AP-42 Section Number: 9.9.1

Reference Number: 28

Title: Atmospheric Emission Evaluation Mayflower Farms Grain And Feed Milling Plant, Portland, OR

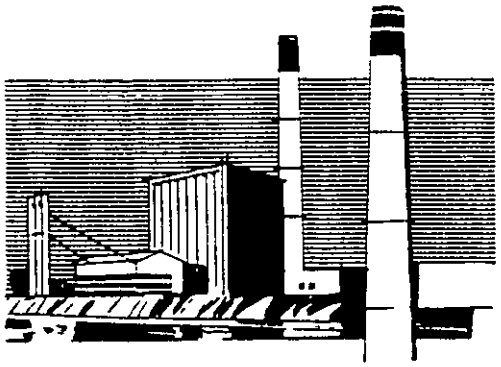
Valentine, Fisher & Tomlinson
Consultant Engineers

February 1973

Feb.

FINAL OK

ATMOSPHERIC EMISSION EVALUATION



U.S.ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Emission Measurements Branch, Field Test Section
Thomas E.Ward, Project Test Officer

Test Number 72-CI-34(GRN)

MAYFLOWER FARMS

GRAIN & FEED MILLING PLANT

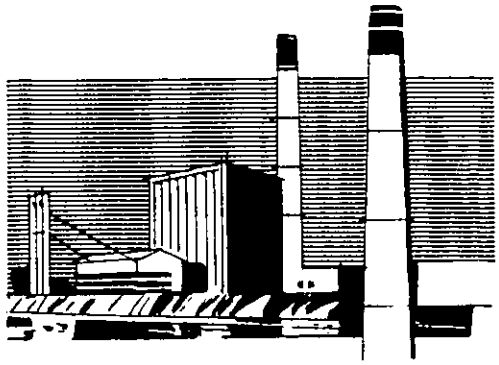
PORTLAND, OREGON

Contract No.68-02-0236 Task Order No. 2

VALENTINE, FISHER & TOMLINSON Consulting Engineers
520 Lloyd Building Seattle,Washington 98101 (206) 623-0717

FINAL OK
10469

ATMOSPHERIC EMISSION EVALUATION



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February 8, 1973

PURPOSE

B1 base outlet!

This atmospheric emission evaluation report is an account of our findings from stack gas samples taken from the exhaust gases of Attrition and Hammer Grinders at Mayflower Farms in Portland, Oregon. The evaluation was conducted at the request of the U.S. Environmental Protection Agency, Office of Air Programs, Emission Testing Branch under Contract No. 68-02-0236 for the purpose of generating background information to esablish emission regulations on Grain and Feed Milling plants. EPA and Hi-Vol sampling trains were used simultaneously for comparison of measured emission.

SUMMARY

The three stack gas samples collected were found to have concentrations of 0.0068, 0.0022, and 0.0023 grains per standard cubic foot from the EPA sampling train and 0.0036, 0.0022, and 0.0012 grains per standard cubic foot from the Hi-Vol sampling train. An additional Hi-Vol sample taken during limited alfalfa pellet milling was found to have a concentration of 0.0163 grains per standard cubic foot. The standard cubic foot is reported at 70°F., 1 atmosphere pressure and dry. Plant production rates during the evaluations were recorded at 7.8, 4.0, 9.9 and 6.3 tons per hour for Runs 1, 2, 4 and 5 respectively. Emissions calculated on the basis of pounds per ton of production are 0.040, 0.010 and 0.015 for Runs 1, 4 and 5 respectively with the EPA train and 0.020, 0.101, 0.010 and 0.009 for Runs 1, 2, 4 and 5 respectively with the Hi-Vol train.

Wesley D. Snowden, P.E.
Manager, Environmental Services

WDS/vc

DISCUSSION OF RESULTS

Run #1 included simultaneous samples with the EPA train and the Hi-Vol train. Run #2 was taken with the Hi-Vol only. Projections based on Runs 1, 4 and 5 on what the EPA train would have recorded for Run #2 indicate that the emission concentration could be as high as 0.03 grains per standard cubic foot. The atmospheric emissions during Run #2 were noticeably greater when the plant was milling alfalfa pellets. Run #3 was terminated when production was curtailed 15 minutes into a desired 108 minute run so run #3 sample was discarded. Run numbers 4 and 5 included simultaneous EPA and Hi-Vol samples.

The two trains were operated with ±10% isokinetic. The Hi-Vol technique did not consider the changes in orifice pressure deflection due to the presence of moisture. The actual cubic feet passing through the Hi-Vol filter was determined by assuming dry air passed through the orifice at 60°F. and then adjusting for temperature changes. Hi-Vol standard cubic feet per minute dry was calculated at standard temperature and pressure, excluding water vapor.

The average actual flow rate for Runs 1, 2, 4 and 5 was 5507 acfm. The square footage of dacron felt fabric was 792 square feet so the air to cloth ratio was 6.95.

Production rates during sampling were determined to be: Run #1 - 2 tons of Oats and 12 tons of Barley/108 min. (7.8 tons/hour); Run #2 - 7.2 tons Alfalfa pellets/108 minutes (4.0 tons per hour); Run #4 - 6 tons of Oats, 9 tons of Corn, and 2 tons of Barley/103 minutes (9.9 tons per hour); and Run #5 - 7 tons of Corn, 5 tons of Wheat, 6 tons of Oats, 1 ton of Barley/ 180 minutes (6.3 tons per hour).

The atmospheric emissions measured with the EPA train per Method #5 of the Federal Register, Vol. 36, No. 247 averaged 0.0038 grains per standard cubic foot and 0.0023 grains per standard cubic foot with the Hi-Vol train (See Table I). Note in Table I that the EPA train per Method 5 reported emissions approximately 60% higher than the Hi-Vol sampling train and Run #2 Hi-Vol emissions were 7 times higher than the average when the plant was milling alfalfa pellets. The inclusion of condenser water hydrocarbon extraction and water evaporation portions in the total particulate of the EPA train increases emissions on the average of 24%.

TABLE 5
MAYFLOWER FARMS GRAIN & FEED MILLING PLANT
COMPILATION OF EMISSIONS

RUN NO.	CONCENTRATION GRAINS/SCF			POLLUTANT MASS RATE POUNDS/HOUR			PROCESS WEIGHT RATE POUNDS/TON			EPA RATIO
	EPA-#5*	EPA-COND.°	HI-VOL	EPA-#5*	EPA-COND.°	HI-VOL	EPA-#5*	EPA-COND.°	HI-VOL.	COND./#5
1	0.0068	0.0080	0.0036	0.309	0.364	0.159	0.040	0.047	0.020	1.179
2		0.0163				0.728			0.101	
4	0.0022	0.0027	0.0022	0.102	0.127	0.101	0.010	0.012	0.010	1.241
5.	0.0023	0.0029	0.0012	0.097	0.121	0.055	0.015	0.019	0.009	1.312
1,4 & 5 TOTALS	0.0113	0.0136	0.0070	0.508	0.612	0.315	0.065	0.0784	0.039	3.732
1,4 & 5 AVERAGES	0.0038	0.0045	0.0023	0.168	0.204	0.105	0.022		0.013	1.244

* Total Particulate determined by EPA Method #5 - Federal Register, Vol. 36, No. 247.

° Total Particulate by Including Condenser Water Extraction & Evaporation Portions.

PROCEDURE

This atmospheric emission evaluation was conducted simultaneously with two sets of sampling equipment. The primary set of equipment was designed by the United States Environmental Protection Agency (EPA) and the comparison set of sampling equipment was designed by Oregon State University refered to as the Hi-Vol procedure. The EPA equipment and procedures used on this evaluation are detailed in the Federal Register, Vol. 36, No. 247, Method 5 and the Hi-Vol equipment and procedures used on this evaluation are partially described in "A High Volume Stack Sampler", Boubel, R.W., Air Pollution Control Association Journal, December 1971, Vol. 21, No. 12, pp. 783-787.

The EPA sampling train was started first because a longer sampling time was established for its use. The Hi-Vol sampling train was started within 15 minutes and located in the sampling port 90° away from the EPA train. The EPA train was operated from 2 to 3 hours on each sample and the Hi-Vol train was operated for 18 minutes on each sample.

The two sampling ports spaced 90° apart were located six diameters above the last obstruction (fan outlet) and 2 diameters below the stack outlet. The EPA train collected its sample from two 18 point traverses (36 points total) and the Hi-Vol train collected its sample from one six point traverse (limited number because sample time was short and velocity readings were not as accurate as with the EPA inclined manometer).

The stack gas velocity was calculated from velocity readings taken during sampling. Preliminary stack temperature, pressure and velocity readings were taken to size the sampling nozzle on the EPA train. With moisture content of 3% determined by wet bulb-dry bulb technique, an EPA-designed nomograph detailed in the "Specifications for Incinerator Testing at Federal Facilities" was used to select a 1/4" diameter nozzle. The Hi-Vol nozzle selected from a group of 4 graphs was a 1.875 inch diameter. The four nozzle and orifice deflection selection graphs are enclosed in the back of this report. Combustion products and/or chemicals were not present in the exhaust gases so the dry weight of the exhaust gases was assumed to be that of air.

Isokinetic velocities were maintained on the Hi-Vol train by establishing a "C" factor on the EPA-designed nomograph by trial pitot and orifice deflections. Maximum and minimum pitot tube readings were used in the 4 calibrated Hi-Vol manufacturer graphs to determine maximum and minimum orifice readings. The two readings crossed the "C" factor line at one place which established the swivel point between velocity to orifice readings. Rapid adjustment of the rate meter reading was possible utilizing the nomograph.

Schematics of the EPA designed and Hi-Vol stack gas sampling trains used on this evaluation project are enclosed in this report. Both trains were calibrated prior to use on this project. The "S" type pitot tube used on this project was calibrated and found to be 0.83.

CLEAN-UP AND ANALYSIS

Clean-up of the EPA train was performed by carefully removing the filter and placing it in a container marked "Run X, Container A". Reagent grade acetone and brushes were used to clean the nozzle, glass probe and pre-filter connections. The acetone wash was placed in a container marked "Run X, Container B". The volume of water in the impinger and bubblers (glassware) was weighed in their respective containers to the nearest 0.1 gram. The original weights which included approximately 100 ml in the bubbler and 100 milliliters in the impinger were then subtracted and the difference added with the water weight gain of the silica gel constituted the amount of water collected during the run. The silica gel was weighed in a bubbler before and after the run. The water from the glassware and a water rinse of the glassware were placed in a container marked "Run X, Container C". An acetone rinse of the glassware and all post-filter glassware (not including the silica gel container) was performed and placed in a container marked "Run X, Container D".

Analysis of the samples in each container was performed according to the following:

Run X, Container A - Transfer the filter and any loose particulate from the sample container to a tared glass weighing dish and desiccate for 24 hours in a desiccator or constant humidity chamber containing a saturated solution of calcium chloride or its equivalent. Weigh to a constant weight and report the results to the nearest 0.1 milligram.

Run X, Container B - Measure the volume to the nearest 0.1 milliliter. Transfer acetone washings from container into a tared beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the result to the nearest 0.1 milligram.

Run X, Container C - Measure the volume to the nearest 0.1 milliliter. Extract organic particulate from the water solution with three 25 milliliter portions of chloroform and three 25 milliliter portions of ethyl ether. Combine the ether and chloroform extracts and transfer to a tared beaker. Evaporate until no solvent remains at about 70°F. This can be accomplished by blowing air that has been filtered through activated charcoal over the sample. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 milligram. After the extraction, evaporate the remaining water to dryness and report the results to the nearest 0.1 milligram.

Run X, Container D - Measure the volume to the nearest 0.1 milliliter. Transfer the acetone washings to a tared beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weigh to a constant weight. Report the results to the nearest 0.1 milligram.

Blanks were taken on the acetone, ether, chloroform, and deionized water and subtracted from the respective sample volumes. The filter paper used with the EPA train was a Mine Safety Appliance 1106 BH, heat treated glass fiber filter mat.

CLEAN-UP AND ANALYSIS

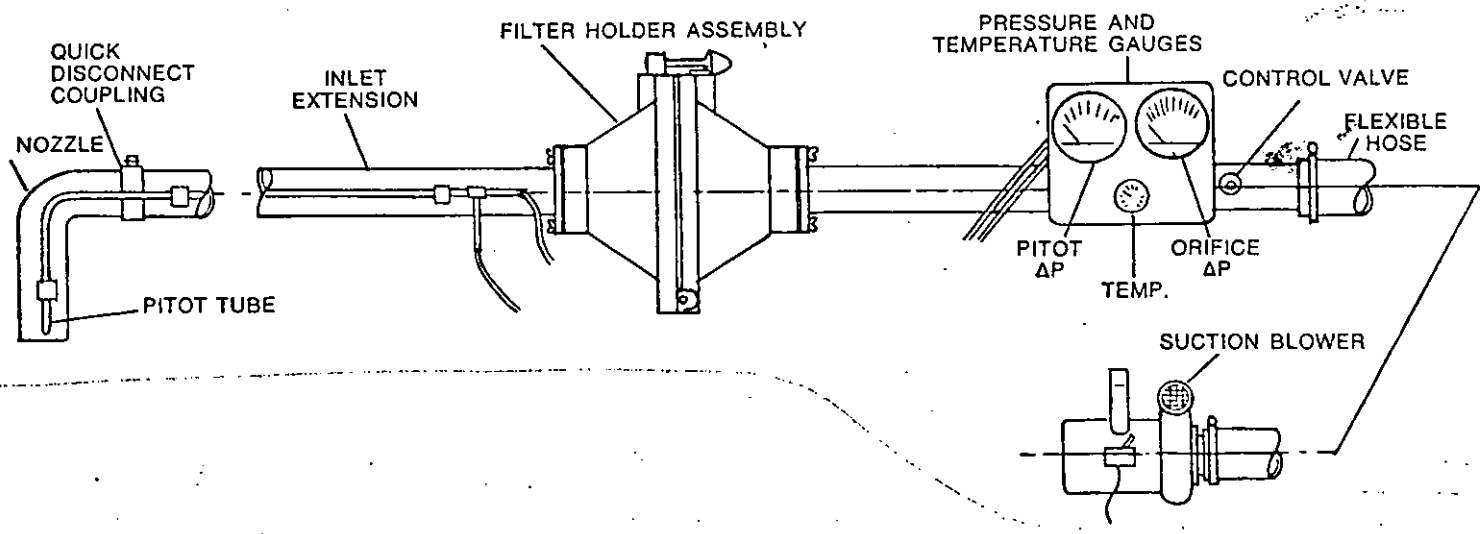
Clean-up of the Hi-Vol sampling train was performed by first carefully removing the 8" x 10" filter, folding collection side in and placing it in its tared 6-1/2" x 9-1/2" manila envelope. An acetone rinse and brushing was performed on the front half of the filter holder, probe and nozzle and placed in a water-tightly sealed, teflon liner glass jar for shipment to the laboratory.

Analysis of each sample was performed according to the following procedure:

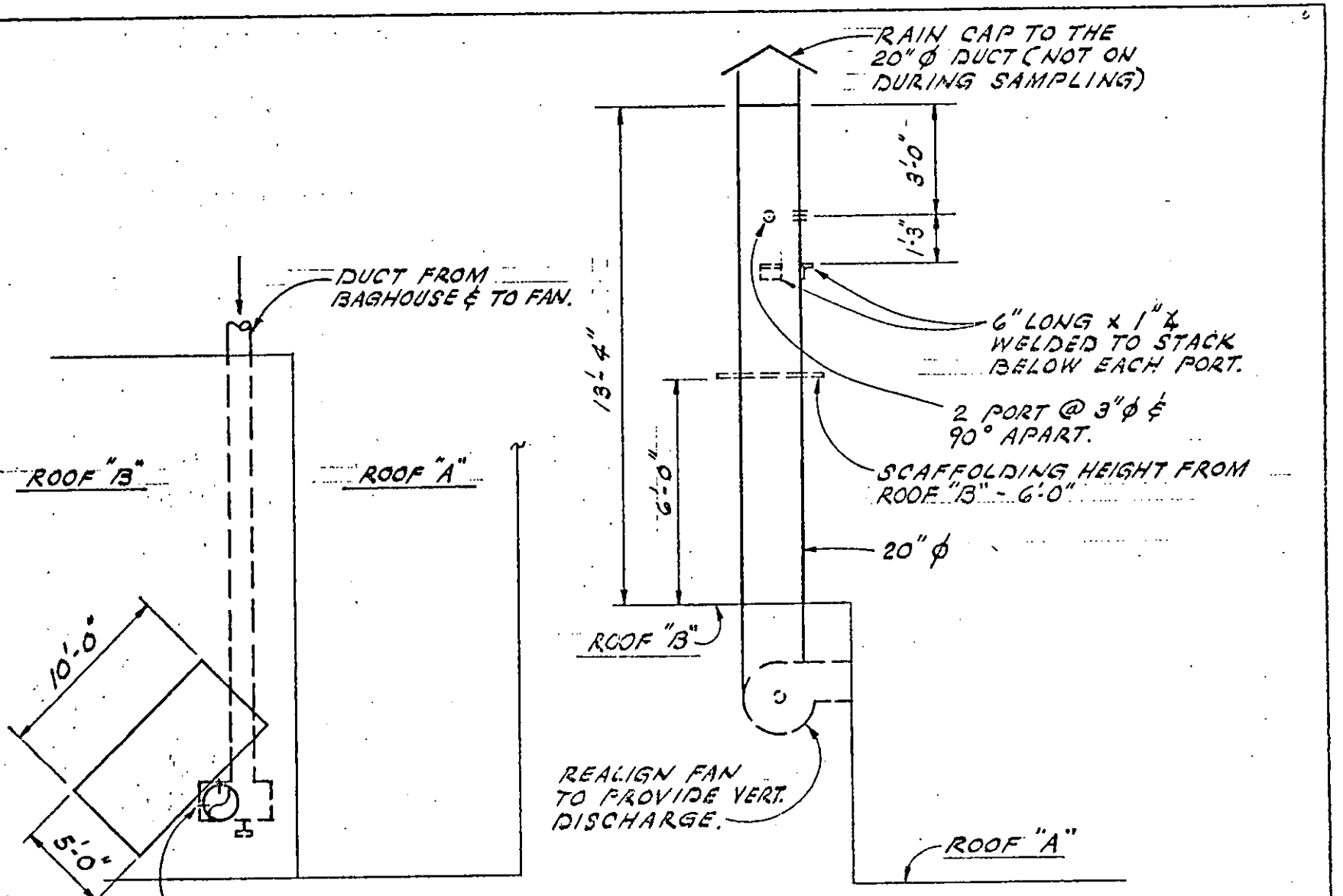
Filter - Desiccate the sample filter and blanks in their tared envelope to dryness for at least 24 hours. Weigh the filters in their manila envelope to a constant weight and report the results to the nearest 0.1 milligram.

Acetone Rinse - Measure the volume to the nearest 0.1 milliliter. Transfer acetone washings from container into a tared beaker and evaporate to dryness at ambient temperature and pressure. Desiccate for 24 hours and weight to a constant weight. Report the result to the nearest 0.1 milligram.

Blanks were taken on the acetone and a proportion of weight based on sample volume was subtracted from the sample weights. The filter paper used with the Hi-Vol train was a Mine Safety Appliance 1106 BH, heat treated glass fiber filter mat.



HI-VOL SAMPLER



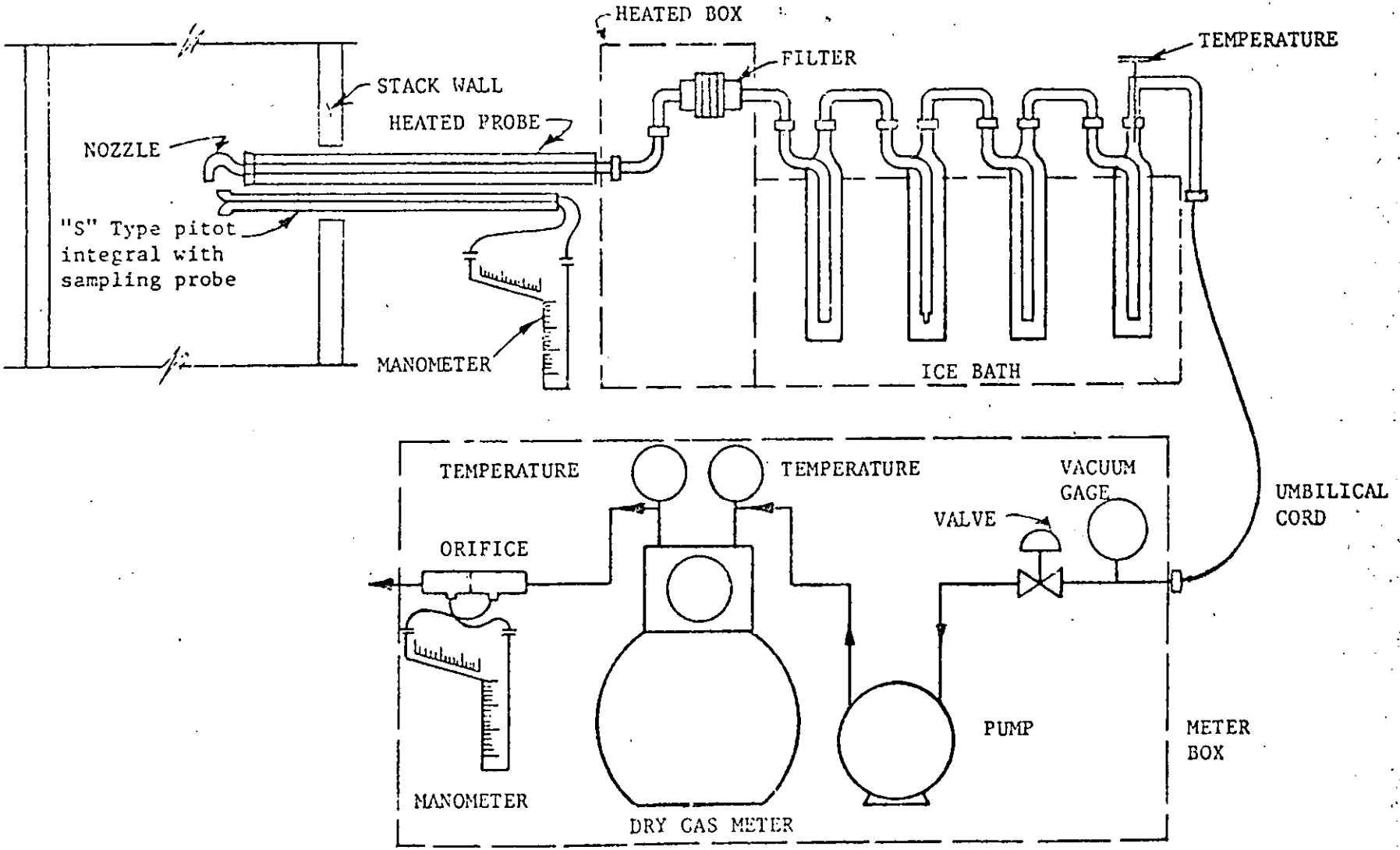
PLAN VIEW
NO SCALE

SIDE VIEW
NO SCALE

ALTERNATE

EPA - ATMOS. EMISSION EVAL.
FROM GRINDER BAGHOUSE
MAYFLOWER FARMS
PORTLAND, OREGON

W.S.	V.F.℄T.	ES-2
8-2-72		



EPA STACK GAS SAMPLING TRAIN

(PARTICULATE)

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ MAYFLOWER FARMS - ROCKLAND, OREGON DATE 9-1-72

PREPARED BY W.D. SCHRODER APPROVED [illegible] PAGE 1 OF 7

SUBJECT RUN # 1 EPA TRAIN EMISSION DATA (P- PER METHOD #5)

		0·33	0·83	0·56 VH	
		556	557	557 T_S	
		13·569819	21·501395	17·661257	
98·90	VOL_M				
30·34	P_M	0·33	0·81	0·58 VH	19·033975 K_a
530	T_{STD}	556	557	557 T_S	
569	T_M	13·569819	21·240762	17·973669	0·83 C_P
					43·417660 V_O
93·414411	VOL_{STD}	0·39	0·81	0·69	2·182 A_S
		559	557	557	
2·21	VOL_W	14·765161	21·240762	19·604336	5604·240840 Q_O
2·311100	M	0·41	0·83	0·72	530 T_{STD}
		559	557	556	557 T_S
0·976089	MF	15·139022	21·501395	20·007998	30·17 P_{SN}
28·95	W_D				
		0·46	0·81	0·72	5387·850428 Q_{OS}
20·696934	W_W	559	557	556	
		16·035505	21·240762	20·007998	557 T_S
1·004399	C_D				530 T_{STD}
30·17	P_{SN}	0·49	0·75	0·72	30·17 P_{SN}
		559	557	556	108 T
0·995847	C_S	16·550226	20·438933	20·007998	0·000341 A_n
		0·38	0·3	0·72	45·102932 V_n
		559	558	556	103·001535 I
		14·574635	12·938315	20·007998	
					40·2 P_T
		0·46	0·365	0·72	0·006627 C_O
		557	558	556	
		16·006873	14·271299	20·007998	
					12 N
		0·46	0·44	0·72	0·006627 C
		557	558	556	
		16·006873	15·669077	20·007998	0·302621 PMR_P
					40·2 P_T
		0·74	0·475	0·68	2·182 A_S
		557	558	556	108 T
		20·302216	16·280356	19·444279	0·000341 A_n
		0·77	0·52	0·64	0·314773 PMR_{AR}
		557	557	556	
		20·709659	17·018813	18·863721	0·309697 PMR_{AVG}
		0·77	0·52	0·54	12 N
		557	557	556	
		20·709659	17·018813	17·337434	0·006759 C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ Marlowe Farms DATE 9-6-72

PREPARED BY W.P. Swanson APPROVED [illegible] PAGE 2 OF 7

SUBJECT Hi-Vol Particulate Emission Data - Run #1 on 8-21-72

2.2	M
0.970000	MF
30.17	P_{SN}
530	T_{STD}
549	T_M
23	T
49.26	$ACFM_M$
1078.641146	VOL_M
28.25	W_D
28.709109	W_W
1.004186	C_D
30.17	P_{SN}
0.995847	C_S

0.35	VH
544	T_S
13.798550	
0.35	VH
547	T_S
17.836545	
0.45	
550	
15.732132	

0.42	VH
550	T_S
15.190604	
0.38	VH
550	T_S
14.456832	
0.35	
550	
13.874436	

14.482063	Ka
1.0	C_P
42.000000	V_O
2.182	A_S
5490.764000	Q_O
530	T_{STD}
556	T_S
30.17	P_{SN}
5169.146155	Q_{OS}
556	T_S
530	T_{STD}
30.17	P_{SN}
23	T
0.019174	A_n
43.364218	V_n
103.245798	I
247	P_T
0.003526	C_O
12	N
0.003526	C
0.156218	PMR_P
247	P_T
2.182	A_S
23	T
0.019174	A_n
0.161512	PMR_{AR}
0.158865	PMR_{AVG}
12	N
0.003526	C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ Weyerhaeuser Forms DATE 9-6-72

PREPARED BY W. D. Sawyer APPROVED [illegible] PAGE 3 OF 7

SUBJECT Hi-Vol Particulate Emission Data Run #2 on 8-22-72

2.3	M	0.40 VH	0.35 VH	
0.970000	MF	556 T_S	557 T_S	14.650117 Ka
		14.913061	13.962449	
				1.0 C_P
30.22	P_{SN}	0.46 VH	0.30 VH	42.456046 V_O
530	T_{STD}	556 T_S	557 T_S	2.182 A_S
552	T_M	15.292492	14.540539	
10	T			5557.664700 Q_O
44.38	$ACFM_M$	0.40	0.33	
757.647015	VOL_M	557	557	530 T_{STD}
28.95	W_D	14.926486	13.557654	557 T_S
				30.22 P_{SN}
28.709100	W_W			5223.770356 Q_{OS}
1.004106	C_D			557 T_S
30.22	P_{SN}			530 T_{STD}
				30.22 P_{SN}
0.995023	C_S			[illegible] T
				0.019174 A_n
				38.925804 V_n
				91.696360 I
				833.6 P_T
				0.016947 C_O
				12 N
				0.016947 C
				0.758766 PMR_P
				833.6 P_T
				2.182 A_S
				10 T
				0.019174 A_n
				0.696669 PMR_{AR}
				0.727718 PMR_{AVG}
				12 N
				0.016253 C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ Mayflower Farms - Portland Oregon DATE 9-1-72

PREPARED BY W. D. Seawood APPROVED [illegible] PAGE 4 OF 7

SUBJECT Run # 4 - EPA Train (Pt. PEC Method #5)

		0.26	0.62	0.64	VH	
		550	546	548	T_S	
		12.409673	21.159395	16.727512		
101.83	VOL_M					
30.32	P_M	0.32	0.61	0.54	VH	17.909885 K_a
530	T_{STD}	559	548	546	T_S	
546	T_M	13.266499	21.008459	17.170905		C_P
						0.33 V_O
100.157604	VOL_{STD}	0.38	0.79	0.64		43.100178 A_S
		550	548	546		2.182
1.87	VOL_W	14.456832	20.804725	18.693314		5647.782646 Q_O
1.872000	M	0.45	0.74	0.60		530 T_{STD}
		550	548	546		546 T_S
0.981672	MF	15.732132	20.137527	19.209687		30.13 P_{SN}
28.95	W_D					
		0.47	0.74	0.64		5395.912762 Q_{OS}
28.749308	W_W	550	548	547		
		16.077935	20.137527	19.710424		548 T_S
1.003403	C_D					530 T_{STD}
30.13	P_{SN}	0.47	0.66	0.64		30.13 P_{SN}
		550	548	547		108 T
0.996506	C_S	16.077935	19.303885	19.710424		0.000341 A_n
				0.60		47.408337 V_n
		0.54	0.33	547		109.275820 I
		550	548	18.116291		
		17.233687	13.447676			13.7 P_T
				0.60		0.002106 C_O
		0.57	0.41	547		
		548	548	18.116291		
		17.673709	14.989329			12 N
				0.60		0.002106 C
		0.80	0.47	547		
		548	548	18.116291		0.097399 PMR_P
		20.938003	16.048675			13.7 P_T
				0.58		2.182 A_S
		0.70	0.48	547		108 T
		546	548	17.811793		0.000341 A_n
		19.549936	16.318507			
		0.82	0.62	0.58		0.107273 PMR_{AR}
		546	548	547		
		21.159395	16.432579	17.811793		0.102336 PMR_{AVG}
		0.78	0.64	0.58		12 N
		546	548	547		
		20.636860	18.727519	17.811793		0.002212 C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ MAYFLOWER FARMS DATE 9-6-72

PREPARED BY W. D. SWANSON APPROVED _____ PAGE 5 OF 7

SUBJECT Hi-Vol. PARTICULATE EMISSION DATA - RUN # 4 ON 8-23-72

1.4	M
0.986000	MF
30.13	P_{SN}
530	T_{STD}
539	T_M
18	T
49.30	$ACFM_M$
966.754710	VOL_M
28.95	W_D
28.796700	W_W
1.002657	C_D
30.13	P_{SN}
0.996508	C_S

0.38	VH
550	T_S
14.456632	
0.40	VH
549	T_S
14.818306	
0.43	
549	
15.364569	

0.43	VH
548	T_S
15.350570	
0.39	VH
547	T_S
14.605820	
0.38	
546	
13.218169	

14.635611	Ka
1.0	C_P
48.400013	V_O
2.182	A_S
5552.057040	Q_O
530	T_{STD}
548	T_S
30.13	P_{SN}
5531.675235	Q_{OS}
548	T_S
530	T_{STD}
30.13	P_{SN}
18	T
0.019174	An
43.586295	V_n
102.778441	I
122.8	P_T
0.002181	C_O
12	N
0.002181	C
0.099666	PMR_P
122.8	P_T
2.182	A_S
18	T
0.019174	An
0.102603	PMR_{AR}
0.101134	PMR_{AVG}
12	N
0.002213	C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ MAYFLOWER FARMS DATE 9-1-72

PREPARED BY W.D. SWANSEN APPROVED [illegible] PAGE 6 OF 7

SUBJECT RUN #5 - EPA TRAIN (Pt per Method #5)

		0.28	0.55	0.54	VH
		550	554	559	T_S
		19.409673	17.455658	17.374118	
	VOL_M				
155.47	P_M	0.32	0.55	0.54	VH
30.29	T_{STD}	550	554	560	T_S
530	T_M	19.266499	17.455658	17.389652	
564					
	VOL_{STD}	0.37	0.55	0.52	
147.904364		550	554	560	
	VOL_W	14.965342	17.455658	17.064503	
2.65					
	M	0.38	0.55	0.55	
1.760100		550	554	560	
	MF	14.456632	17.455658	17.549926	
0.982399					
28.95	W_D	0.43	0.55	0.55	
	W_W	550	555	560	
28.757269		15.378556	17.471405	17.549900	
	C_D				
1.003344	P_{SN}	0.46	0.59	0.58	
30.14		550	555	560	
	C_S	15.905973	17.941571	18.022208	
0.996343					
		0.65	0.3	0.58	
		550	555	560	
		18.907670	12.903487	18.022208	
		0.55	0.26	0.55	
		550	555	560	
		17.392527	12.012493	17.549926	
		0.55	0.36	0.53	
		550	555	560	
		17.392527	14.135062	17.227684	
		0.58	0.39	0.53	
		551	555	560	
		17.876800	14.712239	17.227684	
		0.58	0.46	0.48	
		551	555	560	
		17.876800	15.978110	16.395121	
		0.58	0.46	0.48	
		554	557	560	
		17.925400	16.006873	16.395121	

16.433664	Ka
0.03	C_P
39.556004	V_O
2.182	A_S
5170.672000	Q_O
530	T_{STD}
555	T_S
30.14	P_{SN}
4894.077723	Q_{OS}
555	T_S
530	T_{STD}
30.14	P_{SN}
100	T
0.000341	An
42.510312	V_n
107.468671	I
21.5	P_T
0.002236	C_O
12	N
0.002236	C
0.093877	PMR_P
21.5	P_T
2.182	A_S
100	T
0.000341	An
0.101009	PMR_{AR}
0.097443	PMR_{AVG}
12	N
0.002222	C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA @ MAYFLOWER FARMS DATE 9-6-72

PREPARED BY W. D. SAUNDERS APPROVED [illegible] PAGE 1 OF 1

SUBJECT HI-VOL PARTICULATE EMISSION DATA - RUN #5 ON 8-25-72

1.4	M
0.986666	MF
30.14	P_{SN}
536	T_{STD}
575	T_M
18	T
48.22	$ACFM_M$
794.630399	VOL_M
28.55	W_D
29.796700	W_W
1.002657	C_D
30.14	P_{SN}
0.996343	C_S

0.35	VH
550	T_S
13.874436	
0.39	VH
550	T_S
14.645818	
0.41	
550	
15.016657	

0.39	VH
550	T_S
14.645818	
0.38	VH
550	T_S
14.456632	
0.32	
550	
12.266499	

14.517670	Ka
1.0	C_P
41.479335	V_O
2.182	A_S
5430.474470	Q_O
536	T_{STD}
550	T_S
30.14	P_{SN}
5197.679211	Q_{OS}
550	T_S
536	T_{STD}
30.14	P_{SN}
18	T
0.019174	A_n
40.091927	V_n
96.055182	I
65.2	P_T
0.001263	C_O
12	N
0.001263	C
0.056265	PMR_P
65.2	P_T
2.182	A_S
18	T
0.019174	A_n
0.054476	PMR_{AR}
0.055370	PMR_{AVG}
12	N
0.001242	C'

TABLE 1

PARTICULATE CONCENTRATION AND PMR CALCULATION TERMINOLOGY

VOL_m = Dry gas meter volume @ meter temperature and pressure, dry - acf

P_m = Dry gas meter pressure (recorded as inlet deflection accross orifice meter) - "Hg

T_m = Dry gas meter temperature (average of inlet and outlet)

P_{STD} = Standard atmospheric pressure (29.92" Hg)

T_{STD} = Standard Temperature (520 or 530° R)

VOL_w = Volume of water collected (expressed as vapor at standard temperature and pressure) - scf

M = % water, calculated from amount the train collected in impinger, bubblers, and on silica gel

MF = Mole fraction of dry gas

W_D = Molecular weight of dry stack gas - lb/lb mole

W_W = Molecular weight of wet stack gas - lb/lb mole

W_a = Molecular weight of air - lb/lb mole

C_D = Velocity correction coefficient for gas density

P_{SN} = Stack pressure (static + barometric) - "Hg

C_S = Velocity correction coefficient for stack pressure

VH_n = Pitot tube pressure differential - "H_2O

V_o = Stack velocity @ stack conditions - fps

Q_o = Stack flow rate at stack conditions - acfm

T_s = Average stack temperature - °R

Q_{OS} = Stack flow rate at standard conditions - scfm

T = Time over which sample was collected - minutes

V_n = Velocity of gases inside nozzle during sampling - fps

I = % isokinetic (± 10% desirable)

C_O = Particulate concentration - grains/scf

N = % CO_2 by volume in stack (12 indicates no % CO_2 correction is to be made)

TABLE 1

PARTICULATE CONCENTRATION AND PMR CALCULATION TERMINOLOGY

C	= Particulate concentration corrected to 12% CO_2
PMR_P	= Pollutant mass rate - "concentration method" - lb/hr
PMR_{AR}	= Pollutant mass rate - "area ratio method" - lb/hr
PMR_{AVG}	= Average pollutant mass rate - lb/hr
C'	= Particulate concentration corrected for non-isokinetic sampling condition -grains/scf
P_T	= Total Particulate collected by sampling train - mg
A_s	= Area of Stack - FT^2
A_n	= Area of Nozzle - FT^2
VH	= Velocity head readings for pitot tube - inches water
VOL_{STD}	= Standardized gas that passed through the sampling train - cubic feet, 70° F., 1 atmosphere pressure, and dry.
C_p	= Velocity correction coefficient for type pitot tube - dimensionless 0.83 to 0.87 for "S" type pitot tube normally and 1.0 for "P" type pitot tube.

PARTICULATE CONCENTRATION & PMR CALCULATIONS

1. $VOL_{STD} = \dfrac{(VOL_m)\ (P_m)\ (T_{STD})}{(P_{STD}^*)\ (T_m)}$

2. $M = \dfrac{(100)\ (VOL_w)}{VOL_{STD} + VOL_w}$

3. $MF = \dfrac{100 - M}{100}$

4. $W_w = (W_D)\ (MF) + 18\ (1\text{-}MF)$

5. $C_D = \sqrt{\dfrac{W_a^*}{W_w}}$

6. $C_S = \sqrt{\dfrac{P_{STD}}{P_{SN}}}$

7. $K = \dfrac{\sum\sqrt{VH_n \times T_{S_n}}}{n}$

8. $V_o = 2.9\ (K_a)\ (C_p)\ (C_D)\ (C_S)$

9. $Q_o = (V_o)\ (A_S)\ (60)$

10. $Q_{OS} = \dfrac{Q_o\ (T_{STD})\ (P_{SN})\ (MF)}{(T_S)\ (P_{STD})}$

11. $V_n = \dfrac{(VOL_{STD})\ (P_{STD})(T_S)}{(MF)\ (T_{STD})\ (P_{SN})\ (T)\ (A_N)\ (60)}$

12. $I = (100)\ \dfrac{V_n}{V_o}$

13. $C_O = \dfrac{P_T}{VOL_{STD}}\ (0.0154)$

14. $C = \dfrac{C_O\ (12\%)}{N}$

15. $PMR_p = (C_O)\ (Q_{OS})\ (0.008571)$

16. $PMR_{AR} = \dfrac{P_T}{T}\dfrac{A_S}{A_n}\ (0.000132)$

17. $PMR_{AVG} = \dfrac{PMR_p + PMR_{AR}}{2}$

18. $C' = \dfrac{PMR_{AVG}}{Q_{OSN}}\ (1400)$

* $P_{STD} = 29.92$" Hg.

* $W_a = 28.95$ LB/LB MOLE

HI-VOL PARTICULATE CONCENTRATION & PMR CALCULATION

1. $MF = 1 - M/100$

2. $VOL_{STD} = \dfrac{(ACFM_m)(T)\ T_{STD}\quad P_{SN}\ (MF)}{T_m\qquad P_{STD}}$

3. $M = (100)(VOL_w)/(VOL_{STD} + VOL_w)$

4. $W_w = (W_D)\ (MF) + 18\ (1\text{-}MF)$

5. $C_D = \sqrt{\dfrac{W_a*}{W_w}}$

6. $C_S = \sqrt{\dfrac{P_{STD}}{P_{SN}}}$

7. $K = \dfrac{\sum\sqrt{VH_n \times T_{S_n}}}{n}$

8. $V_o = 2.9\ (K_a)\ (C_p)\ (C_D)\ (C_S)$

9. $Q_o = (V_o)\ (A_S)\ (60)$

10. $Q_{OS} = \dfrac{Q_o\ (T_{STD})\ (P_{SN})\ (MF)}{(T_S)\ (P_{STD})}$

11. $V_n = \dfrac{(VOL_{STD})\ (P_{STD})(T_S)}{(MF)\ (T_{STD})\ (P_{SN})\ (T)\ (A_N)\ (60)}$

12. $I = (100)\ \dfrac{V_n}{V_o}$

13. $C_O = \dfrac{P_T}{VOL_{STD}}\ (0.0154)$

14. $C = \dfrac{C_O\ (12\%)}{N}$

15. $PMR_p = (C_O)\ (Q_{OS})\ (0.008571)$

16. $PMR_{AR} = \dfrac{P_T}{T}\dfrac{A_S}{A_n}\ (0.000132)$

17. $PMR_{AVG} = \dfrac{PMR_p + PMR_{AR}}{2}$

18. $C' = \dfrac{PMR_{AVG}}{Q_{OSN}}\ (1400)$

* $P_{STD} = 29.92"$ Hg.

* $W_a = 28.95$ LB/LB MOLE

* $ACFM_m$ = Flow through orifice @ temperature.
P_{SN} assumed equal to orifice pressure.

VALENTINE, FISHER & TOMLINSON
SEATTLE, WASHINGTON

CLIENT: EPA @ Mayflower Farms
LOCATION: Portland, Oregon
DATE: 8-21-72
OPERATOR/S: Simmons - Kaufstein
RUN NO.: 1
EQUIPMENT: VFT #3 w/ ΔHa = 1.85
FILTER NO.: #8

PARTICULATE FIELD DATA

VERY IMPORTANT: FILL IN ALL BLANKS

AMBIENT TEMP.: 75 °F
BAR. PRESSURE: 30.16 "Hg
ASSUMED MOISTURE: 3 %
HEATER BOX SETTING: 250 °F
PROBE NOZZLE DIA.: 1/4 (Pn = 0.0033 ") In.
PROBE LENGTH: 3 Ft. 0 In.
PROBE HEATER SETTING: 95

CLOCK TIME	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	PUMP VACUUM ("Hg Ga.	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT Δ P ("H_2O)	ORIFICE Δ H ("H_2O) DESIRED	ORIFICE Δ H ("H_2O) ACTUAL	STACK PRESS. ("Hg)	STACK TEMP. (°F)	OPACITY
13:40	895.14	88	82	2	155	60							
13:43	897.02	88	82	2	160	62	1	0.33	1.3	1.3	30.12	78	0 %
13:46	898.98	90	81	2	170	46	2	0.33	1.3	1.3	"	98	"
13:49	901.68	94	81	2.5	185	92	3	0.39	1.55	1.55	30.17	99	"
13:52	903.79	97	82	2.5	175	46	4	0.41	1.65	1.65	"	99	"
13:55	905.60	102	85	3	190	45	5	0.46	1.85	1.85	"	99	"
13:58	907.95	105	84	3	205	46	6	0.49	1.95	1.95	"	99	"
14:01	910.13	106	85	2.5	216	48	7	0.38	1.50	1.50	"	99	"
14:04	912.45	109	86	2.5	175	49	8	0.46	1.85	1.85	"	97	"
14:07	914.82	112	87	4	215	48	9	=0.46	1.85	1.85	"	97	"
14:10	917.76	111	89	4	195	50	10	0.72	2.90	2.90	"	97	"
14:13	920.71	120	90	4	200	50	11	0.77	3.10	3.10	"	97	"
14:16	923.80	122	91	4	220	52	12	0.77	3.10	3.10	"	97	"
14:19	926.59	124	92	5	200	52	13	0.83	3.30	3.30	"	97	"
14:22	930.12	126	94	5	220	52	14	0.81	3.2	3.20	"	97	"
14:25	933.27	128	95	5	220	52	15	0.81	3.2	3.20	"	97	"
TOTAL										39.60		1451	
AVERAGE													

REMARKS:

V.F.T./AP1B

VALENTINE, FISHER & TOMLINSON
SEATTLE, WASHINGTON

CLIENT EPA @ MAYFLOWER FARMS

PARTICULATE FIELD DATA (CONTINUED)

CLOCK TIME	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	PUMP VACUUM ("Hg Ga.	BOX TEMP. (°F.)	IMPINGER TEMP. (°F.)	POINT	PITOT Δ P ("H_2O)	ORIFICE Δ H ("H_2O) DESIRED	ORIFICE Δ H ("H_2O) ACTUAL	STACK PRESS. ("Hg)	STACK TEMP. (°F.)	OPACITY
							16	0.85	3.3	3.3		97	0%
14:29	936.44	130	97	4.5	305	56	17	0.81	3.2	3.2	"	97	"
14:31	939.63	135	99	4.0	210	56	18	0.75	3.0	3.0	"	97	"
14:34	942.78	134	100	4.0	210	56							
14:52	942.78	115	101	3.3	220	48	START 1	0.30	1.39	1.39	30.27" Hg	98	0%
14:55	945.15	116	101	3.6	220	46	2	0.345	1.69	1.66	"	98	"
14:58	947.20	118	101	3.0	225	44	3	0.44	1.92	1.92	"	98	"
15:01	949.69	119	101	3.2	230	42	4	0.475	2.10	2.10	"	98	"
15:04	952.24	122	101	3.5	225	43	5	0.52	2.40	2.40	"	97	"
15:07	954.99	120	102	3.8	220	42	6	0.52	2.40	2.40	"	97	"
15:10	957.69	126	102	3.6	230	43	7	0.56	2.60	2.60	"	97	"
15:13	960.15	129	101	3.9	250	43	8	0.56	2.56	2.56	"	97	"
15:16	962.52	129	101	3.9	250	43	9	0.69	2.90	2.56	"	97	"
15:19	965.11	131	101	4.1	250	43	10	0.72	3.20	3.20	"	96	"
15:22	967.65	134	102	4.3	250	43	11	0.72	3.20	3.20	"	96	"
15:25	970.37	134	105	5.0	250	48	12	0.72	3.20	3.20	"	96	"
15:28	973.45	136	108	5.0	250	49	13	0.72	3.20	3.20	"	96	"
15:31	976.15	137	109	5.0	250	50	14	0.72	3.20	3.20	"	96	"
15:34	979.00	140	109	5.0	250	51	15	0.72	3.20	3.20	"	96	"
15:37	981.97	142	110	4.6	250	51	16	0.68	2.90	2.90	"	96	"
15:40	984.90	142	111	4.2	256	52	17	0.69	2.90	2.90	"	96	"
15:43	987.28	144	113	4.0	256	54	18	0.54	2.40	2.40	"	96	"
15:46	989.64	145	114	4.0	256	56							
										5.5 x 8		2052	
		2934	2114										
										87.33		3499	
TOTAL		4609	3670							2.5 = 0.18"		97 = 55%	C
AVERAGE		109°F = 569°R											

$\therefore P_m = 30.27 + 0.18$

V.F.T./AP1C

STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA @ WEYERHAEUSER

LOCATION PORTLAND OREGON

DATE 8-21-72

RUN NO. 1		
Initial	Final	Net
1230.6	1252.4	21.8
694.7	699.8	5.1
		26.9
		2.21

H_2O CONDENSED IN IMPINGERS, ml (1 ml = 1 gm)

H_2O ABSORBED BY SILICA GEL, ml

TOTAL H_2O COLLECTED, ml

VOL. OF H_2O VAPOR @ 70° F. AND 1 ATM. = 0.0474 x TOTAL H_2O

MOISTURE IN STACK GAS, %

MOLE FRACTION OF DRY GAS

MOLECULAR WT. OF STACK GAS

$$\% \text{ MOISTURE IN STACK GAS} = \frac{100 \times \text{VOL. } H_2O \text{ VAPOR}}{\text{VOL. DRY GAS} + \text{VOL. WET GAS}}$$

$$\text{MOLE FRACTION OF DRY GAS} = \frac{100 - \% \text{ MOISTURE IN STACK GAS}}{100}$$

MOLECULAR WT. OF STACK GAS = AVG. DRY MOL. WT. OF GAS x MOLE FRACTION + 18 x (1-MOLE FRACTION)

	FINAL (gm)	- TARE		NET WATER (gm) (1 gm = 1 ml)
BUBBLER (#1)	449.2	- 447.9	(W/water) =	1.3 (ml)
IMPINGER(#2)	452.1	- 435.5	(W/water) =	16.6 (ml)
BUBBLER (#3)	351.1	- 347.2	(Dry) =	3.9 (ml)
TOTALS	1252.4	- 1230.6	=	~~8.2~~ 21.8 (ml)

1252.4
-1230.6
21.8

VFT/AP3B

VALENTINE, FISHER & TOMLINSON
VELOCITY TRAVERSE DATA SHEET

CLIENT EPA @ MARSHALLVILLE FARMS

DATE 8-21-72 TIME _____ RUN NO. 1-5

SAMPLING PORT LOCATION TRAVERSE LAYOUT FOR EPA TRAIN

STACK AREA, FT.^{2} 20" Ø = 2.182 FT^2

REFERENCE POINT INSIDE EDGE OF STACK

OPERATOR _____

TYPE PITOT TUBE USED "S" WITH C_p = 0.83

BAROMETRIC PRESSURE _____

STATION	DIST. FROM REF. PT.	VH ("H_2O)	STACK TEMP(°F)	T_S (°R)	STACK PRESS. ("Hg)	VH x T_S	$\sqrt{VH \times T_S}$
1	0.50"*						
2	0.83						
3	1.50						
4	2.18						
5	2.92						
6	3.76						
7	4.72						
8	5.92						
9	7.604						
10	12.36						
11	14.08						
12	15.78						
13	16.24						
14	17.08						
15	17.82						
16	18.50						
17	19.12						
18 AVERAGES	19.50*						

*"P" type pitot tube velocity read from velocity tables at stack temperature and vel. head values using the following equation (Ref. Western Precipitation Bulletin WP50):

$$V = 2.9\left(\sqrt{VH \times T_S}\right)_{avg.}$$

T_S = Absolute Stack Temperature, °R
VH = Velocity Head, in.H_2O
V = Point Velocity (fps)

Velocity correction for; "S" type pitot tube = 0.855 x "P" type, gas density = $\sqrt{(28.95 \text{ lb/lb mole}) \text{ air/Mol. Wt. Stack Gas}}$, Stack Pressure Correction = $\sqrt{29.92\text{"Hg./Stack Pressure.}}$

*POINT CLOSEST TO WALL SHOULD BE 0.28" BUT NOZZLE WOULD TOUCH WALL. THEREFORE 0.50" WAS UTILIZED.

VFT/AP2A

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA @ MAYFLOWER FARMS DATE OF ANALYSIS 8/25-30/72

EVALUATION LOCATION PORTLAND, OREGON RUN NO. 1

EVALUATION DATE 8-21-72 CLEAN-UP SET NO. 1

I. EVAPORATION OF 300 (ml) OF REAGENT GRADE ACETONE

RINSE & BRUSHING OF NOZZLE, PROBE AND GLASSWARE BEFORE FILTER.

FINAL 68043.8 (mg) - TARE 68011.2 (mg)

-BLANK ((0.0145 mg/ml) (300 ml) = 4.4 mg) = 28.2 mg.

II. FILTER CATCH MSA 1106BH GLASS FIBER (Media Type)

FINAL 154.0 (mg) - TARE 146.0 (mg) = 12.0 mg.

III. HYDROCARBON OBTAINED BY ETHER-CHLOROFORM EXTRACTION ON WATER IN IMPINGER AND BUBBLERS.

FINAL 59053.0 (mg) - TARE 59,052.4 (mg)

-BLANK (0.9 mg) = 0.0 mg.

IV. PARTICULATE FROM EVAPORATION OF 440 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 57649.5 (mg) - TARE 57645.8 (mg)

-BLANK ((0.0051 mg/ml) (440 ml initial

- 22 ml CONDENSED = 418 ml) = 2.1 mg) = 1.6 mg.

V. PARTICULATE FROM 78 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 62518.6 (mg) - TARE 62511.9 (mg)

-BLANK ((0.0145 mg/ml) (78 ml) = 1.1 mg) = 5.6 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 47.4 mg.
40.2 mg/Meter #5

BLANKS

ACETONE = 2.5 mg/172 ml = 0.0145 mg/ml
FINAL 68609.6 mg.
TARE 68607.1 mg.

ETHER-CHLOROFORM = 0.9 mg. (FINAL 59224.0 mg - TARE 59223.1 mg)

WATER = 1.0 mg/198 ml = 0.0051 mg/ml.
FINAL 60825.2 mg.
TARE 60824.2 mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
SEATTLE, WASHINGTON

CLIENT: EPA @ MAYFLOWER FARMS
LOCATION: PORTLAND, OREGON
DATE: 8-23-72
OPERATOR/S: SWANSON-KLOPPENSTEIN
RUN NO.: 4
EQUIPMENT: VFET #3 w/ ΔH@ = 1.85
FILTER NO.: #6 0.14512

PARTICULATE FIELD DATA

VERY IMPORTANT: FILL IN ALL BLANKS

AMBIENT TEMP.: 60
BAR. PRESSURE: 30.12 IN
ASSUMED MOISTURE: 2.5
HEATER BOX SETTING: 300
PROBE NOZZLE DIA.: 1/4" Ø IN
PROBE LENGTH: 3 ft. 0 IN
PROBE HEATER SETTING: Not Read

8.15 Ref

CLOCK TIME	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	PUMP VACUUM ("Hg Ga.)	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT Δ P ("H_2O)	ORIFICE Δ H ("H_2O) DESIRED	ORIFICE Δ H ("H_2O) ACTUAL	STACK PRESS ("Hg)	STACK TEMP. (°F)	OPACITY
8:17	53.51	62	61	2.2	250	46							
8:20	60.41	67	61	2.2	250	44	1	0.28	1.30	1.30	Amb.	90	0
23	62.38	71	62	"	250	35	2	0.32	1.45	1.45	"	90	0
26	64.55	75	62	3	250	35	3	.38	1.70	1.70	"	90	0
29	66.91	80	63	3	260	35	4	.45	2.0	2.0	"	90	0
32	69.39	84	64	3	260	35	5	.47	2.1	2.1	"	90	0
35	71.88	86	68	3	265	35	6	.47	2.1	2.1	"	90	0
38	74.53	92	68	3	258	35	7	.54	2.4	2.4	"	90	0
41	77.26	96	69	5	260	35	8	.57	2.5	2.5	"	88	0
44	80.38	102	71	5	260	35	9	.80	3.5	3.5	"	88	0
47	83.46	104	73	4.5	260	38	10	.70	3.0	3.0	"	86	0
50	86.58	108	75	5	255	40	11	.82	3.6	3.6	"	86	0
53	89.90	109	77	5	260	40	12	.78	3.4	3.4	"	86	0
56	93.30	111	79	5	260	40	13	.82	3.6	3.6	"	88	0
59	96.54	111	79	5	260	40	14	.81	3.6	3.6	"	88	0
9:02	99.80	111	81	5	255	40	15	.79	3.55	3.55	"	88	0
TOTAL		1471	1113				16						
AVERAGE													

REMARKS:

V.F.T./2B

CLIENT EPA @ MAYFLOWER FARMS

PARTICULATE FIELD DATA (CONTINUED)

CLOCK TIME	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	PUMP VACUUM ("Hg Ga.)	BOX TEMP. (°F.)	IMPINGER TEMP. (°F.)
9:05	103.01	111	81	4.8	255	40
9:08	106.58	112	82	4.5	250	40
9:11	109.49	111	83	4.3	250	40
9:25	111.85	97	81	2.5	235	40
9:28	114.65	100	82	2.9	230	38
9:31	117.26	102	83	3.2	240	39
9:33	120.70	102	82	4.0	240	39
9:36	123.45	106	82	4.2	245	40
9:39	126.42	108	84	4.2	240	40
9:41	127.30	104	84	3.5	245	41
9:43	132.10	108	84	4.0	240	43
9:46	135.02	108	84	4.5	240	43
9:49	138.15	108	84	4.3	240	45
9:51	14 1.08	106	82	4.3	240	45
9:54	14 4.08	104	82	4.0	240	45
9:57	147.00	104	82	4.0	250	45
10:00	149.98	106	82	4.0	245	45
10:03	152.84	105	82	4.0	250	50
10:06	155.58	108	82	4.0	255	50
10:09	158.60	105	82	4.0	255	50
10:12	160.33	104	82	4.0	250	50
		2287	1731			
TOTAL/08	101.82	3728	2841			
AVERAGE		86°F = 546°R				

POINT	PITOT Δ P ("H_2O)	ORIFICE Δ H ("H_2O) DESIRED	ORIFICE Δ H ("H_2O) ACTUAL	STACK PRESS. ("Hg)	STACK TEMP. (°F.)	OPACITY
16	0.74	3.35	3.35	ATM	88	0
17	0.74	3.35	3.35	ATM	88	0
18	0.68	3.10	3.10	"	88	0
1	0.33	1.50	1.50	"	88	0
2	0.41	1.80	1.80	"	88	0
3	0.47	2.10	2.10	"	85	0
4	0.48	2.20	2.20	"	85	0
5	0.62	2.60	2.60	"	85	0
6	0.64	2.90	2.80	"	86	0
7	0.64	2.80	2.80	"	86	0
8	0.52	2.35	2.35	"	86	0
9	0.64	2.80	2.80	"	86	0
10	0.68	3.00	3.00	"	86	0
11	0.64	2.80	2.80	"	87	0
12	0.64	2.80	2.80	"	87	0
13	0.60	2.60	2.60	"	87	0
14	0.60	2.60	2.60	"	87	0
15	0.60	2.60	2.60	"	87	0
16	0.58	2.55	2.55	"	87	0
17	0.58	2.55	2.55	"	87	0
18	0.58	2.55	2.55	"	87	0
			1234		1234	
			11.60		3160	
			2.63 = 0.19"H		88 = 548°R	

STARTED ON SECOND TRAVERSE @ 9:12

$P_m = 30.12 + 0.19$
$= 30.3$ "Hg

V.F.T./AP1C

STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA @ MAYFLOWER FARMS

LOCATION PORTLAND OREGON

DATE 8-23-72

	RUN NO. 4		
	Initial	Final	Net
H_2O CONDENSED IN IMPINGERS, ml (1 ml = 1 gm)	1218.6	1233.6	15.0
H_2O ABSORBED BY SILICA GEL, ml	654.5	709.0 ~~654.5~~	24.5
TOTAL H_2O COLLECTED, ml			39.5
VOL. OF H_2O VAPOR @ 70° F. AND 1 ATM. = 0.0474 x TOTAL H_2O			1.87
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

$$\% \text{ MOISTURE IN STACK GAS} = \frac{100 \times \text{VOL. } H_2O \text{ VAPOR}}{\text{VOL. DRY GAS} + \text{VOL. WET GAS}}$$

$$\text{MOLE FRACTION OF DRY GAS} = \frac{100 - \% \text{ MOISTURE IN STACK GAS}}{100}$$

MOLECULAR WT. OF STACK GAS = AVG. DRY MOL. WT. OF GAS x MOLE FRACTION + 18 x (1-MOLE FRACTION)

	FINAL (gm)	- TARE		NET WATER (gm) (1 gm = 1 ml)
BUBBLER (#1)	433.9	- 433.1	(W/water) =	0.8 (ml)
IMPINGER(#2)	444.1	- 436.1	(W/water) =	8.0 (ml)
BUBBLER (#3)	355.6	- 349.4	(Dry) =	6.2 (ml)
TOTALS	1233.6	- 1218.6	=	15.0 (ml)

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA @ MAYFLOWER FARMS DATE OF ANALYSIS 8/25-30/72

EVALUATION LOCATION PORTLAND, OREGON RUN NO. 5

EVALUATION DATE 8-23-72 CLEAN-UP SET NO. 5

I. EVAPORATION OF 245 (ml) OF REAGENT GRADE ACETONE

RINSE & BRUSHING OF NOZZLE, PROBE AND GLASSWARE BEFORE FILTER.

FINAL 67847.9 (mg) - TARE 67826.9 (mg)

-BLANK ((0.0145 mg/ml) (245 ml) = 3.6 mg) = 17.4 mg.

II. FILTER CATCH MSA 1106 BH GLASSFIBER (Media Type)

FINAL 151.2 (mg) - TARE 146.7 (mg) = 4.5 mg.

III. HYDROCARBON OBTAINED BY ETHER-CHLOROFORM EXTRACTION ON WATER IN IMPINGER AND BUBBLERS.

FINAL 60954.7 (mg) - TARE 60951.9 (mg)

-BLANK (0.9 mg) = 1.9 mg.

IV. PARTICULATE FROM EVAPORATION OF 400 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 66449.4 (mg) - TARE 66447.2 (mg)

-BLANK ((0.0051 mg/ml) (400 ml initial

- 20 ml CONDENSED = 380 ml) = 1.9 mg) = 0.3 mg.

V. PARTICULATE FROM 128 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 66579.8 (mg) - TARE 66573.8 (mg)

-BLANK ((0.0145 mg/ml) (128 ml) = 1.9 mg) = 4.1 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 28.2 mg.

21.9 PER MEETING #5

BLANKS REF. RUN #1

ACETONE = ____ mg/____ ml = 0.0145 mg/ml FINAL ____ mg. TARE ____ mg.

ETHER-CHLOROFORM = 0.9 mg. (FINAL ____ mg - TARE ____ mg)

WATER = ____ mg/____ ml = 0.0051 mg/ml. FINAL ____ mg. TARE ____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
SEATTLE, WASHINGTON

CLIENT: EPA @ Weyerhauser Farms
LOCATION: Portland Oregon
DATE: 8-23-72
OPERATOR/S: Snowden Klopfenstein
RUN NO.: 5
EQUIPMENT: VFTA3 w/ ΔH@=1.85
FILTER NO.: #7 @ ~~151.2 mg~~ 146.7mg TARE

PARTICULATE FIELD DATA

VERY IMPORTANT: FILL IN ALL BLANKS

AMBIENT TEMP. 89 °
BAR. PRESSURE 30.13 "H
ASSUMED MOISTURE 2.5
HEATER BOX SETTING 350 °
PROBE NOZZLE DIA. 1/4 In
PROBE LENGTH 3 Ft. 0 In
PROBE HEATER SETTING No - Required

CLOCK TIME	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	PUMP VACUUM ("Hg Ga.	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT ΔP ("H2O)	ORIFICE ΔH ("H2O) DESIRED	ORIFICE ΔH ("H2O) ACTUAL	STACK PRESS ("Hg)	STACK TEMP. (°F)	OPACITY
11:02	166.47	78	76	2.2	40	180	1	0.38	1.35	1.35	Let	90	0%
11:07	169.10	87	77	2.6	40	200	2	0.32	1.45	1.45	"	90	"
11:12	167.29	94	78	3.0	40	225	3	0.31	1.60	1.60	"	90	"
11:17	170.81	98	80	3.2	38	225	4	0.38	1.67	1.67	"	90	"
11:22	174.77	104	81	3.5	38	225	5	0.43	1.90	1.90	"	90	"
11:27	178.72	108	83	3.5	39	230	6	0.46	1.90	1.95	"	90	"
11:32	182.69	112	85	4.9	38	235	7	0.65	2.90	2.95	"	90	"
11:37	187.60	116	88	4.2	38	235	8	0.55	2.80	2.90	"	90	"
11:42	192.38	120	90	4.2	38	235	9	0.55	2.90	2.90	"	90	"
11:47	197.13	120	92	4.5	38	245	10	0.58	2.60	2.60	"	91	"
11:52	202.81	116	92	4.5	43	255	11	0.58	2.60	2.60	"	91	"
12:52	206.65	84	80	4.5	45	250	12	0.50	2.60	2.60	"	94	"
12:57	211.79	95	82	4.5	40	255	13	0.55	2.90	2.90	"	94	"
13:02	216.35	102	83	4.5	40	220	14	0.50	2.80	2.80	"	94	"
13:07	220.89	106	85	4.5	40	245	15	0.50	2.60	2.65	"	94	"
13:12	225.45	108	86	4.5	35	250							
TOTAL													
AVERAGE													

REMARKS: Plant shut down @ 11:52 & broke for lunch - Started @ ~~12:52~~ 12:47

V.F.T./AP13

VALENTINE, FISHER & TOMLINSON
SEATTLE, WASHINGTON

CLIENT EPA @ Weyerhaeuser Farms

PARTICULATE FIELD DATA (CONTINUED)

CLOCK TIME	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	PUMP VACUUM ("Hg Ga.)	BOX TEMP. (°F.)	IMPINGER TEMP. (°F.)	POINT	PITOT Δ P ("H_2O)	ORIFICE Δ H ("H_2O) DESIRED	ORIFICE Δ H ("H_2O) ACTUAL	STACK PRESS. ("Hg)	STACK TEMP. (°F.)	OPACITY
							16	0.55	2.40	2.40	Amb	94	0 %
13:17	230.03	108	86	4.5	250	45	17	0.55	2.40	2.40	"	95	0
13:22	234.59	112	88	4.5	250	45	18	0.56	2.60	2.60	"	95	0
13:27	239.35	113	89	4.5	235	42							
13:30	239.35	113	91	2.5	220	45	1	0.30	1.35	1.35	Amb	95	0 %
13:35	242.85	115	95	2.5	255	36	2	0.26	1.15	1.15	"	95	"
13.40	246.07	114	95	2.5	250	38	3	0.36	1.55	1.55	"	95	"
13:45	249.75	113	96	2.9	250	28	4	0.39	1.85	1.85	"	95	"
13:50	253.66	115	96	3.6	250	34	5	0.46	2.00	2.00	"	95	"
13.55	257.75	119	97	3.6	250	34	6	0.46	2.00	2.00	"	97	"
13.60	262.10	120	99	3.6	250	46	7	0.51	2.20	2.20	"	99	"
14.05	266.37	125	101	4.0	240	46	8	0.54	2.20	2.20	"	100	"
14.10	270.92	124	103	4.0	220	40	9	0.52	2.10	2.10	"	101	"
14:15	275.25	125	105	3.9	235	40	10	0.55	2.25	2.25	"	100	"
14:20	279.72	133	108	3.9	230	51	11	0.55	2.25	2.25	"	100	"
14.25	284.19	132	108	4.2	220	52	12	0.53	2.45	2.45	"	100	"
14:30	288.96	132	108	4.2	245	52	13	0.56	2.45	2.45	"	100	"
14:35	293.07	135	110	4.0	240	54	14	0.55	2.30	2.30	"	100	"
14:40	298.18	138	112	4.0	230	55	15	0.53	2.25	2.25	"	100	"
14.45	302.98	130	110	4.0	220	54 55	16	0.53	2.25	2.25	"	100	"
14:50	307.34	128	110	3.5	220	54	17	0.48	2.10	2.00	"	100	"
14:55	311.81	132	110	3.5	220	52	18	0.48	2.00	2.00	"	101	"
15:00	315.94	130	112	3.5	245	62							
TOTAL(S)													
AVERAGE		104°F = 564°R											

$\Delta P_{avg} = 30.13 \div 36 = .84$

V.F.T./AP1C

STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA @ Marathon Films

LOCATION Portland Oregon

DATE 8-23-72

	RUN NO. 5		
	Initial	Final	Net
H_2O CONDENSED IN IMPINGERS, ml (1 ml = 1 gm)	1202.6	1222.6	20
H_2O ABSORBED BY SILICA GEL, ml	684.0	720.4	36
TOTAL H_2O COLLECTED, ml			56
VOL. OF H_2O VAPOR @ 70° F. AND 1 ATM. = 0.0474 x TOTAL H_2O			2.65
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

$$\% \text{ MOISTURE IN STACK GAS} = \frac{100 \times \text{VOL. } H_2O \text{ VAPOR}}{\text{VOL. DRY GAS} + \text{VOL. WET GAS}}$$

$$\text{MOLE FRACTION OF DRY GAS} = \frac{100 - \% \text{ MOISTURE IN STACK GAS}}{100}$$

MOLECULAR WT. OF STACK GAS = AVG. DRY MOL. WT. OF GAS x MOLE FRACTION + 18 x (1-MOLE FRACTION)

	FINAL (gm)	- TARE		NET WATER (gm) (1 gm = 1 ml)
BUBBLER (#1)	457.2	- 449.5 (W/water)	=	7.7 (ml)
IMPINGER (#2)	745.4	- 735.6 (W/water)	=	9.8 (ml)
BUBBLER (#3)	320.0	- 317.5 (Dry)	=	2.5 (ml)
TOTALS	1222.6	- 1202.6	=	20.0 (ml)

VFT/AP3B

VALENTINE, FISHER & TOMLINSON

HI-VOL PARTICULATE DATA SHEET

CLIENT EPA @ MAYFLOWER FARMS

LOCATION PORTLAND, OREGON

DATE 8-21-72

OPERATOR/S SWANSEN

RUN # 1

FILTER # 2

NOZZLE SIZE 1 7/8 IN.

%H_2O 2.2 % WB 98 °F

DB 76 °F

STACK AREA 20"Ø = 2.182 FT^2

ATMOS. PRESS. 30.16 IN. Hg

PROCESS TYPE GRAIN MILLING

REF ΔP = 0.85

TIME 24 HR	T_s °F	T_m °F	TRAV. POINT	VH "H_2O	① VEL. fpm	② ORIFICE FLOW cfm	③ ORIFICE FLOW scfm	④ ORIFICE Δ P "H_2O (Across 2 DESIGNED)	STACK PRESS. "H_2O
14:05	82	95							
14:08	85	95	1	0.35				0.50	+.20
14:11	90	95	2	0.35				0.50	
14:13	90	97	3	0.45				0.50	
14:16	90	97	3	0.45				1.10	
14:19	90	97	3	0.45				1.25	
14:22	90	97	4	0.42				1.25	
14:25	90	97	5	0.38				0.98	
14:28	90	97	6	0.35				0.85	
						39.3	37.5	0.5	
						39.6	37.5	0.5	
						39.9	37.5	0.5	
						55.0	52.0	1.10	
						58.0	54.3	1.25	
						58.0	54.3	1.25	
						54.5	50.0	0.98	
						49.3	46.5	0.85	
	T_s	T_m		TOTALS		394.1			
23MIN	867	797		AVG		49.26			=0.01 Hg
	96°F	89°F							
	556°R	549°R							

P_{STN} = 30.17

VWT/AP16

VALENTINE, FISHER & TOMLINSON

HI-VOL PARTICULATE DATA SHEET

CLIENT EPA @ MAYFLOWER FARMS

LOCATION PORTLAND, OREGON

DATE 8-22-72

OPERATOR/S SWEDEN - KLOPPENSTEIN

RUN # 2

FILTER # #3 - RABBIT FEED

NOZZLE SIZE 1 7/8 IN.

%H_2O 2.2% WB 78 °F

DB 76 °F

STACK AREA 2.182 FT^2

BAROS. PRESS. 30.21 IN. Hg

PROCESS TYPE GRAIN MILLING

Ref $\Delta P = 0.85$

TIME 24 HR	T_s °F	T_m °F	TRAV. POINT	VH "H_2O	VEL. fpm	① ORIFICE FLOW cfm	② ORIFICE FLOW scfm	③ ORIFICE ΔP "H_2O	④ STACK PRESS. "H_2O
13:59	96	90	1	0.40		45.2	48	0.88	+6.2 "H_2O
13:62	96	92	2	0.46		47.5	50.2	1.00	
14:05	97	92	3	0.40		45.3	48	0.88	
14:08	97	92	4	0.35		42.8	45.3	0.78	
14:11	97	92	5	0.38		43.5	46.5	0.83	
14:14	97	94	6	0.33		42.0	44.0	0.72	
14:17	97	95							
TOT. 18 MIN.	672	647			TOTAL	266.3			-5.01 "H_2O
AVG.	97°F	92°F			AVERAGE	44.38			
	556°R	552°R							

$\therefore P_m = 30.22$

VPT/APTC

VALENTINE, FISHER & TOMLINSON

HI-VOL PARTICULATE DATA SHEET

CLIENT E.P.A. (Portland Harbor Trials)

LOCATION Portland, Oregon

DATE 8-23-77

OPERATOR/S [illegible]

RUN # 3 4

FILTER # 4

NOZZLE SIZE 1 1/8 IN.

%H_2O 1.4% WB 60 °F

DB 90 °F

STACK AREA 2.04 FT^2

ATMOS. PRESS. 30.12"Hg IN. Hg

PROCESS TYPE Composite

$K_p \cdot \Delta P = 0.85$

TIME 24 HR	T_s °F	T_m °F	TRAV. POINT	VH "H_2O	VEL. fpm ①	ORIFICE FLOW cfm ②	ORIFICE FLOW scfm ③	ORIFICE P "H_2O ④	STACK PRESS. "H_2O
8:31	90	75	1	0.38		49.3	47.5	0.83	+6.2"
8:34	90	77	2	0.40		50.5	48.0	0.85	"
8:37	89	80	3	0.43		51.8	49.2	0.92	"
8:40	88	80	4	0.43		51.8	49.2	0.92	"
8:43	88	81	5	0.39		48.5	46.5	0.82	"
8:46	86	80	6	0.32		45.0	43.0	0.68	"
8:49	86	80							
18 min	617	553			Total	295.9			
	89°F	79°F			Avg.	49.32			+0.3"

548°R 539°R

$P_m = 30.15$

VFT/AP16

VALENTINE, FISHER & TOMLINSON

HI-VOL PARTICULATE DATA SHEET

CLIENT EPA @ MAYFLOWER FARMS

LOCATION PORTLAND, OREGON

DATE 8-23-72

OPERATOR/S SNOWDEN - HOPPENSTEIN

RUN # ~~4~~ 5

FILTER # 6

NOZZLE SIZE 1 7/8 IN.

%H_2O 1.4% WB 67 °F

DB 90 °F

STACK AREA 20"Ø FT^2

ATMOS. PRESS. ~~29.5~~ 32.13 IN. Hg

PROCESS TYPE GRAIN MILLING

TIME 24 HR	T_s °F	T_m °F	TRAV. POINT	VH "H_2O	① VEL. fpm	② ORIFICE FLOW cfm	③ ORIFICE FLOW scfm	④ ORIFICE P "H_2O	STACK PRESS. "H_2O
11:20	90	75							
11:23	90	80	1	0.35		46.8	45.0	0.75	+0.2
11:26	90	83	2	0.39		49.0	47.0	0.85	"
11:29	90	83	3	0.41		50.2	48.0	0.87	"
11:32	90	84	4	0.39		49.3	47.0	0.85	"
11:35	90	85	5	0.38		48.5	46.0	0.82	"
11:38	90	85	6	0.32		45.5	43.0	0.69	"
18 MIN.	630	575			TOTAL	289.3			
	90 =	82°F			AVG.	48.22			= 0.01

550°R 542°R

$\therefore P_m = 30.12$

VALENTINE, FISHER & TOMLINSON
HI - VOL
PARTICULATE LABORATORY SHEET

CLIENT EPA @ Mayflower Farms DATE OF ANALYSIS 8-28-72

LOCATION Portland, Oregon RUN NO. 1-5 (3 voided)

DATE OF SAMPLE 8-21-72 CLEAN-UP REFERENCE 3B Container

RUN NO.	FILTER NO.	WEIGHTS - ~~grams~~ milligrams FINAL	-TARE	+RINSE	(±) BLANKS FILTER	(±) BLANKS ~~WATER~~ RINSE	ΣT (VOL. RAYS)
1	2	15937.7	15702.5	60.5	-44.7	-4.0	247.0
2	3	16337.0	15555.3	101.4	-44.7	-4.6	833.8
4	4	15750.6	15620.8	42.4	-44.7	-4.7	122.8
5	6	15564.7	15965.2	13.1	-44.7	-2.7	65.2
1172 ml Rinse Blank		68609.6	68609.			0.0145 mg/ml	
1	275 ml Rinse	56922.3	56861.8	60.5		-4.0	
2	320 ml Rinse	67816.3	67714.9	101.4		-4.6	
4	325 ml Rinse	68210.5	68168.2	42.4		-4.7	
5	186 ml Rinse	64848.6	64835.5	13.1		-2.7	

VFT/AP15

VALENTINE, FISHER & TOMLINSON
VELOCITY TRAVERSE DATA SHEET

CLIENT EPA @ MAYFLOWER FARMS

DATE 8/21/72 TIME _____ RUN NO. ___

SAMPLING PORT LOCATION TRAVERSE LAYOUT FOR Hi-Vol

STACK AREA, FT.^{2} 2.182 FT^2

REFERENCE POINT INSIDE OF STACK

OPERATOR _____

TYPE PITOT TUBE USED P TYPE w/ C_p=1.0

BAROMETRIC PRESSURE _____

STATION	DIST. FROM REF. PT.	VH ("H_2O)	STACK TEMP(°F)	T_S (°R)	STACK PRESS. ("Hg)	VH x T_S	$\sqrt{VH \times T_S}$
1	0.88						
2	2.94						
3	5.90						
4	14.10						
5	17.06						
6	19.12						
AVERAGES							

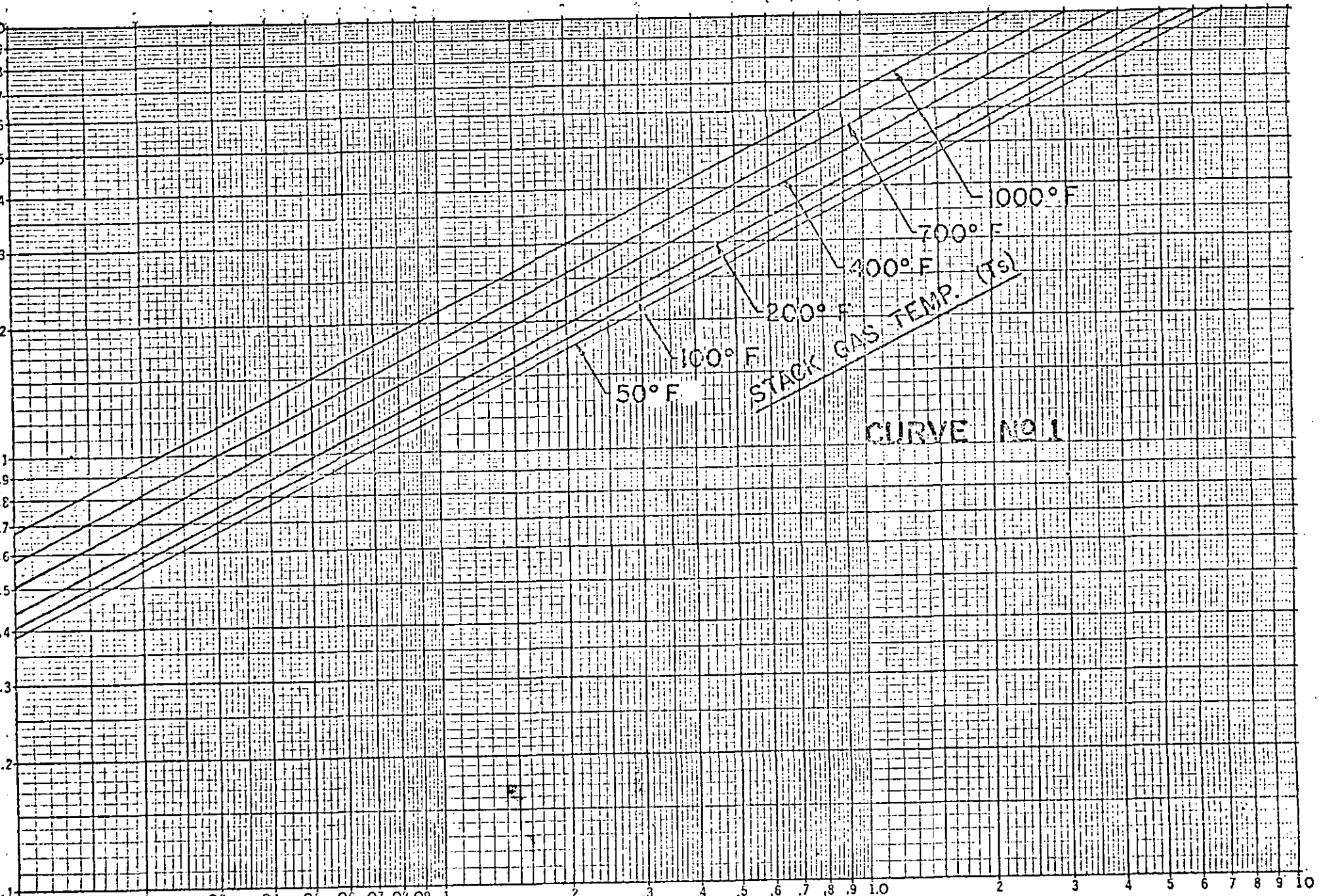
*"P" type pitot tube velocity read from velocity tables at stack temperature and vel. head values using the following equation (Ref. Western Precipitation Bulletin WP50):

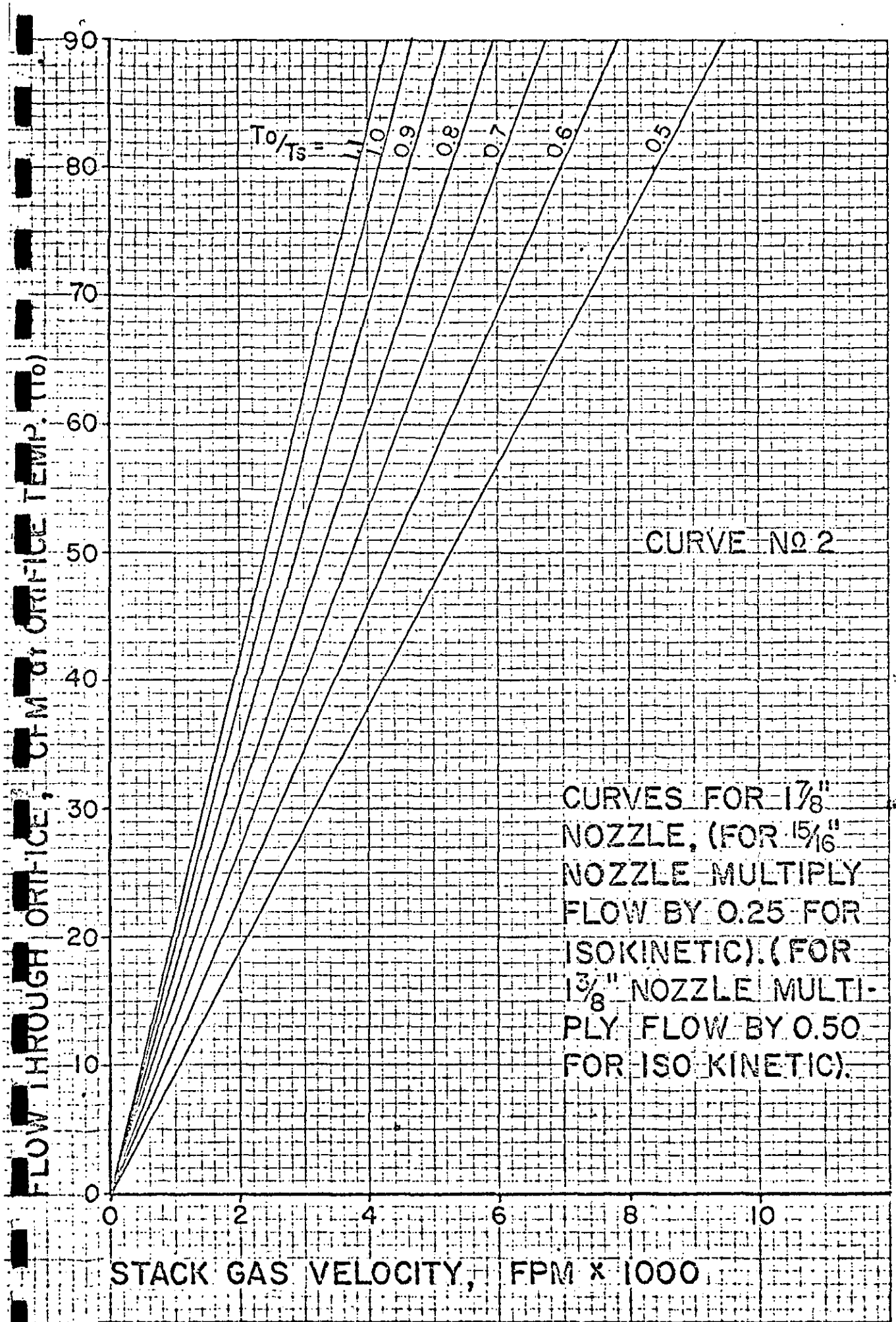
$$V = 2.9\left(\sqrt{VH \times T_S}\right)_{avg.}$$

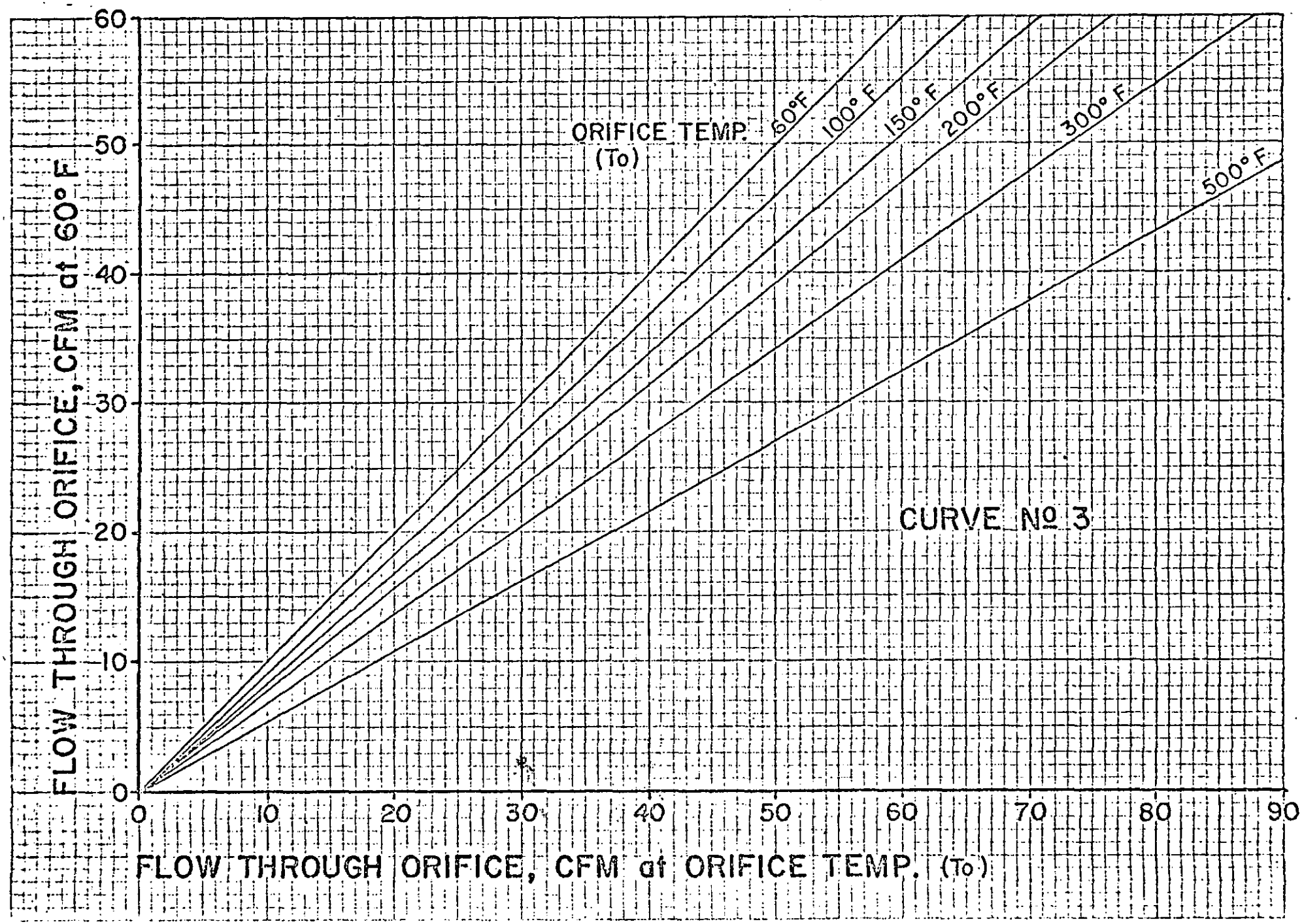
T_S = Absolute Stack Temperature, °R
VH = Velocity Head, in.H_2O
V = Point Velocity (fps)

Velocity correction for; "S" type pitot tube = 0.855 x "P" type, gas density = $\sqrt{(28.95 \text{ lb/lb mole}) \text{ air/Mol. Wt. Stack Gas}}$, Stack Pressure Correction = $\sqrt{29.92\text{"Hg./Stack Pressure.}}$

VFT/AP2A




FLOW THROUGH ORIFICE, CFM at ORIFICE TEMP. (To)
STACK GAS VELOCITY, FPM x 1000
To/Ts = 1.0
0.9
0.8
0.7
0.6
0.5
CURVE Nº 2
CURVES FOR 1 7/8" NOZZLE, (FOR 15/16" NOZZLE MULTIPLY FLOW BY 0.25 FOR ISOKINETIC). (FOR 1 3/8" NOZZLE MULTIPLY FLOW BY 0.50 FOR ISO KINETIC).
0
10
20
30
40
50
60
70
80
90
0
2
4
6
8
10


ORIFICE TEMP. (To)
60°F
100°F
150°F
200°F
300°F
500°F
CURVE No. 3
FLOW THROUGH ORIFICE, CFM at 60° F
FLOW THROUGH ORIFICE, CFM at ORIFICE TEMP. (To)
0
10
20
30
40
50
60
70
80
90