A.Lanfranco & Associates Inc.
Environmental Consultants

Prepared for

WEIR CANADA INC.

18933 34a Ave
Surrey, BC V3Z 1A7

Emission Monitoring Report

March 2019

CERTIFICATION

The field monitoring for this survey was conducted by certified stack test technicians as required by the British Columbia Ministry of Environment (BC MOE) Field Sampling Manual.

The field crew consisted of:

Mr. S. Harrington (certified) and Mr. C. Lanfranco (certified).

The report was prepared by Mr. C. Lanfranco using reporting principles and guidelines generally acceptable to Metro Vancouver (MV).

The field crew and A. Lanfranco and Associates Inc. certify that the test methods used were BC MOE/MV approved reference methods for the parameters investigated.

Report reviewed by:

Mark Lanfranco, CST
President | Owner

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SUMMARY

The following table shows the emission results from three sources located at Weir Canada's manufacturing facility in Surrey, B.C.

SUMMARY TABLE: COMPARISON OF EMISSION TEST RESULTS

Parameter	Rubber Buffing	Grit Booth	Welding Station #19
Test Date	March.15, 2019	March.14, 2019	March.14, 2019
Particulate (mg/m^3)	1.57	0.99	1.64
Particulate (kg/hr)	0.066	0.020	0.001
Detailed Trace Metals Emissions			
Sum of Class I (mg/m3)	0.0002	0.0002	0.0002
Sum of Class II (mg/m3)	0.0019	0.0032	0.0031
Sum of Class III (mg/m3)	0.0038	0.0049	0.0097

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry).

Note – Classes are as per the Metro Vancouver Industrial Solid Waste and Resource Management Plan. Detailed Metals results can be found in Tables 1-3.

1 INTRODUCTION

Weir Canada Inc., commissioned A. Lanfranco and Associates Inc., of Surrey, B.C, to conduct an emissions monitoring survey on three sources associated with their manufacturing process. This report documents the results found. The parameters investigated during this survey include particulate matter, trace metals and volumetric flowrate. The sampling program consisted of, but was not limited to, the planning, execution, analysis, and reporting of three emission sources located at 18933, 43a Ave, Surrey, B.C.

The individual sources that were monitored for compliance are identified as the Welding Station #19, Grit Blast Booth and Rubber Buffing station. Sampling was conducted on March 14 and 15, 2019.

2 METHODOLOGY

All services provided by A. Lanfranco and Associates Inc. were conducted in accordance with approved reference methods as issued by:

- Metro Vancouver (MV)
- BC Ministry of Environment & Climate Change Strategy (BC MOE)
- Environment Canada (EC)
- US Environmental Protection Agency (EPA)

2.1 Sampling and Analytical Methods

The following table lists the test methods used for the different parameters measured. The subsequent paragraphs briefly describe each method.

Table 1: Reference Methods

Parameter	Reference Method
Sample and Velocity traverse points	EPS 1/RM/8 A Determination of Sampling Site and Traverse Points
Velocity and flowrate	EPS 1/RM/8 B Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Gas molecular weight (O_2/CO_2)	EPS 1/RM/8 C Determination of Molecular Weight by Gas Analysis
Flue gas Moisture	EPS 1/RM/8 D Determination of Moisture Content
Particulate Matter	EPS 1/RM/8 E Determination of Particulate Matter Emissions from Stationary Sources
Trace Metals	EPA Method 29 Modified

Sampling Site and Traverse Points

Primary: EPS 1/RM/8 Method A

Supporting: EPA Method 1

This method is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rate from a stationary source. A measurement site where the effluent stream is flowing in a known direction is selected, and the cross-section of the stack is divided into a number of equal areas. Traverse points are then located within each of these equal areas.

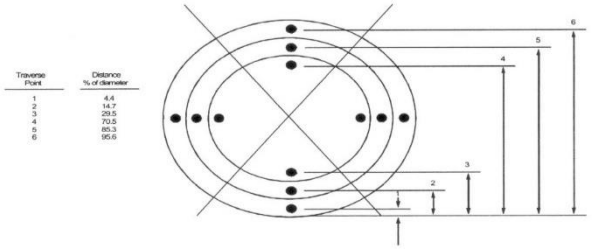

Figure 1. Example showing circular stack cross section divided into 12 equal areas, with location of traverse points.

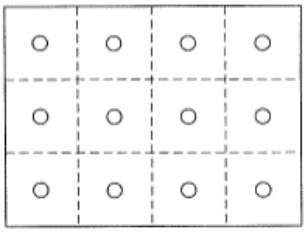

Figure 1A. Example showing rectangular stack cross section divided into 12 equal areas, with location of traverse points

Stack Gas Velocity and Volumetric Flow Rate

Primary: EPS 1/RM/8 Method B

Supporting: EPA Method 2

The average gas velocity in a stack or duct is determined from the gas density and from the measurement of velocity pressure with an S-type pitot tube. A standard pitot tube may be used where plugging of the tube openings due to particulate matter and/or moisture is not likely to occur. Stack gas volumetric flow rate is determined from measurements of stack gas velocity, temperature, absolute pressure, dry gas composition, moisture content, and stack diameter.

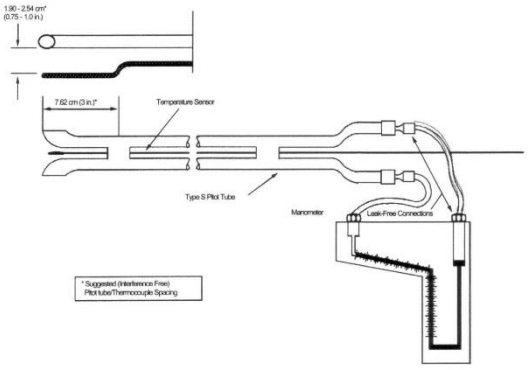

Figure 2. Type S Pitot Tube Manometer Assembly

Molecular Weight by Gas Analysis — Primary: EPS 1/RM/8 Method C; Supporting: EPA Method 3

An integrated or grab sample is extracted from a single point in the gas stream and analyzed for its components using a Fyrite analyzer, a gas chromatograph, or calibrated continuous analyzers.

Moisture Content — Primary: EPS 1/RM/8 Method D; Supporting: EPA Method 4

A gas sample is extracted from a single point in the enclosed gas stream being sampled. The moisture is condensed, and its weight measured. This weight, together with the volume of gas sampled, enables the stack gas moisture content to be calculated.

Particulate Matter — Primary: EPS 1/RM/8 Method E; Supporting: EPA Method 5

Particulate matter is withdrawn isokinetically from a number of sampling or traverse points in an enclosed gas stream. The particulate sample is collected in the nozzle, probe, and on a glass fibre filter, all maintained at a temperature of 120 ± 14°C or such other temperature as is necessary to prevent blinding of the filter from condensation. The particulate weight is determined gravimetrically after removal of uncombined water. Simultaneous determinations of the gas stream moisture content, velocity, temperature, and molecular weight allow calculations of the particulate concentration and the particulate mass emission or release rate to be made.

Trace Metal Primary: EPA Method 29 (modified)

This method is used in conjunction with the above Method 5. A stack sample is withdrawn isokinetically from the source. Particulate emissions are collected in the probe and on a heated filter, and gaseous emissions are then collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all metals excluding Hg). The trace metals are analyzed with inductively coupled argon plasma emission spectroscopy (ICAP), atomic absorption spectroscopy (AAS) and graphite furnace atomic absorption spectroscopy (GFAAS). Figure 3 displays the sample train and its configuration.

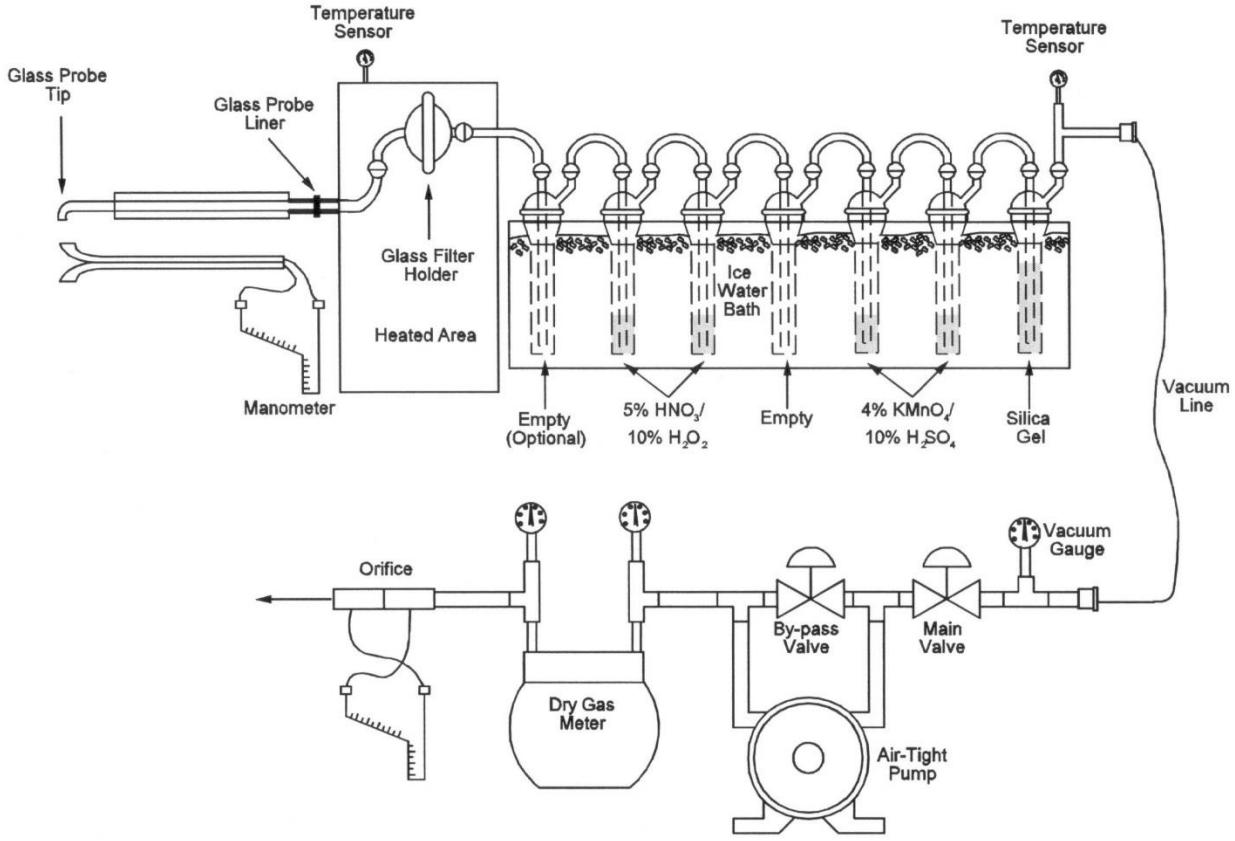

Figure 3. Particulate / Trace Metals Sampling Train

Note: Impingers #5 and #6 for Mercury capture were excluded from the sampling train

2.2 Method Modifications

Three minor method modifications were instituted for this work.

1. Reagent blanks for metals trains were made to the same volumes as all samples. In other words, exactly 100 ml of the various reagents used to recover samples was NOT done, as some sample components (probe washing for example) required more than 100 ml to adequately clean and rinse the probe. Instead, sample recovery was conducted with however much rinsing was deemed adequate. In the laboratory, the blanks and samples were made up with the appropriate reagent so that all samples and blanks were the same volume.

2. Filter and residue weighing were not conducted with the six-hour interval technique. Instead the sample filters and beakers were conditioned with cooling and desiccation and then weighed on two separate laboratory scales after 24 hours. Duplicate or triplicate Blank samples were carried through the gravimetric analysis, and the sample results were adjusted with the Blank data to determine the net filter and probe wash residue weight gain. This is the Environment Canada approved modified approach for weighing probe wash residue.

3. For the purposes of calculating a result, all parameters were given the value of ½ the detection limit when the analysis yielded 'non-detect' results.

All results are expressed using the metric system and corrected to standard conditions of 20 °C and 101.325 kPa, dry gas (unless otherwise noted).

2.3 Calculations

The following sections show the equations and define the variables that were used for this survey. The equations are organized in three sections. Equations 1-10 were used to calculate parameter concentration at standard conditions on a dry basis. Equations 12-26 were used to sample within the 100 ± 10% isokinetic variation and to confirm that sampling meets this isokinetic variation threshold. Equations 27-29 were used to calculate the volumetric flowrate of the stack flue gas.

2.3.1 Parameter Concentration Calculations

$$c = \frac{m}{V_{std}} \quad \textbf{Equation 1}$$

$$m_{part} = m_{filter} + m_{pw} \quad \textbf{Equation 2}$$

$$m_i = m_{ana,i} - m_{blank} \quad \textbf{Equation 3}$$

$$V_{std} = \frac{V_{std(imp)}}{35.315} \quad \textbf{Equation 4}$$

$$V_{std(imp)} = \frac{V_{samp} \times y \times P_m \times (T_{std} + 459.67)}{P_{std} \times (T_{m(ave)} + 459.67)} \quad \textbf{Equation 5}$$

$$V_{samp} = V_{final} - V_{init} \quad \textbf{Equation 6}$$

$$P_m = P_B + \frac{\Delta H_{ave}}{13.6} \quad \textbf{Equation 7}$$

$$\Delta H_{ave} = \frac{1}{n}\sum_{i=1}^{n} \Delta H_{i(act)}, where\ n = the\ number\ of\ points \quad \textbf{Equation 8}$$

$$OC = \frac{20.9 - \%O_{2c}}{20.9 - \%O_{2m}} \quad \textbf{Equation 9}$$

$$\%O_{2m} = \frac{1}{n}\sum_{i=1}^{n} \%O_{2i}, where\ n = the\ number\ of\ O_2\ measurements \quad \textbf{Equation 10}$$

Where,

c	= *Parameter concentration*
m	= *Parameter mass*
m_i	= *Net analytical mass (mg, ng, or µg)*
$m_{ana,i}$	= *Analytical mass (mg, ng, or µg)*
m_{blank}	= *Blank analytical mass (mg, ng, or µg)*
m_{part}	= *Total particulate mass (mg)*
m_{filter}	= *Net particulate gain from filter (mg)*
m_{pw}	= *Net particulate gain from probe wash (mg)*
$V_{std(imp)}$	= *Sample volume at standard conditions (ft^3)*
V_{std}	= *Sample volume at standard conditions (m^3)*
V_{samp}	= *Sample volume at actual conditions (ft^3)*
V_{final}	= *Final gas meter reading (ft^3)*
V_{init}	= *Initial gas meter reading (ft^3)*
T_{std}	= *Standard temperature (68 °F)*
T_m	= *Gas meter temperature (°F)*
$T_{m(ave)}$	= *Average gas meter temperature (°F)*
P_m	= *Absolute meter pressure (inches of Hg)*
P_B	= *Barometric pressure (inches of Hg)*
P_{std}	= *Standard barometric pressure (29.92 inches of Hg)*
ΔH_{ave}	= *Average of individual point orifice pressures (inches of H_2O)*
$\Delta H_{i(act)}$	= *Individual recorded point orifice pressures (inches of H_2O)*
OC	= *Oxygen correction factor (dimensionless)*
$\%O_{2c}$	= *Oxygen concentration to correct to (% dry basis)*
$\%O_{2i}$	= *Individual oxygen measurements (% dry basis)*
$\%O_{2m}$	= *Average measured stack gas oxygen concentration (% dry basis)*

Equation 1 is the general concentration calculation used for all parameters. The mass, *m*, is the net analytic mass for the given parameter. For particulate, *m* is the sum of the mass contributed from probe washing and filter particulate.

For trace metals, *m* is the blank corrected (Equation 3) analytical result (Appendix 1) for each metals species and run. If the analytical result was below the detection limit, half of the detection limit (DL) was used for *m* in Equation 1.

2.3.2 Isokinetic Variation Calculations

$$\Delta H_i = \frac{2.62 \times 10^7 \times c_p \times A_n \times (1 - B_{wo}) \times M_D \times (T_m + 459.67) \times \Delta p_i}{k_o \times M_w \times (T_{Stk} + 459.67)}$$ **Equation 11**

$$R_m = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{stk_i} + 459.67)}{M_w \times P_B}} \times 60 \times A_n \times \frac{(T_{m_i} + 459.67) \times (1 - B_{wo})}{(T_{stk_i} + 459.67) \times y}$$ **Equation 12**

$$A_n = \pi \left(\frac{d_n}{24}\right)^2$$ **Equation 13**

$$M_w = M_D \times (1 - B_{wo}) + 18 \times B_{wo}$$ **Equation 14**

$$M_D = 0.44 \times \%CO_2 + 0.32 \times \%O_2 + 0.28 \times (100 - \%CO_2 - \%O_2)$$ **Equation 15**

$$T_{Stk} = \frac{1}{n} \sum_{i=1}^{n} T_{Stk_i}, where\ n = the\ number\ of\ points$$ **Equation 16**

$$B_{wo} = \frac{V_{cond}}{V_{cond} + V_{std(imp)}}$$ **Equation 17**

$$V_{cond} = 0.04707 \times V_{gain}$$ **Equation 18**

$$Iso = \frac{1}{n} \sum_{i=1}^{n} Iso_i, where\ n = the\ number\ of\ points$$ **Equation 19**

$$Iso_i = \frac{v_{nzi}}{v_i}$$ **Equation 20**

$$v_i = 85.49 \times c_p \times \sqrt{\Delta p_i} \times \sqrt{\frac{(T_{Stk_i} + 459.67)}{(P_{Stk} \times M_W)}}$$ **Equation 21**

$$v_{nzi} = \frac{(V_i - V_{i-1}) \times y \times (T_{Stk_i} + 459.67) \times (P_B + \frac{\Delta H_{i(act)}}{13.6})}{A_n \times t_i \times 60 \times (T_{m(i)} + 459.67) \times P_{stk} \times (1 - B_{wo})}$$ **Equation 22**

$$P_{stk} = P_B + \frac{P_g}{13.6}$$ **Equation 23**

Equation 24

$$v_{stk} = \frac{1}{n}\sum_{i=1}^{n} v_i \,, where\ n = the\ number\ of\ points$$

Equation 25

$$v_{nz} = \frac{1}{n}\sum_{i=1}^{n} v_{nzi} \,, where\ n = the\ number\ of\ points$$

Where,

A_n	= *Nozzle area (ft^2)*
d_n	= *Diameter of nozzle (inches)*
c_p	= *Pitot coefficient (dimensionless)*
Δp_i	= *Individual point differential pressures (inches of H_2O)*
T_{Stk}	= *Average flue gas temperature (°F), second subscript i, indicates individual point measurements*
T_m	= *Average gas meter temperature (°F), second subscript i, indicates individual point measurements*
k_o	= *Gas meter calibration constant (dimensionless)*
y	= *Gas meter calibration factor (dimensionless)*
$\Delta H_{i(act)}$	= *Calculated individual point orifice pressures (inches of H_2O)*
P_g	= *Stack Static pressure (inches of H_2O)*
P_{stk}	= *Absolute stack pressure (inches of Hg)*
M_w	= *Wet gas molecular weight (g/gmol)*
M_D	= *Dry gas molecular weight (g/gmol)*
$\%CO_2$	= *Stack gas carbon dioxide concentration (% dry basis)*
$\%O_2$	= *Stack gas oxygen concentration (% dry basis)*
B_{wo}	= *Stack gas water vapour, proportion by volume*
V_i	= *Gas meter reading at individual point(ft^3)*
t_i	= *Sample time at each point (minutes)*
V_{cond}	= *Total volume of water vapor collected, corrected to standard conditions (ft^3)*
V_{gain}	= *Condensate gain of impinger contents (mL)*
P_{std}	= *Standard pressure (29.92 inches of Hg)*
v_{stk}	= *Average flue gas velocity (ft/sec)*
v_i	= *Individual point flue gas velocity (ft/sec)*
v_{nz}	= *Average velocity at nozzle(ft/sec)*
v_{nzi}	= *Individual point velocity at nozzle(ft/sec)*
Iso_i	= *Individual point isokinetic variation (%)*
Iso	= *Average isokinetic variation (%)*
R_m	= *Isokinetic sampling rate (ft^3/min)*

2.3.3 Volumetric Flowrate Calculations

$$Q_S = Q_A \times \frac{(T_{Std} + 459.67)}{(T_{Stk} + 459.67)} \times \frac{P_{Stk}}{P_{Std}}$$ **Equation 26**

$$Q_A = \frac{v_{stk} \times 60 \times A_{stk}}{35.315}$$ **Equation 27**

$$A_{stk} = \pi \left(\frac{d}{24}\right)^2$$ **Equation 28**

Where,

Q_A = *Actual flowrate (Am³/min)*
Q_S = *Flowrate (m³/min) at standard conditions on a dry basis*
A_{stk} = *Area of stack (ft²)*
d = *Diameter of stack (inches)*

3 PROCESS DESCRIPTIONS

3.1 Rubber Buffing Room – Emission Source 07

Rubber buffing and polishing area with filtered side draft hoods providing 90% control and filtered collection arms providing 99% control.

On March 15, 2019 the work undertaken during monitoring was:
32” x 30” pipe reducers Flange x DOL (x2)
VN-72 1-3/8”

Upstream Diameters: 0.5
Downstream Diameters: 2.7

3.2 Grit Blast Booth – Emission Source 08

Innovative Blast Technologies, pulse cleaning dust collector consisting of 25 cartridges with particulate matter filter.

On March 14, 2019 the work undertaken during monitoring was:
24” reducer x 20” long
Wear cones 37” x 37” x 13” (x12)

Upstream Diameters: 0.4
Downstream Diameters: 0.8

3.3 Welding Station #19 – Emission Source 09

19 welding stations connected to individual Nederman Modular Filter Systems fitted with particle filters.

On March 14, 2019 the work undertaken during monitoring was:
30” diameter pipe (3 passes) – 282” of weld surface
WPS STT.FC.03 flux core wire 1/16”
24V 190 IPM wire feed

Upstream Diameters: > 2
Downstream Diameters: > 8

Note – Emission Source numbers are as per Metro Vancouver Air Permit GVA1081

4 DETAILED TEST RESULTS

The results of stack emissions were calculated using a "STACK" computer program developed by A. Lanfranco and Associates for BC MOE requirements.

Tables 1-4 present the detailed results of all emissions parameters tested for each of the units. Additional data and the computer outputs can be found in the accompanying Appendices.

TABLE 1: RUBBER BUFFING - SUMMARY OF EMISSION TEST RESULTS

Parameter	Run 1
Test Date - Particulate/Metals	15-Mar-19
Test Time - Particulate/Metals	09:43-10:47
Duration - Minutes	60
Stack Temperature (°C)	24
Average Gas Velocity (m/s)	20.2
Dry Flow Rate (m^3/min)	706
Moisture (Vol. %)	0.7
Oxygen (Vol. %)(dry basis)	21.0
Carbon Dioxide (Vol. %)(dry basis)	0.0
Particulate (mg/m^3)	1.57
Isokinetic Variation (%)	101
Trace Metals	
Pb (mg/m3)	0.00123
Sb (mg/m3)	0.00046
Cu (mg/m3)	0.00043
Mn (mg/m3)	0.00003
V (mg/m3)	0.00006
Zn (mg/m3)	0.00129
As (mg/m3)	0.00011
Cr (mg/m3)	0.00033
Co (mg/m3)	0.00003
Ni (mg/m3)	0.00058
Se (mg/m3)	0.00015
Te (mg/m3)	0.00107
Tl (mg/m3)	0.00015
Cd (mg/m3)	0.00002

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry)

TABLE 2: GRIT BLAST BOOTH - SUMMARY OF EMISSION TEST RESULTS

Parameter	Run 1
Test Date - Particulate/Metals	14-Mar-19
Test Time - Particulate/Metals	13:40-14:42
Duration - Minutes	60
Stack Temperature (°C)	26
Average Gas Velocity (m/s)	11.4
Dry Flow Rate (m^3/min)	339
Moisture (Vol. %)	0.7
Oxygen (Vol. %)(dry basis)	21.0
Carbon Dioxide (Vol. %)(dry basis)	0.0
Particulate (mg/m^3)	0.99
Isokinetic Variation (%)	101
Trace Metals	
Pb (mg/m3)	0.00073
Sb (mg/m3)	0.00055
Cu (mg/m3)	0.00055
Mn (mg/m3)	0.00022
V (mg/m3)	0.00007
Zn (mg/m3)	0.00080
As (mg/m3)	0.00013
Cr (mg/m3)	0.00193
Co (mg/m3)	0.00015
Ni (mg/m3)	0.00105
Se (mg/m3)	0.00058
Te (mg/m3)	0.00128
Tl (mg/m3)	0.00018
Cd (mg/m3)	0.00002

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry)

TABLE 3: WELDING STATION #19 - SUMMARY OF EMISSION TEST RESULTS

Parameter	Run 1
Test Date - Particulate/Metals	14-Mar-19
Test Time - Particulate/Metals	10:47-11:49
Duration - Minutes	60
Stack Temperature (°C)	22
Average Gas Velocity (m/s)	6.6
Dry Flow Rate (m^3/min)	10
Moisture (Vol. %)	0.7
Oxygen (Vol. %)(dry basis)	21.0
Carbon Dioxide (Vol. %)(dry basis)	0.0
Particulate (mg/m^3)	1.64
Isokinetic Variation (%)	100
Trace Metals	
Pb	0.00140
Sb	0.00052
Cu	0.00029
Mn	0.00161
V	0.00007
Zn	0.00091
As	0.00028
Cr	0.00485
Co	0.00003
Ni	0.00136
Se	0.00017
Te	0.00122
Tl	0.00017
Cd	0.00002

All data is corrected to standard conditions (S) of 20 °C, 101.325 kPa (dry)

TABLE 4 - GRAVIMETRIC ANALYSIS

Filter Collection:

	Initial (grams)	Final (grams)	Net Difference (grams)	Blank Adjusted (grams)
Rubber Buffing Blank	0.4719	0.4719	0.0000	
Rubber Buffing Run 1	0.4733	0.4733	0.0000	ND
Grit Booth Blank	0.4719	0.4719	0.0000	
Grit Booth Run 1	0.4706	0.4706	0.0000	ND
Welding St. Blank	0.4719	0.4719	0.0000	
Welding St. Run 1	0.4784	0.4784	0.0000	ND

Front Half Washings:

	Initial (grams)	Final (grams)	Net Difference (grams)	Blank Adjusted (grams)
Rubber Buffing Blank	109.5900	109.5896	-0.0004	
Rubber Buffing Run 1	119.4815	119.4836	0.0021	0.0025
Grit Booth Blank	109.5900	109.5896	-0.0004	
Grit Booth Run 1	98.5213	98.5222	0.0009	0.0013
Welding St. Blank	109.5900	109.5896	-0.0004	
Welding St. Run 1	112.9823	112.9842	0.0019	0.0023

5 DISCUSSION

Weir Canada Inc. requested that A. Lanfranco and Associates Inc. perform one emission test run of three emission sources for various parameters to determine a baseline of actual facility emissions.

While there are no existing regulations for direct comparison of emission test results, in 2010 Metro Vancouver published the Industrial Solid Waste and Resource Management Plan (ISWRMP), focusing on the operation of their Waste-to-Energy Facility. Trace Metals were categorized into three groups. Class I: total of Cadmium, Mercury (not applicable) and Thallium, Class II: total of Arsenic, Cobalt, Nickel, Selenium and Tellurium, Class III: total of Antimony, Lead, Chromium, Copper, Manganese, Vanadium and Zinc. The limits are Class I: 0.2 mg/Sm^3, Class II: 1 mg/Sm^3 and Class 3: 5 mg/Sm^3. The emissions from the three sources measured at Weir Canada are approximately 1000 times less than the corresponding limits.

Particulate Matter emissions were low compared to general emission limits across various industries; however, they are above the limits stipulated in GVA 1081.

The particulate mass gathered from all three sources was in the rinsing of the sample nozzle, probe liner and filter housing (top). The gravimetric analysis of the sample filter was non-detectable for all three sources.

Sampling was conducted in accordance with their respective reference methods (EPA 29 except as discussed) and passed all appropriate quality assurance and quality control criteria.

All sampling was conducted/supervised by certified emission testing personnel, using calibrated source sampling equipment and quality controlled reagents.

Each source was measured during normal operating conditions such that the results are representative of day to day activities at Weir Canada.

There were no problems associated with the sampling and the results are therefore reported with a high level of confidence.

APPENDIX 1

COMPUTER OUTPUTS OF MEASURED AND CALCULATED DATA

Client:	Weir Canada	**Date:**	15-Mar-19
Jobsite:	Weir - Surrey, BC	**Run:**	1 - Particulate / Metals
Source:	Rubber Buffing Room	**Run Time:**	09:43-10:47

Concentrations:

Particulate	1.57	mg/dscm	0.00068	gr/dscf
	1.53	mg/Acm	0.00067	gr/Acf

Emission Rates:

Particulate	0.066	Kg/hr	0.146	lb/hr

Flue Gas Characteristics:

Flow	706	dscm/min	24944	dscf/min
	11.77	dscm/sec	416	dscf/sec
	721	Acm/min	25467	Acf/min
Velocity	20.162	m/sec	66.15	f/sec
Temperature	23.7	oC	74.7	oF
Moisture	0.7	%		
Gas Analysis	21.0	% O2		
	0.0	% CO2		
	28.840	Mol. Wt (g/gmole) Dry		
	28.765	Mol. Wt (g/gmole) Wet		

Sample Parameters:

Sample Volume	1.6291	dscm	57.533	dscf
Sample Time	60.0	minutes		
Isokineticity	101.4	%		

*** Standard Conditions:** Metric: 20 deg C, 101.325 kPa
Imperial: 68 deg F, 29.92 in.Hg

Client:	Weir Canada	**Date:**	15-Mar-19
Jobsite:	Weir - Surrey, BC	**Run:**	1 - Particulate / Metals
Source:	Rubber Buffing Room	**Run Time:**	09:43-10:47

Control Unit (Y)	1.0232		
Nozzle Diameter (in.)	0.2112		
Pitot Factor	0.8349		
Baro. Press. (in. Hg)	30.25		
Static Press. (in. H20)	-5.00		
Stack Height (ft)	30		
Stack Dimensions (in.)	42.00	22	
Stack Area (sq.ft.)	6.417		
Minutes Per Reading	2.5		
Minutes Per Point	2.5		

Collection:	
Filter (grams)	0.00005
Washings (grams)	0.00250
Total (grams)	**0.00255**

Gas Analysis (Vol. %):		
	CO2	O2
Traverse 1	0.00	21.00
Traverse 2	0.00	21.00
	0.00	**21.00**

Condensate Collection:	
Impinger 1	-30.0
Impinger 2	27.0
Impinger 3	3.0
Impinger 4	0.0
Impinger 5	0.0
Impinger 6	0.0
Gel	8.5
Gain (grams)	**8.5**

Traverse / Point	Time (min.)	Dry Gas Meter (ft3)	Pitot ^P (in. H2O)	Orifice ^H (in. H2O)	Dry Gas Temperature Inlet (oF)	Dry Gas Temperature Outlet (oF)	Vacuum (in. Hg.)	Stack Temp. (oF)	Wall Dist. (in.)	Isokin. (%)
Traverse 1	0.0	733.920								
1	2.5	736.860	2.30	4.37	62	62	5	75	1.5	101.9
2	5.0	739.670	2.10	3.99	62	62	5	74	4.1	101.8
3	7.5	742.330	1.90	3.61	63	63	5	75	9.3	101.1
4	10.0	744.710	1.50	2.85	63	63	5	75	13.8	101.6
5	12.5	746.660	1.00	1.91	64	64	4	74	17.7	101.5
6	15.0	748.610	1.00	1.91	64	64	4	74	20.7	101.5
Traverse 2	0.0	748.610								
1	2.5	751.420	2.10	4.00	65	65	5	75	1.5	101.3
2	5.0	753.900	1.60	3.06	66	66	4	74	4.1	101.9
3	7.5	756.130	1.30	2.50	66	66	4	74	9.3	101.5
4	10.0	758.070	0.98	1.88	67	67	4	74	13.8	101.4
5	12.5	759.880	0.85	1.63	68	68	4	75	17.7	101.4
6	15.0	761.710	0.87	1.67	68	68	4	75	20.7	101.3
Traverse 3	0.0	761.710								
1	2.5	764.370	1.85	3.55	68	68	4	75	1.5	101.5
2	5.0	766.700	1.40	2.70	70	70	4	75	4.1	101.6
3	7.5	768.850	1.20	2.31	71	71	4	75	9.3	101.0
4	10.0	770.800	0.98	1.90	71	71	4	74	13.8	101.1
5	12.5	772.750	0.98	1.90	72	72	4	74	17.7	100.9
6	15.0	774.710	0.98	1.90	72	72	4	75	20.7	101.6
Traverse 4	0.0	774.710								
1	2.5	777.580	2.10	4.06	72	72	5	75	1.5	102.1
2	5.0	780.150	1.70	3.30	74	74	5	75	4.1	101.1
3	7.5	782.460	1.35	2.63	76	76	4	75	9.3	101.4
4	10.0	784.810	1.40	2.73	76	76	4	75	13.8	101.3
5	12.5	786.990	1.20	2.34	77	77	4	75	17.7	101.2
6	15.0	789.270	1.30	2.54	78	78	4	75	20.7	101.6
Average:			1.414	2.718	69.0	69.0	4.3	74.7		101.4

Client:	Weir Canada	**Date:**	14-Mar-19
Jobsite:	Weir - Surrey, BC	**Run:**	1 - Particulate / Metals
Source:	Grit Blast Booth	**Run Time:**	13:40-14:42

Concentrations:

Particulate	1.0	mg/dscm	0.0004	gr/dscf
	1.0	mg/Acm	0.0004	gr/Acf

Emission Rates:

Particulate	0.020	Kg/hr	0.044	lb/hr

Flue Gas Characteristics:

Flow	339	dscm/min	11981	dscf/min
	5.65	dscm/sec	200	dscf/sec
	345	Acm/min	12180	Acf/min
Velocity	11.394	m/sec	37.38	f/sec
Temperature	25.9	oC	78.5	oF
Moisture	0.7	%		
Gas Analysis	21.0	% O2		
	0.0	% CO2		
	28.840	Mol. Wt (g/gmole) Dry		
	28.760	Mol. Wt (g/gmole) Wet		

Sample Parameters:

Sample Volume	1.3684	dscm	48.325	dscf
Sample Time	60.0	minutes		
Isokineticity	101.0	%		

*** Standard Conditions:** Metric: 20 deg C, 101.325 kPa
Imperial: 68 deg F, 29.92 in.Hg

Client:	Weir Canada	**Date:**	14-Mar-19
Jobsite:	Weir - Surrey, BC	**Run:**	1 - Particulate / Metals
Source:	Grit Blast Booth	**Run Time:**	13:40-14:42

Control Unit (Y)	1.0232		**Collection:**			**Gas Analysis (Vol. %):**		**Condensate Collection:**	
Nozzle Diameter (in.)	0.2575		Filter (grams)	0.00005		CO2	O2	Impinger 1	-10.0
Pitot Factor	0.8349		Washings (grams)	0.00130	Traverse 1	0.00	21.00	Impinger 2	8.0
Baro. Press. (in. Hg)	30.25				Traverse 2	0.00	21.00	Impinger 3	2.0
Static Press. (in. H20)	-0.14		**Total (grams)**	**0.00135**				Impinger 4	0.0
Stack Height (ft)	30							Impinger 5	0.0
Stack Diameter (in.)	23.00	34						Impinger 6	0.0
Stack Area (sq.ft.)	5.431							Gel	7.6
Minutes Per Reading	2.5					**0.00**	**21.00**	**Gain (grams)**	**7.6**
Minutes Per Point	2.5								

Traverse / Point	Time (min.)	Dry Gas Meter (ft3)	Pitot ^P (in. H2O)	Orifice ^H (in. H2O)	Dry Gas Temperature Inlet (oF)	Dry Gas Temperature Outlet (oF)	Vacuum (in. Hg.)	Stack Temp. (oF)	Wall Dist. (in.)	Isokin. (%)
Traverse 1	0.0	687.510								
1	2.5	689.410	0.44	1.85	62	62	4	77	1.5	100.3
2	5.0	691.460	0.51	2.12	62	62	4	78	5.6	100.7
3	7.5	693.520	0.52	2.17	62	62	4	78	10.2	100.3
4	10.0	695.580	0.51	2.12	62	62	4	79	14.0	101.3
5	12.5	697.540	0.47	1.93	62	62	4	78	18.9	100.3
6	15.0	699.400	0.42	1.75	62	62	4	79	21.7	100.7
Traverse 2	0.0	699.400								
1	2.5	701.340	0.46	1.91	62	62	4	79	1.5	100.4
2	5.0	703.290	0.46	1.92	63	63	4	79	5.6	100.7
3	7.5	705.190	0.43	1.80	63	63	4	79	10.2	101.5
4	10.0	707.090	0.43	1.80	63	63	4	79	14.0	101.5
5	12.5	709.050	0.46	1.92	63	63	4	79	18.9	101.3
6	15.0	711.010	0.46	1.92	64	64	4	78	21.7	101.0
Traverse 3	0.0	711.010								
1	2.5	712.750	0.36	1.51	64	64	3	78	1.5	101.2
2	5.0	714.540	0.38	1.60	65	65	3	79	5.6	101.3
3	7.5	716.300	0.37	1.55	64	64	4	78	10.2	101.0
4	10.0	718.140	0.40	1.68	65	65	4	78	14.0	101.4
5	12.5	720.050	0.43	1.80	66	66	4	79	18.9	101.4
6	15.0	721.950	0.43	1.81	66	66	4	78	21.7	100.8
Traverse 4	0.0	721.950								
1	2.5	723.920	0.46	1.93	66	66	4	78	1.5	101.1
2	5.0	725.900	0.46	1.93	67	67	4	79	5.6	101.5
3	7.5	727.920	0.48	2.02	67	67	4	79	10.2	101.4
4	10.0	729.840	0.44	1.85	67	67	4	79	14.0	100.6
5	12.5	731.780	0.45	1.89	67	67	4	79	18.9	100.6
6	15.0	733.680	0.43	1.81	67	67	4	79	21.7	100.7
Average:			0.444	1.858	64.2	64.2	3.9	78.5		101.0

Client:	Weir Canada	**Date:**	14-Mar-19
Jobsite:	Weir - Surrey, BC	**Run:**	1 - Particulate / Metals
Source:	Welding Station #19	**Run Time:**	10:47-11:49

Concentrations:

Particulate	1.64	mg/dscm	0.00072	gr/dscf
	1.64	mg/Acm	0.00072	gr/Acf

Emission Rates:

Particulate	0.001	Kg/hr	0.002	lb/hr

Flue Gas Characteristics:

Flow	10	dscm/min	348	dscf/min
	0.16	dscm/sec	6	dscf/sec
	10	Acm/min	349	Acf/min
Velocity	6.629	m/sec	21.75	f/sec
Temperature	21.6	oC	70.9	oF
Moisture	0.7	%		
Gas Analysis	21.0	% O2		
	0.0	% CO2		
	28.840	Mol. Wt (g/gmole) Dry		
	28.760	Mol. Wt (g/gmole) Wet		

Sample Parameters:

Sample Volume	1.4299	dscm	50.499	dscf
Sample Time	60.0	minutes		
Isokineticity	100.5	%		

*** Standard Conditions:** Metric: 20 deg C, 101.325 kPa
Imperial: 68 deg F, 29.92 in.Hg

Client:	Weir Canada	**Date:**	14-Mar-19
Jobsite:	Weir - Surrey, BC	**Run:**	1 - Particulate / Metals
Source:	Welding Station #19	**Run Time:**	10:47-11:49

Control Unit (Y)	1.0232	**Collection:**			**Gas Analysis (Vol. %):**			**Condensate Collection:**	
Nozzle Diameter (in.)	0.3433	Filter (grams)	0.00005		CO2	O2		Impinger 1	-10.0
Pitot Factor	0.8349	Washings (grams)	0.00230	Traverse 1	0.00	21.00		Impinger 2	10.0
Baro. Press. (in. Hg)	30.25			Traverse 2	0.00	21.00		Impinger 3	1.0
Static Press. (in. H20)	0.30	**Total (grams)**	**0.00235**					Impinger 4	0.0
Stack Height (ft)	30							Impinger 5	0.0
Stack Diameter (in.)	7.00							Impinger 6	0.0
Stack Area (sq.ft.)	0.267							Gel	7.0
Minutes Per Reading	5.0				**0.00**	**21.00**		**Gain (grams)**	**8.0**
Minutes Per Point	5.0								

Traverse / Point	Time (min.)	Dry Gas Meter (ft3)	Pitot ^P (in. H2O)	Orifice ^H (in. H2O)	Dry Gas Temperature Inlet (oF)	Dry Gas Temperature Outlet (oF)	Vacuum (in. Hg.)	Stack Temp. (oF)	Wall Dist. (in.)	Isokin. (%)
Traverse 1	0.0	639.103								
1	5.0	643.020	0.15	1.97	58	58	2	72	1.0	100.0
2	10.0	646.950	0.15	1.97	58	58	2	75	2.0	100.6
3	15.0	650.890	0.15	1.97	58	58	2	75	3.0	100.8
4	20.0	654.970	0.16	2.11	60	60	2	75	4.0	100.7
5	25.0	659.310	0.18	2.38	61	61	2	75	5.0	100.9
6	30.0	663.390	0.16	2.11	62	62	2	76	6.0	100.4
Traverse 2	0.0	663.390								
1	5.0	667.230	0.14	1.88	64	64	2	68	1.0	99.9
2	10.0	671.280	0.15	2.02	65	65	2	68	2.0	101.6
3	15.0	675.180	0.14	1.90	66	66	2	66	3.0	100.9
4	20.0	679.080	0.14	1.90	67	67	2	67	4.0	100.8
5	25.0	683.170	0.16	2.17	68	68	2	67	5.0	98.7
6	30.0	687.210	0.15	2.04	68	68	2	67	6.0	100.7
Average:			0.153	2.035	62.9	62.9	2.0	70.9		100.5

APPENDIX 2

ANALYTICAL DATA

Exova
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Report Transmission Cover Page

Bill To:	A. Lanfranco & Associates	Project ID:	Weir	Lot ID:	**1339597**
	#101, 9488 - 189 Street	Project Name:		Control Number:	
	Surrey, BC, Canada	Project Location:	Surrey, BC	Date Received:	Mar 20, 2019
	V4N 4W7	LSD:		Date Reported:	Mar 26, 2019
Attn:	Missy	P.O.:		Report Number:	2388698
Sampled By:		Proj. Acct. code:			
Company:					

Contact	Company	Address
Mark Lanfranco	**A. Lanfranco & Associates**	#101, 9488 - 189 Street Surrey, BC V4N 4W7 Phone: (604) 881-2582 Fax: (604) 881-2581 Email: mark.lanfranco@alanfranco.com

Delivery	Format	Deliverables
Email - Merge Reports	PDF	COC / Test Report
Email - Multiple Reports By Agreement	PDF	COA
Email - Single Report	PDF	COR

Notes To Clients:

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Analytical Report

Bill To:	A. Lanfranco & Associates	Project ID:	Weir	Lot ID:	**1339597**
	#101, 9488 - 189 Street	Project Name:		Control Number:	
	Surrey, BC, Canada	Project Location:	Surrey, BC	Date Received:	Mar 20, 2019
	V4N 4W7	LSD:		Date Reported:	Mar 26, 2019
Attn:	Missy	P.O.:		Report Number:	2388698
Sampled By:		Proj. Acct. code:			
Company:					

Reference Number	1339597-1	1339597-2	1339597-3
Sample Date	Mar 15, 2019	Mar 14, 2019	Mar 15, 2019
Sample Time	NA	NA	NA
Sample Location			
Sample Description	Metals Blank (Beaker "MC Blk" + 1 Bottle)	Grit Blast - Run #1 (Beaker "MC1" + 1 Bottle)	Rubber Trim - Run #1 (Beaker "MC2" + 1 Bottle)
Matrix	Stack Samples	Stack Samples	Stack Samples

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Air Quality Metals						
Aluminum	Strong Acid Extractable	µg	7.8	12	22	0.5
Antimony	Strong Acid Extractable	µg	<1	<1	<1	1.5
Arsenic	Strong Acid Extractable	µg	<0.4	<0.4	<0.4	0.35
Barium	Strong Acid Extractable	µg	0.50	0.62	0.65	0.2
Beryllium	Strong Acid Extractable	µg	<0.01	<0.01	<0.01	0.01
Cadmium	Strong Acid Extractable	µg	<0.05	<0.05	<0.05	0.05
Calcium	Strong Acid Extractable	µg	85	120	170	0.5
Chromium	Strong Acid Extractable	µg	0.66	3.3	1.2	0.1
Cobalt	Strong Acid Extractable	µg	<0.1	0.2	<0.1	0.1
Copper	Strong Acid Extractable	µg	0.1	0.85	0.80	0.1
Iron	Strong Acid Extractable	µg	9.6	160	26	0.2
Lead	Strong Acid Extractable	µg	<0.5	1	2	0.5
Magnesium	Strong Acid Extractable	µg	28	37	82	1
Manganese	Strong Acid Extractable	µg	2.4	2.7	1.5	0.05
Molybdenum	Strong Acid Extractable	µg	0.3	1.1	0.4	0.1
Nickel	Strong Acid Extractable	µg	0.56	2.0	1.5	0.25
Phosphorus	Strong Acid Extractable	µg	170	160	160	0.5
Potassium	Strong Acid Extractable	µg	31	40	55	2
Selenium	Strong Acid Extractable	µg	<0.5	0.8	<0.5	0.5
Silicon	Strong Acid Extractable	µg	52	150	180	0.25
Silver	Strong Acid Extractable	µg	<0.4	<0.4	<0.4	0.4
Sodium	Strong Acid Extractable	µg	300	290	330	5
Sulfur	Strong Acid Extractable	µg	20	34	36	1
Tellurium	Strong Acid Extractable	µg	<4	<4	<4	3.5
Thallium	Strong Acid Extractable	µg	<0.5	<0.5	<0.5	0.5
Tin	Strong Acid Extractable	µg	14	18	20	0.5
Titanium	Strong Acid Extractable	µg	0.3	0.91	0.67	0.1
Vanadium	Strong Acid Extractable	µg	<0.2	<0.2	<0.2	0.2
Zinc	Strong Acid Extractable	µg	6.4	7.5	8.5	0.05
Zirconium	Strong Acid Extractable	µg	<0.1	0.1	<0.1	0.1

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Analytical Report

Bill To:	A. Lanfranco & Associates	Project ID:	Weir	Lot ID:	**1339597**
	#101, 9488 - 189 Street	Project Name:		Control Number:	
	Surrey, BC, Canada	Project Location:	Surrey, BC	Date Received:	Mar 20, 2019
	V4N 4W7	LSD:		Date Reported:	Mar 26, 2019
Attn:	Missy	P.O.:		Report Number:	2388698
Sampled By:		Proj. Acct. code:			
Company:					

Reference Number	1339597-4
Sample Date	Mar 15, 2019
Sample Time	NA
Sample Location	
Sample Description	Welding Station #19 - Run #1 (Beaker "MC3" + 1 Bottle)
Matrix	Stack Samples

Analyte		Units	Results	Results	Results	Nominal Detection Limit
Air Quality Metals						
Aluminum	Strong Acid Extractable	µg	19			0.5
Antimony	Strong Acid Extractable	µg	<1			1.5
Arsenic	Strong Acid Extractable	µg	0.4			0.35
Barium	Strong Acid Extractable	µg	0.82			0.2
Beryllium	Strong Acid Extractable	µg	<0.01			0.01
Cadmium	Strong Acid Extractable	µg	<0.05			0.05
Calcium	Strong Acid Extractable	µg	210			0.5
Chromium	Strong Acid Extractable	µg	7.6			0.1
Cobalt	Strong Acid Extractable	µg	<0.1			0.1
Copper	Strong Acid Extractable	µg	0.52			0.1
Iron	Strong Acid Extractable	µg	55			0.2
Lead	Strong Acid Extractable	µg	2			0.5
Magnesium	Strong Acid Extractable	µg	67			1
Manganese	Strong Acid Extractable	µg	4.7			0.05
Molybdenum	Strong Acid Extractable	µg	2.5			0.1
Nickel	Strong Acid Extractable	µg	2.5			0.25
Phosphorus	Strong Acid Extractable	µg	170			0.5
Potassium	Strong Acid Extractable	µg	57			2
Selenium	Strong Acid Extractable	µg	<0.5			0.5
Silicon	Strong Acid Extractable	µg	150			0.25
Silver	Strong Acid Extractable	µg	<0.4			0.4
Sodium	Strong Acid Extractable	µg	340			5
Sulfur	Strong Acid Extractable	µg	82			1
Tellurium	Strong Acid Extractable	µg	<4			3.5
Thallium	Strong Acid Extractable	µg	<0.5			0.5
Tin	Strong Acid Extractable	µg	19			0.5
Titanium	Strong Acid Extractable	µg	1.4			0.1
Vanadium	Strong Acid Extractable	µg	<0.2			0.2
Zinc	Strong Acid Extractable	µg	7.7			0.05
Zirconium	Strong Acid Extractable	µg	0.2			0.1

Approved by:

Mathieu Simoneau
Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

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Methodology and Notes

Bill To:	A. Lanfranco & Associates	Project ID:	Weir	Lot ID:	**1339597**
	#101, 9488 - 189 Street	Project Name:		Control Number:	
	Surrey, BC, Canada	Project Location:	Surrey, BC	Date Received:	Mar 20, 2019
	V4N 4W7	LSD:		Date Reported:	Mar 26, 2019
Attn:	Missy	P.O.:		Report Number:	2388698
Sampled By:		Proj. Acct. code:			
Company:					

Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
Metals (Strong Acid Leachable) in air (Surrey)	NIOSH	*	Lead in Surface Wipes, 9100	Mar 20, 2019	Exova Surrey
Metals (Strong Acid Leachable) in air (Surrey)	US EPA	*	Metals & Trace Elements by ICP-AES, 6010C	Mar 20, 2019	Exova Surrey

** Reference Method Modified*

References

NIOSH	National Institute of Occupational Safety and Health
US EPA	US Environmental Protection Agency Test Methods

Exova

Lot: 1339597 COC

ntrol Number

formation Sheet

ed in order to proceed with analysis

Assuring

Billi			**Copy of Report To:**		Copy of invoice:
Company:	A. Lanfranco and Associates		Company:		Mail invoice to this
Address:	Unit 101 - 9488 189 St Surrey BC V4N 4W7	QA/QC Report ☐	Address:		address for approval ☐
		Report Result:			Report Result:
Attention:		Fax ☐	Attention:		Fax ☐
Phone:	604-881-2582	Mail ☐	Phone:		Mail ☐
Fax:		Courier ☐	Fax:		Courier ☐
Cell:		e-mail x	Cell:		e-mail ☐
e-mail:	mark.lanfranco@alanfranco.com	e-Service ☐	e-mail:		e-Service ☐

MAR 20'19 11:4

Information to be included on Report and Invoice

Project ID: Weir
Project Name:
Project Location: Surrey, BC
Legal Location:
PO#:
Proj. Acct. Code:
Agreement ID:

RUSH **Please contact the laboratory to confirm rush dates and times before submitting samples.**

Upon filling out this section, client accepts that surcharges will be attached to this analysis

RUSH required on: All Analysis ☐ or As indicated ☐

Date Required: _____

Signature: _____

Exova Authorization: _____

Sample Custody (Please Print)

Sampled by:

Company Signature

I authorize Exova to proceed with the work work indicated on this form:

Date: Initial:

Received by: LC	Sample Temp. 17.4°C
Waybill #:	Date
Company	Time

Special Instructions / Comments

Please report µg/sample

FOR LAB USE ONLY

Condiftion of containers/coolers upon arrival at lab

☐ Check here if Exova is required to report results directly to a regulatory body (Please include contact information)

☐ Check here if you are testing POTABLE WATER for **HUMAN CONSUMPTION**

Please indicate which regulations you are required to meet: _____

	Sample Identification	Location	Depth IN CM M	Date/Time Sampled	Matrix	Sampling Method	Number of Containers	Metals	Enter tests above (✓ relevant samples below)
1	Metals Blank (Beaker "MC BLK" and 1 Bottle)			March 15/19			2	✓	
2									
3	Grit Blast - Run #1 Metals (Beaker "MC1" + 1 Bottle)			March 14/19			2	✓	
4									
5	Rubber Trim - Run#1 Metals (Beaker "MC2" + 1 Bottle)			March 15/19			2	✓	
6									
7	Welding Station #19- Run #1 Metals (Beaker "MC3" + 1 Bottle)			March 15/19			2	✓	
8									
9									
10									
11									
12									
13									
14									
15									

NOTE: All hazardous samples must be labelled according to WHIMIS guidelines.

APPENDIX 3

FIELD DATA SHEETS and

PROCESS DATA

7

A. Lanfranco and Associates Inc.

CLIENT	WSP	NOZZLE Glass DIAMETER, IN. 0.247	
SOURCE	Rubber Trim + Buff Particulate	PROBE Glass 4A-3 Cp 0.834	
PARAMETER / RUN No	1	PORT LENGTH	
DATE	March 15/19	STATIC PRESSURE, IN. H2O -5.0"	
OPERATOR	SH	STACK DIAMETER 42.0 x 22.0 32.8	
CONTROL UNIT	AA-15Y 1.0237	STACK HEIGHT	
	ΔH@ 1.682		
BAROMETRIC PRESSURE, IN. Hg	30.23	INITIAL LEAK TEST 0.001 @ 15"	
ASSUMED MOISTURE, Bw	1%	FINAL LEAK TEST 0.001 @ 15"	

IMPINGER VOLUMES	INITIAL (mL)	FINAL (mL)	TOTAL GAIN (mL)
Imp. #1	100	70	-30
Imp. #2	100	127	27
Imp. #3	0	3	3
Imp. #4	200		
Imp. #5			
Imp. #6			
Upstream Diameters			
Downstream Diameters			

Point	Clock Time	Dry Gas Meter ft³	Pitot ΔP IN. H_2O	Orifice ΔH IN. H_2O	Temperature °F: Dry Gas Outlet	Stack	Probe	Box	Impinger Exit	Pump Vac. IN. Hg	Fyrites: CO_2 Vol. %	Fyrites: O_2 Vol. %		
	09:43	733.92												
1		736.86	2.30	4.37	62	73	140	250	55	3	0.0	21.0		
2		739.67	2.10	3.99	62	74								
3		742.33	1.90	3.61	63	75	142	256	56	3				
4		744.71	1.50	2.85	63	73								
5		746.66	1.10	1.91	64	74	144	260	56	4				
6		748.61	1.00	1.91	64	74								
1		751.42	2.10	4.00	65	73	142	257	56	5	0.0	21.0		
2		753.90	1.60	3.00	66	74								
3		756.13	1.30	2.50	66	74	210	255	56	4				
4		758.03	0.98	1.88	67	74								
5		759.88	0.85	1.63	68	75	241	255	56	4				
6		761.71	0.87	1.67	68	75								
1		764.37	1.85	3.55	68	75	242	253	57	4	0.0	21.0		
2		766.70	1.40	2.70	70	75								
3		768.85	1.14	2.31	71	75	240	255	57	4				
4		770.80	0.98	1.90	71	74								
5		772.75	0.98	1.90	72	74	241	254	57	4				
6		774.71	0.98	1.90	72	75								
1		777.58	2.10	4.06	72	75	253	242	57	3	0.0	21.0		
2		780.15	1.70	3.30	74	75								
3		782.46	1.35	2.63	76	75	254	240	57	4				
4		784.81	1.40	2.73	76	75								
5		786.99	1.20	2.34	77	75	253	241	57	4				
6	10:47	789.27	1.30	2.34	78	75								

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A. Lanfranco and Associates Inc.

CLIENT	Grit Blast Booth	NOZZLE Type P DIAMETER, IN. 0.2575	
SOURCE		PROBE Glass 4A-3 Cp 0.8349	
PARAMETER / RUN No	Particulates	PORT LENGTH	
DATE	March 14/19	STATIC PRESSURE, IN. H2O -0.14	
OPERATOR:		STACK DIAMETER 23.0 X 34.0 30.4	
CONTROL UNIT	Y 1.0232	STACK HEIGHT	
	ΔH@ 1.682		
BAROMETRIC PRESSURE, IN. Hg	30.25	INITIAL LEAK TEST 0.001 @ 15 "	
ASSUMED MOISTURE, Bw	1%	FINAL LEAK TEST 0.001 @ 15 "	

IMPINGER VOLUMES	INITIAL (mL)	FINAL (mL)	TOTAL GAIN (mL)
Imp. #1	100	98	-18
Imp. #2	100	198	98
Imp. #3	0	2	2
Imp. #4	200		
Imp. #5			
Imp. #6			
Upstream Diameters			
Downstream Diameters			

Point	Clock Time	Dry Gas Meter ft³	Pitot ΔP IN. H_2O	Orifice ΔH IN. H_2O	Temperature °F: Dry Gas Outlet	Stack	Probe	Box	Impinger Exit	Pump Vac. IN. Hg	Fyrites: CO_2 Vol. %	Fyrites: O_2 Vol. %		
1	13:40	687.510	0.44	1.83	60	76	255	254	55	4				
2		689.41	0.37	1.53	61	76					0.0	21.0		
3		691.40	0.37	1.53	61	76	252	260	55	4				
4		693.32	0.37	1.53	61	77								
5		695.58	0.37	1.53	61	78	254	256	55	4				
6		697.54	0.47	1.96	62	78								
		699.40	0.42	1.73	62	79								
1							254							
2		701.34	0.46	1.91	62	79		255	56	4	0.0	21.0		
3		703.29	0.46	1.91	63	79								
4		705.14	0.43	1.80	63	79	256	254	56	4				
5		707.09	0.43	1.80	63	79								
6		709.05	0.46	1.92	63	79	255	256	56	4				
		711.01	0.46	1.92	64	78								
1		712.75	0.36	1.51	64	78	257	255	56	3	0.0	21.0		
2		714.54	0.38	1.60	65	79								
3		716.30	0.37	1.55	64	79	256	255	56	4				
4		718.14	0.40	1.68	65	79								
5		720.05	0.43	1.80	66	79	257	254	56	4				
6		721.95	0.43	1.81	66	78								
1		723.91	0.46	1.93	66	78	255	256	56	4	0.0	21.0		
2		725.90	0.46	1.93	67	79								
3		727.94	0.48	2.01	67	79	257	256	56	4				
4		729.84	0.44	1.85	67	79								
5		731.78	0.43	1.79	67	79	256	255	56	4				
6	14:42	733.68	0.43	1.81	67	79								

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A. Lanfranco and Associates Inc.

CLIENT	Weir	NOZZLE Glass G-343 DIAMETER, IN. 0.3433	
SOURCE	Welding Station #19 Post/Metals	PROBE Glass 4A-3 Cp 0.8349	
PARAMETER / RUN No		PORT LENGTH	
DATE	March 14 19	STATIC PRESSURE, IN. H2O +0.30	
OPERATOR:		STACK DIAMETER 2.0"	
CONTROL UNIT	AA-15 Y 1.9232	STACK HEIGHT	
	ΔH@ 1.687		
BAROMETRIC PRESSURE, IN. Hg	30.25	INITIAL LEAK TEST 0.001 @ 15"	
ASSUMED MOISTURE, Bw	1%	FINAL LEAK TEST 0.001 @ 15"	

IMPINGER VOLUMES	INITIAL (mL)	FINAL (mL)	TOTAL GAIN (mL)
Imp. #1	100	90	-10
Imp. #2	100	110	+10
Imp. #3	0	1	1
Imp. #4	200		
Imp. #5			
Imp. #6			
Upstream Diameters			
Downstream Diameters			

Point	Clock Time	Dry Gas Meter ft³	Pitot ΔP IN. H_2O	Orifice ΔH IN. H_2O	Temperature °F: Dry Gas Outlet	Stack	Probe	Box	Impinger Exit	Pump Vac. IN. Hg	Fyrites: CO_2 Vol. %	Fyrites: O_2 Vol. %	∠
	10:47	639.103											NULL
1		643.92	0.15	1.97	58	72	256	252	55	2	0.0	21.0	0
2	IN	646.93	0.13	1.96	58	73							0
3		650.89	0.15	1.97	58	75	260	261	56	2			0
4	OUT	654.97	0.16	2.11	60	75							0
5		659.31	0.18	2.38	61	73	259	260	56	2	0.0	21.0	0
6		663.39	0.16	2.11	62	76							0
1		667.26	0.14	1.88	64	68	256	253	56	2	0.0	21.0	0
2		671.28	0.13	1.82	65	68							0
3		675.18	0.14	1.90	66	69	254	254	56	2			0
4		679.08	0.14	1.90	67	67							0
5		683.17	0.16	2.17	68	67	255	254	56	2	0.0	21.0	0
6	11:49	687.21	0.15	2.04	68	67							0

Mark Lanfranco

From: Chris Dunn <Chris.Dunn@mail.weir>
Sent: March 25, 2019 10:56 AM
To: Mark Lanfranco
Cc: Ricardo Parodi; Glen Wakelin
Subject: RE: [EXTERNAL] Production information and equipment specs

Hi Mark,

Here is the info for the testing,

Weld station 19:
Welder Raynier,
30" dia pipe 3 passes = 282" of weld sure face
WPS STT.FC.03 flux core wire 1/16"
24v 190 IPM wire feed speed

Grit Blast booth:
Blaster Craig,
24" reducer x 20" long (x1)
Wear cones 37" x 37" x 13" (x12)

Rubber buffing:
Buffers Jagjit and Balvir,
32" x 30" pipe reducers Flange x DOL (x2)
VN-72 1-3/8"

Chris Dunn
Maintenance Supervisor

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APPENDIX 4

SOURCE PHOTOS

Rubber Buffing Room – Emission Source 07

Grit Blast Booth – Emission Source 08

Welding Station #19 – Emission Source 09

APPENDIX 5
CALIBRATION DATA

A.Lanfranco & Associates inc.

EPA Method 5

Meter Box Calibration

English Meter Box Units, English K' Factor

Model #: AU 15
Serial #: 0028SPC-081915-1

Date: 07-Jan-19
Barometric Pressure: 30.01 (in. Hg)
Theoretical Critical Vacuum: 14.16 (in. Hg)

!!!!!!!!!
IMPORTANT For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.
IMPORTANT The Critical Orifice Coefficient, K', must be entered in English units, (ft)^3*(deg R)^0.5/((in.Hg)*(min)).
!!!!!!!!!

---------- DRY GAS METER READINGS ----------									-CRITICAL ORIFICE READINGS-					
					Initial Temps.		Final Temps.					-- Ambient Temperature --		
dH (in H2O)	Time (min)	Volume Initial (cu ft)	Volume Final (cu ft)	Volume Total (cu ft)	Inlet (deg F)	Outlet (deg F)	Inlet (deg F)	Outlet (deg F)	Orifice Serial# (number)	K' Orifice Coefficient (see above)	Actual Vacuum (in Hg)	Initial (deg F)	Final (deg F)	Average (deg F)
3.50	15.00	475.500	491.040	15.540	67.0	67.0	67.0	67.0	73	0.8185	15.5	67.0	67.0	67.0
1.84	15.00	527.700	538.988	11.288	70.0	70.0	71.0	71.0	63	0.5956	17.5	77.0	79.0	78.0
1.05	15.00	541.300	550.134	8.834	72.0	72.0	72.0	72.0	55	0.4606	19.0	73.0	80.0	76.5
0.61	15.00	551.900	558.647	6.747	72.0	72.0	72.0	72.0	48	0.3560	20.0	78.0	79.0	78.5
0.29	15.00	559.400	563.934	4.534	71.0	71.0	71.0	71.0	40	0.2408	21.0	76.0	82.0	79.0

********** RESULTS **********

--- DRY GAS METER ---		--------- ORIFICE ---------			-- DRY GAS METER --		--------- ORIFICE ---------			
					CALIBRATION FACTOR Y		CALIBRATION FACTOR dH@			
VOLUME CORRECTED Vm(std) (cu ft)	VOLUME CORRECTED Vm(std) (liters)	VOLUME CORRECTED Vcr(std) (cu ft)	VOLUME CORRECTED Vcr(std) (liters)	VOLUME NOMINAL Vcr (cu ft)	Value (number)	Variation (number)	Value (in H2O)	Value (mm H2O)	Variation (in H2O)	Ko (value)
15.744	445.9	16.050	454.5	15.978	1.019	-0.004	1.728	43.89	0.046	0.731
11.315	320.4	11.559	327.4	11.747	1.022	-0.002	1.740	44.19	0.058	0.728
8.813	249.6	8.952	253.5	9.072	1.016	-0.007	1.651	41.93	-0.031	0.752
6.724	190.4	6.906	195.6	7.025	1.027	0.004	1.611	40.93	-0.070	0.754
4.523	128.1	4.669	132.2	4.754	1.032	0.009	1.679	42.65	-0.003	0.735
				Average Y---------->	**1.0232**		**Average dH@----->**	**1.682**	**42.7**	**Average Ko----->**	**0.740**

TEMPERATURE CALIBRATION

Calibration Standard -------> Omega Model CL23A S/N:T-218768

Reference Temperature Set-Point (deg F)	Temperature Device Reading (deg F)	Results Variation (degF)	Results Percent of Absolute
32	32	0	0.00%
100	100	0	0.00%
300	300	0	0.00%
500	500	0	0.00%
1000	1000	0	0.00%

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.
For Orifice Calibration Factor dH@, the orifice differential pressure in inches of H20 that equates to 0.75 cfm of air at 68 F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +-0.2.
For Temperature Devicee, the reading must be within 1.5% of certified calibration standard (absolute temperature) to be acceptable.

Calibrated by: Scott Ferguson Signature: _____ Date: January 7, 2019

A. LANFRANCO and ASSOCIATES INC.

ENVIRONMENTAL CONSULTANTS

GLASS NOZZLE DIAMETER CALIBRATION FORM

Calibrated by: Michael Goods
Date: Jan 7th 2019

Signature: 

Nozzle I.D.	d1 (inch)	d2 (inch)	d3 (inch)	difference (inch)	average dia. (inch)	average area (ft^2)
A	0.1250	0.1240	0.1245	0.0010	0.1245	0.0000845
G-165	0.1640	0.1655	0.1660	0.0020	0.1652	0.0001488
P-20	0.1855	0.1865	0.1835	0.0030	0.1852	0.0001870
J	0.1880	0.1880	0.1880	0.0000	0.1880	0.0001928
E	0.1880	0.1895	0.1882	0.0015	0.1886	0.0001939
L	0.2112	0.2120	0.2105	0.0015	0.2112	0.0002434
G-215	0.2160	0.2150	0.2130	0.0030	0.2147	0.0002513
Q	0.2190	0.2170	0.2185	0.0020	0.2182	0.0002596
G-222	0.2215	0.2220	0.2215	0.0005	0.2217	0.0002680
G-225	0.2245	0.2250	0.2240	0.0010	0.2245	0.0002749
P-18	0.2375	0.2370	0.2380	0.0010	0.2375	0.0003076
V-07	0.2447	0.2450	0.2445	0.0005	0.2447	0.0003267
G-250	0.2500	0.2505	0.2510	0.0010	0.2505	0.0003422
G-252	0.2525	0.2520	0.2530	0.0010	0.2525	0.0003477
P	0.2580	0.2570	0.2575	0.0010	0.2575	0.0003616
G-278	0.2775	0.2785	0.2790	0.0015	0.2783	0.0004225
P-2	0.2787	0.2790	0.2785	0.0005	0.2787	0.0004237
G-292	0.2922	0.2920	0.2926	0.0006	0.2923	0.0004659
MV-02	0.3050	0.3040	0.3055	0.0015	0.3048	0.0005068
MV-01	0.3060	0.3065	0.3055	0.0010	0.3060	0.0005107
G-309	0.3095	0.3095	0.3085	0.0010	0.3092	0.0005213
V-06	0.3200	0.3210	0.3210	0.0010	0.3207	0.0005608
G-330	0.3295	0.3300	0.3305	0.0010	0.3300	0.0005940
G-337	0.3380	0.3355	0.3365	0.0025	0.3367	0.0006182
P-27	0.3387	0.3385	0.3390	0.0005	0.3387	0.0006258
G-343	0.3435	0.3430	0.3435	0.0005	0.3433	0.0006429
G-349	0.3490	0.3495	0.3495	0.0005	0.3493	0.0006656
P-9	0.3648	0.3650	0.3645	0.0005	0.3648	0.0007257
G-372	0.3710	0.3730	0.3740	0.0030	0.3727	0.0007575
I	0.3785	0.3785	0.3785	0.0000	0.3785	0.0007814
P-14	0.3910	0.3935	0.3920	0.0025	0.3922	0.0008388
P-17	0.4070	0.4075	0.4065	0.0010	0.4070	0.0009035
C	0.4255	0.4225	0.4235	0.0030	0.4238	0.0009798
G-437	0.4350	0.4345	0.4355	0.0010	0.4350	0.0010321
P-29	0.4680	0.4680	0.4690	0.0010	0.4683	0.0011963
G468	0.4677	0.4670	0.4670	0.0007	0.4672	0.0011907
P-7	0.4965	0.4940	0.4930	0.0035	0.4945	0.0013337
B	0.5015	0.5030	0.5025	0.0015	0.5023	0.0013763
G-540	0.5405	0.5400	0.5405	0.0005	0.5403	0.0015924

Where:

(a) D1, D2, D3 = three different nozzle diameters; each diameter must be measured to within (0.025mm) 0.001 in.

(b) Difference = maximum difference between any two diameters; must be less than or equal to (0.1mm) 0.004 in.

(c) Average = average of D1, D2 and D3

Pitot Tube Calibration

Date: 14-Jan-19 Temp (R): 530
Pbar (in.Hg): 29.50 Dn (in.): 0.25

Pitot ID: **4A-1**

Reference HT-4A (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.230	0.330	32.0	0.8265	0.0069
0.340	0.470	38.9	0.8420	0.0086
0.500	0.690	47.1	0.8427	0.0093
0.650	0.930	53.8	0.8277	0.0058
0.700	1.000	55.8	0.8283	0.0052
		Average :	0.8334	0.0072

Pitot ID: **HT-4A**

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.130	0.180	24.0	0.8413	0.0039
0.285	0.390	35.6	0.8463	0.0011
0.470	0.650	45.7	0.8418	0.0034
0.670	0.920	54.6	0.8448	0.0004
0.770	1.040	58.5	0.8519	0.0066
		Average :	0.8452	0.0031

Pitot ID: **4A-2**

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.145	0.200	25.4	0.8430	0.0034
0.340	0.470	38.9	0.8420	0.0043
0.400	0.550	42.2	0.8443	0.0020
0.550	0.750	49.4	0.8478	0.0015
0.745	1.000	57.5	0.8545	0.0082
		Average :	0.8463	0.0039

Pitot ID: **HT-4B**

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.140	0.190	24.9	0.8498	0.0008
0.210	0.285	30.6	0.8498	0.0008
0.300	0.405	36.5	0.8521	0.0014
0.440	0.600	44.2	0.8478	0.0028
0.710	0.955	56.2	0.8536	0.0030
		Average :	0.8506	0.0018

Pitot ID: **4A-3**

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.240	0.340	32.7	0.8318	0.0031
0.340	0.470	38.9	0.8420	0.0071
0.460	0.650	45.2	0.8328	0.0021
0.640	0.890	53.3	0.8395	0.0046
0.700	1.000	55.8	0.8283	0.0066
		Average :	0.8349	0.0047

Pitot ID: **HT-4C**

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.355	0.470	39.7	0.8604	0.0037
0.400	0.530	42.2	0.8601	0.0034
0.470	0.630	45.7	0.8551	0.0016
0.560	0.750	49.9	0.8555	0.0012
0.630	0.850	52.9	0.8523	0.0044
		Average :	0.8567	0.0029

Pitot ID:

Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		0.0	#DIV/0!	#DIV/0!
		Average :	#DIV/0!	#DIV/0!

Pitot ID: **HT-4D**

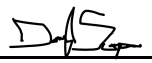
Reference Pitot (in H2O)	S-Type Pitot (in H2O)	Air Velocity (ft/s)	Pitot Coeff. Cp	Deviation (absolute)
0.310	0.450	37.1	0.8217	0.0074
0.370	0.525	40.6	0.8311	0.0020
0.420	0.600	43.2	0.8283	0.0008
0.510	0.720	47.6	0.8332	0.0041
0.740	1.050	57.4	0.8311	0.0020
		Average :	0.8291	0.0033

* Average absolute deviation must not exceed 0.01.

Calibrated by: Jeremy Gibbs Signature: _____ Date: January 14, 2019

BAROMETER CALIBRATION FORM

Device	Cal Date	Pbar Env Canada (kPa)	Pbar Env Canada (inches of Hg)	Device (inches of Hg) Reading	Device (inches of Hg) Elevation Corrected	Difference (Env Can - Elv Corr)
LA	January 17, 2019	99.9	29.51	29.43	29.50	0.00
DS	January 17, 2019	99.9	29.51	29.44	29.51	-0.01
CL	January 17, 2019	99.9	29.51	29.45	29.52	-0.02
ML	January 17, 2019	99.9	29.51	29.42	29.49	0.01
SB	January 17, 2019	99.9	29.51	29.43	29.50	0.00
SH	January 17, 2019	99.9	29.51	29.40	29.47	0.03
MG	January 7, 2019	101.2	29.89	29.80	29.87	0.02
JB	January 17, 2019	99.9	29.51	29.42	29.49	0.01
SF	January 7, 2019	101.2	29.89	29.86	29.93	-0.04
JG	January 17, 2019	99.9	29.51	29.4	29.47	0.03

Calibrated by: Daryl Sampson Signature:  Date: January 17, 2019

Performance Specification is
Device Corrected for Elevation must be +/- 0.1 " Hg of ENV CANADA SEA-LEVEL Pbar
Enter Environment canada Pressure from their website for Vancouver (link below)
and the reading from your barometer on the ground floor of the office.

http://www.weatheroffice.gc.ca/city/pages/bc-74_metric_e.html

MOUNT ROYAL COLLEGE

Faculty of Continuing Education and Extension

Carter Lanfranco

has successfully completed

Stack Sampling

May 2009

Date

Norma D MacDonald

Dean
Faculty of Continuing Education and Extension

BRITISH COLUMBIA INSTITUTE OF TECHNOLOGY

BCIT

Shawn Harrington

has met the requirements of

Stack Testing for Pollutants

(CHSC 7760)

School of Process, Energy and Natural Resources
Chemical Sciences Program

Endorsed by:

Greater Vancouver Regional District

Environment Canada Environnement Canada

Province of British Columbia
Ministry of Environment, Lands and Parks

Marsh Hemekey, Dean
School of Process, Energy and Natural Resources

JUNE 21, 2001
Dated