MᶜCALL ENVIRONMENTAL

March 15, 2010

Prince George Campus
University of Northern British Columbia
3333 University Way
Prince George, BC
V2N 4Z9

Attention: **Doug Carter**
Re: **Air Emission Testing of March 5, 2010**

As requested our firm performed a series of air emission tests at the UNBC facility on March 5, 2010.

Two modified EPA Method 5 particulate tests were performed on the pellet boiler system attached to the greenhouse facility.

Test results are summarized immediately following this cover letter. A discussion of the testing conditions can also be found immediately following this cover letter.

Testing methodology was conducted in accordance with the BC Field Sampling Manual except in instances noted in the Discussion of Test Results.

Please don't hesitate to contact us with any questions or concerns.

Sincerely,

MCCALL ENVIRONMENTAL

Matt McCall
Digitally signed by Matt McCall
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"Testing today for your children's tomorrow"

Summary of Test Results

March 5, 2010- Average of 3 tests

Gas Temperature:	132	°F	55	°C
Moisture Content (by volume):	4.9	%		
Average Stack Gas Velocity:	6.0	ft/sec	1.8	m/sec
Total Actual Gas Flow Rate:	387	ACFM		
Dry Gas flow Rate at Reference Conditions:	308	SCFM	.1	m^3/sec
Total Particulate Concentration:				
Dry Basis Actual at Reference Conditions	.005	gr/ft^3	10.4	mg/m^3
Mass Emission Rate	0.01	lbs/hr	0.01	kg/hr

Discussion of Test Results

The purpose of these tests was to determine a particulate loading on the system in order to assist in creating a set point for the SICK opacity system.

Deviations from standard test methods involved only conducting three 30 minute sample runs. Shorter test durations were performed in order to trend the ‘ramping up’ of the boiler system. The first test being at ramp up and the second and third being at a steadier rate. The outputs from the opacity monitor were recorded by facility staff and will be correlated to our particulate readings for calibration purposes.

McCall Environmental

University of Nothern British Columbia **3/5/2010**
Prince George, B.C.
Pellet Boiler

AVERAGE OF AIR EMISSION TESTS 1 TO 3

Gas Temperature:	132 °F	55 °C
Moisture Content (by volume):	4.9 %	
Average Stack Gas Velocity:	6.0 ft/sec	1.8 m/sec
Total Actual Gas Flow Rate:	387 ACFM	
Dry Gas flow Rate at Reference Conditions:	308 SCFM	.1 m^3/sec
Total Particulate Concentration:		
Dry Basis Actual at Reference Conditions	.005 gr/ft^3	10.4 mg/m^3
Mass Emission Rate	0.01 lbs/hr	0.01 kg/hr

SUMMARY OF AIR EMISSION TESTS

TEST 1: Ramping Up

Gas Temperature:	102 °F	39 °C
Moisture Content (by volume):	4.2 %	
Average Stack Gas Velocity:	5.9 ft/sec	1.8 m/sec
Total Actual Gas Flow Rate:	379 ACFM	
Dry Gas flow Rate at Reference Conditions:	319 SCFM	.2 m^3/sec
Total Particulate Concentration:		
Dry Basis Actual at Reference Conditions	.007 gr/ft^3	17.1 mg/m^3
Mass Emission Rate	0.02 lbs/hr	0.01 kg/hr

TEST 2:

Gas Temperature:	134 °F	56 °C
Moisture Content (by volume):	6.0 %	
Average Stack Gas Velocity:	6.0 ft/sec	1.8 m/sec
Total Actual Gas Flow Rate:	388 ACFM	
Dry Gas flow Rate at Reference Conditions:	303 SCFM	.1 m^3/sec
Total Particulate Concentration:		
Dry Basis Actual at Reference Conditions	.003 gr/ft^3	7.2 mg/m^3
Mass Emission Rate	0.01 lbs/hr	0.00 kg/hr

TEST 3:

Gas Temperature:	160 °F	71 °C
Moisture Content (by volume):	4.3 %	
Average Stack Gas Velocity:	6.1 ft/sec	1.9 m/sec
Total Actual Gas Flow Rate:	395 ACFM	
Dry Gas flow Rate at Reference Conditions:	301 SCFM	.1 m^3/sec
Total Particulate Concentration:		
Dry Basis Actual at Reference Conditions	.003 gr/ft^3	6.8 mg/m^3
Mass Emission Rate	0.01 lbs/hr	0.00 kg/hr

DATA FOR TESTS 1 TO 3

Client:	**University of Nothern British Columbia**
Plant Location:	**Prince George, B.C.**
Process:	**Pellet Boiler**
Plant Type:	**Fink Pellet Boiler**
Permit Number:	**N/A**
Job Number:	**ME1011-004**
Reasons for Test:	**Performance Testing**
Fuel Type:	**Pellets**
Number of Tests:	**3**
Minutes per Point:	**5**
Pollution Abatement Equip.	**Baghouse**
Mix Temp (°C)	

	TEST 1	TEST 2	TEST 3
Filter Number:	23	24	25
Date of Test:	5-Mar-10	5-Mar-10	5-Mar-10
Date of Lab Analysis:	15-Mar-10	15-Mar-10	20-Jun-05
Start Time:	10:33	11:10	11:48
Stop Time:	11:08	11:42	12:20
On-line Sampling Time:	30	30	30
Testing Personnel:	DB/JI	DB/JI	DB/JI
Sampler Model:	1039	1039	1039
Barometric Pressure("Hg):	28.00	28.00	28.00
Static Pressure("H_2O):	-0.01	-0.01	-0.01
%CO_2:	6.5	11.0	11.0
%O_2:	14.5	10.0	10.0
%CO:	0.0	0.0	0.0
%N_2:	79.0	79.0	79.1
Opacity:	0	0	0.00
Diameter of Nozzle(inches):	0.500	0.500	0.500
Meter Factor:	0.9866	0.9866	0.9866
Type-S Pitot Tube Coefficient:	0.83235	0.83235	0.83235
Cross Sectional Area of Stack (ft^2):	1.07	1.07	1.07
Impinger Condensate (g):	10	15	10
Weight of Moisture in Silica Gel (g):	1	1	1
Weight of Filter Particulate (g):	0.0045	0.0013	0.0014
Weight of Cyclone Particulate (g):	0.0001	0.0001	0.0001
Weight of Probe Washings (g):	0.0012	0.0010	0.0007
Total Weight of Particulate (g):	0.0058	0.0024	0.0022
Fuel Consumption Rate (litres/hr)	N/A	N/A	N/A
Production Rate (tonnes/hr):	N/A	N/A	N/A

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Sampling Data for - *TEST 1*
University of Nothern British Columbia
Prince George, B.C.
Pellet Boiler

5-Mar-10

SAMPLE POINT	VELOCITY HEAD ("H_2O)	ORIFICE PRESSURE ("H_2O)	DRY GAS METER TEMP IN (^{o} F)	DRY GAS METER TEMP OUT (^{o} F)	STACK GAS TEMP (^{o} F)	GAS SAMPLE VOLUME (ft^3)	ISOKINETICS
A-6	0.01	0.32	51	51	87	26.83	1.00
A-5	0.01	0.31	49	53	100	29.00	0.97
A-4	0.01	0.32	49	57	103	31.08	0.98
A-3	0.01	0.32	51	60	105	33.18	0.97
A-2	0.01	0.32	53	63	105	35.27	0.97
A-1	0.01	0.32	55	66	111	37.37	0.97
						39.45	

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Sampling Data for - *TEST 2*
University of Northern British Columbia
Prince George, B.C.
Pellet Boiler

5-Mar-10

SAMPLE POINT	VELOCITY HEAD ("H_2O)	ORIFICE PRESSURE ("H_2O)	DRY GAS METER TEMP IN (^{o} F)	DRY GAS METER TEMP OUT (^{o} F)	STACK GAS TEMP (^{o} F)	GAS SAMPLE VOLUME (ft^3)	ISOKINETICS
B-6	0.01	0.32	55	56	119	39.63	1.02
B-5	0.01	0.32	56	63	127	41.74	1.02
B-4	0.01	0.32	59	67	132	43.84	1.02
B-3	0.01	0.32	59	69	138	45.95	1.02
B-2	0.01	0.32	61	72	141	48.06	1.02
B-1	0.01	0.32	62	73	144	50.17	1.02
						52.29	

McCall Environmental

Sampling Data for - *TEST 3*
University of Northern British Columbia
Prince George, B.C.
Pellet Boiler

5-Mar-10

SAMPLE POINT	VELOCITY HEAD ("H_2O)	ORIFICE PRESSURE ("H_2O)	DRY GAS METER TEMP IN (^{o} F)	DRY GAS METER TEMP OUT (^{o} F)	STACK GAS TEMP (^{o} F)	GAS SAMPLE VOLUME (ft^3)	ISOKINETICS
A-6	0.01	0.30	59	59	149	52.54	1.01
A-5	0.01	0.30	61	67	151	54.61	1.00
A-4	0.01	0.30	62	70	158	56.68	1.00
A-3	0.01	0.30	63	72	163	58.75	1.00
A-2	0.01	0.30	64	73	166	60.81	0.99
A-1	0.01	0.30	64	74	170	62.85	0.99
						64.90	

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University of Nothern British Columbia
Prince George, B.C.
Pellet Boiler

Data for ***TEST 1*** — **OVERALL ISOKINETICS - TEST 1: 0.979**

Delta P:	**0.010**	**"H_2O**	**Us avg:**	**5.90**	**ft/sec**
Delta H:	**0.318**		**ACFM:**	**379**	**ft^3/min**
Tm avg:	**514.8**	**^oR**	**SDCFM:**	**319**	**ft^3/min**
Ts avg:	**561.8**	**^oR**	**Vm std:**	**11.96**	**ft^3**
Bwo:	**0.042**		**Vm corr:**	**12.45**	**ft^3**
Md:	**29.62**		**Vm:**	**12.62**	**ft^3**
Ms:	**29.13**		**MF:**	**0.9866**	
Pb:	**28.00**	**"Hg**	**PCON:**	**17.13**	**mg/m^3**
Pm:	**28.02**	**"Hg**	**CORR:**	**31.62**	**mg/m^3**
Ps:	**28.00**	**"Hg**	**ERAT:**	**0.01**	**kg/hr**

Data for ***TEST 2*** — **OVERALL ISOKINETICS - TEST 2: 1.019**

Delta P:	**0.010**	**"H_2O**	**Us avg:**	**6.04**	**ft/sec**
Delta H:	**0.320**		**ACFM:**	**388**	**ft^3/min**
Tm avg:	**522.7**	**^oR**	**SDCFM:**	**303**	**ft^3/min**
Ts avg:	**593.5**	**^oR**	**Vm std:**	**11.82**	**ft^3**
Bwo:	**0.060**		**Vm corr:**	**12.49**	**ft^3**
Md:	**30.16**		**Vm:**	**12.66**	**ft^3**
Ms:	**29.43**		**MF:**	**0.9866**	
Pb:	**28.00**	**"Hg**	**PCON:**	**7.17**	**mg/m^3**
Pm:	**28.02**	**"Hg**	**CORR:**	**7.82**	**mg/m^3**
Ps:	**28.00**	**"Hg**	**ERAT:**	**0.00**	**kg/hr**

Data for ***TEST 3*** — **OVERALL ISOKINETICS - TEST 3: 0.997**

Delta P:	**0.010**	**"H_2O**	**Us avg:**	**6.15**	**ft/sec**
Delta H:	**0.300**		**ACFM:**	**395**	**ft^3/min**
Tm avg:	**525.7**	**^oR**	**SDCFM:**	**301**	**ft^3/min**
Ts avg:	**619.5**	**^oR**	**Vm std:**	**11.47**	**ft^3**
Bwo:	**0.043**		**Vm corr:**	**12.19**	**ft^3**
Md:	**30.19**		**Vm:**	**12.36**	**ft^3**
Ms:	**29.66**		**MF:**	**0.9866**	
Pb:	**28.00**	**"Hg**	**PCON:**	**6.77**	**mg/m^3**
Pm:	**28.02**	**"Hg**	**CORR:**	**7.39**	**mg/m^3**
Ps:	**28.00**	**"Hg**	**ERAT:**	**0.00**	**kg/hr**

Air Emission Monitoring Procedure

Particulate Sampling (Napp-Baldwin Model 31 Sampler)

Particulate sampling and gas velocity measurements were conducted using a Napp-Baldwin Model 31 stack sampler in accordance with the methods specified in EPA Method 5 (See Figure 1).

The air discharge was sampled isokinetically at the centroid of a series of equal area segments across the duct or stack. The stack gas velocity and temperature was recorded during the sample collection period with a calibrated pitot tube and thermocouple mounted on the sampling probe. The sample was delivered from the probe to a cyclone and a filter holder containing a 110mm Type A glass fiber filter. The gas sample was then drawn in through a series of four glass impingers which condensed and absorbed the water from the gas. A leakless vacuum pump carried he sampled gas through a dry gas test meter where the volume, temperature, and pressure were measured; and finally through a flow indicating orifice which allowed for the rapid adjustment to isokinetic sampling rates.

At the end of each test, the probe interior, cyclone and connecting tubing from the probe to the filter housing were rinsed with distilled water and acetone. These washings were evaporated to dryness and the resulting solids were weighed. The weight of the cyclone flask and the filter was used together with the weight of solids in the washings to calculate the particulate concentration. The moisture content of the stack gas was determined from the quantity of water condensed in the impingers and absorbed in the silica gel.

O_2, CO_2, CO (where applicable)

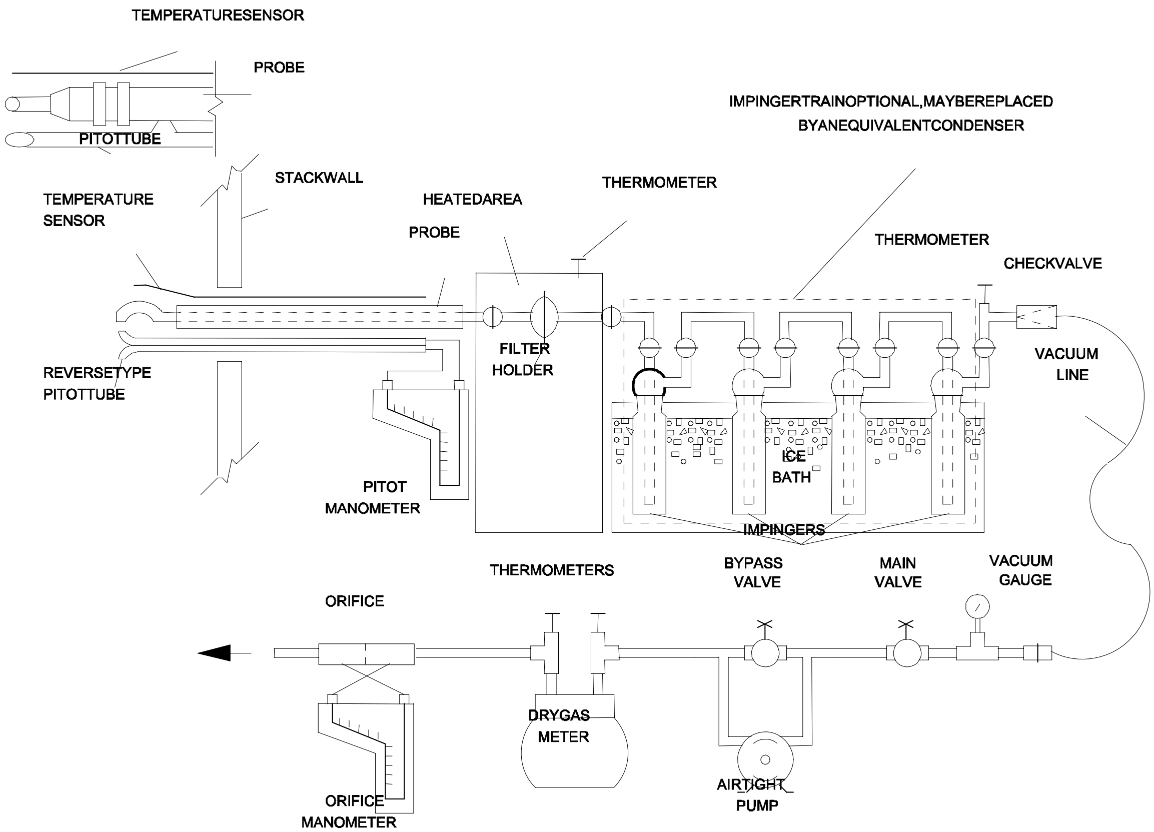
O_2, CO_2, and CO were found using either Fuji Analytical Analyzer by means of infrared and paramagnetic technology (EPA 3A) or by fyrite (EPA Method 3).

NOx (where applicable)

NOx was found using and API Model 252 NOx analyzer that utilizes chemiluminescent technology. Stack gas was Samples were taken over a minimum period of three hours.

VOC’s (where applicable)

Hydrocarbons were measured in accordance with EPA method 25A. Samples were drawn in one hour test runs using a total hydrocarbon analyzer that utilizes Flame Ionization Technology.



EPA Method 5 Diagram- Figure 1

CALCULATIONS

Carry out calculations, retaining at least one extra decimal figure beyond that of the acquired data. Round off figures after the final calculation. Other forms of the equations may be used as long as they give equivalent results.

Nomenclature.

A_n = Cross-sectional area of nozzle, m^2 (ft^2).
B_{ws} = Water vapor in the gas stream, proportion by volume.
C_a = Acetone blank residue concentration, mg/g.
c_s = Concentration of particulate matter in stack gas, dry basis, corrected to standard conditions, g/dscm (g/dscf).
I = Percent of isokinetic sampling.
L_a = Maximum acceptable leakage rate for either a pretest leak check or for a leak check following a component change; equal to 0.00057 m^3/min (0.02 cfm) or 4 percent of the average sampling rate, whichever is less.
L_i = Individual leakage rate observed during the leak check conducted prior to the "i^{th}" component change (i = l, 2, 3...n), m^3/min (cfm).
L_p = Leakage rate observed during the post-test leak check, m^3/min (cfm).
m_a = Mass of residue of acetone after evaporation, mg.
m_n = Total amount of particulate matter collected, mg.
M_w = Molecular weight of water, l8.0 g/g-mole (l8.0 lb/lb-mole).
P_{bar} = Barometric pressure at the sampling site, mm Hg (in. Hg).
P_s = Absolute stack gas pressure, mm Hg (in. Hg).
P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).
R = Ideal gas constant, 0.06236 [(mmHg)(m^3)]/[(°K)(g-mole)] {2l.85 [(in. Hg)(ft^3)]/[(°R)(lb-mole)]}.
T_m = Absolute average DGM temperature (see Figure 5-2), °K (°R).
T_s = Absolute average stack gas temperature (see Figure 5-2), °K (°R).
T_{std} = Standard absolute temperature, 293°K (528°R).
V_a = Volume of acetone blank, ml.
V_{aw} = Volume of acetone used in wash, ml.
V_{lc} = Total volume liquid collected in impingers and silica gel (see Figure 5-3), ml.
V_m = Volume of gas sample as measured by dry gas meter, dcm (dcf).
$V_{m(std)}$= Volume of gas sample measured by the dry gas meter, corrected to standard conditions, dscm (dscf).
$V_{w(std)}$= Volume of water vapor in the gas sample, corrected to standard conditions, scm (scf).
v_s = Stack gas velocity, calculated by Method 2, Equation 2-9, using data obtained from Method 5, m/sec (ft/sec).
W_a = Weight of residue in acetone wash, mg.
Y = Dry gas meter calibration factor.
ΔH = Average pressure differential across the orifice meter (see Figure 5-2), mm H_20 (in. H_20).
ρ_a = Density of acetone, mg/ml (see label on bottle).
ρ_w = Density of water, 0.9982 g/ml (0.00220l lb/ml).
θ = Total sampling time, min.
θ_l = Sampling time interval, from the beginning of a run until the first component change, min.
θ_i = Sampling time interval, between two successive component changes, beginning with the interval between the first and second changes, min.
θ_p = Sampling time interval, from the final (n^{th}) component change until the end of the sampling run, min.
l3.6 = Specific gravity of mercury.
60 = Sec/min.
l00 = Conversion to percent.

Average Dry Gas Meter Temperature and Average Orifice Pressure Drop.

Dry Gas Volume. Correct the sample volume measured by the dry gas meter to standard conditions (20°C, 760 mm Hg or 68°F, 29.92 in. Hg) by using Equation 5-l.

$$V_{m(std)} = V_m\, Y \left(\frac{T_{std}}{T_m}\right)\left[\frac{P_{bar} + \frac{\Delta H}{13.6}}{P_{std}}\right] \qquad \text{Eq. 5-1}$$

$$= K_1\, V_m\, Y\, \frac{P_{bar} + \left(\frac{\Delta H}{13.6}\right)}{T_m}$$

where:

K_l = 0.3858 °K/mm Hg for metric units,

= l7.64 °R/in. Hg for English units.

NOTE: Equation 5-l can be used as written unless leakage rate observed during any of the mandatory leak checks (i.e., the post-test leak check or leak checks conducted prior to component changes) exceeds L_a. If L_p or L_i exceeds L_a, Equation 5-l must be modified as follows:

(a) Case I. No component changes made during sampling run. In this case, replace V_m in Equation 5-l with the expression:

$[V_m - (L_p - L_a)\,\theta]$

(b) Case II. One or more component changes made during the sampling run. In this case, replace V_m in Equation 5-l by the expression:

$$\left[V_m - (L_1 - L_a)\theta_1 - \sum_{i=2}^{n}(L_i - L_a)\theta_i - (L_p - L_a)\theta_p\right]$$

and substitute only for those leakage rates (L_i or L_p) which exceed L_a.

Volume of Water Vapor.

$$V_{w(std)} = \frac{V_{lc}\,\rho_w\, R\, T_{std}}{M_w\, P_{std}} = K_2\, V_{lc} \qquad \text{Eq. 5-2}$$

where:

K_2 = 0.00l333 m^3/ml for metric units,

= 0.04707 ft^3/ml for English units.

Moisture Content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \qquad \text{Eq. 5-3}$$

Acetone Blank Concentration.

$$C_a = \frac{m_a}{V_a \rho_a} \qquad \text{Eq. 5-4}$$

Acetone Wash Blank.

$$W_a = C_a V_{aw} \rho_a \qquad \text{Eq. 5-5}$$

Total Particulate Weight. Determine the total particulate matter catch from the sum of the weights obtained from Containers l and 2 less the acetone blank (see Figure 5-3).

Particulate Concentration.

$$C_s = (0.001 g/mg)(m_n / V_{m(std)}) \qquad \text{Eq. 5-6}$$

Conversion Factors:

From	To	Multiply by
scf	m^3	0.02832
g/ft^3	gr/ft^3	l5.43
g/ft^3	lb/ft^3	2.205×10^{-3}
g/ft^3	g/m^3	35.3l

Isokinetic Variation.

Calculation from Raw Data.

$$I = \frac{100\, T_s \left[K_3 V_{1c} + (V_m Y / T_m)(P_{bar} + \Delta H/13.6)\right]}{60 \theta\, v_s P_s A_n} \qquad \text{Eq. 5-7}$$

where:

K_3 =0.003454 [(mm Hg)(m^3)]/[(ml)(°K)] for metric units,

= 0.002669 [(in. Hg)(ft^3)]/[(ml)(°R)] for English units.

Calculation from Intermediate Values.

$$I = \frac{100\, T_s\, V_{m(std)}\, P_{std}}{60\, T_{std}\, v_s\, \theta\, A_n\, P_s\, (1 - B_{ws})} \qquad \text{Eq.5-8}$$

$$= \frac{K_4\, T_s\, V_{m(std)}}{P_s\, v_s\, A_n\, \theta (1 - B_{ws})}$$

where:

K_4 = 4.320 for metric units,

= 0.09450 for English units.

Acceptable Results. If 90 percent ≤ I ≤ ll0 percent, the results are acceptable. If the PM results are low in comparison to the standard, and "I" is over 110 percent or less than 90 percent, the Administrator may opt to accept the results. Citation 4 in the Bibliography may be used to make acceptability judgments. If "I" is judged to unacceptable, reject the results, and repeat the test.

Average Stack Gas Velocity.

$$v_s = K_p\, C_p\, (\sqrt{\Delta p}\,)_{avg} \sqrt{\frac{T_{s(avg)}}{P_s\, M_s}}$$

Average Stack Gas Dry Volumetric Flow Rate.

$$Q_{sd} = 3{,}600(1 - B_{ws})\, v_s\, A\, \frac{T_{std}}{T_{s(avg)}}\, \frac{P_s}{P_{std}}$$

where:

A = Cross-sectional area of stack, m^2 (ft^2).

B_{ws} = Water vapor in the gas stream (from Method 5 or Reference Method 4), proportion by volume.

C_p = Pitot tube coefficient, dimensionless.

K_p = Pitot tube constant,

M_d = Molecular weight of stack gas, dry basis (see Section 3.6), g/gmole (lb/lb-mole).

M_s = Molecular weight of stack gas, wet basis, g/g-mole (lb/lb-mole).

$$= M_d (1 - B_{ws}) + 18.0\, B_{ws} \qquad \text{Eq. 2-5}$$

P_{bar} = Barometric pressure at measurement site, mm Hg (in. Hg).

P_g = Stack static pressure, mm Hg (in. Hg).

P_s = Absolute stack pressure, mm Hg (in. Hg),

$$= P_{bar} + P_g$$

P_{std} = Standard absolute pressure, 760 mm Hg (29.92 in. Hg).

Q_{sd} = Dry volumetric stack gas flow rate corrected to standard conditions, dsm^3/hr (dscf/hr).

t_s = Stack temperature, C (F).

T_s = Absolute stack temperature, K (R).

Calibration Certificate for S-Type Pitot Tube

Date: Jan 13/10

Barometric Pressure ("Hg): 30.3

Pitot I.D.: **258**

Wind Tunnel Temperature (^{O} F): 72.0

Nozzle: 0.250

Wind Velocity (ft/sec)	*Ref.Pitot ("H_2O)*	*S-Type Pitot ("H_2O)*	*Pitot Factor*
12.10	0.03373	0.04774	0.83219
19.60	0.08848	0.12583	0.83015
40.07	0.36992	0.53416	0.82386
63.26	0.92203	1.28993	0.83700
81.03	1.51256	2.12689	0.83487
102.73	2.43123	3.40903	0.83605
		Average=	0.83235

Note: The new pitot tip should be installed so that the serial number engraved is aligned directly into the gas stream.

Calibrating Technician Signature:

CALIBRATION CERTIFICATE
DRY GAS METER

DATE: Jan 13/10

CONSOLE MANUF.: NAPP MODEL 31

CONSOLE I.D.: C-1039

PARAMETER SUMMARY	RUN #1	RUN #2	RUN #3
Ta = Ambient (WTM) Temperature (oF.)	52.0	52.0	52.0
P=Pres. Differential at WTM ("Hg)	0.1472	0.2870	0.3606
Pb= Atmospheric Pressure ("Hg)	30.30	30.30	30.30
Pv= Vapour Pressure Water at Temp. Ta ("Hg)	0.3902	0.3902	0.3902
H=Pres. Differential at Orifice	1.0	2.0	3.0
Ti= Dry Test Meter Inlet Temp. (oF.)	59.0	57.0	60.0
To= Dry Test Meter Outlet Temp. (oF.)	67.0	69.0	77.0
Ri= Initial Dry Test volume (ft3)	2.39	96.41	8.37
Rf= Final Dry Test Volume (ft3)	7.33	101.43	13.47
Vi= Initial Wet Test Volume (ft3)	0.0	0.0	0.0
Vf= Final Wet Test Volume (ft3)	5.000	5.000	5.000
Pw= Pb - (^P/13.59) "Hg	30.1528	30.0130	29.9394
Pd= Pb + (^H/13.59) "Hg	30.3736	30.4472	30.5208
Tw= Ta +460 (oR.)	512.0	512.0	512.0
Td= [(Ti + To)/2] + 460 (oR.)	523.0	523.0	528.5
Bw= Pv/Pb ("Hg)	0.0129	0.0129	0.0129
WET TEST METER FACTOR (WTMF)	0.9922	0.9922	0.9922
ated Y Value)(WTMF)	1.0053	0.9823	0.9723

Y (MEAN)(WTMF) = 0.9866

MCCALL ENVIRONMENTAL

Calibrating Technician Signature:

ORIFICE METER CALIBRATION

DATE: Jan 13/10

CONSOLE I.D. C-1039

	RUN 1	RUN 2	RUN 3
MD= mol. wt. dry air	28.967	28.967	28.967
Pb=bar. pressure "Hg	30.3	30.3	30.3
Y=gas meter factor	1.0053	1.0053	0.9823
Delta H=	0.5	1	1.5
Ri=int. gas meter vol.	25.1	28	31.8
Rf=final gas meter vol.	27.71	31.6	36.2
min. samp	5	5	5
Qm=Y(Rf-Ri)/^T(FT3/MIN)	0.5247666	0.723816	0.864424
Tm=meter out temp. (oF)	72	74	75
Tm=meter out temp. (oR.)	532	534	535
Pm=Pb + ^H	30.336792	30.373584	30.410375
SQRT(Tm/Pm*H/Md)	0.5501793	0.7790599	0.9544647
Ko=orifice const.	0.9538102	0.929089	0.9056637

Ko MEAN = 0.929521

Ko*4*144= 535.40407

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ORIFICE METER CALIBRATION

DATE: Jan 13/10

CONSOLE I.D. C-1039

	RUN 4	RUN 5	RUN 6
MD= mol. wt. dry air	28.967	28.967	28.967
Pb=bar. pressure "Hg	30.3	30.3	30.3
Y=gas meter factor	0.9823	0.9723	0.9723
Delta H=	2	2.5	3
Ri=int. gas meter vol.	37.3	43	49.2
Rf=final gas meter vol.	42.31	48.58	55.34
min. samp	5	5	5
Qm=Y(Rf-Ri)/^T(FT3/MIN)	0.9842646	1.0850868	1.1939844
Tm=meter out temp. (oF)	76	78	80
Tm=meter out temp. (oR.)	536	538	540
Pm=Pb + ^H	30.447167	30.483959	30.520751
SQRT(Tm/Pm*H/Md)	1.1024837	1.2341663	1.3536555
Ko=orifice const.	0.8927702	0.8792063	0.8820445

Ko MEAN = 0.8846737

Ko*4*144= 509.57203

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