Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 56

Title: Inlet and Outlet Scrubber Serving Chrome Dip Tank, Particulate and Chromium Removal Efficiencies

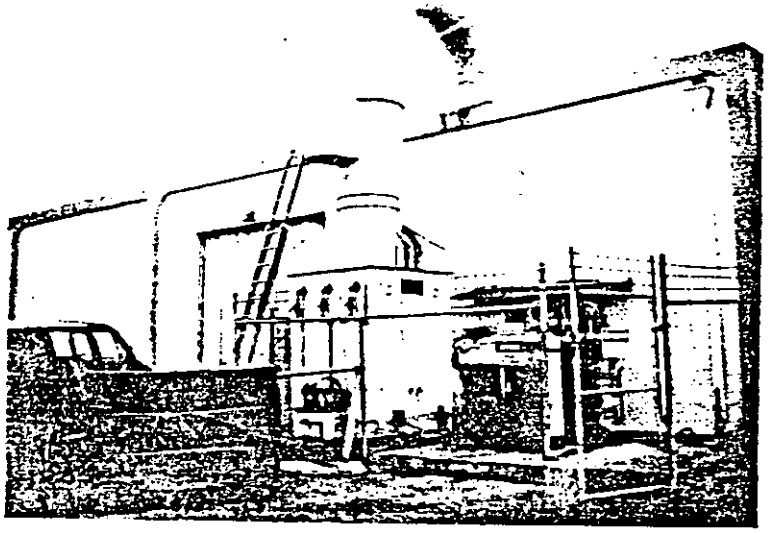
Truesdail Laboratories

April 1986

South Coast Air Quality Management District

Field Report Camera

APPL. NO.	INSPECTION DATE



B. JOHN ATAIAN
Air Quality Engineer

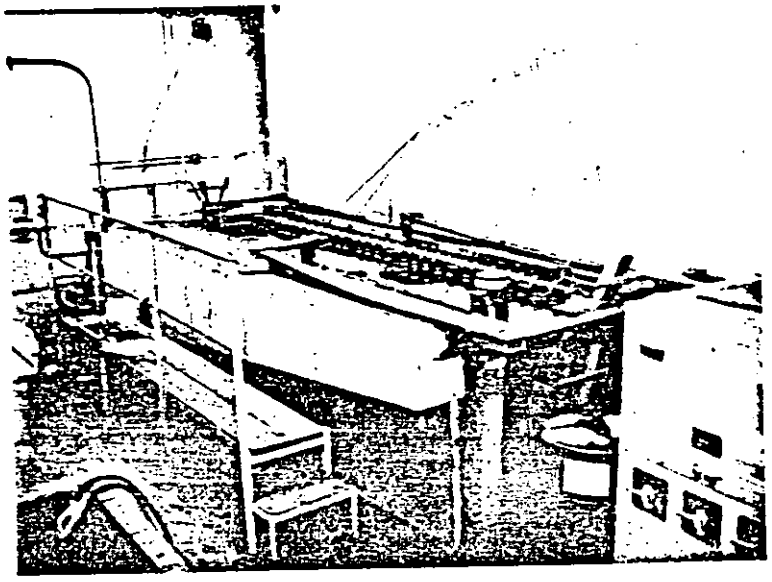
South Coast
Air Quality Management District
Engineering Division

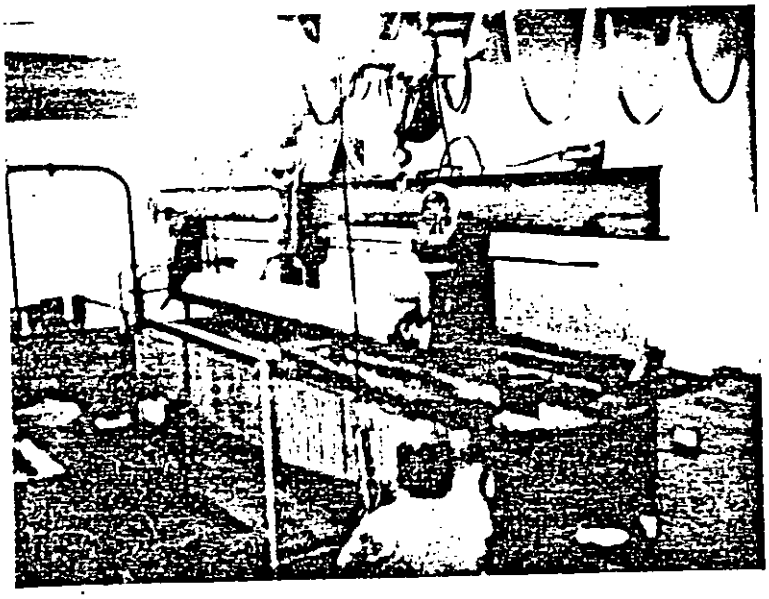
9150 Flair Drive
El Monte, CA 91731
(~~213~~) 572-6180

(BIG)

SCRUBBER IS LOCA. THIS WALL

CHROME TANK





DURING LOADING OF A ROLLER

EMISSION FACTOR DETERMINAION
HARD CROME PLATING TANK

REFERENCE: PAMARCO PACIFIC INC.,APPLICATION NO.133197
TRUESDAIL LAB. NO. 05789(FEB.6,1986)

BASIC EQUIPMENT DESIGN & OPERATING DATA:
TANK DIMENSIONS: 3'-8"W.X15'-0"LX3'-6"D.
OPERATING TEM.: 135 F
SOLUTION : 50 OZ/GAL CHROMIC ACID
APPLIED POWER : 6V/2300A
INTERNAL CONTROL: FLOATS
CONTROL EQUIPMENT DESIGN & OPERATING DATA:
EQUIPMENT : VERTICAL PACKED TYPED WET SCRUBBER WITH 9 NOZZLES, 5'-0"W. X 5'-0" L X 2'-0"H., PACKING & 10" MESH TYPE MIST ELIMINATOR.
TYPE OF PACKING : TRI-PACK NO.2
VELOCITY : 500 FT/MIN
SCRUBBER DIMENSIONS:5'-0"W.X5'-0"L.X8'-0"D.
EQUIVALENT DIAMETER:5'-5"
RECIRCULATION RATE: 100 GPM
GAL/1000CFM: 10
THE SCRUBBER SUMP CAPACITY IS 180GALLONS.
90 GALLONS OF SCRUBBING SOLUTION IS SENT TO THE TANK ONCE DAY & A FRESH WATER IS ADDED TO THE SCRUBBER WITH NO OVERFLOW

EMISSION FACTOR (UNCONTROLLED):
SOLID PARTICULATES : (1.29 Lb/Hr)/(55 SQ.FT.)= 0.023 Lb/Hr-SQ.FT.
CHROMIUM : (0.009Lb/Hr)/(55 SQ.FT.)=0.00016Lb/Hr-SQ.FT.

EMISSION FACTOR (CONTROLLED)
SOLID PARTICULATES:(1.51Lb/Hr)/(55SQ.FT.)= 0.027Lb/Hr-SQ.FT.
CHROMIUM:(0.005LB/Hr)/(55SQ.FT.)= 0.000091Lb/Hr-SQ..FT.
PARTICULATE REMOVAL EFFICIENCY: (-17%)
CHROMIUM REMOVAL EFFICIENCY: 44.4%

RECEIVED ON 4/14/86
IT WAS HANDED TO ME BY MR. STOCKING

REPORT

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 Daloo Engineering
15222 Los Flores
La Mirada, CA. 90638
ATTN: Dale Stocking

DATE April 11, 1986

RECEIVED February 4, 1986

LABORATORY NO. 05789

SAMPLE Inlet and OUtlet of Scrubber Serving Chrome Dip Tank

P.O. NO. 0313

INVESTIGATION Particulate and Chromium Removal Efficiencies

RESULTS

On February 6, 1986 representatives of Truesdail Laboratories, Inc. conducted tests to determine the total particulate matter, total chromium (Cr^{+}), and hevalent chromium (Cr^{+6}) at the inlet and outlet of a scrubber serving the chrome dip tank at Pamarco Company in Orange, Calif.

The tests were conducted at both sampling locations ~~simultaneously~~ and the test period covered the entrance, exit, and 63-minute dip time of the part in the chrome tank. The scrubber discharged into a drum reservoir and sampling was conducted upstream of this point.

For each test location, the particulate matter was collected isokinetically for 3 minutes at each of 24 sampling points (12 on each diameter). The sampling train consisted of a glass probe connected with Teflon tubing to a set of Greenburg-Smith impingers charged with 200 mls of distilled water and followed by a glass fiber backup filter, a vacuum pump and a dry gas meter.

Impinger method

The flue gas flow rate was determined before the sampling traverse by measuring the average velocity head with either an S-type or a Standard Pitot tube and a Magnehelic differential pressure gage, and by measuring the average temperature with a Chromel-Alumel thermocouple and a Micromite potentiometer.

The particulate collections were filtered through their respective backup filters and aliquots of the filtrates were analyzed for total chromium by atomic absorption. The remaining filtrate portions were evaporated to dryness at 100°C and all sample residues were desiccated to a constant weight. No analysis for hexavalent chromium was made because the detection limit for this method was higher than the amount analyzed as total Cr^{+}.

The location of the sampling holes at the scrubber inlet did not meet minimum requirements for velocity measurements. The velocity measurements obtained at this location were used only for isokinetic sampling rates. The flow rates calculated from these measurements disagreed with those of the outlet. Since the outlet location was the less turbulent of the two, allemission rates were calculated from outlet flow rates.

The results were as follows:

PAMARCO
2-6-86

Flue Gas	Scrubber Inlet	Scrubber Outlet
Temperature, °F	68	61
Static Pressure, In. H_2O	-1.4	-0.01
Velocity, Ft/Sec	34.7	27.5
Flue Dimensions, in.	21 x 36	30
Flue Area, sq. ft.	5.25	4.91
Flow Rate, ACFM	(10,900)	8110
, SCFM	(10,800)	8050
, DSCFM	(10,700)	7900 -
Moisture, % by Vol.	1.3	1.9
Saturation, % by vol.	2.3	1.8
Particulate Matter		
Collection, Grams		
Filter	0.0000	0.0001
Impingers	0.0489	0.0449
Total	0.0489	0.0450
Sample Volume, DSCF	39.50	31.07
Concentration, grains/DSCF	0.0191	0.0223
Emission Rate, lbs/hr	1.29*	1.51
Chromium (Cr^+), mg/m^3	0.30	0.18
, lbs/hr	0.009*	0.005
Particulate Removal, %	-17.1	
Chromium Removal, %	44.4	

* Calculated with Outlet Flow Rate.

Respectfully Submitted

TRUESDAIL LABORATORIES, INC.

S. Hugh Brown

S. Hugh Brown, Supervisor
Air Pollution Testing

HEXAVALENT

0.02 MG/DSCM ~~METHOD~~

APPENDIX

Sampling Location: Dalco Inlet — Static Pressure, Ps: -1

Test No.: 3 — Barometric Pressure: 29.

	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
2.3	17	0		0	9	.04	66	11.10	1	.90	66	17.54
6.2	18	.34	67	32.38	10	.52	67	40.04	2	.66	67	45.11
11.3	19	.65	67	44.77	11	.80	67	49.67	3	.86	68	51.54
15.8	20	.50	68	39.30	12	.8	68	49.71	4	.95	68	54.17
20.3	21	.45	68	37.29	13	1.0	68	55.58	5	.90	68	52.73
24.8	22	.50	68	39.30	14	1.0	68	55.58	6	.40	68	35.15
29.2	23	.62	68	43.76	15	.50	68	39.30	7	.08	68	15.7
33.8	24	.15	68	21.53	16	.0		0	8	0		0

Excellent

A. AVERAGE VELOCITY (TRAVERSE) ft/sec 34.64

B. REFERENCE POINT VELOCITY (TRAVERSE) ft/sec

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

D. FLUE FACTOR C/B

E. PITOT TUBE CORRECTION FACTOR 0.83

F. GAS DENSITY CORRECTION FACTOR 1.001

G. CORRECTED VELOCITY, AxExF, ft/sec 34.67
or, AxDxExF, ft/sec

H. AREA OF FLUE, SQ. FT. 5.25

J. AVERAGE FLUE TEMPERATURE, °F 68

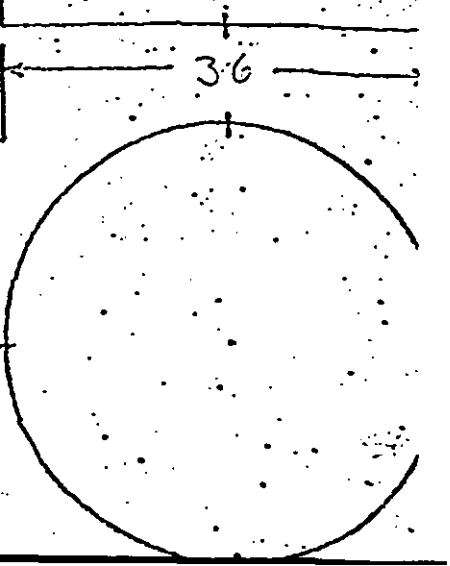
K. FLOW RATE, G x H x 60, CFM 10921

L. FLOW RATE, $K \times \frac{520}{460 + J} \times \frac{BP + Ps/13.6}{29.9}$, SCFM 10842
519

M. FLOW RATE, L x MOISTURE CORR., DSCFM 10701
0.977

4.5
K=.767
.0388

36



Sampling Location: DALCO

Static Pressure, Ps: −0.

Test No.: Outlet

Barometric Pressure: 29.

	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
0.6	1	0.14	60	24.82				0.20	61	29.70		
2.6	2	0.15	61	25.72				0.20	61	29.70		
3.5	3	0.16	61	26.56				0.20	61	29.70		
5.3	4	0.17	61	27.38				0.20	61	29.70		
7.5	5	0.17	61	27.38				0.20	61	29.70		
10.7	6	0.17	61	27.38				0.18	61	28.17		
19.3	7	0.17	61	27.38				0.17	61	27.38		
22.5	8	0.17	61	27.38				0.16	61	26.56		
24.7	9	0.17	61	27.38				0.16	61	26.56		
26.5	10	0.17	61	27.38				0.16	61	26.56		
28.0	11	0.17	61	27.38				0.16	61	26.56		
29.1	12	0.15	61	25.72				0.15	61	25.72		

A. AVERAGE VELOCITY (TRAVERSE) ft/sec Enclosed 27.48

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

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

D. FLUE FACTOR C/B _____

E. PITOT TUBE CORRECTION FACTOR STD 1.0

F. GAS DENSITY CORRECTION FACTOR 1.002

G. CORRECTED VELOCITY, AxExF, ft/sec 27.53
or, AxDxExF, ft/sec _____

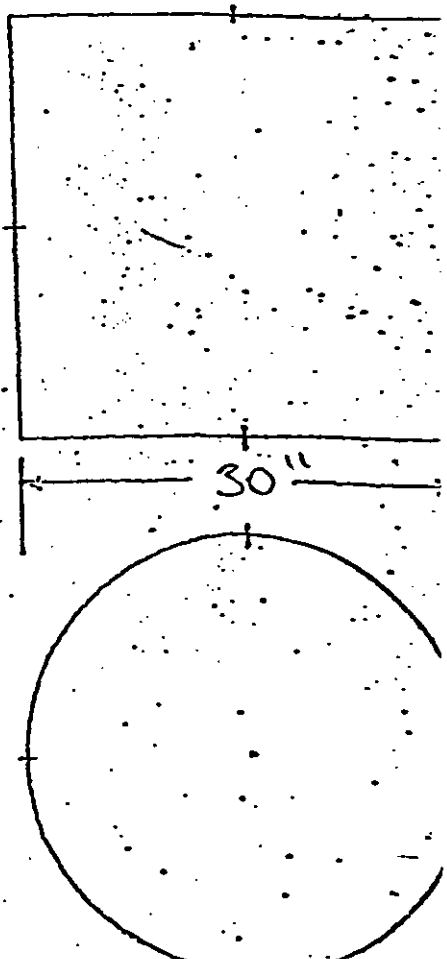
H. AREA OF FLUE, SQ. FT. 4.91

J. AVERAGE FLUE TEMPERATURE, °F 61

K. FLOW RATE, G x H x 60, CFM 8109

L. FLOW RATE, K x $\frac{520}{460 + J}$ x $\frac{BP + Ps/13.6}{29.9}$, SCFM 8050

M. FLOW RATE, L x MOISTURE CORR., DSCFM 7900
0.9814



TRUESDAIL LABORATORIES, INC.

Lab. No. _____

EPA FIELD TEST DATA

Plant Dalco chrome

Sampling Station Inlet

Date 2-6-86

Flue Dimensions 36"X21"

Test No. _____

Amb. Temp., °F _____

Bar. Pressure, In. Hg 29.73

Stack Pressure, In. H_2O -1.4

Sampling Nozzle Diam., In. .225

Pf .83

K = .7672

Sampling Apparatus No.: STO .0388

Trav. Point No.	Sampling Time	Sample Volume, Cu. Ft.	Vel. Head $\sqrt{Ps}$	Orifice ΔH In.H_2O	TEMPERATURE, °F					
					Stack	Probe CFM	Oven	Impinger Inlet	Impinger Outlet	Gas Meter
1	10:36	5.16	.01	.05	66	.28			40	64
2	10:39	5.90	.61	.50	67	.72				64
3	10:42	7.90	.86	.72	68	.82				64
4	10:45	10.50	.95	.75	68	.86			43	64
5	10:48	13.05	.90	.72	68	.84				65
6	10:51	15.60	.40	.27	68	.56				65
7	10:54	17.48	.09	.015	68	.25			45	66
8	10:57	18.28	0							
start		18.28								
9	11:01	18.28	.04	.04	66	.18			40	66
10	11:04	18.99	.52	.44	67	.64				66
11	11:07	20.92	.80	.66	67	.80				67
12	11:10	23.36	.80	.66	69	.80			43	67
13	11:13	25.90	1.0	.82	69	.84				68
14	11:16	28.50	1.0	.87	68	.84				68
15	11:19	31.20	.50	.43	68	.63			43	69
16	11:21	33.14	0							
	11:24	33.14								
17	11:24	33.14	0							
18	11:27	33.14	.34	.20	67	.52			40	69
19	11:30	34.90	.65	.52	67	.72				70
20	11:33	36.90	.50	.42	68	.63			43	70
21	11:36	38.76	.45	.40	69	.60				70
23	11:39	40.60	.50	.42	69	.63				70
23	11:42	42.52	.67	.54	69	.71			45	71
24	11:45	44.70	.15	.10	68	.25				71
	11:48	45.77								
TOTAL		40.61								
AVG.			0.62	.46	68				43	67

Operator(s) CF

3m/cond

TRUESDAIL LABORATORIES, INC.

Date: 2-6-86

Sampling Location: DALCO - INLET

Barometric Pressure: 29.73

Test No. INLET

Nozzle Diameter: 0.225

Time	Gas Meter			Impinger Temp °F T_i	Sample Point				
	Reading cu.ft. V_m	Press. "H_2O P_m	Temp. °F T_m						
	40.61	046	67	43					

Weight Collected, grams

A. Total Weight .0489

B. Condensate Volume, ml. 3

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. 0.14

D. Total Sample Volume, $V_m + C$, cu. ft. 40.75

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr. .987, DSCF 39.50 / m^3 1.12

F. Concentration, 15.43 x A/E, grains/DSCF 0.0191

G. Stack Gas Flow Rate, DSCFM 10701

H. Emissions, 60 x G x F/7000, lbs/hr 1.75

cn + 0.30 mg/m3

TRUESDAIL LABORATORIES, INC.

Sampling Station DALCO - INLET Date 2-6-86

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 29.76

B. Vapor pressure of water at impinger temp., In. Hg. 0.2782

C. Volume of metered gas, Cu. Ft. 40.61

D. Volume of water vapor metered, B X C/A, Cu. Ft. 0.38

E. Volume of water vapor condensed, Cu. Ft. 0.14

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. 0.52

G. Total volume of gas sample, C+E, Cu. Ft. 40.75

H. Percent water vapor in sampled gas, 100 X F/G 1.3

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	0.013	1.0	18.0	0.234
Carbon Dioxide	0.004 Dry Basis	0.987	44.0	0.174
Carbon Monoxide	— Dry Basis		28.0	—
Oxygen	0.210 Dry Basis		32.0	6.633
Nitrogen & Inerts	0.786 Dry Basis		28.2	21.877
			Average Molecular Weight	28.918

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ = 0.9989

K. Gas density correction factor = $\sqrt{\frac{1.00}{J}}$ = 1.001

TRUESDAIL LABORATORIES, INC.

Date: 2/6/85

Sampling Location: DALCO

Barometric Pressure: 29.73

Test No. Outlet Port #1

Nozzle Diameter: 0.225

	Time	Gas Meter: Reading cu.ft. V_m	Gas Meter: Press. "H_2O P_m	Gas Meter: Temp. °F T_m	Impinger Temp °F T_i	cfm Sample Point	V_n	T_{st}		
0	10:39	15.60	0.15	63	34	0.40	0.14	60		
3	10:42	16.80	0.16	64	44	0.42	0.15	61		
6	10:45	18.06	0.18	64	45	0.43	0.16	61		
9	10:48	19.35	0.18	64	45	0.44	0.17	"		
12	10:51	20.67	0.20	65	"	0.44	0.17	"		
15	10:54	21.99	0.20	66	"	"	0.17	"		
18	10:57	23.31	0.20	66	"	"	0.17	"		
21	11:00	24.63	0.20	66	46	"	0.17	"		
24	11:03	25.95	"	"	"	"	0.17	"		
27	11:06	27.27	"	"	"	"	0.17	"		
30	11:09	28.59	"	"	"		0.17	"		
33	11:12	29.91	"	"	47	0.42	0.15	"		
36	11:15	31.15								
		32.04	.20	68	46					

K = 0.9228.

Weight Collected, grams .92

TNPF 00975

A. Total Weight 0.0450

B. Condensate Volume, ml. 6ml

C. Condensate Vapor Volume, $0.00267 \times \frac{460 + T_m}{B.P. + P_m/13.6} \times B$, cu. ft. (535) 0.28

D. Total Sample Volume, $V_m + C$, cu. ft. 32.32

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr. (.9814), DSCF / m^3 31.07 / 0.879

F. Concentration, 15.43 x A/E, grains/DSCF 0.0223

G. Stack Gas Flow Rate, DSCFM 7900

H. Emissions, 60 x G x F/7000, lbs/hr 1.51

Out 0.152 mg/

TRUESDAIL LABORATORIES, INC.

Date:

Sampling Location: DALCO

Barometric Pressure: 29.73

Test No. Outlet Port 2

Nozzle Diameter: 0.225

	Time	Gas Meter: Reading cu. ft. V_m	Gas Meter: Press. "H_2O P_m	Gas Meter: Temp. °F T_m	Impinger Temp °F T_i	CFM Sample Point	V_H	T_S		
0	11:20	31.15	0.25	70	47	0.49	0.20	61		
3	11:23	32.62	"	70	48	"	0.20	"		
6	11:26	34.09	"	70	48	"	0.20	"		
9	11:29	35.56	"	"	49	"	0.20	"		
12	11:32	37.03	"	"	50	"	0.20	"		
15	11:35	38.50	"	69	51	0.46	0.18	"		
18	11:38	39.88	0.22	69	50	0.45	0.17	"		
21	11:41	41.23	0.21	70	50	0.43	0.16	"		
24	11:44	42.52	0.17	70	48	"	0.16	"		
27	11:47	43.81	0.17	70	46	"	0.16	"		
30	11:50	45.10	0.17	71	46	"	0.16	"		
33	11:53	46.39	0.16	71	"	0.42	0.15	"		
36	11:56	47.64	"	"	"					

Weight Collected, grams Sheet 2

A. Total Weight

B. Condensate Volume, ml.

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

D. Total Sample Volume, $V_m + C$, cu. ft.

E. Sample Volume, $D \times \frac{520}{460 + T_m} \times \frac{B.P. + P_m/13.6}{29.9} \times$ Moisture corr., DSCF

F. Concentration, $15.43 \times A/E$, grains/DSCF

G. Stack Gas Flow Rate, DSCFM

H. Emissions, $60 \times G \times F/7000$, lbs/hr

TRUESDAIL LABORATORIES, INC.

Sampling Station Dalco Outlet Date 2-6-86

WATER VAPOR AND GAS DENSITY CALCULATIONS

Percent Water Vapor in Gases

A. Gas pressure at meter, In. Hg. (Absolute) 29.74

B. Vapor pressure of water at impinger temp., In. Hg. .30

C. Volume of metered gas, Cu. Ft. 32.04

D. Volume of water vapor metered, B X C/A, Cu. Ft. .32

E. Volume of water vapor condensed, Cu. Ft. .28

F. Total volume of water vapor in gas sample, D+E, Cu. Ft. = .60

G. Total volume of gas sample, C+E, Cu. Ft. 32.32

H. Percent water vapor in sampled gas, 100 X F/G 1.86

Gas Density Correction Factor

Component	Volume Percent/100	x Moisture Correction	x Mol. Wt.	= Wt./Mole Wet Basis
Water	.0186	1.0	18.0	.335
Carbon Dioxide	.004 Dry Basis	.9814	44.0	.1727
Carbon Monoxide	Dry Basis		28.0	
Oxygen	.210 Dry Basis		32.0	6.595
Nitrogen & Inerts	.786 Dry Basis		28.2	21.753
			Average Molecular Weight	28.86

J. Density of gas referred to air = $\frac{\text{Av. Mol. Wt.}}{28.95}$ .9967

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