



**DILLON**  
CONSULTING

TRIPLE GREEN PRODUCTS

# Biomass Boiler Emissions Testing Program

Morris, Manitoba

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# Executive Summary

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Dillon Consulting Limited (Dillon) was retained by Triple Green Products to conduct source testing for particulate matter and combustion gas emissions associated with their biomass boiler and emission control system. The source testing results were requested to provide documentation on emissions to support bids to install these systems in jurisdictions across Canada.

The biomass boiler is operated by Triple Green Products at their facility near Morris, Manitoba. The fuel was a low grade wood chip waste (26 – 30 % moisture) from a board plant. The estimated average biomass feed rate over the duration of the test program was 292 lbs per hour.

The total suspended particulate matter sampling was completed according to US EPA Methods 1 to 5 while stack gas composition ( $O_2$  and  $CO_2$  concentrations) and combustion gas concentrations ( $NO_x$ ,  $CO$ ,  $SO_2$ ) were measured using US EPA Reference Methods:

- US EPA Method 7E for nitrogen oxides ( $NO_x$ );
- US EPA Method 10 for carbon monoxide ( $CO$ );
- US EPA Method 6C for sulphur dioxide ( $SO_2$ ); and
- US EPA Method 3A for oxygen ( $O_2$ ) and carbon dioxide ( $CO_2$ ).

The average suspended particulate matter emission rate for the three tests was 0.0192 g/s. This result, combined with the boiler fuel (woodwaste) feed rate of 132.5 kg/hr, gives an average fuel-based emission rate of 0.522 g/kg of fuel.

The average  $NO_x$ ,  $CO$  and  $SO_2$  concentrations were 38.7 ppm, 613 ppm and <1 ppm, respectively. On a fuel input basis, the  $NO_x$ ,  $CO$  and  $SO_2$  emission rates were 1.00 g/kg, 9.72 g/kg and <0.036 g/kg, respectively.

Dillon successfully completed the source testing program to quantify total suspended particulate matter and combustion gas emission rates for the biomass boiler and emission control system at the Triple Green Products facility. All source testing was conducted in triplicate following reference methodologies.

## 1.0

# Background

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Dillon Consulting Limited (Dillon) was retained by Triple Green Products to conduct source testing for particulate matter and combustion gas emissions associated with their biomass boiler and emission control system. The subject equipment is installed at a facility located near Morris, Manitoba. The source testing program was conducted to provide compliance quality emission data for the subject equipment.

Dillon performed the emissions testing according to US EPA reference test methods. The on-site sampling for this testing program was conducted by Nick LaValle and Tom Ryan over a two day period of April 16<sup>th</sup> and 17<sup>th</sup>, 2021.

Triple Green Products personnel operated the boiler and emission control systems throughout the testing program. Triple Green Products also arranged for the installation of suitable sampling ports and access to the testing location (mechanical lift).

## 1.1

## Disclaimer

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This report was prepared by Dillon for the sole benefit of our client. The material in it reflects Dillon's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

## Objectives and Scope

The purpose of the source testing program was to quantify the particulate matter and combustion gas emissions associated with the biomass boiler and emission control system. The source testing results were requested to provide documentation on emissions to support bids to install these systems in jurisdictions across Canada. Table 1 provides a Test Matrix for the source testing program.

Table 1: Source Test Program Test Matrix

Sampling Location	No. of Runs	Sample/Type Pollutant	Sampling Method	Sample Run Time (approx.) (min)	Analytical Method	Analytical Laboratory
Biomass Boiler Exhaust	3	Total Suspended Particulate Matter	US EPA M.5	60 to 120/test	EPA M. 5 (gravimetric)	BV Labs
	3	NOx, CO, SO <sub>2</sub> , O <sub>2</sub> , CO <sub>2</sub>	US EPA M.7E, 10, 6C, 3A	60/test	CEM	N/A

Notes:

BV Labs: Bureau Veritas, Mississauga, Ontario

CEM: continuous emission monitor

3.0

## Source Description

The following sections contain a description of the processes and controls for the emission source tested.

3.1

### Process Description

A biomass boiler is manufactured by Triple Green Products at their facility near Morris, Manitoba. The boiler is a Triple Green Flame, Model # TGP-CGS277 with a size rating of 1.7 MBtu. The fuel was a low grade wood chip waste (26 – 30 % moisture) from a board plant.

3.2

### Control Equipment Description

The boiler exhaust is equipped with a TGP Multi-Cyclone dust collector system for the removal of particulate matter emissions.

## 4.0 Sampling Locations

### 4.1 Flue Gas Sampling Locations

The particulate matter sampling location details for the boiler system exhaust are as follows:

SOURCE:	BOILER EXHAUST
Stack Height:	~2.5 m above Roof
Stack Diameter:	0.305 m
Sampling ports location:	~2.0 m above roof, circular exhaust stack
Port Diameter:	7.6 cm
No. of Ports:	2
Ports Ideally Located:	No
Downstream from any disturbance:	>8 stack diameters
Upstream from any disturbance:	>2 stack diameters
No. and configuration of traverse points:	8 points (4 per traverse)
	1) 2.5 (cm)
	2) 7.6 (cm)
	3) 22.9 (cm)
	4) 28.0 (cm)

The exhaust gases are well mixed at the point of entry to the vertical exhaust stack. No reverse flow, cyclonic flow, or stratified flow conditions exist at the exhaust stack sampling location.

## 5.0

# Sampling Methodologies

The sampling and analytical procedures employed for this testing program followed reference test methods and were completed in accordance with these methods without deviation.

## 5.1

## Test Methods

The total suspended particulate matter sampling was completed according to US EPA Methods 1 to 5. The sampling equipment used to measure the stack gas velocity meets US EPA Reference Method 2 requirements and the stack gas moisture content was determined according to US EPA Reference Method 4 (condensation method). The sampling equipment met the requirements set forth in US EPA Method 5. Stack gas flow measurements were made using a calibrated S-type pitot tube/thermocouple assembly along with a primary standard inclined manometer and temperature readouts. Calibration records for the dry gas meter and sampling probe are provided in Appendix B.

The first particulate matter test was conducted over a 120 minute duration. Based on an assessment of the particulate loading for this test, the sample time was reduced to 60 minutes in duration for the second and third tests.

Stack gas composition ( $O_2$  and  $CO_2$  concentrations) and combustion gas concentrations ( $NO_x$ ,  $CO$ ,  $SO_2$ ) were measured using US EPA Reference Methods:

- US EPA Method 7E for nitrogen oxides ( $NO_x$ );
- US EPA Method 10 for carbon monoxide ( $CO$ );
- US EPA Method 6C for sulphur dioxide ( $SO_2$ ); and
- US EPA Method 3A for oxygen ( $O_2$ ) and carbon dioxide ( $CO_2$ ).

A CEM testing trailer was mobilized to the site and located adjacent to the boiler building and stack. The test trailer was equipped with the full CEM monitoring system including stainless steel probes, a heated ceramic filter unit, heated Teflon sample lines, stainless steel heated head pump, gas conditioning system (moisture removal), rack-mounted emission monitors, and an electronic data acquisition system. The trailer also housed the Protocol 1 calibration gases (compressed gases) and the gas dilution system to be used for system calibration.

Three one-hour tests for each of the target combustion gases were conducted for this testing program. Data was logged at one-minute intervals over the 1-hour testing period. Analyzer calibrations were conducted prior to and at the completion of each test to demonstrate compliance with the measurement system performance test criteria defined in Method 6C.

## 5.1.1 Process Data

Triple Green Products monitored the boiler feed and operation throughout the source testing program. The estimated average biomass feed rate over the duration of the test program was 292 lbs per hour.

## 6.0 Source Testing Results

Tables 2, 3 and 4 summarize the results of isokinetic total suspended particulate matter testing and the combustion gas testing performed on the biomass boiler system. Appendix A contains the stack data summary sheets for this testing and Appendix B contains the equipment calibration data. Appendix C contains the BV Labs Certificates of Analysis.

Table 2: Suspended Particulate Matter Test Results

Test Location	Test Date	Test Time	Woodwaste Feed Rate	Flue Gas Temp.	Flue Gas Velocity	Water Vapour Content	Flue Gas Flow Rate			Total Filterable Particulate Emissions				
										Concentration		Emission Rate		
			kg/hr	°C	m/s	% by vol.	acfm	dscfm	m³/s	lb/ft³	mg/m³	lb/hr	g/s	g/kg fuel
Boiler Exhaust	04/17/2021	07:05-09:25	132.5	93	8.4	8.6	1,330	970	0.456	1.87E-06	29.94	0.108	0.0137	0.371
	04/17/2021	10:08-11:18		93	10.2	8.8	1,600	1,160	0.549	1.81E-06	28.98	0.126	0.0159	0.432
	04/17/2021	12:09-13:25		94	9.7	9.4	1,530	1,100	0.520	3.37E-06	53.94	0.222	0.0280	0.762
	Average		132.5	93	9.4	8.9	1,490	1,080	0.508	2.35E-06	37.62	0.152	0.0192	0.522

Table 3: Combustion Gas Concentration Test Results

Source	Date (2021)	Sample Time	Diluent Gas Concentration		Combustion Gas Concentration					
			O <sub>2</sub>	CO <sub>2</sub>	NO <sub>x</sub>		CO		SO <sub>2</sub>	
			%	%	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³
Biomass Boiler Exhaust	April 17	07:00-08:00	16.11	5.08	40.2	75.5	782	900	<1	<2.6
		08:30-09:30	15.43	5.92	37.9	71.3	574	660	<1	<2.6
		13:00-14:00	15.14	6.17	38.1	71.6	482	554	<1	<2.6
	Average:		15.56	5.72	38.7	72.8	613	705	<1	<2.6

Table 4: Combustion Gas Emission Rate Test Results

Source	Date (2021)	Sample Time	Woodwaste Feed Rate	Stack Gas Flow Rate <sup>(1)</sup>	Combustion Gas Emission <sup>(3)</sup>					
					NO <sub>x</sub>		CO		SO <sub>2</sub>	
					kg/hr	m <sup>3</sup> /s (dry, std)	g/s	g/kg fuel	g/s	g/kg fuel
Biomass Boiler Exhaust	April 17	07:00-08:00	132.5	0.508	0.038	1.04	0.457	12.42	<0.001	<0.036
		08:30-09:30			0.036	0.98	0.335	9.11	<0.001	<0.036
		13:00-14:00			0.036	0.99	0.281	7.65	<0.001	<0.036
	Average:		132.5	0.508	0.037	1.00	0.358	9.72	<0.001	<0.036

Note:

(1) Stack gas flow rates were obtained from the three particulate matter test completed on the same day.

## Discussion of Source Testing Results

There were no process interruptions during the source testing program. The boiler load and fuel feed rate was maintained constant for all tests.

Based on the triplicate testing of the biomass boiler on April 17, 2021, the particulate concentrations ranged from 29.9 to 53.9 mg/m<sup>3</sup>, with an average concentration of 37.6 mg/m<sup>3</sup>. The measured stack gas flow rate ranged from 0.456 to 0.549 m<sup>3</sup>/s at reference conditions, with an average flow rate of 0.508 m<sup>3</sup>/s. The stack gas temperature averaged 93 °C while the average stack gas moisture content was 8.9% by volume.

The average suspended particulate matter emission rate for the three tests was 0.0192 g/s. This result, combined with the boiler fuel (woodwaste) feed rate of 132.5 kg/hr, gives an average fuel-based emission rate of 0.522 g/kg of fuel.

The average percent isokineticity for each test on each source was within the acceptable range of 100%±10%. Pre-test and post-test leak checks were within the acceptable leak rate limit. The total suspended particulate matter test results should be accepted as compliance quality data.

Triplicate testing of the biomass boiler for NO<sub>x</sub>, CO, and SO<sub>2</sub> was conducted on April 17, 2021. The average NO<sub>x</sub>, CO and SO<sub>2</sub> concentrations were 38.7 ppm, 613 ppm and <1 ppm, respectively. On a fuel input basis, the NO<sub>x</sub>, CO and SO<sub>2</sub> emission rates were 1.00 g/kg, 9.72 g/kg and <0.036 g/kg, respectively.

The QA/QC measures utilized during the testing program included linearity checks, system bias checks and system drift checks. Results of these sampling system tests were compared to the criteria defined in US EPA Method 6C. A linearity check (analyzer calibration error) was conducted for each analyzer prior to the start of testing. All gas analyzers met the linearity criteria of 2%. The sampling system for each contaminant was calibrated prior to and at the completion of each 1-hour test to allow the calculation of system bias and drift. The system bias criteria of 5% and drift criteria of 3% were met for each of the three tests completed on the generator exhaust.

The combustion gas emission test results should be accepted as compliance quality data.

## Closure

This report was prepared exclusively for the purposes, project, and site location outlined in the report. The report is based on information provided to, or obtained by Dillon as indicated in the report, and applies solely to site conditions existing at the time of the source testing. Dillon's report represents a reasonable review of available information within an agreed work scope, schedule, and budget.

This report was prepared by Dillon for the sole benefit of our client. The material in it reflects Dillon's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Dillon accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Respectfully submitted,

DILLON CONSULTING LIMITED

A handwritten signature in black ink, appearing to read "Dave Diemer". The signature is fluid and cursive, with the first name "Dave" and last name "Diemer" clearly distinguishable.

David Diemer, P.Eng.  
Project Manager

# Appendix A

## Stack Data Summary Sheets

RUN No. R1  
JOB No. 21-1647

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft³)	Pitot ΔP (in. H₂O)	Stack Temp (°F)	Orifice Press. ΔH (in H₂O)		Gas Temperatures (°F)							Pump Vac. (in Hg)	K FACTOR = 22.212	
	Begin	End				Probe	Filter	Imp. Exit	DGM		XAD	% ISO	Vs (fps)				
									Inlet	Outlet							
1	0	3.0	619.380	0.080	199	1.811	1.85	239	247	31	57	58		1.0	101.5	17.78	
1	3	6.0	621.650	0.130	196	2.917	3.00	240	255	32	57	57		2.5	100.2	22.61	
1	6	9.0	624.500	0.150	196	3.353	3.40	239	240	32	57	57		4.0	102.2	24.29	
1	9	12.0	627.620	0.170	195	3.802	3.85	239	254	33	57	57		5.0	100.0	25.83	
1	12	15.0	630.870	0.170	195	3.798	3.80	240	244	35	58	57		5.0	100.8	25.83	
2	15	18.0	634.150	0.170	195	3.802	3.80	238	258	38	58	57		6.0	100.2	25.83	
2	18	21.0	637.410	0.190	195	4.249	4.30	237	242	38	58	57		7.0	99.3	27.31	
2	21	24.0	640.820	0.190	196	4.237	4.30	238	244	39	58	57		7.0	92.6	27.33	
2	24	27.0	644.000	0.190	196	4.237	4.30	240	240	40	58	57		8.0	95.0	27.33	
2	27	30.0	647.260	0.190	197	4.231	4.30	240	248	41	58	57		9.0	95.3	27.35	
3	30	33.0	650.530	0.190	196	4.237	4.30	239	251	42	58	57		10.0	95.3	27.33	
3	33	36.0	653.800	0.180	197	4.008	4.00	240	247	43	57	57		10.0	95.9	26.62	
3	36	39.0	657.000	0.180	197	4.007	4.00	240	251	43	57	57		11.0	96.5	26.62	
3	39	42.0	660.220	0.180	199	3.995	4.00	240	253	44	57	57		11.0	96.9	26.67	
3	42	45.0	663.450	0.180	200	3.989	4.00	241	252	45	57	57		12.0	97.6	26.69	
4	45	48.0	666.700	0.180	201	3.983	4.00	239	240	45	57	57		12.0	95.3	26.71	
4	48	51.0	669.870	0.180	200	3.989	4.00	241	251	47	57	57		12.0	100.0	26.69	
4	51	54.0	673.200	0.170	201	3.762	3.80	239	241	48	57	57		13.0	95.2	25.95	
4	54	57.0	676.280	0.170	200	3.769	3.80	241	241	49	58	57		13.0	97.8	25.93	
4	57	60.0	679.450	0.170	200	3.773	3.80	240	251	49	57	57		13.0	96.7	25.93	
	60	-	682.580												-	-	
1	0	3.0	682.580	0.160	201	3.182	3.60	241	252	49	57	57		13.0	97.8	25.18	
1	3	6.0	685.650	0.160	201	3.544	3.60	241	244	50	58	57		13.0	98.6	25.18	
1	6	9.0	688.750	0.160	202	3.542	3.60	240	249	51	58	57		13.0	98.1	25.20	
1	9	12.0	691.830	0.160	203	3.537	3.60	240	241	51	58	59		13.0	96.7	25.22	
1	12	15.0	694.870	0.160	203	3.544	3.60	239	246	51	58	59		14.0	101.1	25.22	
2	15	18.0	698.050	0.300	193	6.746	6.80	239	249	41	61	60		5.0	97.2	34.27	
2	18	21.0	702.250	0.300	197	6.677	6.80	234	255	41	60	60		5.0	93.4	34.37	
2	21	24.0	706.270	0.350	201	7.736	7.80	231	246	42	60	61		7.0	92.9	37.24	
2	24	27.0	710.570	0.350	201	7.724	1.80	233	247	45	61	61		7.0	91.5	37.24	
2	27	30.0	714.870	0.350	201	7.848	7.80	237	246	45	61	61		9.0	92.6	37.24	
3	30	33.0	719.160	0.300	199	6.647	6.70	236	259	52	62	61		9.0	94.0	34.42	
3	33	36.0	723.210	0.250	202	5.535	5.60	235	243	55	63	62		9.0	94.1	31.50	
3	36	39.0	726.920	0.250	200	5.577	5.60	230	246	56	63	62		9.0	93.4	31.45	
3	39	42.0	730.610	0.230	198	5.147	5.20	227	257	56	63	62		10.0	96.1	30.12	
3	42	45.0	734.260	0.230	198	5.152	5.20	230	246	57	64	62		10.0	96.0	30.12	
4	45	48.0	737.910	0.230	198	5.157	5.20	235	247	58	64	62		10.0	97.0	30.12	
4	48	51.0	741.600	0.230	199	5.149	5.20	234	246	58	64	62		11.0	94.8	30.14	
4	51	54.0	745.200	0.210	199	4.701	4.80	236	243	59	64	62		11.0	95.8	28.80	
4	54	57.0	748.680	0.210	200	4.699	4.80	235	250	61	64	62		11.0	95.0	28.82	
4	57	60.0	752.130	0.200	198	4.488	4.60	235	254	62	64	62		12.0	97.2	28.09	
3	Final DGM:		755.580														

RESULTS	Run Time		Vm	Ts	ΔP (H <sub>2</sub> O)	Tm	ΔH (H <sub>2</sub> O)	Pm in Hg	Max Vac.	%ISO	Vs
			3.857 m <sup>3</sup>	92.6 °C	5.21 mm	15.0 °C	113.35 mm				8.60 m/s
	120.00 min	136.200 ft <sup>3</sup>	198.6 °F	0.205 in	59.1 °F	4.463 in	29.59	14.0	96.7	28.16 ft/s	
	Vm <sub>std</sub>	Vw <sub>std</sub>	%H <sub>2</sub> O	Qsd	Qsw	Qsa	Concentration	Emission Rate			
	3.9744 dscm	0.3722 scm	(meas.)	27.39 dscmm	29.97 scmm	37.58 acmm	29.9 mg/dscm	0.049 kg/hr			
	140.341 dscf	13.142 scf	8.6	967.3 dscfm	1,058 scfm	1,327 acfm	1.87E-06 lb/dscf	0.108 lb/hr			
	Isokinetic validity:		valid run	0.45649 dscm/s	0.49945 scm/s	0.62637 acm/s		0.014 g/s			

Location: <b>TRIPLE GREEN</b>			Start Time: <b>10:08 AM</b>			RUN No. <b>R2</b>		
Date (mm/dd/yy): <b>04/17/21</b>			Method: <b>TSP</b>			End Time: <b>11:18 AM</b>		
						JOB No. <b>21-1647</b>		

STACK DATA			EQUIPMENT			ESTIMATES			FILTERS			STP at 25C 101.3 kPa Sheet Modified June 6, 2011		
% Moisture:	<b>8.8</b>	% est.	METER BOX: <b>M5C-2</b>  Y: <b>1.007</b> Ko: <b>0.706</b> ΔH@: <b>1.746</b> in H <sub>2</sub> O			Est. Tm:	<b>75</b>	°F	Filter #	Tare Weight				
Barometric:	<b>29.24</b>	in Hg				Est. Ts:	<b>95</b>	°F	<b>20121834</b>					
Static Press:	<b>-0.07</b>	in H <sub>2</sub> O				Est. dP:	<b>1.2</b>	in H <sub>2</sub> O						
Stack Press:	<b>29.24</b>	in Hg				Est. Dn:	<b>0.204</b>	inches						
%CO <sub>2</sub> :	<b>5.9</b>	%	PITOT: <b>VES-3A</b> 0 Cp: <b>0.828</b> NOZZLE: <b>12</b> Dn: <b>0.310</b> in			LEAK CHECKS				FINAL CATCH				
%O <sub>2</sub> :	<b>15.4</b>	%				DGM (Vm) initial	<b>755.9</b>	<b>802.01</b>	cf	Liquid Vol. (ml) <b>92.3</b>				
%N <sub>2</sub> /CO:	<b>78.70</b>	%				Vm start timer	<b>755.9</b>	<b>802.2</b>	cf					
Md:	<b>29.56</b>	lb/lb-mole	Stack Area: <b>0.79</b> ft <sup>2</sup> Stack Diameter: <b>12</b> inches			Vm stop timer	<b>755.91</b>	<b>802.2</b>	cf	Particulate Mass (mg) <b>37.7</b>				
Ms:	<b>28.54</b>	lb/lb-mole				Leak Rate	<b>0.005</b>	<b>0</b>	<b>0</b>			cfm		
Msa:	<b>28.5427</b>	lb/lb-mole				Vacuum	<b>15</b>	<b>15</b>	<b>15</b>	in. Hg				

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft <sup>3</sup> )	Pitot ΔP (in. H <sub>2</sub> O)	Stack Temp (°F)	Orifice Press. ΔH (in H <sub>2</sub> O)		Gas Temperatures (°F)						Pump Vac. (in Hg)	K FACTOR = <b>7.843</b>	
	Begin	End				Ideal	Actual	Imp.		DGM		XAD	% ISO		Vs (fps)	
								Probe	Filter	Exit	Inlet					Outlet
1	0	2.5	755.940	0.210	198	1.374	1.15	237	246	47	69	68		1.0	100.6	28.76
1	2.5	5.0	757.590	0.300	200	1.931	1.90	240	248	44	69	68		1.0	95.8	34.42
1	5	7.5	759.460	0.310	201	1.989	2.00	237	248	42	70	69		1.0	97.6	35.02
2	7.5	10.0	761.400	0.290	201	1.863	2.00	239	236	42	70	69		1.0	99.9	33.87
2	10	12.5	763.320	0.280	201	1.799	1.75	241	253	42	71	69		1.0	100.5	33.28
2	12.5	15.0	765.220	0.300	201	1.931	1.90	241	251	43	71	69		2.0	101.2	34.45
3	15	17.5	767.200	0.300	201	1.930	1.90	240	244	44	72	69		2.0	97.5	34.45
3	17.5	20.0	769.110	0.300	202	1.929	1.90	241	251	44	73	69		2.0	101.6	34.48
3	20	22.5	771.100	0.330	202	2.124	2.05	239	248	44	73	69		2.0	99.8	36.16
4	22.5	25.0	773.150	0.340	202	2.187	2.10	242	238	46	74	69		3.0	93.9	36.70
4	25	27.5	775.110	0.320	201	2.063	2.00	240	250	46	74	71		3.0	100.5	35.58
4	27.5	30.0	777.150	0.320	200	2.071	2.00	242	256	46	74	71		3.0	97.5	35.55
	30	-	779.130												-	-
1	0	2.5	779.130	0.260	201	1.459	1.40	241	245	50	75	73		2.0	93.0	32.07
1	2.5	5.0	780.840	0.260	200	1.690	1.65	245	247	47	75	73		3.0	101.2	32.05
1	5	7.5	782.700	0.280	201	1.816	1.75	242	249	45	75	73		3.0	92.4	33.28
2	7.5	10.0	784.460	0.290	200	1.883	1.80	240	250	45	75	73		4.0	98.9	33.85
2	10	12.5	786.380	0.290	196	1.894	1.80	240	256	45	75	73		4.0	100.2	33.74
2	12.5	15.0	788.330	0.290	195	1.897	1.80	240	248	45	75	73		4.0	97.5	33.72
3	15	17.5	790.230	0.290	195	1.897	1.85	240	246	45	76	73		4.0	100.0	33.72
3	17.5	20.0	792.180	0.290	199	1.887	1.85	240	245	45	76	73		4.0	99.8	33.82
3	20	22.5	794.120	0.310	198	2.021	1.95	240	250	45	76	74		5.0	101.4	34.94
4	22.5	25.0	796.160	0.310	199	2.019	1.95	235	244	46	76	75		5.0	95.4	34.97
4	25	27.5	798.080	0.280	199	1.825	1.80	240	252	46	76	75		5.0	102.4	33.23
4	27.5	30.0	800.040	0.300	199	1.956	1.90	242	250	46	76	75		5.0	99.5	34.40
9999	Final DGM:		802.010													

RESULTS	Run Time		Vm	Ts	ΔP (H <sub>2</sub> O)	Tm	ΔH (H <sub>2</sub> O)	Pm	Max Vac.	%ISO	Vs
	60.00	min	1.305 m <sup>3</sup>	93.1 °C	7.46 mm	22.5 °C	46.73 mm	in Hg			10.39 m/s
			46.070 ft <sup>3</sup>	199.7 °F	0.294 in	72.5 °F	1.840 in	29.38	5.0	98.7	34.02 ft/s
	Vm <sub>std</sub>	Vw <sub>std</sub>	%H <sub>2</sub> O (meas.)	Qsd	Qsw	Qsa	Concentration	Emission Rate			
	1.3009 dscm	0.1255 scm		32.93 dscmm	36.11 scmm	45.40 acmm	29.0 mg/dscm	0.057 kg/hr			
	45.936 dscf	4.430 scf	8.8	1,163 dscfm	1,275 scfm	1,603 acfm	1.81E-06 lb/dscf	0.126 lb/hr			
Isokinetic validity:			valid run	0.54887 dscm/s	0.60183 scm/s	0.76 acm/s			0.016 g/s		

Location: **TRIPLE GREEN** Start Time: **12:09 PM** RUN No. **R3**  
 Date (mm/dd/yy): **04/17/21** Method: **Method 5** End Time: **1:25 PM** JOB No. **21-1647**

STACK DATA	EQUIPMENT	ESTIMATES	FILTERS	STP at 25C 101.3 kPa Sheet Modified June 6, 2011
% Moisture: <b>9.4</b> % est.	METER BOX: M5C-S	Est. Tm: <b>75</b> °F	Filter #	
Barometric: <b>29.21</b> in Hg	Y: <b>1.007</b>	Est. Ts: <b>199</b> °F	<b>2021835</b>	
Static Press: <b>-0.07</b> in H <sub>2</sub> O	Ko: <b>0.706</b>	Est. dP: <b>0.2</b> in H <sub>2</sub> O		
Stack Press: <b>29.20</b> in Hg	ΔH@: <b>1.746</b> in H <sub>2</sub> O	Est. Dn: <b>0.334</b> inches		
%CO <sub>2</sub> : <b>6.2</b> %	PITOT: VES-3A	LEAK CHECKS		FINAL CATCH
%O <sub>2</sub> : <b>15.1</b> %	0 Cp: <b>0.828</b>	DGM (Vm) initial <b>802.2</b>	<b>846.43</b> cf	Liquid Vol. (ml)
%N <sub>2</sub> /CO: <b>78.70</b> %	NOZZLE: <b>12</b>	Vm start timer <b>802.265</b>	<b>846.47</b> cf	<b>94.4</b>
Md: <b>29.60</b> lb/lb-mole	Dn: <b>0.310</b> in	Vm stop timer <b>802.265</b>	<b>846.47</b> cf	Particulate Mass (mg)
Ms: <b>28.51</b> lb/lb-mole	Stack Area: <b>0.79</b> ft <sup>2</sup>	Leak Rate <b>0</b> <b>0</b> <b>0</b> cfm		<b>66.6</b>
Msa: <b>28.506</b> lb/lb-mole	Stack Diameter: <b>12</b> inches	Vacuum <b>15</b> <b>15</b> <b>15</b> in. Hg		

Sample Point	Sample Time (minutes)		Dry Gas Meter Reading (ft³)	Pitot	Stack	Orifice Press. ΔH (in H <sub>2</sub> O)		Gas Temperatures (°F)						Pump Vac. (in Hg)	K FACTOR = 6.535	
				ΔP				Temp	Probe		Filter	Imp. Exit	DGM		XAD	% ISO
	(in. H <sub>2</sub> O)	(°F)		Ideal	Actual	Inlet	Outlet									
	Begin	End														
1	0	2.5	802.340	0.200	194	1.314	1.10	245	245	60	73	73		1.0	100.0	28.01
1	2.5	5.0	803.950	0.200	195	1.294	1.30	241	241	48	74	74		1.0	101.8	28.03
1	5	7.5	805.590	0.200	195	1.296	1.30	249	250	44	74	73		1.0	105.0	28.03
2	7.5	10.0	807.280	0.200	196	1.293	1.30	244	248	43	74	73		1.0	98.2	28.06
2	10	12.5	808.860	0.210	199	1.352	1.30	240	243	43	74	73		1.0	99.7	28.81
2	12.5	15.0	810.500	0.220	198	1.418	1.40	240	237	43	75	73		1.0	100.9	29.47
3	15	17.5	812.200	0.220	199	1.417	1.40	242	240	44	75	74		1.0	100.9	29.49
3	17.5	20.0	813.900	0.250	200	1.609	1.60	243	238	44	75	74		1.0	94.7	31.46
3	20	22.5	815.600	0.250	199	1.611	1.60	241	239	44	76	75		1.0	101.2	31.44
4	22.5	25.0	817.420	0.300	199	1.937	1.90	243	250	44	76	75		2.0	98.5	34.44
4	25	27.5	819.360	0.300	200	1.932	1.90	243	249	45	77	75		2.0	102.0	34.47
4	27.5	30.0	821.370	0.300	200	1.934	1.90	245	252	46	77	75		2.0	100.0	34.47
	30	-	823.340												-	-
1	0	2.5	823.340	0.210	197	1.173	1.20	244	256	48	78	76		2.0	92.9	28.77
1	2.5	5.0	824.880	0.300	199	1.944	1.90	240	254	44	78	76		2.0	97.7	34.44
1	5	7.5	826.810	0.310	199	2.005	2.00		250	42	78	76		2.0	101.1	35.01
2	7.5	10.0	828.840	0.290	202	1.867	1.80	230	246	42	78	76		2.0	101.1	33.94
2	10	12.5	830.800	0.280	203	1.801	1.75	241	246	43	78	76		3.0	100.9	33.37
2	12.5	15.0	832.720	0.300	203	1.929	1.90	238	250	43	79	77		3.0	96.3	34.54
3	15	17.5	834.620	0.300	204	1.929	1.90	237	251	43	79	77		3.0	95.4	34.57
3	17.5	20.0	836.500	0.300	205	1.927	1.90	242	250	44	79	77		3.0	91.9	34.60
3	20	22.5	838.310	0.330	206	2.116	2.10	239	250	44	79	77		4.0	98.4	36.31
4	22.5	25.0	840.340	0.340	205	2.182	2.15	238	249	44	79	77		4.0	98.3	36.83
4	25	27.5	842.400	0.320	205	2.054	2.00	240	249	44	79	77		4.0	99.8	35.73
4	27.5	30.0	844.430	0.320	206	2.051	2.00	242	250	44	79	77		4.0	98.4	35.76
9999	Final DGM:		846.430													

RESULTS	Run Time		Vm	Ts	ΔP (H <sub>2</sub> O)	Tm	ΔH (H <sub>2</sub> O)	Pm	Max Vac.	%ISO	Vs
	60.00 min		1.249 m <sup>3</sup>	93.5 °C	6.83 mm	24.5 °C	42.97 mm	in Hg			9.92 m/s
			44.090 ft <sup>3</sup>	200.3 °F	0.269 in	76.0 °F	1.692 in	29.33	4.0	99.0	32.50 ft/s
	Vm <sub>std</sub>		VW <sub>std</sub>	%H <sub>2</sub> O (meas.)	Qsd	Qsw	Qsa	Concentration		Emission Rate	
	1.2349 dscm	0.1283 scm		31.18 dscmm	34.42 scmm	43.36 acmm	53.9 mg/dscm	0.101 kg/hr			
	43.605 dscf	4.531 scf	9.4	1,101 dscfm	1,215 scfm	1,531 acfm	3.37E-06 lb/dscf	0.222 lb/hr			
Isokinetic validity:				valid run	0.5197 dscm/s	0.57362 scm/s	0.72272 acm/s			0.028 g/s	

## SUMMARY CORRECTED DATA

CLIENT PROJECT NUM. LOCATION	TRIPLE GREEN DILLON 21-1647 BOILER			DATE TIME START TIME FINISH	4/17/2021 7:00 8:00	
	TEST NUMBER			1		
	TIME	O2	CO2	CO	NOX	SO2
	%	%	PPM	PPM	PPM	
7:00:02	16.39	4.7	874.8	42.1	0.2	
7:01:03	16.20	5.1	850.2	41.6	0.4	
7:02:02	16.06	5.1	788.6	42.3	-0.5	
7:03:02	15.89	5.3	761.2	42.1	-0.5	
7:04:03	16.39	4.7	877.6	41.1	-0.4	
7:05:02	16.40	4.8	732.1	38.6	-0.7	
7:06:03	16.38	4.8	713.0	39.2	-0.8	
7:07:02	16.35	4.8	690.3	39.3	-0.7	
7:08:03	16.32	4.8	760.8	39.1	-0.6	
7:09:02	16.47	4.7	829.3	38.6	-0.4	
7:10:02	17.00	4.1	903.3	35.3	-0.2	
7:11:03	16.91	4.3	868.5	34.0	0.4	
7:12:02	16.58	4.6	750.6	37.1	0.6	
7:13:03	16.68	4.5	812.2	35.5	0.4	
7:14:02	16.59	4.6	861.9	34.1	0.5	
7:15:03	16.40	4.7	962.5	35.8	0.4	
7:16:02	16.47	4.7	982.6	34.4	0.4	
7:17:02	16.72	4.4	1021.5	36.1	0.4	
7:18:03	16.41	4.8	870.2	35.9	0.4	
7:19:02	16.58	4.5	734.9	38.8	0.2	
7:20:03	16.50	4.7	867.2	32.1	0.3	
7:21:02	15.93	5.3	648.4	40.8	0.3	
7:22:03	15.88	5.3	779.7	41.9	0.5	
7:23:02	16.34	4.7	894.5	39.7	0.7	
7:24:02	16.13	5.1	804.8	42.1	0.6	
7:25:03	16.31	4.8	876.0	39.2	1.5	
7:26:02	16.27	5.0	793.9	34.4	-0.3	
7:27:03	15.92	5.3	823.8	39.1	-0.4	
7:28:02	15.86	5.3	753.1	43.0	-0.6	
7:29:03	16.20	4.9	808.4	41.0	-0.8	
7:30:02	16.61	4.5	773.8	37.0	-0.8	
7:31:02	16.61	4.6	810.3	36.3	-0.9	

## SUMMARY CORRECTED DATA

CLIENT PROJECT NUM. LOCATION	TRIPLE GREEN DILLON 21-1647 BOILER			DATE TIME START TIME FINISH	4/17/2021 7:00 8:00
	TEST NUMBER			1	
TIME	O2	CO2	CO	NOX	SO2
	%	%	PPM	PPM	PPM
7:32:03	16.32	4.8	814.2	36.1	-0.8
7:33:02	16.74	4.4	930.9	37.5	-0.8
7:34:03	16.03	5.3	959.7	38.1	-0.3
7:35:02	15.72	5.4	695.5	44.4	-0.4
7:36:03	16.13	5.0	690.2	39.2	-0.1
7:37:02	16.00	5.2	735.9	40.1	-0.3
7:38:02	16.40	4.7	692.1	39.5	-0.6
7:39:03	16.56	4.7	968.7	35.3	-0.4
7:40:02	16.28	4.9	1064.3	40.1	-0.3
7:41:03	15.99	5.3	732.5	40.3	-0.5
7:42:02	15.64	5.6	902.4	45.4	-0.6
7:43:03	15.99	5.2	862.6	43.3	-0.7
7:44:02	16.07	5.2	669.6	41.3	-0.8
7:45:02	15.84	5.4	642.7	45.2	-0.8
7:46:03	15.45	5.8	590.9	43.9	-0.8
7:47:02	15.29	5.9	751.2	49.3	-0.9
7:48:03	15.61	5.6	804.8	45.9	-0.8
7:49:02	15.81	5.4	758.2	39.3	-0.9
7:50:03	15.52	5.7	684.0	43.9	-0.8
7:51:02	15.57	5.6	831.6	42.6	-0.6
7:52:02	15.54	5.7	628.7	42.9	-0.5
7:53:03	15.83	5.3	581.0	43.3	-0.5
7:54:02	16.04	5.2	608.7	42.9	-0.8
7:55:03	15.79	5.4	605.5	41.5	-0.8
7:56:02	15.69	5.6	697.1	43.0	-0.9
7:57:03	15.65	5.7	665.6	43.1	-1.1
7:58:02	15.21	6.0	670.7	42.1	-1.0
7:59:02	15.38	5.9	605.5	44.9	-1.0
8:00:03	15.03	6.3	600.4	47.7	-1.1
AVERAGE	16.11	5.08	782.4	40.2	-0.3

## SUMMARY CORRECTED DATA

CLIENT PROJECT NUM. LOCATION	TRIPLE GREEN DILLON 21-1647 BOILER			DATE TIME START TIME FINISH		4/17/2021 8:30 9:30
	TEST NUMBER			2		
	TIME	O2	CO2	CO	NOX	SO2
	%	%	PPM	PPM	PPM	
8:30:03	14.25	7.0	417.5	41.9	-1.2	
8:31:02	14.43	6.8	429.1	40.9	-1.2	
8:32:03	14.50	6.8	557.5	38.8	-1.1	
8:33:03	14.74	6.6	633.8	35.0	-0.9	
8:34:03	15.18	6.1	948.3	33.6	-0.9	
8:35:03	15.11	6.2	1184.2	26.8	-0.3	
8:36:03	14.36	7.0	1145.1	29.8	0.0	
8:37:03	13.90	7.4	601.4	42.0	-0.4	
8:38:03	14.77	6.3	542.6	52.4	-0.4	
8:39:03	17.10	4.0	538.8	36.9	-0.8	
8:40:03	17.12	4.2	846.4	29.1	-1.0	
8:41:03	16.12	5.3	496.4	36.7	-1.2	
8:42:03	15.67	5.7	509.2	39.0	-1.2	
8:43:03	15.44	5.9	594.0	33.4	-1.1	
8:44:03	14.47	6.9	552.1	36.5	-1.1	
8:45:03	14.06	7.2	383.8	42.6	-0.9	
8:46:03	14.78	6.5	562.3	45.7	-1.0	
8:47:03	15.02	6.2	526.2	44.6	-0.9	
8:48:03	15.05	6.4	457.9	42.3	-0.9	
8:49:03	14.88	6.4	338.3	43.2	-1.2	
8:50:03	15.06	6.3	495.7	42.5	-1.4	
8:51:03	15.12	6.2	391.5	40.8	-1.3	
8:52:03	15.36	6.0	428.7	40.9	-1.1	
8:53:03	15.54	5.8	425.5	40.4	-1.5	
8:54:03	15.66	5.7	462.3	39.8	-1.6	
8:55:03	15.16	6.3	448.2	39.1	-1.3	
8:56:03	14.74	6.6	374.3	45.5	-1.2	
8:57:03	14.73	6.7	439.3	46.8	-1.3	
8:58:03	14.55	6.8	329.1	45.0	-1.0	
8:59:03	14.65	6.7	368.0	48.0	-1.2	
9:00:03	14.71	6.6	357.8	47.3	-1.0	
9:01:03	15.64	5.7	376.6	39.9	-0.9	

## SUMMARY CORRECTED DATA

CLIENT PROJECT NUM. LOCATION	TRIPLE GREEN DILLON 21-1647 BOILER			DATE TIME START TIME FINISH	4/17/2021 8:30 9:30
	TEST NUMBER			2	
TIME	O2	CO2	CO	NOX	SO2
	%	%	PPM	PPM	PPM
9:02:03	15.85	5.5	465.6	37.7	-0.9
9:03:03	15.69	5.8	678.6	36.9	-0.8
9:04:03	14.88	6.4	546.2	40.4	-1.0
9:05:03	15.54	5.8	688.8	38.6	-0.9
9:06:03	15.56	5.8	612.9	35.6	-0.8
9:07:03	15.95	5.4	524.5	37.3	-1.1
9:08:03	16.13	5.3	620.3	32.4	-1.1
9:09:03	15.33	6.0	496.3	36.8	-0.9
9:10:03	15.58	5.8	680.8	40.1	-0.7
9:11:03	15.06	6.3	642.4	38.8	-0.9
9:12:03	14.50	6.9	482.5	38.7	-0.8
9:13:03	14.66	6.7	468.5	42.5	-0.6
9:14:03	15.00	6.3	512.6	41.4	-0.5
9:15:03	15.19	6.2	478.9	38.7	-0.6
9:16:03	15.15	6.3	561.4	38.5	-0.9
9:17:03	15.06	6.3	483.7	41.3	-1.1
9:18:03	15.43	6.0	424.6	40.9	-1.2
9:19:03	15.77	5.5	583.4	39.5	-1.2
9:20:03	16.60	4.7	932.2	30.6	-1.2
9:21:03	16.41	5.0	1042.0	27.6	-0.9
9:22:03	15.95	5.5	850.7	29.6	-0.7
9:23:03	16.00	5.3	844.8	31.6	-0.7
9:24:03	16.21	5.1	870.2	27.9	-0.5
9:25:03	17.11	4.2	635.6	25.9	-0.4
9:26:03	17.51	3.9	345.7	27.0	-0.6
9:27:03	17.69	3.7	225.0	27.0	-0.5
9:28:03	17.41	4.1	428.8	25.6	-0.5
9:29:03	16.04	5.4	1018.3	36.2	-0.6
9:30:03	15.90	5.5	697.7	40.2	-0.8
AVERAGE	15.43	5.92	573.9	37.9	-0.9

## SUMMARY CORRECTED DATA

CLIENT PROJECT NUM. LOCATION	TRIPLE GREEN DILLON 21-1647 BOILER			DATE TIME START TIME FINISH	4/17/2021 13:00 14:00
	TEST NUMBER			3	
TIME	O2	CO2	CO	NOX	SO2
	%	%	PPM	PPM	PPM
13:00:35	15.21	6.0	416.4	42.4	0.1
13:01:36	15.16	6.1	449.8	38.6	0.2
13:02:35	15.00	6.3	333.4	40.5	0.1
13:03:36	15.49	5.7	370.7	40.6	0.0
13:04:35	15.55	5.8	496.2	35.1	-0.2
13:05:36	15.23	6.1	575.9	35.2	-0.3
13:06:35	14.75	6.6	397.9	39.8	-0.2
13:07:35	14.93	6.3	556.1	42.0	-0.1
13:08:36	14.72	6.6	531.8	41.0	-0.1
13:09:35	15.08	6.2	602.5	41.3	0.1
13:10:36	15.17	6.1	581.9	41.4	0.0
13:11:35	15.14	6.1	545.5	41.9	0.0
13:12:36	14.96	6.4	470.2	39.0	0.2
13:13:35	15.25	6.0	526.9	41.2	0.1
13:14:35	15.49	5.9	532.8	37.2	0.7
13:15:36	14.63	6.6	467.1	41.9	1.6
13:16:35	15.17	6.1	486.3	37.6	0.8
13:17:36	14.89	6.5	392.8	43.0	0.6
13:18:35	14.92	6.3	328.5	43.4	1.1
13:19:36	15.37	6.0	376.3	42.2	0.7
13:20:35	15.33	6.0	509.2	41.0	0.9
13:21:35	14.87	6.5	382.6	43.0	0.4
13:22:36	14.98	6.3	436.5	42.6	0.4
13:23:35	15.39	5.9	414.4	42.7	0.2
13:24:36	14.89	6.4	408.2	41.4	0.2
13:25:35	15.37	5.9	498.0	37.4	0.5
13:26:36	15.76	5.6	467.3	35.3	0.8
13:27:35	16.05	5.3	616.2	35.6	0.1
13:28:35	15.79	5.5	431.6	35.1	0.2
13:29:36	15.53	5.8	442.5	33.6	0.2
13:30:35	14.91	6.4	295.5	39.7	0.1
13:31:36	15.18	6.1	392.0	41.2	0.4

## SUMMARY CORRECTED DATA

CLIENT PROJECT NUM. LOCATION	TRIPLE GREEN DILLON 21-1647 BOILER			DATE TIME START TIME FINISH	4/17/2021 13:00 14:00
TEST NUMBER				3	
TIME	O2	CO2	CO	NOX	SO2
	%	%	PPM	PPM	PPM
13:32:35	15.37	6.0	413.5	37.0	-0.2
13:33:36	15.36	6.0	302.1	38.7	-0.2
13:34:35	15.17	6.2	312.2	40.6	1.0
13:35:35	15.54	5.8	413.2	40.0	-0.2
13:36:36	15.74	5.6	542.7	35.6	0.3
13:37:35	15.29	6.1	537.4	35.2	0.0
13:38:36	14.67	6.6	495.7	36.6	2.0
13:39:35	15.11	6.2	512.8	39.5	0.7
13:40:36	15.02	6.3	520.8	34.7	0.1
13:41:35	15.06	6.2	349.7	40.7	0.3
13:42:35	14.97	6.4	547.8	38.6	0.3
13:43:36	14.55	6.8	454.0	36.4	0.4
13:44:35	14.72	6.5	397.5	38.8	0.3
13:45:36	15.82	5.4	630.8	34.4	0.2
13:46:35	15.82	5.6	816.4	29.9	0.3
13:47:36	15.29	6.0	674.1	33.0	0.3
13:48:35	15.21	6.1	629.9	34.4	-0.2
13:49:35	15.07	6.3	529.2	33.9	0.6
13:50:36	14.71	6.6	506.1	38.2	0.2
13:51:35	15.27	6.0	586.2	32.9	1.1
13:52:36	15.05	6.3	692.9	26.7	0.9
13:53:35	15.25	6.0	693.8	34.0	0.2
13:54:36	14.80	6.6	631.5	31.0	0.4
13:55:35	14.41	6.8	442.4	38.0	0.3
13:56:35	14.60	6.8	480.8	36.0	0.7
13:57:36	14.90	6.4	297.6	39.1	0.6
13:58:35	15.21	6.1	343.6	38.4	0.1
13:59:36	15.05	6.4	483.1	39.0	-0.1
14:00:35	14.30	7.0	407.9	39.1	-0.1
AVERAGE	15.14	6.17	481.6	38.1	0.3

## Appendix B

### Equipment Calibration Records

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

## DRY GAS METER CALIBRATION

Client: VES Box ID: M5C-2

Calibration Date: November 1, 2020 SERIAL#: 1700

Calibration Due: May 1, 2021 Meter Ser # 19112820

GASOMETER TEMPERATURE (DEG F) 67

BAROMETRIC PRESSURE (in. HG.) 29.05

STANDARD VOLUME (CF)	STANDARD VOLUME (DSCF)	METER VOLUME (CF)	ORIFICE ("H2O)	METER TEMP (DEG F)	METER VOLUME (DSCF)	METER FACTOR	TIME (MIN)	DELTA H (a)
2.000	1.979	2.000	3	72.0	1.960	1.009	2.06	1.8131
2.000	1.979	2.000	2.5	72.5	1.958	1.010	2.25	1.8008
2.000	1.979	2.010	2	72.0	1.970	1.004	2.5	1.7802
2.000	1.979	2.010	1.5	72.0	1.970	1.004	2.83	1.7109
2.000	1.979	2.010	1	72.0	1.970	1.004	3.38	1.6270

DRY GAS METER FACTOR 1.007

DELTA H (a) 1.746

### VALLEY ENVIRONMENTAL SERVICES

160 Pony Drive Unit 1

Newmarket, Ontario

PH: (905) 830-0136

Fax: (905) 830-0137

TECHNICIAN NAME: T. Ryan

AUDITOR: 

Calibration Method

Calibration Standard

Standard Verification Number

NIST #

EPA Method 5 / EPS 1/RM/5

Gasometer

G 196

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

## PITOT TUBE CALIBRATION REPORT

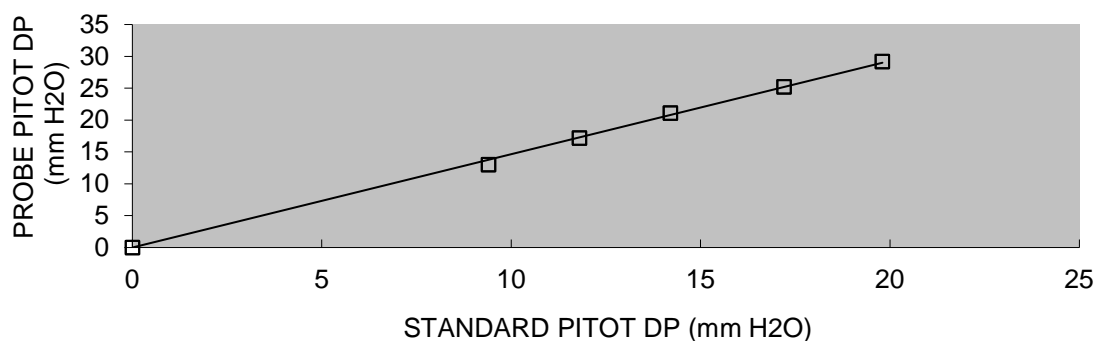
CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #4- 0.125"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
	PITOT	PITOT
m/s	(mm H2O)	(mm H2O)

0.00	0.00	0.00
12.6	9.40	13.00
14.2	11.80	17.20
15.5	14.20	21.10
17.1	17.20	25.20
18.4	19.80	29.20

PITOT FACTOR  $C_p$  = 0.826

PITOT - M5-3A NOZZLE - #4- 0.125"  
05-Feb-21



Technician: Tom Ryan

Signature 

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

## PITOT TUBE CALIBRATION REPORT

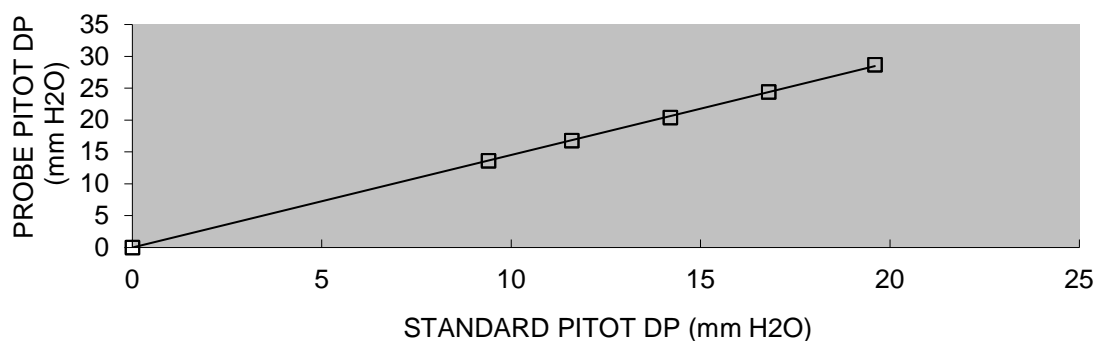
CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #6- 0.1875"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
	PITOT	PITOT
m/s	(mm H2O)	(mm H2O)

0.00	0.00	0.00
12.6	9.40	13.60
14.0	11.60	16.80
15.5	14.20	20.40
16.9	16.80	24.40
18.3	19.60	28.70

PITOT FACTOR  $C_p$  = 0.830

PITOT - M5-3A NOZZLE - #6- 0.1875"  
05-Feb-21



Technician: Tom Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

## PITOT TUBE CALIBRATION REPORT

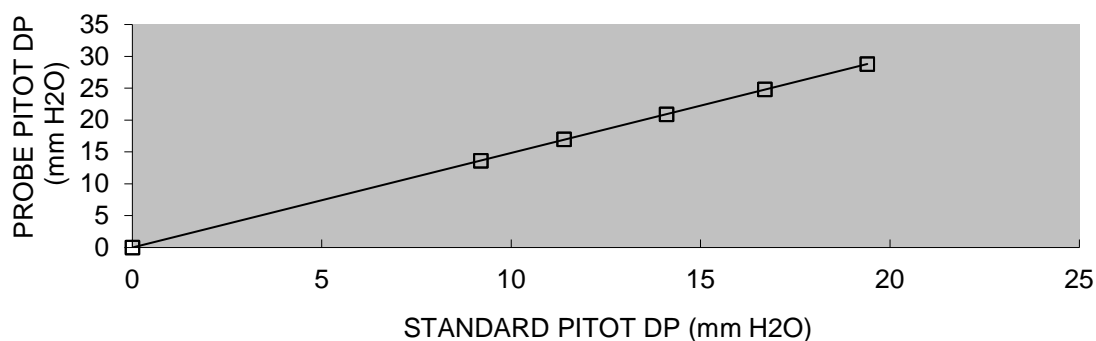
CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #8- 0.250"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
	PITOT	PITOT
m/s	(mm H2O)	(mm H2O)

0.00	0.00	0.00
12.5	9.20	13.60
13.9	11.40	17.00
15.5	14.10	20.90
16.9	16.70	24.80
18.2	19.40	28.80

PITOT FACTOR  $C_p$  = 0.821

PITOT - M5-3A NOZZLE - #8- 0.250"  
05-Feb-21



Technician: Tom Ryan

Signature 

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

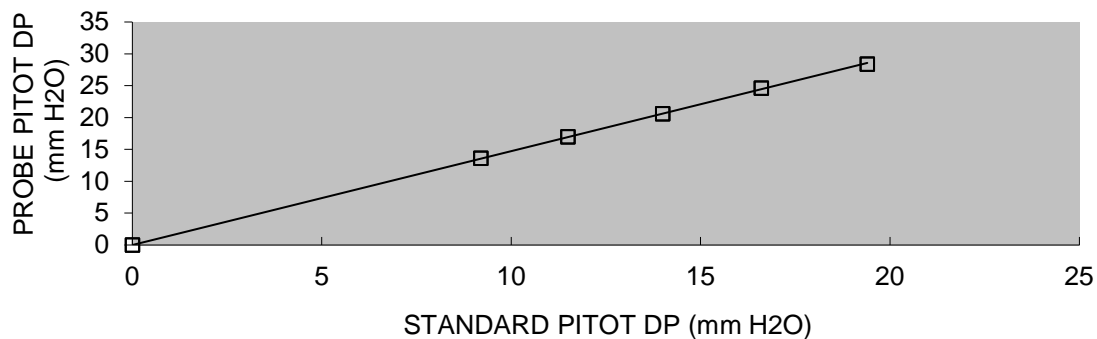
## PITOT TUBE CALIBRATION REPORT

CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #10- 0.3125"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
m/s	PITOT (mm H2O)	PITOT (mm H2O)
0.00	0.00	0.00
12.5	9.20	13.60
14.0	11.50	17.00
15.4	14.00	20.60
16.8	16.60	24.60
18.2	19.40	28.40

PITOT FACTOR  $C_p$  = 0.824

PITOT - M5-3A NOZZLE - #10- 0.3125"  
05-Feb-21



Technician: Tom Ryan

Signature: 

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

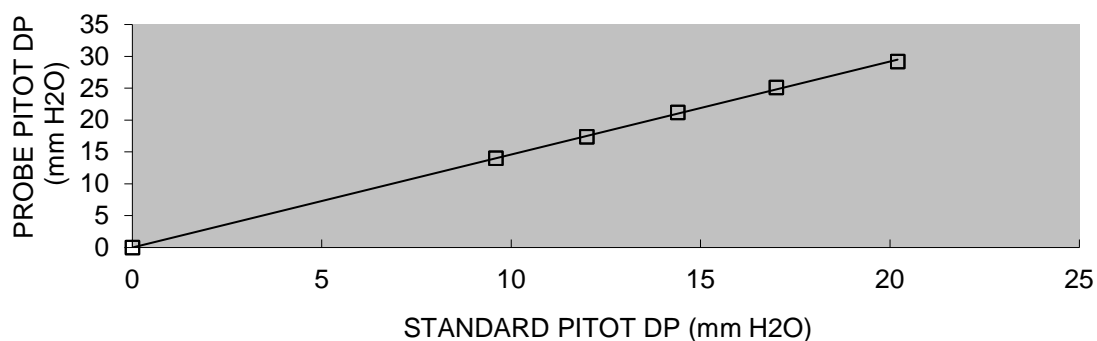
## PITOT TUBE CALIBRATION REPORT

CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #12- 0.375"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
m/s	PITOT (mm H2O)	PITOT (mm H2O)
0.00	0.00	0.00
12.8	9.60	14.00
14.3	12.00	17.40
15.7	14.40	21.20
17.0	17.00	25.10
18.5	20.20	29.20

PITOT FACTOR  $C_p$  = 0.828

PITOT - M5-3A NOZZLE - #12- 0.375"  
05-Feb-21



Technician: Tom Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

## PITOT TUBE CALIBRATION REPORT

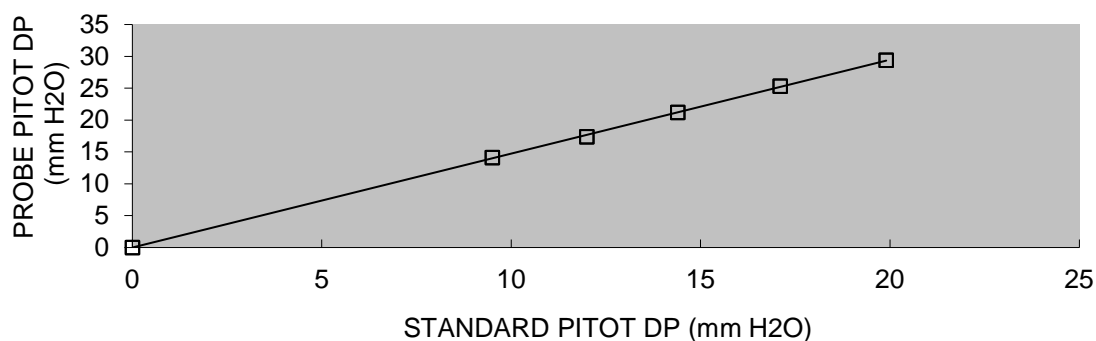
CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #14- 0.4375"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
	PITOT	PITOT
m/s	(mm H2O)	(mm H2O)

0.00	0.00	0.00
12.7	9.50	14.10
14.3	12.00	17.40
15.7	14.40	21.20
17.1	17.10	25.30
18.4	19.90	29.40

PITOT FACTOR  $C_p$  = 0.824

PITOT - M5-3A NOZZLE - #14- 0.4375"  
05-Feb-21



Technician: Tom Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# VALLEY ENVIRONMENTAL CALIBRATION SERVICES

## PITOT TUBE CALIBRATION REPORT

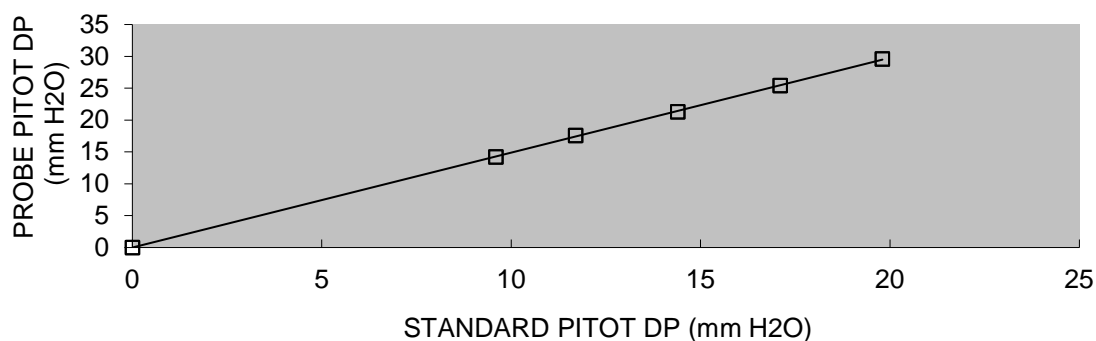
CLIENT - VES  
PROBE ID - M5-3A  
NOZZLE - #16- 0.500"  
DATE - 05-Feb-21

FAN SPEED	STANDARD	PROBE
	PITOT	PITOT
m/s	(mm H2O)	(mm H2O)

0.00	0.00	0.00		
12.8	9.60	14.20		
14.1	11.70	17.60		
15.7	14.40	21.30		
17.1	17.10	25.40		
18.4	19.80	29.60	18	27

PITOT FACTOR  $C_p$  = 0.819

PITOT - M5-3A NOZZLE - #16- 0.500"  
05-Feb-21



Technician: Tom Ryan

Signature

VALLEY ENVIRONMENTAL SERVICES  
160 Pony Drive #1  
Newmarket, Ontario L3Y 7B6  
PH: (905) 830 0136  
FAX: (905) 830 0137

Tunnel	VES
Std. Pitot $C_p$	0.999
Static	-0.25
Barometric	29.2
Temperature	76
Abs Static	29.18

# SYSTEM CALIBRATION AND DRIFT CALCULATIONS

CLIENT	TRIPLE GREEN	DATE	4/17/21
PROJECT NUMBER	DILLON 21-1647	TIME START	7:00
SAMPLE LOCATION	BOILER	TIME FINISH	8:00

TEST NUMBER	1
-------------	---

## INSTRUMENT RANGES

OXYGEN	20	%	CARBON DIOXIDE	20	%
CARBON MONOXIDE	1100	PPM	NITROGEN OXIDES	100	PPM
SULFUR DIOXIDE	100	PPM			

ITEM	CAL.GAS VALUE	ANAL. CAL.	INITIAL VALUES		FINAL VALUES		DRIFT (% SPAN)
			SYSTEM CAL.	SYSTEM CAL. BIAS (% SPAN)	SYSTEM CAL.	SYSTEM CAL. BIAS (% SPAN)	
O2 ZERO	0.00	0.01	0.03	0.1	0.02	0.1	-0.1
O2 SPAN	20.00	19.99	20.01	0.1	19.55	-2.2	-2.3
CO2 ZERO	0.00	0.00	0.01	0.1	0.15	0.8	0.7
CO2 SPAN	20.00	20.00	20.01	0.1	19.82	-0.9	-1.0
CO ZERO	0.0	0.2	1.3	0.1	2.1	0.2	0.1
CO SPAN	495.0	495.1	495.2	0.0	497.2	0.2	0.2
NOx ZERO	0.0	-0.1	-0.1	0.0	1.1	1.2	1.2
NOx SPAN	50.0	50.1	49.5	-0.6	49.1	-1.0	-0.4
SO2 ZERO	0.0	-0.4	-0.5	-0.1	-0.9	-0.5	-0.4
SO2 SPAN	50.0	49.9	47.5	-2.4	48.1	-1.8	0.6

DRIFT CRITERIA <3% SPAN

BIAS CRITERIA <5% SPAN

# SYSTEM CALIBRATION AND DRIFT CALCULATIONS

CLIENT	TRIPLE GREEN	DATE	4/17/21
PROJECT NUMBER	DILLON 21-1647	TIME START	8:30
SAMPLE LOCATION	BOILER	TIME FINISH	9:30

TEST NUMBER	2
-------------	---

## INSTRUMENT RANGES

OXYGEN	20	%	CARBON DIOXIDE	20	%
CARBON MONOXIDE	100	PPM	NITROGEN OXIDES	100	PPM
SULFUR DIOXIDE	100	PPM			

ITEM	INITIAL VALUES			FINAL VALUES			DRIFT (% SPAN)
	CAL.GAS VALUE	ANAL. CAL.	SYSTEM CAL.	SYSTEM CAL. BIAS (% SPAN)	SYSTEM CAL.	SYSTEM CAL. BIAS (% SPAN)	
O2 ZERO	0.00	0.01	0.03	0.1	0.02	0.1	-0.1
O2 SPAN	20.00	19.99	20.01	0.1	19.55	-2.2	-2.3
CO2 ZERO	0.00	0.00	0.01	0.1	0.15	0.8	0.7
CO2 SPAN	20.00	20.00	20.01	0.1	19.82	-0.9	-1.0
CO ZERO	0.0	0.2	1.3	1.1	2.1	1.9	0.8
CO SPAN	495.0	495.1	495.2	0.1	497.2	2.1	2.0
NOx ZERO	0.0	-0.1	-0.1	0.0	1.1	1.2	1.2
NOx SPAN	50.0	50.1	49.5	-0.6	49.1	-1.0	-0.4
SO2 ZERO	0.0	-0.4	-0.5	-0.1	-0.9	-0.5	-0.4
SO2 SPAN	50.0	49.9	47.5	-2.4	48.1	-1.8	0.6

DRIFT CRITERIA <3% SPAN

BIAS CRITERIA <5% SPAN

# SYSTEM CALIBRATION AND DRIFT CALCULATIONS

CLIENT	TRIPLE GREEN	DATE	4/17/21
PROJECT NUMBER	DILLON 21-1647	TIME START	13:00
SAMPLE LOCATION	BOILER	TIME FINISH	14:00

TEST NUMBER	3
-------------	---

## INSTRUMENT RANGES

OXYGEN	20	%	CARBON DIOXIDE	20	%
CARBON MONOXIDE	200	PPM	NITROGEN OXIDES	200	PPM
SULFUR DIOXIDE	100	PPM			

ITEM	INITIAL VALUES			FINAL VALUES			DRIFT (% SPAN)
	CAL.GAS VALUE	ANAL. CAL.	SYSTEM CAL.	SYSTEM CAL. BIAS (% SPAN)	SYSTEM CAL.	SYSTEM CAL. BIAS (% SPAN)	
O2 ZERO	0.00	0.01	0.03	0.1	0.02	0.1	-0.1
O2 SPAN	20.00	19.99	20.01	0.1	19.55	-2.2	-2.3
CO2 ZERO	0.00	0.00	0.01	0.1	0.15	0.8	0.7
CO2 SPAN	20.00	20.00	20.01	0.1	19.82	-0.9	-1.0
CO ZERO	0.0	0.2	1.3	0.6	2.1	1.0	0.4
CO SPAN	495.0	495.1	495.2	0.0	497.2	1.0	1.0
NOx ZERO	0.0	-0.1	-0.1	0.0	1.1	0.6	0.6
NOx SPAN	50.0	50.1	49.5	-0.3	49.1	-0.5	-0.2
SO2 ZERO	0.0	-0.4	-0.5	-0.1	-0.9	-0.5	-0.4
SO2 SPAN	50.0	49.9	47.5	-2.4	48.1	-1.8	0.6

DRIFT CRITERIA <3% SPAN  
BIAS CRITERIA <5% SPAN

## MULTI LINEARITY FORM

Client	TRIPLE GREEN	Sample Location	BOILER
Project #	DILLON 21-1647	Test #	COMPLIANCE
Date	2021-04-17		

Analyzer	Model	Principle	Serial #	Conc. Unit	High Gas Conc.	Unit Span	High Range Gas Fraction of Span
O <sub>2</sub>	CAI Model 100P	Paramagnetic	8K08004	%	20.00	20	100%
CO <sub>2</sub>	CAI Model ZRH	NDIR	A7P2767T	%	10.00	10	100%
CO	CAI Model ZRH	NDIR	A7P2767T	ppm	495.0	1100	45%
NO <sub>x</sub>	API Model 200EH	Chemiluminescence	API2010986	ppm	90.0	100	90%
SO <sub>2</sub>	WRD	NDUV	W2017526	ppm	90.0	100	90%
THC	JUM 109A	Flame Ionization	RW2018562	ppm	90.0	100	90%
THC	JUM 109A	Flame Ionization	RW2018562	ppm	90.0	100	90%

Analyzer	SPAN GAS CONCENTRATION, Cr				INITIAL ANALYZER CALIBRATION CHECK, Cai				INITIAL ANALYZER CALIBRATION ERROR, Ei				Gas Resp.
	Zero	Low	Mid	High	Zero	Low	Mid	High	Zero	Low	Mid	High	Time
O <sub>2</sub>	0.00		####	20.00	0.01		10.05	19.99	0.05%	0.00%	0.25%	-0.05%	41
CO <sub>2</sub>	0.00		####	20.00	0.00		10.02	20.01	0.00%	0.00%	0.20%	0.10%	55
CO	0.0		####	495.0	0.0		201.2	495.0	0.00%	0.00%	0.11%	0.00%	49
NO <sub>x</sub>	0.0		50.0	90.0	-0.1		49.9	90.0	-0.10%	0.00%	-0.10%	0.00%	42
SO <sub>2</sub>	0.0		50.0	90.0	-0.2		48.8	90.1	-0.20%	0.00%	-1.20%	0.10%	65
THC/M									0.00%	0.00%	0.00%	0.00%	
THC/NM									0.00%	0.00%	0.00%	0.00%	

**Ei = ((Cai - Cma)/Span)x100%**  
**Criteria 2%**

AUDIT PERFORMED BY:	NICK LAVALLE
AUDIT DATE:	Saturday, April 17, 2021
AUDITOR SIGNATURE	



Praxair Distribution, Inc.  
6055 Brent Drive  
Toledo, OH 43611  
Tel: (419) 729-7732 Fax: (419) 729-2411  
PGVP ID: F12018

DocNumber: 000029545

## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information:

PRAXAIR PKG PARIS P/H 80271  
41 CONSOLIDATED DR  
PARIS ON N3L 3G

Praxair Order Number: 57488788  
Customer P. O. Number: 70550303 BRAMP  
Customer Reference Number:

Fill Date: 3/26/2018  
Part Number: NI N0500S1E-AS  
Lot Number: 70001808538  
Cylinder Style & Outlet: AS CGA 660  
Cylinder Pressure & Volume: 2000 psig 140 cu. ft.

### Certified Concentration:

Expiration Date:	4/17/2026	NIST Traceable
Cylinder Number:	CC108573	Analytical Uncertainty:
520 ppm	NITRIC OXIDE	± 1 %
497 ppm	SULFUR DIOXIDE	± 0.6 %
Balance	NITROGEN	

NOx = 521 ppm

NOx for Reference Only

Certification Information: Certification Date: 4/17/2018 Term: 96 Months Expiration Date: 4/17/2026

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

### Analytical Data:

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

#### 1. Component: NITRIC OXIDE

Requested Concentration: 500 ppm  
Certified Concentration: 520 ppm  
Instrument Used: Thermo-42i HL  
Analytical Method: Chemiluminescence  
Last Multipoint Calibration: 3/14/2018

First Analysis Data:		Date:	4/10/2018
Z:	0	R:	499
R:	499	Z:	0
Z:	0	C:	520
C:	520	R:	499
UOM:	ppm	Mean Test Assay:	519.33 ppm

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC272181  
Ref. Std. Conc: 499 ppm  
Ref. Std. Traceable to SRM #: 1687b  
SRM Sample #: 41-L-32  
SRM Cylinder #: FF10438

Second Analysis Data:		Date:	4/17/2018
Z:	0	R:	499
R:	499	Z:	0
Z:	0	C:	520
C:	520	R:	499
UOM:	ppm	Mean Test Assay:	520 ppm

#### 2. Component: SULFUR DIOXIDE

Requested Concentration: 500 ppm  
Certified Concentration: 497 ppm  
Instrument Used: HORBIA VIA-510  
Analytical Method: NDIR  
Last Multipoint Calibration: 3/14/2018

First Analysis Data:		Date:	4/10/2018
Z:	0	R:	507
R:	507	Z:	0
Z:	0	C:	498
C:	498	R:	507
UOM:	PPM	Mean Test Assay:	497.67 PPM

Reference Standard Type: GMIS  
Ref. Std. Cylinder #: CC457731  
Ref. Std. Conc: 507 ppm  
Ref. Std. Traceable to SRM #: 1661a  
SRM Sample #: 94-H-17  
SRM Cylinder #: FF28055

Second Analysis Data:		Date:	4/17/2018
Z:	0	R:	507
R:	507	Z:	0
Z:	0	C:	497
C:	497	R:	507
UOM:	PPM	Mean Test Assay:	497 PPM

Analyzed by:

Marcus Huguley

Certified by:

Tera Thomas

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



## CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

### Customer & Order Information

PRAXAIR PKG PARIS P/H 80271  
41 CONSOLIDATED DR  
PARIS ON N3L 3G2

Certificate Issuance Date: 10/03/2019

Praxair Order Number: 86915300

Part Number: NI CD20CMO4E-AS

Customer PO Number: 71101794 Barrie

Fill Date: 09/18/2019

Lot Number: 700019261GB

Cylinder Style & Outlet: AS

Cylinder Pressure and Volume: 2000 psig 140 ft<sup>3</sup>

CGA 590

### Certified Concentration

Expiration Date:	10/02/2027	NIST Traceable
Cylinder Number:	EB0114830	Expanded Uncertainty
497 ppm	Carbon monoxide	± 0.6 %
20.0 %	Carbon dioxide	± 0.4 %
90.4 ppm	Methane	± 0.6 %
20.0 %	Oxygen	± 0.3 %
Balance	Nitrogen	

### ProSpec EZ Cert



### Certification Information:

Certification Date: 10/02/2019

Term: 96 Months

Expiration Date: 10/02/2027

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.

O2 responses have been corrected for CO2 interference.

### Analytical Data:

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

#### 1. Component:

##### Carbon monoxide

Requested Concentration: 500 ppm  
Certified Concentration: 497 ppm  
Instrument Used: MKS 2031  
Analytical Method: FTIR  
Last Multipoint Calibration: 09/23/2019

First Analysis Data:				Date
Z: 0	R: 1088	C: 523	Conc: 497	10/02/2019
R: 1090	Z: 0	C: 522	Conc: 496	
Z: 0	C: 523	R: 1087	Conc: 497	
UOM: ppm	Mean Test Assay: 497 ppm			

#### Reference Standard:

Type / Cylinder #: GMIS / SA16145

Concentration / Uncertainty: 1034 ppm ±0.239%

Expiration Date: 07/03/2026

Traceable to: SRM # / Sample # / Cylinder #: 1681b / 1-K-42 / CAL015913

SRM Concentration / Uncertainty: 983.5 PPM / ±3.0 PPM

SRM Expiration Date: 09/26/2021

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

#### 2. Component:

##### Carbon dioxide

Requested Concentration: 20.0 %  
Certified Concentration: 20.0 %  
Instrument Used: MKS 2031  
Analytical Method: FTIR  
Last Multipoint Calibration: 09/06/2019

First Analysis Data:				Date
Z: 0	R: 20.2	C: 19.97	Conc: 20	10/02/2019
R: 20.15	Z: 0	C: 20	Conc: 20	
Z: 0	C: 19.98	R: 20.11	Conc: 20	
UOM: ppm	Mean Test Assay: 20 %			

#### Reference Standard:

Type / Cylinder #: GMIS / EB0101485

Concentration / Uncertainty: 20.17 % ±0.238%

Expiration Date: 01/13/2026

Traceable to: SRM # / Sample # / Cylinder #: PRM# 3222577.01 / n/a / FF27613

SRM Concentration / Uncertainty: 20.008% / ±0.02%

SRM Expiration Date: 04/01/2020

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: %			

#### 3. Component:

##### Methane

Requested Concentration: 90.0 ppm  
Certified Concentration: 90.4 ppm  
Instrument Used: MKS 2031  
Analytical Method: FTIR  
Last Multipoint Calibration: 10/02/2019

First Analysis Data:				Date
Z: 0	R: 100.5	C: 89.9	Conc: 90.5	10/02/2019
R: 101	Z: 0	C: 89.7	Conc: 90.3	
Z: 0	C: 89.9	R: 101.1	Conc: 90.5	
UOM: ppm	Mean Test Assay: 90.4 ppm			

#### Reference Standard:

Type / Cylinder #: GMIS / CC99733

Concentration / Uncertainty: 101.5 ppm ±0.5%

Expiration Date: 05/25/2024

Traceable to: SRM # / Sample # / Cylinder #: 2751 / 212-C-04 / FF23181

SRM Concentration / Uncertainty: 98.28 PPM / ±0.51 PPM

SRM Expiration Date: 06/01/2018

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



# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

## Customer & Order Information

PRAXAIR PKG PARIS P/H 80271  
41 CONSOLIDATED DR  
PARIS ON N3L 3G2

Certificate Issuance Date: 10/03/2019

Praxair Order Number: 86915300

Part Number: NI CD20CMO4E-AS

Customer PO Number: 71101794 Barrie

Fill Date: 09/18/2019

Lot Number: 700019261GB

Cylinder Style & Outlet: AS

CGA 590

Cylinder Pressure and Volume: 2000 psig 140 ft3

## 4. Component:

### Oxygen

Requested Concentration: 20.0 %  
Certified Concentration: 20.0 %  
Instrument Used: Servomex 575  
Analytical Method: Paramagnetic  
Last Multipoint Calibration: 09/16/2019

First Analysis Data:				Date
				10/02/2019
Z: 0	R: 22.51	C: 20	Conc: 20	
R: 22.51	Z: 0	C: 20	Conc: 20	
Z: 0	C: 20	R: 22.52	Conc: 20	
UOM: %				
Mean Test Assay: 20				%

## Reference Standard:

Type / Cylinder #: GMIS / EB0008354

Concentration / Uncertainty: 22.51 %  $\pm$  0.3%

Expiration Date: 11/17/2025

Traceable to: SRM # / Sample # / Cylinder #: 2659a / 71-D-04 / CAL015785

SRM Concentration / Uncertainty: 20.72 /  $\pm$  0.043

SRM Expiration Date: 08/23/2021

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

Analyzed By

Mike Monnette

Certified By

Edward E Zucal

Issue Date: September 9, 2020

To: Praxair Customer

Attn:

Praxair Order Number:  
Customer Order Number:  
Customer Reference Number:

Product Lot Number: 787025261  
Product Part Number: NI 5.5CE-AS

## CERTIFICATE OF ANALYSIS

### Nitrogen 5.5 Continuous Emission Monitoring Zero

Cylinder Serial Number	Analytes	Specification (Maximum ppm unless otherwise noted)	Analytical Results	Analytical Principle*/ Instrument
EB0110170	Oxygen	0.5	0.3 ppm	O – Teledyne 3000TAXL
	Moisture	2	1.0 ppm	P – Meeco Aquavolt+
	Total Hydrocarbons	0.1	<0.1 ppm LDL	Q – Rosemount 400A
	Carbon Dioxide	1	0.2 ppm	M – Horiba VA-510
	Carbon Monoxide	0.5	< 0.1 ppm LDL	M – Horiba VA-3000
	Sulfur Dioxide	0.1	0.038 ppm	U – Thermo Scientific 43i
	Oxides of Nitrogen	0.1	0.02 ppm	K – Thermo Scientific 42i-LS
	Nitrogen	> 99.9995%	> 99.9995%	R – By Difference

Cylinder Style: AS  
Cylinder Pressure @70°F (21°C): 2000 psig  
Cylinder Volume: 4.01 m<sup>3</sup>

Valve Outlet Connection: CGA-580  
Filling Method: Pressure/Temperature  
Date of Fill: September 8, 2020

Other Cylinders Included in Lot: CC188005, CC329513, SA8850, CC72615

The analytical data and all QC contained in this Certificate of Analysis was reviewed and accepted by the following individual(s):

Approved Signer: \_\_\_\_\_

(Lab Technician)

Counter Signer: \_\_\_\_\_

(Quality Assurance Reviewer)

This analysis of the product described herein was prepared by Praxair Canada Inc. using instruments whose calibration is certified using Praxair Reference Materials. Praxair Reference Materials are prepared either 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 Discharge Ionization Detector | K. Chemiluminescence       | P. Specific Moisture Analyzer |
| B. Gas Chromatography with Helium Ionization Detector         | G. Gas Chromatography with Methanizer Carbonizer         | L. Gravimetric Methods     | Q. Total Hydrocarbon Analyzer |
| C. Gas Chromatography with Electrolytic Conductivity Detector | H. Oxygen Analyzer with Fuel Cell                        | M. Infrared – FTIR or NDIR | R. By Difference              |
| D. Gas Chromatography with Flame Ionization Detector          | I. Gas Chromatography with Reduction Gas Analyzer        | N. Electrochemical         | S. Detector Tube              |
| E. Gas Chromatography with Flame Photometric Detector         | J. Gas Chromatography with Thermal Conductivity Detector | O. Paramagnetic            | T. Odour                      |
| U. Pulsed Fluorescence  |  |                            |                               |

#### 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.

VES 714



Praxair Canada, Inc.  
9501-34th Street  
Edmonton, AB T6B 2X6  
Tel: 780-449-0776  
Fax: 780-449-5302

PRAXAIR CALGARY DIST CTR  
8009 42 ST SE (2366511)  
CALGARY, AB T2C 2T4  
Attention: REPORT PRINTER 360 PICK TICKET PRINTER 361

03/02/2017

Work Order No. 28625961  
Customer Reference No. 03532744

Product Lot/Batch No. 582701102  
Product Part No. AI 0.0UZ-AS

### CERTIFICATE OF ANALYSIS

Air, Ultra Zero Air

Analytes	Specification	Analytical Results	Analytical Principle	Analytical Uncertainty
Oxygen	19.5% - 23.5%	21.87%	O	± 0.05%
Carbon Dioxide	≤ 0.5 ppm	< 0.5 ppm	L	± 15% rel
Carbon Monoxide	≤ 0.5 ppm	0.1 ppm	L	± 15% rel
Total Hydrocarbons	≤ 0.1 ppm	< 0.1 ppm	Q	± 0.1 ppm
Water	≤ 2 ppm	1.6 ppm	P	± 0.4 ppm

Analytical Instruments: Servomex~244A~~  
Horiba~VIA 510~~  
Beckman~400A~~  
Meeco~Aquavolt~~

Cylinder Style: AS  
Cylinder Pressure @70F: 13,790 kPa  
Cylinder Volume: 4.074 M3  
Valve Outlet Connection: CGA-590  
Cylinder No(s): CC110394

Filling Method: Temperature/Pressure  
Date of Fill: 01/11/2017  
Expiration Date: 12/31/2022

Analyst: Alex Auty

This analysis of the product described herein was prepared by Praxair Canada, Inc. using instruments whose calibration is certified using Praxair Canada, Inc. Reference Materials. Praxair Canada, Inc. Reference Materials are prepared either 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 Pecton Capture Detector	D Gas Chromatography with Flame Ionization Detector
E Gas Chromatography with Flame Photometric Detector	F Gas Chromatography with Heptan 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 ND-R
M Mass Spectrometry - MS or GC/MS	N By Difference of Typical Impurities	O Paramagnetic	P Specific Water Analyzer
O Total Hydrocarbon Analyzer	R Wet Chemical	S Laboratory 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 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.

## Appendix C

### BV Labs Certificates of Analysis



Your Project #: T. GREEN  
Your C.O.C. #: 10079

**Attention: Nick Lavalle**

Valley Environmental Services  
160 Pony Dr  
Unit 1  
Newmarket, ON  
CANADA L3Y 7B6

**Report Date: 2021/04/29**  
Report #: R6614328  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1B1169**

**Received: 2021/04/26, 17:08**

Sample Matrix: Stack Sampling Train  
# Samples Received: 5

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Particulates/Filter (M5/315/NJATM1/M201)	5	N/A	2021/04/28	BRL SOP-00109	EPA 5/315/NJATM1 m

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your Project #: T. GREEN  
Your C.O.C. #: 10079

**Attention: Nick Lavalle**

Valley Environmental Services  
160 Pony Dr  
Unit 1  
Newmarket, ON  
CANADA L3Y 7B6

**Report Date: 2021/04/29**  
Report #: R6614328  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1B1169**

**Received: 2021/04/26, 17:08**

Encryption Key



**AUTHORIZED REPORT  
RAPPORT AUTORISÉ**

Bureau Veritas

29 Apr 2021 12:35:31

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Clayton Johnson, CET LEAD-Air Toxics, Source Evaluation

Email: Clayton.Johnson@bureauveritas.com

Phone# (905)817-5769

=====

This report has been generated and distributed using a secure automated process.

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BUREAU  
VERITAS

BV Labs Job #: C1B1169  
Report Date: 2021/04/29

Valley Environmental Services  
Client Project #: T. GREEN

### RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

BV Labs ID		PKN111	PKN112	PKN113	PKN114	PKN223		
Sampling Date		2021/04/16	2021/04/17	2021/04/17	2021/04/17	2021/04/17		
COC Number		10079	10079	10079	10079	10079		
	<b>UNITS</b>	<b>PRELIM</b>	<b>M5- R1A</b>	<b>M5- R1B</b>	<b>M5- R2</b>	<b>M5- R3</b>	<b>RDL</b>	<b>QC Batch</b>
Front Half Particulate Weight on Filter	mg	88.7	66.6	39.6	32.2	63.7 (1)	0.30	7322993
RDL = Reportable Detection Limit								
QC Batch = Quality Control Batch								
(1) LPC Loose particulate material in filter container								



BUREAU  
VERITAS

BV Labs Job #: C1B1169  
Report Date: 2021/04/29

Valley Environmental Services  
Client Project #: T. GREEN

## TEST SUMMARY

**BV Labs ID:** PKN111  
**Sample ID:** PRELIM  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/16  
**Shipped:**  
**Received:** 2021/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	7322993	N/A	2021/04/28	Theodora LI

**BV Labs ID:** PKN112  
**Sample ID:** M5- R1A  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	7322993	N/A	2021/04/28	Theodora LI

**BV Labs ID:** PKN113  
**Sample ID:** M5- R1B  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	7322993	N/A	2021/04/28	Theodora LI

**BV Labs ID:** PKN114  
**Sample ID:** M5- R2  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	7322993	N/A	2021/04/28	Theodora LI

**BV Labs ID:** PKN223  
**Sample ID:** M5- R3  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/26

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	7322993	N/A	2021/04/28	Theodora LI



BUREAU  
VERITAS

BV Labs Job #: C1B1169  
Report Date: 2021/04/29

Valley Environmental Services  
Client Project #: T. GREEN

## GENERAL COMMENTS

Results relate only to the items tested.



BUREAU  
VERITAS

BV Labs Job #: C1B1169  
Report Date: 2021/04/29

Valley Environmental Services  
Client Project #: T. GREEN

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

*Brenda Moore*

---

Brenda Moore, Team Lead, Inorganic

---

BV Labs has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation please refer to the Validation Signature Page.



Your Project #: TRIPLE GREEN  
Site Location: WINNIPEG  
Your C.O.C. #: 10079

**Attention: Nick Lavalle**

Valley Environmental Services  
160 Pony Dr  
Unit 1  
Newmarket, ON  
CANADA L3Y 7B6

**Report Date: 2021/05/06**  
Report #: R6623310  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1B4534**

**Received: 2021/04/29, 13:06**

Sample Matrix: Stack Sampling Train  
# Samples Received: 4

Analyses	Quantity	Date	Date	Laboratory Method	Analytical Method
		Extracted	Analyzed		
Particulates/Acetone Rinse (M5/315/M201)	4	2021/05/06	2021/05/05	BRL SOP-00109	EPA 5/315 m
Final Volume of Acetone Probe Rinse	4	N/A	2021/05/04	BRL SOP-00109	

**Remarks:**

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.

Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.

This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

\* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.



Your Project #: TRIPLE GREEN  
Site Location: WINNIPEG  
Your C.O.C. #: 10079

**Attention: Nick Lavalle**

Valley Environmental Services  
160 Pony Dr  
Unit 1  
Newmarket, ON  
CANADA L3Y 7B6

**Report Date: 2021/05/06**  
Report #: R6623310  
Version: 1 - Final

**CERTIFICATE OF ANALYSIS**

**BV LABS JOB #: C1B4534**

**Received: 2021/04/29, 13:06**

Encryption Key



**AUTHORIZED REPORT  
RAPPORT AUTORISÉ**

Bureau Veritas

06 May 2021 11:49:30

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Clayton Johnson, CET LEAD-Air Toxics, Source Evaluation

Email: Clayton.Johnson@bureauveritas.com

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BV Labs Job #: C1B4534  
Report Date: 2021/05/06

Valley Environmental Services  
Client Project #: TRIPLE GREEN  
Site Location: WINNIPEG

### RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

BV Labs ID		PLF417	PLF418	PLF419	PLF420		
Sampling Date		2021/04/16	2021/04/17	2021/04/17	2021/04/17		
COC Number		10079	10079	10079	10079		
	<b>UNITS</b>	<b>M5- PRELIM</b>	<b>M5- R1</b>	<b>M5- R2</b>	<b>M5- R3</b>	<b>RDL</b>	<b>QC Batch</b>
Acetone Rinse Particulate Weight in Acetone Rinse	mg	13.3	12.8	5.5	2.9	0.5	7337111
Acetone Rinse Volume	ml	99	130	160	110	1	7332813
RDL = Reportable Detection Limit QC Batch = Quality Control Batch							



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## TEST SUMMARY

**BV Labs ID:** PLF417  
**Sample ID:** M5- PRELIM  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/16  
**Shipped:**  
**Received:** 2021/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	7337111	2021/05/05	2021/05/05	Theodora LI
Final Volume of Acetone Probe Rinse		7332813	N/A	2021/05/04	Theodora LI

**BV Labs ID:** PLF418  
**Sample ID:** M5- R1  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	7337111	2021/05/05	2021/05/05	Theodora LI
Final Volume of Acetone Probe Rinse		7332813	N/A	2021/05/04	Theodora LI

**BV Labs ID:** PLF419  
**Sample ID:** M5- R2  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	7337111	2021/05/05	2021/05/05	Theodora LI
Final Volume of Acetone Probe Rinse		7332813	N/A	2021/05/04	Theodora LI

**BV Labs ID:** PLF420  
**Sample ID:** M5- R3  
**Matrix:** Stack Sampling Train

**Collected:** 2021/04/17  
**Shipped:**  
**Received:** 2021/04/29

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	7337111	2021/05/05	2021/05/05	Theodora LI
Final Volume of Acetone Probe Rinse		7332813	N/A	2021/05/04	Theodora LI



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## GENERAL COMMENTS

**Results relate only to the items tested.**



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### QUALITY ASSURANCE REPORT

QA/QC								
Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
7337111	TL2	Method Blank	Acetone Rinse Particulate Weight in Acetone Ri	2021/05/05	<0.5		mg	
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.								



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Site Location: WINNIPEG

### VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

*Brenda Moore*

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Brenda Moore, Team Lead, Inorganic

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