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SOURCE EMISSION TESTING  
ON  
GOLD ROASTER STACK

SEPTEMBER 12-13, 1995

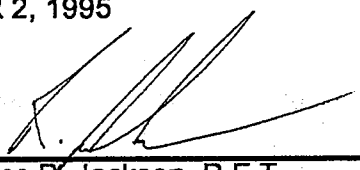
Prepared for:

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

ATTN: PHIL McINTYRE

DATE: OCTOBER 2, 1995  
FILE: 7640/9501

Prepared by:

  
\_\_\_\_\_  
Ross P. Jackson, R.E.T.  
Director of Operations



October 2, 1995

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

ATTENTION: Phil McIntyre

Re: Source Emission Survey - Gold Roaster Stack  
Entech File Number 7640/9501

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The attached report presents the results of the source emission survey conducted by Entech Environmental Services Ltd., on September 12-13, 1995.

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 :

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	Average	Maximum	Minimum
Arsenic			
- mg/m3 dry at Ref.	3.15	4.07	1.46
- kg/h	0.134	0.179	0.058
Sulphur Dioxide			
- g/m3 dry at Ref.	30.81	33.55	29.31
- kg/h	1287.5	1390.7	1181.1

  
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\* 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

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## 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 September 12-13, 1995. 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-AP-74-1
- flue gas composition and molecular weight.....EPS 1-AP-74-1
- velocity profiles, temperature and static.....EPS 1-AP-74-1
- 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**  
**September 12-13, 1995**

		Test One	Test Two	Test Three	Averages
Test Date		95/09/12	95/09/13	95/09/13	
Start Time		12:33	09:21	12:55	
End Time		15:26	12:11	15:49	
Average Gas Temperature	- DegC	77.7	78.9	76.9	77.8
Average Gas Velocity	- m/s	2.48	2.68	2.53	2.56
Total Effluent Flow Rate	- Rm3/s	12.01	13.13	12.43	12.52
Dry Effluent Flow Rate	- Rm3/s	11.10	12.24	11.51	11.62
Water Concentration	mole - %	7.6	6.8	7.3	7.3
<b>Arsenic</b>					
Concentration - dry basis	- mg/Rm3	1.46	4.07	3.94	3.15
Emission Rate	- kg/h	0.058	0.179	0.163	0.134
<b>Sulphur Dioxide</b>					
Concentration - dry basis	- g/Rm3	29.57	29.31	33.55	30.81
Emission Rate	- kg/h	1181.1	1290.8	1390.7	1287.5
<b>Isokinetics</b>					
	- %	102.9	102.3	102.8	

Reference Conditions of 25 degC and 760 mm Hg.

Entech Environmental Services Ltd., Calgary, Alberta

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951616

TEST One  
Gold Roaster Stack  
September 12, 1995

PAGE GEN01

LOCATION OF SAMPLING POINT	45.7 metre level
STACK DIAMETER OR TRAVERSE LENGTH	2.743 metres
RECTANGULAR DUCT WIDTH	0.000 metres
BAROMETRIC PRESSURE	732.8 mm Hg.
AMBIENT TEMPERATURE	10.0 C

AVERAGE COMPOSITION OF FLUE GAS

	DRY BASIS PERCENT	WET BASIS PERCENT
O2	19.009	17.557
CO2	1.000	0.924
N2 by Difference	79.991	73.881
H2O		7.638
CO	0.0000	0.000

SPECIFIC GRAVITY OF FLUE GAS (AIR = 1.0)	0.969
MOLECULAR WEIGHT OF FLUE GAS	28.086 g/g-mole
MOLECULAR WEIGHT OF FLUE GAS (DRY BASIS)	28.920 g/g-mole

STACK GAS FLOW RATE DATA AND CALCULATIONS

PITOT CALIBRATION FACTOR	0.819
STATIC PRESSURE	-0.411 mm Hg.
AVERAGE SQUARE ROOT VELOCITY HEAD	0.132
AVERAGE STACK GAS TEMPERATURE	77.7 C
AVERAGE STACK GAS VELOCITY	2.482 m/s
EFFLUENT FLOW RATE - WET (INCLUDING WATER)	12.014 m3/s ** 1768.545 kg-mole/h
EFFLUENT FLOW RATE - DRY (EXCLUDING WATER)	11.096 m3/s ** 1633.459 kg-mole/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951616

TEST One  
Gold Roaster Stack  
September 12, 1995

PAGE ISO01  
TEST START 12:33  
TEST END 15:26

# POLLUTANT DATA AND CALCULATIONS - ISOKINETIC SAMPLING TRAIN

VOLUME OF FLUE GAS METERED	2.3909 m3
AVERAGE ORIFICE PRESSURE	1.7357 mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	14.8 C
VACUUM AT LAST IMPINGER	1.8 mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	10.3460 mm Hg.
VOLUME OF WATER CONDENSED	119.0 mL

VOLUME OF FLUE GAS METERED AT REF.	2.3923 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			3.4880 mg
CONCENTRATION	NA			NA ppmv wet
	NA	NA	NA	NA ppmv dry
	NA			0.0013 g/m3**wet
	NA	NA	NA	0.0015 g/m3**dry
MASS FLOW				0.0582 kg/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951616

TEST One  
Gold Roaster Stack  
September 12, 1995

PAGE ABS01  
TEST START 13:00  
TEST END 14:00

POLLUTANT DATA AND CALCULATIONS - PROPORTIONAL SAMPLING TRAINS

	ABS #1	ABS #2	
VOLUME OF FLUE GAS METERED	0.4791	0.0000	m3
AVERAGE ORIFICE PRESSURE	0.0000	NA	mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	18	NA	C
VACUUM AT LAST IMPINGER	41.7	NA	mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	6.543	NA	mm Hg.
VOLUME OF WATER CONDENSED	8.0	NA	
VOLUME OF FLUE GAS METERED AT REF.	0.4730	NA	m3 **
<b>Sulphur Dioxide</b>			
50%EA NA NA ACTUAL			
%EA = NA			13987.0000 mg
CONCENTRATION NA			10422.8514 ppmv wet
NA NA	NA	NA	11284.8183 ppmv dry
NA			27.3094 g/m3**wet
NA NA	NA	NA	29.5679 g/m3**dry
MASS FLOW			1181.1257 kg/h
<b>not applicable</b>			
50%EA NA NA ACTUAL			
%EA = NA			NA mg
CONCENTRATION NA			NA ppmv wet
NA NA	NA	NA	NA ppmv dry
NA			NA g/m3**wet
NA NA	NA	NA	NA g/m3**dry
MASS FLOW			NA kg/h
<b>not applicable</b>			
50%EA NA NA ACTUAL			
%EA = NA			NA mg
CONCENTRATION NA			NA ppmv wet
NA NA	NA	NA	NA ppmv dry
NA			NA g/m3**wet
NA NA	NA	NA	NA g/m3**dry
MASS FLOW			NA kg/h
<b>not applicable</b>			
50%EA NA NA ACTUAL			
%EA = NA			NA mg
CONCENTRATION NA			NA ppmv wet
NA NA	NA	NA	NA ppmv dry
NA			NA g/m3**wet
NA NA	NA	NA	NA g/m3**dry
MASS FLOW			NA kg/h

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



Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951617

TEST Two  
Gold Roaster Stack  
September 13, 1995

PAGE GEN01

LOCATION OF SAMPLING POINT	45.7 metre level
STACK DIAMETER OR TRAVERSE LENGTH	2.743 metres
RECTANGULAR DUCT WIDTH	0.000 metres
BAROMETRIC PRESSURE	743.2 mm Hg.
AMBIENT TEMPERATURE	6.0 C

AVERAGE COMPOSITION OF FLUE GAS

	DRY BASIS PERCENT	WET BASIS PERCENT
O <sub>2</sub>	19.283	17.966
CO <sub>2</sub>	1.000	0.932
N <sub>2</sub> by Difference	79.717	74.272
H <sub>2</sub> O		6.830
CO	0.0000	0.000

SPECIFIC GRAVITY OF FLUE GAS (AIR = 1.0)	0.973
MOLECULAR WEIGHT OF FLUE GAS	28.185 g/g-mole
MOLECULAR WEIGHT OF FLUE GAS (DRY BASIS)	28.931 g/g-mole

STACK GAS FLOW RATE DATA AND CALCULATIONS

PITOT CALIBRATION FACTOR	0.819
STATIC PRESSURE	-0.448 mm Hg.
AVERAGE SQUARE ROOT VELOCITY HEAD	0.144
AVERAGE STACK GAS TEMPERATURE	78.9 C
AVERAGE STACK GAS VELOCITY	2.684 m/s
EFFLUENT FLOW RATE - WET (INCLUDING WATER)	13.132 m <sup>3</sup> /s ** 1933.155 kg-mole/h
EFFLUENT FLOW RATE - DRY (EXCLUDING WATER)	12.235 m <sup>3</sup> /s ** 1801.117 kg-mole/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951617

TEST Two  
Gold Roaster Stack  
September 13, 1995

TEST START  
TEST END

PAGE ISO01  
09:21  
12:11

POLLUTANT DATA AND CALCULATIONS - ISOKINETIC SAMPLING TRAIN

VOLUME OF FLUE GAS METERED	2.5332 m3
AVERAGE ORIFICE PRESSURE	1.8933 mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	13.2 C
VACUUM AT LAST IMPINGER	1.3 mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	6.5844 mm Hg.
VOLUME OF WATER CONDENSED	122.0 mL

VOLUME OF FLUE GAS METERED AT REF.	2.5858 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			10.5240 mg
CONCENTRATION	NA			NA ppmv wet
	NA	NA	NA	NA ppmv dry
	NA			0.0038 g/m3**wet
	NA	NA	NA	0.0041 g/m3**dry
MASS FLOW				0.1793 kg/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951617

TEST Two  
Gold Roaster Stack  
September 13, 1995

TEST START  
TEST END

PAGE ABS01  
09:30  
10:30

POLLUTANT DATA AND CALCULATIONS - PROPORTIONAL SAMPLING TRAINS

		ABS #1	ABS #2	
VOLUME OF FLUE GAS METERED		0.4464	0.0000	m3
AVERAGE ORIFICE PRESSURE		0.0000	NA	mm Hg.
AVERAGE DRY GAS METER TEMPERATURE		14.86	NA	C
VACUUM AT LAST IMPINGER		74.7	NA	mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER		6.543	NA	mm Hg.
VOLUME OF WATER CONDENSED		12.0	NA	
VOLUME OF FLUE GAS METERED AT REF.		0.4519	NA	m3 **
<b>Sulphur Dioxide</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	13242.0000 mg
		NA	NA	10420.7022 ppmv wet
		NA	NA	11184.6311 ppmv dry
				27.3038 g/m3**wet
				29.3054 g/m3**dry
MASS FLOW				1290.7943 kg/h
<b>not applicable</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	NA mg
		NA	NA	NA ppmv wet
		NA	NA	NA ppmv dry
				NA g/m3**wet
				NA g/m3**dry
MASS FLOW				NA kg/h
<b>not applicable</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	NA mg
		NA	NA	NA ppmv wet
		NA	NA	NA ppmv dry
				NA g/m3**wet
				NA g/m3**dry
MASS FLOW				NA kg/h
<b>not applicable</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	NA mg
		NA	NA	NA ppmv wet
		NA	NA	NA ppmv dry
				NA g/m3**wet
				NA g/m3**dry
MASS FLOW				NA kg/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951618

TEST Three  
Gold Roaster Stack  
September 13, 1995

PAGE GEN01

LOCATION OF SAMPLING POINT	45.7 metre level
STACK DIAMETER OR TRAVERSE LENGTH	2.743 metres
RECTANGULAR DUCT WIDTH	0.000 metres
BAROMETRIC PRESSURE	743.2 mm Hg.
AMBIENT TEMPERATURE	6.0 C

AVERAGE COMPOSITION OF FLUE GAS

	DRY BASIS PERCENT	WET BASIS PERCENT
O2	19.227	17.818
CO2	1.000	0.927
N2 by Difference	79.773	73.927
H2O		7.329
CO	0.0000	0.000

SPECIFIC GRAVITY OF FLUE GAS (AIR = 1.0)	0.971
MOLECULAR WEIGHT OF FLUE GAS	28.128 g/g-mole
MOLECULAR WEIGHT OF FLUE GAS (DRY BASIS)	28.929 g/g-mole

STACK GAS FLOW RATE DATA AND CALCULATIONS

PITOT CALIBRATION FACTOR	0.819
STATIC PRESSURE	-0.448 mm Hg.
AVERAGE SQUARE ROOT VELOCITY HEAD	0.135
AVERAGE STACK GAS TEMPERATURE	76.9 C
AVERAGE STACK GAS VELOCITY	2.525 m/s
EFFLUENT FLOW RATE - WET (INCLUDING WATER)	12.425 m3/s ** 1829.018 kg-mole/h
EFFLUENT FLOW RATE - DRY (EXCLUDING WATER)	11.514 m3/s ** 1694.977 kg-mole/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951618

TEST Three  
Gold Roaster Stack  
September 13, 1995

PAGE ISO01  
TEST START 12:55  
TEST END 15:49

POLLUTANT DATA AND CALCULATIONS - ISOKINETIC SAMPLING TRAIN

VOLUME OF FLUE GAS METERED	2.4121 m3
AVERAGE ORIFICE PRESSURE	1.6547 mm Hg.
AVERAGE DRY GAS METER TEMPERATURE	14.7 C
VACUUM AT LAST IMPINGER	1.3 mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER	6.5707 mm Hg.
VOLUME OF WATER CONDENSED	126.0 mL

VOLUME OF FLUE GAS METERED AT REF. 2.4483 m3 \*\*

	%EA =	50%EA	NA	NA	ACTUAL
Particulates - Front Half CONCENTRATION		NA			0.0000 mg
		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

	%EA =	50%EA	NA	NA	ACTUAL
Particulates - Back Half CONCENTRATION		NA			0.0000 mg
		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

	%EA =	50%EA	NA	NA	ACTUAL
Particulates - Total Train CONCENTRATION		NA			0.0000 mg
		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

	%EA =	50%EA	NA	NA	ACTUAL
Arsenic CONCENTRATION		NA			9.6370 mg
		NA			NA ppmv wet
		NA	NA	NA	NA ppmv dry
		NA			0.0036 g/m3**wet
		NA	NA	NA	0.0039 g/m3**dry
MASS FLOW					0.1632 kg/h

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

Royal Oak Mines  
Yellowknife, N.W.T.  
DATA FILE NUMBER 951618

TEST Three  
Gold Roaster Stack  
September 13, 1995

PAGE ABS01  
TEST START 13:00  
TEST END 14:00

POLLUTANT DATA AND CALCULATIONS - PROPORTIONAL SAMPLING TRAINS

		ABS #1	ABS #2	
VOLUME OF FLUE GAS METERED		0.4050	0.0000	m3
AVERAGE ORIFICE PRESSURE		0.0000	NA	mm Hg.
AVERAGE DRY GAS METER TEMPERATURE		18.29	NA	C
VACUUM AT LAST IMPINGER		76.2	NA	mm Hg.
WATER VAPOUR PRESSURE AT LAST IMPINGER		6.543	NA	mm Hg.
VOLUME OF WATER CONDENSED		11.0	NA	
VOLUME OF FLUE GAS METERED AT REF.		0.4051	NA	m3 **
<b>Sulphur Dioxide</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	13592.0000 mg
		NA	NA	11866.1906 ppmv wet
		NA	NA	12804.5849 ppmv dry
		NA	NA	31.0912 g/m3**wet
		NA	NA	33.5499 g/m3**dry
MASS FLOW				1390.6657 kg/h
<b>not applicable</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	NA mg
		NA	NA	NA ppmv wet
		NA	NA	NA ppmv dry
		NA	NA	NA g/m3**wet
		NA	NA	NA g/m3**dry
MASS FLOW				NA kg/h
<b>not applicable</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	NA mg
		NA	NA	NA ppmv wet
		NA	NA	NA ppmv dry
		NA	NA	NA g/m3**wet
		NA	NA	NA g/m3**dry
MASS FLOW				NA kg/h
<b>not applicable</b>				
CONCENTRATION	%EA =	50%EA	NA	NA
		NA	NA	ACTUAL
		NA	NA	NA mg
		NA	NA	NA ppmv wet
		NA	NA	NA ppmv dry
		NA	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

0.173	0.071	0.141	0.000
0.200	0.071	0.100	0.000
0.200	0.071	0.100	0.000
0.173	0.071	0.100	0.000
0.173	0.141	0.071	0.000
0.173	0.141	0.071	0.000
0.173	0.173	0.071	0.000
0.173	0.173	0.071	0.000
0.141	0.173	0.000	0.000
0.141	0.173	0.000	0.000
0.100	0.173	0.000	0.000
0.100	0.141	0.000	0.000

dP = 0.132 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 =	2.3909	0.4791	0.0000	m3 actual
Tm =	287.99	291.15	NA	degrees K
Pb =	732.8	732.8	732.8	mm Hg.
dH =	23.6	0.0	NA	mm H2O
Vm(std) =	2.3923	0.4730	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 =	119.0	8.0	NA	mL
Vwc(std) =	0.1613	0.0108	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 =	10.346	6.543	NA	
Vac =	45.7	41.7	NA	
F =	0.0151	0.0095	NA	
Vvw(std) =	0.0366	0.0045	NA	m3 @ ref

Total Volume Sampled at Reference

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

	ISO	ABS #1	ABS #2	
Sv =	2.5901	0.4884	NA	m3 @ ref

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

	ISO	
Bwsc =	0.0764	volume fraction by condensation

Volume Fraction of Water in Total Sample Volume, Saturated StBwss = VPI/Ps

Ts =	77.71875	
VPIs =	323.575	
Ps =	732.4	
Bwss =	0.4418	volume fraction for saturated stack

Bws = 0.0764  
volume fraction

Dry Gas Molecular Weight

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

CO2 =	1	mole %
O2 =	19.009	mole %
N2 =	79.991	mole %
CO =	0.000	mole %
Msd =	28.92	kg/kg-mole

Wet Gas Molecular Weight

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

	ISO	
Msw =	28.09	kg/kg-mole

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

Absolute Stack Pressure		$P_s = P_b + P_g$	
$P_g =$	-0.4		mm Hg.
$P_s =$	732.4		mm Hg.

Average Stack Gas Velocity		$V_s = K_p \cdot C_p \cdot (((dP \cdot T_s) / (P_s \cdot M_{sw}))^{0.5})$	
	ISO		
$K_p =$	34.9219		
$C_p =$	0.819		
$T_s =$	350.86875		K
$V_s =$	2.482		m/s

Average Stack Gas Wet Volumetric Flow Rate		$Q_{sw} = 3600 \cdot V_s \cdot A \cdot T_{std} / P_{std} \cdot P_s / T_s$	
	ISO		
$A =$	5.9102		m <sup>2</sup>
$T_{std} =$	298.15		K
$P_{std} =$	760		mm Hg.
$Q_{sw} =$	43250		scm/h
$Q_{sw} =$	12.0		scm/s

Average Stack Gas Dry Volumetric Flow Rate		$Q_{sd} = (1 - B_{ws}) \cdot Q_{sw}$	
	ISO		
$Q_{sd} =$	39946		dscm/h
$Q_{sd} =$	11.1		dscm/s

Concentration, Dry Basis		$C_{sd} = 0.001 \cdot m_n / V_m(std)$	
	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	0.0015		g/dscm
Sulphur Dioxide		29.5679	g/dscm
not applicable		NA	g/dscm
not applicable			NA g/dscm
not applicable			NA g/dscm

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

Concentration, Wet Basis		$C_{sw} = C_{sd} \cdot (1 - B_{ws})$	
	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	0.0013		g/scm
Sulphur Dioxide		27.3094	g/scm
not applicable		NA	g/scm
not applicable			NA g/scm
not applicable			NA g/scm

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

Emission Rate		$ER = C_{sd} \cdot Q_{sd} / 1000$	
Particulates - Front Half	0.00		kg/h
Particulates - Back Half	0.00		kg/h
Particulates - Total Train	0.00		kg/h
Arsenic	0.06		kg/h
Sulphur Dioxide		1181.13	kg/h
not applicable		NA	kg/h
not applicable			NA kg/h
not applicable			NA kg/h



45.7 / 2.7432 / 0.0

@ 25

## ISOKINETIC TEST DATA

1616

CLIENT NAME / PLANT LOCATION

ROYAL OAK MINES / YELLOWKNIFE, N.W.T.

JOB / FILE NUMBER

PAGE 1 OF 2

TEST CONDUCTED BY

D. BOURGIES / S. JACKSON

## CALCULATOR SET-UP

ORIFICE FACTOR

182.05

MINUTES PER POINT

5.0

BAROMETRIC PRESSURE

28.85

in. Hg.

STATIC PRESSURE

-0.22

in. H<sub>2</sub>O

SPECIFIC GRAVITY

0.984

air = 1.0

WATER CONTENT

5.0

mole %

NOZZLE DIAMETER

0.504

in.

PITOT FACTOR

0.819

INITIAL METER READING

16.796

ft. ^3

## DRY GAS ANALYSIS

O<sub>2</sub>CO<sub>2</sub>Sample  
Bottle  
NumberInitial  
VolumeFinal  
VolumemLs  
Condensed

Imp. 1

DH<sub>2</sub>O

100.0

Imp. 2

DH<sub>2</sub>O

100.0

111.0

Imp. 3

DH<sub>2</sub>O

100.0

## AVERAGES

Imp. 4

BLANK

N/A

N/A

N/A

Imp. 5

SILICAGE

N/A

N/A

N/A

CO readings if taken

19.009

0

0

## Particulate Analytical

EPA

Filter

N/A

P.W.

Acet.

P.W.

Water

Imp.

3.485

Imp.

3.515

## SOURCE INFORMATION

SOURCE NAME:

GOD FASTER STACK

G.C. Sample Number

TEST DATE

SEPT 12 / 1995

TEST NUMBER

ONE

Notes:

P.C. 0.009463/min @ 15" H<sub>2</sub>OVOLUME DOWN = 84.25 ft<sup>3</sup>

TAP

See Over For Additional Notes.

STACK I.D. - meters

108.0"

or traverse length

STACK WIDTH - meters

N/A

If rectangular

Kit Used:

ISO. 005

Pitobe Used:

B-102

TRAV. POINT	START TIME	METER TEMP. C IN	METER TEMP. C OUT	STACK TEMP C	PITOT READING in. H <sub>2</sub> O	ORIFICE SETTING in. H <sub>2</sub> O	METER READING ft. ^3	IMP TEMP C	IMP VAC. in. Hg.	OVEM TEMP. C	CALCULATED METER READING
1.16	12:33	11	10	73	0.03	1.44	20.21	5	2.0	121	20.235
1.15	12:38	13	11	82	0.04	1.90	24.15	12	3.5	117	24.176
1.14	12:43	16	12	75	0.04	1.99	28.17	14	3.5	117	28.184
1.13	12:48	17	12	82	0.03	1.45	31.63	15	4.0	121	31.627
1.12	12:53	16	13	82	0.03	1.45	35.05	15	3.5	117	35.070
1.11	12:58	16	13	82	0.03	1.45	38.50	15	3.5	117	38.513
1.10	13:03	17	13	82	0.03	1.45	41.97	15	3.0	121	41.962
1.09	13:08	17	13	82	0.03	1.45	45.43	15	3.0	117	45.411
1.08	13:13	17	13	82	0.02	0.95	48.23	16	1.5	118	48.227
1.07	13:18	17	14	82	0.02	0.95	51.02	16	1.5	120	51.045
1.06	13:23	17	14	82	0.01	0.46	53.56	14	0.5	117	53.643
1.05	13:28	17	14	82	0.01	0.46	55.03	13	0.5	120	55.037
1.04	13:33	17	14	81	0.005	0.22	56.46	13	0.5	117	56.450
1.03	13:38	16	14	75	0.005	0.22	57.86	12	0.5	120	57.872
1.02	13:43	17	15	77	0.005	0.22	59.29	12	0.5	117	59.215
1.01	13:48	16	15	75	0.005	0.22	60.	11	0.5	117	60.719

Averages

11.75 1.80

43 923 ft<sup>3</sup>

# ISOKINETIC TEST DATA

CLIENT NAME / PLANT LOCATION

ROYAL DAK MINE / YELLOWKNIFE, N.W.T.

JOB / FILE NUMBER

PAGE 2 OF 2

TEST CONDUCTED BY

D. BARKER / J. JACKSON

CALCULATOR SET-UP

ORIFICE FACTOR

180.05

MINUTES PER POINT

5.0

BAROMETRIC PRESSURE

28.85

in. Hg.

STATIC PRESSURE

-0.22

in. H<sub>2</sub>O

SPECIFIC GRAVITY

0.984

air = 1.0

WATER CONTENT

5.0

mole %

NOZZLE DIAMETER

0.504

in.

PITOT FACTOR

0.89

INITIAL METER READING

60.843

ft. ^3

DRY GAS ANALYSIS

O<sub>2</sub>

CO<sub>2</sub>

Sample  
Bottle  
Number

Initial  
Volume

Final  
Volume

mLs  
Condensed

Imp. 1

H<sub>2</sub>O

100.0

Imp. 2

H<sub>2</sub>O

100.0

Imp. 3

H<sub>2</sub>O

100.0

AVERAGES

Imp. 4

BLANK

N/A

N/A

N/A

Imp. 5

SILICA GEL

N/A

N/A

N/A

CO readings if taken

Particulate Analytical

EPA

Filter

N/A

P.W.

Acet.

P.W.

Water

Imp.

Imp.

SOURCE INFORMATION

SOURCE NAME:

GOLD ROSE STAK

G.C. Sample Number

TEST DATE

SEPT 12 / 1995

TEST NUMBER

ONE

Notes:

STACK I.D. - meters  
or traverse length

108.0"

☐ See Over For Additional Notes.

STACK WIDTH - meters  
if rectangular

N/A

Kit Used:

Pitobe Used:

TRAV. POINT	START TIME	METER TEMP. C IN	METER TEMP. C OUT	STACK TEMP C	PITOT READING in. H <sub>2</sub> O	ORIFICE SETTING in. H <sub>2</sub> O	METER READING ft. ^3	IMP TEMP C	IMP VAC. in. Hg.	OVEM TEMP. C	CALCULATED METER READING
2.16	14:03	14	14	81	0.02	0.95	63.69	8	1.5	118	63.673
15	14:11	15	14	82	0.02	0.95	66.46	7	1.5	118	66.484
14	14:16	16	14	81	0.03	1.46	69.95	7	3.0	119	69.938
13	14:21	17	14	81	0.03	1.46	73.37	10	3.0	122	73.398
12	14:26	17	14	82	0.03	1.46	76.82	10	3.0	119	76.853
11	14:31	17	14	79	0.03	1.47	80.34	11	3.0	120	80.303
10	14:36	18	14	82	0.03	1.46	83.80	12	3.0	118	83.784
09	14:41	18	14	82	0.02	0.96	86.60	12	2.0	100	86.609
08	14:46	18	14	83	0.02	0.96	89.43	13	2.0	102	89.431
07	14:51	17	14	83	0.01	0.47	91.42	13	0.5	121	91.403
06	14:56	17	14	82	0.01	0.46	93.42	13	0.5	120	93.418
05	15:01	16	14	79	0.01	0.46	95.43	10	0.5	119	95.418
04	15:06	16	14	75	0.005	0.22	96.81	10	0.5	120	96.840
03	15:11	16	14	60	0.005	0.23	98.30	9	0.5	118	98.293
02	15:16	14	13	55	0.005	0.23	99.78	8	0.5	120	99.751
01	15:21	15	13	44	0.005	0.24	101.23	8	0.5	115	101.235

Averages

40.572



# EMISSION TEST DATA

13.987

Job Number		Test Number	05	Pitot #	N/A	Factor	N/A
Company Name	ROYAL OAK MINES	Barometric Pressure	28.25 in.Hg	NOVA	[ ]	GC	[ ]
Plant Location	YELLOWKNIFE, NWT	Ambient Temperature	10.02	O2	19.5	19.0	19.0 mole %
Source Name	GOLD ROSSER STACK	Train Operators	D.B./J.J.	CO2	1.0	1.0	1.0 mole %
Test Date	SEPT 12 / 1995	Train Used	ARSON 5	CO	N/A	N/A	N/A ppmv

Solution Used	Imp. 1 6% H2O2	Imp. 2 6% H2O2	Cyclonic Flow	Yes [ ]	No [ ]	Angle	N/A
Initial mLs.	200.0	200.0	Static Pressure	+	- [ ]	0.22	in. H2O
Final mLs.		408.0	Leak Checks	✓	Before	✓	After
mLs. Condensed	(100 WASH)	80		0.00 cfm @ 22.0 in.Hg	0.00 cfm @ 22.0 in.Hg		

Sample Time	Clock Time	Meter Volume Units [9.3]	Stack dP in. H2O	Imp. Vacuum in. Hg.	TEMPERATURES C		
					meter	condenser	stack
0	13:00	13.460	↑	2.0	12.0	5.0	↑
10	10	18.027	↑	2.0	14.0	5.0	↑
20	20	21.115	N/A	1.5	16.0	5.0	N/A
30	30	23.30	↓	1.5	18.0	5.0	↓
40	40	25.080	↓	1.5	20.0	5.0	↓
50	50	27.805	↓	1.5	22.0	5.0	↓
60	14:00	30.379	↓	1.5	24.0	5.0	↓
		16.919		1.64	18.0	5.0	

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.							

# ISOKINETIC TEST DATA

1617

CLIENT NAME / PLANT LOCATION

ROYAL OAK MINES / YELLOWKNIFE, N.W.T.

JOB / FILE NUMBER

PAGE 1 OF 2

TEST CONDUCTED BY

D. BURGER / S. JACKSON

CALCULATOR SET-UP

ORIFICE FACTOR

182.05

MINUTES PER POINT

5.0

BAROMETRIC PRESSURE

29.26

in. Hg.

STATIC PRESSURE

-0.24

in. H<sub>2</sub>O

SPECIFIC GRAVITY

0.984

air = 1.0

WATER CONTENT

5.0

mole %

NOZZLE DIAMETER

0.50

in.

PITOT FACTOR

0.819

INITIAL METER READING

1.816

ft. ^3

DRY GAS ANALYSIS

O<sub>2</sub>

CO<sub>2</sub>

19.5

1.0

19.5

1.0

AVERAGES

19.5

1.0

CO readings if taken

19.283

0

0

Sample Bottle Number

Initial Volume

Final Volume

mLs Condensed

Imp. 1

D120

100.0

Imp. 2

D120

100.0

Imp. 3

D120

100.0

Imp. 4

BLANK

—

Imp. 5

BLANK

—

Particulate Analytical

EPA

Filter

P.W.

Acet.

P.W.

Water

Imp.

10.524

SOURCE INFORMATION

SOURCE NAME:

AND RASTER STICK

G.C. Sample Number

TEST DATE

SEPT 13, 1995

TEST NUMBER

Two

Notes:

PC 0.01 H<sub>2</sub>/min @ 15" Hg

VOLUME DRAWN - 89.22

Time 162.7 510.050

See Over For Additional Notes.

STACK I.D. - meters or traverse length

108.0"

STACK WIDTH - meters if rectangular

—

Kit Used:

ISD-006

Pitot Used:

B-102

TRAV. POINT

START TIME

METER TEMP. C IN OUT

STACK TEMP C

PITOT READING in. H<sub>2</sub>O

ORIFICE SETTING in. H<sub>2</sub>O

METER READING ft. ^3

IMP TEMP C

IMP VAC. in. Hg.

OVEM. TEMP. C

CALCULATED METER READING

1.16

09:21

6

6

82

0.03

1.31

5.05

5

2.0

117

5.094

.15

09:26

8

6

83

0.03

1.31

8.35

5

2.0

117

8.380

.14

09:31

10

7

84

0.04

1.79

12.16

7

2.5

121

12.158

.13

09:36

12

8

84

0.04

1.81

16.01

7

2.5

118

16.017

.12

09:41

14

9

84

0.04

1.83

19.86

9

2.5

121

19.866

.11

09:46

15

9

84

0.04

1.83

23.69

10

2.5

122

23.720

.10

09:51

16

10

85

0.03

1.36

27.06

10

2.0

120

27.058

.09

09:56

15

10

85

0.03

1.36

30.43

10

2.0

121

30.409

.08

10:01

15

10

84

0.03

1.36

33.71

9

2.0

119

33.754

.07

10:06

16

12

85

0.02

0.96

36.52

9

1.0

121

36.496

.06

10:11

16

12

84

0.02

0.90

39.20

9

1.0

121

39.240

.05

10:16

16

12

85

0.01

0.43

41.18

9

1.0

121

41.186

.04

10:21

16

13

83

0.01

0.43

43.13

9

1.0

120

43.134

.03

10:26

16

13

77

0.005

0.31

44.50

7

1.0

118

44.507

.02

10:31

16

13

59

0.005

0.22

45.45

6

1.0

120

45.944

.01

10:36

16

13

51

0.005

0.23

47.40

6

1.0

118

47.396

Averages

5.09 1.34

45.576

# ISOKINETIC TEST DATA

CLIENT NAME / PLANT LOCATION

ROYAL OAK MINES / YELLOW KNIFE, N.W.T.

JOB / FILE NUMBER

PAGE 2 OF 2

TEST CONDUCTED BY

D. BURGET / J. JACKSON

CALCULATOR SET-UP

ORIFICE FACTOR

182.05

MINUTES PER POINT

5.0

BAROMETRIC PRESSURE

27.26

in. Hg.

STATIC PRESSURE

-0.24

in. H<sub>2</sub>O

SPECIFIC GRAVITY

0.984

air = 1.0

WATER CONTENT

5.0

mole %

NOZZLE DIAMETER

0.509

in.

PITOT FACTOR

0.89

INITIAL METER READING

47.546

ft. <sup>3</sup>

DRY GAS ANALYSIS

O<sub>2</sub>

CO<sub>2</sub>

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.

Imp.

SOURCE INFORMATION

SOURCE NAME:

GOLD READER STACK

G.C. Sample Number

TEST DATE

Sept 13, 1995

TEST NUMBER

Two

Notes:

STACK I.D. - meters or traverse length

108.0"

☐ See Over For Additional Notes.

STACK WIDTH - meters if rectangular

N/A

Kit Used:

TSO-006

Pitobe Used:

B-100

TRAV. POINT	START TIME	METER TEMP. C IN	METER TEMP. C OUT	STACK TEMP C	PITOT READING in. H <sub>2</sub> O	ORIFICE SETTING in. H <sub>2</sub> O	METER READING ft. <sup>3</sup>	IMP TEMP. C	IMP VAC. in. Hg.	OVEM TEMP. C	CALCULATED METER READING
2.16	10:51	13	12	79	0.08	1.38	50.85	3	1.0	97	50.915
.15	10:56	14	12	84	0.03	1.37	54.27	3	1.0	101	54.266
.14	11:01	15	12	84	0.03	1.37	57.66	2	1.0	106	57.623
.13	11:06	16	13	84	0.03	1.38	60.04	3	1.0	106	60.992
.12	11:11	15	12	84	0.03	1.37	64.34	3	1.0	106	64.345
.11	11:16	16	13	84	0.03	1.38	67.70	2	1.0	108	67.717
.10	11:21	16	13	85	0.03	1.38	71.10	2	1.0	109	71.081
.09	11:26	16	13	84	0.025	1.14	74.16	2	1.0	113	74.150
.08	11:31	17	13	85	0.02	0.91	76.91	2	1.0	112	76.907
.07	11:36	17	13	84	0.015	0.67	79.27	2	1.0	110	79.294
.06	11:41	17	14	84	0.01	0.44	81.29	2	1.0	117	81.245
.05	11:46	16	13	84	0.01	.43	83.170	2	1.0	118	83.190
.04	11:51	16	14	83	.01	.44	85.21	2	1	119	85.141
.03	11:56	16	13	60	.01	.47	87.17	2	1	119	87.155
.02	12:01	16	13	57	.01	.47	89.12	2	1	115	89.175
.01	12:06	16	14	42	.01	.50	91.275	2	1	115	91.252

Averages

43.706



## EMISSION TEST DATA

13242

Job Number		Test Number	TWO	Pitot #	N/A	Factor	N/A		
Company Name	ROYAL OAK MINES	Barometric Pressure	29.26	NOVA	<input type="checkbox"/>	GC	<input type="checkbox"/>	Fvrites	<input type="checkbox"/>
Plant Location	YELLOW KNIFE NWT	Ambient Temperature	5°C	O2	SEE DUST DATA			mole %	
Source Name	GOAL ROASTER STACK	Train Operators	JS DB	CO2				mole %	
Test Date	SEPT 13 / 95	Train Used	SO2 KIT 5	CO				ppmv	

Solution Used	Imp. 1 62 H <sub>2</sub> O <sub>2</sub>	Imp. 2 62 H <sub>2</sub> O <sub>2</sub>	Cyclonic Flow	Yes [ ]	No [ ]	Angle
Initial mLs.	400		Static Pressure	+	[ ] - [ ]	in. H <sub>2</sub> O
Final mLs.	412		Leak Checks		Before	After
mLs. Condensed	12	+ 100 WASH		cfm@	in. Hg.	cfm@ in. Hg.

Sample Time	Clock Time	Meter Volume Units <input type="checkbox"/>	Stack dP in. H <sub>2</sub> O	Imp. Vacuum in. Hg.	TEMPERATURES C		
					meter	condenser	stack
0	9:30 AM	930.421	}	3.0	06	05	}
10	9:40	932.72		3.0	11	05	
20	9:50	935.05		3.0	13	05	
30	10:00	938.52		3.0	17	05	
40	10:10	940.15		3.0	15	05	
50	10:20	943.00		2.7	21	05	
60	10:30	946.184		2.9	21	05	
		15.763		2.94	14.86	5.0	

Ts C	dP in. H <sub>2</sub> O	Ts C	dP in. H <sub>2</sub> O	Ts C	dP in. H <sub>2</sub> O	Ts C	dP in. H <sub>2</sub> 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

CLIENT NAME / PLANT LOCATION

ROYAL OAK MINES / YELLOWKNIFE, N.W.T.

1618

JOB / FILE NUMBER

PAGE 1 OF 2

TEST CONDUCTED BY

D. BOURGET / J. JACKSON

CALCULATOR SET-UP

ORIFICE FACTOR 132.05  
MINUTES PER POINT 5.0  
BAROMETRIC PRESSURE 21.26 in. Hg.  
STATIC PRESSURE -0.24 in. H<sub>2</sub>O  
SPECIFIC GRAVITY 0.984 air = 1.0  
WATER CONTENT 5.0 mole %  
NOZZLE DIAMETER 0.501 in.  
PITOT FACTOR 0.819  
INITIAL METER READING 91.554 ft.<sup>3</sup>

DRY GAS ANALYSIS

O<sub>2</sub> CO<sub>2</sub>

18.0 1.0

18.0 1.0

— —

AVERAGES

CO readings if taken

19.227

0

0

Sample Bottle Number

Initial Volume

Final Volume

mLs Condensed

Imp. 1

Imp. 2

Imp. 3

Imp. 4

Imp. 5

Blank

Blank

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SOURCE INFORMATION

SOURCE NAME:

GOD FORTER STREET

G.C. Sample Number

TEST DATE

Sept 13, 1995

TEST NUMBER

THREE

Notes: P.C. 0.01 ft<sup>3</sup>/min @ 15" H<sub>2</sub>O  
VOLUME DRAWN -

STACK I.D. - meters or traverse length

108.0"

See Over For Additional Notes.

STACK WIDTH - meters if rectangular

N/A

Kit Used:

ISO 005

Pitobe Used:

B-102

TRAV. POINT	START TIME	METER TEMP. C IN	METER TEMP. C OUT	STACK TEMP C	PITOT READING in. H <sub>2</sub> O	ORIFICE SETTING in. H <sub>2</sub> O	METER READING ft. <sup>3</sup>	IMP TEMP C	IMP VAC. in. Hg.	OVEN TEMP. C	CALCULATED METER READING
1.16	12:55	12	12	80	0.03	1.33	94.83	4	1.5	85	94.852
15	13:00	12	12	82	0.03	1.37	98.23	3	1.5	93	98.211
14	13:05	13	12	83	0.03	1.37	101.57	5	2.0	108	101.561
13	13:10	15	12	83	0.03	1.38	104.89	6	2.0	118	104.923
12	13:15	16	13	83	0.03	1.39	108.33	6	2.0	120	108.216
11	13:20	17	13	82	0.03	1.40	111.71	5	2.0	122	111.630
10	13:25	16	13	83	0.02	0.91	114.42	4	1.0	121	114.434
09	13:30	17	13	83	0.02	0.91	117.18	4	1.0	118	117.193
08	13:35	17	13	83	0.02	0.91	119.93	4	1.0	119	119.953
07	13:40	17	14	83	0.02	0.91	122.69	4	1.0	122	122.717
06	13:45	16	14	82	0.01	0.44	124.66	4	1.0	120	124.670
05	13:50	16	14	82	0.01	0.44	126.62	4	1.0	121	126.624
04	13:55	15	14	80	0.01	0.44	128.56	4	1.0	122	128.58
03	14:00	15	14	74	0.01	0.45	130.56	2	1	122	130.553
02	14:05	15	14	59	0.01	0.47	132.55	4	1	121	132.569
01	14:10	15	14	51	0.01	0.48	134.625	4	1	118	134.611

Averages

5.06 1.30

43.107

# ISOKINETIC TEST DATA

CLIENT NAME / PLANT LOCATION

ROYAL DAK MINES / YELLOWKNIFE, N.W.T.

JOB / FILE NUMBER

PAGE 2 OF 2

TEST CONDUCTED BY

D. BOURGET / D. JACKSON

CALCULATOR SET-UP

ORIFICE FACTOR

132.05

MINUTES PER POINT

5.0

BAROMETRIC PRESSURE

21.26

in. Hg.

STATIC PRESSURE

-3.24

in. H<sub>2</sub>O

SPECIFIC GRAVITY

0.984

air = 1.0

WATER CONTENT

5.0

mole %

NOZZLE DIAMETER

0.501

in.

PITOT FACTOR

0.819

INITIAL METER READING

134.768

ft. ^3

DRY GAS ANALYSIS

O<sub>2</sub>

CO<sub>2</sub>

Sample  
Bottle  
Number

Initial  
Volume

Final  
Volume

mLs  
Condensed

Imp. 1

DH<sub>2</sub>O

150.0

Imp. 2

DH<sub>2</sub>O

150.0

7526.0

106.0

Imp. 3

DH<sub>2</sub>O

100.0

AVERAGES

Imp. 4

BLANK

Imp. 5

SILICA GEL

CO readings if taken

Particulate Analytical

EPA

Filter

P.W.

Acet.

P.W.

Water

Imp.

Imp.

SOURCE INFORMATION

SOURCE NAME:

GOOD ROASTER STACK

G.C. Sample Number

TEST DATE

SEPT 13, 1995

TEST NUMBER

THREE

Notes:

STACK I.D. - meters  
or traverse length

108.0"

[ ] See Over For Additional Notes.

STACK WIDTH - meters  
if rectangular

—

Kit Used:

ISO. 006

Pitobe Used:

B-102

TRAV. POINT	START TIME	METER TEMP. C IN	METER TEMP. C OUT	STACK TEMP C	PITOT READING in. H <sub>2</sub> O	ORIFICE SETTING in. H <sub>2</sub> O	METER READING ft. ^3	IMP TEMP C	IMP VAC. in. Hg.	OVEM TEMP. C	CALCULATED METER READING
2.16	14:29	13	13	96	0.03	1.40	138.12	5	1.5	72	138.157
.15	14:34	15	13	82	0.03	1.37	141.54	3	2.0	83	141.537
.14	14:39	16	14	82	0.03	1.46	144.90	3	2.0	86	144.913
.13	14:44	17	14	83	0.025	1.16	148.01	5	2.0	90	148.024
.12	14:49	17	14	82	0.02	0.92	152.75	5	1.5	90	150.771
.11	14:54	17	14	82	0.02	0.92	153.52	6	1.5	90	153.537
.10	14:59	17	14	81	0.02	0.92	156.30	6	1.0	90	156.311
.09	15:04	17	14	82	0.02	0.92	159.09	7	1.0	90	159.077
.08	15:09	17	14	82	0.02	0.92	161.82	6	1.0	90	161.847
.07	15:14	17	14	82	0.02	0.92	164.60	7	1.0	93	164.614
.06	15:19	17	14	81	0.01	0.44	166.56	7	1.0	98	166.574
.05	15:24	16	14	80	0.01	0.44	168.54	7	1.0	98	168.534
.04	15:29	16	15	80	0.01	0.44	170.82	7	1.0	99	170.496
.03	15:34	16	15	66	0.01	.461	172.47	7	1.0	99	172.499
.02	15:39	16	15	46	0.01	0.49	174.56	7	1.0	99	174.564
.01	15:44	16	17	40	0.01	0.50	176.685	7	1.0	97	176.66

15:49

Averages





## EMISSION TEST DATA

13592

Job Number		Test Number	THREE	Pitot #		Factor	
Company Name	ROYAL OAK MINES	Barometric Pressure	29.26	NOVA	<input type="checkbox"/>	GC	<input type="checkbox"/>
Plant Location	YELLOWKNIFE	Ambient Temperature	10	O2			mole %
Source Name	GOLD ROASTER	Train Operators	SS DB	CO2			mole %
Test Date	SEPT 13	Train Used	SO2 # 5	CO			ppmv

Solution Used	Imp. 1 H2O2	Imp. 2		Cyclonic Flow	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Angle	
Initial mLs.	400			Static Pressure	+	-		in. H2O
Final mLs.	411			Leak Checks		Before		After
mLs. Condensed	(100 WASH)					cfm@	in. Hg.	cfm@ in. Hg.

Sample Time	Clock Time	Meter Volume Units	Stack dP in. H2O	Imp. Vacuum in. Hg.	TEMPERATURES C		
					meter	condenser	stack
0	13:00	946.205	}	3.0	13	05	}
10	13:10	950.00		3.0	15	05	
20	13:20	951.56		3.0	17	05	
30	13:30	952.80		3.0	18	05	
40	13:40	955.80		3.0	20	05	
50	13:50	958.73		3.0	22	05	
60	14:00	960.506		3.0	23	05	
		14.301		3.0	18.29	5.0	

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.							



Royal Oak Mines  
Yellowknife, N.W.T.  
Gold Roaster Stack

DATA FILE NUMBER 951616

TEST One

September 12, 1995

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	1.440	0.0966	73.0	11.0	10.0	3.24	101.92
1.15	0.040	1.920	0.1115	82.0	13.0	11.0	3.79	102.51
1.14	0.040	1.990	0.1138	75.0	16.0	12.0	3.75	102.81
1.13	0.030	1.450	0.0979	82.0	17.0	12.0	3.28	103.17
1.12	0.030	1.450	0.0968	82.0	16.0	13.0	3.28	101.97
1.11	0.030	1.450	0.0976	82.0	16.0	13.0	3.28	102.87
1.10	0.030	1.450	0.0982	82.0	17.0	13.0	3.28	103.28
1.09	0.030	1.450	0.0979	82.0	17.0	13.0	3.28	102.99
1.08	0.020	0.950	0.0792	82.0	17.0	13.0	2.68	102.20
1.07	0.020	0.950	0.0790	82.0	17.0	14.0	2.68	101.66
1.06	0.010	0.460	0.0577	82.0	17.0	14.0	1.89	105.25
1.05	0.010	0.460	0.0558	82.0	17.0	14.0	1.89	101.64
1.04	0.005	0.220	0.0405	81.0	17.0	14.0	1.34	104.26
1.03	0.005	0.220	0.0396	75.0	16.0	14.0	1.33	101.38
1.02	0.005	0.220	0.0405	77.0	17.0	15.0	1.33	103.49
1.01	0.005	0.220	0.0404	75.0	16.0	15.0	1.33	103.30
2.16	0.020	0.950	0.0841	81.0	14.0	14.0	2.67	108.67
2.15	0.020	0.950	0.0784	82.0	15.0	14.0	2.68	101.28
2.14	0.030	1.460	0.0988	81.0	16.0	14.0	3.28	103.73
2.13	0.030	1.460	0.0968	81.0	17.0	14.0	3.28	101.47
2.12	0.030	1.460	0.0976	82.0	17.0	14.0	3.28	102.51
2.11	0.030	1.470	0.0996	79.0	17.0	14.0	3.27	104.14
2.10	0.030	1.460	0.0979	82.0	18.0	14.0	3.28	102.63
2.09	0.020	0.960	0.0798	82.0	18.0	14.0	2.68	102.57
2.08	0.020	0.960	0.0795	83.0	18.0	14.0	2.68	102.35
2.07	0.010	0.470	0.0563	83.0	17.0	14.0	1.90	102.82
2.06	0.010	0.460	0.0566	82.0	17.0	14.0	1.89	103.19
2.05	0.010	0.460	0.0569	79.0	16.0	14.0	1.89	103.45
2.04	0.005	0.220	0.0391	75.0	16.0	14.0	1.33	99.93
2.03	0.005	0.230	0.0422	60.0	16.0	14.0	1.30	105.54
2.02	0.005	0.230	0.0419	55.0	14.0	13.0	1.29	104.59
2.02	0.005	0.240	0.0410	44.0	15.0	13.0	1.27	100.56
AVG.		0.929		77.7	16.2	13.5	2.49	102.94
TOTAL			2.3895					
MAX								108.67
MIN								99.93