Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

AP42 Section:	11.3
Background Chapter	4
Reference:	34
Title:	*Source Emissions Survey of Boral Bricks, Inc., Absorber Stack (EPN-K), Henderson, Texas, TACB Permit 21012*, METCO Environmental, Addison, TX, June 1995.

EXHIBIT E (34)
Section 4, Ref 34

Emission Factor Develop for Stack Testing of Scrubber Stack at Boral Bricks, Henderson Plant in June, 1995
by METCO

Kiln 1

Schedule: 43 cars/day
2,916 brick/car
Brick Weight: 3.98 lb/fired brick (verified by quality control reports)

$$= \frac{43\ \text{car}}{\text{day}} \cdot \frac{2{,}916\ \text{brick}}{\text{car}} \cdot \frac{3.98\ \text{lb}}{\text{brick}} \cdot \frac{\text{day}}{24\ \text{hr}} \cdot \frac{\text{ton}}{2000\ \text{lb}}$$

= 10.40 ton/hr

Kiln 2

Schedule: 43 cars/day
2,916 brick/car
Brick Weight: 3.98 lb/fired brick (verified by quality control reports)

$$= \frac{43\ \text{car}}{\text{day}} \cdot \frac{2{,}916\ \text{brick}}{\text{car}} \cdot \frac{3.98\ \text{lb}}{\text{brick}} \cdot \frac{\text{day}}{24\ \text{hr}} \cdot \frac{\text{ton}}{2000\ \text{lb}}$$

= 10.40 ton/hr

Total = 20.79 ton/hr

Emission Factor Development:

$$\text{filterable PM} = \frac{[\text{ Average Emission Rate (lb PM / hr) }]}{[\text{ Kiln Throughput (ton / hr) }]}$$

$$= \frac{9.01\ \text{lb}}{\text{hr}} \cdot \frac{\text{hr}}{20.79\ \text{ton}}$$

filterable PM = 0.43 lb/ton

Emission Factor Summary:

Pollutant	Avg. Emission Rate	Avg. Emission Factor
PM	9.01 lb/hr	0.43 lb/ton
SO_2	20.9 lb/hr	1.01 lb/ton
NOx	5.37 lb/hr	0.26 lb/ton
HF	1.17 lb/hr	0.056 lb/ton

Notes:

METCO ENVIRONMENTAL
P.O. Box 598
Addison, TX 75001
(214) 931-7127

SOURCE EMISSIONS SURVEY
OF
BORAL BRICKS, INC.
ABSORBER STACK (EPN-K)
HENDERSON, TEXAS
TACB PERMIT 21012

JUNE 1995

FILE NUMBER 95-134

METCO ENVIRONMENTAL

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SOURCE EMISSIONS SURVEY
BORAL BRICKS, INC.
ABSORBER STACK (EPN-K)
HENDERSON, TEXAS
TACB PERMIT 21012
FILE NUMBER 95-134

INTRODUCTION

METCO Environmental, Dallas, Texas, conducted a source emissions survey of Boral Bricks, Inc., located in Henderson, Texas, on June 28, 29, and 30, 1995. The purpose of these tests was to determine the concentrations of particulate matter, hydrogen fluoride, sulfur dioxide, and oxides of nitrogen being emitted to the atmosphere via the Absorber Stack (EPN-K). The visible emissions were also determined.

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3B, 4, 5, 6, 7E, 9, and 13B; and in the "Sampling Procedures Manual, Texas Air Control Board, Revised July 1985."

The testing was observed by Mr. Greg Orr of the Texas Natural Resource Conservation Commission.

SUMMARY OF RESULTS

Absorber Stack (EPN-K)

Run Number	Particulate Matter Emissions (gr/dscf*)	Particulate Matter Emissions (lbs/hr)	Hydrogen Fluoride Emissions (ppm)	Hydrogen Fluoride Emissions (lbs/hr)	Sulfur Dioxide Emissions (ppm)	Sulfur Dioxide Emissions (lbs/hr)	Oxides of Nitrogen Emissions (ppm)	Oxides of Nitrogen Emissions (lbs/hr)
1	0.0214	8.07	8.6	1.18	48.2	21.3	16.0	5.08
2	0.0322	12.01	8.2	1.12	46.5	20.9	17.0	5.51
3	0.0186	6.94	8.8	1.20	45.2	20.4	17.0	5.51
Average	0.0241	9.01	8.5	1.17	46.6	20.9	16.7	5.37
Allowable Emission Rate	----	10.2	----	0.9	----	21.2	----	4.0

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

SUMMARY OF RESULTS

Absorber Stack (EPN-K)

Visible Emissions

Run Number	Date	Time	Visible Emissions 1-hour Average (% Opacity)	Visible Emissions Maximum 6-minute (% Opacity)
1	06/29/95	1820-1920	0.5	0.6
2	06/30/95	0838-0938	0.5	1.1
3	06/30/95	1120-1220	0.4	0.6
Average			0.5	0.8
Allowable Visible Emissions			----	≤ 5.0

SUMMARY OF RESULTS

Absorber Stack (EPN-K)

Run Number	1	2	3
Date	06/29/95	06/29/95	06/30/95
Time	1240-1449	1718-1922	1018-1219
Stack Flow Rate - ACFM	84,480	83,852	82,471
Stack Flow Rate - DSCFM*	44,078	43,563	43,601
% Water Vapor - % Vol.	7.45	7.71	7.57
% CO_2 - % Vol.	2.1	2.2	2.0
% O_2 - % Vol.	17.3	17.0	17.2
% Excess Air @ Sampling Point	426	385	408
Stack Temperature -°F	472	472	459
Stack Pressure - "Hg	29.66	29.62	29.68
Percent Isokinetic	100.9	101.4	100.7
Volume Dry Gas Sampled - DSCF*	71.675	71.174	70.738
Particulate Matter Emissions Probe & Filter Catch grains/dscf*	0.0130	0.0217	0.0176
grains/cf @ Stack Conditions	0.0067	0.0113	0.0093
lbs/hr	4.90	8.12	6.59
Total Catch grains/dscf*	0.0214	0.0322	0.0186
grains/cf @ Stack Conditions	0.0111	0.0167	0.0098
lbs/hr	8.07	12.01	6.94
Hydrogen Fluoride - mg	14.484	13.813	14.707
Hydrogen Fluoride Emissions - ppm	8.6	8.2	8.8
Hydrogen Fluoride Emissions - lbs/hr	1.18	1.12	1.20

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

SUMMARY OF RESULTS

Absorber Stack (EPN-K)

Run Number	1	2	3
Date	06/29/95	06/29/95	06/30/95
Time	0953-1110	1512-1632	0825-0941
Stack Flow Rate - ACFM	84,544	87,277	85,329
Stack Flow Rate - DSCFM*	44,301	45,234	45,239
% Water Vapor - % Vol.	7.94	8.12	8.02
% CO_2 - % Vol.	2.2	2.2	2.2
% O_2 - % Vol.	17.0	17.2	17.2
% Excess Air @ Sampling Point	385	414	414
Stack Temperature -°F	463	470	452
Stack Pressure - "Hg	29.66	29.62	29.68
Sulfur Dioxide Emissions - ppm	48.2	46.5	45.2
Sulfur Dioxide Emissions - lbs/hr	21.3	20.9	20.4
Oxides of Nitrogen Emissions - ppm	16.0	17.0	17.0
Oxides of Nitrogen Emissions - lbs/hr	5.08	5.51	5.51

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

DISCUSSION OF RESULTS

The three tests for particulate matter and hydrogen fluoride appeared to be valid representations of the actual emissions during the tests. All leak checks performed on the sampling train and the pitot tubes showed no leaks before or after each test. The indicative parameters calculated from the field data were in close agreement. The moisture percentages for the three tests were within 1.8 percent of the mean value. The measured flow rates (Q_s) for the tests were within 0.8 percent of the mean value. The rates of sampling for the three tests were within the specified limits (90 to 110 percent isokinetic). The greatest deviation from 100 percent isokinetic was 1.4 percent.

The calculated emissions (pounds per hour) of particulate matter for the three tests showed a range of -22.9 percent to +33.3 percent variation from the mean value.

The calculated emissions (pounds per hour) of hydrogen fluoride for the three tests showed a range of -4.0 percent to +2.9 percent variation from the mean value.

The three tests for sulfur dioxide and oxides of nitrogen appeared to be valid representations of the actual emissions during the tests. All leak checks performed on the sampling train, the pitot tubes, and the monitor sampling system showed no leaks before or after each test. The zero and calibration drift tests of the monitor were stable with no variations greater than 3.0 percent. The calibration error check, sampling system bias check, and NO_2 to NO conversion efficiency check performed prior to testing were valid.

The indicative parameters calculated from the field data were in close agreement. The moisture percentages for the three tests were within 1.2 percent of the mean value. The measured flow rates (Q_s) for the tests were within 1.4 percent of the mean value.

The collection efficiencies between the two sulfur dioxide impingers in these tests were very good, indicating that little, if any, sulfur dioxide was bypassed.

The efficiencies were as follows:

Run Number	1	2	3
Impinger #2	99.3	99.0	98.9
Impinger #3	0.7	1.0	1.1

Collection of 90 percent or more of the sampled sulfur dioxide in the first sulfur dioxide impinger is a verification of a representative sample.

The calculated emissions (pounds per hour) of sulfur dioxide for the three tests showed a range of -2.2 percent to +2.1 percent variation from the mean value.

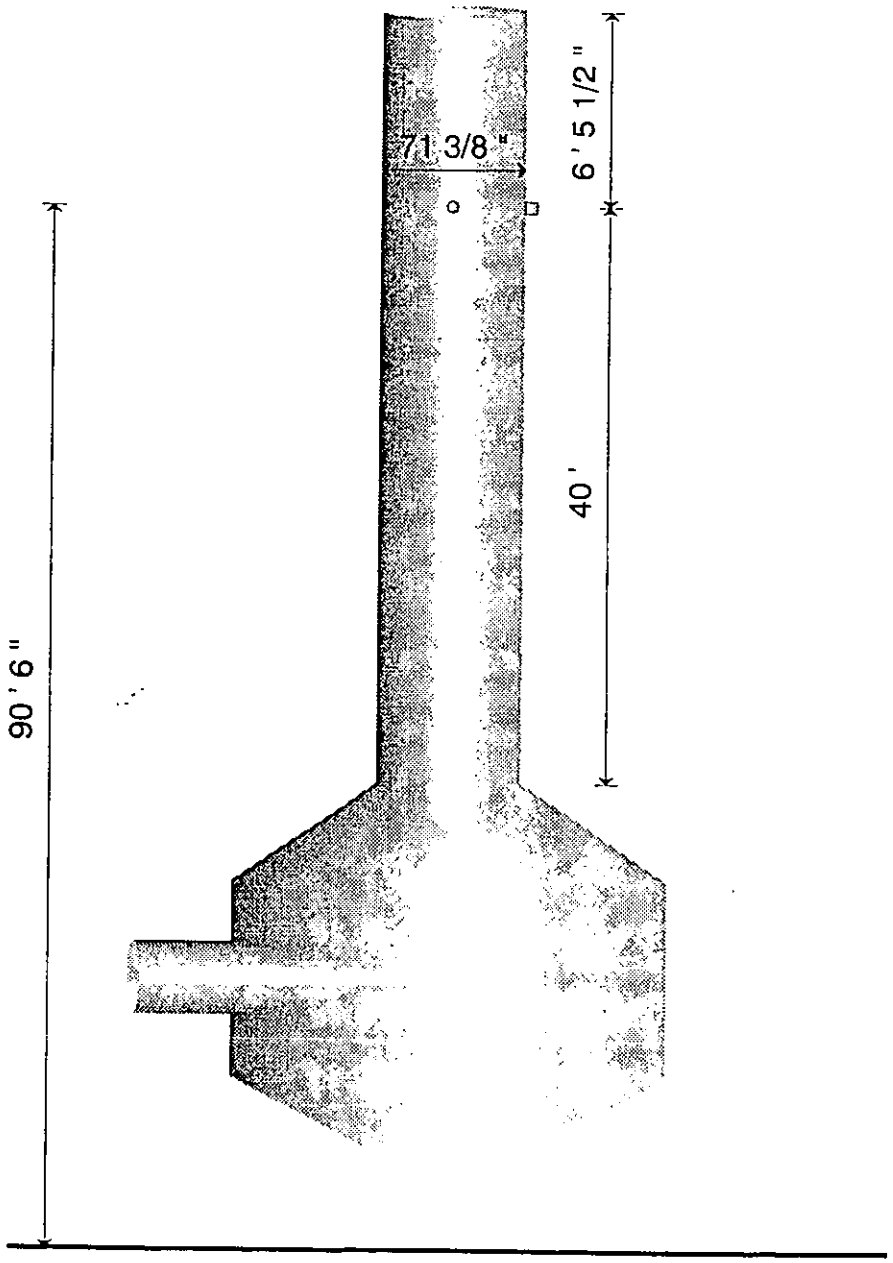
The calculated emissions (pounds per hour) of oxides of nitrogen for the three tests showed a range of -5.3 percent to +2.7 percent variation from the mean value.

DESCRIPTION OF SAMPLING LOCATIONS

The sampling location on the Absorber Stack (EPN-K) is 90 feet 6 inches above the ground. The sampling ports are located 40 feet (6.73 stack diameters) downstream from the inlet to the stack and 6 feet 5 1/2 inches (1.09 stack diameters) upstream from the outlet of the stack.

SAMPLING LOCATION

Absorber Stack (EPN-K)



Not to Scale

SAMPLING AND ANALYTICAL PROCEDURES

The sampling followed the procedures set forth in the Appendix to the Code of Federal Regulations, Title 40, Chapter I, Part 60, Methods 1, 2, 3B, 4, 5, 6, 7E, 9, and 13B; and in the "Sampling Procedures Manual, Texas Air Control Board, Revised July 1985."

A preliminary velocity traverse was made at each of the two ports on the stack, in order to determine the uniformity and magnitude of the flow prior to testing. Several traverse points were checked for cyclonic flow and none was found to be present. Twelve traverse points were sampled from each of the two ports for a total of twenty-four traverse points.

The sampling trains were leak-checked at the nozzle at 15 inches of mercury vacuum before each test, and again after each test at the highest vacuum reading recorded during the test. This was done to predetermine the possibility of a diluted sample.

The pitot tube lines were checked for leaks before and after each test under both a vacuum and a pressure. The lines were also checked for clearance and the manometer was zeroed before each test.

An integrated orsat samples was collected and analyzed according to EPA Method 3B during each test.

Particulate Matter and Hydrogen Fluoride

Triplicate samples for particulate matter and hydrogen fluoride were collected. The samples were taken according to EPA Methods 1, 2, 3B, 4, 5, and 13B; and the "Sampling Procedures Manual, Texas Air Control Board, Revised July 1985." For each run, samples of five-minute duration were taken isokinetically at each of the twenty-four traverse points for a total sampling time of 120 minutes. Reagent blanks were submitted.

The " front-half " of the sampling train contained the following components:

Stainless Steel Nozzle
Heated Glass Probe @ 248°F ± 25°F
Heated Quartz Fiber Filter and Teflon Support @ 248°F ± 25°F

The " back-half " of the sampling train contained the following components:

Impinger Number	Contents	Amount	Parameter Collected
1	HPLC Water	100 ml	Particulate Matter and Hydrogen Fluoride
2	HPLC Water	100 ml	Particulate Matter and Hydrogen Fluoride
3	Empty	--------	Moisture
4	Silica Gel	200 g	Moisture

Particulate matter emissions were calculated from gravimetric analysis using both the " front-half " and " back-half " collections of the sampling train.

The hydrogen fluoride samples were analyzed by ion chromatography.

Sulfur Dioxide

Triplicate samples for sulfur dioxide were collected. The samples were taken according to EPA Methods 1, 2, 3B, 4, and 6; and the "Sampling Procedures Manual, Texas Air Control Board, Revised July 1985." Large impingers (500 ml), as specified in EPA Method 8, were used. For each run, samples of three-minute duration were taken at each of the twenty-four traverse points for a total sampling time of 72 minutes. At the conclusion of each run, the sampling train was purged for fifteen minutes with ambient air at the same rate at which the sample was taken. Reagent blanks were submitted.

The " front-half " of the sampling train contained the following components:

Stainless Steel Nozzle
Heated Glass Probe @ 248°F ± 25°F
Heated Glass Fiber Filter and Glass Support @ 248°F ± 25°F

The " back-half " of the sampling train contained the following components:

Impinger Number	Contents	Amount	Parameter Collected
1	80% Isopropyl Alcohol	200 ml	Sulfur Trioxide
2	6% Hydrogen Peroxide	200 ml	Sulfur Dioxide
3	6% Hydrogen Peroxide	200 ml	Sulfur Dioxide
4	Empty	------	Moisture
5	Silica Gel	200 g	Moisture

The isopropyl alcohol solution was checked for hydrogen peroxide contamination and none was found.

The samples were analyzed by barium perchlorate titration using thorin indicator.

Oxides of Nitrogen

The oxides of nitrogen sampling was performed according to EPA Method 7E. A Thermo Environmental Model 10S Oxides of Nitrogen Analyzer (Serial Number 10S-49429-282) was used to monitor the concentrations of oxides of nitrogen during each run. The reference method analyzer was operated at a range of 0 to 100 parts per million. A multi-point calibration was performed on the reference method analyzer prior to testing. An analyzer calibration error check, a sampling system bias check, and a NO_2 to NO conversion efficiency check were also conducted prior to testing. After each run, the zero and calibration drift of the reference method monitor was checked. The calibration gases were as follows:

Zero Nitrogen
18.7 ppm NO in N_2 (ALM 40839)
48.1 ppm NO in N_2 (BLM 3576)
85.4 ppm NO in N_2 (ALM 38783)

The reference method sampling system consisted of a heated probe, a heated glass fiber filter, a chilled condenser, and a teflon sample line. The calibration gases for the bias and drift checks were introduced upstream of the chilled condenser.

Calibration gas certifications are included in Appendix C.

Visible Emissions

The visible emissions observations were performed according to EPA Method 9. The visible emissions were recorded at fifteen-second intervals over a sixty-minute observation period for a total of 240 readings.

DESCRIPTION OF TESTS

Personnel from METCO Environmental arrived at the plant at 2:30 p.m. on Wednesday, June 28, 1995. After meeting with plant personnel, the equipment was moved onto the Absorber Stack (EPN-K) and secured for the night. All work was completed at 6:00 p.m.

On Thursday, June 29, work began at 6:45 a.m. The monitor was calibrated and the equipment was prepared for testing. The first test for sulfur dioxide and oxides of nitrogen began at 9:53 a.m. Testing continued until the completion of the second test at 4:32 p.m. The first test for particulate matter and hydrogen fluoride began at 12:40 p.m. Testing continued until the completion of the second test at 7:22 p.m. The first test for visible emissions began at 6:20 p.m. and was completed at 7:20 p.m. The monitor was calibrated and the samples were recovered. The equipment was secured for the night and all work was completed at 8:30 p.m.

On Friday, June 30, work began at 7:00 a.m. The monitor was calibrated and the equipment was prepared for testing. The third test for sulfur dioxide and oxides of nitrogen began at 8:25 a.m. and was completed at 9:41 a.m. The third test for particulate matter and hydrogen fluoride began at 10:18 a.m. and was completed at 12:19 p.m. The second test for visible emissions began at 8:38 a.m. Testing continued until the completion of the third test at 12:20 p.m.

The monitor was calibrated and secured for transport. The equipment was moved off of the stack and loaded into the sampling van. The samples were recovered and transported to METCO Environmental's laboratory in Dallas, Texas, for analysis and evaluation.

Operations at Boral Bricks, Inc., Absorber Stack (EPN-K), located in Henderson, Texas, were completed at 3:00 p.m. on Friday, June 30, 1995.

Billy J. Mullins, Jr.

Billy J. Mullins, Jr., P.E.
President

APPENDICES

A. Location of Sampling Points
B. Source Emissions Calculations
C. Calibration Data
D. Field Testing Data
E. Analytical Data
F. Reference Method Monitor Data
G. Visible Emissions Data
H. Plant Operational Data
I. TACB Permit
J. Chain of Custody
K. Resumes of Test Personnel

APPENDIX A

Location of Sampling Points
Absorber Stack (EPN-K)

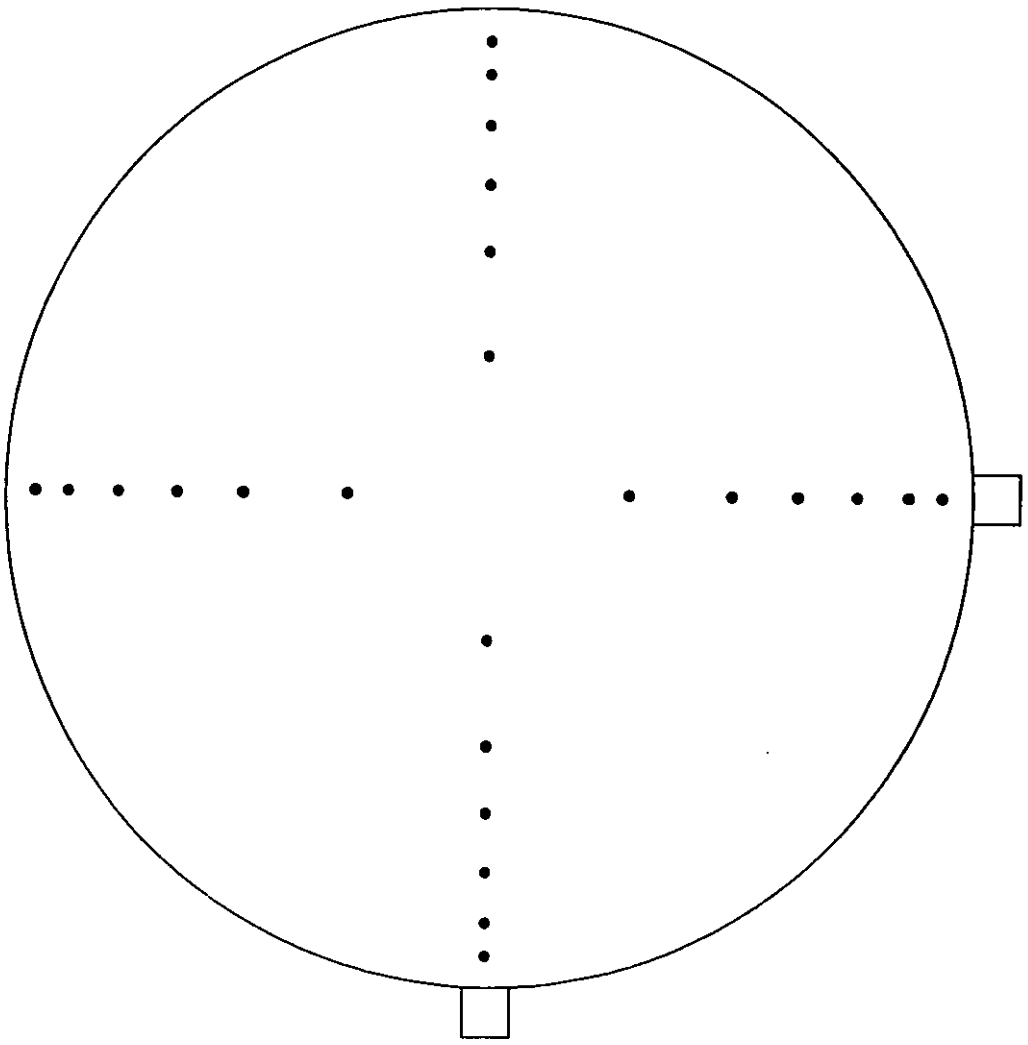
The sampling ports are located 40 feet (6.73 stack diameters) downstream from the inlet to the stack and 6 feet 5 1/2 inches (1.09 stack diameters) upstream from the outlet of the stack. The locations of the sampling points were calculated as follows:

Port and Wall Thickness = 6 1/4 inches
Inside Stack Diameter = 71 3/8 inches

Point Number	Percent of Diameter From Wall	Distance From Wall
1	2.1	1 1/2 "
2	6.7	4 13/16 "
3	11.8	8 7/16 "
4	17.7	12 5/8 "
5	25.0	17 7/8 "
6	35.6	25 7/16 "
7	64.4	45 15/16 "
8	75.0	53 1/2 "
9	82.3	58 3/4 "
10	88.2	62 15/16 "
11	93.3	66 9/16 "
12	97.9	69 7/8 "

APPENDIX A

Location of Sampling Points
Absorber Stack (EPN-K)



APPENDIX B

Nomenclature and Equations
for
Calculation of Source Emissions

METCO ENVIRONMENTAL

NOMENCLATURE FOR PARTICULATE CALCULATIONS

Symbol	English Units	Metric Units	Description
A_s	in.^{2}	m^2	Stack Area
C_{an}	gr/dscf*	g/dscm*	Particulate - probe, cyclone, and filter
C_{ao}	gr/dscf*	g/dscm*	Particulate - total
C_{at}	gr/CF @ stack conditions	g/m^3	Particulate - probe, cyclone, and filter
C_{au}	gr/CF @ stack conditions	g/m^3	Particulate - total
C_{aw}	lbs/hr	kg/hr	Particulate - probe, cyclone, and filter
C_{ax}	lbs/hr	kg/hr	Particulate - total
C_p			Pitot Tube Calibration Factor
D_n	in.	m	Sampling Nozzle Diameter
%EA			Percent Excess Air at sampling point
g	32.2 ft/sec^2		Acceleration of Gravity
%I			Percent Isokinetic
%M			Percent Moisture in the stack gas by volume
M_d			Mole fraction of dry gas
m_f	mg	mg	Particulate - probe, cyclone, and filter

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
M_{water}	18 lb/lb-mole		Molecular Weight of water
m_t	mg	mg	Particulate - total
MW	lb/lb-mole	g/g-mole	Molecular Weight of stack gas
MW_{air}	28.95 lb/ lb-mole		Molecular Weight of air
MW_d	lb/lb-mole	g/g-mole	Molecular Weight of dry stack gas
P_b	"Hg Absolute	mm Hg	Barometric Pressure
P_m	"H_2O	mm H_2O	Orifice Pressure drop
P_s	"Hg Absolute	mm Hg	Stack Pressure
ΔP	"H_2O	mm H_2O	Velocity Head of stack gas
P_{std}	29.92 "Hg	760 mm Hg	Standard Barometric Pressure
Q_a	ACFM	m^3/hr	Stack Gas Volume at actual stack conditions
Q_s	DSCFM*	dscm/hr*	Stack Gas Volume at 29.92 "Hg, 528°R, dry
R	21.83 "Hg-ft^3/lb-mole°R		Universal Gas Constant
T_m	°F	°C	Average Gas Meter Temperature

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

Symbol	English Units	Metric Units	Description
T_t	min	min	Net time of test
T_s	°F	°C	Stack Temperature
T_{std}	528°R	293°K	Standard Temperature
V_m	ft^3	m^3	Volume of dry gas sampled @ meter conditions
Vm_{std}	dscf*	dscm*	Volume of dry gas sampled @ standard conditions
V_s	fpm	m/sec	Stack velocity @ stack conditions
V_w	ml	ml	Total water collected in impingers and silica gel
Vw_{gas}	scf*	scm*	Volume of water vapor collected @ standard conditions
ρ_{air}	0.0748 lbs/ft^3		Density of Air
ρ_{water}	1 g/ml		Density of Water
ρ_{man}	51.63 lbs/ft^3		Density of Manometer Oil

Standard Conditions: 29.92 "Hg, 68°F (760 mm Hg, 20°C)

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

Dry Gas Meter Calibration

Dry Gas Meter Number 17-2

Date: April 11, 1995

ΔH ("H_2O)	C_{DG}
0.5	1.000
1.0	1.002
1.5	1.004
2.0	1.006
3.0	1.007
4.0	1.011
Average	1.005

Variation: + 0.60%

- 0.50%

Calibrator: [illegible]

Checked by: [illegible] #88

C_{DG} @ 2 liters/min. = 1.008

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NOZZLE CALIBRATION

Nozzle Set No. II (17)

Date: 4/11/95 Calibrator: Lane Hudson

	1	2	3	4	5
Reading 1	0.125	0.208	0.259	0.262	0.320
Reading 2	0.125	0.209	0.256	0.262	0.323
Reading 3	0.125	0.209	0.256	0.262	0.319
Reading 4	0.125	0.208	0.255	0.262	0320
Reading 5	0.125	0.209	0.256	0.262	0.322
Reading 6	0.125	0.208	0.256	0.262	0.321
Reading 7	0.125	0.209	0.257	0.262	0.321
Reading 8	0.125	0.209	0.256	0.262	0.320
Reading 9	0.125	0.209	0.256	0.262	0.322
Reading 10	0.125	0.208	0.256	0.262	0.320
Average	0.125	0.209	0.256	0.262	0.321

	6	7	8	9	10
Reading 1	0.306	0.361	0.427	0.428	0.637
Reading 2	0.306	0.363	0.427	0.427	0.637
Reading 3	0.305	0.364	0.428	0.428	0.637
Reading 4	0.305	0.362	0.428	0.427	0.636
Reading 5	0.306	0.363	0.428	0.428	0.637
Reading 6	0.306	0.361	0.427	0.428	0.636
Reading 7	0.305	0.361	0.427	0.427	0.637
Reading 8	0.306	0.364	0.428	0.427	0.637
Reading 9	0.306	0.361	0.428	0.428	0.638
Reading 10	0.306	0.362	0.428	0.427	0.638
Average	0.306	0.362	0.428	0.428	0.637

PITOT TUBE CALIBRATION

Date: 20 April 1995

Time: 0900

Pitot No. 12-10-1 (29)

P_b: 29.10 "Hg P_s: — "H_2O

T_s: 74 °F C_{pstd}: 0.99

Pitot Dimensions: 10' x 1/4"

Motor Setting	fps mark	CALIBRATOR STANDARD START	END	√ STANDARD AVERAGE	HIGH	√ HIGH	CAL. FACTOR	LOW	√ LOW	CAL. FACTOR
4	20	0.10	0.10	0.316	0.15	0.387	0.808	0.15	0.387	0.808
20	30	0.22	0.22	0.469	0.33	0.574	0.808	0.32	0.566	0.821
31	40	0.34	0.34	0.583	0.51	0.714	0.808	0.50	0.707	0.816
39	50	0.54	0.54	0.735	0.82	0.910	0.803	0.79	0.889	0.818
49	60	0.80	0.80	0.894	1.20	1.095	0.808	1.20	1.095	0.808
57	70	1.00	1.00	1.000	1.45	1.204	0.822	1.45	1.204	0.822
68	80	1.30	1.30	1.140	1.95	1.396	0.808	1.90	1.378	0.819
76	90	1.60	1.60	1.265	2.45	1.565	0.800	2.35	1.533	0.817
39	50	0.54	0.54	0.735	0.82	0.910	0.803	0.79	0.889	0.818
39	50	0.54	0.54	0.735	0.82	0.910	0.803	0.79	0.889	0.818
Average							0.808			0.816

Summary of Results:

Normal high side calibration factor 0.808
variation +1.73%, -0.99%

Normal low side calibration factor 0.816
variation +0.74%, -0.98%

#91 Tim Startz
Signature of Calibrator

PITOT TUBE CALIBRATION

Date: 4-6-95

Pitot No. HT 4

Pitot Dimensions: 3/8 x 10'

Time: 14:30

P_b: 29.24 "Hg P_s: — "H_2O

T_s: 74 °F C_{pstd}: 0.99

Motor Setting	fps mark	CALIBRATOR STANDARD START	END	√ STANDARD AVERAGE	HIGH	√ HIGH	CAL. FACTOR	LOW	√ LOW	CAL. FACTOR
4	20	0.10	0.10	0.316	0.15	0.387	0.808 ✓	0.15	0.387	0.808
20	30	0.22	0.22	0.469	0.33	0.574	0.808 ✓	0.33	0.574	0.808
31	40	0.34	0.34	0.583	0.51	0.714	0.808 ✓	0.51	0.714	0.808
39	50	0.54	0.54	0.735	0.81	0.900	0.808 ✓	0.81	0.900	0.808
49	60	0.80	0.79	0.892	1.20	1.095	0.806 ✓	1.15	1.072	0.823
57	70	1.00	1.00	1.00	1.50	1.225	0.808 ✓	1.50	1.225	0.808
68	80	1.30	1.35	1.151	2.00	1.414	0.806 ✓	1.95	1.396	0.816
76	90	1.60	1.60	1.265	2.35	1.533	0.817 ✓	2.35	1.533	0.817
39	50	0.54	0.54	0.735	0.82	0.906	0.803 ✓	0.81	0.900	0.808
39	50	0.54	0.54	0.735	0.81	0.900	0.808 ✓	0.82	0.906	0.803
Average							0.809 ✓			0.812

Summary of Results:

Normal high side calibration factor 0.809
variation +0.99, −0.37% ✓

Normal low side calibration factor 0.812
variation +1.35, −0.49% ✓

✓ JR #102

Jeffrey Coker
Signature of Calibrator

PITOT TUBE CALIBRATION

Date: 4-11-95

Time: 1:10

Pitot No. 17-10-1 (56)

P_b: 29.31 "Hg P_s: — "H_2O

Pitot Dimensions: 10' x 1/4"

T_s: 65 °F C_{pstd}: 0.99

Motor Setting	fps mark	CALIBRATOR STANDARD START	END	√ STANDARD AVERAGE	HIGH	√ HIGH	CAL. FACTOR	LOW	√ LOW	CAL. FACTO
4	20	0.10	0.10	0.316	0.15	0.387	0.808	0.15	0.387	0.808
20	30	0.22	0.22	0.469	0.32	0.566	0.821	0.34	0.583	0.796
31	40	0.34	0.34	0.583	0.50	0.707	0.816	0.51	0.714	0.808
39	50	0.54	0.54	0.735	0.81	0.900	0.808	0.81	0.900	0.808
49	60	0.80	0.80	0.894	1.20	1.095	0.808	1.20	1.095	0.808
57	70	1.00	1.00	1.000	1.45	1.204	0.822	1.50	1.225	0.808
68	80	1.30	1.30	1.140	1.95	1.396	0.808	2.00	1.414	0.798
76	90	1.60	1.60	1.265	2.35	1.533	0.817	2.40	1.549	0.808
39	50	0.54	0.54	0.735	0.81	0.900	0.808	0.81	0.900	0.808
39	50	0.54	0.54	0.735	0.80	0.894	0.813	0.81	0.900	0.808
Average							0.814			0.80

Summary of Results:

Normal high side calibration factor 0.814
variation +0.98%, -0.74%

Normal low side calibration factor 0.805
variation +0.37%, -1.12%

Lance Hudson
Signature of Calibrator

APPENDIX C

Calibration Data

Equipment	Calibration Factor	Calibration Date
Pitot Tube #17-10-1 (56)	0.814	04/11/95
Pitot Tube #HT-4	0.809	04/06/95
Pitot Tube #12-10-1 (29)	0.808	04/20/95
Probe Tip #17-4 (II-4)	0.262	04/11/95
Dry Gas Meter #17-2 (17)	1.005	04/11/95
Stack Unit Orifice #17-2 (17)		04/11/95
Digital Temperature Indicator #17-2 (17)		04/11/95
Barometer #17-2 (10)		04/10/95

METCO ENVIRONMENTAL

SULFUR TRIOXIDE EMISSION DATA

JOB NUMBER: 95-134
JOB NAME: BORAL BRICK INC.
LOCATION: HENDERSON, TEXAS
UNIT TESTED: ABSORBER STACK (EPN - K) SO2

RUN NUMBER	1	2	3
DATE	6-29-95	6-29-95	6-30-95
START TIME	0953	1512	0825
END TIME	1110	1632	0941
N - NORMALITY OF Ba(ClO4)2	0.0100	0.0100	0.0100
ML(I) - ml IN IMPINGER	208.00	300.00	262.00
ML(A) - ml IN ALIQUOT	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE	0.63	0.45	0.70
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	76	88	73
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	42.285	43.234	42.151
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.70	29.66	29.72
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	44,301	45,234	45,239
C(I) - SO3 IN IMPINGERS IN mgs	4.8	4.8	6.8
ppm SO3	1.2	1.2	1.7
C(SO3) - EMISSION RATE OF SO3, lbs/day	16.4	16.7	23.6
Cs - EMISSION RATE OF SULFUR, lbs/day	6.6	6.7	9.4

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 40 / ML(A)
ppm SO3 = 0.6021 * C(I) * [Tm + 460] / Vm * Pb
C(SO3) = ppm SO3 * Qs * 0.0002991
Cs = C(SO3) / 2.5

METCO ENVIRONMENTAL

SULFUR DIOXIDE EMISSION DATA

JOB NUMBER: 95-134
JOB NAME: BORAL BRICK INC.
LOCATION: HENDERSON, TEXAS
UNIT TESTED: ABSORBER STACK (EPN - K) SO2

RUN NUMBER	1	2	3
DATE	6-29-95	6-29-95	6-30-95
START TIME	0953	1512	0825
END TIME	1110	1632	0941
N - NORMALITY OF Ba(ClO4)2	0.0100	0.0100	0.0100
ML(I)- ml IN IMPINGER 2	380.00	395.00	400.00
ML(I)- ml IN IMPINGER 3	335.00	444.00	330.00
ML(A)- ml IN ALIQUOT #2	3.00	3.00	3.00
ML(A)- ml IN ALIQUOT #3	10.00	10.00	10.00
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #2	3.73	3.45	3.33
ML(B) - ml OF Ba(ClO4)2 TO TITRATE #3	0.15	0.15	0.20
ML(BB) - ml OF Ba(ClO4)2 TO TITRATE BLANK	0.05	0.05	0.05
Tm - AVERAGE GAS METER TEMPERATURE, DEG.F	76	88	73
Vm - VOLUME OF DRY GAS SAMPLED @ METER CONDITIONS, FT^3	42.285	43.234	42.151
Pb - BAROMETRIC PRESSURE, "Hg Abs.	29.70	29.66	29.72
Qs - STACK GAS VOLUME DRY @ STANDARD CONDITIONS, *SCFM	44,301	45,234	45,239
C(I) - SO2 IN IMPINGER #2 IN mgs	149.16	143.25	139.95
C(I) - SO2 IN IMPINGER #3 IN mgs	1.07	1.42	1.58
C(T) - TOTAL SO2 IN IMPINGERS, IN mgs	150.2	144.7	141.5
ppm SO2	48.2	46.5	45.2
C(SO2) - EMISSION RATE OF SO2, lbs/day	510.5	502.6	489.6
C(SO2) - EMISSION RATE OF SO2, lbs/hr	21.3	20.9	20.4
Cs - EMISSION RATE OF SULFUR, lbs/day	255.2	251.3	244.8

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

C(I) = ML(I) * [ML(B) - ML(BB)] * N * 32 / ML(A)
C(T) = C(I) #2 + C(I) #3
ppm SO2 = 0.7513 * C(T) * [Tm + 460] / Vm * Pb
C(SO2) = ppm SO2 * Qs * 0.0002392

METCO ENVIRONMENTAL

SOURCE EMISSION CALCULATIONS

BORAL BRICK INC.
HENDERSON, TEXAS
ABSORBER STACK (EPN - K) SO2

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9206	0.9188	0.9198
CO2		%	2.2	2.2	2.2
O2		%	17.0	17.2	17.2
CO		%	0.0	0.0	0.0
N2		%	80.8	80.6	80.6
%EA	EXCESS AIR @ SAMPLING POINT	%	385.3	413.6	413.6
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.03 (29.03)	29.04 (29.04)	29.04 (29.04)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.16 (28.16)	28.14 (28.14)	28.15 (28.15)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H20)	0.486 (12.3)	0.513 (13.0)	0.506 (12.9)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	463 (239)	470 (243)	452 (233)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.66 (753)	29.62 (752)	29.68 (754)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	3,043 (15.46)	3,141 (15.96)	3,071 (15.60)
As	STACK AREA	(SQ.INCHES) (SQ.METERS)	4,001 (2.58)	4,001 (2.58)	4,001 (2.58)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	44,301 (75,267)	45,234 (76,853)	45,239 (76,861)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	84,544 (143,640)	87,277 (148,284)	85,329 (144,974)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 95-134
JOB NAME: BORAL BRICK INC.
LOCATION: HENDERSON, TEXAS
UNIT TESTED: ABSORBER STACK (EPN - K) SO2

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			6-29-95	6-29-95	6-30-95
BEGIN TIME			0953	1512	0825
END TIME			1110	1632	0941
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.70 (754)	29.66 (753)	29.72 (755)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	0.971 (24.7)	1.000 (25.4)	1.000 (25.4)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	42.285 (1.197)	43.234 (1.224)	42.151 (1.194)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	76 (24)	88 (31)	73 (23)
V(m[std])*	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	41.454 (1.174)	41.403 (1.172)	41.586 (1.178)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	75.8	77.5	76.8
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	3.578 (0.101)	3.658 (0.104)	3.625 (0.103)
%M	MOISTURE IN STACK GAS BY VOLUME	%	7.94	8.12	8.02
Tt	NET TIME OF TEST	MINUTES	72	72	72

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

SOURCE EMISSION CALCULATIONS

BORAL BRICK INC.
HENDERSON, TEXAS
ABSORBER STACK (EPN - K) PART/HF

SYMBOL	DESCRIPTION	UNITS			
Tt	NET TIME OF TEST	MINUTES	120	120	120
Dn	SAMPLING NOZZLE DIAM.	IN. (m)	0.262 (0.007)	0.262 (0.007)	0.262 (0.007)
%I	PERCENT ISOKINETIC	%	100.9	101.4	100.7
Mf	PARTICULATE - PROBE, CYCLONE AND FILTER	mg	60.4	100.5	81.0
Mt	PARTICULATE - TOTAL	mg	99.4	148.7	85.3
Can	PARTICULATE - PROBE, CYCLONE AND FILTER	gr/DSCF* (g/DSCM)	0.0130 (0.0297)	0.0217 (0.0498)	0.0176 (0.0404)
Cao	PARTICULATE - TOTAL	gr/DSCF* (g/DSCM)	0.0214 (0.0489)	0.0322 (0.0737)	0.0186 (0.0425)
Cat	PARTIC.-PROBE, CYCLONE AND FILTER @ STACK COND.	gr/CF (g/m3)	0.0067 (0.0154)	0.0113 (0.0258)	0.0093 (0.0213)
Cau	PARTICULATE - TOTAL @ STACK CONDITIONS	gr/CF (g/m3)	0.0111 (0.0254)	0.0167 (0.0382)	0.0098 (0.0224)
Caw	PARTICULATE - PROBE, CYCLONE AND FILTER	LBS/HR (Kg/HR)	4.90 (2.22)	8.12 (3.68)	6.59 (2.99)
Cax	PARTICULATE - TOTAL	LBS/HR (Kg/HR)	8.07 (3.66)	12.01 (5.45)	6.94 (3.15)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION CALCULATIONS

BORAL BRICK INC.
HENDERSON, TEXAS
ABSORBER STACK (EPN - K) PART/HF

SYMBOL	DESCRIPTION	UNITS			
Md	MOL FRACTION OF DRY GAS		0.9255	0.9229	0.9243
CO2		%	2.1	2.2	2.0
O2		%	17.3	17.0	17.2
CO		%	0.0	0.0	0.0
N2		%	80.6	80.8	80.8
%EA	EXCESS AIR @ SAMPLING POINT	%	426.2	385.3	408.4
MWd	MOLECULAR WEIGHT OF DRY STACK GAS	LB/LB-MOLE (g/g-MOLE)	29.03 (29.03)	29.03 (29.03)	29.01 (29.01)
MW	MOLECULAR WEIGHT OF STACK GAS	LB/LB-MOLE (g/g-MOLE)	28.21 (28.21)	28.18 (28.18)	28.17 (28.17)
DELTA P	VELOCITY HEAD OF STACK GAS	"H2O (mm H20)	0.487 (12.4)	0.478 (12.1)	0.470 (11.9)
Ts	STACK TEMPERATURE	DEG. F (DEG. C)	472 (244)	472 (244)	459 (237)
Ps	STACK PRESSURE	"Hg Abs. (mm Hg)	29.66 (753)	29.62 (752)	29.68 (754)
Vs	STACK VELOCITY @ STACK CONDITIONS	FPM (m/SEC.)	3,041 (15.45)	3,018 (15.33)	2,968 (15.08)
As	STACK AREA	(SQ.INCHES) (SQ.METERS)	4,001 (2.58)	4,001 (2.58)	4,001 (2.58)
Qs	DRY STACK GAS VOLUME @ STANDARD CONDITIONS*	DSCFM (DSCM/HR)	44,078 (74,889)	43,563 (74,014)	43,601 (74,078)
Qa	ACTUAL STACK GAS VOLUME @ STACK CONDITIONS	ACFM (m^3/HR)	84,480 (143,532)	83,852 (142,465)	82,471 (140,118)

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

METCO ENVIRONMENTAL

SOURCE EMISSION SURVEY

JOB NUMBER: 95-134
JOB NAME: BORAL BRICK INC.
LOCATION: HENDERSON, TEXAS
UNIT TESTED: ABSORBER STACK (EPN - K) PART/HF

SOURCE EMISSION CALCULATIONS

SYMBOL	DESCRIPTION	UNITS			
RUN #			1	2	3
DATE			6-29-95	6-29-95	6-30-95
BEGIN TIME			1240	1718	1018
END TIME			1449	1922	1219
P(b)	BAROMETRIC PRESSURE	"Hg Abs. (mm Hg)	29.70 (754)	29.66 (753)	29.72 (755)
P(m)	ORIFICE PRESSURE DROP	"H2O (mm H2O)	1.106 (28.1)	1.079 (27.4)	1.075 (27.3)
V(m)	VOLUME DRY GAS SAMPLED @ METER CONDITIONS	ft.^3 (m^3)	74.315 (2.104)	74.035 (2.096)	72.762 (2.060)
T(m)	AVERAGE GAS METER TEMPERATURE	DEG.F (DEG.C)	85 (29)	86 (30)	81 (27)
V(m[std])*	VOLUME DRY GAS SAMPLED @ STANDARD CONDITIONS*	DSCF (DSCM)	71.675 (2.030)	71.174 (2.015)	70.738 (2.003)
V(w)	TOTAL WATER COLLECTED, IMPINGERS & SILICA GEL	ml	122.2	125.9	122.8
V(w[gas])	VOLUME WATER VAPOR COLLECTED @ STANDARD CONDITIONS*	SCF (SCM)	5.768 (0.163)	5.942 (0.168)	5.796 (0.164)
%M	MOISTURE IN STACK GAS BY VOLUME	%	7.45	7.71	7.57

* 68 Deg.F, 29.92 "Hg (20 Deg.C, 760 mm Hg)

EXAMPLE CALCULATIONS

Equation 6C-1

$$C_{gas} = (\overline{C} - C_o) \frac{C_{ma}}{C_m - C_o}$$

Where: C_{gas} = *Effluent gas concentration - dry basis (ppm)*

$\overline{C}$ = *Average gas concentration indicated by gas analyzer - dry basis (ppm)*

C_o = *Average of initial and final system calibration bias check responses for the zero gas (ppm)*

C_m = *Average of initial and final system calibration bias check responses for the upscale calibration gas (ppm)*

C_{ma} = *Actual concentration of the upscale calibration gas (ppm)*

EXAMPLE CALCULATIONS

lbs/hr = ppm x CF x 60 min/hr x DSCFM*

CF = Conversion Factor for ppm to lbs/scf*

Compound	Conversion Factor
NO_x	1.194×10^{-7}

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

EXAMPLE CALCULATIONS

$$\text{lbs/hr} = \frac{\text{mg}}{Vm_{std}} \times 2.205 \times 10^{-6}\ \text{lbs/mg} \times \text{DSCFM*} \times 60\ \text{min/hr}$$

Vm_{std} = Volume of dry gas sampled (dscf*)

DSCFM* = Stack Flow Rate

$$\text{ppm} = \frac{\text{mg}}{Vm_{std}\ (m^3)} \times \frac{24.04}{MW}$$

24.04 = Ideal Gas Constant liters/g-mole

Vm_{std} = Volume of dry gas sampled (m^{3*})

MW = Molecular Weight

Compound	Molecular Weight
Hydrogen Fluoride	20.01

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

15. Particulate - probe, cyclone, and filter at stack conditions.

$$C_{at} = C_{an} \times \frac{P_s}{P_{std}} \times \frac{(T_{std})}{(T_s + 460)} \times M_d$$

$$C_{at} = \frac{17.65 \times C_{an} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{at} = gr/CF \times 2.290 = g/m^3$$

16. Particulate - total, at stack conditions.

$$C_{au} = \frac{17.65 \times C_{ao} \times P_s \times M_d}{T_s + 460} = gr/CF$$

$$C_{au} = gr/CF \times 2.290 = g/m^3$$

17. Particulate - probe, cyclone, and filter.

$$C_{aw} = C_{an} \times Q_s \times \frac{60 \text{ min}}{1 \text{ hr}} \times \frac{1 \text{ lb}}{7000 \text{ gr}}$$

$$C_{aw} = 0.00857 \times C_{an} \times Q_s = lbs/hr$$

$$C_{aw} = lbs/hr \times 0.4536 = kg/hr$$

18. Particulate - total.

$$C_{ax} = 0.00857 \times C_{ao} \times Q_s = lbs/hr$$

$$C_{ax} = lbs/hr \times 0.4536 = kg/hr$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

12. Percent isokinetic.

$$\%I = \frac{Vm_{std} \; x \; (T_s + 460) \; x \; P_{std} \; x \; 100 \; x \; 144}{M_d \; x \; T_{std} \; x \; P_s \; x \; T_t \; x \; V_s \left(\frac{\pi D_n^2}{4}\right)}$$

$$\%I = \frac{1039 \; V_{std} \; x \; (T_s + 460)}{M_d \; x \; P_s \; x \; T_t \; x \; V_s \; x \; D_n^2}$$

13. Particulate - probe, cyclone, and filter.

$$C_{an} = \frac{m_f}{Vm_{std}} \; x \; \frac{1 \; gr}{64.8 \; mg}$$

$$C_{an} = 0.0154 \; x \; \frac{m_f}{Vm_{std}} = gr/dscf^*$$

$$C_{an} = gr/dscf \; x \; 2.290 = g/dscm^*$$

14. Particulate total.

$$C_{ao} = 0.0154 \; x \; \frac{m_t}{Vm_{std}} = gr/dscf^*$$

$$C_{ao} = gr/dscf \; x \; 2.290 = g/dscm^*$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

9. Stack velocity at stack conditions.

$$V_s = C_p\ 60 \left[\frac{2g \times \rho_{man} \times P_{std} \times MW_{air} \times (T_s + 460) \times \Delta P_s}{12 \times \rho_{air} \times P_s \times MW \times T_{std}} \right]^{1/2}$$

$$V_s = 5{,}123.8\ C_p \left[\frac{(T_s + 460)}{P_s \times MW} \right]^{1/2} \sqrt{\Delta P}\ average = fpm$$

$$V_s = fpm \times 0.00508 = m/\text{sec}$$

10. Dry stack gas volume at standard conditions.*

$$Q_s = \frac{1}{144}\ V_s \times A_s \times M_d \times \frac{T_{std}}{T_s + 460} \times \frac{P_s}{P_{std}}$$

$$Q_s = \frac{0.123\ V_s \times A_s \times M_d \times P_s}{T_s + 460} = DSCFM$$

$$Q_s = DSCFM \times 1.6990 = dscm/hr$$

11. Actual stack gas volume at stack conditions.

$$Q_a = \frac{V_s \times A_s}{144} = ACFM$$

$$Q_a = ACFM \times 1.6990 = m^3/hr$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

4. Mole fraction of dry gas.

$$M_d = \frac{100 - \%M}{100}$$

5. Average molecular weight of dry stack gas.

$$MW_d = \left[\%CO_2 \times \frac{44}{100}\right] + \left[\%O_2 \times \frac{32}{100}\right] + \left[\%N_2 \times \frac{28}{100}\right] + \left[\%CO \times \frac{28}{100}\right] = lb/lb\text{-}mole$$

$$= g/g\text{-}mole$$

6. Molecular weight of stack gas.

$$MW = MW_d \times M_d + 18\ (1 - M_d) = \frac{lb}{lb\text{-}mole} = g/g\text{-}mole$$

7. Percent excess air at sampling point.

$$\%EA = \frac{100\ (\%O_2 - 0.5\%\ CO)}{0.265\ (\%N_2) - [(\%O_2) + 0.5\ (\%CO)]}$$

8. Stack Pressure.

$$P_s = P_b + \frac{Stack\ Pressure\ "H_2O}{13.6} = "Hg\ Absolute$$

$$P_s = "Hg\ Abs. \times 25.4 + mm\ Hg$$

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1@0.50 "H_2O P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0849	5.164 cf	71 °F	-1.30 "H_2O	999.296 cf	71 °F	69 °F	0.50 "H_2O
Start	0837	0.000 cf	71 °F	-1.30 "H_2O	994.200 cf	70 °F	68 °F	0.50 "H_2O
		5.164 cf	71 °F	-1.30 "H_2O	5.096 cf	70 °F		0.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.164 \left(\frac{29.28 + \frac{-1.30}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.993} = 4.974 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 5.096 \left(\frac{29.28 + \frac{0.50}{13.6}}{70 + 460} \right) = 4.975 \text{ dscf}$$

$$C_{DG} = \frac{4.974}{4.975} = \boxed{1.000}$$

MITECO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995.

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1@1.00 "H_2O P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0903	5.379 cf	71 °F	-1.90 "H_2O	005.822 cf	76 °F	70 °F	1.00 "H_2O
Start	0854	0.000 cf	71 °F	-1.90 "H_2O	000.520 cf	72 °F	69 °F	1.00 "H_2O
		5.379 cf	71 °F	-1.90 "H_2O	5.302 cf	72 °F		1.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 5.379 \left(\frac{29.28 + \frac{-1.90}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.993} = 5.174 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 5.302 \left(\frac{29.28 + \frac{1.00}{13.6}}{72 + 460} \right) = 5.163 \text{ dscf}$$

$$C_{DG} = \frac{5.174}{5.163} = \boxed{1.002}$$

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995.

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1@1.50" H_2O P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0922	10.062 cf	71 °F	-2.30 "H_2O	017.510 cf	78 °F	71 °F	1.50 "H_2O
Start	0908	0.000 cf	71 °F	-2.30 "H_2O	007.600 cf	75 °F	70 °F	1.50 "H_2O
		10.062 cf	71 °F	-2.30 "H_2O	9.910 cf	74 °F		1.50 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.062 \left(\frac{29.28 + \frac{-2.30}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.993} = 9.668 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.910 \left(\frac{29.28 + \frac{1.50}{13.6}}{74 + 460} \right) = 9.627 \text{ dscf}$$

$$C_{DG} = \frac{9.668}{9.627} = \boxed{1.004}$$

METCO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995.

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 @ 2.00" H_2O

P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0938	10.690 cf	71 °F	-2.70 "H_2O	028.635 cf	83 °F	72 °F	2.00 "H_2O
Start	0925	0.000 cf	71 °F	-2.70 "H_2O	018.112 cf	77 °F	71 °F	2.00 "H_2O
		10.690 cf	71 °F	-2.70 "H_2O	10.523 cf	76 °F		2.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.690 \left(\frac{29.28 + \frac{-2.70}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.993} = 10.261 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.523 \left(\frac{29.28 + \frac{2.00}{13.6}}{76 + 460} \right) = 10.197 \text{ dscf}$$

$$C_{DG} = \frac{10.261}{10.197} = \boxed{1.006}$$

MITECO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995.

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1@3.00" H_2O

P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	0952	10.140 cf	71 °F	-3.70 "H_2O	38.947 cf	83 °F	73 °F	3.00 "H_2O
Start	0942	0.000 cf	71 °F	-3.70 "H_2O	29.000 cf	79 °F	72 °F	3.00 "H_2O
		10.140 cf	71 °F	-3.70 "H_2O	9.947 cf	77 °F		3.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.140 \left(\frac{29.28 + \frac{-3.70}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.993} = 9.709 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 9.947 \left(\frac{29.28 + \frac{3.00}{13.6}}{77 + 460} \right) = 9.645 \text{ dscf}$$

$$C_{DG} = \frac{9.709}{9.645} = \boxed{1.007}$$

MITECO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995.

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: @ 4.00 "H_2O

P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 2)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1003	10.471 cf	71 °F	-4.60 "H_2O	050.023 cf	85 °F	74 °F	4.00 "H_2O
Start	0954	0.000 cf	71 °F	-4.60 "H_2O	039.806 cf	82 °F	73 °F	4.00 "H_2O
		10.471 cf	71 °F	-4.60 "H_2O	10.217 cf	79 °F		4.00 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 10.471 \left(\frac{29.28 + \frac{-4.60}{13.6}}{71 + 460} \right) \times \underset{(C_f)}{0.993} = 10.003 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 10.217 \left(\frac{29.28 + \frac{4.00}{13.6}}{79 + 460} \right) = 9.894 \text{ dscf}$$

$$C_{DG} = \frac{10.003}{9.894} = \boxed{1.011}$$

MITECO ENVIRONMENTAL

DRY GAS METER CALIBRATION

Meter Number: 17-2 Calibrator: GORDON SMITH

Date: April 11, 1995.

$$\text{Calibration Factor } (C_{DG}) = \frac{\text{Wet Test Meter } V_{m_{std}}}{\text{Dry Gas Meter } V_{m_{std}}}$$

Run No.: 1 @ 21/min. P_b: 29.28 "Hg

Control Module Vacuum 5.0 "Hg

	WET TEST METER (No. 1)				DRY GAS METER			
	Time	Meter Reading	Temp.	P_m	Meter Reading	Temp. In	Temp. Out	P_m
End	1101	2.042 cf	70 °F	-1.10 "H_2O	053.760 cf	73 °F	73 °F	0.02 "H_2O
Start	1034	0.000 cf	70 °F	-1.10 "H_2O	051.722 cf	74 °F	73 °F	0.02 "H_2O
		2.042 cf	70 °F	-1.10 "H_2O	2.038 cf	73 °F		0.02 "H_2O

$$\text{Wet Test Meter } V_{m_{std}} = 17.65 \times 2.042 \left(\frac{29.28 + \frac{-1.10}{13.6}}{70 + 460} \right) \times \underset{(C_f)}{1.003} = 1.992 \text{ dscf}$$

$$\text{Dry Gas Meter } V_{m_{std}} = 17.65 \times 2.038 \left(\frac{29.28 + \frac{0.02}{13.6}}{73 + 460} \right) = \cancel{1.977}\ 1.976 \text{ dscf}$$

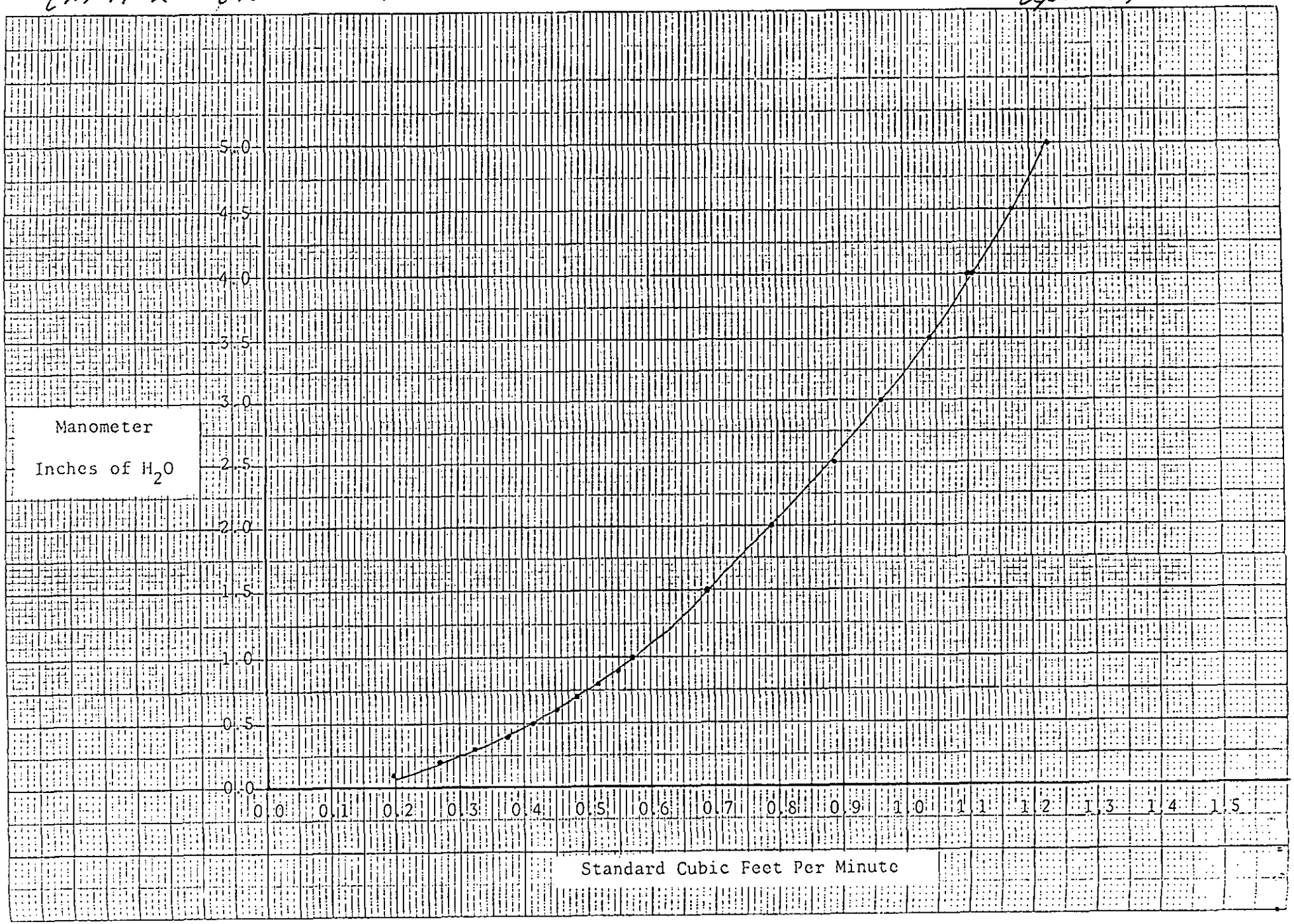
$$C_{DG} = \frac{1.992}{\cancel{1.977}\ 1.976} = \boxed{1.008}$$

10 X 10 KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1320

CM 17-2 CAL. FACTOR 1.005

April 11, 1995.



MEICO ENVIRONMENTAL

DIGITAL TEMPERATURE INDICATOR NO. 17-2(17)

CALIBRATION DATA

Date: April 11, 1995

Media	Time	Mercury Thermometer (°F)	DTI (°F)
Ice Bath	0800	34	34
Ambient Air	0800	66	66
Boiling Water	0815	212	214
Oven	0826	252	253
Oven	0829	302	303
Oven	0836	349	350
Oven	0844	376	378

Meter Adjusted? Yes____ No K

Signature of Calibrator

METCO ENVIRONMENTAL

BAROMETER CALIBRATION

Barometer No. 172

Date: 4/10/95

Time: 1600

Barometric Pressure @ Addison Field @ 719 ft.	=	29.54
	-	0.719
Absolute Pressure at Addison Field	=	28.821
	+	0.083
Absolute Pressure @ METCO @ 636 ft.	=	28.90
Barometer Reading	=	28.86
Variation	=	+0.04

Barometer Adjusted? Yes ✓ No ____

Signature of Calibrator

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
METCO ENVIRONMENTAL
Attn : Jim Monfries
16115 Dooley Road
Dallas, TX 75244

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 3067
Scott Project # : 572186

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards; Procedure G1; September, 1993.

Cylinder Number : ALM040839 **Certificate Date :** 10/26/94 **Expiration Date :** 10/26/96
Cylinder Pressure + : 1900 psig **Previous Certificate Date :** None

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	18.72 ppm	±1% NIST Directly Traceable
Total Oxides of Nitrogen	19.10 ppm	Reference Value Only

Balance Gas: Nitrogen

+Do not use when cylinder presssure is below 150 psig.
*Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM 1684	4/1/96	ALM-024582	95.2 ppm Nitric Oxide in Nitrogen

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
NO : Horiba/OPE-235/483814	10/25/94	Chemiluminescence

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Nitric Oxide

First Triad Analysis

Date: 10/19/94	Response Units: mv	
Z1=0.00	R1=95.20	T1=18.80
R2=95.20	Z2=0.00	T2=18.70
Z3=0.00	T3=18.70	R3=95.20
Avg. Conc. of Cust. Cyl. 18.73 ppm		

Second Triad Analysis

Date: 10/26/94	Response Units: mv	
Z1=0.00	R1=95.20	T1=18.70
R2=95.20	Z2=0.00	T2=18.70
Z3=0.00	T3=18.70	R3=95.20
Avg. Conc. of Cust. Cyl: 18.70 ppm		

Calibration Curve

Concentration=A+Bx+Cx^2+Dx^3+Ex^4	
r=0.99999	NTRM 1684
Constants:	A=0.000000000
B=1.000000000	C=0.000000000
D=0.000000000	E=0.000000000

Special Notes

Customer

Analyst

MISP/P-1

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
METCO ENVIRONMENTAL
16115 DOOLEY ROAD
DALLAS, TX 75244

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 2835
Scott Project # : 565362

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards; Procedure G1; September, 1993.

Cylinder Number : BLM003576 **Certificate Date :** 5/16/94 **Expiration Date :** 5/16/96
Cylinder Pressure + : 1900 psig **Previous Certificate Date :** None

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	48.05 ppm	±1% NIST Directly Traceable
Total Oxides of Nitrogen	48.20 ppm	Reference Value Only

Balance Gas: Nitrogen

+Do not use when cylinder presssure is below 150 psig.
*Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM 1694	4/1/96	ALM-024622	95.3 ppm Nitric Oxide in Nitrogen

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
NO : Horiba/OPE-235/483814	5/4/94	Chemiluminesence

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components: Nitric Oxide

First Triad Analysis

Date: 5/9/94	Response Units: mv	
Z1=0.00	R1=95.30	T1=48.00
R2=95.30	Z2=0.00	T2=48.00
Z3=0.00	T3=48.00	R3=95.30
Avg. Conc. of Cust. Cyl. 48.00 ppm		

Second Triad Analysis

Date: 5/16/94	Response Units: mv	
Z1=0.00	R1=95.30	T1=48.10
R2=95.30	Z2=0.00	T2=48.10
Z3=0.00	T3=48.10	R3=95.30
Avg. Conc. of Cust. Cyl: 48.10 ppm		

Calibration Curve

Concentration=A+Bx+Cx^2+Dx^3+Ex^4	
r=0.99999	NTRM 1694
Constants:	A=0.000000000
B=1.000000000	C=0.000000000
D=0.000000000	E=0.000000000

Special Notes

Don Eichler Jr

Analyst Don Eichler, Jr

Scott Specialty Gases, Inc.

1290 COMBERMERE STREET, TROY, MI 48083 (810) 589-2950 FAX:(810) 589-2134

CERTIFICATE OF ANALYSIS: EPA PROTOCOL GAS

Customer
METCO ENVIRONMENTAL
Attn : Jim Monfries
16115 Dooley Road
Dallas, TX 75244

Assay Laboratory
Scott Specialty Gases, Inc
1290 Combermere
Troy, MI 48083

Purchase Order : 3067
Scott Project # : 572186

ANALYTICAL INFORMATION

This certification was performed according to EPA Traceability Protocol For Assay and Certification of Gaseous Calibration Standards; Procedure G1; September, 1993.

Cylinder Number : ALM038783 **Certificate Date :** 10/26/94 **Expiration Date :** 10/26/96
Cylinder Pressure + : 1900 psig **Previous Certificate Date :** None

ANALYZED CYLINDER

Components	Certified Concentration	Analytical Uncertainty*
Nitric Oxide	85.40 ppm	±1% NIST Directly Traceable
Total Oxides of Nitrogen	86.10 ppm	Reference Value Only

Balance Gas: Nitrogen

+Do not use when cylinder pressure is below 150 psig.
*Analytical accuracy is inclusive of usual known error sources which at least include precision of the measurement processes.

REFERENCE STANDARD

Type	Expiration Date	Cylinder Number	Concentration
NTRM 1684	4/1/96	ALM-024582	95.2 ppm Nitric Oxide in Nitrogen

INSTRUMENTATION

Instrument/Model/Serial #	Last Date Calibrated	Analytical Principle
NO : Horiba/OPE-235/483814	10/25/94	Chemiluminescence

ANALYZER READINGS (Z=Zero Gas R=Reference Gas T=Test Gas r=Correlation Coefficient)

Components
Nitric Oxide

First Triad Analysis

Date: 10/19/94	Response Units: mv	
Z1=0.00	R1=95.20	T1=85.50
R2=95.20	Z2=0.00	T2=85.10
Z3=0.00	T3=85.00	R3=95.20
Avg. Conc. of Cust. Cyl. 85.20 ppm		

Second Triad Analysis

Date: 10/26/94	Response Units: mv	
Z1=0.00	R1=95.20	T1=85.60
R2=95.20	Z2=0.00	T2=85.60
Z3=0.00	T3=85.60	R3=95.20
Avg. Conc. of Cust. Cyl: 85.60 ppm		

Calibration Curve

Concentration=A+Bx+Cx^2+Dx^3+Ex^4	
r=0.99999	NTRM 1684
Constants:	A=0.000000000
B=1.000000000	C=0.000000000
D=0.000000000	E=0.000000000

Special Notes

Customer

Analyst

MISP/P-1

APPENDIX D

Field Testing Data

METCO ENVIRONMENTAL

Job Number 95-134
Job Name Boral Brick
Run Number 2. 1
Unit Absorber Stack
Date 29 JUNE 1995
Operator Starts / Greenfeather / Smith
Sample Box No. M1 Meter Box No. M-2

PART. / HF Field Data

Read and record at the start of each test point.

Purge to: —
Purge time: —
Pitot Leak Check Initial ✓ Final ✓

Ambient Temp. °F 92
Assumed Moisture % 7
Probe Length 10'
C Factor 10/22.5 to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 8.0 "Hg = 0.002 cfm

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H_2O (ΔP_s)	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual (P_m)	Pump Vacuum "Hg Guage	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet (T_m)	Remarks
B 12	1240	064.113	0.53	1.20	1.20	6.0	469	262	279	92	79	78	Integrated orsat
11	1245	067.29	0.52	1.20	1.20	6.0	470	264	263	75	81	78	
10	1250	070.54	0.54	1.20	120	6.0	471	245	232	64	83	78	
9	1255	073.80	0.54	1.20	1.20	6.0	471	251	225	61	85	78	
8	1300	077.05	0.53	1.20	1.20	6.0	472	258	228	62	87	79	
7	1305	080.31	0.50	1.15	1.15	6.0	472	226	257	63	88	79	
6	1310	083.45	0.44	1.00	1.00	6.0	472	229	261	65	89	79	
5	1315	086.44	0.44	1.00	1.00	6.0	472	225	269	65	90	80	
4	1320	089.38	0.42	0.96	0.96	6.0	471	243	264	65	90	80	
3	1325	092.27	0.43	1.00	1.00	6.0	472	232	264	65	91	81	
2	1330	095.25	0.39	0.90	0.90	6.0	471	238	272	65	91	81	
1	1335	098.10	0.28	0.64	0.64	4.0	466	238	264	66	91	81	LK CK Gas 0.142
End B	1340	100.443	—	—	—	—	—	—	—	—	—	—	
A 12	1349	100.585	0.45	1.05	1.05	5.5	469	239	243	74	86	82	
11	1354	103.55	0.47	1.05	1.05	5.5	474	240	241	63	89	82	
10	1359	106.60	0.46	1.05	1.05	6.0	473	241	236	60	90	82	
9	1404	109.70	0.43	0.98	0.98	6.0	474	247	234	60	91	83	
8	1409	112.62	0.39	0.90	0.90	5.0	473		242	61	91	83	

Pitot Tube Calibration Factor C_p 0.809
Volume Collected V_m ~~74.457~~ 73.945 ft^3
Water Collected V_w 122.2 ml
Time of Test T_t 120 min.
Stack Pressure P_s -0.50 "H_2O

Pitot Tube No. HT-4
Baro. Press. P_b 29.70 "Hg
Probe Tip Dia. D_n 0.262 in.
% CO_2 2.1 % CO 0.0
% O_2 12.3 % N_2 80.6
Area Stack A_s 4001 in^2

Barometer No. 17-2
Probe Tip No. 17-4
Total Volume of Leak Checks After Start: 0.142 ft^3
V_m = Dry Gas Meter Calibration Factor 1005 X ~~74.087~~ 73.945

[Dry Gas Meter Reading — ft^3 - (T_t — min. X Leak Rate — cfm)]

Impinger Box No. M1

			Water Weight Gain		
Impinger 1	Final Weight	715.7		Impinger 1	87.5
	Initial Weight	628.2		Impinger 2	15.1
	Increase	87.5			
Impinger 2	Final Weight	613.7		Impinger 3	4.3
	Initial Weight	598.6		Impinger 4	15.3
	Increase	15.1			
Impinger 3	Final Weight	498.4	V_w =	Impinger 5	
	Initial Weight	494.1	g SO_2 =		
	Increase	4.3	V_w =	Impinger 6	
Impinger 4	Final Weight	884.3		Impinger 7	
	Initial Weight	869.0			
	Increase	15.3		Total	122.2 = V_w
Impinger 5	Final Weight		P_b = 29.70	%CO_2 = 2.1	
	Initial Weight		V_m = ~~74.457~~ 74.315	%O_2 = 17.3	
	Increase		V_w = 122.2	%CO = 0.0	
			P_m = 1.106	%N_2 = 80.6	
Impinger 6	Final Weight		Avg ΔP = ~~0.8~~ ~~0.458~~ 0.487	A_s = 400	
	Initial Weight			D_n = 0.262	
	Increase		Avg$\sqrt{\Delta P}$ = 0.695	T_t = 120	
			C_p = 0.809		
Impinger 7	Final Weight		P_s = -0.50 'H$_2$O	29.66 'Hg	
	Initial Weight		T_m = 85 °F	545 °R	
	Increase		T_s = 472 °F	932 °R	

Moisture Content: %M = 7.45 M_d = 0.9255 MW_d = 29.28 MW = 28.21

$$Vm_{std} = 17.65\ Vm \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = 17.65 \times \overset{74.315}{\cancel{74.457}} \left[\frac{29.70 + \frac{1.106}{13.6}}{85 + 460}\right] = \frac{71.675}{0.597}\ \text{sft}^3 \ \text{scfm}$$

Vw_{gas} = 0.0472 x Vw = 0.0472 x 122.2 = 5.768 sft^3

% Moisture = $\frac{Vw_{gas}}{Vm_{std} + Vw_{gas}}$ x 100 = $\frac{5.768}{71.675 + 5.768}$ x 100 = 7.45 %

V_s = 5123.8 x 0.809 $\sqrt{\frac{932}{29.66 \times 28.21}}$ x 0.695 - 3041 fpm

ACFM: 84480

SCFM: 44078

%I = $\frac{1,039 \times 932 \times 71.675}{3041 \times 120 \times 0.9255 \times 29.66 \times (0.262)^2}$ = 100.9 %

%EA: 426.2

Run Number ~~2~~ 1

Unit Absorber Stack

Date 29 June 1995

Part. HF FIELD DATA

Point	Clock Time	Dry Gas Meter, CF	ΔP_s "Pitot" "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	P_m Pump Vacuum "Hg Guage	T_s Stack Temp °F	Probe Temp °F	Oven Temp °F	Effluent Temp °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
7	1414	115.42	0.40	0.92	0.92	5.5	474	250	240	61	92	83	
6	1419	118.29	0.62	1.40	1.40	6.0	474	247	240	60	93	84	
5	1424	121.74	0.60	1.35	1.35	6.0	474	237	236	59	94	84	
4	1429	125.10	0.63	1.40	1.40	6.5	475	243	238	60	94	84	
3	1434	128.46	0.61	1.40	1.40	6.5	475	257	240	60	94	84	
2	1439	131.85	0.58	1.30	1.30	6.5	474	240	240	60	95	85	
1	1444	135.11	0.50	1.10	1.10	6.0	472	259	237	61	94	85	
End All	1449	138.200	—	—	—	—	—	—	—	—	—	—	

METCO ENVIRONMENTAL

Job Number 95-134
Job Name Boral Brick
Run Number 2
Unit Absorber Stack
Date 29 June 1995
Operator Starts / Greenfeather / Smith
Sample Box No. M4 Meter Box No. 17-2

Part / HF Field Data

Read and record at the start of each test point.

Purge to: —
Purge time: —
Pitot Leak Check Initial ✓ Final ✓

Ambient Temp. °F 90
Assumed Moisture % 9
Probe Length 10'
C Factor 10 / 22.5 to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H₂O (ΔP_s)	Orifice ΔH "H₂O Desired	Orifice ΔH "H₂O Actual (P_m)	Pump Vacuum "Hg Guage	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
B 12	1718	189.220	0.53	1.20	1.20	6.0	471	242	234	71	83	84	Integrated orsat
11	1723	192.68	0.55	1.25	1.25	6.0	472	258	244	64	84	84	
10	1728	196.00	0.55	1.25	1.25	6.5	472	261	242	58	86	84	
9	1733	199.33	0.55	1.25	1.25	6.5	473	243	239	56	87	84	
8	1738	202.60	0.54	1.25	1.25	6.5	473	233	245	57	88	84	
7	1743	205.87	0.50	1.10	1.10	6.0	473	235	240	57	89	84	
6	1748	209.00	0.45	1.00	1.00	6.0	473	241	243	58	89	84	
5	1753	211.99	0.45	1.00	1.00	6.0	473	251	243	59	89	84	
4	1758	214.97	0.45	1.00	1.00	6.0	472	246	242	59	90	84	
3	1803	217.95	0.44	1.00	1.00	6.0	472	244	239	59	90	84	
2	1808	220.93	0.37	~~1.00~~ 0.84	~~1.00~~ 0.84	6.0	470	242	241	59	90	84	
1	1813	223.88	0.37	~~1.00~~ 0.84	~~1.00~~ 0.84	5.0	471	245	240	59	90	84	
End B	1818	226.463	—	—	—	—	—	—	—	—	—	—	
A 12	1822	226.463	0.54	1.25	1.25	6.5	472	240	236	64	87	84	
11	1827	229.73	0.56	1.25	1.25	6.5	472	241	243	58	89	84	
10	1832	232.99	0.56	1.25	1.25	6.5	472	247	245	58	89	84	
9	1837	236.25	0.55	1.25	1.25	6.5	473	240	236	56	90	84	
8	1842	239.52	0.55	1.25	1.25	6.5	473	241	246	56	91	84	

Pitot Tube Calibration Factor C_p 0.809
Volume Collected V_m 74.035 ft³
Water Collected V_w 125.9 ml
Time of Test T_t 120 min.
Stack Pressure P_s -0.50 "H₂O

Pitot Tube No. HT 4
Baro. Press. P_b 29.66 "Hg
Probe Tip Dia. D_n 0.262 in.
% CO_2 2.2 % CO 0.0
% O_2 17.0 % N_2 80.8
Area Stack A_s 400 in²

Barometer No. 17-2
Total Volume of Leak Checks After Start: — ft³
V_m = Dry Gas Meter Calibration Factor 1.005 X 73.667

Probe Tip No. 17-4

{Dry Gas Meter Reading — ft³ - (T_t — min. X Leak Rate — cfm)}

Impinger Box No. M4

Impinger 1	Final Weight	709.8		Impinger 1	88.3
	Initial Weight	621.5			
	Increase	88.3		Impinger 2	17.9
Impinger 2	Final Weight	622.1		Impinger 3	3.0
	Initial Weight	604.2			
	Increase	17.9		Impinger 4	16.7
			V_w =		
Impinger 3	Final Weight	489.3	g SO_2 =	Impinger 5	
	Initial Weight	486.3	V_w =		
	Increase	3.0		Impinger 6	
Impinger 4	Final Weight	882.0		Impinger 7	
	Initial Weight	865.3			
	Increase	16.7		Total	125.9 = V_w

Water Weight Gain

Impinger 5	Final Weight		P_b =	29.66	$\%CO_2$ =	2.2
	Initial Weight		V_m =	74.035	$\%O_2$ =	17.0
	Increase		V_w =	125.9	%CO =	0.0
			P_m =	1.079	$\%N_2$ =	80.8
Impinger 6	Final Weight		Avg ΔP =	0.478	A_s =	4001
	Initial Weight				D_n =	0.262
	Increase		Avg$\sqrt{\Delta P}$ =	0.689	T_t =	120
			C_p =	0.809		
Impinger 7	Final Weight		P_s =	-0.50 "H_2O	29.62	"Hg
	Initial Weight		T_m =	86 °F	546	°R
	Increase		T_s =	472 °F	932	°R

Moisture Content: %M = 7.71 M_d = 0.9229 MW_d = 29.032 MW = 28.18

$$Vm_{std} = 17.65\ Vm \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = 17.65 \times 74.035 \left[\frac{29.66 + \frac{1.079}{13.6}}{86 + 460}\right] = \begin{matrix} 71.174 \text{ sft}^3 \\ 0.593 \text{ scfm} \end{matrix}$$

Vw_{gas} = 0.0472 x Vw = 0.0472 x 125.9 = 5.942 sft^3

$$\% \text{ Moisture} = \frac{Vw_{gas}}{Vm_{std} + Vw_{gas}} \times 100 = \frac{5.942}{71.174 + 5.942} \times 100 = 7.71\ \%$$

$$V_s = 5123.8 \times 0.809 \sqrt{\frac{932}{29.62 \times 28.18}} \times 0.689 - 3018 \text{ fpm}$$

ACFM: 83,852

SCFM: 43,563

$$\%I = \frac{1.039 \times 932 \times 71.174}{0.9229 \times 120 \times 3018 \times 29.62 \times (0.262)^2} = 101.4\ \%$$

%EA: 385.3

Run Number 2

Unit Absorber Stack

Date 28 June 1995

Part. 1HF FIELD DATA P. 2

Point	Clock Time	Dry Gas Meter, CF	ΔP_s "Pitot" "H_2O	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	P_m Pump Vacuum "Hg Guage	T_s Stack Temp °F	Probe Temp °F	Oven Temp °F	Effluent Temp °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks:
7	1847	242.75	0.51	1.15	1.15	6.0	473	232	232	56	91	84	
6	1852	245.85	0.45	1.00	1.00	6.0	472	240	233	56	91	84	
5	1857	248.82	0.45	1.00	1.00	6.0	472	242	237	58	91	84	
4	1902	251.76	0.43	0.98	0.98	6.0	471	243	239	58	91	84	
3	1907	254.74	0.42	0.96	0.96	6.0	471	245	241	58	90	84	
2	1912	257.65	0.38	0.86	0.86	6.0	471	242	248	59	90	84	
1	1917	260.42	0.31	0.71	0.71	5.0	468	244	247	59	90	84	
End kil	1922	262.887	—	—	—	—	—	—	—	—	—	—	

METCO ENVIRONMENTAL

Job Number 95-134
Job Name Boral Brick
Run Number 3
Unit Absorber Stack
Date 30 June 1995
Operator Stautz/Greenfeather/Smith
Sample Box No. M1 Meter Box No. 17-2

Part/H.F. Field Data

Read and record at the start of each test point.

Purge to: —
Purge time: —
Pitot Leak Check Initial ✓ Final ✓

Ambient Temp. °F 85
Assumed Moisture % 9
Probe Length 10'
C Factor 10/22.5 to reference
Initial Leak @ 150 "Hg = 0.000 cfm
Final Leak @ 80 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H_2O (ΔP_s)	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Pump Vacuum "Hg Guage (P_m)	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
A 12	1018	320.600	0.53	1.20	1.20	5.5	452	277	262	74	76	74	Integrated Orsat
11	1023	323.80	0.56	1.25	1.25	5.5	454	259	250	63	78	73	
10	1028	326.94	0.55	1.25	1.25	6.0	455	269	251	57	80	73	
9	1033	330.08	0.55	1.25	1.25	6.0	456	241	247	57	82	73	
8	1038	333.22	0.54	1.25	1.25	6.0	456	245	250	60	83	74	
7	1043	336.45	0.50	1.15	1.15	6.0	457	263	253	62	84	74	
6	1048	339.57	0.46	1.05	1.05	6.0	458	257	258	64	85	74	
5	1053	342.64	0.48	1.10	1.10	6.0	458	252	264	64	86	75	
4	1058	345.63	0.46	1.05	1.05	6.0	459	258	274	63	86	75	
3	1103	348.62	0.45	1.00	1.00	6.0	459	269	275	63	87	76	
2	1108	351.59	0.39	1.00	1.00	6.0	459	269	272	64	87	76	
1	1113	354.55	0.31	0.70	0.70	6.0	456	275	268	65	87	76	
End A	1118	357.036	—	—	—	—	—	—	—	—	—	—	
B 12	1119	357.036	0.49	1.10	1.10	6.0	458	270	268	69	86	77	
11	1124	360.08	0.51	1.15	1.15	6.0	460	255	253	65	87	77	
10	1129	363.18	0.53	1.20	1.20	6.0	461	239	251	65	87	77	
9	1134	366.32	0.52	1.20	1.20	6.0	462	240	262	66	87	77	
8	1139	369.48	0.52	1.20	1.20	6.0	462	264	267	67	88	78	

Pitot Tube Calibration Factor C_p 0.809
Volume Collected V_m 72.762 ft^3
Water Collected V_w 122.8 ml
Time of Test T_t 120 min.
Stack Pressure P_s -0.50 "H_2O

Pitot Tube No. HT-4
Baro. Press. P_b 29.72 "Hg
Probe Tip Dia. D_n 0.262 in.
% CO_2 2.0 % CO 0.0
% O_2 17.2 % N_2 80.8
Area Stack A_s 4001 in^2

Barometer No. 17.2
Probe Tip No. 17-4
Total Volume of Leak Checks After Start: — ft^3
V_m = Dry Gas Meter Calibration Factor 1.005 X 72.400

[Dry Gas Meter Reading — ft^3 - (T_t — min. X Leak Rate — cfm)]

Impinger Box No. M 1

			Water Weight Gain		
Impinger 1	Final Weight	712.7		Impinger 1	87.5
	Initial Weight	625.2			
	Increase	87.5		Impinger 2	18.6
Impinger 2	Final Weight	619.2		Impinger 3	1.7
	Initial Weight	600.6			
	Increase	18.6		Impinger 4	150
			V_w =		
Impinger 3	Final Weight	497.9	g SO_2 =	Impinger 5	
	Initial Weight	496.2	V_w =		
	Increase	1.7		Impinger 6	
Impinger 4	Final Weight	899.3		Impinger 7	
	Initial Weight	884.3			
	Increase	150		Total	122.8 = V_w

Impinger 5	Final Weight		P_b =	29.72	$\%CO_2$ =	20	
	Initial Weight		V_m =	72.762	$\%O_2$ =	17.2	
	Increase		V_w =	122.8	%CO =	0.0	
			P_m =	1.075	$\%N_2$ =	80.8	
Impinger 6	Final Weight		Avg ΔP =	0.470	A_s =	4001	
	Initial Weight				D_n =	0.262	
	Increase		Avg$\sqrt{\Delta P}$ =	0.683	T_t =	120	
			C_p =	0.809			
Impinger 7	Final Weight		P_s =	-0.50	$'H_2O$	29.68	'Hg
	Initial Weight		T_m =	81	°F	541	°R
	Increase		T_s =	459	°F	919	°R

Moisture Content %M = 7.57 M_d = 0.9243 MW_d = 29.008 MW = 28.17

$$Vm_{std} = 17.65\ Vm \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = 17.65 \times 72.762 \left[\frac{29.72 + \frac{1.075}{13.6}}{81 + 460}\right] = \begin{matrix} 70.738\ sft^3 \\ 0.589\ scfm \end{matrix}$$

Vw_{gas} = 0.0472 x Vw = 0.0472 x 122.8 = 5.796 sft^3

$$\%\ Moisture = \frac{Vw_{gas}}{Vm_{std} + Vw_{gas}} \times 100 = \frac{5.796}{70.738 + 5.796} \times 100 = 7.57\ \%$$

$$V_s = 5123.8 \times 0.809 \sqrt{\frac{919}{29.68 \times 28.17} \times 0.683} = 2968\ fpm$$

ACFM: 82,471

SCFM: 43,601

$$\%I = \frac{1.000 \times 919 \times 70.738}{0.9243 \times 120 \times 2968 \times 2968 \times (0.262)^2} = 100.7\ \%$$

%EA: 408.4

Run Number 3

Unit Absorber Stack

Date 30 June 1995

Part / HF FIELD DATA P. 2

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H_2O (ΔP_s)	Orifice ΔH "H_2O Desired (P_m)	Orifice ΔH "H_2O Actual	Pump Vacuum "Hg Guage	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
7	1144	372.65	0.48	1.10	1.10	6.0	463	262	266	67	88	78	
6	1149	375.80	0.45	1.05	1.05	6.0	464	267	254	61	88	78	
5	1154	378.85	0.44	1.00	1.00	6.0	464	248	250	62	88	78	
4	1159	381.81	0.44	1.00	1.00	6.0	464	249	252	62	88	78	
3	1204	384.76	0.42	0.96	0.96	6.0	464	260	237	63	88	79	
2	1209	387.66	0.39	0.90	0.90	6.0	463	252	247	63	88	79	
1	1214	390.49	0.30	0.68	0.68	5.0	459	237	246	63	88	79	
END N1	1219	393.000	—	—	—	—	—	—	—	—	—	—	

METCO ENVIRONMENTAL

Job Number 95-134
Job Name Boral Brick
Run Number 1
Unit Absorber Stack
Date 29 June 1995
Operator Startz / Greenfeather / Smith
Sample Box No. 17-1 Meter Box No. 17-2

SO2 Field Data

Read and record at the start of each test point.

Purge to: 063.736
Purge time: 1114 - 1119
Pitot Leak Check Initial ✓ Final ✓

Ambient Temp. °F 80
Assumed Moisture % —
Probe Length 10'
C Factor — to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H2O (ΔP_s)	Orifice ΔH "H2O Desired	Orifice ΔH "H2O Actual (P_m)	Pump Vacuum "Hg Guage	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
A 12	0953	012.725	0.42	0.65	0.65	5.0	460	253	273	77	71	69	Integrated orsat
11	0956	014.10	0.46	0.65	0.65	5.0	460	257	270	66	72	69	
10	0959	015.55	0.45	1.00	1.00	6.0	461	269	264	67	73	69	
9	1002	017.33	0.40	1.00	1.00	6.0	461	272	257	65	74	68	
8	1005	019.02	0.42	1.00	1.00	6.0	462	259	250	66	75	70	
7	1008	020.77	0.42	1.00	1.00	6.0	462	249	247	67	76	69	
6	1011	022.51	0.62	1.00	1.00	6.0	463	242	241	66	77	71	
5	1014	024.26	0.64	1.00	1.00	6.0	464	239	238	66	77	70	
4	1017	026.01	0.64	1.00	1.00	6.0	464	248	254	65	79	70	
3	1020	027.76	0.62	1.00	1.00	6.0	464	259	261	64	79	70	
2	1023	029.53	0.61	1.00	1.00	6.0	463	271	268	64	80	71	
1	1026	031.30	0.43	1.00	1.00	6.0	462	272	249	64	81	71	
End A	1029	033.096	—	—	—	—	—	—	—	—	—	—	
B 12	1034	033.096	0.52	1.00	1.00	6.0	460	242	276	61	80	72	
11	1037	034.84	0.55	1.00	1.00	6.0	464	240	275	61	80	72	
10	1040	036.60	0.55	1.00	1.00	6.0	464	242	271	60	80	72	
9	1043	038.32	0.55	1.00	1.00	6.0	464	244	267	60	82	73	
8	1046 1047	040.64	0.53	1.00	1.00	6.0	465	249	253	59	83	73	

Pitot Tube Calibration Factor C_p 0.814
Volume Collected V_m 42.285 ft^3
Water Collected V_w ~~76.0~~ 75.8 ml
Time of Test T_t ~~60~~ 72 min.
Stack Pressure P_s -0.50 "H_2O

Pitot Tube No. 17-10-1 (56)
Baro. Press. P_b 29.70 "Hg
Probe Tip Dia. D_n 0.428 in.
% CO_2 2.2 % CO 0.0
% O_2 17.0 % N_2 80.8
Area Stack A_s 400 in^2

Barometer No. 17-2 Probe Tip No. II - 8
Total Volume of Leak Checks After Start: — ft^3
V_m = Dry Gas Meter Calibration Factor 1.005 X 42.075

[Dry Gas Meter Reading — ft^3 - (T_t — min. X Leak Rate — cfm)]

Impinger Box No. 17-1

			Water Weight Gain		
Impinger 1	Final Weight	630.8		Impinger 1	-48.8
	Initial Weight	679.6			
	Increase	-48.8		Impinger 2	68.5
Impinger 2	Final Weight	805.5		Impinger 3	30.3
	Initial Weight	737.0			
	Increase	68.5		Impinger 4	3.0
			V_w = 76.0		
Impinger 3	Final Weight	725.8	g SO_2 = 0.2	Impinger 5	23.0
	Initial Weight	695.5	V_w = 75.8		
	Increase	30.3		Impinger 6	
Impinger 4	Final Weight	493.5		Impinger 7	
	Initial Weight	490.5			
	Increase	3.0		Total	76.0 = V_w
Impinger 5	Final Weight	852.6	P_b = 29.70	$\%CO_2$ = 2.2, 2.2	
	Initial Weight	829.6	V_m = 42285	$\%O_2$ = 17.0, 17.0	
	Increase	23.0	V_w = ~~76.0~~ 75.8	%CO = 0.0	
			P_m = 0.971	$\%N_2$ = 80.8, 80.8	
Impinger 6	Final Weight		Avg ΔP = 0.486	A_s = 4001	
	Initial Weight			D_n = 0.428	
	Increase		Avg$\sqrt{\Delta P}$ = 0.694	T_t = 72	
			C_p = 0.814		
Impinger 7	Final Weight		P_s = -0.50 "H_2O	29.66 "Hg	
	Initial Weight		T_m = 76 °F	536 °R	
	Increase		T_s = 463 °F	~~99~~ 923 °R	

Moisture Content: %M = ~~7.96~~ 7.94 M_d = ~~0.9204~~ 0.9206 MW_d = 29.032 MW = ~~28.15~~ 28.16

$$Vm_{std} = 17.65\ Vm \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = 17.65 \times 42{,}285 \left[\frac{29.70 + \frac{0.971}{13.6}}{76 + 460}\right] = \frac{41.454\ sft^3}{0.576\ scfm}$$

Vw_{gas} = 0.0472 x Vw = 0.0472 x ~~76.0~~ 75.8 = ~~3.587~~ 3.578 sft^3

% Moisture = $\frac{Vw_{gas}}{Vm_{std} + Vw_{gas}}$ x 100 = $\frac{3.578}{3.578 + 41.454}$ x 100 = ~~7.96~~ 7.94 %

V_s = 5123.8 x 0.814 $\sqrt{\frac{923}{29.66 \times 28.16}}$ x 0.694 = 3043 fpm

ACFM: ~~84,559~~ 84,544

SCFM: ~~44,292~~ 44,301

%I = 1,039 x ____ x ____ x ____ x 2 x( )^2 = ____ %

%EA: 385.3

Run Number 1

Unit Absorber Stack

Date 29 June 1995

SO2 FIELD DATA p. 2

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H_2O (ΔP_s)	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual (P_m)	Pump Vacuum "Hg Guage	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
7	~~1050~~ 1040	042.41	0.48	1.00	1.00	6.0	465	250	240	60	83	73	
6	~~1053~~ 1052	044.16	0.39	1.00	1.00	6.0	464	248	242	60	84	74	
5	~~1056~~ 1055	045.93	0.40	1.00	1.00	6.0	464	250	233	61	84	74	
4	~~1059~~ 1058	047.70	0.41	1.00	1.00	6.0	465	245	252	62	84	74	
3	~~1102~~ 1101	049.45	0.41	1.00	1.00	6.0	464	241	256	62	85	75	
2	~~1105~~ 1104	051.21	0.44	1.00	1.00	6.0	464	238	256	63	86	75	
1	~~1108~~ 1107	053.00	0.31	1.00	1.00	6.0	462	239	258	63	86	75	
END	~~1111~~ 1110	054.800	—	—	—	—	—	—	—	—	—	—	
All													

METCO ENVIRONMENTAL

Job Number 95-134
Job Name Boral Brick
Run Number 3 2
Unit Absorber Stack
Date 29 June 1993
Operator Stretz / Greenfeather / Smith
Sample Box No. 17-1 Meter Box No. 17-2

SO2 Field Data

Read and record at the start of each test point.

Purge to: 189.340
Purge time: 1635-1650
Pitot Leak Check Initial ✓ Final ✓

Ambient Temp. °F 92
Assumed Moisture % —
Probe Length 10'
C Factor — to reference
Initial Leak @ 15.0 "Hg = 0.00 cfm
Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H2O (ΔP_s)	Orifice ΔH "H2O Desired	Orifice ΔH "H2O Actual (P_m)	Pump Vacuum "Hg Guage	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
A 12	1512	138.508	0.42	1.00	1.00	6.0	467	264	247	77	86	86	Integrated Orsat
11	1515	140.26	0.46	1.00	1.00	6.0	472	258	251	66	87	86	
10	1518	142.03	0.46	1.00	1.00	6.0	472	252	246	62	88	86	
9	1521	143.82	0.42	1.00	1.00	6.0	472	251	248	59	88	86	
8	1524	145.61	0.41	1.00	1.00	6.0	471	250	260	58	89	86	
7	1527	147.40	0.41	1.00	1.00	6.0	471	244	261	58	90	85	
6	1530	149.19	0.58	1.00	1.00	6.0	471	240	264	58	90	85	
5	1533	150.96	0.64	1.00	1.00	6.0	472	238	253	57	91	85	
4	1536	152.80	0.64	1.00	1.00	6.0	472	241	254	57	91	85	
3	1539	154.55	0.63	1.00	1.00	6.0	472	243	254	58	91	85	
2	1542	156.40	0.61	1.00	1.00	6.0	471	244	261	58	91	85	
1	1545	158.10	0.51	1.00	1.00	6.0	469	242	261	58	91	85	
End A	1548	159.823	—	—	—	—	—	—	—	—	—	—	
B 12	1556	159.873	0.50	1.00	1.00	6.0	471	258	242	59	89	85	
11	1559	161.70	0.51	1.00	1.00	6.0	471	242	246	58	89	85	
10	1562	163.60	0.50	1.00	1.00	6.0	470	238	249	55	89	85	
9	1565	165.37	0.53	1.00	1.00	6.0	470	241	246	55	89	85	
8	1608	167.20	0.55	1.00	1.00	6.0	470	247	249	55	90	85	

Pitot Tube Calibration Factor C_p 0.814
Volume Collected V_m 43.234 ft³
Water Collected V_w ~~77.6~~ 77.5 ml
Time of Test T_t 72 min.
Stack Pressure P_s -0.50 "H2O

Pitot Tube No. 17-10-1 (56)
Baro. Press. P_b 29.66 "Hg
Probe Tip Dia. D_n — in.
% CO_2 2.2 % CO 0.0
% O_2 17.2 % N_2 80.6
Area Stack A_s 4001 in²

Barometer No. 17-2 Probe Tip No. —
Total Volume of Leak Checks After Start: — ft³
V_m = Dry Gas Meter Calibration Factor 1.005 X 43.019

[Dry Gas Meter Reading — ft³ - (T_t — min. X Leak Rate — cfm)]

Impinger Box No. 17-1

Impinger 1	Final Weight	680.3		Water Weight Gain	
	Initial Weight	676.4		Impinger 1	3.9
	Increase	3.9		Impinger 2	51.0
Impinger 2	Final Weight	788.5		Impinger 3	10.7
	Initial Weight	737.5			
	Increase	51.0		Impinger 4	0.9
			V_w = 77.6		
Impinger 3	Final Weight	705.5	g SO_2 = 0.1	Impinger 5	11.1
	Initial Weight	694.8	V_w = 77.5		
	Increase	10.7		Impinger 6	
Impinger 4	Final Weight	494.3		Impinger 7	
	Initial Weight	493.4			
	Increase	0.9		Total	77.6 = V_w
Impinger 5	Final Weight	863.6	P_b = 29.66	$\%CO_2$ = 2.2	
	Initial Weight	852.5	V_m = 43.234	$\%O_2$ = 17.2	
	Increase	11.1	V_w = 77.5 ~~77.6~~	%CO = 0.0	
			P_m = 1.000	$\%N_2$ = 80.6	
Impinger 6	Final Weight		Avg ΔP = 0.513	A_s = 4001	
	Initial Weight			D_n = —	
	Increase		Avg$\sqrt{\Delta P}$ = 0.713	T_t = 72	
			C_p = 0.814		
Impinger 7	Final Weight		P_s = -0.50 'H$_2$O	29.62 'Hg	
	Initial Weight		T_m = 88 °F	548 °R	
	Increase		T_s = 470 °F	930 °R	

Moisture Content: %M = 8.12 ~~8.13~~ M_d = 0.9188 ~~0.9187~~ MW_d = 29.040 MW = 28.14

$$Vm_{std} = 17.65\ Vm \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = 17.65 \times 43.234 \left[\frac{29.66 + \frac{1.000}{13.6}}{88 + 460}\right] = \frac{41.403}{0.575}\ \frac{sft^3}{scfm}$$

Vw_{gas} = 0.0472 x Vw = 0.0472 x 77.5 ~~77.6~~ = 3.658 ~~3.663~~ sft^3

% Moisture = $\frac{Vw_{gas}}{Vm_{std} + Vw_{gas}}$ x 100 = $\frac{3.658\ \cancel{3.663}}{41.403 + 3.658\ \cancel{3.663}}$ x 100 = 8.12 ~~8.13~~ %

V_s = 5123.8 x 0.814 $\sqrt{\frac{930}{29.62 \times 28.14}}$ x 0.713 - 3141 fpm

ACFM: 87277

SCFM: 45,234 ~~45229~~

%I = 1.039 x x x x 29.62 x( )² = — %

%EA: 413.6

Run Number 2

Unit Absorber Stack

Date 29 June 1995

SO2 FIELD DATA P. 2

Point	Clock Time	Dry Gas Meter, CF	ΔP_s "Pitot" "H_2O	Orifice ΔH "H_2O Desired	P_m Orifice ΔH "H_2O Actual	Pump Vacuum "Hg Guage	T_s Stack Temp °F	Probe Temp °F	Oven Temp °F	Effluent Temp °F	T_m Dry Gas Temp. °F Inlet	Dry Gas Temp. °F Outlet	Remarks
7	1611	169.10	0.56	1.00	1.00	6.0	470	258	247	57	90	85	
6	1614	170.87	0.64	1.00	1.00	6.0	470	261	254	57	91	85	
5	1617	172.65	0.61	1.00	1.00	6.0	470	262	253	56	91	85	
4	1620	174.43	0.58	1.00	1.00	6.0	470	254	244	55	91	85	
3	1623	176.25	0.43	1.00	1.00	6.0	468	246	253	56	91	85	
2	1626	177.98	0.39	1.00	1.00	6.0	468	244	258	58	91	85	
1	1629	179.76	0.31	1.00	1.00	6.0	465	246	257	58	91	85	
End	1632	181.527	—	—	—	—	—	—	—	—	—	—	
All													

METCO ENVIRONMENTAL

Job Number 95-134
Job Name Boral Brick
Run Number 3
Unit Absorber Stack
Date 30 June 1995
Operator Stortz/Greenfeather/Smith
Sample Box No. 17-1 Meter Box No. 17-2

SO_2 Field Data

Read and record at the start of each test point.

Purge to: 320, 325
Purge time: 0943 - 0958
Pitot Leak Check Initial ✓ Final ✓

Ambient Temp. °F 78
Assumed Moisture % —
Probe Length 10'
C Factor — to reference
Initial Leak @ 15.0 "Hg = 0.000 cfm
Final Leak @ 10.0 "Hg = 0.000 cfm

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H₂O (ΔP_s)	Orifice ΔH "H₂O Desired	Orifice ΔH "H₂O Actual	Pump Vacuum "Hg Guage (P_m)	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
B 12	0825	269.462	0.56	1.00	1.00	6.0	451	241	256	63	68	67	Integrated air sat
11	0828	271.21	0.58	1.00	1.00	6.0	452	246	252	58	68	67	
10	0831	272.94	0.53	1.00	1.00	6.0	452	241	247	56	70	67	
9	0834	274.68	0.56	1.00	1.00	6.0	452	242	241	56	71	67	
8	0837	276.44	0.56	1.00	1.00	6.0	452	251	251	57	72	67	
7	0840	278.18	0.52	1.00	1.00	6.0	452	255	256	58	73	67	
6	0843	279.93	0.49	1.00	1.00	6.0	452	258	271	59	75	67	
5	0846	281.71	0.49	1.00	1.00	6.0	451	260	270	60	76	67	
4	0849	283.42	0.49	1.00	1.00	6.0	451	261	270	60	76	68	
3	0852	285.17	0.48	1.00	1.00	6.0	451	259	261	60	77	68	
2	0855	286.93	0.43	1.00	1.00	6.0	450	255	255	61	78	68	
1	0858	288.69	0.33	1.00	1.00	6.0	448	261	262	62	78	68	
End	0901	290.400	—	—	—	—	—	—	—	—	—	—	
A 12	0905	290.400	0.55	1.00	1.00	6.0	452	272	269	63	76	69	
11	0908	292.18	0.57	1.00	1.00	6.0	453	265	269	61	77	69	
10	0911	293.85	0.56	1.00	1.00	6.0	453	258	260	60	78	69	
9	0914	295.60	0.56	1.00	1.00	6.0	453	254	258	60	78	69	
8	0917	297.34	0.54	1.00	1.00	6.0	451	246	251	61	79	69	

Pitot Tube Calibration Factor C_p 0.808
Volume Collected V_m 42.151 ft³
Water Collected V_w ~~76.9~~ 76.8 ml
Time of Test T_t 72 min.
Stack Pressure P_s -0.50 "H_2O

Pitot Tube No. 12-10-1
Baro. Press. P_b 29.72 "Hg
Probe Tip Dia. D_n — in.
% CO_2 2.2 % CO 0.0
% O_2 17.2 % N_2 80.6
Area Stack A_s 400 in²

Barometer No. 17-2
Probe Tip No. —
Total Volume of Leak Checks After Start: — ft³
V_m = Dry Gas Meter Calibration Factor 1.005 X 41.941

[Dry Gas Meter Reading — ft³ - (T_t — min. X Leak Rate — cfm)]

Impinger Box No. 17-1

Impinger 1	Final Weight	660.1		Impinger 1	-20.9
	Initial Weight	681.0			
	Increase	-20.9		Impinger 2	66.5
Impinger 2	Final Weight	806.2		Impinger 3	16.1
	Initial Weight	739.7			
	Increase	66.5		Impinger 4	0.8
Impinger 3	Final Weight	719.8	V_w = 76.9 g SO_2 = -0.1	Impinger 5	~~14.0~~ 14.4
	Initial Weight	703.7	V_w = 76.8		
	Increase	16.1		Impinger 6	
Impinger 4	Final Weight	501.5		Impinger 7	
	Initial Weight	500.7			
	Increase	0.8		Total	76.9 = V_w
Impinger 5	Final Weight	877.4	P_b = 29.72	$\%CO_2$ = 2.2	
	Initial Weight	863.0	V_m = 42.151	$\%O_2$ = 17.2	
	Increase	~~14.0~~ 14.4	V_w = ~~76.9~~ 76.8	%CO = 0.0	
			P_m = 1.000	$\%N_2$ = 80.0	
Impinger 6	Final Weight		Avg ΔP = 0.506	A_s = 4.001	
	Initial Weight			D_n = —	
	Increase		Avg$\sqrt{\Delta P}$ = 0.710	T_t = 72	
			C_p = 0.808		
Impinger 7	Final Weight		P_s = -0.50 'H$_2$O	29.68 'Hg	
	Initial Weight		T_m = 73 °F	533 °R	
	Increase		T_s = 452 °F	912 °R	

Water Weight Gain

Moisture Content: %M = ~~8.03~~ 8.02 M_d = ~~0.9197~~ 0.9198 MW_d = 29.040 MW = 28.15

$$Vm_{std} = 17.65\ Vm \left[\frac{P_b + \frac{P_m}{13.6}}{T_m + 460}\right] = 17.65 \times 42.151 \left[\frac{29.72 + \frac{1.000}{13.6}}{73 + 460}\right] = \frac{41.586}{0.578}\ \frac{sft^3}{scfm}$$

Vw_{gas} = 0.0472 x Vw = 0.0472 x ~~76.9~~ 76.8 = ~~3.630~~ 3.625 sft^3

% Moisture = $\frac{Vw_{gas}}{Vm_{std} + Vw_{gas}}$ x 100 = $\frac{3.625 \text{ ~~3.630~~}}{41.586 + \text{~~3.630~~ } 3.625}$ x 100 = ~~8.03~~ 8.02 %

V_s = 5123.8 x ~~0.808~~ $\sqrt{\frac{912}{29.68 \times 28.15}}$ x 0.710 = 3021 fpm

ACFM: 85329

SCFM: ~~45,234~~ 45,239

%I = 1,039 x ___ x ___ x ___ x ( )² = — %

%EA: 413.6

Run Number 3

Unit Boral Brick

Date 30 June 1995

SO2 FIELD DATA

Point	Clock Time	Dry Gas Meter, CF	"Pitot" "H_2O (ΔP_s)	Orifice ΔH "H_2O Desired	Orifice ΔH "H_2O Actual	Pump Vacuum "Hg Guage (P_m)	Stack Temp °F (T_s)	Probe Temp °F	Oven Temp °F	Effluent Temp °F	Dry Gas Temp. °F Inlet (T_m)	Dry Gas Temp. °F Outlet	Remarks
7	0920	299.09	0.56	1.00	1.00	6.0	454	244	247	61	80	70	
6	0923	300.84	0.51	1.00	1.00	6.0	454	239	241	62	80	70	
5	0926	302.59	0.49	1.00	1.00	6.0	454	235	242	62	80	70	
4	0929	304.34	0.48	1.00	1.00	6.0	454	245	241	62	81	71	
3	0932	306.10	0.49	1.00	1.00	6.0	453	246	243	62	81	71	
2	0935	307.84	0.46	1.00	1.00	6.0	452	265	240	63	82	71	
1	0938	309.58	0.36	1.00	1.00	6.0	450	267	238	64	82	71	
End	0941	311.403	–	–	–	–	–	–	–	–	–	–	

APPENDIX E

Analytical Data

METCO Environmental

Particulate Analysis Summary

Job Number 95-134
Job Name Boral Brick
Location Henderson, Ky

Date Analysis Completed 7-10-95
Unit Tested Absorber Stack

Run No.	1	2	3		
Particulate on Filter (mg)	24.8	25.4	23.0		
Particulate in Front Wash (mg) DI-H2O	31.6	70.0	52.9		
Particulate in Front Wash (mg)* acetone	4.0	5.1	5.1		
MF (mg)	60.4	100.5	81.0		
Particulate in Impinger #1 (mg)	39.0	48.2	4.3		
MT (mg)	99.4	148.7	85.3		

Mary Hunter
Analyst

* Less Acetone Residue

METCO Environmental

Particulate Analysis EPA Method 5

Stack Filters + HF

Job Number 95-134 Location Henderson, Ky.

Job Name Basal Bricks Unit Tested Absorber Stack

Desiccator Time In	10:00 7/5	10:30 7/6			
Desiccator Time Out	10:25 7/6	13:45 7/7			

Run No. 1	Filter No. 88QR40				
Filter & Particulate + Tare Weight (g)					
Tare Weight (g)			✓		
Filter & Particulate (g)	0.5348	0.5350			

Filter & Particulate Average (g) 0.5349

Initial Filter Weight (g) 0.5101

Total Particulate (mg) 24.8

Run No. 2	Filter No. 88QR41				
Filter & Particulate + Tare Weight (g)					
Tare Weight (g)			✓		
Filter & Particulate (g)	0.5326	0.5322			

Filter & Particulate Average (g) 0.5324

Initial Filter Weight (g) 0.5070

Total Particulate (mg) 25.4

Run No. 3	Filter No. 88QR48				
Filter & Particulate + Tare Weight (g)					
Tare Weight (g)			✓		
Filter & Particulate (g)	0.5281	0.5282			

Filter & Particulate Average (g) 0.5282

Initial Filter Weight (g) 0.5052

Total Particulate (mg) 23.0

MG

Analyst

METCO Environmental

Particulate Analysis EPA Method 5

Stack Filters

Job Number 95-134 Location Henderson, Fl.

Job Name Boral Brick Unit Tested Absorber Stack

Desiccator Time In	10:00 7/5	10:32 7/6			
Desiccator Time Out	10:30 7/6	13:50 7/7			

Run No. Blank Filter No. 88QR43					
Filter & Particulate + Tare Weight (g)					
Tare Weight (g)			✓		
Filter & Particulate (g)	0.5115	0.5115			

Filter & Particulate Average (g) 0.5115

Initial Filter Weight (g) 0.5104

Total Particulate (mg) 1.1

Run No. _____ Filter No. _____					
Filter & Particulate + Tare Weight (g)					
Tare Weight (g)					
Filter & Particulate (g)					

Filter & Particulate Average (g) _____

Initial Filter Weight (g) _____

Total Particulate (mg) _____

Run No. _____ Filter No. _____					
Filter & Particulate + Tare Weight (g)					
Tare Weight (g)					
Filter & Particulate (g)					

Filter & Particulate Average (g) _____

Initial Filter Weight (g) _____

Total Particulate (mg) _____

Analyst

METCO Environmental

Particulate Analysis EPA Method 5

DI - H_2O Front Wash

Job Number 95-134 Location Henderson, Ky.

Job Name Basal Brick Unit Tested Asphalt Stack

Desiccator Time In	830 7/6	1325 7/6			
Desiccator Time Out	1320 7/6	1125 7/7			

Run No. 1	Volume (ml) 222				
Final Weight (g)	165.7929	165.7930	✓		
Initial Weight (g)	165.7614	165.7614			
Particulate Weight (g)	0.0315	0.0316			

Particulate Average (mg) 31.6 ✓
Less Ammonium Sulfate (mg) —
Total Particulate (mg) 31.6 ✓

Run No. 2	Volume (ml) 233				
Final Weight (g)	124.9063	124.9062	✓		
Initial Weight (g)	124.8363	124.8363			
Particulate Weight (g)	0.0700	0.0699			

Particulate Average (mg) 70.0 ✓
Less Ammonium Sulfate (mg) —
Total Particulate (mg) 70.0 ✓

Run No. 3	Volume (ml) 265				
Final Weight (g)	125.5382	125.5382	✓		
Initial Weight (g)	125.4853	125.4853			
Particulate Weight (g)	0.0529	0.0529			

Particulate Average (mg) 52.9 ✓
Less Ammonium Sulfate (mg) —
Total Particulate (mg) 52.9 ✓

Blank	Volume (ml) 250				
Final Weight (g)	162.3912	162.3908	✓		
Initial Weight (g)	162.3907	162.3907			
Difference (g)	0.0005	0.0001			

Average (mg) 0.3 ✓
Less Ammonium Sulfate (mg)
Total Particulate (mg)
mg/l 1.2 ✓

mb
Analyst

METCO Environmental

Particulate Analysis EPA Method 5

Acetone Front Wash

Job Number 94-134 Location Henderson, Ky.

Job Name Boral Brick Unit Tested Absorber Stack

Desiccator Time In	800 7/6	1312 7/6			
Desiccator Time Out	1312 7/6	115 7/7			

Run No. 1	Volume (ml) 197				
Final Weight (g)	143.4934	143.4932	✓		
Initial Weight (g)	143.4877	143.4877			
Particulate Weight (g)	0.0057	0.0055			

Particulate Average (mg) 5.6 ✓
Less Acetone Blank (mg) 1.6 ✓
Total Particulate (mg) 4.0 ✓

Run No. 2	Volume (ml) 200				
Final Weight (g)	128.5476	128.5476	✓		
Initial Weight (g)	128.5409	128.5409			
Particulate Weight (g)	0.0067	0.0067			

Particulate Average (mg) 6.7 ✓
Less Acetone Blank (mg) 1.6 ✓
Total Particulate (mg) 5.1 ✓

Run No. 3	Volume (ml) 183				
Final Weight (g)	122.7285	122.7282	✓		
Initial Weight (g)	122.7219	122.7219			
Particulate Weight (g)	0.0066	0.0063			

Particulate Average (mg) 6.5 ✓
Less Acetone Blank (mg) 1.4 ✓
Total Particulate (mg) 5.1 ✓

Acetone Blank	Volume (ml) 300				
Final Weight (g)	171.2265	171.2264	✓		
Initial Weight (g)	171.2241	171.2241			
Difference (g)	0.0024	0.0023			

Average (mg) 2.4 ✓
* mg/l 8.0 ✓

* Note: If greater than 7.9 mg/1, use 7.9 mg/1.

Analyst

METCO Environmental

Particulate Analysis EPA Method 5

Back Half Analysis

Job Number 95-134 Imp 1, 2, & 3 Location Henderson, KY

Job Name Boral Brick Unit Tested Aperture Stack

Desiccator Time In	830 7/7	1415 7/7			
Desiccator Time Out	1410 7/7	930 7/10			

Run No. 1	Volume (ml) 361 + 255				
Final Weight (g)	160.0591	160.0595	✓		
Initial Weight (g)	160.0203	160.0203			
Particulate Weight (g)	0.0388	0.0392			

Particulate Average (mg) 39.0

Less Ammonium Sulfate (mg) —

Total Particulate (mg) 39.0

Run No. 2	Volume (ml) 345 + 231				
Final Weight (g)	156.3310	156.3311	✓		
Initial Weight (g)	156.2829	156.2829			
Particulate Weight (g)	0.0481	0.0482			

hydroscope

Particulate Average (mg) 48.2

Less Ammonium Sulfate (mg) —

Total Particulate (mg) 48.2

Run No. 3	Volume (ml) 274 + 215				
Final Weight (g)	123.1508	123.1513	✓		
Initial Weight (g)	123.1468	123.1468			
Particulate Weight (g)	0.0040	0.0045			

Particulate Average (mg) 4.3

Less Ammonium Sulfate (mg) —

Total Particulate (mg) 4.3

Run No.	Volume (ml)				
Final Weight (g)					
Initial Weight (g)					
Particulate Weight (g)					

Particulate Average (mg)

Less Ammonium Sulfate (mg)

Total Particulate (mg)

MB

Analyst

METCO ENVIRONMENTAL

JOB No. 95-134

UNIT Absorber Stack

CLIENT Boral Brick

DATE 07-18-95

Location Henderson, Texas

RUN	IMP.	VOL. ml.	Dil.	F Conc. ppm	F Conc. Dup ppm	HF ug	% R.D.
1	Filter	25	1	1.526	1.523	40.16	0.20%
	Front Wash	222	1	2.555		597.06	
I1 Back Half		361	5	6.957		13218.30	
I 2,3		255	1	2.343		628.91	
RUN TOTALS, ug						**14,484.4**	

2	Filter	25	1	1.803	1.781	47.45	1.23%
	Front Wash	233	1	4.610		1130.66	
I1 Back Half		345	5	6.594	6.513	11973.32	1.24%
I 2,3		271	1	2.320		661.81	
RUN TOTALS, ug						**13,813.2**	

3	Filter	25	1	1.547		40.71	
	Front Wash	265	1	4.567	4.564	1273.95	0.07%
I1 Back Half		274	5	8.850	8.865	12762.63	0.17%
I 2,3		215	1	2.783		629.84	
RUN TOTALS, ug						**14,707.1**	

			% REC.	% REC. DUP.
R2 DIFW(2X) SPK 5 PPM	7.268	7.321	99.26%	100.32%

FILTER BLANK	25	0.339

DI BLANK	0.017

METCO ENVIRONMENTAL

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==============================================================================
! Sample Name: R1 FILTER (25ML)                Date: 07/17/1995 16:00:00      !
! Data File  : C:\DX\DATA\ANIONS\95-134\7-170011.D02                          !
! Method     : C:\DX\METHOD\FLUO.MET                                          !
! ACI Address: 1  System: 1  Inject#: 2                     Detector:CDM-2    !
! Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         !
==============================================================================
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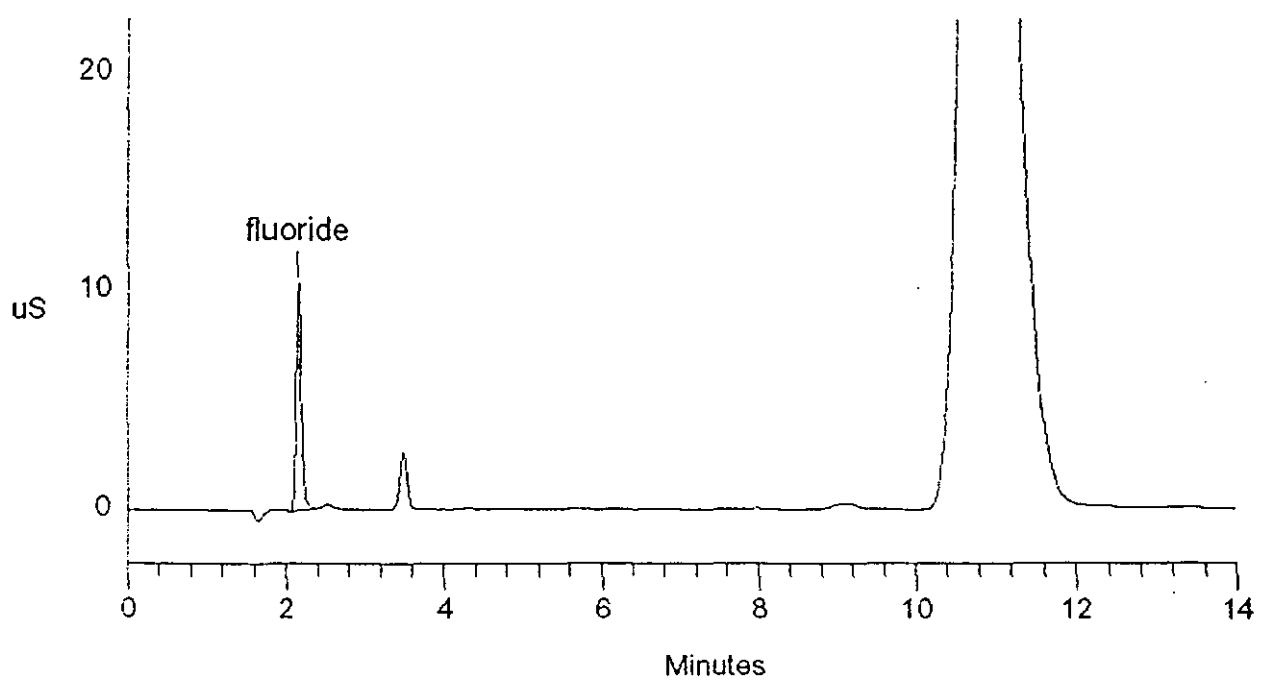
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	45807458	10181323	1.526
	Totals	45807458	10181323	1.526

File: 7-170011.D02 Sample: R1 FILTER (25ML)



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==========================================================================
| Sample Name: R1 FILTER (25ML) DUP          Date: 07/17/1995 16:46:19   |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-170001.D05                     |
| Method     : C:\DX\METHOD\FLUO.MET                                     |
| ACI Address: 1  System: 1  Inject#: 5                  Detector:CDM-2  |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94      |
==========================================================================
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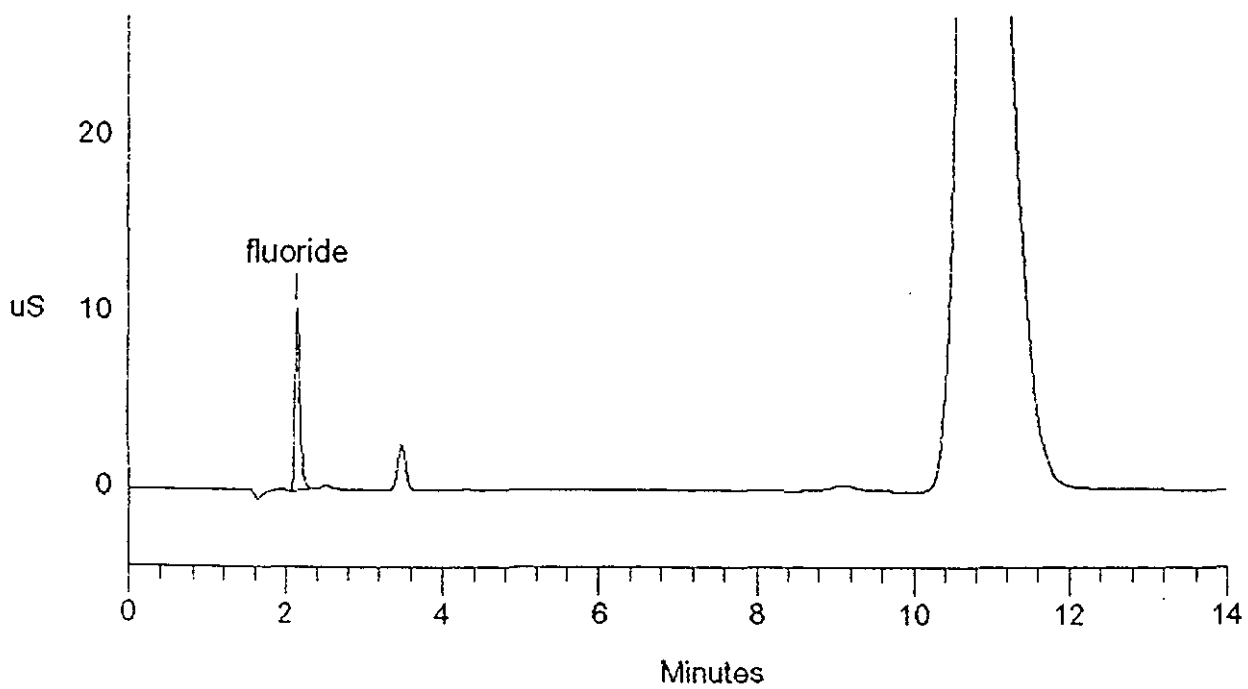
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	45714635	10235629	1.523
	Totals	45714635	10235629	1.523

File: 7-170001.D05 Sample: R1 FILTER (25ML) DUP



METCO ENVIRONMENTAL

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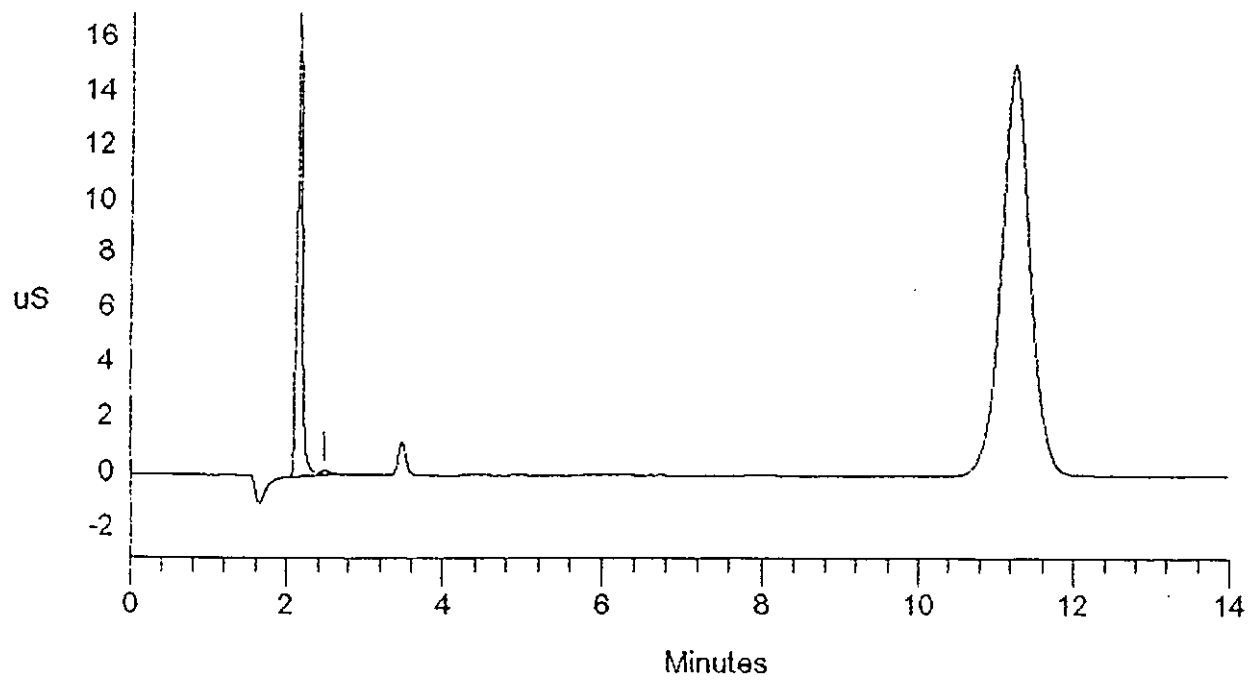
==============================================================================
| Sample Name: R1 DIFW (222ML)                    Date: 07/17/1995 17:41:35   |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-170001.D09                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 9                     Detector:CDM-2    |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	76692821	15756763	2.555
	Totals	76692821	15756763	2.555

File: 7-170001.D09 Sample: R1 DIFW (222ML)



METCO ENVIRONMENTAL

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==========================================================================
| Sample Name: R1I1 DIBH (361ML) 5X          Date: 07/18/1995 14:41:37   |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D15                     |
| Method     : C:\DX\METHOD\FLUO.MET                                     |
| ACI Address: 1  System: 1  Inject#: 15                Detector:CDM-2   |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94      |
==========================================================================
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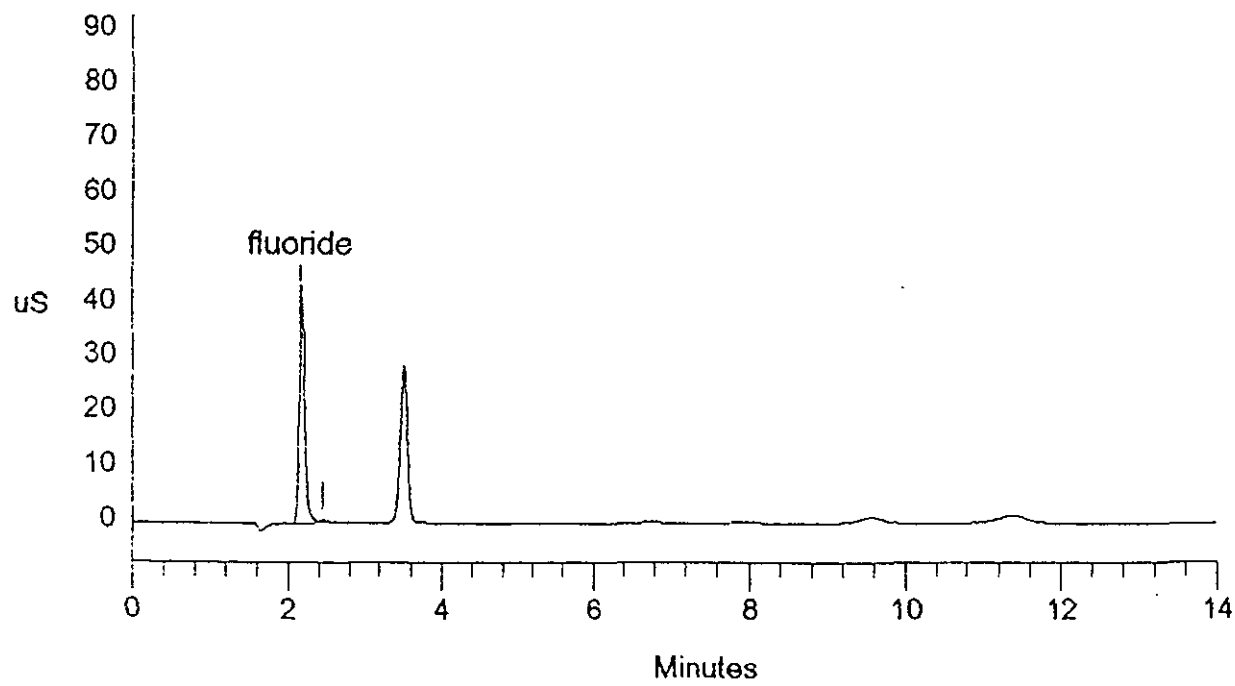
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	208839017	40452395	6.957
	Totals	208839017	40452395	6.957

File: 7-180001.D15 Sample: R1I1 DIBH (361ML) 5X



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R1I2,3 (255ML)                    Date: 07/18/1995 13:20:58    |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D10                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 10                   Detector:CDM-2     |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
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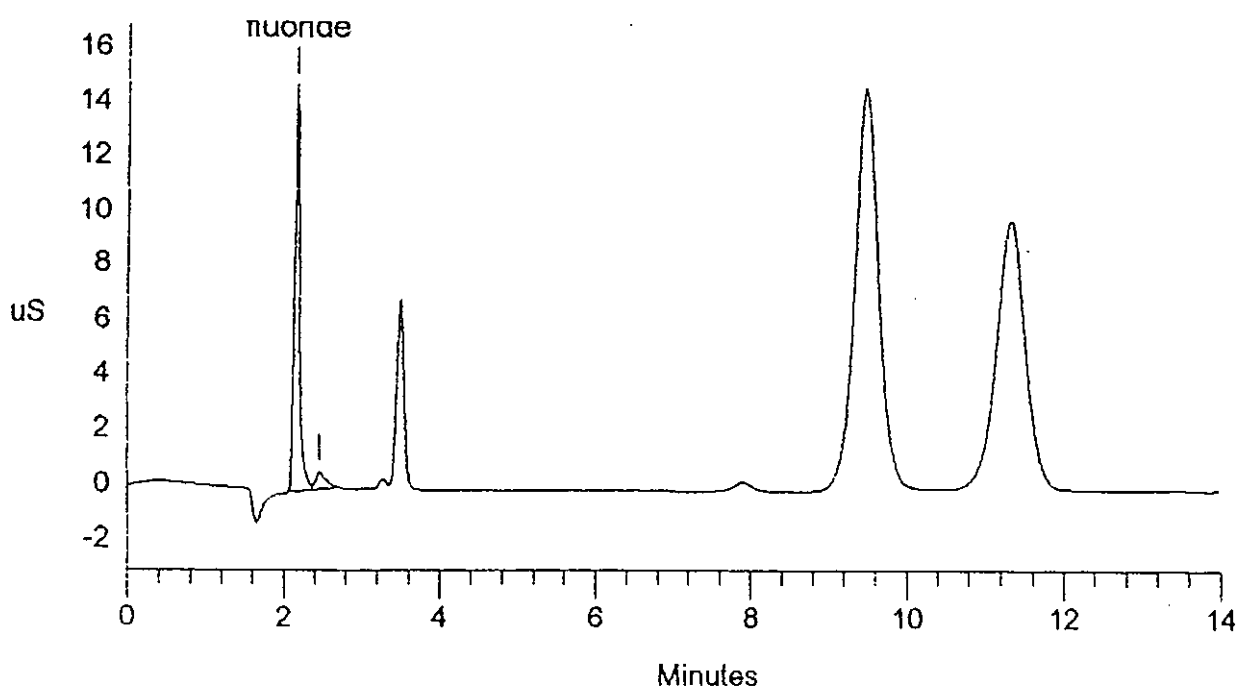
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	70335155	14926708	2.343
	Totals	70335155	14926708	2.343

File: 7-180001.D10 Sample: R1I2,3 (255ML)



METCO ENVIRONMENTAL

Data Reprocessed On 07/17/1995 16:25:30

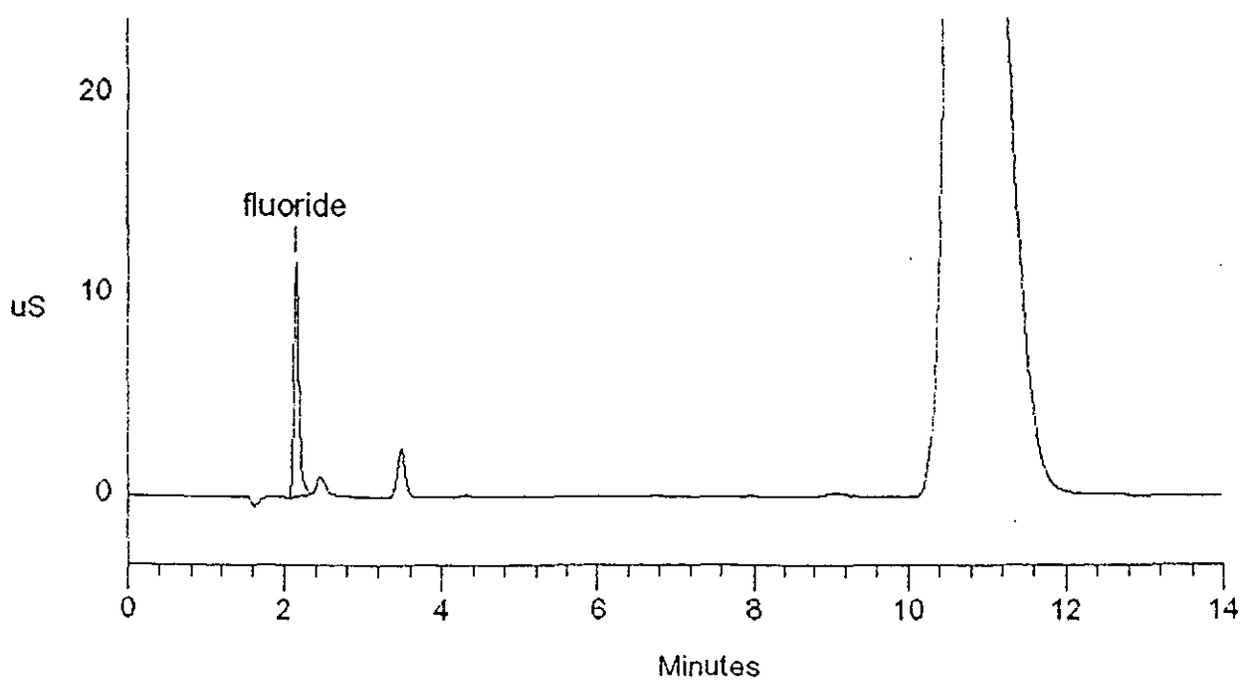
Sample Name: R2 FILTER (25ML)	Date: 07/17/1995 16:15:24
Data File : C:\DX\DATA\ANIONS\95-134\7-170001.D03	
Method : C:\DX\METHOD\FLUO.MET	
ACI Address: 1 System: 1 Inject#: 3	Detector:CDM-2
Analyst : Column: AS4A-SC,4mm, STARTED 10-14-94	

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area	Reject
External	1	1	4200	5Hz	0.00	14.00		500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	54135912	11658143	1.803
	Totals	54135912	11658143	1.803

File: 7-170001.D03 Sample: R2 FILTER (25ML)



METCO ENVIRONMENTAL

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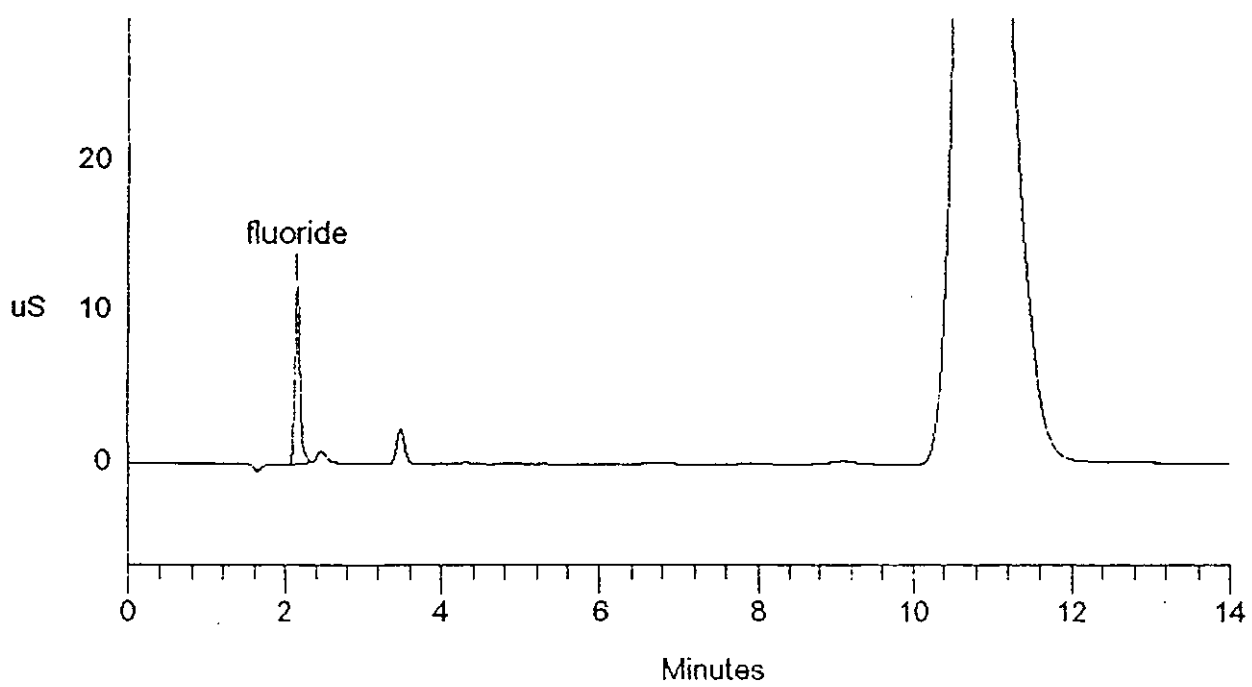
==============================================================================
| Sample Name: R2 FILTER (25ML)DUP            Date: 07/17/1995 17:01:38      |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-170001.D06                         |
| Method     : C:\DX\METHOD\FLUO.MET                                         |
| ACI Address: 1  System: 1  Inject#: 6                   Detector:CDM-2     |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94          |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	53453218	11511294	1.781
	Totals	53453218	11511294	1.781

File: 7-170001.D06 Sample: R2 FILTER (25ML)DUP



METCO ENVIRONMENTAL

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==========================================================================
! Sample Name: R2 DIFW (233ML)                Date: 07/17/1995 17:56:59  !
! Data File  : C:\DX\DATA\ANIONS\95-134\7-170001.D10                     !
! Method     : C:\DX\METHOD\FLUO.MET                                     !
! ACI Address: 1  System: 1  Inject#: 10                Detector:CDM-2   !
! Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94      !
==========================================================================
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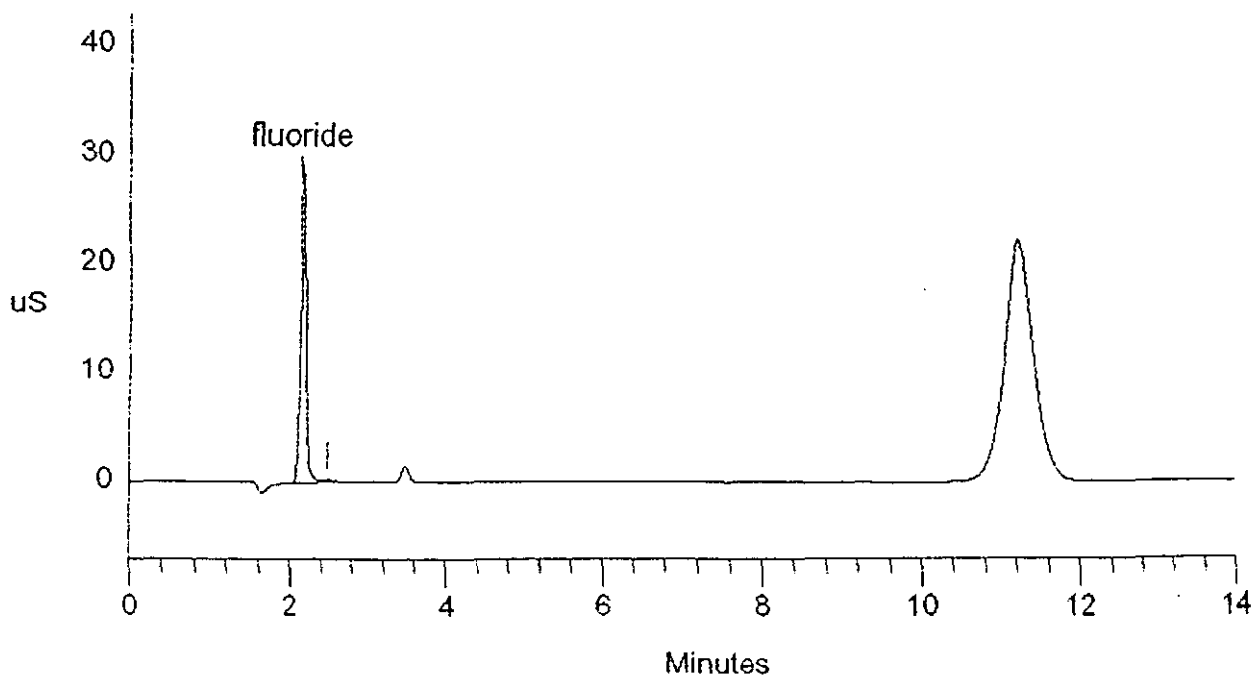
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	138393191	26608543	4.610
	Totals	138393191	26608543	4.610

File: 7-170001.D10 Sample: R2 DIFW (233ML)



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R2 DIFW (2X)SPK 5 PPM          Date: 07/18/1995 16:36:58       |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D23                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 23                  Detector:CDM-2      |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94           |
==============================================================================
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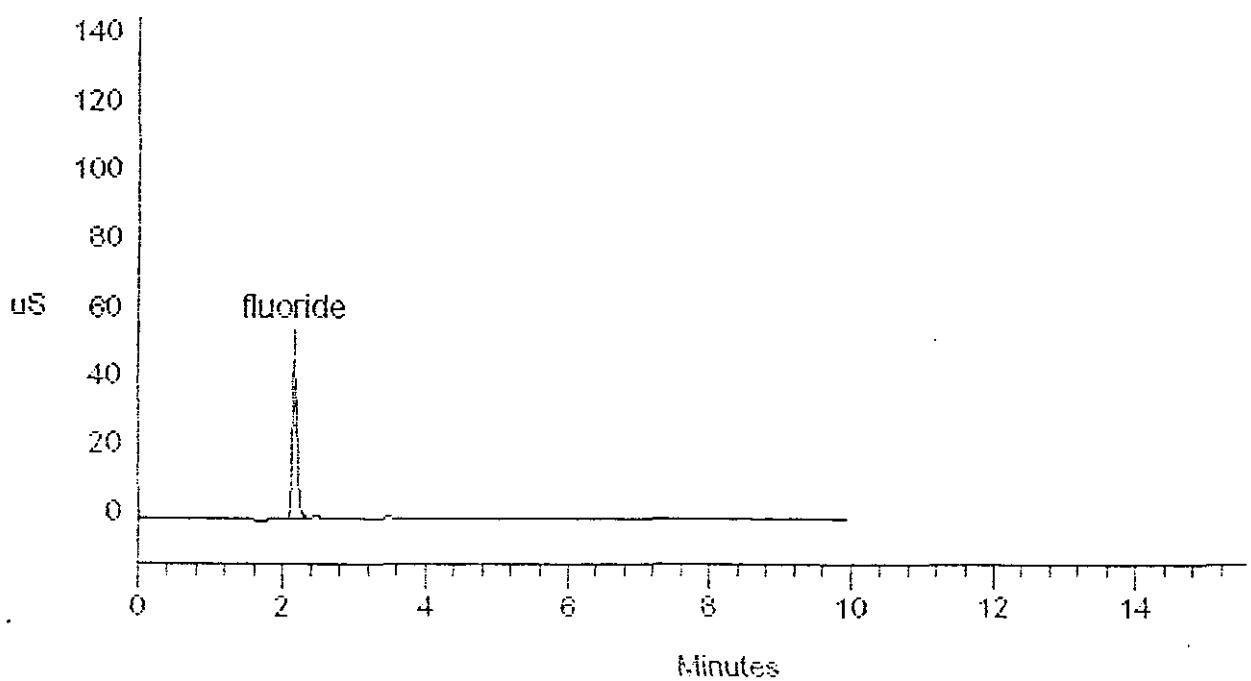
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area	Reject
External	1	1	2991	5Hz	0.00	15.57		500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	218192518	44018947	7.268
	Totals	218192518	44018947	7.268

File: 7-180001.D23 Sample: R2 DIFW (2X)SPK 5 PPM



METCO ENVIRONMENTAL

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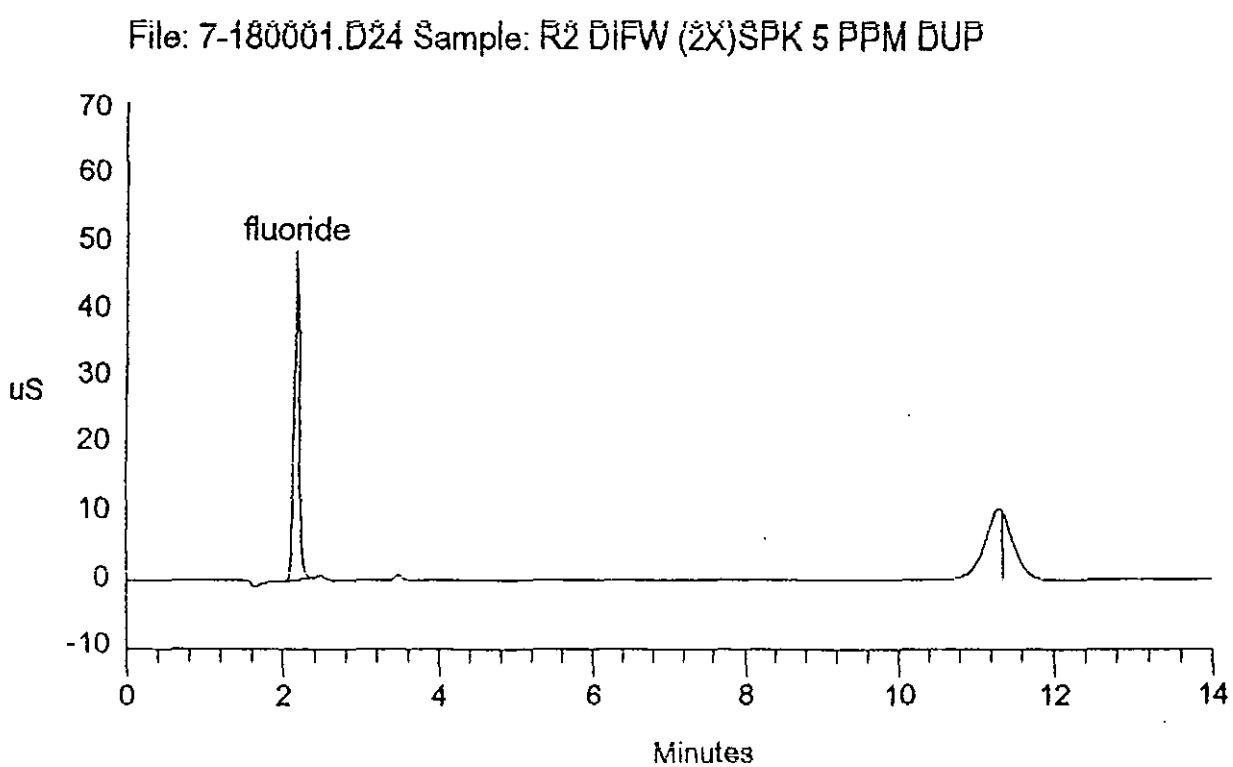
==================================================================================
| Sample Name: R2 DIFW (2X)SPK 5 PPM DUP      Date: 07/18/1995 16:53:10          |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D24                             |
| Method     : C:\DX\METHOD\FLUO.MET                                             |
| ACI Address: 1  System: 1  Inject#: 24                   Detector:CDM-2        |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94              |
==================================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area	Reject
External	1	1	4200	5Hz	0.00	14.00		500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	219787830	43305568	7.321
	Totals	219787830	43305568	7.321



METCO ENVIRONMENTAL

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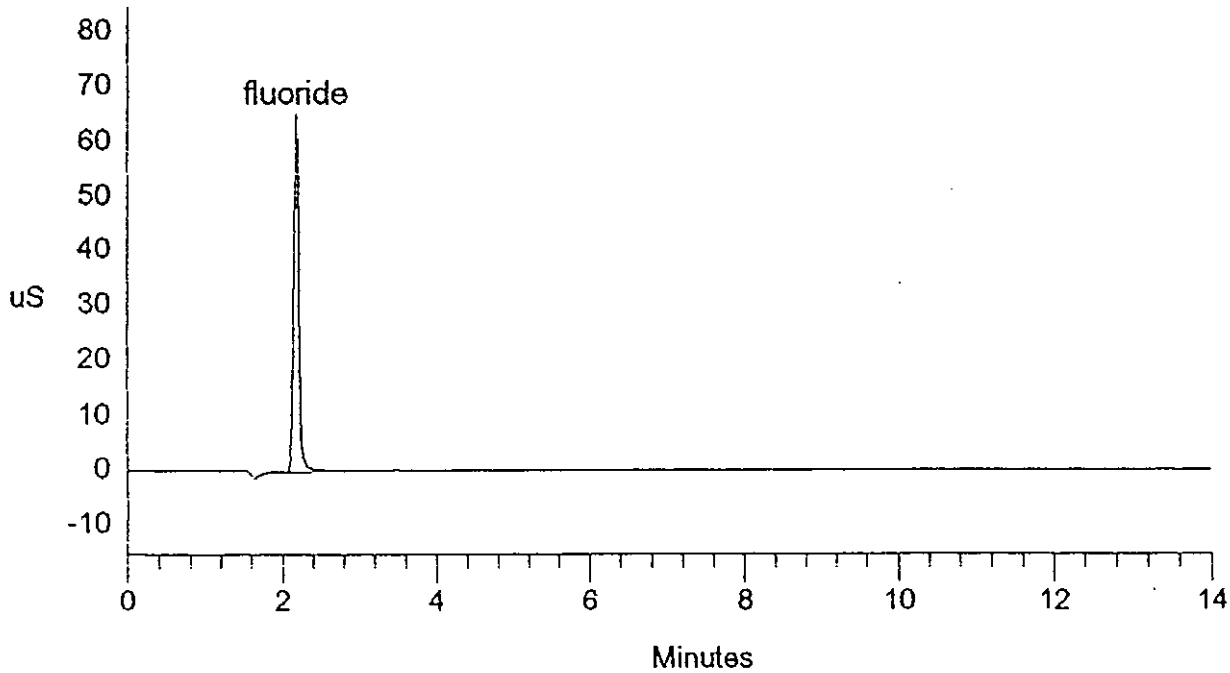
==============================================================================
| Sample Name: CCV 10 PPM F STD                Date: 07/18/1995 11:18:10      |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D02                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 2                     Detector:CDM-2    |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.18	fluoride	305275841	58437700	10.169
	Totals	305275841	58437700	10.169

File: 7-180001.D02 Sample: CCV 10 PPM F STD



METCO ENVIRONMENTAL

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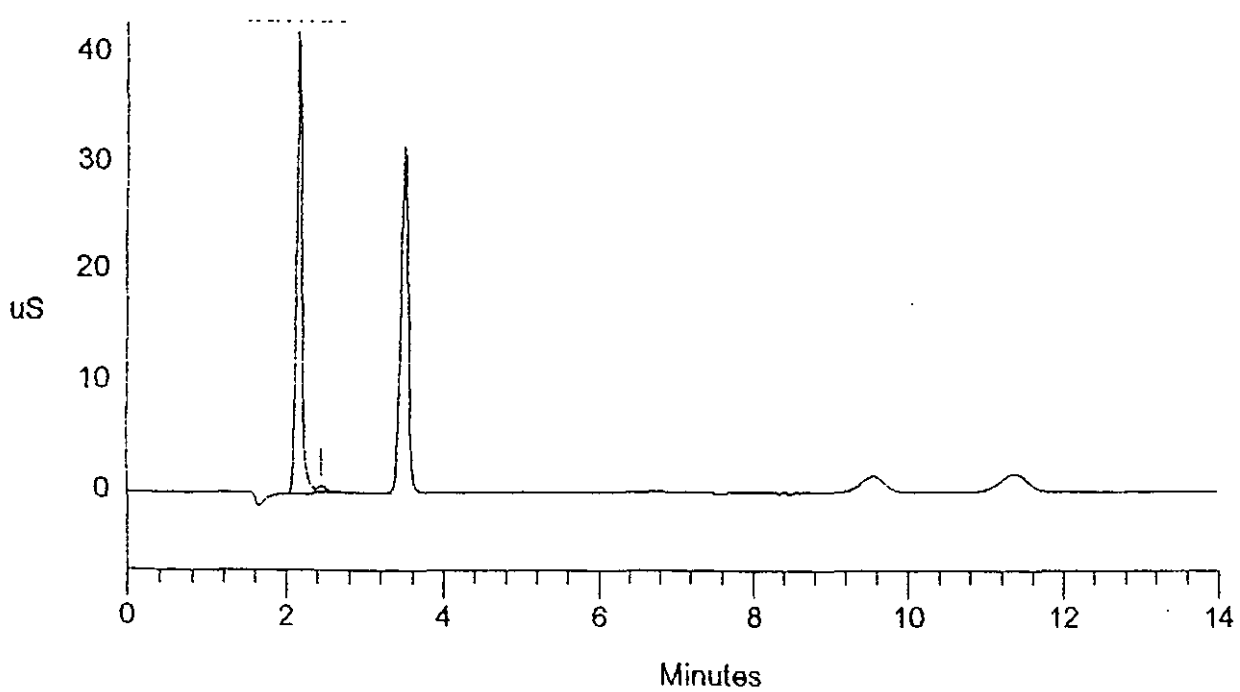
==============================================================================
| Sample Name: R2I1 DIBH (345ML) 5X          Date: 07/18/1995 15:12:16        |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D17                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 17                  Detector:CDM-2      |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94           |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	197969472	38695533	6.594
	Totals	197969472	38695533	6.594

File: 7-180001.D17 Sample: R2I1 DIBH (345ML) 5X



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R2I1 DIBH (345ML) 5X DUP        Date: 07/18/1995 15:27:36      |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D18                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 18                    Detector:CDM-2    |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
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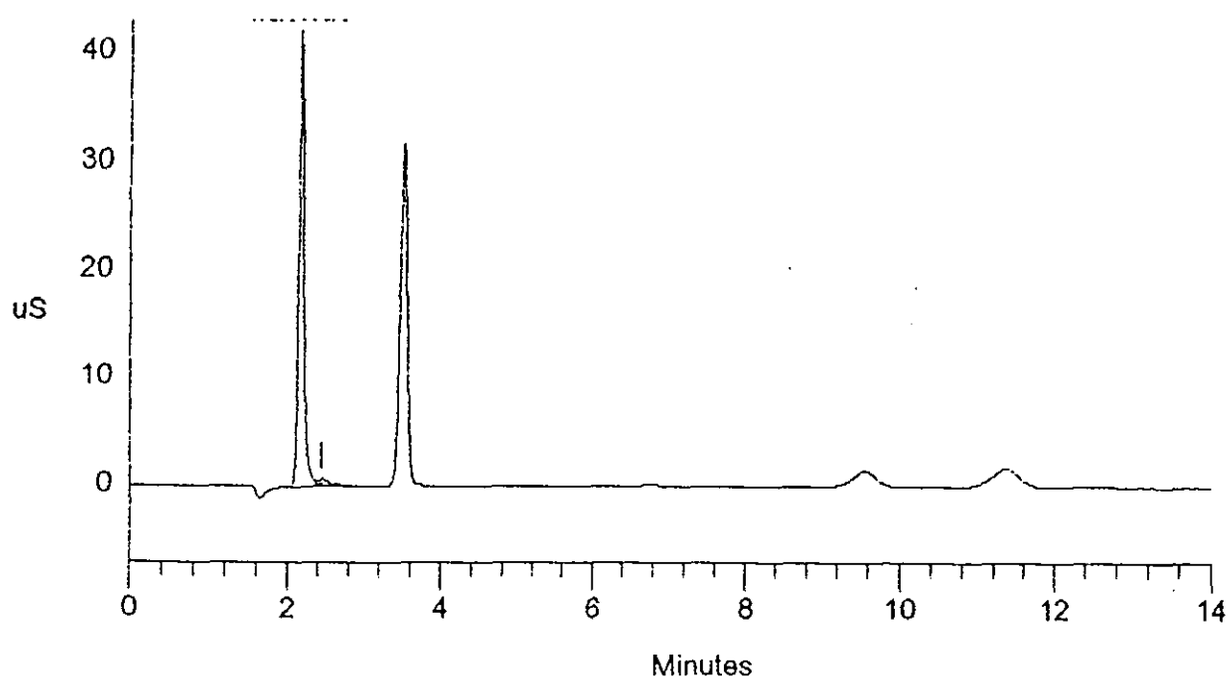
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	195512773	38612399	6.513
	Totals	195512773	38612399	6.513

File: 7-180001.D18 Sample: R2I1 DIBH (345ML) 5X DUP



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R2I2.3 (271ML)                    Date: 07/18/1995 13:36:17    |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D11                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 11                    Detector:CDM-2    |
| Analyst    :                  Column: AS4A-SC,4mm, STARTED 10-14-94        |
==============================================================================
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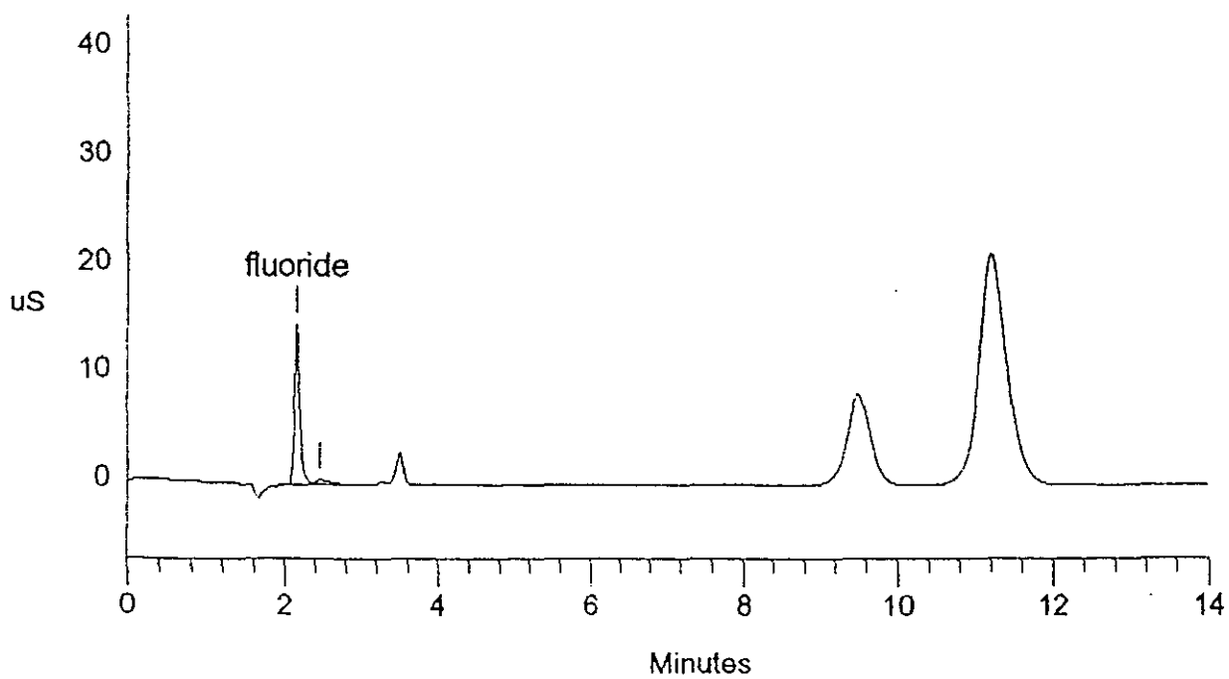
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	69641120	14881802	2.320
	Totals	69641120	14881802	2.320

File: 7-180001.D11 Sample: R2I2.3 (271ML)



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R3 FILTER (25ML)                Date: 07/17/1995 16:30:43      |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-170001.D04                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 4                    Detector:CDM-2     |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
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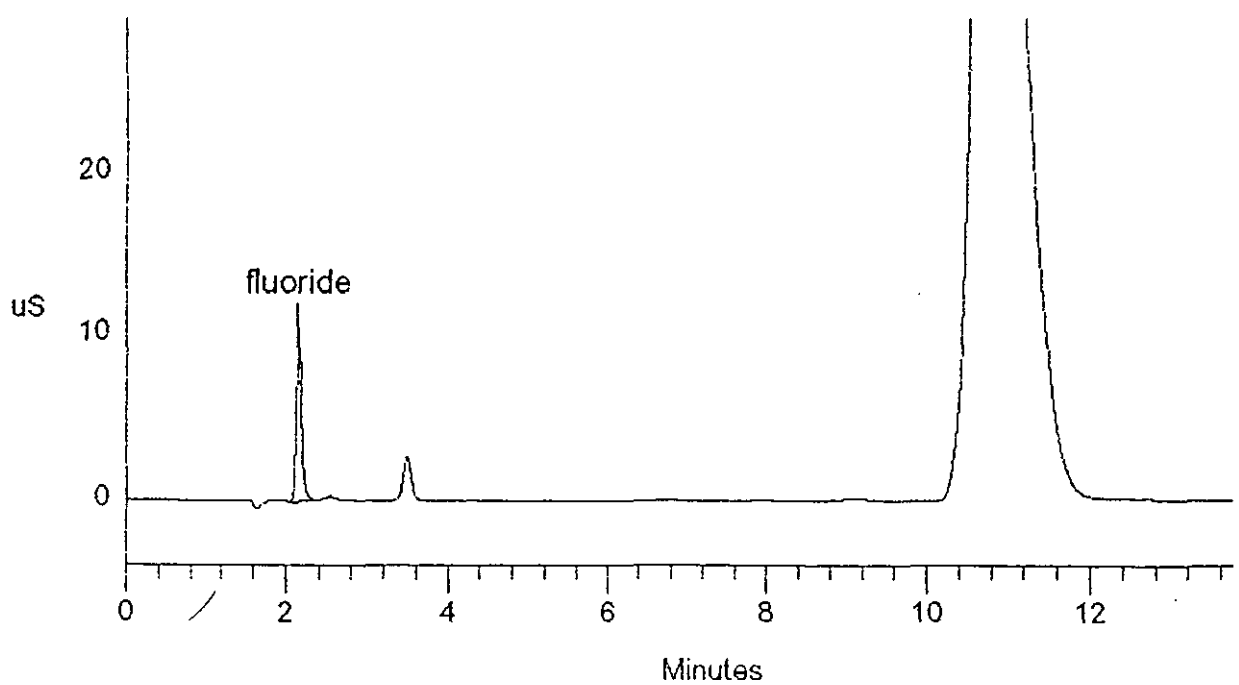
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4129	5Hz	0.00	13.76	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	46435664	9808065	1.547
	Totals	46435664	9808065	1.547

File: 7-170001.D04 Sample: R3 FILTER (25ML)



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R3 DIFW (265ML)                    Date: 07/18/1995 11:48:50   |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D04                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 4                     Detector:CDM-2    |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
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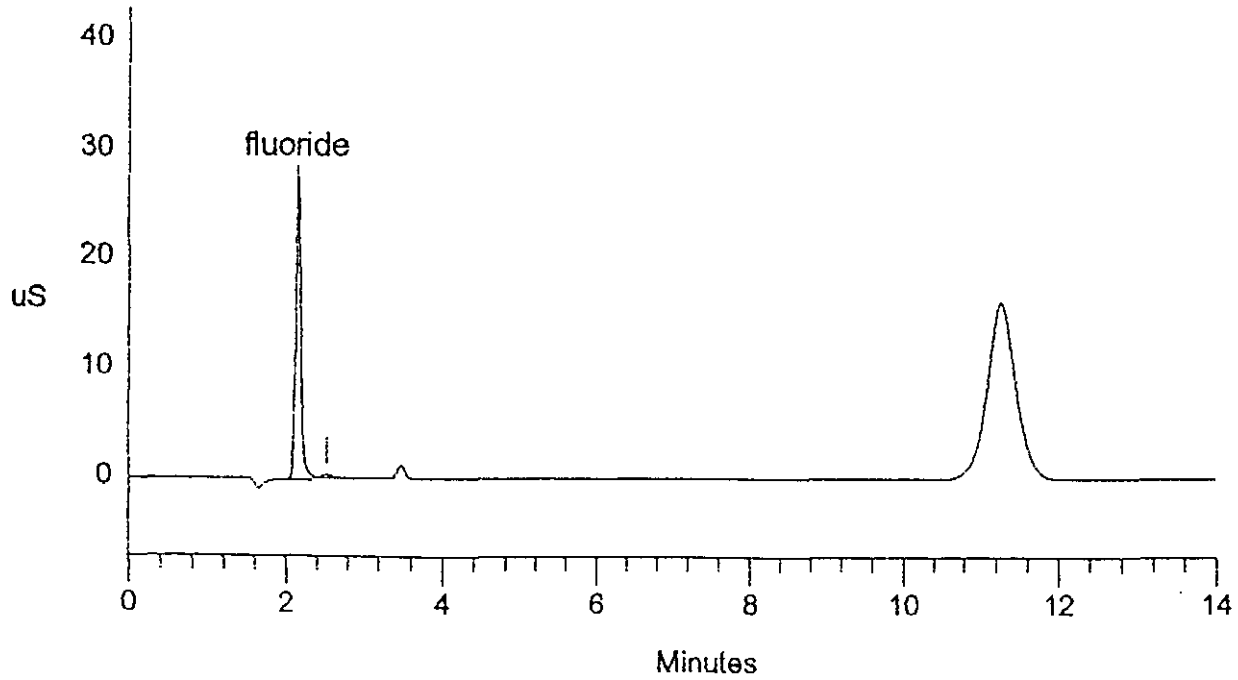
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	137105384	25215950	4.567
	Totals	137105384	25215950	4.567

File: 7-180001.D04 Sample: R3 DIFW (265ML)



METCO ENVIRONMENTAL

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==============================================================================
| Sample Name: R3 DIFW (265ML)DUP              Date: 07/18/1995 12:04:14      |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D05                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 5                    Detector:CDM-2     |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
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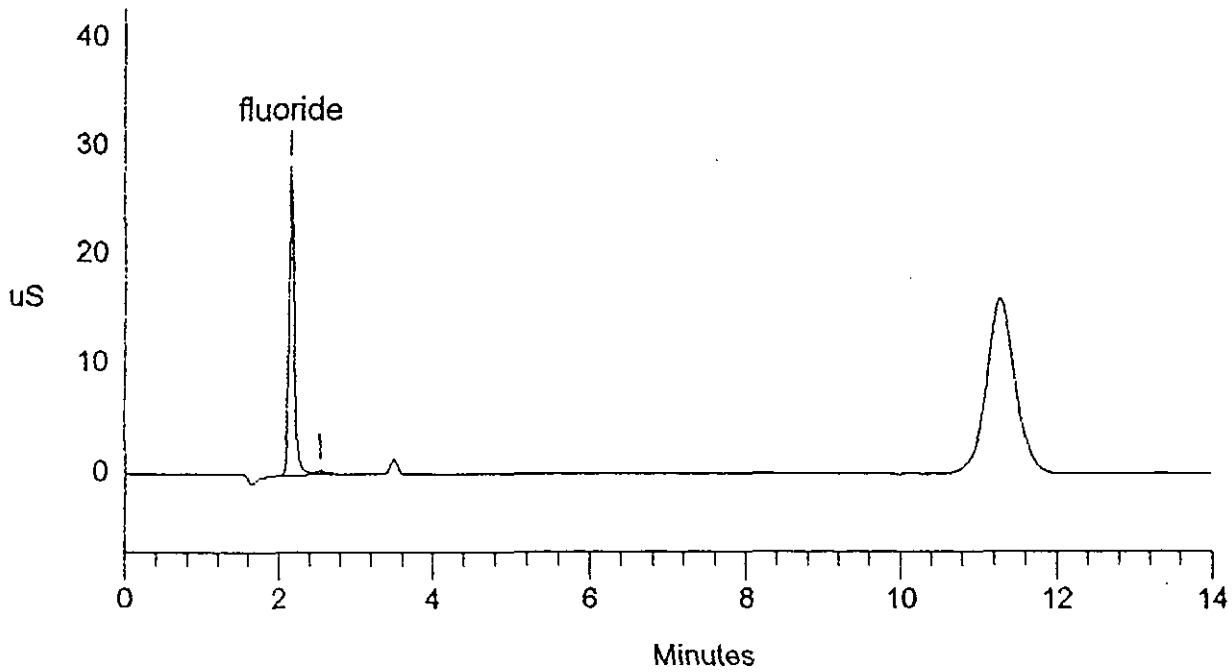
Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	137020354	28290570	4.564
	Totals	137020354	28290570	4.564

File: 7-180001.D05 Sample: R3 DIFW (265ML)DUP



METCO ENVIRONMENTAL

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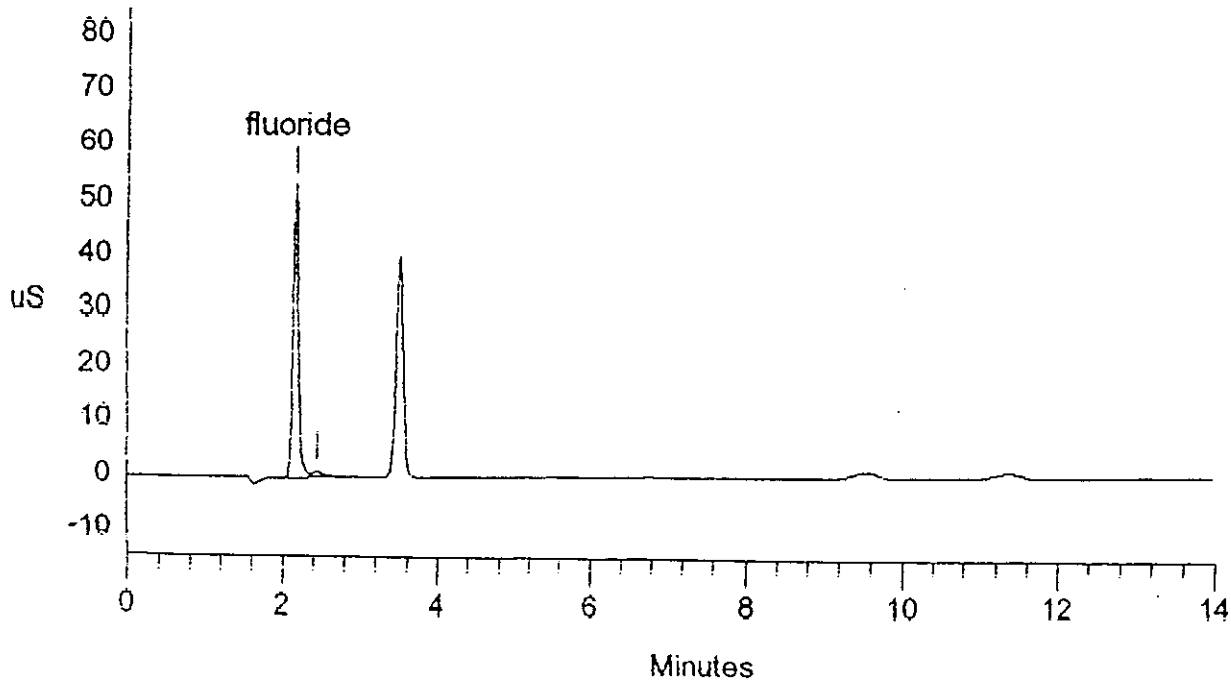
==============================================================================
| Sample Name: R3I1 DIBH (274ML) 5X          Date: 07/18/1995 15:42:56        |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D19                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 19                  Detector:CDM-2      |
| Analyst    :                Column: AS4A-SC,4mm, STARTED 10-14-94           |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.18	fluoride	265669319	53124065	8.850
	Totals	265669319	53124065	8.850

File: 7-180001.D19 Sample: R3I1 DIBH (274ML) 5X



METCO ENVIRONMENTAL

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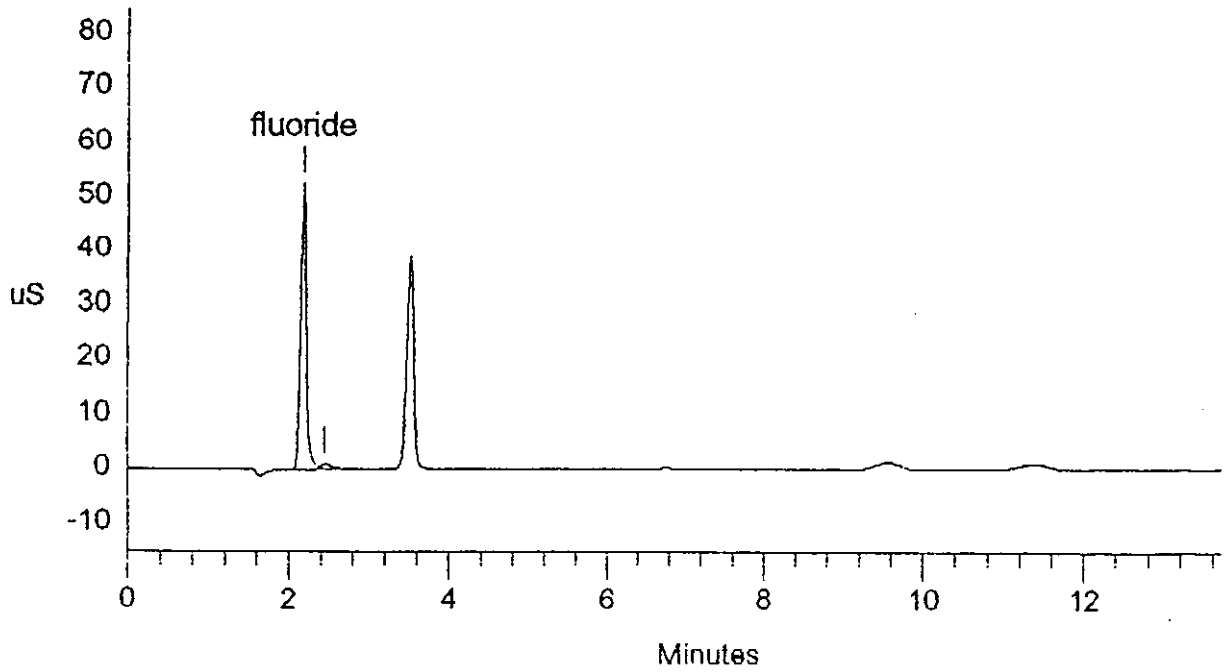
==============================================================================
| Sample Name: R3I1 DIBH (274ML) 5X DUP        Date: 07/18/1995 15:58:07      |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D20                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 20                   Detector:CDM-2     |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area	Reject
External	1	1	4120	5Hz	0.00	13.73		500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.18	fluoride	266136227	52666831	8.865
	Totals	266136227	52666831	8.865

File: 7-180001.D20 Sample: R3I1 DIBH (274ML) 5X DUP



METCO ENVIRONMENTAL

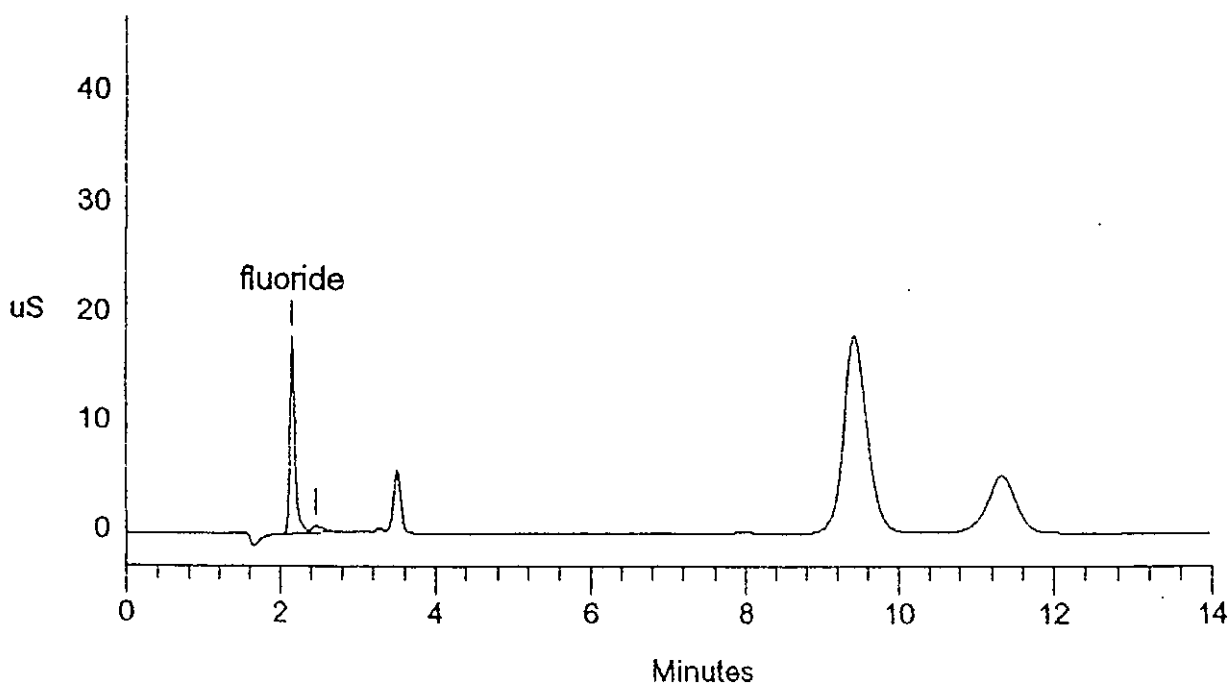
```
==============================================================================
| Sample Name: R3I2,3 (215ML)                    Date: 07/18/1995 13:51:37    |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D12                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 12                   Detector:CDM-2     |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area	Reject
External	1	1	4200	5Hz	0.00	14.00		500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.17	fluoride	83536272	17962802	2.783
	Totals	83536272	17962802	2.783

File: 7-180001.D12 Sample: R3I2,3 (215ML)



METCO ENVIRONMENTAL

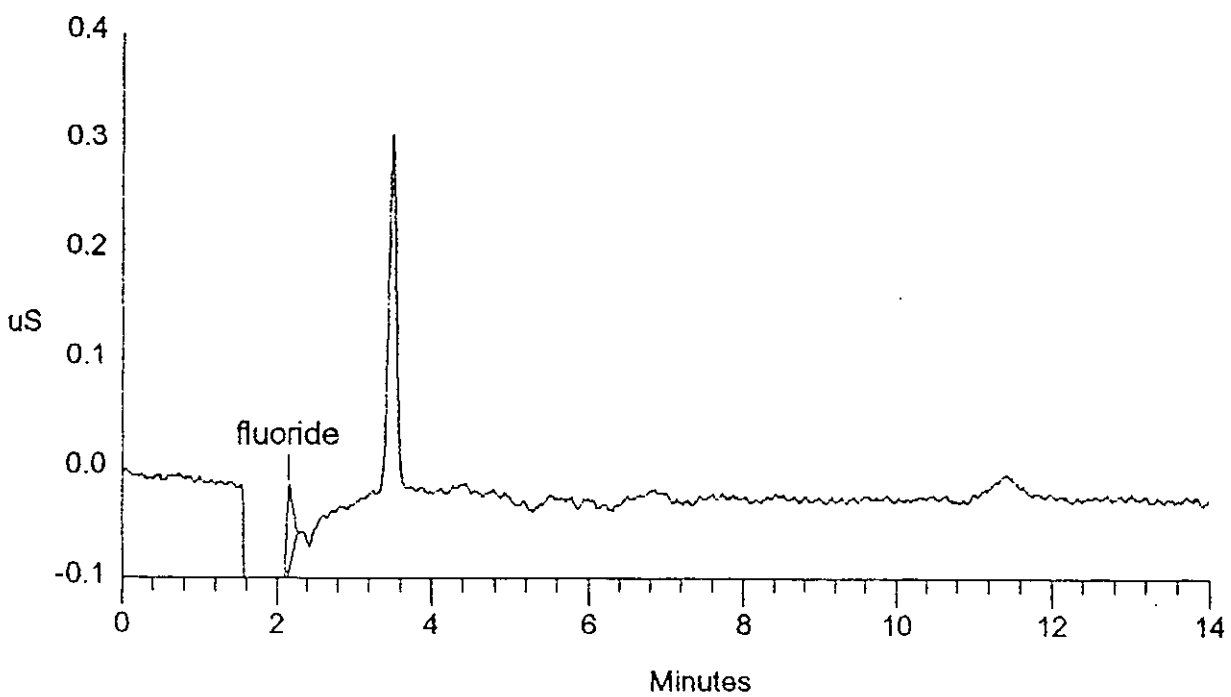
```
==============================================================================
| Sample Name: DI BLANK                          Date: 07/18/1995 14:26:19    |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-180001.D14                          |
| Method     : C:\DX\METHOD\FLUO.MET                                          |
| ACI Address: 1  System: 1  Inject#: 14                   Detector:CDM-2     |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94         |
==============================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area Reject
External	1	1	4200	5Hz	0.00	14.00	500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	516949	75216	0.017
	Totals	516949	75216	0.017

File: 7-180001.D14 Sample: DI BLANK



METCO ENVIRONMENTAL

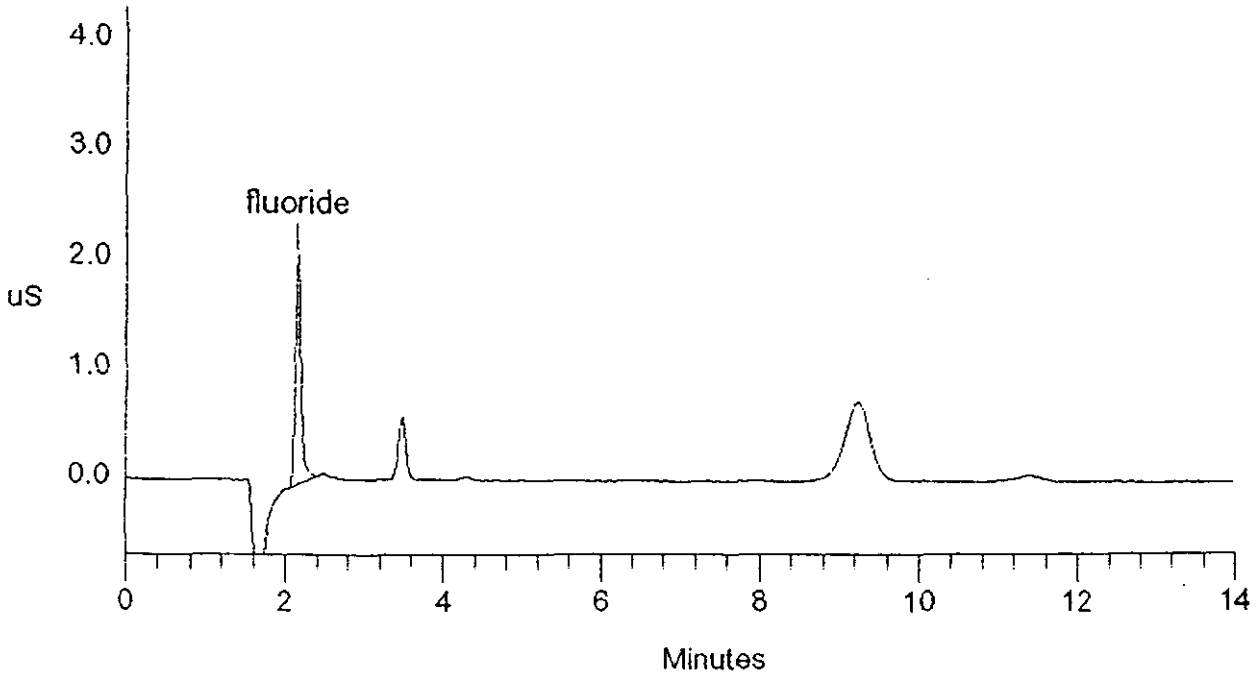
```
==================================================================================
| Sample Name: FILTER BLANK                    Date: 07/17/1995 17:26:15          |
| Data File  : C:\DX\DATA\ANIONS\95-134\7-170001.D08                              |
| Method     : C:\DX\METHOD\FLUO.MET                                              |
| ACI Address: 1  System: 1  Inject#: 8                      Detector:CDM-2       |
| Analyst    :                 Column: AS4A-SC,4mm, STARTED 10-14-94              |
==================================================================================
```

Calibration	Volume	Dilution	Points	Rate	Start	Stop	Area	Reject
External	1	1	4200	5Hz	0.00	14.00		500

********** Component Report: Components Found **********

Ret Time	Component Name	Area	Height	Concentration ppm
2.15	fluoride	10190970	2040563	0.339
	Totals	10190970	2040563	0.339

File: 7-170001.D08 Sample: FILTER BLANK



SO_2 EMISSION DATA

Job Number 95-134 Location Henderson, Ky.

Job Name Boral Bricks Unit Tested Absorber Stack

Run Number	1	2	3			
N - normality of $Ba(ClO_4)_2$	0.0100	→	→			
ML_I - ml in impinger #2	380	395	400			
ML_I - ml in impinger #3	335	444	330			
ML_A - ml in aliquot #2	3	3	3			
ML_A - ml in aliquot #3	10	10	10			
ML_B - ml of $Ba(ClO_4)_2$ to titrate #2	3.75	3.45	3.30			
	3.70	3.45	3.35			
	3.75	3.45	3.35			
Average ML_B - ml of $Ba(ClO_4)_2$	3.73	3.45	3.33			
ML_B - ml of $Ba(ClO_4)_2$ to titrate #3	0.15	0.15	0.20			
	0.15	0.15	0.20			
	0.15	0.15	0.20			
Average ML_B - ml of $Ba(ClO_4)_2$	0.15	0.15	0.20			
ML_{BB} - ml of $Ba(ClO_4)_2$ to titrate blank	0.05	→	→			
T_m - average gas meter temp., °F						
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$						
P_b - barometric pressure, "Hg Abs.						
Q_s - stack gas volume dry @ standard conditions, *SCFM						
C_I - SO_2 in impinger #2, mgs	149.1	143.3	139.9			
C_I - SO_2 in impinger #3, mgs	1.1	1.4	1.6			
C_T - total SO_2 in impingers, mgs	150.2	144.7	141.5			
ppm SO_2						
C_{SO_2} - emission rate of SO_2, lbs/day						
C_{SO_2} - emission rate of SO_2, lbs/hr						
C_s - emission rate of S, lbs/day						

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times N \times 32}{ML_A}$$

$$C_T = C_I \#2 + C_I \#3$$

$$\text{ppm } SO_2 = \frac{0.7513 \times C_T \times (T_m + 460)}{V_m P_b}$$

$$C_{SO_2} = \text{ppm } SO_2 \times Q_s \times 239.2 \times 10^{-6}$$

$$C_s = \frac{C_{SO_2}}{2}$$

METCO ENVIRONMENTAL

SULFUR TRIOXIDE EMISSION DATA

Job Number 95-134 Location Henderson, Ky

Job Name Boral Brick Unit Tested Absorber Stack

Run Number	1	2	3			
Date						
Time						
$\underline{N}$ - normality of $Ba(ClO_4)_2$	0.0100	→	→			
ML_I - ml in impinger	208	300	262			
ML_A - ml in aliquot	10	10	10			
ML_B - ml of $Ba(ClO_4)_2$ to titrate	Interference 0.45	Interference 0.30	Interference 0.35			
	0.80	0.55	1.10			
	0.65	0.50	0.65			
Average ML_B - ml of $Ba(ClO_4)_2$ to titrate	0.63	0.45	0.70			
ML_{BB} - ml of $Ba(ClO_4)_2$ to titrate blank	0.05	→	→			
T_m - average gas meter temp., °F						
V_m - volume of dry gas sampled @ meter conditions, $ft.^3$						
P_b - barometric pressure, "Hg Abs.						
Q_s - stack gas volume dry @ standard conditions, *SCFM						
C_I - SO_3 in impinger, mgs	4.8	4.8	6.8			
ppm SO_3						
C_{SO_3} - emission rate of SO_3, lbs/day						
C_S - emission rate of S, lbs/day						

* 29.92 "Hg, 68°F (760 mm Hg, 20°C)

$$C_I = \frac{ML_I \times (ML_B - ML_{BB}) \times \underline{N} \times 40}{ML_A}$$

$$\text{ppm } SO_3 = \frac{0.6021 \times C_I \times (T_m + 460)}{V_m \; P_b}$$

$$C_{SO_3} = \text{ppm } SO_3 \times Q_s \times 299.1 \times 10^{-6}$$

$$C_S = \frac{C_{SO_3}}{2.5}$$

APPENDIX F

Reference Method Monitor Data

Absorber Stack (EPN - K)
Oxides of Nitrogen
Concentration

Run Number	Measured (ppm)	Adjusted (ppm*)
1	16.5	16.0
2	17.4	17.0
3	17.7	17.0

*Calculated according to equation 6C-1.

Absorber Stack (EPN - K)
Calibration Summary
Oxides of Nitrogen

Run Number	NOx Calibration Initial Drift Check (ppm)	NOx Calibration Final Drift Check (ppm)	NOx Calibration Average (ppm)	NOx Zero Initial Drift Check (ppm)	NOx Zero Final Drift Check (ppm)	NOx Zero Average (ppm)	Actual NOx Calibration Value (ppm)	Actual NOx Zero Value (ppm)
1	49.8	48.3	49.1	0.3	0.1	0.2	48.1	0.0
2	48.3	48.6	48.5	0.3	0.5	0.4	48.1	0.0
3	49.6	49.1	49.4	0.3	0.2	0.3	48.1	0.0

INITIAL CALIBRATION

LEAK CHECK 15"Hg. GOOD

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BORAL BRICK
HENDERSON TEXAS
ABSORBER STACK
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		NOX PPM	
06/29/95	07:18	0.0C	
06/29/95	07:19	0.0C	
06/29/95	07:20	0.0C	
06/29/95	07:21	0.0C	
06/29/95	07:22	0.0C	ZERO N_2 SG 910712 ALC
06/29/95	07:23	0.0C	
06/29/95	07:24	85.5C	
06/29/95	07:25	86.8C	86.1ppm NOX ALM038783
06/29/95	07:26	86.8C	
06/29/95	07:27	48.0C	
06/29/95	07:28	0.2C	
06/29/95	07:29	2.9C	
06/29/95	07:30	50.2C	
06/29/95	07:31	49.6C	48.05ppm NOX BLM003576
06/29/95	07:32	49.6C	
06/29/95	07:33	25.1C	
06/29/95	07:34	0.2C	
06/29/95	07:35	0.1C	
06/29/95	07:36	0.0C	
06/29/95	07:37	8.3C	
06/29/95	07:38	18.9C	
06/29/95	07:39	18.7C	18.72ppm NOX ALM040839
06/29/95	07:40	18.6C	
06/29/95	07:41	9.9C	
06/29/95	07:42	0.1C	

AVERAGES :		22.4	

Auxiliary Average Report

DCNID : 07 Site Name : DORAL Aux Interval : 1 Date : 6/29/95

NOX CONVERTER CHECK

Time	NOX PPM
07:47	30.0000C
07:48	30.0000C
07:49	30.0000C
07:50	29.9000C
07:51	29.9000C
07:52	29.9000C
07:53	29.9000C
07:54	29.9000C
07:55	29.9000C
07:56	29.9000C
07:57	30.0000C
07:58	30.0000C
07:59	29.9000C
08:00	29.9000C
08:01	29.9000C
08:02	29.9000C
08:03	30.0000C
08:04	29.9000C
08:05	29.9000C
08:06	29.9000C
08:07	29.9000C
08:08	29.8000C
08:09	29.8000C
08:10	29.8000C
08:11	29.7000C
08:12	29.7000C
08:13	29.7000C
08:14	29.7000C
08:15	29.6000C
08:16	29.7000C

MAX :	30.0000
MIN :	29.6000
AVG :	29.8667
SCANS:	30

BIAS CHECK AND RESPONSE CHECK

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BORAL BRICK
HENDERSON TEXAS
ABSORBER STACK
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		NOX PPM	
06/29/95	08:29	0.90	
06/29/95	08:30	0.60	
06/29/95	08:31	0.50	
06/29/95	08:32	0.30	ZERO N_2 BIAS CHECK
06/29/95	08:33	0.20	
06/29/95	08:34	6.00	
06/29/95	08:35	47.60	
06/29/95	08:36	49.20	
06/29/95	08:37	49.50	
06/29/95	08:38	49.70	48.05ppm NOX BIAS CHECK
06/29/95	08:39	49.90	
06/29/95	08:40	50.00	
06/29/95	08:41	50.10	
06/29/95	08:42	14.30	
06/29/95	08:43	0.30	
06/29/95	08:44	0.20	
06/29/95	08:45	0.20	
06/29/95	08:46	0.10	
06/29/95	08:47	0.10	
06/29/95	08:48	10.30	RESPONSE TIME CHECK
06/29/95	08:49	17.60	
06/29/95	08:50	17.20	

AVERAGES :		18.9	

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SORAL BRICK
HENDERSON TEXAS
ABSORBER STACK
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		NOX PPM
06/29/95	14:55	0.30
06/29/95	14:56	0.30
06/29/95	14:57	0.30
06/29/95	14:58	11.50
06/29/95	14:59	47.30
06/29/95	15:00	47.90
06/29/95	15:01	48.20
06/29/95	15:02	48.40
06/29/95	15:03	43.40
06/29/95	15:04	2.20
06/29/95	15:05	0.60
06/29/95	15:06	0.50

AVERAGES :		20.9

ZERO N_2 BIAS CHECK

48.05 ppm NOX BIAS CHECK

Auxiliary Average Report

DCNID : 07 Site Name : BORAL Aux Interval : 1 Date : 6/29/95

RUN #2
PORT B

Time	NOX PPM
15:13	17.1000
15:14	17.1000
15:15	17.0000
15:16	17.1000
15:17	17.2000
15:18	17.2000
15:19	17.3000
15:20	17.5000
15:21	17.5000
15:22	17.7000
15:23	17.7000
15:24	17.5000
15:25	17.5000
15:26	17.5000
15:27	17.4000
15:28	17.3000
15:29	18.3000
15:30	18.4000
15:31	17.0000
15:32	16.7000
15:33	16.5000
15:34	17.0000
15:35	17.3000
15:36	17.4000
15:37	17.3000
15:38	17.3000
15:39	17.5000
15:40	17.0000
15:41	16.6000
15:42	16.4000
MAX :	18.4000
MIN :	16.4000
AVG :	17.2867
SCANS:	30

Auxiliary Average Report

DCN1D : 07 Site Name : BORAL Aux Interval : 1 Date : 6/29/95

RUN #2
POCT A

Time	NOX PPM
15:57	17.8000
15:58	17.4000
15:59	17.3000
16:00	17.3000
16:01	17.3000
16:02	18.3000
16:03	18.4000
16:04	17.4000
16:05	17.2000
16:06	17.4000
16:07	17.6000
16:08	17.8000
16:09	17.7000
16:10	17.5000
16:11	17.5000
16:12	17.6000
16:13	17.4000
16:14	17.1000
16:15	17.0000
16:16	17.1000
16:17	17.4000
16:18	17.4000
16:19	17.4000
16:20	17.3000
16:21	17.5000
16:22	17.5000
16:23	17.7000
16:24	17.7000
16:25	17.5000
16:26	17.6000
16:27	17.8000
MAX :	18.4000
MIN :	17.0000
AVG :	17.5129
SCANS:	31

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		NOX PPM
06/29/95	16:47	11.5
06/29/95	16:48	1.5
06/29/95	16:49	0.5
06/29/95	16:50	0.4
06/29/95	16:51	5.4
06/29/95	16:52	47.3
06/29/95	16:53	48.3
06/29/95	16:54	48.5
06/29/95	16:55	48.7
06/29/95	16:56	24.0
06/29/95	16:57	0.9
06/29/95	16:58	0.7
06/29/95	16:59	0.6

AVERAGES :		18.3

ZERO N_2 BIAS CK.

48.05 ppm NOX BIAS CK.

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BORAL BRICK
HENDERSON TEXAS
ABSORBER STACK
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LEAK CHECK 15" Hg.

		NOX PPM	
06/30/95	07:05	-0.1C	
06/30/95	07:06	-0.1C	S6910171 2ACC
06/30/95	07:07	-0.1C	ZERO Nz ~~BIAS EFFECT~~
06/30/95	07:08	-0.1C	
06/30/95	07:09	17.8C	
06/30/95	07:10	0.1C	
06/30/95	07:11	0.1C	
06/30/95	07:12	37.5C	
06/30/95	07:13	85.2C	
06/30/95	07:14	86.4C	86.1 ppm NOx ALm038783
06/30/95	07:15	86.4C	
06/30/95	07:16	45.4C	
06/30/95	07:17	0.3C	
06/30/95	07:18	14.0C	
06/30/95	07:19	49.7C	48.05 ppm NOX BLm003576
06/30/95	07:20	49.7C	
06/30/95	07:21	27.2C	
06/30/95	07:22	0.2C	
06/30/95	07:23	0.1C	
06/30/95	07:24	11.9C	
06/30/95	07:25	18.8C	
06/30/95	07:26	18.6C	18.72 ppm NOX ALm040839
06/30/95	07:27	18.6C	
06/30/95	07:28	12.7C	
06/30/95	07:29	0.2C	
06/30/95	07:30	0.1C	
06/30/95	07:31	0.1C	

AVERAGES :		21.5	

Auxiliary Average Report

DCN:0 : 07 Site Name : BORAL Aux Interval : 1 Date : 6/30/93

NOX CONVERTER CHECK

Time	NOX PPM
07:34	35.2000C
07:35	35.2000C
07:36	35.2000C
07:37	35.2000C
07:38	35.2000C
07:39	35.2000C
07:40	35.2000C
07:41	35.2000C
07:42	35.2000C
07:43	35.2000C
07:44	35.2000C
07:45	35.2000C
07:46	35.2000C
07:47	35.2000C
07:48	35.2000C
07:49	35.1000C
07:50	35.1000C
07:51	35.1000C
07:52	35.1000C
07:53	35.0000C
07:54	35.0000C
07:55	34.9000C
07:56	34.9000C
07:57	34.9000C
07:58	34.8000C
07:59	34.8000C
08:00	34.8000C
08:01	34.8000C
08:02	34.7000C
08:03	34.8000C
MAX :	35.2000
MIN :	34.7000
AVG :	35.0600
SCANS:	30

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BORAL BRICK
HENDERSON TEXAS
ABSORBER STACK
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		NOX PPM	
06/30/95	08:08	0.40	
06/30/95	08:09	0.30	ZERO N_2 BIAS CHECK
06/30/95	08:10	0.20	
06/30/95	08:11	18.70	
06/30/95	08:12	49.00	
06/30/95	08:13	49.30	
06/30/95	08:14	49.50	48.05 ppm NOx BIAS CK.
06/30/95	08:15	49.70	
06/30/95	08:16	18.20	
06/30/95	08:17	0.40	
06/30/95	08:18	0.70	—
06/30/95	08:19	17.30	RESPONSE CHECK
06/30/95	08:20	18.00	—
06/30/95	08:21	18.30	

AVERAGES :		20.7	

Auxiliary Average Report

UCID : 07 Site Name : BORAL Aux Interval : 1 Date : 6/30/90

RUN #3
PORT A

Time	NOX PPM
08:26	18.0000
08:27	17.9000
08:28	17.9000
08:29	17.6000
08:30	17.4000
08:31	18.3000
08:32	18.4000
08:33	17.7000
08:34	17.2000
08:35	17.4000
08:36	17.5000
08:37	17.7000
08:38	17.8000
08:39	17.8000
08:40	17.7000
08:41	17.8000
08:42	17.6000
08:43	17.3000
08:44	16.9000
08:45	17.0000
08:46	17.2000
08:47	17.7000
08:48	18.0000
08:49	18.0000
08:50	17.7000
08:51	18.0000
08:52	17.8000
08:53	17.7000
08:54	17.5000
08:55	17.4000
MAX :	18.4000
MIN :	16.9000
AVG :	17.6633
SCANS:	30

Auxiliary Average Report

DCMID : 07 Site Name : BORAL Aux Interval : 1 Date : 6/30/93

RUN #3

PORT B

Time	NOX PPM
09:06	18.4000
09:07	17.6000
09:08	17.7000
09:09	17.7000
09:10	18.1000
09:11	18.1000
09:12	17.9000
09:13	18.0000
09:14	17.8000
09:15	17.6000
09:16	17.4000
09:17	17.1000
09:18	17.1000
09:19	17.3000
09:20	17.6000
09:21	17.8000
09:22	17.6000
09:23	17.9000
09:24	17.9000
09:25	17.7000
09:26	17.8000
09:27	17.7000
09:28	17.6000
09:29	17.7000
09:30	17.9000
09:31	17.8000
09:32	17.7000
09:33	17.7000
09:34	17.8000
09:35	17.3000
MAX :	18.4000
MIN :	17.1000
AVG :	17.7100
SCANS:	30

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BORAL BRICK
HENDERSON TEXAS
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		NOX PPM	
06/30/95	09:44	0.40	
06/30/95	09:45	0.20	ZERO N_2 BIAS CHECK
06/30/95	09:46	0.20	
06/30/95	09:47	6.00	
06/30/95	09:48	47.30	
06/30/95	09:49	48.40	
06/30/95	09:50	48.70	
06/30/95	09:51	48.80	48.05 ppm NOX BIAS CHECK
06/30/95	09:52	49.30	
06/30/95	09:53	19.30	
06/30/95	09:54	0.50	
06/30/95	09:55	0.30	
06/30/95	09:56	0.30	
06/30/95	09:57	0.20	
06/30/95	09:58	0.20	

AVERAGES :		18.0	

APPENDIX G

Visible Emissions Data

VISIBLE EMISSIONS OBSERVATION FORM

Source Name ZOREL BRICK Observation Date 6/29/95 Start Time 1820 Stop Time 1920

Address 1309 KILGORE DR. Phone 903-657-3505 Source ID Number EPN-K

Process Equipment ABSORBER STK. Operating Mode 100%

City HENDERSON State TX Zip Code 75652 Control Equipment DRY SCRUBBER Operating Mode 180 SEC.

	0	15	30	45		0	15	30	45
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	5	0	0	0	33	5	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	5	0	0	0	36	10	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	10	0	0	0	39	5	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	5	0	0	0	42	5	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	5	0	0	0	45	5	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	5	0	0	0	48	5	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	5	0	0	0	51	5	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	5	0	0	0	54	5	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	5	0	0	0	57	5	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0
30	5	0	0	0	60	5	0	0	0

Describe Emission Point STK

Height Above Ground Level 100'

Distance from Observer 200' Direction from Observer N

Describe Emissions FAN

Emission Color WHITE

Plume Type: ___ Continuous ___ Fugitive ✓ Intermittent

Water Droplets Present: ✗ No ___ Yes

If Water Droplet Plume: ___ Attached ___ Detached

Point in the Plume at which Opacity was determined 2'

Describe the Background GRAY SKY

Background Color GRAY Sky Conditions OVERCAST

Wind Speed 5-10 Wind Direction N

Ambient Temperature 85

Average Opacity for Highest Period _____

Number of Readings Above _____ % Were _____

Range of Opacity Readings: 0 Minimum 10 Maximum

Observers Name (Print) GORDON SMITH

Observers Signature [signature] Date 6/29/95

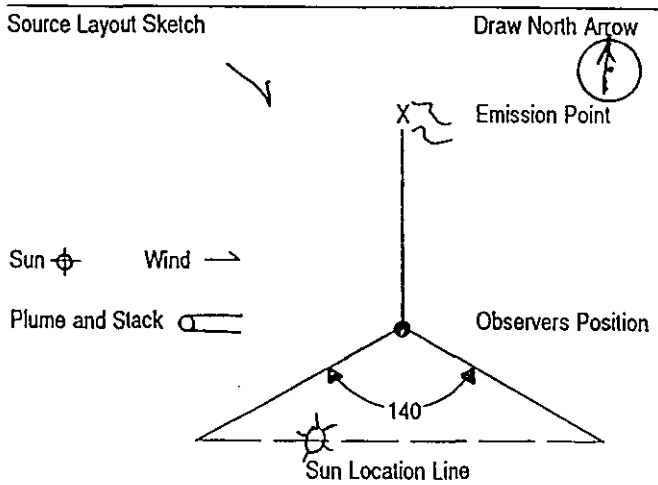
Organization METCO ENVIRONMENTAL

Certified By TNRCC Date 8/95

Verified By _____ Date _____

Source Layout Sketch

Draw North Arrow



Comments: OPACITY OCCURS WHEN UNIT CHANGES OVER (OPACITY 10 SEC. DURATIO.

I have received a copy of these opacity observations

Signature _____

Title _____ Date _____

AVG - 0.5

VISIBLE EMISSIONS OBSERVATION FORM

Source Name BORAL BRICK Observation Date 6/30/95 Start Time 0838 Stop Time 0938

Address 1309 KILGORE DR. Phone 2 903 6573505 Source ID Number EPN K

Process Equipment ABSORBER STK. Operating Mode FULL CAP. 100%

City HENDERSON State TX. Zip Code 75652 Control Equipment DRY SCRUBBER Operating Mode 180 SEC.

	0	15	30	45		0	15	30	45
1	5	0	0	0	31	5	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	5	0	0	0	34	10	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	5	0	0	0	37	5	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	10	0	0	0	40	5	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	5	0	0	0	43	5	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	5	0	0	0	46	5	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	5	0	0	0	49	5	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	5	0	0	0	52	5	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	5	0	0	0	55	5	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	5	0	0	0	58	20	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

Describe Emission Point STACK

Height Above Ground Level 100'

Distance from Observer 200' Direction from Observer N

Describe Emissions FAN

Emission Color WHITE

Plume Type: ___ Continuous ___ Fugitive X Intermittent

Water Droplets Present: X No ___ Yes

If Water Droplet Plume: ___ Attached ___ Detached

Point in the Plume at which Opacity was determined 2'

Describe the Background SKY

Background Color BLUE Sky Conditions CLEAR

Wind Speed 5 Wind Direction NORTH

Ambient Temperature 80

Average Opacity for Highest Period _____

Number of Readings Above _____ % Were _____

Range of Opacity Readings: 0 Minimum 20 Maximum

Observers Name (Print) GORDON SMITH

Observers Signature [signature] Date 6/30/95

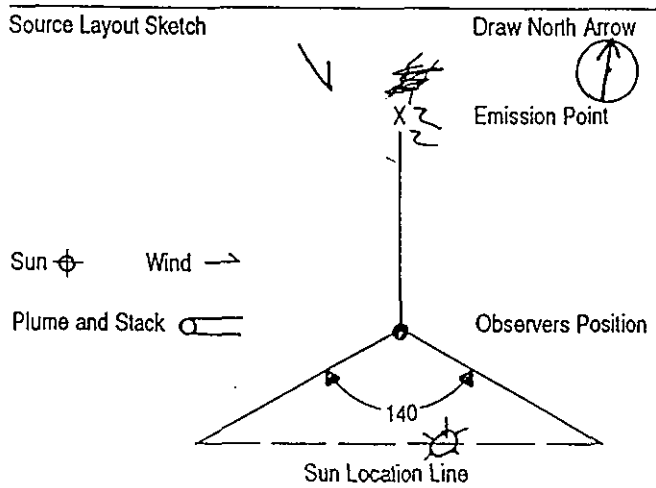
Organization METRO ENVIRONMENTAL

Certified By TNRCC Date 3/95

Verified By _____ Date _____

Source Layout Sketch

Draw North Arrow



Comments: OPACITY OCCURS WHEN UNIT CHANGES OVER (OPACITY 10 SEC. DURATION)

I have received a copy of these opacity observations

Signature _____

Title _____ Date _____

Avg - 0.5

VISIBLE EMISSIONS OBSERVATION FORM

Source Name BORAL BRICK Observation Date 6/30/95 Start Time 1120 Stop Time 1220

Address 1309 KILGORE DR. Phone 9036573505 Source ID Number EPN-K

Process Equipment ABSORBER STA Operating Mode 100%

City HENDERSON State TX. Zip Code 75652 Control Equipment DRY SCRUBBER Operating Mode 180 SEC.

	0	15	30	45		0	15	30	45
1	5	0	0	0	31	5	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	5	0	0	0	34	5	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	5	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	5	0	0	0	40	10	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	5	0	0	0	43	5	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	10	0	0	0	46	5	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	5	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	5	0	0	0	52	5	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	5	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	5	0	0	0	58	10	0	0	0
29	0	0	0	0	59	0	0	0	0
30	0	0	0	0	60	0	0	0	0

Avg - 0.4

Describe Emission Point STACK

Height Above Ground Level 100'

Distance from Observer 200' Direction from Observer N

Describe Emissions FAN

Emission Color WHITE

Plume Type: ___ Continuous ___ Fugitive X Intermittent

Water Droplets Present: X No ___ Yes

If Water Droplet Plume: ___ Attached ___ Detached

Point in the Plume at which Opacity was determined 2'

Describe the Background SKY

Background Color BLUE Sky Conditions CLEAR SCATT

Wind Speed 5 Wind Direction N

Ambient Temperature 85

Average Opacity for Highest Period ___

Number of Readings Above ___ % Were ___

Range of Opacity Readings: 0 Minimum 10 Maximum

Observers Name (Print) GORDON G. SMITH

Observers Signature [signature] Date ___

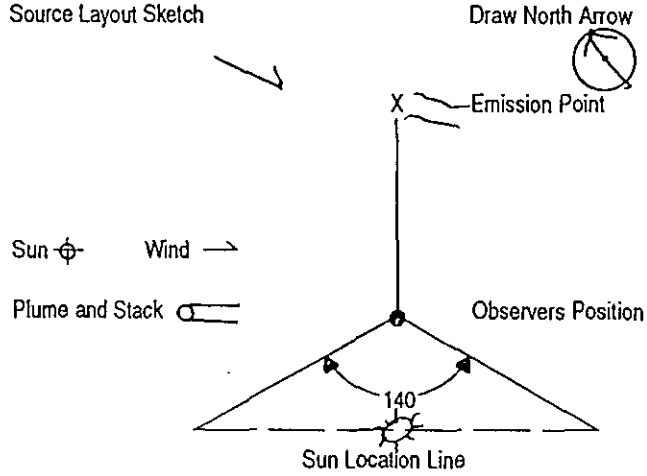
Organization METCO ENVIRONMENTAL

Certified By TNRCC Date 3/95

Verified By ___ Date ___

Source Layout Sketch

Draw North Arrow



Comments: OPACITY OCCURS WHEN UNIT CHANGES OVER (10 SEC. DURATION

I have received a copy of these opacity observations

Signature ___

Title ___ Date ___

APPENDIX H

Plant Operational Data

BORAL BRICKS

Henderson Division
P.O. Box 2110 • Henderson, Texas 75653-2110
Telephone 903/657-3505 FAX 903/657-7139

RECEIVED
JUL 12 1995
By_____

July 3, 1995

Mr. Rob Patterson
METCO Environmental
P. O. Box 598
Addison, TX 75001

Dear Mr. Patterson:

On Thursday and Friday June 29th and 30th, 1995, your firm performed Source Emission Testing on the Adsorber Stack (EPN-K) at the Henderson Plant to demonstrate compliance with Texas Natural Resource Conservation Commission Permit No. 21012 requirements.

The following operating parameters were recorded during this Source Emission Testing and are submitted to METCO for reporting operating data on your report.

Kiln #1 and #2 Throughput: 499.1 Tons/Day Of Fired Ware

Kiln #1 and #2 Fuel Input: 1,266 MCF/Day Natural Gas

Kiln #1 Stack Temperature: 485° F

Kiln #2 Stack Temperature: 550° F

Boral Bricks and I thank you for your cooperation in this matter, and if you have any questions or need more information, please contact me at (903) 657-3505.

Thank You!

Sincerely,

J. Wisenhour, Jr.
Manufacturing Manager
Boral Bricks, Inc.

APPENDIX I

TACB Permit

TEXAS AIR CONTROL BOARD

A PERMIT IS HEREBY ISSUED TO

BORAL BRICKS, INC. - HENDERSON BRICK DIVISION

AUTHORIZING THE CONSTRUCTION AND OPERATION OF

Henderson Brick - Plant No. 1

TO BE LOCATED AT

Henderson, Rusk County, Texas
Lat. 32°10'51" Long. 94°48'12"

and which is to be constructed and operated in accordance with and subject to the Texas Clean Air Act (Texas Health and Safety Code, Chapter 382) and all Rules, Regulations and Orders of the Texas Air Control Board. Said permit is subject to any additional or amended Rules, Regulations and Orders of the Board adopted pursuant to the Act and to all of the following conditions:

1. This permit may not be transferred, assigned or conveyed by the holder, and applies only to the location specified herein.

2. This permit is automatically void upon the occurrence of any of the following:
   a. Failure to begin construction within eighteen months of the date of issuance.
   b. Discontinuance of construction prior to completion for a period of eighteen consecutive months or more.
   c. Failure to complete construction within a reasonable time.

3. The facilities covered by this permit shall be constructed and operated as specified in the application for the permit.

4. All representations regarding construction plans and operation procedures contained in the permit application, unless specifically changed in the application for this permit, become conditions upon which this permit is issued. It shall be unlawful for any person to vary from such representation if the change will cause a change in the method of control of emissions, the character of the emissions or will result in an increase in the discharge of the various emissions, unless he first makes application to the Executive Director to amend this permit in that regard and such amendment is approved.

5. The Board shall be notified prior to the start-up of the facilities authorized by this permit in such a manner that a representative of the Texas Air Control Board may be present at the time of start-up.

6. The Board shall be notified prior to the start of any required sampling and/or monitoring of the facilities authorized by this permit in such a manner that a representative of the Texas Air Control Board may be present during the required sampling and/or monitoring. Upon request by the Executive Director, the holder of this permit shall make sufficient stack sampling analyses, or other tests, to prove satisfactory equipment performance. All sampling and testing procedures shall be approved by the Executive Director and coordinated with the regional representatives of the Texas Air Control Board.

7. This permit does not absolve the holder from the responsibility for the consequences of noncompliance with all Rules, Regulations and Orders of the Texas Air Control Board or with the requirements of the Texas Clean Air Act.

8. The facilities covered by this permit shall not be operated unless all associated air pollution abatement equipment is maintained in good working order and operating properly during normal facility operations.

9. Emissions from this facility must not cause or contribute to a condition of 'air pollution' as defined in Section 382.003(3) of the Texas Clean Air Act or violate Section 382.085 of the Texas Clean Air Act. If the Executive Director determines that such a condition or violation occurs, the holder shall implement additional abatement measures as necessary to control or prevent the condition or violation.

10. Provisions: See attachments labeled "General Provisions 21012," 1-6, and "Special Provisions 21012," 1-9.

Acceptance of the permit constitutes an acknowledgement and agreement that the holder will comply with all Rules, Regulations and Orders of the Board issued in conformity with the Act and the conditions precedent to the granting of this permit. Failure to comply with all conditions and special provisions of this permit will subject the holder to the enforcement provisions of the Texas Clean Air Act.

This permit expires 5 years from date of issuance unless renewed as defined in Section 382.055 of the Texas Clean Air Act.

PERMIT NO. 21012 DATE 5/7/93

William R Campbell

EXECUTIVE DIRECTOR, TEXAS AIR CONTROL BOARD

GENERAL PROVISIONS

Permit No. 21012

1. Equivalency of Methods - It shall be the responsibility of the holder of this permit to demonstrate or otherwise justify the equivalency of emission control methods, sampling or other emission testing methods and monitoring methods proposed as alternatives to methods indicated in the provisions of this permit. Alternative methods shall be applied for in writing and shall be reviewed and approved by the Executive Director prior to their use in fulfilling any requirements of this permit.

2. Sampling Requirements - If sampling of stacks or process vents is required, the holder of this permit must contact the Source and Mobile Monitoring Division of the Texas Air Control Board (TACB) prior to sampling to obtain the proper data forms and procedures. The holder of this permit is also responsible for providing sampling facilities and conducting the sampling operations at his own expense.

3. Appeal - This permit may be appealed pursuant to Rule 103.81 of the Procedural Rules of the TACB and Section 382.032 of the Texas Clean Air Act. Failure to take such appeal constitutes acceptance by the applicant of all terms of the permit.

4. Construction Progress - Start of construction, construction interruptions exceeding 45 days and completion of construction shall be reported to the appropriate regional office of the TACB not later than 10 working days after occurrence of the event.

5. Recordkeeping - Information and data concerning production, operating hours, sampling and monitoring data, if applicable, fuel type and fuel sulfur content, if applicable, shall be maintained in a file at the plant site and made available at the request of personnel from the TACB or any local air pollution control program having jurisdiction. The file shall be retained for at least two years following the date that the information or data is obtained.

6. Maintenance of Emission Control - The facilities covered by this permit shall not be operated unless all air pollution emission capture equipment and abatement equipment are maintained in good working order and operating properly during normal facility operations.

SPECIAL PROVISIONS

Permit No. 21012

EMISSION STANDARDS AND FUEL SPECIFICATIONS

1. This permit covers only those sources of emissions listed in the attached table entitled "Emission Sources - Maximum Allowable Emission Rates", and those sources are limited to the emission limits and other conditions specified in that attached table. Annual emissions are calculated for a consecutive 12-month period.

2. Fuels used in both kilns shall be limited to natural gas (NG). The NG shall contain no more than 0.25 grains of hydrogen sulfide and 5 grains of total sulfur per 100 dry standard cubic feet. Use of any other fuel shall require an amendment to the permit.

3. Opacity of emissions from Emission Point No. (EPN)-K shall not exceed 5 percent, averaged over a 6-minute period, except for those periods described in Rule 111.111(a)(1)(E) of Texas Air Control Board (TACB) Regulation I.

INITIAL DETERMINATION OF COMPLIANCE

4. The holder of this permit shall perform stack sampling and other testing as required to establish the actual pattern and quantities of air contaminants being emitted into the atmosphere from EPN-K. The testing required by this special provision shall be used to determine initial compliance with the pound-per-hour limits of the maximum allowable emission rates table. Initial compliance with the permit opacity limit shall be demonstrated on the basis of 30 six-minute averages. Sampling must be conducted in accordance with appropriate procedures of the TACB Sampling Procedures Manual and in accordance with Environmental Protection Agency (EPA) Reference Method 9 for opacity, Reference Method 10 for carbon monoxide (CO), Reference Method 7E for nitrogen oxides (NO_x), and Reference Method 3 for oxygen (O_2) or equivalent methods. The holder of this permit is responsible for providing the sampling and testing facilities, conducting the sampling and testing operation and all associated expenses.

   A. The TACB regional office with jurisdiction shall be notified as soon as testing is scheduled, but not less than 45 days prior to sampling to arrange a pretest meeting. The notice shall include:

6. Operational logs shall be kept for each piece of equipment listed in the Permit Table 1(a). These logs shall report the daily and year-to-date hours of operation and finished product production rates. Any abatement equipment downtime shall be recorded on the operational logs and referenced to the equipment it serves. Operational logs shall be kept on-site for a period of two years and made available upon request to any representative of the TACB or EPA with jurisdiction.

7. Upon request by the TACB, the holder of this permit, at its own expense, shall make sufficient stack sampling analyses, or other tests, to prove compliance with this permit. All sampling and testing procedures shall be approved by the TACB and coordinated with the regional representatives of the TACB.

8. Upon request by the TACB, the holder of this permit, at its own expense, shall perform air dispersion modeling analyses as directed by the TACB to prove compliance with this permit.

ADDITIONAL PROVISIONS

9. The holder of this permit shall physically identify and mark in a conspicuous location all equipment that has the potential of emitting air contaminants as follows:

   A. The facility identification number as submitted to the Emissions Inventory Section of the TACB.

   B. The EPN as listed on the maximum allowable emission rates table.

EMISSION SOURCES - MAXIMUM ALLOWABLE EMISSION RATES

Permit No. 21012

This table lists the maximum allowable emission rates and all sources of air contaminants on the applicant's property covered by this permit. The emission rates shown are those derived from information submitted as part of the application for permit and are the maximum rates allowed for these facilities. Any proposed increase in emission rates may require an application for a modification of the facilities covered by this permit.

AIR CONTAMINANTS DATA

Emission Point No. (1)	Source Name (2)	Air Contaminant Name (3)	Emission Rates* lb/hr	TPY
K	Adsorber for both Tunnel Kiln Stacks	VOC	0.2	0.9
		NOx	4.0	17.6
		SO2	21.2	93.3
		PM	10.2	44.8
		CO	1.3	5.8
		HF	0.9	3.9

(1) Emission point identification - either specific equipment designation or emission point number from plot plan.

(2) Specific point source name. For fugitive sources use area name or fugitive source name.

(3) VOC - volatile organic compounds as defined in General Rule 101.1
NOx - total oxides of nitrogen
SO2 - sulfur dioxide
CO - carbon monoxide
HF - hydrogen fluoride
PM - particulate matter (all forms)

* Emission rates are based on and the facilities are limited by the following maximum operating schedule; are based upon simultaneous operation of both kilns:

Hrs/day 24 Days/week 7 Weeks/year 52 or Hrs/year 8,760

APPENDIX J

Chain of Custody

METCO ENVIRONMENTAL

Chain of Custody

JOB# 95-134

Client BORAL BRICK

Location HENDERSON, TX.

Unit ABSORBER STK.

Date 6/29/95 / 6/30/95

Method 13B

Project Mgr. G. SMITH

	No. of Containers	Absorb. Solution	Init. Vol.	Part.	SO2	SO3	Other Analyses
Filter Cont	111			✓			HF
Front Wash	111	HPLC DI RINSE		✓			HF
Back Wash	111	HPLC DI RINSE		✓			HF
Impinger 1		HPLC DI	100ml.				
Impinger 2	111	HPLC DI	100ml.	✓			HF
Impinger 3		DRY					
ACETONE F.W. ~~Impinger 4~~	111			✓			
~~Impinger 5~~							
Blank 1	1	HPLC DI					
Blank 2	1	ACE.					
~~NOx~~ FILTER BLANK	1						
Other							

Special Instruction

Sample# 1 Recov. by [signature] Date 6/29 Time 1500 Location VAN

Sample# 2 Recov. by [signature] Date 6/29 Time 2000 Location VAN

Sample# 3 Recov. by [signature] Date 6/30 Time 1430 Location VAN

Sample# Recov. by Date Time Location

Samples Rcvd. by [signature] For transport. Date 6/30/95 Time 1500

Sample Rcvd. at lab by [signature] Date 7/5/95 Time 0800

Sample Analyzed by [signature] / [signature] (HF) Date 7/6/95 / 7/19/95 Time 1100 / 1900

Data Checked by [signature] Date 7/10/95 / 7/20/95 Time 1400 / 1900

METCO ENVIRONMENTAL

Chain of Custody

JOB# 95-134

Date 6/29/95

Client BORAL BRICK

Method 6

Location HENDERSON, TX.

Project Mgr. G. Smith

Unit ABSORBER STACK

	No. of Containers	Absorb. Solution	Init. Vol.	Part.	SO2	SO3	Other Analyses
Filter Cont							
Front Wash							
Back Wash							
Impinger 1	111	80% IPA ~~H_2O~~	200			✓	
Impinger 2	111	6% H_2O_2	200		✓		
Impinger 3	111	6% H_2O_2	200		✓		
Impinger 4							
Impinger 5							
Blank 1	1	80% IPA					
Blank 2	1	6% H_2O_2					
~~NOx~~ BLANK 3	1	D.I.					
Other							

Special Instruction

Sample# 1 Recov. by [signature] Date 6/29 Time 1300 Location VAN

Sample# 2 Recov. by Tim Starr Date 6/29 Time 1840 Location VAN

Sample# 3 Recov. by [signature] Date 6/30 Time 1430 Location VAN

Sample# Recov. by Date Time Location

Samples Rcvd. by [signature] For transport. Date 6/30 Time 1500

Sample Rcvd. at lab by Mary Hunter Date 7/5/95 Time 0800

Sample Analyzed by Mary Hunter Date 7/10/95 Time 1700

Data Checked by HT Date 7/11/95 Time 0900

APPENDIX K

Resumes of Test Personnel

BILLY J. MULLINS, JR., President

Education	Post Graduate Study Environmental Engineering at Southern Methodist University, Dallas, Texas 1970. M.S. 1969, New York University, New York, New York, in Civil Engineering (Air Resources). B.S. 1968, Texas Tech University, Lubbock, Texas, in Civil Engineering (Water Resources). Studies in Engineering at U.S. Naval Academy, Annapolis, Maryland, 1963-1964.
Professional Training Courses	Attended Short Course on Air Pollution Engineering at the University of Texas at Austin, February 1970. Attended four-week management course presented by the American Management Association, 1976.
Certification	Registered Professional Engineer Certified Visible Emissions Evaluator Certified Fallout Shelter Analyst Licensed Private Pilot (Multi-Engine-Land, Instrument) Diplomat in the American Academy of Environmental Engineers Inductee into the Stack Sampling Hall of Fame
Professional Memberships	Air & Waste Management Association - Past Chairman, Past Vice Chairman and Past Board of Directors Southwest Section: Past Chairman, Consultants Committee; Past Chairman, Source Measurement Committee Source Evaluation Society - Past President, Past Board of Directors American Management Association

MULLINS

Publications

Co-authored "Sulfur Compound Emissions of the Petroleum Production Industry," December 1974.

Co-authored "Field Procedure for Stabilizing Hydrogen Sulfide Samples to be Analyzed Using Modified Methylene Blue Technique," presented at the Conference on Ambient Air Quality Measurements, Austin, Texas, March 1975.

Co-authored "Atmospheric Emissions Survey of the Sour Gas Industry," October 1975.

Co-authored "Technique for Insuring the Validity of Samples for High Concentrations of Sulfur Dioxide Using the EPA Method 5 Sampling Train," presented at the Third National Conference on Energy and the Environment, College Corner, Ohio, September 1975.

Teaching Experience

Served as a lecturer in the Environmental Protection Agency's training course number 450, "Source Sampling for Particulate Pollutants," for two years from January 1974 to October 1975 and in March, 1992.

Conducted a two-day training course entitled "Technical Assistance in Source Sampling" at Iowa State University, Ames, Iowa, for the Environmental Protection Agency, October 1974.

Conducted EPA's training course number 450, "Source Sampling for Particulate Pollutants," for the EPA at Research Triangle Park, North Carolina, September 1975.

MULLINS

Teaching Experience	Conducted a two-day short course entitled "Performing and Observing Source Sampling" at Dallas, Texas, July 1976, May 1977, October 1977, November 1987 and November 1988; at Lake Charles, Louisiana, May 1977; at Casper, Wyoming, May 1977; and at Point Comfort, Texas, November 1992. Served as a lecturer in the Environmental Protection Agency's two-day seminar entitled "Asphalt Industry Environmental Solutions," presented in Dallas, Texas, on March 21 and 22, 1979. Conducted a two-day short course entitled "Performing and Observing Source Sampling" in Phoenix, Arizona in August, 1990 for the State of Arizona, Department of Environmental Quality; in Lincoln, Nebraska, in March 1980 for the State of Nebraska, Air Quality Control Division.
Technical Experience	Directed and performed stack sampling on over 2000 sources of which over 500 were sampled simultaneously using more than one sampling train at several points in the flue gas stream. 1972-present. Directed and performed over 200 short-term ambient air studies using mobile sampling vans and various ambient air sampling equipment. 1972-present. Designed, directed and operated over 20 permanent ambient air networks of various size and duration for a variety of parameters. 1972-present. Designed surface and underground drainage systems for residential subdivisions, public works projects, and shopping centers. 1969-1972. Designed several residential subdivisions including lot layout, street design, drainage design, and utility design. 1969-1972.

MULLINS

Research Projects	Supervised and conducted a study made by the Hawaiian Sugar Planters' Association to characterize the emissions for several bagasse-fired boilers. April-May 1976.
	Supervised and conducted a study made by the Rio Grande Valley Sugar Growers, Inc. to determine the area affected by the burning of sugarcane fields prior to harvesting. November 1974-April 1975.
	Supervised and conducted a study by a lightweight aggregate manufacturer to develop a material balance around the process through sampling and analysis of several parameters. November 1973.
	Conducted a study in New York City to attempt to develop a correlation in the ambient air between carbon dioxide and sulfur dioxide to provide a tool for predicting air pollution episodes. January-May 1969.
Related Projects	Served as Chairman of the Engineering Foundation Conference on Stack Sampling and Source Evaluation in Santa Barbara, California, 1985.
	Served as Session Chairman at the Engineering Foundation Conference on Stack Sampling and Source Evaluation in Hershey, Pennsylvania, 1984; in San Diego, California, 1993; and in Palm Coast, Florida, 1994.

GORDON G. SMITH, Project Supervisor I

Education	B.S. 1988, University of Massachusetts, Amherst, Massachusetts, in Environmental Design. A.S. 1986, Stockbridge School of Agriculture, Amherst, Massachusetts, in Landscape Operations.
Professional Training Courses	Attended 40-hour Occupational and Environmental Training Program on Hazardous Materials (CFR 1910.120) Dallas, Texas, April 1992.
Technical Experience	Participated in the sampling of over 150 sources, including several of which were sampled simultaneously using more than one sampling train. Thoroughly trained in all EPA testing procedures. 1992-present.

TIM STARTZ, Project Supervisor

Education	B.B.A. 1991, University of Texas at Arlington, Arlington, Texas, in Management with a minor in Accounting.
Professional Training Courses	Attended 40-hour Occupational and Environmental Training Program on Hazardous Materials (CFR 1910.120) Dallas, Texas, April 1992. Also attended an 8-hour refresher course, February 1995.
Technical Experience	Participated in the sampling of over 300 sources, including several of which were sampled simultaneously using more than one sampling train. Thoroughly trained in all EPA testing procedures. 1992-present.

Experienced in the analysis of commercial calibration gas cylinders for CO_2, O_2, NO_x, SO_2, and CO.

Experienced with the Modified Method 5 Sampling Train (Method 0010).

Experienced with the Chrome 6 Sampling Train.

Experienced with the PM_{10} Sampling Train.

Experienced with various multiple metals and acid gas sampling trains.

Experienced with the VOST sampling procedure (Method 0030).

Experienced with calibration techniques for all field testing equipment.

Has performed on-site SO_2 analysis.

Has performed on-site H_2S analysis.

STARTZ

Thoroughly trained in the operation and routine maintenance of the following:

Thermo Environmental Model 10AR and 10S Oxides of Nitrogen Analyzers
Teledyne Model 326 Oxygen Analyzer
Ratfisch Model RS-55 Total Hydrocarbon Analyzer
Horiba Model PIR 2000 Carbon Dioxide Analyzer
J.U.M. Model VE-7 Total Hydrocarbon Analyzer
Western Research 721M Sulfur Dioxide Analyzer
Thermo Environmental Model 48 Carbon Monoxide Analyzer
Anarad 880 Oxides of Nitrogen Analyzer
Anarad 23 Oxygen Analyzer
Anarad 30 Sulfur Dioxide Analyzer
Anarad 50C Carbon Dioxide Analyzer

DALE GREENFEATHER, Environmental Technician I

Education — B.S. 1994, Wichita State University, Wichita, Kansas, in Geology.

Technical Experience — Participated in the sampling of over 25 sources, including several of which were sampled simultaneously using more than one sampling train. Thoroughly trained in all EPA testing procedures. 1994-present.