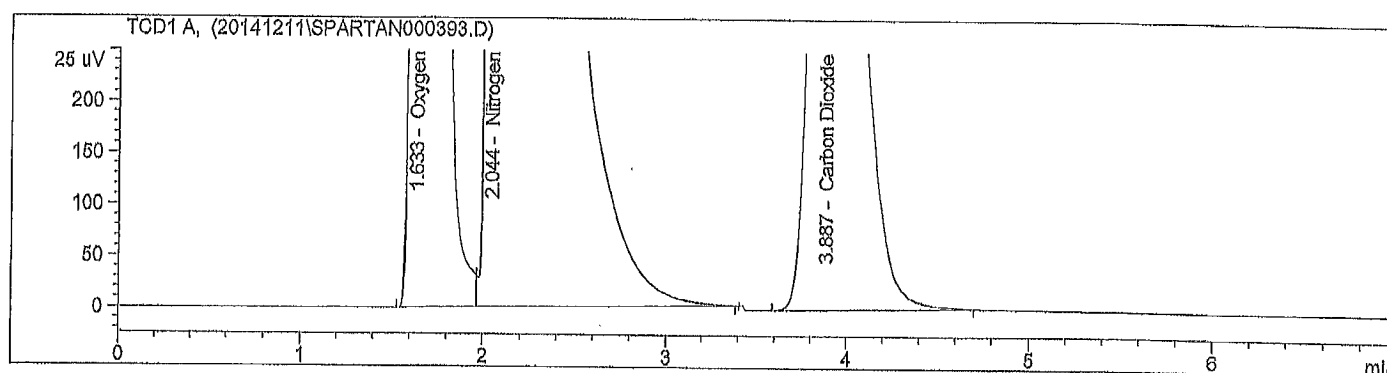
\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\20141211\SPARTAN000393.D  
Sample Name: T3B1B Tr#73307 1 cc inj

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 11-Dec-14, 15:01:51	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:57:55 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 3:08:58 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B  
1B - Tr#73307 - 15:30 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.633	BV	3.46669e4	3.93155e-4	14.180886	-	Oxygen
2.044	VBAS	1.95951e5	3.94065e-4	80.341579	-	Nitrogen
3.887	BBA	1.57500e4	3.34257e-4	5.477535	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

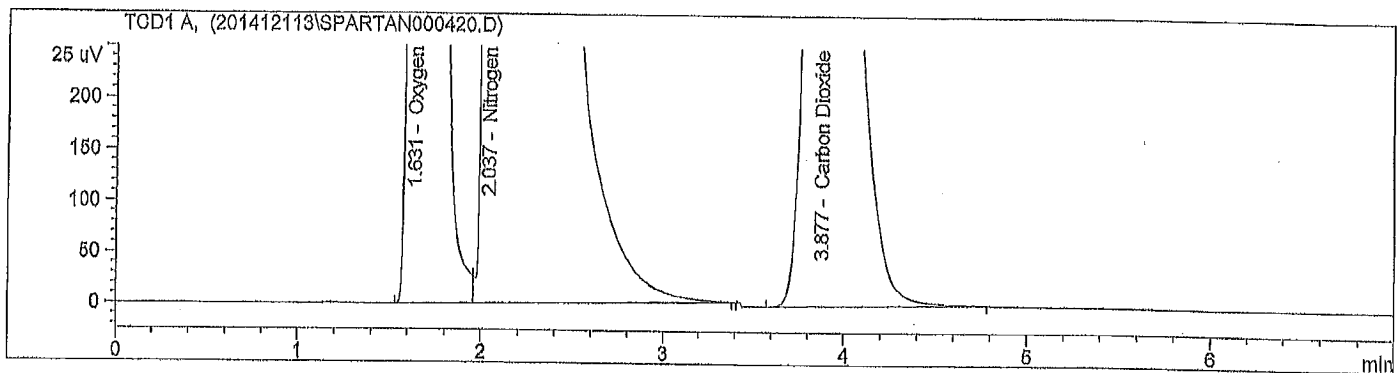
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 15:55:23 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 3:51:42 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 4:02:30 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-10 - T3B  
1B - Tr#73307 - 15:30 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.631	BV	3.57662e4	3.93152e-4	14.244248		Oxygen
2.037	VBAS	2.01309e5	3.94093e-4	80.365252		Nitrogen
3.877	BBA	1.59201e4	3.34254e-4	5.390500		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

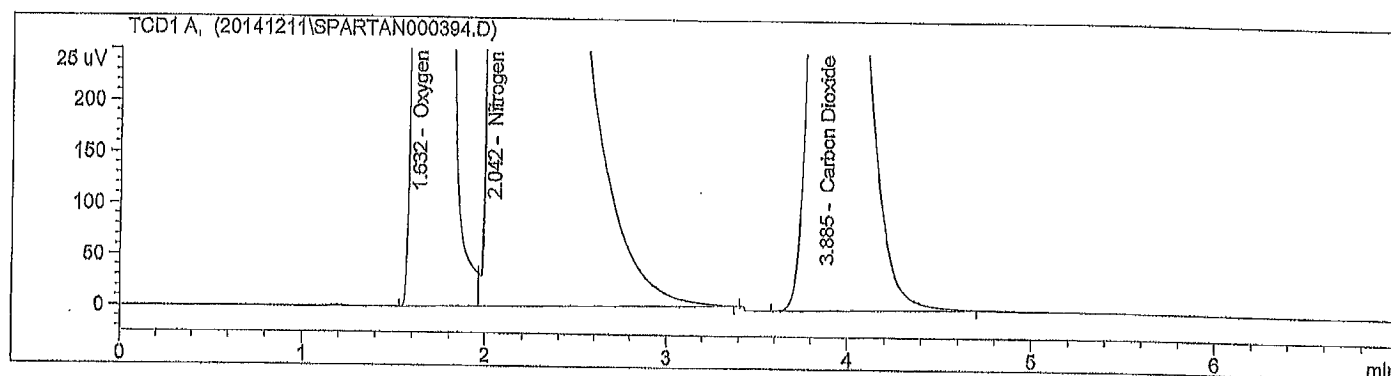
Sample Name: T4B1A Tr#73308 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:14:42        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:09:08 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:21:49 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                  1A - Tr#73308 - 08:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By           : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier          : 1.0000
Dilution            : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.632	BV	3.50873e4	3.93154e-4	14.300138	-	Oxygen
2.042	VBAS	1.96554e5	3.94068e-4	80.293665	-	Nitrogen
3.885	BBA	1.56020e4	3.34259e-4	5.406196	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

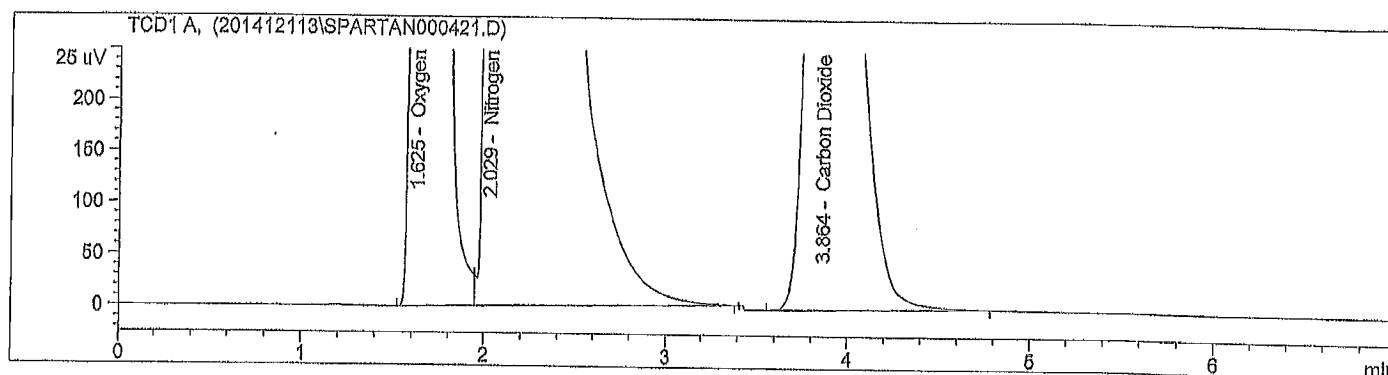
Sample Name: T4B1A Tr#73308 1 cc Inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:05:23
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:02:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:12:30 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1A - Tr#73308 - 08:30 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.625	BV	3.59375e4	3.93151e-4	14.351923	-	Oxygen
2.029	VBAS	2.00660e5	3.94089e-4	80.326213	-	Nitrogen
3.864	BBA	1.56740e4	3.34258e-4	5.321864	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

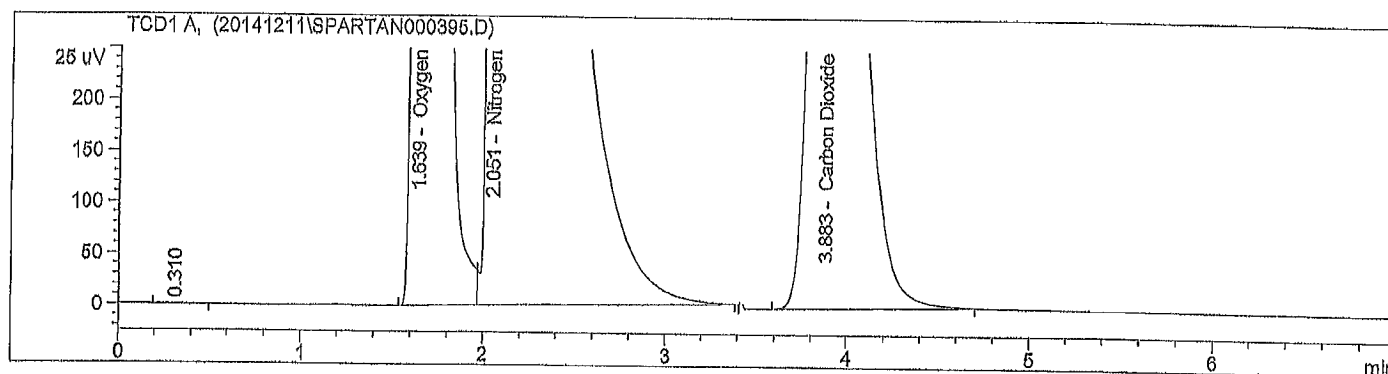
Sample Name: T4B1B Tr#73309 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 15:23:50
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:21:59 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:30:57 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1B - Tr#73309 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.639	BV	3.39189e4	3.93157e-4	13.916811	-	Oxygen
2.051	VBAS	1.95505e5	3.94063e-4	80.399981	-	Nitrogen
3.883	BBA	1.62927e4	3.34248e-4	5.683209	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

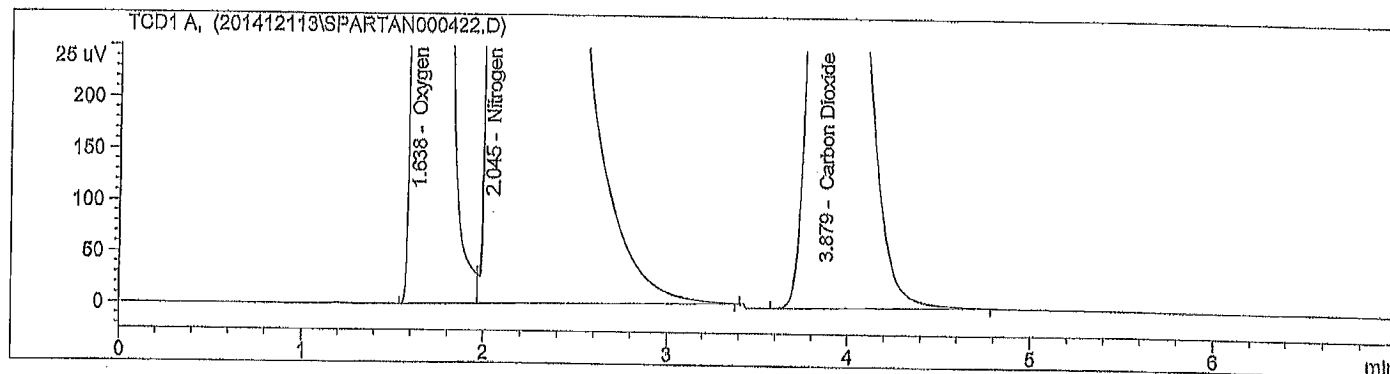
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:15:03
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:12:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:22:10 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B
                1B - Tr#73309 - 09:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.638	BV	3.46772e4	3.93155e-4	13.972656	-	Oxygen
2.045	VBAS	1.99080e5	3.94081e-4	80.405218	-	Nitrogen
3.879	BBA	1.64120e4	3.34247e-4	5.622126	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



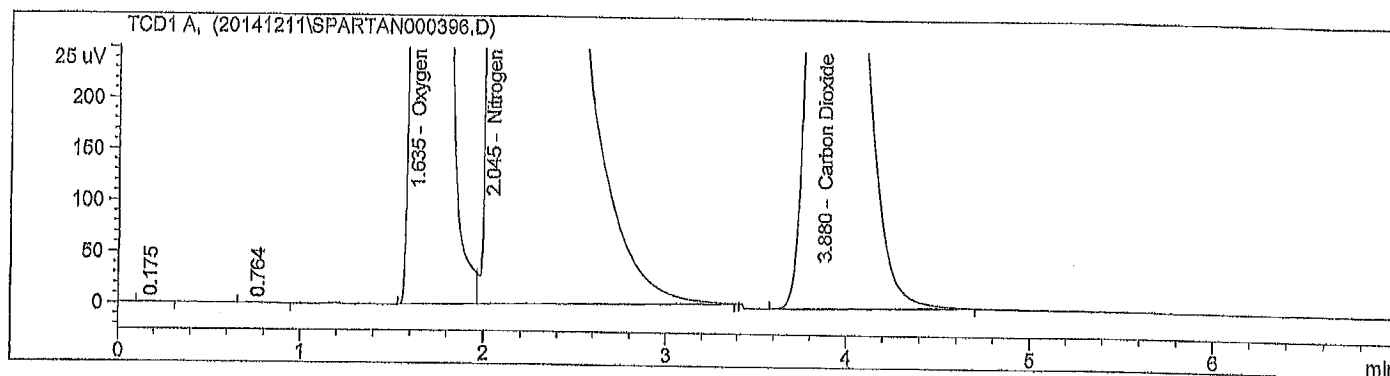
Sample Name: T5B1A Tr#73310 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:32:31        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:31:08 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:39:38 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                  1A - Tr#73310 - 10:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325		-	-	-		Hydrogen
1.635	BV	3.43879e4	3.93156e-4	14.059841		Oxygen
2.045	VBAS	1.96084e5	3.94066e-4	80.356370		Nitrogen
3.880	BBA	1.60637e4	3.34252e-4	5.583788		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

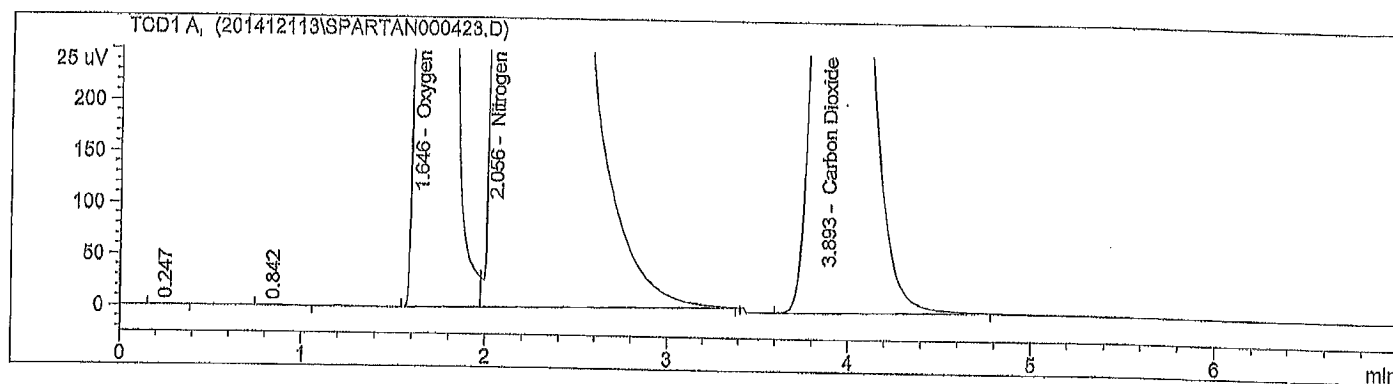
```

=====
*** End of Report ***
=====

```

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:23:40
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:22:20 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:30:47 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                1A - Tr#73310 - 10:05 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.646	BV	3.53111e4	3.93153e-4	14.098912	-	Oxygen
2.056	VBAS	2.00880e5	3.94090e-4	80.397902	-	Nitrogen
3.893	BBA	1.62118e4	3.34250e-4	5.503186	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

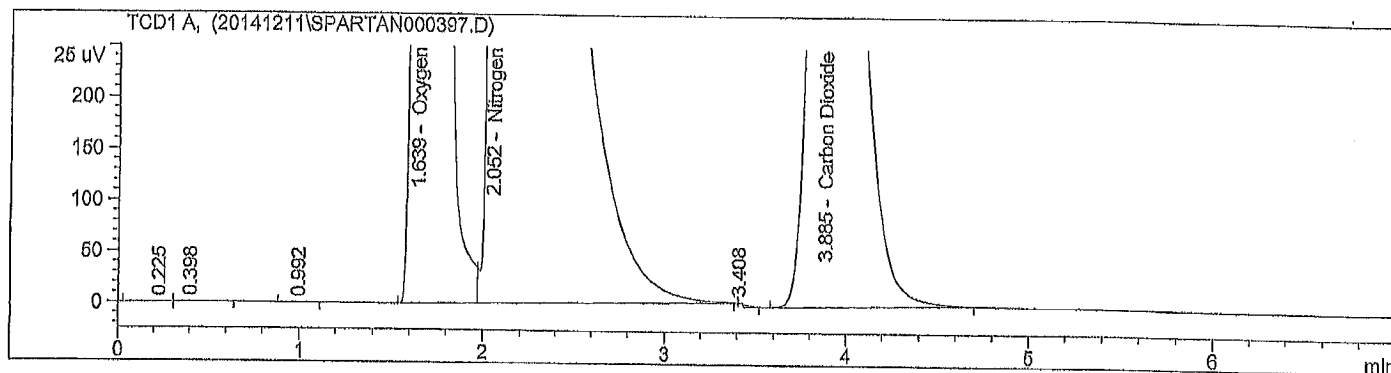
Sample Name: T5B1B Tr#73311 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 11-Dec-14, 15:40:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:39:48 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/11/2014 3:48:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                1B - Tr#73311 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.639	BV	3.45241e4	3.93155e-4	14.267644	-	Oxygen
2.052	VBAS	1.93883e5	3.94054e-4	80.308618	-	Nitrogen
3.885	BBA	1.54364e4	3.34262e-4	5.423738	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

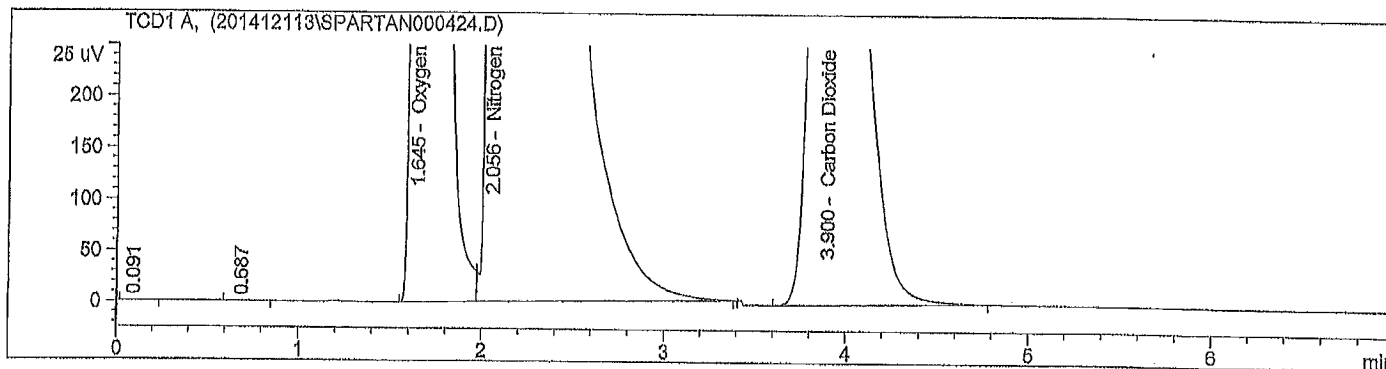
Sample Name: T5B1B Tr#73311 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 16:32:27        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 4:30:57 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 4:39:34 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T5B
                  1B - Tr#73311 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.645	BV	3.58574e4	3.93152e-4	14.311728	-	Oxygen
2.056	VBAS	2.00765e5	3.94090e-4	80.322505	-	Nitrogen
3.900	BBA	1.58125e4	3.34256e-4	5.365767	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

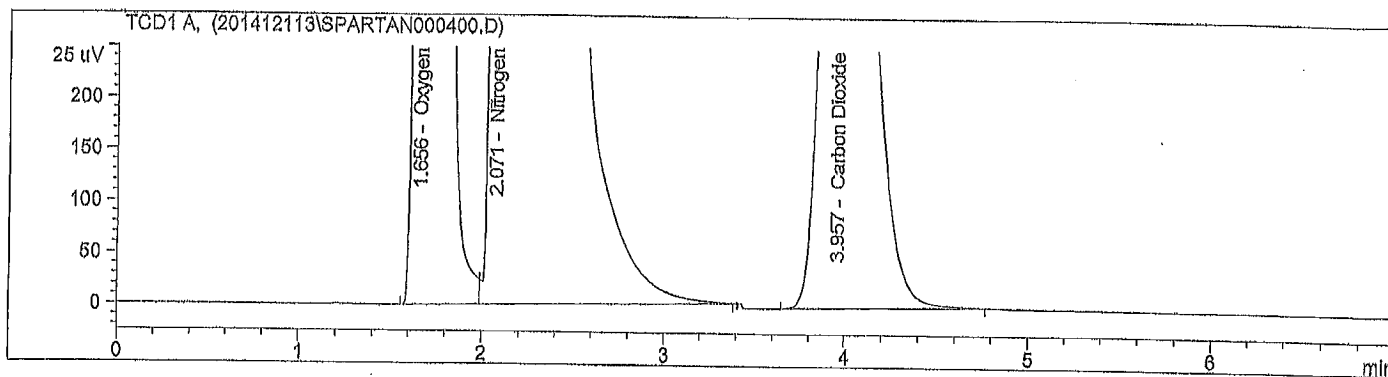
=====
*** End of Report ***

```

=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 11:39:00 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 11:31:43 AM by Maxxam - ID# 6538 - BW  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 11:46:00 AM by Maxxam - ID# 6538 - BW  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T4B  
1A - Tr#73325 - 13-00 - 1 cc injection  
11:35 *SW*



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.656	BV	3.75849e4	3.93147e-4	15.077657	-	Oxygen
2.071	VBAS	1.99116e5	3.94082e-4	80.067842	-	Nitrogen
3.957	BBA	1.42320e4	3.34283e-4	4.854500	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

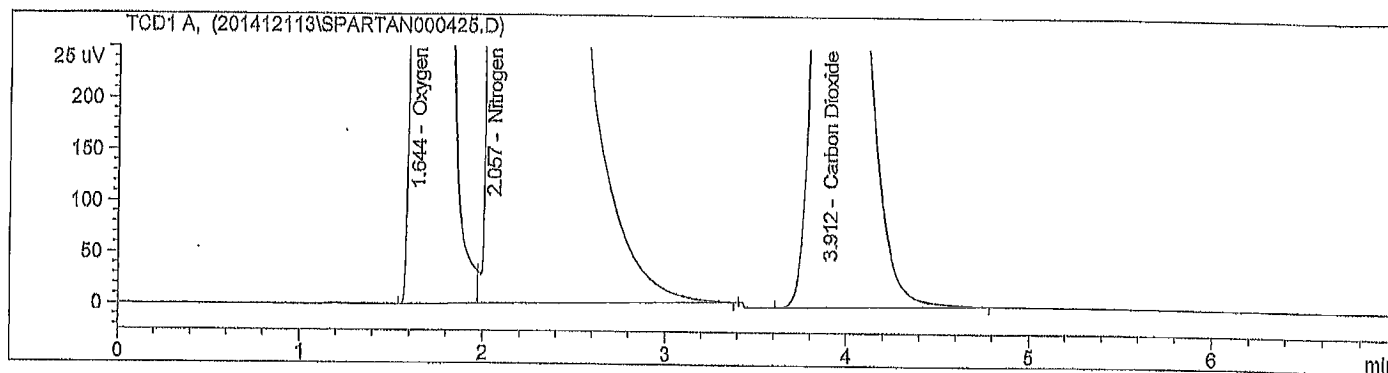
Sample Name: T6B1A Tr#73325 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:42:59
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:39:44 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:50:06 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B
                1A - Tr#73325 - 11:35 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.77631e4	3.93147e-4	15.071963	-	Oxygen
2.057	VBAS	2.00252e5	3.94087e-4	80.115548	-	Nitrogen
3.912	BBA	1.41810e4	3.34284e-4	4.812489	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

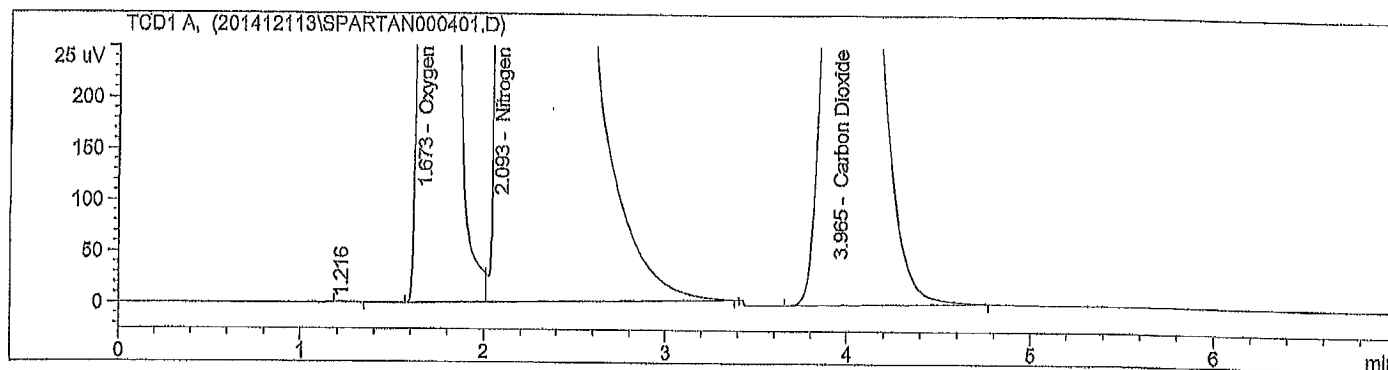
Sample Name: T6B1B Tr#73326 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 11:51:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 11:46:15 AM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:01:17 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - TAB
                  1B - Tr#73326 - 13-25 - 1 cc injection
                  (2:10 BW)

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:01:17 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.673	BV	3.68061e4	3.93149e-4	14.779464	-	Oxygen
2.093	VBAS	1.99260e5	3.94082e-4	80.202555	-	Nitrogen
3.965	BBA	1.46975e4	3.34274e-4	5.017980	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

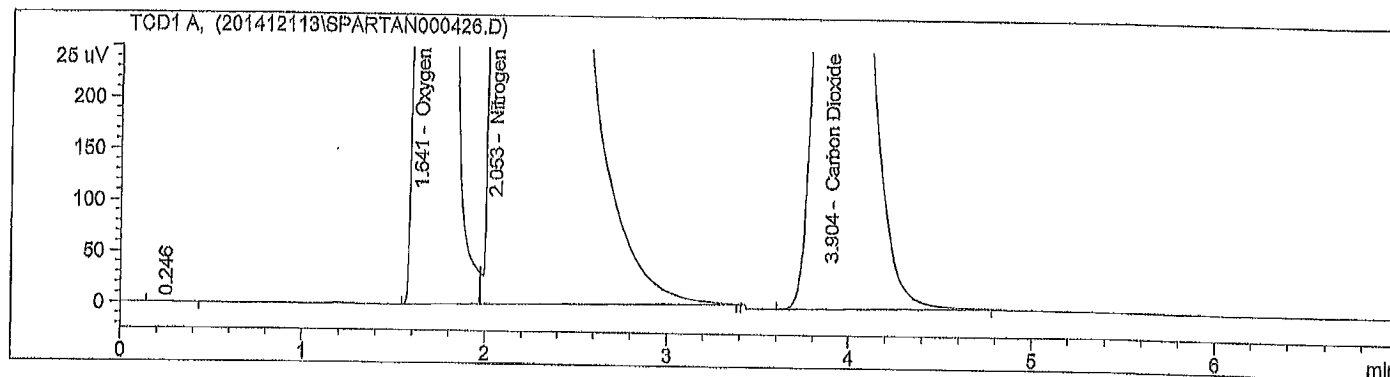
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 16:52:12
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:50:16 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:59:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T6B
                1B - Tr#73326 - 12:10 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.71464e4	3.93148e-4	14.793015		Oxygen
2.053	VBAS	2.00913e5	3.94091e-4	80.202516		Nitrogen
3.904	BBA	1.47800e4	3.34273e-4	5.004470		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



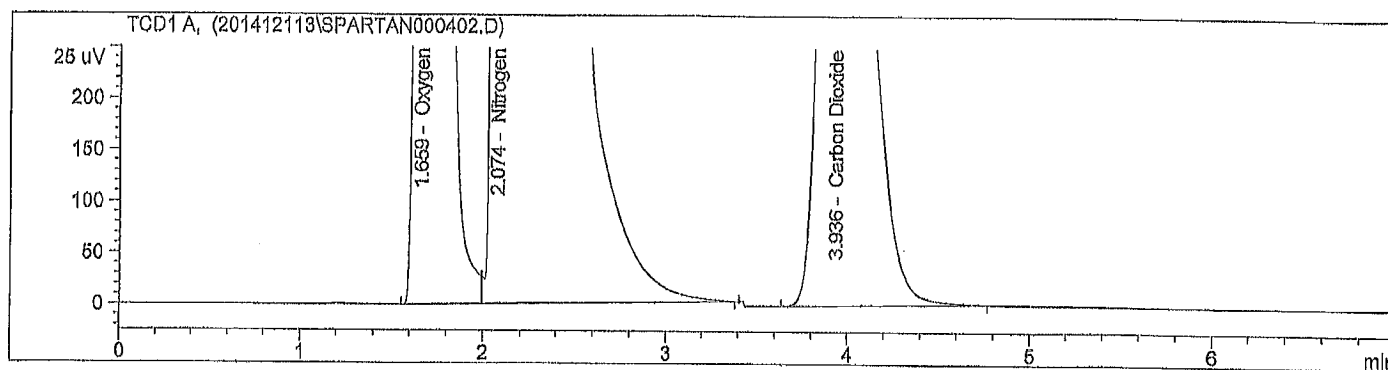
Sample Name: T7B1A Tr#73327 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 12:04:15
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:01:17 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:11:22 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1A - Tr#73327 - 14:30 - 1 cc injection
                B:05 BW
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:01:17 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.659	BV	3.61436e4	3.93151e-4	14.572023		Oxygen
2.074	VBAS	1.98592e5	3.94079e-4	80.255580		Nitrogen
3.936	BBA	1.50893e4	3.34267e-4	5.172397		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

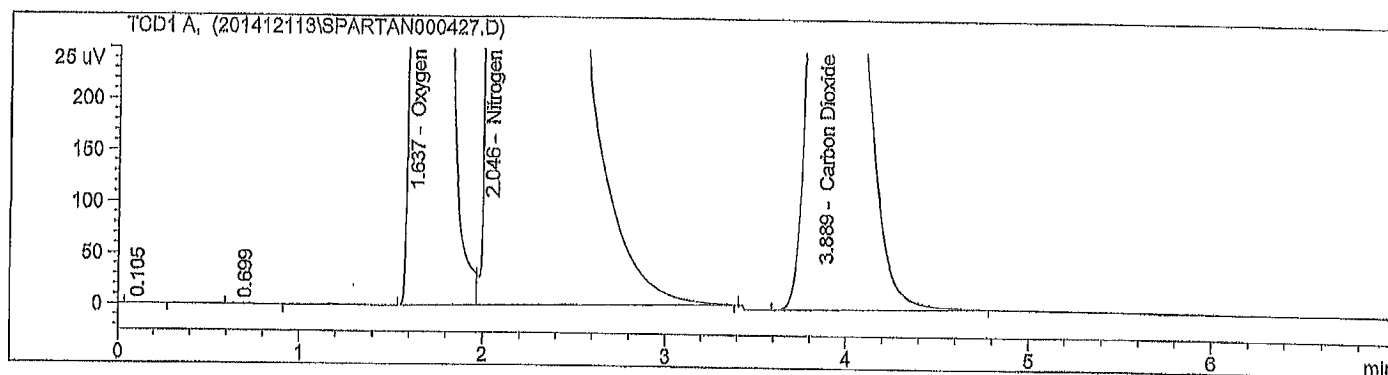
Sample Name: T7B1A Tr#73327 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:00:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 4:59:29 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:08:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1A - Tr#73327 - 13:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.637	BV	3.64309e4	3.93150e-4	14.577224	-	Oxygen
2.046	VBAS	2.00098e5	3.94087e-4	80.256618	-	Nitrogen
3.889	BBA	1.51855e4	3.34266e-4	5.166158	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

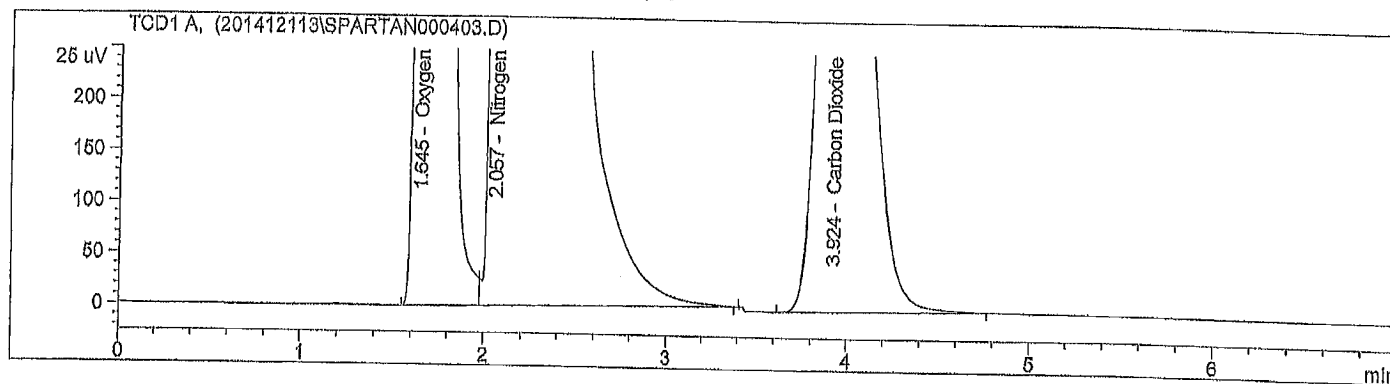
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 12:13:43 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:11:32 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:27:28 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B  
1B - Tr#73328 - 15.05 - 1 cc injection  
13:40 SW



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.645	BV	3.74293e4	3.93148e-4	14.976146	-	Oxygen
2.057	VBAS	1.99774e5	3.94085e-4	80.123857	-	Nitrogen
3.924	BBA	1.44030e4	3.34280e-4	4.899997	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals ; 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

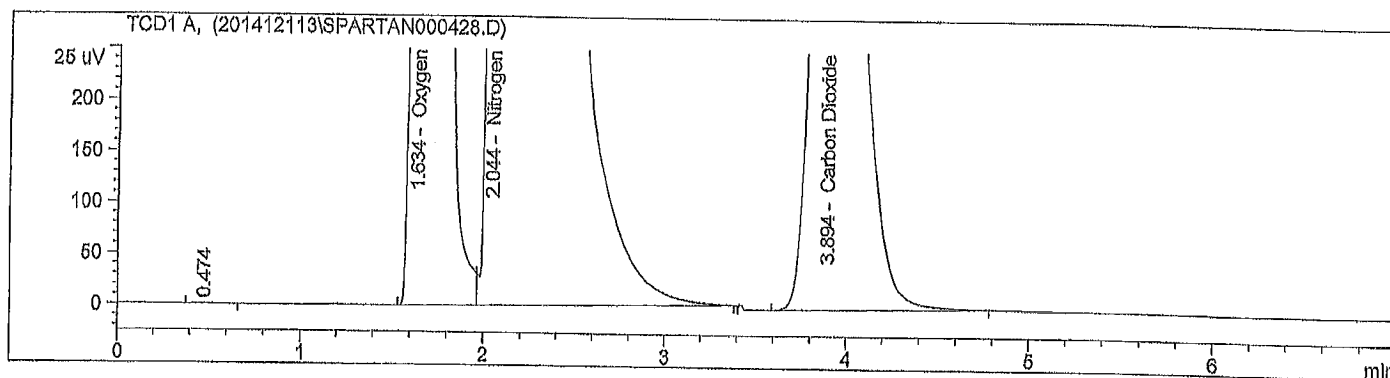
Sample Name: T7B1B Tr#73328 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:09:57
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:08:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:17:04 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T7B
                1B - Tr#73328 - 13:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.634	BV	3.74772e4	3.93147e-4	14.998602	-	Oxygen
2.044	VBAS	1.99745e5	3.94085e-4	80.129646	-	Nitrogen
3.894	BBA	1.43168e4	3.34281e-4	4.871752	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

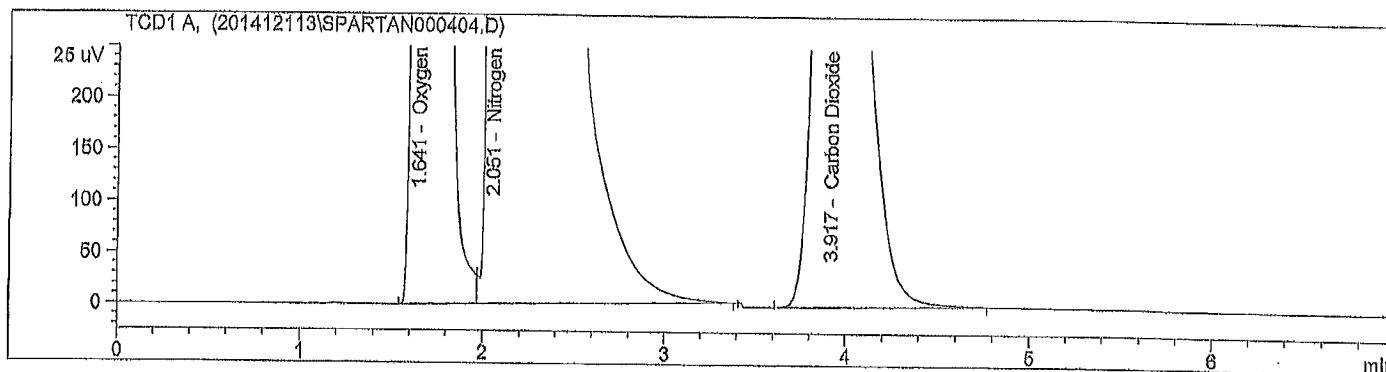
```

=====
*** End of Report ***

```

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 12:29:28        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:27:28 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:36:35 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                  1A - Tr#73329 - 14:40 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.70739e4	3.93148e-4	14.934592	-	Oxygen
2.051	VBAS	1.98443e5	3.94078e-4	80.128397	-	Nitrogen
3.917	BBA	1.44140e4	3.34280e-4	4.937010	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

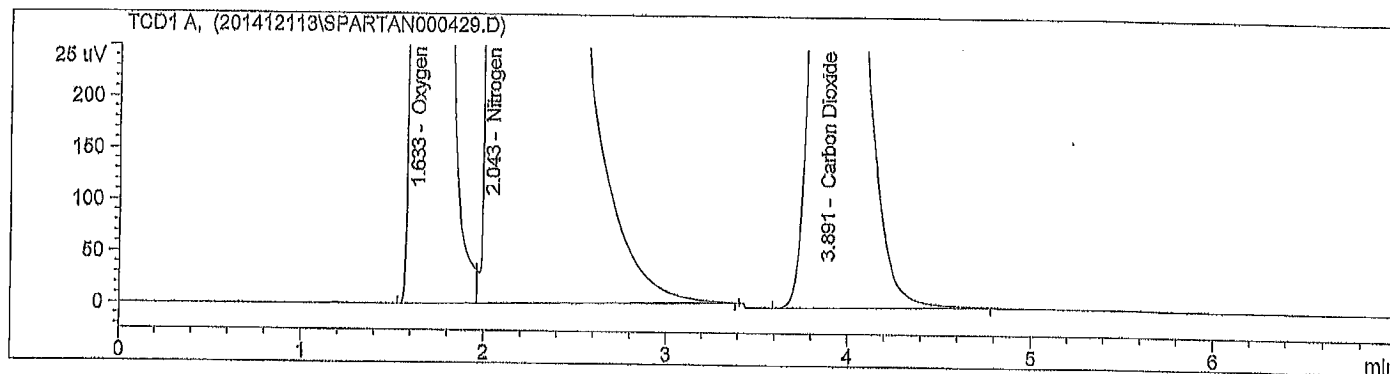
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:19:57
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:17:14 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:27:05 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                  1A - Tr#73329 - 14:40 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.633	BV	3.73907e4	3.93148e-4	14.931972		Oxygen
2.043	VBAS	2.00243e5	3.94087e-4	80.158246		Nitrogen
3.891	BBA	1.44596e4	3.34279e-4	4.909782		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

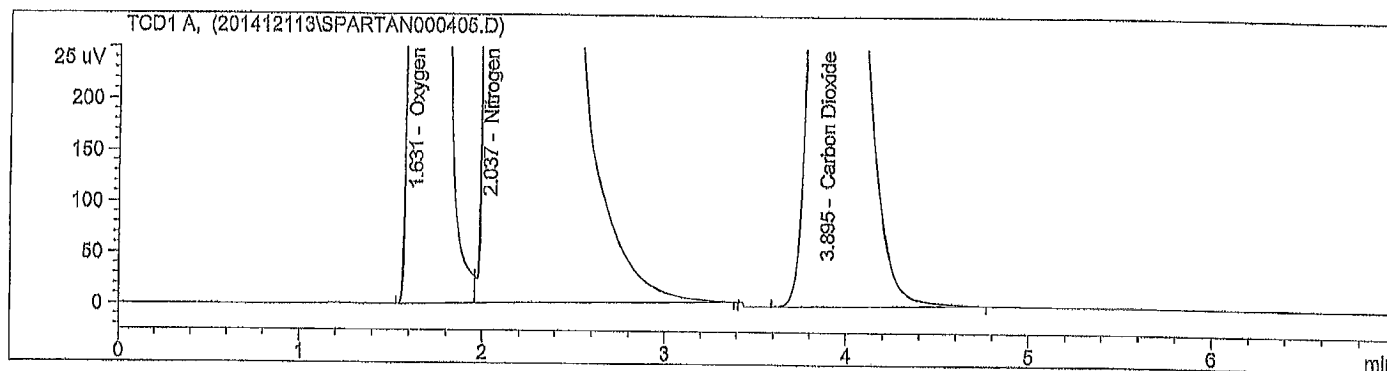
Sample Name: T8B1B Tr#73330 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 12:40:38        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:36:45 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 12:47:45 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                  1B - Tr#73330 - 15:15 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.631	BV	3.67733e4	3.93149e-4	14.750073		Oxygen
2.037	VBA5	1.99428e5	3.94083e-4	80.182205		Nitrogen
3.895	BBA	1.48597e4	3.34271e-4	5.067721		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

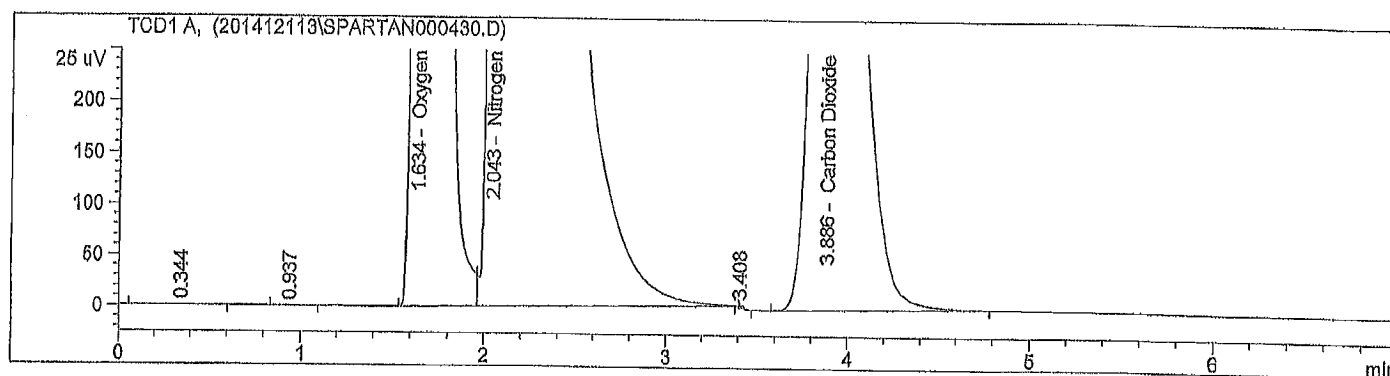
Sample Name: T8B1B Tr#73330 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:28:28
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:27:15 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:35:35 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T8B
                1B - Tr#73330 - 15:15 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.634	BV	3.67586e4	3.93149e-4	14.742918		Oxygen
2.043	VBAS	1.99503e5	3.94084e-4	80.205760		Nitrogen
3.886	BBA	1.48128e4	3.34272e-4	5.051322		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

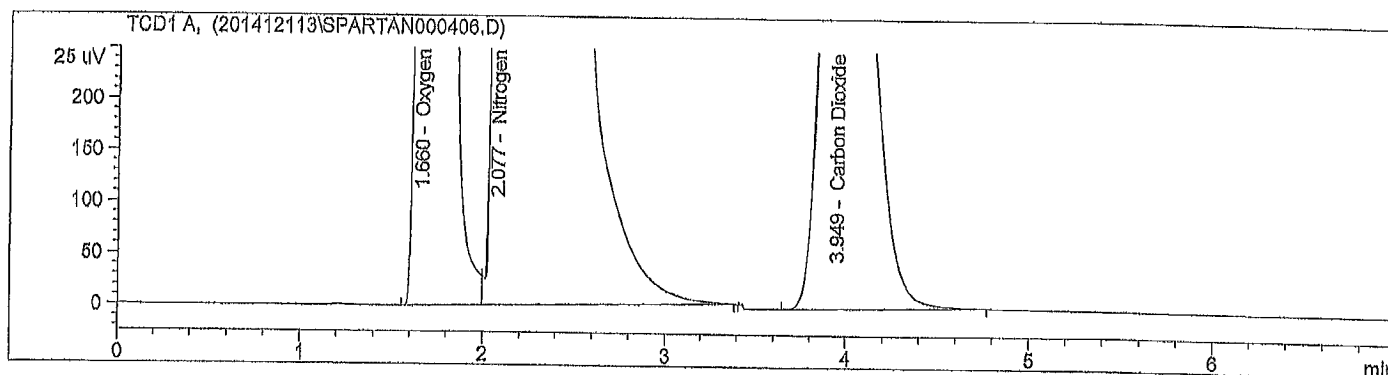


Data File C:\CHEM32\1\DATA\201412113\SPARTAN000406.D  
Sample Name: T9B1A Tr#73331 1 cc inj

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	
Acq. Instrument	: Instrument 1	Location : -
Injection Date	: 13-Dec-14, 12:50:07	Inj : 1
		Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:47:55 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 12:57:14 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B  
1A - Tr#73331 - 16:10 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.660	BV	3.86333e4	3.93145e-4	15.425678		Oxygen
2.077	VBAS	1.99967e5	3.94086e-4	80.034680		Nitrogen
3.949	BBA	1.33707e4	3.34301e-4	4.539642		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

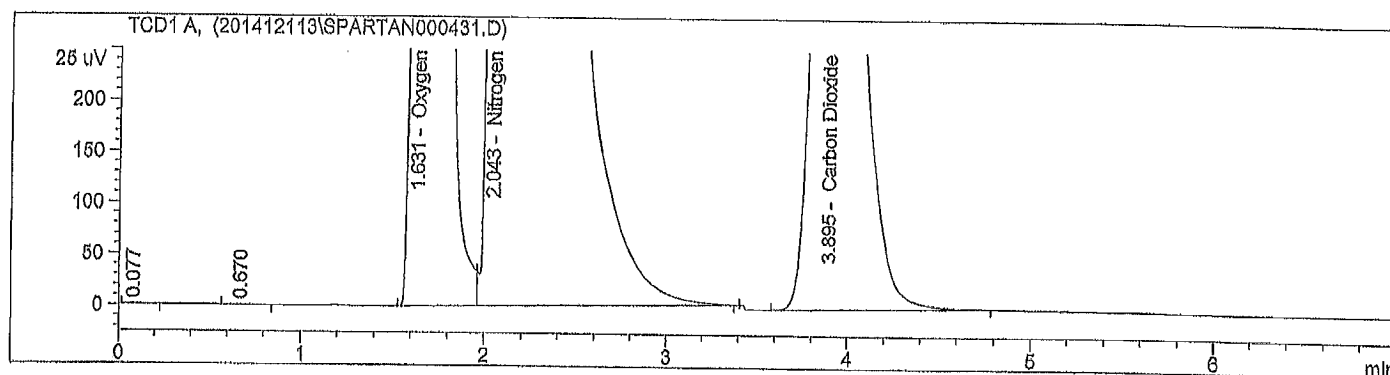
Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:37:15
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:35:46 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:44:22 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                1A - Tr#73331 - 16:10 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.631	BV	3.86016e4	3.93145e-4	15.414385	-	Oxygen
2.043	VBAS	1.99939e5	3.94086e-4	80.030773	-	Nitrogen
3.895	BBA	1.34143e4	3.34300e-4	4.554841	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

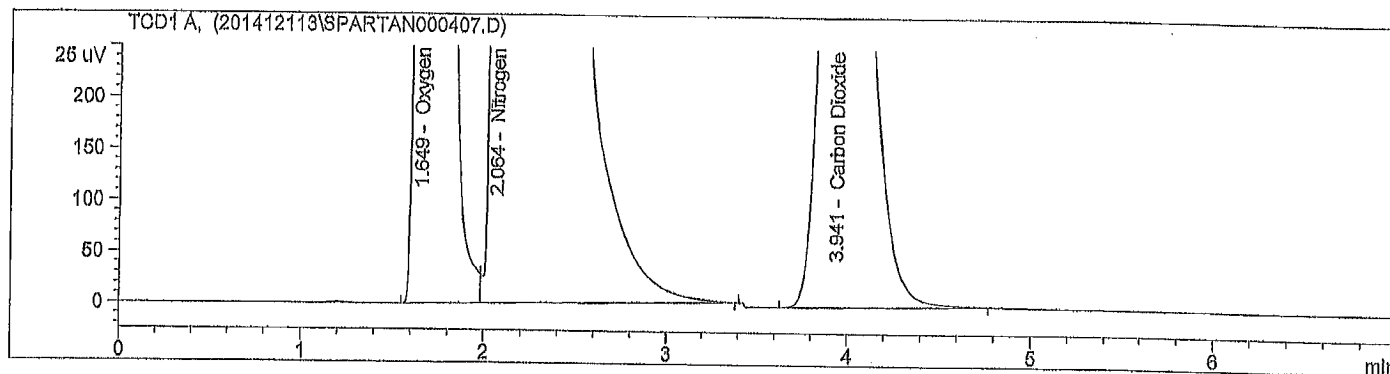
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:01:24
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 12:57:24 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:08:31 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                  1B - Tr#73332 - 16:45 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with TSTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.649	BV	3.89435e4	3.93144e-4	15.642914	-	Oxygen
2.064	VBAS	1.98546e5	3.94079e-4	79.942179	-	Nitrogen
3.941	BBA	1.29253e4	3.34311e-4	4.414907	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

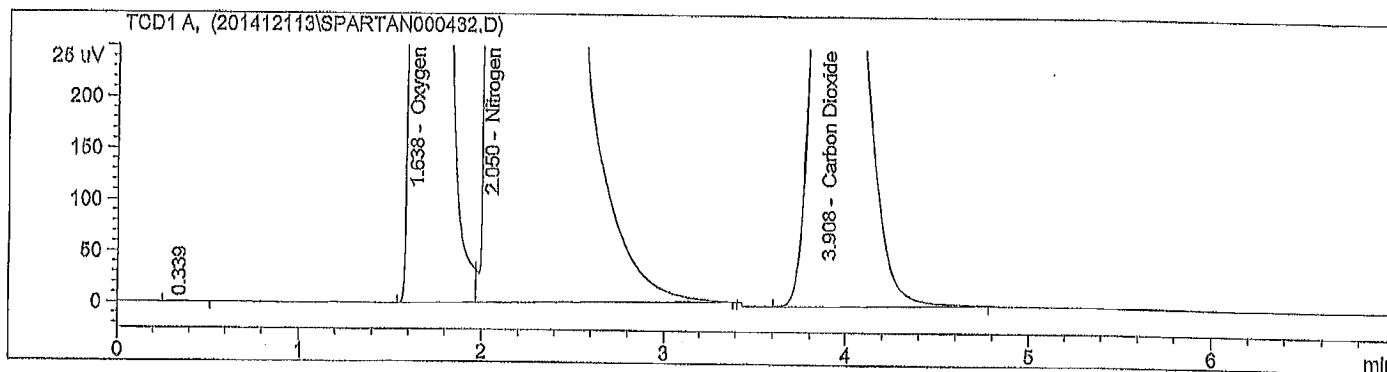
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 17:46:22
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:44:33 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 5:53:30 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-11 - T9B
                  1B - Tr#73332 - 16:45 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.638	BV	3.92800e4	3.93143e-4	15.657882	-	Oxygen
2.050	VBAS	2.00053e5	3.94086e-4	79.937040	-	Nitrogen
3.908	BBA	1.29956e4	3.34309e-4	4.405079	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

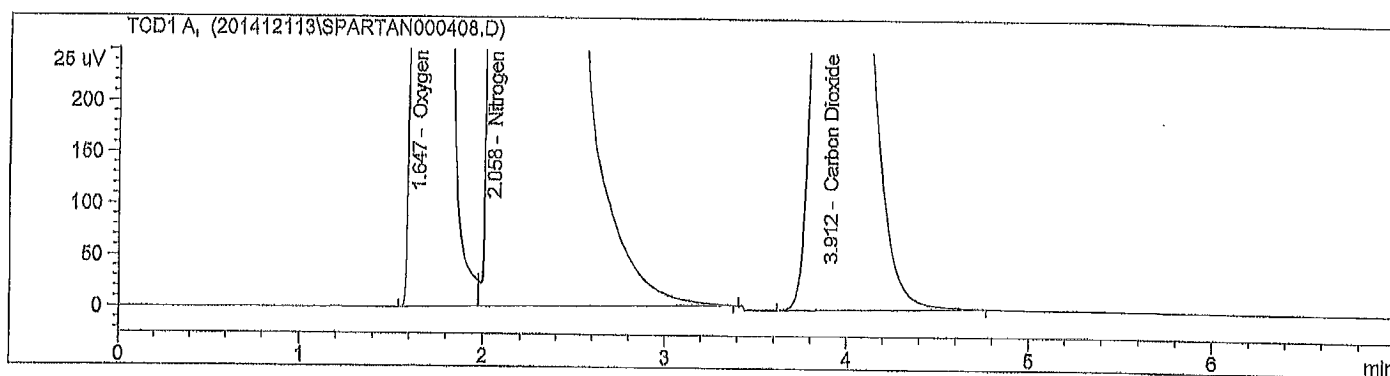
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\201412113\SPARTAN000408.D  
Sample Name: T10B1A Tr#73333 1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:14:16
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:08:41 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:21:23 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                B1A - Tr#73333 - 08:25 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.647	BV	3.56009e4	3.93152e-4	14.320501		Oxygen
2.058	VBAS	1.99147e5	3.94082e-4	80.296274		Nitrogen
3.912	BBA	1.57408e4	3.34257e-4	5.383224		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

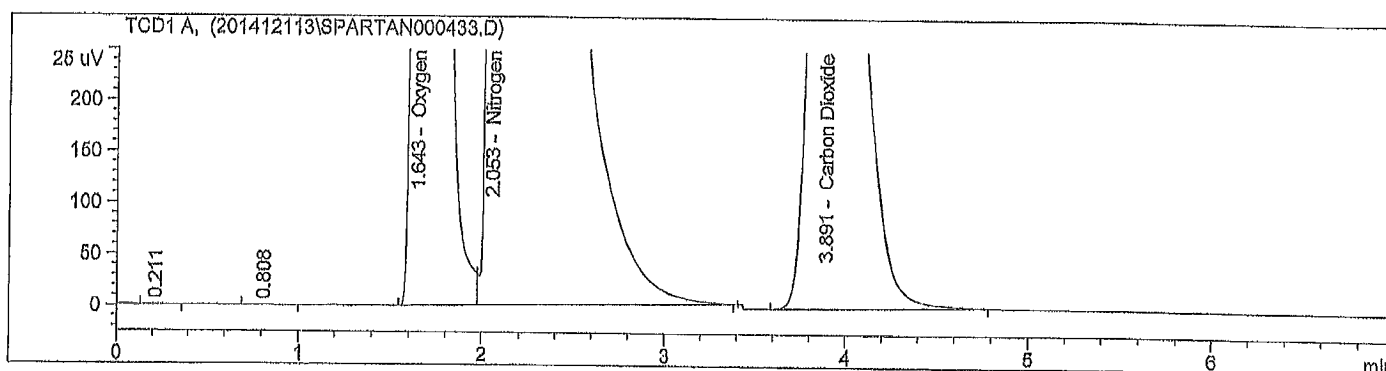
\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\201412113\SPARTAN000433.D  
Sample Name: T10B1A Tr#73333 1 cc inj

=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 17:55:02	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 5:53:39 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:02:09 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T10  
B1A - Tr#73333 - 08:25 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.643	BV	3.60246e4	3.93151e-4	14.322703	-	Oxygen
2.053	VBAS	2.01529e5	3.94094e-4	80.316412	-	Nitrogen
3.891	BBA	1.58596e4	3.34255e-4	5.360885	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

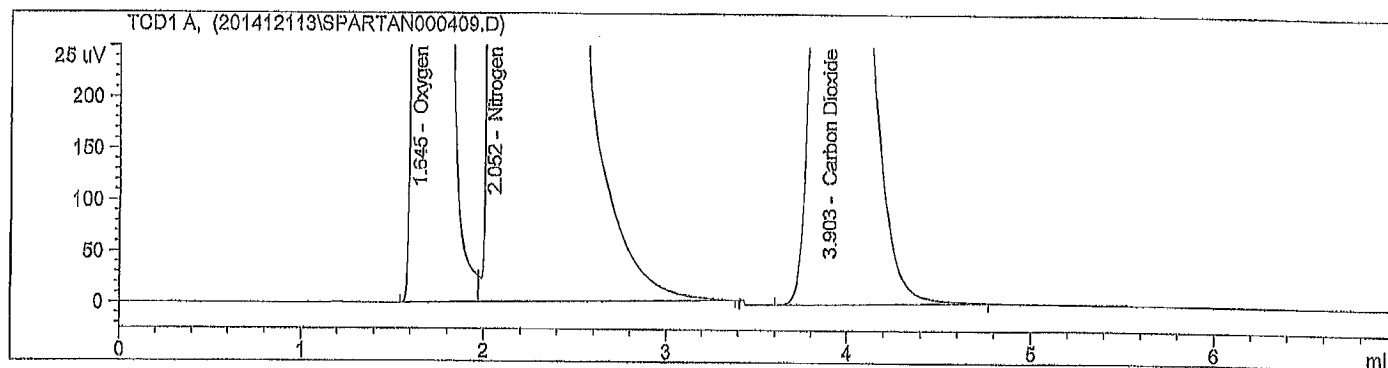
Sample Name: T10B1B Tr#73334 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:23:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 1:21:33 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 1:31:02 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                  B1B - Tr#73334 - 09:05 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355						Hydrogen
1.645	BV	3.45542e4	3.93155e-4	13.924563		Oxygen
2.052	VBAS	1.99010e5	3.94081e-4	80.385387		Nitrogen
3.903	BBA	1.66087e4	3.34244e-4	5.690050		Carbon Dioxide
5.038						Methane
6.085						Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

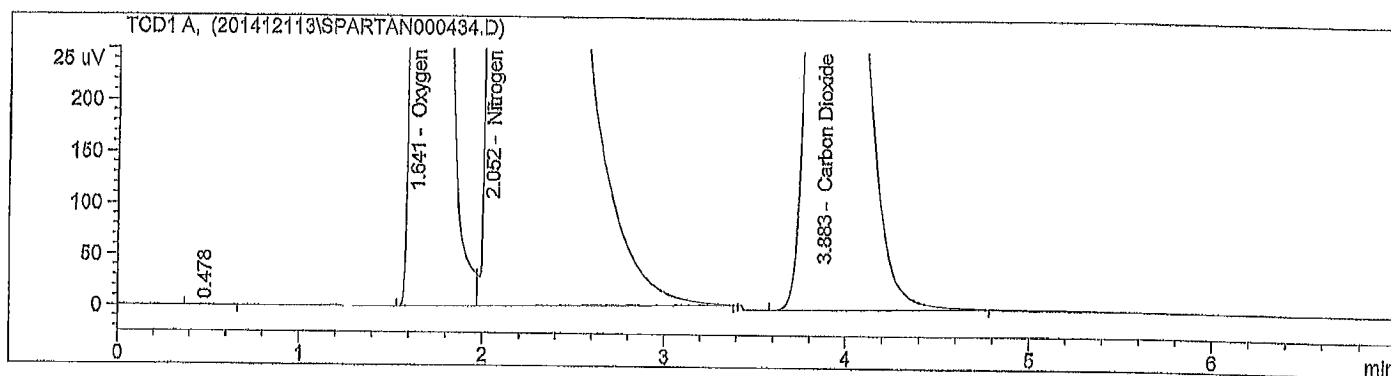
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:04:01
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:02:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:11:08 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T10
                B1B - Tr#73334 - 09:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.641	BV	3.48761e4	3.93154e-4	13.919748	-	Oxygen
2.052	VBAS	2.01031e5	3.94091e-4	80.426722	-	Nitrogen
3.883	BBA	1.66616e4	3.34243e-4	5.653530	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

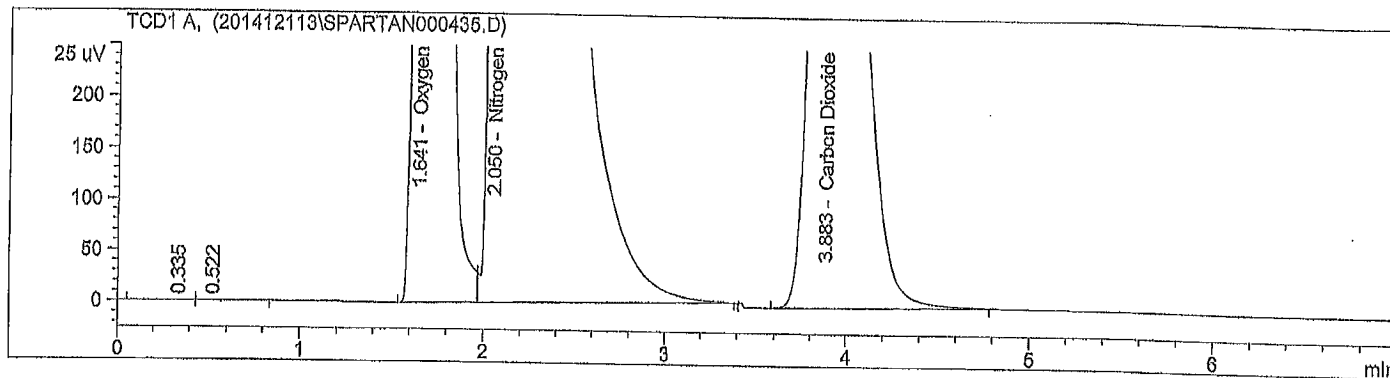
Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*



```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 18:12:21        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 6:11:18 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 6:19:28 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                  B1A - Tr#73335 - 09:55 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.55167e4	3.93152e-4	14.107470		Oxygen
2.050	VBAS	2.01806e5	3.94095e-4	80.350639		Nitrogen
3.883	BBA	1.64110e4	3.34247e-4	5.541891		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

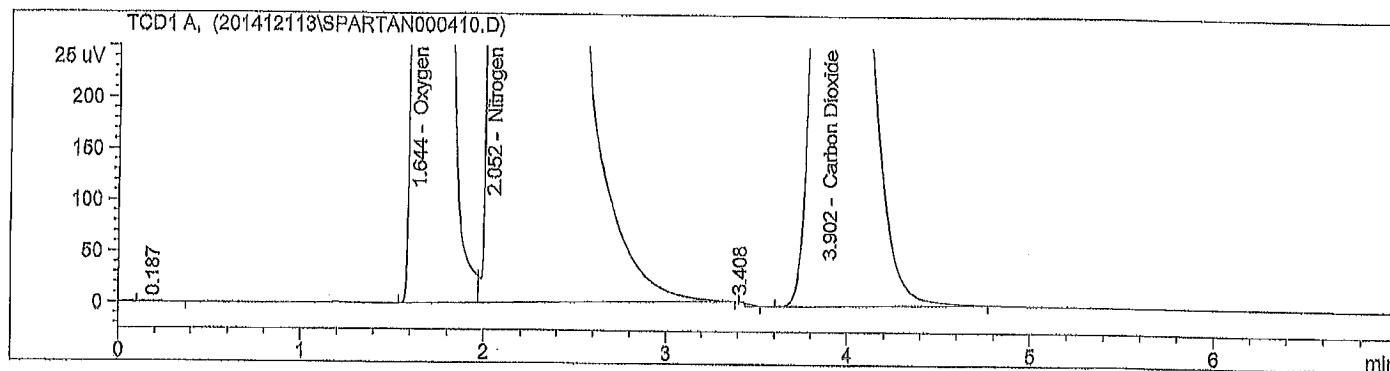
Sample Name: T11B1A Tr#73335 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:33:12
Location       : -
Inj           : 1
Inj Volume    : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:31:12 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:40:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1A - Tr#73335 - 09:55 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.644	BV	3.50528e4	3.93154e-4	14.088072		Oxygen
2.052	VBAS	1.99442e5	3.94083e-4	80.347443		Nitrogen
3.902	BBA	1.62850e4	3.34249e-4	5.564486		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```

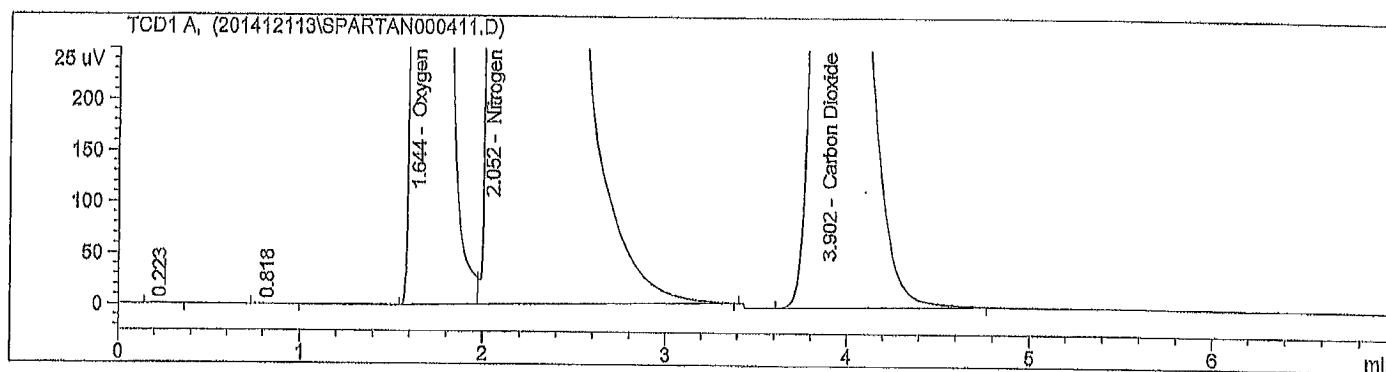
Sample Name: T11B1B Tr#73336 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 13:41:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:40:29 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:48:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1B - Tr#73336 - 10:40 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.644	BV	3.54348e4	3.93153e-4	14.149885	-	Oxygen
2.052	VBAS	2.00705e5	3.94090e-4	80.336850	-	Nitrogen
3.902	BBA	1.62396e4	3.34249e-4	5.513266	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

```
Totals : 100.000000
```

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***
=====

```

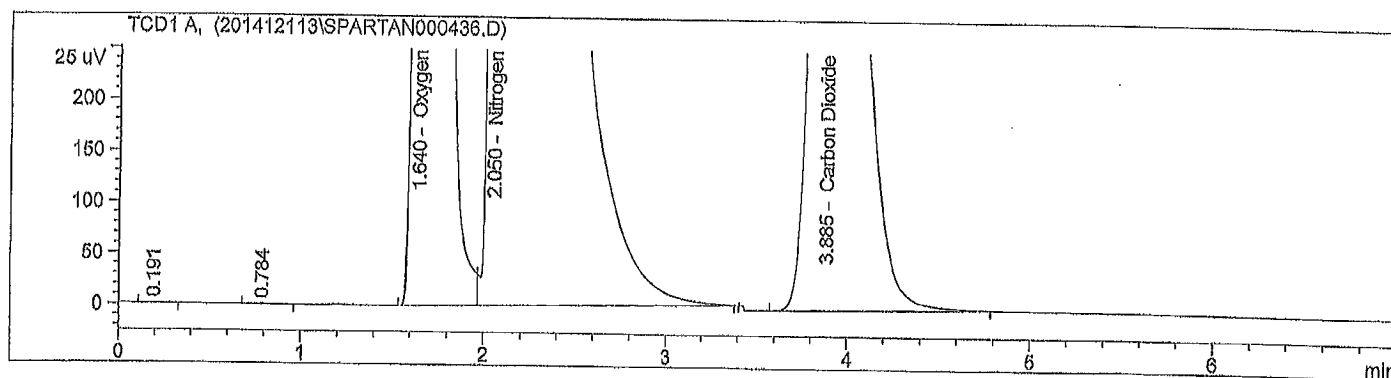
Sample Name: T11B1B Tr#73336 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:21:02
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:19:38 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:28:09 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T11
                B1B - Tr#73336 - 10:40 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.640	BV	3.55673e4	3.93152e-4	14.153537	-	Oxygen
2.050	VBAS	2.01436e5	3.94093e-4	80.350585	-	Nitrogen
3.885	BBA	1.62448e4	3.34249e-4	5.495878	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

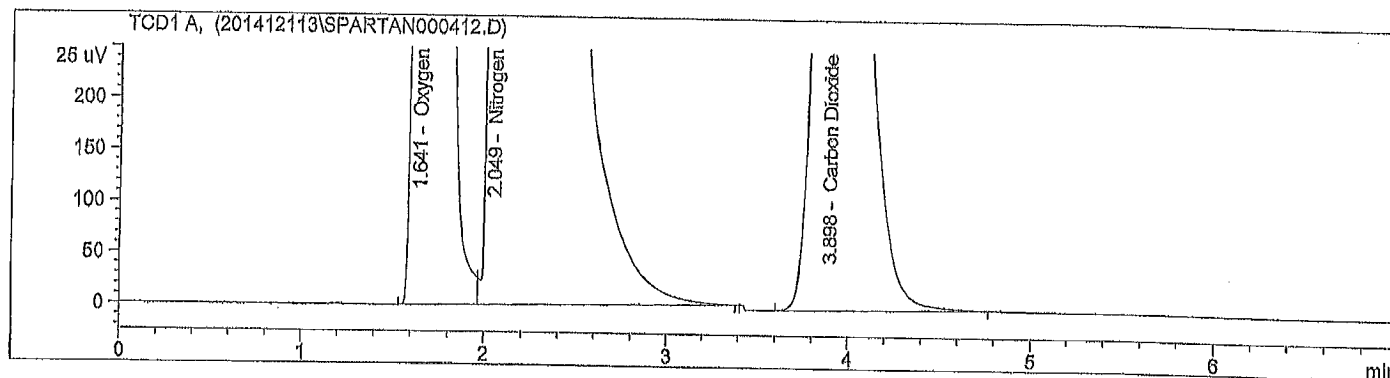
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\201412113\SPARTAN000412.D  
Sample Name: T12B1A Tr#73337 1 cc inj

=====  
Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 13:51:45 Inj : 1  
Inj Volume : Manually  
Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:49:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 1:58:52 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T12  
B1A - Tr#73337 - 11:30 - 1 cc injection



=====  
Normalized Percent Report  
=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.641	BV	3.54625e4	3.93153e-4	14.223440		Oxygen
2.049	VBAS	1.99767e5	3.94085e-4	80.313218		Nitrogen
3.898	BBA	1.60217e4	3.34252e-4	5.463342		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

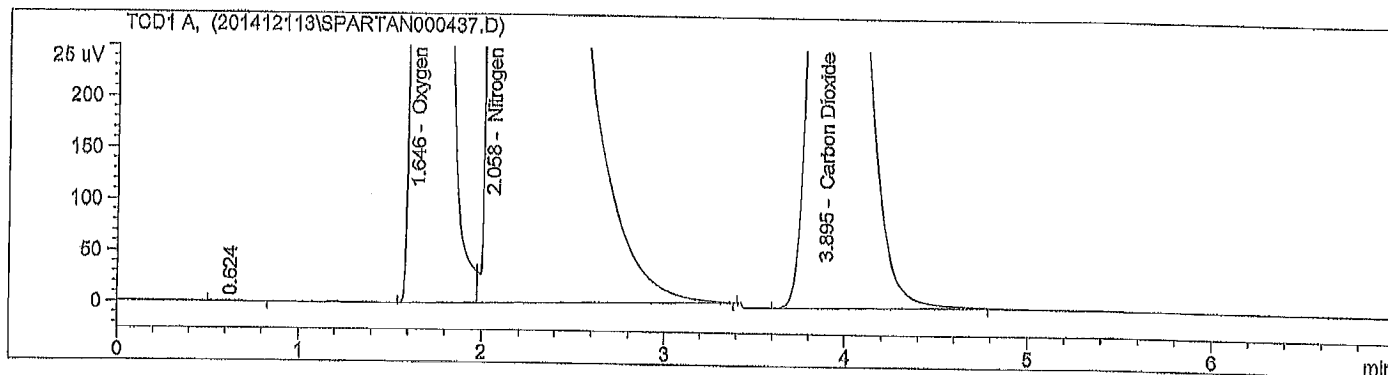
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====  
\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:29:52
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:28:19 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:36:59 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                B1A - Tr#73337 - 11:30 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.646	BV	3.55005e4	3.93152e-4	14.220822		Oxygen
2.058	VBAS	2.00058e5	3.94086e-4	80.329728		Nitrogen
3.895	BBA	1.60011e4	3.34253e-4	5.449449		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

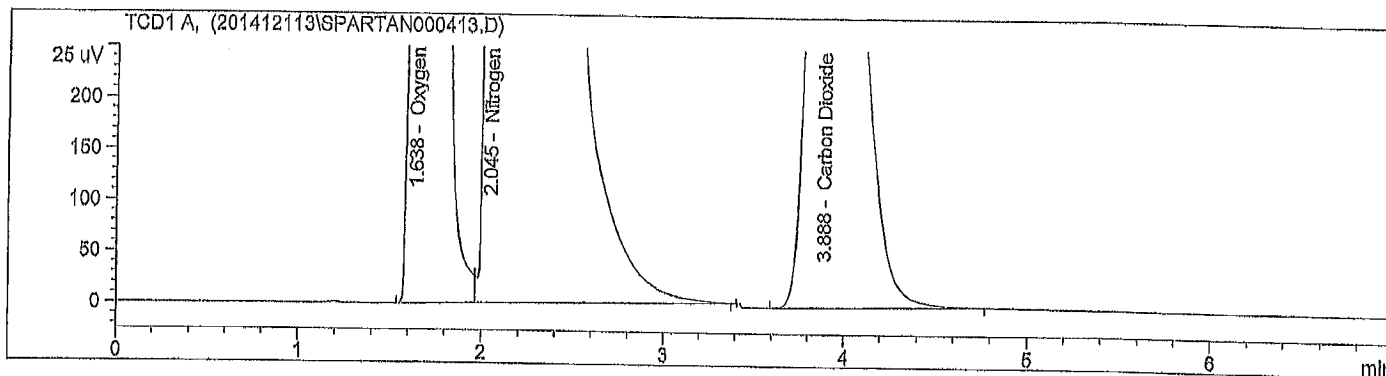
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:08:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 1:59:02 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:16:02 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                  B1B - Tr#73338 - 12:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.638	BV	3.52385e4	3.93153e-4	14.029007		Oxygen
2.045	VBAS	2.01397e5	3.94093e-4	80.370934		Nitrogen
3.888	BBA	1.65455e4	3.34245e-4	5.600059		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

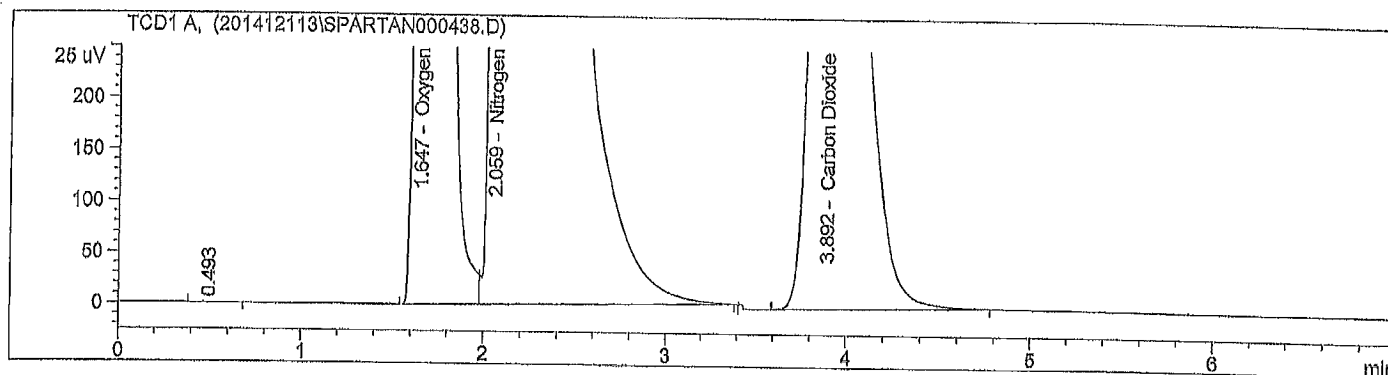
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 18:38:51
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:37:09 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 6:45:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T12
                B1B - Tr#73338 - 12:05 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution      : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.647	BV	3.50068e4	3.93154e-4	14.018034		Oxygen
2.059	VBAS	2.00287e5	3.94088e-4	80.392815		Nitrogen
3.892	BBA	1.64175e4	3.34247e-4	5.589151		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

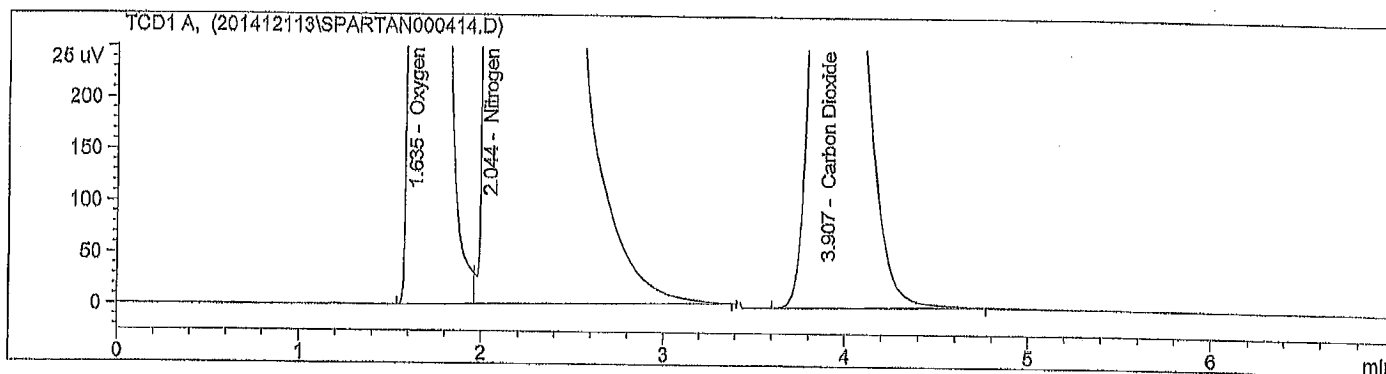
\*\*\* End of Report \*\*\*



=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 13-Dec-14, 14:18:30	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 2:16:12 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 2:25:37 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T13  
B1A - Tr#73339 - 13:00 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.635	BV	3.86394e4	3.93145e-4	15.457051	-	Oxygen
2.044	VBAS	1.99469e5	3.94083e-4	79.984714	-	Nitrogen
3.907	BBA	1.34004e4	3.34300e-4	4.558235	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

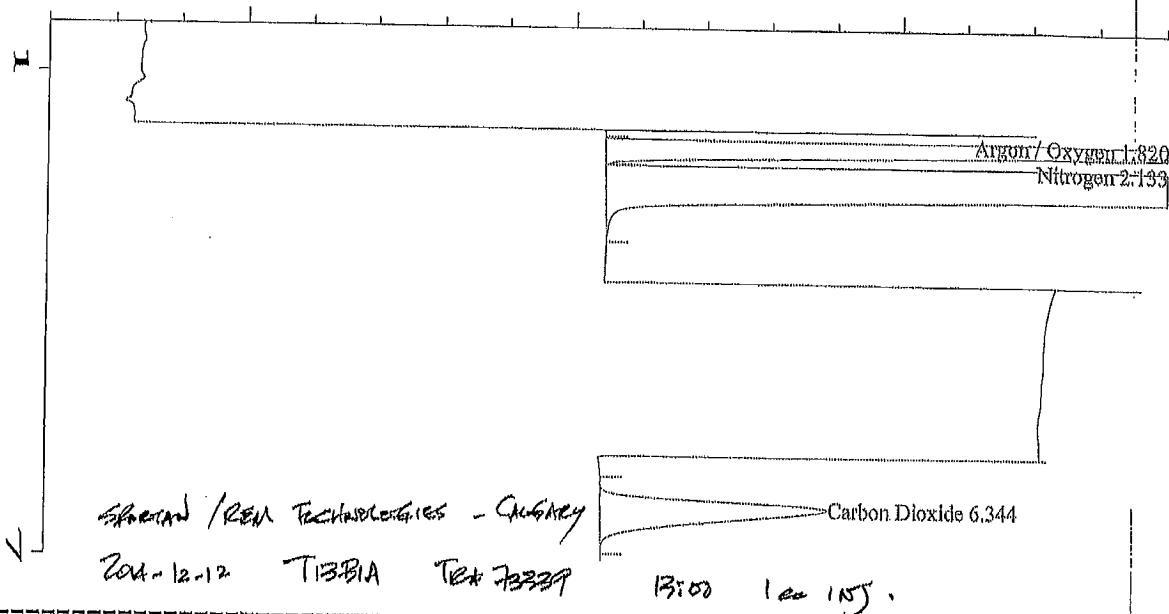
Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*



=====

Normalized Percent Report

=====

Data File Name : C:\HPCHEM\...\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REMT13B1A-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:33:58 Instrument Method:  
 Report Created on: 15 Dec 14 10:57 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

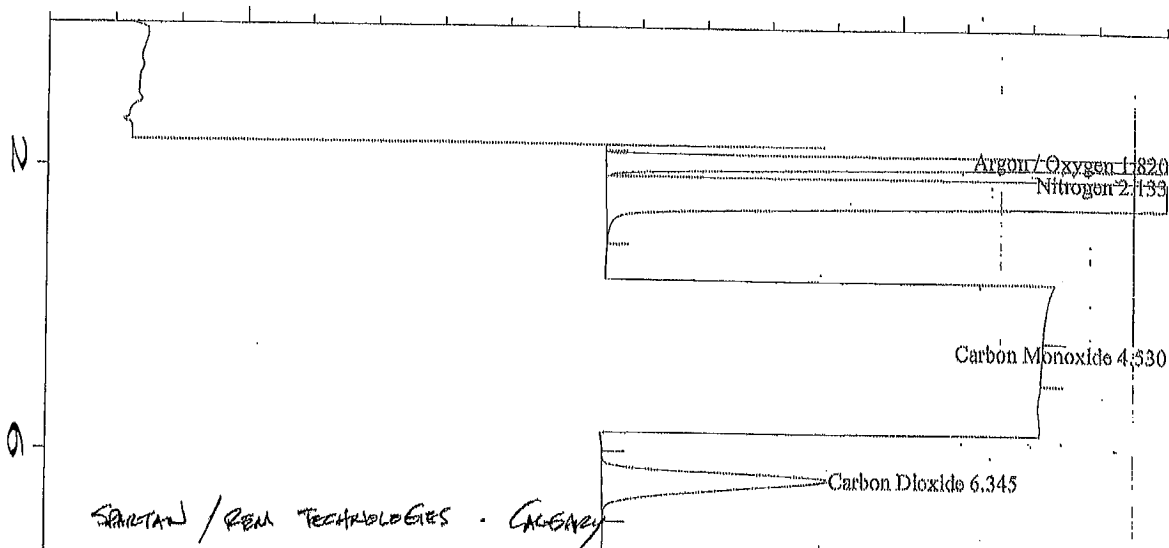
Sig. 1 In C:\HPCHEM\...\2014\REM-SP~1\REMT13B1A-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *			1		Hydrogen
1.820	333085 BV	0.122	1		15.427	Argon / Oxygen
2.133	1670841 VBA	0.192	1		80.056	Nitrogen
3.913	* not found *			1		Methane
4.559	* not found *			1		Carbon Monoxide
6.344	112833 BV	0.254	1		4.517	Carbon Dioxide

Total amount = 99.0285

Not all calibrated peaks were found

=====



2014-12-12 T13B1A TR# 73339 13:00 1cc 100%.

# Normalized Percent Report

Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REMT13B1A-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:44:28 Instrument Method:  
 Report Created on: 15 Dec 14 10:59 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\... \2014\REM-SP~1\REMT13B1A-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	332968	BV	0.122	1	15.429	Argon / Oxygen
2.133	1670092	VBA	0.192	1	80.056	Nitrogen
3.913	* not found *	1				Methane
4.530	96	BBA	0.082	1	0.000141	Carbon Monoxide
6.345	112755	BV	0.255	1	4.516	Carbon Dioxide

Total amount = 98.9839

Not all calibrated peaks were found

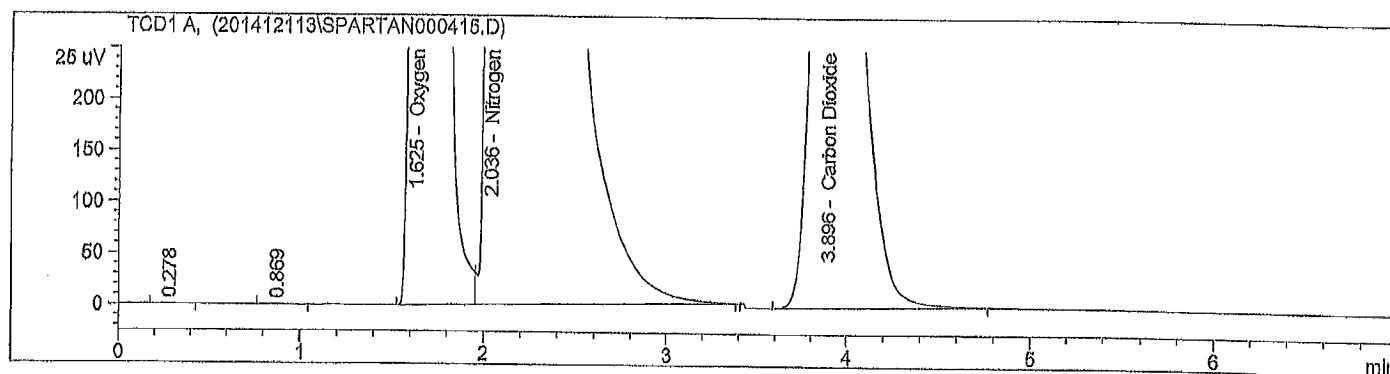
Sample Name: T13B1B Tr#73340 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:36:58
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:35:40 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:44:05 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T13
                B1B - Tr#73340 - 13:35 - 1 cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.625	BV	3.85337e4	3.93145e-4	15.527256	-	Oxygen
2.036	VBAS	1.97964e5	3.94076e-4	79.958974	-	Nitrogen
3.896	BBA	1.31733e4	3.34305e-4	4.513770	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

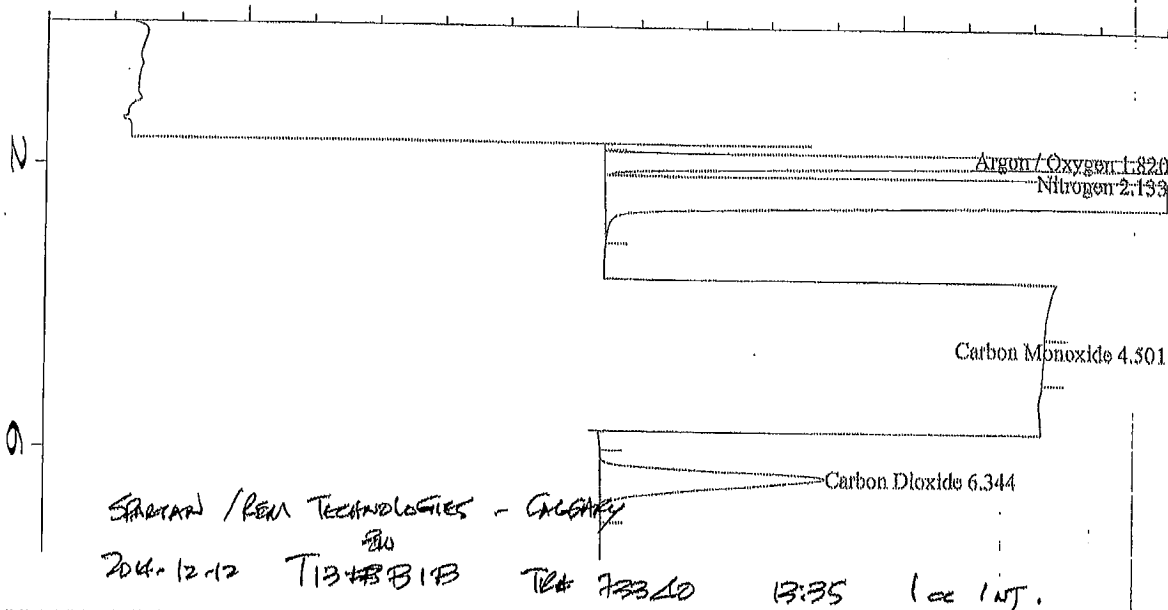
1 Warnings or Errors :

Warning : Calibrated compound(s) not found

```

=====
*** End of Report ***

```



# Normalized Percent Report

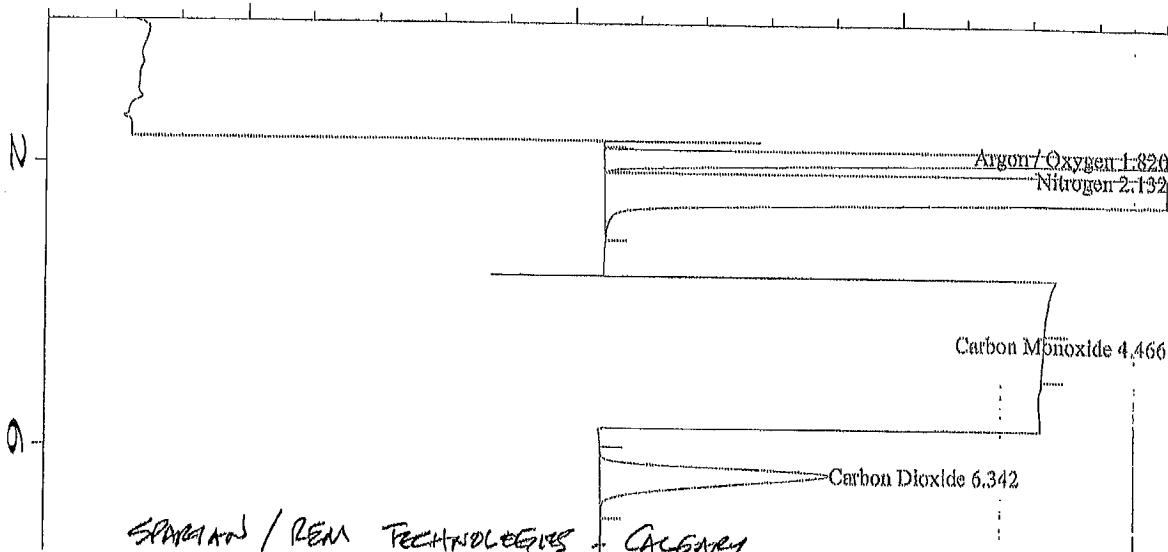
Data File Name : C:\HPCHEM\...ITRS-TCID\HPCHEM~1\2014\REM-SP~1\REMT13B1B-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:54:47 Instrument Method:  
 Report Created on: 15 Dec 14 11:00 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REMT13B1B-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *		1			Hydrogen
1.820	333945 BV	0.122	1		15.499	Argon / Oxygen
2.133	1666980 VBA	0.192	1		80.030	Nitrogen
3.913	* not found *		1			Methane
4.501	130 BBA	0.121	1		0.000191	Carbon Monoxide
6.344	111490 BV	0.255	1		4.471	Carbon Dioxide

Total amount = 98.8272

Not all calibrated peaks were found



SPRINT / REM TECHNOLOGIES - CALGARY

2014-12-12 T13B1B TR# 73340 13:35 1cc 10J.

# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T13B1B-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:06:19 Instrument Method:  
 Report Created on: 15 Dec 14 11:01 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on: 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\T13B1B-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.820	335519	BV	0.122	1	15.499	Argon / Oxygen
2.132	1674636	VBA	0.192	1	80.027	Nitrogen
3.913	* not found *	1				Methane
4.466	131	BBA	0.438	1	0.000192	Carbon Monoxide
6.342	112095	BV	0.251	1	4.475	Carbon Dioxide

Total amount = 99.2941

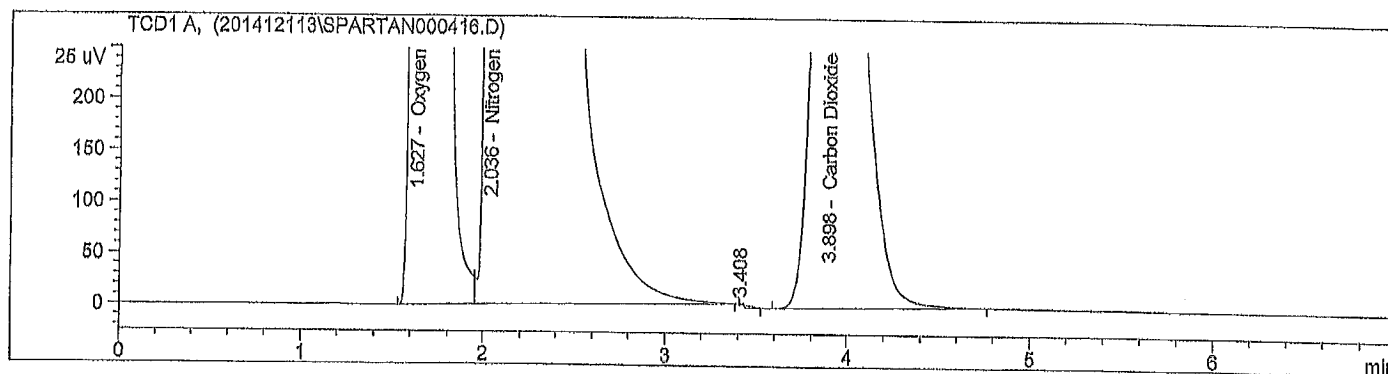
Not all calibrated peaks were found

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 14:48:54
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:44:15 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 2:56:02 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info    : Spartan / REM Technologies - Calgary - 2014-12-12 - T14
                  B1A - Tr#73341 - 14:30 - 1 cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.627	EV	3.88828e4	3.93144e-4	15.474906		Oxygen
2.036	VBAS	2.00447e5	3.94088e-4	79.967244		Nitrogen
3.898	BBA	1.34681e4	3.34298e-4	4.557850		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

\*\*\* End of Report \*\*\*

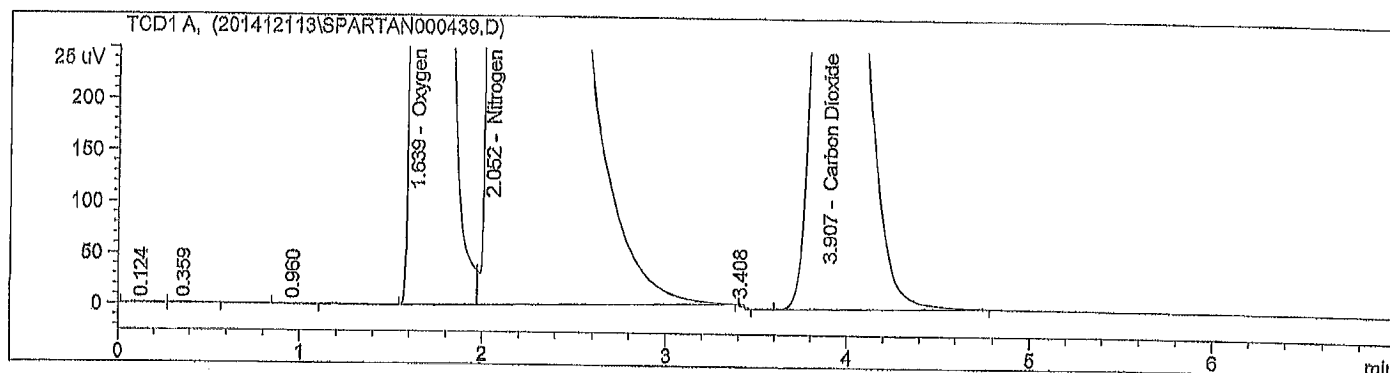
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 13-Dec-14, 18:47:21 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:46:08 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/13/2014 6:54:28 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Spartan / REM Technologies - Calgary - 2014-12-12 - T14  
B1A - Tr#73341 - 14:30 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355	-	-	-	-	-	Hydrogen
1.639	BV	3.90190e4	3.93144e-4	15.463890	-	Oxygen
2.052	VBAS	2.01351e5	3.94093e-4	79.991345	-	Nitrogen
3.907	BBA	1.34861e4	3.34298e-4	4.544765	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*



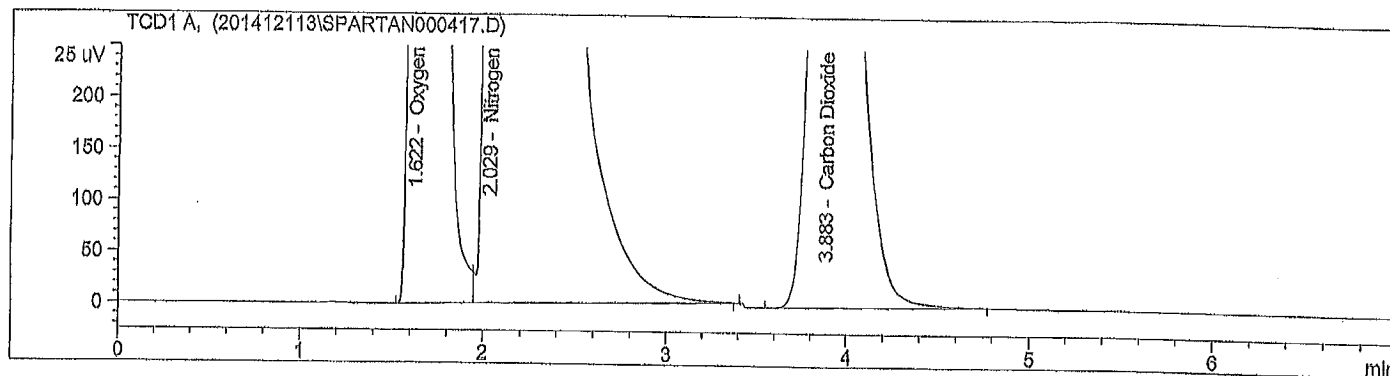
Data File C:\CHEM32\1\DATA\201412113\SPARTAN000417.D  
Sample Name: T14B1B Tr#73342 1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                      Location : -
Injection Date  : 13-Dec-14, 14:59:59              Inj : 1
                                                    Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 2:56:12 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:07:06 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)

Sample Info     : Spartan / REM Technologies - Calgary - 2014-12-12 - T14
                  B1B - Tr#73342 - 15:05 - 1 cc injection
=====
```



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 12/13/2014 12:27:28 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.355		-	-	-		Hydrogen
1.622	BV	3.84951e4	3.93145e-4	15.350323		Oxygen
2.029	VBAS	2.00192e5	3.94087e-4	80.020010		Nitrogen
3.883	BBA	1.36540e4	3.34295e-4	4.629667		Carbon Dioxide
5.038		-	-	-		Methane
6.085		-	-	-		Carbon Monoxide

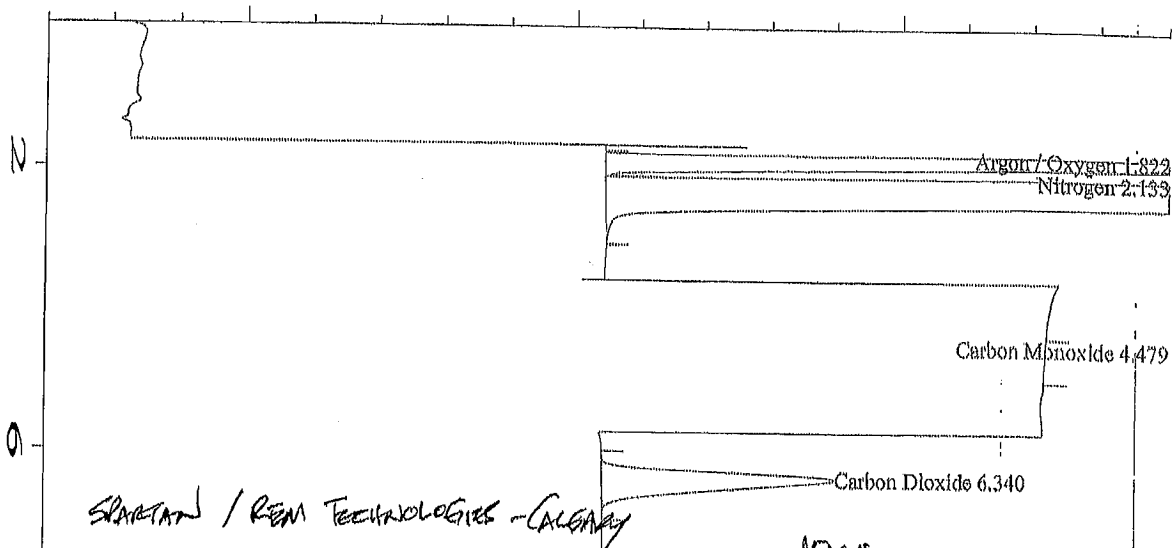
Totals : 100.000000

1 Warnings or Errors :

Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*



Normalized Percent Report

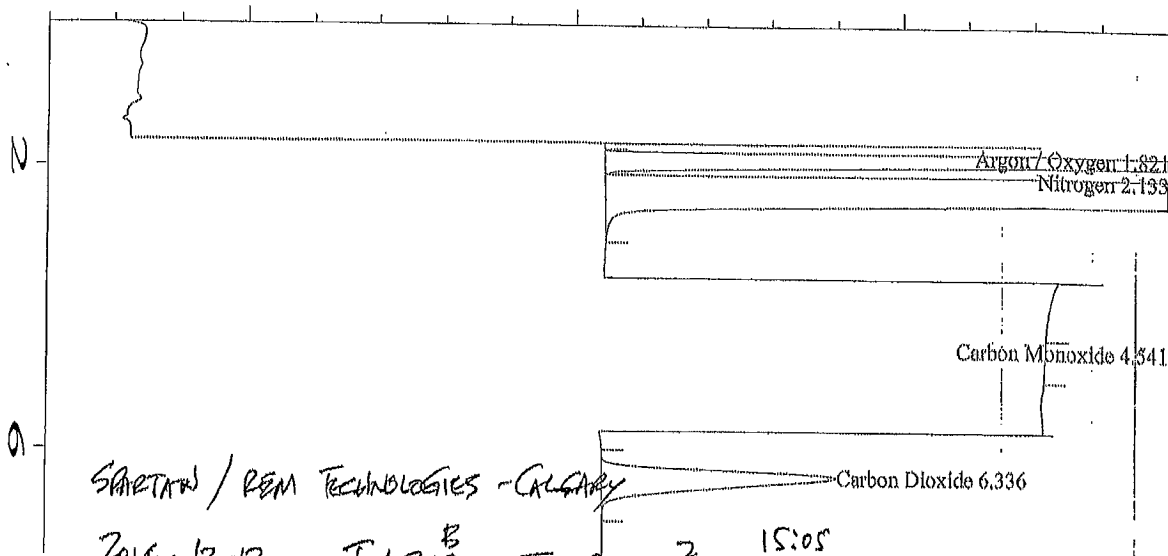
Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T14B1B-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:16:31 Instrument Method:  
 Report Created on: 15 Dec 14 11:01 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\... \2014\REM-SP~1\REM\T14B1B-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.822	330679	BV	0.121	1	15.328	Argon / Oxygen
2.133	1669905	VBA	0.192	1	80.078	Nitrogen
3.913	* not found *	1				Methane
4.479	186	BV	0.453	1	0.000274	Carbon Monoxide
6.340	114611	BV	0.251	1	4.593	Carbon Dioxide

Total amount = 98.9449

Not all calibrated peaks were found



Normalized Percent Report

Data File Name : C:\HPCHEM\... \TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\T14B1B-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:26:43 Instrument Method:  
 Report Created on: 15 Dec 14 11:02 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Slg. 1 In C:\HPCHEM\... \2014\REM-SP~1\REM\T14B1B-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.457	* not found *	1				Hydrogen
1.821	328801 BV	0.122	1		15.328	Argon / Oxygen
2.133	1660620 VBA	0.191	1		80.080	Nitrogen
3.913	* not found *	1				Methane
4.541	111 BBA	0.374	1		0.000165	Carbon Monoxide
6.336	113914 BV	0.249	1		4.591	Carbon Dioxide

Total amount = 98.3814

Not all calibrated peaks were found

=====

Calibration Table

=====

Calib. Data Modified : 11/20/2014 11:10:56 AM

G.C. ID# 6538

Calculate : Normalized Percent  
Based on : Peak Area

2014-11-19

Rel. Reference Window : 3.000 %  
Abs. Reference Window : 0.300 min  
Rel. Non-ref. Window : 3.000 %  
Abs. Non-ref. Window : 0.300 min  
Do not use Multiplier & Dilution Factor with ISTDs  
Uncalibrated Peaks : not reported  
Partial Calibration : Yes, identified peaks are recalibrated  
Correct All Ret. Times: No, only for identified peaks

Curve Type : Linear  
Origin : Included  
Weight : Equal

Recalibration Settings:  
Average Response : Average all calibrations  
Average Retention Time: Floating Average New 75%

Calibration Report Options :

Printout of recalibrations within a sequence:

Calibration Table after Recalibration

Normal Report after Recalibration

If the sequence is done with bracketing:

Results of first cycle (ending previous bracket)

Signal 1: TCD1 A,

RetTime [min]	Lvl Sig	Amount [Mole %]	Area	Amt/Area	Ref Grp Name
1.325	1 3	1.00000e-1	7.96014e-1	1.25626e-1	Hydrogen
	2	5.00000e-1	3.70561	1.34930e-1	
	1	1.00000	6.92623	1.44379e-1	
1.787	1 3	6.00000e-1	1559.54932	3.84727e-4	Oxygen
	2	3.00000	7531.69385	3.98317e-4	
	1	6.00000	1.52983e4	3.92201e-4	
2.250	1 3	8.08000	2.14924e4	3.75947e-4	Nitrogen
	2	40.40000	1.02827e5	3.92894e-4	
	1	80.80000	2.04934e5	3.94273e-4	
4.025	1 3	1.20000	3644.35571	3.29276e-4	Carbon Dioxide
	2	6.00000	1.78148e4	3.36800e-4	
	1	12.00000	3.59777e4	3.33540e-4	
5.038	1 3	1.00000e-2	21.17078	4.72349e-4	Methane
	2	5.00000e-2	95.72540	5.22327e-4	
	1	1.00000e-1	201.92026	4.95245e-4	
6.085	1 3	1.00000e-2	21.98953	4.54762e-4	Carbon Monoxide
	2	5.00000e-2	122.41664	4.08441e-4	
	1	1.00000e-1	253.91801	3.93828e-4	

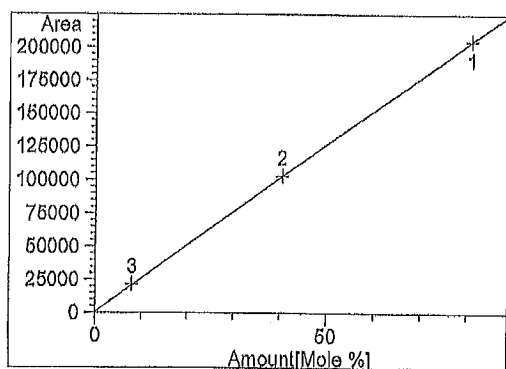
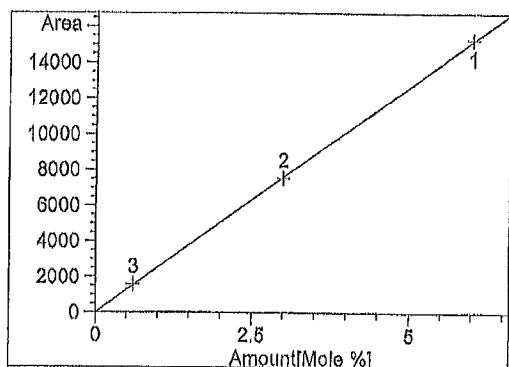
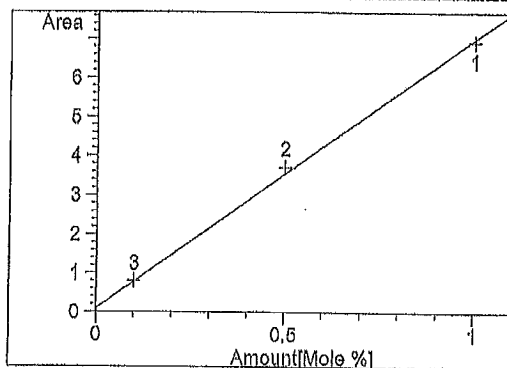
=====

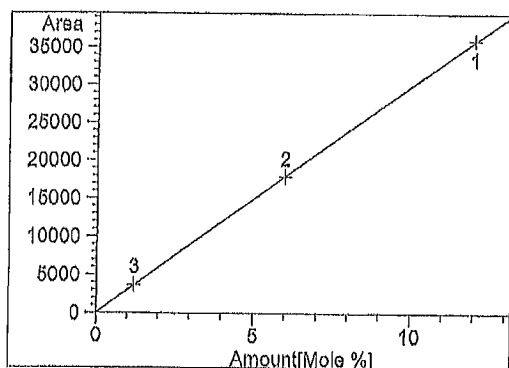
Peak Sum Table

=====

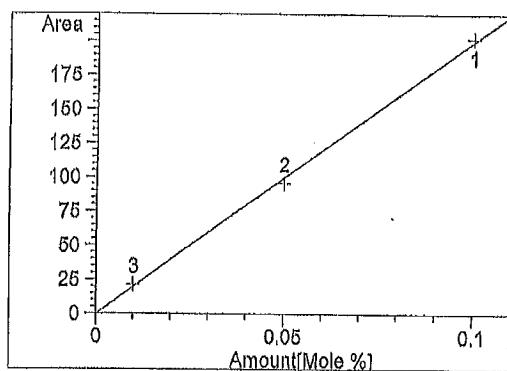
\*\*\*No Entries in table\*\*\*

Calibration Curves

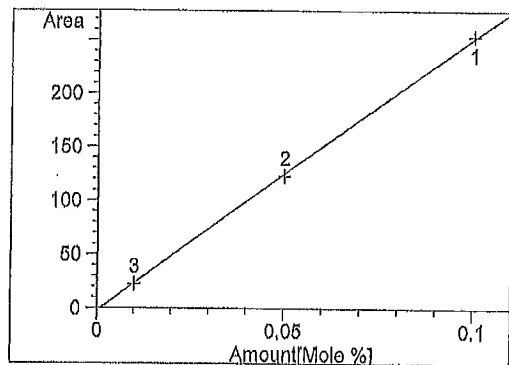




Carbon Dioxide at exp. RT: 4.025  
TCD1 A,  
Correlation: 0.99998  
Residual Std. Dev.: 115.80990  
Formula:  $y = mx + b$   
m: 2993.92133  
b: -11.62622  
x: Amount  
y: Height



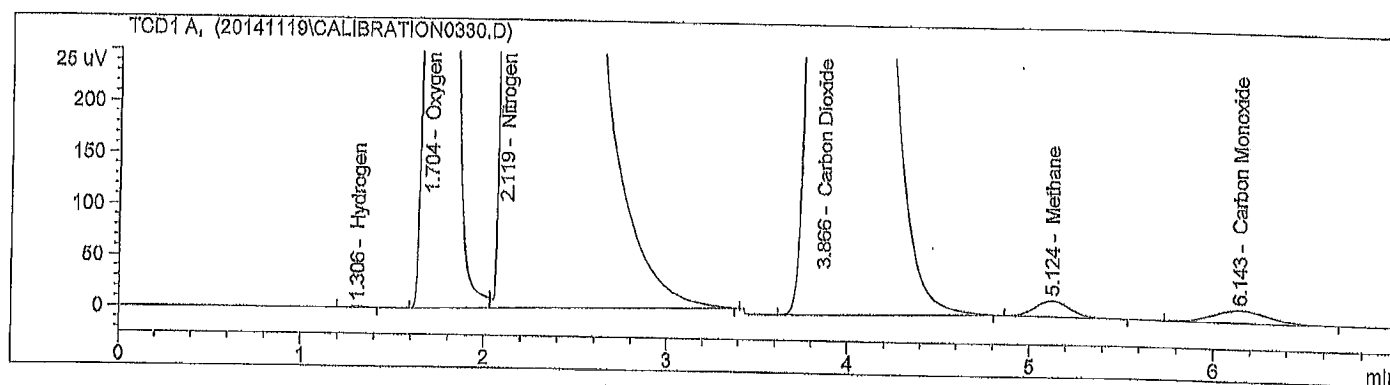
Methane at exp. RT: 5.038  
TCD1 A,  
Correlation: 0.99954  
Residual Std. Dev.: 3.37306  
Formula:  $y = mx + b$   
m: 2006.02358  
b: -5.36834e-1  
x: Amount  
y: Height



Carbon Monoxide at exp. RT: 6.085  
TCD1 A,  
Correlation: 0.99980  
Residual Std. Dev.: 2.82061  
Formula:  $y = mx + b$   
m: 2548.31630  
b: -2.35161  
x: Amount  
y: Height

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 13:51:55
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 1:49:29 PM by Maxxam - ID# 6538 - BW
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 1 - run 1 - ID# 11-10-27-22 - 1 cc
                injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

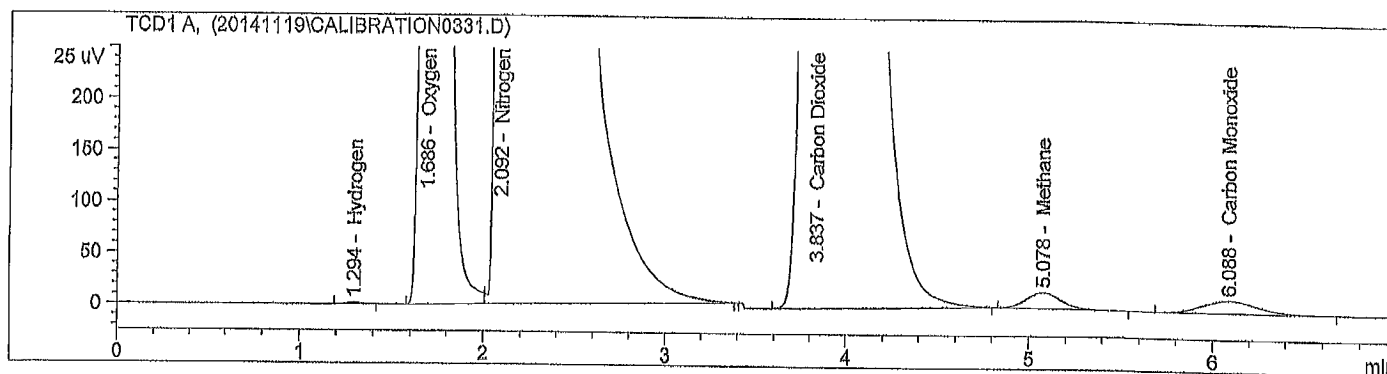
RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.306	BBA	6.95264	1.42717e-1	0.986598		Hydrogen
1.704	BV	1.54031e4	3.93277e-4	6.023090		Oxygen
2.119	VBAS	2.06180e5	3.94116e-4	80.794853		Nitrogen
3.866	BBA	3.61016e4	3.34118e-4	11.993334		Carbon Dioxide
5.124	BBA	205.76920	4.99799e-4	0.102256		Methane
6.143	BBA	253.60886	3.96055e-4	0.099870		Carbon Monoxide

Totals : 100.000000

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:05:16
Location       : -
Inj           : 1
Inj Volume    : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:03:58 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 1 - run 2 - ID# 11-10-27-22 - 1 cc
                injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.294	BBA	6.88176	1.42698e-1	0.980902		Hydrogen
1.686	BV	1.53162e4	3.93278e-4	6.016701		Oxygen
2.092	VBAS	2.05130e5	3.94111e-4	80.752692		Nitrogen
3.837	BBA	3.60992e4	3.34118e-4	12.047740		Carbon Dioxide
5.078	BBA	202.26636	4.99822e-4	0.100983		Methane
6.088	BBA	255.27438	3.96031e-4	0.100982		Carbon Monoxide

Totals : 100.000000

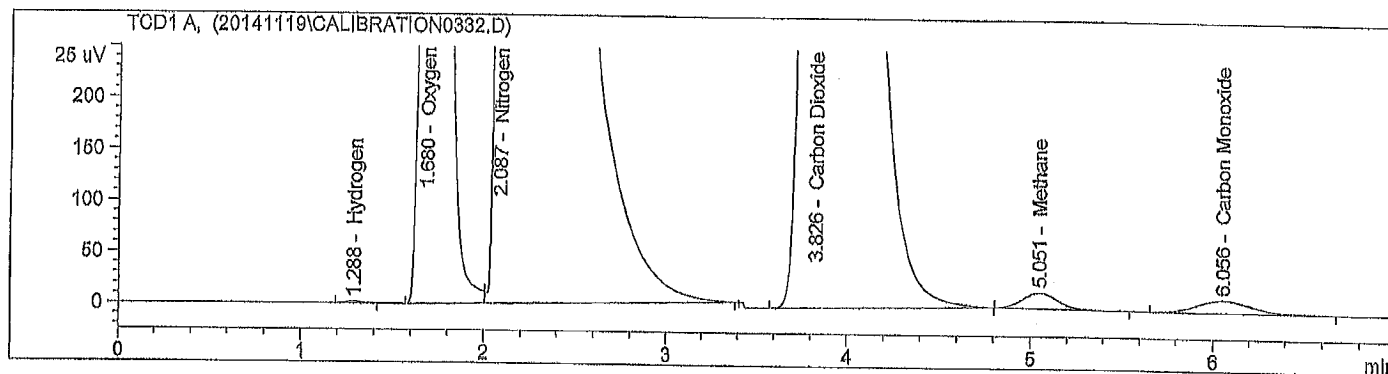
\*\*\* End of Report \*\*\*



=====

Acq. Operator	: Maxxam - ID# 6538 - BW	Location	: -
Acq. Instrument	: Instrument 1	Inj	: 1
Injection Date	: 19-Nov-14, 14:18:22	Inj Volume	: Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 11/19/2014 2:16:41 PM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW  
(modified after loading)  
Sample Info : Calibration - Level 1 - run 3 - ID# 11-10-27-22 - 1 cc  
injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:10:56 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.288	BBA	6.94429	1.42715e-1	0.998099		Hydrogen
1.680	BV	1.51756e4	3.93280e-4	6.010682		Oxygen
2.087	VBAS	2.03492e5	3.94103e-4	80.767144		Nitrogen
3.826	BBA	3.57322e4	3.34119e-4	12.023674		Carbon Dioxide
5.051	BBA	197.72522	4.99852e-4	0.099536		Methane
6.056	BBA	252.87079	3.96065e-4	0.100865		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

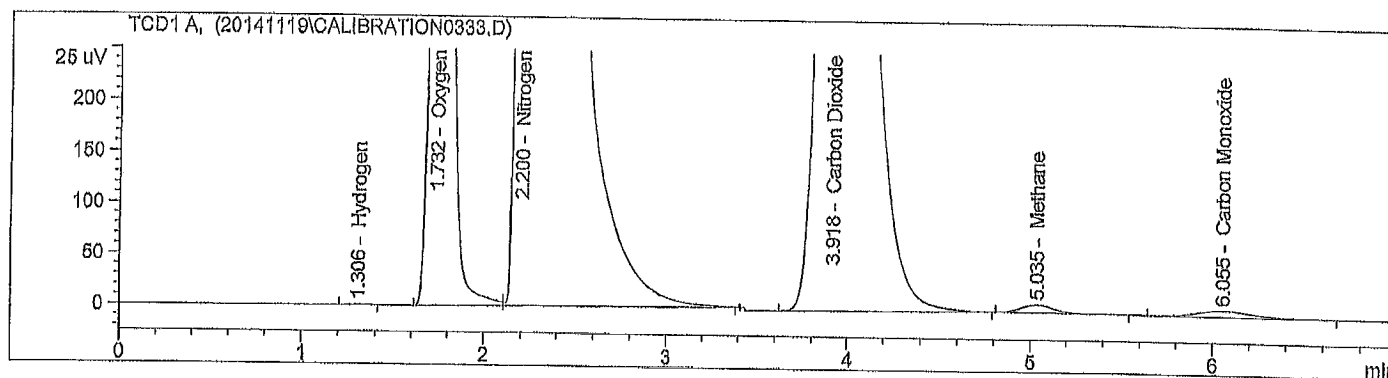
Sample Name: Level 2 - run 1 0.5 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:38:37
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:36:49 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 2 - run 1 - ID# 11-10-27-22 - 0.5
                cc injection
=====

```



```

=====
Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.306	BBA	3.66942	1.41027e-1	1.036414		Hydrogen
1.732	BV	7525.45117	3.93506e-4	5.930871		Oxygen
2.200	VBAS	1.02771e5	3.93133e-4	80.918075		Nitrogen
3.918	BBA	1.78080e4	3.34228e-4	11.920423		Carbon Dioxide
5.035	BBA	96.20104	5.01280e-4	0.096582		Methane
6.055	BBA	121.87815	3.99988e-4	0.097635		Carbon Monoxide

```
Totals : 100.000000
```

```

=====
*** End of Report ***
=====

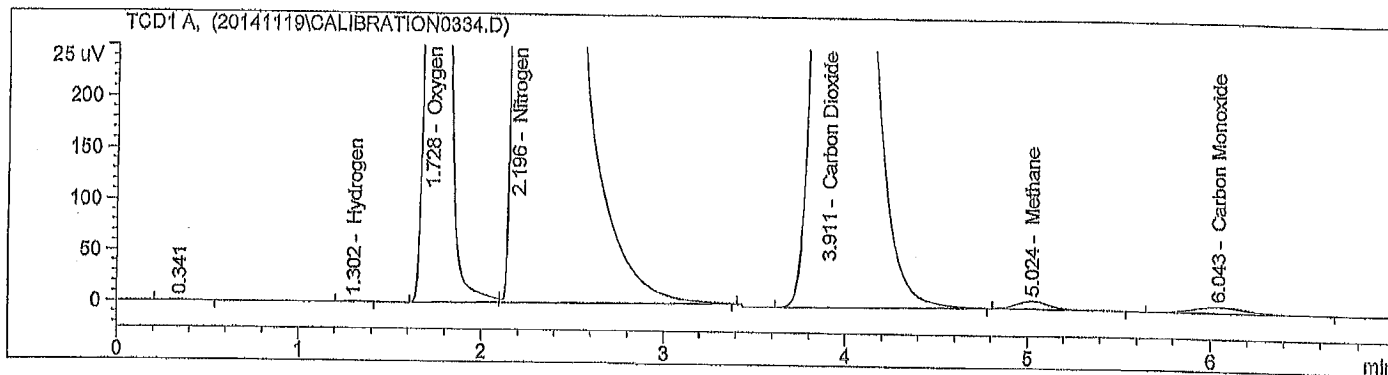
```

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:47:46
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:45:54 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 2 - run 2 - ID# 11-10-27-22 - 0.5
                cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.302	BBA	3.74180	1.41096e-1	1.056029		Hydrogen
1.728	BV	7537.93652	3.93506e-4	5.933126		Oxygen
2.196	VBAS	1.02882e5	3.93135e-4	80.902696		Nitrogen
3.911	BBA	1.78215e4	3.34228e-4	11.914282		Carbon Dioxide
5.024	BBA	95.24976	5.01308e-4	0.095510		Methane
6.043	BBA	122.95512	3.99921e-4	0.098356		Carbon Monoxide

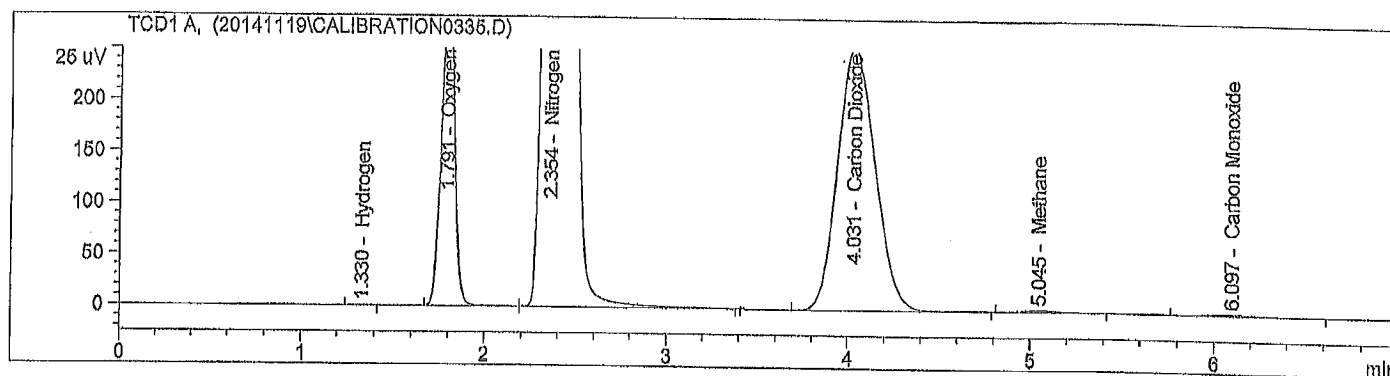
Totals : 100.000000

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\20141119\CALIBRATION0335.D  
Sample Name: Level 3 - run 1 0.1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 14:58:21
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 2:55:04 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 3 - run 1 - ID# 11-10-27-22 - 0.1
                cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.330	BBA	7.91850e-1	1.28018e-1	0.992228		Hydrogen
1.791	BV	1553.33228	3.95234e-4	6.009202		Oxygen
2.354	VBA	2.14240e4	3.85691e-4	80.879747		Nitrogen
4.031	BBA	3634.52686	3.35079e-4	11.920459		Carbon Dioxide
5.045	BB	21.13526	5.11160e-4	0.105746		Methane
6.097	BB	21.76138	4.34822e-4	0.092618		Carbon Monoxide

Totals : 100.000000

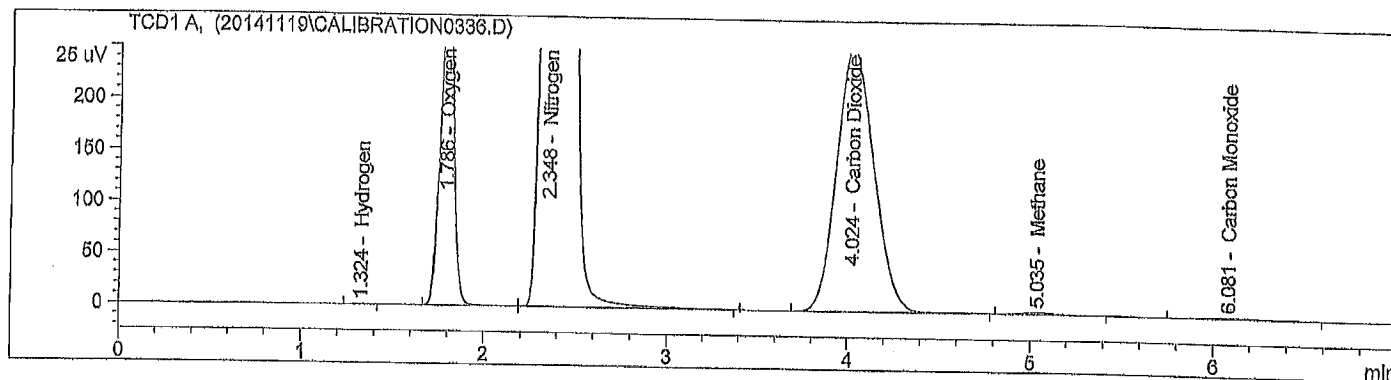
\*\*\* End of Report \*\*\*

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 19-Nov-14, 15:08:13
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/19/2014 3:07:10 PM by Maxxam - ID# 6538 - BW
                (modified after loading)
Analysis Method: C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/20/2014 11:11:51 AM by Maxxam - ID# 6538 - BW
                (modified after loading)
Sample Info    : Calibration - Level 3 - run 2 - ID# 11-10-27-22 - 0.1
                cc injection
=====

```



Normalized Percent Report

```

=====
Sorted By      : Signal
Calib. Data Modified : 11/20/2014 11:10:56 AM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.324	BBA	8.00179e-1	1.28190e-1	0.997489		Hydrogen
1.786	BV	1565.76636	3.95216e-4	6.017657		Oxygen
2.348	VBA	2.15607e4	3.85751e-4	80.878889		Nitrogen
4.024	BBA	3654.18457	3.35073e-4	11.906805		Carbon Dioxide
5.035	BB	21.20629	5.11118e-4	0.105403		Methane
6.081	BB	22.21768	4.33951e-4	0.093757		Carbon Monoxide

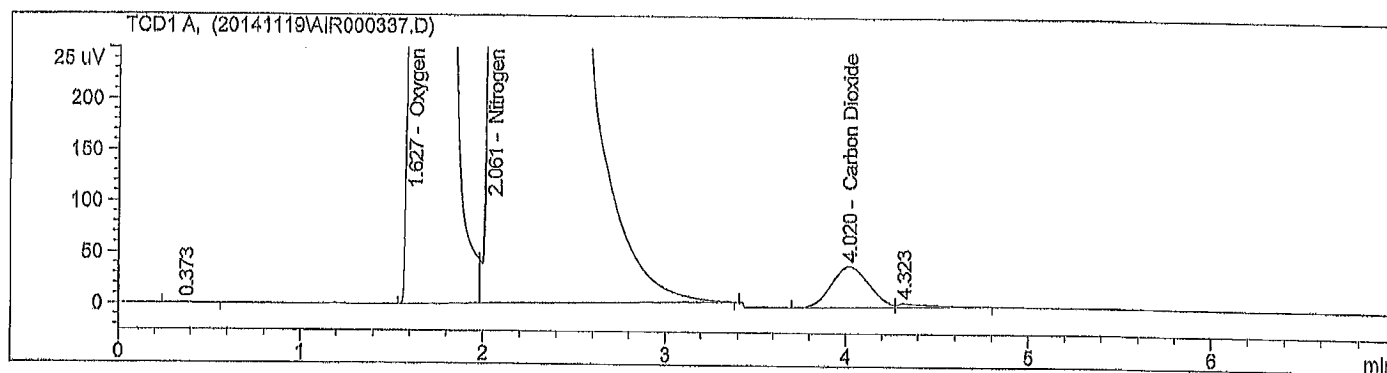
Totals : 100.000000

\*\*\* End of Report \*\*\*

Data File C:\CHEM32\1\DATA\20141119\AIR000337.D  
Sample Name: Air 1 cc inj

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 19-Nov-14, 15:17:19         Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 11/19/2014 3:15:30 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 11/20/2014 11:16:02 AM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Air - 1 cc injection
=====
```



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/20/2014 11:15:08 AM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.325	-	-	-	-	-	Hydrogen
1.627	BV S	5.39117e4	3.93120e-4	21.422795	-	Oxygen
2.061	VBAS	1.96779e5	3.94070e-4	78.382674	-	Nitrogen
4.020	BV	564.56024	3.40889e-4	0.194532	-	Carbon Dioxide
5.038	-	-	-	-	-	Methane
6.085	-	-	-	-	-	Carbon Monoxide

Totals : 100.000000

1 Warnings or Errors :

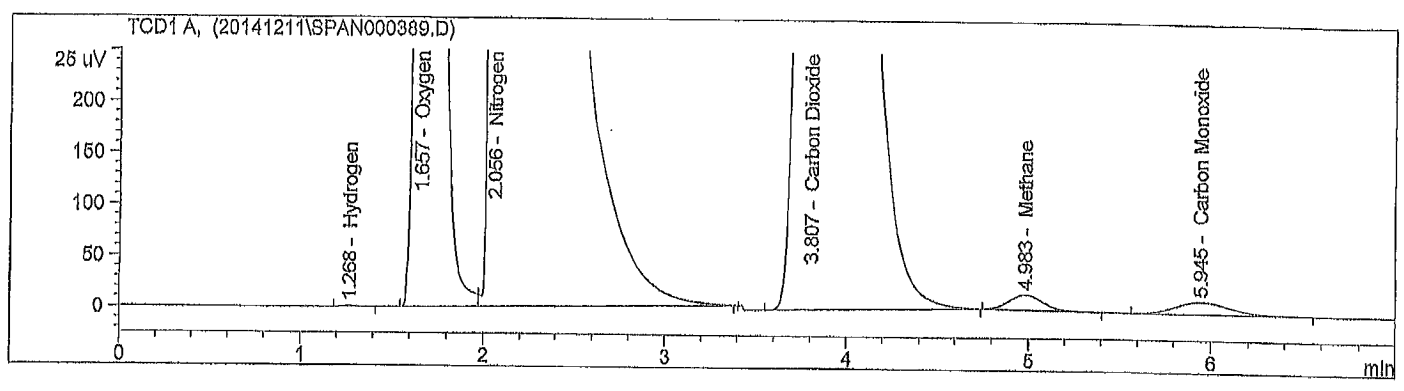
Warning : Calibrated compound(s) not found

=====

\*\*\* End of Report \*\*\*

```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 14:09:43        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 11/26/2014 2:03:01 PM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:24:34 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.268	BBA	5.94273	1.42396e-1	0.867649		Hydrogen
1.657	BV	1.49409e4	3.93283e-4	6.024776		Oxygen
2.056	VBAS	2.00089e5	3.94087e-4	80.849146		Nitrogen
3.807	BBA	3.51987e4	3.34120e-4	12.058402		Carbon Dioxide
4.983	BBA	193.17958	4.99884e-4	0.099013		Methane
5.945	BBA	248.70967	3.96126e-4	0.101015		Carbon Monoxide

Totals : 100.000000

\*\*\* End of Report \*\*\*

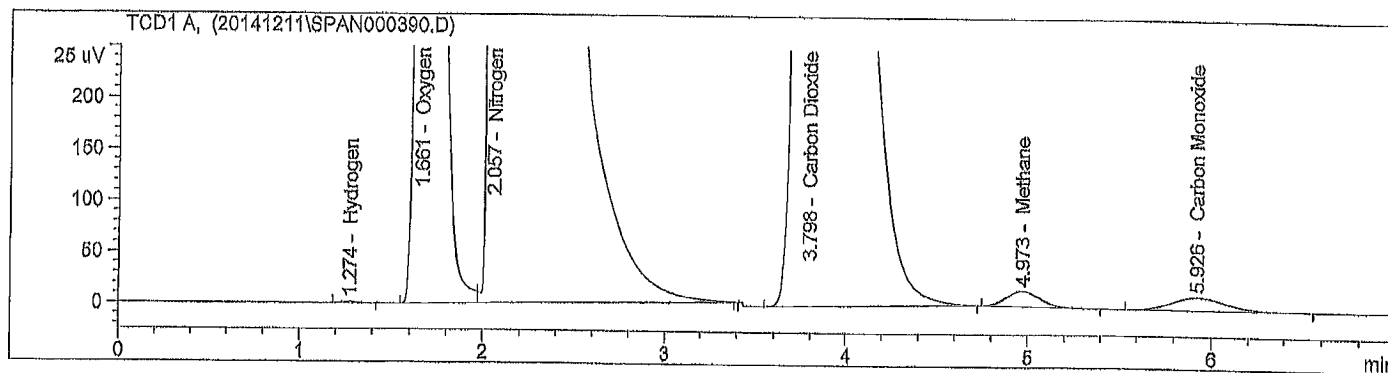
=====

Acq. Operator : Maxxam - ID# 6538 - BW  
Acq. Instrument : Instrument 1 Location : -  
Injection Date : 11-Dec-14, 14:25:30 Inj : 1  
Inj Volume : Manually

Acq. Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:24:34 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Analysis Method : C:\CHEM32\1\METHODS\TCD.M  
Last changed : 12/11/2014 2:32:37 PM by Maxxam - ID# 6538 - BW  
(modified after loading)

Sample Info : Span Check - ID# 11-10-27-22 - 1 cc injection



=====

Normalized Percent Report

=====

Sorted By : Signal  
Calib. Data Modified : 11/26/2014 1:51:59 PM  
Multiplier : 1.0000  
Dilution : 1.0000  
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.274	BBA	5.84992	1.42361e-1	0.858268		Hydrogen
1.661	BV	1.48660e4	3.93285e-4	6.025345		Oxygen
2.057	VBAS	1.99137e5	3.94082e-4	80.876270		Nitrogen
3.798	BBA	3.49651e4	3.34121e-4	12.039830		Carbon Dioxide
4.973	BBA	191.44820	4.99896e-4	0.098631		Methane
5.926	BBA	249.01297	3.96122e-4	0.101656		Carbon Monoxide

Totals : 100.000000

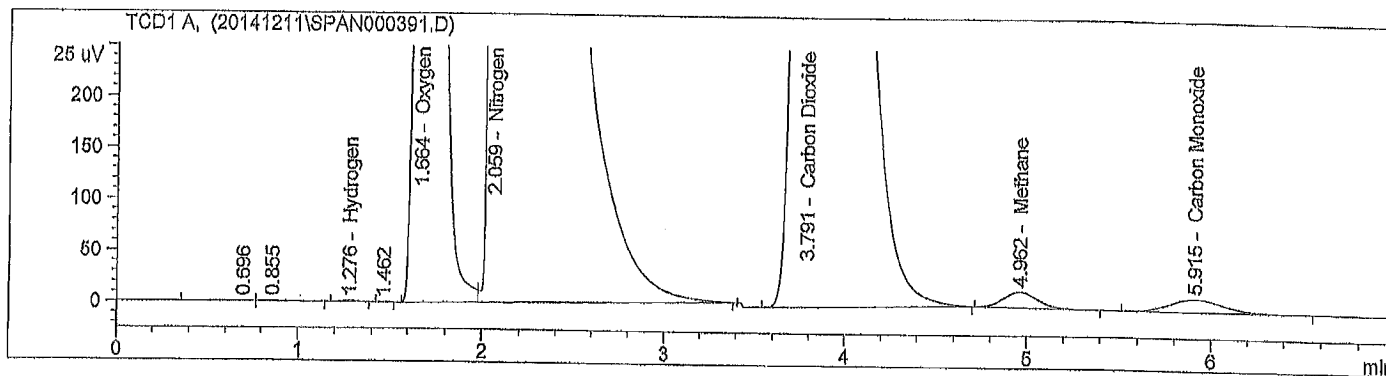
=====

\*\*\* End of Report \*\*\*



```
=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 14:33:29         Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:32:47 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 2:47:24 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====
```



Normalized Percent Report

```
=====
Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs
=====
```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.276	BV	6.21625	1.42493e-1	0.913639		Hydrogen
1.664	BV	1.48556e4	3.93285e-4	6.026265		Oxygen
2.059	VBAS	1.98890e5	3.94080e-4	80.844069		Nitrogen
3.791	BBA	3.48630e4	3.34121e-4	12.014899		Carbon Dioxide
4.962	BBA	193.45824	4.99882e-4	0.099748		Methane
5.915	BBA	248.11813	3.96135e-4	0.101380		Carbon Monoxide

Totals : 100.000000

\*\*\* End of Report \*\*\*

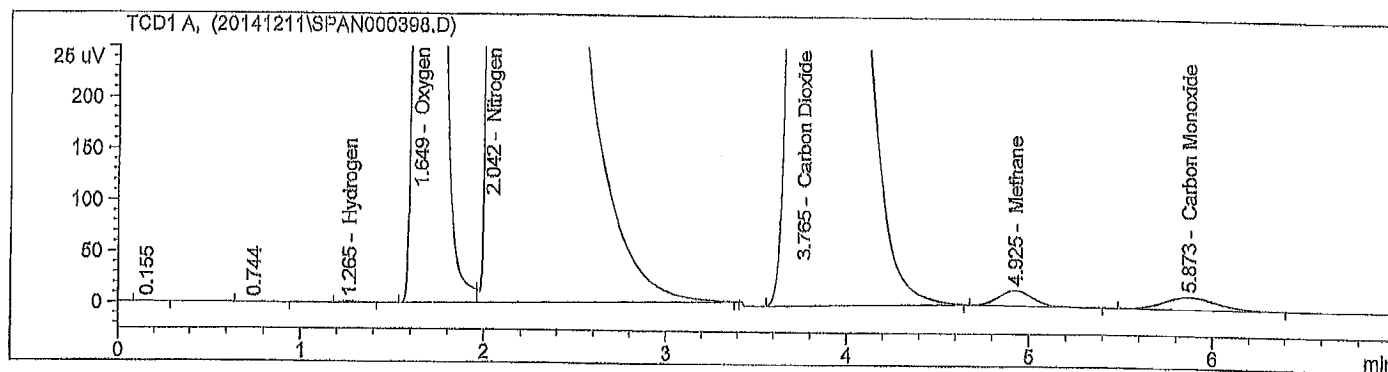
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 11-Dec-14, 15:49:40        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:48:15 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/11/2014 3:59:25 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



```

=====
                        Normalized Percent Report
=====

```

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.265	BBA	5.67366	1.42291e-1	0.835041		Hydrogen
1.649	BV	1.48336e4	3.93285e-4	6.034194		Oxygen
2.042	VBAS	1.98546e5	3.94079e-4	80.930284		Nitrogen
3.765	BBA	3.47237e4	3.34122e-4	12.000443		Carbon Dioxide
4.925	BBA	191.79823	4.99894e-4	0.099172		Methane
5.873	BBA	246.15312	3.96165e-4	0.100867		Carbon Monoxide

Totals : 100.000000

```

=====
*** End of Report ***
=====

```

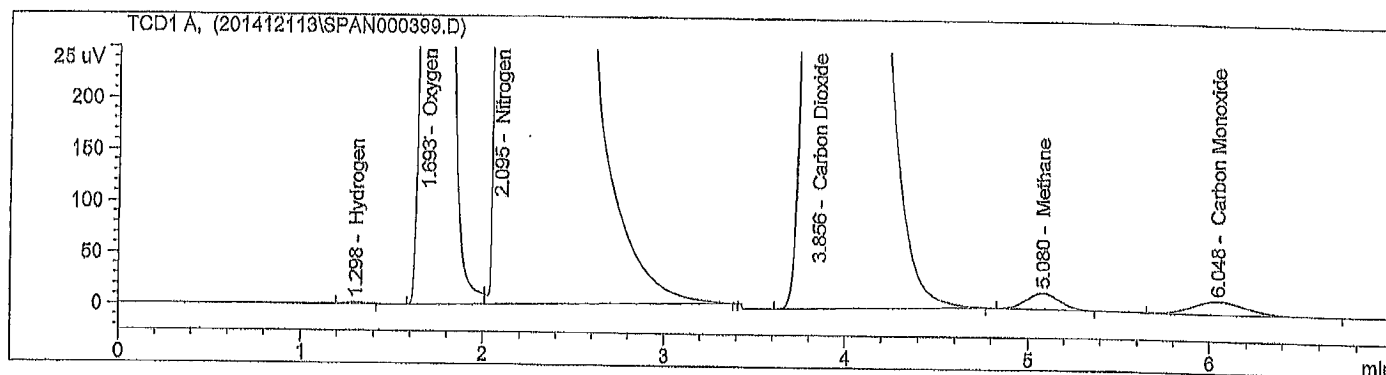
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1
Injection Date  : 13-Dec-14, 11:24:27
Location       : -
Inj            : 1
Inj Volume     : Manually

Acq. Method    : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 11/26/2014 2:03:01 PM by Maxxam - ID# 6538 - BW
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed   : 12/13/2014 11:31:27 AM by Maxxam - ID# 6538 - BW
Sample Info    : Span Check - ID# 11-10-27-22 - 1 cc injection
=====

```



=====

Normalized Percent Report

=====

```

Sorted By      : Signal
Calib. Data Modified : 11/26/2014 1:51:59 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.298	BBA	6.97662	1.42724e-1	0.993227		Hydrogen
1.693	BV	1.53576e4	3.93277e-4	6.024606		Oxygen
2.095	VBAS	2.05441e5	3.94113e-4	80.763405		Nitrogen
3.856	BBA	3.60542e4	3.34118e-4	12.016069		Carbon Dioxide
5.080	BBA	204.12659	4.99810e-4	0.101768		Methane
6.048	BBA	255.48210	3.96028e-4	0.100924		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

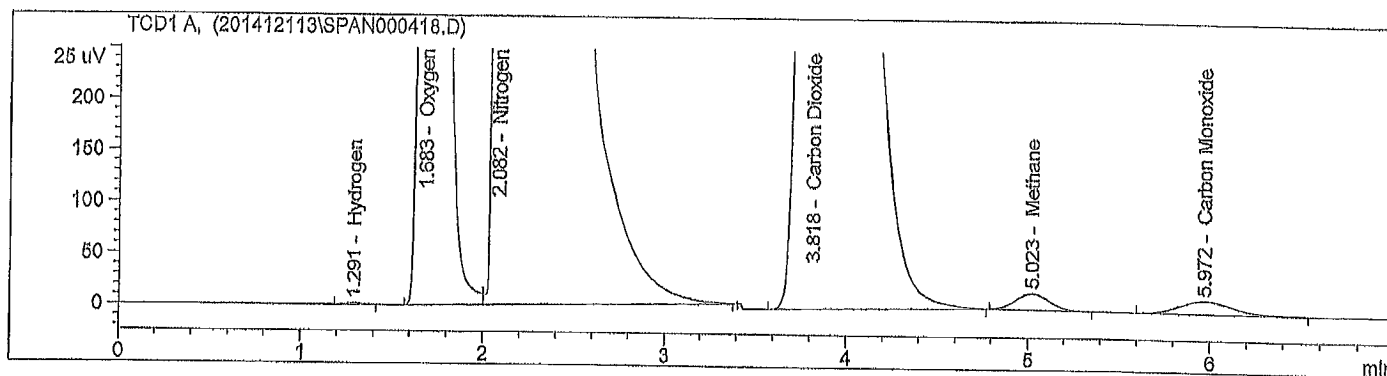
Sample Name: Span 1 cc inj

```

=====
Acq. Operator   : Maxxam - ID# 6538 - BW
Acq. Instrument : Instrument 1                Location : -
Injection Date  : 13-Dec-14, 15:23:04        Inj : 1
                                           Inj Volume : Manually

Acq. Method     : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:07:16 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Analysis Method : C:\CHEM32\1\METHODS\TCD.M
Last changed    : 12/13/2014 3:41:00 PM by Maxxam - ID# 6538 - BW
                  (modified after loading)
Sample Info     : Span Check - ID# 11-10-27-22 - 1 cc Injection
=====

```



=====

Normalized Percent Report

=====

```

Sorted By      : Signal
Calib. Data Modified : 12/13/2014 12:27:28 PM
Multiplier     : 1.0000
Dilution       : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

```

Signal 1: TCD1 A,

RetTime [min]	Type	Area [25 uV*s]	Amt/Area	Norm %	Grp	Name
1.291	BBA	6.84476	1.42687e-1	0.990908		Hydrogen
1.683	BV	1.51029e4	3.93281e-4	6.026322		Oxygen
2.082	VBAS	2.02190e5	3.94097e-4	80.844724		Nitrogen
3.818	BBA	3.52096e4	3.34120e-4	11.935842		Carbon Dioxide
5.023	BBA	199.69040	4.99839e-4	0.101269		Methane
5.972	BBA	251.16362	3.96090e-4	0.100935		Carbon Monoxide

Totals : 100.000000

=====

\*\*\* End of Report \*\*\*

# Calibration Table

Pk#	RT	Lvl	Mole %	Amt/Area	Ref Istd I#	Name
1	1.457	1	1.0	5.997e-004	1	Hydrogen
	2		0.5	6.6957e-004		
	3		0.1	7.9221e-004		
2	1.895	1	6.0	4.5687e-005	1	Argon / Oxygen
	2		3.0	4.5461e-005		
	3		0.6	4.3221e-005		
3	2.241	1	80.8	4.7623e-005	1	Nitrogen
	2		40.4	4.5948e-005		
	3		8.08	4.237e-005		
4	3.913	1	0.1	1.8827e-006	1	Methane
	2		0.05	1.8635e-006		
	3		0.01	1.7607e-006		
5	4.559	1	0.1	1.492e-006	1	Carbon Monoxide
	2		0.05	1.4927e-006		
	3		0.01	1.4498e-006		
6	6.316	1	12.0	4.0229e-005	1	Carbon Dioxide
	2		6.0	3.9701e-005		
	3		1.2	3.782e-005		

## Calibration Settings

Title:

Calibration 2014-12-13

Reference window: 15.000 %  
Non-reference window: 15.000 %  
Units of amount: Mole %  
Multiplier: 1.0  
RF uncal peaks: 0.0  
ISTD# to adjust uncal peaks: 0  
Sample Amount: 0.0

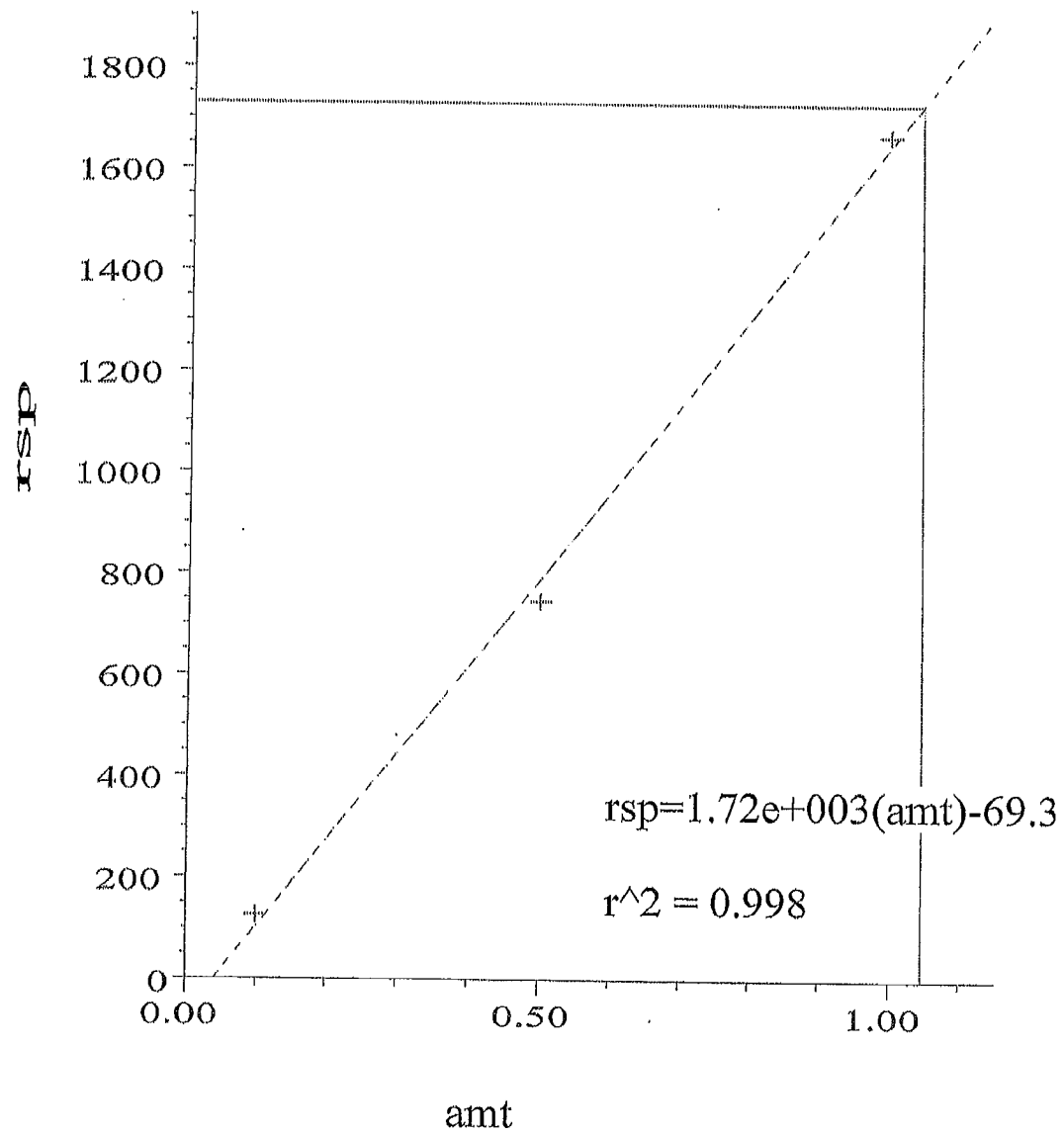
## Sample ISTD Information

No Sample ISTD Amounts

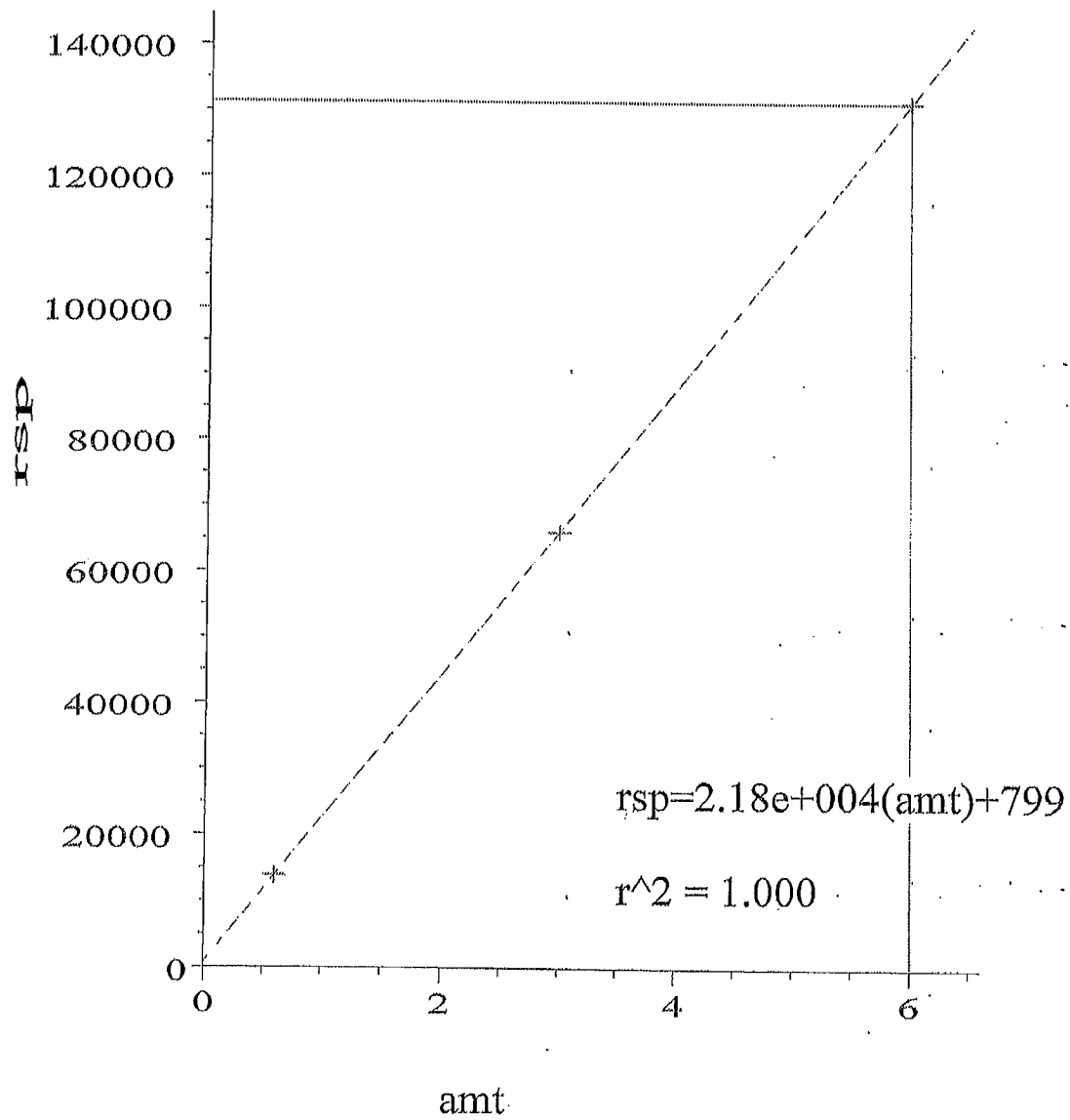
## Multilevel Information

Fit: Linear  
Origin: Force

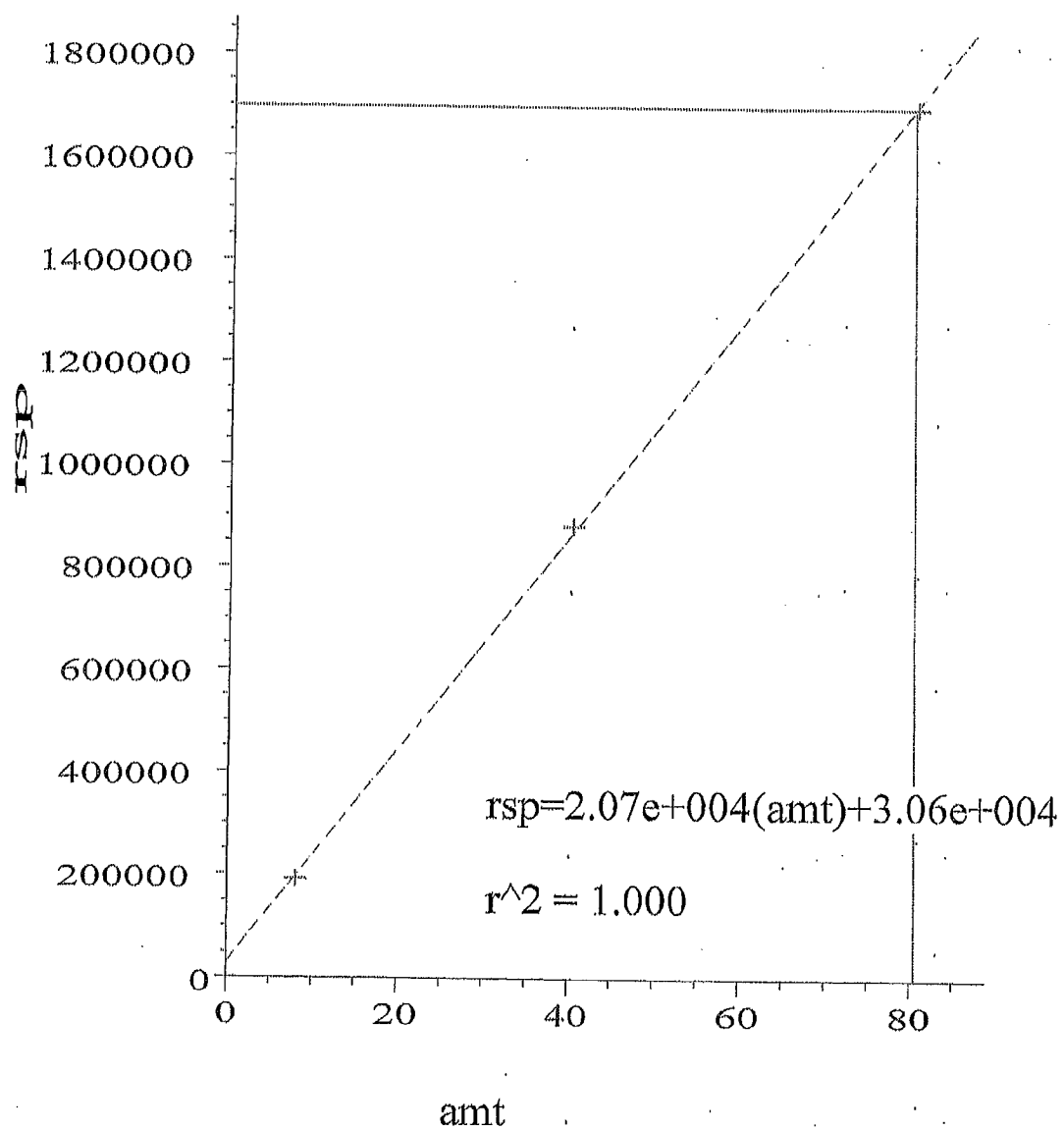
# Hydrogen



# Argon / Oxygen

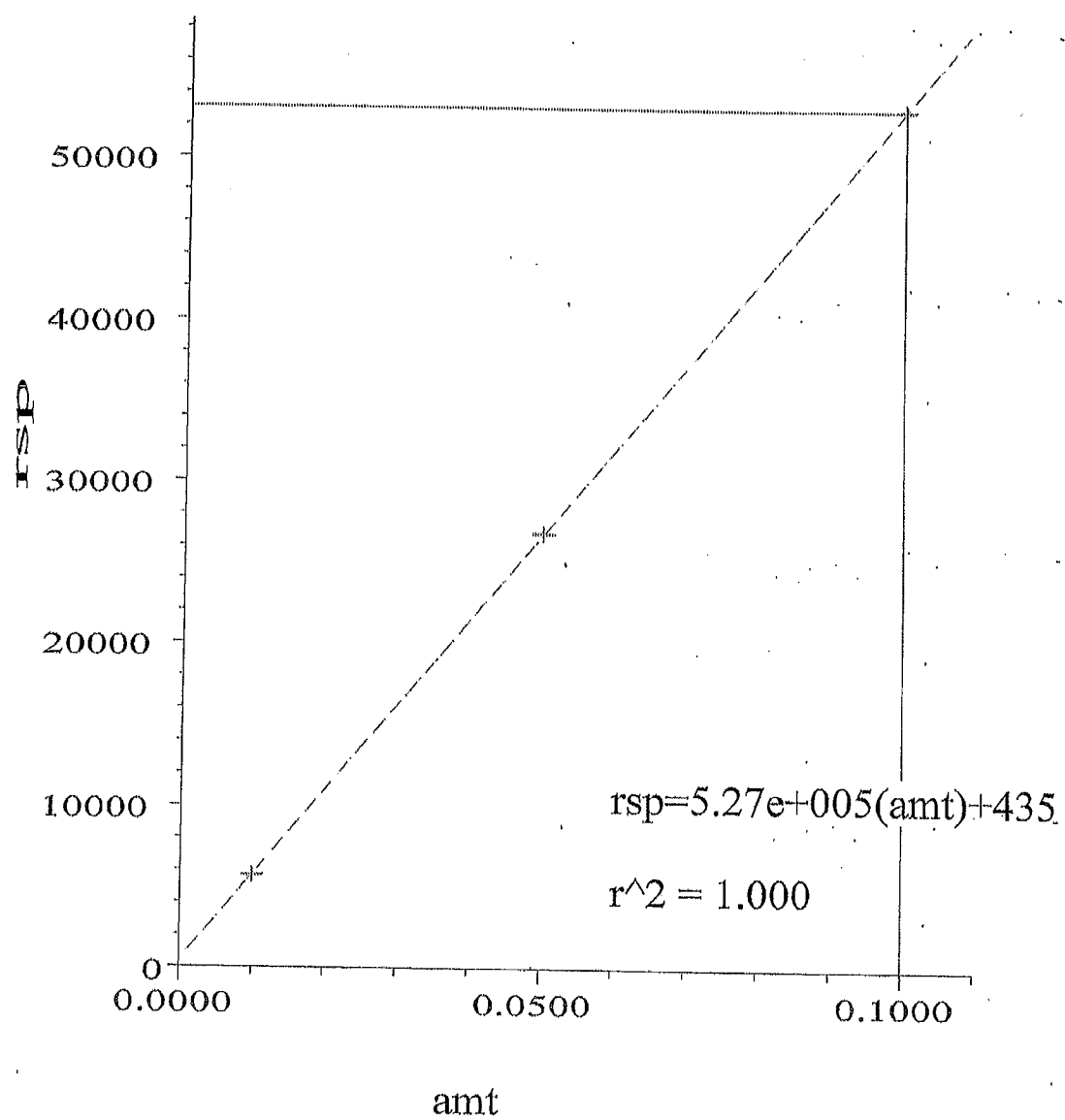


# Nitrogen

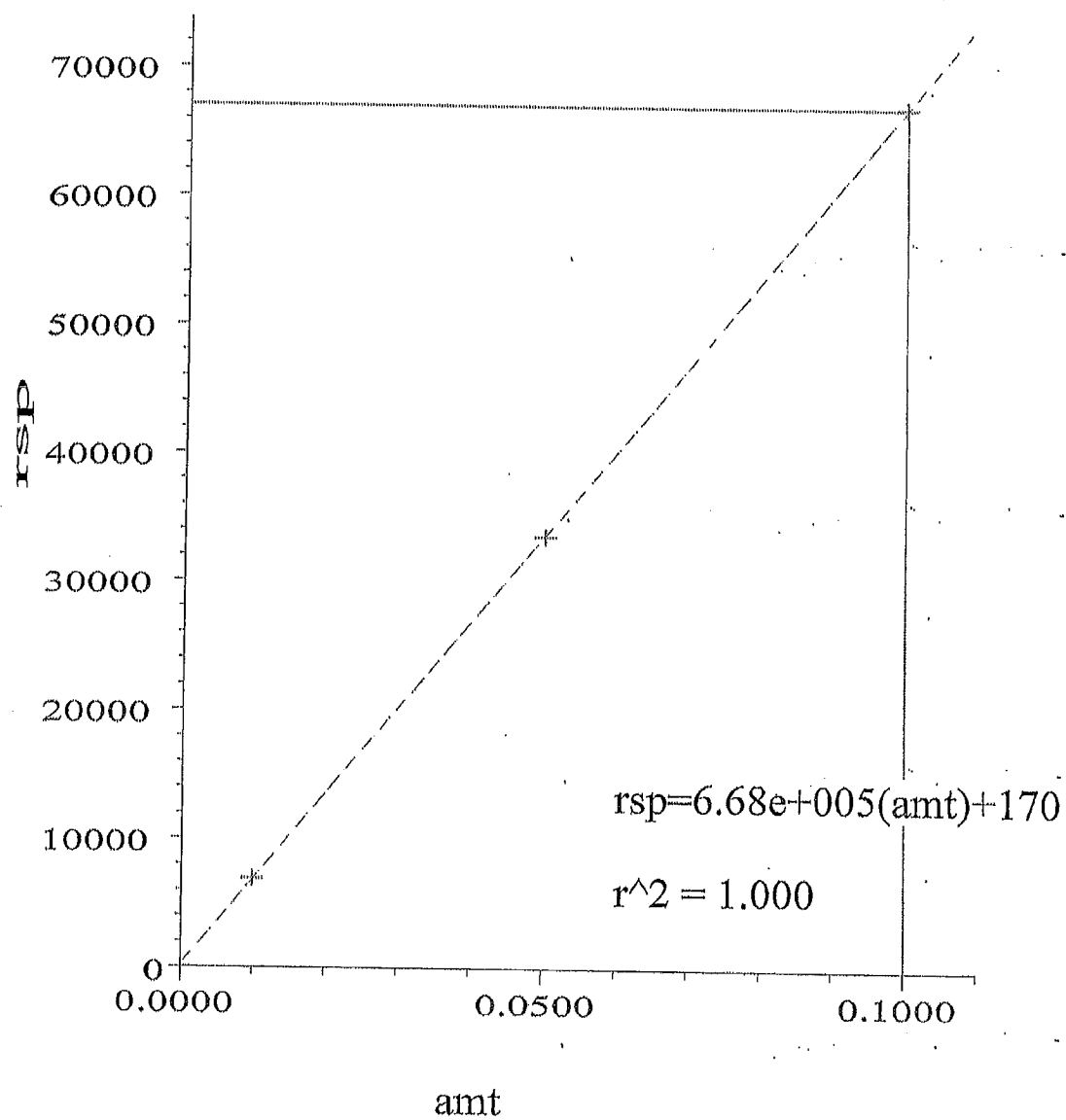




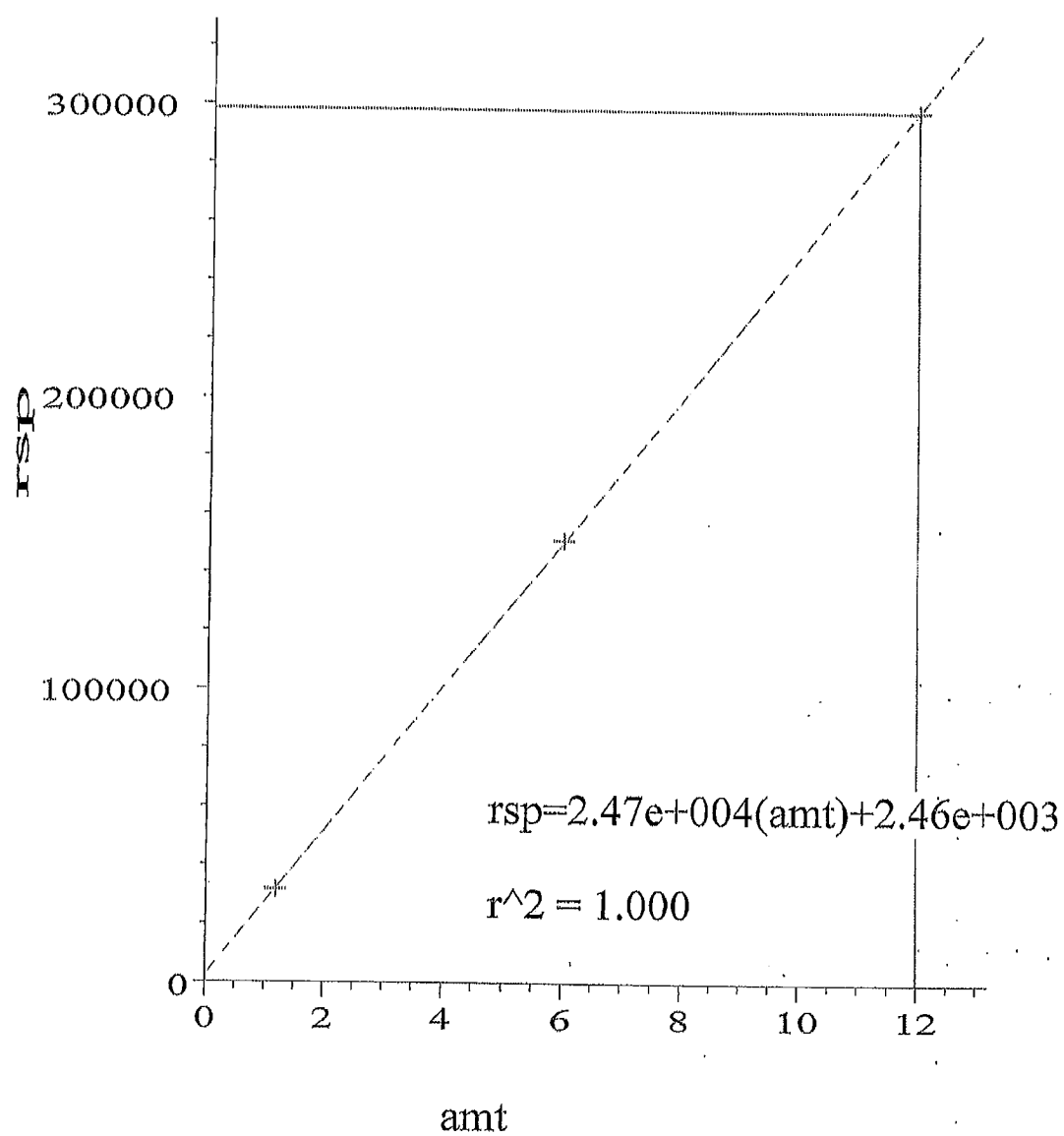
# Methane

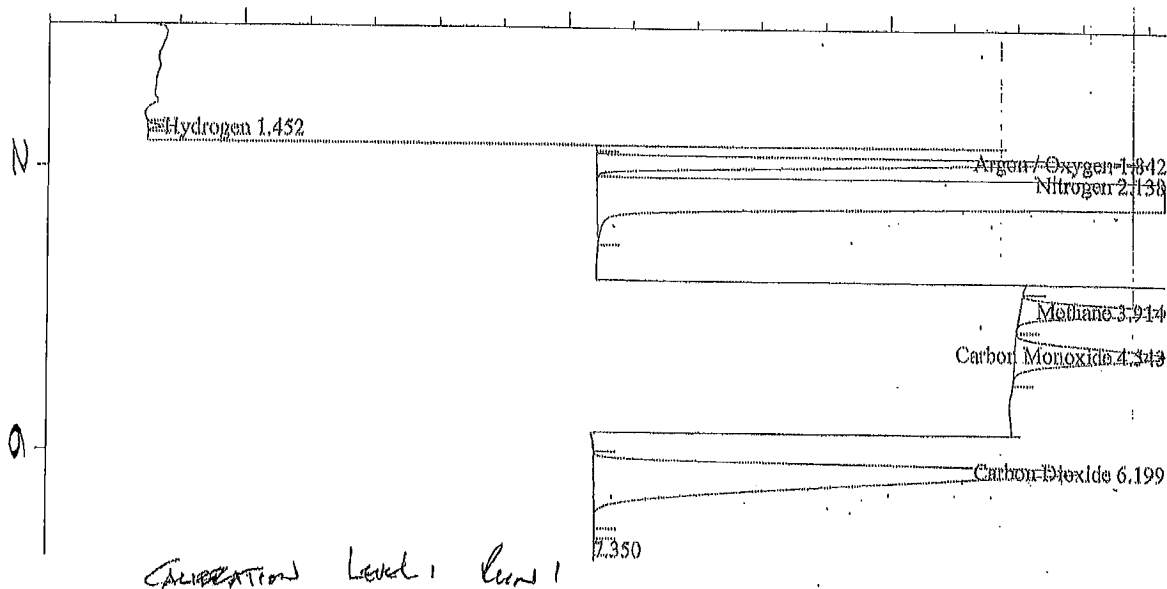


# Carbon Monoxide



# Carbon Dioxide



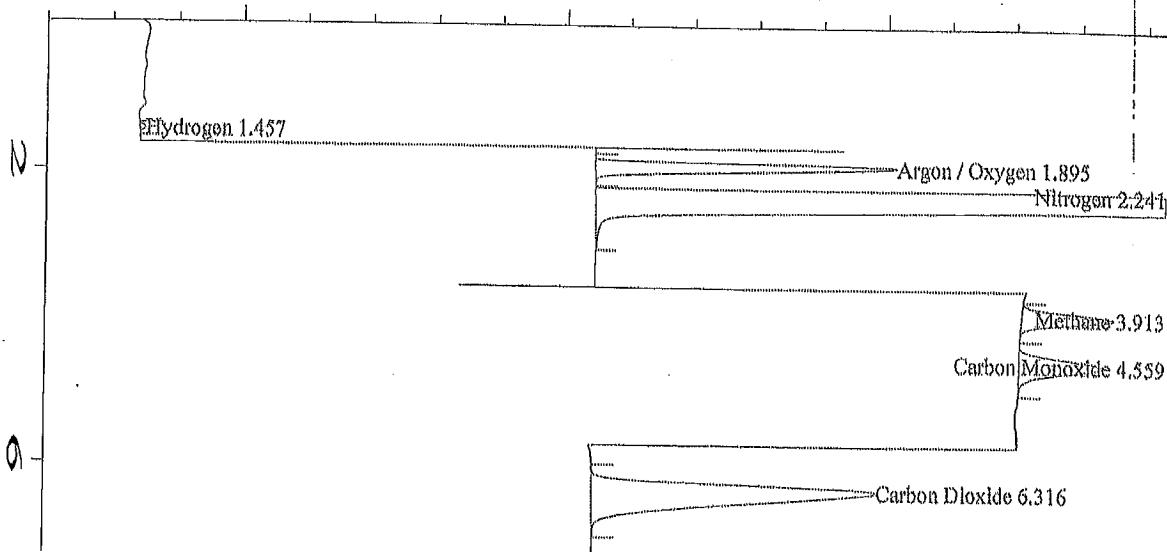


# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL1-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 1914 15:44:05 Instrument Method:  
 Report Created on: 15 Dec 14 10:54 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\CAL1-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.452	1636	BBA	0.054	1	0.993	Hydrogen
1.842	131328	BV	0.118	1	6.001	Argon / Oxygen
2.138	1696645	VBA	0.192	1	80.525	Nitrogen
3.914	53114	BBA	0.156	1	0.100	Methane
4.543	67022	BBA	0.224	1	0.100	Carbon Monoxide
6.199	298291	BBA	0.304	1	11.989	Carbon Dioxide



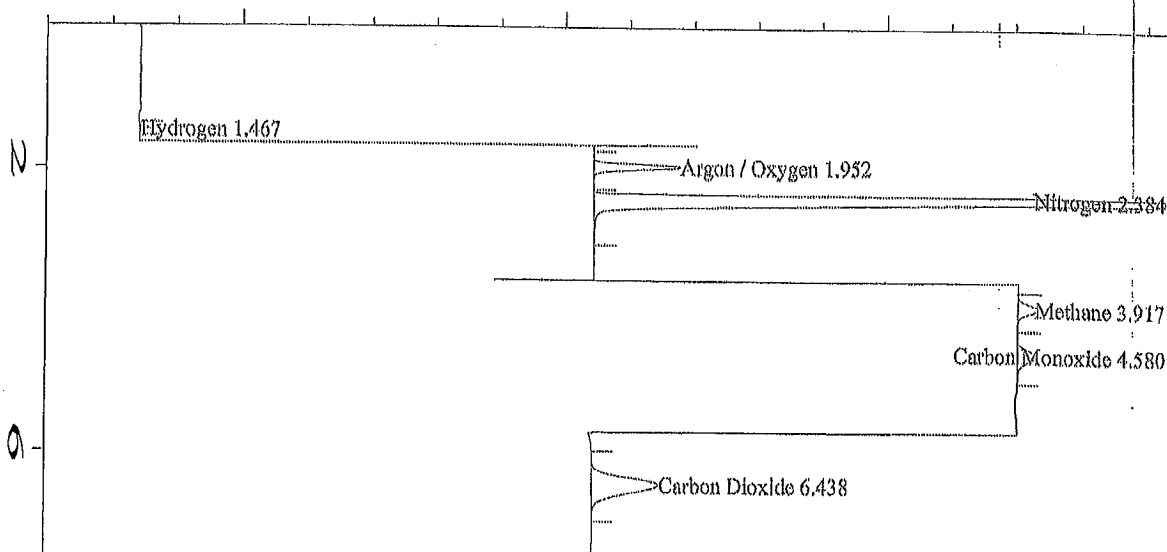
*Combustion level 2 Run 1*

# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL2-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 16:08:58 Instrument Method:  
 Report Created on: 15 Dec 14 10:51 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\CAL2-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.457	747	BBA	0.068	1	0.475	Hydrogen
1.895	65991	BV	0.117	1	2.997	Argon / Oxygen
2.241	879257	PBA	0.151	1	41.018	Nitrogen
3.913	26832	BBA	0.152	1	0.0501	Methane
4.559	33496	BBA	0.207	1	0.0499	Carbon Monoxide
6.316	151130	BV	0.267	1	6.025	Carbon Dioxide



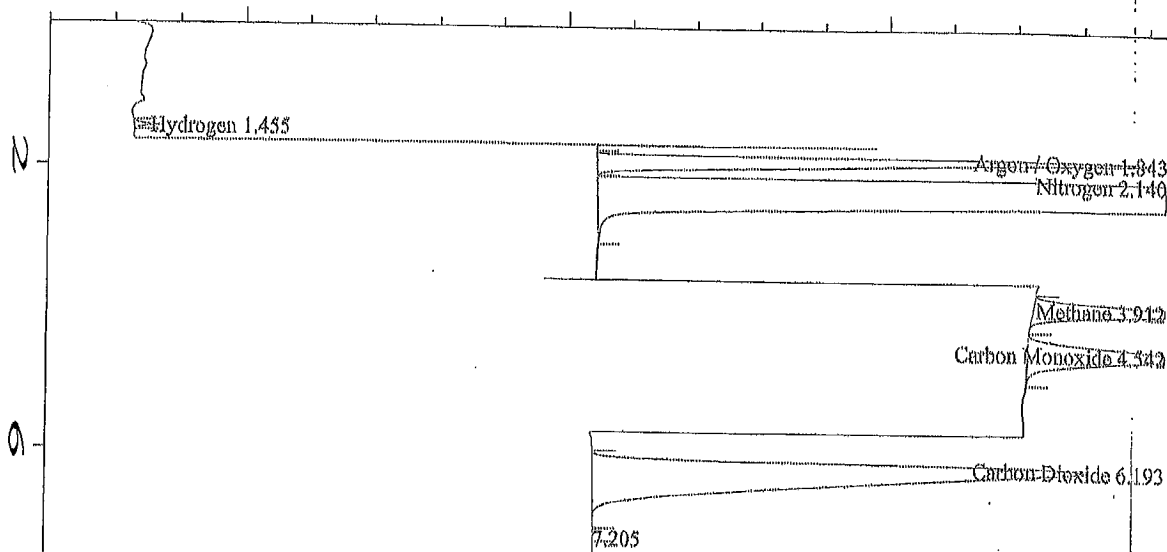
Calibration level 3 run 1

# External Standard Report

Data File Name : C:\HPCHEM\1\DATA\TRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\CAL3-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 16:19:48 Instrument Method:  
 Report Created on: 15 Dec 14 10:56 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\1\2014\REM-SP~1\REM\CAL3-1.D

Ret Time	Area	Type	Width	Ref#	Mole %	Name
1.467	126	BBA	0.075	1	0.114	Hydrogen
1.952	13882	BV	0.083	1	0.602	Argon / Oxygen
2.384	190702	PBA	0.098	1	7.737	Nitrogen
3.917	5679	BBA	0.144	1	0.00995	Methane
4.580	6898	BBA	0.191	1	0.0101	Carbon Monoxide
6.438	31729	BV	0.241	1	1.186	Carbon Dioxide



Shut check - run 1 11-10-27-27

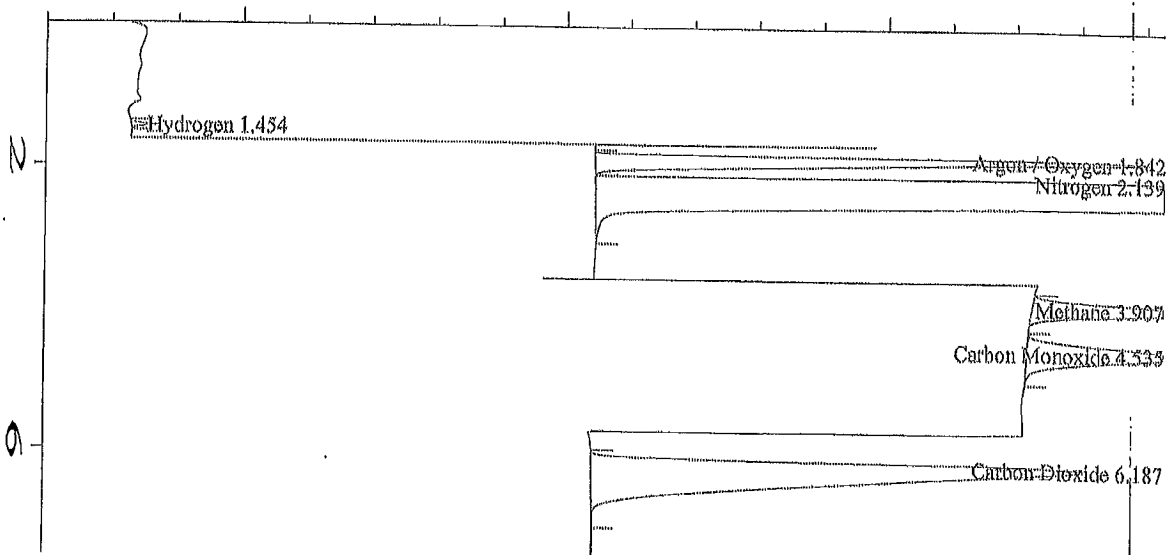
# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:00:41 Instrument Method:  
 Report Created on: 15 Dec 14 10:49 AM Analysis Method : TCDHS1.MTH  
 Last Recalib on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\SPAN1-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.455	1663	BBA	0.054	1	1.008	Hydrogen
1.843	131956	BV	0.118	1	6.025	Argon / Oxygen
2.140	1703043	VBA	0.192	1	80.762	Nitrogen
3.912	53408	BBA	0.159	1	0.100	Methane
4.542	67369	BBA	0.226	1	0.100	Carbon Monoxide
6.193	298942	BBA	0.302	1	12.005	Carbon Dioxide

Total amount = 100.09



Span Check - Run #2 ID# 11-10-27-22

# Normalized Percent Report

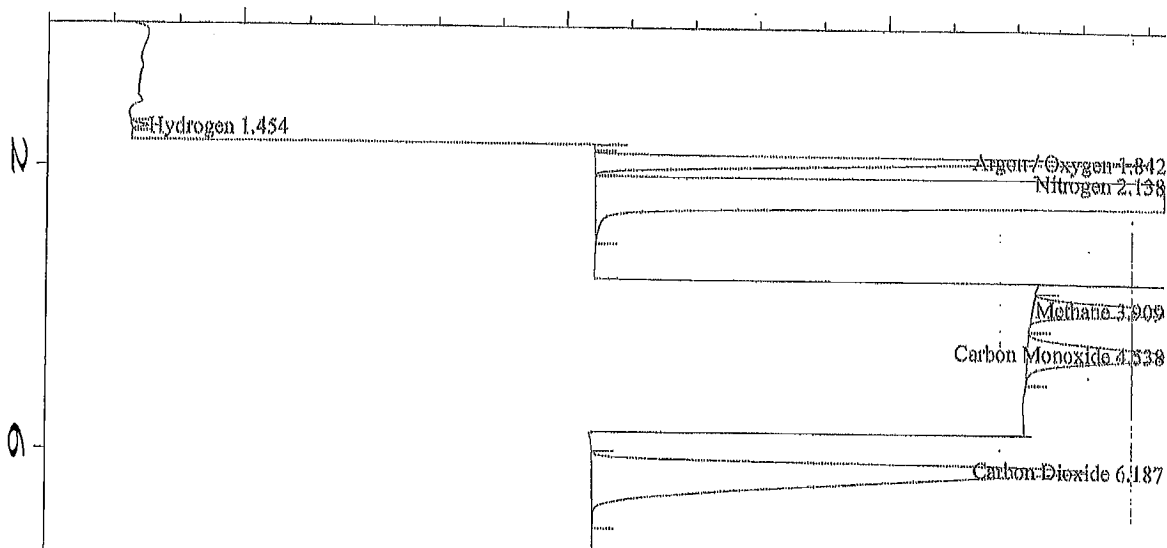
Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-2.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:10:46 Instrument Method:  
 Report Created on: 15 Dec 14 10:49 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\SPAN1-2.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.454	1652	BBA	0.054	1	1.007	Hydrogen
1.842	131103	BV	0.118	1	6.024	Argon / Oxygen
2.139	1692608	VBA	0.191	1	80.773	Nitrogen
3.907	52989	BBA	0.158	1	0.100	Methane
4.535	67035	BBA	0.226	1	0.101	Carbon Monoxide
6.187	296833	BBA	0.298	1	11.995	Carbon Dioxide

Total amount = 99.4526





span check - Run #3 11-10-27-22

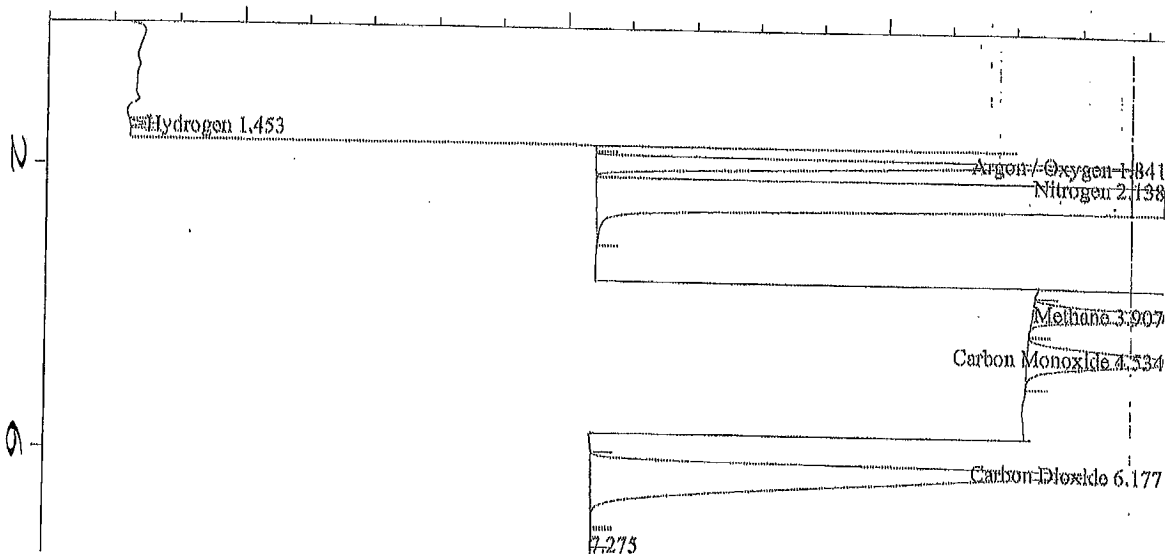
# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN1-3.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 17:22:45 Instrument Method:  
 Report Created on: 15 Dec 14 10:50 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 In C:\HPCHEM\...2014\REM-SP~1\REM\SPAN1-3.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.454	1662	BBA	0.054	1	1.010	Hydrogen
1.842	131492	BV	0.118	1	6.023	Argon / Oxygen
2.138	1697737	VBA	0.192	1	80.766	Nitrogen
3.909	53310	BBA	0.158	1	0.101	Methane
4.538	67294	BBA	0.226	1	0.101	Carbon Monoxide
6.187	297864	BBA	0.296	1	11.999	Carbon Dioxide

Total amount = 99.7675



Run Check

12/16/10-27-22

# Normalized Percent Report

Data File Name : C:\HPCHEM\...ITRS-TCD\HPCHEM~1\2014\REM-SP~1\REM\SPAN2-1.D  
 Operator : Page Number : 1  
 Instrument : HP5890A Vial Number : 0  
 Sample Name : TCD/PID 4129 Injection Number :  
 Run Time Bar Code: Sequence Line :  
 Acquired on : DEC 13, 2014 18:36:35 Instrument Method:  
 Report Created on: 15 Dec 14 10:50 AM Analysis Method : TCDHS1.MTH  
 Last Recall on : 15 Dec 14 10:46 AM Sample Amount : 0  
 Multiplier : 1 ISTD Amount :

Sig. 1 in C:\HPCHEM\...2014\REM-SP~1\REM\SPAN2-1.D

Ret Time	Area	Type	Width	Ref#	Amount %	Name
1.453	1621	BBA	0.054	1	0.994	Hydrogen
1.841	130613	BV	0.119	1	6.026	Argon / Oxygen
2.138	1686834	VBA	0.191	1	80.829	Nitrogen
3.907	52816	BBA	0.156	1	0.100	Methane
4.534	66706	BBA	0.226	1	0.101	Carbon Monoxide
6.177	294510	BV	0.293	1	11.951	Carbon Dioxide

Total amount = 99.0383



Praxair Distribution, Inc.  
9501-34th Street  
Edmonton, AB T6B 2X6  
Tel: 780-449-0778  
Fax: 780-449-6302

10/14/2011

PRAXAIR CALGARY DIST CTR  
8009 42 ST SE (236-6511)  
CALGARY, AB T2C 2T4  
Attention: REPORT PRINTER 360 PICK TICKET PRINTER 361

Praxair Order No. **14043294**  
Customer Reference No. **02171899**

Product Lot/Batch No. **Z582128701**  
Praxair Part No. **NI CD12CX2P-AS**

## CERTIFICATE OF ANALYSIS

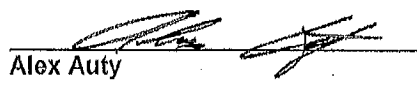
### Primary Standard



Component	Requested Concentration	Certified Concentration	Analytical Principle	Analytical Accuracy
Carbon dioxide	12%	12.04%	L	±.02%abs
Carbon monoxide	1000 ppm	1001 ppm	U	± 1% rel
Hydrogen	1%	1.00%	U	± 1%rel
Methane	1000 ppm	999 ppm	U	± 1% rel
Oxygen	6%	6.00%	U	±.02%abs
Nitrogen	Balance	Balance		

Analytical Instruments: Horiba~VIA 510~~  
Hewlett-Packard (Agilent)~6890~~  
Chandler Engineering~Carle Series 400 AGC~~  
Servomex~244A~~

Cylinder Style: AS  
Cylinder Pressure @70F: 13,790 kPa  
Cylinder Volume: 4.216 M3  
Valve Outlet Connection: CGA-590  
Cylinder No(s): SA21434

Filling Method: Gravimetric  
Date of Fill: 10/13/2011  
Expiration Date: 10/14/2014

Analyst:   
Alex Auty

Received 2011-10-27   
Opened 2011-10-27   
INTERNAL TRACKING # 11-10-27-22

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

Key to Analytical Techniques:			
A Flame Ionization with Methanizer	B Gas Chromatography with Discharge Ionization Detector	O Gas Chromatography with Electrolytic Conductivity Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Helium Ionization Detector	G Gas Chromatography with Methanizer Carbonizer	H Gas Chromatography with Photoionization Detector
I Gas Chromatography with Reduction Gas Analyzer	J Gas Chromatography with Thermal Conductivity Detector	K Binary Gas Analyzer with Thermal Conductivity Detector	L Infrared - FTIR or NDIR
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
Q Total Hydrocarbon Analyzer	R Wet Chemical	S Detector Tube	T Other
U Gravimetric Methods	V Biochemical	W Gas Chromatography with Chemiluminescence Detector	

#### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 availability 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.



Praxair Distribution Inc  
9501 - 34 Street  
Edmonton, AB T6B 2X6  
Tel.: (780) 449-0778  
Fax.: (780) 449-5302

Issue Date: June 21, 2011

To: Praxair Calgary  
8009 42 St SE  
Calgary, AB  
For: Maxxam 12864240

Praxair Order Number: 12864348  
Customer Order Number: 00045158

Product Lot Number: Z582117202  
Product Part Number: NI CD12CX2P-AS

## CERTIFICATE OF ANALYSIS

*Primary Standard*

Cylinder Serial Number	Components	Requested Concentration	Certified Concentration	Analytical Principle*/ Instrument	Analytical Uncertainty
CC246723	Carbon Dioxide	12 %	12.00 %	L*	+/- 0.02% Absolute
	Carbon Monoxide	0.1 %	0.10 %	L*	+/- 1% Relative
	Hydrogen	1 %	1.00 %	L*	+/- 1% Relative
	Methane	0.1 %	0.10 %	L*	+/- 1% Relative
	Oxygen	6 %	6.00 %	L*	+/- 0.02% Absolute
	Nitrogen	Balance	Balance	By Difference	N/A

Cylinder Style: AS  
Cylinder Pressure @70°F (21°C): 13790 kPa  
Cylinder Volume: 3.81 m<sup>3</sup>

Valve Outlet Connection: CGA 590  
Filling Method: Gravimetric  
Fill Date: June 7, 2011  
Expiry Date: June 21, 2014

Approved Signer: Michelle Pearce  
QA

Rec'd 2011-06-23 BW  
Open'd 2011-06-23 BW  
INTERNAL TR# 11-11-01-25

This gas calibration cylinder standard prepared by Praxair Distribution is considered a certified standard. It is prepared by gravimetric, volumetric, or partial pressure techniques. The calibration standard provided is certified against Praxair 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

\*Key to Analytical Principles:

A. Flame Ionization with Methanizer	F. Gas Chromatography with Helium Ionization Detector	K. Gas Chromatography with Ultrasonic Detector	P. Specific Water Analyzer
B. Gas Chromatography with Discharge Ionization Detector	G. Gas Chromatography with Methanizer Carbonizer	L. Gravimetric Methods	Q. Total Hydrocarbon Analyzer
C. Gas Chromatography with Electrolyte Conductivity Detector	H. Gas Chromatography with Photoionization Detector	M. Infrared - FTIR or NDIR	R. Wet Chemical
D. Gas Chromatography with Flame Ionization Detector	I. Gas Chromatography with Reduction Gas Analyzer	N. Mass Spectrometry - MS or GC/MS	S. Detector Tube
E. Gas Chromatography with Flame Photometric Detector	J. Gas Chromatography with Thermal Conductivity Detector	O. Paramagnetic	T. Odor

### IMPORTANT

The information contained herein has been prepared at your request by personnel within Praxair Distribution. 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 arising out of the use of the information contained herein exceed the fee established for providing such information.

***APPENDIX III***  
***SAMPLE CUSTODY***



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Email Howard.Malm@semtechnology.com

Project #: 35118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: \_\_\_\_\_

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: Dec 18/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)	LAB Test
Spartan T1B1A	<u>Dec 10/2014 10:25</u>	<u>AGFT LABS</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73302</u>
Spartan T1B1B	<u>12/10/14 11:00</u>	<u>✓</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73303</u>
Spartan T2B1A	<u>12:10</u>	<u>✓</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73304</u>
Spartan T2B1B	<u>12:45</u>	<u>✓</u>	<u>Hold as backup</u>	<u>✓</u>	<u>73305</u>
Spartan T3B1A	<u>✓ 15:00</u>	<u>✓</u>	<u>Oxygen, CO<sub>2</sub>, CH<sub>4</sub>, H<sub>2</sub>O, Moisture</u>	<u>✓</u>	<u>73306</u>
Spartan T3B1B	<u>15:30</u>	<u>✓</u>	<u>"</u>	<u>✓</u>	<u>73307</u>

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
<u>Charles Adelsky</u>	<u>Howard Malm</u>	<u>12/10/14</u>
	<u>Bill Wong</u>	<u>2014-12-11 12:00</u>

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Pages 1 of 2



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm  
Email Howard.Malm@remtechnology.com  
Project #: 35118

Company: Maxxam Analytics  
Contact: Bill Wong  
Purchase Order: 672130-08  
Date: \_\_\_\_\_

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)  
☐ Rush: Next Day  
☐ Rush: Same Day

Date Required: Dec 18/14

Send Additional Copy to:  
Name Greg Brown  
Email brown-greg@spartancontrols.com

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)	Lab TC#
Spartan T4B1A	12/11/14 0830	AG-AT Labs	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , Moisture	✓	73308
Spartan T4B1B	0905	✓	"	✓	73309
Spartan T5B1A	1005	✓	"	✓	73310
Spartan T5B1B	1040	✓	"	✓	73311
—	—	—	—	—	—
—	—	—	—	—	—

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
<u>Charles Buckle</u>	<u>Howard Malm, Jr. Malm</u>	12/11/14
	<u>Bill Wong</u>	2014-12-11 12:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Company: Maxxan Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: Dec 12/14

### SERVICE REQUESTED:

Standard: (5-7 working days) ☒

Rush: Next Day ☐

Rush: Same Day ☐

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Spartan T6B1A	12/12/14	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , water	100% TC
" T6B1B	"	AGAT		73225
				73226

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Frellicks	H. Malm	12/12/14 13:10
H. Malm	Bill Wong	12/12/14 14:00
H. Malm	Gov.	

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Pages 3 of 3





305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

## CHAIN OF CUSTODY RECORD

Duplicate Copy Required

### REPORT INFORMATION

(Please send report to:)

Name Howard Malin

Email howard@remtechnology.com

Project #: 35118

### SERVICE REQUESTED:

☒ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

Date Required: Dec 19/14

Company: Maxxon Analytics

Contact: Bill Wong

Purchase Order: 672130-OP

Date: Dec 12/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
Spartan T7B1A	11/12/14 1305	AG-AT	O <sub>2</sub> CO <sub>2</sub> CH <sub>4</sub> N <sub>2</sub> water	
T7B1B	1340			
T8B1A	1440			
T8B1B	1515			
T9B1A	1610			
T9B1B	1645			

14870#  
73327  
73328  
73329  
73330  
73331  
73332

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Clayde Ridgely	H. Malin	12/12/14 13:10
Howard Malin	Bill Wong	12/12/14 14:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malin

Email Howard.Malin@rentedtechnology.com

Project #: 35118

Send Additional Copy to:

Name Greg Brown

Email brown-greg@spartancontrols.com

## SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☐ Rush: Next Day

☐ Rush: Same Day

Date Required: \_\_\_\_\_

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: Dec 12/14

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
SPARTAN T10B1A	12/12/14 08:25	AGAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , water	
SPARTAN T10B1B	12/12/14 905			
SPARTAN T11B1A	955			
SPARTAN T11B1B	1040			
SPARTAN T12B1A	1130			
SPARTAN T12B1B	1205	✓	✓	

Lab ID#  
73323  
73324  
73325  
73326  
73327  
73328

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
Claude Pickett	H. Malin	12/12/14 13:10
H. Malin	Bill Wong	12/12/14 14:00

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Pages 1 of 3



305-27 Street NE, Calgary  
Alberta, Canada T2A 7V2

# CHAIN OF CUSTODY RECORD

Duplicate Copy Required

## REPORT INFORMATION

(Please send report to:)

Name Howard Malm

Email Howard.Malm@rentechtechnology.com

Project #: 35118

Company: Maxxam Analytics

Contact: Bill Wong

Purchase Order: 672130-08

Date: \_\_\_\_\_

Send Additional Copy to:

Name Greg Brown

Email brown.greg@spartancontrols.com

## SERVICE REQUESTED:

☐ Standard: (5-7 working days)

☐ Rush: Next Day

☒ Rush: Same Day

Date Required: December 19, 2014

Sample Identification	Date/Time Sampled (mm/dd/yy)	Sampled by	Analysis Requested	Hold for 60 Days (Y/N)
SPARTAN T13B1A	12/12/14 13:00	ACAT	O <sub>2</sub> , CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> , Water	<u>Lab Test</u>
SPARTAN T13B1B	12/12/14 13:35	ACAT	}	<u>73339</u>
SPARTAN T14B1A	12/12/14 14:30	ACAT	}	<u>73340</u>
SPARTAN T14B1B	12/12/14 15:05	ACAT	}	<u>73341</u>
				<u>73342</u>

Samples Relinquished by (Print Name and Sign)	Samples Received by (Print Name and Sign)	Date/Time (mm/dd/yy)
<u>JOE WEHLEBE</u> Gregory Brown	Gregory Brown Bill Wong	12/12/14 16:10
		12/12/14 09:50

If samples were shipped for analysis, please sign & date this form, scan it and forward to Spartan Contact noted above.

Steve Millar  
Source Testing Manager – Air Quality Monitoring Division  
AGAT Laboratories Ltd.  
2420 – 42<sup>nd</sup> Avenue N.E.  
Calgary, Alberta  
T2E 7T6

September 28, 2015

Howard Malm  
REM Technology  
305 27<sup>th</sup> St. S.E  
Calgary, Alberta  
T2A 7V6

Dear Howard,

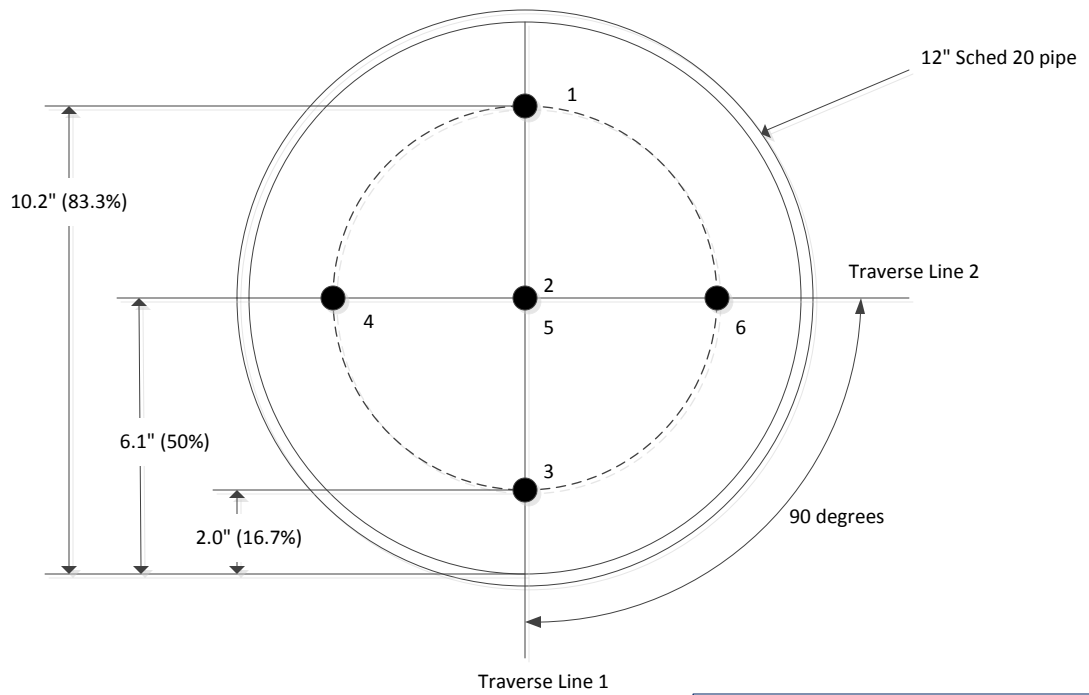
This letter is to inform that the traverse locations for the sampling of THC and CO using Method 10/24A, which is indicated on the traverse point diagram, were completed in accordance with sections 60.5413(d)(8) and (d)(9)(i)-(ii).

Regards,

Steve Millar



# Stack Sample Locations GTS-12



Traverse Line	Point	% of distance
1	1	83.3
1	2	50
1	3	16.7
2	4	83.3
2	5	50
2	6	16.7

**From:** [Greg Brown](#)  
**To:** [Mia Marcia](#)  
**Cc:** [Patty Centofanti](#); [Garwood, Gerri](#); [Jason Huckaby](#); [Howard Malm](#); [Cam Dowler](#); [Charlie Bischoff](#)  
**Subject:** RE: Initial Review of Spartan Slipstream Combustor  
**Date:** Friday, October 09, 2015 7:46:51 PM  
**Attachments:** [Spartan Controls REM Technologies December 2014 Source Emission Survey u....pdf](#)

---

Hi Marcia,

On behalf of Howard Malm, I have forwarded a revised statement, please see Page (1) of the attached document, from AGAT Laboratories Ltd. confirming that the M25A THC results presented in the AGAT report (starting on page 111 in the original "EPA Burner Report – Rev-0.pdf" file) are reported as propane, per 40 CFR 60.5413(d)(9)(v).

Please let us know if this meets with your requirements.

Best regards,

Greg Brown

**Greg Brown** | Research & Development Engineer | ASC-PIC Project Services

**Spartan Controls** | 305 - 27 Street S.E. | Calgary | AB | T2A 7V2 | Canada

T+1 (403) 695-2312 | M+1 (403) 589-2779 | F+1 (403) 207-0874

[Brown.Greg@spartancontrols.com](mailto:Brown.Greg@spartancontrols.com)

An Emerson Process Management Local Business Partner

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**From:** Mia, Marcia [<mailto:Mia.Marcia@epa.gov>]

**Sent:** Monday, October 05, 2015 3:25 PM

**To:** Howard Malm <[Howard.Malm@remtechnology.com](mailto:Howard.Malm@remtechnology.com)>; Patty Centofanti <[PCentofanti@trinityconsultants.com](mailto:PCentofanti@trinityconsultants.com)>

**Cc:** Garwood, Gerri <[Garwood.Gerri@epa.gov](mailto:Garwood.Gerri@epa.gov)>; Jason Huckaby <[Jason.Huckaby@erg.com](mailto:Jason.Huckaby@erg.com)>

**Subject:** RE: Initial Review of Spartan Slipstream Combustor

Thank you Howard.

We need a confirmatory statement, if applicable, that the M25A THC results presented in the AGAT report (starting on page 111 in the original "EPA Burner Report – Rev-0.pdf" file) are reported as propane, per 40 CFR 60.5413(d)(9)(v).

If you are able to make this statement and get it to us, I think that will wrap things up on our end. I am out of the office until October 14, 2015 and will look for your response upon my return.

Marcia B Mia

Office of Compliance/Air Branch

2227A WJCS

U.S. Environmental Protection Agency

202-564-7042

**From:** Howard Malm [<mailto:Howard.Malm@remtechnology.com>]

**Sent:** Wednesday, September 30, 2015 1:12 PM

**To:** Mia, Marcia; Patty Centofanti

**Cc:** Garwood, Gerri; Jason Huckaby

**Subject:** RE: Initial Review of Spartan Slipstream Combustor

Marcia:

I am pleased to provide the requested information as follows:

1. The missing gas custody form is attached in file "Chain of Custody-ORTECH"
2. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows that the GC-TDC calibration procedure was modified using EPA Alt-045. Please see page 3 of the revised report.
3. The traverse locations for the sample locations are specified by the letter and diagram in the attached document "AGAT Letter Sep 2015".
4. The attached revised report "Project # 35118 - Spartan Controls - REM Technology - Dec 2014 - Rev 2" shows a revised table in Appendix 1 (page 9 of the document) entitled "Summary of Analytical Results – THC as Propane Analysis" where the THC is reported as propane.

I trust the attached material will fully answer the points raised.

Yours truly

Howard Malm Ph.D. P.Eng.

Chief Technical Officer

REM Technology Inc.

403-695-2373 (off)

604-562-9438 (cell)

**From:** Mia, Marcia [<mailto:Mia.Marcia@epa.gov>]

**Sent:** Wednesday, September 09, 2015 2:08 PM

**To:** Howard Malm; Patty Centofanti

**Cc:** Garwood, Gerri; Jason Huckaby

**Subject:** Initial Review of Spartan Slipstream Combustor

We have completed our initial review of the performance test that you submitted under NSPS OOOO and MACT HH/HHH on 02/16/15.

We need additional detail on the following items:

1. Missing Inlet Gas Sampling Chain of Custody forms - Section 60.5413(d)(5)(i)(A)-(C) requires certain sampling and chain of custody (COC) protocols are followed. Please provide the

missing COC forms.

2. We are unable to determine if the GC-TCD calibration procedure was modified using EPA Alt-045 – Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 3C must be modified using EPA Alt-045. Please confirm. An affirmative statement is sufficient.
3. The narrative regarding the traverse locations for THC and CO is unclear and there is no traverse point diagram– Section 60.5413(d)(8) and (d)(9)(i)-(ii) require that Method 10/25A is conducted using a three point traverse. Please provide a diagram of the traverse and confirm that the Method 10/25A was conducted using a three point traverse.
4. Is THC reported as propane? - Section 60.5413(d)(9)(v)-(vi) requires that THC is measured as propane. The information on page 473 is presented as methane. Please confirm that THC is measured as propane.

You may provide the information in response to this email. We may elect to have a follow-up call after we receive the information. If you would like to have a conference call in any event, please let me know and I will schedule something. Thanks for your time in providing this information.

Marcia B Mia  
Office of Compliance/Air Branch  
2227A WJCS  
U.S. Environmental Protection Agency  
202-564-7042





## SOURCE EMISSION SURVEY

### Spartan Controls Ltd.

REM Technology Inc.

14C914464



Spartan Controls Ltd.

REM Technology Inc.

305 - 27 St. SE

Calgary, Alberta

T2A 7V2

Attention: Dr. Howard Malm

December 10-12, 2014

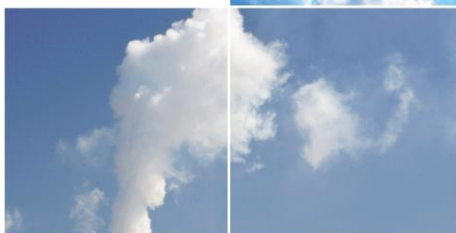
Submitted By:

**AGAT Laboratories Ltd.**

2420 42<sup>nd</sup> Avenue NE

Calgary, Alberta T2E 7T6

Phone: 403.736.5300



#### Canadian Technology in Action:

Accredited by:

- The Canadian Association for Laboratory Accreditation (CALA)
- The Standards Council of Canada (SCC) for ISO 17025:2005 Certification

(Accreditation is limited to specific laboratory locations and registered tests)  
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# AGAT Laboratories

Service Beyond Analysis ■ [www.agatlabs.com](http://www.agatlabs.com)



# AGAT Laboratories

January 07, 2015

Spartan Controls Ltd  
REM Technology Inc.  
305 – 27 St. SE  
Calgary, Alberta  
T2A 7V2

---

Attention: Dr. Howard Malm

Subject: REM Technology Inc. – December 2014 Source Emission Survey

---

AGAT Laboratories' Source Testing Services Group is pleased to submit the following Source Emission report. The test program was conducted for Spartan Controls Ltd. – REM Technology Inc. on December 10-12, 2014. Parameters tested were Carbon Monoxide, Total Hydrocarbons (reported as propane), Flow, and Sample Level Temperature.

If you have any questions or concerns regarding this report, please contact Mr. Steve Millar at (403) 736-5304 or via E-mail at [millar@agatlabs.com](mailto:millar@agatlabs.com). Alternatively, please contact Mr. Nitin Monteiro at (403) 736-5305, or via E-mail at [monteiro@agatlabs.com](mailto:monteiro@agatlabs.com). Thank you for your patronage, and we look forward to being of service to you in the future.

Yours truly,

**AGAT Laboratories**

Steve Millar  
Source Testing Manager

Nitin Monteiro, B.Sc., EPt.  
Client Project Manager

## SUMMARY

**Table 1: Summary of Results for Process Condition of 0 to 30%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>6.88</b>
CO Emission Rate	t/d	<b>0.0000420</b>
	kg/hr	<b>0.00175</b>
Total Hydrocarbons	ppmvd	<b>0.195</b>
THC Emission Rate	t/d	<b>0.000000667</b>
	kg/hr	<b>0.0000278</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.15</b>
	lb/hr	<b>561</b>
	ft <sup>3</sup> /hr	<b>7,573</b>
	m <sup>3</sup> /sec	<b>0.0596</b>
Stack Temperature	°C	<b>476</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 2: Summary of Results for Process Condition of 30 to 70%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>5.12</b>
CO Emission Rate	t/d	<b>0.0000356</b>
	kg/hr	<b>0.00148</b>
Total Hydrocarbons	ppmvd	<b>0.318</b>
THC Emission Rate	t/d	<b>0.00000120</b>
	kg/hr	<b>0.0000500</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.83</b>
	lb/hr	<b>633</b>
	ft <sup>3</sup> /hr	<b>8,583</b>
	m <sup>3</sup> /sec	<b>0.0675</b>
Stack Temperature	°C	<b>514</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 3: Summary of Results for Process Condition of 70 to 100%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>4.36</b>
CO Emission Rate	t/d	<b>0.0000291</b>
	kg/hr	<b>0.00121</b>
Total Hydrocarbons	ppmvd	<b>0.403</b>
THC Emission Rate	t/d	<b>0.00000146</b>
	kg/hr	<b>0.0000608</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.54</b>
	lb/hr	<b>602</b>
	ft <sup>3</sup> /hr	<b>8,157</b>
	m <sup>3</sup> /sec	<b>0.0642</b>
Stack Temperature	°C	<b>541</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 4: Summary of Results for Process Condition of 90 to 100%**

<b>REM Technology Inc.</b>		
<b>Parameter</b>	<b>Units</b>	<b>Incinerator Stack</b>
Carbon Monoxide	ppmvw	<b>3.45</b>
CO Emission Rate	t/d	<b>0.0000207</b>
	kg/hr	<b>0.000862</b>
Total Hydrocarbons	ppmvd	<b>0.102</b>
THC Emission Rate	t/d	<b>0.000000325</b>
	kg/hr	<b>0.0000135</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.01</b>
	lb/hr	<b>543</b>
	ft <sup>3</sup> /hr	<b>7,367</b>
	m <sup>3</sup> /sec	<b>0.0579</b>
Stack Temperature	°C	<b>530</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

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## **Part 1 – INTRODUCTION**

### **1.1 Background Information**

AGAT Laboratories' Source Testing Services Group was retained by Dr. Howard Malm of Spartan Controls Ltd. – REM Technology Inc. to perform a Source Emission Survey. These tests were conducted from December 10-12, 2014.

### **1.2 Key Personnel**

Mr. Claude Ricketts was the AGAT project manager with Dr. Howard Malm acting as the client contact and coordinator. Mr. Claude Ricketts, Mr. Joseph Woehleke, Mr. Alexander Sanguino and Mr. Nitin Monteiro performed the on-site sampling program. Mr. Nitin Monteiro performed the data reduction and produced the final report.

### **1.3 Project Scope**

Project scope included Source Emission Survey tests for Carbon Monoxide, Total Hydrocarbons (reported as propane), Volumetric Flow, and Sample Level Temperature.



## Part 2 – TEST PROCEDURE

### 2.1 Standard Methods

**Table 5: Standard Methods**

PARAMETER	METHOD
Velocity Traverse	Method 1 – Sample and Velocity Traverses for Stationary Sources, U.S. EPA
Stack Gas Velocity and Volumetric Flow Rate	Method 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate (type S pitot tube), U.S. EPA
Stack Gas Molecular Weight	Method 3A/3C – Gas Analysis for the Determination of Dry Molecular Weight, U.S. EPA
Moisture Content	Method 4 – Determination of Moisture Content in Stack Gases, U.S. EPA
Carbon Monoxide	Method 10 - Determination of Carbon Monoxide Emissions from Stationary Sources, U.S. EPA
Total Hydrocarbons	Method 25A – Determination of Total Hydrocarbons Emissions from Stationary Sources, USEPA
Fugitive Opacity	Method 22 – Determination of Fugitive Opacity from Stationary Sources, U.S. EPA

In the determination of percent CO<sub>2</sub> and percent O<sub>2</sub> content of the exhaust gas, an integrated bag sampling procedure was used as a grab-sample of the exhaust gas over the course of each test. One 10L bag was filled during every half hour, which amounted to two 10L bags for each test run. The exhaust gas was sampled at a constant rate of 0.30 L/min for five minutes at each traverse point and this was done simultaneously with flow measurements.

### Gaseous Sampling System

Stack gas was withdrawn via an out-of-stack probe system with a 1:1 ratio that ensures the gas delivered to the analyzer is what is drawn out of the stack. The gas is delivered to a manifold through an inert teflon line. Test gas is passed through the manifold to a gas filter where it is analyzed for CO by a broad band infrared light. Additionally, the sample gas is also delivered through the manifold of a second analyzer for analysis of Total Hydrocarbons by a flame ionization detector. The sample gas is passed through the analyzer at a precise rate of flow and pressure to maintain sample integrity.

## **Volumetric Flow Measurements**

Stack gas velocity was determined from moisture content of the stack gas as well as differential pressure and temperature readings collected at six points along two diameters of the stack. Pressure differentials are measured by calibrated S-type Pitot tube and inclined oil manometer. Temperature measurements are made with a calibrated K-type thermocouple. Velocity, when multiplied by the cross sectional area of the stack equates to the volumetric flow.

## **2.2 Quality Assurance / Quality Control**

AGAT Laboratories is accredited by Canadian Association for Laboratory Accreditation (CALA), the Standards Council of Canada (SCC), and is an ISO 17025:2005 registered company. AGAT Laboratories is also ISO 9001:2008 registered company.

- Regular maintenance and calibration of all field-sampling equipment as per the applicable sampling protocols.
- Linearity and response time checks are conducted on all analyzers prior to use.
- Calibration drift is checked between all tests to assure instruments are performing within allowable limits.
- QA/QC on all final lab analysis and final written reports.

## **PART 3 – DISCUSSION**

The source emission survey for Spartan Controls Ltd. – REM Technology Inc. was conducted through four different process conditions (0-30%, 30-70%, 70-100% and 90-100%) comprising of a total of twelve tests.

At each traverse point of the stack at which the probe was placed, five (5) minutes of data were collected throughout each of the sixty (60) minute test runs. Therefore twelve (12) traverse points were measured during each of the one (1) hour test runs.

During the determination of fugitive opacity, two observers were used, alternating every 20 minutes, for the continuous observation period for each of the twelve (12) tests and it was determined that zero emissions were observed during each of the twelve (12) tests.

The survey was conducted over a span of three days and the test results are an accurate representation of emission characteristics for the process conditions maintained on the Spartan Controls Ltd. – REM Technology Inc. Incinerator Stack on the test dates of December 10-12, 2014.

## Part 4 – RESULTS

**Table 6: Parameter Results for Process Condition of 0 to 30%**

REM Technology Inc.					
Parameter	Units	Test 7	Test 11	Test 12	Average
Date and Time	14/12/11-12	16:10-17:20	13:00-14:10	14:30-15:40	
Flow Rate	%	0-30%	0-30%	0-30%	
Carbon Monoxide	ppmvw	6.47	6.82	7.34	6.88
CO Emission Rate	t/d	0.0000471	0.0000384	0.0000406	0.0000420
	kg/hr	0.00196	0.00160	0.00169	0.00175
Total Hydrocarbons	ppmvd	0.221	0.197	0.166	0.195
THC Emission Rate	t/d	0.000000889	0.000000610	0.000000501	0.000000667
	kg/hr	0.0000370	0.0000254	0.0000209	0.0000278
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	6.12	4.71	4.61	5.15
	lb/hr	673	510	500	561
	ft <sup>3</sup> /hr	9,005	6,931	6,783	7,573
	m <sup>3</sup> /sec	0.0708	0.0545	0.0534	0.0596
Stack Temperature	°C	475	474	480	476

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 7: Parameter Results for Process Condition of 30 to 70%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 4</b>	<b>Test 5</b>	<b>Test 6</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/11</b>	<b>11:35-12:45</b>	<b>13:05-14:15</b>	<b>14:40-15:50</b>	
<b>Flow Rate</b>	<b>%</b>	<b>30-70%</b>	<b>30-70%</b>	<b>30-70%</b>	
Carbon Monoxide	ppmvw	<b>5.40</b>	<b>4.72</b>	<b>5.24</b>	<b>5.12</b>
CO Emission Rate	t/d	<b>0.0000332</b>	<b>0.0000347</b>	<b>0.0000388</b>	<b>0.0000356</b>
	kg/hr	<b>0.00139</b>	<b>0.00145</b>	<b>0.00162</b>	<b>0.00148</b>
Total Hydrocarbons	ppmvd	<b>0.392</b>	<b>0.344</b>	<b>0.219</b>	<b>0.318</b>
THC Emission Rate	t/d	<b>0.00000133</b>	<b>0.00000138</b>	<b>0.000000893</b>	<b>0.00000120</b>
	kg/hr	<b>0.0000554</b>	<b>0.0000575</b>	<b>0.0000372</b>	<b>0.0000500</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.17</b>	<b>6.12</b>	<b>6.21</b>	<b>5.83</b>
	lb/hr	<b>562</b>	<b>664</b>	<b>673</b>	<b>633</b>
	ft <sup>3</sup> /hr	<b>7,607</b>	<b>9,005</b>	<b>9,138</b>	<b>8,583</b>
	m <sup>3</sup> /sec	<b>0.0598</b>	<b>0.0708</b>	<b>0.0719</b>	<b>0.0675</b>
Stack Temperature	°C	<b>511</b>	<b>519</b>	<b>512</b>	<b>514</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 8: Parameter Results for Process Condition of 70 to 100%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 1</b>	<b>Test 2</b>	<b>Test 3</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/10/11</b>	<b>15:00-16:10</b>	<b>08:30-09:40</b>	<b>10:05-11:15</b>	
<b>Flow Rate</b>	<b>%</b>	<b>70-100%</b>	<b>70-100%</b>	<b>70-100%</b>	
Carbon Monoxide	ppmvw	<b>4.24</b>	<b>4.59</b>	<b>4.27</b>	<b>4.36</b>
CO Emission Rate	t/d	<b>0.0000265</b>	<b>0.0000319</b>	<b>0.0000288</b>	<b>0.0000291</b>
	kg/hr	<b>0.00110</b>	<b>0.00133</b>	<b>0.00120</b>	<b>0.00121</b>
Total Hydrocarbons	ppmvd	<b>0.447</b>	<b>0.390</b>	<b>0.372</b>	<b>0.403</b>
THC Emission Rate	t/d	<b>0.00000151</b>	<b>0.00000149</b>	<b>0.00000138</b>	<b>0.00000146</b>
	kg/hr	<b>0.0000629</b>	<b>0.0000622</b>	<b>0.0000574</b>	<b>0.0000608</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.15</b>	<b>5.84</b>	<b>5.64</b>	<b>5.54</b>
	lb/hr	<b>556</b>	<b>635</b>	<b>614</b>	<b>602</b>
	ft <sup>3</sup> /hr	<b>7,578</b>	<b>8,593</b>	<b>8,299</b>	<b>8,157</b>
	m <sup>3</sup> /sec	<b>0.0596</b>	<b>0.0676</b>	<b>0.0653</b>	<b>0.0642</b>
Stack Temperature	°C	<b>558</b>	<b>527</b>	<b>537</b>	<b>541</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

**Table 9: Parameter Results for Process Condition of 90 to 100%**

<b>REM Technology Inc.</b>					
<b>Parameter</b>	<b>Units</b>	<b>Test 8</b>	<b>Test 9</b>	<b>Test 10</b>	<b>Average</b>
<b>Date and Time</b>	<b>14/12/12</b>	<b>08:25-09:35</b>	<b>09:55-11:05</b>	<b>11:30-12:40</b>	
<b>Flow Rate</b>	<b>%</b>	<b>90-100%</b>	<b>90-100%</b>	<b>90-100%</b>	
Carbon Monoxide	ppmvw	<b>3.73</b>	<b>3.12</b>	<b>3.49</b>	<b>3.45</b>
CO Emission Rate	t/d	<b>0.0000225</b>	<b>0.0000198</b>	<b>0.0000198</b>	<b>0.0000207</b>
	kg/hr	<b>0.000938</b>	<b>0.000823</b>	<b>0.000825</b>	<b>0.000862</b>
Total Hydrocarbons	ppmvd	<b>0.117</b>	<b>0.0209</b>	<b>0.167</b>	<b>0.102</b>
THC Emission Rate	t/d	<b>0.000000384</b>	<b>0.0000000724</b>	<b>0.000000517</b>	<b>0.000000325</b>
	kg/hr	<b>0.0000160</b>	<b>0.00000302</b>	<b>0.0000215</b>	<b>0.0000135</b>
Volumetric Flow	E <sup>3</sup> M <sup>3</sup> /Day	<b>5.02</b>	<b>5.28</b>	<b>4.72</b>	<b>5.01</b>
	lb/hr	<b>543</b>	<b>574</b>	<b>511</b>	<b>543</b>
	ft <sup>3</sup> /hr	<b>7,387</b>	<b>7,769</b>	<b>6,945</b>	<b>7,367</b>
	m <sup>3</sup> /sec	<b>0.0581</b>	<b>0.0611</b>	<b>0.0546</b>	<b>0.0579</b>
Stack Temperature	°C	<b>523</b>	<b>527</b>	<b>539</b>	<b>530</b>

Note:\* Reported at 760 mm Hg and 25<sup>0</sup>C

## **Appendix I**

### **Emission Data and Calculations**



	<b>Company:</b>	Spartan Controls										
	<b>Date:</b>	2014/12/10-12										
Actual Span Gas Conc	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13	5.13
Pre Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Pre Test Span	4.45	5.18	5.56	5.81	5.63	5.41	5.39	4.95	4.77	4.84	5.21	5.10
RATA Test #	1	2	3	4	5	6	7	8	9	10	11	12
Process Condition	70-100%	70-100%	70-100%	30-70%	30-70%	30-70%	0-30%	90-100%	90-100%	90-100%	0-30%	0-30%
PPM Dry to Wet	4.235	4.589	4.270	5.404	4.718	5.238	6.467	3.729	3.118	3.491	6.817	7.341
CO PPM drift corrected	4.495	4.772	4.467	5.614	4.953	5.463	6.715	3.916	3.267	3.665	7.125	7.690
Reference ppm, dry	3.895	4.995	4.950	6.260	5.330	5.750	7.160	3.710	3.060	3.590	7.160	7.450
mg/m3,wet	5.15	5.46	5.11	6.43	5.67	6.25	7.69	4.48	3.74	4.20	8.16	8.80
Reference Flow (E'M <sup>3</sup> /Day)	5.15	5.84	5.64	5.17	6.12	6.21	6.12	5.02	5.28	4.72	4.71	4.61
CO kg/h	0.001104	0.001329	0.001202	0.001385	0.001446	0.001618	0.001960	0.000938	0.000823	0.000825	0.001601	0.001691
CO t/d	0.00002651	0.00003191	0.00002884	0.00003323	0.00003471	0.00003884	0.00004705	0.00002251	0.00001975	0.00001981	0.00003842	0.00004059
Ref Temp °C All Points	558.4	526.7	536.8	511.4	518.9	511.6	475.3	523.2	526.5	539.3	474.3	479.5
Velocity (m/sec)	2.590	2.862	2.800	2.485	2.970	2.983	2.804	2.441	2.581	2.342	2.153	2.122
Stack Gas Moisture	0.0580	0.0383	0.0440	0.0375	0.0475	0.0411	0.0370	0.0478	0.0457	0.0475	0.0432	0.0453
CO Test Time start	15:00	08:30	10:05	11:35	13:05	14:40	16:10	08:25	09:55	11:30	13:00	14:30
End	16:10	09:40	11:15	12:45	14:15	15:50	17:20	09:35	11:05	12:40	14:10	15:40
Velocity Test Times Start	15:56	08:34	10:06	11:38	13:08	14:44	16:14	08:28	09:58	11:33	13:03	14:33
End	16:06	09:38	11:06	12:41	14:11	15:47	17:16	09:33	11:03	12:37	14:06	15:37
Post Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Post Test Span	4.44	5.56	5.81	5.63	5.41	5.39	5.55	4.77	4.84	5.21	5.10	4.84

	Company: Date:		Spartan 2014/12/10-12 RATA Table									
Actual Span Gas Conc	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09	9.09
Pre Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Pre Test Span	8.13	8.56	8.24	8.86	8.76	8.70	7.88	8.93	8.20	9.20	8.23	7.43
RATA Test #	1	2	3	4	5	6	7	8	9	10	11	12
Process Condition	70-100%	70-100%	70-100%	30-70%	30-70%	30-70%	0-30%	90-100%	90-100%	90-100%	0-30%	0-30%
THC PPM drift corrected	0.447	0.390	0.372	0.392	0.344	0.219	0.221	0.117	0.0209	0.167	0.197	0.166
Reference ppm, wet	0.410	0.360	0.350	0.380	0.330	0.200	0.200	0.110	0.0200	0.160	0.170	0.135
mg/m3,wet	0.293	0.256	0.244	0.257	0.225	0.144	0.145	0.077	0.0137	0.109	0.129	0.109
Reference Flow (E <sup>3</sup> M <sup>3</sup> /Day)	5.15	5.84	5.64	5.17	6.12	6.21	6.12	5.02	5.28	4.72	4.71	4.61
THC kg/h	0.0000629	0.0000622	0.0000574	0.0000554	0.0000575	0.0000372	0.0000370	0.0000160	0.00000302	0.0000215	0.0000254	0.0000209
THC t/d	0.00000151	0.00000149	0.00000138	0.00000133	0.00000138	0.000000893	0.000000889	0.000000384	0.0000000724	0.000000517	0.000000610	0.000000501
Ref Temp °C All Points	558.4	526.7	536.8	511.4	518.9	511.6	475.3	523.2	526.5	539.3	474.3	479.5
Velocity (m/sec)	2.590	2.862	2.800	2.485	2.970	2.983	2.804	2.441	2.581	2.342	2.153	2.122
Stack Gas Moisture	0.0580	0.0383	0.0440	0.0375	0.0475	0.0411	0.0370	0.0478	0.0457	0.0475	0.0432	0.0453
THC Test Time start	1500	0830	1005	1135	1305	1440	1610	0825	0955	1130	1300	1430
End	1610	0940	1115	1245	1415	1550	1720	0935	1105	1240	1410	1540
Velocity Test Times Start	1556	0834	1006	1138	1308	1444	1614	0828	0958	1133	1303	1433
End	1606	0938	1106	1241	1411	1547	1716	0933	1103	1237	1406	1537
Post Test Zero	0	0	0	0	0	0	0	0	0	0	0	0
Post Test Span	8.56	8.24	8.86	8.76	8.70	7.88	8.54	8.20	9.20	8.23	7.43	7.38

Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/10  
Test# 1

Source Incinerator Test # 1 Date 2014/12/10

Start Time 15:56 End Time 16:06

Summary

Average Stack Gas Velocity 2.59 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 202 std m3/hour  
Wet 215 std m3/hour  
Dry 0.0562 std m3/sec  
Wet 0.0596 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 238 kg/hour  
Wet 252 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 558 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.8 kg/kg-mol

Molar Fraction Water Vapor 0.058

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.5	5.5	81.0	#N/A
Wet	12.7	5.2	76.3	#N/A

# Data and Calculations

Source Incinerator Test # 1 Date 2014/12/10

Start Time 15:56 End Time 16:06

Average Stack Gas Velocity. **2.590 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**  
214.60 std m3/hour  
5.15 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 252.25 \text{ kg/hour}$$

Dry Molecular Wt. **29.42 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.76 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 5.8012142 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0580**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0217 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5066 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0095 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$  34.9219 Pitot tube constant  
 $\_C_p$  0.803 Pitot tube coefficient  
 $\_NP$  12 Number of traverse points  
 $\_Dts$  558.4 Temperature Stack C  
 $\_Ts$  831.6 Absolute stack temperature K  
 $\_Bp$  668.6 Barometric Pressure mmHg  
 $\_Pst$  -0.3048 Static Pressure mmH2O  
 $\_Ps$  668.56 Absolute stack pressure mm Hg  
 $\_Ms$  28.76 Molecular weight of stack gas, wet basis g/g-mole  
 $\_A$  0.0730 Area Square Meters 0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K  
 $\_Pstd$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.56328	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	18.50	Temperature meter Celsius
_Tm	291.7	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	9.20	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/11  
Test# 2

Source Incinerator Test # 2 Date 2014/12/11

Start Time 8:34 End Time 9:38

Summary

Average Stack Gas Velocity 2.86 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 234 std m3/hour  
Wet 243 std m3/hour  
Dry 0.065 std m3/sec  
Wet 0.0676 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 277 kg/hour  
Wet 288 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 527 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.0383

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.5	5.3	78.4	#N/A

## Data and Calculations

Source Incinerator Test # 2 Date 2014/12/11

Start Time 8:34 End Time 9:38

Average Stack Gas Velocity. **2.862 m/s**

$$V_s = K_p C_p (\text{Avg.dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
243.41 std m3/hour  
5.84 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 288.17 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.96 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.8263946 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0383**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0176 \_Vw(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5111 \_Vm(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0027 \_Vsg(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	526.7	Temperature Stack C
_Ts	799.8	Absolute stack temperature K
_Bp	660.2	Barometric Pressure mmHg
_Pst	-0.3302	Static Pressure mmH2O
_Ps	660.17	Absolute stack pressure mm Hg
_Ms	28.96	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
		0.3048 Diameter Meters

\_Tstd 298.15 Standard absolute temperature K

\_Pstd 760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	13.0	Final Weight of water in grams
_V	0.57852	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm



Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/11  
Test# 3

Source Incinerator Test # 3 Date 2014/12/11

Start Time 10:06 End Time 11:06

Summary

Average Stack Gas Velocity 2.8 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 225 std m3/hour  
Wet 235 std m3/hour  
Dry 0.0625 std m3/sec  
Wet 0.0653 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 266 kg/hour  
Wet 279 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 537 Celsius

Dry Molecular Weight 29.5 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.044

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.5	6.0	80.5	#N/A
Wet	12.9	5.7	77.0	#N/A

### Data and Calculations

Source Incinerator Test # 3 Date 2014/12/11

Start Time 10:06 End Time 11:06

Average Stack Gas Velocity. **2.800 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
235.18 std m3/hour  
5.64 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 278.71 \text{ kg/hour}$$

Dry Molecular Wt. **29.5 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.99 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.402453 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0440**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5005 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(\text{sg}) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$  34.9219 Pitot tube constant  
 $\_C_p$  0.803 Pitot tube coefficient  
 $\_NP$  12 Number of traverse points  
 $\_Dts$  536.8 Temperature Stack C  
 $\_Ts$  810.0 Absolute stack temperature K  
 $\_Bp$  660.2 Barometric Pressure mmHg  
 $\_Pst$  -0.2794 Static Pressure mmH2O  
 $\_Ps$  660.18 Absolute stack pressure mm Hg  
 $\_Ms$  28.99 Molecular weight of stack gas, wet basis g/g-mole  
 $\_A$  0.0730 Area Square Meters 0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K  
 $\_Pstd$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.56652	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	6	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	80.5	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/11  
Test# 4

Source Incinerator Test # 4 Date 2014/12/11

Start Time 11:38 End Time 12:41

Summary

Average Stack Gas Velocity 2.49 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 207 std m3/hour  
Wet 216 std m3/hour  
Dry 0.0576 std m3/sec  
Wet 0.0599 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 245 kg/hour  
Wet 255 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 511 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0375

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.0	5.0	81.0	#N/A
Wet	13.5	4.8	78.0	#N/A

### Data and Calculations

Source Incinerator Test # 4 Date 2014/12/11

Start Time 11:38 End Time 12:41

Average Stack Gas Velocity. **2.485 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{0.5} (T_s / P_s M_s)^{0.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**  
215.50 std m3/hour  
5.17 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 254.87 \text{ kg/hour}$$

Dry Molecular Wt. **29.36 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.93 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.7478721 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0375**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. M}^3 \quad 0.0163 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. M}^3 \quad 0.5224 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. M}^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	511.4	Temperature Stack C
$\_T_s$	784.6	Absolute stack temperature K
$\_B_p$	660.2	Barometric Pressure mmHg
$\_P_{st}$	-0.2794	Static Pressure mmH2O
$\_P_s$	660.18	Absolute stack pressure mm Hg
$\_M_s$	28.93	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	12.0	Final Weight of water in grams
_V	0.59124	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/11  
Test# 5

Source Incinerator Test # 5 Date 2014/12/11

Start Time 13:08 End Time 14:11

Summary

Average Stack Gas Velocity 2.97 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 243 std m3/hour  
Wet 255 std m3/hour  
Dry 0.0675 std m3/sec  
Wet 0.0709 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 287 kg/hour  
Wet 301 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 519 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0475

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.5	5.5	81.0	#N/A
Wet	12.9	5.2	77.2	#N/A

### Data and Calculations

Source Incinerator Test # 5 Date 2014/12/11

Start Time 13:08 End Time 14:11

Average Stack Gas Velocity. **2.970 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

255.11 std m3/hour

6.12 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437$$

301.12 kg/hour

Dry Molecular Wt. **29.42 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.88 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7515786 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0475**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0217 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5164 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0041 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	518.9	Temperature Stack C
$\_Ts$	792.1	Absolute stack temperature K
$\_Bp$	660.2	Barometric Pressure mmHg
$\_Pst$	-0.2794	Static Pressure mmH2O
$\_Ps$	660.18	Absolute stack pressure mm Hg
$\_Ms$	28.88	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$	298.15	Standard absolute temperature K
$\_Pstd$	760	Standard absolute pressure



---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.58447	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/11  
Test# 6

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Source Incinerator Test # 6 Date 2014/12/11

Start Time 14:44 End Time 15:47

Summary

Average Stack Gas Velocity 2.98 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 248 std m3/hour  
Wet 259 std m3/hour  
Dry 0.0689 std m3/sec  
Wet 0.0718 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 293 kg/hour  
Wet 305 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 512 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0411

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.0	5.0	81.0	#N/A
Wet	13.4	4.8	77.7	#N/A

## Data and Calculations

Source Incinerator Test # 6 Date 2014/12/11

Start Time 14:44 End Time 15:47

Average Stack Gas Velocity. **2.983 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**  
258.60 std m3/hour  
6.21 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 305.40 \text{ kg/hour}$$

Dry Molecular Wt. **29.36 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.89 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.1075717 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0411**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0163 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5383 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0068 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	511.6	Temperature Stack C
$\_T_s$	784.7	Absolute stack temperature K
$\_B_p$	660.2	Barometric Pressure mmHg
$\_P_{st}$	-0.2794	Static Pressure mmH2O
$\_P_s$	660.18	Absolute stack pressure mm Hg
$\_M_s$	28.89	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	12.0	Final Weight of water in grams
_V	0.60928	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

---

Source Incinerator Test # 7 Date 2014/12/11

Start Time 16:14 End Time 17:16

Summary

Average Stack Gas Velocity 2.8 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 245 std m3/hour  
Wet 255 std m3/hour  
Dry 0.0682 std m3/sec  
Wet 0.0708 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 290 kg/hour  
Wet 301 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 475 Celsius

Dry Molecular Weight 29.3 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.037

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	4.5	81.0	#N/A
Wet	14.0	4.3	78.0	#N/A

### Data and Calculations

Source Incinerator Test # 7 Date 2014/12/11

Start Time 16:14 End Time 17:16

Average Stack Gas Velocity. **2.804 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.07 std m3/sec**

254.85 std m3/hour

6.12 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 300.85 \text{ kg/hour}$$

Dry Molecular Wt. **29.3 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.88 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 3.7042476 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0370**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0136 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.4936 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0054 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	475.3	Temperature Stack C
$\_Ts$	748.4	Absolute stack temperature K
$\_Bp$	660.2	Barometric Pressure mmHg
$\_Pst$	-0.254	Static Pressure mmH2O
$\_Ps$	660.18	Absolute stack pressure mm Hg
$\_Ms$	28.88	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$	298.15	Standard absolute temperature K
$\_Pstd$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	10.0	Final Weight of water in grams
_V	0.55872	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	4.5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

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Project #14C914464  
2014/12/12  
Test# 8

Source Incinerator Test # 8 Date 2014/12/12

Start Time 8:28 End Time 9:33

Summary

Average Stack Gas Velocity 2.44 m/s

Average Stack Gas Volumetric Flow Rate  
Dry 199 std m3/hour  
Wet 209 std m3/hour  
Dry 0.0553 std m3/sec  
Wet 0.058 std m3/sec

Average Stack Gas Mass Flow Rate  
Dry 235 kg/hour  
Wet 246 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 523 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0478

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.4	5.2	77.6	#N/A



### Data and Calculations

Source Incinerator Test # 8 Date 2014/12/12

Start Time 8:28 End Time 9:33

Average Stack Gas Velocity. **2.441 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

208.96 std m3/hour

5.02 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{sw} K_g = Q_{sw} (M_s) / 24.465437 \quad 246.45 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.85 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7813766 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0478**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.019 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5132 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0068 \_V_{sg}(\text{std})$$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	523.2	Temperature Stack C
$\_T_s$	796.3	Absolute stack temperature K
$\_B_p$	661.5	Barometric Pressure mmHg
$\_P_{st}$	-0.1778	Static Pressure mmH2O
$\_P_s$	661.45	Absolute stack pressure mm Hg
$\_M_s$	28.85	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_T_{std}$	298.15	Standard absolute temperature K
$\_P_{std}$	760	Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.57774	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	19.00	Temperature meter Celsius
_Tm	292.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 9 Date 2014/12/12

Start Time 9:58 End Time 11:03

Summary

Average Stack Gas Velocity 2.58 m/s

Average Stack Gas Volumetric Flow Rate Dry 210 std m3/hour  
Wet 220 std m3/hour  
Dry 0.0583 std m3/sec  
Wet 0.0611 std m3/sec

Average Stack Gas Mass Flow Rate Dry 248 kg/hour  
Wet 260 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 527 Celsius

Dry Molecular Weight 29.5 kg/kg-mol  
Wet Molecular Weight 29 kg/kg-mol

Molar Fraction Water Vapor 0.0457

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	6.0	81.0	#N/A
Wet	12.4	5.7	77.3	#N/A

### Data and Calculations

Source Incinerator Test # 9 Date 2014/12/12

Start Time 9:58 End Time 11:03

Average Stack Gas Velocity. **2.581 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.06 std m3/sec**

220.01 std m3/hour

5.28 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437$$

260.39 kg/hour

Dry Molecular Wt. **29.48 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.96 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.5679914 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0457**

$$V_w(\text{std}) = K (W_f - W_i)$$

Volume Water vapor at s.t.p. M<sup>3</sup>

0.0217  $\_V_w(\text{std})$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m)$$

Volume meter gas at s.t.p. M<sup>3</sup>

0.5098  $\_V_m(\text{std})$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i)$$

Water Water in silica s.t.p. M<sup>3</sup>

0.0027  $\_V_{sg}(\text{std})$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	526.5	Temperature Stack C
$\_Ts$	799.7	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.96	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K

$\_Pstd$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.57589	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	6	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Spartan  
Calgary  
Incinerator

Project #14C914464  
2014/12/12  
Test# 10

---

Source Incinerator Test # 10 Date 2014/12/12  
Start Time 11:33 End Time 12:37

Summary

Average Stack Gas Velocity 2.34 m/s

Average Stack Gas Volumetric Flow Rate Dry 187 std m3/hour  
Wet 197 std m3/hour  
Dry 0.052 std m3/sec  
Wet 0.0546 std m3/sec

Average Stack Gas Mass Flow Rate Dry 221 kg/hour  
Wet 232 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 539 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0475

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	13.0	5.5	81.5	#N/A
Wet	12.4	5.2	77.6	#N/A

## Data and Calculations

Source Incinerator Test # 10 Date 2014/12/12

Start Time 11:33 End Time 12:37

Average Stack Gas Velocity. **2.342 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

196.51 std m3/hour

4.72 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 231.80 \text{ kg/hour}$$

Dry Molecular Wt. **29.4 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.86 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.7487394 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor. **0.0475**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.0203 \_V_w(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.5168 \_V_m(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0054 \_V_{sg}(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_Dts$	539.3	Temperature Stack C
$\_Ts$	812.4	Absolute stack temperature K
$\_Bp$	661.5	Barometric Pressure mmHg
$\_Pst$	-0.1524	Static Pressure mmH2O
$\_Ps$	661.46	Absolute stack pressure mm Hg
$\_Ms$	28.86	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

$\_Tstd$  298.15 Standard absolute temperature K

$\_Pstd$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	15.0	Final Weight of water in grams
_V	0.58381	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5.5	Molar Percent Carbon Dioxide
_O2	13	Molar Percent Oxygen
_N2	81.5	Molar Percent Nitrogen
_CO	#N/A	ppm



---

Source Incinerator Test # 11 Date 2014/12/12

Start Time 13:00 End Time 14:06

Summary

Average Stack Gas Velocity 2.15 m/s

Average Stack Gas Volumetric Flow Rate Dry 188 std m3/hour  
Wet 196 std m3/hour  
Dry 0.0522 std m3/sec  
Wet 0.0545 std m3/sec

Average Stack Gas Mass Flow Rate Dry 221 kg/hour  
Wet 231 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 474 Celsius

Dry Molecular Weight 29.3 kg/kg-mol  
Wet Molecular Weight 28.8 kg/kg-mol

Molar Fraction Water Vapor 0.0432

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	4.5	81.0	#N/A
Wet	13.9	4.3	77.5	#N/A

### Data and Calculations

Source Incinerator Test # 11 Date 2014/12/12

Start Time 13:00 End Time 14:06

Average Stack Gas Velocity. **2.153 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

196.37 std m3/hour

4.71 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437 \quad 231.25 \text{ kg/hour}$$

Dry Molecular Wt. **29.3 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.81 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O \quad 4.3239159 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0432**

$$V_w(\text{std}) = K (W_f - W_i) \quad \text{Volume Water vapor at s.t.p. } M^3 \quad 0.019 \_Vw(\text{std})$$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m) \quad \text{Volume meter gas at s.t.p. } M^3 \quad 0.51 \_Vm(\text{std})$$

$$V_{sg}(\text{std}) = K_2(sg) (W_f - W_i) \quad \text{Water Water in silica s.t.p. } M^3 \quad 0.0041 \_Vsg(\text{std})$$

$$\%H_2O = V_w(\text{std}) + V_{sg}(\text{std}) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

_Kp	34.9219	Pitot tube constant
_Cp	0.803	Pitot tube coefficient
_NP	12	Number of traverse points
_Dts	474.3	Temperature Stack C
_Ts	747.5	Absolute stack temperature K
_Bp	661.5	Barometric Pressure mmHg
_Pst	-0.1524	Static Pressure mmH2O
_Ps	661.46	Absolute stack pressure mm Hg
_Ms	28.81	Molecular weight of stack gas, wet basis g/g-mole
_A	0.0730	Area Square Meters
		0.3048 Diameter Meters

\_Tstd 298.15 Standard absolute temperature K

\_Pstd 760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	14.0	Final Weight of water in grams
_V	0.57618	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	4.5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	81.0	Molar Percent Nitrogen
_CO	#N/A	ppm

Source Incinerator Test # 12 Date 2014/12/12

Start Time 14:33 End Time 15:37

Summary

Average Stack Gas Velocity 2.12 m/s

Average Stack Gas Volumetric Flow Rate Dry 183 std m3/hour  
Wet 192 std m3/hour  
Dry 0.051 std m3/sec  
Wet 0.0534 std m3/sec

Average Stack Gas Mass Flow Rate Dry 216 kg/hour  
Wet 227 kg/hour

Stack Cross Sectional Area 0.073 m2

Average Stack Gas Temperature 480 Celsius

Dry Molecular Weight 29.4 kg/kg-mol  
Wet Molecular Weight 28.9 kg/kg-mol

Molar Fraction Water Vapor 0.0453

Fixed Gas	%O2	%CO2	%N2	CO ppm
Dry	14.5	5.0	80.5	#N/A
Wet	13.8	4.8	76.9	#N/A

### Data and Calculations

Source Incinerator Test # 12 Date 2014/12/12

Start Time 14:33 End Time 15:37

Average Stack Gas Velocity. **2.122 m/s**

$$V_s = K_p C_p (\text{Avg. dp})^{.5} (T_s / P_s M_s)^{.5}$$

Average Stack Gas Wet Volumetric Flow Rate.

**0.05 std m3/sec**

192.15 std m3/hour

4.61 E3M3/day

$$Q_{sw} = 3600 V_s A (T_{std} P_s / T_s P_{std})$$

$$Q_{swKg} = Q_{sw}(M_s) / 24.465437$$

226.71 kg/hour

Dry Molecular Wt. **29.38 kg/kg-mol**

$$M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$$

Wet Molecular Wt. **28.86 kg/kg-mol**

$$M_s = M_d (1 - \%H_2O/100) + 18.0 * \%H_2O/100$$

$$\_H_2O = 4.5270035 \text{ Molar Percent Water}$$

Molar Fraction Water Vapor.

**0.0453**

$$V_w(\text{std}) = K (W_f - W_i)$$

Volume Water vapor at s.t.p. M<sup>3</sup>

0.0217  $\_V_w(\text{std})$

$$V_m(\text{std}) = V_m Y P_m T_{std} / (P_{std} T_m)$$

Volume meter gas at s.t.p. M<sup>3</sup>

0.5146  $\_V_m(\text{std})$

$$V_{sg}(\text{std}) = K_2(\text{sg}) (W_f - W_i)$$

Water Water in silica s.t.p. M<sup>3</sup>

0.0027  $\_V_{sg}(\text{std})$

$$\%H_2O = (V_w(\text{std}) + V_{sg}(\text{std})) / (V_w(\text{std}) + V_m(\text{std}) + V_{sg}(\text{std}))$$

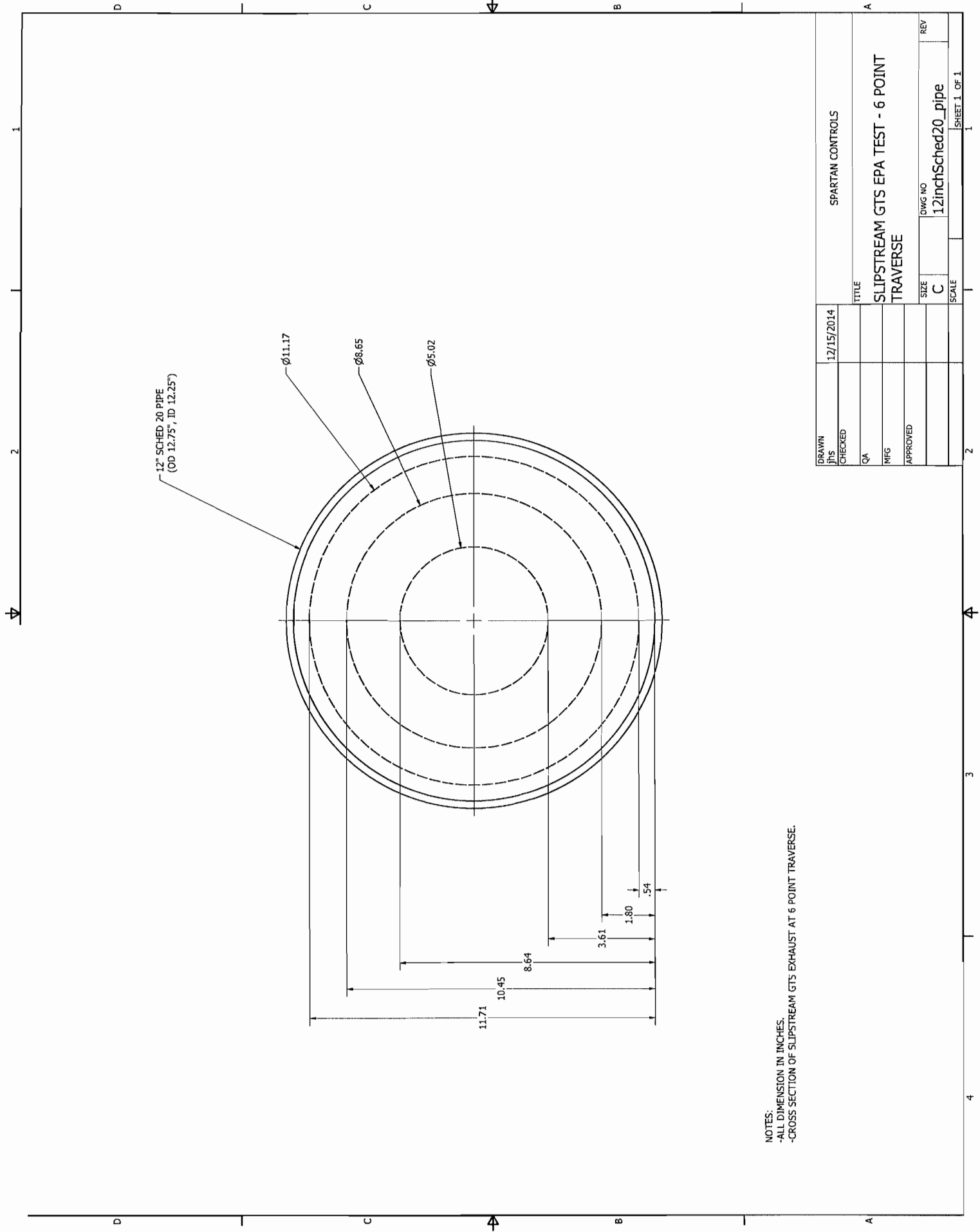
$\_K_p$	34.9219	Pitot tube constant
$\_C_p$	0.803	Pitot tube coefficient
$\_NP$	12	Number of traverse points
$\_D_{ts}$	479.5	Temperature Stack C
$\_T_s$	752.7	Absolute stack temperature K
$\_B_p$	661.5	Barometric Pressure mmHg
$\_P_{st}$	-0.1524	Static Pressure mmH2O
$\_P_s$	661.46	Absolute stack pressure mm Hg
$\_M_s$	28.86	Molecular weight of stack gas, wet basis g/g-mole
$\_A$	0.0730	Area Square Meters
		0.3048 Diameter Meters

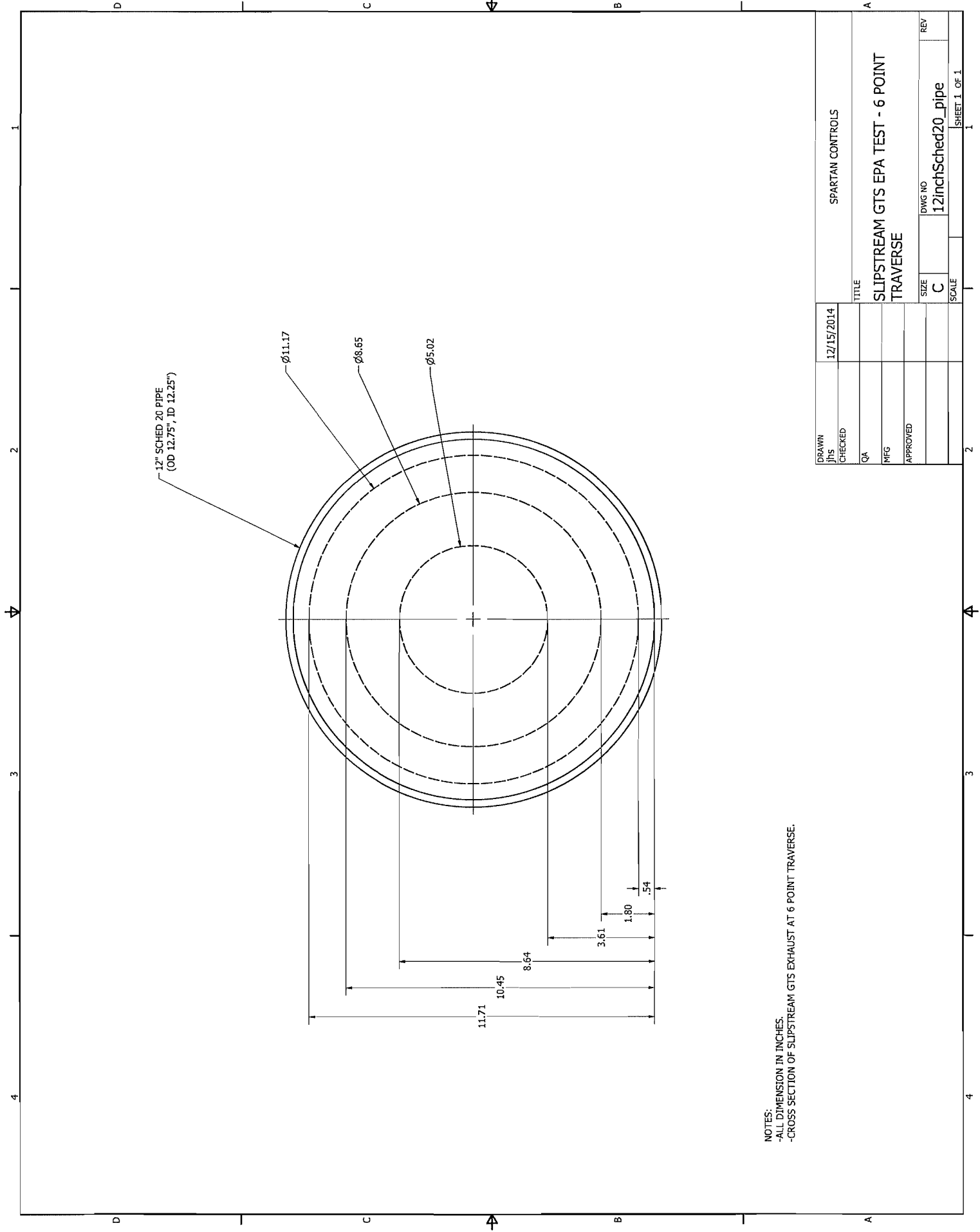
$\_T_{std}$  298.15 Standard absolute temperature K

$\_P_{std}$  760 Standard absolute pressure

---

_K	0.0013552	Constant = Density R Tstd / (P(std) Mw)
_K2(sg)	0.0013592	Constant = R Tstd / (P(std) Mw)
_Wi	0.0	Initial Weight of Water in grams
_Wf	16.0	Final Weight of water in grams
_V	0.58135	Volume of gas metered cubic meters
_Y	1.021	Meter factor
_Tmc	20.00	Temperature meter Celsius
_Tm	293.2	Temperature Meter Kelvin
_Vac	330.20	Impinger Vacuum mmHg
_Vp	8.54	Vapor Pressure mmHg
_CO2	5	Molar Percent Carbon Dioxide
_O2	14.5	Molar Percent Oxygen
_N2	80.5	Molar Percent Nitrogen
_CO	#N/A	ppm





NOTES:  
-ALL DIMENSION IN INCHES  
-CROSS SECTION OF SLIPSTREAM GTS EXHAUST AT 6 POINT TRAVERSE.

DRAWN JHS	12/15/2014	SPARTAN CONTROLS	
CHECKED		TITLE	
QA		SLIPSTREAM GTS EPA TEST - 6 POINT TRAVERSE	
MFG		REV	
APPROVED		SIZE	DWG NO
		C	12InchSched20_pipe
		SCALE	SHEET 1 OF 1

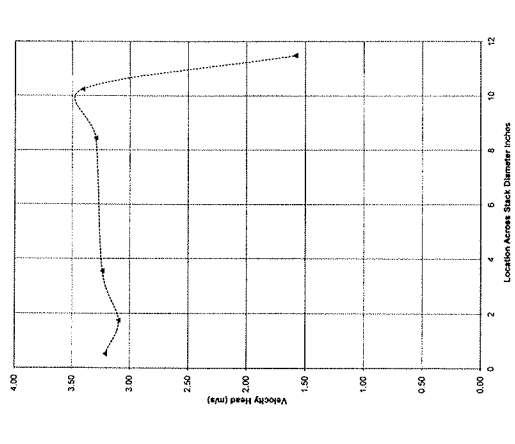


## **Appendix II**

### **Velocity Traverse Profiles**

Project: E1C214464  
2014/12/10  
Test # 1  
Spartan  
Calgary  
Incinerator

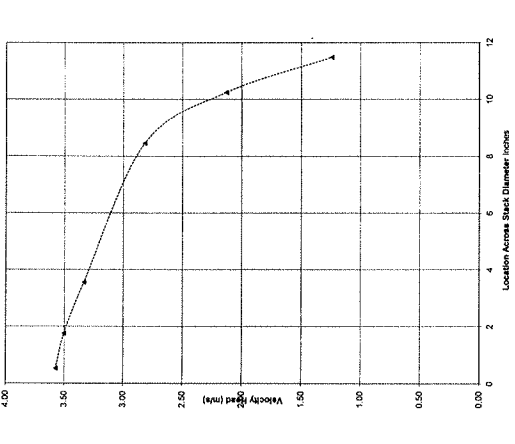
Velocity Profile East to West  
Incinerator Test #1 2014/12/10



AGAT Laboratories

Project: E1C214464  
2014/12/11  
Test # 2  
Spartan  
Calgary  
Incinerator

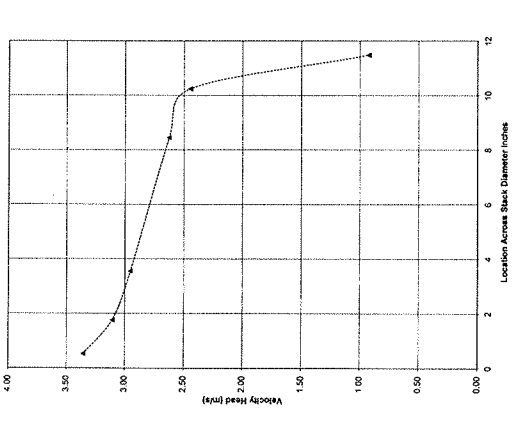
Velocity Profile East to West  
Incinerator Test #2 2014/12/11



AGAT Laboratories

Project: E1C214464  
2014/12/10  
Test # 1  
Spartan  
Calgary  
Incinerator

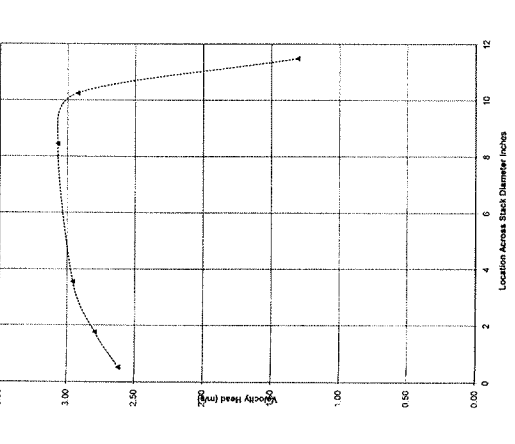
Velocity Profile North to South  
Incinerator Test #1 2014/12/10



AGAT Laboratories

Project: E1C214464  
2014/12/10  
Test # 1  
Spartan  
Calgary  
Incinerator

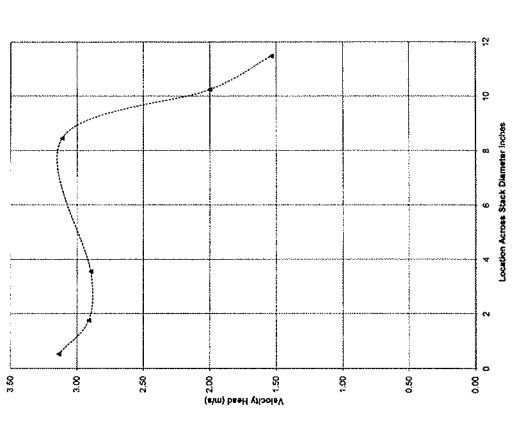
Velocity Profile East to West  
Incinerator Test #1 2014/12/10



AGAT Laboratories

Project: E1C214464  
2014/12/11  
Test # 4  
Spartan  
Calgary  
Incinerator

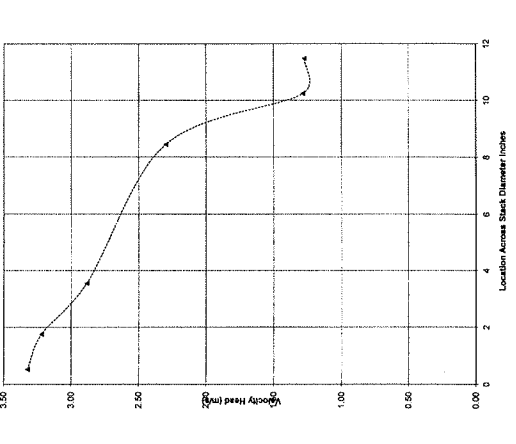
Velocity Profile North to South  
Incinerator Test #4 2014/12/11



AGAT Laboratories

Project: E1C214464  
2014/12/11  
Test # 4  
Spartan  
Calgary  
Incinerator

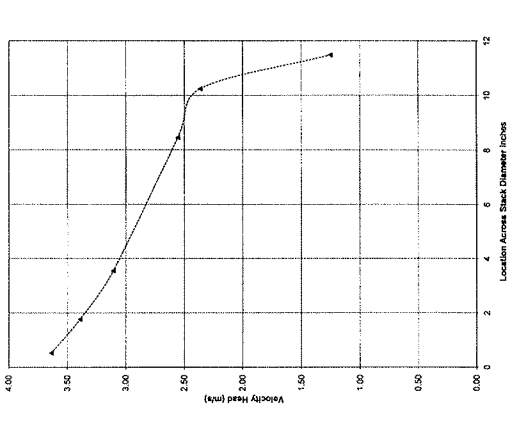
Velocity Profile East to West  
Incinerator Test #4 2014/12/11



AGAT Laboratories

Project: E1C214464  
2014/12/11  
Test # 3  
Spartan  
Calgary  
Incinerator

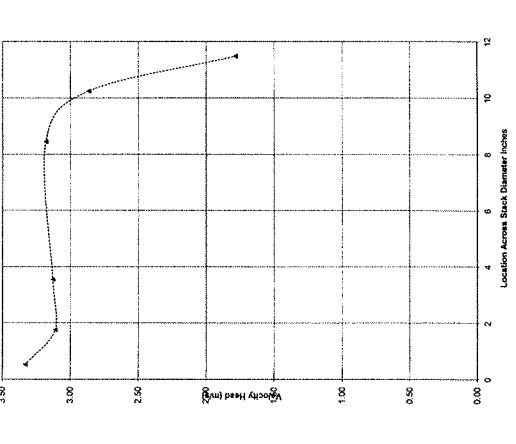
Velocity Profile North to South  
Incinerator Test #3 2014/12/11



AGAT Laboratories

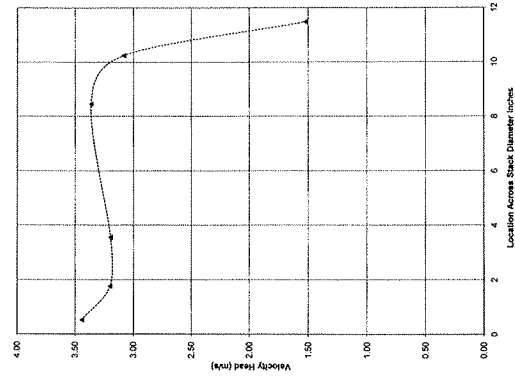
Project: E1C214464  
2014/12/11  
Test # 3  
Spartan  
Calgary  
Incinerator

Velocity Profile East to West  
Incinerator Test #3 2014/12/11

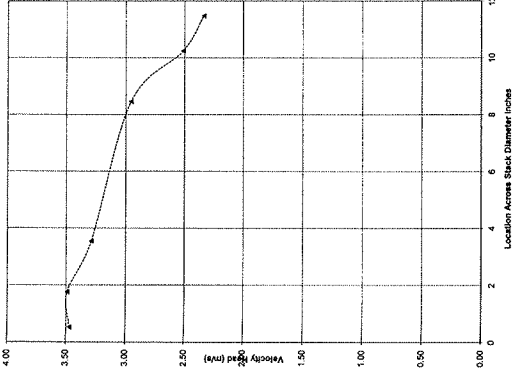


AGAT Laboratories

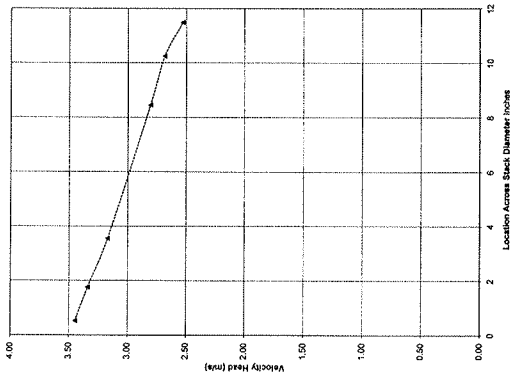
Velocity Profile North to South  
Incinerator Test # 6 2014/12/11



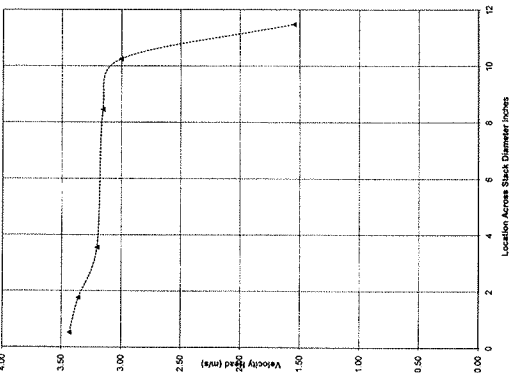
Velocity Profile East to West  
Incinerator Test # 6 2014/12/11



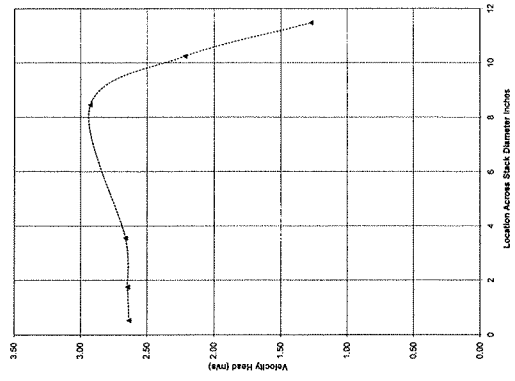
Velocity Profile North to South  
Incinerator Test # 5 2014/12/11



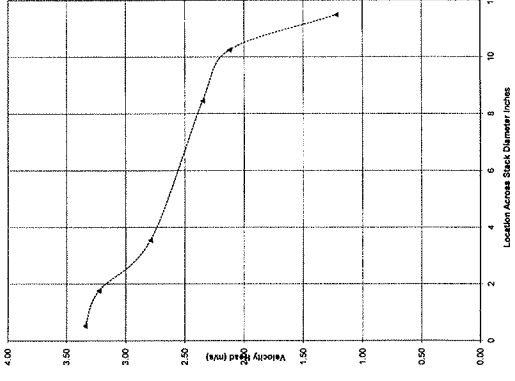
Velocity Profile East to West  
Incinerator Test # 5 2014/12/11



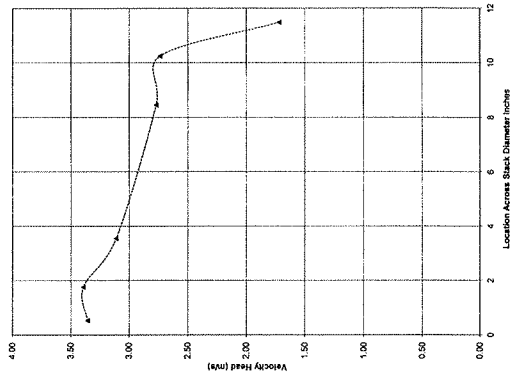
Velocity Profile North to South  
Incinerator Test # 8 2014/12/12



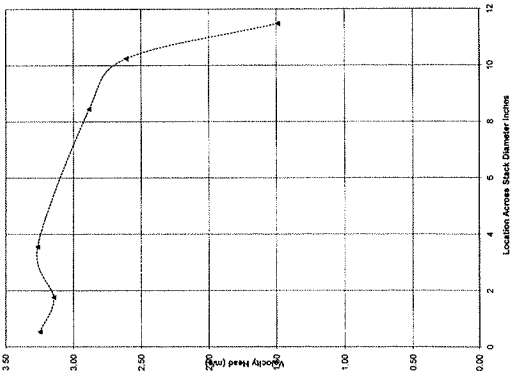
Velocity Profile East to West  
Incinerator Test # 8 2014/12/12



Velocity Profile North to South  
Incinerator Test # 7 2014/12/11



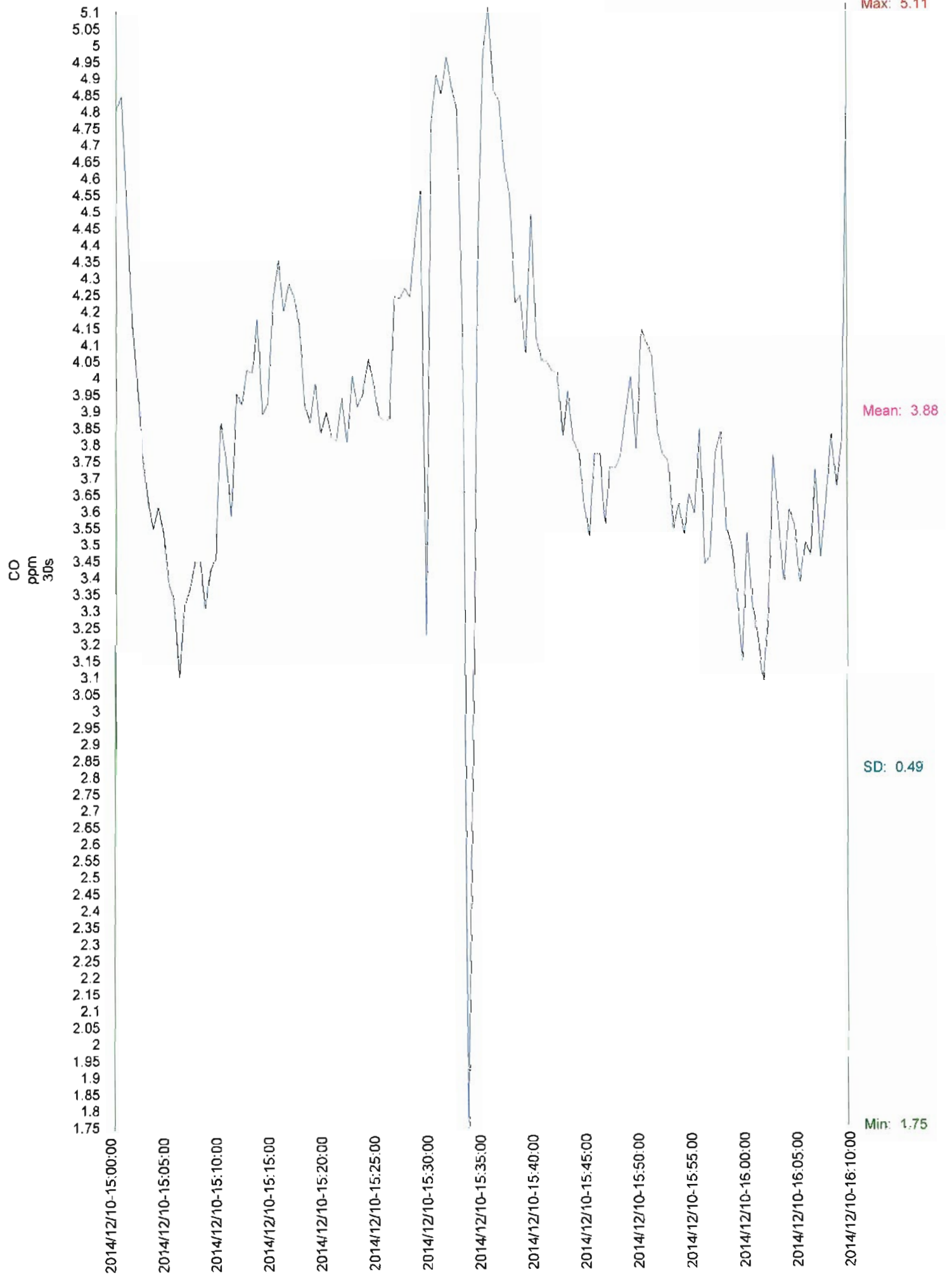
Velocity Profile East to West  
Incinerator Test # 7 2014/12/11

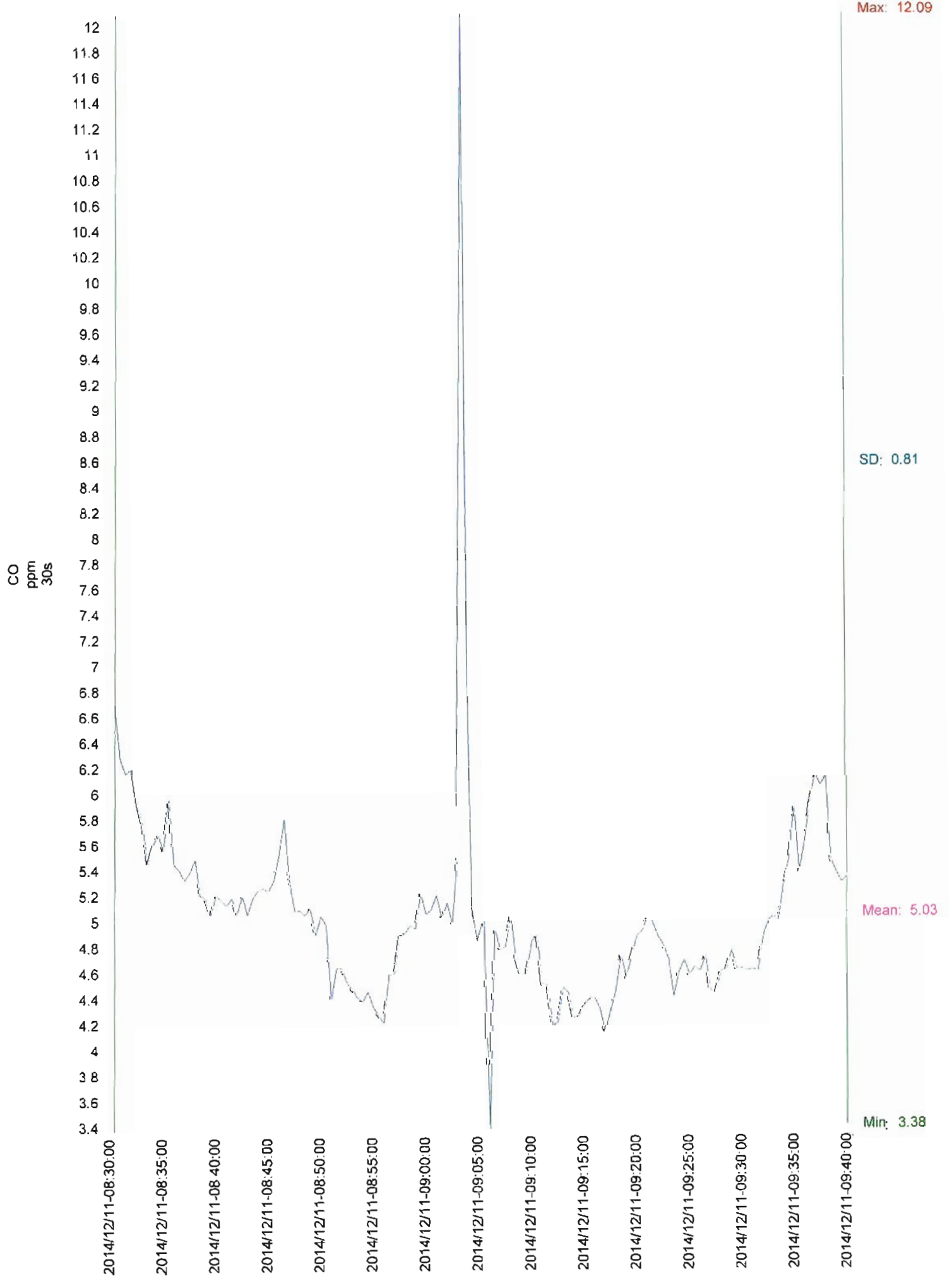


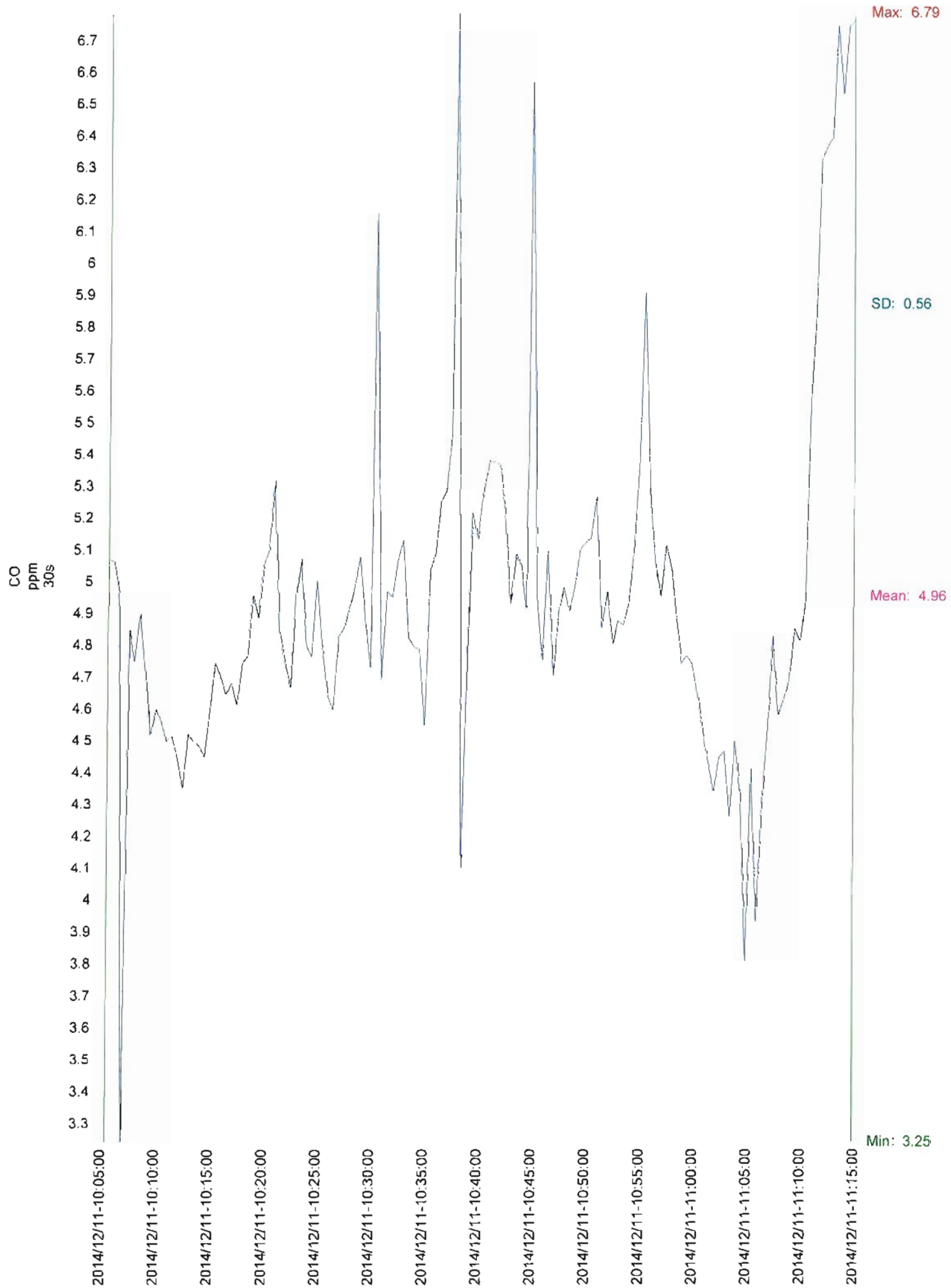


## **Appendix III**

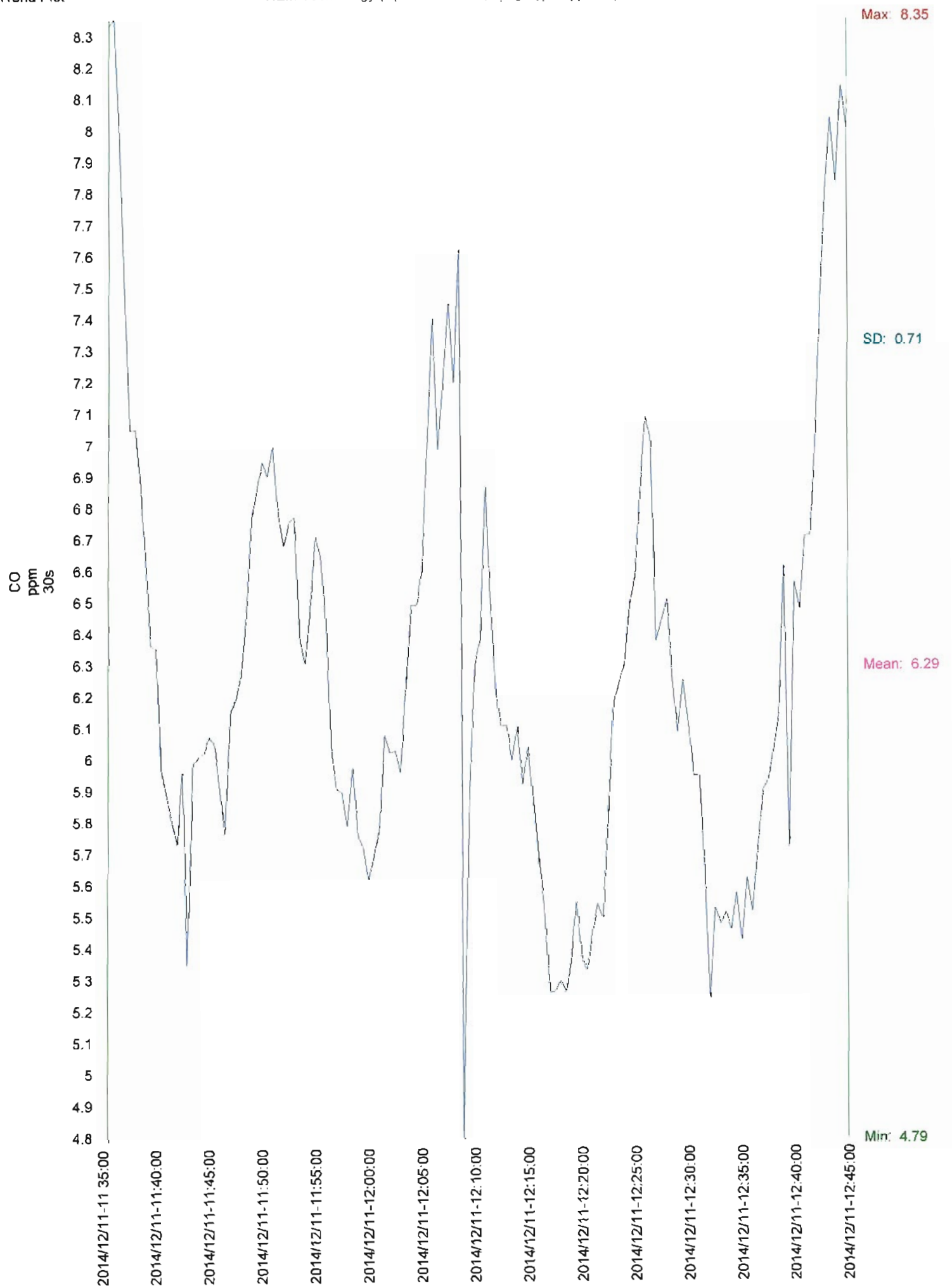
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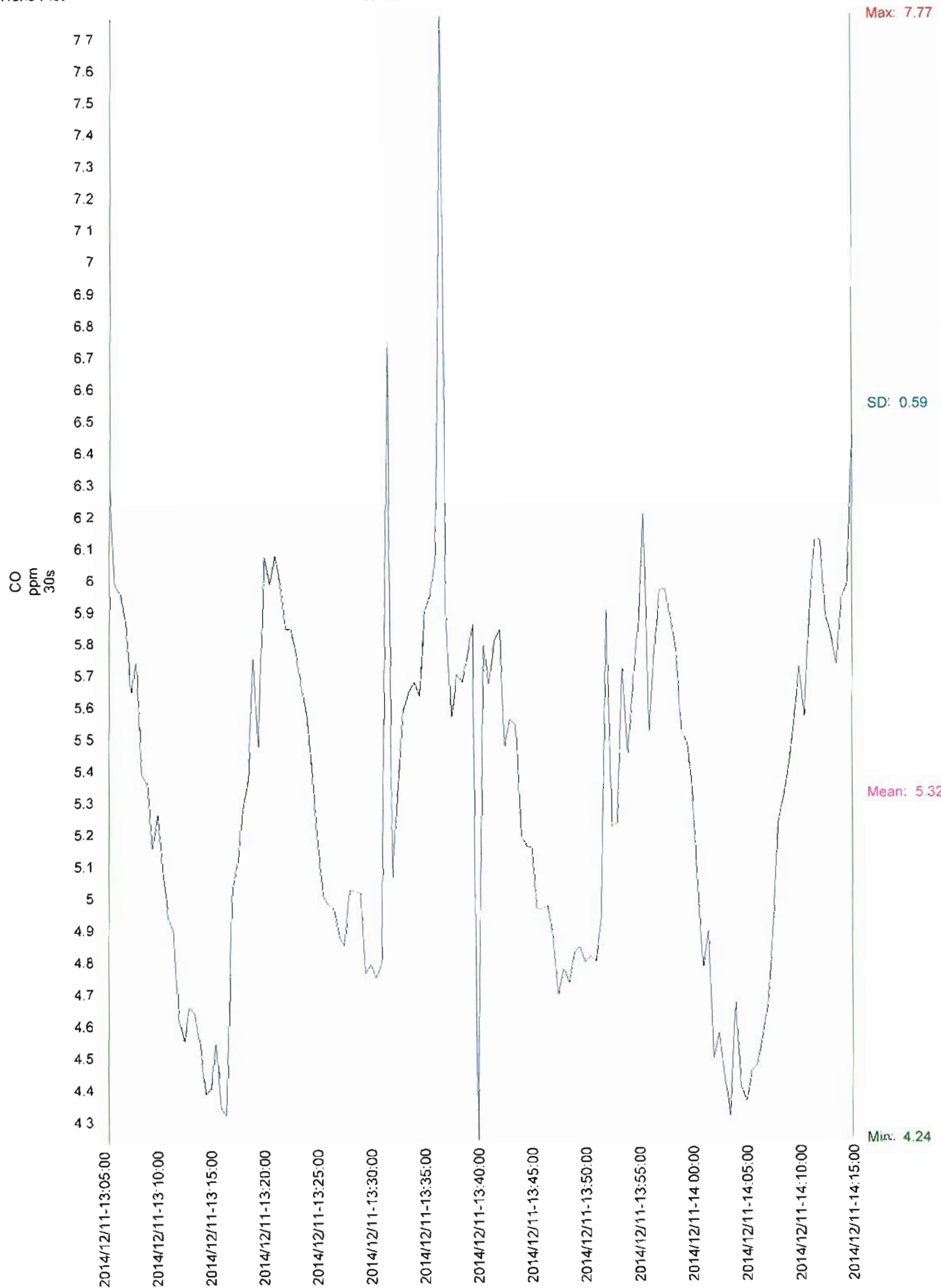


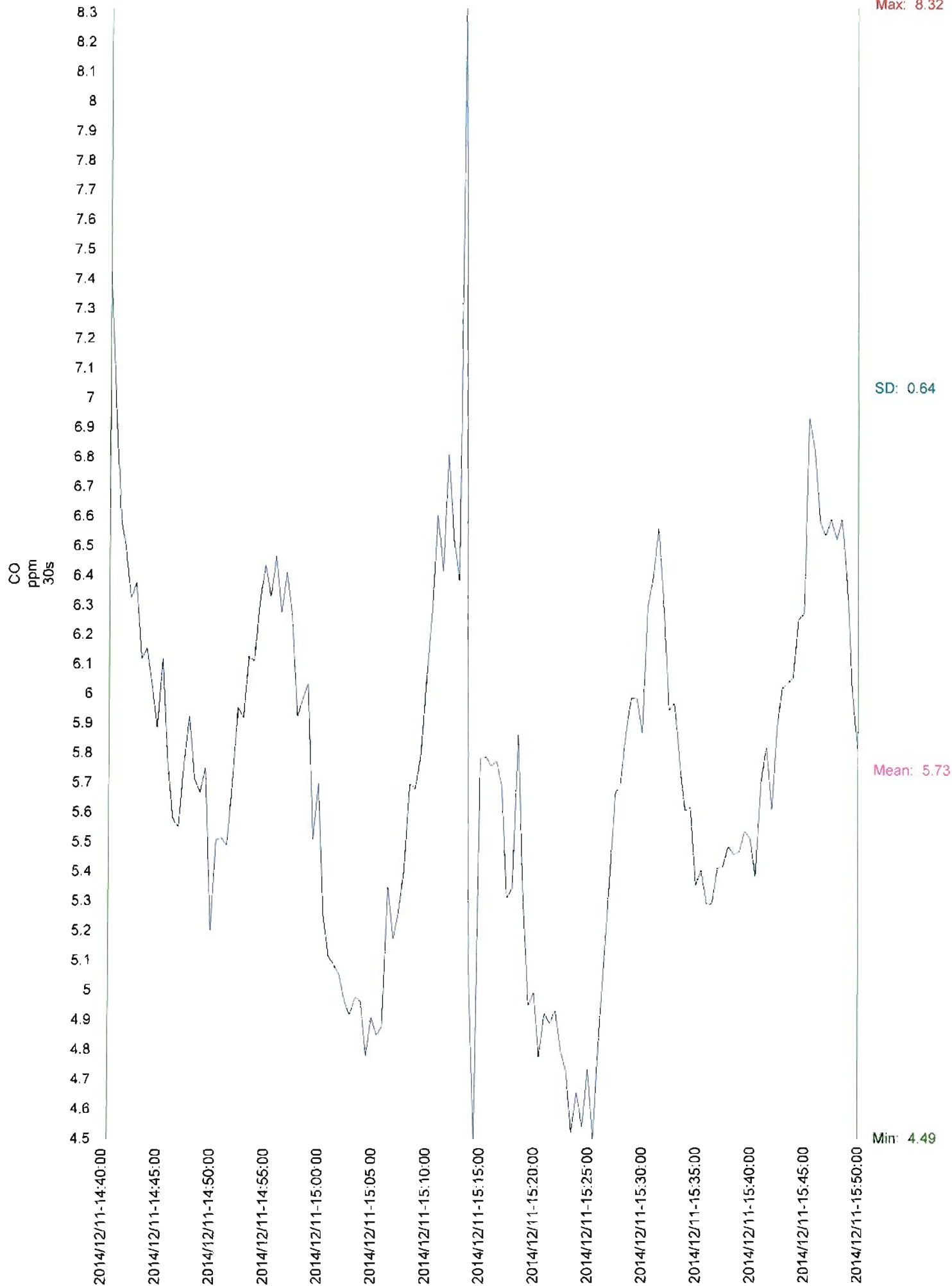


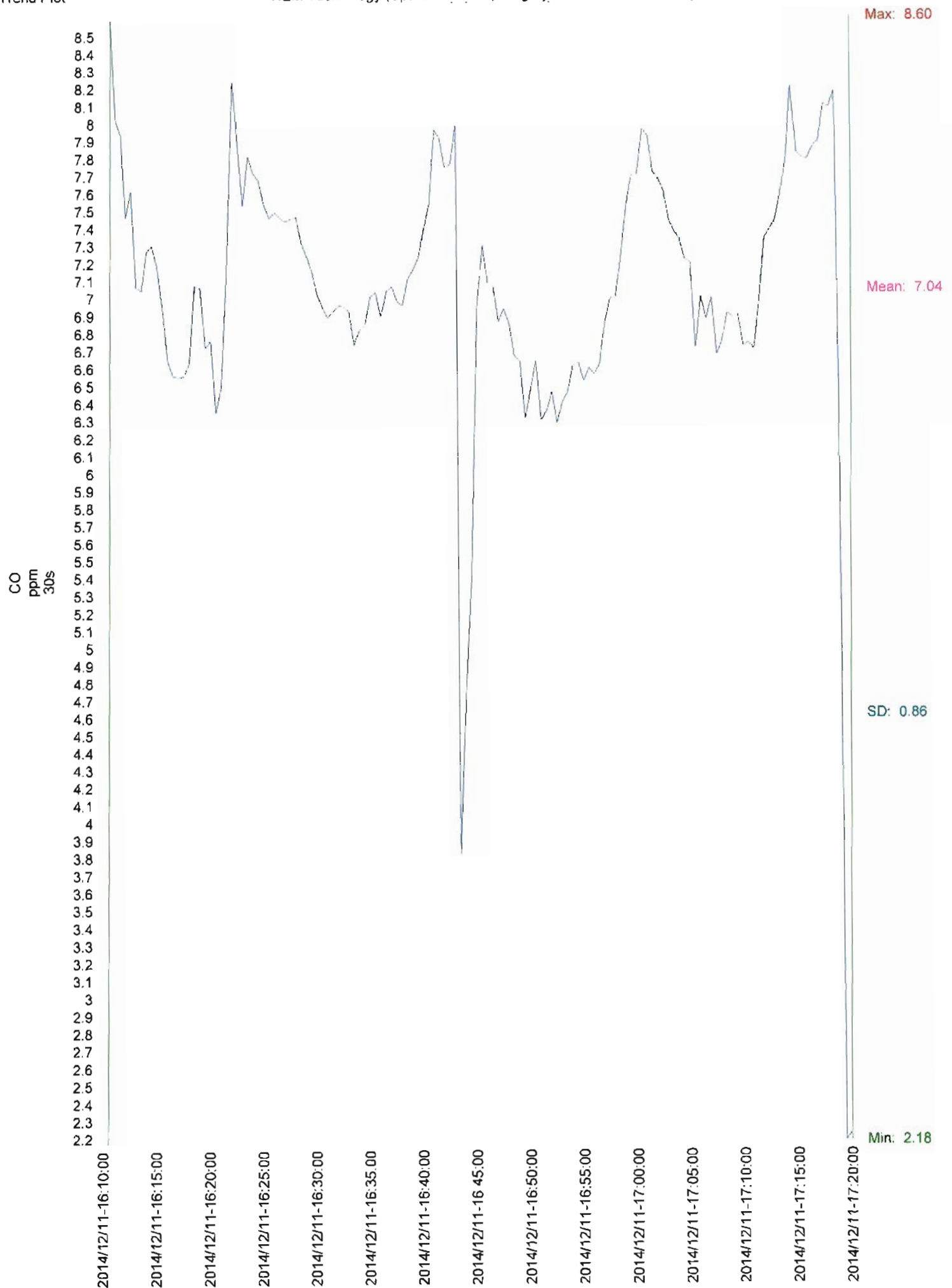


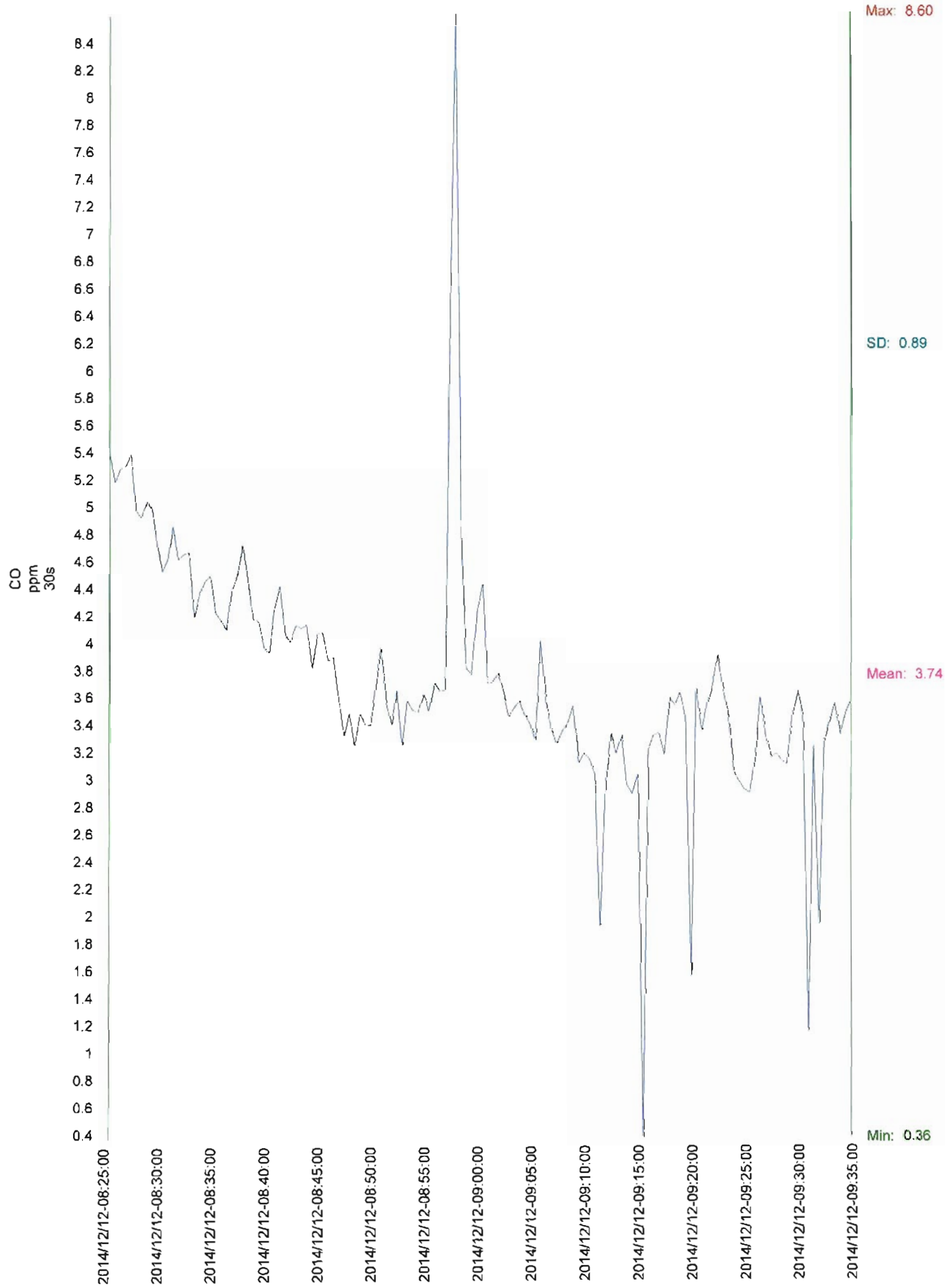


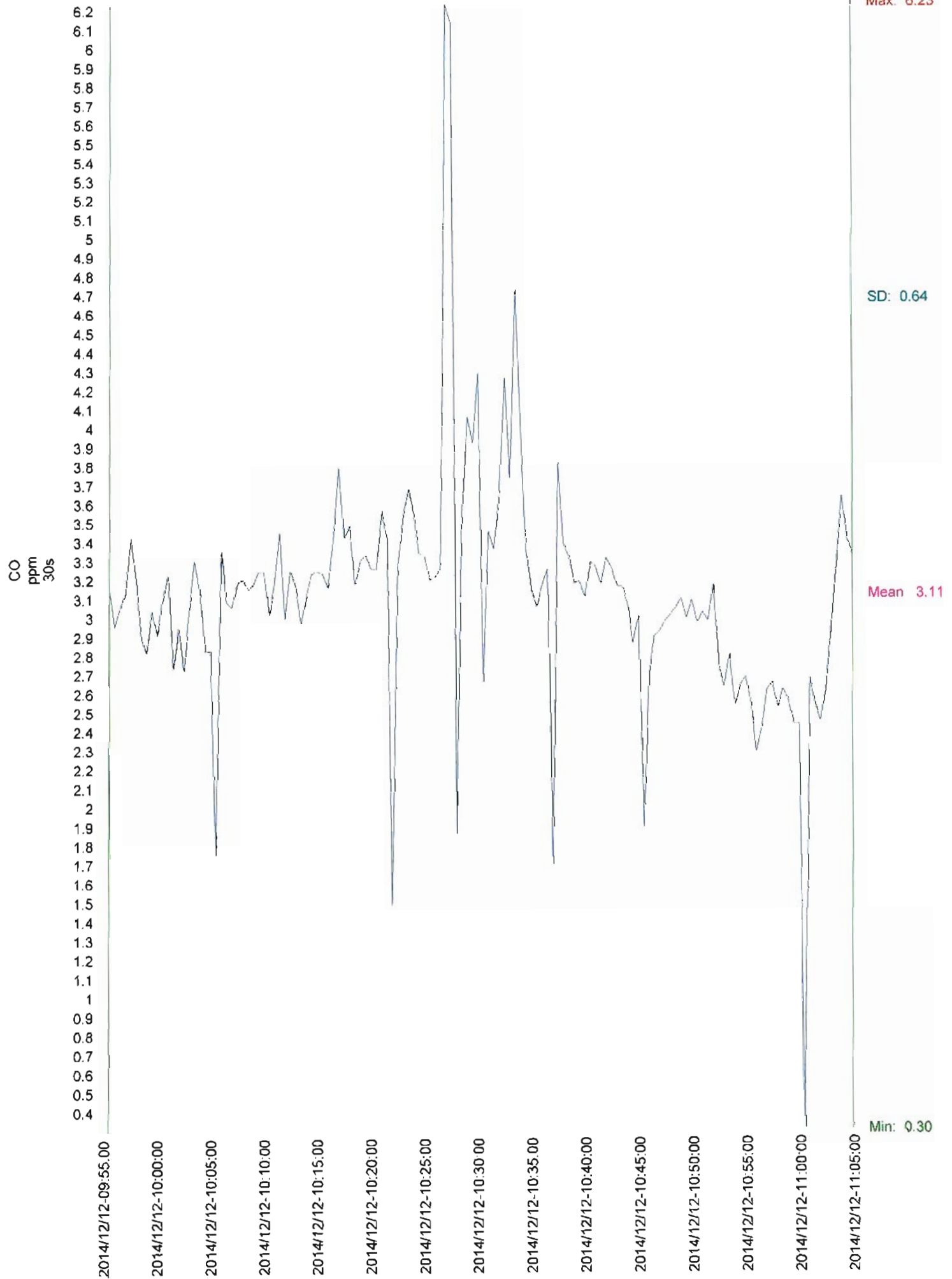


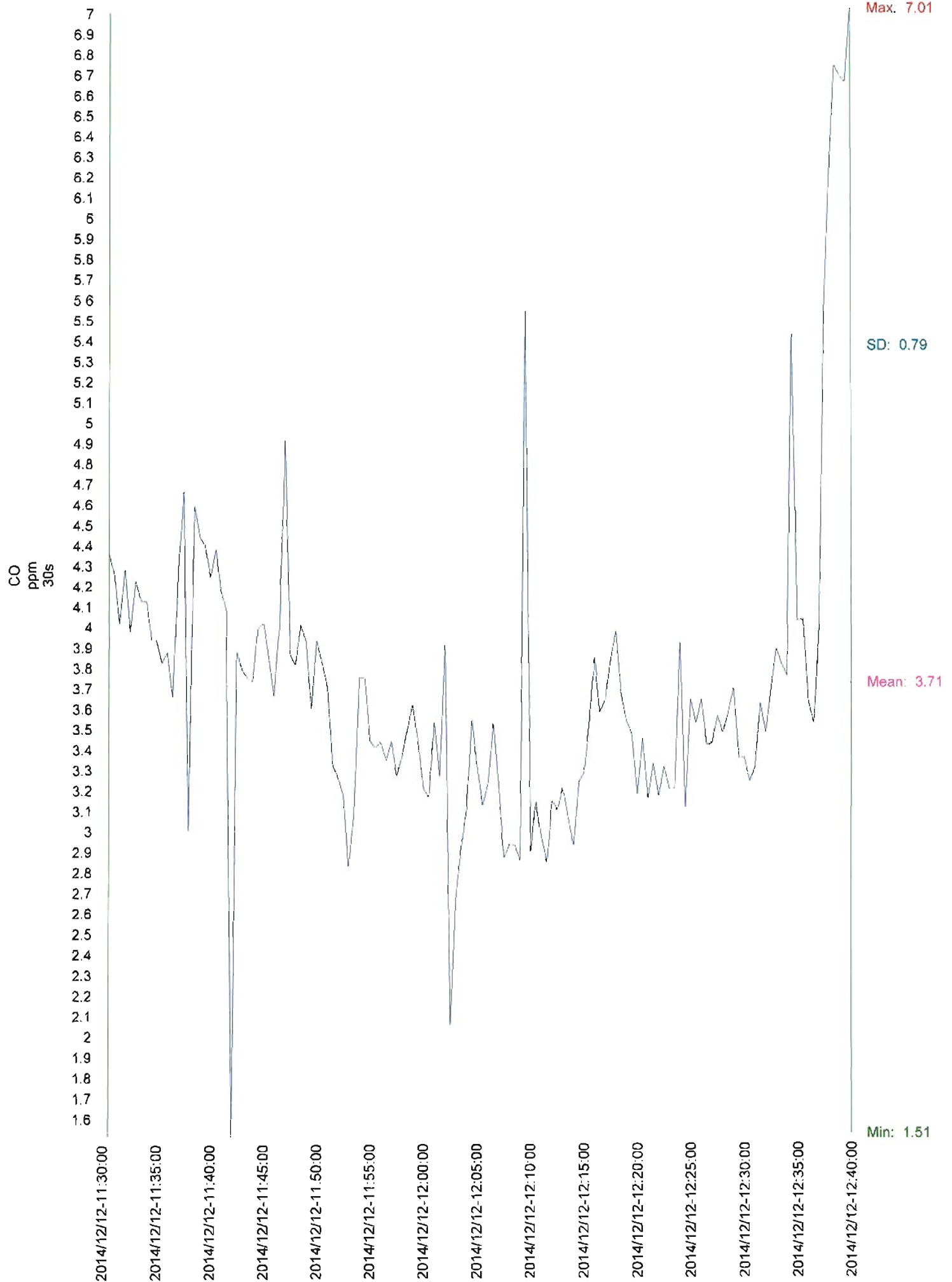


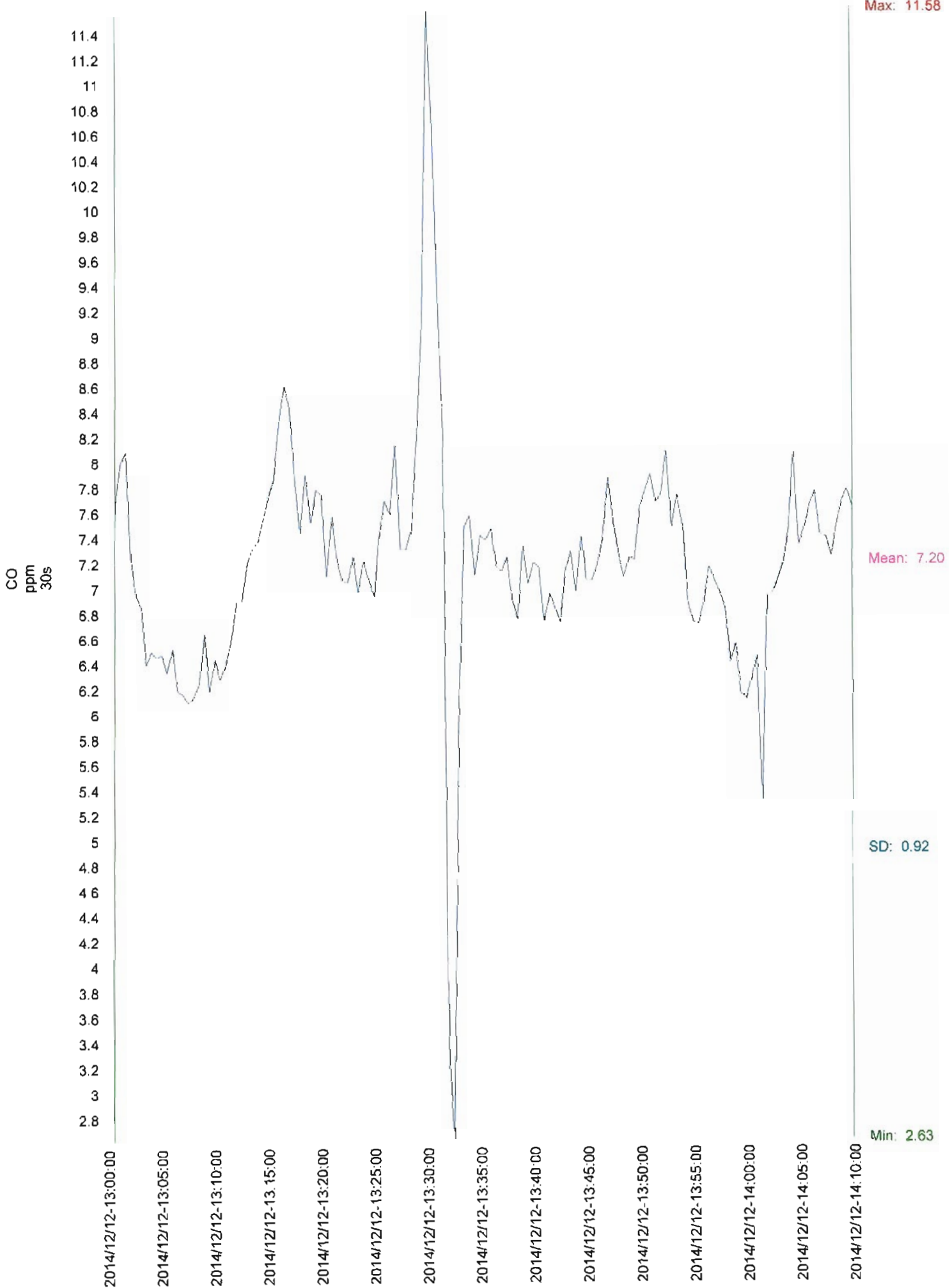




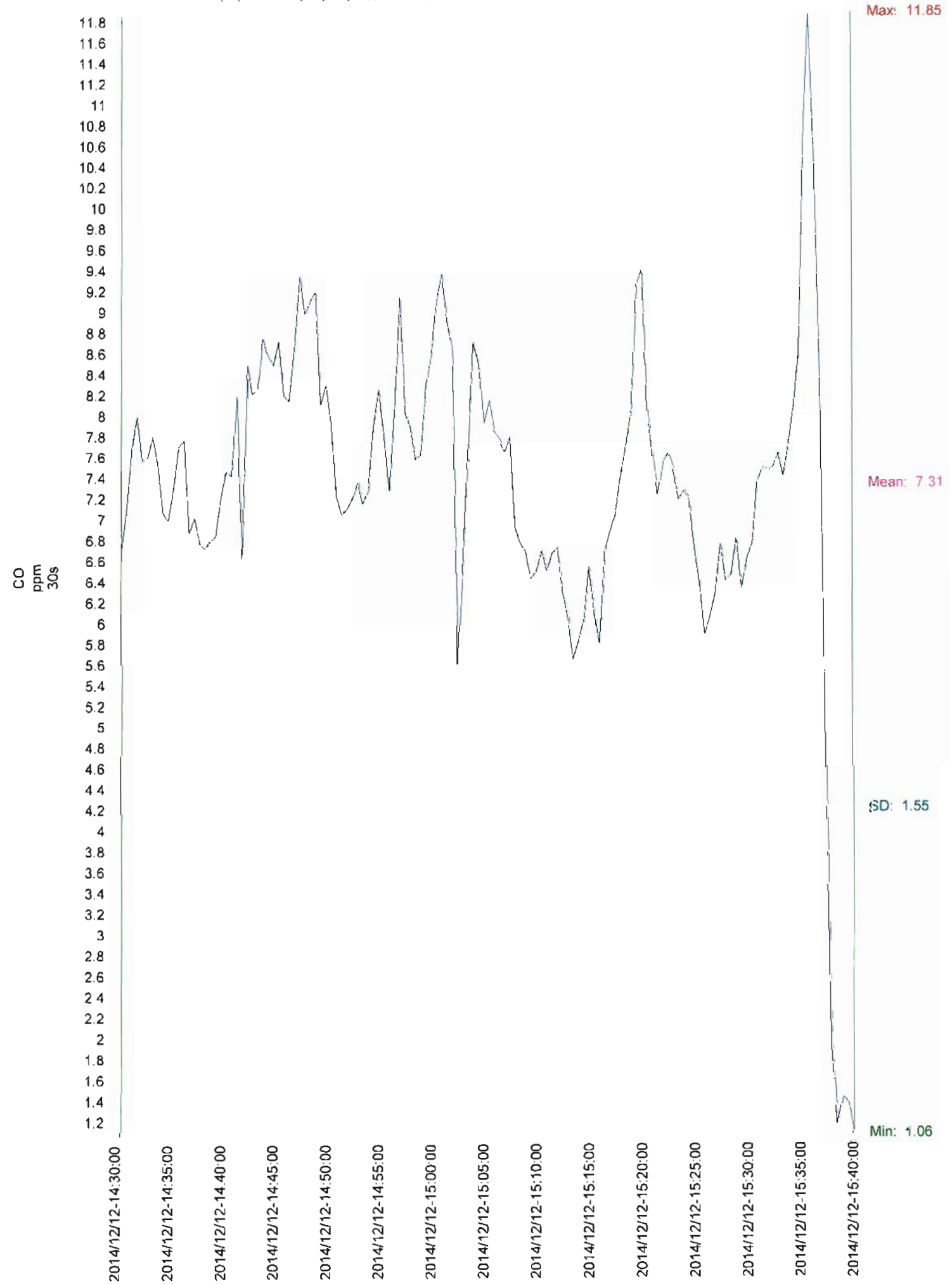


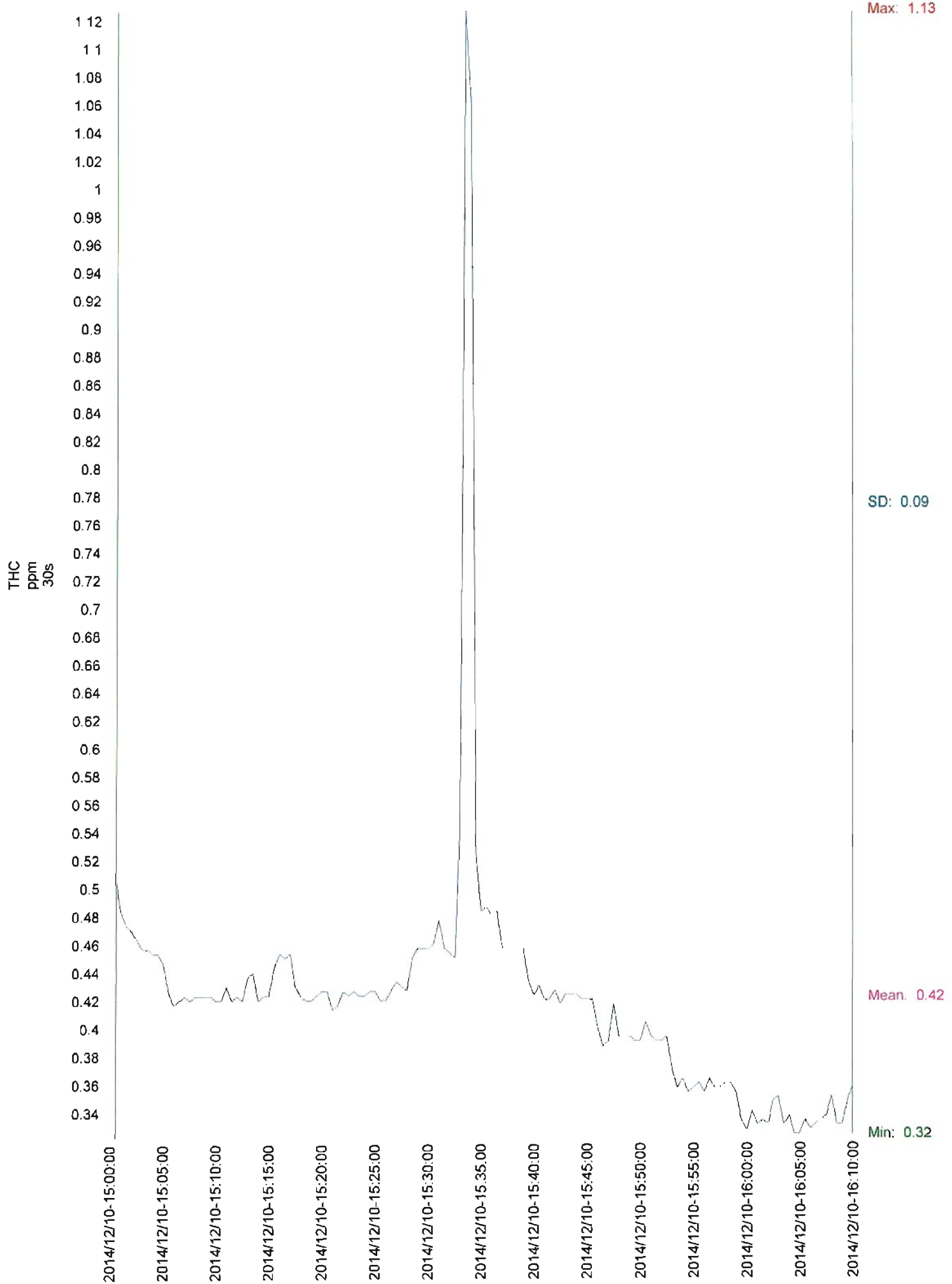












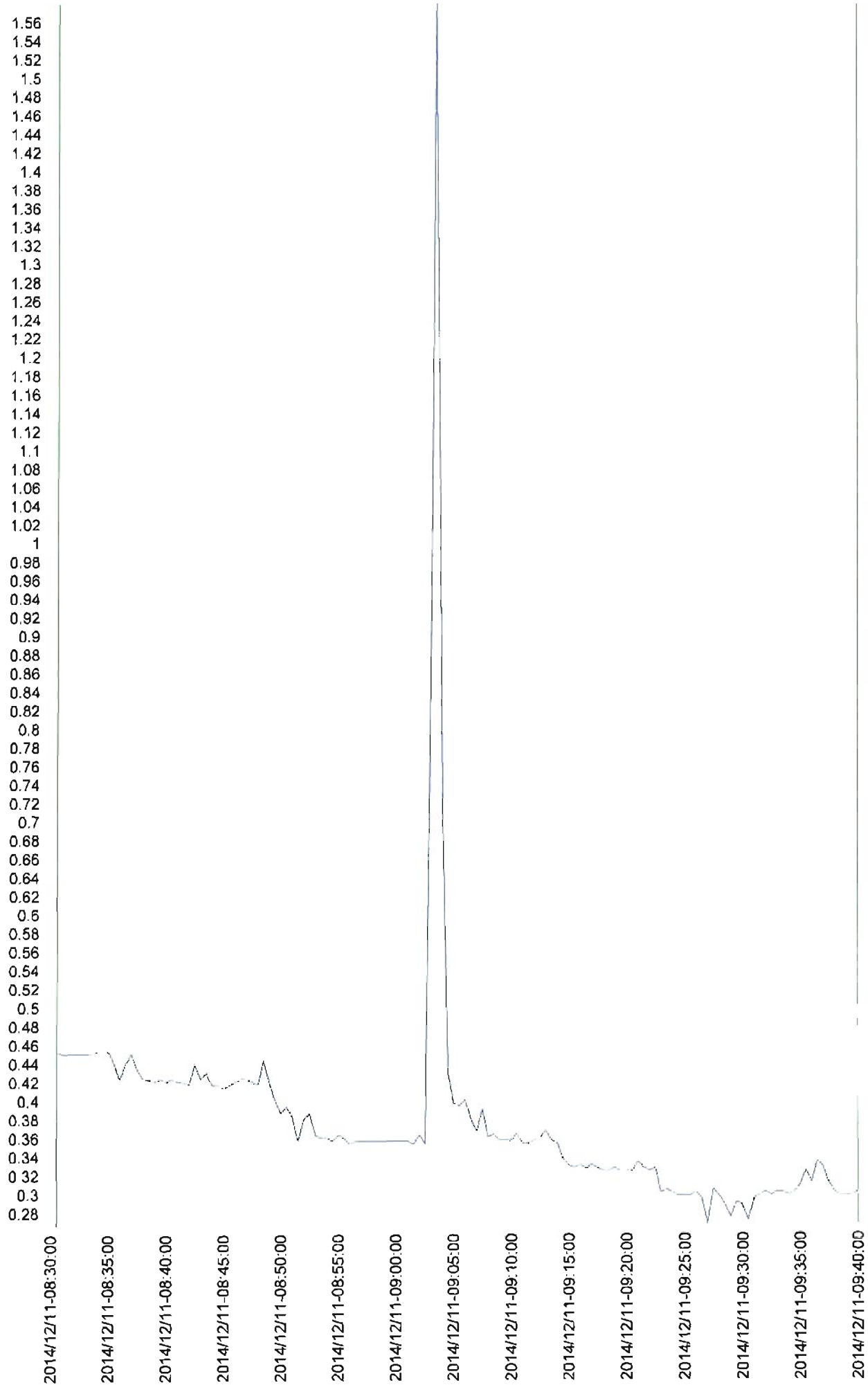
THC  
ppm  
30s

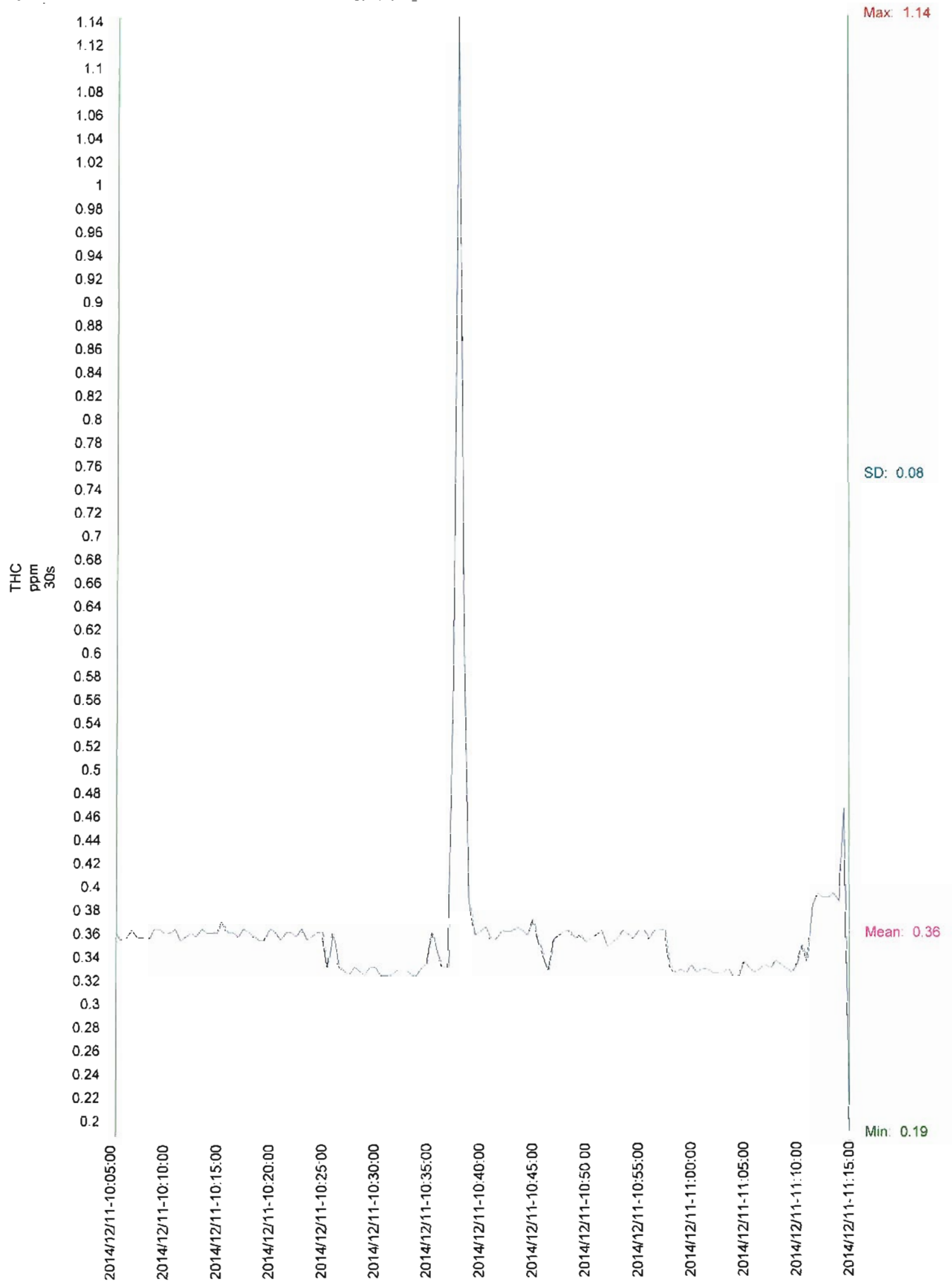
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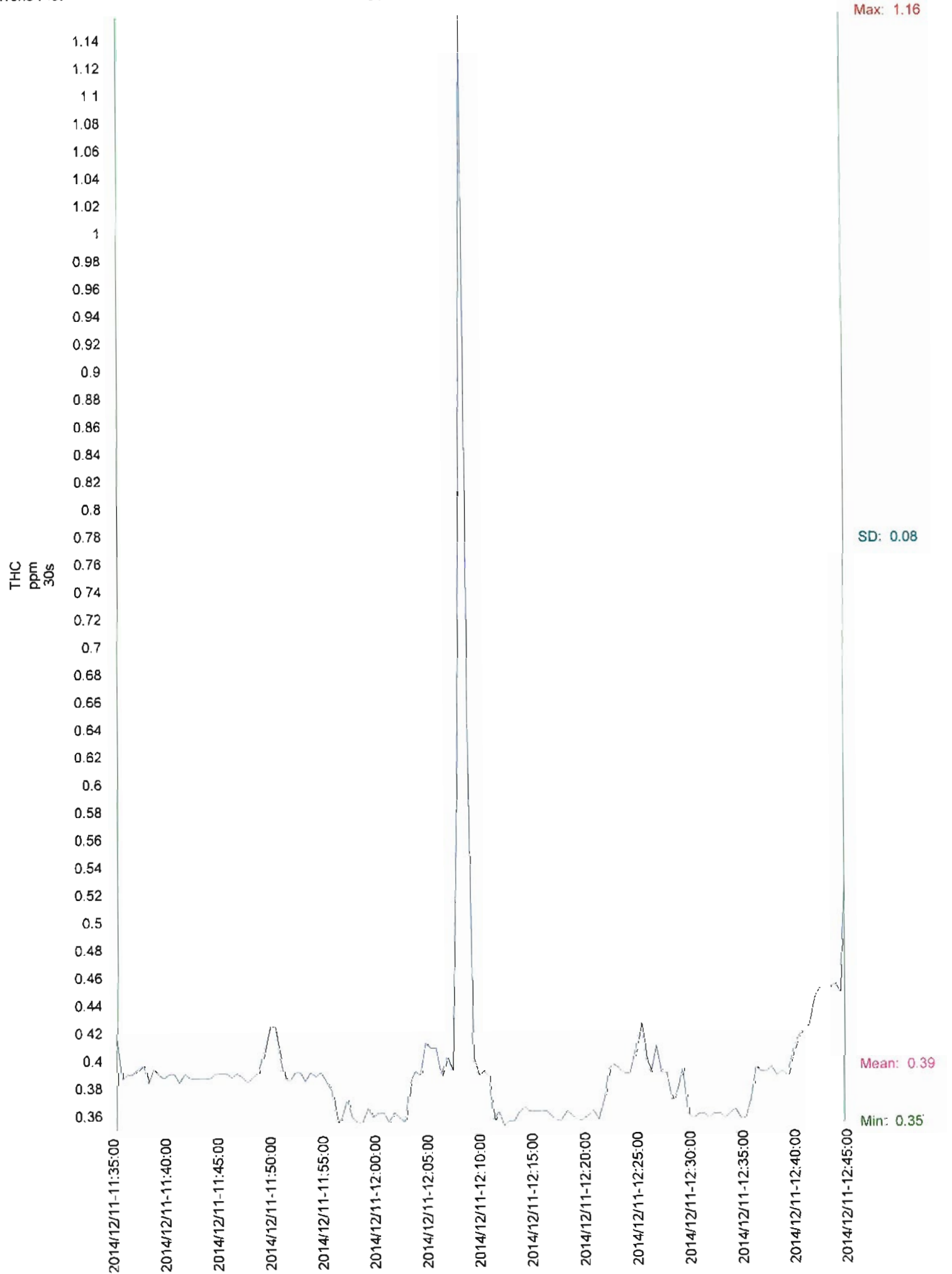
SD: 0.13

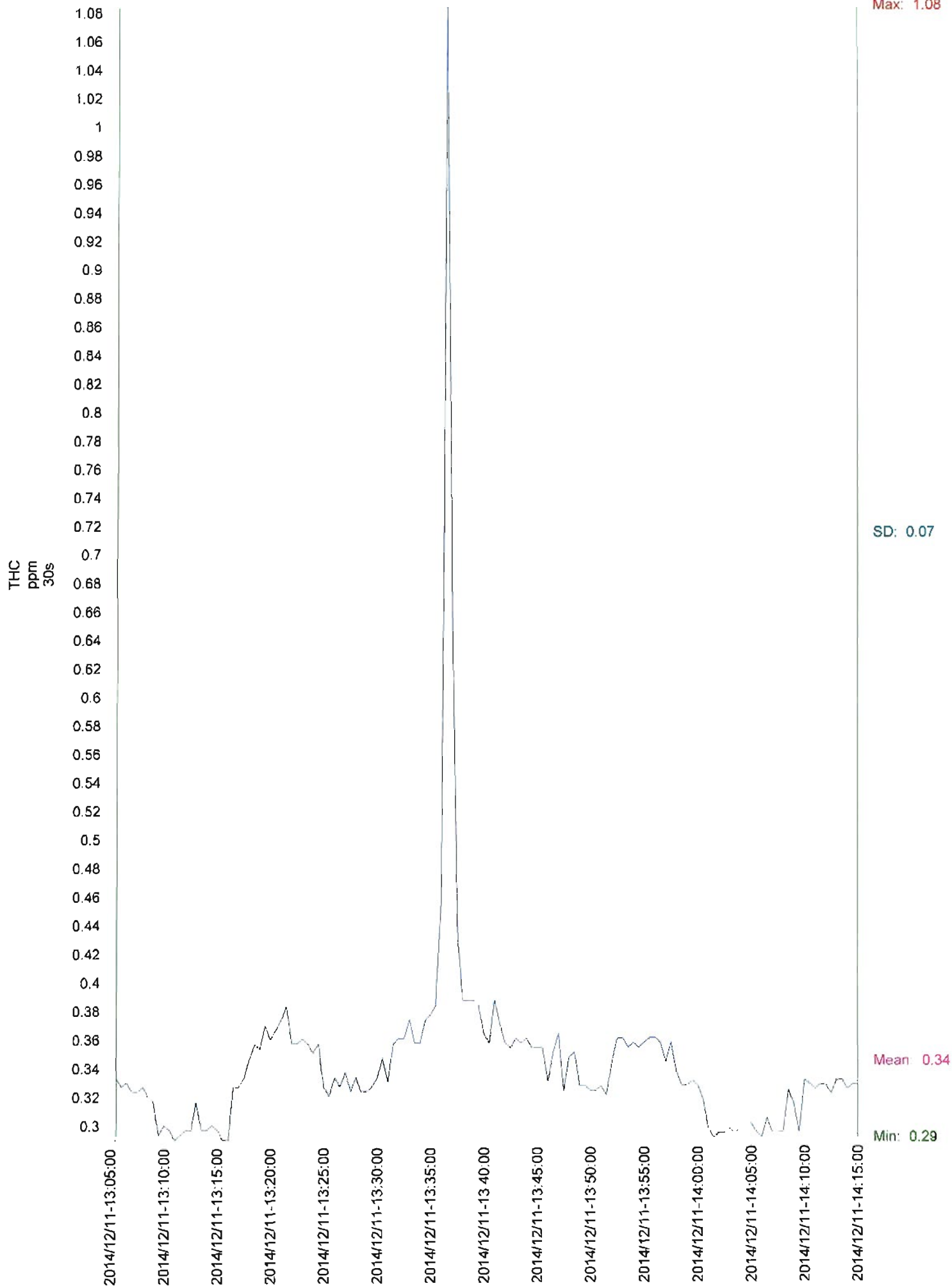
Mean: 0.38

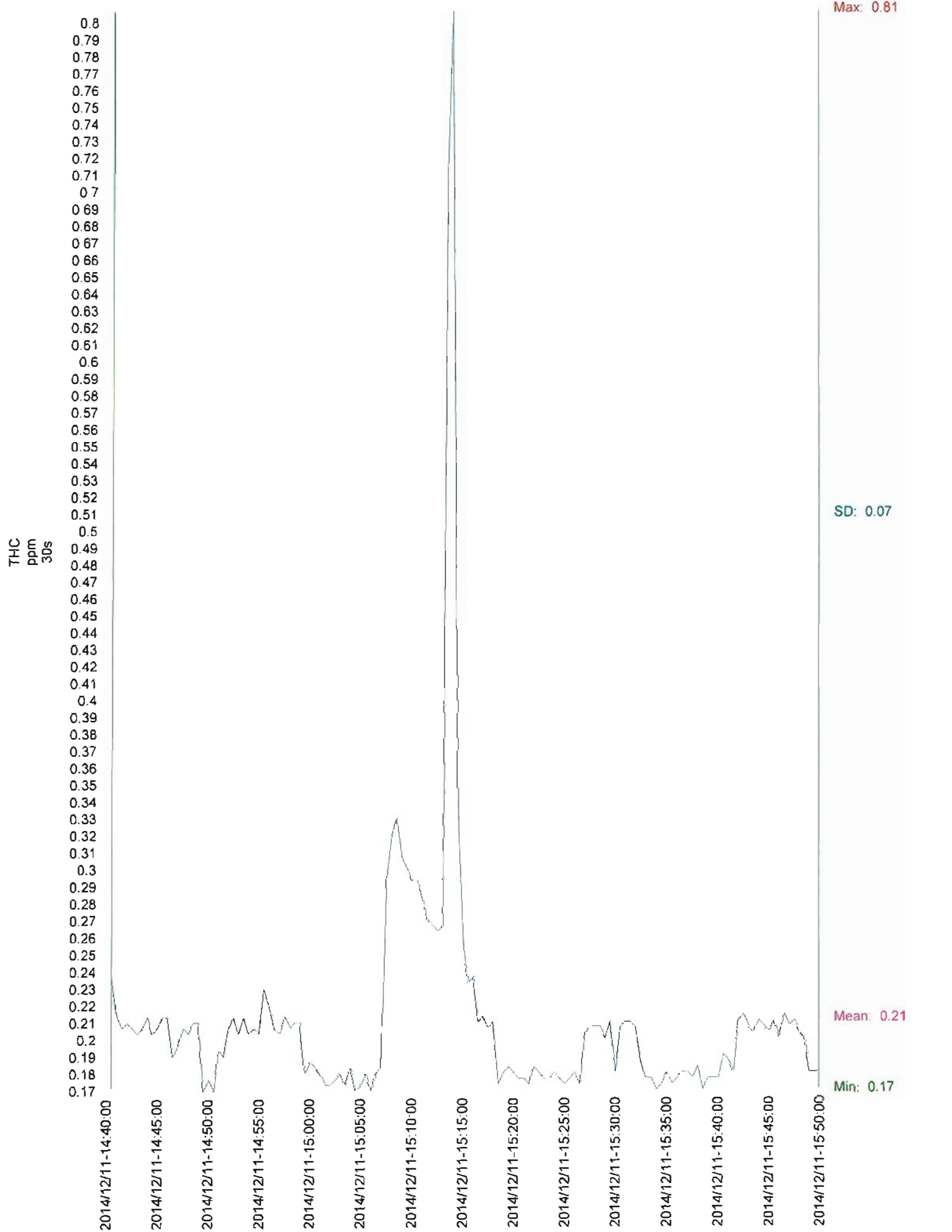
Min: 0.27

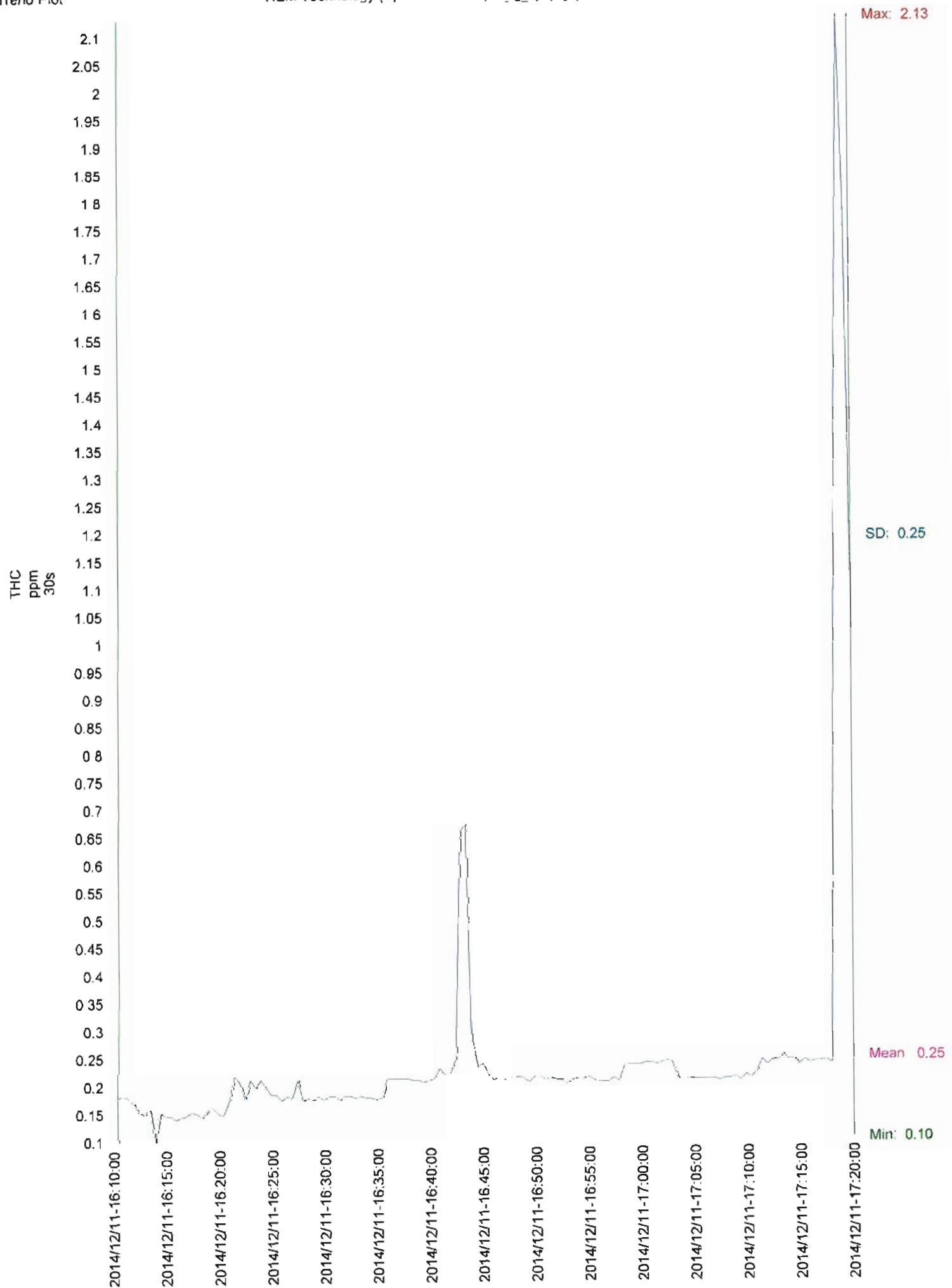




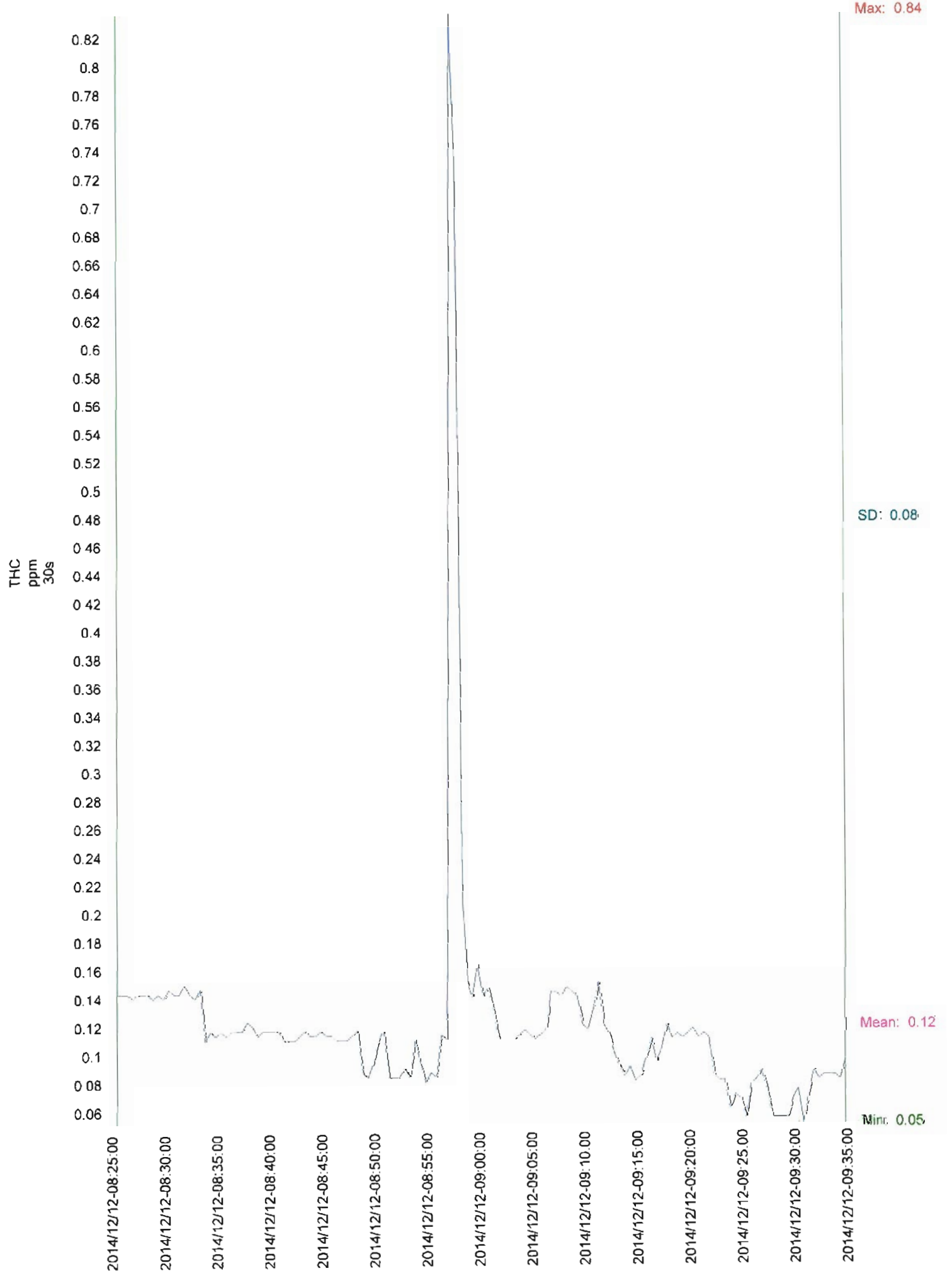


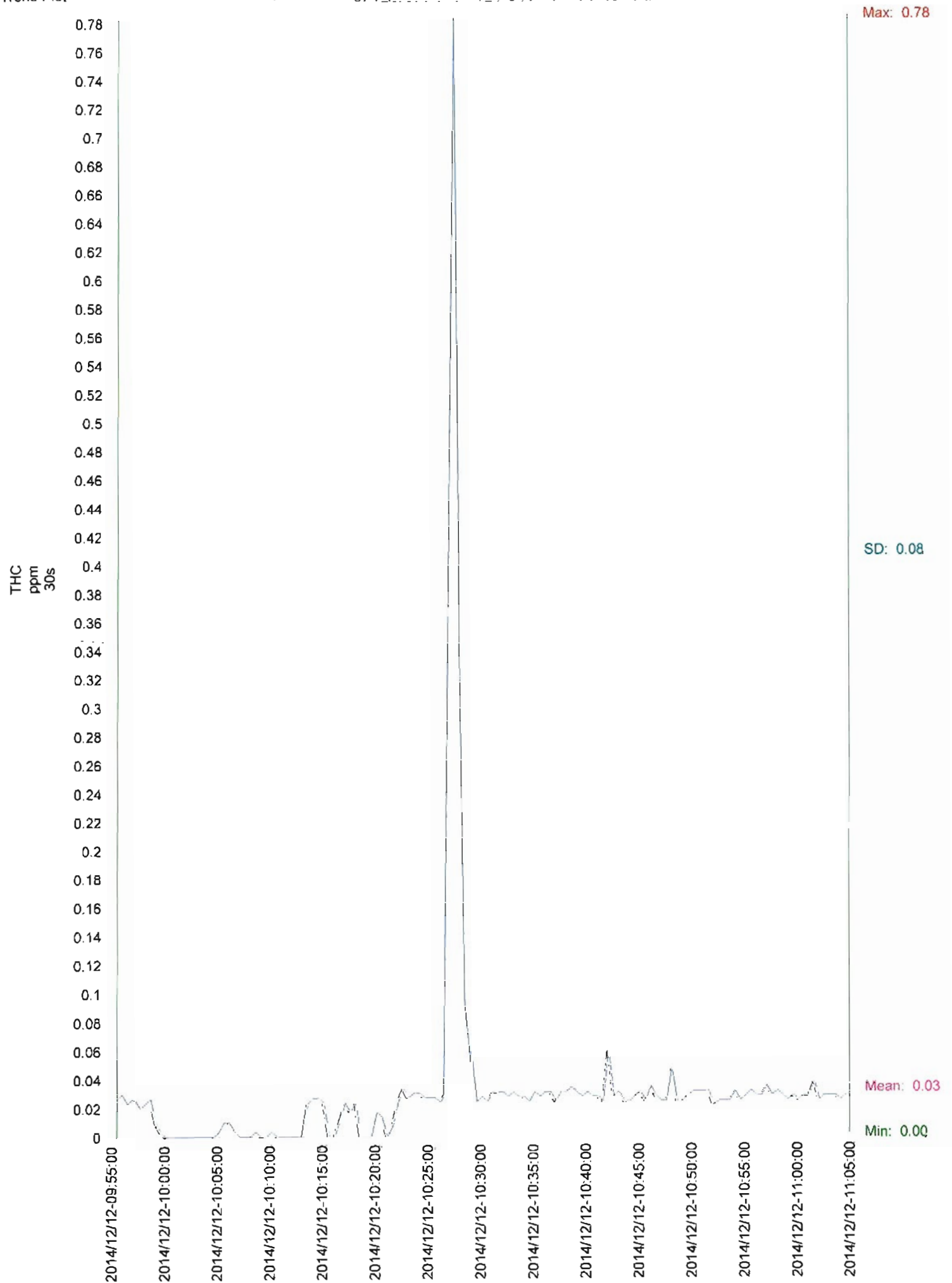


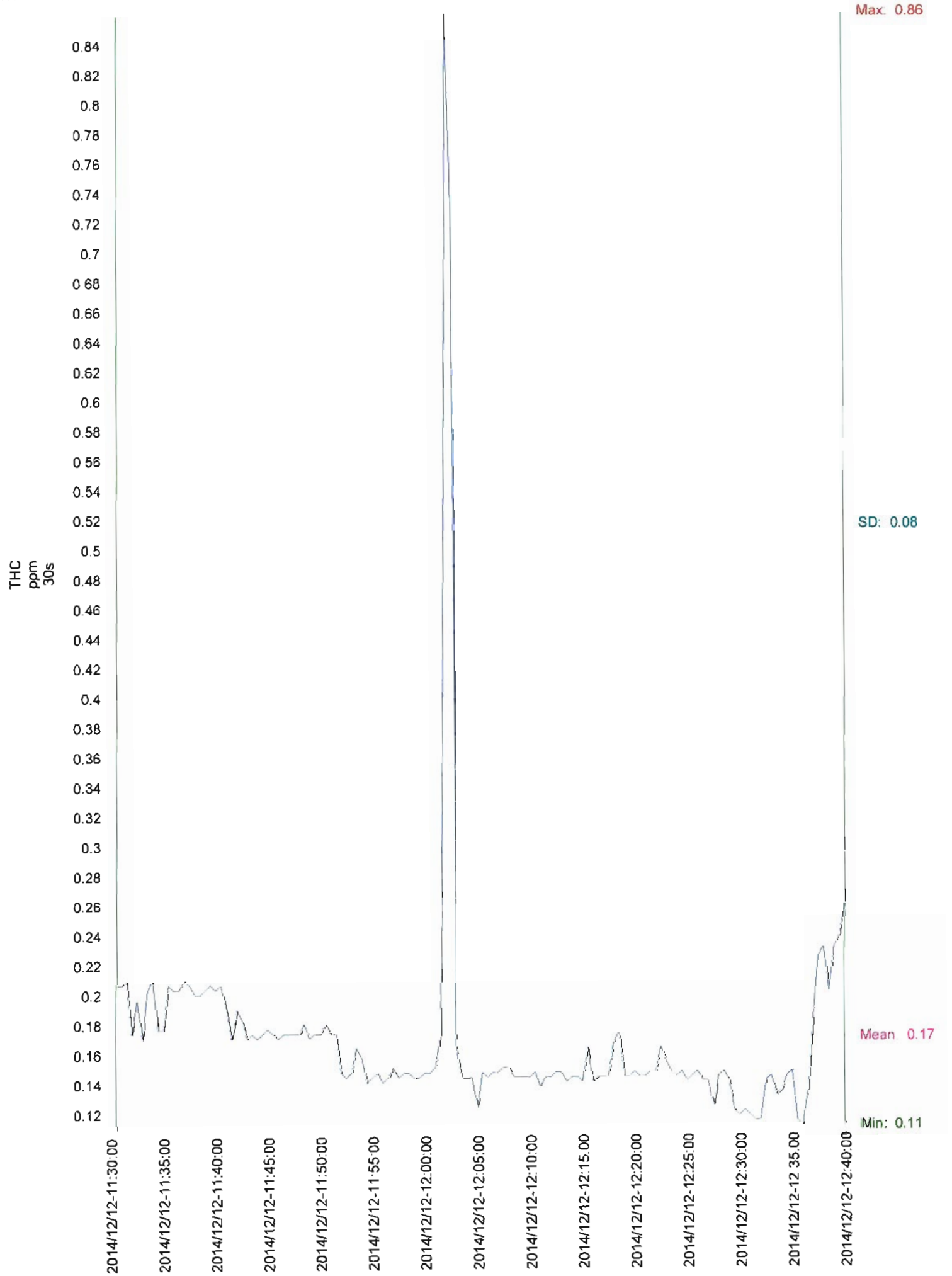


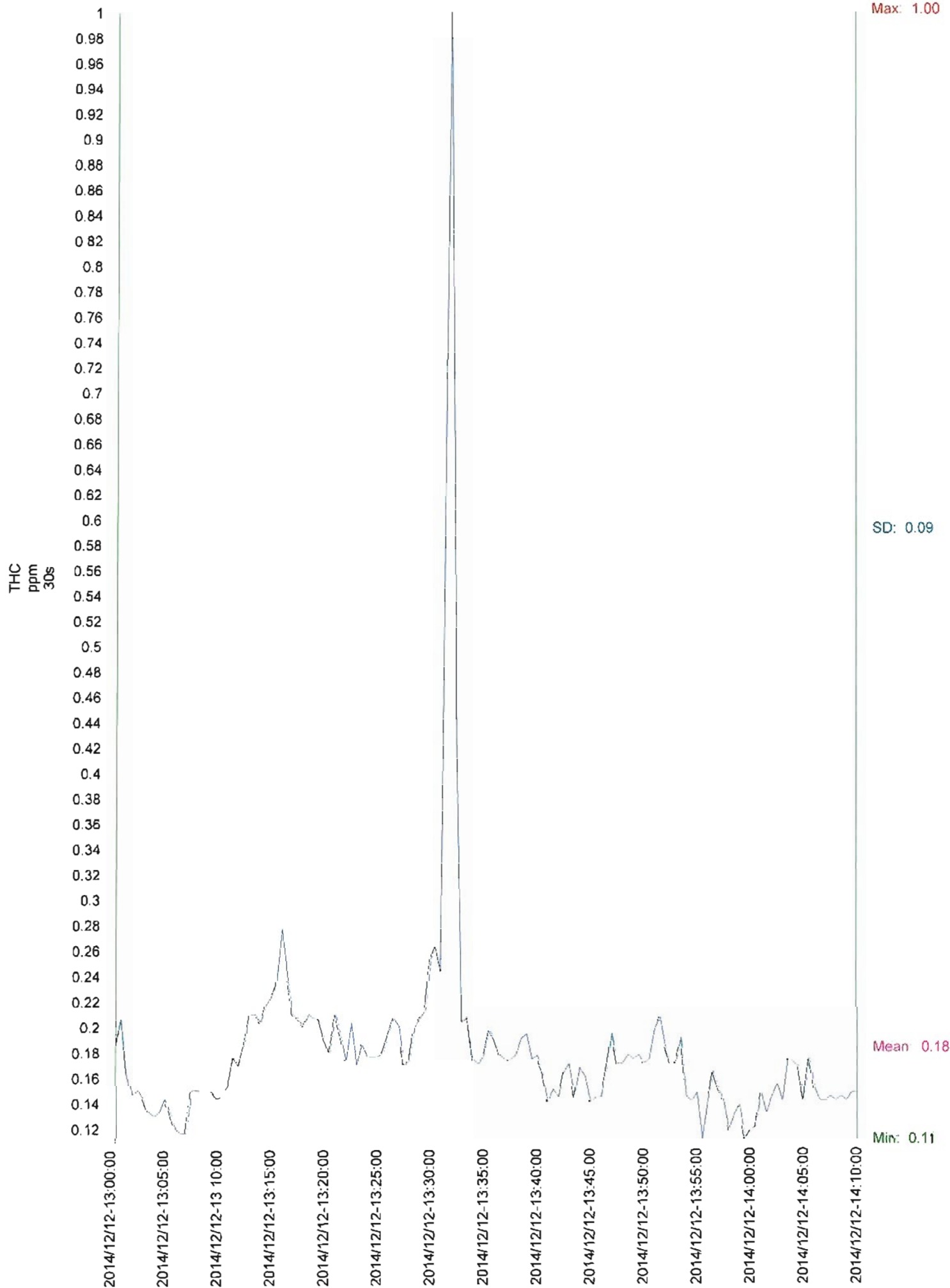


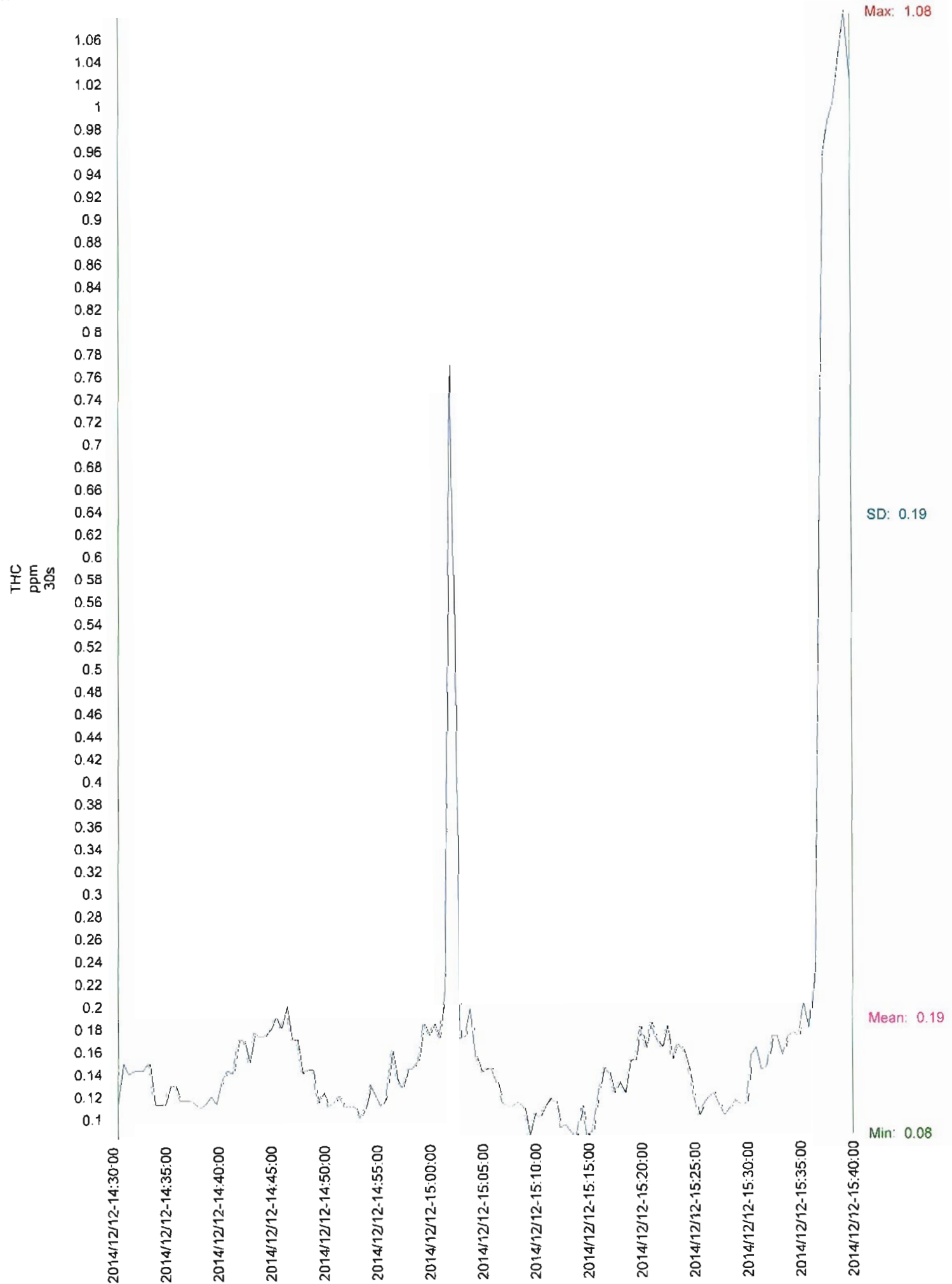












## **Appendix IV**

### **Field Data Sheets**

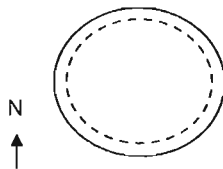
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u><del>0.012</del> -0.012</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DH H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/10</u>	Test #: <u>One</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>HC</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/No: <u>(X) No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>316</u>
B.P. (in. Hg): <u>29.80</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>327</u>
Pitot ID#: <u>PT 5 Edm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>7</u>
Meter #: <u>RATA 33</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>23</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C/°F)	Impinger Temp (°C/°F)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	1500	171.336	13	18	8	Initial: 0.000	Final: 0.000	21	21
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1530	13.5	5.5	
40									
50									
60	1610	190.821	13	19	12				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 1.315

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2

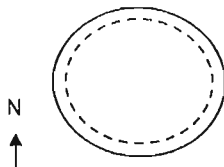
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.013</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DIH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Two</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>Jiw</u>	Team Leader: <u>KS</u>	Final Volume of Abs. Sol. (ml): <u>213</u>
Fluke Temp. Meter ID #: <u>43</u>		Volume Condensed (ml): <u>13</u>
Cyclonic Flow ? Yes(No) <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>323</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (0/f): <u>8</u>	Post Silica Weight (g): <u>325</u>
Pitot ID#: <u>PTSEFm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>2</u>
Meter #: <u>DATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>15</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (C/F)	Impinger Temp (C/F)	Leak Check Data			
						Initial:	ft <sup>3</sup> /m <sup>3</sup>	in Hg.	
0	0830	196.004	13	20	8	Final:	0.000	ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						0838	13	5.5	
40									
50									
60	0940	211.216	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 4.315

Annulus Length(in.): 9.5

Stack Diameter(in.): 12



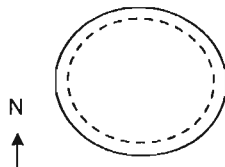
# AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.01</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>02/4/11</u>	Test #: <u>Three</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>UC</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>325</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (C/F): <u>8</u>	Post Silica Weight (g): <u>328</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA33</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

Point	Time	Port #1	(E-W)	Port #2	(N-S)	Port #3	( )	Port #4	( )
#	(24 Hrs)	Temp(c/f)	ΔP	Temp(c/f)	ΔP	Temp(c/f)	ΔP	Temp(c/f)	ΔP
6	1006	546	0.013	573	0.015				
5		571	0.011	577	0.013				
4		581	0.011	570	0.011				
3		536	0.012	510	0.008				
2		515	0.010	493	0.007				
1	1106	490	0.004	450	0.002				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume ft <sup>3</sup> /m <sup>3</sup>	Vacuum (in. Hg )	Meter Temp (C/F)	Impinger Temp (C/F)	Leak Check Data			
						Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.	Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.
0	1005	21.205	13	20	8				
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1020	13.5	6.0	
40									
50									
60	1115	230.302	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5

Stack Diameter(in.): 12

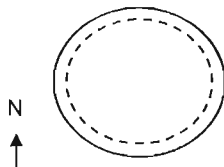
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.012</u>
Contact Name:	Source: <u>Incenterator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Fair</u>	Initial Volume of Abs.Sol. (ml): <u>300</u>
Sampled by: <u>JW</u>	Team Leader: <u>KT</u>	Final Volume of Abs. Sol. (ml): <u>212</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>12</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>328</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>331</u>
Pitot ID#: <u>PTS Edm</u>	Pitot Factor: <u>0.503</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>15</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume ft <sup>3</sup> /m <sup>3</sup>	Vacuum (in. Hg.)	Meter Temp (°F)	Impinger Temp (°F)	Leak Check Data			
						Initial:	ft <sup>3</sup> /m <sup>3</sup>	in Hg.	
0	1135	230.991	13	20	8	Final:	0.0000	ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1200	14	5	
40									
50									
60	1245	231.443	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft):

Port Diameter(in.): \_\_\_\_\_

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2

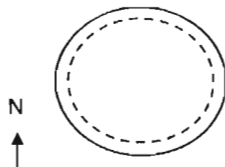
# AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.011</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJ H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Five</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>LP</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#13</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>331</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>334</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 38</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

Point #	Time (24 Hrs)	Port #1 Temp(°f)	Port #1 ΔP	Port #2 Temp(°f)	Port #2 ΔP	Port #3 Temp(c/f)	Port #3 ΔP	Port #4 Temp(c/f)	Port #4 ΔP
6	1308	531	0.014	538	0.014				
5		556	0.013	547	0.013				
4		544	0.012	527	0.012				
3		520	0.012	480	0.010				
2		510	0.011	493	0.009				
1	1411	490	0.003	491	0.008				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(°f)	Impinger Temp (°f)	Leak Check Data			
0	1305	25.630	13	20	8	Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1530	13.5	5.5	
50									
60	1415	27.848	15	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 9.5

Annulus Length(in.): 12

Stack Diameter(in.): 12

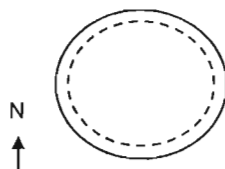
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.01</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DIH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>Six</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>GR</u>	Final Volume of Abs. Sol. (ml): <u>212</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>12</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>297</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>302</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>5</u>
Meter #: <u>RATX 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp(c/f)	Impinger Temp (c/f)	Leak Check Data			
						Initial: 0.000	ft <sup>3</sup> /m <sup>3</sup> 21	in Hg.	
0	1440	272.036	13	20	8	Final: 6.000	ft <sup>3</sup> /m <sup>3</sup> 21	in Hg.	
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1500	14	5	
40									
50									
60	1550	293.112	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 0.5

Annulus Length(in.): 4.5

Stack Diameter(in.): 12

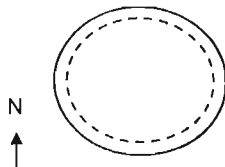
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.010</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DIH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/11</u>	Test #: <u>seven</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>CS</u>	Final Volume of Abs. Sol. (ml): <u>210</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>10</u>
Cyclonic Flow ? Yes <u>(No)</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>302</u>
B.P. (in. Hg): <u>29.47</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>306</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>4</u>
Meter #: <u>RATA 313</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>14</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C/F)	Impinger Temp (°C/F)	Leak Check Data			
						Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.	Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21 in Hg.
0	1610	293.308	13	20	8				
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1700	14.5	4.5	
40									
50									
60	1720	312.68	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 0.6

Annulus Length(in.):

Stack Diameter(in.): 1.2



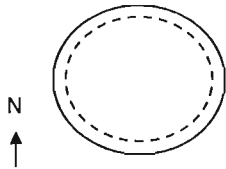
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.007</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DI H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Eight</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>HS</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/ <input checked="" type="checkbox"/> No	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>306</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (C/F): <u>6</u>	Post Silica Weight (g): <u>311</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>5</u>
Meter #: <u>RATA 36</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°C/°F)	Impinger Temp (°C/°F)	Leak Check Data			
						Initial: (ft <sup>3</sup> /m <sup>3</sup> )	Final: (ft <sup>3</sup> /m <sup>3</sup> )	in Hg.	in Hg.
0	0825	310.832	13	18	8	Initial: 0.000	21	in Hg.	
10						Final: 0.000	31	in Hg.	
20						FYRITE TESTS			
30						Time	%O2	%CO2	(%/ppm) CO
40						0900	13	5.5	
50									
60	0935	332.817	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 6.5

Annulus Length(in.): 7.5

Stack Diameter(in.): 12

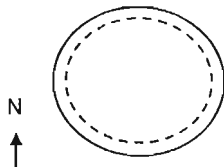
# AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DJH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Nine</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>SW</u>	Team Leader: <u>HR</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>311</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (°f): <u>6</u>	Post Silica Weight (g): <u>313</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H <sub>2</sub> O in Silica Condensed: <u>2</u>
Meter #: <u>RATA 3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H <sub>2</sub> O Condensed (ml): <u>18</u>
Comments:		Rinse Volume (ml):

Point #	Time (24 Hrs)	Port #1 Temp(°f)	Port #1 ΔP	Port #2 Temp(°f)	Port #2 ΔP	Port #3 Temp(c/f)	Port #3 ΔP	Port #4 Temp(c/f)	Port #4 ΔP
6	0958	570	0.009	573	0.012				
5		577	0.009	577	0.010				
4		581	0.010	572	0.008				
3		511	0.011	518	0.007				
2		473	0.008	483	0.006				
1	1103	466	0.007	417	0.002				

## ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg)	Meter Temp(°f)	Impinger Temp(c/f)	Leak Check Data			
0	0955	333.010	13	20	8	Initial: 0.0000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						Final: 0.0000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
20						FYRITE TESTS			
30						Time	%O <sub>2</sub>	%CO <sub>2</sub>	(%/ppm) CO
40						1030	13	6	
50									
60	1105	352.931	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM  
Sample Level(m/ft): \_\_\_\_\_  
Port Diameter(in.): \_\_\_\_\_  
Annulus Length(in.): 9.5  
Stack Diameter(in.): 12

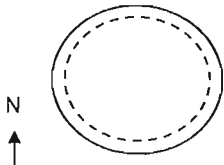
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name:	Source: <u>Inchwater</u>	Absorbing Solution: <u>DI H<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Ten</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>GS</u>	Final Volume of Abs. Sol. (ml): <u>215</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>15</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>313</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (°C): <u>8</u>	Post Silica Weight (g): <u>317</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>4</u>
Meter #: <u>RATA33</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>19</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (C/F)	Impinger Temp (C/F)	Leak Check Data			
						Initial: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
0	1130	53.128	13	20	8	Final: 0.000 ft <sup>3</sup> /m <sup>3</sup>	21	in Hg.	
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30						1200	13	5.5	
40									
50									
60	1240	573.323	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 0.6

Annulus Length(in.): 9.5

Stack Diameter(in.): 1.2



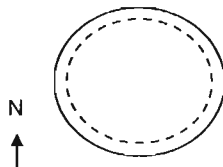
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contract Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DT1750</u>
Date(Y/M/D): <u>20/4/12/12</u>	Test #: <u>Elwyn</u>	Initial Volume of Abs.Sol. (ml): <u>260</u>
Sampled by: <u>SW</u>	Team Leader: <u>MR</u>	Final Volume of Abs. Sol. (ml): <u>214</u>
Fluke Temp. Meter ID #: <u>#3</u>		Volume Condensed (ml): <u>14</u>
Cyclonic Flow ? Yes/No <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>317</u>
B.P. (in. Hg): <u>29.52</u>	Ambient Temperature (C/F): <u>8</u>	Post Silica Weight (g): <u>320</u>
Pitot ID#: <u>PTSEdm</u>	Pitot Factor: <u>0.803</u>	H2O in Silica Condensed: <u>3</u>
Meter #: <u>RATA 38</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>17</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp (°F)	Impinger Temp (°F)	Leak Check Data			
						Initial: 0.000 (ft <sup>3</sup> /m <sup>3</sup> )	21 in Hg.	Final: 0.000 (ft <sup>3</sup> /m <sup>3</sup> )	21 in Hg.
0	1300	373.507	13	20	8				
10						FYRITE TESTS			
20						Time	%O2	%CO2	(%/ppm) CO
30							14.5	4.8	
40									
50									
60	1410	393.438	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 1.315

Annulus Length(in.): 4.5

Stack Diameter(in.): 7.5

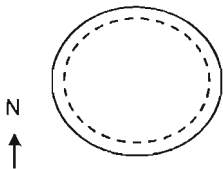
## AGAT VELOCITY/ ABSORPTION DATA SHEET

Company: <u>Spartan</u>	Location: <u>Calgary</u>	Stack Static Pressure: <u>-0.006</u>
Contact Name:	Source: <u>Incinerator</u>	Absorbing Solution: <u>DTH<sub>2</sub>O</u>
Date(Y/M/D): <u>2014/12/12</u>	Test #: <u>Twelve</u>	Initial Volume of Abs.Sol. (ml): <u>200</u>
Sampled by: <u>JW</u>	Team Leader: <u>HL</u>	Final Volume of Abs. Sol. (ml): <u>216</u>
Fluke Temp. Meter ID #: <u>6083</u>		Volume Condensed (ml): <u>16</u>
Cyclonic Flow ? Yes/ <u>No</u>	Average Null Angle from Vertical=	Pre Silica Weight (g): <u>320</u>
B.P. (in. Hg): <u>29.53</u>	Ambient Temperature (°F): <u>8</u>	Post Silica Weight (g): <u>322</u>
Pitot ID#: <u>PTSEda</u>	Pitot Factor: <u>0.805</u>	H2O in Silica Condensed: <u>2</u>
Meter #: <u>RATA3B</u>	Meter Factor: <u>1.0209</u>	Total Volume H2O Condensed (ml): <u>18</u>
Comments:		Rinse Volume (ml):

[illegible]

### ABSORPTION DATA

Min.	Time (24Hrs)	Volume (ft <sup>3</sup> /m <sup>3</sup> )	Vacuum (in. Hg.)	Meter Temp(c/f)	Impinger Temp (c/f)	Leak Check Data			
						Initial:	Final:	in Hg.	in Hg.
0	1430	393.625	13	20	8	0.000	0.000	21	21
10									
20									
30									
40									
50									
60	1540	413.735	13	20	10				



Show Stack Features: Ladder/Ports/Power/Lights/CEM

Sample Level(m/ft): \_\_\_\_\_

Port Diameter(in.): 2

Annulus Length(in.): 9.5

Stack Diameter(in.): 12

## **SUMMARY OF OBSERVATIONS**

The following observations were conducted on the test dates of December 10-12, 2014 at the Spartan Controls Ltd – REM Technology Inc. Incinerator Stack. Through the twelve source emission survey tests, it was found that no visible emissions were observed.

Test 1

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

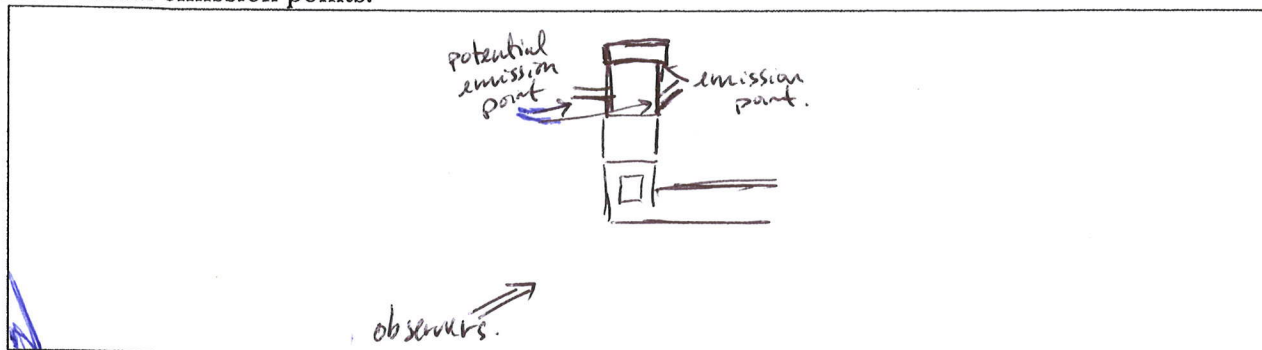
Company <u>REM technology limited</u>	Observer <u>Nitin/Alex</u>
Location <u>9815 48 St SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg/Howard.</u>	Date <u>Dec 10/14</u>
Precipitation <u>None.</u>	Wind Speed <u>14.0 km/h S</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) light overhead (more SW)

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>15:00</u>	<u>14.0 km/h S / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>15:25</u>	<u>17.0 km/h S / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>15:45</u>	<u>14.0 km/h S / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>15:51</u>	<u>19. km/h S / variable clouds</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>16:05</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
• the final clock time.	<u>16:10</u>	<u>19 km/h S / variable clouds</u>	<u>                    </u>
For more details on recording this data and taking breaks, see #7 and #10 above.	<u>Accumulated Observation: 1 hr 10 min</u>		
End Observation			





10/12/2014 15:01

Test 2

~~XXXXXX~~

FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

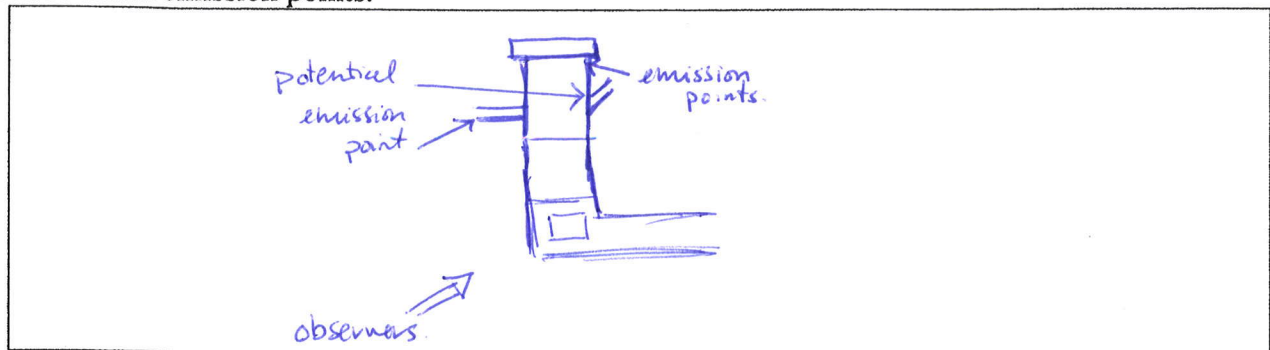
Company <u>REM Technology limited</u>	Observer <u>Nitin / Alex.</u>
Location <u>9815 48 St. SE Calgary.</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg / Howard.</u>	Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>16 km/h W.</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>8:30</u>	<u>16 km/h W / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>8:50</u>	<u>20 km/h SW / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>9:10</u>	<u>20 km/h SW / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>9:30</u>	<u>5 km/h SW / clear skies</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>9:40</u>	<u>5 km/h SW / clear skies</u>	<u>                    </u>
• the final clock time.			
	<u>Accumulated Observation: 1hr 10min</u>		
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





11/12/2014 08:49

Test 3

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

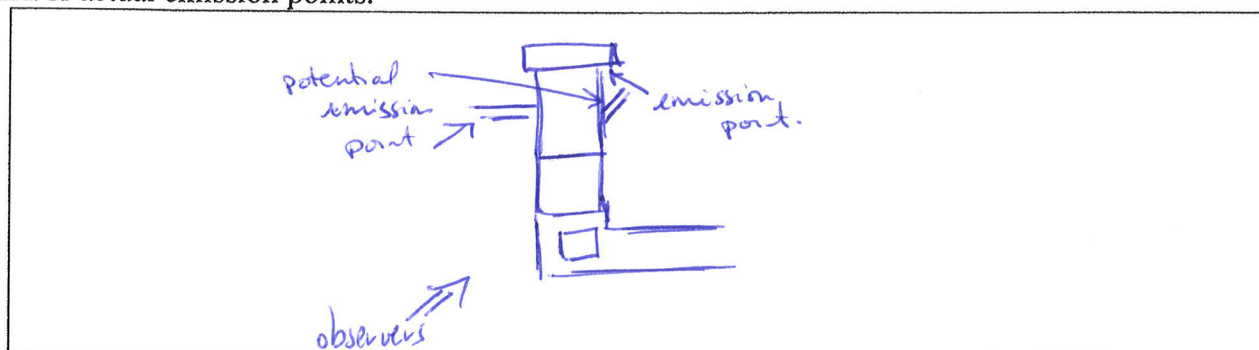
Company <u>REM Technology Limited</u>	Observer <u>Nitin / Alex</u>
Location <u>9815 48 St. SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg / Howard</u>	Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>5.0 km/h SW</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
--	------------	--	--

Begin

Observation

To complete this form, record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

<u>10:10</u>	<u>6 km/h SE / clear SKIES</u>	<u>                    </u>
<u>10:30</u>	<u>5.0 km/h SE / variable clouds</u>	<u>                    </u>
<u>10:50</u>	<u>5 km/h SE / variable clouds</u>	<u>                    </u>
<u>11:10</u>	<u>6.1 km/h SSE / variable clouds.</u>	<u>                    </u>
<u>11:35</u>	<u>6.1 km/h SSE / variable clouds</u>	<u>                    </u>
<u>Accumulated observation: thr 10 min</u>		

For more details on recording this data and taking breaks, see #7 and #10 above.

End

Observation





11/12/2014 10:07

T2

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

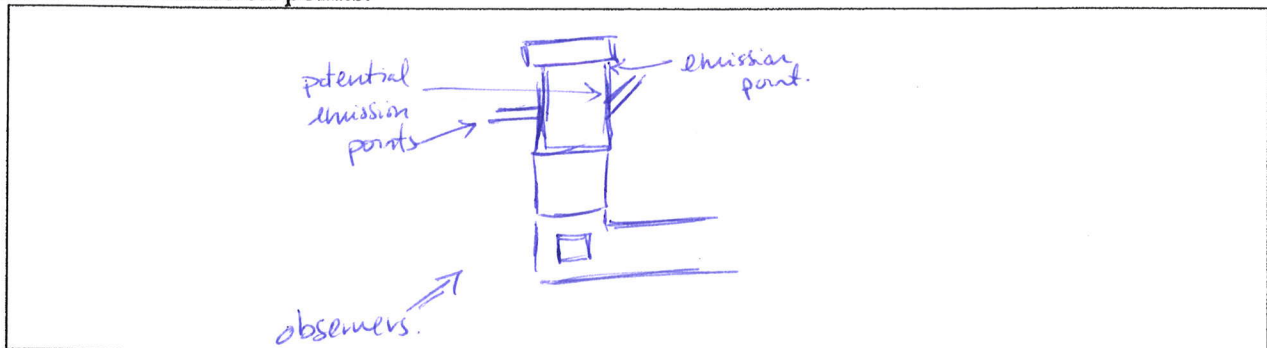
Company <u>REM Technology Limited.</u>	Observer <u>Nitin / Alex.</u>
Location <u>9815 48st. SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg/Howard.</u>	Date <u>Dec 11 / 2014</u>
Precipitation <u>None.</u>	Wind Speed <u>5.4 km/h SE</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

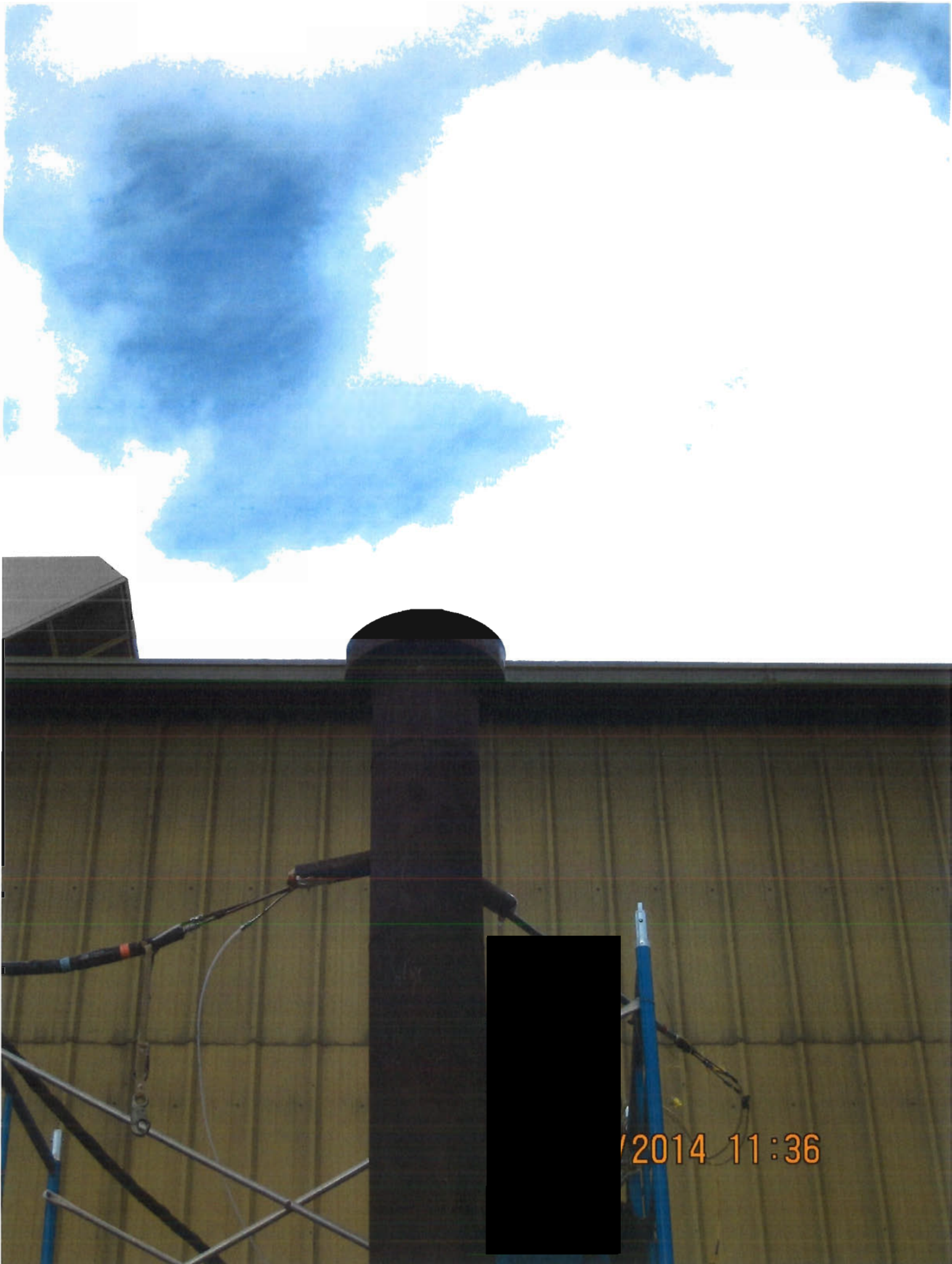
Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<u>11:35</u>	<u>5.4 km/h SE / variable clouds</u>	<u>                    </u>
To complete this form, record the following:	<u>11:55</u>	<u>12.2 km/h SE / variable clouds</u>	<u>                    </u>
• the initial clock time	<u>12:15</u>	<u>12.2 km/h SE / variable clouds</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>12:35</u>	<u>2.9 km/h SE / overcast.</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>Accumulated observation = the 10 min</u>		
• the final clock time.			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			





Test 5

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48<sup>th</sup> SE Calgary  
Company Rep. Greg/Howard

Observer Alex/Nitin  
Affiliation AGAT Labs  
Date Dec 11/2014

Precipitation None

Wind Speed

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

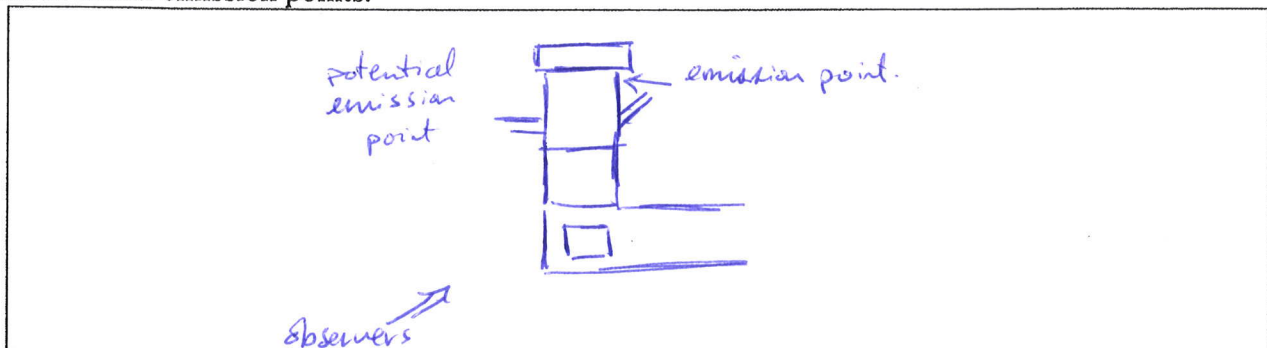
natural

Light location (overhead, behind observer, etc.)

overhead

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

13:05

3.4 km/h W/S / overcast

13:20

5.8 km/h SE / overcast

13:40

9.36 km/h SSE / overcast

14:00

4.0 km/h SE / overcast

14:15

4.0 km/h SE / overcast

Accumulated Observation - the 10 min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation



11/12/2014 14:04



Test 8

FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

Company REM Technology Limited  
Location 9815 48 St. SE Calgary  
Company Rep. Greg/Howard

Observer Alex/Nitin  
Affiliation AGAT Labs  
Date Dec 11/2014

Precipitation None

Wind Speed

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

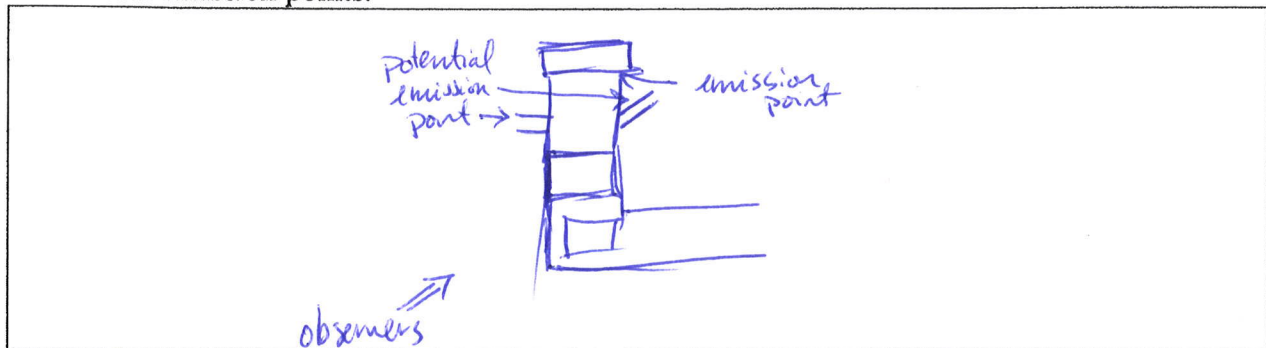
natural

Light location (overhead, behind observer, etc.)

overhead

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

14:40

5.0 km/h SE / overcast.

15:00

13.0 km/h / overcast

15:20

10.1 km/h / overcast.

15:40

9.8 km/h / overcast.

15:50

9.7 km/h / overcast

Accumulated Observation: 1hr 10min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation





Test #

FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

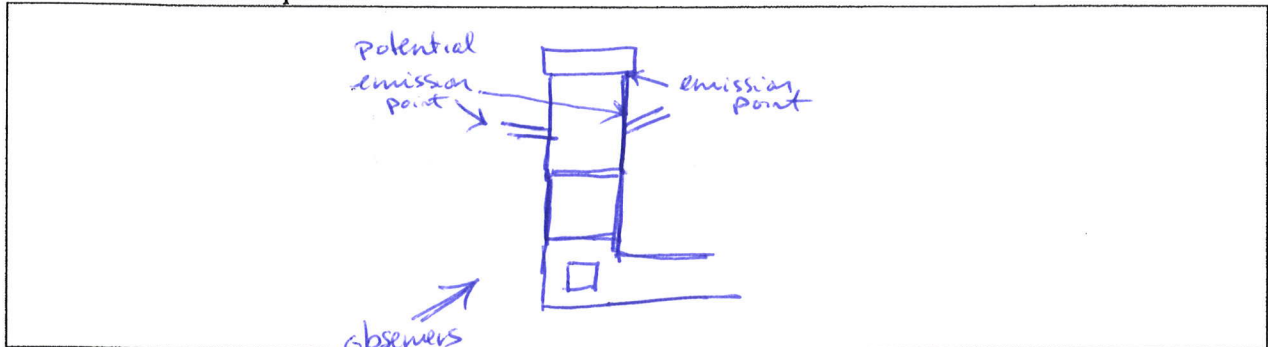
Company <u>REM Technology Limited</u>	Observer <u>Alex/Nitin</u>
Location <u>9815 48st SE Calgary</u>	Affiliation <u>AGAT Labs.</u>
Company Rep. <u>Greg/Harvard</u>	Date <u>Dec 11/2014</u>
Precipitation <u>None.</u>	Wind Speed <u>2.1 km/h SE</u>
Industry	Process Unit

Light type (fluorescent, incandescent, natural) natural

Light location (overhead, behind observer, etc.) overhead.

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

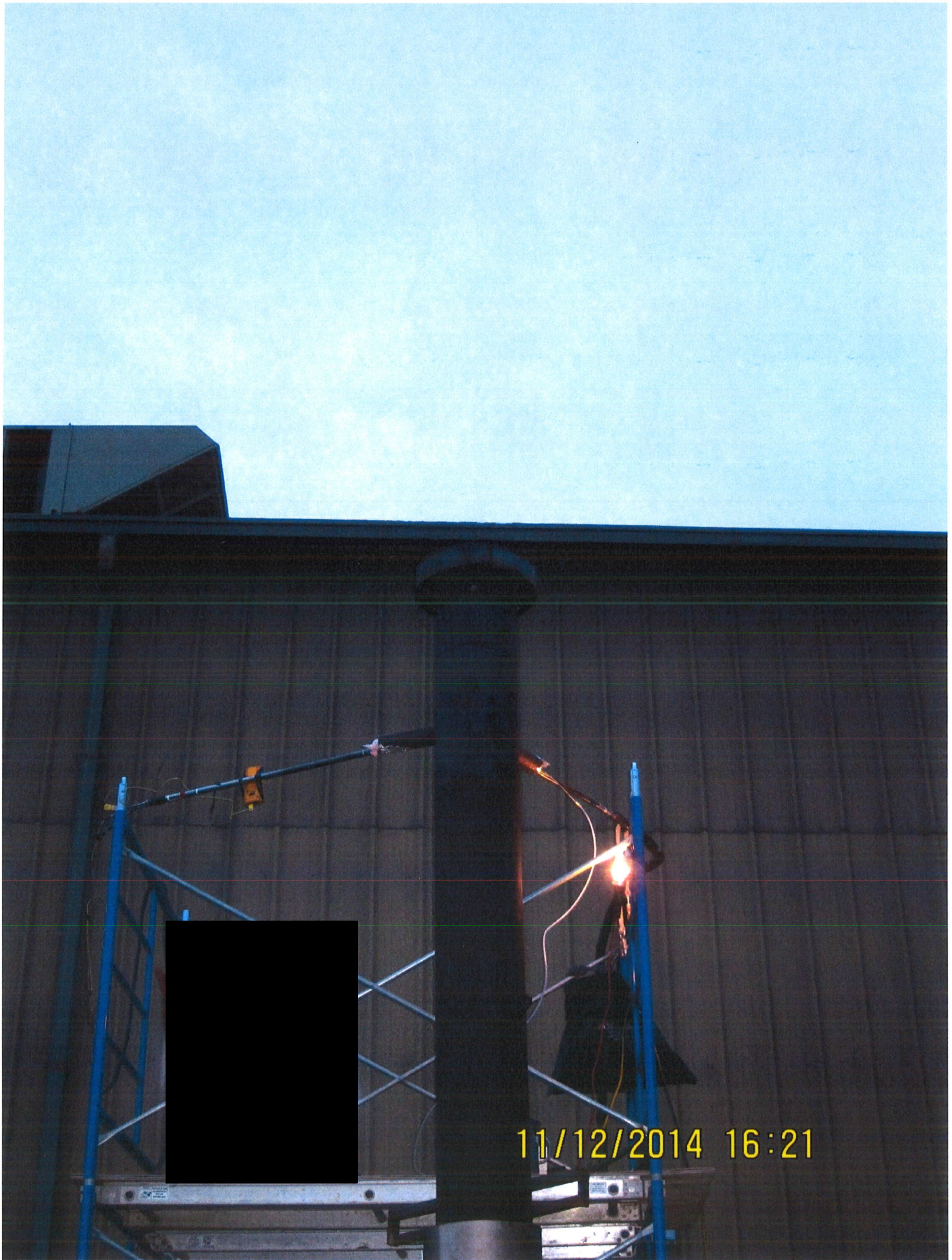
Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	<u>16:00</u>	<u>2.1 km/h SE / overcast.</u>	<u>                    </u>
To complete this form, record the following:	<u>16:20</u>	<u>2.0 km/h SE / overcast</u>	<u>                    </u>
• the initial clock time	<u>16:40</u>	<u>4.7 km/h SE / overcast</u>	<u>                    </u>
• the total time of the observation (from SW1)	<u>17:00</u>	<u>4.3 km/h SE / overcast</u>	<u>                    </u>
• the total time of emissions (from SW2), and	<u>17:20</u>	<u>4.1 km/h SE / overcast</u>	<u>                    </u>
• the final clock time.	<u>Accumulated Observation: thr 20 min</u>		
For more details on recording this data and taking breaks, see #7 and #10 above.	<u>                    </u>	<u>                    </u>	<u>                    </u>
	<u>                    </u>	<u>                    </u>	<u>                    </u>
End Observation	<u>                    </u>	<u>                    </u>	<u>                    </u>
	<u>                    </u>	<u>                    </u>	<u>                    </u>





11/12/2014 16:21



Test 8

# FUGITIVE OR SMOKE EMISSION INSPECTION INDOOR LOCATION

Company REM Technology Limited.  
Location 9815 48 St. SE Calgary  
Company Rep. Greg/Howard.

Observer Nitin/Howard  
Affiliation AGAT Labs./REM Tech.  
Date Dec 12/2014

Precipitation None.

Wind Speed 5.0 km/h SW

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

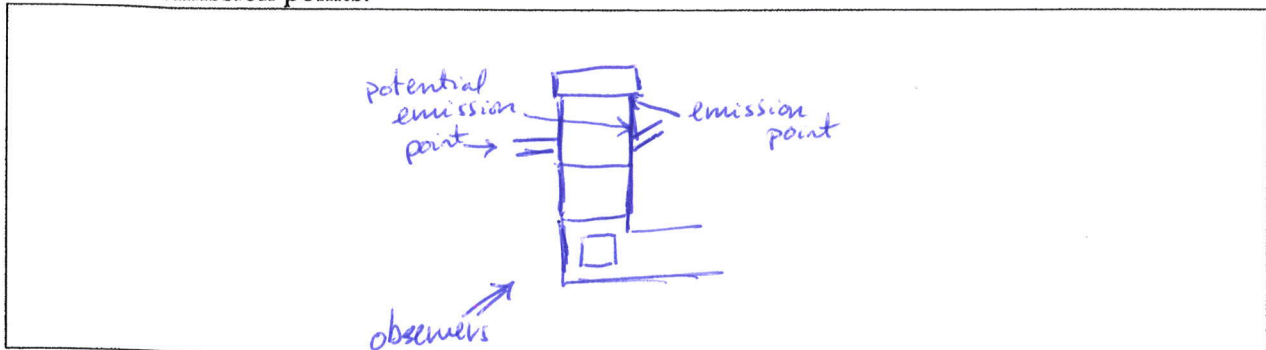
natural

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

Begin  
Observation

Clock  
Time

Observation  
period  
duration,  
minutes:seconds

Accumulated  
emission  
time,  
minutes:seconds

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

8:25

6.0 km/h SW/overcast.

8:50

1.8 km/h SW/overcast.

9:10

2.1 km/h SE/overcast

9:35

2.0 km/h SE/overcast

Accumulated Observation - 1hr 10min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End  
Observation

12/12/2014 09:34





Test 9

FUGITIVE OR SMOKE EMISSION INSPECTION  
INDOOR LOCATION

Company REM Technology limited  
Location 9815 48st. #8E calgary  
Company Rep. Greg/Howard.

Observer Nitin/Howard  
Affiliation AGAT Laboratories./REM Tech.  
Date Dec 12/2014

Precipitation None.

Wind Speed 2.5 km/h S

Industry

Process Unit

Light type (fluorescent, incandescent, natural)

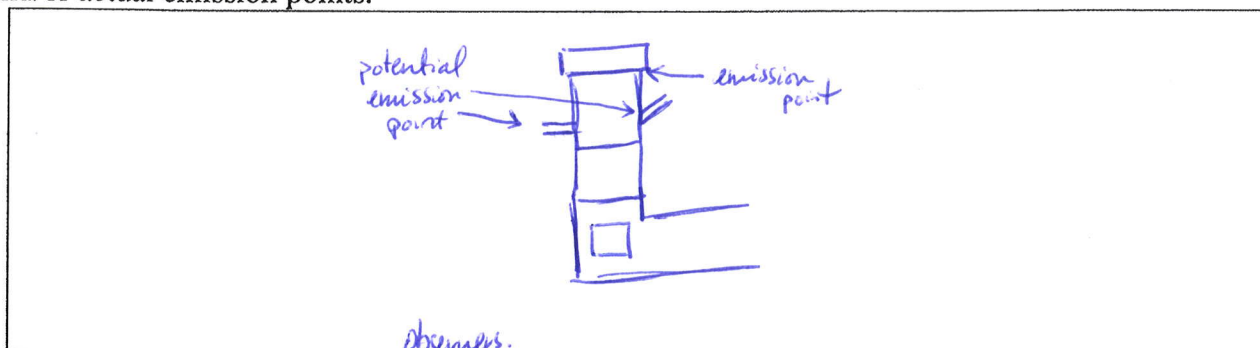
natural.

Light location (overhead, behind observer, etc.)

SE

Illuminance (must be greater than or equal to 100 lux or 10 foot candles)

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

Begin

Observation

To complete this form,  
record the following:

- the initial clock time
- the total time of the observation (from SW1)
- the total time of emissions (from SW2), and
- the final clock time.

Clock  
Time

Observation

period  
duration,  
minutes:seconds

Accumulated

emission  
time,  
minutes:seconds

09:55

~~10:00~~

10:15

~~10:20~~

10:35

10:05

2.5 km/h / S variable clouds

1.4 km/h / S variable clouds

1.1 km/h / S variable clouds

4.7 km/h SE variable clouds

Accumulated Observation: thr 10 min

For more details on  
recording this data and  
taking breaks, see #7 and  
#10 above.

End

Observation



12/12/2014 11:02



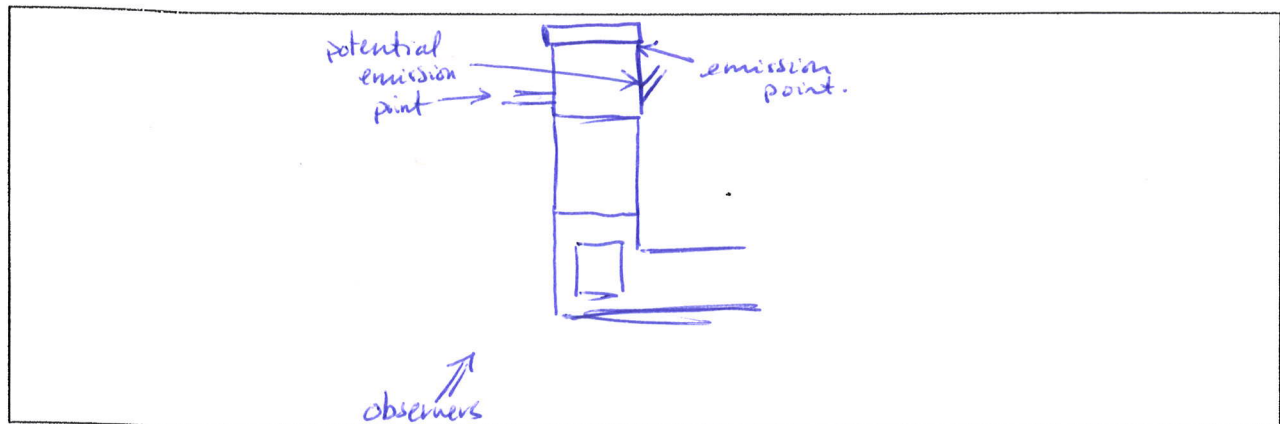


Test 10

# FUGITIVE OR SMOKE EMISSION INSPECTION OUTDOOR LOCATION

Company REM Technology limited	Observer Nitin / Howard.
Location 9815 48 St. SE Calgary	Affiliation AGAT Laboratories / REM Tech.
Company Rep. Greg / Howard.	Date Dec 12 / 2014
Sky Conditions variable clouds.	Wind Direction SE NW
Precipitation None.	Wind Speed 5.4 km/h NW
Industry	Process Unit

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



## OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	11:30	5.4 km/h NW / variable clouds	_____
To complete this form, record the following:	11:50	2.9 km/h SE / variable clouds	_____
• the initial clock time	12:10	3.2 km/h SE / variable clouds	_____
• the total time of the observation (from SW1)	12:40	2.5 km/h SE / variable clouds	_____
• the total time of emissions (from SW2), and	Accumulated Observation: the 10 min		
• the final clock time.	_____	_____	_____
For more details on recording this data and taking breaks, see #7 and #10 above.	_____	_____	_____
End Observation	_____	_____	_____





9/17/2014 12:37

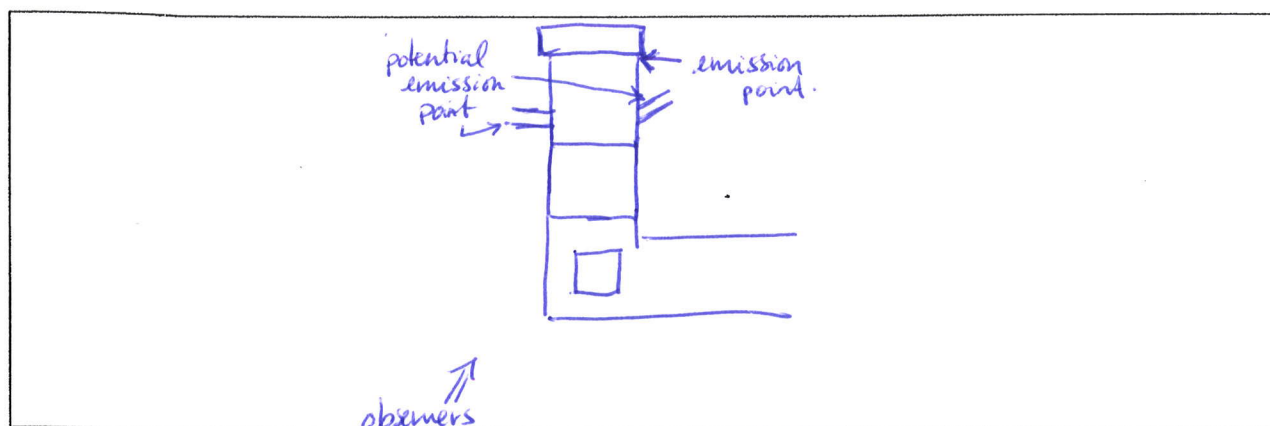


Test 11

FUGITIVE OR SMOKE EMISSION INSPECTION  
OUTDOOR LOCATION

Company <i>REM Technology limited.</i>	Observer <i>Nitin / Alex. Scott</i>
Location <i>9815 48 St. SE Calgary.</i>	Affiliation <i>AGAT Labs. / Spartan Controls</i>
Company Rep. <i>Greg / Howard.</i>	Date <i>Dec 10 / 2014.</i>
Sky Conditions <i>variable clouds.</i>	Wind Direction <i>S</i>
Precipitation <i>none.</i>	Wind Speed <i>2.5 km/h.</i>
Industry	Process Unit

Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation			
	<i>13:00</i>	<i>2.5 km/h S / variable clouds.</i>	<i>_____</i>
	<i>13:20</i>	<i>2.2 km/h S / variable clouds.</i>	<i>_____</i>
	<i>13:40</i>	<i>0.0 km/h. / variable clouds.</i>	<i>_____</i>
	<i>14:10</i>	<i>1.1 km/h / variable clouds.</i>	<i>_____</i>
	<i>14:05</i>		
	<i>Accumulated Observation: the 10 min</i>		
End Observation			

- To complete this form, record the following:
- the initial clock time
  - the total time of the observation (from SW1)
  - the total time of emissions (from SW2), and
  - the final clock time.

For more details on recording this data and taking breaks, see #7 and #10 above.



12/12/14 14:04



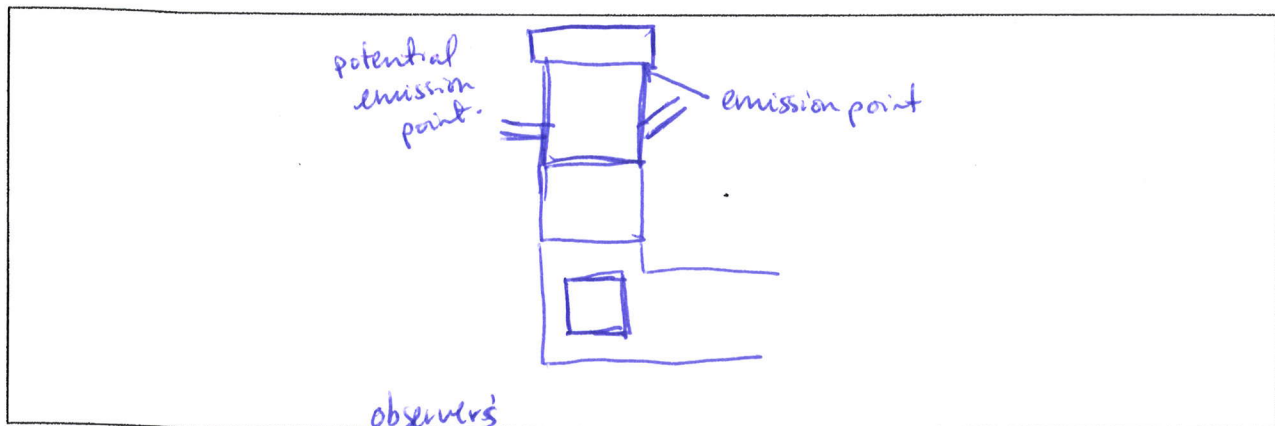


Test 12

FUGITIVE OR SMOKE EMISSION INSPECTION  
OUTDOOR LOCATION

Company	REM Technology Limited	Observer	Nth/Alex Scott
Location	9815 48 St. SE Calgary.	Affiliation	AGAT Labs. / Spartan Controls
Company Rep.	Greg Howard	Date	Dec 10 / 2014
Sky Conditions	variable clouds	Wind Direction	<del>SW</del> NW
Precipitation	None.	Wind Speed	1.8 km/h
Industry		Process Unit	

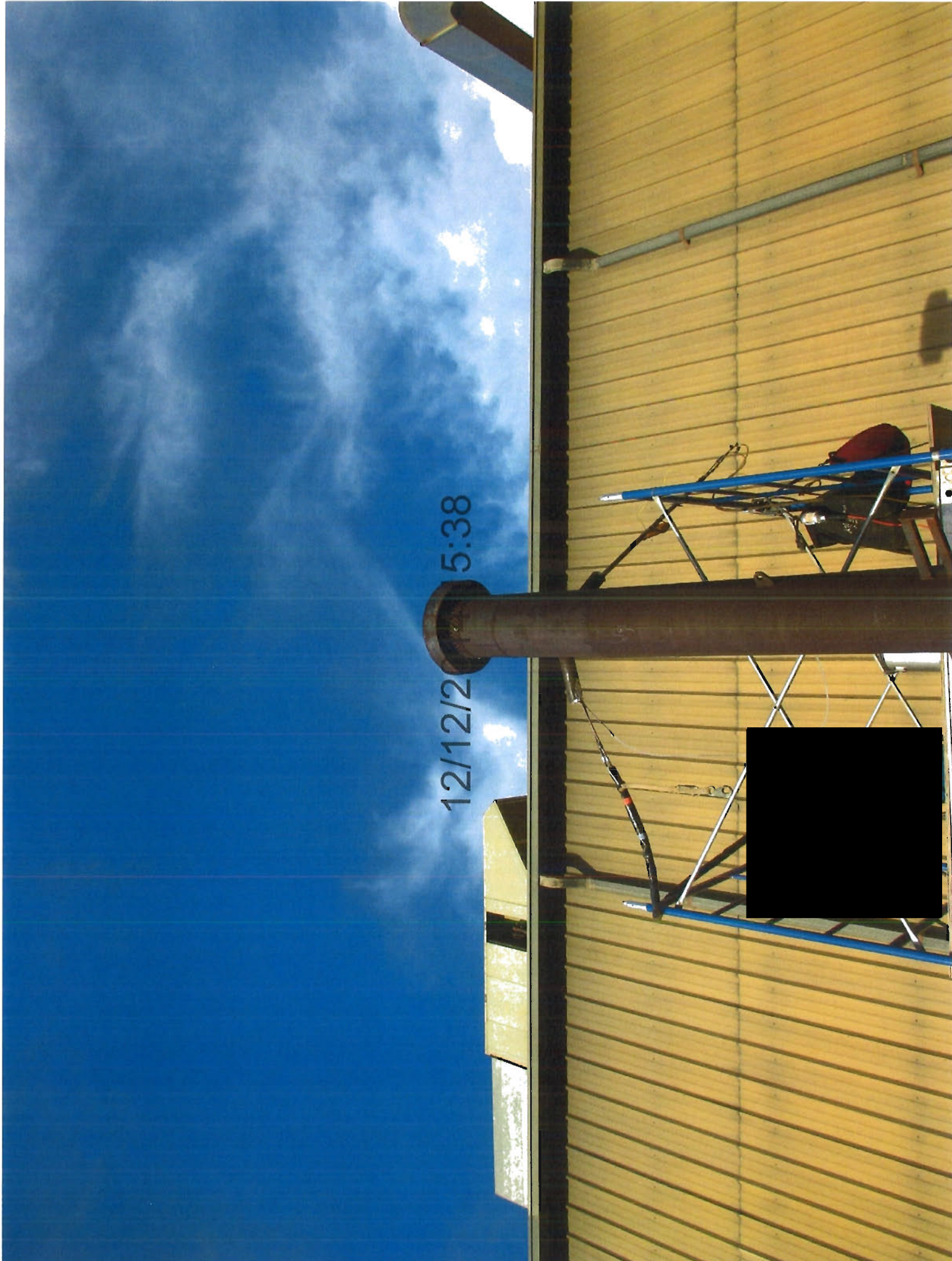
Sketch process unit: indicate observer position relative to source; indicate potential emission points and/or actual emission points.



OBSERVATIONS

	Clock Time	Observation period duration, minutes:seconds	Accumulated emission time, minutes:seconds
Begin Observation	14:30	1.8 km/h NW / variable clouds.	
To complete this form, record the following:	14:50	2.1 km/h NW / variable clouds.	
• the initial clock time	15:10	1.8 km/h NW / variable clouds.	
• the total time of the observation (from SW1)	15:40	0.0 km/h. / variable clouds.	
• the total time of emissions (from SW2), and	Accumulated observation: the 10 min		
• the final clock time.			
For more details on recording this data and taking breaks, see #7 and #10 above.			
End Observation			

12/12/2015 5:38



## **Appendix V**

### **AGAT Calibration Data**



# ANALYZER CALIBRATION FORM

Parameter

CO

On-Site to Probe

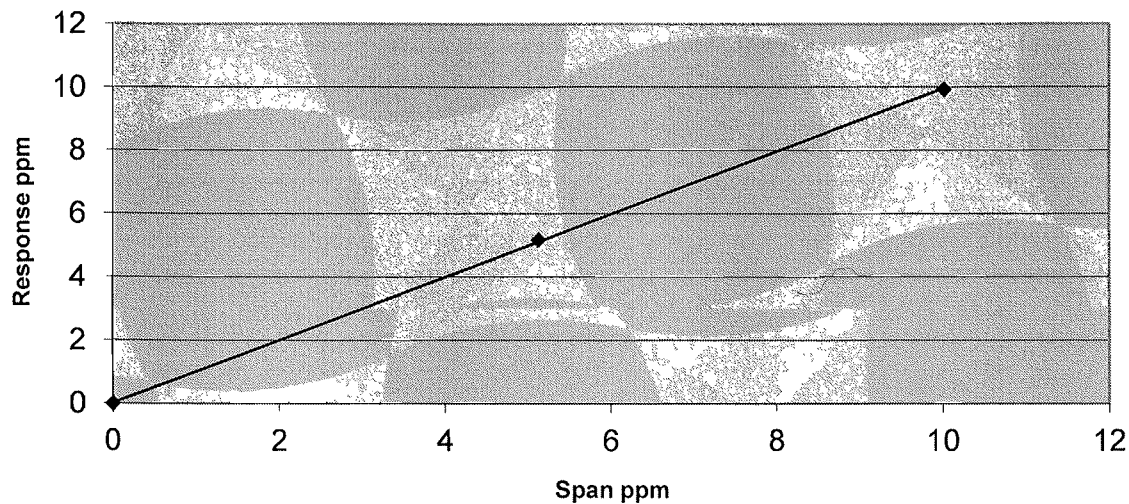
Company: Spartan Controls Location: Calgary  
 Staff: CR/JW/AS/NM Parameter: Pre -Test Linearity  
 Date: 2014/12/10-12 Time: 8:00-8:22  
 Analyzer: \_\_\_\_\_ S/N: \_\_\_\_\_  
 Data System: ICIS 3 Dilution: 1:1

Calibration Standard	Gas	ID Number	Concentration
Compressed Cylinders	CO	0	0 ppm
- Balance Nitrogen	CO	CC258434	5.13 ppm
	CO	CC119196	10.01 ppm
Zero Air	N2	N/A	100 %

Analyzer Span: 10.01 110 seconds

Calibration Data					
Set Point	Required PPM	Dilution Factor	Actual PPM	D.A.S. Response	Percent Difference
1	-0.2002 - 0.2002	100	0		0.000
2	-0.2002 - 0.2002	100	0	0	0.000
3	4.9298 - 5.3302	100	5.13	5.19	-0.599
4	9.8098 - 10.2102	100	10.01	9.94	0.699
5	-0.2002 - 0.2002	100	0	0	0.0000

Linearity Slope: 0.9949 Y-Intercept: 0.0169 Correlation: 0.99995



**AGAT Laboratories**  
**Source Testing Services, Calgary, Alberta**

**RESPONSE TIME TESTS**

**Test Date :** 2014/12/10-12  
**Analyzer Type :**   
**Operator:** CR  
**Client:** Spartan Controls

Span Gas Concentration: 5.13 ppm  
Analyzer Span Setting: 10.01 ppm

**Upscale:**

1	<u>110</u>	Seconds
2	<u>110</u>	Seconds
3	<u>110</u>	Seconds
Average:	<u><b>110</b></u>	Seconds

**Downscale**

1	<u>110</u>	Seconds
2	<u>110</u>	Seconds
3	<u>110</u>	Seconds
Average:	<u><b>110</b></u>	Seconds

The system average response time is equivalent to the slower of the  
upscale and downscale response times, which is: **110**

**ANALYZER DRIFT**  
AGAT Laboratories

Company: Spartan Controls Location: Calgary Staff: CR/JW/AS/NM  
Date: 2014/12/10-12 Test Type: RATA Condition: Normal  
Span: CO 10.01 ppm

Test #:	One	Time:	15:00	--	16:10	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 4.45 10.01 4.44 0.10

Test #:	Two	Time:	08:30	--	09:40	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 5.18 10.01 5.56 -3.80

Test #:	Three	Time:	10:05	--	11:15	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 5.56 10.01 5.81 -2.50

Test #:	Four	Time:	11:35	--	12:45	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 5.81 10.01 5.63 1.80

Test #:	Five	Time:	13:05	--	14:15	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 5.63 10.01 5.41 2.20

Test #:	Six	Time:	14:40	--	15:50	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 5.41 10.01 5.39 0.20

Test #:	Seven	Time:	16:10	--	17:20	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 5.39 10.01 5.55 -1.60

Test #:	Eight	Time:	08:25	--	09:35	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 4.95 10.01 4.77 1.80

Test #:	Nine	Time:	09:55	--	11:05	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 4.77 10.01 4.84 -0.70

Test #:	Ten	Time:	11:30	--	12:40	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0.00	10.01 4.84 10.01 5.21 -3.70

Test #:	Eleven	Time:	13:00	--	14:10	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0	10.01 5.21 10.01 5.10 1.10

Test #:	Twelve	Time:	14:30	--	15:40	2014/12/10-12
	Initial	Final	% Drift	Initial	Final	% Drift
	ZERO	DAS	ZERO	DAS	SPAN	DAS
CO	0	0	0	0	0	10.01 5.10 10.01 4.84 2.60

# ANALYZER CALIBRATION FORM

Parameter

THC

On-Site to Probe

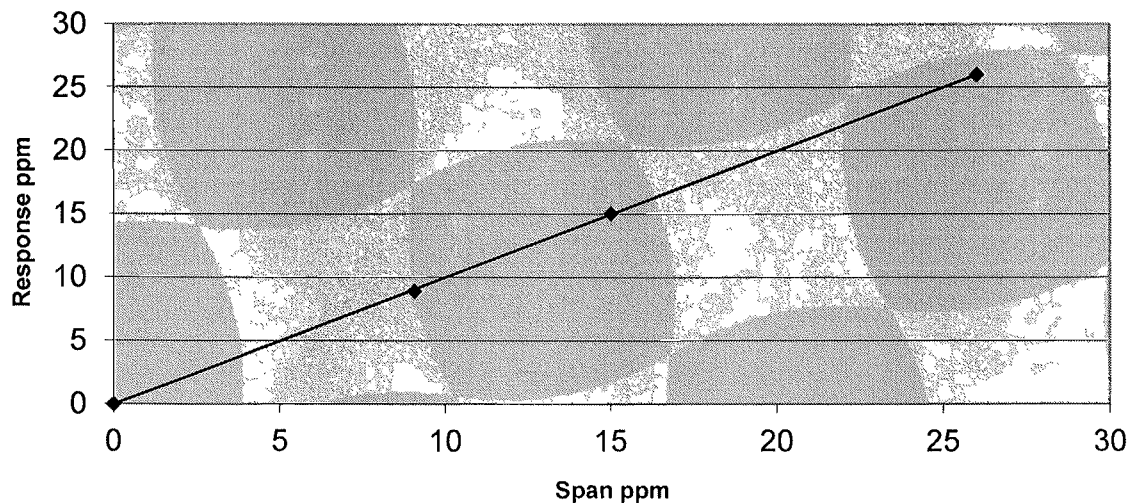
Company: Spartan Location: Calgary  
 Staff: CR/JW/AS/NM Parameter: Pre -Test Linearity  
 Date: 2014/12/10-12 Time: 8:15-8:45  
 Analyzer: \_\_\_\_\_ S/N: \_\_\_\_\_  
 Data System: ICIS 3 Dilution: 1:1

Calibration Standard	Gas	ID Number	Concentration
Compressed Cylinders	THC	CC140651	9.09 ppm
- Balance Nitrogen	THC	CSA15547	15 ppm
	THC	CC107358	26 ppm
Zero Air	N2	N/A	100 %

Analyzer Span: 26 120 seconds

Calibration Data					
Set Point	Required PPM	Dilution Factor	Actual PPM	D.A.S. Response	Percent Difference
1	-0.52 - 0.52	100	0	0	0.000
2	8.57 - 9.61	100	9.09	8.93	0.615
3	14.48 - 15.52	100	15	15.07	-0.269
4	25.48 - 26.52	100	26	26.01	-0.038
5	-0.52 - 0.52	100	0	0	0.0000

Linearity Slope: 1.0014 Y-Intercept: -0.0297 Correlation: 0.99997





**AGAT Laboratories**  
**Source Testing Services, Calgary, Alberta**

**RESPONSE TIME TESTS**

**Test Date :** 2014/12/10-12  
**Analyzer Type :** \_\_\_\_\_  
**Operator:** CR  
**Client:** Spartan

**Span Gas Concentration:** 9.09 ppm  
**Analyzer Span Setting:** 26.0 ppm

**Upscale:**

1	<u>120</u>	Seconds
2	<u>120</u>	Seconds
3	<u>120</u>	Seconds
Average:	<u>120</u>	Seconds

**Downscale**

1	<u>120</u>	Seconds
2	<u>120</u>	Seconds
3	<u>120</u>	Seconds
Average:	<u>120</u>	Seconds

The system average response time is equivalent to the slower of the  
upscale and downscale response times, which is: **120**

**ANALYZER DRIFT**  
AGAT Laboratories

Company: Spartan Location: Calgary Staff: CR/JW/AS/NM  
Date: 2014/12/10-12 Test Type: RATA Condition: Normal

Span: THC 26 ppm  
Test #: One Time: 1500 -- 1610 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.13	26	8.56	-1.65

Test #: Two Time: 0830 -- 0940 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.56	26	8.24	1.23

Test #: Three Time: 1005 -- 1115 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.24	26	8.86	-2.38

Test #: Four Time: 1135 -- 1245 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.86	26	8.76	0.38

Test #: Five Time: 1305 -- 1415 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.76	26	8.70	0.23

Test #: Six Time: 1440 -- 1550 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.70	26	7.88	3.15

Test #: Seven Time: 1610 -- 1720 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	7.88	26	8.54	-2.54

Test #: Eight Time: 0825 -- 0935 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.93	26	8.20	2.81

Test #: Nine Time: 0955 -- 1105 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	8.20	26	9.20	-3.85

Test #: Ten Time: 1130 -- 1240 2014/12/10-12

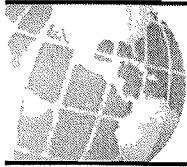
	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
THC	0	0	0	0	0.00	26	9.20	26	8.23	3.73

Test #: Eleven Time: 13:00 -- 14:10 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	26	8.23	26	7.43	3.08

Test #: Twelve Time: 14:30 -- 15:40 2014/12/10-12

	Initial		Final		% Drift	Initial		Final		% Drift
	ZERO	DAS	ZERO	DAS		SPAN	DAS	SPAN	DAS	
CO	0	0	0	0	0.00	26	7.43	26	7.38	0.19



# AGAT Laboratories

## S-TYPE PITOT TUBE CALIBRATION

Calibration Device/Location: SAIT Wind Tunnel/standard Pit

Pitot Tube Number: PT 5 EDM

Technician: TN

Calibration Date (D/M/Y): 23-Jan-14

Date Last Calibrated (D/M/Y): 24-Jan-13

Previous Factor: \_\_\_\_\_

Approx. Velocity	Reference	S-Type		Pitot Factor	Error
ft/sec	$\Delta Pr$	$\Delta Ps$	$(Ref/S-type)^{0.5}$		$\pm 0.01$ from the new factor
10	0.0245	0.0380	0.803	0.795	-0.01
10	0.0240	0.0360	0.816	0.808	0.00
20	0.0670	0.102	0.810	0.802	0.00
20	0.0680	0.103	0.813	0.804	0.00
40	0.312	0.473	0.812	0.804	0.00
40	0.312	0.472	0.813	0.805	0.00
60	0.731	1.106	0.813	0.805	0.00
60	0.731	1.109	0.812	0.804	0.00

Standard Pitot Tube Factor: 0.990      New Factor: **0.803**

Calibration Notes: Pitot Tube tips are in good shape, clean, with no deformations or damage.  
Calibrated with thermocouples in place.  
\_\_\_\_\_  
\_\_\_\_\_

# Dry Gas Meter Calibration

**Meter:** Sensus 01  $V_{Tr} = \frac{536.7}{29.92} \times \frac{(BP + Dp)}{(Tm + 460)} \times \text{Volume Reference}$   
**Technician:** TN

**Date:** Jan.21,2014  
**B.P.:** 26.49 in.Hg.  $V_{DGr} = \frac{536.7}{29.92} \times \frac{(BP + Dp)}{(Tm + 460)} \times \text{Volume Dry Gas Meter}$   
**Old Factor:** 0.9098  
**Ref. Factor** 1.0000

Reference Temperature is 77°F  
 Reference Pressure is 29.92 in.Hg

	<u><b>Trial 1</b></u>	<u><b>Trial 2</b></u>	<u><b>Trial 3</b></u>	
<b>Test Meter</b>				
Qw Volume :	10.00	10.00	10.00	cubic feet
Temp Meter :	76.0	76.0	74.5	°F
Pressure Meter:	3.15	3.15	3.20	in.H2O
Ref Vol:	8.947	8.947	8.974	Ft.3 @ REF

<b>Dry Gas Meter</b>				
Qd Volume :	9.853	9.880	9.895	cubic feet
Temp Meter :	75.5	76.0	75.5	°F
Pressure Meter:	0.31	0.31	0.31	in.H2O
Ref Vol:	8.755	8.771	8.792	Ft.3 @ REF

Meter Factor:	1.0220	1.0201	1.0206
---------------	--------	--------	--------

**New Factor:** **1.0209**

**Signature:** 

% Change: 12.2113

Notes: \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

## Certificate of Calibration Hand Held Temp Indicator

**Company:** Agat Laboratories Ltd.  
**Address:** 2910 12 Street N.E.  
Calgary, Alberta. T2P 7P7

**Date:** July 11, 2014  
**Due:** July 11, 2015  
**Tech:** Brandon McKay

**Make:** Fluke  
**Model** 51 Series II  
**Range** Various

**Location:** Lab  
**Serial #:** 88170074

### Calibration Data Type K

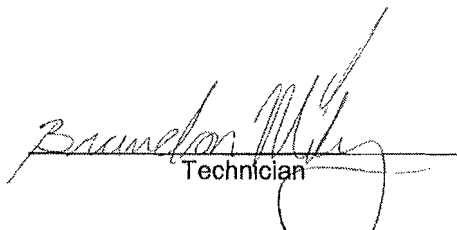
Test Point (°C)	As Found (°C)	As Left (°C)	Error (°C)	Allowable Error (°C)
1200.00	1200	1200	0.0	±1.1
800.00	799.9	799.9	-0.1	±0.9
400.00	400.0	400.0	0.0	±0.7
0.00	0.0	0.0	0.0	±0.5
-200.00	-199.8	-199.8	-0.2	±0.9

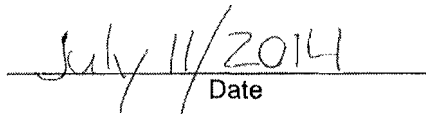
**Comments:** Thermometer is within  $\pm 0.05\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) above  $100^{\circ}\text{C}$  for J,K,E, and T types or  $\pm 0.2\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) below  $100^{\circ}\text{C}$  for J, K, and E types.  $\pm 0.5\% + 0.3^{\circ}\text{C}$  ( $0.5^{\circ}\text{F}$ ) Below  $100^{\circ}\text{C}$  for T type.

The test accuracy ratio of this calibration is at least 4:1 unless otherwise indicated. This unit has been calibrated using equipment and standards traceable to the National Research Council of Canada (NRC), the National Institute of Standards and Technology (NIST), or derived from accepted values of natural physical constants. This calibration certificate applies only to the item described and shall not be reproduced, other than in full, without approval from Reding Instrument Services Ltd.

### Calibration Standard(s) Used

Asset Used	Model Number	Serial Number	Asset Due Date
Fluke	5520A	8979001	April 17, 2015

  
Technician

  
Date



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000073270

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876395  
Customer P. O. Number: 75785  
Customer Reference Number:

Fill Date: 10/27/2014  
Part Number: EV NICOR1E-AS  
Lot Number: 109430004  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	11/4/2022	NIST Traceable
Cylinder Number:	CC258434	Analytical Uncertainty:
5.13 ppm	CARBON MONOXIDE	± 0.9 %
Balance	NITROGEN	

Certification Information: Certification Date: 11/4/2014 Term: 96 Months Expiration Date: 11/4/2022

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: 5 ppm  
Certified Concentration: 5.13 ppm  
Instrument Used: Horiba VIA-510 S/N 576876015  
Analytical Method: NDIR  
Last Multipoint Calibration: 10/20/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC130322  
Ref. Std. Conc: 10.15 ppm  
Ref. Std. Traceable to SRM #: 1677c  
SRM Sample #: 5-J-42  
SRM Cylinder #: CAL015337

First Analysis Data:				Date:	11/4/2014
Z:	0	R:	83.8	C:	42.4
R:	84.2	Z:	0	C:	42.4
Z:	0	C:	42.5	R:	84
UOM:	ppm	Mean Test Assay:	5.127	ppm	

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

Analyzed by:

Ying Yu

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000073271

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876395  
Customer P. O. Number: 75785  
Customer Reference Number:

Fill Date: 10/27/2014  
Part Number: EV NICOR1E-AS  
Lot Number: 109430005  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	11/4/2022	NIST Traceable
Cylinder Number:	CC119196	Analytical Uncertainty:
10.01 ppm	CARBON MONOXIDE	± 0.8 %
Balance	NITROGEN	

Certification Information: Certification Date: 11/4/2014 Term: 96 Months Expiration Date: 11/4/2022

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: 10 ppm  
Certified Concentration: 10.01 ppm  
Instrument Used: Horiba VIA-510 S/N 576876015  
Analytical Method: NDIR  
Last Multipoint Calibration: 10/20/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC130322  
Ref. Std. Conc: 10.15 ppm  
Ref. Std. Traceable to SRM #: 1677c  
SRM Sample #: 5-J-42  
SRM Cylinder #: CAL015337

First Analysis Data:				Date:	11/4/2014
Z:	0	R:	84.2	C:	82.8
R:	83.9	Z:	0	C:	82.9
Z:	0	C:	82.6	R:	83.8
UOM:	ppm	Mean Test Assay:	10.005 ppm		

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

Analyzed by:

Ying Yu

Certified by:

Jack Fu



Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072845

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR9ME-A8  
Lot Number: 109428713  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	CC140651	Analytical Uncertainty:
9.09 ppm	PROPANE	± 1 %
Balance	NITROGEN	

Certification Information: Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 9 ppm  
Certified Concentration: 9.09 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1668b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

First Analysis Data: Date: 10/21/2014  
Z: 0 R: 23.28 C: 21.36 Conc: 9.1  
R: 23.18 Z: 0 C: 21.31 Conc: 9.079  
Z: 0 C: 21.31 R: 23.25 Conc: 9.079  
UOM: ppm Mean Test Assay: 9.086 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: 0 ppm

Analyzed by:

Ying Yu

Certified by:

Jack Fu





Praxair  
5700 South Alameda Street  
Los Angeles, CA 90058  
Tel: (323) 585-2154 Fax: (714) 542-6689  
PGVPID: F22014

DocNumber: 000072846

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR15ME-AS  
Lot Number: 109428712  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	SA15547	Analytical Uncertainty:
15.0 ppm PROPANE		± 1 %
Balance NITROGEN		

Certification Information: Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 15 ppm  
Certified Concentration: 15.0 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1666b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

First Analysis Data: Date: 10/21/2014  
Z: 0 R: 23.28 C: 35.27 Conc: 15.027  
R: 23.18 Z: 0 C: 35.27 Conc: 15.027  
Z: 0 C: 35.27 R: 23.25 Conc: 15.027  
UOM: ppm Mean Test Assay: 15.027 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: 0 ppm

Analyzed by:

Ying Yu

Certified by:

Jack Fu



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5700 South Alameda Street  
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PGVPID: F22014

DocNumber: 000072847

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

AGAT LAB \*G\*MS\*  
2420 42 AVE NE  
CALGARY AB T1Y 7H

Praxair Order Number: 21876447  
Customer P. O. Number: 75786  
Customer Reference Number:

Fill Date: 10/14/2014  
Part Number: NI PR26ME-AS  
Lot Number: 109428711  
Cylinder Style & Outlet: AS CGA 350  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	10/21/2022	NIST Traceable
Cylinder Number:	CC107358	Analytical Uncertainty:
26.0 ppm PROPANE	± 1 %	
Balance NITROGEN		

Certification Information: Certification Date: 10/21/2014 Term: 96 Months Expiration Date: 10/21/2022

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: PROPANE

Requested Concentration: 26 ppm  
Certified Concentration: 26.0 ppm  
Instrument Used: HORIBA, FIA-510, 851135122  
Analytical Method: Flame Ionization  
Last Multipoint Calibration: 10/11/2014

First Analysis Data: Date: 10/21/2014  
Z: 0 R: 23.2 C: 60.9 Conc: 25.913  
R: 23.3 Z: 0 C: 61.1 Conc: 25.998  
Z: 0 C: 61.1 R: 23.3 Conc: 25.998  
UOM: ppm Mean Test Assay: 25.97 ppm

Analyzed by:

Ying Yu

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC147258  
Ref. Std. Conc: 9.900 ppm  
Ref. Std. Traceable to SRM #: 1666b  
SRM Sample #: 84-K-35  
SRM Cylinder #: FF10676

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: 0 ppm

Certified by:

Jack E. [Signature]

**-END OF DOCUMENT-**