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.

Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 49

Title: Source Test of Intermetro Industries, 9393 Arrow Highway, Cucamonga, CA

Truesdail Laboratories, Inc.

April 1988

ELECTROPLATING
REF. 4-49

TRUESDAIL LABORATORIES, INC.
Source Test of Intermetro Industries
9393 Arrow Highway
Cucamonga, California 91730

UNACCEPTABLE

Page 1 of the report describes cyclonic flow that was found at the outlet. The page also mentions that sampling was done at the angle of maximum velocity head which was 45 degrees. When testing for cyclonic flow, the angle of maximum delta p is not the angle of flow. The angle of flow is 90 degrees from the null reading on the pitot tube which is not the same as the angle of maximum delta p. When cyclonic flow is present, the sampling time per point must also be adjusted based on the angle. If all the angles are the same, the time adjustment is not necessary, however, in this case, it is not possible to know what the true angles were.

EMBEE PLATING TEST
2136 South Hathaway
Santa Ana, California 92705

UNACCEPTABLE

This report should not be used. First, there are not enough data sheets and related forms/sheets to tell how precisely the test was performed. On System 1, the moisture content was given at 3.7 percent. Saturation moisture content at 70 degrees F is 2.47 percent Emission data based on 3.7 percent are incorrect. The text also mentions that a piece of 3/8 inch Teflon tubing was used to collect the sample. There is no mention of a nozzle so it must be assumed that the tubing is also the nozzle. To sample isokinetically, the sample size should have been around 90 cubic feet an hour. The sample volume was about half that so the sampling was not within the acceptable isokinetic limits. For System 2, the runs are not within the isokinetic limits that the Agency requires.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

122 [illegible]

MEMORANDUM

SUBJECT: Acceptability of Test Reports for Use as a Data Base for Chromium NESHAP

FROM: Frank R. Clay FRC
Field Testing Section, EMB, TSD (MD-14)

TO: Andrew Smith
Industrial Studies Branch, ESD (MD-13)

I have reviewed the test reports that are attached. Some of the reports are acceptable while others are not. The reports are listed below, and unacceptable reports are described in detail as to why they should not be used. I will continue to review the other reports that you have given to me and will send another group of reports as soon as the review has been completed.

TRUESDAIL LABORATORIES, INC.
Test of Dames and Moore
222 E. Annapamu
Santa Barbara, California 93101

UNACCEPTABLE

In reviewing the data, the outlet location gives the moisture content at the outlet as 2.50 percent. At 66°F, saturation moisture content at the absolute stack pressure and this temperature is 2.16 percent.

There are no meter box calibration sheets present, and consequently, no meter box correction factor.

There are no delta p values on the field data sheets to determine the point velocities during sampling.

The nozzles do not appear to have been measured with a micrometer.

CHEVROLET LIVONIA BUMPER PLANT
No. 4 Heil Evaporator
Tested by the Chevrolet Central Office of Environmental Engineering Department
Tested September 24, 1979

UNACCEPTABLE

This report is unacceptable for the following reasons: First, the necessary field data sheets to determine the correctness of the values in the report are not available. Second, all points at the inlet were not sampled (see further comments). Third, this test effort was made to gather data to correct emission problems, not to sample the control device in normal operating conditions. Fourth, there appears to be a large discrepancy between the volumetric flow rates found by the EMB test and this test.

This facility has been tested by EMB, but only at the inlet location. EMB testing performed in the normal production mode. The test done by the Chevrolet environmental group was done in an effort to maximize collection efficiency, and two parameters of the evaporator operation were monitored and/or altered to simulate conditions which could exist within the system, possibly causing an upset in the collection efficiency of the unit. Thus data generated on this test may not be typical of normal operating conditions.

The Chevrolet test sampled the inlet location at only two ports and chose sampling points of average velocity. While the points may be of average velocity, it does not necessarily follow that the distribution of chromium in the duct is uniform. Furthermore, the outlet volumetric flow rate was also used to determine emissions at the inlet. If leakage occurs between the inlet and outlet, the mass emission rates at the inlet will be biased high and the control device efficiency will also be biased high. When comparing the inlet volumetric flow rates, the EMB flows are about 28 percent lower than company flows.

In checking the outlet data, there are no field data sheets or other associated data sheets that were generated at the site; only typewritten data are provided. It appears that the calculations were done based on 70 degrees as standard temperature rather than 68.

It appears that the outlet data might be usable if the data sheets from the test could be provided. One item to consider, however, is whether or not this test represents process conditions that could be used in determining chromium emission standards.

SOURCE EMISSION TESTING AND INDUSTRIAL VENTILATION SURVEY
OF BUILDING 210 PLATING SHOP
Long Beach Naval Shipyard
Long Beach, California
7 May - 2 June 1984

ACCEPTABLE

SOURCE EMISSION TESTING OF THE BUILDING 195 PLATING SHOP
Norfolk Naval Shipyard
Portsmouth, Virginia
11-18 March 1985

ACCEPTABLE

F. Clay

REPORT COPY

APR 11 1988

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT: **Intermetro Industries**
9393 Arrow Highway
Cucamonga, CA 91730
Attention: Duane Ostrum
Telephone: (714) 982-4731

DATE: April 5, 1988

RECEIVED: Feb. 24, 1988

LABORATORY NO.: 25830

SAMPLE: Source tests for chromium on scrubber
P.O.#: 22926

INVESTIGATION: Total and hexavalent chromium

RESULTS

On February 24, 1988 representatives of Truesdail Laboratories, Inc. conducted source tests on the inlet and outlet of a scrubber for total and hexavalent chromium at the Intermetro Industries facility in Cucamonga, California.

A six hour isokinetic sample was collected at each sampling location by the wet impingement method (SCAQMD method 5.1). The sampling train consisted of a glass probe connected with Teflon tubing to a set of Greenburg-Smith impingers charged with 200 mls of 0.1N NaOH and followed by a Teflon filter on a glass fiber backing filter, vacuum pump, and a dry gas meter.

The flue gas flow rate was determined at both sampling locations by measuring the average velocity head with a Standard Pitot tube connected to a Magnehelic differential pressure gage, and by measuring the average temperature with a chromel-alumel thermocouple connected to a Micromite potentiometer. SCAQMD methods 1.1 and 2.1 were employed to determine the matrix of traverse points and sampling rates.

The scrubber outlet flow rate was determined to be cyclonic and the angle of maximum velocity head was measured at 45° for each traverse point. The isokinetic sampling rates were calculated from the actual velocity head and sampling was conducted at 45° for each traverse point. The emissions rates however were calculated from the corrected flow rate (i.e. The flow rate perpendicular to the duct cross sectional area which was determined from the cosine of the flow angle.

This report applies only to the sample, or samples, investigated and is not necessarily indicative of the quality or condition of apparently identical or similar products. As a mutual protection to clients, the public and these Laboratories, this report is submitted and accepted for the exclusive use of the client to whom it is addressed and upon the condition that it is not to be used, in whole or in part, in any advertising or publicity matter without prior written authorization from these Laboratories.

COPY

Sampling trains were prepared by soaking all impingers for 12 hours in 50% nitric acid, then rinsing three times with distilled water and charging with 100 mls of 0.1N NaOH. All probes and Teflon tubing were rinsed on site with 50% nitric acid and washed three times with distilled water. Samples were recovered by measuring condensate gain and rinsing the probe, Teflon tubing, and impingers twice with 0.1N NaOH and once with 0.1N nitric acid.

The total chrome was determined by atomic absorption with a graphite furnace and the hexavalent chrome by the diphenylcarbazide colormetric method. The analyses included calibration curves, spike recovery, and a blank sampling train.

The results were as follows:

TRUESDAIL LABORATORIES, INC.

APR 11 1988

INTERMETRO INDUSTRIES
2-24-88

COPY

Flue Gas:	Scrubber Inlet	Scrubber Outlet
Temperature, °F	72	65
Velocity, ft./sec	36.4	43.1*
Static Pressure, in H_2O	-2.4	-2.3
Duct Diameter, in.	22	22
Duct Area, Sq. Ft.	2.64	2.64
Gas Volume: ACFM	5,780	6,820.*
SCFM	5,380	6,430.*
DSCFM	5,300	6,290.*
Moisture, % by Vol.	1.6	2.2
Chromium:		
Sampling Time	10:30 - 16:40	10:25 - 16:34
Sample Volume, DSCF	229.72	208.33
Concentration, PPB		
Total Cr	503.	1.0
Cr^{+6}	431.	<0.3
Concentration, mg/m^3		
Total Cr	1.1	0.0023
Cr^{+6}	0.95	<0.0006
Emission Rate, lbs/hr		
Total Cr	0.022	0.00005
Cr^{+6}	0.019	<0.00002
Removal Efficiency, %		
Total Cr		99.5
Cr^{+6}		>99.9
Scrubber Water, PPM		
Total Cr	645.	
Cr^{+6}	320.	

*Cyclonic flow was corrected to perpendicular flow.

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

APR 11 1988

COPY

APPENDIX

COPY
APR 11 1988

Sampling Location: INTERMETRO - INLET

Test No.: 1

Static Pressure, Ps: -2.40

Barometric Pressure: 28.65

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
0.5	1	.170	72	28.27	1	.250	72	36.28				
1.5	2	.185	72	29.49	2	.290	73	36.96				
2.6	3	.210	72	31.42	3	.310	72	38.18				
3.6	4	.220	71	32.13	4	.320	73	38.82				
5.5	5	.230	71	32.85	5	.320	73	38.82				
7.8	6	.250	72	34.28	6	.325	72	38.79				
14.2	7	.285	72	36.60	7	.340	73	40.02				
16.5	8	.305	71	37.83	8	.350	73	40.60				
18.1	9	.300	71	37.52	9	.345	73	40.31				
19.4	10	.322	72	37.56	10	.370	73	41.75				
20.5	11	.320	72	37.56	11	.330	72	39.39				
21.5	12	.250	71	34.28	12	.260	73	35.00				

LEAK CHECK
PRE ✓ POST _

EQUIPMENT IDENTIFICATION
MAGNEHELIC AG44 (1½')
MICROMITE 6

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 36.45

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR 4'std 1.0

F. GAS DENSITY CORRECTION FACTOR 1.002

G. CORRECTED VELOCITY, AxExF, ft/sec 36.52
or, AxDxExF, ft/sec _____

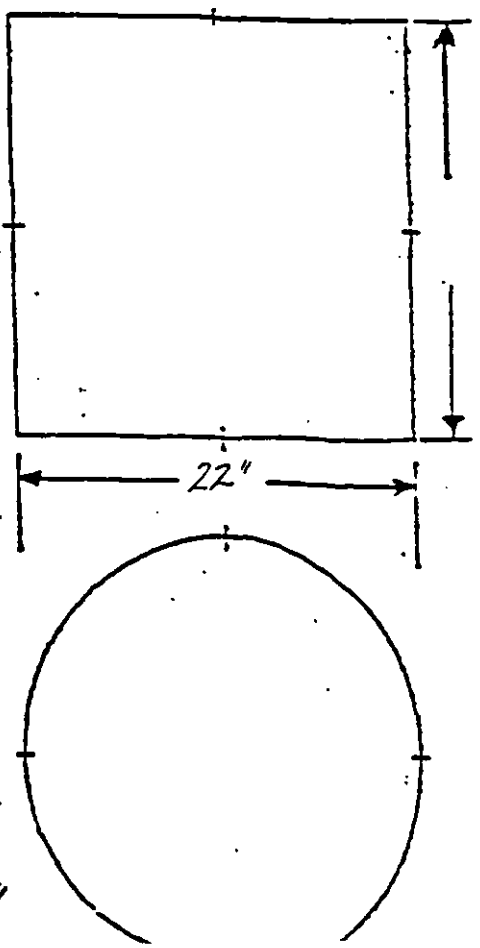
H. AREA OF FLUE, SQ. FT. 2.64

J. AVERAGE FLUE TEMPERATURE, °F 72

K. FLOW RATE, G x H x 60, CFM 5,785

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM 5,385

M. FLOW RATE, L x MOISTURE CORR. (0.9840), DSCFM 5,299



TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 1988

Sampling Location: INTERMETRO - INLET Barometric Pressure: 28.65

Test No. Nozzle Diameter: 1/4"

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
10:30	579.77	0.70	76	—	2	0.71			
10:45	590.26	0.70	80	49	2	0.71			
11:00	601.14	0.74	85	48	3	0.73			
11:15	612.42	0.76	86	47	4	0.74			
11:30	623.70	0.76	87	47	5	0.74			
11:45	635.16	0.76	86	47	6	0.74			
12:00	646.18	0.79	88	51	7	0.76			
12:15	657.62	0.83	92	47	8	0.77			
12:30	669.56	0.81	94	46	9	0.77			
12:45	680.87	0.87	98	45	10	0.80			
13:00	692.70	0.77	101	47	11	0.75			
13:15	703.94	0.77	102	47	12	0.75			
13:30	715.66	—	—	48					

Weight Collected, grams

Meter I.D. Ø10 $M_d = 0.94$

Leak Ckeck CFM K: 0.0

PRE- ✓

POST- ✓

BLANK 205 ml M 280 ml

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. _____

D. Total Sample Volume, Vm + C, cu. ft. _____

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr., DSCF _____

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

1/48

TRUESDAIL LABORATORIES, INC. COPY

Date: 2/24/88

APR 11 1988

Sampling Location: INTERMETRO - INLET

Barometric Pressure: 28.6"

Test No.

Nozzle Diameter: 1/4"

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
13:40	715.66	0.44	93	—	2	0.57			
13:55	725.00	0.44	94	47	2	0.57			
14:10	737.38	0.50	94	47	3	0.61			
14:25	742.26	0.52	94	48	4	0.62			
14:40	751.65	0.54	94	48	5	0.63			
14:55	761.41	0.58	97	49	6	0.66			
15:10	771.46	0.70	99	49	7	0.71			
15:25	782.50	0.74	101	49		0.73			—
15:40	793.73	0.72	100	49		0.72			
15:55	804.70	0.73	100	47		0.72			
16:10	815.27	0.72	100	48		0.72			
16:25	826.43	0.72	95	48	M	0.72			
16:40	837.20	—	—	49					
	257.42	0.69	93	48					

Weight Collected, grams

Meter I.D. Ø10

Leak Ckeck CFM

PRE- ✓

POST- ✓

M_f: 0.94

K = 0.85

M 300 ml

224 ml

A. Total Weight _____

B. Condensate Volume, ml. 24 ml

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. 1.23

D. Total Sample Volume, Vm + C, cu. ft. 258.6

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9} \times$ Moisture corr. (0.9840), DSCF 229.72

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC.

JCM

COPY APR 11 1988

Sampling Station INTERMETRO - INLET Date 2/25/88

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, in. Hg. (absolute) 28.70

B. Vapor pressure of water at impinger temp., in. Hg. 0.3364

C. Volume of metered gas, cu. ft. 257.42

D. Volume of water vapor metered, B X C/A, cu. ft. 3.02

E. Volume of water vapor condensed, cu. ft. 1.23

F. Total volume water vapor in gas sample, D + E, cu. ft. 4.25

G. Total volume of gas sample, C + E, cu. ft. 258.65

H. Percent water vapor in sampled gas, 100 x F/G 1.6

GAS DENSITY CORRECTION FACTOR

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.016	1.0	18.0	0.288
Carbon Dioxide	Dry Basis	0.9840	44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	0.21 Dry Basis	0.9840	32.0	6.613
Nitrogen & Inerts	0.79 Dry Basis	0.9840	28.2	21.922
			Average Molecular Weight	28.823

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.995

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.002

Sampling Location: INTERMETCO - OUTLET Static Pressure, Ps: -2.3

Test No.: APR 11 1988 Barometric Pressure: 28.65

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
0.5	1	.90	65	64.61	1	.55	67	62.91				
1.5	2	.90	65	64.61	2	1.0	67	68.21				
2.6	3	.45	65	45.69	3	1.05	67	69.92				
3.9	4	.55	65	51.51	4	1.05	67	69.92				
5.5	5	.65	64	54.86	5	1.0	66	68.17				
7.8	6	.65	64	54.86	6	.75	66	59.04				
14.2	7	.65	64	54.86	7	.50	66	48.20				
16.5	8	.50	64	45.11	8	1.0	66	68.17				
18.1	9	.65	64	54.86	9	1.05	66	69.85				
19.4	10	.65	64	54.86	10	1.10	66	71.50				
20.5	11	.65	64	54.86	11	1.05	66	69.85				
21.5	12	.95	64	62.73	12	.95	67	66.51				

LEAK CHECK
PRE ✓ POST ✓

EQUIPMENT IDENTIFICATION
MAGNEHELIC RVJ 2 (2")
MICROMITE C

A. AVERAGE VELOCITY (TRAVERSE) ft/sec (60.72 x $\sqrt{0.71}$ x cos 45°) = 42.94

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR S'std 1.0

F. GAS DENSITY CORRECTION FACTOR 1.003

G. CORRECTED VELOCITY, AxExF, ft/sec 43.07
or, AxDxExF, ft/sec _____

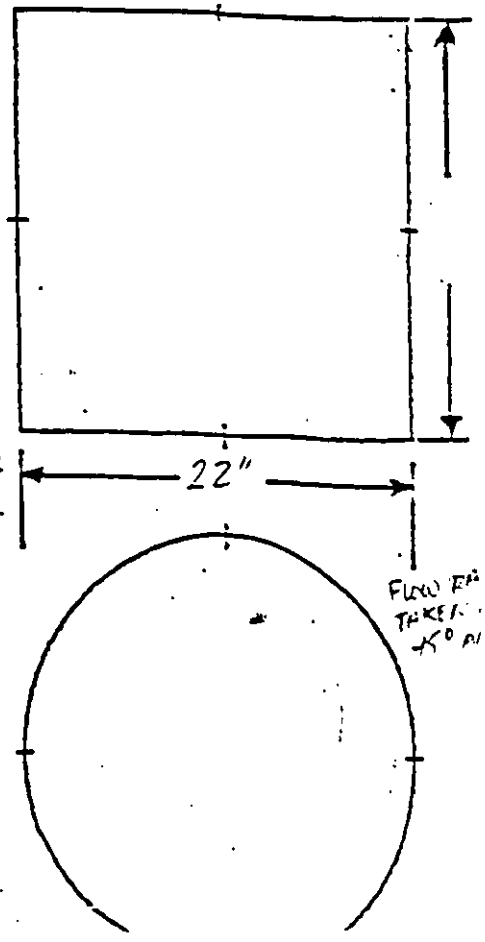
H. AREA OF FLUE, SQ. FT. 2.64

J. AVERAGE FLUE TEMPERATURE, °F 65.38

K. FLOW RATE, G x H x 60, CFM 6,822

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 6,432

M. FLOW RATE, L x 0.9750 MOISTURE CORR., DSCFM 6,290



TRUESDAIL LABORATORIES, INC. COPY

Date: 2/24/88

Sampling Location: INTERMETRO-OUTLET

Barometric Pressure: 28.65

Test No.

Nozzle Diameter: 3/16" - 5mm

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
1025	052.55	.48	68	—	2	.71			
1040	62.82	.50	72	45	2	.71			
1055	73.45	.52	79	50	3	.73			
1110	84.40	.55	82	49	4	.75			
1125	95.40	.52	83	48	5	.73			
1140	106.40	.45	83	47	6	.64			
1155	116.66	.30	82	48	7	.50			
1210	125.20	.52	84	49	8	.73			
1225	135.20	.55	86	49	9	.75			
1240	146.20	.55	91	49	10	.77			
1255	156.50	.52	89	48	11	.73			
1310	168.30	.52	90	47	11	.73			
1320	179.06		—	48					

Weight Collected, grams

Meter I.D. 065

Leak Ckeck CFM

PRE- ✓

POST- ✓

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. _____

D. Total Sample Volume, Vm + C, cu. ft. _____

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr., DSCF _____

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

/KB **TRUESDAIL LABORATORIES, INC.** COPY Date: 2/24/88 APR 11 1988

Sampling Location: INTERMETRO - OUTLET Barometric Pressure: 29.65
Test No. Nozzle Diameter: 5/16" - 5mm

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
1334	179.06	.43	86	—	2	.68			
1349	189.26	.43	86	46	"	.68			
1404	199.46	.25	86	47	3	.53			
1419	206.66	.25	85	48	"	.53			
1434	214.61	.27	84	45	5	.57			
1449	222.50	.27	84	45	6	.57			
1504	230.50	.27	86	45	"	.57			
1519	238.50	.27	84	46	8	.50			
1534	246.70	.33	86	47	9	.57			
1549	255.50	.35	85	47	10	.57			
1604	264.36	.35	85	47	11	.57			
1619	273.11	.35	83	45	"	.57			
1634	282.45	—	—	45					
	229.90	0.41	84	47					

Weight Collected, grams

Meter I.D. DGM 3
Leak Ckeck CFM
PRE- ✓
POST- ✓

K = 0.99
MF = 0.91

M 332 ml
248 ml

A. Total Weight _____

B. Condensate Volume, ml. 48 ml

C. Condensate Vapor Volume, 0.00267 X $\frac{460 + Tm}{B.P + Pm/13.6}$ x B, cu. ft. 2.43

D. Total Sample Volume, Vm + C, cu. ft. 232.33

E. Sample Volume, D x $\frac{520}{460 + Tm}$ x $\frac{B.P. + Pm/13.6}{29.9}$ x 0.9770 Moisture corr., DSCF 208.33

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

COPY

TRUESDAIL LABORATORIES, INC.

Sampling Station INTERMETRO - OUTLET Date 2/24/88

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, in. Hg. (absolute) 28.68

B. Vapor pressure of water at impinger temp., in. Hg. 0.3240

C. Volume of metered gas, cu. ft. 229.90

D. Volume of water vapor metered, B X C/A, cu. ft. 2.60

E. Volume of water vapor condensed, cu. ft. 2.43

F. Total volume water vapor in gas sample, D + E, cu. ft. 5.03

G. Total volume of gas sample, C + E, cu. ft. 232.33

H. Percent water vapor in sampled gas, 100 x F/G 2.2

GAS DENSITY CORRECTION FACTOR

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.022	1.0	18.0	0.396
Carbon Dioxide	Dry Basis	0.9780	44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.21 Dry Basis	0.9780	32.0	6.572
Nitrogen & Inerts	.79 Dry Basis	0.9780	28.2	21.788
			Average Molecular Weight	28.756

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.9933

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.003

COPY

APR 11 1988

INTERMETRO

INLET

TOTAL CHROME -

229.72 DSCF = 6.508 m³

$$23.91 \frac{mg}{\ell} \times 0.300\ell \times \frac{1 mm}{52 mg} \times \frac{23.7 m\ell}{1 mm} \times \frac{1000 \mu l}{1 m\ell} \times \frac{1 DSCF}{28.3\ell} \times \frac{1}{229.}$$

$$= 0.503 \text{ PPM} = 1.10 \text{ mg/m}^3$$

$$\frac{LBS}{HR} = \frac{0.503 \text{ PPM} \times 52 \times 60 \times 5.299}{379,000,000} = 2.19 \times 10^{-2} \frac{LBS}{HR} \text{ CF TOTM}$$

HEXAVALENT CHROME

$$20.50 \frac{mg}{\ell} \times 0.300\ell \times \frac{1 mm}{52 mg} \times \frac{23.7 m\ell}{1 mm} \times \frac{1000 \mu l}{1 m\ell} \times \frac{1 DSCF}{28.3\ell} =$$

$$= 0.431 \text{ PPM } \mu g/\ell$$

$$= 0.945 \text{ mg/m}^3$$

$$\frac{LBS}{HR} = \frac{0.431 \times 52 \times 60 \times 5.299}{379,000,000} = 1.88 \times 10^{-2} \frac{LBS}{HR} \text{ CF}$$

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INTERMETRO

OUTLET

TOTAL

208.33 DSCF = 5.90 m^3

$$0.07 - \underset{(BLANK)}{0.03} = 0.04 \frac{mg}{\ell}$$

$$= 0.04 \frac{mg}{\ell} \times 0.332 \times \frac{1\,mm}{52\,mg} \times \frac{23.7\,ml}{1\,mm} \times \frac{1000\,\mu l}{1\,ml} \times \frac{1\,DSCF}{28.3\,\ell} \times \frac{1}{208}$$

$$= 0.001 \text{ PPM} = 0.0023 \text{ mg/m3}$$

$$\frac{LBS}{HR} = \frac{0.001 \times 52 \times 60 \times 6.290}{379,000,000} = 0.5 \times 10^{-4} \frac{LBS}{HR} \text{ TOTAL}$$

HEXAVALENT

$$< 0.01 \frac{mg}{\ell}$$

$$= 0.01 \frac{mg}{\ell} \times 0.332 \times \frac{1\,mm}{52\,mg} \times \frac{23.7\,ml}{1\,mm} \times \frac{1000\,\mu l}{1\,ml} \times \frac{1\,DSCF}{28.3\,\ell} \times \frac{1}{208}$$

$$= < 0.0003 \text{ PPM}$$

$$= < 0.0006 \text{ mg/m3}$$

$$\frac{LBS}{HR} = \frac{0.0003 \text{ PPM} \times 52 \times 60 \times 6.290}{379,000,000} = < 1.55 \times 10^{-5} \frac{LBS}{HR} \text{ HEX}$$

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METER CALIBRATION

12/29/87 METER #003 RUN 1

CBP: 30.02

WET: 12.208
DRY: 12.277
dY: 0.994

WET TEST #1 DRY TEST #1

VOL	dP	T in C	CFM	VOL	dP	T in F
0.000	**********		0.30	50.43	**********	
1.000	0.08	15.9		51.41	0.10	52
2.000	0.08	15.9		52.38	0.10	52
3.000	0.08	15.9		53.37	0.10	52
4.000	0.08	15.9		54.35	0.10	53
4.000	**********		0.49	55.34	**********	
5.000	0.17	15.9		55.34	0.27	53
6.000	0.17	15.9		56.34	0.28	53
7.000	0.17	15.9		57.34	0.28	53
8.000	0.17	15.9		58.32	0.28	53
8.000	**********		0.69	59.32	**********	
9.000	0.28	15.9		59.32	0.52	53
10.000	0.28	15.9		60.32	0.52	54
11.000	0.28	15.9		61.32	0.52	54
12.000	0.28	15.9		62.31	0.52	54
0.001	**********				**********	
12.001	0.16	15.9		11.88	0.30	53
		61.0 in F				

CALCULATION:

$$\text{WET, SCF: } 12.001 * \frac{528}{521} * \left(\frac{30.02 + 0.16 / 13.6}{29.92}\right) = 12.208$$

$$\text{DRY, SCF: } 11.880 * \frac{528}{513} * \left(\frac{30.02 + 0.30 / 13.6}{29.92}\right) = 12.277$$

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METER CALIBRATION

12/29/87 METER #003 RUN 2

CBP:	30.04	WET:	12.217
T in F:	71	DRY:	12.235
		dY:	0.999

WET TEST #2				DRY TEST #2		
VOL	dP	T in C	CFM	VOL	dP	T in F
0.000	**********		0.31	62.31	**********	
1.000	0.08	15.9		63.30	0.10	55
2.000	0.08	16.0		64.29	0.10	55
3.000	0.08	16.0		65.27	0.10	55
4.000	0.08	16.0		66.24	0.10	55
4.000	**********		0.52	67.24	**********	
5.000	0.17	16.0		67.24	0.28	55
6.000	0.17	16.0		68.24	0.28	55
7.000	0.17	16.0		69.23	0.28	56
8.000	0.17	16.0		70.21	0.28	56
8.000	**********		0.70	71.21	**********	
9.000	0.28	16.0		71.21	0.53	56
10.000	0.28	16.0		72.21	0.53	56
11.000	0.28	16.0		73.22	0.53	56
12.000	0.28	16.0		74.21	0.53	56
0.002	**********				**********	
12.002	0.16	16.0		11.90	0.3	56
		61.0 in F				

CALCULATION:

$$\text{WET, SCF:} \quad 12.002 * \frac{528}{521} * \left(\frac{30.04 + 0.16 / 13.6}{29.92}\right) = 12.217$$

$$\text{DRY, SCF:} \quad 11.900 * \frac{528}{516} * \left(\frac{30.04 + 0.30 / 13.6}{29.92}\right) = 12.235$$

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METER CALIBRATION

12/29/87 METER #010 RUN 1

CBP: 29.96
T in F: 72

WET, SCF: 12.182
DRY, SCF: 12.073
dY: 1.009

WET TEST #1

VOL	dP	T in C	CFM
0.000	**********		0.28
1.000	0.06	16.3	
2.000	0.06	16.3	
3.000	0.06	16.3	
4.000	0.06	16.3	
4.000	**********		0.50
5.000	0.14	16.3	
6.000	0.14	16.3	
7.000	0.14	16.3	
8.000	0.14	16.3	
8.000	**********		0.68
9.000	0.23	16.3	
10.000	0.23	16.2	
11.000	0.24	16.2	
12.000	0.24	16.1	
0.000	**********		
12.000	0.15	16.3	

61 in F

DRY TEST #1

VOL	dP	T in F
29.57	**********	
30.55	0.10	58
31.53	0.10	58
32.51	0.10	58
33.50	0.10	58
34.47	**********	
34.47	0.29	58
35.46	0.29	58
36.45	0.29	57
37.42	0.29	57
38.42	**********	
38.42	0.55	57
39.41	0.54	57
40.40	0.54	57
41.39	0.54	57
	**********	
11.82	0.31	58

CALCULATION:

$$\text{WET, SCF: } 12.000 * \frac{528}{521} * \left(\frac{29.96 + 0.15 / 13.6}{29.92}\right) = 12.182$$

$$\text{DRY, SCF: } 11.820 * \frac{528}{518} * \left(\frac{29.96 + 0.31 / 13.6}{29.92}\right) = 12.073$$

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METER CALIBRATION

12/29/87 METER #010 RUN 2

CBP: 29.96
T in F:

WET, SCF: 12.184
DRY, SCF: 12.046
dY: 1.011

WET TEST #2 DRY TEST #2

VOL	dP	T in C	CFM	VOL	dP	T in F
0.000	**********		0.30	41.39	**********	
1.000	0.06	16.0		42.36	0.10	56
2.000	0.06	16.0		43.35	0.10	56
3.000	0.06	15.9		44.33	0.10	56
4.000	0.06	15.9		45.30	0.10	56
4.000	**********		0.51	46.28	**********	
5.000	0.15	15.9		46.28	0.30	56
6.000	0.15	15.9		47.26	0.30	57
7.000	0.15	15.9		48.24	0.30	57
8.000	0.15	15.9		49.21	0.30	57
8.000	**********		0.68	50.20	**********	
9.000	0.24	15.9		50.20	0.55	57
10.000	0.24	15.9		51.19	0.55	58
11.000	0.24	15.9		52.17	0.55	58
12.000	0.24	15.9		53.16	0.55	58
0.002	**********				**********	
12.002	0.15	15.9		11.77	0.32	57
		61.0 in F				

CALCULATION:

$$\text{WET, SCF: } 12.002 * \frac{528}{521} * \left(\frac{29.96 + 0.15 / 13.6}{29.92}\right) = 12.184$$

$$\text{DRY, SCF: } 11.770 * \frac{528}{517} * \left(\frac{29.96 + 0.32 / 13.6}{29.92}\right) = 12.046$$

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MICROMITE CALIBRATION

DATE: 3/16/88

MICRO	LOW		MED		HIGH	
	MICRO	THERM	MICRO	THERM	MICRO	THERM
A	32 F	32 F	71 F	72 F	211 F	100 C - 212 F
B	31	32	71	72	212	101 - 213.8
C	32	32	72	72	212	101 - 213.8
D	32	32	71	72	211	100 - 212

ICE WATER AMBIENT AIR BOILING WATER

(THERMOMETER #280-6, #280-4)

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MAGNEHELIC CALIBRATION

DATE: 3/16/88

MAGY. #	LOW		MED		HIGH	
	MAGY.	MICRO.	MAGY.	MICRO.	MAGY.	MICRO.
1/4" - GW92	0.042	0.042	0.112	0.108	0.225	0.216
1/2" - AG44	0.050	0.044	0.250	0.244	0.450	0.434
1/2" - AM78	0.055	0.057	0.248	0.248	0.472	0.470
1" - AM112	0.125	0.124	0.525	0.526	0.895	0.894
1" - NH125	0.095	0.092	0.520	0.522	0.900	0.902
1" - PM283	0.090	0.082	0.500	0.499	0.890	0.892
2" - PM2	0.250	0.254	1.000	1.034	1.750	1.754
2" - M28	0.350	0.332	1.000	1.006	1.750	1.722
2" - M28	0.245	0.246	1.000	1.042	1.750	1.796

(CALIBRATED WITH DWYER MICROTECTOR)

REPORT COPY APR 11 1988

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH — DEVELOPMENT — TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT Intermetro Industries
9393 Arrow Highway
Cucamonga, CA 91730
Attention: Duane Ostrum

DATE April 5, 1988

RECEIVED Feb. 24, 1988

LABORATORY NO. 25830

SAMPLE

Source tests for chromium on scrubber
P.O.#: 22926

RECEIVED APR 22 1988

INVESTIGATION

Total and hexavalent chromium

RESULTS

On February 24, 1988 representatives of Truesdail Laboratories, Inc. conducted source tests on the inlet and outlet of a scrubber for total and hexavalent chromium at the Intermetro Industries facility in Cucamonga, California.

A six hour isokinetic sample was collected at each sampling location by the wet impingement method (SCAQMD method 5.1). The sampling train consisted of a glass probe connected with Teflon tubing to a set of Greenburg-Smith impingers charged with 200 mls of 0.1N NaOH and followed by a Teflon filter on a glass fiber backing filter, vacuum pump, and a dry gas meter.

The flue gas flow rate was determined at both sampling locations by measuring the average velocity head with a Standard Pitot tube connected to a Magnehelic differential pressure gage, and by measuring the average temperature with a chromel-alumel thermocouple connected to a Micromite potentiometer. SCAQMD methods 1.1 and 2.1 were employed to determine the matrix of traverse points and sampling rates.

The scrubber outlet flow rate was determined to be cyclonic and the angle of maximum velocity head was measured at 45° for each traverse point. The isokinetic sampling rates were calculated from the actual velocity head and sampling was conducted at 45° for each traverse point. The emissions rates however were calculated from the corrected flow rate (i.e. The flow rate perpendicular to the duct cross sectional area which was determined from the cosine of the flow angle.

This report applies only to the sample, or samples, investigated and is not necessarily indicative of the quality or condition of apparently identical or similar products. As a mutual protection to clients, the public and these Laboratories, this report is submitted and accepted for the exclusive use of the client to whom it is addressed and upon the condition that it is not to be used, in whole or in part, in any advertising or publicity matter without prior written authorization from these Laboratories.

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Sampling trains were prepared by soaking all impingers for 12 hours in 50% nitric acid, then rinsing three times with distilled water and charging with 100 mls of 0.1N NaOH. All probes and Teflon tubing were rinsed on site with 50% nitric acid and washed three times with distilled water. Samples were recovered by measuring condensate gain and rinsing the probe, Teflon tubing, and impingers twice with 0.1N NaOH and once with 0.1N nitric acid.

The total chrome was determined by atomic absorption with a graphite furnace and the hexavalent chrome by the diphenylcarbazide colormetric method. The analyses included calibration curves, spike recovery, and a blank sampling train.

The results were as follows:

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INTERMETRO INDUSTRIES
2-24-88

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Flue Gas:	Scrubber Inlet	Scrubber Outlet
Temperature, °F	72	65
Velocity, ft./sec	36.4	43.1*
Static Pressure, in H_2O	-2.4	-2.3
Duct Diameter, in.	22	22
Duct Area, Sq. Ft.	2.64	2.64
Gas Volume: ACFM	5,780	6,820.*
SCFM	5,380	6,430.*
DSCFM	5,300	6,290.*
Moisture, % by Vol.	1.6	2.2
Chromium:		
Sampling Time	10:30 - 16:40	10:25 - 16:34
Sample Volume, DSCF	229.72	208.33
Concentration, PPB		
Total Cr	503.	1.0
Cr^{+6}	431.	<0.3
Concentration, mg/m^3		
Total Cr	1.1	0.0023
Cr^{+6}	0.95	<0.0006
Emission Rate, lbs/hr		
Total Cr	0.022	0.00005
Cr^{+6}	0.019	<0.00002
Removal Efficiency, %		
Total Cr		99.5
Cr^{+6}		>99.9
Scrubber Water, PPM		
Total Cr	645.	
Cr^{+6}	320.	

*Cyclonic flow was corrected to perpendicular flow.

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

APR 11 1988

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APPENDIX

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Sampling Location: INTERMETRO - INLET

Test No.: 1

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Static Pressure, Ps: -2.40

Barometric Pressure: 28.65

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
0.5	1	.170	72	28.27	1	.250	72	36.28				
1.5	2	.185	72	29.49	2	.290	73	36.96				
2.6	3	.210	72	31.42	3	.310	72	38.18				
3.6	4	.220	71	32.13	4	.320	73	38.82				
5.5	5	.230	71	32.85	5	.320	73	38.82				
7.8	6	.250	72	34.28	6	.325	72	38.79				
14.2	7	.285	72	36.60	7	.340	75	40.02				
16.5	8	.305	71	37.83	8	.350	73	40.60				
18.1	9	.300	71	37.52	9	.345	73	40.31				
19.4	10	.388	72	37.56	10	.370	73	41.75				
20.5	11	.330	72	37.56	11	.330	72	39.39				
21.5	12	.350	71	34.75	12	.260	73	35.00				

LEAK CHECK
PRE ✓ POST _

EQUIPMENT IDENTIFICATION
MAGNEHELIC AG44 (1/2")
MICROMITE B

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 36.45

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR S'std 1.0

F. GAS DENSITY CORRECTION FACTOR 1.002

G. CORRECTED VELOCITY, AxExF, ft/sec 36.52
or, AxDxExF, ft/sec _____

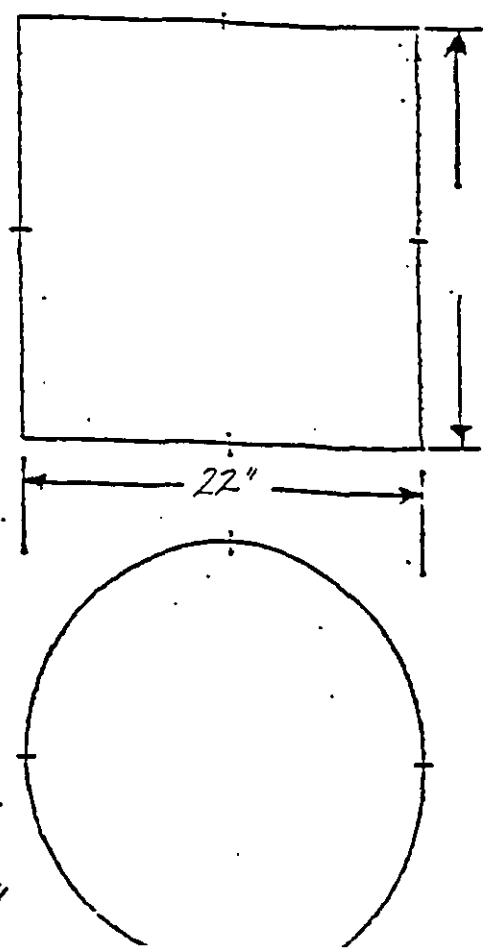
H. AREA OF FLUE, SQ. FT. 2.64

J. AVERAGE FLUE TEMPERATURE, °F 72

K. FLOW RATE, G x H x 60, CFM 5,785

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 5,385

M. FLOW RATE, L x 0.9845 MOISTURE CORR., DSCFM 5,299



TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 1988

Sampling Location: INTERMETRO - INLET Barometric Pressure: 28.65

Test No. Nozzle Diameter: 1/4"

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
10:30	579.77	0.70	76	—	2	0.71			
10:45	590.26	0.70	80	49	2	0.71			
11:00	601.14	0.74	85	48	3	0.73			
11:15	612.42	0.76	86	47	4	0.74			
11:30	623.70	0.76	87	47	5	0.74			
11:45	635.16	0.76	86	47	6	0.74			
12:00	646.18	0.79	88	51	7	0.76			
12:15	657.62	0.83	92	47	8	0.78			
12:30	669.56	0.81	94	46	9	0.77			
12:45	680.87	0.87	98	45	10	0.80			
13:00	692.70	0.77	101	47	11	0.75			
13:15	703.94	0.77	102	47	11	0.75			
13:30	715.66	—	—	48					

Weight Collected, grams

Meter I.D. Ø10 M_d = 0.994

Leak Ckeck CFM K = 0.03

PRE- ✓

POST- ✓

BLANK 205 ml M 280 ml

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, 0.00267 X $\frac{460 + Tm}{B.P + Pm/13.6}$ x B, cu. ft. _____

D. Total Sample Volume, Vm + C, cu. ft. _____

E. Sample Volume, D x $\frac{520}{460 + Tm}$ x $\frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr., DSCF _____

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 198

Sampling Location: INTERMETRO - INLET Barometric Pressure: 28.67

Test No. Nozzle Diameter: 1/4"

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
13:40	715.66	0.44	93	—	2	0.57			
13:55	725.00	0.44	94	47	2	0.57			
14:10	733.38	0.50	94	47	3	0.61			
14:25	742.26	0.52	94	48	4	0.62			
14:40	751.65	0.54	94	48	5	0.63			
14:55	761.41	0.58	97	49	6	0.66			
15:10	771.46	0.70	99	49	7	0.71			
15:25	782.50	0.74	101	49		0.73			—
15:40	793.73	0.72	100	49		0.72			
15:55	804.70	0.72	100	47		0.72			
16:10	815.27	0.72	100	48		0.72			
16:25	826.43	0.72	95	48	M	0.72			
16:40	837.20	—	—	49					
	257.42	0.69	93	48					

Weight Collected, grams

Meter I.D. Ø1Ø

Leak Ckeck CFM

PRE- ✓

POST- ✓

M_f: 0.94

K = 0.9[illegible]85

M 300 ml

224 ml

A. Total Weight _____

B. Condensate Volume, ml. 24 ml

C. Condensate Vapor Volume, 0.00267 X $\frac{460 + Tm}{B.P + Pm/13.6}$ x B, cu. ft. 1.23

D. Total Sample Volume, Vm + C, cu. ft. 258.6

E. Sample Volume, D x $\frac{520}{460 + Tm}$ x $\frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr. 0.9840, DSCF 229.73

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC.

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Sampling Station INTERMETRO - INLET Date 2/25/88

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, in. Hg. (absolute) 28.70

B. Vapor pressure of water at impinger temp., in. Hg. 0.3364

C. Volume of metered gas, cu. ft. 257.42

D. Volume of water vapor metered, B X C/A, cu. ft. 3.02

E. Volume of water vapor condensed, cu. ft. 1.23

F. Total volume water vapor in gas sample, D + E, cu. ft. 4.25

G. Total volume of gas sample, C + E, cu. ft. 258.65

H. Percent water vapor in sampled gas, 100 x F/G 1.6

GAS DENSITY CORRECTION FACTOR

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.016	1.0	18.0	0.288
Carbon Dioxide	Dry Basis	0.9840	44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	0.21 Dry Basis	0.9840	32.0	6.613
Nitrogen & Inerts	0.79 Dry Basis	0.9840	28.2	21.922
			Average Molecular Weight	28.823

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.995

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.002

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Sampling Location: INTERMETRO - OUTLET Static Pressure, Ps: -2.3

Test No.: APR 11 1988 Barometric Pressure: 28.65

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
0.5	1	.90	65	64.61	1	.85	67	62.91				
1.5	2	.90	65	64.61	2	1.0	67	68.24				
2.6	3	.45	65	45.69	3	1.05	67	69.92				
3.9	4	.55	65	50.51	4	1.05	67	69.92				
5.5	5	.65	64	54.86	5	1.0	66	68.17				
7.8	6	.65	64	54.86	6	.75	66	59.04				
14.2	7	.65	64	54.86	7	.50	66	48.20				
16.5	8	.50	64	48.11	8	1.0	66	68.17				
18.1	9	.65	64	54.86	9	1.05	66	69.85				
19.4	10	.65	64	54.86	10	1.10	66	71.50				
20.5	11	.65	64	54.86	11	1.05	66	69.85				
21.5	12	.95	64	62.73	12	.95	67	66.51				

LEAK CHECK
PRE ✓ POST ✓

EQUIPMENT IDENTIFICATION
MAGNEHELIC PD 2 (2")
MICROMITE C

A. AVERAGE VELOCITY (TRAVERSE) ft/sec (60.72 x $\sqrt{0.7}$ (45°)) = 42.94

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR 4'SYd 1.0

F. GAS DENSITY CORRECTION FACTOR 1.003

G. CORRECTED VELOCITY, AxExF, ft/sec 43.07
or, AxDxExF, ft/sec _____

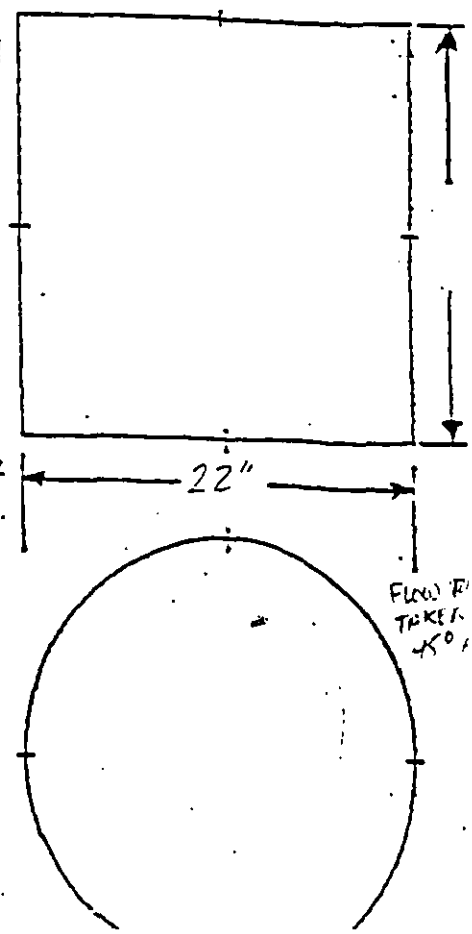
H. AREA OF FLUE, SQ. FT. 2.64

J. AVERAGE FLUE TEMPERATURE, °F 65.38

K. FLOW RATE, G x H x 60, CFM 6,822

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 6,432

M. FLOW RATE, L x MOISTURE CORR. (0.9758^{0}), DSCFM 6,290



TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 '88

Sampling Location: INTERMETRO-OUTLET Barometric Pressure: 26.65

Test No. Nozzle Diameter: 3/16" - 5mm

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
1025	052.55	.48	68	—	2	.71			
1040	62.82	.50	72	45	2	.71			
1055	73.45	.52	79	50	3	.73			
1110	84.40	.55	92	49	4	.75			
1125	95.45	.52	83	48	5	.73			
1140	106.40	.45	83	47	6	.64			
1155	116.60	.30	90	48	7	.50			
1210	125.20	.52	94	49	8	.73			
1225	135.20	.55	86	49	9	.75			
1240	146.20	.55	97	49	10	.77			
1255	156.81	.52	89	48	11	.73			
1310	168.30	.52	90	47	11	.73			
1320	179.06		—	48					

Weight Collected, grams

Meter I.D. 003

Leak Ckeck CFM ✓

PRE- ✓

POST- ✓

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. _____

D. Total Sample Volume, Vm + C, cu. ft. _____

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr., DSCF _____

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

1/86 **TRUESDAIL LABORATORIES, INC.** COPY Date: 2/24/88 APR 11 1988

Sampling Location: INTERMETRO - OUTLET Barometric Pressure: 25.65
Test No. Nozzle Diameter: 5/16" - 5mm

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
1334	179.06	.43	86	—	0	.68			
1349	189.26	.43	86	46	2	.68			
1404	199.40	.25	86	47	3	.53			
1419	206.66	.25	85	48	4	.53			
1434	214.61	.27	84	45	5	.57			
1449	222.50	.27	84	45	6	.57			
1504	230.50	.27	86	45	7	.57			
1519	238.50	.27	84	46	8	.50			
1534	246.70	.33	86	47	9	.57			
1549	255.50	.35	85	47	10	.57			
1604	264.36	.35	85	47	11	.57			
1619	273.11	.35	83	45	11	.57			
1634	282.45	—	—	45					
	279.90	0.41	84	47					

Weight Collected, grams

Meter I.D. 003
Leak Ckeck CFM
PRE- ✓
POST- ✓

K = 0.99
MF = 0.91

M 332 ml
248 ml

A. Total Weight _____

B. Condensate Volume, ml. 48 ml

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. 2.43

D. Total Sample Volume, Vm + C, cu. ft. 232.3

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9} \times$ Moisture corr. (0.9770), DSCF 208.33

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC. COPY APR 11 1988

Sampling Station INTERMETRO - OUTLET Date 2/24/88

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, in. Hg. (absolute) 28.68

B. Vapor pressure of water at impinger temp., in. Hg. 0.3240

C. Volume of metered gas, cu. ft. 229.90

D. Volume of water vapor metered, B X C/A, cu. ft. 2.60

E. Volume of water vapor condensed, cu. ft. 2.43

F. Total volume water vapor in gas sample, D + E, cu. ft. 5.03

G. Total volume of gas sample, C + E, cu. ft. 232.33

H. Percent water vapor in sampled gas, 100 x F/G 2.2

GAS DENSITY CORRECTION FACTOR

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.022	1.0	18.0	0.396
Carbon Dioxide	Dry Basis	0.9780	44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.21 Dry Basis	0.9780	32.0	6.572
Nitrogen & Inerts	.79 Dry Basis	0.9780	28.2	21.788
		Average Molecular Weight		28.756

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.9933

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.003

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APR 11 1

INTERMETRO

INLET

TOTAL CHROME - 229.72 DSCF = 6.508 m

$$23.91 \frac{mg}{\ell} \times 0.300\ell \times \frac{1mm}{52mg} \times \frac{23.7 m\ell}{1mm} \times \frac{1000\mu l}{1m\ell} \times \frac{1 DSCF}{28.3\ell} \times \frac{}{22}$$

$$= 0.503 \text{ PPM} = 1.10 \ mg/m^3$$

$$\frac{LBS}{HR} = \frac{0.503 \text{ PPM} \times 52 \times 60 \times 5.299}{379,000,000} = 2.19 \times 10^{-2} \frac{LBS}{HR} \ C_{TO}$$

HEXAVALENT CHROME

$$20.50 \frac{mg}{\ell} \times 0.300\ell \times \frac{1mm}{52mg} \times \frac{23.7 m\ell}{1mm} \times \frac{1000\mu l}{1m\ell} \times \frac{1 DSCF}{28.3\ell} =$$

$$= 0.431 \text{ PPM } \mu g/\ell$$

$$= 0.945 \ mg/m^3$$

$$\frac{LBS}{HR} = \frac{0.431 \times 52 \times 60 \times 5.299}{379,000,000} = 1.88 \times 10^{-2} \frac{LBS}{HR} \ C_E$$

APR 11 1988

COPY

INTERMETRO

OUTLET

TOTAL

208.33 DSCF = 5.90 m³

$$0.07 - \underset{(\text{BLANK})}{0.03} = 0.04 \frac{mg}{l}$$

$$= 0.04 \frac{mg}{l} \times 0.332 \times \frac{1\,mm}{52\,mg} \times \frac{23.7\,ml}{1\,mm} \times \frac{1000\,\mu l}{1\,ml} \times \frac{1\,DSCF}{28.3\,l} \times \frac{1}{20}$$

$$= 0.001 \text{ PPM} = 0.0023 \text{ mg/m}^3$$

$$\frac{LBS}{HR} = \frac{0.001 \times 52 \times 60 \times 6,290}{379,000,000} = 0.5 \times 10^{-4} \frac{LBS}{HR} \text{ Cr TOTAL}$$

HEXAVALENT

$$< 0.01 \frac{mg}{l}$$

$$= 0.01 \frac{mg}{l} \times 0.332 \times \frac{1\,mm}{52\,mg} \times \frac{23.7\,ml}{1\,mm} \times \frac{1000\,\mu l}{1\,ml} \times \frac{1\,DSCF}{28.3\,l} \times \frac{1}{20}$$

$$= < 0.0003 \text{ PPM}$$

$$= < 0.0006 \text{ mg/m}^3$$

$$\frac{LBS}{HR} = \frac{0.0003 \text{ PPM} \times 52 \times 60 \times 6,290}{379,000,000} = < 1.55 \times 10^{-5} \frac{LBS}{HR} \text{ HEX}$$

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METER CALIBRATION

12/29/87 METER #003 RUN 1

CBP: 30.02

WET: 12.208
DRY: 12.277
dY: 0.994

WET TEST #1				DRY TEST #1		
VOL	dP	T in C	CFM	VOL	dP	T in F
0.000	**********		0.30	50.43	**********	
1.000	0.08	15.9		51.41	0.10	52
2.000	0.08	15.9		52.38	0.10	52
3.000	0.08	15.9		53.37	0.10	52
4.000	0.08	15.9		54.35	0.10	53
4.000	**********		0.49	55.34	**********	
5.000	0.17	15.9		55.34	0.27	53
6.000	0.17	15.9		56.34	0.28	53
7.000	0.17	15.9		57.34	0.28	53
8.000	0.17	15.9		58.32	0.28	53
8.000	**********		0.69	59.32	**********	
9.000	0.28	15.9		59.32	0.52	53
10.000	0.28	15.9		60.32	0.52	54
11.000	0.28	15.9		61.32	0.52	54
12.000	0.28	15.9		62.31	0.52	54
0.001	**********				**********	
12.001	0.16	15.9		11.88	0.30	53
		61.0 in F				

CALCULATION:

$$\text{WET, SCF: } 12.001 * \frac{528}{521} * \left(\frac{30.02 + 0.16 / 13.6}{29.92}\right) = 12.208$$

$$\text{DRY, SCF: } 11.880 * \frac{528}{513} * \left(\frac{30.02 + 0.30 / 13.6}{29.92}\right) = 12.277$$

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METER CALIBRATION

12/29/87 METER #003 RUN 2

CBP:	30.04	WET:	12.217
T in F:	71	DRY:	12.235
		dY:	0.999

WET TEST #2

VOL	dP	T in C	CFM
0.000	**********		0.31
1.000	0.08	15.9	
2.000	0.08	16.0	
3.000	0.08	16.0	
4.000	0.08	16.0	
4.000	**********		0.52
5.000	0.17	16.0	
6.000	0.17	16.0	
7.000	0.17	16.0	
8.000	0.17	16.0	
8.000	**********		0.70
9.000	0.28	16.0	
10.000	0.28	16.0	
11.000	0.28	16.0	
12.000	0.28	16.0	
0.002	**********		
12.002	0.16	16.0	
		61.0 in F	

DRY TEST #2

VOL	dP	T in F
62.31	**********	
63.30	0.10	55
64.29	0.10	55
65.27	0.10	55
66.24	0.10	55
67.24	**********	
67.24	0.28	55
68.24	0.28	55
69.23	0.28	56
70.21	0.28	56
71.21	**********	
71.21	0.53	56
72.21	0.53	56
73.22	0.53	56
74.21	0.53	56
	**********	
11.90	0.3	56

CALCULATION:

$$\text{WET, SCF: } 12.002 * \frac{528}{521} * \left(\frac{30.04 + 0.16 / 13.6}{29.92}\right) = 12.217$$

$$\text{DRY, SCF: } 11.900 * \frac{528}{516} * \left(\frac{30.04 + 0.30 / 13.6}{29.92}\right) = 12.235$$

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METER CALIBRATION

12/29/87 METER #010 RUN 1

CBP: 29.96
T in F: 72

WET, SCF: 12.182
DRY, SCF: 12.073
dY: 1.009

WET TEST #1

VOL	dP	T in C
0.000	**********	
1.000	0.06	16.3
2.000	0.06	16.3
3.000	0.06	16.3
4.000	0.06	16.3
4.000	**********	
5.000	0.14	16.3
6.000	0.14	16.3
7.000	0.14	16.3
8.000	0.14	16.3
8.000	**********	
9.000	0.23	16.3
10.000	0.23	16.2
11.000	0.24	16.2
12.000	0.24	16.1
0.000	**********	
12.000	0.15	16.3

61 in F

CFM
0.28
0.50
0.68

DRY TEST #1

VOL	dP	T in F
29.57	**********	
30.55	0.10	58
31.53	0.10	58
32.51	0.10	58
33.50	0.10	58
34.47	**********	
34.47	0.29	58
35.46	0.29	58
36.45	0.29	57
37.42	0.29	57
38.42	**********	
38.42	0.55	57
39.41	0.54	57
40.40	0.54	57
41.39	0.54	57
	**********	
11.82	0.31	58

CALCULATION:

$$\text{WET, SCF: } 12.000 * \frac{528}{521} * \left(\frac{29.96 + 0.15 / 13.6}{29.92}\right) = 12.182$$

$$\text{DRY, SCF: } 11.820 * \frac{528}{518} * \left(\frac{29.96 + 0.31 / 13.6}{29.92}\right) = 12.073$$

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METER CALIBRATION

12/29/87 METER #010 RUN 2

CBP: 29.96
T in F:

WET, SCF: 12.184
DRY, SCF: 12.046
dY: 1.011

WET TEST #2

VOL	dP	T in C	CFM
0.000	**********		0.30
1.000	0.06	16.0	
2.000	0.06	16.0	
3.000	0.06	15.9	
4.000	0.06	15.9	
4.000	**********		0.51
5.000	0.15	15.9	
6.000	0.15	15.9	
7.000	0.15	15.9	
8.000	0.15	15.9	
8.000	**********		0.68
9.000	0.24	15.9	
10.000	0.24	15.9	
11.000	0.24	15.9	
12.000	0.24	15.9	
0.002	**********		
12.002	0.15	15.9	
		61.0 in F	

DRY TEST #2

VOL	dP	T in F
41.39	**********	
42.36	0.10	56
43.35	0.10	56
44.33	0.10	56
45.30	0.10	56
46.28	**********	
46.28	0.30	56
47.26	0.30	57
48.24	0.30	57
49.21	0.30	57
50.20	**********	
50.20	0.55	57
51.19	0.55	58
52.17	0.55	58
53.16	0.55	58
	**********	
11.77	0.32	57

CALCULATION:

$$\text{WET, SCF: } 12.002 * \frac{528}{521} * \left(\frac{29.96 + 0.15 / 13.6}{29.92}\right) = 12.184$$

$$\text{DRY, SCF: } 11.770 * \frac{528}{517} * \left(\frac{29.96 + 0.32 / 13.6}{29.92}\right) = 12.046$$

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MICROMITE CALIBRATION

DATE: 3/16/88

MICRO	LOW		MED		HIGH	
	MICRO	THERM	MICRO	THERM	MICRO	THERM
A	32 F	32 F	71 F	72 F	211 F	100 C - 212 F
B	31	32	71	72	212	101 - 213.8
C	32	32	72	72	212	101 - 213.8
D	32	32	71	72	211	100 - 212

ICE WATER AMBIENT AIR BOILING WATER

(THERMOMETER #280-6, #280-4)

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MAGNEHELIC CALIBRATION

DATE: 3/16/88

MAGY. #	LOW		MED		HIGH	
	MAGY.	MICRO.	MAGY.	MICRO.	MAGY.	MICRO.
1/4" - GW92	0.042	0.042	0.112	0.108	0.225	0.216
1/2" - AG44	0.050	0.044	0.250	0.244	0.450	0.434
1/2" - AM78	0.055	0.057	0.248	0.248	0.472	0.470
1" - AM112	0.125	0.124	0.525	0.526	0.895	0.894
1" - NH125	0.095	0.092	0.520	0.522	0.900	0.902
1" - PM283	0.090	0.082	0.500	0.499	0.890	0.892
2" - PM2	0.250	0.254	1.000	1.034	1.750	1.754
2" - M28	0.350	0.332	1.000	1.006	1.750	1.722
2" - M28	0.245	0.246	1.000	1.042	1.750	1.796

(CALIBRATED WITH DWYER MICROTECTOR)

REPORT COPY

APR 11 1988

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
RESEARCH - DEVELOPMENT - TESTING

14201 FRANKLIN AVENUE
TUSTIN, CALIFORNIA 92680
AREA CODE 714 • 730-6239
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT: Intermetro Industries
9393 Arrow Highway
Cucamonga, CA 91730
Attention: Duane Ostrum

DATE: April 5, 1988

RECEIVED: Feb. 24, 1988

LABORATORY NO.: 25830

SAMPLE: Source tests for chromium on scrubber
P.O.#: 22926

RECEIVED APR 22 1988

INVESTIGATION: Total and hexavalent chromium

RESULTS

On February 24, 1988 representatives of Truesdail Laboratories, Inc. conducted source tests on the inlet and outlet of a scrubber for total and hexavalent chromium at the Intermetro Industries facility in Cucamonga, California.

A six hour isokinetic sample was collected at each sampling location by the wet impingement method (SCAQMD method 5.1). The sampling train consisted of a glass probe connected with Teflon tubing to a set of Greenburg-Smith impingers charged with 200 mls of 0.1N NaOH and followed by a Teflon filter on a glass fiber backing filter, vacuum pump, and a dry gas meter.

The flue gas flow rate was determined at both sampling locations by measuring the average velocity head with a Standard Pitot tube connected to a Magnehelic differential pressure gage, and by measuring the average temperature with a chromel-alumel thermocouple connected to a Micromite potentiometer. SCAQMD methods 1.1 and 2.1 were employed to determine the matrix of traverse points and sampling rates.

The scrubber outlet flow rate was determined to be cyclonic and the angle of maximum velocity head was measured at 45° for each traverse point. The isokinetic sampling rates were calculated from the actual velocity head and sampling was conducted at 45° for each traverse point. The emissions rates however were calculated from the corrected flow rate (i.e. The flow rate perpendicular to the duct cross sectional area which was determined from the cosine of the flow angle.

This report applies only to the sample, or samples, investigated and is not necessarily indicative of the quality or condition of apparently identical or similar products. As a mutual protection to clients, the public and these Laboratories, this report is submitted and accepted for the exclusive use of the client to whom it is addressed and upon the condition that it is not to be used, in whole or in part, in any advertising or publicity matter without prior written authorization from these Laboratories.

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Sampling trains were prepared by soaking all impingers for 12 hours in 50% nitric acid, then rinsing three times with distilled water and charging with 100 mls of 0.1N NaOH. All probes and Teflon tubing were rinsed on site with 50% nitric acid and washed three times with distilled water. Samples were recovered by measuring condensate gain and rinsing the probe, Teflon tubing, and impingers twice with 0.1N NaOH and once with 0.1N nitric acid.

The total chrome was determined by atomic absorption with a graphite furnace and the hexavalent chrome by the diphenylcarbazide colormetric method. The analyses included calibration curves, spike recovery, and a blank sampling train.

The results were as follows:

TRUESDAIL LABORATORIES, INC.

APR 11 1988

INTERMETRO INDUSTRIES
2-24-88

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Flue Gas:	Scrubber Inlet	Scrubber Outlet
Temperature, °F	72	65
Velocity, ft./sec	36.4	43.1*
Static Pressure, in H_2O	-2.4	-2.3
Duct Diameter, in.	22	22
Duct Area, Sq. Ft.	2.64	2.64
Gas Volume: ACFM	5,780	6,820.*
SCFM	5,380	6,430.*
DSCFM	5,300	6,290.*
Moisture, % by Vol.	1.6	2.2
Chromium:		
Sampling Time	10:30 - 16:40	10:25 - 16:34
Sample Volume, DSCF	229.72	208.33
Concentration, PPB		
Total Cr	503.	1.0
Cr^{+6}	431.	<0.3
Concentration, mg/m^3		
Total Cr	1.1	0.0023
Cr^{+6}	0.95	<0.0006
Emission Rate, lbs/hr		
Total Cr	0.022	0.00005
Cr^{+6}	0.019	<0.00002
Removal Efficiency, %		
Total Cr		99.5
Cr^{+6}		>99.9
Scrubber Water, PPM		
Total Cr	645.	
Cr^{+6}	320.	

*Cyclonic flow was corrected to perpendicular flow.

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

APR 11 1988

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APPENDIX

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APR 11 1988

Sampling Location: INTERMETRO - INLET

Test No.:

Static Pressure, Ps: -2.40

Barometric Pressure: 28.65

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
0.5	1	.170	72	28.27	1	.250	72	36.28				
1.5	2	.185	72	29.49	2	.290	73	36.96				
2.6	3	.210	72	31.42	3	.310	72	38.18				
3.6	4	.220	71	32.13	4	.320	73	38.82				
5.5	5	.230	71	32.85	5	.320	73	38.82				
7.8	6	.250	72	34.28	6	.305	72	38.79				
14.2	7	.285	72	36.60	7	.340	73	40.02				
16.5	8	.305	71	37.83	8	.350	73	40.60				
18.1	9	.300	71	37.52	9	.345	73	40.31				
19.4	10	.310	72	37.56	10	.370	73	41.75				
20.5	11	.320	72	37.56	11	.330	72	39.39				
21.5	12	.250	71	34.28	12	.260	73	35.00				

LEAK CHECK
PRE ✓ POST _

EQUIPMENT IDENTIFICATION
MAGNEHELIC AG44 (1½")
MICROMITE 6

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 36.45

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR 4' std 1.0

F. GAS DENSITY CORRECTION FACTOR 1.002

G. CORRECTED VELOCITY, AxExF, ft/sec 36.52
or, AxDxExF, ft/sec _____

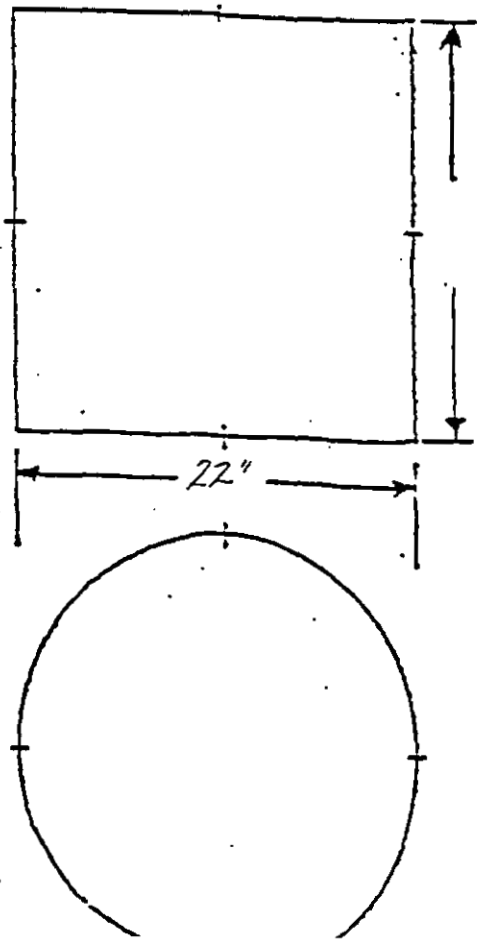
H. AREA OF FLUE, SQ. FT. 2.64

J. AVERAGE FLUE TEMPERATURE, °F 72

K. FLOW RATE, G x H x 60, CFM 5,785

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 5,385

M. FLOW RATE, L x MOISTURE CORR., DSCFM 5,299



TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 1988

Sampling Location: INTERMETRO - INLET Barometric Pressure: 28.65

Test No. Nozzle Diameter: 1/4"

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
10:30	579.77	0.70	76	—	2	0.71			
10:45	[illegible]0.26	0.70	80	49	2	0.71			
11:00	[illegible]1.14	0.74	85	48	3	0.73			
11:15	612.42	0.76	86	47	4	0.74			
11:30	[illegible]3.70	0.76	87	47	5	0.74			
11:45	[illegible]35.16	0.76	86	47	[illegible]	0.74			
12:00	646.18	0.79	88	51	7	0.76			
12:15	657.62	0.83	92	47	8	0.77			
12:30	669.56	0.81	94	46	9	0.77			
12:45	680.87	0.87	98	45	10	0.80			
13:00	692.70	0.77	101	47	[illegible]	0.75			
13:15	703.94	0.77	102	47	11	0.75			
13:30	715.66	—	—	48					

Weight Collected, grams

Meter I.D. Ø10 M_d = 0.94

Leak Ckeck CFM K = 0.9[illegible]

PRE- ✓

POST- ✓

BLANK 205ml M 280ml

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, 0.00267 X $\frac{460 + Tm}{B.P + Pm/13.6}$ x B, cu. ft. _____

D. Total Sample Volume, Vm + C, cu. ft. _____

E. Sample Volume, D x $\frac{520}{460 + Tm}$ x $\frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr., DSCF _____

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 198

Sampling Location: INTERMETRO - INLET Barometric Pressure: 28.6"
Test No. Nozzle Diameter: 1/4"

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
13:40	715.66	0.44	93	—	2	0.57			
13:55	725.00	0.44	94	47	2	0.57			
14:10	737.78	0.50	94	47	3	0.61			
14:25	747.26	0.52	94	48	4	0.62			
14:40	751.65	0.54	94	48	5	0.63			
14:55	761.41	0.58	97	49	6	0.66			
15:10	771.46	0.70	99	49	7	0.71			
15:25	782.50	0.74	101	49		0.73			—
15:40	793.73	0.72	100	49		0.72			
15:55	804.70	0.72	100	47		0.72			
16:10	815.27	0.72	100	48		0.72			
16:25	826.43	0.72	95	48	M	0.72			
16:40	837.20	—	—	49					
	257.42	0.69	93	48					

Weight Collected, grams

Meter I.D. 010
Leak Ckeck CFM
PRE- ✓
POST- ✓

M_f = 0.94
K = 0.9[illegible]5
M 300 ml
224 ml

A. Total Weight _____

B. Condensate Volume, ml. 24 ml

C. Condensate Vapor Volume, 0.00267 X $\frac{460 + Tm}{B.P + Pm/13.6}$ x B, cu. ft. 1.23

D. Total Sample Volume, Vm + C, cu. ft. 258.6

E. Sample Volume, D x $\frac{520}{460 + Tm}$ x $\frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr. (0.9840), DSCF 229.72

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC.

COPY APR 11 1988

Sampling Station INTERMETRO - INLET Date 2/25/88

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, in. Hg. (absolute) 28.70

B. Vapor pressure of water at impinger temp., in. Hg. 0.3364

C. Volume of metered gas, cu. ft. 257.42

D. Volume of water vapor metered, B X C/A, cu. ft. 3.02

E. Volume of water vapor condensed, cu. ft. 1.23

F. Total volume water vapor in gas sample, D + E, cu. ft. 4.25

G. Total volume of gas sample, C + E, cu. ft. 258.65

H. Percent water vapor in sampled gas, 100 x F/G 1.6

GAS DENSITY CORRECTION FACTOR

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.016	1.0	18.0	0.288
Carbon Dioxide	Dry Basis	0.9840	44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	0.21 Dry Basis	0.9840	32.0	6.613
Nitrogen & Inerts	0.79 Dry Basis	0.9840	28.2	21.922
			Average Molecular Weight	28.823

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.995

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.002

COPY

Sampling Location: INCINERATOR - OUTLET Static Pressure, Ps: -2.3

Test No.: APR 11 1988 Barometric Pressure: 28.65

	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec	Point	Vel. Head H_2O"	Temp. °F	Velocity ft/sec
0.5	1	.90	65	64.61	1	.55	67	62.91				
1.5	2	.90	65	64.61	2	1.0	67	68.24				
2.6	3	.45	65	45.69	3	1.05	67	69.92				
3.9	4	.55	65	50.51	4	1.05	67	69.92				
5.5	5	.65	64	54.86	5	1.0	66	68.17				
7.8	6	.65	64	54.86	6	.75	66	59.04				
14.2	7	.65	64	54.86	7	.50	66	48.20				
16.5	8	.50	64	48.11	8	1.0	66	68.17				
18.1	9	.45	64	54.86	9	1.05	66	69.85				
19.4	10	.65	64	54.86	10	1.10	66	71.50				
20.5	11	.65	64	54.86	11	1.05	66	69.85				
21.5	12	.85	64	62.73	12	.95	67	66.51				

LEAK CHECK
PRE ✓ POST ✓

EQUIPMENT IDENTIFICATION
MAGNEHELIC PD 2 (2")
MICROMITE C

A. AVERAGE VELOCITY (TRAVERSE) ft/sec: $(60.72 \times \overset{0.7}{(\cos 45°)}) = 42.94$

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec _____

C. AVERAGE VELOCITY (REFERENCE PT.) ft/sec _____

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR S'std 1.0

F. GAS DENSITY CORRECTION FACTOR 1.003

G. CORRECTED VELOCITY, AxExF, ft/sec 43.07
or, AxDxExF, ft/sec _____

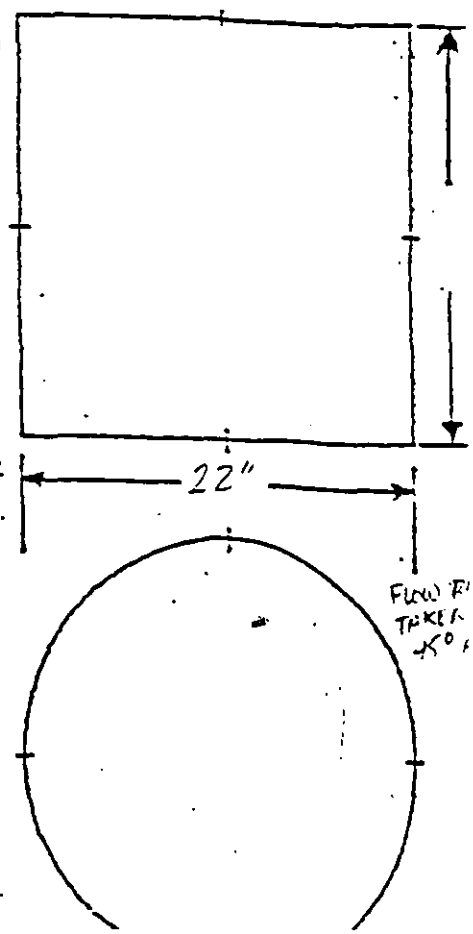
H. AREA OF FLUE, SQ. FT. 2.64

J. AVERAGE FLUE TEMPERATURE, °F 65.38

K. FLOW RATE, G x H x 60, CFM 6,822

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM 6,432

M. FLOW RATE, L x $\overset{0.9758}{\text{MOISTURE}}$ CORR., DSCFM 6,290



TRUESDAIL LABORATORIES, INC. COPY Date: 2/24/88 APR 11 19..

Sampling Location: INTERMETRO-OUTLET Barometric Pressure: 28.65

Test No. Nozzle Diameter: 3/16" - 5mm

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
1025	052.55	.48	68	—	2	.71			
1040	62.82	.50	72	45	2	.71			
1055	73.45	.52	79	50	3	.73			
1110	84.40	.55	82	49	4	.75			
1125	95.40	.52	83	48	5	.73			
1140	106.40	.45	83	47	6	.64			
1155	116.60	.30	82	48	7	.50			
1210	125.20	.52	94	49	8	.73			
1225	135.20	.55	86	49	9	.75			
1240	146.20	.55	97	49-	10	.77			
1255	156.[illegible]	.52	89	48	11	.75			
1310	167.30	.52	90	47	11	.73			
1320	179.06		—	48					

Weight Collected, grams

Meter I.D. 003

Leak Ckeck CFM

PRE- ✓

POST- ✓

A. Total Weight _____

B. Condensate Volume, ml. _____

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. _____

D. Total Sample Volume, Vm + C, cu. ft. _____

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9}$ x Moisture corr., DSCF _____

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

KB **TRUESDAIL LABORATORIES, INC.** COPY Date: 2/24/88 APR 11 1988

Sampling Location: INTERMETRO - OUTLET Barometric Pressure: 29.65

Test No. Nozzle Diameter: 3/16" - 5mm

Time	Gas Meter Reading cu. ft. Vm	Gas Meter Press. in. H_2O Pm	Gas Meter Temp. °F Tm	Impinger Temp. °F Ti	Sample Point	CFM			
1334	179.06	.43	86	—	2	.68			
1349	189.26	.43	86	46	2	.68			
1404	199.46	.25	86	47	3	.48			
1419	206.66	.25	85	48	4	.53			
1434	214.61	.27	84	45	5	.57			
1449	222.50	.27	84	45	6	.57			
1504	230.50	.27	86	45	7	.57			
1519	238.50	.27	84	46	8	.50			
1534	246.70	.33	86	47	9	.57			
1549	255.50	.35	85	47	10	.57			
1604	264.36	.35	85	47	11	.57			
1619	273.41	.35	83	45	11	.57			
1634	280.45	—	—	45					
	279.90	0.41	84	47					

Weight Collected, grams

Meter I.D. ~~DGT~~ 3 K = 0.99
Leak Ckeck CFM MC = 0.91
PRE- ✓
POST- ✓

M 332 ml
248 ml

A. Total Weight _____

B. Condensate Volume, ml. 48 ml

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + Tm}{B.P + Pm/13.6} \times B$, cu. ft. 2.43

D. Total Sample Volume, Vm + C, cu. ft. 232.3

E. Sample Volume, $D \times \frac{520}{460 + Tm} \times \frac{B.P. + Pm/13.6}{29.9} \times$ Moisture corr. 0.9770, DSCF 208.33

F. Concentration, 15.43 x A/E, grains/DSCF _____

G. Stack Gas Flow Rate, DSCFM _____

H. Emissions, 60 x G x F/7000, lbs/hr _____

TRUESDAIL LABORATORIES, INC. COPY APR 11 1988

Sampling Station INTERMETRO - OUTLET Date 2/24/88

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, in. Hg. (absolute) 28.68

B. Vapor pressure of water at impinger temp., in. Hg. 0.3240

C. Volume of metered gas, cu. ft. 229.90

D. Volume of water vapor metered, B X C/A, cu. ft. 2.60

E. Volume of water vapor condensed, cu. ft. 2.43

F. Total volume water vapor in gas sample, D + E, cu. ft. 5.03

G. Total volume of gas sample, C + E, cu. ft. 232.33

H. Percent water vapor in sampled gas, 100 x F/G 2.2

GAS DENSITY CORRECTION FACTOR

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.022	1.0	18.0	0.396
Carbon Dioxide	Dry Basis	0.9780	44.0	
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.21 Dry Basis	0.9780	32.0	6.572
Nitrogen & Inerts	.79 Dry Basis	0.9780	28.2	21.788
		Average Molecular Weight		28.756

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.9933

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.003

COPY

APR 11 1

INTERMETRO

INLET

TOTAL CHROME - 229.72 DSCF = 6.508 m

$$23.91 \frac{mg}{\ell} \times 0.300\ell \times \frac{1mm}{52mg} \times \frac{23.7 m\ell}{1mm} \times \frac{1000\mu l}{1m\ell} \times \frac{1DSCF}{28.3\ell} \times \frac{}{22}$$

$$= 0.503 \text{ PPM} = 1.10 \ mg/m^3$$

$$\frac{LBS}{HR} = \frac{0.503 \text{ PPM} \times 52 \times 60 \times 5.299}{379,000,000} = 2.19 \times 10^{-2} \frac{LBS}{HR} \ C_{TO}$$

HEXAVALENT CHROME

$$20.50 \frac{mg}{\ell} \times 0.300\ell \times \frac{1mm}{52mg} \times \frac{23.7 m\ell}{1mm} \times \frac{1000\mu l}{1m\ell} \times \frac{1DSCF}{28.3\ell} =$$

$$= 0.431 \text{ PPM } \mu g/\ell$$

$$= 0.945 \ mg/m^3$$

$$\frac{LBS}{HR} = \frac{0.431 \times 52 \times 60 \times 5.299}{379,000,000} = 1.88 \times 10^{-2} \frac{LBS}{HR} \ C_F$$

APR 11 1988

COPY

INTERMETRO

OUTLET

TOTAL

208.33 DSCF = 5.90 m³

$$0.07 - \underset{(BLANK)}{0.03} = 0.04 \frac{mg}{\ell}$$

$$= 0.04 \frac{mg}{\ell} \times 0.332 \times \frac{1\,mm}{52\,mg} \times \frac{23.7\,m\ell}{1\,mm} \times \frac{1000\,\mu\ell}{1\,m\ell} \times \frac{1\,DSCF}{28.3\,\ell} \times \frac{1}{20}$$

$$= 0.001 \text{ PPM} = 0.0023 \text{ mg/m}^3$$

$$\frac{LBS}{HR} = \frac{0.001 \times 52 \times 60 \times 6.290}{379,000,000} = 0.5 \times 10^{-4} \frac{LBS}{HR} \text{ CR TOTAL}$$

HEXAVALENT

$$< 0.01 \frac{mg}{\ell}$$

$$= 0.01 \frac{mg}{\ell} \times 0.332 \times \frac{1\,mm}{52\,mg} \times \frac{23.7\,m\ell}{1\,mm} \times \frac{1000\,\mu\ell}{1\,m\ell} \times \frac{1\,DSCF}{28.3\,\ell} \times \frac{1}{20}$$

$$= < 0.0003 \text{ PPM}$$

$$= < 0.0006 \text{ mg/m}^3$$

$$\frac{LBS}{HR} = \frac{0.0003 \text{ PPM} \times 52 \times 60 \times 6.290}{379,000,000} = < 1.55 \times 10^{-5} \frac{LBS}{HR} \text{ HEX}$$

COPY APR 11 1988

METER CALIBRATION

12/29/87 METER #003 RUN 1

CBP: 30.02

WET: 12.208
DRY: 12.277
dY: 0.994

WET TEST #1 DRY TEST #1

VOL	dP	T in C	CFM	VOL	dP	T in F
0.000	**********		0.30	50.43	**********	
1.000	0.08	15.9		51.41	0.10	52
2.000	0.08	15.9		52.38	0.10	52
3.000	0.08	15.9		53.37	0.10	52
4.000	0.08	15.9		54.35	0.10	53
4.000	**********		0.49	55.34	**********	
5.000	0.17	15.9		55.34	0.27	53
6.000	0.17	15.9		56.34	0.28	53
7.000	0.17	15.9		57.34	0.28	53
8.000	0.17	15.9		58.32	0.28	53
8.000	**********		0.69	59.32	**********	
9.000	0.28	15.9		59.32	0.52	53
10.000	0.28	15.9		60.32	0.52	54
11.000	0.28	15.9		61.32	0.52	54
12.000	0.28	15.9		62.31	0.52	54
0.001	**********				**********	
12.001	0.16	15.9		11.88	0.30	53
		61.0 in F				

CALCULATION:

$$\text{WET, SCF: } 12.001 * \frac{528}{521} * \left(\frac{30.02 + 0.16 / 13.6}{29.92}\right) = 12.208$$

$$\text{DRY, SCF: } 11.880 * \frac{528}{513} * \left(\frac{30.02 + 0.30 / 13.6}{29.92}\right) = 12.277$$

APR 11 1988

COPY

METER CALIBRATION

12/29/87 METER #003 RUN 2

CBP: 30.04
T in F: 71

WET: 12.217
DRY: 12.235
dY: 0.999

WET TEST #2

VOL	dP	T in C	CFM
0.000	**********		0.31
1.000	0.08	15.9	
2.000	0.08	16.0	
3.000	0.08	16.0	
4.000	0.08	16.0	
4.000	**********		0.52
5.000	0.17	16.0	
6.000	0.17	16.0	
7.000	0.17	16.0	
8.000	0.17	16.0	
8.000	**********		0.70
9.000	0.28	16.0	
10.000	0.28	16.0	
11.000	0.28	16.0	
12.000	0.28	16.0	
0.002	**********		
12.002	0.16	16.0	
		61.0 in F	

DRY TEST #2

VOL	dP	T in F
62.31	**********	
63.30	0.10	55
64.29	0.10	55
65.27	0.10	55
66.24	0.10	55
67.24	**********	
67.24	0.28	55
68.24	0.28	55
69.23	0.28	56
70.21	0.28	56
71.21	**********	
71.21	0.53	56
72.21	0.53	56
73.22	0.53	56
74.21	0.53	56
	**********	
11.90	0.3	56

CALCULATION:

$$\text{WET, SCF: } 12.002 * \frac{528}{521} * \left(\frac{30.04 + 0.16 / 13.6}{29.92}\right) = 12.217$$

$$\text{DRY, SCF: } 11.900 * \frac{528}{516} * \left(\frac{30.04 + 0.30 / 13.6}{29.92}\right) = 12.235$$

APR 11 1988

COPY

METER CALIBRATION

12/29/87 METER #010 RUN 1

CBP: 29.96
T in F: 72

WET, SCF: 12.182
DRY, SCF: 12.073
dY: 1.009

WET TEST #1

VOL	dP	T in C	CFM
0.000	**********		0.28
1.000	0.06	16.3	
2.000	0.06	16.3	
3.000	0.06	16.3	
4.000	0.06	16.3	
4.000	**********		0.50
5.000	0.14	16.3	
6.000	0.14	16.3	
7.000	0.14	16.3	
8.000	0.14	16.3	
8.000	**********		0.68
9.000	0.23	16.3	
10.000	0.23	16.2	
11.000	0.24	16.2	
12.000	0.24	16.1	
0.000	**********		
12.000	0.15	16.3	

61 in F

DRY TEST #1

VOL	dP	T in F
29.57	**********	
30.55	0.10	58
31.53	0.10	58
32.51	0.10	58
33.50	0.10	58
34.47	**********	
34.47	0.29	58
35.46	0.29	58
36.45	0.29	57
37.42	0.29	57
38.42	**********	
38.42	0.55	57
39.41	0.54	57
40.40	0.54	57
41.39	0.54	57
	**********	
11.82	0.31	58

CALCULATION:

$$\text{WET, SCF: } 12.000 * \frac{528}{521} * \left(\frac{29.96 + 0.15 / 13.6}{29.92}\right) = 12.182$$

$$\text{DRY, SCF: } 11.820 * \frac{528}{518} * \left(\frac{29.96 + 0.31 / 13.6}{29.92}\right) = 12.073$$

APR 11 1988

COPY

METER CALIBRATION

12/29/87 METER #010 RUN 2

CBP: 29.96
T in F:

WET, SCF: 12.184
DRY, SCF: 12.046
dY: 1.011

WET TEST #2

VOL	dP	T in C	CFM
0.000	**********		0.30
1.000	0.06	16.0	
2.000	0.06	16.0	
3.000	0.06	15.9	
4.000	0.06	15.9	
4.000	**********		0.51
5.000	0.15	15.9	
6.000	0.15	15.9	
7.000	0.15	15.9	
8.000	0.15	15.9	
8.000	**********		0.68
9.000	0.24	15.9	
10.000	0.24	15.9	
11.000	0.24	15.9	
12.000	0.24	15.9	
0.002	**********		
12.002	0.15	15.9	
		61.0 in F	

DRY TEST #2

VOL	dP	T in F
41.39	**********	
42.36	0.10	56
43.35	0.10	56
44.33	0.10	56
45.30	0.10	56
46.28	**********	
46.28	0.30	56
47.26	0.30	57
48.24	0.30	57
49.21	0.30	57
50.20	**********	
50.20	0.55	57
51.19	0.55	58
52.17	0.55	58
53.16	0.55	58
	**********	
11.77	0.32	57

CALCULATION:

$$\text{WET, SCF: } 12.002 * \frac{528}{521} * \left(\frac{29.96 + 0.15 / 13.6}{29.92}\right) = 12.184$$

$$\text{DRY, SCF: } 11.770 * \frac{528}{517} * \left(\frac{29.96 + 0.32 / 13.6}{29.92}\right) = 12.046$$

APR 11 1988

MICROMITE CALIBRATION

COPY

DATE: 3/16/88

	LOW		MED		HIGH	
MICRO	MICRO	THERM	MICRO	THERM	MICRO	THERM
A	32 F	32 F	71 F	72 F	211 F	100 C - 212 F
B	31	32	71	72	212	101 - 213.8
C	32	32	72	72	212	101 - 213.8
D	32	32	71	72	211	100 - 212

ICE WATER AMBIENT AIR BOILING WATER

(THERMOMETER #280-6, #280-4)

APR 11 1988

COPY

MAGNEHELIC CALIBRATION

DATE: 3/16/88

MAGY. #	LOW		MED		HIGH	
	MAGY.	MICRO.	MAGY.	MICRO.	MAGY.	MICRO.
1/4" - GW92	0.042	0.042	0.112	0.108	0.225	0.216
1/2" - AG44	0.050	0.044	0.250	0.244	0.450	0.434
1/2" - AM78	0.055	0.057	0.248	0.248	0.472	0.470
1" - AM112	0.125	0.124	0.525	0.526	0.895	0.894
1" - NH125	0.095	0.092	0.520	0.522	0.900	0.902
1" - PM283	0.090	0.082	0.500	0.499	0.890	0.892
2" - PM2	0.250	0.254	1.000	1.034	1.750	1.754
2" - M28	0.350	0.332	1.000	1.006	1.750	1.722
2" - M28	0.245	0.246	1.000	1.042	1.750	1.796

(CALIBRATED WITH DWYER MICROTECTOR)