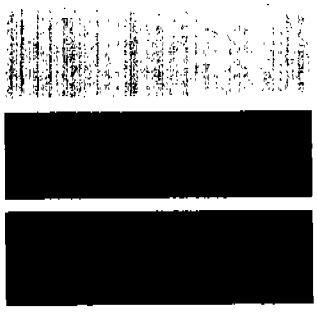
SOURCE EVALUATION RESULTS

PREPARED BY



Envisage Environmental Incorporated

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[redacted]

May 9, 1994

[redacted]

Mr.Phillip McGuiness
Metropolitan Ceramics Inc.
1201 Millerton Road
Canton, Ohio 44707

Dear Mr. McGuiness:

The following report is the result of the fluorides, sulphur dioxide, and particulate emission evaluation conducted March 30, and April 14, 1994 at the above facility. Three test runs each of the above was conducted at the TK1, TK2, and TK3 common exhaust for regulatory purposes.

The results are true and accurate to the degree specified in the pertinent sections of the Code of Federal Regulations, in force at the time of the tests.

I look forward to answering any questions you may have and assisting you in the future.

Respectfully submitted,

Robert C. Hovan
Air Quality Supervisor
ENVISAGE ENVIRONMENTAL INC.

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Envisage Environmental Incorporated
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INTRODUCTION

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INTRODUCTION

On March 30, 1994, Envisage Environmental Inc. conducted a particulate and fluoride emission evaluation and on April 14, 1994, continued the testing for sulfur dioxide emissions at the Metropolitan Ceramic Inc. facility, Canton, Ohio. Three (3) test runs for particulate, fluorides and sulfur dioxide emissions were performed at the common exhaust serving the TK1, TK2, and TK3. Test parameters were in accordance with USEPA Reference Methods 1 - 5, 6, and 13. The kiln operations were monitored by Metropolitan Ceramic Inc. personnel throughout the duration of the testing program(s).

The purpose of this evaluation was to determine the particulate, fluoride and sulfur dioxide emission rates from the above exhaust to determine compliance with OEPA regulations. The Envisage test teams consisted of Messrs. Greg Sinkovich, Terry Campbell, David Donelson and Jeff Belino on March 30, 1994 and Messrs. Robert Hovan, Terry Campbell, and Clint Holley on April 14, 1994. The Canton Department of Air Pollution Control was represented by Mr. Rick Miller on both dates. Mr. Phillip McGuiness, Metropolitan Ceramic Inc., coordinated the tests.

Results are presented in this report for particulate, fluorides and sulfur dioxide emissions as pounds/hour and the various velocity, volumetric, and temperature measurements associated with these tests.

DESCRIPTION OF PROGRAM

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DESCRIPTION OF PROGRAM

The emission test consisted of three (3) test runs at the common exhaust serving the TK1, TK2, TK3 for particulate, fluoride, and sulfur dioxide. Two sampling ports with twelve (12) sample points in each of the ports were utilized for testing on March 30, and four (4) ports with six sample points were utilized for testing on April 14,1994. Sample time per point was two and one-half (2.5) minutes for the isokinetic sample. The total time per test run was sixty (60) minutes.

The particulate and fluoride samples were taken from the gas stream isokinetically through a five (5) foot pyrex lined probe and a quarter (.25) inch nozzle. The entire length of the probe was heated and attached to a standard EPA Method 5 sample train. The hot box temperature was maintained between 225 and 273 degrees Fahrenheit. Exit gas temperature of the impingers was maintained below 68 degrees Fahrenheit with an ice bath. The nozzle, probe and connecting glassware was cleaned before testing and at the conclusion of each test run with acetone. After the particulate analysis was completed, the filters and impinger solutions were sent to a laboratory for the fluoride evaluation. Leak checks of the pitot tube lines and the sample trains were all acceptable by EPA regulations.

The method 6 evaluation was conducted on the second date, due to a problem with accuracy on the audit evaluation on the first test date. The method 6 sample train utilized the following reagents; 100ml of 80% IPA, 100ml of 3% H_2O_2, 100ml of 3% H_2O_2, and 200 grams of Silica Gel. Sampling was conducted at one sample point, with volumetric determinations conducted before and after each test run. The average of these readings was utilized for the emission calculations. The analysis of the impinger solution was conducted by Barium-Thorin titration. An OEPA audit sample was analyzed prior to the test samples to assure quality control.

Description cont.

Flue gas analysis was conducted by drawing an integrated air bag sample and analyzing it on a Hays Republic Model 621A "Orsat" Portable Gas Analyzer. The average of these readings for each run were used in calculating the emission rates.

Calibration of the equipment used, including the dry gas meters, temperature measuring devices, orifice meters, and the "S" type pitot tubes were conducted within 60 days of the test date. Copies of the data are included in this report.

All analytical procedures were performed in accordance with the methods specified in the Code of Federal Regulations, Title 40, Part 60, Volume 43. Blanks were collected and analyzed in the evaluation. The acetone blank was recorded and incorporated into the results.

The example equations included in this report use the figures from Run # 1 on both dates.

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TEST RESULTS SUMMARY

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TEST RESULTS SUMMARY

Metropolitan Ceramics Inc.

Canton, Ohio

Particulate & Fluorides Emission Evaluation

TK1, TK2, & TK3 Exhaust

Conducted - March 30, 1994

PARAMETER	RUN # 1	RUN # 2	RUN # 3	
Particulate Emissions				
Pounds/hour	9.12	12.32	8.19	9.88
Grains/dscf	0.0298	0.0376	0.0249	
Fluorides Emissions				
Pounds/hour	2.63	2.34	2.78	2.58
Grains/dscf	8.60E-03	7.12E-03	8.43E-03	
System Flow Rates				
ACFM	53,215	56,750	56,701	
DSCFM	35,697	38,284	38,412	
Degrees Fahrenheit	273	274	271	
Moisture Content	3.79	3.20	3.09	

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TEST RESULTS SUMMARY

Metropolitan Ceramics Inc.

Canton, Ohio

Sulfur Dioxide Emission Evaluation

TK1, TK2, & TK3 Exhaust

Conducted - April 14, 1994

PARAMETER	RUN # 1	RUN # 2	RUN # 3	
Sulfur Dioxide Emissions				
Pounds/hour	39.20	40.06	39.41	39.56
Grains/dscf	1.70E-05 .119	1.73E-05 .121	1.69E-05 .118	AVE. .119
System Flow Rates				
ACFM	57,385	58,347	58,754	
DSCFM	38,370	38,659	38,827	
Degrees Fahrenheit	276	285	286	
Moisture Content	3.75	3.49	3.63	

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TEST RESULTS
DETAILED

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TEST RESULTS

Metropolitan Ceramics Inc.

TK1, TK2, & TK3 Exhaust

Particulate & Fluorides Emission Evaluation

DATE: March 30, 1994	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
Time of Day			1135 1240	1322 1425	1506 1612
1 Gas Volume-dry,std.	Vmstd	cu. ft.	39.64	41.63	41.73
2 Condensate Vapor Vol.	Vwstd	cu. ft.	1.56	1.37	1.33
3 Gas Stream Moisture	Bws	vol.dec	0.0379	0.0320	0.0309
4 Mol.Wt-flue gas (dry)	Msd	lb/lb mo.	28.96	28.96	28.82
5 Mol.Wt-flue gas (wet)	Ms	lb/lb mo.	28.54	28.61	28.49
6 Flue Gas Velocity	Vs	ft/sec	45.17	48.17	48.13
7 Flue Gas Volume-Actual	ACFM	cu. ft.	53,215	56,750	56,701
8 Flue Gas Volume-Std.	DSCFM	cu. ft.	35,697	38,284	38,412
9 Particulate Conc.	Cs				
- Probe		gr/dscf	0.0081	0.0186	0.0059
- Filter		gr/dscf	0.0217	0.0189	0.0190
- Total		gr/dscf	0.0298	0.0376	0.0249
- Fluorides		gr/dscf	0.0086	0.0071	0.0084
10 Emission Rate	E				
- Probe		lb/hr	2.48	6.12	1.94
- Filter		lb/hr	6.65	6.20	6.26
- Total		lb/hr	9.12	12.32	8.19
- Fluorides		lb/hr	2.63	2.34	2.78
11 Isokinetic Rate	I	%	106.6	104.4	104.3

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TEST RESULTS

Metropolitan Ceramics Inc.

TK1, TK2, & TK3 Exhaust

Sulfur Dioxide Emission Evaluation

	DATE: April 14, 1994	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
	Time of Day			0955 1055	1122 1222	1244 1344
1	Gas Volume-dry,std.	Vmstd	cu. ft.	43.47	43.17	43.31
2	Condensate Vapor Vol.	Vwstd	cu. ft.	1.69	1.56	1.63
3	Gas Stream Moisture	Bws	vol.dec	0.0375	0.0349	0.0363
4	Mol.Wt-flue gas (dry)	Msd	lb/lb mo.	28.91	28.90	28.91
5	Mol.Wt-flue gas (wet)	Ms	lb/lb mo.	28.50	28.52	28.51
6	Flue Gas Velocity	Vs	ft/sec	48.71	49.53	49.87
7	Flue Gas Volume-Actual	ACFM	cu. ft.	57,385	58,347	58,754
8	Flue Gas Volume-Std.	DSCFM	cu. ft.	38,370	38,659	38,827
9	Normality of Ba(ClO4)2	N	meq/ml	0.0110	0.0110	0.0110
10	Volume of solution	Vsln	ml	240.0	240.0	231.0
11	Volume aliquot titrant	Va	ml	1.00	1.00	1.00
12	Volume Ba(ClO4)2 Blank	Vtb	ml	0.0	0.0	0.0
13	Volume Ba(ClO4)2 Sampl	Vt	ml	3.97	4.00	4.08
14	Concentration SO2	Cso2	lb/scf	1.70E-05	1.73E-05	1.69E-05
15	Concentration SO2	PPM	ppmV	102.4	103.9	101.8
16	Emission Rate SO2	Eso2	lb/hr	39.20	40.06	39.41

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OPERATIONAL PARAMETERS

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METROPOLITAN EMISSION COMPLIANCE TEST

TO BE PERFORMED ON TUNNEL KILNS #1, #2, #3.

DATE 14th April 1994

CARRIED OUT BY ENVISAGE ENVIRONMENTAL INC.

RELEVENT DATA

	KILN SPEED	PRODUCT	CLAY	SHALE	* DRY TONS/KILN
TK #1	34 cars per day	507	100%	nil	62.832
TK #2	34 cars per day	507	100%	nil	62.832
TK #3	40 cars per day	310	30%	70%	73.92

* DRY' TONS (Weight of raw materials only) Number of cars per kiln per day x 2.2 average wet tons per car x 0.84 (allowing for 16% moisture removed from tiles before firing)

KILN CAPACITY

POTENTIAL FOR THE 3 KILNS 221.76 tons
(3 x 40 cars per day x 2.2 average wet tons per car x 0.84 (as above))

ACTUAL CAPACITY DURING TEST 199.584 tons
(34 + 34 + 40) = 108 cars per day x 2.2 x 0.84

% CAPACITY 90 %

RETEST FOR SO2

TESTS

For SO2 (as per NOI submitted)

RAW MATERIAL TEST

Samples of clay tiles, (2 doubles/car), will be taken, prior to entering the kilns, from the cars that will be directly in the areas of the measured emissions
Each test will be represented by 32 pieces of clay tile per test.
Each test series of clay tiles will be ground and sent to either Stark Ceramics or Skyline Labs (Denver, CO), to be tersted for Sulfur content. 3 series of ground clay tile, representing each emission test, will consist of 3 batches (1 per kiln).

PEAK TEMPERATURES

TK#1	1194 °C
TK#2	1194 °C
TK#3	1147 °C

CAR NUMBERS FOR SAMPLE TILES

4/14/94 TEST 1	TK #1	18	100	171	201	50	177	12	15	239	121		
9:55	TK #2	13	23	32	114	274	237	30	245	19	230		
	TK #3	275	10	54	47	111	77	256	155	46	204	278	207
4/14/94 TEST2	TK #1	171	201	50	177	12	15	239	121	66	202		
11:20	TK #2	32	114	276	237	30	245	19	230	3	156		
	TK #3	47	111	77	256	155	46	204	278	207	208	97	260
4/14/94 TEST 3	TK #1	177	12	15	239	121	66	202	162	256	150		
12:45	TK #2	276	237	30	245	19	230	3	156	1	185		
	TK #3	77	256	155	46	204	278	207	208	97	260	137	168

RETEST FOR SO2

SAMPLE POINT LOCATION DIAGRAM

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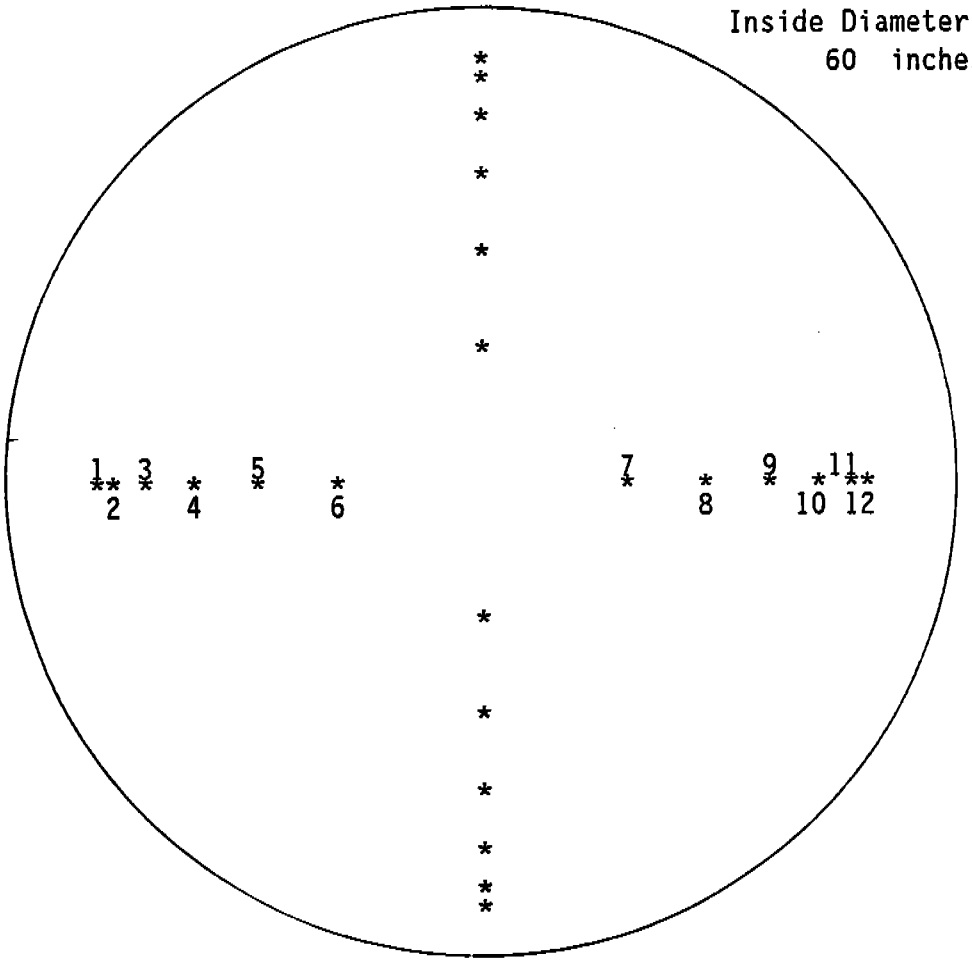
SAMPLE POINT LOCATIONS

Metropolitan Ceramics Incorporated
Canton, Ohio
TK1, TK2, and TK3 Common Exhaust



Point #	Distance From Inside Wall	Point #	Distance From Inside Wall
1	58.7 inches	7	21.4 inches
2	56.0 inches	8	15.0 inches
3	52.9 inches	9	10.6 inches
4	49.4 inches	10	7.1 inches
5	45.0 inches	11	4.0 inches
6	38.6 inches	12	1.3 inches

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SAMPLING TRAIN DIAGRAM

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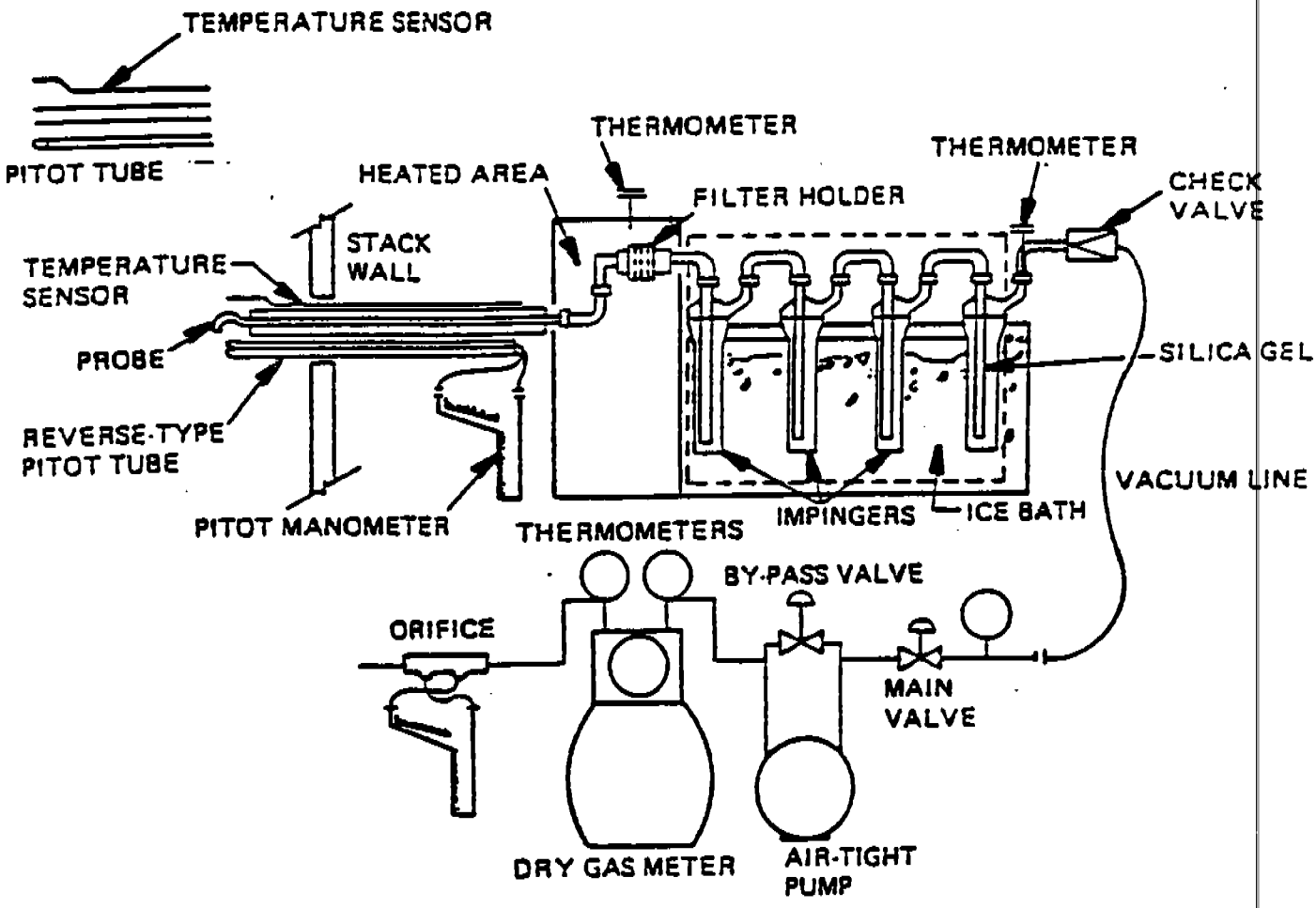
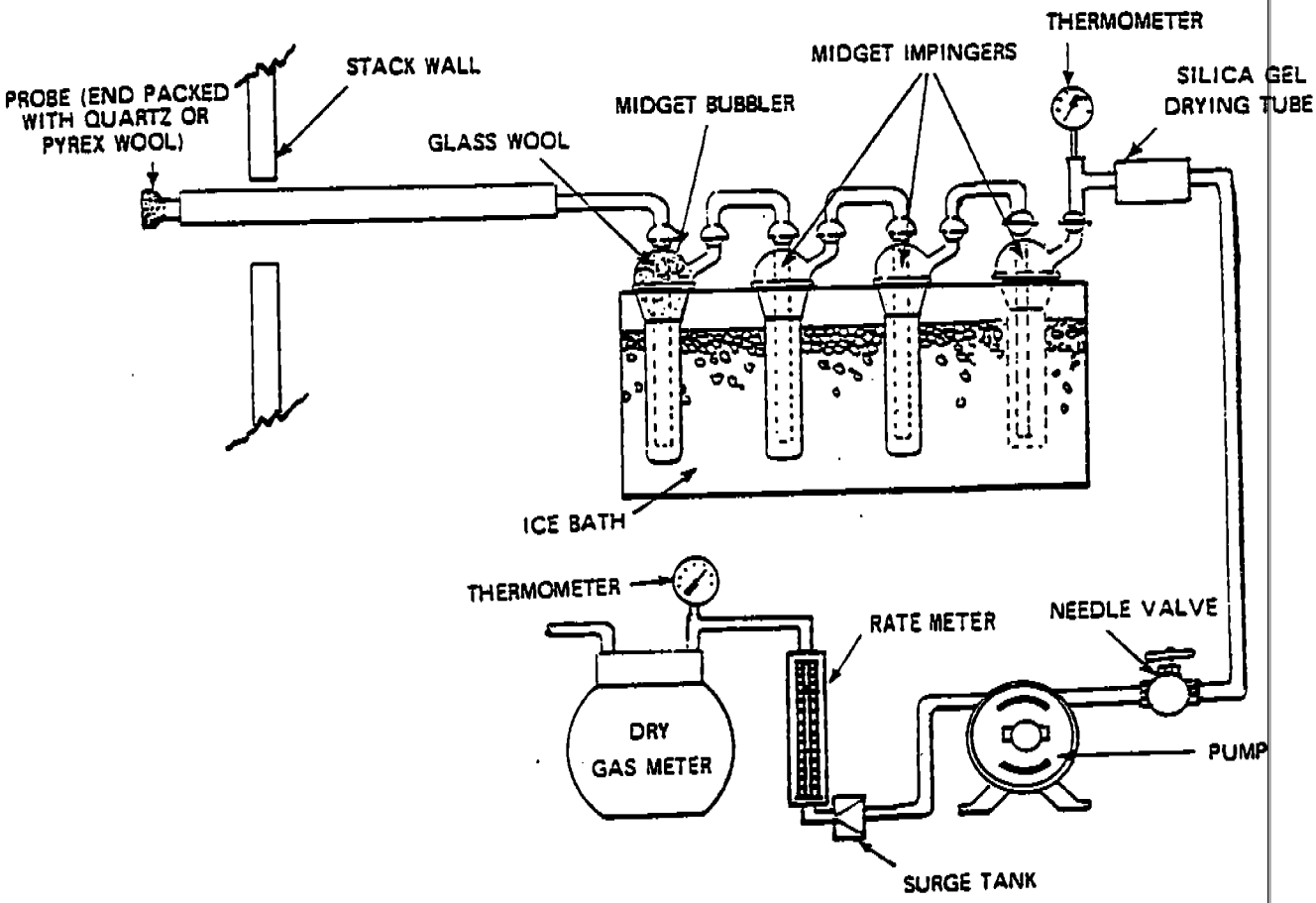
EPA METHOD 5 PARTICULATE SAMPLE TRAIN



EPA METHOD 6
SAMPLE TRAIN



LABORATORY SECTION

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LABORATORY SUMMARY SHEET

Metropolitan Ceramics Inc.

TK1, TK2, & TK3 Exhaust

Particulate & Fluorides Emission Evaluation

DATE: March 30, 1994	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
1 Sampling Time	t	minutes	60.0	60.0	60.0
2 Barometric Pressure	Pb	in. Hg	29.02	29.02	29.02
3 Static Pressure	Pg	in. H2O	-0.71	-0.71	-0.71
Stack Pressure	Ps	in. Hg	28.97	28.97	28.97
4 Gas Meter Volume	Vm	cu. ft.	43.73	45.15	45.12
5 Stack Area	A	sq. ft.	19.63	19.63	19.63
6 Nozzle Diameter	Dn	dec. in.	0.25	0.25	0.25
7 "Y" Factor			1.00	1.00	1.00
8 Meter Temperature		degrees F	107.1	97.8	96.0
	Tm	degrees R	567.1	557.8	556.0
9 Stack Temperature		degrees F	273.2	273.5	271.3
	Ts	degrees R	733.2	733.5	731.3
10 Velocity Head	^P	in. H2O	0.668	0.713	0.712
11 Orifice Pressure	^H	in. H2O	1.50	1.67	1.67
12 Carbon dioxide	CO2	%	1.0	1.0	0.4
13 Oxygen	O2	%	20.0	20.0	19.0
14 Carbon monoxide	CO	%	0.0	0.0	0.0
15 Nitrogen	N2	%	79.0	79.0	80.6
16 Pitot Coefficient	Cp		0.84	0.84	0.84
17 Water Collected	Vlc	ml	33.2	29.2	28.3
18 Sample Weight:	Mn				
- Probe		g	0.0208	0.0503	0.0159
- Filter		g	0.0558	0.0510	0.0514
- Fluorides		mg	22.1	19.2	22.8

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LABORATORY SUMMARY SHEET

Metropolitan Ceramics Inc.

TK1, TK2, & TK3 Exhaust

Sulfur Dioxide Emission Evaluation

DATE: April 14, 1994	Symbol	Units	RUN # 1	RUN # 2	RUN # 3
1 Sampling Time	t	minutes	60.0	60.0	60.0
2 Barometric Pressure	Pb	in. Hg	29.02	29.02	29.02
3 Static Pressure	Pg	in. H2O	-0.55	-0.55	-0.55
Stack Pressure	Ps	in. Hg	28.98	28.98	28.98
4 Gas Meter Volume	Vm	cu. ft.	46.25	46.46	46.75
5 Stack Area	A	sq. ft.	19.63	19.63	19.63
6 Meter Temperature		degrees F	87.4	93.5	95.3
	Tm	degrees R	547.4	553.5	555.3
7 Stack Temperature		degrees F	276.1	284.9	285.7
	Ts	degrees R	736.1	744.9	745.7
8 Velocity Head	^P	in. H2O	0.719	0.727	0.731
9 Orifice Pressure	^H	in. H2O	1.80	1.80	1.80
10 Carbon dioxide	CO2	%	1.0	1.0	1.0
11 Oxygen	O2	%	18.8	18.7	18.7
12 Carbon monoxide	CO	%	0.0	0.0	0.0
13 Nitrogen	N2	%	80.2	80.3	80.3
14 Pitot Coefficient	Cp		0.84	0.84	0.84
15 Water Collected	Vlc	ml	36.0	33.2	34.7

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PLANT Metropolitan Ceramic

DATE March 30, 1994

RUN NO. 1

CASE NO. 16

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED			
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN	
248	0.6649	0.6091	0.0558	FILTER
N/A	N/A	N/A	N/A	IMPINGERS
611	105.6688	105.6480	0.0208	PROBE *

* Corrected for Acetone Blank

VOLUME OF LIQUID WATER COLLECTED			
	IMPINGER VOLUME (ml)	SILICA GEL WEIGHT (g)	
FINAL	225	238.5	
INITIAL	200	230.3	
NET LIQUID COLLECTED	25	8.2	
TOTAL NET VOLUME	33.2	g *	ml

* Convert weight of water to volume by dividing weight increase by density of water:

$$\frac{\text{Increase g}}{(1\ \text{g/ml})} = \text{Volume Water, ml}$$

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PLANT Metropolitan Ceramic

DATE March 30, 1994

RUN NO. 2

CASE NO. 38

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED			
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN	
254	0.6590	0.6080	0.0510	FILTER
N/A	N/A	N/A	N/A	IMPINGERS
99	94.2642	94.2139	0.0503	PROBE *

* Corrected for Acetone Blank

VOLUME OF LIQUID WATER COLLECTED			
	IMPINGER VOLUME (ml)	SILICA GEL WEIGHT (g)	
FINAL	220	239.5	
INITIAL	200	230.3	
NET LIQUID COLLECTED	20	9.2	
TOTAL NET VOLUME	29.2	g *	ml

* Convert weight of water to volume by dividing weight increase by density of water:

$$\frac{\text{Increase g}}{(1\ \text{g/ml})} = \text{Volume Water, ml}$$

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PLANT Metropolitan Ceramic

DATE March 30, 1994

RUN NO. 3

CASE NO. 29

CONTAINER NUMBER	WEIGHT OF PARTICULATE COLLECTED			
	FINAL WEIGHT	TARE WEIGHT	WEIGHT GAIN	
246	0.6628	0.6114	0.0514	FILTER
N/A	N/A	N/A	N/A	IMPINGERS
71	101.9547	101.9388	0.0159	PROBE *

* Corrected for Acetone Blank

VOLUME OF LIQUID WATER COLLECTED			
	IMPINGER VOLUME (ml)	SILICA GEL WEIGHT (g)	
FINAL	220	238.6	
INITIAL	200	230.3	
NET LIQUID COLLECTED	20	8.3	
TOTAL NET VOLUME	28.3	g *	ml

* Convert weight of water to volume by dividing weight increase by density of water:

$$\frac{\text{Increase g}}{(1\ \text{g/ml})} = \text{Volume Water, ml}$$

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ORSAT ANALYSIS WORK SHEET

DATE: 3/30/94

LOCATION: Morro Ceramics

OPERATOR: T.C.

RUN # 1

	1		2		3		
	ACTUAL	NET	ACTUAL	NET	ACTUAL	NET	AVERAGE
CO_2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
O_2	21.0	20.0	21.0	20.0	21.0	20.0	20.0
CO	21.0	0	21.0	0	21.0	20	20

RUN # 2

	1		2		3		
	ACTUAL	NET	ACTUAL	NET	ACTUAL	NET	AVERAGE
CO_2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
O_2	21.0	20.0	21.0	20.0	21.0	20.0	20.0
CO	21.0	0	21.0	0	21.0	0	0

RUN # 3

	1		2		3		
	ACTUAL	NET	ACTUAL	NET	ACTUAL	NET	AVERAGE
CO_2	.4	.4	.4	.4	.4	.4	.4
O_2	19.4	19.0	19.4	19.0	19.4	19.0	19.0
CO	19.4	0	19.4	0	19.4	0	0

COMMENTS: _____

FE-8-92

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ORSAT ANALYSIS WORK SHEET

DATE: 4/14/94

LOCATION: Nevo Ceramics

OPERATOR: T.C./BH

RUN # 1

	1		2		3		
	ACTUAL	NET	ACTUAL	NET	ACTUAL	NET	AVERAGE
CO_2	1.0	1.0	1.0	1.0	1.0	1.0	1.0
O_2	19.8	18.8	19.8	18.8	19.8	18.8	18.8
CO	19.8	0	19.8	0	19.8	0	0

RUN # 2

	1		2		3		
	ACTUAL	NET	ACTUAL	NET	ACTUAL	NET	AVERAGE
CO_2	1.0	1.0	1.0	1.0	.9	.9	.967
O_2	19.7	18.7	19.7	18.7	19.6	18.7	18.7
CO	19.7	0	19.7	0	19.6	0	0

RUN # 3

	1		2		3		
	ACTUAL	NET	ACTUAL	NET	ACTUAL	NET	AVERAGE
CO_2		1.0		1.0		1.0	1.0
O_2	19.7	18.7	19.6	18.6	19.7	18.7	18.67
CO	19.7	0	19.6	0	19.7	0	0

COMMENTS: _____

FH-8-92

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Phone (216) 526-0980

Sample Description: Filter #246 **Lab No.:** 01

Analyte Description	Result	Units	EQL
Fluoride anal. by EPA 13B	<EQL	Total mg	1.5

Sample Description: Filter #248 **Lab No.:** 02

Analyte Description	Result	Units	EQL
Fluoride anal. by EPA 13B	<EQL	Total mg	1.5

Sample Description: Filter #254 **Lab No.:** 03

Analyte Description	Result	Units	EQL
Fluoride anal. by EPA 13B	<EQL	Total mg	1.5

Sample Description: Impinger Run# 1 **Lab No.:** 04

Analyte Description	Result	Units	EQL
Sample volume	225	Total mL	5
Fluoride anal. by EPA 13B	22.1	Total mg	1.5

Sample Description: Impinger Run# 2 **Lab No.:** 05

Analyte Description	Result	Units	EQL
Sample volume	220	Total mL	5
Fluoride anal. by EPA 13B	19.2	Total mg	1.5

Sample Description: Impinger Run# 3 **Lab No.:** 06

Analyte Description	Result	Units	EQL
Sample volume	220	Total mL	5
Fluoride anal. by EPA 13B	22.8	Total mg	1.5

AUDIT DATA

Envisage
Environmental
Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

CANTON CITY HEALTH DEPARTMENT
DIVISION OF AIR POLLUTION CONTROL
420 MARKET AVENUE NORTH
CANTON, OHIO 44702

FAX: (216) 489-3335

TELEFAX TRANSMITTAL

DATE: 4-26-94

FOR THE ATTENTION OF: FRANK HEZOCKY

FIRM: ENVISAGE

FAX NUMBER: 1-526-8555

RE: METRO. CERAMICS AUDIT SAMPLES (SO_2)

This transmission consists of 1 pages including this page.

Please notify us if you do not receive all the pages at (216) 489-3385.

FROM: Cindy Parks

THE SO_2 CONCENTRATIONS REPORTED FOR SAMPLES NO. 8847 AND 8823 ARE WITHIN THE ACCEPTABLE RANGE.

AUDIT SAMPLE # 8823

Sulfur dioxide Concentration

$$C_{SO_2} = K_2 \frac{(V_t - V_{tb})\ N \left| - \frac{Vsln}{Va} - \right|}{V_{m(given)}}$$

(EPA Equation 6-2)

Nomenclature:

C_{SO_2} = Concentration of sulfur dioxide in Audit sample, mg/dscm.

K_2 = Constant, 32.03 mg/meq.

V_t = Volume of barium perchlorate titrant used for the sample, ml (average of replicate titrations).

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

N = Normality of barium perchlorate titrant, milliequivalents/ml.

V_{sln} = Volume of solution containing sulfur dioxide sample, ml.

V_a = Volume of aliquot titrated, ml.

$V_{m(given)}$ = Volume of gas sample (given with each audit sample), dscm.

Where:

V_t	=	2.03 ml	V_{sln}	=	100.0 ml
V_{tb}	=	0.00 ml	V_a	=	5.0 ml
N	=	0.0111 meq/ml	$V_{m(given)}$	=	0.0210 M^3

$$C_{SO_2} = 32.03 \frac{(2.03 - 0.00)\ 0.0111 \left| - \frac{100.0}{5.0} - \right|}{0.0210}$$

$$= \underline{688.5} \text{ mg/dscm}$$

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AUDIT SAMPLE # 8947

Sulfur dioxide Concentration

$$C_{SO_2} = K_2 \frac{(V_t - V_{tb})\ N \left| - \frac{Vsln}{Va} - \right|}{V_{m(given)}}$$

(EPA Equation 6-2)

Nomenclature:

C_{SO_2} = Concentration of sulfur dioxide in Audit sample, mg/dscm.

K_2 = Constant, 32.03 mg/meq.

V_t = Volume of barium perchlorate titrant used for the sample, ml (average of replicate titrations).

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

N = Normality of barium perchlorate titrant, milliequivalents/ml.

V_{sln} = Volume of solution containing sulfur dioxide sample, ml.

V_a = Volume of aliquot titrated, ml.

$V_{m(given)}$ = Volume of gas sample (given with each audit sample), dscm.

Where:

V_t	=	4.93 ml	V_{sln}	=	100.0 ml
V_{tb}	=	0.00 ml	V_a	=	5.0 ml
N	=	0.0111 meq/ml	$V_{m(given)}$	=	0.0210 M^3

$$C_{SO_2} = 32.03 \frac{(4.93 - 0.00)\ 0.0111 \left| - \frac{100.0}{5.0} - \right|}{0.0210}$$

$$= \underline{1667.6}\ \text{mg/dscm}$$

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

EMISSION SAMPLING EQUIPMENT SPECIFICATIONS

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

Equipment and Specifications
Test Reference Methods

Control Unit (meter box)	Equipment Designation
__Envisage Environmental Inc.	Control Unit #'s MB 08 & 09
_X_Andersen Samplers	Control Unit #'s MB 01 - 02
__Remanufactured RAC	Control Unit #'s MB 03 - 07
__DuPont Constant Flow Pumps	Control Unit #'s MB 01 - 05

Sample Box	
_X_EEI	SB 01, 02 & 05 - 07
__Remanufactured RAC	SB 03 & 04
__EEI Special Design	SB 08 - 11

Impingers - per sample train (each set changed for each test run)

_X_EEI	3 Modified Smith Greenburg type
_X_EEI	1 Smith Greenburg type

Probes	length	lining type
__EEI	2 foot	SS, PYREX, QUARTZ
__EEI	3 foot	SS, PYREX, QUARTZ
_X_EEI	5 foot	SS, PYREX, QUARTZ
__EEI	7 foot	SS, PYREX, QUARTZ
__EEI	10 foot	SS, PYREX, QUARTZ
__EEI	12 foot	SS, PYREX, QUARTZ
__EEI	15 foot	SS, PYREX, QUARTZ
__EEI	24 foot	SS, PYREX, QUARTZ

Temperature Sensors	Equipment Designation
__Omega Engineering	PY 01 & 02
__Thermo Electric	PY 03 - 08
_X_Fluke 51	PY 01 - 05
__Fisher Scientific	Mercury in Glass
__Fisher Scientific	Bimetallic

Pressure Gauges	Type
_X_Dwyer Incline Manometer	Oil, 0 - 10 in. water
__Dwyer Magnehelic	Magnetic/Mechnical 0 - 1 in. water
__Dwyer Magnehelic	Magnetic/Mechnical 0 - 10 in. water
__Dwyer "U" Tube Manometer	Mercury, 36 inches
__Dwyer "U" Tube Manometer	Water, 72 inches
__Dwyer Microtector (micro-manometer)	Water, 0 - 10 inches of water
__Davis Electromanometer	Electric, .001 - .100 in. water

Chemicals and Reagents	
_X_Water	Deionized/Distilled
_X_Acetone	Reagent Grade (<0.001% residual)
_X_Silica Gel	6 - 16 Mesh
_X_Stopcock Grease	Acetone insoluble & heat resistant
__Nitric Acid	Reagent Grade
__.1 N Sulfuric Acid	Reagent Grade
__Methylene Chloride	Reagent Grade
__5% HNO_3 / 10% H_2O_2	Reagent Grade
__Sodium Hydroxide	Reagent Grade
__$KMNO_4$/Sodium Hydroxide	

Envisage Environmental Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

FIELD DATA SHEETS

Envisage
Environmental
Incorporated
P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

FIELD DATA COVER SHEET

PLANT Metro CERAMICS

DATE 30 mar 94

SAMPLING LOCATION outlet

SAMPLING METHOD 1-5

OPERATOR T.C.

AMBIENT TEMPERATURE 50

BAROMETRIC PRESSURE 29.02

STATIC PRESSURE -.71

HEATER BOX SETTING 248±25

PROBE TEMP SETTING 248±25

PROBE LENGTH 5'

NOZZLE I.D. .25

ASSUMED MOISTURE 2%

METER BOX I.D. 1 New

METER ΔH 1.80

METER "Y" FACTOR 1.00

NOMOGRAPH "C" FACTOR 1.1

PROBE I.D. 62

THERMOCOUPLE I.D.'s -

PITOT COR. FACTOR .84

SAMPLE TRAIN I.D. 1

CYCLONIC FLOW CHECK ok

TRAVERSE POINT LOCATIONS

1. 1.5	7. 46.3
2. 4.8	8. 54
3. 8.5	9. 59.2
4. 12.7	10. 63.8
5. 18	11. 67.2
6. 25.6	12. 70.5

UPSTREAM DISTANCE _____

DOWNSTREAM DISTANCE _____

NOZZLE CALIBRATION

Diameter 1 .250
Diameter 2 .250
Diameter 3 .250
Average .250

Test Team Members TC JB DD GS

EPA Representative/s Rick Miller

Facility Contact Phillip McGuiness

EEI Team Leader G.S.

FH394

PLANT Metic Lawns DATE 3/30/94 RUN# CASE# 16 LOCATION Exhaust page 1 of

POINT NUMBER	SAMPLE TIME	GAS METER READING	VELOCITY Δp	VELOCITY HEAD √Δp	ORIFICE PRESSURE	STACK TEMP	GAS METER TEMP IN	GAS METER TEMP OUT	PUMP VACUUM	FILTER HOLDER	IMPINGER TEMP
1	0/11:35	562.40	.48	.693	1.58	261	120	84	1.5	250	30
2	2.5	564.50	.54	.735	1.75	279	143	85	2.0	250	30
3	5	566.30	.55	.742	1.80	279	147	85	2.0	250	30
4	7.5	568.28	.55	.742	1.80	270	151	86	2.0	250	34
5	10	570.27	.54	.735	1.75	277	149	86	2.0	255	34
6	12.5	572.25	.54	.735	1.75	277	145	87	2.0	255	34
7	15	574.27	.48	.693	1.58	276	146	87	1.5	255	36
8	17.5	576.09	.42	.648	1.38	279	138	87	1.0	260	36
9	20	577.78	.36	.600	1.18	279	138	87	1.0	260	38
10	22.5	579.47	.34	.583	1.12	278	136	88	1.0	260	38
11	25	581.14	.32	.566	1.05	272	133	88	1.0	260	38
12	27.5	582.68	.25	.5	.82	250	129	88	1.0	260	38
1	30	584.05	.55	.742	1.80	275	117	86	2.0	260	38
2	32.5	586.20	.58	.762	1.89	272	127	86	2.0	260	38
3	35	588.19	.58	.762	1.89	276	128	85	2.0	260	38
4	37.5	590.16	.56	.748	1.85	274	128	86	2.0	260	38
5	40	592.20	.54	.735	1.75	275	125	85	2.0	265	40
6	42.5	594.14	.50	.707	1.62	276	124	85	2.0	265	40
7	45	596.00	.50	.707	1.62	275	122	85	2.0	265	40
8	47.5	597.97	.48	.693	1.58	275	120	85	1.5	265	40
9	50	599.72	.42	.648	1.38	275	117	86	1.5	265	40
10	52.5	601.70	.40	.632	1.3	277	118	83	1.5	265	40
11	55	603.29	.36	.6	1.18	271	112	82	1.5	265	40
12	57.5	604.88	.20	.447	.66	270	103	81		265	40
	60/12:40	606.13									

SAMPLE TRAIN LEAK CHECKS
PRE-TEST .005 CFM @ 15 "Hg POST-TEST .002 CFM @ 7 "Hg

PITOT TUBE LEAK CHECKS
PRE-TEST #2 0@15.8 #4 0@15.8 POST-TEST #2 0@7.5 #4 0@6.2

43.73 1.50 273.17 107.09 .668

38

methal 5

PLANT Metro Ceramics DATE 3/30/94 RUN# 2 CASE# 38 LOCATION Exhaust page 1 of 1

POINT NUMBER	SAMPLE TIME	GAS METER READING	VELOCITY Δp HEAD	√Δp	ORIFICE PRESSURE	STACK TEMP	GAS METER TEMP IN	GAS METER TEMP OUT	PUMP VACUUM	FILTER HOLDER	IMPINGER TEMP
1	0/3:22	637.00	.58	.762	1.85	270	92	65	2.0	240	32
2	2.5	638.96	1.58	.762	1.85	276	111	70	2.0	240	32
3	5	641.04	.60	.775	1.95	275	118	71	3.0	250	32
4	7.5	643.01	1.58	.762	1.84	275	121	72	2.5	260	34
5	10	645.04	.55	.742	1.80	275	121	72	2.5	260	34
6	12.5	647.59	.54	.735	1.75	275	123	73	2.5	260	36
7	15	649.40	.52	.721	1.70	274	124	74	2.0	260	36
8	17.5	650.84	.48	.693	1.58	276	122	74	2.0	260	36
9	20	652.66	.46	.678	1.50	276	123	74	2.0	265	36
10	22.5	654.45	.42	.648	1.38	275	122	74	2.0	265	38
11	25	656.14	.42	.648	1.38	274	118	74	2.0	265	38
12	27.5	657.81	.45	.671	1.49	272	119	74	2.0	265	38
1	30	659.68	.55	.742	1.80	267	105	73	2.5	260	38
2	32.5	661.61	.58	.762	1.84	271	122	74	3.0	260	38
3	35	663.62	.58	.762	1.85	274	127	74	3.0	265	38
4	37.5	665.49	.56	.748	1.85	276	128	75	3.0	265	38
5	40	667.59	.55	.742	1.80	275	128	75	3.0	265	38
6	42.5	669.55	.54	.735	1.77	275	125	76	2.5	265	38
7	45	671.54	.54	.735	1.75	274	127	78	2.5	265	40
8	47.5	673.50	.52	.721	1.70	273	128	77	2.5	265	40
9	50	675.33	.48	.693	1.58	272	129	77	2.0	265	40
10	52.5	677.16	.45	.671	1.49	271	128	78	2.0	260	40
11	55	678.95	.42	.648	1.38	272	126	79	2.0	260	40
12	57.5	680.70	.20	.548	.98	272	124	78	1.0	260	40
	60/2:52	682.15									

SAMPLE TRAIN LEAK CHECKS
PRE-TEST .007 CFM @ 15 "Hg POST-TEST .002 CFM @ 7 "Hg

PITOT TUBE LEAK CHECKS
PRE-TEST #2 @ 0 @ 0 POST-TEST #2 @ 5.2
#1 @ 7.3 #1 @ 6.7

45.15 .713 1.67 273.54 97.83

39

methal 5

PLANT Nevo Ceramics DATE 3/30/94 RUN 3 CASE# 29 LOCATION EXHAUST page 1 of 1

POINT NUMBER	SAMPLE TIME	GAS METER READING	VELOCITY Δp HEAD	√Δp	ORIFICE PRESSURE	STACK TEMP	GAS METER TEMP IN	GAS METER TEMP OUT	PUMP VACUUM	FILTER HOLDER	IMPINGER TEMP
1	0/5.00	682.60	.56	.748	1.85	268	85	62	4.5	240	36
2	2.5	684.51	.53	.762	1.89	272	108	64	5.0	240	36
3	5	686.57	.60	.775	1.55	272	116	64	5.0	245	36
4	7.5	688.58	.58	.762	1.89	272	114	66	5.0	255	38
5	10	690.57	.56	.748	1.85	272	122	67	4.5	260	38
6	12.5	692.53	.55	.742	1.80	271	122	69	4.5	260	38
7	15	694.51	.52	.721	1.70	274	123	69	4.5	255	40
8	17.5	696.38	.46	.678	1.50	276	123	71	4.0	255	40
9	20	698.17	.46	.678	1.50	275	122	72	4.0	255	42
10	22.5	699.93	.48	.693	1.58	276	122	73	4.0	255	42
11	25	701.80	.45	.671	1.49	273	123	73	4.0	255	42
12	27.5	703.56	.46	.678	1.50	271	123	73	4.0	255	42
1	30	705.40	.58	.762	1.89	270	58	72	5.0	260	42
2	32.5	707.41	.60	.775	1.55	270	121	73	5.0	260	42
3	35	709.44	.58	.762	1.89	273	125	74	5.0	260	42
4	37.5	711.52	.56	.748	1.85	274	128	75	5.0	260	42
5	40	713.43	.56	.748	1.85	273	126	76	5.0	260	42
6	42.5	715.30	.56	.748	1.85	273	126	76	5.0	260	42
7	45	717.33	.52	.721	1.70	272	126	76	4.5	260	42
8	47.5	719.35	.52	.721	1.70	272	125	76	4.0	260	42
9	50	721.30	.48	.693	1.58	271	126	76	4.0	260	42
10	52.5	723.14	.42	.648	1.38	273	124	76	3.5	255	42
11	55	724.75	.32	.566	1.05	272	124	77	3.0	255	42
12	57.5	726.25	.30	.548	1.00	245	124	77	2.5	255	42
	60/16.17	727.72									

SAMPLE TRAIN LEAK CHECKS
PRE-TEST 0.05 CFM @ 15 "Hg POST-TEST 0 CFM @ 7 "Hg

PITOT TUBE LEAK CHECKS
PRE-TEST #2 good #4 good POST-TEST #2 good #4 good

45.12 .712 1.67 271.25 96.04

40

method 5

FIELD DATA COVER SHEET

PLANT Metro Ceramics

DATE 4-14-94

SAMPLING LOCATION Kiln Exhaust

SAMPLING METHOD 6

OPERATOR BH

AMBIENT TEMPERATURE 80's

BAROMETRIC PRESSURE

STATIC PRESSURE -.55

HEATER BOX SETTING N/A

PROBE TEMP SETTING N/A

TRAVERSE POINT LOCATIONS

1. 1.3
2. 4.0
3. 7.5
4. 10.6
5. 13.0
6. 25.4
7. 38.6
8. 45.0
9. 49.2
10. 52.9
11. 56
12. 58.7

PROBE LENGTH 8 ft

NOZZLE I.D. N/A

ASSUMED MOISTURE N/A

METER BOX I.D. New

METER ΔH 1.82

METER "Y" FACTOR 1

NOMOGRAPH "C" FACTOR N/A

PROBE I.D. 301

THERMOCOUPLE I.D.'s 5

PITOT COR. FACTOR .84

SAMPLE TRAIN I.D. N/A

CYCLONIC FLOW CHECK ok

UPSTREAM DISTANCE _____

DOWNSTREAM DISTANCE _____

NOZZLE CALIBRATION

Diameter 1 N/A
Diameter 2 _____
Diameter 3 _____
Average _____

Test Team Members CH, TC

EPA Representative/s Rick Miller - Cawton DAQC

Facility Contact Phillip McGuinness

EEI Team Leader BH

FH394

CASE #88

PLANT Metro Ceramic DATE 4/14/94 RUN# 1 CASE# LOCATION Kiln page of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0/0955	437.90	1.80	97	66	6.0	45
5	441.8	1.80	101	68	7.0	45
10	445.3	1.80	99	69	7.0	48
15	449.3	1.80	100	70	7.0	45
20	453.2	1.80	101	72	7.0	50
25	457.1	1.80	103	73	7.0	50
30	460.0	1.80	104	74	7.0	50
35	464.8	1.80	105	75	7.0	50
40	468.7	1.80	106	75	7.0	50
45	472.6	1.80	106	77	7.0	50
50	476.4	1.80	107	77	7.0	50
55	480.2	1.80	105	77	7.0	50
60/1055	484.15					
	46.25	1.80		87.38		

System Leak Checks: Pre-Test 0 CFM @ 13 "Hg
Post-Test 0.0 CFM @ 8 "Hg

PLANT Metro Ceramics DATE 4/14/94 RUN# 2 CASE# 49 LOCATION Kiln Exhaust page of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0/1122	484.50	1.80	86	77	5.0	50
5	488.3	1.80	112	78	5.0	50
10	492.1	1.80	111	78	5.0	50
15	496.2	1.80	111	79	5.0	50
20	499.9	1.80	110	79	5.0	52
25	503.8	1.80	110	79	5.0	52
30	507.7	1.80	110	80	5.0	52
35	511.5	1.80	110	80	5.0	52
40	515.4	1.80	110	81	5.0	52
45	519.3	1.80	109	80	5.0	52
50	523.2	1.80	108	79	5.0	54
56	526.9	1.80	109	74	5.0	54
60/1222	530.955					
	46.455	1.80		93.54		

System Leak Checks: Pre-Test 0 CFM @ 13 "Hg
Post-Test 0 CFM @ 8 "Hg

PLANT Metro Ceramic DATE 4/14/94 RUN# 3 CASE# 83 LOCATION Kiln Exhaust page of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger#4 Temperature
0 / 1244	531.30	1.80	86	78	5.0	50
5	535.00	1.80	109	78	5.0	50
10	538.94	1.80	110	79	5.0	50
15	542.8	1.80	111	81	6.0	52
20	546.6	1.80	111	80	6.0	52
25	550.6	1.80	111	81	6.0	52
30	554.5	1.80	112	82	6.0	54
35	558.4	1.80	112	82	6.0	54
40	562.3	1.80	112	82	6.0	54
45	566.2	1.80	113	83	6.0	54
50	570.2	1.80	113	83	6.0	56
55	574.1	1.80	114	84	6.0	56
60 / 1344	578.045					
	46.745	1.80		95.29		

System Leak Checks: Pre-Test 0 CFM @ 15 "Hg
Post-Test 0 CFM @ 8 "Hg

PLANT Metro Ceramics DATE 4/14/94 RUN# Pre1 LOCATION Kiln page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{sw}	$\sqrt{\Delta p}$
1	.60	260		.775
2	.59	260		.768
3	.55	265		.742
4	.49	261		.7
5	.47	260		.686
6	.46	260		.678
1	.55	274		.742
2	.55	275		.742
3	.54	277		.735
4	.53	282		.728
5	.51	283		.714
6	.495	283		.704
1	.53	255		.728
2	.57	276		.755
3	.51	280		.714
4	.54	281		.735
5	.55	283		.742
6	.54	282		.735
1	.56	250		.748
2	.56	254		.748
3	.54	260		.735
4	.49	263		.7
5	.47	265		.686
6	.44	266		.663

PITOT TUBE LEAK CHECKS

PRE-TEST #2 0.6.1 #4 0.6.5

POST-TEST #2 0.5.6 #4 0.5.4

-.55

.725

268.96

PLANT Metro Ceramic DATE 4/14/94 RUN# Pre 2 LOCATION Kiln Exhaust page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{sw}	$\sqrt{\Delta p}$
1	.52	250		.721
2	.52	265		.721
3	.50	278		.707
4	.47	281		.686
5	~~.40~~ .45	280		.671
6	.43	288		.656
1	.55	280		.742
2	.53	290		.728
3	.49	289		.7
4	.44	286		.663
5	.44	283		.663
6	.44	287		.663
1	.53	283		.728
2	.55	287		.742
3	.54	289		.735
4	.52	289		.721
5	.49	290		.7
6	.46	289		.678
1	.55	282		.742
2	.55	286		.742
3	.57	287		.755
4	.57	288		.755
5	.55	289		.742
6	.53	285		.728

PITOT TUBE LEAK CHECKS

PRE-TEST #2 0@7.9 POST-TEST #2 0@6.1

#4 0@7.1 #4 0@7.8

.712

283.33

PLANT Metro Ceramic DATE 4/14/94 RUN# Pre 3 LOCATION Kiln Exhaust page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_S	TEMPERATURE WET T_{SU}	$\sqrt{\Delta p}$
1	.60	280		.775
2	.61	286		.781
3	.58	290		.762
4	.57	290		.755
5	.56	294		.748
6	.53	297		.728
1	.53	275		.728
2	.56	285		.748
3	.57	287		.755
4	.54	290		.735
5	.50	290		.707
6	.46	291		.678
1	.56	278		.748
2	.57	284		.755
3	.56	285		.748
4	.54	280		.735
5	.52	289		.721
6	.45	290		.671
1	.53	280		.728
2	.57	281		.755
3	.58	285		.762
4	.58	291		.762
5	.58	288		.762
6	.56	280		.748

PITOT TUBE LEAK CHECKS

PRE-TEST #2 0 0 6 7 POST-TEST #2 0 0 6 1

#4 @ 5.6 #4 @ 7.4

286.42

.741

PLANT Metro Ceramic DATE 4/14/94 RUN# Post 3 LOCATION Kiln Exhaust page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{su}	$\sqrt{\Delta p}$
1	.54	279		.748
2	.57	281		.755
3	.54	282		.735
4	.52	285		.721
5	.48	283		.693
6	.42	280		.648
1	.51	288		.714
2	.52	291		.721
3	.50	293		.707
4	.51	289		.714
5	.49	291		.7
6	.47	287		.686
1	.49	280		.7
2	.51	283		.714
3	.52	288		.721
4	.54	288		.735
5	.53	287		.728
6	.54	281		.735
1	.53	275		.728
2	.54	283		.735
3	.55	287		.742
4	.54	289		.735
5	.53	290		.728
6	.52	281		.721

PITOT TUBE LEAK CHECKS

PRE-TEST #2 OK 1 POST-TEST #2 OK 5

#4 OK 1.8 #4 OK 5.9

.721

285.04

CALIBRATION SECTION

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DRY GAS METER CALIBRATION

Using Wet Test Meter

Meter Box Number	MB 1A	65	deg F, Ambient Temp.
Calibration Date	3/18/94	28.28	"Hg, Baro. Press.
Technician	Krisak		

Dry Gas Meter

Orifice Differential	*"H2O*	1.0	2.0	3.0	4.0
Meter Temperature	*deg F*	102.0	105.0	105.5	105.5
Volume	*cu ft*	7.300	14.175	26.500	28.195

Wet Test Meter

Orifice Differential	*"H2O*	-1.4	-2.1	-3.0	-4.0
Volume	*cu ft*	6.790	13.375	25.005	26.715
Temperature	*deg F*	66.0	65.5	65.0	65.0
Time of Test	*minutes*	11.75	17.00	26.25	24.50
Totals					
Delta H@	*.75 cfm*	1.69	1.82	1.86	1.89
Y Factor		0.991	1.009	1.009	1.010

Dry Gas Meter	MB 1A
Average Delta H@	1.82
Average Y Factor	1.005

CALCULATIONS

$$Y = \frac{Vt * Pbar * (Tm)}{Vm * [\ Pbar + (\Delta H / 13.6)\ ] * (Tmw)}$$

$$\Delta H@ = \frac{.0317 * \Delta H * Tmo * min}{Pbar * (Tm) * Vw}$$

NOMENCLATURE

Orifice Differential	= ^H	Dry Gas Meter	= sub m
Temperature	= T	Wet Test Meter	= sub w
Volume	= cu ft	Barometric Pressure	= Pbar
Time of Test	= min		

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DRY GAS METER CALIBRATION

Using Wet Test Meter

Meter Box Number	MB 01	62	deg F, Ambient Temp.
Calibration Date	4/1/94	28.96	"Hg, Baro. Press.
Technician	Krisak		

Dry Gas Meter

Orifice Differential	*"H2O*	1.0	2.0	3.0	4.0
Meter Temperature	*deg F*	74.3	76.3	78.0	79.8
Volume	*cu ft*	6.430	9.050	17.555	14.830

Wet Test Meter

Orifice Differential	*"H2O*	-1.5	-2.5	-3.5	-4.3
Volume	*cu ft*	6.274	8.765	16.850	14.105
Temperature	*deg F*	61.0	61.0	61.0	61.0
Time of Test	*minutes*	11.00	11.00	17.50	13.00

Totals

Delta H@	*.75 cfm*	1.73	1.77	1.81	1.90
Y Factor		0.998	0.992	0.984	0.975

Dry Gas Meter	MB 01
Average Delta H@	1.80
Average Y Factor	0.987

CALCULATIONS

$$Y = \frac{Vw * Pbar * (Tm)}{Vm * [\ Pbar + (\Delta H / 13.6)\ ] * (Tw)}$$

$$\Delta H@ = \frac{.0317 * \Delta H * Tmo * min}{Pbar * (Tm) * Vw}$$

NOMENCLATURE

Orifice Differential	= ^H	Dry Gas Meter	= sub m
Temperature	= T	Wet Test Meter	= sub w
Volume	= cu ft	Barometric Pressure	= Pbar
Time of Test	= min		

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"S" TYPE PITOT TUBE CALIBRATION

"S" Type Pitot Tube (Probe) # 501 - 5 ft Probe

Calibration Date: March 4, 1994

$$C_p = C_{std} \sqrt{\frac{\Delta p_{std}}{\Delta p_p}} \qquad \text{(EPA Equation 2-2)}$$

where:

C_p = Coefficient of Type S pitot tube, dimensionless

C_{std} = Coefficient of Standard Pitot Tube (0.99), dimensionless

Δp_{std} = Velocity head measured by standard pitot tube, inches H_2O

Δp_p = Velocity head measured by Type S pitot tube, inches H_2O

	Δp_{std}	Δp_p	C_p
Side A	0.23	0.32	0.839
Side B	0.23	0.32	0.839
Side A	0.41	0.56	0.847
Side B	0.41	0.56	0.847
Side A	0.82	1.14	0.840
Side B	0.82	1.14	0.840

Average - 0.84

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"S" TYPE PITOT TUBE CALIBRATION

"S" Type Pitot Tube (Probe) # 303 - 3 ft Probe

Calibration Date: March 4, 1994

$$C_p = C_{std} \sqrt{\frac{\Delta p_{std}}{\Delta p_p}}$$ (EPA Equation 2-2)

where:

C_p = Coefficient of Type S pitot tube, dimensionless

C_{std} = Coefficient of Standard Pitot Tube (0.99), dimensionless

Δp_{std} = Velocity head measured by standard pitot tube, inches H_2O

Δp_p = Velocity head measured by Type S pitot tube, inches H_2O

	Δp_{std}	Δp_p	C_p
Side A	0.27	0.38	0.834
Side B	0.27	0.38	0.834
Side A	0.44	0.61	0.841
Side B	0.44	0.61	0.841
Side A	0.78	1.06	0.849
Side B	0.78	1.06	0.849

Average - 0.84

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Thermocouple/Thermometer Calibration

Calibration Date: April 11, 1994

Technician: Krisak

Identification Number	Low Reading	Reference	Medium Reading	Reference	High Reading	Reference	Average Deviation
1	44	45	86	86	206	208	1.00
2	42	42	89	89	209	209	0.00
3	46	45	90	90	209	210	0.67
4	44	44	91	91	208	209	0.33
5	45	46	82	80	204	204	1.00
6	46	45	92	92	205	205	0.33
7	41	40	91	91	204	204	0.33
8	40	41	89	89	204	204	0.33
9	42	42	88	87	203	206	1.33
10	44	44	87	87	202	202	0.00
11	46	46	92	91	200	200	0.33
12	48	47	91	91	200	200	0.33
13	44	45	94	94	198	199	0.67
14	42	42	96	96	198	200	0.67
15	41	41	96	96	196	198	0.67
16	40	40	96	96	196	195	0.33
17	44	44	94	94	195	195	0.00
18	44	44	95	95	195	195	0.00
19	45	45	94	94	200	201	0.33
20	42	42	94	94	201	202	0.33
21	41	41	95	96	202	203	0.67

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EMISSION SAMPLING NOMENCLATURE

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SAMPLING NOMENCLATURE

A = Cross sectional area of stack or duct, $ft.^2$.

A_n = Cross sectional area of nozzle entry plane, $ft.^2$.

B_{ws} = Water vapor in gas stream, proportion by volume.

C = Nomograph correction factor, dimensionless.

C_s = Concentration of particulate matter in gas stream, dry basis-corrected to standard conditions, gr/dscf.

D_n = Nominal diameter of probe nozzle entry plane, in.

E = Particulate Emission Rate, lb./hr.

$\hat{}H$ = Average pressure differential across orifice, in. of H_2O.

$\hat{}H_@$ = Orifice meter calibration factor, in. of H_2O.

I = Percent of isokinetic sampling, %.

K_p = Pitot tube constant, 85.49 ft./sec.

M_d = Molecular weight of gas, dry basis, lb./lb.-mole.

M_n = Total amount of particulate matter collected, g.

M_s = Molecular weight of gas, wet basis, lb./lb.-mole.

M_w = Molecular weight of water, 18 lb./lb.-mole.

P_{bar} = Barometric pressure, in. of H_g.

P_g = Pressure differential from gas stream to atmosphere, (static pressure) in. of H_2O.

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SAMPLING NOMENCLATURE - continued

P_s = Absolute gas stream pressure, $(P_{bar} + P_g/13.6)$ in. of H_g.

P_{std} = Absolute pressure at standard conditions, 29.92 in. of H_g.

PPM = Parts per million

P_w = Density of water, 0.0022 lb./ml.

ΔP_{avg} = Average of the square roots of the velocity head readings, in. of H_2O.

Q = Volumetric flow rate at gas stream conditions, A.C.F.M.

Q_{std} = Dry volumetric gas flow rate corrected to standard conditions, D.S.C.F.M.

R = Ideal gas constant, 21.85 in. of H_g-ft^3 / °R-lb.-mole.

t = Total sampling time, minutes.

T_m = Average dry gas meter temperature, °R.

T_s = Average absolute gas stream temperature, °R.

T_{std} = Standard absolute temperature, 528° rankine.

V_{lc} = Volume of water collected in impingers and silica gel, ml.

VOC = Volatile organic compounds

V_m = Volume of gas sample measured at meter box (meter conditions), $ft.^3$.

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), $ft.^3$.

V_s = Average gas stream velocity, ft./sec.

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$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions), $ft.^3$.

13.6 = Specific gravity of mercury (H_g).

$\%CO_2$ = Percent by volume of CO_2 in gas stream (dry basis).

$\%O_2$ = Percent by volume of O_2 in gas stream (dry basis).

%CO = Percent by volume of CO in gas stream (dry basis).

$\%N_2$ = Percent by volume of N_2 in gas stream (dry basis).

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EMISSION SAMPLING CALCULATIONS

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1) Volume of dry gas sampled through meter box at standard conditions,

$$V_{m(std)} = V_m \left[\frac{T_{std}}{T_m} \right] \left[\frac{P_b + \frac{\Delta H}{13.6}}{P_{std}} \right]$$

(EPA Equation 5-1)

Where:

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

V_m = Volume of gas sample measured at meter box (meter conditions), ft^3.

T_{std} = Standard absolute temperature, 528^o Rankine.

T_m = Average dry gas meter temperature, ^oR.

P_{bar} = Barometric Pressure, in. Hg.

ΔH = Average pressure differential across orifice, in. H_2O.

13.6 = Specific gravity of mercury (Hg).

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Example: Run 1

V_m = 43.73 ft^3

T_m = 567.1 ^oR

ΔH = 1.50 in. H_2O

P_{bar} = 29.02 in. Hg

$$V_{m(std)} = 43.73 \left[\frac{528.0}{567.1} \right] \left[\frac{29.02 + \frac{1.50}{13.6}}{29.92} \right]$$

$$= 43.73 \quad (0.9310) \quad (0.9736)$$

$$= 39.64 \quad ft^3$$

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2) Volume of water vapor collected at standard conditions,

$$V_{w(std)} = V_{lc} \left[\frac{P_w}{M_w} \right] \left[\frac{(R)(T_{std})}{P_{std}} \right]$$

(EPA Equation 5-2)

Where:

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions) ft^3.

V_{lc} = Volume of water collected in impingers & silica gel, ml.

P_w = Density of water, 0.0022 lb/ml.

M_w = Molecular weight of water, 18 lb/lb-mole.

R = Ideal gas constant, 21.85 in. Hg-ft^3/ ^oR-lb-mole.

T_{std} = Standard absolute temperature, 528 ^{o} Rankine.

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Example: Run 1

V_{lc} = 33.2 ml

$$V_{w(std)} = 33.2 \left[\frac{0.0022}{18.0} \right] \left[\frac{(21.85)(528.0)}{29.92} \right]$$

= 1.56 ft^3

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3) Moisture content of gas stream,

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$

(EPA Equation 5-3)

Where:

B_{ws} = Water vapor in gas stream, proportion by volume.

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions) ft^3.

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

Example: Run 1

$V_{w(std)}$ = 1.56 ft^3

$V_{m(std)}$ = 39.64 ft^3

$$B_{ws} = \frac{1.56}{39.64 + 1.56}$$

$$= 0.0379$$

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4) Dry Molecular Weight of gas in gas stream,

$$M_d = 0.440\ (\%CO_2) + 0.320\ (\%O_2) + 0.280\ (\%N_2 + \%CO)$$

(EPA Equation 3-2)

Where:

M_d = Molecular weight of gas, dry basis, lb/lb-mole.

0.440 = Molecular weight of CO_2 divided by 100.

0.320 = Molecular weight of O_2 divided by 100.

0.280 = Molecular weight of N_2 or CO (same for both compounds) divided by 100.

$\%\ CO_2$ = Percent by volume of CO_2 in gas stream (dry basis).

$\%\ O_2$ = Percent by volume of O_2 in gas stream (dry basis).

% CO = Percent by volume of CO in gas stream (dry basis).

$\%\ N_2$ = Percent by volume of N_2 in gas stream (dry basis).

Example: Run 1

$\%\ CO_2$ = 1.0

$\%\ O_2$ = 20.0

% CO = 0.0

$\%\ N_2$ = 79.0

M_d = 0.440 (1.0) + 0.320 (20.0) + 0.280 (79.0)

= 0.440 + 6.400 + 22.120

= 28.96 lb/lb-mole

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5) Molecular Weight of gas in gas stream,

$$M_s = M_d (1 - B_{ws}) + M_w (B_{ws})$$

(EPA Equation 2-5)

Where:

M_s = Molecular weight of gas, wet basis, lb/lb-mole.

M_d = Molecular weight of gas, dry basis, lb/lb-mole.

B_{ws} = Water vapor in gas stream, proportion by volume.

M_w = Molecular weight of water, 18 lb/lb-mole.

Example: Run 1

M_d = 28.96 lb/lb-mole

B_{ws} = 0.0379

M_s = 28.96 (1 - 0.0379) + 18 (0.0379)

= 27.862 + 0.683

= 28.54 lb/lb-mole

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6) Average Gas Stream Velocity,

$$V_s = K_p \, C_p \, \Delta P_{avg} \sqrt{\frac{T_s}{P_s \, M_s}}$$

(EPA Equation 2-9)

Where:

V_s = Average gas stream velocity, ft/sec.

K_p = Pitot tube constant, $85.49 \; \frac{ft}{sec} \left| \frac{(lb/lb\text{-}mole)(in.Hg)}{(^oR)(in.H_2O)} \right|^{1/2}$

C_p = Pitot tube coefficient, dimensionless.

ΔP_{avg} = Average of the square roots of the velocity head readings, ($\sqrt{\Delta p}$) ($in.H_2O$).

T_s = Average absolute gas stream temperature, ^oR.

P_s = Absolute gas stream pressure, $(P_{bar} + P_g/13.6)$ in.Hg.

P_{bar} = Barometric Pressure, in. Hg.

P_g = Pressure differential from gas stream to atmosphere, (static pressure) $in.H_2O$.

M_s = Molecular weight of gas, wet basis, lb/lb-mole.

Example: Run 1

C_p = 0.84

ΔP_{avg} = 0.668 $in.H_2O^{1/2}$

T_s = 733.2 ^oR

P_s = $P_{bar} + P_g/13.6$ = 29.02 + -0.71 /13.6 = 28.97 in.Hg

M_s = 28.54 lb/lb-mole

$$V_s = (85.49)(0.84) (0.668) \sqrt{\frac{733.2}{(28.97) (28.54)}}$$

= 45.17 ft/sec

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7) Volumetric Flow Rate at Gas Stream Conditions,

$$Q = A \times V_s \times 60$$

Where:

Q = Volumetric flow rate at gas stream conditions, A.C.F.M.

A = Cross sectional area of stack or duct, ft^2.

V_s = Average gas stream velocity, ft/sec.

60 = Conversion factor from seconds to minutes.

Example: Run 1

A = 19.63 ft^2

V_s = 45.17 ft/sec

$Q = (19.63) (45.17) 60$

$= 53,215$ ACFM

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8) Volumetric Flow Rate at Standard Conditions,

$$Q_{sd} = 60 \quad (1 - B_{ws}) \quad V_s \quad A \left| \frac{T_{std}}{T_s} \right| \left| \frac{P_s}{P_{std}} \right| \qquad 67$$

(EPA Equation 2-10)

Where:

Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, S.C.F.M.

60 = Conversion factor from seconds to minutes.

B_{ws} = Water vapor in gas stream, proportion by volume.

V_s = Average gas stream velocity, ft/sec.

A = Cross sectional area of stack or duct, ft^2.

T_{std} = Standard absolute temperature, 528 ^{o} Rankine.

T_s = Average absolute gas stream temperature, ^oR.

P_s = Absolute gas stream pressure, $(P_{bar} + P_g/13.6)$ in.Hg.

P_{bar} = Barometric Pressure, in. Hg.

P_g = Pressure differential from gas stream to atmosphere, (static pressure) in.H_2O.

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Example: Run 1

B_{ws} = 0.0379

V_s = 45.17 ft/sec

A = 19.63 ft^2

T_s = 733.2 ^oR

P_s = $P_{bar} + P_g /13.6$ = 29.02 + -0.71 /13.6 = 28.97 in.Hg

$$Q_{sd} = 60 \quad (1 - 0.0379) \quad (\quad 45.17 \quad) \quad (\quad 19.63 \quad) \left(\frac{528.0}{733.2} \right) \left(\frac{28.97}{29.92} \right)$$

= 35,697 SCFM

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9) Gas Stream Particulate Concentration,

$$C_s = 15.43 \text{ gr./g} \left| \frac{M_n}{V_{m(std)}} \right|$$

(EPA Equation 5-6)

Where:

C_s = Concentration of particulate matter in gas stream, dry basis-corrected to standard conditions, gr/dscf.

M_n = Total amount of particulate matter collected in probe wash and on filter, g.

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

Example: Run 1

$$M_n = \underset{\text{(probe)}}{0.0208} + \underset{\text{(filter)}}{0.0558} = 0.0766 \text{ g}$$

$$V_{m(std)} = 39.64 \text{ ft}^3$$

$$C_s = 15.43 \left| \frac{0.0766}{39.64} \right|$$

$$= 0.0298 \text{ gr/dscf}$$

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10) Particulate Emission Rate,

$$E = Q_{sd} \; C_s \left[\frac{1 \text{ pound}}{7000 \text{ grains}}\right] \left[\frac{60 \text{ minutes}}{1 \text{ hour}}\right]$$

Where:

E = Particulate Emission Rate, lb/hr.

Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, S.C.F.M.

C_s = Concentration of particulate matter in gas stream, dry basis-corrected to standard conditions, gr/dscf.

Example: Run 1

Q_{sd} = 35,697 ft^3

C_s = 0.0298 gr/dscf

$$E = (\ 35,697\ )\ (\ 0.0298\ ) \left[\frac{60}{7000}\right]$$

= 9.12 lb/hr

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11) Percent of Isokinetic Sampling,

$$I = \frac{100\ T_s \left[K_3\ V_{lc} + \left[\frac{V_m}{T_m} \right] \left[P_{bar} + \frac{\Delta H}{13.6} \right] \right]}{60\ A_n\ V_s\ P_s\ t} \qquad 70$$

(EPA Equation 5-7

Where:

I = Percent of Isokinetic sampling, %.

T_s = Average absolute gas stream temperature, ^oR.

K_3 = Constant, 0.002669 in.Hg-ft^3/ml-^oR.

V_{lc} = Volume of water collected in impingers & silica gel, ml.

V_m = Gas sample volume measured at meter box (meter conditions), ft^3.

T_m = Average dry gas meter temperature, ^oR.

P_{bar} = Barometric Pressure, in. Hg.

ΔH = Average pressure differential across orifice, in. H_2O.

t = Total sampling time, minutes.

V_s = Average gas stream velocity, ft/sec.

P_s = Absolute gas stream pressure, in.Hg.

D_n = Nominal diameter of probe nozzle tip, inches.

A_n = Cross sectional area of nozzle, ft^2.

Example: Run 1

T_s	=	733.2	^oR	ΔH	=	1.50	in.H_2O
V_{lc}	=	33.2	ml	t	=	60.0	min.
V_m	=	43.73	ft^3	V_s	=	45.17	ft/sec
T_m	=	567.1	^oR	P_s	=	28.97	in.Hg
A_n	=	0.0003408	ft^2	P_{bar}	=	29.02	in.Hg
"Y"	=	1.000					

$$I = \frac{733.2\ (\ 100\ ) \left[0.002669\ (\ 33.2\ ) + \left[\frac{43.73}{567.1} \right] \left[29.02 + \frac{1.50}{13.6} \right] \right]}{60\ (0.0003408\ )\ (\ 45.17\ )\ (\ 28.97\ )\ (\ 60.0\ )} *$$

$$= 106.6\ \%$$

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Gas Stream Fluoride Concentration,

$$C_s = 15.43 \text{ gr./g} \left[\frac{M_n}{V_{m(std)}} \right]$$

(EPA Equation 5-6)

Where:

C_s = Concentration of fluoride matter in gas stream, dry basis-corrected to standard conditions, gr/dscf.

M_n = Total amount of fluoride matter collected in probe wash and on filter, g.

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

Example: Run 1

M_n = 0.0221

$V_{m(std)}$ = 39.64 ft^3

$$C_s = 15.43 \left[\frac{0.0221}{39.64} \right]$$

= 8.60E-03 gr/dscf

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P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

Fluoride Emission Rate,

$$E = Q_{sd}\ C_s \left[\frac{1 \text{ pound}}{7000 \text{ grains}}\right] \left[\frac{60 \text{ minutes}}{1 \text{ hour}}\right]$$

Where:

E = Fluoride Emission Rate, lb/hr.

Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, S.C.F.M.

C_s = Concentration of Fluoride matter in gas stream, dry basis-corrected to standard conditions, gr/dscf.

Example: Run 1

Q_{sd} = 35,697 ft^3

C_s = 0.0086 gr/dscf

$$E = (\ 35,697\ )\ (\ 0.0086\ ) \left[\frac{60}{7000}\right]$$

= 2.63 lb/hr

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1) Volume of dry gas sampled through meter box at standard conditions,

$$V_{m(std)} = V_m \left[\frac{T_{std}}{T_m} \right] \left[\frac{P_b + \frac{\Delta H}{13.6}}{P_{std}} \right]$$

(EPA Equation 5-1)

Where:

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

V_m = Volume of gas sample measured at meter box (meter conditions), ft^3.

T_{std} = Standard absolute temperature, 528^o Rankine.

T_m = Average dry gas meter temperature, ^oR.

P_{bar} = Barometric Pressure, in. Hg.

ΔH = Average pressure differential across orifice, in. H_2O.

13.6 = Specific gravity of mercury (Hg).

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Example: Run 1

V_m = 46.25 ft^3

T_m = 547.4 ^oR

ΔH = 1.80 in. H_2O

P_{bar} = 29.02 in. Hg

$$V_{m(std)} = 46.25 \left[\frac{528.0}{547.4} \right] \left[\frac{29.02 + \frac{1.80}{13.6}}{29.92} \right]$$

= 43.47 ft^3

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2) Volume of water vapor collected at standard conditions,

$$V_{w(std)} = V_{lc} \left| \frac{P_w}{M_w} \right| \left| \frac{(R)(T_{std})}{P_{std}} \right|$$

(EPA Equation 5-2)

Where:

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions) ft^3.
V_{lc} = Volume of water collected in impingers & silica gel, ml.
P_w = Density of water, 0.0022 lb/ml.
M_w = Molecular weight of water, 18 lb/lb-mole.
R = Ideal gas constant, 21.85 in. Hg-ft^3/ ^oR-lb-mole.
T_{std} = Standard absolute temperature, 528 ^{o} Rankine.
P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Example: Run 1

V_{lc} = 36.0 ml

$$V_{w(std)} = 36.0 \left| \frac{0.0022}{18.0} \right| \left| \frac{(21.83)(528.0)}{29.92} \right|$$

= 1.70 ft^3

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3) Moisture content of gas stream,

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}}$$

(EPA Equation 5-3)

Where:

B_{ws} = Water vapor in gas stream, proportion by volume.

$V_{w(std)}$ = Volume of water vapor in gas sample (standard conditions) ft^3.

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

Example: Run 1

$V_{w(std)} = 1.70 \ ft^3$

$V_{m(std)} = 43.47 \ ft^3$

$$B_{ws} = \frac{1.70}{43.47 + 1.70}$$

$$= 0.0375$$

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Phone (216) 526-0990

4) Dry Molecular Weight of gas in gas stream,

$$M_d = 0.440\ (\%CO_2) + 0.320\ (\%O_2) + 0.280\ (\%N_2 + \%CO)$$

(EPA Equation 3-2)

Where:

M_d = Molecular weight of gas, dry basis, lb/lb-mole.

0.440 = Molecular weight of CO_2 divided by 100.

0.320 = Molecular weight of O_2 divided by 100.

0.280 = Molecular weight of N_2 or CO (same for both compounds) divided by 100.

% CO_2 = Percent by volume of CO_2 in gas stream (dry basis).

% O_2 = Percent by volume of O_2 in gas stream (dry basis).

% CO = Percent by volume of CO in gas stream (dry basis).

% N_2 = Percent by volume of N_2 in gas stream (dry basis).

Example: Run 1

% CO_2 = 1.0

% O_2 = 18.8

% CO = 0.0

% N_2 = 80.2

M_d = 0.440 (1.0) + 0.320 (18.8) + 0.280 (80.2)

= 28.91 lb/lb-mole

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5) Molecular Weight of gas in gas stream,

$$M_s = M_d (1 - B_{ws}) + M_w (B_{ws})$$

(EPA Equation 2-5)

Where:

M_s = Molecular weight of gas, wet basis, lb/lb-mole.

M_d = Molecular weight of gas, dry basis, lb/lb-mole.

B_{ws} = Water vapor in gas stream, proportion by volume.

M_w = Molecular weight of water, 18 lb/lb-mole.

Example: Run 1

M_d = 28.91 lb/lb-mole

B_{ws} = 0.0375

M_s = 28.91 (1 - 0.0375) + 18 (0.0375)

= 28.50 lb/lb-mole

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6) Average Gas Stream Velocity,

$$V_s = K_p \; C_p \; \Delta P_{avg} \sqrt{\frac{T_s}{P_s \; M_s}}$$

(EPA Equation 2-9)

Where:

V_s = Average gas stream velocity, ft/sec.

K_p = Pitot tube constant, 85.49 $\frac{ft}{sec} \left| \frac{(lb/lb\text{-}mole)(in.Hg)}{(^oR)(in.H_2O)} \right|^{1/2}$

C_p = Pitot tube coefficient, dimensionless.

ΔP_{avg} = Average of the square roots of the velocity head readings, ($\sqrt{\Delta p}$) ($in.H_2O$).

T_s = Average absolute gas stream temperature, ^oR.

P_s = Absolute gas stream pressure, ($P_{bar} + P_g/13.6$) in.Hg.

P_{bar} = Barometric Pressure, in. Hg.

P_g = Pressure differential from gas stream to atmosphere, (static pressure) $in.H_2O$.

M_s = Molecular weight of gas, wet basis, lb/lb-mole.

Example: Run 1

C_p = 0.84

ΔP_{avg} = 0.719 $in.H_2O^{1/2}$

T_s = 736.1 ^oR

P_s = $P_{bar} + P_g/13.6$ = 29.02 + -0.55 /13.6 = 28.98 in.Hg

M_s = 28.50 lb/lb-mole

$$V_s = (85.49)(0.84)(0.719)\sqrt{\frac{736.1}{(28.98)(28.50)}}$$

$$= 48.71 \text{ ft/sec}$$

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7) Volumetric Flow Rate at Gas Stream Conditions,

$$Q = A \times V_s \times 60$$

Where:

Q = Volumetric flow rate at gas stream conditions, A.C.F.M.

A = Cross sectional area of stack or duct, ft^2.

V_s = Average gas stream velocity, ft/sec.

60 = Conversion factor from seconds to minutes.

Example: Run 1

A = 19.63 ft^2

V_s = 48.71 ft/sec

$$Q = (19.63) (48.71) 60$$

$$= 57,385 \text{ ACFM}$$

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Phone (216) 526-0990

8) Volumetric Flow Rate at Standard Conditions,

$$Q_{sd} = 60 \quad (1 - B_{ws}) \quad V_s \quad A \left| \frac{T_{std}}{T_s} \right| \left| \frac{P_s}{P_{std}} \right|$$

(EPA Equation 2-10)

Where:

Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, S.C.F.M.

60 = Conversion factor from seconds to minutes.

B_{ws} = Water vapor in gas stream, proportion by volume.

V_s = Average gas stream velocity, ft/sec.

A = Cross sectional area of stack or duct, ft^2.

T_{std} = Standard absolute temperature, 528 ^{o} Rankine.

T_s = Average absolute gas stream temperature, ^oR.

P_s = Absolute gas stream pressure, $(P_{bar} + P_g/13.6)$ in.Hg.

P_{bar} = Barometric Pressure, in. Hg.

P_g = Pressure differential from gas stream to atmosphere, (static pressure) in.H_2O.

P_{std} = Absolute pressure at standard conditions, 29.92 in. Hg.

Example: Run 1

B_{ws} = 0.0375

V_s = 48.71 ft/sec

A = 19.63 ft^2

T_s = 736.1 ^oR

$P_s = P_{bar} + P_g /13.6 = 29.02 + -0.55 /13.6 = 28.98$ in.Hg

$$Q_{sd} = 60 \quad (1 - 0.0375) \quad (48.710) \quad (19.63 \left| \frac{528.0}{736.1} \right| \left| \frac{28.98}{29.92} \right|$$

= 38,369 SCFM

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9) Gas Stream Sulfur dioxide Concentration (lb/dscf),

$$C_{SO_2} = K_2 \frac{(V_t - V_{tb})\ N \left| - \frac{Vsln}{Va} - \right|}{V_{m(std)}}$$

(EPA Equation 6-2)

Where:

C_{SO_2} = Concentration of sulfur dioxide, dry basis corrected to standard conditions, lb/dscf.

K_2 = Constant, 7.061×10^{-5} lb/meq.

V_t = Volume of barium perchlorate titrant used for the sample, ml (average of replicate titrations).

V_{tb} = Volume of barium perchlorate titrant used for the blank, ml.

N = Normality of barium perchlorate titrant, milliequivalents/ml.

V_{sln} = Total volume of solution in which the sulfur dioxide sample is contained, ml.

V_a = Volume of aliquot titrated, ml.

$V_{m(std)}$ = Volume of gas sample measured at meter box (corrected to standard conditions), ft^3.

Example: Run 1

V_t	=	4.0	ml
V_{tb}	=	0.0	ml
N	=	0.0110	meq/ml
V_{sln}	=	240.0	ml
V_a	=	1.0	ml
$V_{m(std)}$	=	43.47	ft^3

$$C_{SO_2} = 7.061 \times 10^{-5} \frac{(4.0 - 0.0)\ 0.0110 \left| - \frac{240.0}{1.0} - \right|}{43.47}$$

$$= \frac{0.1703 \times 10^{-4}}{} \text{ lb/dscf}$$

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10) Gas Stream Sulfur dioxide Concentration (ppm),

$$PPM = C_{SO_2} \left| \frac{M.V.}{M.W.} \right| \times 10^6$$

Where:

PPM = Concentration of sulfur dioxide emissions, ppmV.

C_{SO_2} = Concentration of sulfur dioxide, dry basis corrected to standard conditions, lb/dscf.

M.V. = Molar volume at standard conditions of 68^{o} Fahrenheit and 29.92" Hg, 0.849531 ft^{3}/mole.

M.W. = Molecular weight of sulfur dioxide (64.0628 g /453.59 g/lb), 0.141235 lb/mole.

Example: Run 1

C_{SO_2} = 1.703E-05 lb/dscf

$$PPM = 1.703E\text{-}05 \left| \frac{0.849531}{0.141235} \right| \times 10^6$$

= 102.4 ppmV

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11) Sulfur dioxide Emission Rate,

$$E_{SO_2} = C_{SO_2} \; Q_{sd} \left[\frac{60 \text{ minutes}}{1 \text{ hour}} \right]$$

Where:

E_{SO_2} = Sulfur Dioxide Emission Rate, lb/hr.

Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, S.C.F.M.

C_{SO_2} = Concentration of sulfur dioxide, dry basis corrected to standard conditions, lb/dscf.

Example: Run 1

Q_{sd} = 38,369 SCFM

C_{SO_2} = 1.703E-05 lb/dscf

E_{SO_2} = (1.703E-05)(38,369) (60)

= 39.19 lb/hr

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P.O. Box 152 Richfield, Ohio 44286
Phone (216) 526-0990

Run #1

VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Metropolitan Industries
LOCATION: 1201 Millerton Rd. SE
LOCATION: 15 76 05 1149
CITY: Canton | STATE: OH | ZIP: 44707

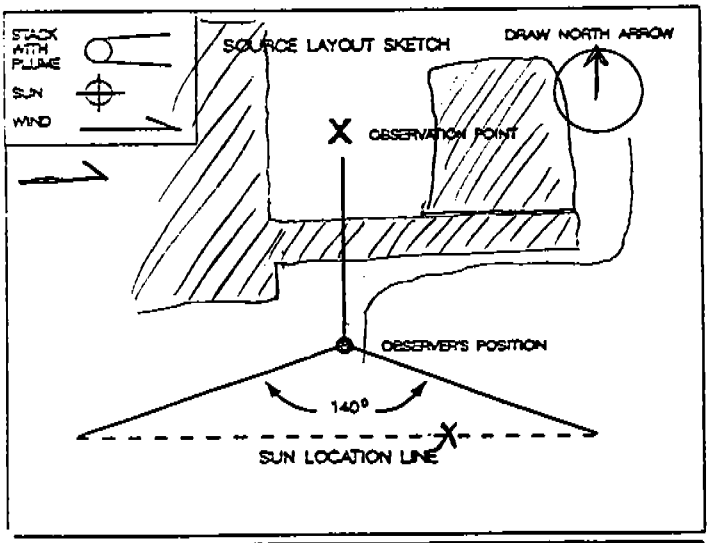
PROCESS EQUIPMENT: Tile Tunnel Kilns #1 #2 #3 | OPERATING MODE: #1 + #2 — 1190°F, #3 — 1150°F
CONTROL EQUIPMENT: none | OPERATING MODE:

DESCRIBE EMISSION POINT: Top of Rnd. Stainless stack — 5' in dia.

HEIGHT ABOVE GROUND LEVEL: START 2150' END | HEIGHT RELATIVE TO OBSERVER: START 2150' END
DISTANCE FROM OBSERVER: START 2525' END | DIRECTION FROM OBSERVER: START N END
VERTICAL ANGLE TO OBS. PT.: START 18° END | DIRECTION TO OBS. PT.: START N END

DESCRIBE EMISSIONS: START detached END
EMISSION COLOR: START bluish/wht. END | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ NA ☑
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START #4 [illegible]0' END

DESCRIBE PLUME BACKGROUND: START sky END
BACKGROUND COLOR: START blue/wht/gray END | SKY CONDITIONS: START bro ken END
WIND SPEED: START 5-10 mph END | WIND DIRECTION: START W END
AMBIENT TEMP: START 32°F END | WET BULB TEMP: | RH PERCENT: 81%



ADDITIONAL INFORMATION:

FORM NUMBER: Run #1 | PAGE: 1 OF 2

OBSERVATION DATE: 3/30/94 | START TIME: 11:11 | END TIME: 12:11

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5	5	0	0	0	
6	5	0	0	0	
7	0	5	0	0	
8	0	5	5	5	
9	5	5	5	5	
10	5	5	5	0	
11	0	0	0	0	
12	5	0	5	0	
13	5	5	5	5	
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15	10	10	5	5	Blue sky
16	5	5	5	5	
17	5	10	10	10	Blue sky
18	5	10	10	10	Blue sky
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26	0	5	5	5	
27	5	5	0	0	
28	0	0	5	5	
29	5	5	5	0	
30	0	5	5	5	

OBSERVER'S NAME (PRINT): Rick L. Miller
OBSERVER'S SIGNATURE: Rick L. Miller | DATE: 3/30/94
ORGANIZATION: Canton LAA
CERTIFIED BY: ETA | DATE: 3/23/94

CONTINUED ON VEO FORM NUMBER:

ETA Revised 05-01-92

VISIBLE EMISSION OBSERVATION FORM

DATA REDUCTION TABLE

SET NUMBER	TIME	OPACITY	
	START -- END	SUM	AVERAGE

FORM NUMBER

PAGE 2 OF 2

OBSERVATION DATE 3/30/94

START TIME

END TIME 12:11

SEC / MIN	0	15	30	45	COMMENTS
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2	0	0	5	0	
3	0	0	0	5	
4	5	5	5	5	
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6	5	10	10	0	
7	0	0	0	0	
8	5	5	0	10	
9	10	5	5	5	
10	5	0	0	0	
11	0	0	0	0	
12	0	0	0	5	
13	0	5	5	5	
14	0	5	0	5	
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25	5	0	5	5	
26	0	5	5	0	
27	5	5	5	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	0	0	0	

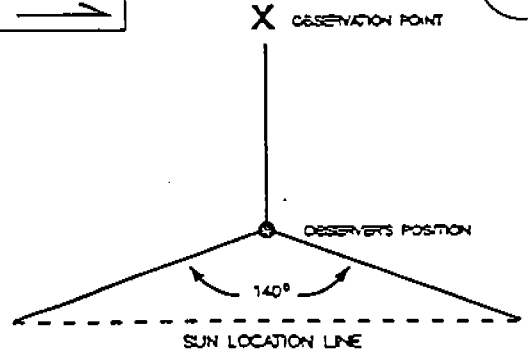
STACK WITH PLUME

SUN

WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



ADDITIONAL INFORMATION

OBSERVER'S NAME (PRINT) Rick L. Miller

OBSERVER'S SIGNATURE Rick L. Miller DATE 3/30/94

ORGANIZATION Canton LAA

CERTIFIED BY ETA DATE 3/23/94

CONTINUED ON VSO FORM NUMBER

Run #2

VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Metropolitan Industries

LOCATION: 1201 Millerton Rd. SE

LOCATION: 15 76 05 1149

CITY: Canton | STATE: OH | ZIP: 44707

PROCESS EQUIPMENT: Tilt Tunnel Kilns #1, #2, #3 | OPERATING MODE: #1 & #2 - 1190°F, #3 - 1150°F

CONTROL EQUIPMENT: none | OPERATING MODE:

DESCRIBE EMISSION POINT: Top of Rad. Stainless Stack - 5' in dia.

HEIGHT ABOVE GROUND LEVEL: START ~150' END | HEIGHT RELATIVE TO OBSERVER: START ~150' END

DISTANCE FROM OBSERVER: START ~525' END | DIRECTION FROM OBSERVER: START N END

VERTICAL ANGLE TO OBS. PT.: START 18° END | DIRECTION TO OBS. PT.: START N END

DESCRIBE EMISSIONS: START detached END

EMISSION COLOR: START Wht/Light END | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ NA ☑

DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ~4-10' END

DESCRIBE PLUME BACKGROUND: START Sky END

BACKGROUND COLOR: START Blue/Light/Gray END | SKY CONDITIONS: START Broken END

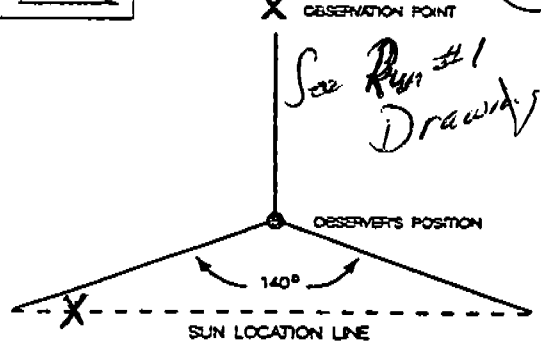
WIND SPEED: START 10-15 mph END | WIND DIRECTION: START W END

AMBIENT TEMP: START 39°F END | WET BULB TEMP | RH PERCENT

STACK WITH PLUME, SUN, WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



ADDITIONAL INFORMATION

FORM NUMBER: Run #2 | PAGE: 1 OF 2

OBSERVATION DATE: 3/30/94 | START TIME: 13:42 | END TIME: 14:27

SEC / MIN	0	15	30	45	COMMENTS
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25	5	0	5	5	
26	5	0	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	5	0	
30	0	0	0	0	

OBSERVER'S NAME (PRINT): Rick L. Miller

OBSERVER'S SIGNATURE: Rick L. Miller | DATE: 3/30/94

ORGANIZATION: Canton LAA

CERTIFIED BY: ETA | DATE: 3/23/94

CONTINUED ON VEO FORM NUMBER

VISIBLE EMISSION OBSERVATION FORM

DATA REDUCTION TABLE

SET NUMBER	TIME	OPACITY	
	START -- END	SUM	AVERAGE

FORM NUMBER | PAGE 2 OF 2

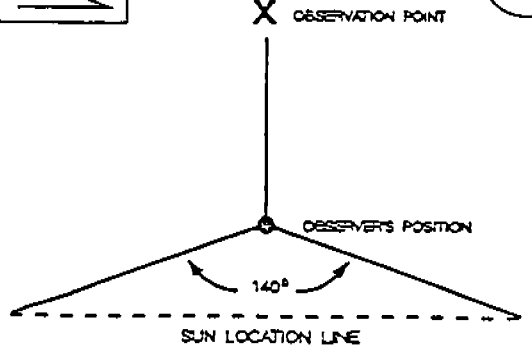
OBSERVATION DATE 3/30/94 | START TIME | END TIME 11:27

SEC / MIN	0	15	30	45	COMMENTS
1	0	0	5	0	
2	5	5	0	5	
3	5	5	5	5	Blue sky
4	5	5	5	5	" "
5	5	10	10	10	" "
6	10	5	5	0	" "
7	5	0	0	0	
8	0	0	0	5	
9	5	5	0	0	
10	0	0	0	5	
11	0	0	0	0	
12	0	0	5	0	
13	5	5	5	5	
14	0	5	0	0	
15	0	0	0	0	
16					Did not catch beginning of Run #2 stopped VE Readings to verify leak check
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					

STACK WITH PLUME
SUN
WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



OBSERVER'S NAME (PRINT) Rick L. Miller

OBSERVER'S SIGNATURE Rick L. Miller | DATE 3/30/94

ORGANIZATION Canton LAA

CERTIFIED BY ETA | DATE 3/23/94

ADDITIONAL INFORMATION

CONTINUED ON VEO FORM NUMBER

ETA Revised 05-01-92

Run #3

VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Metropolitan Industries
LOCATION: 1201 Millerton Rd. SE
LOCATION: 15 76 05 11419
CITY: Canton | STATE: OH | ZIP: 44707

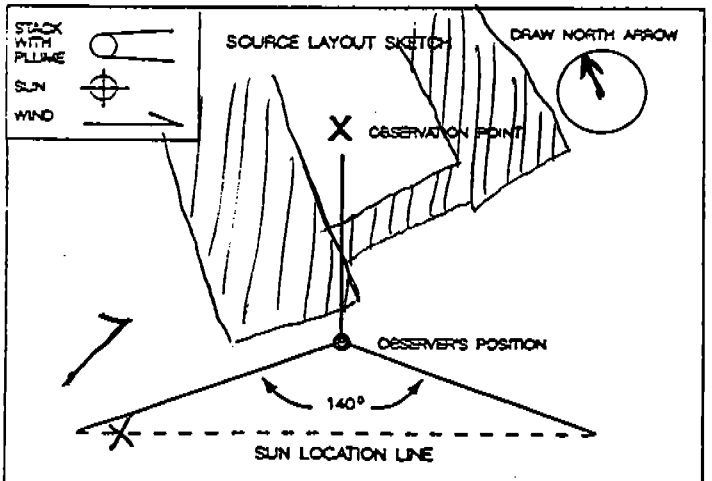
PROCESS EQUIPMENT: Tile Tunnel Kilns #1, #2, #3 | OPERATING MODE: #1 & #2 – 1190°F, #3 – 1150°F
CONTROL EQUIPMENT: none | OPERATING MODE:

DESCRIBE EMISSION POINT: Top of Rd. Stainless Stack - 5 in dia.

HEIGHT ABOVE GROUND LEVEL	HEIGHT RELATIVE TO OBSERVER
START ~150' END	START ~150' END
DISTANCE FROM OBSERVER	DIRECTION FROM OBSERVER
START ~525' END	START NNE END
VERTICAL ANGLE TO OBS. PT.	DIRECTION TO OBS. PT.
START 16° END	START NNE END

DESCRIBE EMISSIONS: START detached END
EMISSION COLOR: START Wht/lt gry END
IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ NA ☑
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ~4-10' END

DESCRIBE PLUME BACKGROUND: START Sky END
BACKGROUND COLOR: START blue/lt. gry/gry END
SKY CONDITIONS: START Broken END
WIND SPEED: START 10-15 mph END
WIND DIRECTION: START SW-WSW END
AMBIENT TEMP: START 40°F END
WET BULB TEMP:
RH PERCENT:



ADDITIONAL INFORMATION: Roadways need dust control

FORM NUMBER: Run #3 | PAGE: 1 OF 2

OBSERVATION DATE: 3/30/94 | START TIME: 15:03 | END TIME: 16:03

SEC / MIN	0	15	30	45	COMMENTS
1	5	5	5	5	
2	5	0	5	0	
3	5	0	5	5	
4	0	5	0	5	
5	5	0	5	5	
6	5	5	5	5	
7	0	0	0	0	
8	0	0	5	5	
9	0	0	0	5	
10	5	5	0	0	
11	0	5	5	5	
12	5	5	5	5	
13	0	5	0	0	
14	0	0	0	0	
15	5	5	0	0	
16	0	5	5	5	Blue Sky
17	5	5	5	10	" "
18	5	5	5	5	" "
19	5	5	5	5	" "
20	10	10	5	5	" "
21	5	5	5	5	" "
22	5	5	0	0	
23	5	5	0	5	
24	5	5	5	5	
25	5	5	0	5	
26	5	5	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	Blue Sky
30	0	0	0	0	" "

OBSERVER'S NAME (PRINT): Rick L. Miller
OBSERVER'S SIGNATURE: Rick L. Miller | DATE: 3/30/94
ORGANIZATION: Canton L.A.A.
CERTIFIED BY: ETA | DATE: 3/23/94

CONTINUED ON VEO FORM NUMBER:

VISIBLE EMISSION OBSERVATION FORM

DATA REDUCTION TABLE

SET NUMBER	TIME	OPACITY	
	START -- END	SUM	AVERAGE

FORM NUMBER

PAGE 2 OF 2

OBSERVATION DATE | START TIME | END TIME 16:03

SEC / MIN	0	15	30	45	COMMENTS
1	0	0	0	0	Blue sky
2	0	0	0	0	" "
3	0	0	0	5	" "
4	10	10	5	0	" "
5	0	5	5	5	
6	5	0	5	5	
7	0	0	5	0	
8	0	0	0	0	
9	5	5	5	10	
10	10	10	10	5	
11	5	0	0	0	
12	0	0	0	5	
13	5	5	0	0	
14	5	5	5	5	
15	5	5	0	0	
16	0	5	0	0	
17	0	0	0	0	
18	0	0	0	0	
19	0	0	0	5	
20	0	0	0	0	
21	0	0	0	5	
22	5	0	0	0	Blue sky
23	0	0	0	0	" "
24	0	0	0	0	" "
25	0	0	0	0	
26	0	5	0	0	
27	0	0	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	0	5	5	5	

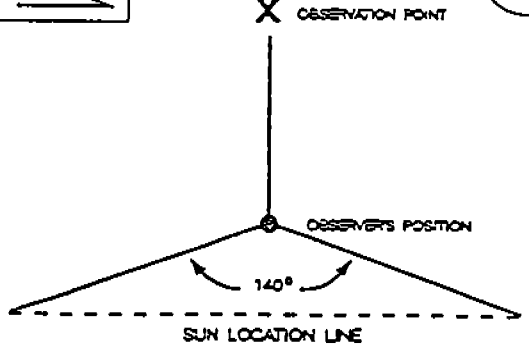
STACK WITH PLUME

SUN

WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



OBSERVER'S NAME (PRINT) Rick L. Miller

OBSERVER'S SIGNATURE Rick L. Miller | DATE 3/30/94

ORGANIZATION Canton LAA

CERTIFIED BY ETA | DATE 3/29/94

ADDITIONAL INFORMATION

CONTINUED ON VEO FORM NUMBER

ETA Revised 05-01-92

Run #1

VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Metropolitan Industries
LOCATION: 1201 Millerton Rd. SE
LOCATION: 15 76 05 1149
CITY: Canton | STATE: OH | ZIP: 44707

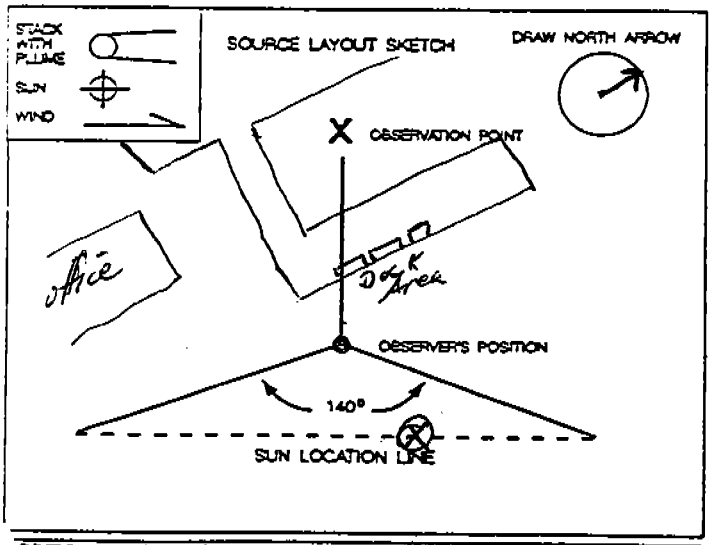
PROCESS EQUIPMENT: Tile Tunnel Kilns #1, #2 + #3 | OPERATING MODE: #1 & #2 – 1194°F, #3 – 1147°F
CONTROL EQUIPMENT: none | OPERATING MODE:

DESCRIBE EMISSION POINT: Top of Round Stainless stack
5' 12 dia.

HEIGHT ABOVE GROUND LEVEL: START ~150' END | HEIGHT RELATIVE TO OBSERVER: START ~150' END
DISTANCE FROM OBSERVER: START ~570' END | DIRECTION FROM OBSERVER: START NW END
VERTICAL ANGLE TO OBS. PT.: START 14° END | DIRECTION TO OBS. PT.: START NW END

DESCRIBE EMISSIONS: START detached END
EMISSION COLOR: START blank/wht END | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ NA ☒
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ~4–10' END

DESCRIBE PLUME BACKGROUND: START sky END
BACKGROUND COLOR: START Blue END | SKY CONDITIONS: START Clear END
WIND SPEED: START 10-15 mph END | WIND DIRECTION: START SW END
AMBIENT TEMP: START 49°F END | WET BULB TEMP: | RH PERCENT:



ADDITIONAL INFORMATION
w/ the background + lightness of emissions VE's were just barely detectable from that distance

ETA Revised 05-01-92

FORM NUMBER: Run #1 | PAGE: 1 OF 2

OBSERVATION DATE: 4/14/94 | START TIME: 9:56 | END TIME: 10:56

SEC / MIN	0	15	30	45	COMMENTS
1	S	S	S	S	
2	S	S	S	S	
3	S	S	S	S	
4	S	S	S	S	
5	S	S	S	S	
6	S	S	S	S	
7	S	S	S	S	
8	S	S	S	S	
9	S	S	S	S	
10	S	S	S	S	
11	S	S	S	S	
12	S	S	S	S	
13	S	S	S	S	
14	S	S	S	S	
15	S	S	S	S	
16	S	S	S	S	
17	S	S	S	S	
18	S	S	S	S	
19	S	S	S	S	
20	S	S	S	S	
21	S	S	S	S	
22	S	S	S	S	
23	S	S	S	S	
24	S	S	S	S	
25	S	S	S	S	
26	S	S	S	S	
27	S	S	S	S	
28	S	S	S	S	
29	S	S	S	S	
30	S	S	S	S	

OBSERVER'S NAME (PRINT): Rick L. Miller
OBSERVER'S SIGNATURE: Rick L. Miller | DATE: 4/14/94
ORGANIZATION: Canton L&A
CERTIFIED BY: ETA | DATE: 3/94

CONTINUED ON VEO FORM NUMBER:

VISIBLE EMISSION OBSERVATION FORM

DATA REDUCTION TABLE

SET NUMBER	TIME	OPACITY	
	START -- END	SUM	AVERAGE

FORM NUMBER

PAGE 2 OF 2

OBSERVATION DATE 4/14/94

START TIME

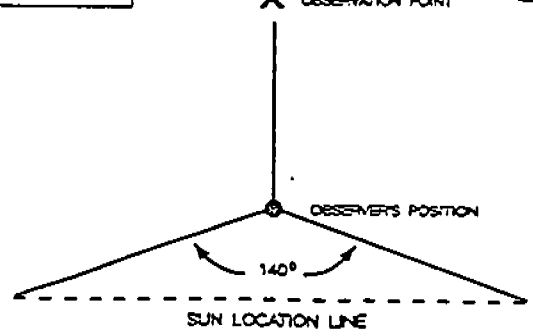
END TIME

SEC / MIN	0	15	30	45	COMMENTS
1	✓	✓	✓	✓	
2	✓	✓	✓	✓	
3	✓	✓	✓	✓	
4	✓	✓	✓	✓	
5	✓	✓	✓	✓	
6	✓	✓	✓	✓	
7	✓	✓	✓	✓	
8	✓	✓	✓	✓	
9	✓	✓	✓	✓	
10	✓	✓	✓	✓	
11	✓	✓	✓	✓	
12	✓	✓	✓	✓	
13	✓	✓	✓	✓	
14	✓	✓	✓	✓	
15	✓	✓	✓	✓	
16	✓	✓	✓	✓	
17	✓	✓	✓	✓	
18	✓	✓	✓	✓	
19	✓	✓	✓	✓	
20	✓	✓	✓	✓	
21	✓	✓	✓	✓	
22	✓	✓	✓	✓	
23	✓	✓	✓	✓	
24	✓	✓	✓	✓	
25	✓	✓	✓	✓	
26	✓	✓	✓	✓	
27	✓	✓	✓	✓	
28	✓	✓	✓	✓	
29	✓	✓	✓	✓	
30	✓	✓	✓	✓	

STACK WITH PLUME
SUN
WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



OBSERVER'S NAME (PRINT) R. K. L. Miller

OBSERVER'S SIGNATURE K. L. Miller DATE 4/14/94

ORGANIZATION

CERTIFIED BY DATE

ADDITIONAL INFORMATION

CONTINUED ON VEO FORM NUMBER

ETA Revised 05-01-92

Run #2

VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Metropolitan Industries

LOCATION: 1201 Millertown Rd. SE.

LOCATION: 15 76 05 1149

CITY: Canton | STATE: OH | ZIP: 44707

PROCESS EQUIPMENT: Tile Tunnel Kilns #1, #2 + #3 | OPERATING MODE: #1 + #2 - 1194°F, #3 - 1147°F

CONTROL EQUIPMENT: none | OPERATING MODE:

DESCRIBE EMISSION POINT: Stack - Round Stainless 5' dia.

HEIGHT ABOVE GROUND LEVEL: START ~150' END | HEIGHT RELATIVE TO OBSERVER: START ~150' END

DISTANCE FROM OBSERVER: START ~570' END | DIRECTION FROM OBSERVER: START NW END

VERTICAL ANGLE TO OBS. PT.: START 14° END | DIRECTION TO OBS. PT.: START NW END

DESCRIBE EMISSIONS: START Detached END

EMISSION COLOR: START Wht/Wht END | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ NA ☑

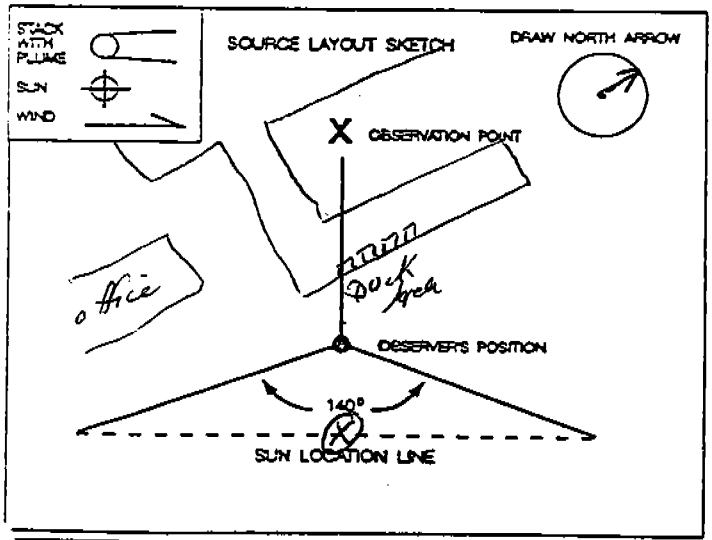
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ~4-10' END

DESCRIBE PLUME BACKGROUND: START Sky END

BACKGROUND COLOR: START Blue END | SKY CONDITIONS: START Clear END

WIND SPEED: START 15-20 mph END | WIND DIRECTION: START SW END

AMBIENT TEMP: START 55°F END | WET BULB TEMP: | RH PERCENT:



ADDITIONAL INFORMATION: VE's primarily - but hard to see at plume distance -

FORM NUMBER: Run #2 | PAGE: 1 OF 2

OBSERVATION DATE: 4/14/94 | START TIME: 11:22 | END TIME: 12:22

SEC / MIN	0	15	30	45	COMMENTS
1	S	S	S	S	
2	S	S	S	S	
3	S	S	S	S	
4	S	S	S	S	
5	S	S	S	S	
6	S	S	S	S	
7	S	S	S	S	
8	S	S	S	S	
9	S	S	S	S	
10	S	S	S	S	
11	S	S	S	S	
12	S	S	S	S	
13	S	S	S	S	
14	S	S	S	S	
15	S	S	S	S	
16	S	S	S	S	
17	S	S	S	S	
18	S	S	S	S	
19	S	S	S	S	
20	S	S	S	S	
21	S	S	S	S	
22	S	S	S	S	
23	S	S	S	S	
24	S	S	S	S	
25	S	S	S	S	
26	S	S	S	S	
27	S	S	S	S	
28	S	S	S	O	light clouds moved in
29	O	O	O	O	
30	O	S	S	O	

OBSERVER'S NAME (PRINT): Rick L. Miller

OBSERVER'S SIGNATURE: Rick L. Miller | DATE: 4/14/94

ORGANIZATION: Canton LAA

CERTIFIED BY: ETA | DATE: 3/94

CONTINUED ON VEO FORM NUMBER:

ETA Revised 05-01-92

VISIBLE EMISSION OBSERVATION FORM

DATA REDUCTION TABLE

SET NUMBER	TIME	OPACITY	
	START -- END	SUM	AVERAGE

FORM NUMBER

PAGE 2 OF 2

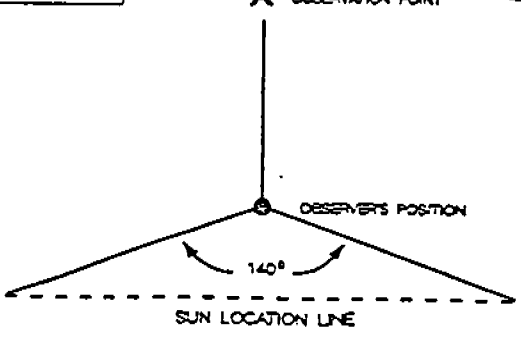
OBSERVATION DATE 4/14/94 | START TIME | END TIME

SEC / MIN	0	15	30	45	COMMENTS
1	S	S	S	S	
2	S	0	0	S	
3	S	S	0	S	
4	0	S	S	0	heavy clouds moving
5	0	0	0	0	in
6	0	0	0	S	
7	0	0	S	S	
8	0	0	S	0	
9	0	0	0	0	
10	0	0	0	S	clouds passed but
11	S	0	0	0	not illuminate - no
12	0	0	0	0	sunshine
13	0	0	0	0	
14	0	0	0	0	
15	0	0	0	0	
16	0	0	0	0	
17	0	0	0	S	sunshine back
18	S	S	S	S	
19	S	S	S	S	
20	S	S	S	S	
21	S	S	S	S	
22	S	S	S	S	
23	S	S	S	S	
24	S	S	S	S	
25	0	0	0	0	
25	S	0	0	S	
27	S	S	S	0	
28	0	S	0	0	
29	0	0	0	0	
30	0	S	S	0	

STACK WITH PLUME
SUN
WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



OBSERVER'S NAME (PRINT) Rick L. Miller

OBSERVER'S SIGNATURE Rick L. Miller | DATE 4/14/94

ORGANIZATION

CERTIFIED BY | DATE

ADDITIONAL INFORMATION

CONTINUED ON VEO FORM NUMBER

ETA Revised 05-01-92

Run #3

VISIBLE EMISSION OBSERVATION FORM

COMPANY NAME: Metropolitan Industries
LOCATION: 1201 Millerton Rd. SE
LOCATION: 15 76 05 1149
CITY: Canton | STATE: OH | ZIP: 44707

PROCESS EQUIPMENT: Tile Tunnel Kiln #1, #2 + #3 | OPERATING MODE: #1 + #2 — 1194°F, #3 — 1147°F
CONTROL EQUIPMENT: None | OPERATING MODE:

DESCRIBE EMISSION POINT: Stack - Round Stainless
5' dia.

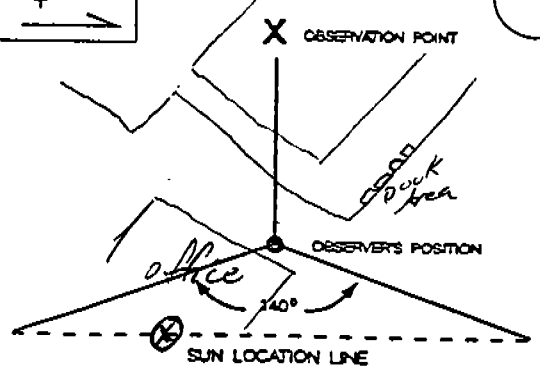
HEIGHT ABOVE GROUND LEVEL: START ~150' END | HEIGHT RELATIVE TO OBSERVER: START ~150' END
DISTANCE FROM OBSERVER: START ~420' END | DIRECTION FROM OBSERVER: START NW END
VERTICAL ANGLE TO OBS. PT.: START 16° END | DIRECTION TO OBS. PT.: START NW END

DESCRIBE EMISSIONS: START detached END
EMISSION COLOR: START Wht/wht END | IF WATER DROPLET PLUME: ATTACHED ☐ DETACHED ☐ NA ☒
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ~4-10' END

DESCRIBE PLUME BACKGROUND: START Sky END
BACKGROUND COLOR: START Blue/wht END | SKY CONDITIONS: START Scattered END
WIND SPEED: START 15-20 mph END | WIND DIRECTION: START SW END
AMBIENT TEMP: START 61 °F END | WET BULB TEMP | RH PERCENT

STACK WITH PLUME
SUN
WIND

SOURCE LAYOUT SKETCH — DRAW NORTH ARROW



ADDITIONAL INFORMATION

FORM NUMBER: Run #3 | PAGE: 1 OF 2

OBSERVATION DATE: 4/14/94 | START TIME: 12:44 | END TIME: 13:44

SEC / MIN	0	15	30	45	COMMENTS
1	0	0	5	5	
2	5	0	0	5	
3	5	0	0	0	
4	5	0	0	5	
5	0	0	5	0	
6	5	5	0	5	
7	0	0	0	0	
8	5	0	0	5	
9	5	0	0	0	
10	0	0	0	0	
11	0	5	5	5	
12	5	5	0	0	
13	0	0	0	0	
14	0	0	5	5	
15	5	5	5	5	
16	5	5	5	0	
17	0	5	0	0	
18	5	5	5	5	
19	5	5	5	5	
20	5	5	5	5	
21	5	0	0	0	
22	0	0	0	0	
23	0	0	0	5	
24	5	5	5	5	
25	5	5	5	5	
26	5	0	0	0	
27	0	0	5	5	
28	5	5	5	0	
29	0	5	5	5	
30	5	5	5	5	

OBSERVER'S NAME (PRINT): Rick L. Miller
OBSERVER'S SIGNATURE: Rick L. Miller | DATE: 4/14/94
ORGANIZATION: Canton LAA
CERTIFIED BY: ETA | DATE: 3/94

CONTINUED ON VEO FORM NUMBER

ETA Revised 05-01-92

VISIBLE EMISSION OBSERVATION FORM

DATA REDUCTION TABLE

SET NUMBER	TIME	OPACITY	
	START -- END	SUM	AVERAGE

FORM NUMBER

PAGE 2 OF 2

OBSERVATION DATE 4/14/94

START TIME

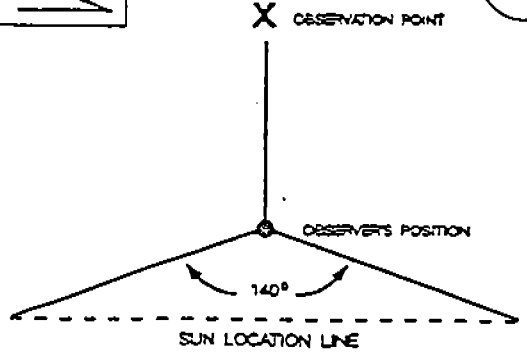
END TIME

MIN \ SEC	0	15	30	45	COMMENTS
1	S	S	S	S	
2	S	S	S	0	
3	0	0	0	S	
4	S	S	S	0	
5	0	S	S	0	
6	0	0	S	S	
7	S	S	S	S	
8	S	S	S	S	
9	S	S	S	S	
10	S	S	S	S	
11	S	S	0	0	
12	0	0	0	0	
13	0	0	S	S	
14	0	0	S	S	
15	S	S	S	S	
16	S	S	0	0	
17	0	0	0	0	
18	S	S	0	S	
19	S	S	0	0	
20	0	0	S	0	
21	0	0	S	S	
22	S	S	S	S	
23	0	0	0	S	
24	0	0	0	0	
25	0	0	0	0	
25	0	S	S	S	
27	S	S	0	0	
28	0	0	0	0	
29	0	0	0	0	
30	S	S	S	0	

STACK WITH PLUME
SUN
WIND

SOURCE LAYOUT SKETCH

DRAW NORTH ARROW



ADDITIONAL INFORMATION

OBSERVER'S NAME (PRINT) Rick L. Miller

OBSERVER'S SIGNATURE Rick L. Miller DATE 4/14/94

ORGANIZATION

CERTIFIED BY DATE

CONTINUED ON VEO FORM NUMBER

STACK TEST
OBSERVATION REPORT
METROPOLITAN INDUSTRIES
15 76 05 1149
P004, P005 & P006
MARCH 30 & APRIL 14, 1994

On March 30, 1994, George Long and I observed the stack testing of the present three tunnel kilns, all in operation and ducted to a common stack (150 foot stainless). The testing firm was Envisage Environmental. The representative from Envisage was Greg Sinkovich. I did the VE readings during the stack test, the final leak checks on the unit located on the stack platform about 75 feet above the ground and observed the sampling trains used. George observed the testing technique and the final leak checks on the SO_2 unit stationed on the ground at the base of the stack.

Tunnel Kiln #1 (P004) and Tunnel Kiln #2 (P005) use a common dryer and therefore, process the same tile composite materials. They were being operated at a rate of 34 cars per day (each) and processing product 507, which is a 100% clay product. This calculates to 62.832 dry tons of product / kiln / day, concerning these two kilns. Tunnel Kiln #3 (P006) was being operated at a rate of 40 cars per day, and was processing product 310, which is a 30% clay, 70% shale composite. TK #3 was calculated as processing 73.92 dry tons of product / day. The total capacity during the stack test was at a rate equivalent to 199.584 tons / day, which is 90% rated capacity for the operation. Attached is confirmation from Metropolitan. It was explained previously at a meeting that the manufacturers rating for the kilns is 36 cars / day, which makes 108 cars / day the 100% capacity rating for the operation of all three kilns. However, 40 cars / day is the potential Metropolitan can push. Therefore, 108 cars / day could be viewed as 90% potential capacity.

A Particulate Sampling - Observation Checklist was completed. The stack test was for particulates, SO_2 and fluorides (Method 1-5, Method 6 and Method 13A, respectively). Audit samples for SO_2 were given for analysis, C8613 & C8853. No problems were seen in the test methods. All leak checks were ok. The peak temperature in TK #1 & #2 was 1190°F, and in TK #3 it was 1150°F. Copies of all raw data were collected at the time of the testing.

Audit sample results from Envisage indicated that their results could not be accepted for the SO_2 portion of the stack test. Therefore, the SO_2 portion of the stack test (Method 6) had to be repeated on April 14, 1994. All operation parameters for the April 14th test were the same as that of the March 30th test. Audit samples for SO_2 were again given (C8947 & C8823). This time, the results came back within an acceptable range. The Envisage rep. during the April 14th test was Bob Hovan. The tile samples collected by Metropolitan during the last stack test were to be sent out for sulfur analysis.

The April 14th testing was observed by myself. I did the VE readings on emissions from the Metropolitan stack and final leak checks on the Envisage equipment. The weather conditions were better than that of March, and a steady flow of low emissions was very evident. Once again, raw data was collected at the time of testing. This data was collected by Philip McGuinness of Metropolitan and copies made available the following day. Dan Aleman of our office received them.

Rick L. Miller
Staff Field Inspector

Envisage Environmental Incorporated

[redacted]

February 23, 1994

Mr. Andy Pasko
Canton City Health Department
Air Pollution Control
420 Market Avenue N.
Canton, Ohio 44702

Dear Mr. Pasko:

I am enclosing your copy of the Intent to Test Notification for testing of the TK1, TK2, and TK3 Common Exhaust at the Metropolitan Ceramics facility, Canton, Ohio. Please review for accuracy of information.

One copy has been sent to Mr. Phillip McGuiness, Metropolitan Ceramics; and one copy has been retained for our files. If there are any changes please notify us as soon as possible.

Questions may be directed to Mr. Frank Hezoucky or myself.

Sincerely,

Robert C. Hovan
Air Quality Supervisor
ENVISAGE ENVIRONMENTAL INC.

Enclosure

P.O. Box 152 Richfield, Ohio 44286 Phone (216) 526-0990 Fax (216) 526-8555

1

07:09:51 0104 01 MALONE COL 04/14/94

	01	02	03	04	05	06	
CHAN	SO2	WD	WS	TEMP 1	TEMP 2	O3	SD1
UNITS	PPM	DEGR	MPH	DEG C	DEG C	PPM	DEG
FSCL	.473	540	50.0	50.0	50.0	.471	99.9
ZERO	- .024	0	0.0	0.0	-30.0	- .024	00.0
01:00	0.001	248	11.7	23.4	7.1	0.033	10.7
02:00	0.001	251	10.6	23.6	6.5	0.032	9.8
03:00	0.001	245	9.4	23.6	5.9	0.031	9.2
04:00	0.001	254	13.4	23.4	6.8	0.037	10.6
05:00	0.001	241	10.1	23.4	6.9	0.036	11.8
06:00	0.004	229	7.9	23.6	7.0	0.028	14.3
07:00	0.005<	225<	8.0<	23.7<	7.3<	0.021<	14.7
08:00	0.005	226	8.6	23.9	8.9	0.027	15.8
09:00	0.003	216	9.3	24.1	10.2	0.036	15.7
10:00	0.003	200	7.3	24.4	11.9	0.037	18.6
11:00	0.003	185	7.3	25.2	13.4	0.041	19.9
12:00	0.010	184	8.3	26.1	14.5	0.042	16.9
13:00	0.022	201	9.2	27.1	16.2	0.042	22.1
14:00	0.016	212	10.4	27.4	18.6	0.050	18.6
15:00	0.013	241	10.3	27.3	20.5	0.056	19.4
16:00	0.007	253	14.7	27.3	21.0	0.061	15.7
17:00	0.005	262	12.3	27.2	21.2	0.062	13.9
18:00	0.003	269	10.0	27.2	21.1	0.065A	13.1
19:00	0.003	254	7.1	27.2	20.3	0.056	10.7
20:00	0.005	272	2.6	27.2	19.0	0.018	30.9
21:00	0.003	109	1.2	27.2	18.3	0.031	26.2
22:00	0.006	116	4.2	27.4	17.1	0.004	7.1
23:00	0.008	183	5.7	27.0	17.1	0.024	8.7
24:00	0.012	198	6.8	27.2	17.0	0.021	8.8
DLYAV	0.006	------	8.6	25.6	13.9	0.037	

CALIBRATION RESULTS

NONE CONDUCTED

FIELD DATA COVER SHEET

PLANT Metro Ceramics

DATE 4-14-94

SAMPLING LOCATION

Kiln Exhaust

SAMPLING METHOD 6

OPERATOR BH

AMBIENT TEMPERATURE 50's

BAROMETRIC PRESSURE

STATIC PRESSURE -.55

HEATER BOX SETTING N/A

PROBE TEMP SETTING N/A

PROBE LENGTH 8 ft

NOZZLE I.D. N/A

ASSUMED MOISTURE N/A

METER BOX I.D. New

METER ΔH 1.82

METER "Y" FACTOR 1

NOMOGRAPH "C" FACTOR N/A

PROBE I.D. 301

THERMOCOUPLE I.D.'s 5

PITOT COR. FACTOR .84

SAMPLE TRAIN I.D. N/A

CYCLONIC FLOW CHECK OK

TRAVERSE POINT LOCATIONS

1. 1.5	7. 46.3
2. 4.8	8. 54
3. 8.5	9. 59.2
4. 12.7	10. 63.4
5. 18	11. 61.2
6. 25.4	12. 70.5

UPSTREAM DISTANCE _____

DOWNSTREAM DISTANCE _____

NOZZLE CALIBRATION

Diameter 1 N/A
Diameter 2 _____
Diameter 3 _____
Average _____

Test Team Members CH, TC

EPA Representative/s Rick Miller - Canton DAPC

Facility Contact Phillip McGuire

EEI Team Leader BH

FH394

KRM

PLANT Metro Ceramics DATE 4/14/94 RUN# Pre1 LOCATION Kiln page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{su}	$\sqrt{\Delta p}$
1	.60	260		
2	.59	260		
3	.55	265		
4	.49	261		
5	.47	260		
6	.46	260		
1	.55	274		
2	.55	275		
3	.54	277		
4	.53	282		
5	.51	283		
6	.495	283		
1	.53	255		
2	.57	276		
3	.51	280		
4	.54	281		
5	.55	283		
6	.54	282		
1	.56	280		
2	.56	254		
3	.54	260		
4	.49	263		
5	.47	265		
6	.44	266		

-.55

PITOT TUBE LEAK CHECKS

PRE-TEST #2 0096 #4 0095

POST-TEST #2 0096 #4 0094

CASE #88

PLANT Metro Ceramic DATE 4/14/84 RUN# 1 CASE# LOCATION Kiln page of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0/0955	437.90	1.80	97	64	6.0	45
5	441.5	1.80	101	68	7.0	45
10	445.3	1.80	99	69	7.0	46
15	449.3	1.80	100	70	7.0	45
20	453.2	1.80	101	72	7.0	50
25	457.1	1.80	103	73	7.0	50
30	461.0	1.80	104	74	7.0	50
35	464.8	1.80	105	75	7.0	50
40	468.7	1.80	106	75	7.0	50
45	472.6	1.80	106	77	7.0	50
50	476.4	1.80	107	77	7.0	50
55	480.2	1.80	105	77	7.0	50
60/1055	484.15					
	46.25	1.80				

System Leak Checks: Pre-Test 0 CFM @ 13 "Hg
Post-Test 0.0 CFM @ 8 "Hg

PLANT Metro Ceramic DATE 4/14/94 RUN# Pre 2 LOCATION Kiln Exhaust page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{sw}	$\sqrt{\Delta p}$
1	.52	250		
2	.52	265		
3	.50	278		
4	.47	281		
5	~~.40~~ .45	280		
6	.43	288		
1	.55	280		
2	.53	290		
3	.49	289		
4	.44	286		
5	.44	283		
6	.44	287		
1	.53	283		
2	.55	287		
3	.54	289		
4	.52	289		
5	.49	290		
6	.46	284		
1	.55	282		
2	.55	286		
3	.57	287		
4	.57	288		
5	.55	284		
6	.53	285		

PITOT TUBE LEAK CHECKS

PRE-TEST #2 0@7.4 #4 0@7.1

POST-TEST #2 0@6.1 #4 0@7.8

PLANT Metro Ceramics DATE 4/14/94 RUN# 2 CASE# 49 LOCATION Kiln Exhaust page of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0 11 1122	484.50	1.80	86	77	5.0	50
5	488.3	1.80	112	78	5.0	50
10	492.1	1.80	111	78	5.0	50
15	496.2	1.80	111	79	5.0	50
20	499.9	1.80	110	79	5.0	52
25	503.8	1.80	110	79	5.0	52
30	507.7	1.80	110	80	5.0	52
35	511.5	1.80	110	80	5.0	52
40	515.4	1.80	110	81	5.0	52
45	519.3	1.80	109	80	5.0	52
50	523.2	1.80	108	79	5.0	54
56	526.9	1.80	109	79	5.0	54
60 1122	530.955					
	46.455	1.80				

System Leak Checks: Pre-Test 0 CFM @ 13 "Hg
Post-Test 0 CFM @ 8 "Hg

PLANT Metro Ceramic DATE 4/14/94 RUN# Run 3 LOCATION Kiln Exhaust page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{su}	$\sqrt{\Delta p}$
1	.60	280		
2	.61	286		
3	.58	290		
4	.57	290		
5	.56	294		
6	.53	297		
1	.53	275		
2	.56	285		
3	.57	287		
4	.54	290		
5	.50	290		
6	.46	291		
1	.56	278		
2	.57	284		
3	.56	285		
4	.54	288		
5	.52	289		
6	.45	290		
1	.53	280		
2	.57	281		
3	.58	285		
4	.58	291		
5	.58	288		
6	.56	280		

PITOT TUBE LEAK CHECKS

PRE-TEST#2 0.01 POST-TEST#2 0.01

#40 @ 5.6 #40 @ 7.9

PLANT Metro Ceramic DATE 4/14/94 RUN# 3 CASE# 83 LOCATION Kiln Exhaust Page of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0 / 1248	531.30	1.80	86	78	5.0	50
5	535.00	1.80	109	78	6.0	50
10	538.54	1.80	110	79	5.0	50
15	542.8	1.80	111	81	6.0	52
20	546.6	1.80	111	80	6.0	52
25	550.6	1.80	111	81	6.0	52
30	554.5	1.80	112	82	6.0	54
35	558.4	1.80	112	82	6.0	54
40	562.3	1.80	112	82	6.0	54
45	566.2	1.80	113	83	6.0	54
50	570.2	1.80	113	83	6.0	56
55	574.1	1.80	114	84	6.0	56
60 / 1344	578.045					
	46.745	1.80				

System Leak Checks: Pre-Test 0 CFM @ 15 "Hg
Post-Test 0 CFM @ 8 "Hg

PLANT Metro Ceramic DATE 4/14/94 RUN# Post3 LOCATION Kiln Exhaust page of

POINT NUMBER	VELOCITY PRESSURE Δp	TEMPERATURE DRY T_s	TEMPERATURE WET T_{SU}	$\sqrt{\Delta p}$
1	.54	279		
2	.57	281		
3	.54	282		
4	.52	285		
5	.48	283		
6	.42	280		
1	.51	288		
2	.52	291		
3	.50	293		
4	.51	289		
5	.49	291		
6	.47	287		
1	.49	280		
2	.51	283		
3	.62	288		
4	.54	288		
5	.53	287		
6	.54	281		
1	.53	275		
2	.54	283		
3	.55	287		
4	.54	289		
5	.53	290		
6	.52	281		

PITOT TUBE LEAK CHECKS

PRE-TEST#2 0.1 POST-TEST#2 0.5

#4 0.8 #4 0.9

METROPOLITAN EMISSION COMPLIANCE TEST

TO BE PERFORMED ON TUNNEL KILNS #1, #2, #3.

DATE 14th April 1994

CARRIED OUT BY ENVISAGE ENVIRONMENTAL INC.

RELEVENT DATA

	KILN SPEED	PRODUCT	CLAY	SHALE	* DRY TONS/KILN
TK #1	34 cars per day	507	100%	nil	62.832
TK #2	34 cars per day	507	100%	nil	62.832
TK #3	40 cars per day	310	30%	70%	73.92

* DRY TONS (Weight of raw materials only) Number of cars per kiln per day x 2.2 average wet tons per car x 0.84 (allowing for 16% moisture removed from tiles before firing)

KILN CAPACITY

POTENTIAL FOR THE 3 KILNS 221.76 tons
(3 x 40 cars per day x 2.2 average wet tons per car x 0.84 (as above))

ACTUAL CAPACITY DURING TEST 199.584 tons
(34 + 34 + 40) = 108 cars per day x 2.2 x 0.84

% CAPACITY 90 %

RETEST FOR SO2

TESTS

For SO2 (as per NOI submitted)

RAW MATERIAL TEST

Samples of clay tiles, (2 doubles/car), will be taken, prior to entering the kilns, from the cars that will be directly in the areas of the measured emissions
Each test will be represented by 32 pieces of clay tile per test.
Each test series of clay tiles will be ground and sent to either Stark Ceramics or Skyline Labs (Denver, CO), to be tersted for Sulfur content. 3 series of ground clay tile, representing each emission test, will consist of 3 batches (1 per kiln).

PEAK TEMPERATURES

TK#1	1194 °C
TK#2	1194 °C
TK#3	1147 °C

CAR NUMBERS FOR SAMPLE TILES

4/14/94 TEST 1	TK #1	18	100	171	201	50	177	12	15	239	121		
9:55	TK #2	13	23	32	114	274	237	30	245	19	230		
	TK #3	275	10	54	47	111	77	256	155	46	204	278	207
4/14/94 TEST2	TK #1	171	201	50	177	12	15	239	121	66	202		
11:20	TK #2	32	114	276	237	30	245	19	230	3	156		
	TK #3	47	111	77	256	155	46	204	278	207	208	97	260
4/14/94 TEST 3	TK #1	177	12	15	239	121	66	202	162	256	150		
12:45	TK #2	276	237	30	245	19	230	3	156	1	185		
	TK #3	77	256	155	46	204	278	207	208	97	260	137	168

RETEST FOR SO2

Aud. of Sampler - SO_2
C8947
C8823

SO_2

~~Particulate~~ Sampling - Observation Checklist

Date: April 14, 1994
Observer(s): Rick L. Miller

Facility: Metropolitan Industries
Source: Tile Tunnel Kiln #1 #2 & #3
Test Firm: Envisage Environmental (Bob Hoven)

Sampling Method(s):
RM 5 [ ]; 5A [ ]; 5B [ ]; 5D [ ]; 5E [ ]; 5F [ ]; 8 [ ]; 12 [ ]; 17 [ ];
or other [X] (If other, please describe.) Method 6

Are there any modifications to the specified reference method(s)?
Yes [ ]; No [X] (If yes, please describe modification.) _____

Do the inlet (if applicable) and outlet sampling locations meet the requirements specified in RM 1?
Yes [ ]; No [ ] (If no, how was (were) the location(s) modified to allow sampling?) NA - only outlet sampling

If inlet/outlet sampling is being performed, are the samples being taken simultaneously?
Yes [ ]; No [ ] (If no, be sure that the source operating parameters are the same when they switch from one to the other.)

If cyclonic flow is present and other sampling locations do not exist, how will the samples be withdrawn?
Directional probe technique [ ]; Alignment technique [X]; other [ ]
(If other, please describe.) _____

Is the sampling train set up properly, in accordance with the reference method or as agreed upon in the pre-test meeting?
Yes [ ]; No [ ] (If no, correct problems and continue, if possible.)

Check to ensure that the sampling equipment has been recently calibrated (i.e., meter box, thermometers/thermocouples, pitot tubes, etc.) OK [X]; not OK [ ] 3/18/94 (w/in 60 days of test)

Type of filter: _____
Is the filter assembly positioned properly?
Yes [ ]; No [ ] (If no, adjust and continue, if possible. Please note that the filter may be changed during the test run; however, it is recommended that the entire filter assembly be changed.)

Nozzle Diameter: _____
(Please note that the nozzle may not be changed during the test run.)

Number of sampling points on a traverse: _____
Sampling time per point: _____

Type of probe: (quartz, stainless steel, water jacketed, etc.)

Type of probe liner (if applicable): _____

Impinger contents:
First – 100 ml 80% IPA
Second – 100 ml 3% H_2O_2
Third – 100 ml 3% H_2O_2
Fourth – 200 gm silica gel
Modifications – _____

Will the stack moisture content be determined as part of RM 5? Yes [ ]; No [ ] (If no, please describe the procedure for the separate moisture determination.) NA

Gas analysis:
Orsat [ ]; Fyrite [ ]; Grab [ ]; other [ ] (If other, please describe.) NA

Indicate probe and filter box temperature settings:
Probe (if applicable) – NA
Filter box – _____
(If on, have probe checked to ensure it is heating properly.)

Reminder: When conducting tests on boilers, the probe and filter box temperatures may not exceed 320 degrees Fahrenheit

Ensure that the sampling port(s) is (are) sealed around the probe(s) when sampling. OK [X]; not OK [ ]

Check and note color and condition of silica gel: _____

Leak-checks:

		Run #1	Run #2	Run #3		Run #1	Run #2	Run #3	
	Pre-test (optional) –	0	0	0	cfm @				"Hg
SO_2	Post-test (mandatory) –	0	0	0	cfm @	8	8	8	"Hg

(The post-test leak-check must be conducted at or above the highest vacuum reading encountered during the test run. The leak check should be conducted by plugging the inlet to the probe nozzle. The maximum acceptable leakage rate for a leak-check is .02 cfm (.0057 cmm) or 4% of the average sampling rate, whichever

PLANT Metro Lowers DATE 3/30/94 RUN# CASE# 16 LOCATION page 1 of

POINT NUMBER	SAMPLE TIME	GAS METER READING	VELOCITY Δp HEAD √Δp	ORIFICE PRESSURE	STACK TEMP	GAS METER TEMP IN	GAS METER TEMP OUT	PUMP VACUUM	FILTER HOLDER	IMPINGER TEMP
1	0/11.35	562.40	.48	1.55	261	120	84	1.5	250	30
2	2.5	564.50	.54	1.75	279	143	85	2.0	250	30
3	5	566.10	.55	1.80	279	147	85	2.0	250	30
4	7.5	568.28	.55	1.80	278	151	86	2.0	250	34
5	10	570.27	.54	1.75	277	149	86	2.0	255	34
6	12.5	572.25	.51	1.75	277	145	87	2.0	255	34
7	15	574.27	.48	1.58	276	146	87	1.5	255	36
8	17.5	576.07	.42	1.38	279	138	87	1.0	260	36
9	20	577.78	.36	1.18	279	138	87	1.0	260	38
10	22.5	579.47	.34	~~1.07~~	278	136	88	1.0	260	38
11	25	581.14	.32	1.05	282	133	88	1.0	260	38
12	27.5	582.68	.25	.82	250	129	88	1.0	260	38
1	30	584.05	.55	1.80	275	117	86	2.0	260	38
2	32.5	586.20	.58	1.89	277	127	86	2.0	260	38
3	35	588.19	.58	1.89	276	128	85	2.0	260	38
4	37.5	590.16	.56	1.85	274	128	86	2.0	260	38
5	40	592.20	.54	1.75	275	125	85	2.0	265	40
6	42.5	594.14	.50	1.62	276	124	85	2.0	265	40
7	45	596.00	.50	1.62	275	122	85	2.0	265	40
8	47.5	597.97	.48	1.58	275	120	85	1.5	265	40
9	50	599.72	.42	1.38	275	117	86	1.5	265	40
10	52.5	601.70	.40	1.3	277	118	83	1.5	265	40
11	55	603.23	.36	1.18	271	112	82	1.5	265	40
12	57.5	604.88	.20	.66	270	103	81		265	40
	60/12.40	606.13								

SAMPLE TRAIN LEAK CHECKS
PRE-TEST ~~.010~~ .005 CFM @ 15 "Hg POST-TEST .007 CFM @ 7 "Hg

PITOT TUBE LEAK CHECKS
PRE-TEST #2 0 @ 6.0
#4 0 @ 15.0
POST-TEST #2 0 @ 7.0
#4 0 @ 6.0

methnl 5

PLANT Metro Ceramics DATE 3-30-94 RUN #1 CASE #26 LOCATION Outlet PAGE of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0/11:33	516.89	1.21	60	63	12.0	45
5	520.09		72	64	12.0	45
10	523.19		80	66	12.0	45
15	526.46		80	66	12.0	45
20	529.77		81	66	12.0	45
25	531.61		82	67	12.0	45
30	534.98		82	67	12.0	45
35	537.10		83	68	12.0	45
40	540.08		83	68	12.0	45
45	544.12		83	68	12.0	45
50	547.99		84	69	12.0	45
55	551.32		84	69	12.0	45
60/12:33	555.75					

System Leak Checks: Pre-Test 0 CFM @ 15 "Hg
Post-Test .01 CFM @ 15 "Hg

Method #4

PLANT Metro Ceramics DATE 3/30/94 RUN# 2 CASE# 38 LOCATION page 1 of 1

POINT NUMBER	SAMPLE TIME	GAS METER READING	VELOCITY Δp HEAD √Δp	ORIFICE PRESSURE	STACK TEMP	GAS METER TEMP IN	GAS METER TEMP OUT	PUMP VACUUM	FILTER HOLDER	IMPINGER TEMP
1	0/3.22	637.00	.58	1.85	270	92	65	2.0	240	32
2	2.5	638.56	158	1.84	276	111	70	2.0	240	32
3	5	641.04	.60	1.95	295	118	71	3.0	250	32
4	7.5	643.01	158	1.84	275	121	72	2.5	260	34
5	10	645.04	.55	1.80	275	121	72	2.5	260	34
6	12.5	647.59	.54	1.75	275	123	73	2.5	260	36
7	15	649.40	.52	1.70	274	124	74	2.0	260	36
8	17.5	650.84	.48	1.58	276	122	74	2.0	260	36
9	20	652.66	.46	1.50	276	123	74	2.0	265	36
10	22.5	654.45	.42	1.38	275	122	74	2.0	265	38
11	25	656.14	.42	1.38	274	119	74	2.0	265	38
12	27.5	657.81	.45	1.49	272	119	74	2.0	265	38
1	30	659.68	.55	1.80	267	105	73	2.5	260	38
2	32.5	661.61	.58	1.89	271	122	74	3.0	260	38
3	35	663.62	.58	1.85	274	127	74	3.0	265	38
4	37.5	665.49	.56	1.85	276	128	75	3.0	265	38
5	40	667.59	.55	1.80	275	128	75	3.0	265	38
6	42.5	669.55	.54	1.75	275	125	76	2.5	265	38
7	45	671.54	.54	1.75	274	127	78	2.5	265	40
8	47.5	673.50	.52	1.70	273	128	77	2.5	265	40
9	50	675.33	.48	1.58	272	129	77	2.0	265	40
10	52.5	677.16	.45	1.49	271	128	78	2.0	260	40
11	55	678.95	.42	1.38	272	126	79	2.0	260	40
12	57.5	680.70	.20	.98	272	124	78	1.0	260	40
	60/27	682.15								

SAMPLE TRAIN LEAK CHECKS
PRE-TEST .002 CFM @ 15 "Hg POST-TEST .002 CFM @ 7 "Hg

PITOT TUBE LEAK CHECKS
PRE-TEST #2 0000 POST-TEST #2 00 52
#4 00 53 #4 00 53

SO_2

PLANT Metro Ceramics DATE 30 MAR 94 RUN 2 CASE #83 LOCATION outlet PAGE of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0 1335	556.10	1.21	74	70	12	46
5	558.38		84	70	12	45
10	561.98		86	71	12	45
15	565.12		86	71	12	45
20	570.12		87	71	12	46
25	573.38		86	72	12	46
30	576.62		85	71	12	47
35	579.31		86	71	12	47
40	583.10		86	72	12	47
45	587.33		86	72	12	47
50	590.86		86	72	12	48
55	594.32		83	73	12	48
60 1435	596.03		--			

System Leak Checks: Pre-Test 0 CFM @ 15 "Hg
Post-Test 0 CFM @ 15 "Hg

method 4

PLANT Nevo Cranes DATE 7/30/14 RUN # 3 CASE # 29 LOCATION page 1 of 1

POINT NUMBER	SAMPLE TIME	GAS METER READING	VELOCITY Δp	VELOCITY HEAD	VELOCITY √Δp	ORIFICE PRESSURE	STACK TEMP	GAS METER TEMP IN	GAS METER TEMP OUT	PUMP VACUUM	FILTER HOLDER	IMPINGER TEMP
1	0/5:00	682.60	.56			1.85	268	85	62	4.5	240	36
2	25	684.51	.53			1.89	272	108	64	5.0	240	36
3	5	686.57	.60			1.95	272	116	64	5.0	245	36
4	7.5	688.58	.58			1.89	272	115	66	5.0	255	38
5	10	690.57	.56			1.85	272	122	67	4.5	260	38
6	12.5	692.53	.55			1.80	271	122	69	4.5	260	38
7	15	694.51	.52			1.70	274	123	69	4.5	255	40
8	17.5	696.38	.46			1.50	276	123	71	4.0	255	40
9	20	698.17	.46			1.50	275	122	72	4.0	255	42
10	22.5	699.93	.48			1.58	276	122	73	4.0	255	42
11	25	701.80	.45			1.49	273	123	73	4.0	255	42
12	27.5	703.56	.46			1.50	271	123	73	4.0	255	42
1	30	705.40	.58			1.89	270	98	72	5.0	260	42
2	32.5	707.41	.60			1.95	270	121	73	5.0	260	42
3	35	709.44	.58			1.89	273	125	74	5.0	260	42
4	37.5	711.52	.56			1.85	274	128	75	5.0	270	42
5	40	713.43	.56			1.85	273	126	76	5.0	260	42
6	42.5	715.30	.56			1.85	273	126	76	5.0	260	42
7	45	717.33	.52			1.70	272	126	76	4.5	260	42
8	47.5	719.35	.52			1.70	272	125	76	4.5	260	42
9	50	721.30	.48			1.58	271	126	76	4.0	260	42
10	52.5	723.14	.42			1.38	273	124	76	3.5	255	42
11	55	724.75	.32			1.05	272	124	77	3.0	255	42
12	57.5	726.25	.30			1.00	245	124	77	2.5	255	42
	60/16:12	727.72										

SAMPLE TRAIN LEAK CHECKS
PRE-TEST 0.005 CFM @ 15 "Hg POST-TEST 0 CFM @ 7 "Hg

PITOT TUBE LEAK CHECKS
PRE-TEST #2 0.0 #1 0.0 POST-TEST #2 0.0 #1 0.0

melhat 5

SO2

PLANT Metro Ceram. DATE 30 mar 94 RUN# 3 CASE# 64 LOCATION outlet PAGE of

Sample Time	Gas Meter Reading	Flow Rate Setting	Gas Meter Temperature In	Gas Meter Temperature Out	Pump Vacuum	Impinger Temperature
0 1506	596.31	1.21	68	71	10.0	40
5	599.02		72	71	10.0	40
10	602.71		73	72	10.0	40
15	606.01		75	72	10.0	40
20	609.78		78	72	10.0	40
25	611.02	↓	80	73	10.0	40
30	614.97	1.21	84	74	10.0	40
35	1:1805		86	74	10.0	40
40	620.00		86	74	10.0	40
45	622.96		88	74	10.0	40
50	626.90		87	75	10.0	40
55	629.89	↓	87	75	10.0	40
60	633.62	+				

System Leak Checks: Pre-Test .01 CFM @ 15 "Hg
Post-Test .005 CFM @ 15 "Hg

method #4

METROPOLITAN EMISSION COMPLIANCE TEST

TO BE PERFORMED ON TUNNEL KILNS #1, #2, #3.

DATE 30th March 1994

CARRIED OUT BY ENVISAGE ENVIRONMENTAL INC.

RELEVENT DATA

	KILN SPEED	PRODUCT	CLAY	SHALE	* DRY TONS/KILN
TK #1	34 cars per day	57X	100%	nil	62.832
TK #2	34 cars per day	57X	100%	nil	62.832
TK #3	40 cars per day	31X	30%	70%	73.92

* DRY TONS
(Weight of raw materials only)

Number of cars per kiln per day x 2.2 average wet tons per car x 0.84 (allowing for 16% moisture removed from tiles before firing)

KILN CAPACITY

POTENTIAL FOR THE 3 KILNS 221.76 tons
(3 x 40 cars per day x 2.2 average wet tons per car x 0.84 (as above))

ACTUAL CAPACITY DURING TEST 199.584 tons
(34 + 34 + 40) = 108 cars per day x 2.2 x 0.84

% CAPACITY 90 %

TESTS

For SO2, F (to be split into HF & F), Particulate (as per NOI submitted)

RAW MATERIAL TEST

Samples of clay tiles, (2 doubles/car), will be taken, prior to entering the kilns, from the cars that will be directly in the areas of the measured emissions
Each kiln will be represented by 15 pieces of clay tile per test.
Each test series of clay tiles will be ground and sent to either Stark Ceramics or Skyline Labs (Denver, CO), to be tested for Sulfur content. 3 series of ground clay tile, representing each emission test, will consist of 3 batches (1 per kiln).

PEAK TEMPERATURES

TK#1	1190 °C
TK#2	1190 °C
TK#3	1150 °C

CAR NUMBERS FOR SAMPLE TILES

3/30/94 TEST 1	TK #1	124	41	254	57	238	215	241	75	283	270		
11:20	TK #2	183	235	197	219	225	81	123	119	186	279		
	TK #3	138	175	268	129	153	38	136	131	7	244	118	6
3/30/94 TEST 2	TK #1	57	238	215	241	75	283	270	44	139	111		
13:15	TK #2	219	225	81	123	119	186	279	282	221	148		
	TK #3	129	153	38	136	131	7	244	118	6	158	54	209
3/30/94 TEST 3	TK #1	215	241	75	283	270	44	139	111	160	266		
15:00	TK #2	81	123	119	186	279	282	221	148	277	29		
	TK #3	131	7	244	118	6	158	54	209	275	55	22	249

Audit Samples Given:
SO_2 C8613
C8853

Particulate Sampling - Observation Checklist

Date: March 30 1994
Observer(s): Rick L. Miller
George Long
Facility: Metropolitan Industries
Source: Tile Tunnel Kilns #1, #2 & #3
Test Firm: Envirogen Environmental (Greg Sinkovich)

Sampling Method(s):
RM 5 [X]; 5A []; 5B []; 5D []; 5E []; 5F []; 8 []; 12 []; 17 []; or other [] (If other, please describe.) 6 & 13A also

Are there any modifications to the specified reference method(s)?
Yes [X]; No [ ] (If yes, please describe modification.) Method 5 & Method 13A will be combined in the sample train.

Do the inlet (if applicable) and outlet sampling locations meet the requirements specified in RM 1?
Yes [ ]; No [] (If no, how was (were) the location(s) modified to allow sampling?) (NA) - only outlet sampling

If inlet/outlet sampling is being performed, are the samples being taken simultaneously?
Yes []; No [] (If no, be sure that the source operating parameters are the same when they switch from one to the other.)

If cyclonic flow is present and other sampling locations do not exist, how will the samples be withdrawn?
Directional probe technique []; Alignment technique [X]; other [] (If other, please describe.)

Is the sampling train set up properly, in accordance with the reference method or as agreed upon in the pre-test meeting?
Yes [X]; No [] (If no, correct problems and continue, if possible.) * empty impinger was not used in Method 6 sample train
** ice was not used in ice bath - temp. outside was low (~40°F)

Check to ensure that the sampling equipment has been recently calibrated (i.e., meter box, thermometers/thermocouples, pitot tubes, etc.) OK [X]; not OK [] w/in 60 days of test? Yes - 3/17/94

Type of filter: Whatman Glass microfiber
Is the filter assembly positioned properly?
Yes [X]; No [] (If no, adjust and continue, if possible. Please note that the filter may be changed during the test run; however, it is recommended that the entire filter assembly be changed.)

Nozzle Diameter: .25 in.
(Please note that the nozzle may not be changed during the test run.)

Number of sampling points on a traverse: 12 — 24 total
Sampling time per point: 2.5

Type of probe: (quartz, (stainless steel), water jacketed, etc.)

Type of probe liner (if applicable): pyrex

Impinger contents:	Method 5/13A	Method 6
First –	100ml H_2O	100 ml 80% IPA
Second –	100ml H_2O	100 ml 3% H_2O_2
Third –	empty	100 ml 3% H_2O_2
Fourth –	200g silica gel	~~empty~~ (none)
Modifications		200g silica gel

Will the stack moisture content be determined as part of RM 5? Yes [X]; No [] (If no, please describe the procedure for the separate moisture determination.)

Gas analysis:
Orsat [X]; Fyrite []; Grab []; other [] (If other, please describe.)

Indicate probe and filter box temperature settings:
Probe (if applicable) – 248 ± 25 °F
Filter box – 248 ± 25 °F
(If on, have probe checked to ensure it is heating properly.)

Reminder: When conducting tests on boilers, the probe and filter box temperatures may not exceed 320 degrees Fahrenheit

Ensure that the sampling port(s) is (are) sealed around the probe(s) when sampling. OK [X]; not OK []

Check and note color and condition of silica gel: black/wht. — loose

Leak-checks:

	Run #1	Run #2	Run #3		Run #1	Run #2	Run #3	
Post-test (SO_2) –	.01	0	.005	cfm @	15	15	15	"Hg
PM+Fluoride Post-test (mandatory) –	.002	.002	0	cfm @	7	7	7	"Hg

(The post-test leak-check must be conducted at or above the highest vacuum reading encountered during the test run. The leak check should be conducted by plugging the inlet to the probe nozzle. The maximum acceptable leakage rate for a leak-check is .02 cfm (.0057 cmm) or 4% of the average sampling rate, whichever

is less. If the sampling was stopped during the test run to change a sampling train component, be sure the sampling train is leak-checked again.)

Periodically record readings from the test firm's raw data sheet(s) (i.e., delta H, delta P, initial gas volume, filter numbers, filter box temperatures, etc.). Or photocopies of the raw data sheets may be requested from the test firm. (Attach the readings and/or photocopies to this checklist.)

Check to ensure that the sample train recovery procedures are conducted properly (i.e., filter handling, probe wash, liquid transfers, appropriate sample recovery solution(s), recovery of nozzel catch, etc.).

Will there be additional sampling and/or analyses performed (i.e., particle size distributions, back-half analysis, HCl analysis, metals analysis, etc.)?
Yes [X]; No [] (If yes, please describe.) Method 6 for SO_2 + Method 13A for Fluorides

Optional checks/verifications:

The test firm may be asked to do a ten (10) minute run on their dry gas meter for calibration verification. Operate the meter at the delta H setting obtained from the test firm's calibration sheet. Record the volume collected, the dry gas meter temperature and the barometric pressure. Calculate a dry gas meter calibration check value, Yc, as follows:

$$Yc = \frac{10}{Vm} \frac{[0.0319 * Tm]1/2}{Pbar}$$

Where:

Yc = dry gas meter calibration check value (dimensionless)
10 = ten minute verification run

Compare the Yc value with the dry gas meter calibration factor Y to determine that: $0.97\ Y < Yc < 1.03\ Y$. If the Yc value is not within this range the meter should be recalibrated and if completed the run and/or test should be voided.

The test firm may be required to perform at least one actual moisture determination. (This check should be performed after the first run.)

Measure or have the test firm remeasure the nozzle diameter to verify it's calibration. (This should be performed for each nozzle utilized.)

Source operating conditions - Compliance demonstation checklist

Source operating rate(s) (i.e., total heat input, feed rate(s), steam loadings, charge rates, etc.): See attachment of fax from Metropolitan

Periodically check and record the operating rate(s) during the test period.

Total heat input determined by: F Factor [ ]; coal scales [ ]

Date of coal scale calibration: _____

Process weight rate: _____

For incinerators, indicate the operating temperature(s) and retention time(s) (if known): _____

Did the source perform sootblowing, ash pulling, ESP plate rapping or fabric filter cleaning during any of the test runs? Yes []; No [] (If yes, please indicate activity and time interval(s).) _____

Indicate the type(s) of continuous monitor(s) utilized by the source being tested:
Opacity []; SO2 []; NOx []; CO []; O2 []; other [] (If other please describe.) _____

Periodically check and record the readings from the monitors during the test period.

Are visible emission readings being taken in accordance with RM 9 procedures? Yes [✓]; No [] If yes, are the RM 9 readings comparable to the continuous opacity monitor readings? Yes []; No [] (If no, indicate the discrepancies.) NA

Are the coal and/or auxiliary fuel(s) and scrubber water and/or ash samples (if applicable) being collected at the proper location and frequency? Yes []; No [] (If no, correct and continue, if possible.)

Additional source or process information: _____

Facsimile Cover Sheet

To: Rick Miller.
Company: Canton Air Quality.
Phone:
Fax: 489-3335.

From: Philip McGuinness (484-4887)
Company: Metropolitan Ceramics
Phone: 216-484-8453
Fax: 216-484-8455

Date: 3/29/94
Pages including this cover page: 3

Comments:

Rick

Outline of test data, as requested.

Regards

Phil C.

Set up time is approx 8-30/9-00 am.

METROPOLITAN EMISSION COMPLIANCE TEST

TO BE PERFORMED ON TUNNEL KILNS #1, #2, #3.

DATE 30th March 1994

CARRIED OUT BY ENVISAGE ENVIRONMENTAL INC.

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CARBON AND SULFUR TESTING 1994

DAILY CLAY/SHALE SAMPLES OF 10gms TOTAL COLLECTED TO REPRESENT THE DAYS PRODUCTION COLOR, ACCUMULATED FOR A 7 DAY PERIOD, TO GIVE A COMPOSITE SAMPLE FOR TESTING AT STARK CERAMICS FOR CARBON AND SULFUR CONTENT.

E.G. 310 PRODUCTION COLOR (70% SHALE, 30% CLAY) REPRESENTE BY 7gms SHALE AND 3gms CLAY

SAMPLE DATES	PRODUCTION COLORS TKI & TK2	TK3	CARBON %	SULFUR %	TOTAL %	MONTH AVER:% SULFUR	KILN SCHEDULES TK1	TK2	TK3	Average Wet Tons/car	WetTons Product /day	Dry Tons Product /day	# of KILNS OPERATING
12/29–1/9	BISQ, 101, 507	310	0.181	0.068	0.249		40	0	38	2.2	172	144	TK1-TK3
1/10–1/16	507, 57X	310	0.213	0.082	0.295		40	0	40	2.2	176	148	TK1-TK3
1/17–1/23	57X	310, 31X	0.213	0.152	0.365		40	0	40	2.2	176	148	TK1-TK3
1/24–1/30	507	31X, 240, 310	0.199	0.116	0.315	0.105	40	0	40	2.2	176	148	TK1-TK3
1/31–2/6	507	310	0.228	0.118	0.346		40	0	40	2.2	176	148	TK1-TK3
2/7–2/13	507, 57X	310	0.248	0.074	0.321		40	0	40	2.2	176	148	TK1-TK3
2/14–2/20	57X, 105	310, 31X	0.356	0.138	0.494		27	27	40	2.2	207	174	TK1-TK2-TK3
2/21–2/27	105, 15X, 107	31X, 308	0.290	0.114	0.404	0.111	27	27	40	2.2	207	174	TK1-TK2-TK3
2/28–3/6	107240	308310	0.200	0.118	0.318		31	31	40	2.2	224	188	TK1-TK2-TK3
3/7–3/13	240, 250, 350	310	0.250	0.062	0.312		37	37	28	2.2	224	188	TK1-TK2-TK3
3/14–3/20	240, 507	310	0.268	0.098	0.366		31	31	40	2.2	224	188	TK1-TK2-TK3
3/21–3/27	507, 57X	310, 31X					31	31	40	2.2	224	188	TK1-TK2-TK3
3/28–4/3	57X	31X					34	34	40	2.2	238	200	TK1-TK2-TK3
											0	0	
											0	0	
											0	0	
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											0	0	
											0	0	
		Average % Sulfur todate		0.104									

CARBON AND SULFUR TESTING   1994

DAILY CLAY/SHALE SAMPLES OF 10gms TOTAL COLLECTED TO REPRESENT THE DAYS PRODUCTION COLOR, ACCUMULATED FOR A 7 DAY PERIOD, TO GIVE A COMPOSITE SAMPLE FOR TESTING AT STARK CERAMICS FOR CARBON AND SULFUR CONTENT.

E.G. 310 PRODUCTION COLOR (70% SHALE, 30% CLAY) REPRESENTE BY 7gms SHALE AND 3gms CLAY

SAMPLE DATES	PRODUCTION COLORS TK1 & TK2	PRODUCTION COLORS TK3	CARBON %	SULFUR %	TOTAL %	MONTH AVER.% SULFUR	KILN SCHEDULES TK1	KILN SCHEDULES TK2	KILN SCHEDULES TK3	Average Wet Tons/car	WetTons Product /day	Dry Tons Product /day	# of KILNS OPERATING
12/29–1/9	BISQ 101,507	310	0.181	0.068	0.249		40	0	38	2.2	172	144	TK1-TK3
1/10–1/16	507, 57X	310	0.213	0.082	0.295		40	0	40	2.2	176	148	TK1-TK3
1/17–1/23	57X	310, 31X	0.213	0.152	0.365		40	0	40	2.2	176	148	TK1-TK3
1/24–1/30	507	31X, 240, 310	0.199	0.116	0.315	0.105	40	0	40	2.2	176	148	TK1-TK3
1/31–2/6	507	310	0.228	0.118	0.346		40	0	40	2.2	176	148	TK1-TK3
2/7–2/13	507, 57X	310	0.248	0.074	0.321		40	0	40	2.2	176	148	TK1-TK3
2/14–2/20	57X, 105	310, 31X	0.356	0.138	0.494		27	27	40	2.2	207	174	TK1-TK2-TK3
2/21–2/27	105, 15X, 107	31X, 308	0.290	0.114	0.404	0.111	27	27	40	2.2	207	174	TK1-TK2-TK3
2/28–3/6	107240	308310	0.200	0.118	0.318		31	31	40	2.2	224	188	TK1-TK2-TK3
3/7–3/13	240, 250, 350	310	0.250	0.062	0.312		37	37	28	2.2	224	188	TK1-TK2-TK3
3/14–3/20	240, 507	310	0.268	0.098	0.366		31	31	40	2.2	224	188	TK1-TK2-TK3
3/21–3/27	507, 57X	310, 31X					31	31	40	2.2	224	188	TK1-TK2-TK3
3/28–4/3							26	26	40	2.2	202	170	TK1-TK2-TK3
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Average % Sulfur todate: 0.104

TK3 – 40 car 310 — 310: 70% SL, 30% CL. — 40 × 2.2 × 0.84 = 73.92 tons — Shale 51.744 – Clay 22.176 t

TK1 & TK2 – 62 – 507 (31/31) — 100% CL. — 62 × 2.2 × 0.84 = 114.576

188.496 – SL 51.744 – Clay 136.752

27.45% — 72.55

28 — 72.

2.8g — 7.2g.

7 day

ADDITIONAL TERMS & CONDITIONS
METROPOLITAN INDUSTRIES
15 76 05 1149
P004

1. Performance Test Requirements

The permittee shall conduct, or have conducted, performance testing on the air contaminant source(s) in accordance with procedures approved by the Agency. Two copies of the written report shall be submitted and signed by the person responsible for the test, describing the test procedures followed and the results of such tests. The Director, or an Ohio EPA representative, shall be allowed to witness the tests, examine testing equipment and require the acquisition or submission of data and information necessary to assure that the source data and information necessary to assure that the source operation and testing procedures provide a valid characterization of the emissions from the source and/or the performance of the control equipment.

A completed Intent to Test notification form shall be submitted to the Canton City Health Department, Division of Air Pollution Control, 420 Market Avenue North, Canton, Ohio 44702. This notice shall be made thirty (30) days in advance and shall specify the source operating parameters, the proposed test procedures and the time, data, place and person(s) conducting such tests.

Two copies of the test results shall be submitted within thirty (30) days after the completion of the performance test.

Tests shall be performed for the following sources and pollutants:

Source	Pollutant(s)
P004, P005, P006	SO_2, Fluorides

Test Method 13A should be employed to measure fluoride emissions.

Test Method 6 should be employed to measure SO_2 emissions. This test shall be run with all three kilns (#1, #2, #3) operating. This test shall be run at or near the maximum production capacity of all three kilns.

This stack test shall include an analysis of the sulfur content of the raw materials (clay and shale).

This test shall be conducted before May 1, 1994.

2. A sulfur content limit will be established for the raw materials (clay and shale) used in Kiln #1 (P004), Kiln #2 (P005) and Kiln #3 (P006). This limit shall be based on the results of the stack test done with all three kilns operating and shall be on a quarterly weighted average. Sulfur analysis method LECO will be used.

At any one time, only two of the three kilns can be using a 100% clay mix with no shale. The third kiln must be using a mix with a shale content of at least 40%.

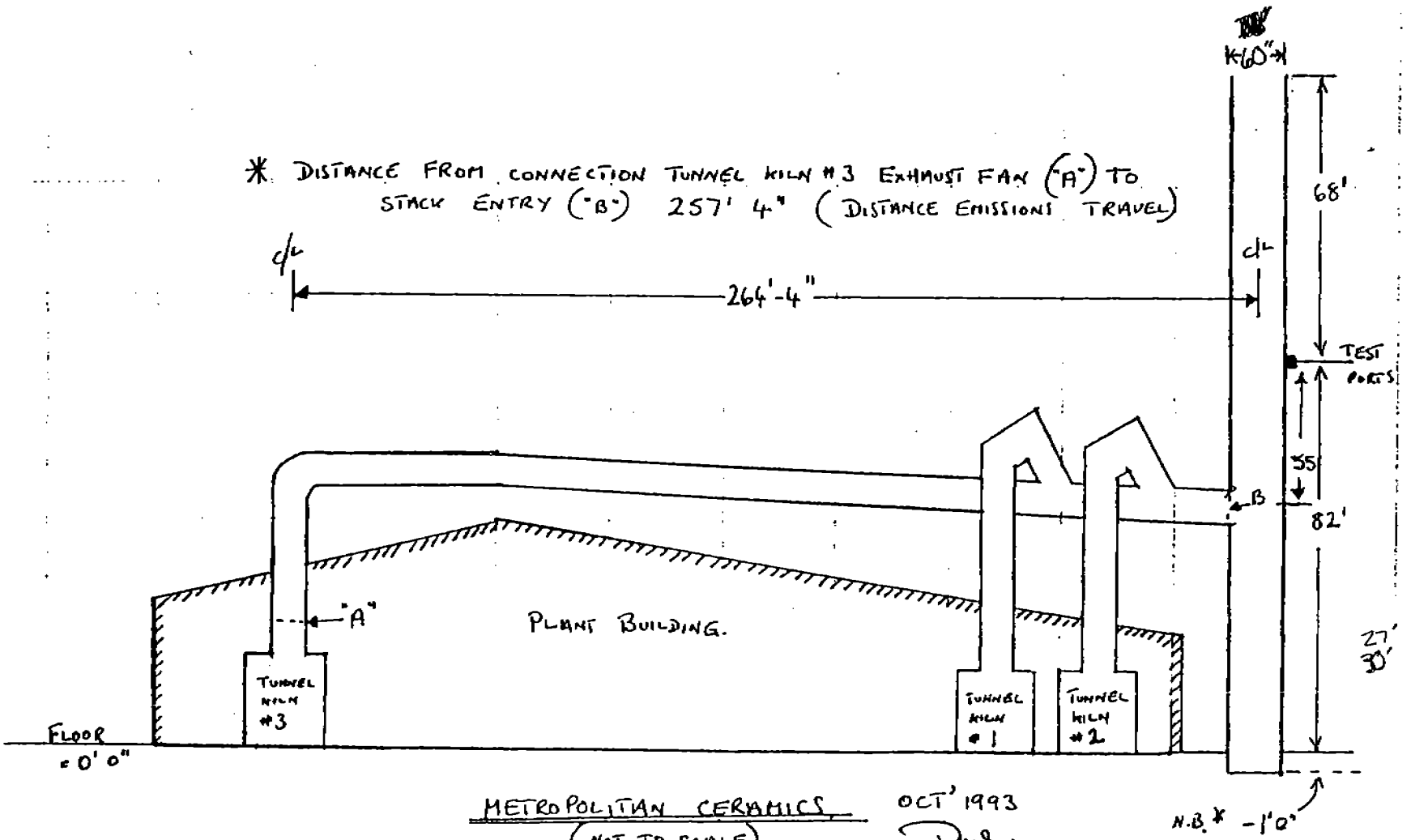
No more than 79 tons of raw materials shall be used in each kiln in any one day.

The facility shall maintain monthly records which:

A. List the weekly average sulfur content (percent) of daily sampled clay and shale and analyzed as weekly composite samples;

B. List the clay and shale content of mixes used in each kiln each day; and

lb Sulfur / lb. of clay mix



METROPOLITAN CERAMICS
(NOT TO SCALE)

OCT' 1993

PMD.