U.S. Environmental Protection Agency
EMB Report 78-NHF-1

DRAFT

108

EMISSION TESTING

at an

AMMONIUM SULFATE MANUFACTURING PLANT

Facility B
8.4
BR ch.4 p 5

Dow-Badische, Inc.
Freeport, Texas
October 3 and 4, 1978

Prepared for the

U.S. Environmental Protection Agency
Emission Measurement Branch
Research Triangle Park, North Carolina 27711

Prepared by

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EMB REPORT NO. 78-NHF-1

Work Assignments 5 and 6

Contract No. 68-02-2817

November, 1978

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I. INTRODUCTION

The U.S. Environmental Protection Agency (EPA) retained Clayton Environmental Consultants, Inc. to perform a particulate and caprolactam emission study of the venturi scrubber at the Dow-Badische plant in Freeport, Texas. The objective of this study was to determine the mass loading rates and the mass control efficiency of the scrubber which controls emissions from the fluidized bed salt dryer. The results of this study will be used in research and development efforts for supporting national New Source Performance Standards. This study was commissioned as Project No. 78-NHF-1, Contract No. 68-02-2817, Work Assignments 5 and 6.

The testing program, conducted on October 3 and 4, 1978, included the following:

1) triplicate particulate samples acquired simultaneously at the inlet to and outlet of the venturi scrubber;
2) a single determination of the particle size distribution of the gas stream at the scrubber inlet;
3) moisture contents of six ammonium sulfate samples (three taken from the inlet and three from the outlet of the salt dryer);

4) three scrubber water samples to be analyzed for percent ammonium sulfate; and,

5) visible emission observations at the outlet of the venturi scrubber for the duration of each particulate sample run.

Auxiliary data included exhaust gas velocities, temperatures, and flowrates, as determined from the traverses.

Figures 1.1 and 1.2 present schematics of the process/control system layout as tested.

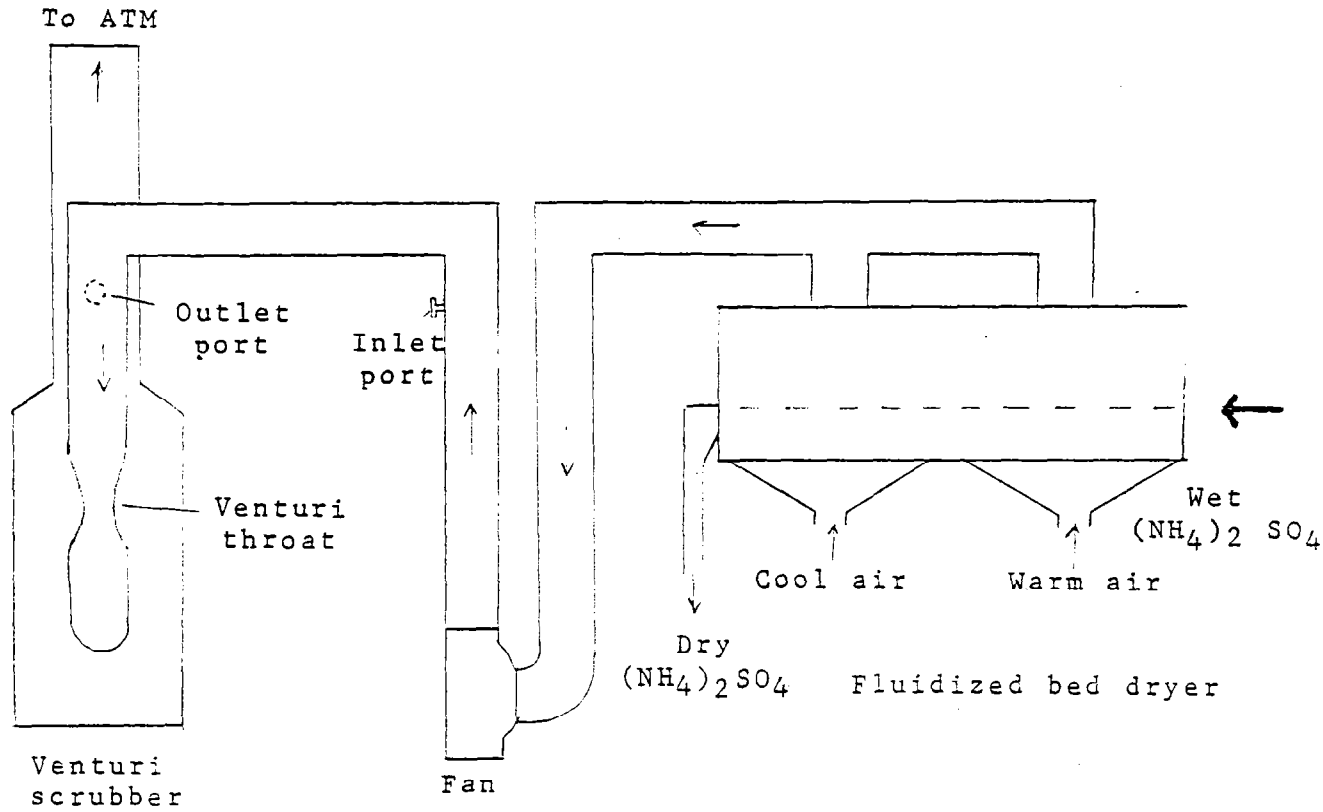


Figure 1.1. Fluidized bed dryer and control system

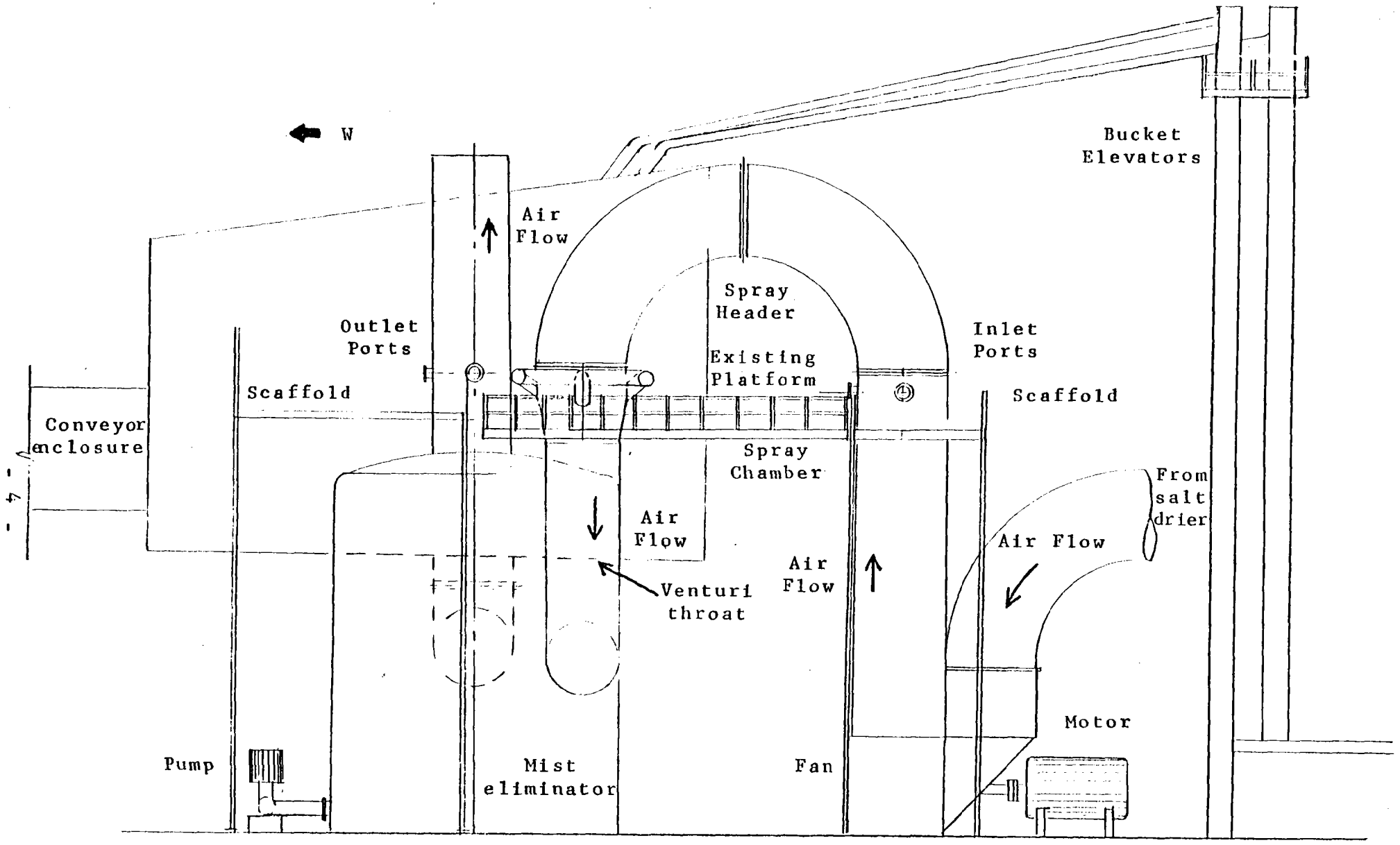


Figure 1.2. Control system schematic/sampling locations

II. SUMMARY AND DISCUSSION OF RESULTS

Particulate Emissions

Results of the particulate emission study are presented in Tables 2.1, 2.2,and 2.3. Tables 2.1 and 2.2 present the concentrations and emission rates for filterable and total particulate, respectively. Concentrations are expressed as grains per dry standard cubic foot (gr/DSCF) and metrically as milligrams per dry standard cubic meter (mg/DSM^3). Emission rates are expressed as pounds per hour (lb/hr) and metrically as kilograms per hour (kg/hr). Averages are presented for each sampling location. Table 2.3 presents the particulate removal efficiency of the venturi scrubber based on the total particulate emission rate. Removal efficiencies are expressed as a percent.

From Table 2.1, it is seen that the filterable concentrations at the inlet ranged from 16.5 to 17.7 gr/DSCF (37,700 to 40,400 mg/DSM^3) and averaged 17.2 gr/DSCF (39,400 mg/DSM^3). Concentrations at the outlet ranged from 0.008 to 0.032 gr/DSCF (19.1 to 74.1 mg/DSM^3) and averaged 0.019 gr/DSCF (44.1 mg/DSM^3). Emission rates at the inlet ranged from 5970 to 6440 lb/hr (2710 to 2920 kg/hr) and averaged 6270 lb/hr (2850 kg/hr). Emission rates at the outlet ranged from 3.58 to 14.2 lb/hr (1.63 to 6.42 kg/hr) and averaged 8.43 lb/hr (3.82 kg/hr). The data at both locations generally show good reproducibility.

Table 2.1. Summary of Filterable Particulate Concentrations and Emission Rates

Sampling Location	Sample No.	Stack Gas Conditions		Concentration		Emission Rate	
		Flowrate (DSCFM)	Temp. (°F)	(gr/DSCF)	(mg/DSM^3)	(lb/hr)	(kg/hr)
Inlet	P-1	43,000	182	17.5	40,000	6440	2920
	P-2	42,300	188	16.5	37,700	5970	2710
	P-3	42,300	188	17.7	40,400	6410	2910
Average		42,500	186	17.2	39,400	6270	2850
Outlet	P-1	51,100	105	0.017	39.2	7.50	3.40
	P-2	50,200	110	0.008	19.1	3.58	1.63
	P-3	51,000	104	0.032	74.1	14.2	6.42
Average		50,800	106	0.019	44.1	8.43	3,82

Total particulate concentrations and emission rates at the inlet (Table 2.2) were identical to those for the filterable particulate fraction at the same location. Concentrations averaged 17.2 gr/DSCF (39,400 mg/DSM^3) and emission rates averaged 6270 lb/hr (2850 kg/hr). Total concentrations at the outlet ranged from 0.010 to 0.036 gr/DSCF (22.0 to 82.4 mg/DSM^3) and averaged 0.021 gr/DSCF (48.7 mg/DSM^3). Total emission rates at the outlet ranged from 4.13 to 15.7 lb/hr (1.87 to 7.14 kg/hr) and averaged 9.26 lb/hr (4.21 kg/hr).

Table 2.3 presents the particulate removal efficiencies. The removal efficiency averaged 99.9 percent for the three tests.

Tables 2.4 and 2.5, respectively, present summaries of filterable and total Caprolactam concentrations and emission rates. Inlet filterable concentrations averaged 3.29 ppm (10,900 $\mu g/DSM^3$), while filterable emission rates averaged 2.46 lb/hr and 1.12 kg/hr. Outlet filterable concentrations averaged 0.201 ppm (948 $\mu g/DSM^3$), while filterable emission rates averaged 0.181 lb/hr (0.082 kg/hr).

Table 2.5 reveals that the majority of the Caprolactam in the gas stream was present in the vapor phase. Total concentrations at the inlet averaged 57.8 ppm (272,000 $\mu g/DSM^3$) and emission rates averaged 43.3 lb/hr (19.6 kg/hr). At the outlet, total concentrations averaged 6.92 ppm (32,600 $\mu g/DSM^3$ and emission rates averaged 6.20 lb/hr(2.81 kg/hr).

Table 2.2. Summary of Total Particulate Concentrations and Emission Rates

Sampling Location	Sample No.	Stack Gas Conditions		Concentration		Emission Rate	
		Flowrate (DSCFM)	Temp. (°F)	(gr/DSCF)	(mg/DSM^3)	(lb/hr)	(kg/hr)
Inlet	P-1	43,000	182	17.5	40,000	6440	2920
	P-2	42,300	188	16.5	37,700	5970	2710
	P-3	42,300	188	17.7	40,400	6410	2910
Average		42,500	186	17.2	39,400	6270	2850
Outlet	P-1	51,100	105	0.018	41.6	7.96	3.61
	P-2	50,200	110	0.010	22.0	4.13	1.87
	P-3	51,000	104	0.036	82.4	15.7	7.14
Average		50,800	106	0.021	48.7	9.26	4.21

Table 2.3 Particulate Removal Efficiency

1978 Sampling Date	Sample No.	Percent Removal Efficiency
10/3	P-1	99.9
10/4	P-2	99.9
10/4	P-3	99.8
Average		99.9

Table 2.4 Summary of Filterable Caprolactam Concentrations and Emission Rates

Sampling Location	Sample No.	Stack Gas Conditions		Concentration		Emission Rate	
		Flowrate (DSCFM)	Temp. (°F)	ppm	($\mu g/DSM^3$)	(lb/hr)	(kg/hr)
Inlet	P-1	43,000	182	1.90	8,960	1.44	0.655
	P-2	42,300	188	4.67	22,000	3.48	1.58
	P-3	42,300	188	< 0.350	<1,650	< 0.261	< 0.118
Average		42,500	186	3.29	10,900	2.46	1.12
Outlet	P-1	51,100	105	0.201	948	0.181	0.082
	P-2	50,200	110	< 0.257	<1,210	< 0.227	< 0.103
	P-3	51,000	104	< 0.277	<1,305	< 0.249	< 0.113
Average		50,800	106	0.201	948	0.181	0.082

Table 2.5 Summary of Total Caprolactam Concentrations and Emission Rates

Sampling Location	Sample No.	Stack Gas Conditions		Concentration		Emission Rate	
		Flowrate (DSCFM)	Temp. (°F)	ppm	($\mu g/DSM^3$)	(lb/hr)	(kg/hr)
Inlet	P-1	43,000	182	49.9	235,000	37.8	17.1
	P-2	42,300	188	60.3	284,000	45.0	20.4
	P-3	42,300	188	63.3	298,000	47.2	21.4
Average		42,500	186	57.8	272,000	43.3	19.6
Outlet	P-1	51,100	105	5.64	26,600	5.09	2.31
	P-2	50,200	110	6.89	32,500	6.10	2.77
	P-3	51,000	104	8.23	38,800	7.40	3.36
Average		50,800	106	6.92	32,600	6.20	2.81

Therefore, approximately 94.3 percent of the Caprolactam was in the vapor phase at the inlet and 97.1 percent was vapor at the outlet. Detailed summaries of the Caprolactam analyses (by GC methods) are presented in Appendix F.

The single sample taken at the scrubber inlet to determine particle size distribution resulted in the size distribution by weight data presented in Table 2.6. Virtually all particles sized were greater than 2.74 μm with about 99.3 percent of the material greater than 8.04 μm . The analyses showed that no material was captured on impactor stages 2 through 5.

The ammonium sulfate drier resulted in an average 91.8 percent reduction in moisture content of the ammonium sulfate material, from analyses of inlet and outlet samples (Appendix D). Analyses of the scrubber water samples (also presented in Appendix D) resulted in an average 356 gm/l concentration of ammonium sulfate.

Table 2.6 Particle Size Distribution

Brink Impactor Fraction	Characteristic Diameter of Particles (μ)	Weight (mg)	Size Distribution by Weight	
			Percent	Cumulative Percent
Cyclone	>8.04	289.2	99.3	100
Stage 1	2.74-8.04	2.0	0.7	0.7
Stage 2	1.62-2.74	<0.1	<0.1	<0.1
Stage 3	1.10-1.62	<0.1	<0.1	<0.1
Stage 4	0.58-1.10	<0.1	<0.1	<0.1
Stage 5	0.36-0.58	0.1	<0.1	<0.1
Back-Up Filter	<0.36	0.06	<0.1	<0.1
TOTAL		291.4	100	

III. PROCESS DESCRIPTION AND OPERATION

To be supplied by E.P.A.

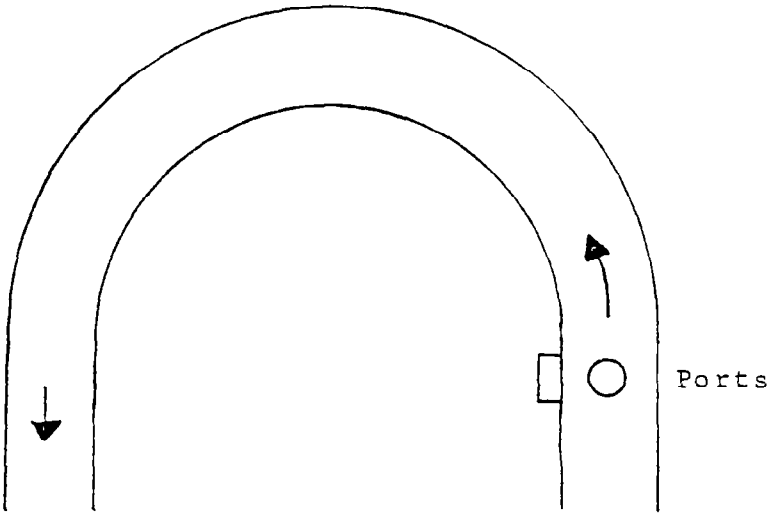
IV. LOCATION OF SAMPLING POINTS

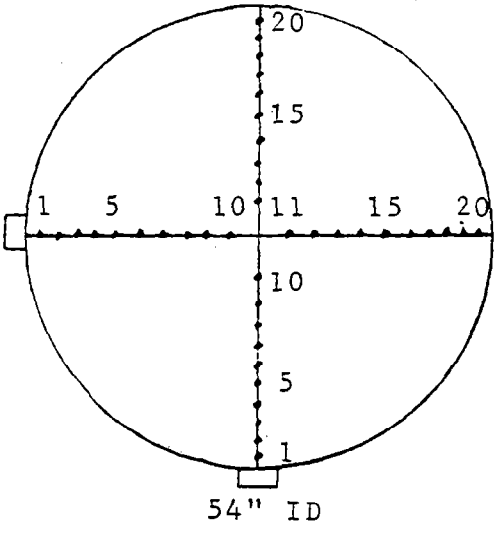
The inlet sampling location was a 54 inch (137.2 cm) I.D. duct leading from the ammonium sulfate dryer to the venturi scrubber. Two three-inch ports, facing west and south and approximately 45 feet (13.7 meters) above ground level, were accessed for sampling. This sampling location was approximately 7.8 duct diameters downstream from the fan and two duct diameters upstream from a 180 degree bend. The duct is represented schematically in Figure 1.2.

The scrubber outlet is a 54 inch (137.2 cm) duct with the sampling platform 45 feet (13.7 meters) above ground level. Two three-inch ports, facing west and south, were accessed for sampling. This sampling location was approximately two duct diameters downstream of the mist eliminator and approximately two duct diameters upstream from the outlet. This duct is also shown schematically in Figure 1.2.

Velocity pressures and temperatures were measured at 40 sampling points at both the inlet and outlet sampling locations. Figures 4.1 and 4.2 respectively, are diagrams of the inlet and outlet sampling locations showing each of the traverse points and their respective distances from the stack wall.

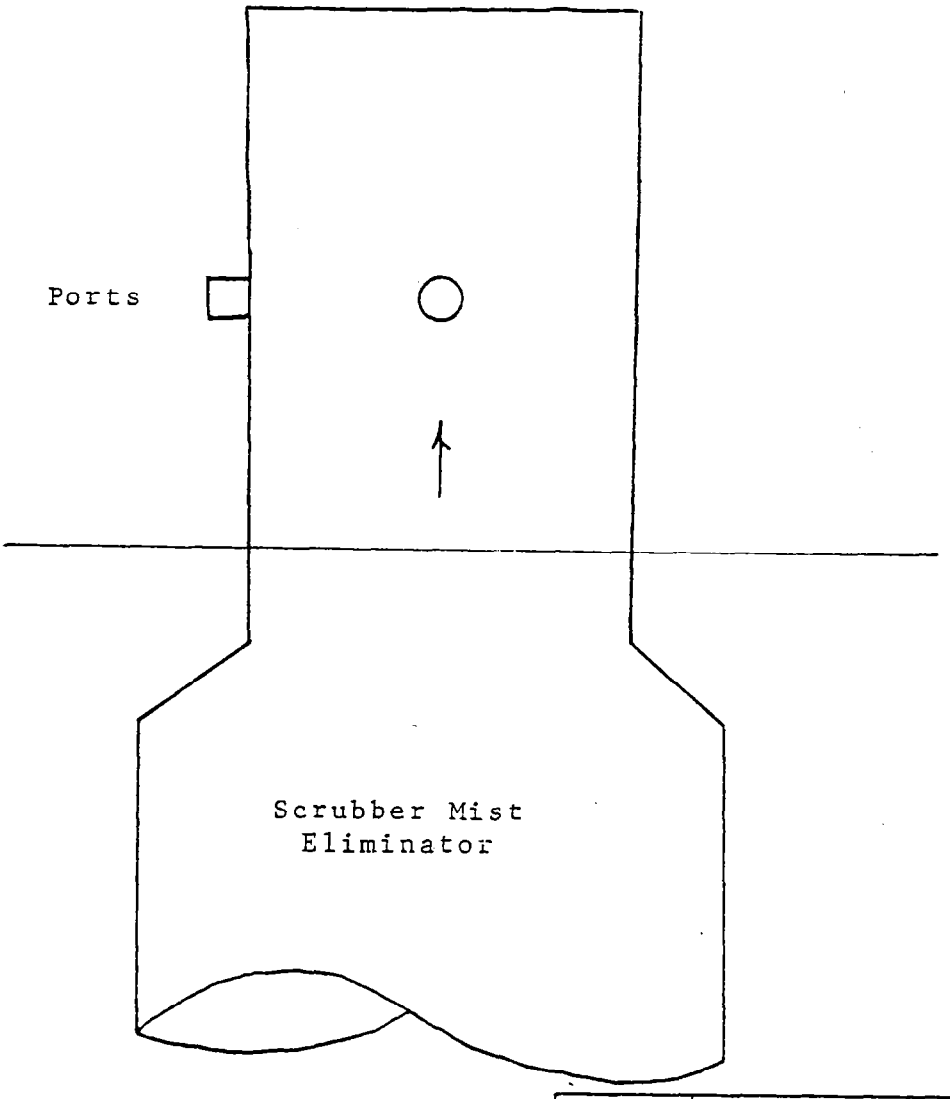
The ammonium sulfate samples, acquired at the inlet and outlet of the ammonium sulfate dryer, were taken by plant process engineers. Samples of the scrubber water effluent were acquired in the same manner.

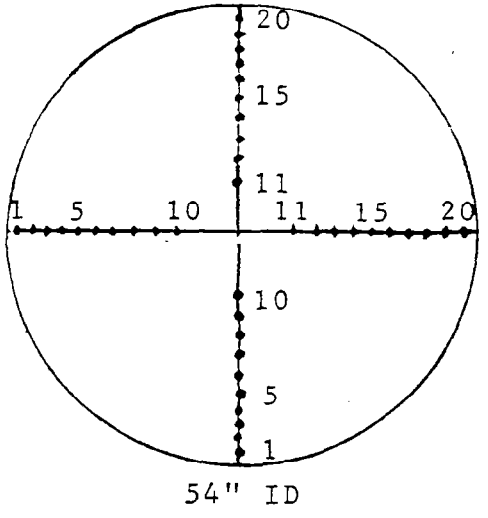




Points	Distance	
	(inches)	(centimeters)
1	0.7	1.78
2	2.1	5.33
3	3.6	9.14
4	5.2	13.2
5	7.0	17.8
6	8.9	22.6
7	11.0	27.9
8	13.5	34.3
9	16.5	41.9
10	21.0	53.3
11	33.0	83.8
12	37.5	95.2
13	40.5	103.
14	43.0	109.
15	45.1	115.
16	47.0	119.
17	48.8	124.
18	50.4	128.
19	51.9	132.
20	53.3	135.

Figure 4.1. Scrubber inlet port and sampling point locations





Points	Distance	
	(inches)	(centimeters)
1	0.7	1.78
2	2.1	5.33
3	3.6	9.14
4	5.2	13.2
5	7.0	17.8
6	8.9	22.6
7	11.0	27.9
8	13.5	34.3
9	16.5	41.9
10	21.0	53.3
11	33.0	83.8
12	37.5	95.2
13	40.5	103.
14	43.0	109.
15	45.1	115.
16	47.0	119.
17	48.8	124.
18	50.4	128.
19	51.9	132.
20	53.3	135.

Figure 4.2. Scrubber outlet port and sampling point locations

V. SAMPLING AND ANALYTICAL PROCEDURES

Particulate Emissions

Triplicate two hour particulate samples were extracted simultaneously from the inlet and outlet of the venturi scrubber system. Exhaust gases were withdrawn isokinetically for three minutes at each of 40 sampling points. During each test, the probe, Pitot-tube, and impinger assembly were moved to each sampling point, the velocity pressure and temperature of the exhaust gas were measured, and isokinetic sampling flow rates were adjusted accordingly using an orifice-type meter to indicate instantaneous flow rates. All field data sheets are included in Appendix B.

The sampling trains at both sites were checked for leaks before and after each test in accordance with the requirement that the initial leak rate shall not exceed 0.02 ft^3 per minute at 15 inches of mercury vacuum and the final leak rate shall not exceed 0.02 ft^3 per minute at the greatest vacuum occurring during the test.

At both locations, an EPA Method 5 sampling train was used. The sampling train consisted of a sharp, tapered, stainless steel sampling nozzle, a heated glass-lined probe, a heated pre-weighed 110 mm Type A glass-fiber filter, a modified Greenburg-Smith impinger containing 100 ml of distilled water, a standard Greenburg-Smith impinger containing 100 ml of distilled water, an empty modified Greenburg-Smith impinger, a modified Greenburg-Smith impinger containing approximately 300 grams of silica gel, a leakless pump with vacuum gauge, a calibrated dry gas meter equipped with

bimetallic inlet and outlet thermometers, and a calibrated orifice-type flow meter that was connected to a zero to ten inch range inclined (water gauge)manometer. At the scrubber inlet sampling location, a cyclone was inserted into the sampling train between the probe and the glass-fiber filter.

The impinger trains were immersed in an ice bath to maintain the temperature in the last impingers at 70°F or less. All of the sampling train glassware was connected by ground glass joints, sealed with stopcock grease, and clamped to prevent leakage. A calibrated S-type Pitot tube was connected to the sampling probe and velocity pressures were read on the inclined manometer. An iron-constantan (I/C) thermocouple, attached to the Pitot-probe assembly, was connected to a calibrated pyrometer. During the course of testing, the filter temperature was kept below 250°F, but greater than the stack temperature to prevent filter blinding. Schematic diagrams of the sampling trains used at the scrubber inlet and outlet locations are presented in Figures 5.1 and 5.2, respectively.

At the end of each 120 minute test period, the sampling train was transferred to a dust free clean-up area. The volumes of the impinger solutions were measured and volume increases recorded. The solutions were placed in glass sample bottles and sealed with Teflon®-lined caps. The silica gel was weighed to determine the weight gain

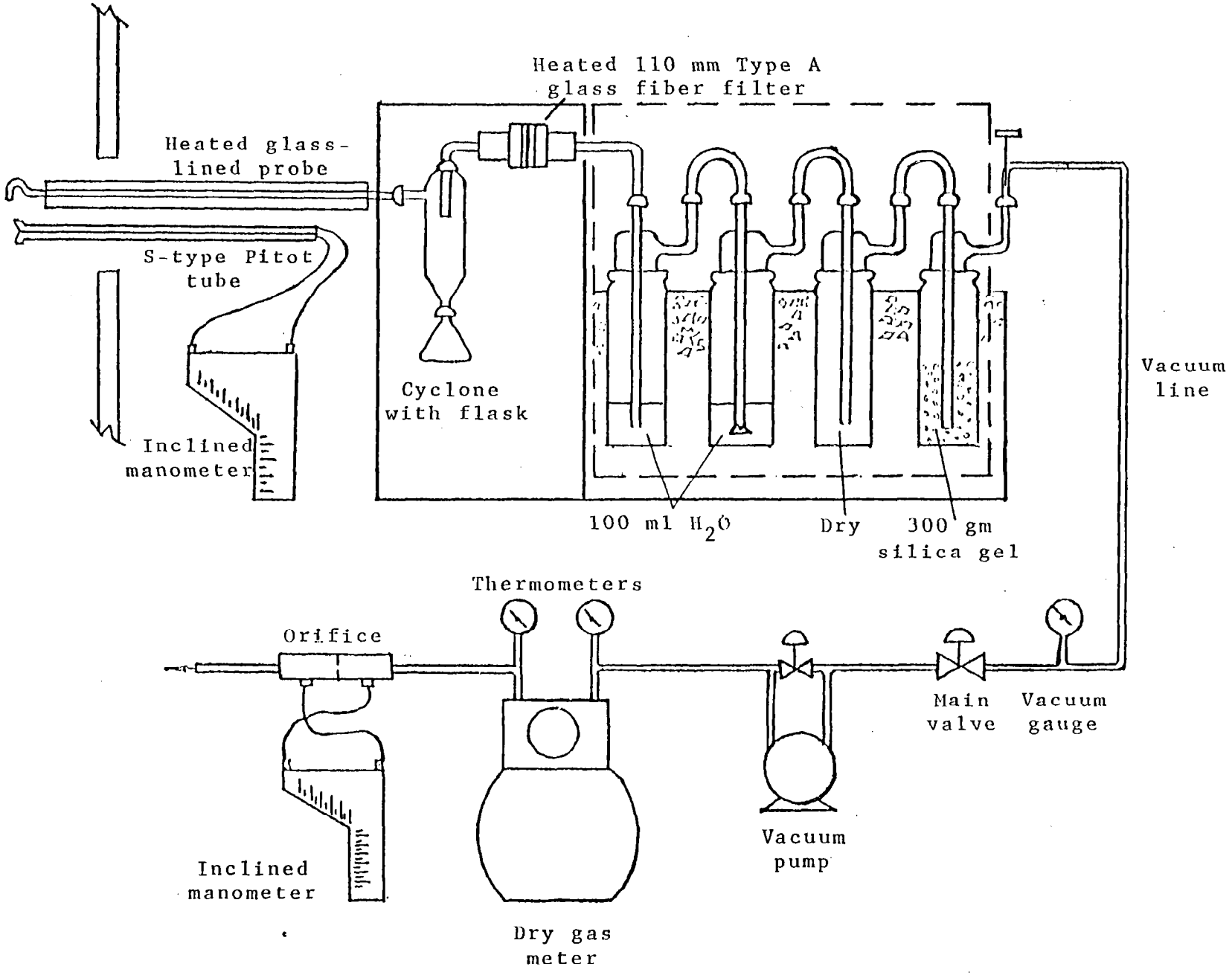


Figure 5.1 Particulate sampling train - Venturi scrubber inlet

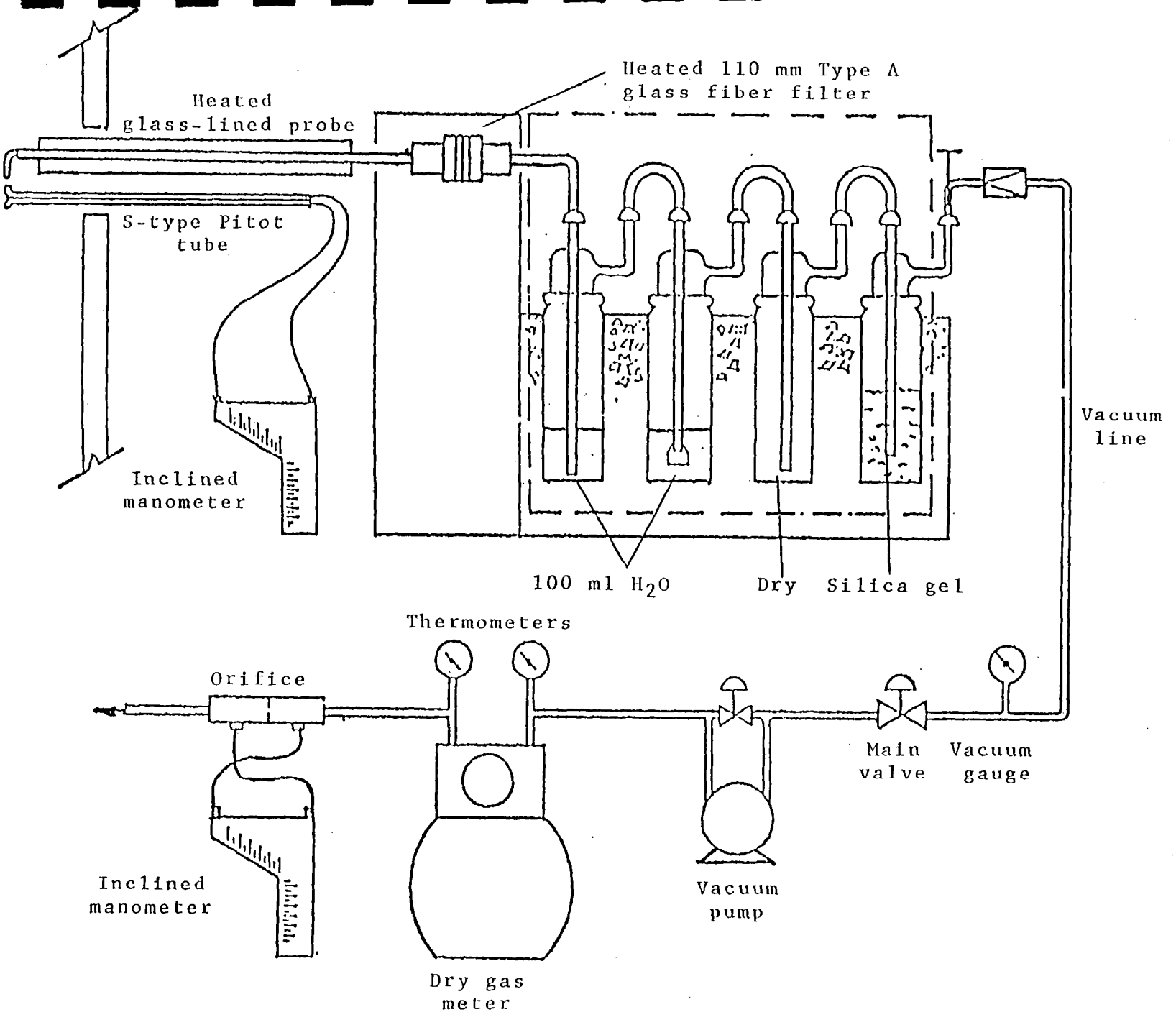


Figure 5.2 Particulate sampling train - Venturi scrubber outlet

(as condensate). The probe and nozzle assembly was thoroughly washed with water, and the rinsings were collected in a glass sample bottle with a Teflon®-lined cap. Following the water wash, the probe and nozzle assembly was then rinsed with acetone, and the rinsings transferred to a glass sample bottle and sealed with a Teflon®-lined cap. The impinger assembly was thoroughly washed with water, and these water washings were placed with the impinger solutions. Following the water wash of the impingers, the entire impinger assembly was then rinsed with acetone and these rinsings were placed in a glass sample bottle and sealed with a Teflon®-lined cap.

After each particulate test, therefore, five sample fractions had been collected (summary presented in Appendix C):

(1) water rinsings of probe and nozzle assembly;

(2) acetone rinsings of probe and nozzle assembly;

(3) 110 mm Type A glass-fiber filter;

(4) impinger contents and distilled water rinsings; and,

(5) acetone rinsings of impingers.

In the laboratory, Fractions 1, 2, 4, and 5 were placed into beakers. Fraction 3 was vacuum dessicated and weighed on an analytical balance.

Following the weight determination, Fraction 3 was placed in a known volume of water, stirred, and decanted. This leachate and aliquots of Fractions 1 and 4 were analyzed for caprolactam on a Hewlett-Packard Model 5702A

gas chromatograph equipped with a flame ionization detector. The column chosen for this analysis was a 5% Carbowax 20-TPA in Chromosorb W-AW, six feet x 1/4 inches, maintained at 200°C. A Hewlett-Packard Model 3352B Laboratory Data System was employed to determine the areas under the peaks. A four-point calibration for linearity with caprolactam in water standards was performed in the laboratory. A summary of the GC data along with the calibration curve are presented in Appendix F.

The remainders of Fractions 1 and 4 were evaporated to residues at 105°C and weighed. Fractions 2 and 5 were dried with circulating air at 22°C until reaching a constant weight, and weighed. All weight determinations were performed on an analytical balance having a sensitivity of 0.1 milligrams.

Particle Size Distribution

A single particle size distribution sample was extracted from the scrubber inlet. Exhaust gases were withdrawn isokinetically for six minutes at the stack centerline. A Monsanto Brinks Cascade Impactor was used for the sampling of particulate for particle size distribution determination.

The cascade impactor, which was held in-stack, has five in-line stages arranged in series, each of which has a jet incorporating a collection cup as an impaction plate. When the incoming gas stream is drawn through a

jet, those particles with sufficient inertia impact and remain against a cup. Those particles with insufficient inertia will pass through annular slots surrounding the cup periphery and enter the next jet. The smallest particles which are not impacted on any plate are caught on a back-up Type A glass-fiber filter. The particle size distribution results may be found in Table 2.6.

APPENDIX A

PROJECT PARTICIPANTS

PROJECT PARTICIPANTS

Clayton Environmental Consultants, Inc.

N. Steve Walsh	Director, Air Resource Engineering
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Sandra L. King	Laboratory Technician

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James Martin

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Dennis P. Holzschuh

APPENDIX B

FIELD DATA SHEETS

B-1. Particulate Test Data Sheets
B-2. Sampling Summary Data
B-3. Particle Sizing Data Sheet
B-4. Visible Emissions Data Sheets

APPENDIX B-1

PARTICULATE TEST DATA SHEETS

SAMPLING TRAIN DATA

3.17 $\frac{T_m}{T_s}$ H = Δ

Company:

Source Designation: Inlet Scrubber

Date: 10-3-78 | Filter Heater Setting:

Test Number: P-1 | Probe Heater Setting:

Field Person: DLS | Nozzle Number: 1/4, Dia. (in.): 0.249

Filter Number: | Pitot Tube No. 23, Corr. Factor: 0.82

Barometric Pressure ("Hg): 29.81 | Meter Box No. RAC3, Corr. Factor: 1.99

Stack Static Pressure ("H_2O): +.7 Hg | Meter Isokinetic Factor:

Stack Dimensions: 4'6" ID | Assumed Moisture (%): 11%

Plume Appearance: | Condensate Volume (ml):

Ambient Temperature (°F): | Silica Gel Weight Gain (g):

Record all Data Every 3 Minutes | Leak Rate 0.0 CFM at 15 "Hg

86 × 4 = 344 (Velocity Pressure) | 42 (Stack Temp) | 6 → 8 (Orifice Pressure Differential)

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
S-2	0	1600	0.75	186	154.709	86	86	2.01	240	70	
S-3	3	1603	0.74	185	157.15	86	88	1.99	240	70	
S-4	6	1606	0.82	184	159.38	90	89	2.21	240	70	
S-5	9	1609	0.75	184	161.52	92	88	2.03	240	70	
S-6	12	1612	0.80	184	163.70	94	89	2.17	240	70	
S-7	15	1615	0.79	184	166.1	97	90	2.15	240	70	
S-8	18	1618	0.83	184	168.51	99	90	2.27	240	70	
S-9	21	1621	0.84	184	171.18	101	91	2.3	230	70	
S-10	24	1624	0.91	184	173.71	102	92	2.2	230	70	
S-11	27	1627	0.86	184	176.0	104	92	2.36	230	70	
S-12	30	1630	0.87	184	178.9	105	93	2.39	230	72	
S-13	33	1633	0.90	182	181.57	105	94	2.49	230	72	
S-14	36	1636	0.95	182	184.30	107	95	2.63	230	74	
S-15	39	1639	1.0	182	187.08	107	96	2.77	230	74	
S-16	42	1642	1.0	182	189.93	108	96	2.77	230	74	
S-17	45	1645	1.0	182	192.90	109	97	2.78	230	74	
S-18	48	1648	0.97	182	195.69	110	98	2.70	230	74	
AVERAGE (TOTAL)					( )						

SAMPLING TRAIN DATA

Company: _____

Source Designation: _____

Date: _____ Filter Heater Setting: _____

Test Number: P-1 page 2 Probe Heater Setting: _____

Field Person: DLS Nozzle Number: ____, Dia.(in.): _____

Filter Number: _____ Pitot Tube No. ___, Corr.Factor: _____

Barometric Pressure ("Hg): _____ Meter Box No. _____, Corr.Factor: _____

Stack Static Pressure ("H_2O): _____ Meter Isokinetic Factor: _____

Stack Dimensions: _____ Assumed Moisture(%): _____

Plume Appearance: _____ Condensate Volume(ml): _____

Ambient Temperature(°F): _____ Silica Gel Weight Gain(g): _____

Record all Data Every _____ Minutes Leak Rate _____ CFM at _____ "Hg

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
S-19	51	1651	0.93	181	198.00	112	98	2.60	210	73	
S-19	54	1654	0.95	181	201.28	112	99	2.66	210	73	
S-3	57	1657	0.95	182	204.01	112	100	2.65	210	73	
W-2	50	1714	0.84	182	207.48	100	99	2.32	215	74	
W-2	63	1727	0.80	182	209.7	105	100	2.22	215	68	
W-3	66	1720	0.90	182	212.24	108	100	2.51	215	68	
W-4	69	1723	0.83	182	215.09	110	100	2.32	215	68	
W-5	72	1726	0.93	195	217.62	111	101	2.55	215	68	
W-6	75	1809	0.9	185	219.03	92	92	2.44	120	70	
W-7	78	1832	0.96	181	222.74	94	92	2.63	210	66	
W-8	81	1806	0.94	181	225.53	98	94	2.58	230	68	
W-9	84	1809	0.94	181	228.31	102	94	2.59	230	68	
W-10	87	1842	0.92	181	231.11	104	95	2.55	230	68	
W-11	90	1815	0.9	178	233.88	106	95	2.51	230	68	
W-12	93	1818	0.9	178	235.0	108	98	2.52	230	68	
W-13	96	1821	0.78	183	239.39	108	96	2.16	230	72	
W-14	99	1824	0.70	180	241.96	109	96	1.95	230	72	
W-15	102	1827	0.72	180	244.41	109	97	2.01	230	72	
AVERAGE (TOTAL)					( )						

SAMPLING TRAIN DATA

Company: _____

Source Designation: _____

Date: _____ Filter Heater Setting: _____

Test Number: P-1 page 3 Probe Heater Setting: _____

Field Person: DLS Nozzle Number: ____, Dia. (in.): _____

Filter Number: A-236-12 Pitot Tube No. ___, Corr. Factor: _____

Barometric Pressure ("Hg): _____ Meter Box No. _____, Corr. Factor: _____

Stack Static Pressure ("H_2O): _____ Meter Isokinetic Factor: _____

Stack Dimensions: _____ Assumed Moisture (%): _____

Plume Appearance: _____ Condensate Volume (ml): 52

Ambient Temperature (°F): _____ Silica Gel Weight Gain (g): 24.7

Record all Data Every _____ Minutes Leak Rate _____ CFM at _____ "Hg

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
W-16	105	1830	0.69	180	246.84	108	98	1.92	220	74	0
W-17	108	1833	0.71	176	249.26	108	98	1.99	220	74	
W-18	111	1836	0.68	176	251.66	108	98	1.91	225	76	
W-19	114	1839	0.68	176	254.02	108	99	1.91	225	76	
W-19	117	1842	0.66	176	256.41	108	99	1.85	225	76	
	120	1845			258.755						
			23.34			99					
AVERAGE (TOTAL)				182	( )		average 5	2.3¼			

90 = 350
30 = 340

SAMPLING TRAIN DATA

ΔH = 3.69 $\frac{\text{in}}{\text{Ts}}$ H

Company: EPA - Task 6

Source Designation: Scrubber - Inlet

Date: 10/4/78

Test Number: P-2

Field Person: DL / CLK

Filter Number: P-263-15

Barometric Pressure ("Hg): 29.85

Stack Static Pressure ("H_2O): -7.7 Hg

Stack Dimensions: 4'6"

Plume Appearance: C

Ambient Temperature (°F): 80

Record all Data Every 3 Minutes

Filter Heater Setting:

Probe Heater Setting:

Nozzle Number: ½ , Dia. (in.):

Pitot Tube No. 23, Corr. Factor:

Meter Box No. R&C-3, Corr. Factor: 0.99

Meter Isokinetic Factor:

Assumed Moisture (%): 4%

Condensate Volume (ml): 56 ml

Silica Gel Weight Gain (g): 28.3

Leak Rate 0.0 CFM at 15 "Hg

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
W-2	0	0750	~~0.7~~		~~255.172~~	~~82~~	~~80~~	~~2.17~~			
2	3		0.55	180	261.68	80	84	2.59	210	64	2.0
3	6		0.92	180	263.32	90	86	2.91	210	64	2.0
4	9		0.96	180	266.15	95	88	3.06	210	66	2.0
5	12		0.94	180	269.06	102	88	3.21	215	69	2.0
6	15		0.90	180	272.9	102	96	2.89	215	68	2.0
7	18		0.95	180	276.31	104	96	3.05	215	70	2.0
8	21		0.90	180	278.73	104	96	2.89	220	72	2.0
9	24		0.94	180	281.56	106	97	3.03			2.0
10	27		0.92	180	284.45	106	92	2.97			
	30		0.89	185	287.32	106	94	2.85			
12	33		0.85	180	290.16	106	94	2.74			
11	36		0.82	180	292.92	106	94	2.65			
10	39		0.79	185	295.45	102	96	2.54	220	72	1.5
9	42		0.73	185	298.31	106	96	2.34			1.5
8	45		0.69	185	300.86	106	96	2.21			2.0
7	48		0.69	185	303.31	106	96	2.21			2.0
AVERAGE (TOTAL)					( )						

SAMPLING TRAIN DATA

Company: Dow Badische - EPA Task 6
Source Designation: Scrubber - Inlet
Date: 10/4/85
Test Number: P-2 run 2 cont.
Field Person: DC/Gold
Filter Number: P-2&3-15
Barometric Pressure ("Hg): 29.85
Stack Static Pressure ("H_2O): ____
Stack Dimensions: 4'6"
Plume Appearance: ____
Ambient Temperature (°F): 75°
Record all Data Every 3 Minutes

Filter Heater Setting: ____
Probe Heater Setting: ____
Nozzle Number: ____, Dia. (in.): ½
Pitot Tube No. 23, Corr. Factor: ____
Meter Box No. Gold-23, Corr. Factor: ____
Meter Isokinetic Factor: ____
Assumed Moisture (%): ____
Condensate Volume (ml): ____
Silica Gel Weight Gain (g): ____
Leak Rate ____ CFM at ____ "Hg

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
19	51		0.66	185	305.85	106	96	2.13			
19	54		0.64	185	308.27	104	96	2.05	270	74	
19	57		0.65	190	310.64	106	97	2.07			
	60	0950	~~——~~	~~190~~	313.07	~~——~~	~~——~~				
Shank point	—										
5-1	60	0955	0.75	190	313.09	100	94	2.38			
5-2	63		0.80	195	315.55	103	98	2.52			
5-3	66		0.77	190	318.22	106	98	2.46			
5-4	69		0.76	190	320.84	108	100	2.43			2.0
5-5	72		0.77	190	323.50	110	100	2.47			
5-6	75		0.73	190	326.14	110	100	2.34			
5-7	78		0.76	190	328.77	112	100	2.44	270	75	
5-8	81		0.75	190	331.34	112	102	2.41			2.0
5-9	84		0.76	195	333.95	112	102	2.43			
5-10	87		0.76	190	336.59	112	104	2.45	305	77	
5-11	90		0.74	190	339.23	112	104	2.55			
5-12	93		0.75	195	341.93	112	104	2.42			
AVERAGE (TOTAL)				( )							

SAMPLING TRAIN DATA

Company: EPA - Task 6 Dave Ballash
Source Designation: Scrubber - Inlet
Date: 10/4/78
Test Number: P-2 run 3 Mont
Field Person: D. Kirk
Filter Number: P-263-15
Barometric Pressure ("Hg): 29.55
Stack Static Pressure ("H_2O): -0.7
Stack Dimensions: 4'6" ID
Plume Appearance:
Ambient Temperature (°F): 75
Record all Data Every 3 Minutes

Filter Heater Setting:
Probe Heater Setting:
Nozzle Number: , Dia. (in.):
Pitot Tube No. 23, Corr. Factor:
Meter Box No. Mont-1, Corr. Factor:
Meter Isokinetic Factor:
Assumed Moisture (%):
Condensate Volume (ml):
Silica Gel Weight Gain (g):
Leak Rate CFM at "Hg

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
S-13	96		0.87	195	344.71	114	104	2.79			2.0
S-14	99		0.95	195	347.56	114	104	3.05			2.0
S-15	102		1.00	195	350.48	115	105	3.25			2.0
S-16	105		0.96	195	353.45	116	106	3.06			2.0
S-17	108	1046	0.96	195	356.40	115	105	3.08	210	75	2.0
S-18	111		0.97	195	359.35	115	105	3.11			2.0
S-19	114		0.92	195	362.31	116	106	2.96			2.0
S-19	117		0.89	190	365.20	112	105	2.87			
	120				368.05						
					108.32						
AVERAGE (TOTAL)			1??		( )	107	77	2.65			

3.69

SAMPLING TRAIN DATA

Company: EPA Task 6
Source Designation: Outlet
Date: 10-4-78
Test Number: P-3
Field Person: DLS
Filter Number:
Barometric Pressure ("Hg): 24.85
Stack Static Pressure (~~"H2O~~): 0.7 Hg
Stack Dimensions:
Plume Appearance:
Ambient Temperature (°F):
Record all Data Every 3 Minutes

Filter Heater Setting:
Probe Heater Setting:
Nozzle Number: 1/6, Dia. (in.): 0.249
Pitot Tube No. 23, Corr. Factor:
Meter Box No. RAC3, Corr. Factor: 0.99
Meter Isokinetic Factor:
Assumed Moisture (%): 4%
Condensate Volume (ml): 60.0
Silica Gel Weight Gain (g): 31.1
Leak Rate 0.01 CFM at "H

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
2	0	1413	0.77	185	368.440	90	90	2.42	210	82	
2	3	1418	0.79	187	370.99	91	90	2.48	210	78	
3	6	1421	0.84	190	373.62	92	90	2.63	210	73	
4	9	1424	0.89	190	376.40	91	90	2.80	215	73	
5	12	1427	0.90	195	379.28	100	91	2.82	215	73	
6	15	1430	0.89	195	382.10	102	92	2.79	215	73	
7	18	1433	0.90	195	385.98	103	92	2.83	222	76	
8	21	1436	0.92	195	388.40	104	94	2.90	222	76	
9	24	1439	0.92	193	390.7	105	95	2.91	222	76	
10	27	1442	0.94	193	393.59	106	96	2.98	222	76	
11	30	1445	0.95	191	396.56	105	96	3.03	222	76	
12	33	1448	0.87	190	399.41	110	97	2.78	230	76	
13	36	1451	0.85	187	402.24	110	98	2.73	230	76	
14	39	1454	0.74	184	405.11	110	99	2.39	230	77	
15	42	1457	0.80	200	408.0	108	99	2.50	230	78	
16	45	1535	0.73	190	410.42	100	96	2.31	230	80	
17	48	1538	0.70	186	413.20	108	101	2.24	230	80	
AVERAGE (TOTAL)					( )						

4594 ~

SAMPLING TRAIN DATA

Company: EPA Task C
Source Designation: Scrubber Outlet
Date: 10-4-78
Test Number: P-3 Orsat
Field Person: DLS
Filter Number:
Barometric Pressure ("Hg): 29.85
Stack Static Pressure ("H_2O): 0.7 Hg
Stack Dimensions: 46" ID
Plume Appearance:
Ambient Temperature (°F):
Record all Data Every 3 Minutes

Filter Heater Setting:
Probe Heater Setting:
Nozzle Number: , Dia. (in.):
Pitot Tube No. , Corr. Factor:
Meter Box No. , Corr. Factor:
Meter Isokinetic Factor:
Assumed Moisture (%):
Condensate Volume (ml):
Silica Gel Weight Gain (g):
Leak Rate CFM at "H

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Samplin Train Static Pressur ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
18	51	1541	0.68	186	416.1	109	101	2.19	230	80	
519	54	1544	0.66	184	418.2	110	101	2.14	230	80	
519	57	1547	0.67	183	420.74	111	102	2.18	230	80	
W2	60	1550	0.7	184	423.285	105	100	2.26	230	80	
2	103	1553	0.72	184	425.85	110	103	2.34	230	80	
3	66	1556	0.74	184	428.46	110	103	2.40	220	80	
4	69	1559	0.78	186	431.30	113	104	2.27	220	80	
5	72	1605	0.75	184	433.72	110	104	2.44	220	80	
6	75	1608	0.72	184	436.36	112	104	2.34	220	80	
7	78	1611	0.77	182	438.97	114	105	2.52	220	80	
8	81	1614	0.75	183	441.56	115	105	2.45	205	77	
9	84	1617	0.80	183	444.21	115	106	2.62	205	77	
10	87	1620	0.85	185	447.0	116	106	2.78	205	77	
11	90	1623	0.90	185	449.79	116	106	2.94	205	77	
12	93	1626	0.98	188	453.4	116	106	3.19	205	77	
13	96	1629	0.94	188	455.77	116	106	3.06	205	77	
14	99	1632	0.96	188	458.82	117	106	3.12	205	77	
AVERAGE (TOTAL)				( )							

SAMPLING TRAIN DATA

Company: _____

Source Designation: Texas

Date: 10-4-78 | Filter Heater Setting: _____

Test Number: P-3 pag 3 | Probe Heater Setting: _____

Field Person: DLS | Nozzle Number: ____, Dia. (in.): _____

Filter Number: _____ | Pitot Tube No. ___, Corr. Factor: ___

Barometric Pressure ("Hg): _____ | Meter Box No. _____, Corr. Factor: ____

Stack Static Pressure ("H_2O): _____ | Meter Isokinetic Factor: _____

Stack Dimensions: _____ | Assumed Moisture (%): _____

Plume Appearance: _____ | Condensate Volume (ml): _____

Ambient Temperature (°F): 85 | Silica Gel Weight Gain (g): _____

Record all Data Every _____ Minutes | Leak Rate _____ CFM at _____ "H

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Samplin Train Static Pressur ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
16	102	1635	0.96	185	461.90	118	106	3.14	205	77	
16	105	1638	0.93	185	465.3	118	107	3.05	205	77	
17	108	1641	0.95	185	467.8	116	106	3.10	205	77	
18	111	1644	0.90	185	470.81	116	106	2.94	205	77	
19	114	1647	0.93	185	473.74	117	106	3.04	205	77	
19	117	1650	0.92	185	477.0	117	107	3.01	205	77	
	120	1653			479.62						
			23.17								
AVERAGE (TOTAL)				188	(110.[illegible])	109	100	2.68			

(1)

SAMPLING TRAIN DATA

$\Delta m = 1.24 \frac{T_m}{T_s} .11$

Company: _____

Source Designation: Outlet (Scrubber)

Date: 10-3-78

Test Number: P-1

Field Person: CMS / TVM

Filter Number: -11

Barometric Pressure ("Hg): 29.81

Stack Static Pressure ("H_2O): +.75 H_2O

Stack Dimensions: 4.5 ϕ

Plume Appearance: _____

Ambient Temperature (°F): _____

Record all Data Every 3 Minutes

Filter Heater Setting: 60

Probe Heater Setting: 50

Nozzle Number: 3/16, Dia. (in.): 0.1875

Pitot Tube No. 38, Corr. Factor: .822

Meter Box No. RAC 4, Corr. Factor: 1.02

Meter Isokinetic Factor: 1585

Assumed Moisture (%): 4%

Condensate Volume (ml): _____

Silica Gel Weight Gain (g): _____

Leak Rate .00 CFM at 20 "Hg

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
S-3	0	16:00	.86	75	346.852	81	81	1.09	210	82	0.0
2	3		.96	75	349.4	81	81	1.08	210	70	0.0
3	6		.86	75	350.1	81	81	1.08	215	70	0.0
4	9		.91	75	352.2	90	86	1.13	215	68	0.0
5	12		1.1	75	353.8	94	86	1.38	205	69	0.0
6	15		.85	75	356.1	100	86	1.08	205	69	0.0
7	18		.90	75	357.7	101	88	1.14	205	69	0.0
8	21		.86	75	360.0	104	88	1.09	200	70	0.0
9	24		.84	75	361.2	105	90	1.07	200	70	0.0
10	27		.89	75	363.3	110	96	1.12	200	70	0.0
11	30		.84	75	364.7	110	96	1.07	200	70	0.0
12	33		1.1	75	366.6	110	94	1.4	200	70	0.0
13	36		1.3	75	368.6	110	94	1.65	200	70	1.0
14	39		1.5	75	371.2	114	95	1.91	200	70	1.0
15	42		1.7	75	373.1	114	98	2.16	200	70	1.5
16	45		1.4	75	376.0	120	100	2.44	200	72	2.0
17	48		1.9	75	378.2	122	100	2.44	200	72	2.5
AVERAGE (TOTAL)					( )						

(2)

SAMPLING TRAIN DATA

Company: _____

Source Designation: OUTLET (SCRUBBER

Date: _____ Filter Heater Setting: 60

Test Number: P-1 (cont) Probe Heater Setting: 50

Field Person: CMS/TVM Nozzle Number: 3/16, Dia. (in.): 0.192

Filter Number: _____ Pitot Tube No. 38, Corr. Factor: _____

Barometric Pressure ("Hg): 29.81 Meter Box No. RAC #4, Corr. Factor: _____

Stack Static Pressure ("H_2O): +.75 Meter Isokinetic Factor: 1585

Stack Dimensions: 4.5' ⌀ Assumed Moisture (%): 4%

Plume Appearance: _____ Condensate Volume (ml): _____

Ambient Temperature (°F): _____ Silica Gel Weight Gain (g): _____

Record all Data Every 3 Minutes Leak Rate .00 CFM at 20 "Hg

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
18	51		2.1	75	381.5	125	102	2.7	205	73	4.0
19	54		2.2	75	384.3	125	104	2.8	205	73	4.0
20	57		2.5	75	386.4	130	104	3.2	205	73	4.5
	60				389.2	100					
1-A	~~0~~	17:14	~~2.10~~	75	389.2	110	108	1.02	200	80	0.0
2	63		.82	75	391.2	114	108	1.02	200	80	0.0
3	66		.48	75	393.0	118	110	.57	200	80	0.0
4	69		.42	75	394.3	118	116	.53	200	75	0.0
5	72	17:29	.48	75	395.1	120	110	.61	200	70	0.0
6	75	17:32	.62	75	397.3	110	110	.756	200	70	0.0
7	78		.65	75	399.0	110	110	.791	200	70	0.0
8	81		.70	75	400.3	110	110	.853	205	69	0.0
9	84		.61	75	402.2	110	110	.82	205	69	0.0
10	87		.76	75	403.7	110	110	.93	205	69	0.0
11	90		1.2	75	405.0	110	110	1.46	205	68	0.0
12	93		1.6	75	407.3	112	110	2.0	205	68	1.5
13	96		1.5	75	410.0	120	112	1.88	205	68	1.3
AVERAGE (TOTAL)					( )						

(3)

SAMPLING TRAIN DATA

Company: _____

Source Designation: SCRUBBER (OUTLET)

Date: _____

Test Number: P-1 (RUN 1)

Field Person: CMS / TWM

Filter Number: _____

Barometric Pressure ("Hg): 29.81

Stack Static Pressure ("H_2O): _____

Stack Dimensions: 4.5' Ø

Plume Appearance: _____

Ambient Temperature (°F): _____

Record all Data Every 3 Minutes

Filter Heater Setting: 60

Probe Heater Setting: 50

Nozzle Number: 7/16, Dia. (in.) 0.1875

Pitot Tube No. 38, Corr. Factor: _____

Meter Box No. RAC #4, Corr. Factor: ~~0.98~~

Meter Isokinetic Factor: 1585

Assumed Moisture (%): 4%

Condensate Volume (ml): 88

Silica Gel Weight Gain (g): 21.6

Leak Rate 0.0 CFM at 20 "Hg

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
14	99		1.8	75	412.0	121	112	2.3	205	68	2.0
15	102		1.9	75	415.0	125	114	2.4	205	68	2.0
16	105		2.1	75	417.2	127	115	2.7	205	68	2.5
1	108		2.1	75	420.2	127	115	2.7	205	68	2.5
2	111		2.2	75	422.7	130	115	2.8	205	68	2.5
3	114		2.1	75	425.8	130	115	2.7	205	68	2.5
4	117		2.2	75	428.6	132	115	2.8	205	68	4.0
	120				431.036						
AVERAGE (TOTAL)				105	( )						

(1)

SAMPLING TRAIN DATA

$1.29\left(\frac{Tm+460}{TS+460}\right)H$

Company:

Source Designation: Scrubber (OUTLET)

Date: 10-4-78

Test Number: P-2

Field Person: CMS / TUM

Filter Number:

Barometric Pressure ("Hg): 29.85

Stack Static Pressure ("H_2O): 0.75

Stack Dimensions: 4.5' ⌀

Plume Appearance:

Ambient Temperature (°F):

Record all Data Every 3 Minutes

Filter Heater Setting: 6.5

Probe Heater Setting: 250

Nozzle Number: 3/16, Dia. (in.): 0.1875

Pitot Tube No. 38, Corr. Factor: 0.829

Meter Box No. RAC#4, Corr. Factor: 1.021

Meter Isokinetic Factor: 1585

Assumed Moisture (%): 4%

Condensate Volume (ml):

Silica Gel Weight Gain (g): ~~21~~

Leak Rate 0.01 CFM at 20 "Hg

x 110

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
W-2	0	07:50	1.2	75	431.390	76	76	1.49	180	69	1.0
2	3		1.2	75	433.7	90	82	1.5	180	69	1.0
3	6		.61	75	436.6	97	82	.85	180	69	1.0
4	9		.61	75	439.8	100	86	.86	180	69	1.0
5	12		.63	75	439.0	104	88	.81	190	65	0.0
6	15		.63	75	440.3	104	88	.81	190	65	0.0
7	18		.65	75	442.0	106	90	.84	190	65	0.0
8	21		.69	75	443.9	109	92	.89	190	65	0.0
9	24		.73	75	445.5	110	93	.95	190	65	0.0
10	27		.72	75	447.0	110	94	.93	190	65	0.0
11	30		1.2	75	448.7	110	94	1.6	190	65	0.0
12	33		1.5	75	450.4	114	96	1.9	195	65	1.0
13	36		1.6	75	452.5	116	98	2.1	195	69	1.0
14	39		1.8	75	455.6	120	100	2.4	195	69	2.0
15	42		1.7	75	457.8	120	100	2.2	195	69	2.0
16	45		1.8	75	460.5	122	100	2.3	195	69	2.0
17	48		2.0	75	463.2	124	102	2.6	195	69	2.0
AVERAGE (TOTAL)					( )						

(2)

SAMPLING TRAIN DATA

Company: _____

Source Designation: Scrubber outlet

Date: 10-4-78 | Filter Heater Setting: 65

Test Number: P-2 (cont) | Probe Heater Setting: 50

Field Person: GMC / TVM | Nozzle Number: 3/4, Dia.(in.): 0.497

Filter Number: _____ | Pitot Tube No. 38, Corr.Factor: _____

Barometric Pressure ("Hg): _____ | Meter Box No. RAC #4, Corr.Factor: _____

Stack Static Pressure ("H_2O): _____ | Meter Isokinetic Factor: 1.585

Stack Dimensions: 4.5' ϕ | Assumed Moisture(%): 4%

Plume Appearance: _____ | Condensate Volume(ml): _____

Ambient Temperature(°F): _____ | Silica Gel Weight Gain(g): _____

Record all Data Every 3 Minutes | Leak Rate 0.01 CFM at 20 "Hg

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
18	51		1.9	75	466.1	124	109	2.5	195	71	4.0
19	54		1.9	75	468.7	126	109	2.5	195	71	4.0
20	57		1.9	75	471.4	126	106	2.5	195	71	4.0
	60	9:50			473.9						
5B	—	9:55	.92	75	473.4	160	104	1.7	195	71	0.0
2	63		.92	75	475.4	114	114	1.4	205	71	0.0
3	66		.78	75	477.2	114	114	1.0	210	71	0.0
4	69		.77	75	478.8	120	114	1.0	210	71	0.0
5	72		.80	75	480.6	120	114	1.1	210	71	0.0
6	75		.80	75	482.6	122	114	1.1	210	71	0.0
7	78		.82	75	484.7	122	114	1.1	210	71	0.0
8	81		.80	75	486.2	124	114	1.1	210	71	0.0
9	84		.86	75	488.2	124	114	1.2	210	71	0.0
10	87		.83	75	490.2	124	114	1.1	210	71	0.0
11	90		.80	75	492.0	124	114	1.1	210	71	0.0
12	93		.85	110	493.6	124	114	1.1	210	71	0.0
13	96		1.1	110	495.3	124	114	1.5	210	71	0.0
AVERAGE (TOTAL)					( )						

(3)

SAMPLING TRAIN DATA

Company: _____

Source Designation: SCRUBBER (OUTLET)

Date: 10-4-78

Test Number: P-2 (CONT)

Field Person: GMS / TVM

Filter Number: A-263-13

Barometric Pressure ("Hg): _____

Stack Static Pressure ("H_2O): _____

Stack Dimensions: 4.5' Ø

Plume Appearance: _____

Ambient Temperature (°F): _____

Record all Data Every 3 Minutes

Filter Heater Setting: 65

Probe Heater Setting: 50

Nozzle Number: 3/16, Dia. (in.): 0.182

Pitot Tube No. 35, Corr. Factor: _____

Meter Box No. ~~PAC#4~~, Corr. Factor: _____

Meter Isokinetic Factor: 1585

Assumed Moisture (%): 4%

Condensate Volume (ml): 90

Silica Gel Weight Gain (g): 21.6

Leak Rate 0.01 CFM at 20 "Hg

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
14	99		1.3	110	498.1	126	114	1.6	210	71	1.0
15	102		1.4	110	500.5	128	114	1.8	210	71	1.5
16	105		1.6	110	502.9	128	114	2.0	240	73	2.0
17	108		1.7	110	505.7	130	114	2.2	210	73	2.0
18	111		2.2	110	508.2	130	114	2.8	210	73	3.0
19	114		2.2	110	510.4	132	114	2.8	210	73	3.0
20	117		2.4	110	513.5	136	116	3.0	210	73	4.0
	120				516.737						
				89.9							
AVERAGE (TOTAL)				0	(~~83.64~~)	117	~~104~~	1.59			

(1)

1.29 ($\frac{Tm+460}{Ts+460}$)

SAMPLING TRAIN DATA

Company: _____

Source Designation: SC Rubber (outlet)

Date: 10-4-75 | Filter Heater Setting: 65

Test Number: 2-3 | Probe Heater Setting: 50

Field Person: C-MS/TVM | Nozzle Number: 3/4, Dia.(in.): .615

Filter Number: A - 263 - 09 | Pitot Tube No. 38, Corr.Factor: .82

Barometric Pressure ("Hg): 29.85 | Meter Box No. PAC-5, Corr.Factor: 1.02

Stack Static Pressure ("H_2O): 0.5 | Meter Isokinetic Factor: 1585

Stack Dimensions: 4.5' ⌀ | Assumed Moisture (%): 4%

Plume Appearance: _____ | Condensate Volume (ml): 87

Ambient Temperature (°F): 75° | Silica Gel Weight Gain (g): 29.6

Record all Data Every 3 Minutes | Leak Rate .001 CFM at 16 "H

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
A-2	0	1415	1.3	100	516.99	92	92	1.6	165	71	1.0
2	3		1.3	100	518.5	94	92	1.6	165	71	1.0
3	6		.79	100	520.4	98	92	.97	165	71	0.0
4	9		.81	100	522.2	100	94	1.0	190	70	0.0
5	12		.75	105	524.2	104	94	.92	190	70	0.0
6	15		.75	105	526.0	104	94	.92	190	70	0.0
7	18		.71	105	525.0	105	98	.88	205	71	0.0
8	21		.72	105	530.0	110	98	.89	205	71	0.0
9	24		.72	105	531.3	110	98	.89	205	71	0.0
10	27		.74	105	532.8	112	100	.92	205	71	0.0
11	30		1.3	105	534.4	114	100	1.6	205	71	0.0
12	33		1.6	105	537.0	116	102	2.0	205	71	2.0
13	36		1.5	105	539.0	120	104	1.4	205	71	2.0
14	39		1.6	105	541.4	122	104	2.0	205	71	2.0
15	42		1.6	105	544.0	124	106	2.0	205	71	2.0
16	45	DB (5.5)	1.7	105	546.9	126	110	2.1	205	71	2.0
17	48		1.7	105	549.3	118	112	2.3	205	71	2.0
AVERAGE (TOTAL)					( )						

(2)

SAMPLING TRAIN DATA

Company: _____

Source Designation: Separator (outlet)

Date: 12-4-78 | Filter Heater Setting: 61

Test Number: T-3 (Cont) | Probe Heater Setting: 50

Field Person: _____ | Nozzle Number: 3/16, Dia.(in.): 0.1

Filter Number: A-263-13 | Pitot Tube No. 38, Corr.Factor: _____

Barometric Pressure ("Hg): _____ | Meter Box No. Kitag, Corr.Factor: _____

Stack Static Pressure ("H_2O): _____ | Meter Isokinetic Factor: _____

Stack Dimensions: 4.5' ϕ | Assumed Moisture(%): 42

Plume Appearance: _____ | Condensate Volume(ml): _____

Ambient Temperature(°F): 25° | Silica Gel Weight Gain(g): _____

Record all Data Every 3 Minutes | Leak Rate 0.01 CFM at 16 "H

Traverse Point No.	Time		Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter			Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Samplin Train Static Pressur ("Hg)
	Sampling (min)	Clock			Volume (ft^3)	Temp (°F) Inlet	Outlet				
18	51		1.9	105	5519	126	112	2.4	215	70	3.0
19	54		1.9	105	5542	130	113	2.4	215	70	3.0
20	57		1.9	105	5566	130	113	2.4	215	70	3.0
	60				5589.0						
S-2	—	15:52	1.1	105	5599.0	126	114	1.4	215	70	0.5
2	03		1.0	105	5611.6	124	115	1.3	215	70	0.5
3	06		.84	105	5624.9	120	116	1.1	215	70	0.5
4	09		.98	105	5635.1	128	116	1.3	215	70	0.0
5	12		.98	105	5646.6	120	116	1.2	220	70	0.5
6	15		.93	105	5659.1	126	118	1.2	220	70	0.2
7	18		.89	105	5671.3	124	118	1.1	220	70	0.2
8	21		.91	105	5683.0	132	119	1.2	220	70	0.1
9	24		.83	105	5695.0	130	119	1.1	220	70	0.0
10	27		.78	105	5707.4	130	120	1.0	220	70	0.0
11	30		.82	105	5718.4	132	120	1.0	220	70	0.0
12	33		.91	105	5729.4	132	120	1.2	220	70	0.0
13	36		1.1	105	5742.2	132	120	1.4	220	70	0.5
AVERAGE (TOTAL)					( )						

SAMPLING TRAIN DATA

Company: _____

Source Designation: S-Rubber (outlet)

Date: 10-4-95 | Filter Heater Setting: 250

Test Number: P-3 (cont) | Probe Heater Setting: 250

Field Person: GMS / TVM | Nozzle Number: 3/4, Dia. (in.): 0.18

Filter Number: A-263-13 | Pitot Tube No. 38, Corr. Factor: _____

Barometric Pressure ("Hg): 29.55 | Meter Box No. ~~2-C~~ 4, Corr. Factor: _____

Stack Static Pressure ("H_2O): _____ | Meter Isokinetic Factor: 1.585

Stack Dimensions: 4.5' Ø | Assumed Moisture (%): 4%

Plume Appearance: _____ | Condensate Volume (ml): _____

Ambient Temperature (°F): 75° | Silica Gel Weight Gain (g): _____

Record all Data Every 3 Minutes | Leak Rate 0.01 CFM at 16 "H

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Sampling Train Static Pressure ("Hg)
14	99		1.3	105	584.2	125	120	1.6	~~2~~10	80	1.0
15	102		1.5	105	588.8	130	120	1.9	210	80	1.5
16	105		1.5	105	589.0	130	120	1.9	210	80	1.5
17	108		1.7	105	591.4	130	120	2.2	210	80	2.0
18	111		2.0	105	593.7	130	120	2.4	~~2~~10	80	2.0
19	114		2.1	105	596.3	130	120	2.7	210	80	3.5
20	117		2.1	105	599.1	130	120	2.7	210	80	3.5
	120				601.794						
AVERAGE (TOTAL)			104	([illegible])		100	110	1.5			

APPENDIX B-2

SAMPLING SUMMARY DATA

Table B-2.1. Summary of Stack Conditions and Flowrates

Sample Location	Sample No.	Date (1978)	Temperature		Stack Flowrate			
			Stack		DSCFM	ACFM	$\frac{DSM^3}{min.}$	$\frac{ASM^3}{min.}$
			^oF	^oC				
Inlet	P-1	10-3	182	83	43,000	53,100	1220	1510
	P-2	10-4	188	87	42,300	52,800	1200	1490
	P-3	10-4	188	87	42,300	52,900	1200	1500
	Average		186	86	42,500	52,900	1210	1500
Outlet	P-1	10-3	105[a]	41	51,100	58,300	1450	1650
	P-2	10-4	110[a]	43	50,200	57,700	1420	1630
	P-3	10-4	104	40	51,000	58,200	1440	1650
	Average		106	41	50,800	58,100	1440	1640

[a] Due to a malfunctioning pyrometer, these temperatures are estimated based on the preliminary and subsequent temperature traverses.

SAMPLING SUMMARY SHEET

Plant Dow-Badische Location Freeport, Texas

Sampled Source Ammonium Sulfate - Inlet

Run	Date	N_p	P_m	P_b	V_m	T_m	$V_{m_{std}}$	V_w	$V_{w_{gas}}$	%M	M_d
P-1	10-3-78	40	2.34	29.81	103.630	99	98.102	76.7	3.61	3.5	0.964
P-2	10-4-78	40	2.65	29.85	108.387	102	102.272	84.3	3.97	3.7	0.963
P-3	10-4-78	40	2.68	29.85	110.737	104	104.126	91.1	4.29	4.0	0.960

Run	MW_d	MW	P_{st}	P_s	C_p	$\sqrt{\Delta P_s X (T_s+460)^c}$	V_s	T_s	T_t	D_n	%I
P-1	28.96	28.57	+0.7	30.51	0.828	23.28	3343	182	120	0.249	88.8
P-2	28.96	28.56	+0.7	30.55	0.828	23.13	3320	188	120	0.249	94.1
P-3	28.96	28.51	+0.7	30.55	0.828	23.17	3329	188	120	0.249	95.9

SH

$$V_{m_{std}} = \frac{17.65 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)}$$

$$V_{w_{gas}} = 0.0471 \times V_w$$

$$MW_d = (\%CO_2 \times \tfrac{44}{100}) + (\%O_2 \times \tfrac{32}{100}) + (\%CO + \%N_2) \times \tfrac{28}{100}$$

$$MW = MW_d \times M_d + 18 (1 - M_d)$$

$$P_s = P_b \pm P_{st}$$

$$V_s = 5120.8 \times Cp \times \sqrt{\Delta P_s \times (T_s + 460)} \left[\frac{1}{P_s \times MW}\right]^{1/2}$$

$$\%I = \frac{1,032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2}$$

$$\%H = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}}$$

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

N_p Total No. of Sampling Points

P_m Average Orifice Pressure Drop, in. H_2O

P_b Barometric Pressure, in. Hg. Absolute

V_m Volume of Dry Gas at Meter Conditions, DCF

T_m Average Meter Temperature, °F

$V_{m_{std}}$ Volume of Dry Gas at STP, DSCF[a]

V_w Total H_2O Collected in Impingers and Silica Gel, ml

$V_{w_{gas}}$ Volume of Water Vapor Collected at STP, SCF[b]

%H Moisture by Volume

M_d Mole Fraction of Dry Gas

$\%CO_2$ Volume % Dry

$\%O_2$ Volume % Dry

%CO Volume % Dry

$\%N_2$ Volume % Dry

MW_d Molecular Weight of Stack Gas, Dry Basis

MW Molecular Weight of Stack Gas, Wet Basis

P_{st} Static Pressure of Stack Gas, in. Hg

P_s Stack Gas Pressure, in. Hg Absolute

C_p Pitot Tube Coefficient

V_s Stack Gas Velocity at Stack Conditions, fpm

T_s Average Stack Temperature °F

T_t Net Time of Test, Min.

D_n Sampling Nozzle Diameter, in.

%I Percent Isokinetic

[a] Dry standard cubic feet at 68°F, 29.92 in. Hg.

[b] Standard conditions at 68°F, 29.92 in. Hg.

[c] $\sqrt{\Delta P_s \times (T_s + 460)}$ is determined by averaging the square root of the product of the velocity head (ΔP_s) and the absolute

SAMPLING SUMMARY SHEET

Plant Dow-Badische Location Freeport, Texas

Sampled Source Ammonium Sulfate - Outlet

Run	Date	N_p	P_m	P_b	V_m	T_m	$V_{m_{std}}$	V_w	$V_{w_{gas}}$	%M	M_d
P-1	10-3-78	40	1.62	29.81	85.954	107	80.080	109.6	5.16	6.1	0.939
P-2	10-4-78	40	1.59	29.85	86.639	110	80.394	111.6	5.26	6.1	0.939
P-3	10-4-78	40	1.57	29.85	86.780	115	79.821	115.6	5.44	6.4	0.936

Run	MW_d	MW	P_{st}	P_s	C_p	$\sqrt{\Delta P_s X (T_s+460)^c}$	V_s	T_s	T_t	D_n	%I
P-1	28.96	28.30	0.055	29.86	0.829	26.09	3810	105	120	0.1875	103.6
P-2	28.96	28.29	0.055	29.90	0.829	25.82	3769	110	120	0.1875	106.3
P-3	28.96	28.26	0.055	29.90	0.829	26.04	3803	104	120	0.1875	103.5

$$V_{m_{std}} = \frac{17.65 \times V_m \left(P_b + \frac{P_m}{13.6}\right)}{(T_m + 460)}$$

$$\%\,M = \frac{100 \times V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}}$$

$$V_{w_{gas}} = 0.0471 \times V_w$$

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

$$MW_d = (\%CO_2 \times \tfrac{44}{100}) + (\%O_2 \times \tfrac{32}{100}) + [\%CO + \%N_2) \times \tfrac{28}{100}$$

$$MW = MW_d \times M_d + 18\,(1 - M_d)$$

$$P_s = P_b \pm P_{st}$$

$$V_s = 5120.8 \times Cp \times \sqrt{\Delta P_s \times (T_s + 460)} \left[\frac{1}{P_s \times MW}\right]^{1/2}$$

$$\%I = \frac{1{,}032 \times (T_s + 460) \times V_{m_{std}}}{V_s \times T_t \times P_s \times M_d \times (D_n)^2}$$

N_p Total No. of Sampling Points

P_m Average Orifice Pressure Drop, in. H_2O

P_b Barometric Pressure, in. Hg. Absolute

V_m Volume of Dry Gas at Meter Conditions, DCF

T_m Average Meter Temperature, °F

$V_{m_{std}}$ Volume of Dry Gas at STP, DSCF[a]

V_w Total H_2O Collected in Impingers and Silica Gel, ml

$V_{w_{gas}}$ Volume of Water Vapor Collected at STP, SCF[b]

%M % Moisture by Volume

M_d Mole Fraction of Dry Gas

$\%\,CO_2$ Volume % Dry

$\%\,O_2$ Volume % Dry

%CO Volume % Dry

$\%\,N_2$ Volume % Dry

MW_d Molecular Weight of Stack Gas, Dry Basis

MW Molecular Weight of Stack Gas, Wet Basis

P_{st} Static Pressure of Stack Gas, in. Hg

P_s Stack Gas Pressure, in. Hg Absolute

C_p Pitot Tube Coefficient

V_s Stack Gas Velocity at Stack Conditions, fps.

T_s Average Stack Temperature °F

T_t Net Time of Test, Min.

D_n Sampling Nozzle Diameter, in.

%I Percent Isokinetic

[a] Dry standard cubic feet at 68°F, 29.92 in. Hg.

[b] Standard conditions at 68°F, 29.92 in. Hg.

[c] $\sqrt{\Delta P_s \times (T_s + 460)}$ is determined by averaging the square root of the product of the velocity head (ΔPs) and the absolute

APPENDIX B-3

PARTICLE SIZING DATA SHEET

Company: EPA Task 6

Source Designation: Inlet Venturi Scrubber

Date: 10/4/78

Test Number: PS-1

Field Person: RGK

Filter Number: SEE BELOW

Barometric Pressure ("Hg): 29.85

Stack Static Pressure ("~~H_2O~~ Hg): + 0.7 "Hg

Stack Dimensions: 4'6"

Potentiometer No.

Ambient Temperature (°F): 88

Record all Data Every 10 Minutes

Filter Heater Setting: In stack

Probe Heater Setting:

Nozzle Number: , Dia. (in.): .0

Pitot Tube No. 23 , Corr. Factor:

Meter Box No. 8 , Corr. Factor:

Meter Isokinetic Factor: 226,44(

Assumed Moisture (%): 4

Condensate Volume (ml):

Silica Gel Weight Gain (g):

Leak Rate CFM at

Traverse Point No.	Time: Sampling (min)	Time: Clock	Velocity Pressure ("H_2O)	Stack Temp (°F)	Dry Gas Meter: Volume (ft^3)	Dry Gas Meter: Temp (°F) Inlet	Dry Gas Meter: Temp (°F) Outlet	Orifice Pressure Differential ("H_2O)	Filter Box Temp (°F)	Last Imp. Gas Temp (°F)	Samp Tr Sta Pres ("I
PM CL	~~30~~	1632	.85	185	434.937	87	90	4.5			3.~~5~~
	10	1638	.85	185	435.513	90	92	4.5			3.8
AVERAGE (TOTAL)				185	( )	88	91	4.5			

ANDERSON IN/OUT OF STACK

	Filter No.	Comments
CYCLONE		
STAGE 0	AFP- -	
STAGE 1	AFP- -	
STAGE 2	AFP- -	
STAGE 3	AFP- -	
STAGE 4	AFP- -	
STAGE 5	AFP- -	
STAGE 6	AFP- -	
STAGE 7	AFP- -	
BACK UP	A- -	

BRINKS IN/~~OUT~~ OF STACK

	Filter No	Comment
CYCLONE	A	
STAGE 1	A- -	
STAGE 2	A- -	
STAGE 3	A- -	
STAGE 4	A- -	
STAGE 5	A- -	
BACK-UP	A- -	

APPENDIX B-4

VISIBLE EMISSIONS DATA SHEETS

SUMMARY
RECORD OF VISIBLE EMISSIONS

Type of Plant Ammonium Sulfate Date 10/3/78

Company Name Dow-Badische / Epa Task 6 Hours of Observation _____

Plant Address _____ Observer D Lazarevic

Type of Discharge (STACK) OTHER _____

Discharge Location Scrubber Outlet

Height of Point of Discharge 55'

Observer's Location:

Distance to Discharge Point 250'

Height of Observation Point ground level

Direction from Discharge Point 105° East

Background Description Green elevator shaft

Weather: Clear (Overcast) Partly Cloudy Other _____ Color black/grey

Wind Direction SE 125° Wind Velocity 5 mi/hr

Plume Description:

Detached: Yes (No)

Color: Black (White) Other _____

Plume Dispersion Behavior: Looping Coning Fanning

Lofting Fumigating Other straight up

Estimated Distance Plume Visible _____

Summary of Observations:

Opacity	Aggregate Time @ Opacity	Opacity	Aggregate Time @ Opacity
0	min. sec.	55	
5		60	
10		65	
15		70	
20		75	
25		80	
30		85	
35		90	
40		95	
45		100	
50			

RECORD OF VISIBLE EMISSIONS

Company Name Dow Badische Equity Date 10/3/78

Plant Address _____ Observer [illegible]

Stack Location _____ Observer's Location 105° East

Weather Conditions Overcast - occasional rain

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
15:15	00	10	10	10	10	- using green elevator shaft to read off of.
	01	10	10	10	10	
	02	10	10	10	10	- very good overcast day
	03	10	10	10	10	5 feet
15:20	04	10	10	10	10	
	05	10	10	10	10	
	06	10	10	10	10	
	07	10	10	10	10	
	08	10	10	10	10	
	09	10	10	10	10	
	10	10	10	10	10	
	11	10	10	10	10	
	12	10	10	10	10	
	13	10	10	10	10	
15:30	14	10	10	10	10	
	15	10	10	10	10	
	16	10	10	10	10	
	17	10	10	10	10	
	18	10	10	10	10	
	19	10	10	10	10	
	20	10	10	10	10	
	21	10	10	10	10	
	22	10	10	10	10	
	23	10	10	10	10	
	24	10	10	10	10	
	25	10	10	10	10	
	26	10	10	10	10	
	27	10	10	10	10	
	28	10	10	10	10	
15:45	29	10	10	10	10	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME		SECONDS				COMMENTS
HR	MIN	00	15	30	45	
15:46	30	10	10	10	10	
	31	10	10	10	10	
	32	10	10	10	10	
	33	10	10	10	10	
	34	10	10	10	10	
	35	10	10	10	10	
	36	10	10	10	10	
	37	10	10	10	10	
	38	10	10	10	10	
15:55	39	10	10	10	10	
↓	40	10	10	10	10	
	41	10	10	10	10	
	42	10	10	10	10	
	43	10	10	10	10	
	44	10	10	10	10	
	45	10	10	10	10	
	46	10	10	10	10	TEST STARTED (16:00)
16:03	47	10	10	10	10	
	48	10	10	10	10	
	49	10	10	10	10	
	50	10	10	10	10	
	51	10	10	10	10	
16:09	52	10	10	10	10	
	53	10	10	10	10	
	54	10	10	10	10	
	55	10	10	10	10	
	56	10	10	10	10	
	57	10	10	10	10	
	58	10	10	10	10	
	59	10	10	10	10	

pg. 2

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
16:16	00	10	10	10	10	steady plume
	01	10	10	10	10	-
	02	10	10	10	10	-
	03	10	10	10	10	-
	04	10	10	10	10	-
	05	10	10	10	10	-
	06	10	10	10	10	
	07	10	10	10	10	
	08	10	10	10	10	
16:25	09	10	10	10	10	
	10	10	10	10	10	
	11	10	10	10	10	
	12	10	10	10	10	
	13	10	10	10	10	
16:30	14	10	10	10	10	Rain stopped
	15	10	10	10	10	
	16	10	10	10	10	
	17	10	10	10	10	
	18	10	10	10	10	
	19	10	10	10	10	
	20	10	10	10	10	
	21	10	10	10	10	
	22	10	10	10	10	
	23	10	10	10	10	
	24	10	10	10	10	
	25	10	10	10	10	
	26	10	10	10	10	
	27	10	10	10	10	
	28	10	10	10	10	
16:45	29	10	10	10	10	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME						COMMENTS
HR	MIN	SECONDS				
		00	15	30	45	
	30	10	10	10	10	
1047	31	10	10	10	10	
	32	10	10	10	10	
	33	10	10	10	10	
	34	10	10	10	10	
	35	10	10	10	10	
	36	10	10	10	10	
	37	10	10	10	10	
	38	10	10	10	10	
	39	10	10	10	10	
	40	10	10	10	10	
	41	10	10	10	10	
	42	10	10	10	10	
	43	10	10	10	10	
17:00	44	10	10	10	10	
	45	10	10	10	10	
	46	10	10	10	10	
17.03	47	10	10	10	10	Changing ports (W)
	48	10	10	10	10	
	49	10	10	10	10	
	50	10	10	10	10	
	51	10	10	10	10	
	52	10	10	10	10	
	53	10	10	10	10	
	54	10	10	10	10	
	55	10	10	10	10	
	56	10	10	10	10	
	57	10	10	10	10	
	58	10	10	10	10	
1215	59	10	10	10	10	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME						COMMENTS
HR	MIN	SECONDS				
		00	15	30	45	
1716	00	10	10	10	10	
	01	10	10	10	10	
	02	10	10	10	10	
	03	10	10	10	10	
	04	10	10	10	10	
1721	05	10	10	10	10	
1726	06	10	10	10	10	
	07	10	10	10	10	
	08	10	10	10	10	
	09	10	10	10	10	
	10	10	10	10	10	
1733	11	10	10	10	10	
	12	10	10	10	10	
	13	10	10	10	10	
	14	10	10	10	10	
1731	15	10	10	10	10	Stop test - system down
1800	16	10	10	10	10	wind has died down 0-5 Start up
	17	10	10	10	10	
	18	10	10	10	10	
	19	10	10	10	10	
	20	10	10	10	10	
1805	21	10	10	10	10	
	22	10	10	10	10	
	23	10	10	10	10	
	24	10	10	10	10	
	25	10	10	10	10	
	26	10	10	10	10	
	27	10	10	10	10	
	28	10	10	10	10	
	29	10	10	10	10	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
8:14	30	10	10	10	10	
	31	10	10	10	10	wind Changed direction NW 0-5 mi/hr
	32	10	10	10	10	
14:42	33	10	15	15	15	
	34	15	15	15	15	
	35	15	15	15	15	
	36	15	15	15	15	
	37	15	15	15	15	
	38	15	15	15	15	
	39	15	15	15	15	
	40	15	15	15	15	
	41	15	15	15	15	
	42	15	15	15	15	
	43	15	15	15	15	
	44	10	15	15	15	
	45	15	15	15	15	
	46	15	15	15	15	
	47	15	15	15	15	
	48	15	15	15	15	
	49	15	15	15	15	
	50	15	15	15	15	
	51	15	15	15	15	
	52	15	15	15	15	
	53	15	15	15	15	
18:54	54	15	15	15	15	
	55	15	15	15	15	
	56	15	15	15	15	
	57	15	15	15	15	
	58	15	15	15	15	
	59	15	15	15	15	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME						COMMENTS
HR	MIN	SECONDS				
		00	15	30	45	
	00	15	15	15	15	
	01	15	15	15	15	
	02	15	15	15	15	
4:27	03	15	15	15	15	
	04	10				
	05					
	06					
	07					
	08					
	09					
	10					
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					

SUMMARY
RECORD OF VISIBLE EMISSIONS

Type of Plant Concrete Batch Date 10-4-78

Company Name Dow Badische Hours of Observation

Plant Address Texas Observer Donna Schuch

Type of Discharge STACK OTHER

Discharge Location Scrubber Exhaust

Height of Point of Discharge 55'

Observer's Location:

Distance to Discharge Point 60'

Height of Observation Point 55'

Direction from Discharge Point SE

Background Description

Weather: Clear Overcast Partly Cloudy Other Hazy Color

Wind Direction NE Wind Velocity 10 mi/hr

Plume Description:

Detached: Yes (No)

Color: Black (White) Other

Plume Dispersion Behavior: Looping Coning Fanning

Lofting Fumigating Other

Estimated Distance Plume Visible 1'

Summary of Observations:

Opacity	Aggregate Time @ Opacity	Opacity	Aggregate Time @ Opacity
0	min. sec.	55	
5		60	
10		65	
15		70	
20		75	
25		80	
30		85	
35		90	
40		95	
45		100	
50			

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date 10-4-78

Plant Address _____ Observer Donna Schoch

Stack Location _____ Observer's Location 100' SE of Stack

Weather Conditions Hazy

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
18	40	5	5	5	5	Plume
	41	5	5	5	5	5-10 out of HE
	42	5	5	5	5	
	43	5	5	5	5	
	44	5	5	5	0	
	45	5	5	5	5	
	46	5	0	5	5	
	47	5	5	5	5	
	48	5	5	5	5	
	49	5	5	5	5	
	50	5	5	5	5	
	51	5	5	5	5	
	52	5	5	5	5	
	53	5	5	5	5	
	54	0	5	0	0	
	55	5	0	0	5	
	56	5	5	0	5	
	57	5	5	5	5	
	58	0	5	0	0	
	59	5	0	5	0	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's location _____

Weather Conditions _____

TIME						COMMENTS
HR	MIN	SECONDS				
		00	15	30	45	
	00	0	0	5	0	
	01	5	5	5	5	
	02	5	5	5	0	
	03	5	0	5	5	
	04	0	0	5	0	
	05	0	0	0	5	
	06	5	0	5	5	
	07	5	5	0	5	
	08	5	0	0	5	
	09	0	0	5	0	
	10	5	5	5	5	
	11	5	5	5	5	
	12	5	5	5	5	
	13	5	5	5	0	
	14	5	0	0	0	
	15	5	5	0	5	
	16	5	5	5	5	
	17	5	5	0	0	
	18	0	5	0	5	
	19	5	0	0	0	
	20	0	0	0	0	
	21	0	0	0	5	
	22	5	5	0	5	
	23	5	5	0	5	
	24	5	5	0	0	
	25	5	5	0	0	
	26	5	5	5	5	
	27	0	0	0	0	
	28	5	5	5	5	
	29	0	5	5	0	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME						COMMENTS
HR	MIN	SECONDS				
		00	15	30	45	
	30	5	5	0	5	
	31	0	5	0	0	
	32	0	0	0	0	
	33	0	0	0	0	
0934	34	0	0	0	0	
	35	0	0	0	0	
	36	0	0	0	0	
	37	0	0	0	0	
	38	0	5	0	0	
	39	0	0	0	0	
	40	0	0	0	0	
	41	0	0	0	0	
	42	0	0	0	0	
	43	0	0	0	0	
	44	5	0	5	0	
	45	0	0	0	0	
	46	0	0	0	0	
	47	0	0	0	0	
	48	0	0	0	0	
	49	0	0	0	0	
	50	0	0	0	0	Port Change
	51	0	0	0	0	
	52	0	0	5	0	
	53	5	0	0	0	
	54	0	0	0	0	
	55	0	0	0	0	
	56	0	0	0	0	
	57	0	0	0	0	
	58	0	0	0	0	
	59	0	0	5	0	

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME		SECONDS				COMMENTS
HR	MIN	00	15	30	45	
10	00	0	0	0	0	Start at 2nd point
	01	0	0	0	0	
	02	0	5	0	0	
	03	0	0	0	0	
	04	0	0	0	0	
	05	0	0	5	0	
	06	5	0	0	5	
	07	0	0	0	0	
	08	0	0	0	0	
	09	0	0	0	0	
	10	0	0	0	0	
	11	0	0	0	0	
	12	0	0	0	0	
	13	0	0	0	0	
	14	0	0	0	0	
	15	0	0	0	0	
	16	0	0	5	0	
	17	0	0	0	0	
	18	0	0	0	0	
	19	0	0	0	0	
	20	0	0	0	0	
	21	0	0	0	0	
	22	0	0	0	0	
	23	0	0	0	0	
	24	0	0	0	0	
	25	0	0	0	0	
	26	0	0	0	0	
	27	0	0	0	0	
	28	0	5	0	0	
	29	0	0	0	0	

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME						COMMENTS
HR	MIN	SECONDS				
		00	15	30	45	
	30	0	0	0	0	
	31	0	0	0	0	
	32	0	0	0	5	
	33	0	0	0	0	
	34	0	0	0	0	
	35	0	0	0	0	
	36	0	0	0	0	
	37	0	5	5	0	
	38	0	0	0	0	
	39	0	0	0	5	
10	40	0	0	0	0	
	41	0	0	0	0	
	42	0	0	0	0	
	43	0	0	0	0	
	44	0	0	0	0	
	45	0	0	0	0	
	46	0	0	0	0	
	47	0	5	5	5	
	48	0	0	0	0	
	49	0	0	0	0	
	50	0	0	0	0	
	51	0	0	0	0	
	52	0	5	5	0	
	53	0	0	0	0	
	54	0	0	0	0	
	55	5	0	5	5	
	56	5	5	0	5	
	57	0	5	0	0	
	58	0	0	0	0	
10	59	0	0	0	0	

SUMMARY
RECORD OF VISIBLE EMISSIONS

Type of Plant Ammonium Sulfate Date 10/4/78

Company Name Dow Badische Hours of Observation _____

Plant Address _____ Observer A Figueroa

Type of Discharge (STACK) OTHER _____

Discharge Location Scrubber Outlet

Height of Point of Discharge [redacted]

Observer's Location:

Distance to Discharge Point 250'

Height of Observation Point ground level

Direction from Discharge Point E 105°

Background Description green elevator shaft

Weather: Clear Overcast (Partly Cloudy) Other Hazy Color _____

Wind Direction NE 45° Wind Velocity 5-10 ± mi/hr

Plume Description:

Detached: Yes (No)

Color: Black (White) Other _____

Plume Dispersion Behavior: Looping Coning Fanning

Lofting Fumigating Other straight up

Estimated Distance Plume Visible _____

Summary of Observations:

Opacity	Aggregate Time @ Opacity	Opacity	Aggregate Time @ Opacity
0	min. sec.	55	
5		60	
10		65	
15		70	
20		75	
25		80	
30		85	
35		90	
40		95	
45		100	
50			

RECORD OF VISIBLE EMISSIONS

Company Name Dow - Bridge Date 10/2/78

Plant Address _____ Observer D'Lafreniere

Stack Location _____ Observer's Location East 105°

Weather Conditions Overcast - hazy - very windy

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
1415	00	10	10	10	5	during P-3
	01	5	10	10	10	
	02	10	10	10	10	
	03	10	10	10	10	
	04	10	10	10	10	
	05	10	10	10	10	
	06	10	5	5	5	
	07	5	5	10	10	
	08	10	10	10	10	
	09	10	10	10	10	
	10	10	10	10	10	
	11	10	10	10	10	
	12	10	10	10	10	
	13	10	10	10	10	
	14	10	10	10	10	
	15	10	10	10	10	
	16	10	10	10	10	
	17	10	10	10	10	
	18	10	10	10	10	
	19	10	10	10	10	
1435	20	10	10	10	10	
	21	10	10	10	10	
	22	10	10	10	10	
	23	10	10	10	10	
	24	10	10	10	10	
	25	10	10	10	10	
	26	10	10	10	10	
	27	10	10	10	10	
	28	10	10	10	10	
	29	10	10	10	10	

RECORD OF VISIBLE EMISSIONS

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
1445	30	10	10	10	10	
	31	5	5	5	5	
	32	5	5	5	10	
	33	10	10	10	10	
	34	10	10	10	10	
1450	35	10	10	10	10	
	36	10	10	10	10	
	37	10	10	10	10	
1453	38	10	10	10	5	Down down
1526	39	5	5	5	5	but started
	40	5	5	5	5	
	41	5	5	5	5	
	42	5	5	5	5	
	43					
	44	5	5	5	5	
1531	45	5	5	5	5	
	46	5	5	5	5	
	47	5	5	5	5	
	48	5	5	5	10	
	49	10	10	10	10	
	50	10	10	5	5	
1534	51	5	5	5	5	
	52	5	5	5	5	
	53	5	5	5	5	
	54	5	5	5	5	
	55	5	5	5	5	
	56	5	5	5	5	
1538	57	5	5	5	5	
	58	5	5	5	5	
	59	5	5	5	5	

RECORD OF VISIBLE EMISSIONS

Company Name Dow Badische — Date 10/4/78

Plant Address — Observer D. Lazarus

Stack Location — Observer's Location

Weather Conditions overcast - hazy

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
1546	00	5	5	5	5	
	01	5	5	5	5	
	02	5	5	5	5	
1548	03	5	5	5	5	changing ports
	04	5	5	5	5	
	05	5	5	5	5	
	06	5	5	5	5	
	07	5	5	5	5	
	08	5	5	5	5	
1551	09	5	5	5	5	
	10	5	5	5	5	
	11	5	5	5	5	
	12	5	5	5	5	
	13	5	5	5	5	
	14	5	5	5	5	
1554	15	5	5	5	5	
1	16	5	5	5	5	
	17	5	5	5	5	
	18	5	5	5	5	
	19	5	5	5	5	
	20	5	5	5	5	
1602	21	5	5	5	5	
	22	5	5	5	5	
	23	5	5	5	5	
	24	5	5	5	5	
	25	5	5	5	5	
	26	5	5	5	5	
1608	27	5	5	5	5	
	28	5	5	5	5	
	29	5	5	5	5	

RECORD OF VISIBLE EMISSIONS

Company Name Dow Badische Date 10/4/70

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME HR	MIN	SECONDS 00	15	30	45	COMMENTS
16:16	30	5	5	5	5	
	31	5	5	5	5	
	32	5	5	5	5	
16:19	33	5	5	5	5	
	34	5	5	5	5	
	35	5	5	5	5	
	36	5	5	5	5	
	37	5	5	5	5	
	38	5	5	5	5	
16:25	39	5	5	5	5	
	40	5	5	5	5	
	41	5	5	5	5	
	42	5	5	5	5	
	43	5	5	5	5	
	44	5	5	5	5	Southeast wind direction
16:31	45	5	5	5	5	
	46	5	5	5	5	
	47	5	5	5	5	
	48	5	5	5	5	
	49	5	5	5	5	
	50	5	5	5	5	
16:37	51	5	5	5	5	
	52	5	5	5	5	
	53	5	5	5	5	
	54	5	5	5	5	
	55	5	5	5	5	
	56	5	5	5	5	
16:43	57	5	5	5	5	
	58	5	5	5	5	
	59	5	5	5	5	

Company Name _____ Date _____

Plant Address _____ Observer _____

Stack Location _____ Observer's Location _____

Weather Conditions _____

TIME		SECONDS				COMMENTS
HR	MIN	00	15	30	45	cont
16:4[illegible]	00	5	5	5	5	
	01	5	5	5	5	
	02	5	5	5	5	
1643	03	5	5	5	5	
	04	5	5	5	5	
	05	5	5	5	5	
	06	5	5	5	5	
	07	5	5	5	5	
	08	5	5	5	5	
1455	09	5	5	5	5	
	10	5	5	5	5	
	11	5	5	5	5	
	12	5	5	5	5	
	13	5	5	5	5	
1700	14	5	5	5	5	
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					

APPENDIX C

SUMMARY OF PARTICULATE WEIGHT BY FRACTION AND CAPROLACTAM DETERMINATIONS BY FRACTION

Table C.1 Summary of Particulate Weight by Fraction, Grams

Sampling Location	Sample No.	110 mm Type A Glass-Fiber Filter (gm)	Front Acetone Wash (gm)	Front Water Wash (gm)	Filterable Particulate (gm)	Back Acetone Wash (gm)	Back Water Wash (gm)	Total Particulate (gm)
Inlet	P-1	0.2223	0.0121	110.81	111.04	0.0083	0.0035	111.06
	P-2	0.2900	0.0129	108.57	108.87	0.0069	0.0121	108.89
	P-3	0.2542	0.0080	118.87	119.13	0.0233	0.0113	119.17
Outlet	P-1	0.0089	0.0099	0.0701	0.0889	0.0015	0.0040	0.0944
	P-2	0.0097	0.0056	0.0281	0.0434	0.0049	0.0017	0.0500
	P-3	0.0096	0.0093	0.1486	0.1675	0.0078	0.0109	0.1862

Table C.2 Summary of Caprolactam Determinations by Fraction, Milligrams

Sampling Location	Sampling No.	Front Water Rinse	Filter	Filterable Portion	Back Half Water	Total
Inlet	P-1	24.9	<0.25	24.9	627	652
	P-2	63.5	<0.25	63.5	756	820
	P-3	<4.60	<0.25	<4.85	877	877
Outlet	P-1	2.15	<0.25	2.15	58.1	60.3
	P-2	<2.50	<0.25	<2.75	73.9	73.9
	P-3	<2.70	<0.25	<2.95	87.6	87.6

APPENDIX D

AMMONIUM SULFATE DETERMINATIONS AND PERCENT MOISTURES

Table D.1 Summary of Ammonium Sulfate in Scrubber Water

Sample No.	Date	$(NH_4)_2 SO_4$ (g/l)
1	10-3-78	320
2	10-4-78	367
3	10-4-78	380
Average		356

Table D.2 Percent Moisture in Ammonium Sulfate

Sample No.	Date	Percent Moisture		Percent Moisture Reduction
		Dryer Inlet	Dryer Outlet	
1	10-3-78	0.96	0.09	90.6
2	10-4-78	1.02	0.09	91.2
3	10-4-78	1.10	0.07	93.6
Average		1.03	0.08	91.8

APPENDIX E

SUMMARY OF VISIBLE EMISSIONS

SUMMARY OF VISIBLE EMISSIONS

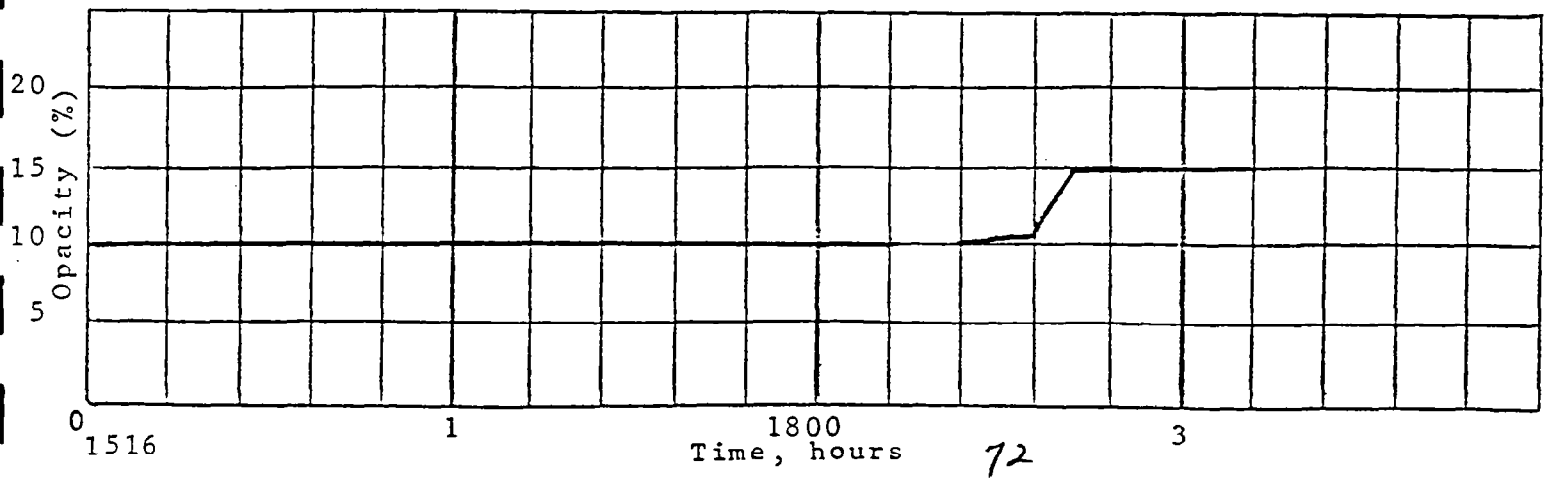
Sample No. 1

Date: 10-3-78
Type of Discharge: Particulate
Height of Point of Discharge: 55'
Wind Direction: SE & NW
Color of Plume: white
Observer No.: Dusanka Lazarevic
Type of Plant: Ammonium Sulfate
Location of Discharge: Scrubber Exhaust
Description of Sky: Overcast
Wind Velocity: 0-5 mph
Detached Plume: No
Duration of Observation: 3 hr. 2 min.
Distance from Observer to Discharge Point: 250'
Direction of Observer from Discharge Point: East
Height of Observation Point: Ground level
Description of Background: green elevator shaft

SUMMARY OF AVERAGE OPACITY

Set Number	Time		Opacity		Set Number	Time		Opacity	
	Start	End	Sum	Average		Start	End	Sum	Average
1	1516	1521	240	10	21	1716	1721	240	10
2	1522	1527	240	10	22	1722	1727	240	10
3	1528	1533	240	10	23	1728	1731	240	10
4	1534	1539	240	10	24	1800	1805	240	10
5	1540	1545	240	10	25	1806	1811	240	10
6	1546	1551	240	10	26	1812	1817	255	11
7	1552	1557	240	10	27	1818	1823	360	15
8	1558	1603	240	10	28	1824	1829	360	15
9	1604	1609	240	10	29	1830	1835	360	15
10	1610	1615	240	10	30	1836	1841	360	15
11	1616	1621	240	10	31	1842	1847	360	15
12	1622	1627	240	10	32				
13	1628	1633	240	10	33				
14	1634	1639	240	10	34				
15	1640	1645	240	10	35				
16	1646	1651	240	10	36				
17	1652	1657	240	10	37				
18	1658	1703	240	10	38				
19	1704	1709	240	10	39				
20	1710	1715	240	10	40				

Sketch Showing How Opacity Varied With Time:

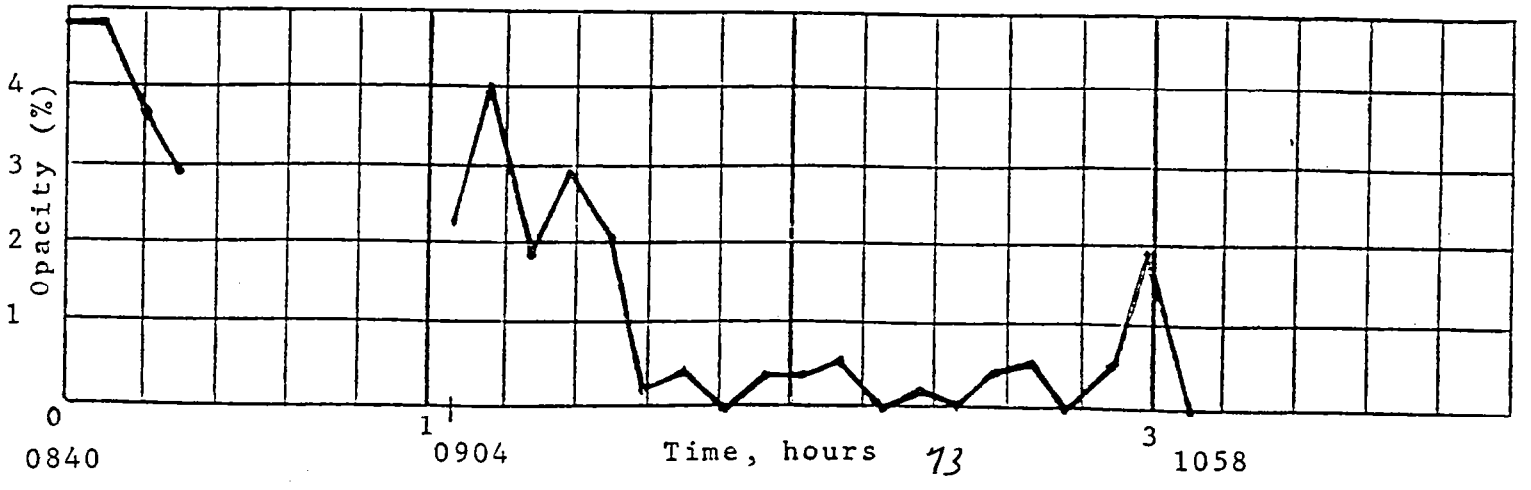


SUMMARY OF VISIBLE EMISSIONS
Sample No. 2

Date: 10-4-78
Type of Discharge: Particulate
Height of Point of Discharge: 55'
Wind Direction: NE
Color of Plume: White
Observer No.: Donna Schick
Type of Plant: Ammonium Sulfate
Location of Discharge: Scrubber Exhaust
Description of Sky: Hazy
Wind Velocity: 10 mph
Detached Plume: No
Duration of Observation: 2 hr. 19 min.
Distance from Observer to Discharge Point: 60'
Direction of Observer from Discharge Point: SE
Height of Observation Point: 55'
Description of Background: Building

SUMMARY OF AVERAGE OPACITY									
Set Number	Time		Opacity		Set Number	Time		Opacity	
	Start	End	Sum	Average		Start	End	Sum	Average
1	0840	0845	115	4.8	21	1040	1045	0	0
2	0846	0851	115	4.8	22	1046	1051	15	0.6
3	0852	0857	90	3.7	23	1052	1057	45	1.9
4	0858	0903	70	2.9	24	1058	1059	0	0
5	0904	0909	55	2.3	25				
6	0910	0915	95	4.0	26				
7	0916	0921	45	1.9	27				
8	0922	0927	70	2.9	28				
9	0928	0933	50	2.1	29				
10	0934	0939	5	0.2	30				
11	0940	0945	10	0.4	31				
12	0946	0951	0	0	32				
13	0952	0957	10	0.4	33				
14	0958	1003	10	0.4	34				
15	1004	1009	15	0.6	35				
16	1010	1015	0	0	36				
17	1016	1021	5	0.2	37				
18	1022	1027	0	0	38				
19	1028	1033	10	0.4	39				
20	1034	1039	15	0.6	40				

Sketch Showing How Opacity Varied With Time:

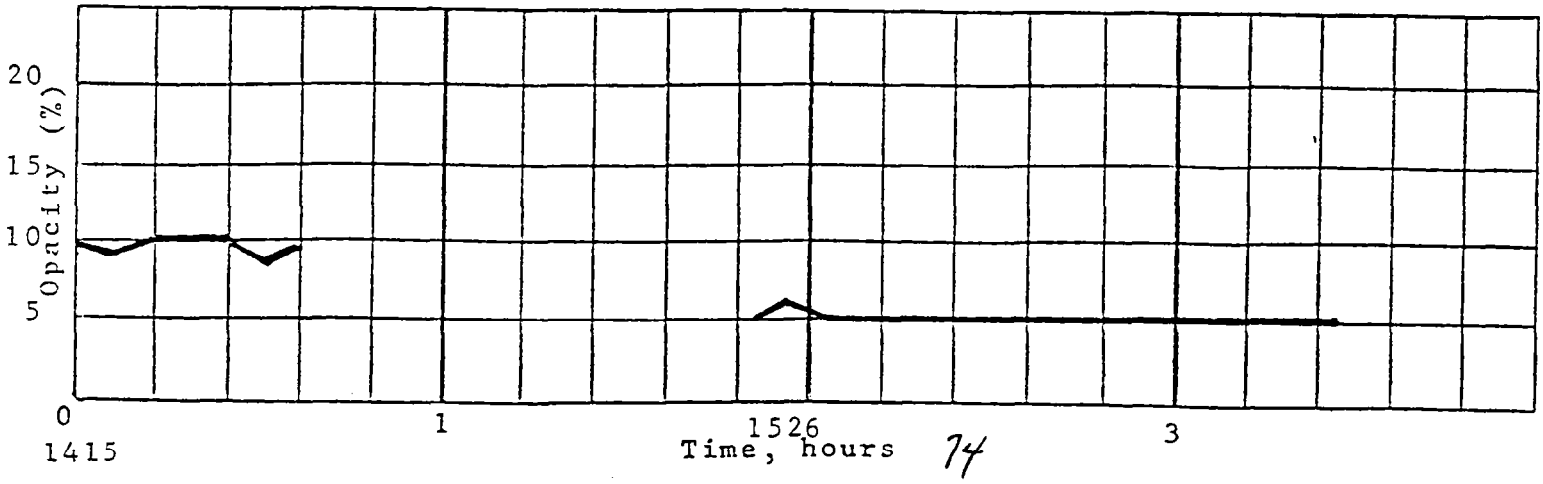


SUMMARY OF VISIBLE EMISSIONS
Sample No. 3

Date: 10-4-78
Type of Discharge: Particulate
Height of Point of Discharge: 55'
Wind Direction: NE
Color of Plume: White
Observer No.: Dusanka Lazarevic
Type of Plant: Ammonium Sulfate
Location of Discharge: Scrubber Exhaust
Description of Sky: Partly Cloudy/Hazy
Wind Velocity: 5-10 mph
Detached Plume: No
Duration of Observation: 2 hr. 45 min
Distance from Observer to Discharge Point: 250'
Direction of Observer from Discharge Point: East
Height of Observation Point: Ground level
Description of Background: green elevator shaft

SUMMARY OF AVERAGE OPACITY								
Set Number	Time		Opacity		Set Number	Time		Opacity	
	Start	End	Sum	Average		Start	End	Sum	Average
1	1415	1420	230	9.6	21	1644	1649	120	5.0
2	1421	1426	215	9.0	22	1650	1655	120	5.0
3	1427	1432	240	10.0	23	1656	1700	100	5.0
4	1433	1438	240	10.0	24				
5	1439	1444	240	10.0	25				
6	1445	1450	205	8.5	26				
7	1451	1453	115	9.6	27				
8	1526	1531	120	5.0	28				
9	1532	1537	155	6.5	29				
10	1538	1543	120	5.0	30				
11	1544	1549	120	5.0	31				
12	1550	1555	120	5.0	32				
13	1556	1601	120	5.0	33				
14	1602	1607	120	5.0	34				
15	1608	1613	120	5.0	35				
16	1614	1619	120	5.0	36				
17	1620	1625	120	5.0	37				
18	1626	1631	120	5.0	38				
19	1632	1637	120	5.0	39				
20	1638	1643	120	5.0	40				

Sketch Showing How Opacity Varied With Time:



APPENDIX F

GAS CHROMATOGRAPH DATA SUMMARY

Data Results for Gas Chromatographic Testing for Caprolactam Using 5% Carbowax 20-TPA On Chromosorb W-AW 6' x 1/4"

Test No.	Date of Test	Sample fraction	Sample Volume	Peak area	Concentration (PPM)	weight (mg)
inlet P-1	10-3-78	H_2O front half	830 ml	63,552	30	24.9
inlet P-2	10-4-78	H_2O front half	635 ml	116,564	100	63.5
inlet P-3	10-4-78	H_2O front half	460 ml	26,077	<10	<4.60
inlet P-1	10-3-78	H_2O back half	570 ml	952,186	1100	627
inlet P-2	10-4-78	H_2O back half	540 ml	1,240,516	1400	756
inlet P-3	10-4-78	H_2O back half	702 ml	1,125,674	1250	877
outlet P-1	10-3-78	H_2O front half	215 ml	35,699	10	2.15
outlet P-2	10-4-78	H_2O front half	250 ml	Ø	<10	<2.50
outlet P-3	10-4-78	H_2O front half	270 ml	17,036	<10	<2.70
outlet P-1	10-3-78	H_2O back half	505 ml	129,650	115	58.1
outlet P-2	10-4-78	H_2O back half	308 ml	250,930	240	73.9
outlet P-3	10-4-78	H_2O back half	1030 ml	100,930	85	87.6
inlet P-1	10-3-78	filter A-263-12	25 ml	8,316	<10	<0.25
inlet P-2	10-4-78	filter A-263-15	25 ml	12,437	<10	<0.25
inlet P-3	10-4-78	filter A-263-14	25 ml	10,220	<10	<0.25
outlet P-1	10-3-78	filter A-263-11	25 ml	5,543	<10	<0.25
outlet P-2	10-4-78	filter A-263-13	25 ml	6,728	<10	<0.25
outlet P-3	10-4-78	filter A-263-09	25 ml	7,279	<10	<0.25
all	10-3,4-78	H_2O blank	290 ml	Ø	<10	<2.90
all	10-3,4-78	filter blank	25 ml	Ø	<10	<0.25

Caprolactam Standard Curve Calibrations

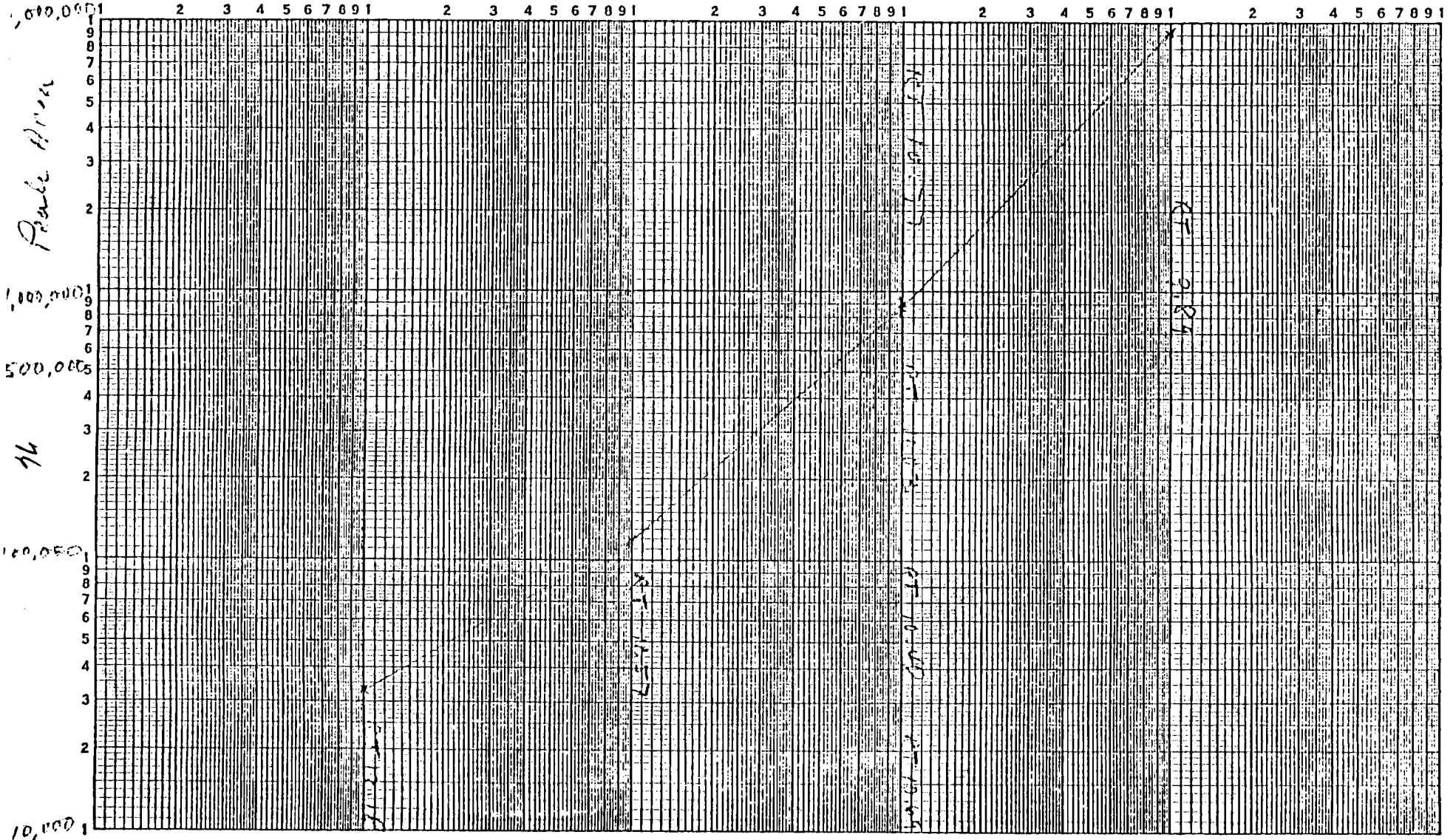
Using 5% Carbowax 20-TPA On Chromosorb WAW 6' x 1/4"

Standard Stock Solution 0.10118 g per 100 ml H_2O (1012 ppm)

SOLUTION	CONCENTRATION	AREA
Standard	1012 ppm	872,728
"	"	904,516
"	"	881,360
"	"	848,351
		Avg = 876,738
Standard x 1/10	~100 ppm	118,784
Standard x 1/100	~10 ppm	34,861
Standard x 1/1000	~1 ppm	No peak
Standard x 10	~10,000 ppm	9,159,168

Calvonax 20M TPA 6' 190° 250/250

Aqueous Equilibrium by pc



APPENDIX G

EXAMPLE CALCULATIONS

Nomenclature

A_s = Stack area, inches^2

C_f = Front half (probe & filter) particulate concentration, gr/DSCF

C_p = Pitot tube correction factor, dimensionless

C_t = Total particulate concentration, gr/DSCF

CM_f = Front half (probe & filter) particulate concentration, mg/DSm^3

CM_t = Total particulate concentration, mg/DSm^3

D_n = Sampling nozzle diameter, inches

ER_f = Emission rate of front half particulate, lb/hr

ER_t = Emission rate of total particulate, lb/hr

ERM_f = Emission rate of front half particulate, kg/hr

ERM_t = Emission rate of total particulate, kg/hr

M_d = Mole fraction of dry gas, g/g-mole

MW = Molecular weight of wet stack gas

MW_d = Molecular weight of dry stack gas

P_b = Barometric pressure, inches mercury

P_m = Average orifice pressure drop, inches water

P_s = Absolute stack gas pressure, inches mercury

P_{st} = Static pressure of stack gas, inches mercury

Qa = Actual stack gas flowrate at stack conditions, ACFM

Q_{am} = Actual stack gas flowrate at stack conditions, Am^3/min

Q_m = Dry stack gas flowrate at standard conditions, DSm^3/min

Q_s = Dry stack gas flowrate at standard conditions, DSCFM

SW_f = Front half sample weight, mg

SW_t = Total sample weight, mg

T_m = Average meter temperature, °F

T_s = Stack temperature, °F

T_t = Net time of test, minutes

V_m = Volume of dry gas at meter conditions, ft^3

$V_{m_{std}}$ = Volume of dry gas at standard conditions, DSCF

V_s = Stack gas velocity at stack conditions, fpm

V_w = Total condensate collected in sampling train, ml

$V_{w_{gas}}$ = Volume of water vapor at standard conditions, SCF

ΔP_s = Velocity pressure, inches water

%I = Percent of isokinetic variation, dimensionless

%M = Percent moisture, dimensionless

%R = Percent of removal efficiency, dimensionless

Calculation of Particulate Emissions

The dry volume of sampled gas corrected to standard conditions of 20°C and 760 mm Hg (29.92 in. Hg) is calculated as follows:

$$V_{m_{std}} = \frac{17.65 * V_m * P_b + \left(\frac{P_m}{13.6}\right)}{T_m + 460} \quad .$$

The dry stack gas flowrate corrected to standard conditions is calculated using the following set of equations sequentially:

$$V_{w_{gas}} = 0.0471 * V_w$$

$$\%M = \frac{100 * V_{w_{gas}}}{V_{m_{std}} + V_{w_{gas}}}$$

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

$$MW_d = (\%CO_2 * 44/100) + (\%O_2 * 32/100) + \left[(\%CO + \%N_2) * 28/100\right]$$

$$MW = (MW_d * M_d) + 18(1 - M_d)$$

$$P_s = P_b + P_{st}$$

$$V_s = 5120.8 * C_p * \sqrt{\Delta P_s * (T_s + 460)} * \sqrt{\frac{1}{P_s * MW}}$$

$$Q_s = \frac{0.1225 * V_s * A_s * M_d * P_s}{T_s + 460} .$$

Stack gas flowrate may be expressed metrically as dry normal cubic meters per minute (DNm^3/min) and in terms of actual cubic feet per minute (ACFM) and metrically as actual cubic meters per minute (Am^3/min) with use of the following equations:

$$Q_m = Q_s * 0.02832$$

$$Q_a = \frac{0.05667 * Q_s * (T_s + 460)}{P_s * M_d}$$

$$Q_{am} = Q_a * 0.02832.$$

The equation employed to determine percent of isokinetic variation is:

$$\%I = \frac{1032 * (T_s + 460) * V_{m_{std}}}{V_s * T_t * P_s * M_d * (D_n)^2} .$$

To determine the concentration of particulate matter in grains per dry standard cubic foot (gr/DSCF), one of the following equations is used:

$$C_f = 0.01543 * \frac{SW_f}{V_{m_{std}}} \quad \text{and}$$

$$C_t = 0.01543 * \frac{SW_t}{V_{m_{std}}} .$$

$$\%R = \frac{ER_{t\ inlet} - ER_{t\ outlet}}{ER_{t\ inlet}}$$

Example Calculation

Using the data from particulate Test 3 at the inlet location an example of the calculation of sampled volume in dry standard cubic feet (DSCF) is as follows:

Given:

P_b = 29.85 in. Hg

P_m = 2.68 in. H_2O

T_m = 104°F

V_m = 110.737 ft^3

V_w = 91.1 ml

and using the first two equations on page 2:

$V_{w_{gas}}$ = 4.29 SCF

$V_{m_{std}}$ = 104 DSCF

With the following additional information from the data sheet one can determine the flowrate in dry standard cubic feet per minute (DSCFM).

$\sqrt{P_s * (T_s + 460)}$ = 23.17

C_p = 0.828

T_s = 88°F

A_s = 2290 sq.in.

P_{st} = 0.7 in. Hg

Since no Orsat was run, and using the equations on page 2, we can determine the following information:

When metric units are desired, the concentration is calculated in milligrams per dry standard cubic meter (mg/DSm^3) as follows:

$$CM_f = \frac{SW_f}{(0.02832)(V_{m_{std}})} \quad \text{and}$$

$$CM_t = \frac{SW_t}{(0.02832)(V_{m_{std}})} \quad .$$

Front half particulate concentrations are obtained by summing the weight of particulate matter collected on the filter and all portions of the train preceding it. Total particulate concentration includes, in addition, any particulate matter collected in the impingers.

The emission rate of particulate matter can be calculated from the filterable or total particulate concentration using one of the following equations:

$$ER_f = 0.00857 * C_f * Q_s \quad \text{and}$$

$$ER_t = 0.00857 * C_t * Q_s \quad .$$

For metric units,

$$ERM_f = (1.70 * 10^{-6}) * CM_f * Q_s \quad \text{and}$$

$$ERM_t = (1.70 * 10^{-6}) * CM_t * Q_s \quad .$$

To avoid rounding errors it is preferable to carry out the calculation of concentration and emission rate in one operation. Removal efficiency is calculated using the pounds per hour emission rate in the following equation:

MW_d = 28.96

Then using the equations on pages 2 and 3, the flowrate in dry standard cubic feet per minute can be calculated.

%M = 4.0

M_d = 0.960

MW = 28.51

P_s = 30.55 in. Hg

V_s = 3330 fpm

Q_s = 42300 DSCFM.

Then using the equations on page 3, flowrate can be expressed as follows:

Q_m = 1200 DNm^3/min

Q_a = 52900 ACFM

Q_{am} = 1500 Am^3/min.

Having determined sampled volume to be 104 DSCF and the flowrate to be 42300 DSCFM, the percent of isokinetic variation can be determined.

Given:

$V_{m_{std}}$ = 104 DSCF

Q_s = 42300

T_t = 120 min.

D_n = 0.249 in.

then using the equation on page 3

%I = 95.9

The concentration and emission rate can now be calculated for this particulate test as follows:

Given:

SW_f = 119.13 g

SW_t = 119.17 g

Using equations on page 3 the concentration of filterable particulate and total particulate, both in grains per dry standard cubic foot (gr/DSCF), are as follows:

C_f = 17.5 gr/DSCF

C_t = 17.5 gr/DSCF

Concentrations may be expressed metrically as follows:

CM_f = 40,400 mg/DSm^3

CM_t = 40,500 mg/DSm^3

The emission rates in pounds per hour (lb/hr), and metrically as kilograms per hour (kg/hr) are as follows:

ER_f = 6410 lb/hr

ER_t = 6410 lb/hr

ERM_f = 2910 kg/hr

ERM_t = 2910 kg/hr

Removal efficiency can be determined using the pounds per hour value previously calculated together with the pounds per hour value calculated for the simultaneous test at the outlet location and the equation on page 4.

Given:

$ER_{t_{outlet}}$ = 15.7

then:

%R = 99.8%

APPENDIX H

CALIBRATION DATA

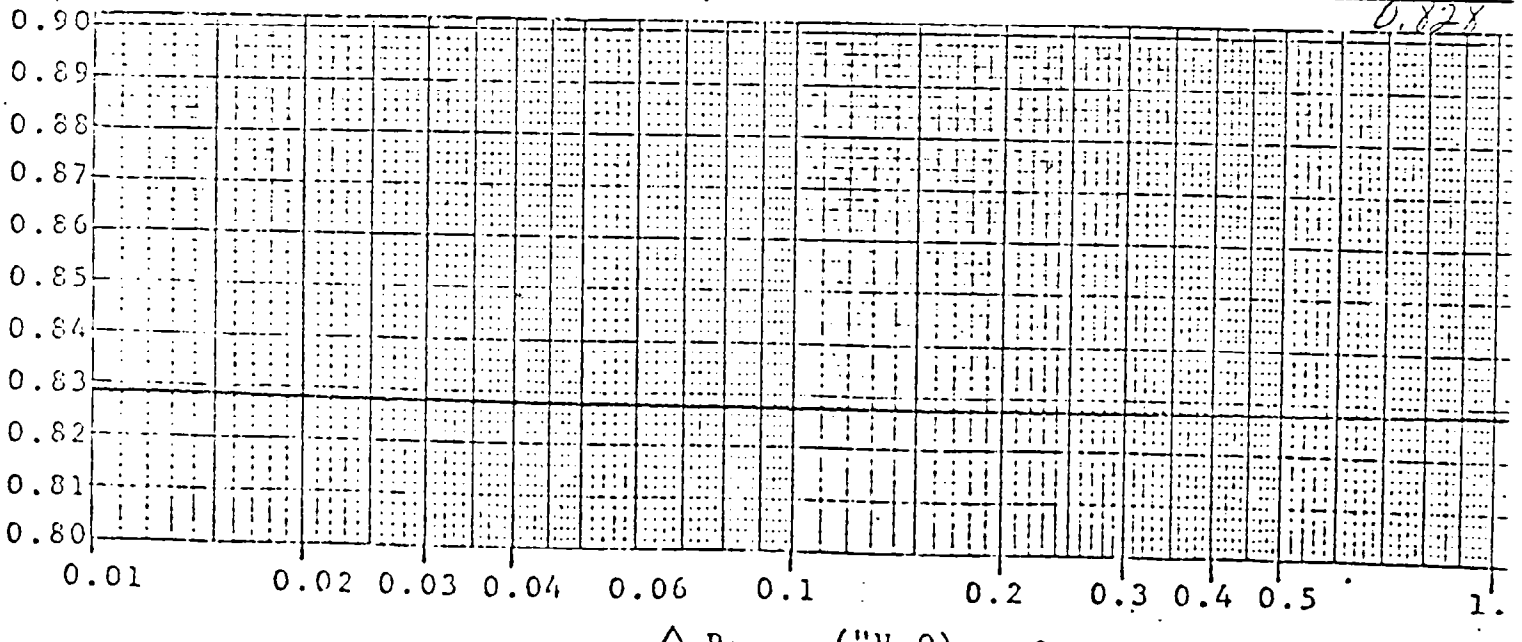
$C_{Ptest} = 0.99\sqrt{\frac{\Delta P_{std}}{\Delta P_{test}}}$

Pitot Tube Type S Pitot Tube No. 2

Standard Pitot Tube No. —

Calibrator: TVM Date: 8-22-78 Client: _____

Anticipated ΔP_{std}	ΔP_{std}	A		B	
		ΔP_{test}	ΔC_{Ptest}	ΔP_{test}	ΔC_{Ptest}
0.02	0._____	0._____	0._____	0._____	0._____
0.04	0._____	0._____	0._____	0._____	0._____
0.06	0._____	0._____	0._____	0._____	0._____
0.08	0._____	0._____	0._____	0._____	0._____
0.10	0.110	0.154	0.837	0.158	0.826
0.12	0.111	0.158	0.830	0.160	0.825
0.16	0.110	0.158	0.826	0.158	0.826
0.20	0._____	0._____	0._____	0._____	0._____
0.30	0._____	0._____	0._____	0._____	0._____
0.50	0._____	0._____	0._____	0._____	0._____
0.70	0.1_____	0._____	0._____	0._____	0._____
0.80	0._____	0._____	0._____	0._____	0._____



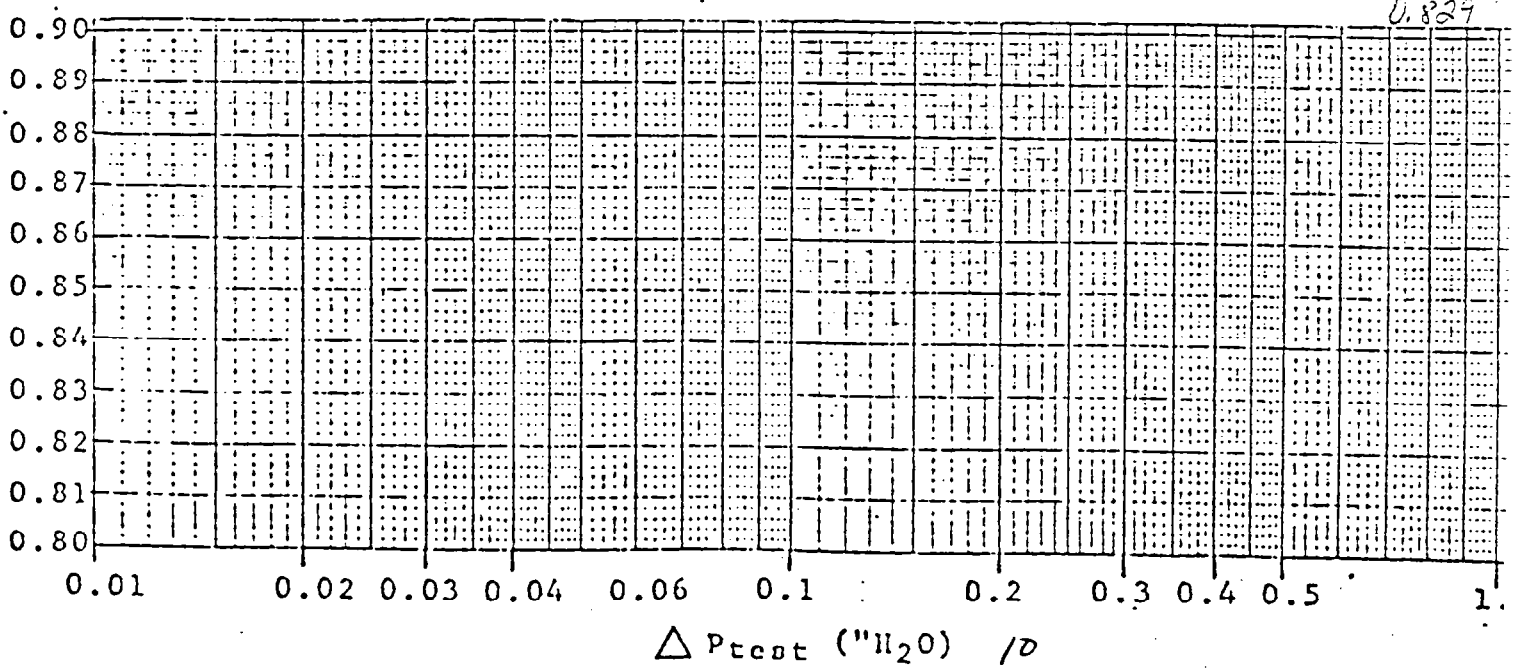
$C_{Ptest} = 0.99\sqrt{\frac{\Delta P_{std}}{\Delta P_{test}}}$

Pitot Tube Type _____ Pitot Tube No. 23

Standard Pitot Tube No. S

Calibrator: BFE/TUM Date: 10 OCT 78 Client: DOW - CDA TASK

Anticipated ΔP_{std}	ΔP_{std}	A		B	
		ΔP_{test}	ΔC_{Ptest}	ΔP_{test}	ΔC_{Ptest}
0.02	0.____	0.____	0.____	0.____	0.____
0.04	0.____	0.____	0.____	0.____	0.____
0.06	0.0998	0.1434	0.826	0.1380	0.842
0.08	0.0966	0.1390	0.825	0.1388	0.826
0.10	0.0972	0.1380	0.831	0.1408	0.823
0.12	0.____	0.____	0.____	0.____	0.____
0.16	0.____	0.____	0.____	0.____	0.____
0.20	0.____	0.____	0.____	0.____	0.____
0.30	0.____	0.____	0.____	0.____	0.____
0.50	0.____	0.____	0.____	0.____	0.____
0.70	0.____	0.____	0.____	0.____	0.____
0.80	0.____	0.____	0.____	0.____	0.____



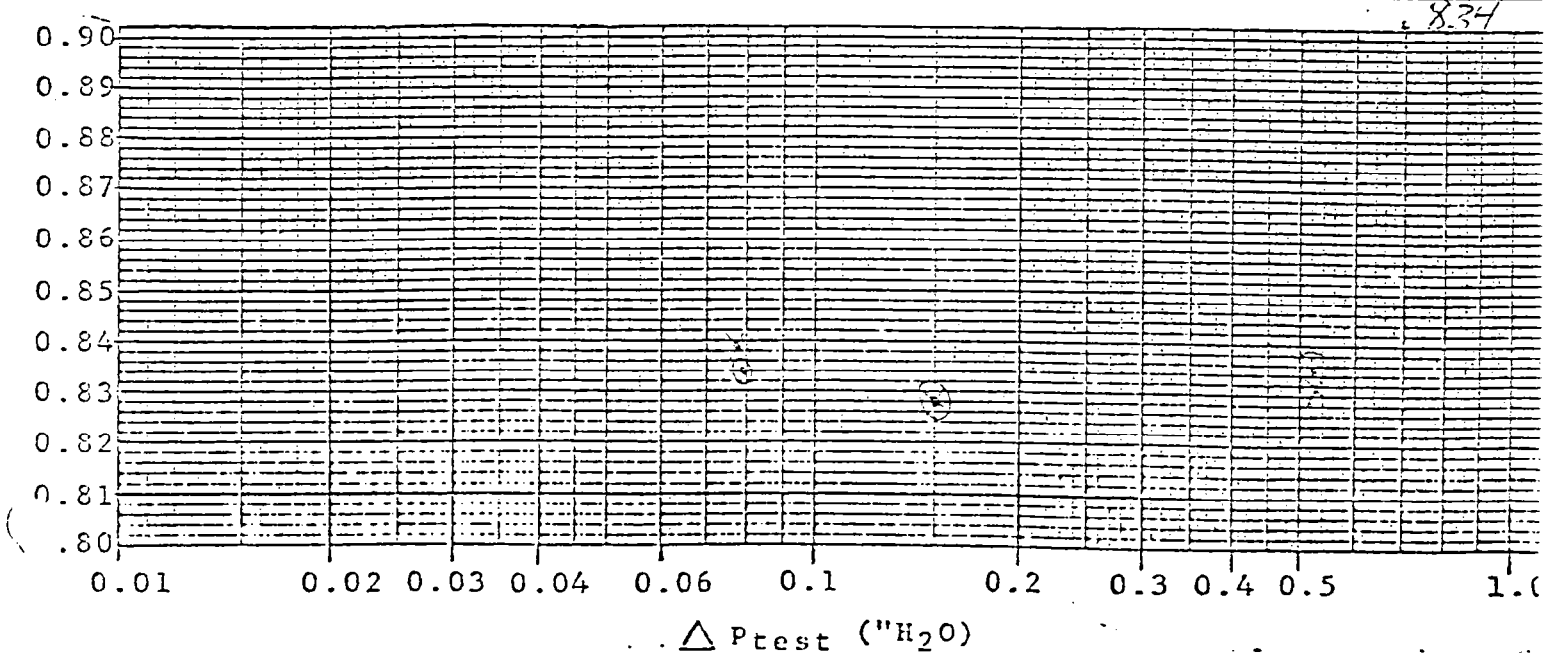
$C_{Ptest} = 0.99\sqrt{\frac{\Delta P_{std}}{\Delta P_{test}}}$

Pitot Tube Type S Pitot Tube No. 39

Standard Pitot Tube No. 18

Calibrator: DJC Date: 3/1/78 Client:

Anticipated ΔP_{std}	ΔP_{std}	A		B	
		ΔP_{test}	ΔC_{Ptest}	ΔP_{test}	ΔC_{Ptest}
0.02	0.____	0.____	0.____	0.____	0.____
0.04	0.____	0.____	0.____	0.____	0.____
0.06	0.056	0.078	0.839	0.079	0.834
0.08	0.____	0.____	0.____	0.____	0.____
0.10	0.105	0.150	0.828	0.150	0.828
0.12	0.____	0.____	0.____	0.____	0.____
0.16	0.____	0.____	0.____	0.____	0.____
0.20	0.____	0.____	0.____	0.____	0.____
0.30	0.371	0.525	0.832	0.521	0.835
0.50	0.____	0.____	0.____	0.____	0.____
0.70	0.____	0.____	0.____	0.____	0.____
0.80	0.1.066	0.1.484	0.839	0.1.482	0.839



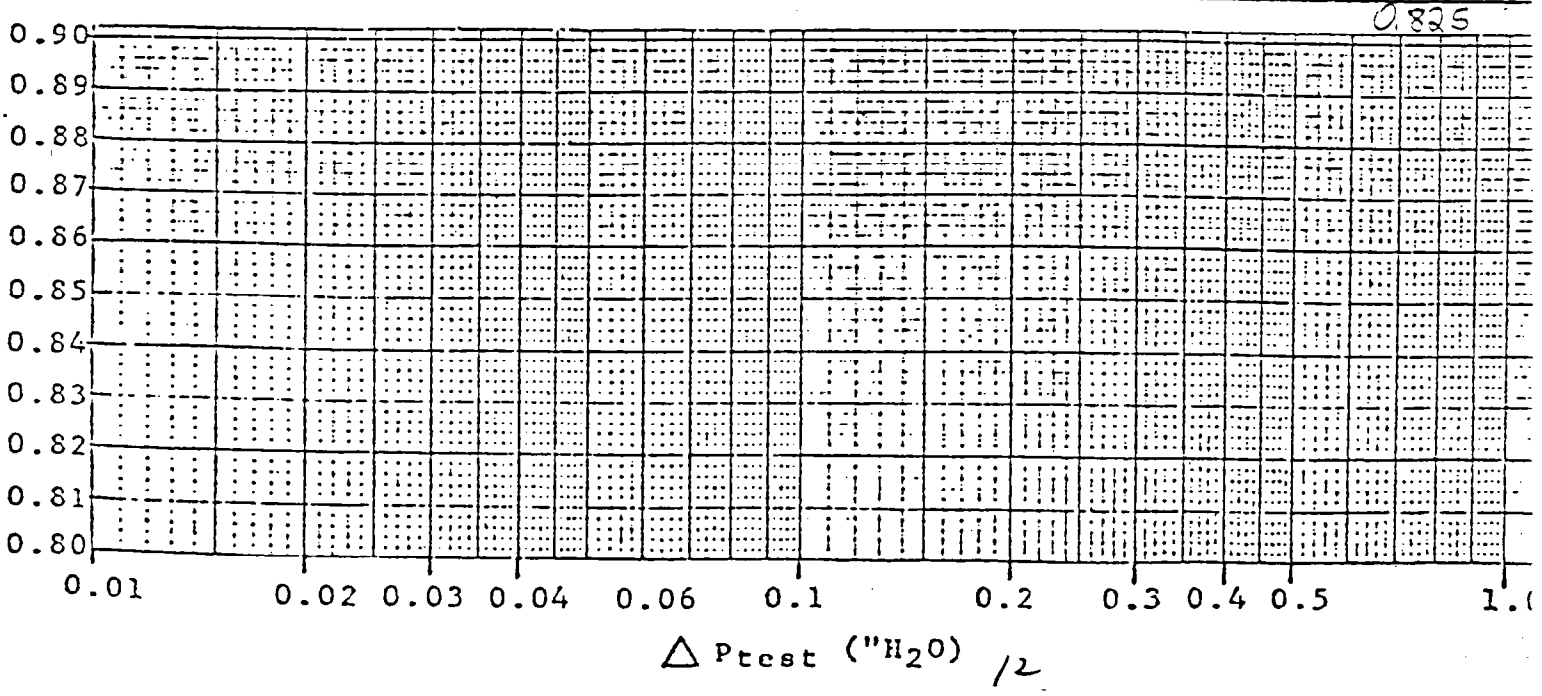
$C_{Ptest} = 0.99\sqrt{\frac{\Delta Pstd}{\Delta Ptest}}$

Pitot Tube Type S Pitot Tube No. 38

Standard Pitot Tube No. _____

Calibrator: TVM Date: 11-9-78 Client: U.S. EPA - Dow

Anticipated ΔPstd	ΔPstd	A		B	
		ΔPtest	ΔC_{Ptest}	ΔPtest	ΔC_{Ptest}
0.02	0._____	0._____	0._____	0._____	0._____
0.04	0._____	0._____	0._____	0._____	0._____
0.06	0._____	0._____	0._____	0._____	0._____
0.08	0._____	0._____	0._____	0._____	0._____
0.10	0.99	~~1.40~~	0.833	~~1.42~~	0.827
0.12	0.96	0.1.40	0.820	~~1.39~~	0.823
0.16	0.97	~~1.39~~	0.827	~~1.41~~	0.821
0.20	0._____	0._____	0._____	0._____	0._____
0.30	0._____	0._____	0._____	0._____	0._____
0.50	0._____	0._____	0._____	0._____	0._____
0.70	0._____	0._____	0._____	0._____	0._____
0.80	0._____	0._____	0._____	0._____	0._____



METER AND OR ICE CALIBRATION

Date 9-5-78 Client _____ Meter Box Number RAC-3

Barometric Pressure Pb ("Hg) 29.45 Calibrator BFE Gas Meter Number _____

	Orifice Manometer Setting, Δm (in. H_2O)	Gas Volume Wet Test Meter V_w (ft^3)	Gas Volume Dry Gas Meter V_d (ft^3)	Temperature: Wet Test Meter t_w (°F)	Temperature: Dry Gas Meter Inlet t_{di} (°F)	Temperature: Dry Gas Meter Outlet t_{do} (°F)	Temperature: Dry Gas Meter Average t_d (°F)	Vacuum Wet Test Meter P_w (in. H_2O)	Time θ (min)	γ	K_m
Stop	0.5	5593.00	86.731	75.0	85	79		0.05	12:20		
Start		5588.00	81.710	74.5	78	76					
Average	29.49	(5) 5.0	5.021	74.75			79.5	29.45	12.33	1.003	0.135
Stop	1.0	5598.00	91.952	75.5	85	82					
Start		5593.00	86.731	75.0	85	79		0.05	8:38		
Average	29.52	(5) 5.0	5.221	75.25			82.75	29.45	8.63	0.969	0.136
Stop	2.0	5658.00	153.155	74	96	85					
Start		5640.00	134.860	74	85	85		0.05	22:26		
Average	29.60	(10) 18	18.295	74			87.75	29.45	22.43	1.004	0.133
Stop	3.0	5618.05	111.319	76	103	90					
Start		5608.00	101.184	75.5	85	82		0.05	9:11		
Average	29.67	(10) 10.05	10.135	75.75			90.00	29.45	9.18	1.010	0.148
Stop	4.0	5630.00	123.674	76	104	91					
Start		5618.05	111.319	76	103	90		0.05	10:53		
Average	29.74	(10) 11.95	12.355	76			97.0	29.45	10.88	0.995	0.129
Stop	5.0	5640.00	134.860	75.5	105	91					
Start		5630.00	123.674	76	104	91		0.05	8:02		
Average	29.82	(10) 10.0	11.186	75.75			97.75	29.45	8.03	0.919	0.131
									AVERAGE	0.983	0.135

$$P_w = P_b - \frac{P_w}{13.6} \qquad P_d = P_b + \frac{\Delta m}{13.6} \qquad K_m = \frac{V_w}{\theta}\sqrt{\frac{P_w}{T_w \Delta m}}$$

$$\gamma = \frac{V_w P_w (t_d + 460)}{V_d P_d (t_w + 460)}$$

Factor in isokinetic equation $= \frac{27.40}{(K_m)^2} = \frac{27.40}{(\quad)^2} =$ 1496

METER AND ORIFICE CALIBRATION

Date 10-7-78 Client US EPA Dow-Pridische Meter Box Number BAC 3

Barometric Pressure Pb ("Hg) 29.38 Calibrator TVM Gas Meter Number

	Orifice Manometer Setting, Δm (in. H_2O)	Gas Volume Wet Test Meter V_w (ft^3)	Gas Volume Dry Gas Meter V_d (ft^3)	Temperature: Wet Test Meter t_w (°F)	Temperature: Dry Gas Meter Inlet t_{di} (°F)	Temperature: Dry Gas Meter Outlet t_{do} (°F)	Temperature: Dry Gas Meter Average t_d (°F)	Vacuum Wet Test Meter P_w (in. H_2O)	Time θ (min)	γ	K_m
Stop	0.5	6531.000	514.920	62	76	69			21:10		
Start		6522.000	505.759	62	74	64		0		.998	.143
Average	29.42	(5) 9.000	9.161	62	75	66.5	70.8	29.38	21.17		
Stop	1.0	6544.000	528.191	62	79	72			22:29		
Start		6531.000	514.920	62	76	69		0		1.000	.137
Average	29.45	(5) 13.000	13.271	62	77.5	70.5	74.0	29.38	22.48		
Stop	2.0	6556.000	540.391	60	83	73			14:53		
Start		6544.000	528.191	60	79	72		0		1.006	.135
Average	29.53	(10) 12.000	12.200	62	81	72.5	76.8	29.38	14.88		
Stop	3.0	6576.000	560.630	62	85	74			20:23		
Start		6556.000	540.391	62	83	73		0		1.012	.134
Average	29.60	(10) 20.000	20.239	62	84	73.5	78.8	29.38	20.38		
Stop	4.0	6604.000	588.889	61.5	87	75			25:06		
Start		6576.000	560.630	62	85	74		0		1.016	.132
Average	29.67	(10) 28.000	28.259	61.8	86	74.5	80.3	29.38	25.10		
Stop	5.0	6637.000	622.160	61	88	75			26:47		
Start		6604.000	588.889	61.5	87	75		0		1.017	.131
Average	29.75	(10) 33.000	33.271	61.3	87.5	75	81.3		26.78		
									AVERAGE	1.008	.135

$P_w = P_b - \frac{P_w}{13.6}$ $\quad P_d = P_b + \frac{\Delta m}{13.6}$ $\quad K_m = \frac{V_w}{\theta}\sqrt{\frac{P_w}{T_w \Delta m}}$

$\gamma = \frac{V_w P_w (t_d + 460)}{V_d P_d (t_w + 460)}$ $\quad$ Factor in isokinetic equation $= \frac{27.40}{(\overline{K}_m)^2} = \frac{27.40}{(\quad)^2} =$ 1494

METER AND ORIFICE CALIBRATION

Date 9-29-78 Client _____ Meter Box Number RAC 4

Barometric Pressure Pb ("Hg) 29.61 Calibrator TVM Gas Meter Number _____

	Orifice Manometer Setting, Δm (in. H_2O)	Gas Volume Wet Test Meter V_w (ft^3)	Gas Volume Dry Gas Meter V_d (ft^3)	Temperature: Wet Test Meter t_w (°F)	Temperature: Dry Gas Meter Inlet t_{di} (°F)	Temperature: Dry Gas Meter Outlet t_{do} (°F)	Temperature: Dry Gas Meter Average t_d (°F)	Vacuum Wet Test Meter P_w (in. H_2O)	Time θ (min)	γ	K_m
Stop	0.5	6245.000	220.842	66.5	78	66			14:28		
Start	2.65	6239.000	214.914	66	65	64		0		1.015	0.1391
Average		(5) 6.000	5.928	66.25			68.25	29.61	14.47		
Stop	1.0	6256.000	231.824	67	94	74			19:19		
Start	19.68	6245.000	220.842	66.5	78	66		0		1.021	0.1350
Average		(5) 11.000	10.982	66.75			78	29.61	19.32		
Stop	2.0	6284.000	260.184	68	105	85			35:37		
Start	34.76	6256.000	231.824	67	94	74		0		1.023	0.1317
Average		(10) 28.000	28.360	67.5			89.5	29.61	35.62		
Stop	3.0	6298.000	274.462	68	108	87			14:46		
Start	29.83	6284.000	260.184	68	105	85		0		1.025	0.1296
Average		(10) 14.000	14.278	68			96.25	29.61	14.77		
Stop	4.0	6343.000	320.506	68.5	110	90			41:31		
Start	29.90	6298.000	274.462	68	108	87		0		1.024	0.1283
Average		(10) 45.000	45.044	68.25			98.75	29.61	41.52		
Stop	5.0	6361.000	338.942	69	112	91			15:00		
Start	29.98	6343.000	320.506	68.5	110	90		0		1.023	0.1270
Average		(10) 18.000	18.436	68.75			100.75	29.61	15.0		
									AVERAGE	1.022	0.1318

$P_w = P_b - \frac{P_w}{13.6}$ $\quad P_d = P_b + \frac{\Delta m}{13.6}$ $\quad K_m = \frac{V_w}{\theta}\sqrt{\frac{P_w}{T_w \Delta m}}$

$\gamma = \frac{V_w P_w (t_d + 460)}{V_d P_d (t_w + 460)}$ $\quad$ Factor in isokinetic equation $= \frac{27.40}{(\overline{K_m})^2} = \frac{27.40}{(\quad)^2} = 1578$

.131

METER AND ORIFICE CALIBRATION

ate: 10-7-78 Client US EPA Dan Radecke Meter Box Number RAC 1

arometric Pressure Pb ("Hg) 29.38 Calibrator TVM Gas Meter Number

	Orifice Manometer Setting, Δm (in. H_2O)	Gas Volume Wet Test Meter V_w (ft^3)	Gas Volume Dry Gas Meter V_d (ft^3)	Temperature: Wet Test Meter t_w (°F)	Temperature: Dry Gas Meter Inlet t_{di} (°F)	Temperature: Dry Gas Meter Outlet t_{do} (°F)	Temperature: Dry Gas Meter Average t_d (°F)	Vacuum Wet Test Meter P_w (in. H_2O)	Time θ (min)	γ	K_m
top	0.5	6643.000	615.393	61	74	62			14:33		
tart		6637.000	609.421	61	69	58		0	14.55	1.010	.138
verage	29.42	(5) 6.000	5.972	61	69	60	64.5	29.38			
top	1.0	6656.000	628.475	61	86	70			23:09		
tart		6643.000	615.393	61	74	62		0	23.15	1.015	.133
verage	29.45	(5) 13.000	13.082	61	81	66	73.5	29.38			
top	2.0	6670.000	642.690	61	96	76			17:55		
tart		6656.000	628.475	61	88	70		0	17.92	1.020	.131
verage	29.53	(10) 14.000	14.215	61	92	73	82.5	29.38			
top	3.0	6689.000	662.088	61	100	80			20:11		
tart		6670.000	642.690	61	96	76		0	20.18	1.023	.129
verage	29.60	(10) 19.000	19.398	61	98	78	88	29.38			
top	4.0	6710.000	683.636	61	104	82			19:34		
tart		6689.000	662.088	61	100	80		0	19.57	1.021	.127
verage	29.67	(10) 21.000	21.548	61	102	81	91.5	29.38			
top	5.0	6729.000	703.170	61	106	85			15:57		
tart		6710.000	683.636	61	104	82		0	15.95	1.022	.127
verage	29.75	(10) 19.000	19.534	61	105	83.5	94.3	29.38			
									AVERAGE	1.019	.131

$$w = P_b - \frac{P_w}{13.6} \quad 29.38 \qquad P_d = P_b + \frac{\Delta m}{13.6} \qquad K_m = \frac{V_w}{\theta}\sqrt{\frac{P_w}{T_w \Delta m}}$$

$$= \frac{V_w P_w (t_d + 460)}{V_d P_d (t_w + 460)}$$

Factor in isokinetic equation $= \frac{27.40}{(\overline{K_m})^2} = \frac{27.40}{(\quad)^2} = \frac{1601}{1596}$