



**SOURCE EMISSION TESTING
ON
GOLD ROASTER STACK**

OCTOBER 1-2, 1997

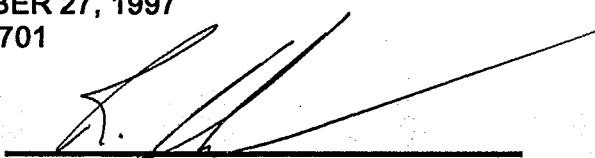
Prepared for:

**ROYAL OAK MINES INC.
N.W.T. DIVISION
P.O. BAG 3000
YELLOWKNIFE, N.W.T.
X1A 2M2**

ATTN: BRIAN CROSS

**DATE: OCTOBER 27, 1997
FILE: 7640/9701**

Prepared by:



**Ross P. Jackson, R.E.T.
Director of Operations**



October 27, 1997

Royal Oak Mines Inc.
N.W.T. Division
P.O. Bag 3000
Yellowknife, N.W.T.
X1A 2M2

ATTENTION: Brian Cross

Re: Source Emission Survey - Gold Roaster Stack
Entech File Number 7640/9701

The attached report presents the results of the source emission survey conducted by Entech Environmental Services Ltd., on October 1-2, 1997.

At this time, testing was performed on the Gold Roaster Stack to determine the concentrations and emission rates of arsenic and sulphur dioxide.

A total of three tests were completed with the results indicating the following :

	Average	Maximum	Minimum
Arsenic			
- mg/m3 dry at Ref.	3.66	4.03	3.37
- kg/h	0.172	0.176	0.165
Sulphur Dioxide			
- g/m3 dry at Ref.	25.96	33.02	21.87
- kg/h	1213.5	1440.4	1071.2

* ref - 25 C and 760 mm Hg.

Should you have any questions concerning the results or if we may be of further assistance, please contact us at your earliest convenience.

Yours Truly
Entech Environmental Services

Table of Contents

Introduction

Discussion

Calculations and Results

Methods and Procedures

Table 1 - Summary of Emission Test Results

Appendix A - Computer Output and Example Calculations

Appendix B - Field Data Sheets and Calibration data

Appendix C - Isokinetic Variations

Introduction

Entech Environmental Services Ltd., working on behalf of Royal Oak Mines, conducted a compliance source emission survey at the Royal Oak Mines, N.W.T. Division, on October 1-2, 1997. The purpose of the survey was to determine the concentrations and emission rates of arsenic and sulphur dioxide from the Gold Roaster Stack.

Discussion

The compliance source emission survey consisted of three tests, during each of which the following flue gas parameters were determined:

- flue gas water concentration,
- flue gas composition and molecular weight,
- velocity profiles, temperature and static pressure,
- arsenic concentration and
- sulphur dioxide concentration.

There were no problems reported during the collection of the samples or during the subsequent analysis.

Calculations and Results

The results of the test program are summarized on table 1 and detailed in the appendices.

In all, three appendices are attached which provide the detailed computer output, copies of the field data sheets and point by point isokinetics results.

Methods and Procedures

Sampling and analysis were conducted as follows;

- water determination.....EPS 1/RM/8
- flue gas composition and molecular weight.....EPS 1/RM/8
- velocity profiles, temperature and static.....EPS 1/RM/8
- arsenic determination.....EPS 1-AP-79-1
- sulphur dioxide determination.....EPS 1-AP-74-3

Table 1

Summary of Emission Test Results
Royal Oak Mines, Yellowknife, N.W.T.
Gold Roaster Stack
October 1-2, 1997

		Test One	Test Two	Test Three	Averages
Test Date		97/10/01	97/10/01	97/10/02	
Start Time		09:47	13:16	08:42	
End Time		12:38	16:01	11:25	
Average Gas Temperature	- DegC	80.3	80.4	82.2	81.0
Average Gas Velocity	- m/s	2.96	2.70	3.02	2.89
Total Effluent Flow Rate	- Rm3/s	14.34	13.05	14.55	13.98
Dry Effluent Flow Rate	- Rm3/s	13.64	12.12	13.60	13.12
Water Concentration	mole - %	4.8	7.1	6.5	6.2
Arsenic					
Concentration - dry basis	- mg/Rm3	3.57	4.03	3.37	3.66
Emission Rate	- kg/h	0.175	0.176	0.165	0.172
Sulphur Dioxide					
Concentration - dry basis	- mole %	0.8773	1.2601	0.8349	0.9908
Concentration - dry basis	- g/Rm3	22.99	33.02	21.87	25.96
Emission Rate	- kg/h	1128.8	1440.4	1071.2	1213.5
Isokinetics					
	- %	98.7	101.9	100.5	

Reference Conditions of 25 degC and 760 mm Hg.

Entech Environmental Services Ltd., Calgary, Alberta

Royal Oak Ltd.
Glant Mine, Yellowknife
DATA FILE NUMBER 970619

TEST One
Gold Roaster Stack
October 1, 1997

PAGE GEN01

LOCATION OF SAMPLING POINT	15.2 metre level
STACK DIAMETER OR TRAVERSE LENGTH	2.743 metres
RECTANGULAR DUCT WIDTH	0.000 metres
BAROMETRIC PRESSURE	738.9 mm Hg.
AMBIENT TEMPERATURE	5.0 C

AVERAGE COMPOSITION OF FLUE GAS

	DRY BASIS PERCENT	WET BASIS PERCENT
O2	19.625	18.674
CO2	0.069	0.066
N2 by Difference	80.306	76.415
H2O		4.845
CO	0.0000	0.000

SPECIFIC GRAVITY OF FLUE GAS (AIR = 1.0)	0.976
MOLECULAR WEIGHT OF FLUE GAS	28.273 g/g-mole
MOLECULAR WEIGHT OF FLUE GAS (DRY BASIS)	28.796 g/g-mole

STACK GAS FLOW RATE DATA AND CALCULATIONS

PITOT CALIBRATION FACTOR	0.804
STATIC PRESSURE	-0.430 mm Hg.
AVERAGE SQUARE ROOT VELOCITY HEAD	0.161
AVERAGE STACK GAS TEMPERATURE	80.3 C
AVERAGE STACK GAS VELOCITY	2.959 m/s
EFFLUENT FLOW RATE - WET (INCLUDING WATER)	14.336 m3/s ** 2110.337 kg-mole/h
EFFLUENT FLOW RATE - DRY (EXCLUDING WATER)	13.641 m3/s ** 2008.097 kg-mole/h
	kg/h cond 1845

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.
 Giant Mine, Yellowknife
 DATA FILE NUMBER 970619

TEST One
 Gold Roaster Stack
 October 1, 1997

PAGE ISO01
 TEST START 09:47
 TEST END 12:38

POLLUTANT DATA AND CALCULATIONS - ISOKINETIC SAMPLING TRAIN

VOLUME OF FLUE GAS METERED	2.7568 m3
AVERAGE ORIFICE PRESSURE	1.8536 mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	15.2 C
VACUUM AT LAST IMPINGER	2.0 mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	9.3958 mm Hg.
VOLUME OF WATER CONDENSED	76.0 mL

VOLUME OF FLUE GAS METERED AT REF.	2.7783 m3 **
------------------------------------	--------------

	50%EA	NA	NA	ACTUAL	
Particulates - Front Half	%EA = NA			0.0000 mg	
CONCENTRATION	NA			0.0000 kg/1000kg	wet
	NA	NA	NA	0.0000 kg/1000kg	dry
	NA			0.0000 g/m3**wet	
	NA	NA	NA	0.0000 g/m3**dry	
MASS FLOW				0.0000 kg/h	

	50%EA	NA	NA	ACTUAL	
Particulates - Back Half	%EA = NA			0.0000 mg	
CONCENTRATION	NA			0.0000 kg/1000kg	wet
	NA	NA	NA	0.0000 kg/1000kg	dry
	NA			0.0000 g/m3**wet	
	NA	NA	NA	0.0000 g/m3**dry	
MASS FLOW				0.0000 kg/h	

	50%EA	NA	NA	ACTUAL	
Particulates - Total Train	%EA = NA			0.0000 mg	
CONCENTRATION	NA			0.0000 kg/1000kg	wet
	NA	NA	NA	0.0000 kg/1000kg	dry
	NA			NA ppmv wet	
	NA	NA	NA	NA ppmv dry	
	NA			0.0000 g/m3**wet	
	NA	NA	NA	0.0000 g/m3**dry	
MASS FLOW				0.0000 kg/h	

	50%EA	NA	NA	ACTUAL	
Arsenic	%EA = NA			9.9200 mg	
CONCENTRATION	NA			NA ppmv wet	
	NA	NA	NA	NA ppmv dry	
	NA			0.0034 g/m3**wet	
	NA	NA	NA	0.0036 g/m3**dry	
MASS FLOW				0.1753 kg/h	

** At Reference of 25 degrees C and 760 mm Hg.

POLLUTANT DATA AND CALCULATIONS - PROPORTIONAL SAMPLING TRAINS

	ABS #1	ABS #2	
VOLUME OF FLUE GAS METERED	0.2749	0.0000	m3
AVERAGE ORIFICE PRESSURE	0.0000	NA	mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	15.6	NA	C
VACUUM AT LAST IMPINGER	66.0	NA	mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	0.000	NA	mm Hg.
VOLUME OF WATER CONDENSED	3.0	NA	
VOLUME OF FLUE GAS METERED AT REF.	0.2760	NA	m3 **
Sulphur Dioxide			
50%EA NA NA ACTUAL			
%EA = NA 6343.6000 mg			
CONCENTRATION NA 8348.1607 ppmv wet			
NA NA 8773.1995 ppmv dry			
NA 21.8734 g/m3**wet			
NA NA 22.9871 g/m3**dry			
MASS FLOW			1128.8495 kg/h
not applicable			
50%EA NA NA ACTUAL			
%EA = NA NA mg			
CONCENTRATION NA NA ppmv wet			
NA NA NA ppmv dry			
NA NA g/m3**wet			
NA NA g/m3**dry			
MASS FLOW			NA kg/h
not applicable			
50%EA NA NA ACTUAL			
%EA = NA NA mg			
CONCENTRATION NA NA ppmv wet			
NA NA NA ppmv dry			
NA NA g/m3**wet			
NA NA g/m3**dry			
MASS FLOW			NA kg/h
not applicable			
50%EA NA NA ACTUAL			
%EA = NA NA mg			
CONCENTRATION NA NA ppmv wet			
NA NA NA ppmv dry			
NA NA g/m3**wet			
NA NA g/m3**dry			
MASS FLOW			NA kg/h

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.
Giant Mine, Yellowknife
DATA FILE NUMBER 970620

TEST Two
Gold Roaster Stack
October 1, 1997

PAGE GEN01

LOCATION OF SAMPLING POINT	15.2 metre level
STACK DIAMETER OR TRAVERSE LENGTH	2.743 metres
RECTANGULAR DUCT WIDTH	0.000 metres
BAROMETRIC PRESSURE	738.9 mm Hg.
AMBIENT TEMPERATURE	5.0 C

AVERAGE COMPOSITION OF FLUE GAS

	DRY BASIS PERCENT	WET BASIS PERCENT
O2	21.136	19.627
CO2	0.055	0.051
N2 by Difference	78.809	73.182
H2O		7.141
CO	0.0000	0.000

SPECIFIC GRAVITY OF FLUE GAS (AIR = 1.0)	0.969
MOLECULAR WEIGHT OF FLUE GAS	28.079 g/g-mole
MOLECULAR WEIGHT OF FLUE GAS (DRY BASIS)	28.854 g/g-mole

STACK GAS FLOW RATE DATA AND CALCULATIONS

PITOT CALIBRATION FACTOR	0.804
STATIC PRESSURE	-0.430 mm Hg.
AVERAGE SQUARE ROOT VELOCITY HEAD	0.146
AVERAGE STACK GAS TEMPERATURE	80.4 C
AVERAGE STACK GAS VELOCITY	2.695 m/s
EFFLUENT FLOW RATE - WET (INCLUDING WATER)	13.050 m3/s ** 1921.105 kg-mole/h
EFFLUENT FLOW RATE - DRY (EXCLUDING WATER)	12.118 m3/s ** 1783.928 kg-mole/h
kg hcond	2475.46

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.
 Giant Mine, Yellowknife
 DATA FILE NUMBER 970620

TEST Two
 Gold Roaster Stack
 October 1, 1997

PAGE ISO01
 TEST START 13:16
 TEST END 16:01

POLLUTANT DATA AND CALCULATIONS - ISOKINETIC SAMPLING TRAIN

VOLUME OF FLUE GAS METERED	2.5595 m3
AVERAGE ORIFICE PRESSURE	1.5729 mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	18.9 C
VACUUM AT LAST IMPINGER	2.0 mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	8.8455 mm Hg.
VOLUME OF WATER CONDENSED	120.0 mL

VOLUME OF FLUE GAS METERED AT REF.	2.5460 m3 **
------------------------------------	--------------

	50%EA	NA	NA	ACTUAL
Particulates - Front Half	%EA = NA			0.0000 mg
CONCENTRATION	NA			0.0000 kg/1000kg wet
	NA	NA	NA	0.0000 kg/1000kg dry
	NA			0.0000 g/m3**wet
	NA	NA	NA	0.0000 g/m3**dry
MASS FLOW				0.0000 kg/h

	50%EA	NA	NA	ACTUAL
Particulates - Back Half	%EA = NA			0.0000 mg
CONCENTRATION	NA			0.0000 kg/1000kg wet
	NA	NA	NA	0.0000 kg/1000kg dry
	NA			0.0000 g/m3**wet
	NA	NA	NA	0.0000 g/m3**dry
MASS FLOW				0.0000 kg/h

	50%EA	NA	NA	ACTUAL
Particulates - Total Train	%EA = NA			0.0000 mg
CONCENTRATION	NA			0.0000 kg/1000kg wet
	NA	NA	NA	0.0000 kg/1000kg dry
	NA			NA ppmv wet
	NA	NA	NA	NA ppmv dry
	NA			0.0000 g/m3**wet
	NA	NA	NA	0.0000 g/m3**dry
MASS FLOW				0.0000 kg/h

	50%EA	NA	NA	ACTUAL
Arsenic	%EA = NA			10.2700 mg
CONCENTRATION	NA			NA ppmv wet
	NA	NA	NA	NA ppmv dry
	NA			0.0037 g/m3**wet
	NA	NA	NA	0.0040 g/m3**dry
MASS FLOW				0.1760 kg/h

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.
Glant Mine, Yellowknife
DATA FILE NUMBER 970620

TEST Two
Gold Roaster Stack
October 1, 1997

PAGE ABS01
TEST START 13:36
TEST END 14:36

POLLUTANT DATA AND CALCULATIONS - PROPORTIONAL SAMPLING TRAINS

	ABS #1	ABS #2	
VOLUME OF FLUE GAS METERED	0.4215	0.0000	m3
AVERAGE ORIFICE PRESSURE	0.0000	NA	mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	15.6	NA	C
VACUUM AT LAST IMPINGER	76.2	NA	mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	0.000	NA	mm Hg.
VOLUME OF WATER CONDENSED	24.0	NA	
VOLUME OF FLUE GAS METERED AT REF.	0.4231	NA	m3 **
Sulphur Dioxide			
50%EA NA NA ACTUAL			
%EA = NA 13969.1000 mg			
CONCENTRATION NA 11701.1046 ppmv wet			
NA NA 12600.8762 ppmv dry			
NA 30.6586 g/m3**wet			
NA NA 33.0161 g/m3**dry			
MASS FLOW			1440.3612 kg/h
not applicable			
50%EA NA NA ACTUAL			
%EA = NA NA mg			
CONCENTRATION NA NA ppmv wet			
NA NA NA ppmv dry			
NA NA g/m3**wet			
NA NA g/m3**dry			
MASS FLOW			NA kg/h
not applicable			
50%EA NA NA ACTUAL			
%EA = NA NA mg			
CONCENTRATION NA NA ppmv wet			
NA NA NA ppmv dry			
NA NA g/m3**wet			
NA NA g/m3**dry			
MASS FLOW			NA kg/h
not applicable			
50%EA NA NA ACTUAL			
%EA = NA NA mg			
CONCENTRATION NA NA ppmv wet			
NA NA NA ppmv dry			
NA NA g/m3**wet			
NA NA g/m3**dry			
MASS FLOW			NA kg/h

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.
Glant Mine, Yellowknife
DATA FILE NUMBER 970621

TEST Three
Gold Roaster Stack
October 2, 1997

PAGE GEN01

LOCATION OF SAMPLING POINT	15.2 metre level
STACK DIAMETER OR TRAVERSE LENGTH	2.743 metres
RECTANGULAR DUCT WIDTH	0.000 metres
BAROMETRIC PRESSURE	738.9 mm Hg.
AMBIENT TEMPERATURE	5.0 C

AVERAGE COMPOSITION OF FLUE GAS

	DRY BASIS PERCENT	WET BASIS PERCENT
O2	19.610	18.328
CO2	0.080	0.075
N2 by Difference	80.310	75.060
H2O		6.537
CO	0.0000	0.000

SPECIFIC GRAVITY OF FLUE GAS (AIR = 1.0)	0.970
MOLECULAR WEIGHT OF FLUE GAS	28.091 g/g-mole
MOLECULAR WEIGHT OF FLUE GAS (DRY BASIS)	28.797 g/g-mole

STACK GAS FLOW RATE DATA AND CALCULATIONS

PITOT CALIBRATION FACTOR	0.804
STATIC PRESSURE	-0.504 mm Hg.
AVERAGE SQUARE ROOT VELOCITY HEAD	0.163
AVERAGE STACK GAS TEMPERATURE	82.2 C
AVERAGE STACK GAS VELOCITY	3.021 m/s
EFFLUENT FLOW RATE - WET (INCLUDING WATER)	14.554 m3/s ** 2142.478 kg-mole/h
EFFLUENT FLOW RATE - DRY (EXCLUDING WATER)	13.603 m3/s ** 2002.417 kg-mole/h
	kg/hcond 2527.49

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.	TEST Three	PAGE ISO01
Giant Mine, Yellowknife	Gold Roaster Stack	08:42
DATA FILE NUMBER 970621	October 2, 1997	TEST END 11:25

POLLUTANT DATA AND CALCULATIONS - ISOKINETIC SAMPLING TRAIN

VOLUME OF FLUE GAS METERED	2.7584 m3
AVERAGE ORIFICE PRESSURE	1.8566 mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	11.1 C
VACUUM AT LAST IMPINGER	2.3 mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	8.2675 mm Hg.
VOLUME OF WATER CONDENSED	120.0 mL

VOLUME OF FLUE GAS METERED AT REF. 2.8199 m3 **

	50%EA	NA	NA	ACTUAL
Particulates - Front Half	%EA = NA			0.0000 mg
CONCENTRATION	NA			0.0000 kg/1000kg wet
	NA	NA	NA	0.0000 kg/1000kg dry
	NA			0.0000 g/m3**wet
	NA	NA	NA	0.0000 g/m3**dry
MASS FLOW				0.0000 kg/h

	50%EA	NA	NA	ACTUAL
Particulates - Back Half	%EA = NA			0.0000 mg
CONCENTRATION	NA			0.0000 kg/1000kg wet
	NA	NA	NA	0.0000 kg/1000kg dry
	NA			0.0000 g/m3**wet
	NA	NA	NA	0.0000 g/m3**dry
MASS FLOW				0.0000 kg/h

	50%EA	NA	NA	ACTUAL
Particulates - Total Train	%EA = NA			0.0000 mg
CONCENTRATION	NA			0.0000 kg/1000kg wet
	NA	NA	NA	0.0000 kg/1000kg dry
	NA			NA ppmv wet
	NA	NA	NA	NA ppmv dry
	NA			0.0000 g/m3**wet
	NA	NA	NA	0.0000 g/m3**dry
MASS FLOW				0.0000 kg/h

	50%EA	NA	NA	ACTUAL
Arsenic	%EA = NA			9.5000 mg
CONCENTRATION	NA			NA ppmv wet
	NA	NA	NA	NA ppmv dry
	NA			0.0031 g/m3**wet
	NA	NA	NA	0.0034 g/m3**dry
MASS FLOW				0.1650 kg/h

** At Reference of 25 degrees C and 760 mm Hg.

Royal Oak Ltd.
 Giant Mine, Yellowknife
 DATA FILE NUMBER 970621

TEST Three
 Gold Roaster Stack
 October 2, 1997

PAGE ABS01
 TEST START 09:26
 TEST END 10:26

POLLUTANT DATA AND CALCULATIONS - PROPORTIONAL SAMPLING TRAINS

		ABS #1	ABS #2	
VOLUME OF FLUE GAS METERED		0.4048	0.0000	m3
AVERAGE ORIFICE PRESSURE		0.0000	NA	mm Hg.
AVERAGE DRY GAS METER TEMPERATURE		15.6	NA	C
VACUUM AT LAST IMPINGER		76.2	NA	mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER		0.000	NA	mm Hg.
VOLUME OF WATER CONDENSED		24.0	NA	
VOLUME OF FLUE GAS METERED AT REF.		0.4064	NA	m3 **
Sulphur Dioxide				
CONCENTRATION	50%EA	NA	NA	ACTUAL
	%EA =	NA		8889.5000 mg
		NA		7802.8457 ppmv wet
		NA	NA	8348.6216 ppmv dry
		NA		20.4446 g/m3**wet
		NA	NA	21.8746 g/m3**dry
MASS FLOW				1071.1806 kg/h
not applicable				
CONCENTRATION	50%EA	NA	NA	ACTUAL
	%EA =	NA		NA mg
		NA		NA ppmv wet
		NA	NA	NA ppmv dry
		NA		NA g/m3**wet
		NA	NA	NA g/m3**dry
MASS FLOW				NA kg/h
not applicable				
CONCENTRATION	50%EA	NA	NA	ACTUAL
	%EA =	NA		NA mg
		NA		NA ppmv wet
		NA	NA	NA ppmv dry
		NA		NA g/m3**wet
		NA	NA	NA g/m3**dry
MASS FLOW				NA kg/h
not applicable				
CONCENTRATION	50%EA	NA	NA	ACTUAL
	%EA =	NA		NA mg
		NA		NA ppmv wet
		NA	NA	NA ppmv dry
		NA		NA g/m3**wet
		NA	NA	NA g/m3**dry
MASS FLOW				NA kg/h

** At Reference of 25 degrees C and 760 mm Hg.

Square Roots of Traverse Data

0.141	0.141	0.173	0.000
0.158	0.141	0.158	0.000
0.158	0.141	0.158	0.000
0.173	0.100	0.141	0.000
0.173	0.187	0.141	0.000
0.173	0.200	0.141	0.000
0.173	0.212	0.122	0.000
0.173	0.200	0.122	0.000
0.173	0.173	0.000	0.000
0.158	0.173	0.000	0.000
0.158	0.187	0.000	0.000
0.141	0.173	0.000	0.000

dP = 0.161 Average Square Root

Dry Gas Volume Metered at Reference Conditions

$$Vm(std) = K1 * Vm * Y * (Pb + (dH/13.6)) / Tm$$

	ISO	ABS #1	ABS #2	
K1 =	0.3923	0.3923	0.3923	K/mm Hg.
Y =	1.0000	1.0000	NA	
Vm =	2.7568	0.2749	0.0000	m3 actual
Tm =	288.34	288.75	NA	degrees K
Pb =	738.9	738.9	738.9	mm Hg.
dH =	25.2	0.0	NA	mm H2O
Vm(std) =	2.7783	0.2760	NA	m3 @ ref

Volume of Water Condensed at Reference Conditions

$$Vwc(std) = K2 * Vlc$$

	ISO	ABS #1	ABS #2	
K2 =	0.0014	0.0014	0.0014	m3/mL
Vlc =	76.0	3.0	NA	mL
Vwc(std) =	0.1030	0.0041	NA	m3 @ ref

Volume of Water in Silica Gel at Reference Conditions

$$Vvw(std) = F * Vm(std) / (1-F)$$

$$F = VPI / (Pb - Vac)$$

	ISO	ABS #1	ABS #2	
VPI =	9.396	0.000	NA	
Vac =	50.8	66.0	NA	
F =	0.0137	0.0000	NA	
Vvw(std) =	0.0385	0.0000	NA	m3 @ ref

Total Volume Sampled at Reference

$$Sv = Vm(std) + Vwc(std) + Vvw(std)$$

	ISO	ABS #1	ABS #2	
Sv =	2.9198	0.2800	NA	m3 @ ref

Volume Fraction of Water in Total Sample Volume, Condensation $Bwsc = (Vwc(std) + Vvw(std)) / Sv$

ISO
Bwsc = 0.0484 volume fraction by condensation

Volume Fraction of Water in Total Sample Volume, Saturated Stack $Bwss = VPIs / Ps$

Ts = 80.28125
VPIs = 359.214
Ps = 738.5
Bwss = 0.4864 volume fraction for saturated stack

Bws = 0.0484
volume fraction

kg/h H2O by condensation

1844.995881

kg/h H2O by saturation

1841.244615

Dry Gas Molecular Weight

$$Msd = (0.44 * CO2) + (0.32 * O2) + (0.28 * (N2 + CO))$$

CO2 =	0.069	mole %
O2 =	19.625	mole %
N2 =	80.306	mole %
CO =	0.000	mole %
Msd =	28.80	kg/kg-mole

Wet Gas Molecular Weight

$$Msw = (Msd * (1-Bws)) + (18 * Bws)$$

ISO
Msw = 28.27 kg/kg-mole

CALCULATIONS PAGE 2 Stack Flow, Pollutant Concentrations and Pollutant Emission Rates

Absolute Stack Pressure		$P_s = P_b + P_g$	
Pg =	-0.4		mm Hg.
Ps =	738.5		mm Hg.

Average Stack Gas Velocity		$V_s = K_p * C_p * (((dP * T_s) / (P_s * M_{sw}))^{0.5})$	
	ISO		
Kp =	34.9219		
Cp =	0.804		
Ts =	353.43125		K
Vs =	2.959		m/s

Average Stack Gas Wet Volumetric Flow Rate		$Q_{sw} = 3600 * V_s * A * T_{std} / P_{std} * P_s / T_s$	
	ISO		
A =	5.9102		m ²
Tstd =	298.15		K
Pstd =	760		mm Hg.
Qsw =	51608		scm/h
Qsw =	14.3		scm/s

Average Stack Gas Dry Volumetric Flow Rate		$Q_{sd} = (1 - B_{ws}) * Q_{sw}$	
	ISO		
Qsd =	49108		dscm/h
Qsd =	13.6		dscm/s

Concentration, Dry Basis		$C_{sd} = 0.001 * m_n / V_m(std)$	
	ISO	ABS #1	ABS #2
Particulates - Front Half	0.0000		g/dscm
Particulates - Back Half	0.0000		g/dscm
Particulates - Total Train	0.0000		g/dscm
Arsenic	0.0036		g/dscm
Sulphur Dioxide		22.9871	g/dscm
not applicable		NA	g/dscm
not applicable			NA g/dscm
not applicable			NA g/dscm

Concentration, Dry Basis		$C_{pd} = 0.0244654 * m_n / (V_m(std) * M_{sd})$	
Particulates - Front Half	0.0000		kg/1000kg
Particulates - Back Half	0.0000		kg/1000kg
Particulates - Total Train	0.0000		kg/1000kg

Concentration, Wet Basis		$C_{sw} = C_{sd} * (1 - B_{ws})$	
	ISO	ABS #1	ABS #2
Particulates - Front Half	0.0000		g/scm
Particulates - Back Half	0.0000		g/scm
Particulates - Total Train	0.0000		g/scm
Arsenic	0.0034		g/scm
Sulphur Dioxide		21.8734	g/scm
not applicable		NA	g/scm
not applicable			NA g/scm
not applicable			NA g/scm

Concentration, Wet Basis		$C_{pw} = 0.0244654 * m_n / ((1/(1 - B_{ws})) * V_m(std)) * M_{sw}$	
Particulates - Front Half	0.0000		kg/1000kg
Particulates - Back Half	0.0000		kg/1000kg
Particulates - Total Train	0.0000		kg/1000kg

Emission Rate		$ER = C_{sd} * Q_{sd} / 1000$	
Particulates - Front Half	0.00		kg/h
Particulates - Back Half	0.00		kg/h
Particulates - Total Train	0.00		kg/h
Arsenic	0.18		kg/h
Sulphur Dioxide		1128.85	kg/h
not applicable		NA	kg/h
not applicable			NA kg/h
not applicable			NA kg/h

B

ISOKINETIC TEST DATA

619

CLIENT NAME / PLANT LOCATION

Grant Mines / Yellowknife / NW

JOB / FILE NUMBER

PAGE 1 OF 2

TEST CONDUCTED BY

DB, DL

CALCULATOR SET-UP

ORIFICE FACTOR

170.05

MINUTES PER POINT

5

BAROMETRIC PRESSURE

29.09

in. Hg.

STATIC PRESSURE

-0.23

in. H₂O

SPECIFIC GRAVITY

0.97

air = 1.0

WATER CONTENT

7%

mole %

NOZZLE DIAMETER

0.4998

in.

PITOT FACTOR

0.804

INITIAL METER READING

482.268

ft.³

DRY GAS ANALYSIS

O₂

CO₂

Sample
Bottle
Number

Initial
Volume

Final
Volume

mLs
Condensed

21

2

Imp. 1

H₂O

100

21

2

Imp. 2

H₂O

100

376 - 76

Imp. 3

H₂O

100

AVERAGES

Imp. 4

dry

Imp. 5

Si

CO readings if taken

19.625

.069

0

Particulate Analytical

EPA

Filter

N/A

P.W.

Acet.

P.W.

Water

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

Imp.

G.C. Sample Number

Notes:

L.C. 20.02 cfm @ 15 in Hg.

See Over For Additional Notes.

Kit Used:

ISO.003

Pitoe Used:

B-121

TRAV. POINT	START TIME	METER TEMP. C	STACK TEMP. C	PITOT READING in. H ₂ O	ORIFICE SETTING in. H ₂ O	METER READING ft. ³	IMP TEMP. C	IMP VAC. in. Hg.	OVERALL TEMP. C	CALCULATED METER READING
-------------	------------	---------------	---------------	------------------------------------	--------------------------------------	--------------------------------	-------------	------------------	-----------------	--------------------------

16	09:47	8	7	82	0.02	0.70	484.85	6	2.0	121	484.868
15	:52	9	7	82	.025	.88	487.76	10	2.0	120	487.780
14	:57	11	9	84	.025	.89	490.68	10	2.0	117	490.704
13	10:02	13	9	84	.03	1.10	493.90	11	2.0	120	493.919
12	:07	14	10	84	.03	1.10	497.13	11	2.0	121	497.146
11	:12	15	10	84	.03	1.10	500.37	12	2.0	119	500.377
10	:17	15	11	84	.03	1.10	503.62	12	2.0	117	503.615
9	:22	16	12	85	.03	1.10	506.86	12	2.0	116	506.859
8	:27	15	12	84	.03	1.10	510.09	13	2.0	117	510.102
7	:32	15	12	85	.025	.91	513.05	13	2.0	117	513.059
6	:37	16	12	85	.025	.92	516.02	13	2.0	117	516.021
5	:42	16	13	84	.02	.73	518.67	13	2.0	118	518.678
4	:47	16	13	82	.02	.73	521.33	14	2.0	117	521.343
3	:52	16	13	82	.02	.73	524.00	14	2.0	117	524.007
2	:57	16	13	82	.02	.73	526.67	14	2.0	117	526.672
1	11:02	17	14	81	.01	.35	528.569	14	2.0	120	528.566

Averages

10.3 2.0

ISOKINETIC TEST DATA

CLIENT NAME / PLANT LOCATION

Grant Mines / Yellowknife NW

JOB / FILE NUMBER

PAGE 2 OF 2

TEST CONDUCTED BY

DB, DL

CALCULATOR SET-UP

ORIFICE FACTOR

MINUTES PER POINT

BAROMETRIC PRESSURE

in. Hg.

STATIC PRESSURE

in. H₂O

SPECIFIC GRAVITY

air = 1.0

WATER CONTENT

mole %

NOZZLE DIAMETER

in.

PITOT FACTOR

INITIAL METER READING

ft. ³

SOURCE INFORMATION

SOURCE NAME: Gold Roaster Stack

TEST DATE

Oct. 01 / 97

TEST NUMBER

One

STACK I.D. - meters

108 inches

or traverse length

STACK WIDTH - meters

if rectangular

TRAV. POINT	START TIME	METER TEMP. C IN	STACK TEMP C	PITOT READING in. H ₂ O	ORIFICE SETTING in. H ₂ O	METER READING ft. ³	IMP TEMP C	IMP VAC. in. Hg.	OVEN TEMP. C	CALCULATED METER READING	
16	11:18	14	13	83	.035	1.31	532.06	9	2.0	120	532.074
15	:23	16	14	84	.040	1.51	535.84	11	2.0	117	535.838
14	:28	18	14	84	.045	1.72	539.85	11	2.0	117	539.845
13	:33	19	15	84	.04	1.54	543.61	11	2.0	120	543.636
12	:38	20	15	80	.03	1.15	546.93	9	2.0	121	546.943
11	:43	20	15	79	.03	1.16	550.26	9	2.0	117	550.255
10	:48	20	16	78	.035	1.37	553.84	9	2.0	118	553.843
9	:53	20	16	77	.03	1.17	557.15	8	2.0	119	557.170
8	:58	21	17	75	.03	1.18	560.52	8	2.0	120	560.518
7	12:03	21	17	75	.025	.98	563.56	8	2.0	117	563.574
6	:08	21	17	73	.025	.98	566.64	8	2.0	120	566.639
5	:13	21	17	73	.02	.78	569.39	7	2.0	116	569.380
4	:18	20	17	73	.02	.78	572.13	7	2.0	117	572.117
3	:23	20	17	73	.02	.78	574.87	7	2.0	116	574.854
2	:28	20	18	72	.015	.58	577.24	7	2.0	120	577.231
1	:33	20	18	72	.015	.58	579.622	7	2.0	120	579.609

Averages



EMISSION TEST DATA

Job Number	N/A	Test Number	OE	Pitot #	N/A	Factor	N/A
Company Name	ROYAL OAK MINE LTD.	Barometric Pressure	29.09 in. Hg	NOVA	[]	GC	[]
Plant Location	YELLOW KNIFE, N.W.T.	Ambient Temperature	52	O2	—	—	—
Source Name	GOLD ROASTER STACK	Train Operators	D. BOURGET	CO2	SEE DUST SHEETS	—	—
Test Date	OCT 1, 1997	Train Used	ABS 002	CO	—	—	—

Solution Used	Imp. 1 6% H ₂ O ₂	Imp. 2 BLANK	Cyclonic Flow	Yes []	No []	Angle	N/A
Initial mLs.	250.0	—	Static Pressure	+	[]	—	N/A in. H ₂ O
Final mLs.	251.0	—	Leak Checks	✓	Before	✓	After
mLs. Condensed	1.0	—		0.00 cfm @ 16.0 in. Hg.	0.00 cfm @ 16.0 in. Hg.		

2

Sample Time	Clock Time	Meter Volume Units (ft ³)	Stack dP in. H ₂ O	Imp. Vacuum in. Hg.	TEMPERATURES C		
					meter	condenser (g)	stack
0	10:46	20.731	↑	1.0	15.6	306.0	↑
10	:56	22.401	↑	2.0	15.6	↑	↑
20	:06	23.920	↑	3.0	15.6	↑	↑
30	:16	24.425	N/A	3.0	15.6	↑	N/A
40	:26	27.057	↑	3.0	15.6	↑	↑
50	:36	28.620	↑	3.0	15.6	↑	↑
60	11:46	30.439	↓	3.0	15.6	308.0	↓
		9.708		2.6	15.6		

Ts C	dP in. H ₂ O	Ts C	dP in. H ₂ O	Ts C	dP in. H ₂ O	Ts C	dP in. H ₂ O
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
11		11		11		11	
12		12		12		12	
13		13		13		13	
14		14		14		14	—
15		15		15		15	
16		16		16		16	

PORT IDENT.

SOKINETIC TEST DATA

620

TEST NAME / PLANT LOCATION

Giant Mines / Yellowknife NWT

LOG / FILE NUMBER

PAGE 1 OF 2

TEST CONDUCTED BY

DB, BL

CALCULATOR SET-UP

ORIFICE FACTOR	170.05	
MINUTES PER POINT	5	
BAROMETRIC PRESSURE	29.09	in. Hg.
STATIC PRESSURE	-0.23	in. H ₂ O
SPECIFIC GRAVITY	0.97	air = 1.0
WATER CONTENT	6	moist %
NOZZLE DIAMETER	0.4998	in.
PITOT FACTOR	0.804	
INITIAL METER READING	587.181	R-3

DRY GAS ANALYSIS

O ₂	CO ₂
21	0
21	0
AVERAGES	
CO readings if taken	
21.136	
.055	
0	

Sample Bottle Number	Initial Volume	Final Volume	mLs Condensed
----------------------	----------------	--------------	---------------

Imp. 1	H ₂ O	100	
Imp. 2	H ₂ O	100	420 + 120
Imp. 3	H ₂ O	100	
Imp. 4	Dry	—	
Imp. 5	Sil	—	

Particulate Analytical			
EPA Filter	N/A		10.27
P.W. Acet.			
P.W. Water			
Imp.			
Imp.			13969.1

SOURCE INFORMATION

SOURCE NAME: Gold Roaster Stack

TEST DATE: Oct. 01 / 97

TEST NUMBER: Two

Notes: L.C. 20.02 cfm @ 15 in Hg.

STACK I.D. - meters
or traverse length: 108 inches

90.387 cfm
See Over For Additional Notes.

STACK WIDTH - meters
if rectangular

Kit Used: ISO-003 Pitot Used: B-12

TRAV. POINT	START TIME	METER TEMP. IN	STACK TEMP. OUT	PITOT READING in. -20	ORIFICE SETTING in. H ₂ O	METER READING R-3	IMP TEMP C	IMP VAC. in. Hg.	OVEN TEMP. C	CALCULATED METER READING
16	13:16	15	15	73	0.025	0.98	590.26	8	2.0	119 590.237
15	121	15	15	76	.03	1.17	593.58	6	2.0	119 593.569
14	126	17	16	78	.03	1.18	596.91	8	2.0	120 596.910
13	131	18	15	78	.03	1.18	600.24	10	2.0	118 600.250
12	136	19	16	79	.025	0.98	603.31	10	2.0	118 603.306
11	141	19	16	80	.025	.98	606.37	10	2.0	120 606.357
10	146	20	16	80	.025	.98	609.42	10	2.0	121 609.414
9	151	20	16	81	.025	.98	612.46	10	2.0	118 612.466
8	156	20	17	81	.025	.98	615.52	10	2.0	116 615.524
7	14:01	20	17	81	.02	.77	618.27	10	2.0	119 618.258
6	14:06	20	17	81	.02	.77	620.98	10	2.0	117 620.993
5	14:11	20	17	81	.02	.77	623.71	10	2.0	117 623.728
4	14:16	21	17	80	.02	.78	626.45	10	2.0	117 626.471
3	14:21	20	18	80	.02	.78	629.20	10	2.0	118 629.215
2	14:26	21	18	78	.02	.79	631.97	10	2.0	120 631.970
1	14:31	21	18	78	.015	.58	634.37	10	2.0	120 634.357

Averages 9.4 2.0

ISOKINETIC TEST DATA

CLIENT NAME / PLANT LOCATION

Grand Mines / Yellowknife NWT

JOB / FILE NUMBER

PAGE 2 OF 2

TEST CONDUCTED BY

DB, DL

CALCULATOR SET-UP

ORIFICE FACTOR

MINUTES PER POINT

BAROMETRIC PRESSURE

in. Hg.

STATIC PRESSURE

in. H₂O

SPECIFIC GRAVITY

air = 1.0

WATER CONTENT

mole %

NOZZLE DIAMETER

in.

PITOT FACTOR

INITIAL METER READING

ft³

DRY GAS ANALYSIS

O₂

CO₂

Sample
Bottle
Number

Initial
Volume

Final
Volume

mLs
Condensed

Imp. 1

Imp. 2

Imp. 3

AVERAGES

Imp. 4

Imp. 5

CO readings if taken

Particulate Analytical

EPA

Filter

P.W.

Acet.

P.W.

Water

Imp.

G.C. Sample Number

Imp.

SOURCE INFORMATION

SOURCE NAME: *Gold Roaster Stack*

TEST DATE

Oct. 01 / 97

TEST NUMBER

Two

Notes:

STACK I.D. - meters

or traverse length

108 inches

See Over For Additional Notes.

STACK WIDTH - meters

if rectangular

Kit Used:

Probe Used:

TRAV. POINT	START TIME	METER TEMP. C IN	STACK TEMP C OUT	PITOT READING in. H ₂ O	ORIFICE SETTING in. H ₂ O	METER READING ft ³	IMP TEMP C	IMP VAC. in. Hg.	OVEN TEMP. C	CALCULATED METER READING
----------------	---------------	------------------------	---------------------------	--	--	-------------------------------------	------------------	------------------------	--------------------	--------------------------------

16	14:41	20	18	79	0.02	.78	637.12	X8	2.0	116	637.104
15	:46	20	18	82	.025	.98	640.17	9	2.0	116	640.163
14	:51	21	18	82	.025	.98	643.22	9	2.0	121	643.226
13	:56	21	18	83	.03	1.19	647.58	10	2.0	122	646.578
12	15:01	22	19	83	.025	.99	649.63	10	2.0	121	649.647
11	:06	22	19	83	.02	.78	652.37	10	2.0	121	652.393
10	:11	22	19	83	.02	.78	655.15	10	2.0	119	655.139
9	:16	21	19	83	.02	.78	657.88	10	2.0	121	657.885
8	:21	21	19	83	.02	.78	660.63	9	2.0	122	660.630
7	:26	21	19	83	.02	.78	663.38	9	2.0	120	663.362
6	:31	21	19	82	.02	.78	666.12	9	2.0	119	666.107
5	:36	22	19	82	.015	.58	668.49	9	2.0	117	668.488
4	:41	21	19	81	.015	.58	670.89	9	2.0	117	670.869
3	:46	21	19	80	.015	.58	673.27	9	2.0	117	673.253
2	:51	21	19	79	.015	.58	675.63	9	2.0	118	675.640
1	:56	21	19	79	.01	.38	677.568	9	2.0	120	677.589

Averages



EMISSION TEST DATA

Job Number	N/A	Test Number	Two	Pitot #	N/A	Factor	N/A
Company Name	ROYAL OAKS MINE LTD	Barometric Pressure	29.09 in. Hg	NOVA	[]	GC	[✓] Fyrites [✓]
Plant Location	YELLOWKNIFE MINT	Ambient Temperature	5°C	O2	—	—	— mole %
Source Name	GOD ROOSTER STACK	Train Operators	D. ROUGET	CO2	SEE DUST SHEETS		mole %
Test Date	OCT 1, 1997	Train Used	ABS 002	CO	—	—	— ppmv

Solution Used	Imp. 1 6% H ₂ O ₂	Imp. 2 BLANK	Cyclonic Flow	Yes [] No []	Angle	N/A
Initial mLs.	250.0	—	Static Pressure	+ [] - []		N/A in. H ₂ O
Final mLs.	268.0	—	Leak Checks	✓ Before	✓ After	
mLs. Condensed	18.0	—		0.00 cfm @ 16.0 in. Hg.	0.00 cfm @ 16.0 in. Hg.	

6

Sample Time	Clock Time	Meter Volume Units (F ³)	Stack dP in. H ₂ O	Imp. Vacuum in. Hg.	TEMPERATURES C		
					meter	condenser	stack
0	13:36	30.539	↑	3.0	15.6	30.5	↑
10	:46	33.169	↑	3.0	15.6	↑	↑
20	:56	35.427	↑	3.0	15.6	↑	↑
30	:06	37.720	N/A	3.0	15.6	↑	N/A
40	:16	40.395	↓	3.0	15.6	↓	↓
50	:26	42.859	↓	3.0	15.6	↓	↓
60	14:36	45.423	↓	3.0	15.6	31.5	↓
		14.884		3.0	15.6		

Ts C	dP in. H ₂ O	Ts C	dP in. H ₂ O	Ts C	dP in. H ₂ O	Ts C	dP in. H ₂ O
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
11		11		11		11	
12		12		12		12	
13		13		13		13	
14		14		14		14	—
15		15		15		15	
16		16		16		16	
PORT IDENT.							

ISOKINETIC TEST DATA

621

CLIENT NAME / PLANT LOCATION

Royal Oak / yellowknife NW

JOB / FILE NUMBER

PAGE 1 OF 2

TEST CONDUCTED BY

DB, DL

CALCULATOR SET-UP

ORIFICE FACTOR 170.05
 MINUTES PER POINT 5
 BAROMETRIC PRESSURE 28.95 in. Hg.
 STATIC PRESSURE -0.27 in. H₂O
 SPECIFIC GRAVITY 0.97 air = 1.0
 WATER CONTENT 7 mole %
 ORIFICE DIAMETER 0.4998 in.
 PITOT FACTOR 0.804
 INITIAL METER READING 684.341 R-3

DRY GAS ANALYSIS

O₂ CO₂

Sample Bottle Number Initial Volume Final Volume mLs Condensed

Imp. 1 H₂O 100 }
 Imp. 2 H₂O 100 } 420 - 120
 Imp. 3 H₂O 100 }
 AVERAGES Imp. 4 Dry —
 Imp. 5 Sil —

CO readings if taken

19.610
 .080
 0

Particulate Analytical

EPA Filter N/A 9.50
 P.W. Acet.
 P.W. Water
 Imp.
 Imp.

SOURCE INFORMATION

SOURCE NAME: Gold Roaster Stack

G.C. Sample Number

TEST DATE Oct. 02 87

Notes: L.C. 20.02 cfm @ 15 in Hg

TEST NUMBER Three

STACK I.D. - meters 108 inches
 or traverse length

See Over For Additional Notes.

STACK WIDTH - meters
 if rectangular

Kit Used: ISO.003

Pitot Used: R-121

TRAV. POINT	START TIME	METER TEMP. IN	METER TEMP. OUT	STACK TEMP. C	PITOT READING in. -20	ORIFICE SETTING in. H ₂ O	METER READING R-3	IMP TEMP. C	IMP VAC. in. Hg.	OVEN TEMP. C	CALCULATED METER READING
16	08:42	5	4	85	0.03	1.04	687.50	6	2.0	119	687.485
15	:47	7	5	85	.04	1.42	691.14	8	2.0	120	691.136
14	:52	7	5	85	.035	1.23	694.54	8	2.0	121	694.551
13	:57	9	6	81	.03	1.08	697.72	9	2.0	121	697.747
12	09:02	9	6	80	.03	1.08	700.93	8	2.0	118	700.948
11	:07	9	6	79	.025	.89	703.87	8	2.0	122	703.874
10	:12	10	7	78	.025	.90	706.82	8	2.0	120	706.814
9	:17	10	7	78	.025	.90	709.77	8	2.0	119	709.755
8	:22	10	7	83	.025	.89	712.69	8	2.0	116	712.675
7	:27	11	8	83	.02	.71	715.31	8	2.0	118	715.296
6	:32	11	8	83	.02	.71	717.93	8	2.0	118	717.917
5	:37	11	8	83	.02	.71	720.55	8	2.0	120	720.538
4	:42	11	8	82	.02	.71	723.14	8	2.0	119	723.162
3	:47	12	9	82	.015	.53	725.45	8	2.0	118	725.444
2	:52	12	10	80	.015	.53	727.73	8	2.0	118	727.735
1	:57	11	9	79	.01	.34	729.619	8	2.0	119	729.602

Averages

8.4 2.25

ISOKINETIC TEST DATA

CLIENT NAME / PLANT LOCATION

Royal Oak Mines / Yellowknife NWT

JOB / FILE NUMBER

PAGE 2 OF 2

TEST CONDUCTED BY

DB, DL

CALCULATOR SET-UP

ORIFICE FACTOR

MINUTES PER POINT

BAROMETRIC PRESSURE

in. Hg.

STATIC PRESSURE

in. H₂O

SPECIFIC GRAVITY

air = 1.0

WATER CONTENT

mole %

NOZZLE DIAMETER

in.

PITOT FACTOR

INITIAL METER READING

ft.³

DRY GAS ANALYSIS

O₂ CO₂

21 1.0

21 1.0

AVERAGES

CO readings if taken

Sample
Bottle
Number

Initial
Volume

Final
Volume

mLs
Condensed

Imp. 1

Imp. 2

Imp. 3

Imp. 4

Imp. 5

Particulate Analytical

EPA

Filter

P.W.

Acet.

P.W.

Water

Imp.

G.C. Sample Number

Imp.

SOURCE INFORMATION

SOURCE NAME: Gold Roaster Stack

TEST DATE

Oct. 02 / 97

TEST NUMBER

Three

Notes:

STACK I.D. - meters
or traverse length

108 inches

See Over For Additional Notes.

STACK WIDTH - meters
if rectangular

Kit Used:

Probe Used:

TRAV. POINT	START TIME	METER TEMP. C IN	METER TEMP. C OUT	STACK TEMP C	PITOT READING in. H ₂ O	ORIFICE SETTING in. H ₂ O	METER READING ft.³	IMP TEMP C	IMP VAC. in. Hg.	OVEN TEMP. C	CALCULATED METER READING
16	10:05	13	11	83	0.035	1.30	733.13	7	2.5	116	733.100
15	1:10	14	11	84	.035	1.30	736.64	9	2.5	119	736.599
14	1:15	16	12	84	.035	1.31	740.14	9	2.5	117	740.117
13	1:20	15	11	83	.035	1.31	743.63	9	2.5	120	743.627
12	1:25	16	11	83	.035	1.31	747.14	9	2.5	118	747.143
11	1:30	17	12	83	.035	1.32	750.67	9	2.5	119	750.671
10	1:35	17	13	83	.035	1.33	754.21	9	2.5	119	754.206
9	1:40	17	13	83	.035	1.33	757.74	9	2.5	117	757.741
8	1:45	17	13	84	.03	1.13	761.02	9	2.5	118	761.009
7	1:50	14	11	82	.03	1.11	764.27	9	2.5	117	764.257
6	1:55	16	13	83	.03	1.13	767.55	9	2.5	118	767.524
5	11:00	16	14	83	.03	1.13	770.79	9	2.5	118	770.796
4	1:05	16	13	83	.025	.93	773.77	9	2.5	118	773.779
3	1:10	16	13	82	.025	.93	776.74	9	2.5	119	776.765
2	1:15	14	12	82	.02	.73	779.41	9	2.5	119	779.422
1	1:20	14	12	80	.015	.54	781.752	9	2.5	117	781.730

Averages



EMISSION TEST DATA

Job Number	N/A	Test Number	THREE	Pitot #	N/A	Factor	N/A
Company Name	ROYAL OAK CO.	Barometric Pressure	28.95 in.Hg	NOVA	[]	GC	[] Fyrites [✓]
Plant Location	YELLOWKNIFE, NT	Ambient Temperature	52	O2	—	—	— mole %
Source Name	GOLD ROASTER STACK	Train Operators	D. BOURLET	CO2	SEE DUST SHEETS	—	— mole %
Test Date	OCT 21, 1997	Train Used	ABS O2	CO	—	—	— ppmv

Solution Used	Imp. 1 68% H2O2	Imp. 2 BLANK	Cyclonic Flow	Yes [] No []	Angle	N/A
Initial mLs.	250.0	—	Static Pressure	+ [] - []	N/A	in. H2O
Final mLs.	—	—	Leak Checks	✓ Before	✓ After	
mLs. Condensed	—	—		0.00 cfm @ 16.0 in.Hg.	0.00 cfm @ 16.0 in.Hg.	

5.0

Sample Time	Clock Time	Meter Volume Units [F ³]	Stack dP in. H2O	Imp. Vacuum in. Hg.	TEMPERATURES C		
					meter	condensers	stack
0	09:26	45.774	↑	3.0	15.6	314.0	↑
10	:36	48.120	↑	3.0	15.6	↑	↑
20	:46	50.552	↑	3.0	15.6	↑	↑
30	:56	52.269	N/A	3.0	15.6	↑	N/A
40	:06	54.852	↓	3.0	15.6	↓	↓
50	:16	57.769	↓	3.0	15.6	↓	↓
60	10:26	60.070	↓	3.0	15.6	319.0	↓
		14.296		3.0	15.6		

Ts C	dP in.H2O	Ts C	dP in.H2O	Ts C	dP in.H2O	Ts C	dP in.H2O
1		1		1		1	
2		2		2		2	
3		3		3		3	
4		4		4		4	
5		5		5		5	
6		6		6		6	
7		7		7		7	
8		8		8		8	
9		9		9		9	
10		10		10		10	
11		11		11		11	
12		12		12		12	
13		13		13		13	
14		14		14		14	—
15		15		15		15	
16		16		16		16	
PORT IDENT.							

ENTECH ENVIRONMENTAL SERVICES LTD.

CHAIN OF CUSTODY

COMPANY: ROYAL OAK LTD.

LOCATION: YELLOWKNIFE, NWT

SOURCE: GOLD ROASTER

TEST NUMBER(S): 1-3

SAMPLED BY: D. BOURGET / D. LAIRONE

SAMPLE DATE: OCT 1-2 / 97

RECOVERY BY:

RECOVERY DATE:

FILTER NUMBER(S): N/A

TEST NUMBER	SAMPLE BOTTLE NUMBER	DESCRIPTION OF SAMPLE
<u>ONE</u>	<u>971228</u>	<u>DH₂O (150mL NaOH Rinse - As)</u>
<u>ONE</u>	<u>971229</u>	<u>PROBE WASH (NaOH + DH₂O)</u>
<u>ONE</u>	<u>971227</u>	<u>6% H₂O₂ (SO₂)</u>
<u>N/A</u>	<u>N/A</u>	<u>N/A</u>

COLOR OF SILICA GEL: BLUE

DESCRIPTION OF IMPINGER WATER: CLEAR / COLORLESS

BOTTLE LEVEL MARKED: Y (N)

FILTER NUMBER(S): N/A

TEST NUMBER	SAMPLE BOTTLE NUMBER	DESCRIPTION OF SAMPLE
<u>TWO</u>	<u>971226</u>	<u>DH₂O (150mL NaOH Rinse - As)</u>
<u>TWO</u>	<u>971223</u>	<u>PROBE WASH (NaOH + DH₂O)</u>
<u>TWO</u>	<u>971230</u>	<u>6% H₂O₂ (SO₂)</u>
<u>N/A</u>	<u>N/A</u>	<u>N/A</u>

COLOR OF SILICA GEL: BLUE

DESCRIPTION OF IMPINGER WATER: CLEAR / COLORLESS

BOTTLE LEVEL MARKED: Y (N)

FILTER NUMBER(S):

TEST NUMBER	SAMPLE BOTTLE NUMBER	DESCRIPTION OF SAMPLE
<u>THREE</u>	<u>971221</u>	<u>DH₂O (150mL NaOH Rinse - As)</u>
<u>THREE</u>	<u>971225</u>	<u>PROBE WASH (NaOH + DH₂O)</u>
<u>THREE</u>	<u>971220</u>	<u>6% H₂O₂</u>
<u>N/A</u>	<u>N/A</u>	<u>N/A</u>

COLOR OF SILICA GEL: BLUE

DESCRIPTION OF IMPINGER WATER: CLEAR / COLORLESS

BOTTLE LEVEL MARKED: Y (N)

FILTER NUMBER(S):

TEST NUMBER	SAMPLE BOTTLE NUMBER	DESCRIPTION OF SAMPLE

COLOR OF SILICA GEL:

DESCRIPTION OF IMPINGER WATER:

BOTTLE LEVEL MARKED: Y N

COMMENTS:

- PROBE WASH SAMPLES TO BE ADDED TO IMPINGER CATCH CONTAINERS FOR ANALYSIS.
- T-1 RESULTS MAY BE LOWER DUE TO PLANT PROBLEMS (ROASTER WAS SHUT DOWN FROM 11:00-13:00)

RELINQUISHED BY: WB

DATE: OCT 3 / 97

TIME: 12:52

RECEIVED BY: bw

DATE: 97-10-03

TIME: 13:00

RELINQUISHED BY:

DATE:

TIME:

RECEIVED BY:

DATE:

TIME:

PITOT TUBE/PITOT BE CALIBRATION DATA						
UPDATED 26-August-97						
A=>PITOT	Length					
B=>PITOT BE	TYPE	FL	Pf	A	Pf	B DATE
A-021	PITOT	2.0	0.770	A		04-Feb-97
A-04SH1	PITOT	5.0	0.773	A		18-Feb-97
A-051	PITOT	5.0	0.782	A		02-Jun-97
A-06S1	PITOT	6.0	0.762	A		05-Feb-97
A-081	PITOT	8.0	0.786	A		04-Feb-97
A-14SH1	PITOT	14.0	0.794	A		05-Feb-97
A-14SH2	PITOT	14.0	0.763	A		05-Feb-97
A-14SH3	PITOT	14.0	0.800	A		05-Feb-97
A-141	PITOT	14.0	0.823	A		18-Feb-97
A-142	PITOT	14.0	0.754	A		05-Feb-97
A-143 Mon.	PITOT	14.0	0.779	A		05-Feb-97
A-WE101	PITOT	8.0	0.730	A		18-Feb-97
A-WE102	PITOT	8.0	0.771	A		18-Feb-97
B-032	PITOT BE	3.0	0.792	A		21-Aug-97
B-033	PITOT BE	3.0	0.802	A		05-Feb-97
B-051	PITOT BE	5.0	0.805	A		04-Feb-97
B-052	PITOT BE	5.0	0.841	A		04-Feb-97
B-081	PITOT BE	6.0	0.831	A		04-Feb-97
B-072	PITOT BE	7.0	0.811	A		04-Feb-97
B-081	PITOT BE	8.0	0.829	A		04-Feb-97
B-091	PITOT BE	9.0	0.795	A		04-Feb-97
B-10MRC	PITOT BE	10.0	0.790	A		05-Feb-97
B-102	PITOT BE	10.0	0.808	A		04-Feb-97
B-121	PITOT BE	12.0	0.804	A		21-Aug-97
ASTM-02	Tip	0.822	A			05-Feb-97
ASTM-03	Tip	0.812	A			05-Feb-97
ASTM-04	Tip	0.807	A			04-Feb-97
ASTM-05	Tip	0.812	A			04-Feb-97
ASTM-07	Tip	0.805	A			05-Feb-97
ASTM-09	Tip	0.801	A			04-Feb-97
ASTM-10	Tip	0.807	A			18-Feb-97
ASTM-11	Tip	0.821	A			18-Feb-97
Anderson	Tip	0.803	A			04-Feb-97
B-H2O	Tip	0.803	A			04-Feb-97

NOx Bomb Calibrations	
As Of Nov. 12, 1996	
Bomb #	Volume
2000	2022
2001	2046
2002	2003
2003	1994
2004	2025
2005	2056
2006	1967
2007	2042
2008	1991
2009	2010
2010	1974
2011	2080
2012	1985
2013	1932
2014	1973
2015	2029
2016	1995
2017	2034
2018	1993
2019	2009
2020	2019
2021	1995
2022	1972
2023	2008
2024	1969
2025	1976
2027	2002
2028	2023
2029	2013
2030	1997
2031	1989
2032	2006
2033	2095
2034	1992
2035	2022
2036	2037
2037	2029
2038	1970
2039	2020
2040	2060
2041	2064
2042	1998
2043	2094
2044	2068
2045	2095
2046	2087
2047	2080
2048	2019

Nozzle	Size	Nozzle	Size	Nozzle	Size
3/32 SS-01	0.0903	1/4 SS-01	0.2490	5/16 SS-01	0.3120
3/32 SS-03	0.0925	1/4 SS-02	0.2538	5/16 SS-02	0.3143
		1/4 SS-03	0.2558		
1/8 SS-01	0.1320	1/4 SS-04	0.2528	3/8 SS-02	0.3680
		1/4 SS-05	0.2510	3/8 SS-03	0.3688
3/16 SS-01	0.1900	1/4 SS-06	0.2513	3/8 SS-04	0.3688
3/16 SS-02	0.1950	1/4 SS-07	0.2553	3/8 SS-05	0.3700
3/16 SS-03	0.1908	1/4 SS-08	0.2505	3/8 SS-06	0.3745
3/16 SS-04	0.1895	1/4 SS-09	0.2643		
3/16 SS-05	0.1908	1/4 SS-10	0.2498	3/8 INC-01	0.3693
3/16 SS-06	0.1905			3/8 INC-02	0.3735
3/16 SS-07	0.1905	9/32 SS-01	0.2758		
3/16 SS-08	0.1910	9/32 SS-02	0.2810	1/2 SS-01	0.4998
3/16 SS-10	0.1858	9/32 SS-03	0.2835	1/2 SS-02	0.5010
3/16 SS-11	0.1905	9/32 SS-04	0.2825	1/2 SS-03	0.5013
3/16 SS-12	0.1903	9/32 SS-05	0.2808		
		9/32 SS-06	0.2783	1/2 SS-05	0.5063
		9/32 SS-07	0.2825		
7/32 SS-02	0.2220	9/32 SS-08	0.2820	1/2 NIC-01	0.4983
7/32 SS-03	0.2230	9/32 SS-09	0.2820		
		9/32 SS-10	0.2858	7/16 Quartz	0.4360

METER/ORIFICE CALIBRATION DATA				
FULL CERTIFICATION			VERIFICATION DATES	
DGM	ORIFICE	DATE		
ISO 002	0.996	170.04	97/08/05	
ISO 003	0.993	170.05	97/08/07	
ISO 004	0.995	171.08	97/08/07	
ISO 005	0.997	179.08	97/08/07	
ISO 006	0.995	175.04	97/08/12	
ABS 001	0.999		97/08/21	
ABS 002	1.000		02/97	05/97
ABS 003	0.999 @ 1.6 l/min		02/97	05/97
ABS 003	0.993 @ 1.0 l/min		02/97	
ABS 005	0.998		97/08/15	
ABS 006	0.992		97/08/20	
ABS 007	1.002		02/97	05/97
ABS 008	0.992		02/97	05/97
ABS 009	0.991		02/97	05/97
ABS 010	1.002		97/08/22	
REF 001	1.000	vs. REF 002	21-Feb-97	
REF 001	1.000	vs. MRCwet	21-Feb-97	
REF 002	1.000	vs. MRCwet	21-Feb-97	

PLANT NAME	
PLANT LOCATION	
SOURCE NAME	
TEST DATE	

Royal Oak Ltd.
Giant Mine, Yellowknife
Gold Roaster Stack

DATA FILE NUMBER 970619
TEST One
October 1, 1997

GAS SPEED AND ISOKINETIC CALCULATIONS

POINT #	VELOCITY PRES. in.H2O	ORIFICE PRES. in.H2O	VOLUME m3	STACK TEMP. C	METER-TEMP IN C	OUT C	STACK VEL m/s	PERCENT ISOKIN.
1.16	0.020	0.700	0.0731	82.0	8.0	7.0	2.61	98.08
1.15	0.025	0.880	0.0824	82.0	9.0	7.0	2.92	98.65
1.14	0.025	0.890	0.0826	84.0	11.0	9.0	2.93	98.57
1.13	0.030	1.100	0.0911	84.0	13.0	9.0	3.20	98.82
1.12	0.030	1.100	0.0914	84.0	14.0	10.0	3.20	98.78
1.11	0.030	1.100	0.0917	84.0	15.0	10.0	3.20	98.91
1.10	0.030	1.100	0.0920	84.0	15.0	11.0	3.20	99.04
1.09	0.030	1.110	0.0917	85.0	16.0	12.0	3.21	98.53
1.08	0.030	1.110	0.0914	84.0	15.0	12.0	3.20	98.26
1.07	0.025	0.910	0.0838	85.0	15.0	12.0	2.93	98.83
1.06	0.025	0.920	0.0841	85.0	16.0	12.0	2.93	98.99
1.05	0.020	0.730	0.0750	84.0	16.0	13.0	2.62	98.49
1.04	0.020	0.730	0.0753	82.0	16.0	13.0	2.61	98.58
1.03	0.020	0.730	0.0756	82.0	16.0	13.0	2.61	98.95
1.02	0.020	0.730	0.0756	82.0	16.0	13.0	2.61	98.95
1.01	0.010	0.350	0.0537	81.0	17.0	14.0	1.84	99.14
2.16	0.035	1.310	0.0988	83.0	14.0	13.0	3.46	98.13
2.15	0.040	1.510	0.1070	84.0	16.0	14.0	3.70	98.97
2.14	0.045	1.720	0.1135	84.0	18.0	14.0	3.93	98.59
2.13	0.040	1.540	0.1064	84.0	19.0	15.0	3.70	97.76
2.12	0.030	1.150	0.0940	80.0	20.0	15.0	3.19	99.04
2.11	0.030	1.160	0.0942	79.0	20.0	15.0	3.18	99.19
2.10	0.035	1.370	0.1013	78.0	20.0	16.0	3.43	98.37
2.09	0.030	1.170	0.0937	77.0	20.0	16.0	3.17	98.15
2.08	0.030	1.180	0.0954	75.0	21.0	17.0	3.16	99.30
2.07	0.025	0.980	0.0860	75.0	21.0	17.0	2.89	98.17
2.06	0.025	0.980	0.0872	73.0	21.0	17.0	2.88	99.18
2.05	0.020	0.780	0.0778	73.0	21.0	17.0	2.58	99.05
2.04	0.020	0.780	0.0775	73.0	20.0	17.0	2.58	98.86
2.03	0.020	0.780	0.0775	73.0	20.0	17.0	2.58	98.86
2.02	0.015	0.580	0.0671	72.0	20.0	18.0	2.23	98.48
2.01	0.015	0.580	0.0674	72.0	20.0	18.0	2.23	98.98
AVG.		0.993		80.3	16.8	13.5	2.96	98.71
TOTAL			2.7551					
MAX								99.30
MIN								97.76

Royal Oak Ltd.
Giant Mine, Yellowknife
Gold Roaster Stack

DATA FILE NUMBER 970620

TEST Two

October 1, 1997

GAS SPEED AND ISOKINETIC CALCULATIONS

POINT #	VELOCITY PRES. in.H2O	ORIFICE PRES. in.H2O	VOLUME m3	STACK TEMP. C	METER-TEMP IN C	OUT C	STACK VEL m/s	PERCENT ISOKIN.
1.16	0.025	0.980	0.0871	73.0	15.0	15.0	2.89	102.65
1.15	0.030	1.170	0.0940	76.0	15.0	15.0	3.18	101.43
1.14	0.030	1.180	0.0942	78.0	17.0	16.0	3.19	101.50
1.13	0.030	1.180	0.0942	78.0	18.0	15.0	3.19	101.50
1.12	0.025	0.980	0.0869	79.0	19.0	16.0	2.92	102.35
1.11	0.025	0.980	0.0866	80.0	19.0	16.0	2.92	102.16
1.10	0.025	0.980	0.0863	80.0	20.0	16.0	2.92	101.65
1.09	0.025	0.980	0.0860	81.0	20.0	16.0	2.92	101.46
1.08	0.025	0.980	0.0866	81.0	20.0	17.0	2.92	101.95
1.07	0.020	0.770	0.0778	81.0	20.0	17.0	2.61	102.49
1.06	0.020	0.770	0.0767	81.0	20.0	17.0	2.61	101.00
1.05	0.020	0.770	0.0773	81.0	20.0	17.0	2.61	101.75
1.04	0.020	0.780	0.0775	80.0	21.0	17.0	2.61	101.80
1.03	0.020	0.780	0.0778	80.0	20.0	18.0	2.61	102.17
1.02	0.020	0.790	0.0784	78.0	21.0	18.0	2.60	102.45
1.01	0.015	0.580	0.0679	78.0	21.0	18.0	2.25	102.59
2.16	0.020	0.780	0.0778	79.0	20.0	18.0	2.61	101.99
2.15	0.025	0.980	0.0863	82.0	20.0	18.0	2.93	101.59
2.14	0.025	0.980	0.0863	82.0	21.0	18.0	2.93	101.42
2.13	0.030	1.190	0.0951	83.0	21.0	18.0	3.21	102.08
2.12	0.025	0.990	0.0863	83.0	22.0	19.0	2.93	101.21
2.11	0.020	0.780	0.0775	83.0	22.0	19.0	2.62	101.71
2.10	0.020	0.780	0.0787	83.0	22.0	19.0	2.62	103.19
2.09	0.020	0.780	0.0773	83.0	21.0	19.0	2.62	101.51
2.08	0.020	0.780	0.0778	83.0	21.0	19.0	2.62	102.25
2.07	0.020	0.780	0.0778	83.0	21.0	19.0	2.62	102.25
2.06	0.020	0.780	0.0775	82.0	21.0	19.0	2.62	101.74
2.05	0.015	0.580	0.0671	82.0	22.0	19.0	2.27	101.49
2.04	0.015	0.580	0.0679	81.0	21.0	19.0	2.26	102.81
2.03	0.015	0.580	0.0674	80.0	21.0	19.0	2.26	101.81
2.02	0.015	0.580	0.0668	79.0	21.0	19.0	2.26	100.81
2.01	0.010	0.380	0.0548	79.0	21.0	19.0	1.84	101.44
AVG.		0.842		80.4	20.1	17.6	2.69	101.88
TOTAL			2.5580					
MAX								103.19
MIN								100.81

Royal Oak Ltd.
Giant Mine, Yellowknife
Gold Roaster Stack

DATA FILE NUMBER 970621
TEST Three
October 2, 1997

GAS SPEED AND ISOKINETIC CALCULATIONS

POINT #	VELOCITY PRES. in.H2O	ORIFICE PRES. in.H2O	VOLUME m3	STACK TEMP. C	METER-TEMP IN C	OUT C	STACK VEL m/s	PERCENT ISOKIN.
1.16	0.030	1.040	0.0894	85.0	5.0	4.0	3.22	100.85
1.15	0.040	1.420	0.1030	85.0	7.0	5.0	3.72	100.00
1.14	0.035	1.230	0.0962	85.0	7.0	5.0	3.48	99.90
1.13	0.030	1.080	0.0900	81.0	9.0	6.0	3.20	99.86
1.12	0.030	1.080	0.0908	80.0	9.0	6.0	3.20	100.66
1.11	0.025	0.890	0.0832	79.0	9.0	6.0	2.91	100.90
1.10	0.025	0.900	0.0835	78.0	10.0	7.0	2.91	100.74
1.09	0.025	0.900	0.0835	78.0	10.0	7.0	2.91	100.74
1.08	0.025	0.890	0.0826	83.0	10.0	7.0	2.93	100.42
1.07	0.020	0.710	0.0741	83.0	11.0	8.0	2.62	100.43
1.06	0.020	0.710	0.0741	83.0	11.0	8.0	2.62	100.43
1.05	0.020	0.710	0.0741	83.0	11.0	8.0	2.62	100.43
1.04	0.020	0.710	0.0733	82.0	11.0	8.0	2.62	99.14
1.03	0.015	0.530	0.0654	82.0	12.0	9.0	2.27	101.79
1.02	0.015	0.530	0.0645	80.0	12.0	10.0	2.26	100.01
1.01	0.010	0.340	0.0535	79.0	11.0	9.0	1.84	101.74
2.16	0.035	1.300	0.0994	83.0	13.0	11.0	3.47	100.70
2.15	0.035	1.300	0.0993	84.0	14.0	11.0	3.47	100.63
2.14	0.035	1.310	0.0991	84.0	16.0	12.0	3.47	99.82
2.13	0.035	1.310	0.0988	83.0	15.0	11.0	3.47	99.74
2.12	0.035	1.310	0.0993	83.0	16.0	11.0	3.47	100.14
2.11	0.035	1.320	0.0999	83.0	17.0	12.0	3.47	100.36
2.10	0.035	1.330	0.1002	83.0	17.0	13.0	3.47	100.46
2.09	0.035	1.330	0.0999	83.0	17.0	13.0	3.47	100.18
2.08	0.030	1.130	0.0928	84.0	17.0	13.0	3.22	100.73
2.07	0.030	1.110	0.0920	82.0	14.0	11.0	3.21	100.41
2.06	0.030	1.130	0.0928	83.0	16.0	13.0	3.21	100.77
2.05	0.030	1.130	0.0917	83.0	16.0	14.0	3.21	99.37
2.04	0.025	0.930	0.0843	83.0	16.0	13.0	2.93	100.34
2.03	0.025	0.930	0.0841	82.0	16.0	13.0	2.93	99.86
2.02	0.020	0.730	0.0756	82.0	14.0	12.0	2.62	100.95
2.01	0.015	0.540	0.0663	80.0	14.0	12.0	2.26	102.01
AVG.		0.994		82.2	12.6	9.6	3.02	100.45
TOTAL			2.7567					
MAX								102.01
MIN								99.14