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SOURCE SAMPLING RESIDENTIAL FIREPLACES FOR EMISSION FACTOR DEVELOPMENT

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

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by

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U.S. ENVIRONMENTAL PROTECTION AGENCY
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I. INTRODUCTION

This Atmospheric Emission Evaluation was conducted on an "Average Fireplace" located in the Seattle area for use in the development of an Emission Factor for residential fireplaces, EPA Contract No. 68-02-1992. This Project was funded by the United States Environmental Protection Agency's National Air Data Branch, Technical Development Section, with Messrs. James A. Southerland and Tom Lahre serving as advisors during the entire evaluation. Messrs. David A. Alguard, Gregory A. Swanson and William E. Stolberg, of Valentine, Fisher & Tomlinson, served as project leader and colleagues respectively. The field sampling was performed during the period of July 29 through August 20, 1975.

Area wide emissions can be projected from the enclosed point source emissions factors by establishing the number and use frequency for residential fireplaces.

II. SUMMARY

The average pollutant mass rate was found to be 76.1 grams/hour and the grams of particulate per kilogram of wood burned was found to be 10.4 grams/kilogram. The average particle size was 3.0 microns. 66.3% of the particulate was condensables caught in the back half or impinger section of the Method 5 sampling trains. A back-up filter was used in anticipation of this high back half catch. All atmospheric emissions reported are calculated using front half plus back half particulate including the back-up filter. Poor combustion conditions of considerable excess air was indicated by CO_2 concentrations of consistently less than 1.0%.

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III. DISCUSSION OF EMISSION FACTORS

The representative fireplace in the Seattle area was prepared for sampling as shown on Figure 1. The selection of the representative fireplace is discussed in Appendix A. A total of 24 samples consisting of 18 EPA Method 5 samples, 3 polycyclic organic material (POM) samples and 3 particle sizing runs were collected from the selected fireplace. Sampling was performed using alder, pine, douglas fir, locust and coal as fuels. Coal was not included in computing final average emission parameters because of its current low frequency of use.

A summary of emissions and burning conditions is presented in Table I. Sampling was conducted under three burning conditions of start-up, stable, and smolder. Start-up conditions were present just after building the fire. The flue gas temperatures were rising during this condition. Stable conditions were present when the fire had reached a constant combustion rate. The flue gas temperatures were at a constant level during this burning condition. Smolder conditions were present when the fire was no longer stoked. Since no fuel was being added during smoldering, burning rate was decreasing. Flue gas temperatures dropped throughout the smolder condition.

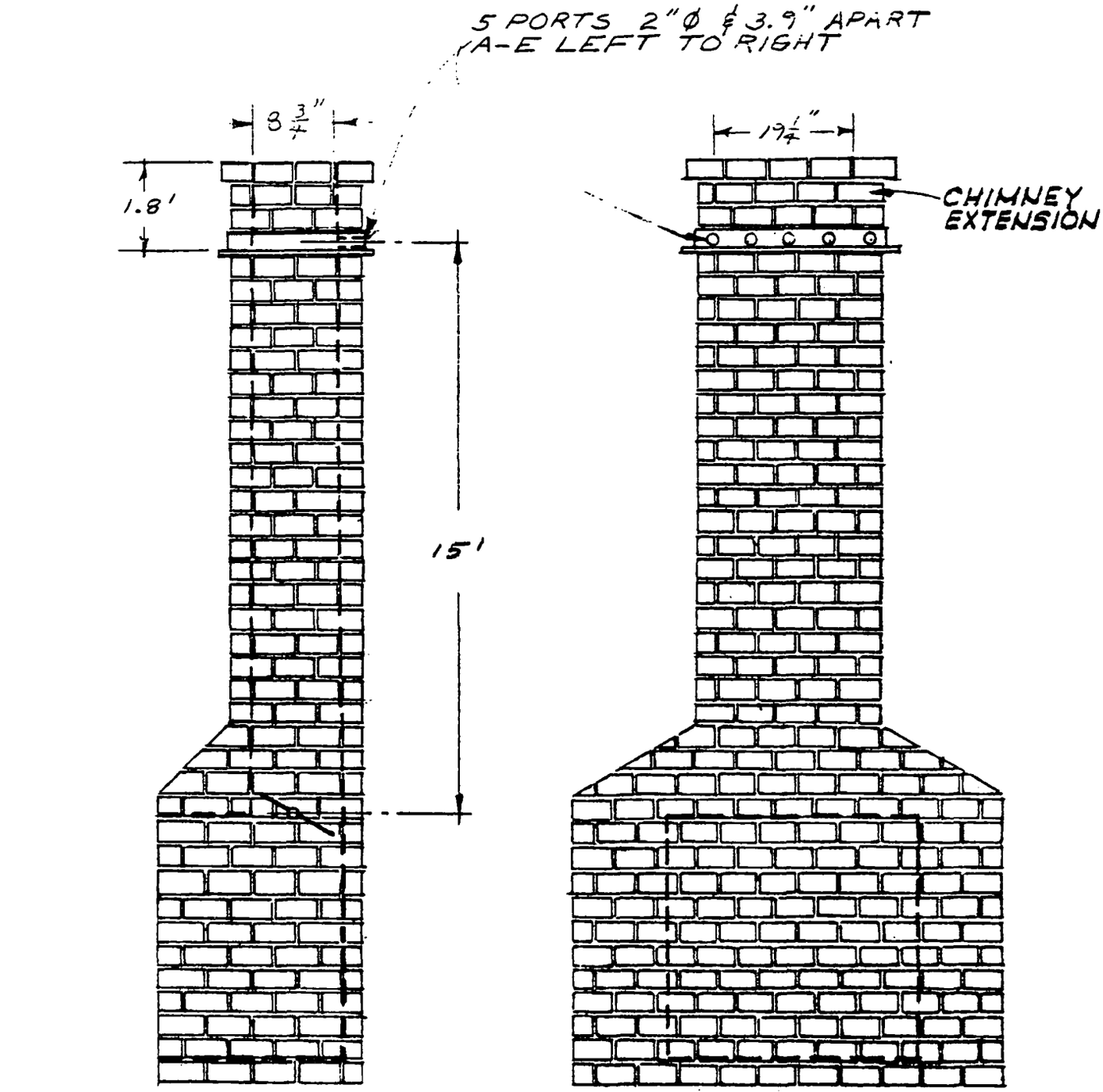
Emissions reported in Table I are calculated using the EPA Method 5 front half section plus the back half section which includes a back-up filter. In addition to the standard EPA-designed particulate sampling train (referred to generally as Method 5) a back-up filter was added between the dry bubbler and the bubbler containing silica gel. The sampling train with the back-up filter is shown in Figure 2. The average back-up filter catch for the 18 particulate runs was found to be 61% as heavy as the front half filter catch (see Tabulation of the Ratio of Back Half to Front Half Catch, Appendix B). In four cases the back-up filter catch was more than the front half filter catch.

Concentrations of CO_2 reported in Table I were measured by an Orsat analyzer. Subsequent particulate concentrations corrected to 12% CO_2 are susceptible to errors due to the magnitude of correction and the accuracy of the CO_2 analysis. More accurate determinations of CO_2 were made by infrared analysis as shown in Table II.

The data given in Table I shows how three factors affecting atmospheric emissions were developed during this project. The factors are 7.4 kilograms per hour wood burning rate (BR), 76.1 grams per hour pollutant mass rate (PMR) and 11.7 grams emissions per kilogram of wood burned (PMR/BR). The BR and the PMR were calculated from the average of fifteen modified EPA Method 5 sampling runs. From these fifteen runs a 95 percent confidence interval was found for the BR, PMR, and PMR/BR to be $\pm$ 1.15, $\pm$ 11.6 and $\pm$ 2.3 respectively.

All samples utilized for emission parameters reported in Table I were collected within 100 $\pm$ 10% of isokinetic conditions. Stack sampling utilized 3-foot heated glass probes within S type pitobes. A 1/2-inch diameter nozzle was used to collect all particulate and POM samples. Section IV, Procedures, describes in more detail the sampling procedure used for this evaluation.

An important emission parameter which allows comparison of the emissions of various types of wood being burned, is gm particulate/kg wood burned. A plot of this parameter versus burning condition, Figure 3, reveals that emissions



AVERAGE FIREPLACE SAMPLING PORT LOCATIONS

FIGURE 1

E.P.A. FIREPLACE EMISSION EVALUATION

DRAWN: W.B.	Prepared by: VALENTINE, FISHER & TOMLINSON Consulting Engineers 520 LLOYD BUILDING SEATTLE, WASHINGTON
CHECKED: G.A.S.	
DATE: [illegible] 73	ES-1

TABLE I

Summary of Emissions and Burning Conditions

Fuel Type	Run	*Burning Conditions	Burning Rate Kg/hr (BR)	Stack Temp °C	Stack Gas Flow Rate Std.a m3/min	**Pollutant Mass Rate gm/hr (PMR)	**Concentration gm/std.m3	% CO2	**Concentration gm/std.m3 @12%CO2	Pollutant Mass Rate / Burning Rate (PMR/BR) gm/Kg
Alder	1	Start Up	4.8	83	11.538	76.6	.111	0.1	13.279	16.0
Alder	2	Stable	7.8	108	10.513	46.0	.073	0.6	1.389	5.9
Alder	3	Smolder	1.9	67	8.262	42.2	.085	0.1	10.211	22.2
Alder	4	Start Up	10.8	114	9.242	135.4	.244	0.6	4.690	12.5
Alder	5b	Stable	9.1	92	---b	---b	---b	---	---b	----b
Alder	6c	Stable	6.2	99	12.771	---c	---c	0.5	---c	----c
Alder Average		Start Up	7.8	98	10.39	106	.178	0.4	8.984	14.2
Alder Average		Stable e	7.8e	108e	10.513e	46.0e	.073e	0.6e	1.389e	5.9e
Alder Average		All Conditions e	6.3e	93e	9.889e	75.0e	0.128e	0.4e	7.392e	14.15e
Douglas Fir	7	Stable	5.7	79	12.139	65.7	.090	0.2	5.414	11.5
Douglas Fir	8	Stable	4.1	88	11.715	58.9	.084	0.4	2.322	14.4
Douglas Fir	9	Start Up	8.3	83	8.787	72.7	.138	0.6	2.759	8.8
Douglas Fir	10	Stable	6.7	110	11.814	90.2	.127	0.4	3.817	13.5
Douglas Fir	11c	Stable	4.3	88	11.737	---c	---c	0.5	---c	----c
Douglas Fir Average		Start Up	8.3	83	8.787	72.7	.138	0.6	2.759	8.8
Douglas Fir Average		Stable	5.5e	92e	11.889e	71.6e	.104e	0.3e	3.851e	13.1e
Douglas Fir Average		All Conditions	6.2e	90e	11.114e	71.9e	.110e	0.4e	3.578e	12.05e
Locust	14	Start Up	9.0	86	10.046	85.2	.141	0.4	.430	9.5
Locust	15	Stable	6.2	92	11.414	78.7	.115	0.4	.397	12.7
Locust	16	Start Up	5.2	82	9.918	60.4	.102	0.6	2.150	11.6
Locust	17b	Stable	4.5	91	----b	---b	---b	---	---b	---b
Locust	18	Stable	5.5	91	12.709	84.2	.110	0.4	3.312	15.3
Locust Average		Start Up	7.1	84	9.982	72.8	.112	0.5	1.290	10.6
Locust Average		Stable	5.8d	92d	12.062d	81.4d	.112d	0.4d	1.854d	14.0d
Locust Average		All Conditions	6.5d	88d	11.022d	77.1d	.117d	0.4d	1.572d	12.3d

Table I, Continued

Summary of Emissions and Burning Conditions

Fuel Type	Run	Burning Conditions	Burning Rate (BR) Kg/hr	Stack Temp °C	Stack Gas Flow Rate Std. a m3/min	Pollutant Mass Rate gm/hr (PMR)	Concentration gm/std.m3	% CO2	Concentration gm/std.m3 @12%CO2	Pollutant Mass Rate / Burning Rate(PMR/BR) gm/Kg
Pine	19	Start Up	11.2	125	11.857	80.5	.113	0.2	6.792	7.2
Pine	20	Stable	14.0	109	10.986	91.4	.139	0.2	8.323	6.5
Pine	21c	Stable	10.0	104	10.539	----c	----c	---c	----c	---
Pine	22f	Start Up	11.1	136	8.484	151.5	0.298	1.0f	3.572	13.6
Pine	23	Stable	9.1	105	10.727	73.9	.115	0.5	2.755	8.1
Pine	24b	Stable	13.6	97	----	----	----	---	----	---
Pine Average		Start Up	11.2e	125e	11.857e	80.5e	.113e	0.2e	6.792e	7.2e
Pine Average		Stable	11.6e	107e	10.856e	82.6e	.127e	0.4e	5.539e	7.3e
Pine Average		All Conditions	11.4e	113e	11.190e	81.9e	.122e	.3e	5.957e	7.3e
Coal	12	Start Up	2.3	80	11.290	69.8	.103	0.2	6.186	30.3
Coal	13	Stable	2.7	74	11.597	38.8	.056	0.3	2.231	14.4
Coal Average		All Conditions	2.5	77	11.444	54.3	.080	0.2	4.208	22.4
All Types h	Aver.	All Conditions	7.4	95	10.778	76.1	.119	0.4	4.536	***11.7

a) Standard - 76 cm Mercury 21.1°C and dry
b) Particle sizing - see particle sizing results
c) Sampling for polycyclic organic materials (POM) - See Table II
d) Particle sizing runs not included in average
e) POM; particle sizing, smolder and glass front, (if run) are not included in average
f) Glass fireplace screen was used for this run - note higher % CO2
g) POM runs are not included in average
h) Coal, POM, particle sizing and glass front runs are not included in average

* Start Up - Initial ignition of fire or fuel addition, increasing combustion rate.
Stable - Constant combustion rate.
Smolder - Tail end of combustion, decreasing combustion rate.

** All values reported from results of modified EPA Method 5; front half, back half impinger catch, and back-up filter.

***Statistically determined mean from individual values or PMR/BR. Division of mean PMR by mean BR is not equal to the mean of the individual PMR/BR values due to statistical procedure for obtaining mean values

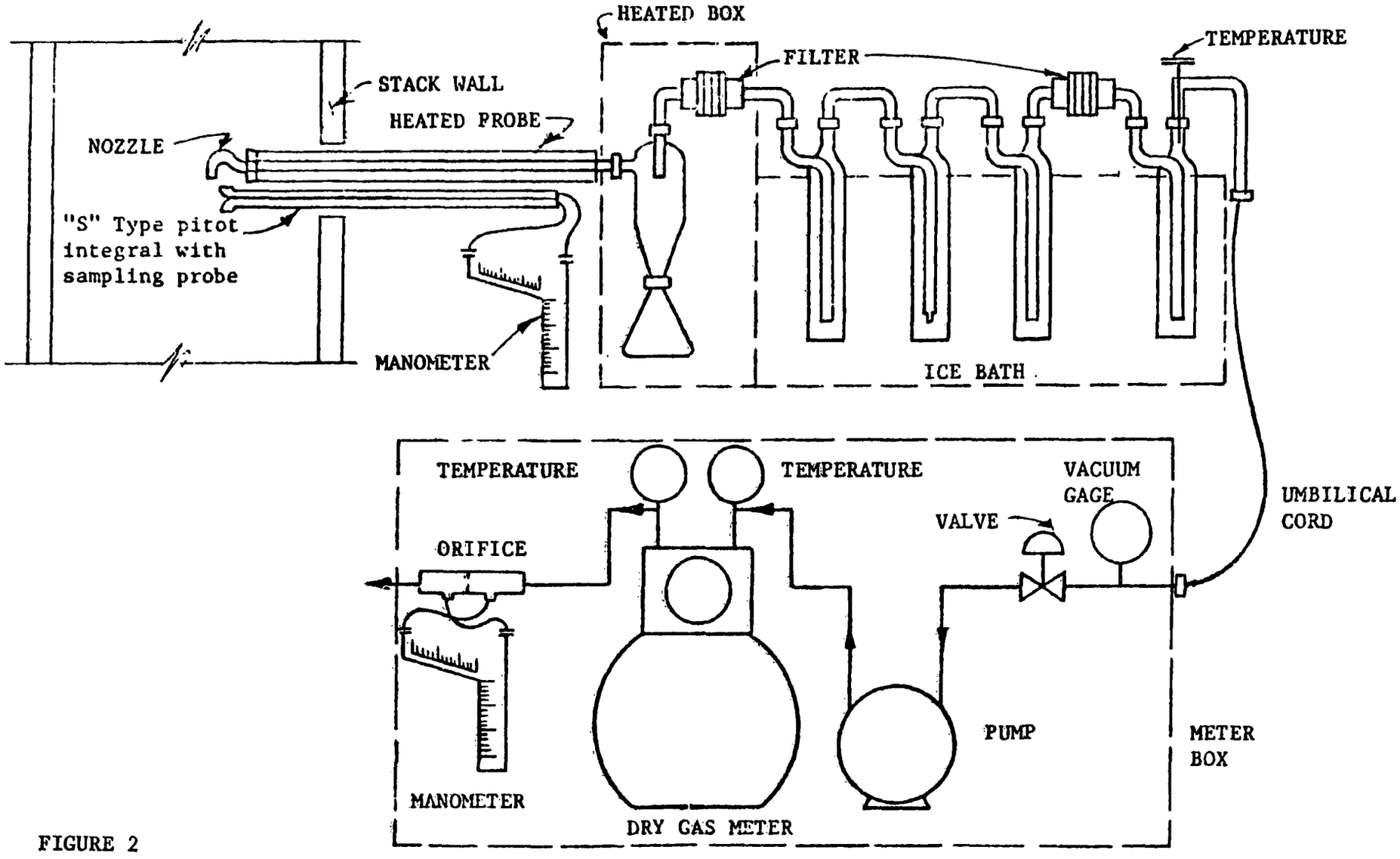


FIGURE 2

VALENTINE, FISHER & TOMLINSON STACK GAS SAMPLING TRAIN WITH BACK-UP FILTER

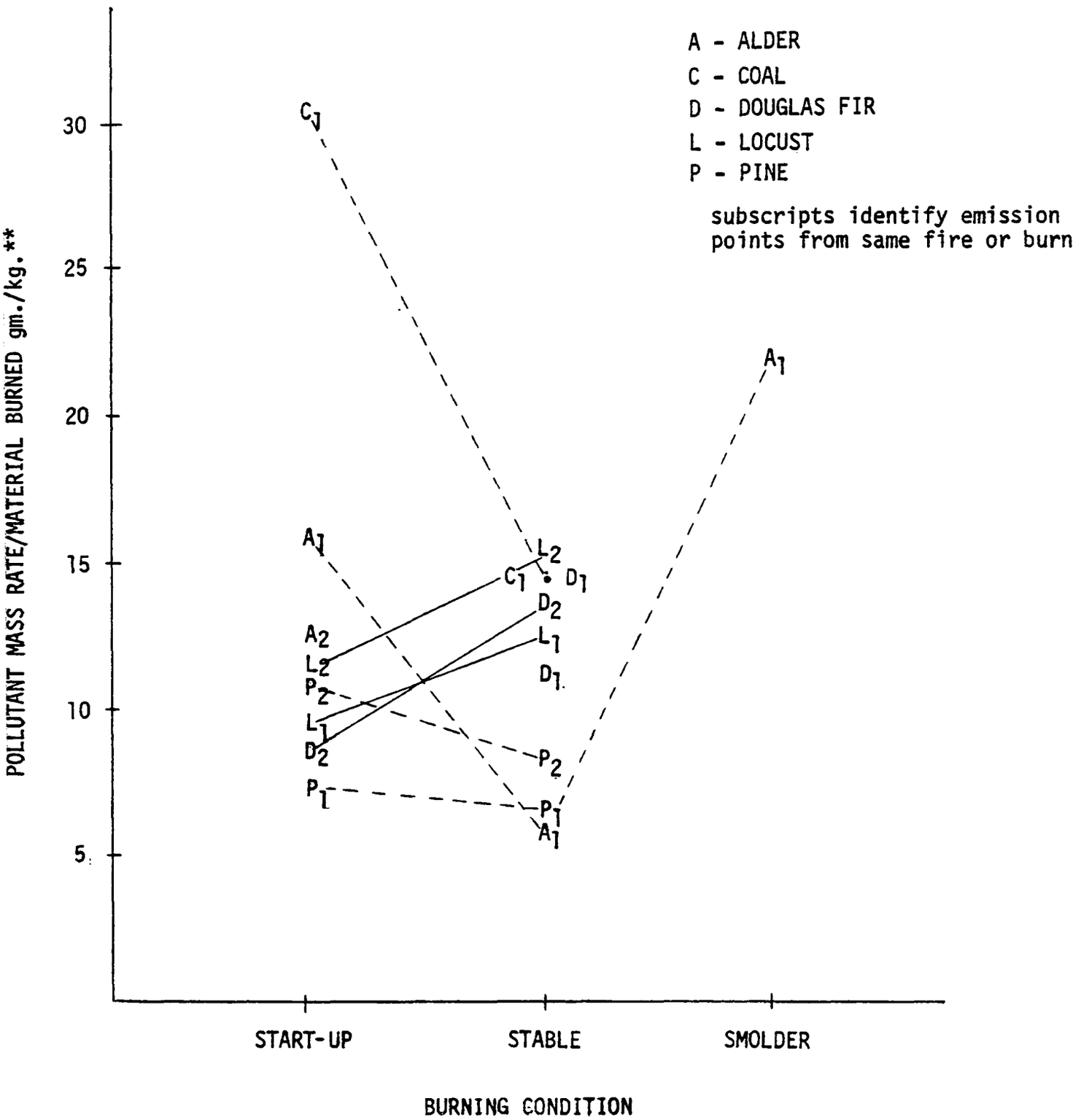


FIGURE 3

ATMOSPHERIC EMISSION VARIATION
WITH BURNING CONDITIONS

**Emissions were calculated using front half and back half particulate collected in the EPA Method 5 type sampling train.

are mainly grouped within a range of from 5.9 to 16 grams of particulate per kg wood burned. No general trend of emissions at the various burning conditions for all species can be observed from this plot. Emissions from pine wood and alder burning decrease from start up to stable burning while douglas fir and locust increase. Only one sample was obtained during smoldering as it was observed during testing that the stack gas opacity was so low and little fuel was being consumed. In retrospect, more samples should have been taken during this burning mode. These erratic results would indicate that emission trends cannot be projected simply from factors such as wood species and burning conditions. Other factors which might be included in the final emission factor development might be moisture content and density of the fuel and temperature of combustion. Also, nebulous factors such as fire stoking technique and fuel configuration (e.g., split or unsplit) could cause some variability.

The back half of the EPA Method 5 sampling train (impingers and back-up filter) caught more particulate than the front half (filter and probe). The back half particulate catch was an average of twice the front half catch, indicating that fireplace burning is a partial combustion process releasing a significant portion of vaporized hydrocarbons (See Appendix B). The back half particulate catch appeared as a golden coloration of the condenser water and as a similar color on the back-up filter.

During the field sampling phase of this project, we expected to use particulate collected in the front half (i.e. probe and filter) of POM sampling to project a total particulate catch. When analysis was completed, it became obvious that no general relation between front half and back half particulate developed as projected (see Appendix B). Consequently, POM samples are not used in the determination of average particulate parameters.

The flue gas was analyzed to quantitatively determine various components. These components are nitrogen (N_2), oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO). Gas analysis and determinations of N_2, O_2, CO, CO_2 and dry molecular weight of the stack gas were performed according to EPA Method 3, Federal Register, December 23, 1971, Sections 3.2, 3.3 and 4.3 (see Section IV for procedures).

In addition to in-the-field Orsat determinations of N_2, O_2, CO and CO_2, more accurate determinations were made in the laboratory using gas chromatography (GC) and infrared spectrophotometry (IR). Three runs, 6, 8 and 15, were selected for the analysis of these parameters. GC methods were used to quantitatively determine the N_2 and O_2 values for these runs. CO and CO_2 quantities were determined using IR. The values of these emission constituents can be found in Table III. Non-methane volatile hydrocarbons, (NMVH), were also quantified (see Table III), using infrared spectophotometry. Hexane was used as a standard and all results are read as Hexane. The average NMVH was found to be 4.8 ppm. (See Appendix C for GC graph and Appendix D for IR graph.)

A good indicator of the accuracy of Orsat analysis is to compare the quantites of CO_2 obtained by Infrared (IR) analysis, with those obtained by Orsat analysis. It can be seen in Table II that the difference in % CO_2 is significant.

TABLE II

COMPARISON OF CO_2 RESULTS

Run No.	% CO_2 Infrared (IR)	% CO_2 Orsat	Difference
6	0.63	0.5	0.13
8	0.79	0.4	0.39
15	0.65	0.4	0.25

The lower Orsat measured carbon dioxide concentrations at 0.4% indicates that combustion of wood in a fireplace is taking place with 4900% excess air (See Appendix F for % excess air calculation). Carbon dioxide was calculated at 1% theoretically which yields 1900% excess air. In either calculation, the high excess air quantities indicate that fireplace burning of wood is at best a partial combustion process.

One sample was taken with a glass front fitted on the fireplace to determine the effect of reduced air supply to the fireplace. Carbon dioxide was increased indicating more efficient combustion but atmospheric emissions were not significantly reduced.

Three POM samples were collected, one each, on alder, douglas fir and pine fires. POM concentrations in the stack gas averaged 6,946 ng per cubic meter (76 cmHg and 21.1°C dry). The complete results showing each constituent analyzed is shown in Appendix E. The procedure of POM sampling and analysis is discussed in Section IV. The total concentration of POM in runs 6, 11 and 21 are shown in Table III.

Three cascade impactor particle sizings were made, (one each), on alder, locust, and pine wood using a Brinks particle sizer built into the Method 5 type sampling train (see Figure 5 in Section IV). The mean particle sizes are 3.5 microns, 2.2 microns, and 3.4 microns respectively. The average particle size for the three runs (Nos. 5, 17 and 24) is 3.0 microns. The particle size samples were collected at 358, 385 and 269% of isokinetic conditions for runs 5, 17 and 24 respectively. These high % of isokinetic values are due to under sizing of the sampling nozzle. The stack gas velocity was 7.8 feet/sec. at the point of sampling. The nozzle was sized by previous sampling experience where approximately 25 feet/sec. is normally encountered. (Procedures of particle sizing runs are found in Section IV. Calculations and distribution graphs are found in Appendix G.)

Precautions were taken to maintain uniform burning conditions during sampling. Stack gas temperatures were revealed during sampling to provide a good indication of the state of combustion conditions. As stack gas temperatures dropped, more fuel was added which maintained the stack gas temperature within a relatively constant range. A "P" type pitot at a single reference point was utilized to attempt to monitor flue gas flow changes during sampling. The reference pitot also would have allowed corrections to be made in the flue gas

TABLE III

Summary of Emission Constituents

Fuel Type	Run	Burning Condition	Polycyclic Organic Materials a (ng)	Concentration Polycyclic Organic Materials ng/std. m3 b	Parameters Obtained by Gas Chormatography and Mass Spectophotometry % O2	% N2	PPM CO	PPM CO2	PPM NMVHc
Alder	6	Stable	166,000	5,746	20.2	79	280	6,300	4.5
Douglas Fir	8	Stable	---	---	20.0	79	405	7,900	4.7
Douglas Fir	11	Stable	220,000	7,444	---	--	---	---	---
Locust	15	Stable	---	---	20.2	79	440	6,500	5.3
Pine	21		162,000	7,647	---	--	---	---	---
All Average			183,000	6,946	20.1	79	375	6,900	4.8

a) See table V for quantification of specific materials
b) Standard - 76 cm. Mercury 21.1°C and dry
c) NMVH - Non Methane Volatile Hydrocarbons

flow recorded during traverse sampling if the flow fluctuations would have been significant. The procedures used in sampling and calculations involving the reference pitot are found in Section IV. Example calculations of a velocity correction coefficient (See Appendix H) indicate that three of the most variable samples required an average air flow adjusted increase of 2.2%. Therefore, the resulting correction in total air flow from the flue gases for all runs would be less than 2.2%. With this correction so slight, a correction was not made in reported flows.

A special expanded inclined manometer (24 inches long) was utilized to obtain precise stack pitot readings. The velocities of the stack gas averaged 2.15 meters per/sec. on 20 runs, with such low velocities the expanded manometer was most useful.

Wood burning rates, (tabulated in Appendix I), were determined from data collected during sampling runs. The wood burning rate for all types of wood in the particulate samples excluding one smolder run and the glass fireplace screen run was 7.4 kg per hour. Procedures for determining fuel consumption rates are found in Section IV.

The ultimate heating efficiency of the reference fireplace was determined in an energy balance found in Appendix F. The efficiency at 70°F outside temperatures was determined to be 30%. With lower outside temperatures, this efficiency will decrease.

The moisture content and density of the fuel consumed during this project are found in Table IV. The average moisture content of the wood fuel was 12.5%. The wood fuel density averaged 0.52 grams per cubic centimeter. The fuel analysis procedures are found in Section IV.

Two projects separate from this report were previously performed by Valentine, Fisher & Tomlinson. The atmospheric emission parameters of these projects are found in Appendix J.

TABLE IV

FUEL CHARACTERISTICS

Fuel Type	Percent Moisture	Dry Density grams/cc	Wet Density grams/cc
Alder	12.2	0.43	0.49
Fir	10.6	0.39	0.44
Locust	11.7	0.64	0.73
Pine	15.4	0.36	0.43
Coal	----	1.18	----

IV. PROCEDURES

PARTICULATE SAMPLING TRAIN

Stack gas sampling equipment designed by the United States Environmental Protection Agency, (EPA), Office of Air Quality Planning and Standards was used on this evaluation. A schematic of the sampling equipment is shown in Figure 2.

Sampling was performed according to the following:
The number of sampling points were determined by considering the number of duct diameters between obstructions in the duct upstream and downstream of the sampling ports. The rectangular chimney 8.75 in. x 19.25 in. had an area of 1.17 ft^2 and was equivalent in area to a round duct 1.22 ft. in diameter or by equation 1-1 of Method 1 Standards of Performance for New Stationary Sources, i.e. $\frac{2 \text{ (length) (width)}}{\text{(length + width)}}$ or the chimney was equivalent to a round duct 1.0 ft. in diameter. Thus the number of stack diameters downstream from the damper was 15, and the number of diameters upstream from the chimney top was 1.8. The minimum number of points required would be 10. The actual number of points selected was 20 to improve air flow measurement and sampling accuracy. A drawing of the fireplace port locations is shown on Figure 1. The five ports A, B, C, D and E are spaced 3.85 inches apart and ports A and E are 1.92 inches from the inside wall of the chimney.

Five ports with 4 sampling points each giving 20 points total were required in order to meet criteria from the Federal Register Method 1 Section 2.2.2. The ratio of the length to width of each elemental area was 1.76 meeting the 1 to 2 ratio requirements.

Stack pressure, temperature moisture content and maximum velocity head readings were measured. An EPA designed nomograph was set up using this data and the correct nozzle diameter was selected using the nomograph.

The sampling train was prepared as follows:
A filter (MSA 1106-BH) was labeled and desiccated for at least 24 hours to a constant weight and weighed to the nearest 0.5 mg. The filter was placed in a glass holder and was supported by a glass frit. The outlet side of the filter holder was connected to the condenser section. 100 miligrams of water was placed in the first bubbler and second impinger. The third bubbler was left dry. The fourth bubbler was filled with approximately 500 gram of silica gel. All four sections of the condenser were then weighed individually to the nearest 0.1 gram and recorded. A back-up filter (MSA 1106-BH) was desiccated for more than 24 hours to a constant weight and weighed to the nearest 0.5 mg. The back-up filter was placed between the third and fourth bubblers.

Just prior to sampling, a leak test was performed on the assembled sampling train. The leak rate did not exceed 0.02 cfm at a vaccum of approximately 24 inches Hg. The probe was heated so that the gas temperature at the probe outlet was approximately 250°F. The filter was heated to approximately 250°F to avoid condensation of moisture on the filter. Crushed ice was placed in the condenser section at the beginning of the test with new ice being added as required to keep the gases leaving the sampling train below 70°F.

The train was operated as follows:
The probe was inserted into the stack to the first traverse point with the nozzle tip pointing directly into the gas stream. The pump was started and immediately adjusted to sample at isokinetic velocities. Equal time was spent at selected points of equal elemental areas of the duct with the pertinent data being recorded from each time interval. The EPA nomograph was used to maintain isokinetic sampling throughout the sampling period. At the conclusion of the run the pump was turned off, the probe was removed, and the final readings were recorded.

Clean up of the sample train and analysis of the samples were performed according to the Clean-Up and Analysis procedure found on page 18.

POLYCYCLIC ORGANIC MATERIALS

The Polycyclic Organic Materials (POM) determined by the consulting laboratories of Batelle Columbus Laboratories, Columbus, Ohio, were sampled as follows:

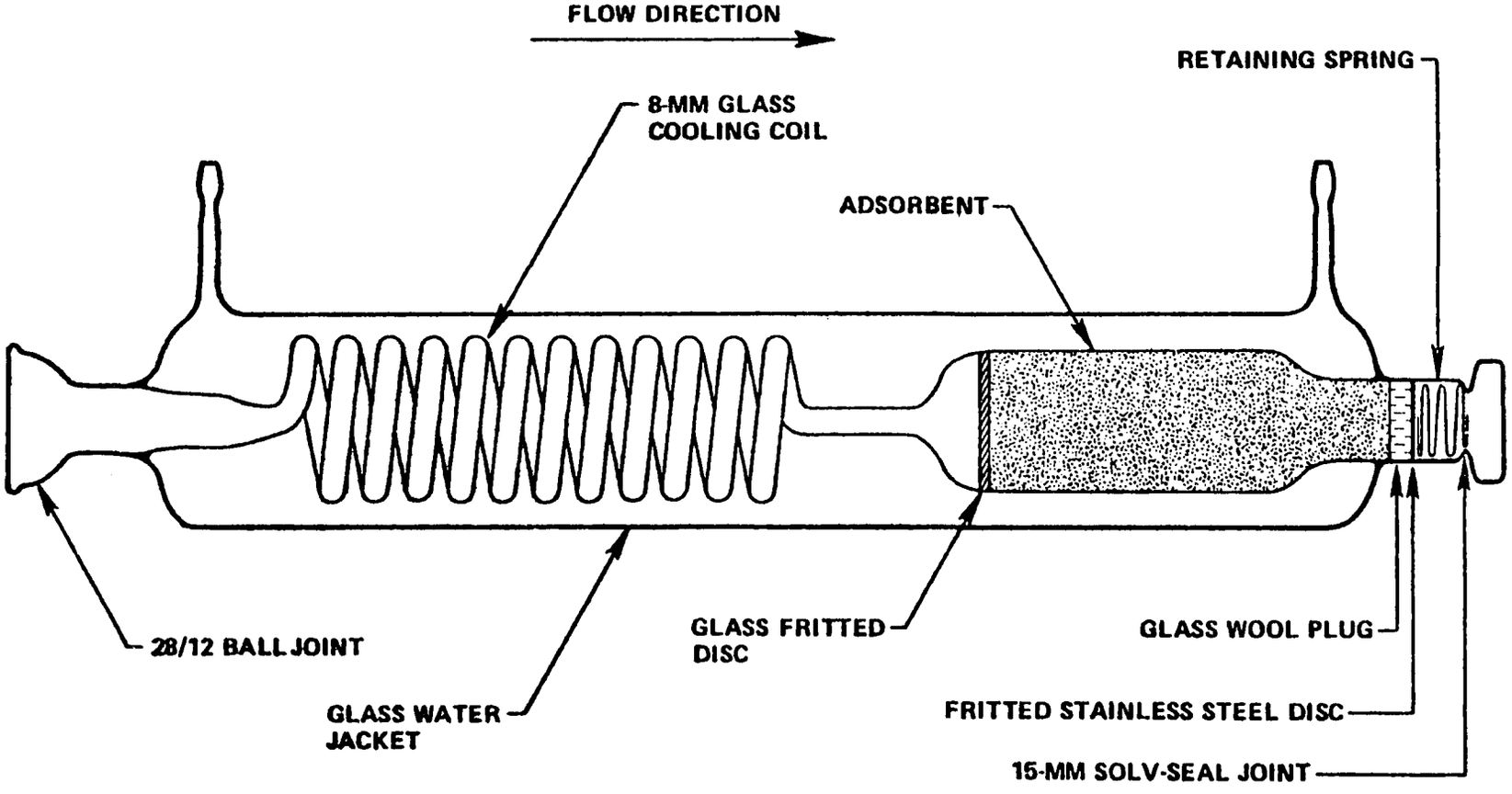
Sampling was conducted by Valentine, Fisher & Tomlinson's Environmental Services Team. Sample collection was made at isokinetic conditions at all preselected traverse points. The sampling system was a modified EPA Method 5 sampling train using a special POM adsorbent column of Tenax (see Figure 4). The column was located directly after the heated filter. Prior to passing through the adsorbent, the gas was cooled to 55°C in a thermostatically controlled circulating water bath. From here the gas entered the regular EPA condenser section.

Aluminum foil was wrapped around the Tenax column to prevent light exposure. After sampling, the Tenax column and cooling jacket were removed from the POM train and sealed with a Solv-Seal cap and a ball-joint stopper. This section was stored out of light prior to shipment to Batelle Laboratories for analysis. The tared acid treated glass filter was removed and desiccated until a constant weight was obtained. The filter was weighed to the nearest 0.1 mg. The impinger section was weighed and the amount of water collected was determined. The probe and prefilter connections were cleaned up with brushes and reagent grade acetone. The washings were transferred to a tared beaker and after evaporation and desiccation the net weight gain was determined. The filter and Tenax column section were shipped in padded containers to Batelle for analysis. Gas chromatographic separation was utilized to quantify the POM constituents.

More detailed sampling and analysis procedures can be found in "Efficient Collection of Polycyclic Organic Compounds From Combustion Effluents," by Peter W. Jones et. al, Paper No. 75-33.3, Batelle Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201, presented at Annual Meeting of Air Pollution Control Association in Boston, Mass., June 1975.

"P" TYPE REFERENCE PITOT

The "P" type reference pitot was positioned 9" below point C-3 during each particulate and POM sampling runs to correct for total air flow but sampling revealed the correction to be unnecessary. Reference pitot readings



ADSORBENT SAMPLING SYSTEM

From the Paper: Efficient Collection of Polycyclic Organic Compounds from Combustion Effluents, by Peter W. Jones et.al.

FIGURE 4

were made during each sampling point time interval. The method by which the velocity could have been corrected for a particular run is as follows:

The average square root of all reference pitot readings ratioed over the square root of each particular reference reading yielded the pitot correction coefficient for each point on the stack traverse. Each traverse pitot reading was corrected by calculating the product of the pitot correction coefficient times the traverse pitot reading. The ratio of the average of all corrected traverse pitot readings over the average of all traverse pitot readings yielded the stack velocity correction coefficient. The velocity calculated from the actual data can then be corrected by this coefficient. (See three examples in the Appendix).

INTEGRATED GRAB BAG GAS SAMPLING

An integrated sample of stack gas was taken for each run during the evaluation according to the following method. A probe was inserted into the stack. In line with the probe was a drying tube which contained glass wool and silica gel to remove particulate and moisture. This assembly was connected to a sampling pump inlet. All connections were checked for leaks and the sampling line was purged. An evacuated flexible aluminized scotchpak (polyvinyl chloride) bag was then connected to the pump outlet and an integrated sample was taken at a rate proportional to the stack flow rate.

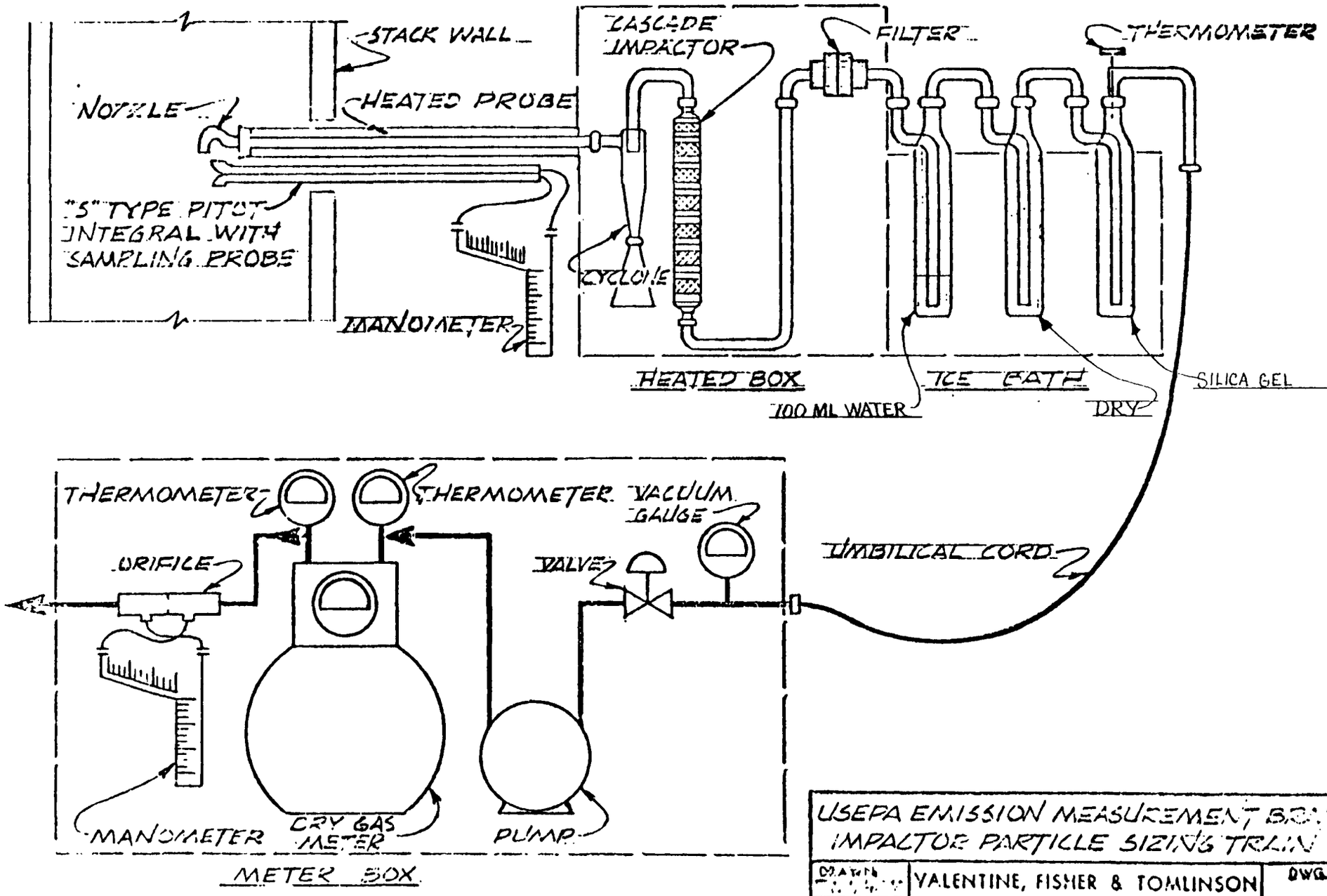
PARTICLE SIZING

Particle sizing was accomplished using a cascade impactor as set up in the sampling train shown in Figure 5.

The Brinks Cascade Impactor consisted of five stages, each of which contained a collection cup and a nozzle jet. Particles suspended in the sample gas passed through the jet and were impacted on the disk. The amount of particles collected on each disk was a function of the gas velocity through the jet, the particle characteristics, and the amount of sample drawn.

The sampling train is set up as in the drawing. The nozzle tip diameter was essentially the only means of providing for isokinetic sampling. A 0.125 in diameter nozzle was utilized in sampling. The sample flow rate was fixed by the pressure drop across the impactor (pressure drop is determined by the 3rd impactor stage, and its requirements for maximum collection). With the normally small flow rates, a 0.125 inch nozzle tip was necessary to prevent under isokinetic sampling (unrepresentative large particle capture).

The sample train was leak tested under 24 inch mercury vacuum. A leak test of 0.02 cubic feet per minute was obtained. The probe and the sample box were heated to 250°F. The sample probe was inserted in the process stream and gas flow through the impactor was started and held near constant until the end of the test. The vacuum was held constant at 5.0 inches of mercury. Sampling time was 20, 30 and 30 minutes on runs 5, 17 and 24 respectively.



USEPA EMISSION MEASUREMENT BRANCH
IMPACTOR PARTICLE SIZING TRAIN

DRAWN	VALENTINE, FISHER & TOMLINSON	DWG NO.
CHECKED	CONSULTING ENGINEERS	ES-1
DATE 5-11-73	520 LLOYD BLDG., SEATTLE	

FIGURE 5

After each test, the sample cups were removed from the impactor with tweezers. The quantity collected on each cup was determined by weighing to the nearest 0.1 mg after desiccation. Similarly, the quantity of material collected on the filter was determined. The nozzle, probe and pre-filter connections were rinsed with reagent grade acetone. The nozzle and probe washers were evaporated to dryness in a 150 ml tared beaker. The prefilter connections wash was also evaporated to dryness in a tared beaker. The weight of residue in both beakers were determined. A blank value for the acetone used was also determined.

CLEAN-UP AND ANALYSIS

Clean-up of the EPA train was performed by carefully removing the filter and placing it in a container marked Sample #___ 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 Sample #___ B. The impinger and bubblers were weighed in their respective containers to the nearest 0.1 gram. The original weights which included approximately 100 ml water in one bubbler and 100 ml water in the impinger were then subtracted and the differences added with the water weight gain of the silica gel. This 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 Sample #___ 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 Sample #___ D. The back-up filter was carefully removed and placed in a container marked Sample #___ E.

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

Sample #___ 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 containing "drierite." Weigh and redesiccate repeating until a constant weight is obtained and report the results to the nearest 0.1 milligram.

Sample #___ 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. redesiccate and weigh repeating until a constant weight is obtained. Report the result to the nearest 0.1 milligram.

Sample #___ 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 and redesiccate 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.

Sample #___ 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.

Sample #___ E - 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. Weigh to a constant weight and 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.

FUEL DENSITY AND MOISTURE CONTENT

Samples of each type of wood fuel were determined for moisture by weighing samples of each and drying these at 105°C. for several days. After cooling in a desiccator the samples were weighed. This process continued until constant weights were found. The % moisture was calculated by dividing the weight lost by the original weight times 100.

The densities of all fuels including coal were determined by weighing samples of each and then measuring the liquid displacement of each sample. Density was calculated by dividing the weight by the displaced volume.

WOOD WEIGHT AND FIRE STOKING

Prior to sampling, the fire was built with a weighed quantity of fuel. The wood was weighed with a spring balance. With this data the fire stoker would estimate the quantity of wood in the fire at the start of sampling and record the estimate on the data sheet. As wood was required for the fire, it was weighed and placed on the fire. The time and weights of the wood added were recorded on the data sheet. At the end of sampling the stoker would estimate the quantity of wood left in the fire and would record this data. Each day of sampling was begun with the fireplace swept out. A hearth of ribbed cast iron was used throughout the evaluation.

GAS ANALYSIS

On runs 6, 8 and 15, nitrogen and oxygen were analyzed utilizing thermal conductivity gas chromatography techniques. A 20-foot long 1/4-inch diameter 45/60 molecular sieve column at 100°C and an attenuation of 16 X was used for this determination. The carrier gas was Helium at 50cc/minute. A 0.25 milliliter sample was injected into the G.C. Three representative G.C. peaks per parameter for each run analyzed substantiated the reported values as measured against standard N_2 and O_2 peaks.

Carbon monoxide, carbon dioxide, and non-methane volatile hydrocarbon were analyzed by means of an infrared spectrophotometer with a 10 meter cell. Standard curves for CO, CO_2, hexane and methane were run. The value for methane was determined for each run analyzed, then subtracted from the total volatile hydrocarbon value measured as hexane, resulting in the reported quantity of total volatile non-methane hydrocarbons.

All runs except particle size runs and POM run #21, utilized the hand-operated Orsat for quantifying oxygen, carbon dioxide, carbon monoxide and nitrogen concentrations in the stack gas. The samples were collected as described in the preceding procedure in integrated grab bag. In analysis CO_2 was absorbed in the first column of the analyzer. The gas sample was passed through the column several times to insure complete collection. The volume of displaced gas was recorded. Oxygen and then carbon monoxide were measured similarily. In all cases of quantifying the gas constituents of the grab bag sample at least three separate samples were pumped into the Orsat for separate analysis. Nitrogen was quantified by subtracting the total percent of the measured gases from 100.

SECTION IV

APPENDIX

APPENDIX A

SELECTION OF THE REPRESENTATIVE FIREPLACE WITH STATISTICAL CALCULATIONS

The representative fireplace was selected from a sample distribution of 34 fireplaces. The 34 fireplaces were selected from employees, friends and relatives of Valentine, Fisher & Tomlinson, Inc. Wider and more statistically random selection of the fireplaces was limited due to U.S. Government, Office of Management and Budget solicitation form approval procedures and contract funding limitations. Valentine, Fisher & Tomlinson is confident that the fireplace selected is of a representative nature.

The fireplace dimension parameters included in the sample were those considered to have an effect on the quality of burning in a fireplace. The parameters included were: (a) area of the fire box opening, (b) cross sectional area of the chimney opening and (c) chimney height. These dimensional parameters are illustrated in Figure 6.

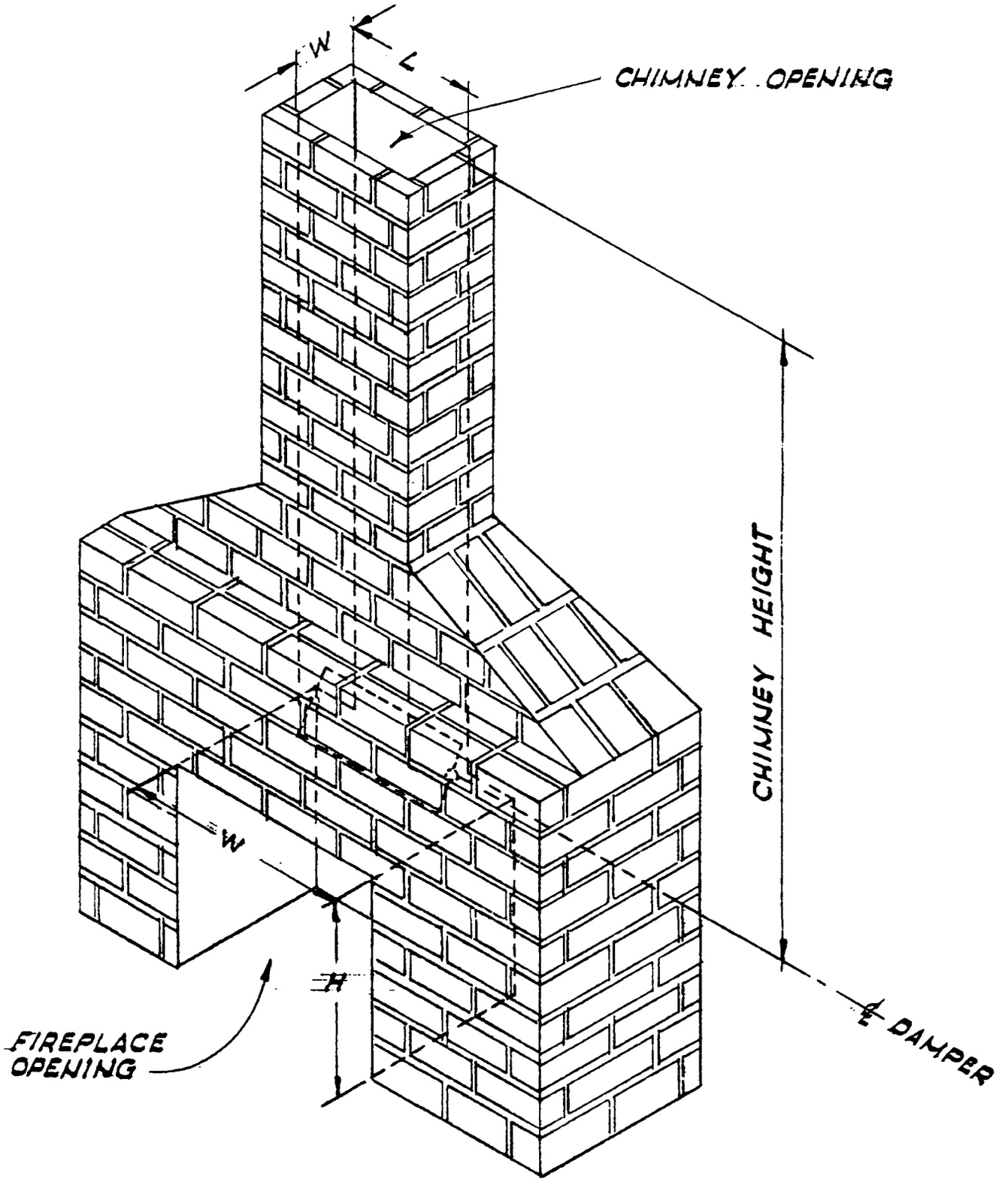
From the compilation of the 34 sets of parameters, a population mean was compute for each parameter. A standard deviation was then computed which was used to determine a 95 percent confidence interval for each mean dimension. No fireplac fit within a 99 percent confidence interval.

Fireplaces were picked which had dimensions which were within the 95 percent confidence intervals. Three fireplaces were examined more closely and a final selection was made based on accuracy of dimension, accessibility for sampling and consent of the owner. The fireplace selected has an opening of 6187 sq. cm, a chimney cross sectional area of 1087 sq. cm^2 and a chimney height of 4.66 m. Note that the chimney height was selected so that a 0.46 m extension could be added and still remain within the 95 percent confidence interval of chimney height.

Table V

Representative Fireplace Mean Dimensions and 95% Confidence Interval

Parameter	Mean Dimension	Confidence Interval
Fireplace Opening	6336 cm^2	5865 to 6807 cm
Chimney Opening	961 cm^2	832 to 1,090 cm
Chimney Height	4.4 meters	3.87 to 4.97 meters



FIREPLACE DIMENSIONS

NO SCALE

FIGURE 6

E.P.A. FIREPLACE REPORT	
EMISSION TESTS	
DRAWN: W.B.	Prepared by: VALENTINE, FISHER & TOMLINSON Consulting Engineers 520 LLOYD BUILDING SEATTLE, WASHINGTON
CHECKED: G.A.S.	
DATE: SEPT. 19, 75	

APPENDIX B

Tabulation of Front Half to Back Half Ratios

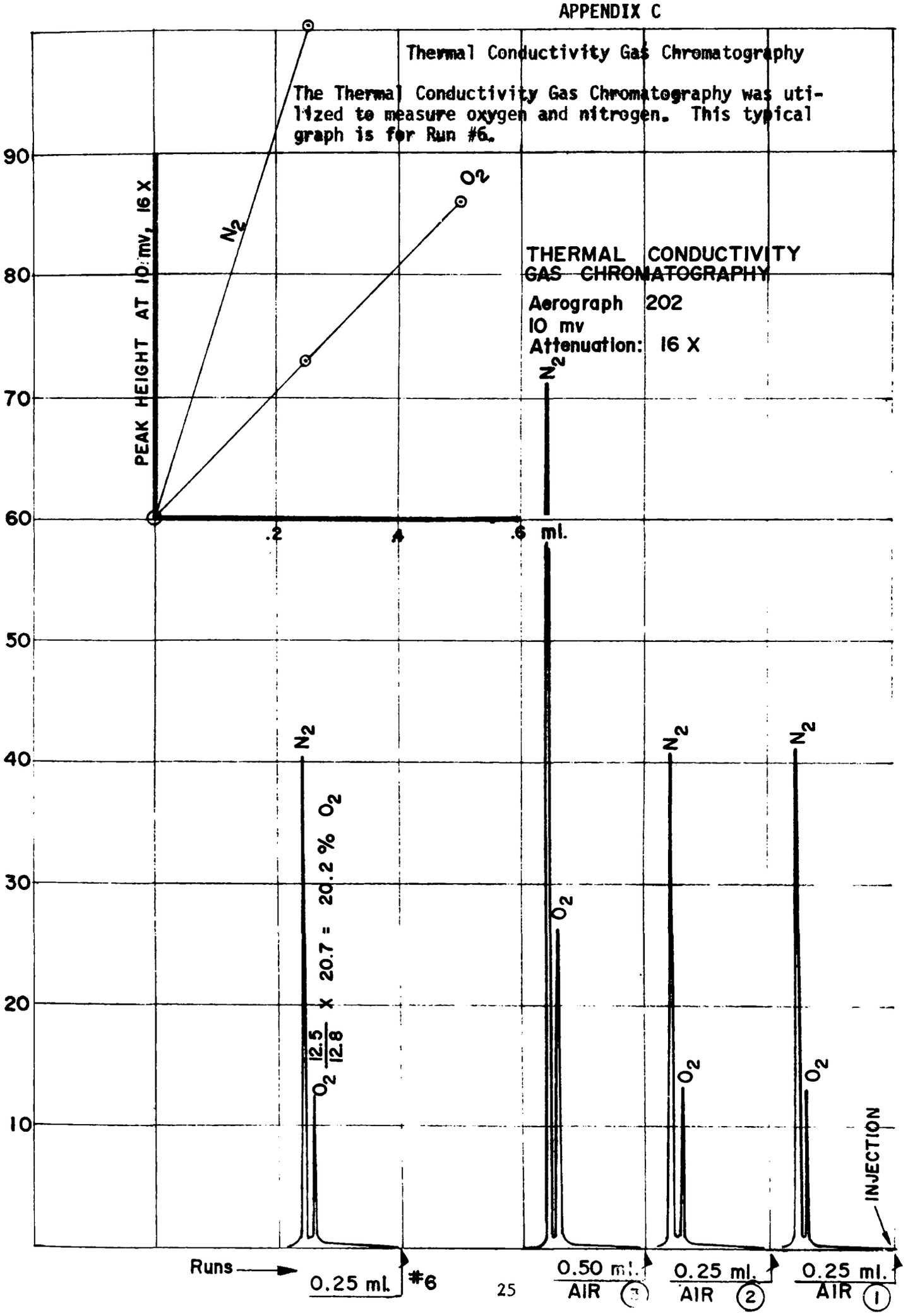
This tabulation of the front half to the back half ratios in 18 runs show the significance of the back half particulate. Also, the back-up filter shows to be important in this type of sampling.

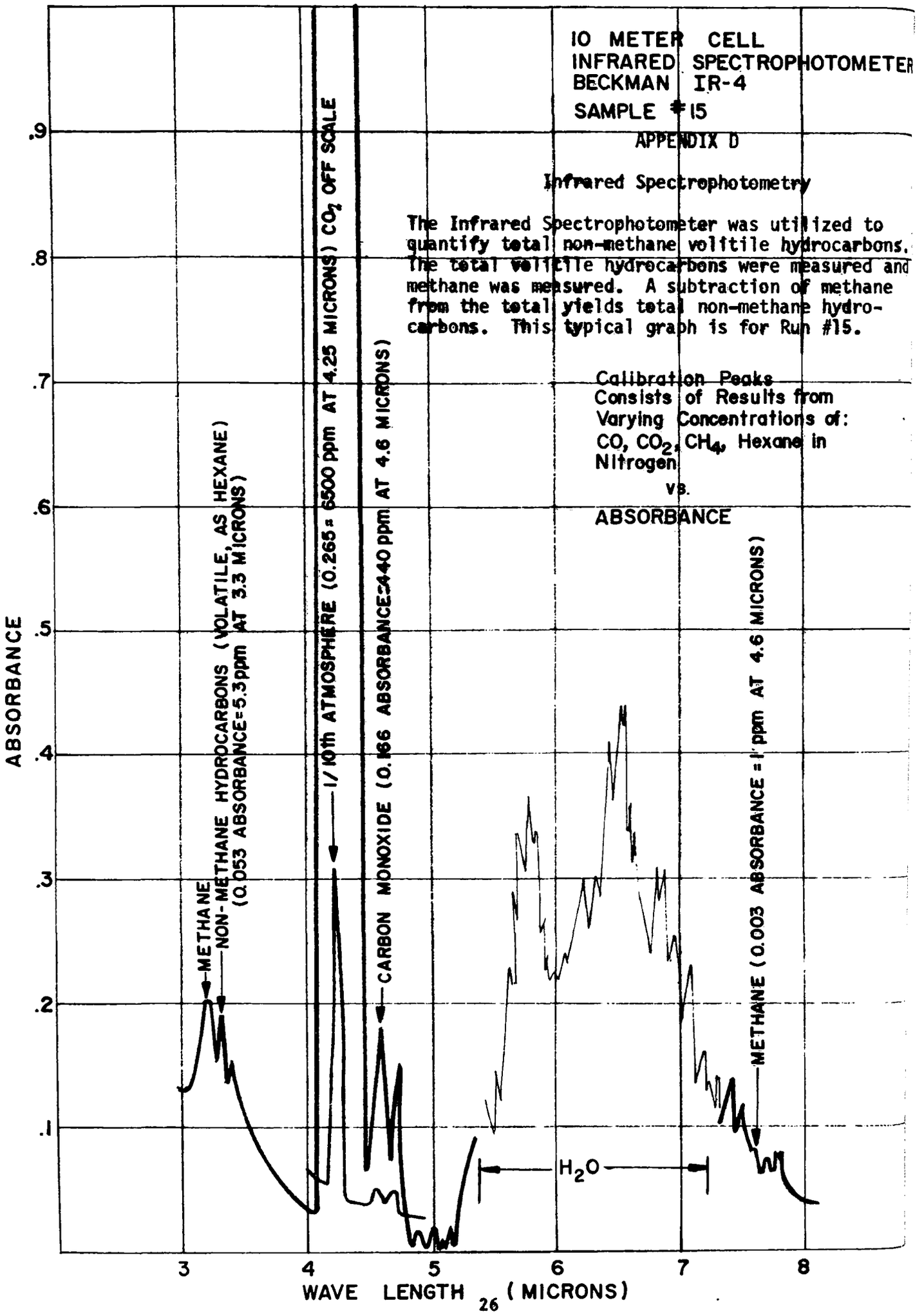
Run #	Ratio: $\frac{BH\ particulate}{FH\ particulate}$	Ratio: $\frac{BU\ Filter\ particulate}{F\ Filter\ particulate}$
1	2.07	0.463
2	1.93	0.542
3	0.688	0.289
4	9.36	1.020
5	—	—
6	—	—
7	2.18	0.540
8	3.35	1.32
9	2.99	1.37
10	3.93	1.79
11	—	—
12	0.509	.064
13	1.05	0.143
14	2.08	0.525
15	2.90	0.761
16	—	—
17	—	—
18	1.94	0.200
19	0.537	.028
20	1.82	1.07
21	—	—
22	0.528	.027
23	1.10	0.239
ave.	1.968	0.612

APPENDIX C

Thermal Conductivity Gas Chromatography

The Thermal Conductivity Gas Chromatography was utilized to measure oxygen and nitrogen. This typical graph is for Run #6.





APPENDIX D

Infrared Spectrophotometry

The Infrared Spectrophotometer was utilized to quantify total non-methane volitile hydrocarbons. The total volitile hydrocarbons were measured and methane was measured. A subtraction of methane from the total yields total non-methane hydrocarbons. This typical graph is for Run #15.

Calibration Peaks
Consists of Results from
Varying Concentrations of:
CO, CO_2, CH_4, Hexane in
Nitrogen

vs.

ABSORBANCE

Table V

APPENDIX E

Fireplace Atmospheric Emissions

POM Quantification

POM QUANTIFICATION (ng)

POM quantification is reported in nanograms. The samples were collected by the methods described in the Procedure section, Page 13.

Component	NAS Notation	SAMPLE Alder 69-5	D. Fir 76-5	Pine 8605
Anthracene/Phenanthrene		52,450	59,600	52,100
Methyl anthracenes		21,300	32,900	---
Fluoranthene		16,100	27,200	21,400
Pyrene		18,900	24,700	21,750
Methyl Pyrene/Fluoranthene		17,800	13,400	450
Benzo(c)phenanthrene	***	4,300	3,800	2,450
Chrysene/Benz(a)anthracene	*	11,900	17,800	7,950
Methyl chrysenes	*	5,300	9,200	28,300
Benzo fluoranthenes	**	5,400	7,300	3,000
Benz(a)pyrene	***	5,200	8,900	12,400
Benz(e)pyrene				
Perylene		---	---	---
-Mehtylcholanthrenes	****	3,300	9,600	5,650
Indene(1,2,3-cd)pyrene	*	1,300	2,600	3,050
Benzo(ghi)perylene		2,800	3,200	3,000
Dibenxo(a,h)anthracene	***	---	---	---
Diebenzo(c,g)carbazole	***	---	---	---
Dibenz(ai and ah)pyrenes	***	---	---	---
Coronene		---	---	---
TOTAL		166,000	220,000	162,000

APPENDIX F

ENERGY BALANCE, % EXCESS AIR

In order to evaluate the combustion characteristics and heating efficiency of the fireplace during testing, calculations were done to determine air requirements for burning, % CO_2, theoretical heat available, and heat losses from the fireplace. These calculations are contained in this section.

Combustion calculations were based mainly on stoichiometric equations of combusti and the ultimate analysis of wood. The heat available for combustion was also calculated with data from ultimate analysis.

Heat losses from the fireplace were divided into four components. These components include: heat lost in exhaust gases, heat lost due to air infiltration, heat lost from the fire box, and heat lost from the chimney. Each of these components were then calculated using approximate thermodynamic and heat transfer equations and techniques.

① Ultimate analysis of wood

Ref. - Air Pollution Handbook (p-1-16)
Magill, P.C., McGraw Hill 1956

Dry basis	
C =	52 %
H =	6 %
S =	< 0.1 %
N =	0.1 %
O =	40 %
ash =	2 %
Btu/lb. =	8700

@ 15% H_2O	
C =	44 %
H =	5.1 %
S =	0
N =	0
O =	34 %
ash =	1.7 %
H_2O =	15 %
Btu/lb. =	7400

② Theoretical air needed for combustion of 1 lb. of wood with 15% moisture:

Basic Equation for combustion

$$C + \tfrac{3}{2} O_2 + 2H \longrightarrow CO_2 + H_2O$$

To determine air required for combustion seperate reation and calculate air required

a) $C + O_2 \longrightarrow CO_2$

$$\frac{0.44\ lb\ C}{lb.\ wood} \times \frac{32\ lb.\ O_2}{12\ lb.\ C} \times \frac{56.4\ SCF\ air}{1\ lb.\ O_2} \approx 66.2\ \frac{SCF\ air}{lb\ wood}$$

b) $2H + \frac{1}{2} O_2 \longrightarrow H_2O$

$$\frac{0.051\ lb.H}{lb.\ wood} \times \frac{16\ lb.O_2}{2\ lb.H} \times \frac{56.4\ SCF\ air}{lb.\ O_2} \approx 23.0\ \frac{SCF\ air}{lb.\ wood}$$

c) O_2 available from fuel:

$$\frac{0.34\ lb\ O}{lb.\ wood} \times \frac{32\ lb.O_2}{32\ lb.O} \times \frac{56.4\ SCF\ air}{lb.\ O_2} \approx -\frac{19.2\ SCF\ air}{lb.\ wood}$$

d) Total Air Needed @ 0% Excess Air

$$Q_{air} = 66.2 + 23 - 19.2 = 70\ \frac{SCF\ air}{lb.\ wood}$$

③ Products of combustion from 1 lb. wood wet

a) CO_2 : $C + O_2 \longrightarrow CO_2$

$$\frac{44\ lb.CO_2}{12\ lb.C} \times \frac{0.44\ lb\ C}{lb.\ wood} \times \frac{1\ lb\ mole\ CO_2}{44\ lb.CO_2} \times \frac{379\ SCF\ CO_2}{lb\text{-}mole\ CO_2} = \frac{14\ SCF}{lb.\ wo}$$

b) H_2O : $2H + \frac{1}{2} O_2 \longrightarrow H_2O$

$$\frac{18\ lb.H_2O}{2\ lb.H} \times \frac{0.05\ lb\ H}{lb.\ wood} \times \frac{1\ lb\text{-}mole\ H_2O}{18\ lb.H_2O} \times \frac{379\ SCF\ H_2O}{lb\text{-}mole\ H_2O} = \frac{9.7\ SCF}{lb.\ wo}$$

c) H_2O (from fuel)

$$\frac{0.15\ lb\ H_2O}{lb.\ wood} \times \frac{1\ lb\text{-}mole\ H_2O}{18\ lb\ H_2O} \times \frac{379\ SCF\ H_2O}{lb\text{-}mole\ H_2O} = \frac{3.2\ SCF\ H_2O}{lb.\ wood}$$

d) N_2 carried through combustion

$$70\ \frac{SCF\ air}{lb\text{-}wood} \times \frac{79\ SCF\ N_2}{100\ SCF\ air} = \frac{55.3\ SCF\ N_2}{lb.\ wood}$$

@ 0% excess air

e) Total combustion products @ 0% excess air

$$Q_{comb.} = 14 + 9.7 + 3.2 + 55 \approx 81.9 \ \frac{SCF\ products\ (wet)}{lb.\ wood}$$

$$Q_{comb\text{-}dry} = 14 + 55 = \frac{69\ SCF\ CO_2}{lb.\ wood}\ (dry)$$

f) % CO_2 at 0% E.A. and dry

$$\%\ CO_2 = \frac{14\ SCF\ CO_2}{69\ SCF\ products} \approx 20\ \%\ CO_2$$

④ Excess air during combustion

average CO_2: 0.4% (orsat), 0.7% (by I.R.)

average wood consumption: $7.4\ \frac{kg}{hr} \approx 16.3\ \frac{lb}{hr.}$

average stack gas flow rate: $10.8\ \frac{scm}{min} = 382\ \frac{SCF}{min}$

a) % CO_2 (calculated):

$$\%\ CO_2 = \frac{14\ SCF\ CO_2}{lb.\ wood} \times \frac{16.3\ lb\ wood}{hr.} \times \frac{1\ hr}{60\ min.} \times \frac{1\ min}{382\ SCF_{a.r}} \times 100$$

$$\%\ CO_2 \approx 1.0\ \%$$

Note: best agreement between calculated CO_2 and that measured with I.R.

b) % Excess air:

$$Ea = \frac{382\ SCF/min. - 16.3\ lb\ wood/hr. \times 69\ SCF/lb.\ wood \times 1\ hr/60\ m}{\frac{16.3 \times 69}{60}}$$

$$= 19.43 \times 100 = 1,943\%\ E.A.$$

Note: $\left(\frac{20\%\ CO_2 - 1\%\ CO_2}{1\%\ CO_2}\right) \times 100 = 1,900\%\ E.A.$

(5) Energy balance

a) Heat released by wood:

$$\frac{7400\ Btu}{lb.} \times \frac{16.3\ lb}{hr.} \approx 120,620\ \frac{Btu}{hr.}$$

b) Heat lost in exhaust

$$382\ SCF/min. \times 0.24\ Btu/lb.°F \times (203°F - 70°F)(.075\ lb/SCF) \times 60\ min/hr. \approx 54,870\ Btu/hr.$$

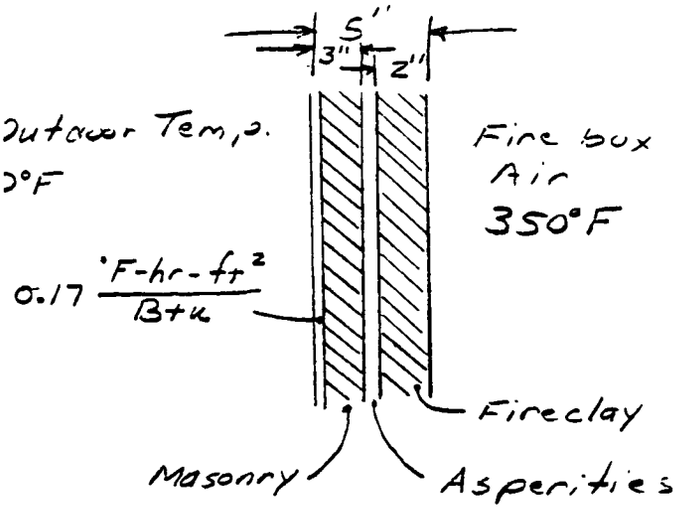
c) Heat lost to infiltrating air:

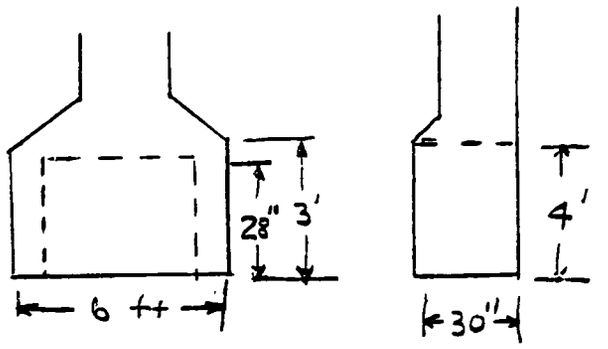
Assume infiltration rate ≈ 382 SCF/min.

If outside temp. ≈ inside temp (as was the case during testing)

heat lost in warming incoming air = $\frac{0\ Btu}{hr.}$

(D) Heat lost through fire box





Total area of fire box

$A_{total} = (4' \times 6') + 2(4' \times 2.5') = 44 ft^2$

Thermal Conductivities

Perry's Chemical Engineering Handbook page 3-211 and Kreith's Principles of Heat Transfer page 595

Material	K Btu-ft/Hr-ft²-°F	R' °F-hr-ft²/Btu
Masonry	0.4	
Fireclay	0.6	
Air @ 200°F	0.02	
Air @ w/ wind		0.17

Assume wall temperature of fire box is 400°F

Calculation of thermal resistances

$R'_{fireclay}$: 0.17 ft. thick = L

$$R'_{fc} = \frac{L}{K} = \frac{0.17}{0.6} = .0278 \quad \frac{°F-hr-ft^2}{Btu}$$

$R'_{Asperities\ in\ brick}$: Asperities in brick = 1/32 in.
Solid to Solid contact 30% of area

$$R'_{As} = \frac{(R_{as})(R_{air})}{R_{as} + R_{air}}$$

$$R_{as} = \frac{L}{0.3K} = \frac{.0026}{(0.3)(0.6)} = 0.014 \quad \frac{°F-hr-ft^2}{Btu}$$

$$R_{air} = \frac{L}{0.7K_i} = \frac{.0026}{(0.7)(.02)} = 0.186 \quad \frac{°F-hr-ft^2}{Btu}$$

$$R'_{As} = \frac{(0.014)(0.186)}{0.014 + 0.186} = 0.013 \quad \frac{°F-hr-ft^2}{Btu}$$

R'_{Brick} : 0.25 ft. = L

$$R'_b = \frac{L}{K} = \frac{0.25}{0.4} = 0.625 \quad \frac{°F-hr-ft^2}{Btu}$$

$R'_{Outside\ air}$: From ASHRAE GUIDE

$$R'_{Air} = 0.25 \quad \frac{°F-hr-ft^2}{Btu}$$

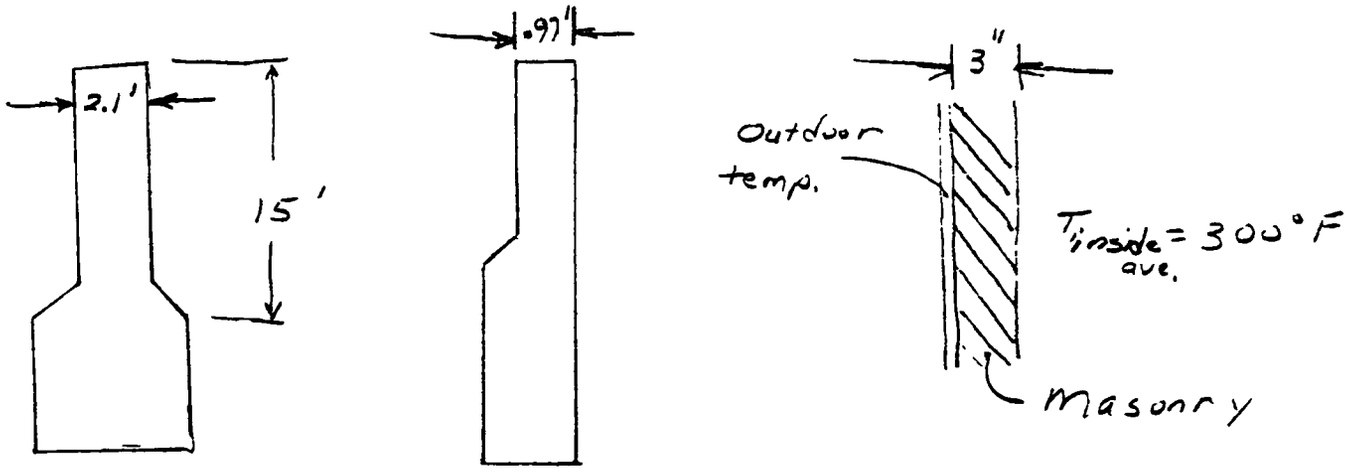
$$R'_{TOTAL} = \Sigma R' = 0.9158 \quad \frac{°F-hr-ft^2}{Btu}$$

Heat loss through fire box, Q_{Fb} :

Use 44 ft^2 Area

$$Q_{Fb} = \frac{\Delta T}{R'_T} A = \frac{(350-70)}{(0.9158)}(44) \approx 13,453 \quad \frac{Btu}{hr.}$$

(E) Heat lost through chimney:



Total Chimney Area: Neglect wall facing house since heat is transfered to house and is therefore not lost

$$A_T = (15')(2.1') + 2(.97')(15')$$

$$= 60.6\ ft^2$$

Assume average wall temp. = 300°F

$$R'_{outside} = 0.25\ °F\text{-}hr\text{-}ft^2/Btu$$

$$K_{brick} = 0.4\ Btu\text{-}ft/hr.\ ft^2\ °F$$

$$R'_{brick} = \frac{L}{K} = \frac{0.25}{0.4} = 0.625\ °F\text{-}hr\text{-}ft^2/Btu$$

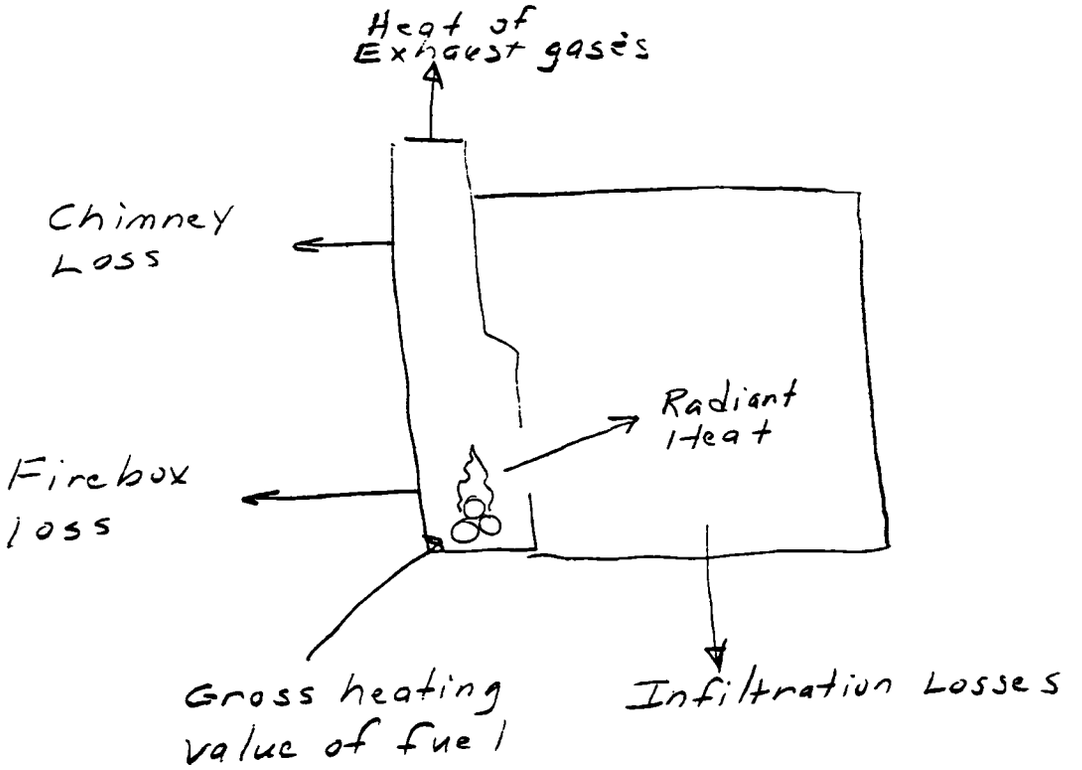
$$R_{total} = \Sigma R = 0.875\ °F\text{-}hr\text{-}ft^2/Btu$$

Heat loss through chimney, Q_{Ch}

Use $60.6\ ft^2$ area

$$Q_{Ch} = \frac{\Delta T A}{R_T} = \frac{(300-70)(60.6)}{0.875} \approx 15,929\ Btu/hr.$$

(F) Efficiency of fire place



$$\%\,Eff. = \frac{\text{Radiant heat}}{\text{Total heat available}} = \frac{\text{Total} - \text{heat losses}}{\text{Total}}$$

$$\text{Heat losses} = 59{,}870 + 0 + 13{,}453 + 15{,}929 = 84{,}252$$

$$\%\,Eff. = \frac{120{,}620\ \text{Btu/hr.} - 84{,}252\ \text{Btu/hr.}}{120{,}620\ \text{Btu/hr.}}$$

$$\approx 0.30 \text{ or } 30\%\ \text{efficiency}$$

G) Note: at lower outside temperatures with higher winds the efficiency is lowered

- Infiltration heat losses are increased
- Firebox losses are increased

Chimney losses increase but this increase is offset by decreased heat losses in exhaust gases.

APPENDIX G

Particle Sizing

Particle sizing was performed by a Brinks Cascade Impactor. The samples were collected and determined by the methods found in the Procedure section, Page 15. This appendix contains Particle Sizing Calculations, Secondary Data and Size Distribution Graphs. Field Data and Moisture Determination is found in Appendix L.

CASCADE IMPACTOR CALCULATIONS

V_o = $(8465.41)(VOL_m)\ (P_m) / (T_m)\ (TIME) + (22.6417)(VOL_w) / (TIME)$

a = $(234.0)\ (\mu^2) / (\rho)\ (P_2)$

b = $(2.05 \times 10^8)\ (\mu)\ (P_2) / (\rho_p)\ (V_o)\ (P_o)$

D_{pc} = $\sqrt{a + bD_c^3} - \sqrt{a}$

V_o = Gas flow at inlet to impactor at 25° C. and 14.7 psia, cc per second.

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

P_m = Dry gas meter pressure, "Hg

T_m = Dry gas meter temperature, °R

TIME = Sampling time, minutes

VOL_w = Volume of water collected, ml

μ = Viscosity of gas in impactor, gm / (cm) (sec)

ρ = Density of gas in impactor, gm per cc

P_2 = Average pressure in impactor, atm.

ρ_p = Density of aerosal particle, gm per cc

P_o = Pressure at inlet to impactor, atm.

D_{pc} = Characteristic diameter of aerosol particle for impactor stage, microns

D_c = Diameter of impactor jet, cm.

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JOB NAME EPA. FIREPLACE DATE AUG. 21, 1975

PREPARED BY SWANSON APPROVED PAGE 1 OF 1

SUBJECT Particle Sizing Run's 5, 17 and 24 67-5, 82-5, 89-5

	RUN NO. 5	RUN NO. 17	RUN NO. 24
VOL_m	2·28	2·797	2·416
P_m	29·813	29·72	29·79
T_m	533	539	548
TIME	20	30	30
VOL_w	0·6	26·1	1·6
V_o	54·659056	63·217313	38·268256
ρ_p	0·6087	0·6087	0·6087
P_o	0·9963	0·9933	0·9956
μ	0·000275	0·000275	0·00021
ρ	0·0008587	0·000861	0·0008471
P_2	0·9146	0·9131	0·9142
a	0·021645	0·021623	0·012911
b	1555·472020	1346·744274	1697·022253
D_c	0·249	0·249	0·249
D_{pc}	4·755430	4·415042	5·006094
D_c	0·1775	0·1775	0·1775
D_{pc}	2·805816	2·601155	2·969012
D_c	0·1396	0·1396	0·1396
D_{pc}	1·915043	1·772527	2·037841
D_c	0·0946	0·0946	0·0946
D_{pc}	1·009413	0·930435	1·089948
D_c	0·0731	0·0731	0·0731
D_{pc}	0·645518	0·592448	0·707805

CASCADE IMPACTOR DATA

Client E.P.A. FIREPLACE

Sampling Location AVERAGE FIREPLACE

Date July 30, 1975

Run Number 5 67-5

Comments

PARTICULATE

	FINAL (gm)		TARE (gm)		NET PARTICULATE (gm)	
Cyclone	78.4436	-	78.4406	=	.0024	-.0006 BLANK
Stage #1	3.2883	-	3.2878	=	.0005	
Stage #2	3.4524	-	3.4220	=	.0004	
Stage #3	3.5337	-	3.5334	=	.0003	
Stage #4	3.3191	-	3.3190	=	.0001	
Stage #5	3.5137	-	3.5129	=	.0004	
Filter (#16-5)	182.1	-	181.1	=	.0011	
Filter holder front	79.4720	-	79.4709	=	.0008	-.0003 BLANK
TOTALS		-		=	.0060	

MOISTURE

	FINAL (gm)		TARE (gm)		NET WATER (ml = gm)
Bubbler (#1)		-		=	
Impinger (#2)		-		=	
Bubbler (#3)		-		=	
Bubbler (#4)		-		=	
TOTALS		-		=	

CASCADE IMPACTOR RESULTS

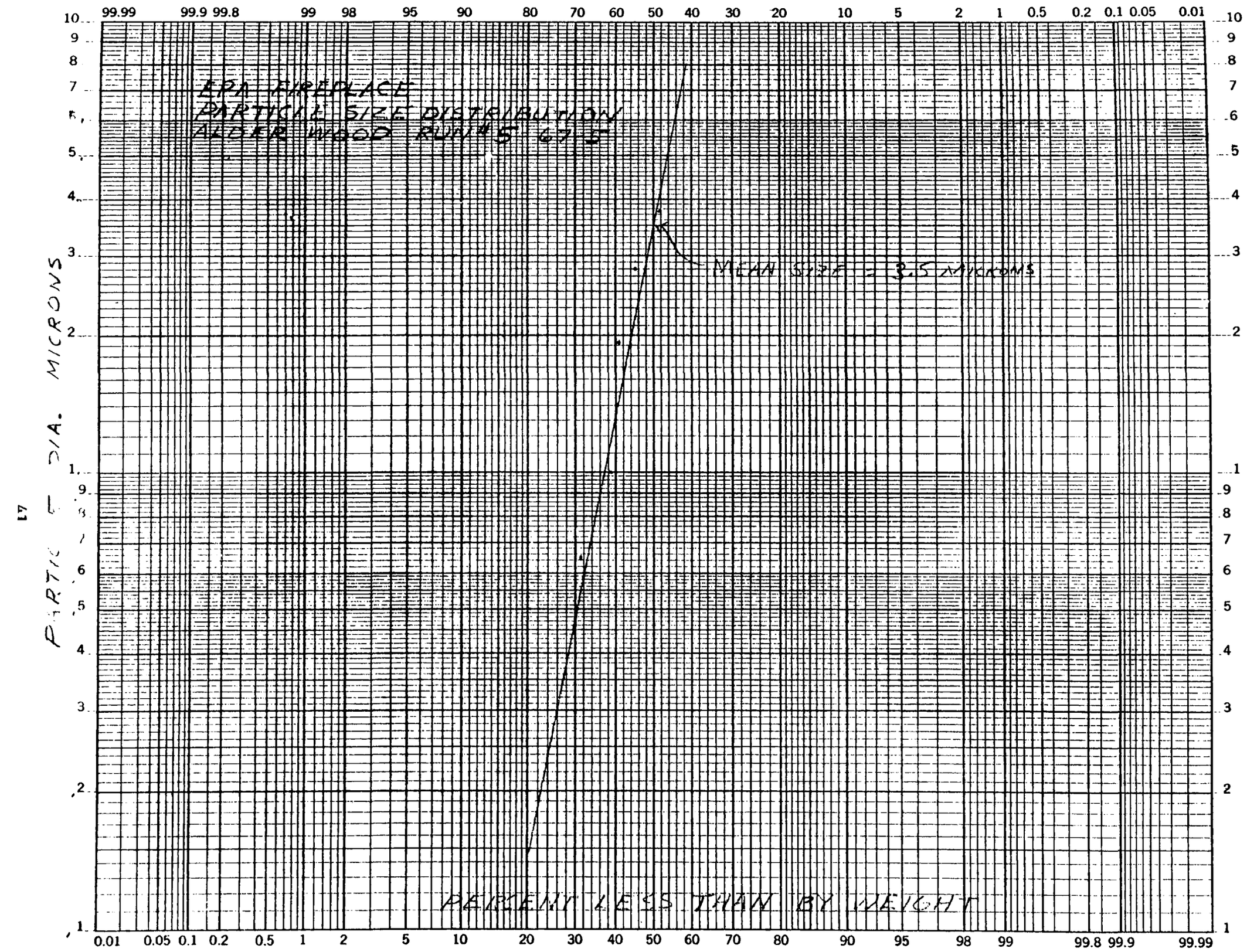
Client: EPA FIREPLACE

Sampling Location: AVERAGE FIREPLACE

Date: July 30, 1975

Run No: 5

ITEM	Dp (=Dpc), microns	Particulate collected, mg	Weight % collected	Cumulative % less than Dp
Cyclone		2.4	40.0	
Stage #1	4.755	0.5	8.3	51.8
Stage #2	2.806	0.4	6.7	45.1
Stage #3	1.915	0.3	5.0	40.1
Stage #4	1.009	0.1	1.7	38.4
Stage #5	0.646	0.4	6.7	31.7
Filter		1.9	31.7	


EPA FIREPLACE
PARTICLE SIZE DISTRIBUTION
ALDER WOOD RUN #5 6-7-5
MEAN SIZE = 3.5 MICRONS
PERCENT LESS THAN BY WEIGHT
PARTICLE DIA. MICRONS
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

CASCADE IMPACTOR DATA

Client E.P.A. FIREPLACE

Sampling Location AVERAGE FIREPLACE

Date 8/13/75

Run Number 17 82-5

Comments

PARTICULATE

	FINAL (gm)		TARE (gm)		NET PARTICULATE (gm)	
Cyclone	76.7264	-	76.7242	=	.0016	-.0006
Stage #1	3.2883	-	3.2882	=	.0001	
Stage #2	3.4522	-	3.4521	=	.0001	
Stage #3	3.5339	-	3.5335	=	.0004	
Stage #4	3.3193	-	3.3190	=	.0003	
Stage #5	3.5135	-	3.5129	=	.0006	
Filter (#27-5)	181.2	-	180.1	=	.0011	
TOTALS		-		=	.0042	

MOISTURE

	FINAL (gm)		TARE (gm)		NET WATER (ml = gm)
Bubbler (#1)		-		=	
Impinger (#2)		-		=	
Bubbler (#3)		-		=	
Bubbler (#4)		-		=	
TOTALS		-		=	

CASCADE IMPACTOR RESULTS

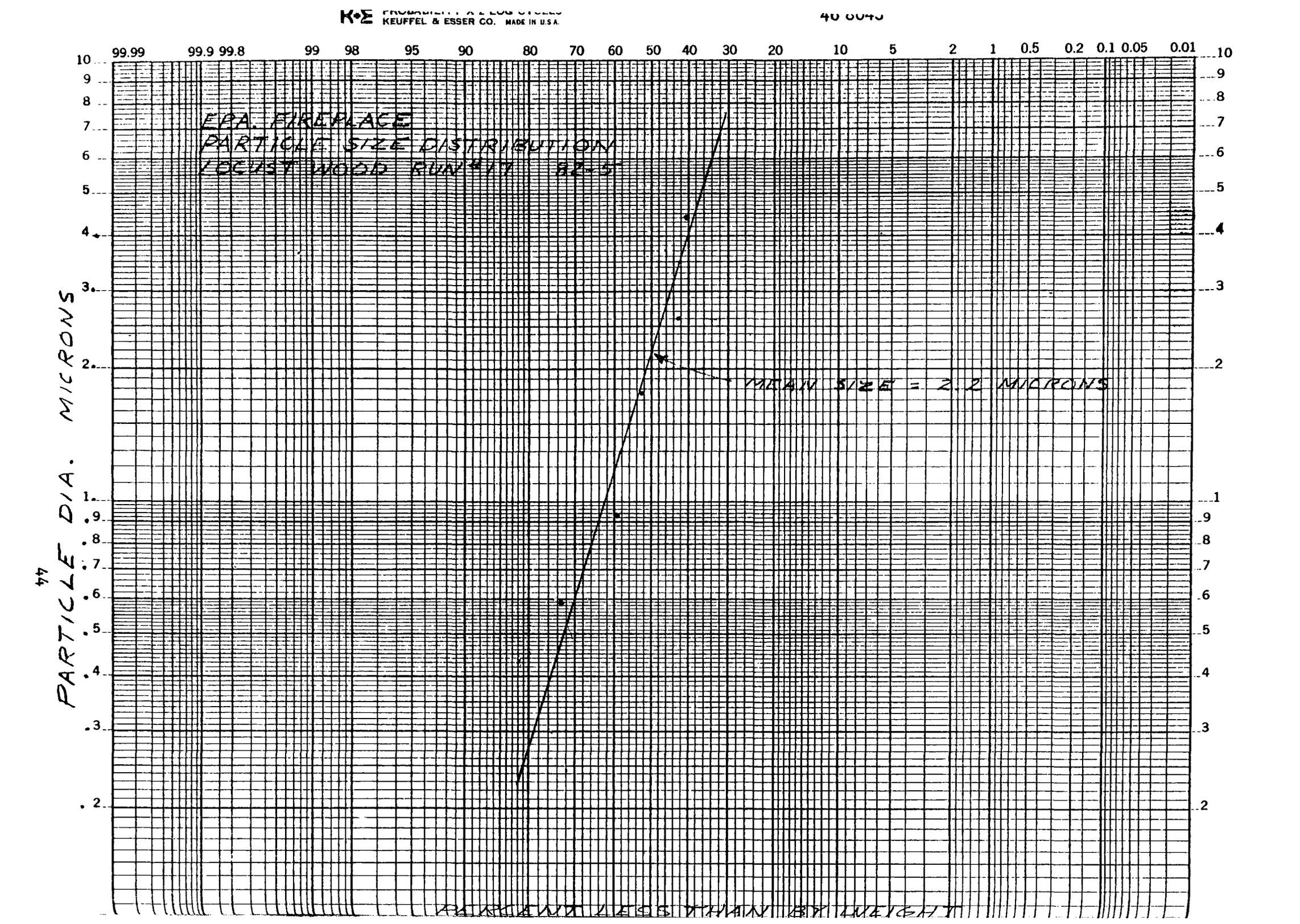
Client: EPA FIREPLACE

Sampling Location: AVERAGE FIREPLACE

Date: 13 AUGUST 1975

Run No: 17 - 82-5

ITEM	Dp (=Dpc), microns	Particulate collected, mg	Weight % collected	Cumulative % less than Dp
Cyclone		7.6	38.1	
Stage #1	4.415	0.1	2.4	59.5
Stage #2	2.601	0.1	2.4	57.1
Stage #3	1.772	0.4	9.5	47.6
Stage #4	0.930	0.3	7.1	40.5
Stage #5	0.592	0.6	14.3	26.2
Filter		1.1	26.2	


K•Σ PROBABILITY X 2 LOG CYCLES
KEUFFEL & ESSER CO. MADE IN U.S.A.
40 8045
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
10 9 8 7 6 5 4 3 2 1 .9 .8 .7 .6 .5 .4 .3 .2
EPA FIREPLACE
PARTICLE SIZE DISTRIBUTION
LOCUST WOOD RUN #17 82-5
MEAN SIZE = 2.2 MICRONS
PARTICLE DIA. MICRONS
PERCENT LESS THAN BY WEIGHT
44

CASCADE IMPACTOR DATA

Client E.P.A. FIREPLACE

Sampling Location AVERAGE FIREPLACE

Date 20 AUGUST 1975

Run Number 24 89-5

Comments

PARTICULATE

	FINAL (gm)		TARE (gm)		NET PARTICULATE (gm)
Cyclone	78.4917	-	78.4902	=	.0012
Stage #1	3.7738	-	3.7736	=	.0002
Stage #2	3.2296	-	3.2295	=	.0001
Stage #3	3.5293	-	3.5290	=	.0003
Stage #4	3.4134	-	3.4133	=	.0001
Stage #5	3.6565	-	3.6564	=	.0001
Filter (# 32-5)	182.1	-	181.2	=	.0009
TOTALS		-		=	.0029

MOISTURE

	FINAL (gm)		TARE (gm)		NET WATER (ml = gm)
Bubbler (#1)		-		=	
Impinger (#2)		-		=	
Bubbler (#3)		-		=	
Bubbler (#4)		-		=	
TOTALS		-		=	

CASCADE IMPACTOR RESULTS

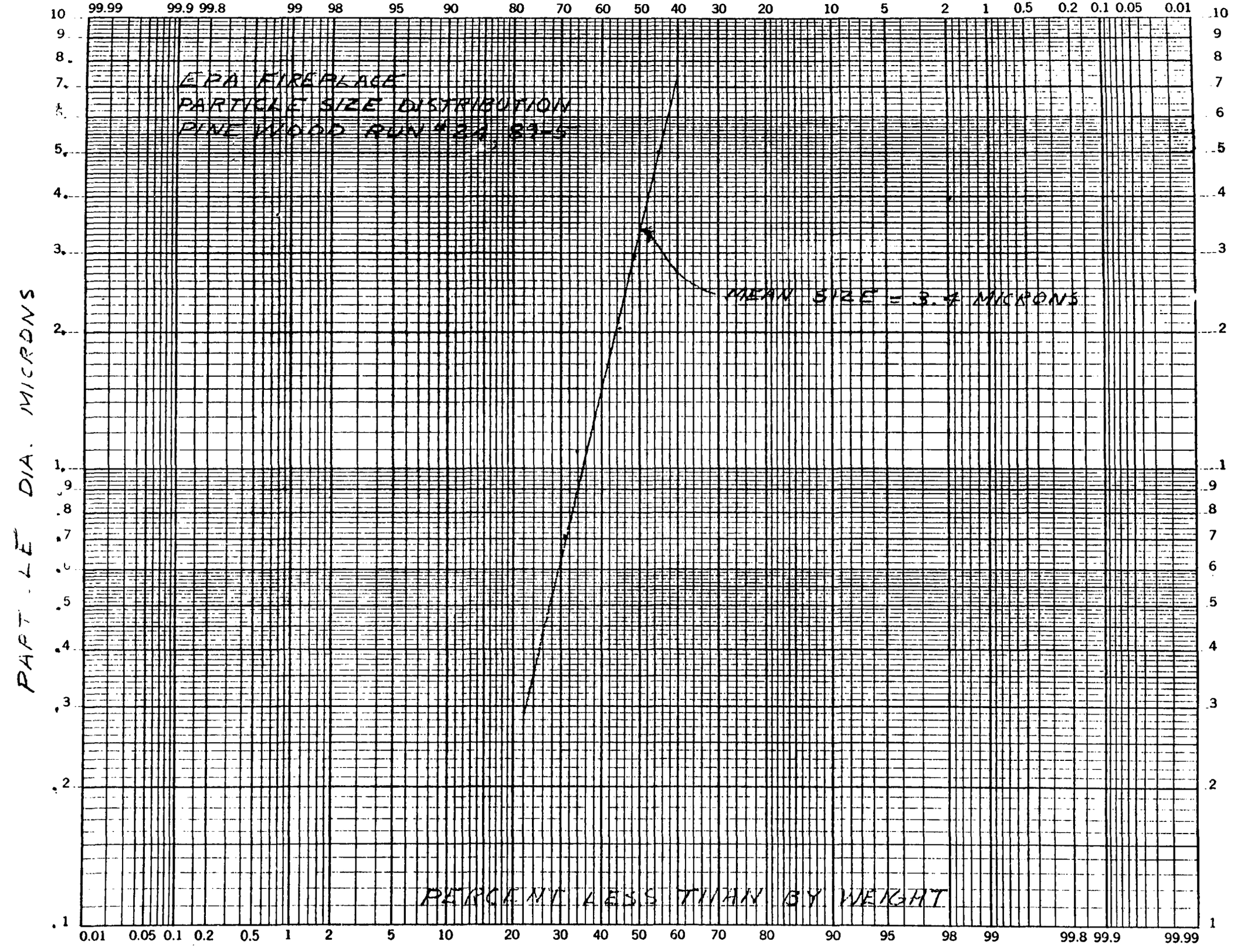
Client: EPA FIREPLACE

Sampling Location: AVERAGE FIREPLACE

Date: 20 AUGUST 1975

Run No: 24 — 89-5

ITEM	Dp (=Dpc), microns	Particulate collected, mg	Weight % collected	Cumulative % less than Dp
Cyclone		1.2	41.4	
Stage #1	5.006	.2	6.9	55.2
Stage #2	2.969	.1	3.5	48.3
Stage #3	2.038	.3	10.3	44.8
Stage #4	1.090	.1	3.5	34.5
Stage #5	0.708	.1	3.5	31
Filter		.9	31	


EPA FIREPLACE
PARTICLE SIZE DISTRIBUTION
PINE WOOD RUN #24, 83-5
MEAN SIZE = 3.4 MICRONS
PERCENT LESS THAN BY WEIGHT
PARTICLE DIA. MICRONS
99.99 99.9 99.8 99 98 95 90 80 70 60 50 40 30 20 10 5 2 1 0.5 0.2 0.1 0.05 0.01
0.01 0.05 0.1 0.2 0.5 1 2 5 10 20 30 40 50 60 70 80 90 95 98 99 99.8 99.9 99.99

APPENDIX H

Velocity Correction Coefficient

The reference point velocity correction calculation was performed on 3 of the m variable samples. Findings are discussed on Page 8. The procedures for measur and calculating are found in the Procedure section, Page 13.

SUBJECT REFERENCE POINT VELOCITY CORRECTION, RUN 8 OF

TRAV. PT.		$\sqrt{Tr\ V_H}$	$\sqrt{Ref\ V_H}$	$\frac{Av.\sqrt{Ref\ V_H}}{\sqrt{Ref\ V_H}}$	$\sqrt{Tr\ V_H} \times$	Av. $\sqrt{R}$
	1	.110	.1	1.08		.11
	2	.1	.1	1.08		.10
	3	.1	.07	1.543		.15
	4	.122	.1	1.08		.13
	5	.1	.1	1.08		.10
	6	.122	.1	1.08		.13
	7	.132	.1	1.08		.14
	8	.141	.1	1.08		.15
	9	.110	.1	1.08		.11
	10	.122	.1	1.08		.13
	11	.141	.1	1.08		.15
	12	.122	.122	.885		.10
	13	.122	.122	.885		.10
	14	.132	.122	.885		.11
	15	.132	.122	.885		.1
	16	.148	.122	.885		.1
	17	.1	.122	.885		.0
	18	.112	.122	.885		.0
	19	.132	.122	.885		.1
	20	.122	.122	.885		.1
TOTAL	20	Av. .121	Av. .108	1111		Av. .1

TRUE AVERAGE VELOCITY =

$$= \left[1 - \left(\frac{.121 - .122}{.121}\right)\right] \text{AVERAGE TRAVERSE VELOCITY}$$

$(1.0083)(7.475\ \text{feet/sec}) = 7.535$ feet/sec

SHOWING THAT THE AVERAGE TRAVERSE VELOCITY IS

$$\frac{7.475 - 7.535}{7.535} \times 100 = -.8\%$$ OR IS .8% BELOW TRUE AVERAGE VELOCITY

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JOB NAME E.P.A. FIREPLACE DATE 9-25-75

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SUBJECT REFERENCE PITOT VELOCITY CORRECTIONS, RUN 10

TRAV. PT.	$\sqrt{Tr.VH}$	$\sqrt{REF\,VH}$	$\frac{Av.\sqrt{REF\,VH}}{\sqrt{REF\,VH}}$	$\sqrt{TrVH} \times \frac{Av.\sqrt{REF\,VH}}{\sqrt{TrVH}}$
1	.100	.122	1.02	.102
2	.110	.122	1.02	.112
3	.122	.122	1.02	.124
4	.141	.122	1.02	.143
5	.182	.141	.886	.115
6	.110	.122	1.02	.112
7	.132	.122	1.02	.133
8	.132	.122	1.02	.133
9	.100	.141	.886	.089
10	.122	.122	1.02	.124
11	.122	.122	1.02	.124
12	.141	.122	1.02	.143
13	.100	.122	1.02	.102
14	.110	.1	1.25	.125
15	.141	.12	1.02	.143
16	.148	.122	1.02	.153
17	.122	.141	.886	.106
18	.148	.141	.886	.136
19	.141	.122	1.02	.143
20	.141	.122	1.02	.143
TOTAL 20	Av .126	Av .125	////	Av .124

TRUE AVERAGE VELOCITY =

$$= \left[1 - \left(\frac{.126 - .124}{.126}\right)\right] \text{AVERAGE TRAVERSE VELOCITY}$$

$$= (.984)(7.97 \text{ feet/sec}) = 7.84 \text{ feet/sec}$$

SHOWING THAT AVERAGE TRAVERSE VELOCITY IS

$\frac{7.97 - 7.84}{7.84} \times 100 = 1.7\%$ ABOVE TRUE VELOCITY

VALENTINE, FISHER & TOMLINSON ● CONSULTING ENGINEERS

COMPUTATION & DESIGNING SHEET

JOB NAME EPA FIREPLACE DATE 9-26-75

PREPARED BY D.A. ALGUARD PAGE OF

SUBJECT REFERENCE PITOT VELOCITY CORRECTIONS, RUN 23

TRAV. PT.	$\sqrt{Tr.V_H}$	$\sqrt{Ref.V_H}$	$\frac{\sqrt{Av.Ref.V_H}}{\sqrt{Ref.V_H}}$	$\sqrt{Tr.V_H} \times \frac{Av.\sqrt{Ref.V_H}}{\sqrt{Tr.V_H}}$
1	0.100	0.1	1.055	.106
2	0.110	0.095	0.959	.105
3	0.114	0.095	0.925	.105
4	0.118	0.095	0.894	.105
5	0.095	0.089	1.111	.106
6	0.105	0.084	1.005	.106
7	0.126	0.095	.837	.105
8	0.130	0.1	.812	.106
9	0.105	0.095	1.005	.106
10	0.105	0.089	1.005	.106
11	0.126	0.105	.837	.105
12	0.122	0.110	.865	.106
13	0.105	0.126	1.005	.106
14	0.126	0.122	.837	.105
15	0.126	0.126	.837	.105
16	0.122	0.134	.865	.106
17	0.095	0.126	1.111	.106
18	0.100	0.114	1.055	.106
19	0.100	0.105	1.055	.106
20	0.100	0.105	1.055	.106
TOTAL 20	$Av. = 0.1115$	$Av. = .1055$		$Av. = .1056$

TRUE AVERAGE VELOCITY =

$= \left[1 - \left(\frac{.1115 - .1056}{.1115}\right)\right]$ AVERAGE TRAVERSE VELOCITY

$= [.947] \quad [7.16] = 6.78$ feet/sec

SHOWING THAT THE AVERAGE TRAVERSE VELOCITY

IS $\frac{7.16 - 6.78}{6.78} \times 100 = 5.6\%$ ABOVE THE TRUE AVERAGE

APPENDIX I

Wood Burning Rates

The wood burning rate data was collected during each POM and particulate emission evaluation. The data was collected by the methods described in the Procedure section, Page 16.

Run No.	WOOD ADDED LB.	WOOD REMAINING LB.	WOOD BURNT LB.	TIME START	TIME END	BURNING TIME HR.	BURNING RATE LB/HR
1	21	9	12	11.43	12.57	1.14	10.5
2	47	8.5	38.5	2.5	4.75	2.25	17.1
3	8	4	4.0	17.05	18.00	0.95	4.2
4	31.5	12.0	19.5	10.25	11.27	0.82	23.8
5	22	7	15	1.08	1.83	0.75	20.0
6	25.25	4	21.25	14.58	16.13	1.55	13.7
7	22.5	3.0	19.5	12.42	13.98	1.56	12.5
8	21.5	3.0	18.5	14.33	16.37	2.04	9.1
9	31.5	9	22.5	9.83	11.05	1.22	18.4
10	28	4	24	12.38	14.00	1.62	14.8
11	23	2	21	14.00	16.20	2.2	9.5
12	14 *	8 *	6 *	9.63	10.83	1.2	5.0 *
13	16 *	9 *	7 *	11.4	12.57	1.17	6.0 *
14	42	15	27	11.37	12.73	1.36	19.8
15	28	9	17	13.35	14.6	1.25	13.6
16	31	17	14	10.45	11.65	1.2	11.7
17	16	9	5	13.72	14.22	0.5	10.00
18	28	12	16	2.97	14.28	1.31	12.21
19	42	14	28	11.75	12.88	1.13	24.8
20	33.5	11	22.5	14.75	15.48	0.73	30.8
21	31	[illegible]	21	16.32	17.27	0.95	22.1
22	31.5 23	18 10	13.5 13	11.3 12.33	11.83 12.88	0.53 0.55	25.47 > 24.5 23.64
23	28	10	18	14.77	15.67	0.9	20.0
24	22	7	15	16.48	16.98	0.5	30.0

* COAL WAS BEING BURNED INSTEAD OF WOOD

APPENDIX J

Auxiliary Atmospheric Emission Data

Two projects separate to this study were performed by Valentine, Fisher & Tomlinson wherein atmospheric emissions were measured from combustion of fuels in residential fireplaces. The first project was evaluating emissions from a compacted-waste-wood formed into a log and burned under simulated fireplace conditions. The results of the emissions are shown in Table VI. The second project was sampling atmospheric emissions from burning alder wood in a residential fireplace and were reported in a paper by W. D. Snowden and I. J. Primlani titled "Atmospheric Emissions from Residential Space Heating," presented at the Pacific Northwest International Section of the Air Pollution Control Association annual meeting in Boise, Idaho, in November, 1974. Emissions from the second project are also shown in Table VI.

Table VI

Auxiliary Fireplace Atmospheric Emission Data

Project No.	Burning Rate (BR)	Stack Temp.	Stack Gas Flow Rate	Pollutant Mass Rate(PMR)	$\%CO_2$	(PMR/BR)
1	8 kg/hr	54° C	14.2 m^3/min	18.8 gm/hr	0.2%	2.4 gm/kg
2	19.8 kg/hr	107° C	11.7 m^3/min	129 gm/hr	0.25%	6.5 gm/kg
3*	7258 kg/hr	363° C	3881 m^3/min	34500 gm/hr	3.5%	4.8 gm/kg

*Air Curtain Wood Waste Combustion System

APPENDIX K, COMPUTER PRINT-OUTS OF PARTICULATE EMISSION DATA WITH CALCULATIONS AND TERMINOLOGY

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 orifi 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 tempera 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 ($\pm$ 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)

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. $C' = \dfrac{PMR_{AVG}}{Q_{OS}N}\ (1400)$

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

* $W_a = 28.95$ LB/LB MOLE

CALCULATIONS (Continued)

The weight of the dust per volume and weight of dust per time were calculated using two procedures:

1. The Concentration Method:

   The concentration of dust entering the sampling nozzle is calculated and then multiplied by the volumetric flow rate of the stack gases to obtain the Pollutant Mass Rate (PMR).

   Concentration in Nozzle x Volumetric Flow Rate = Pollutant Mass Rate On Concentration Basis.

   $$(P_T/VOL_{STD}) \times Q_{os} = PMR_p$$

Assuming the nozzle velocity is greater than the average stack gas velocity (V_n greater than V_o), the calculated Pollutant Mass Rate will be less than the true Pollutant Mass Rate because the heavier dust particles will leave their streamline and not enter the nozzle. If V_n is less than V_o then the calculated PMR will be greater than the true PMR.

2. The Area Ratio Method:

   The weight of dust collected is divided by the sampling time and multiplied by the ratio of the Stack Area to the nozzle area to obtain the calculated Pollutant Mass Rate (PMR_{AR}).

   $$\frac{\text{Weight Collected}}{\text{Sample Time}} \times \frac{\text{Area of Stack}}{\text{Area of Nozzle}} = \text{Pollutant Mass Rate on Area Ratio Basis.}$$

   $$(P_T/T) \times A_s/A_n = PMR_{AR}$$

Assuming the nozzle velocity is greater than the average stack gas velocity (V_n greater than V_o), the calculated Pollutant Mass Rate will be greater than the true Pollutant Mass Rate because the lighter particles in the dust laden stream follow their streamlines and enter the sampling nozzle resulting in P_T/T being greater than true. If V_n is less than V_o, the calculated PMR_{AR} will be greater than the true PMR.

To obtain a more true Pollutant Mass Rate, the two calculated pollutant mass rates are averaged. This allows some of the bias introduced because of non-isokinetic sampling calculated by one method to offset the bias of the other method.

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SUBJECT FIREPLACE EMISSIONS RUN NO. 1 64-5

20.319	VOLm	0.011	VH	0.02	VH		
30.30	Pm	640	Ts	635	Ts	2.977091	K_a
530	Tstd	2.653299		3.563705			
341	Tm					0.023	C_p
		0.02	VH	0.01	VH	7.120595	V_0
20.158674	VOLstd	645	Ts	630	Ts	1.170	A_s
		3.591656		2.509980			
0.40348	VOLw					499.065760	Q_0
		0.02		0.01			
		640		625		530	T_{st}
2.542100	M	3.577708		2.500000		642	T_s
						30.25	P_{st}
0.976579	MF	0.02		0.015			
28.78	Wd	665		620		407.441630	Q_0
		3.646916		3.049590			
28.527521	Ww					642	T_s
		0.015		0.015		530	T_{st}
1.007377	Cd	665		620		30.25	P_{st}
30.25	Psn	3.158322		3.049590		40	T
						0.00136	A_n
0.994530	Cs	0.015		0.01			
		665		640			
		3.158322		2.529822		7.577034	V_n
						106.410124	I
		0.02		0.01			
		650		625		63.3	P_t
		3.605551		2.500000		0.048357	C_0
		0.02		0.0015			
		635		650		0.1	N
		3.563705		0.987420		5.802840	C
		0.01		0.015			
		660		640			Pl
		2.569046		3.098386		0.160071	P_t
						63.3	
		0.015				1.170	A_t
		660				40	T
		3.146426				0.00136	A_t
						0.179922	Pl
		0.015					
		640				0.174796	Pl
		3.098386					
						0.1	N
						5.092370	C

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SUBJECT FIREPLACE EMISSIONS RUN # 2 65-5

27.542	VOLm
30.29	Pm
530	Tstd
549	Tm
26.917621	VOLstd
0.63516	VOLw
2.305200	M
0.976948	MF
28.90	Wd
28.648733	Ww
1.005243	Cd
30.25	Psn
0.994530	Cs

0.01	VH
690	Ts
2.626785	
0.015	VH
700	Ts
3.240370	
0.015	
690	
3.217141	
0.0125	
670	
2.893959	
0.015	
710	
3.263433	
0.015	
710	
3.263433	
0.0175	
710	
3.524911	
0.02	
690	
3.714835	
0.01	
675	
2.598076	
0.01	
675	
2.598076	
0.015	
667	
3.163068	

0.015	VH
650	Ts
3.122498	
0.01	VH
695	Ts
2.636285	
0.015	
677	
3.186691	
0.015	
675	
3.181980	
0.02	
705	
3.754996	
0.0005	
677	
0.581807	
0.005	
670	
1.830300	
0.005	
670	
1.830300	
0.01	
720	
2.683281	

2.845611	K_a
0.84	C_p
6.930131	V_o
1.170	A_s
486.495180	Q_o
530	T_{std}
686	T_s
30.25	P_{sn}
371.249205	Q_{os}
686	T_s
530	T_{std}
30.25	P_{sn}
60	T
0.00136	A_n
7.204571	V_n
103.960098	I
55.7	P_t
0.031866	C_o
0.63	N
0.606971	C
0.101396	PMRp
55.7	P_t
1.170	A_s
60	T
0.00136	A_n
0.105547	PMR_{ar}
0.103471	PMR_{avg}
0.63	N
0.619355	C'

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SUBJECT FIREPLACE EMISSIONS RUN NO. 3 66-

14.428	VOLm
30.27	Pm
530	Tstd
556	Tm
13.914193	VOLstd
0.37446	VOLw
2.620600	M
0.973794	MF
28.83	Wd
28.546189	Ww
1.007047	Cd
30.25	Psn
0.994530	Cs

0.005	VH
645	Ts
1.795828	
0.005	VH
635	Ts
1.781852	
0.0075	
645	
2.199431	
0.0075	
640	
2.190890	
0.005	
630	
1.774823	
0.0075	
625	
2.165063	
0.01	
620	
2.489979	
0.01	
625	
2.500000	
0.005	
622	
1.763519	
0.0075	
615	
2.147673	
0.0075	
615	
2.147673	

0.0075	VH
610	Ts
2.138924	
0.005	VH
611	Ts
1.747855	
0.005	
611	
1.747855	
0.005	
596	
1.726267	
0.0075	
594	
2.110607	
0.005	
586	
1.711724	
0.005	
585	
1.710263	
0.0075	
583	
2.091052	
0.0075	
580	
2.085665	

2.001351	Ka
0.84	Cp
4.862708	Vo
1.170	As
342.771660	Qo
530	Tstd
613	Ts
30.25	Psn
291.777087	Qo
613	Ts
530	Tstd
30.25	Psn
40	T
0.00136	An
5.007965	Vn
102.563637	I
33.6	Pt
0.037107	Ct
0.1	N
4.402440	C
0.092998	Pl
33.6	Pt
1.170	A
40	T
0.00136	A
0.095304	Pl
0.094251	Pl
0.1	N
4.522336	C

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SUBJECT FIREPLACE EMISSIONS RUN #4 68-5

15.421	VOLm
29.84	Pm
530	Tstd
532	Tm
15.321948	VOLstd
0.41238	VOLw
2.620800	M
0.973792	MF
28.90	Wd
28.614332	Ww
1.005847	Cd
29.81	Psn
1.001843	Cs

0.005	VH
660	Ts
1.816590	
0.0075	VH
690	Ts
2.274862	
0.0075	
700	
2.291287	
0.015	
710	
3.263433	
0.01	
660	
2.569046	
0.01	
745	
2.729468	
0.02	
754	
3.883297	
0.02	
735	
3.834057	
0.0075	
705	
2.299456	
0.0075	
700	
2.291287	
0.0125	
695	
2.947456	

0.015	VH
695	Ts
3.228776	
0.0075	VH
670	Ts
2.241651	
0.005	
710	
1.884144	
0.012	
695	
2.887905	
0.0075	
675	
2.250000	
0.005	
710	
1.884144	
0.0075	
690	
2.274862	
0.0075	
675	
2.250000	
0.0075	
670	
2.241651	

2.567168	K_a
0.84	C_p
6.301775	V_o
1.170	A_s
442.384560	Q_o
530	T_{std}
697	T_s
29.81	P_{sn}
326.369556	Q_{os}
697	T_s
530	T_{std}
29.81	P_{sn}
40	T
0.00136	A_n
6.362879	V_n
100.969631	I
106.2	P_t
0.106740	C_o
0.625	N
2.049408	C
0.298585	PMRp
106.2	P_t
1.170	A_s
40	T
0.00136	A_n
0.301860	PMR_{ar}
0.300222	PMR_{avg}
0.625	N
2.060539	C'

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SUBJECT RUN #5 IMPACTOR

		0.013	VH	0.013	VH		
0.00	VOLm	630	Ts	675	Ts	7.1[illegible]745	Ka
29.61	Pm	2.061017		7.405603			
530	Tstd					[illegible].042	Cp
533	Tm	0.013	VH	0.013	VH	7.007022	Vo
		625	Ts	670	Ts	1.17	As
0.250831	VOLstd	7.061062		0.951270			
						540.052000	Qo
0.020804	VOLw	0.013		0.010			
		636		660		530	Tst
1.060600	M	2.075413		3.446737		607	Ts
						29.61	Psn
0.007394							
28.95	MF	0.02		0.010			
	Wd	607		650			
28.811964		3.706750		7.122493		434.034491	Qo
	Ww						
1.002392		0.015		0.015		657	Ts
29.61	Cd	607		647		530	Tst
				3.115284			
	Psn	3.010140				29.61	Psn
1.001043						20	T
	Cs					0.000035	An
						27.004061	Vn
						357.433330	I
							Pt
							Co
							N
							C
							PM
							Pt
							As
							T
							An
							PM
							PM
							N
							C'

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SUBJECT FIREPLACE EMISSIONS RUN NO. 6 69-5

29.307	VOLm
30.66	Pm
530	Tstd
551	Tm
28.887249	VOLstd
0.58776	VOLw
1.994000	M
0.980060	MF
28.89	Wd
28.672853	Ww
1.004820	Cd
30.62	Psn
0.988503	Cs

0.015	VH
705	Ts
3.251922	
0.015	VH
660	Ts
3.146426	
0.0175	
665	
3.411378	
0.015	
655	
3.134485	
0.01	
667	
2.582634	
0.015	
667	
3.163068	
0.0125	
660	
2.872281	
0.015	
660	
3.146426	
0.01	
640	
2.529822	
0.015	
690	
3.217141	
0.027	
695	
4.331858	

0.02	VH
700	Ts
3.741657	
0.075	VH
660	Ts
7.035623	
0.012	
650	
2.792848	
0.015	
680	
3.193743	
0.02	
670	
3.660601	
0.01	
690	
2.626785	
0.012	
667	
2.829134	
0.015	
655	
3.134485	
0.015	
652	
3.127299	

3.346480	K_a
0.84	C_p
8.097142	V_o
1.17	A_s
568.419360	Q_o
530	T_{std}
670	T_s
30.62	P_{sn}
450.989249	Q_{os}
670	T_s
530	T_{std}
30.62	P_{sn}
60	T
0.00136	A_n
7.436470	V_n
91.840676	I
11.71	P_t
0.006242	C_o
0.5	N
0.149808	C
0.024127	PMRp
11.71	P_t
1.17	A_s
60	T
0.00136	A_n
0.022189	PMR_{ar}
0.023158	PMRavg
0.5	N
0.143778	C'

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SUBJECT FIREPLACE EMISSIONS - RUN # 7 72-5

29.535	VOLm	0.075	VH	0.022	VH		
29.66	Pm	625	Ts	665	Ts	0.111193	K_a
530	Tstd	0.846531		3.024910			
543	Tm					0.03	C_p
		0.01	VH	0.01	VH	7.574172	V_o
28.316643	VOLstd	630	Ts	635	Ts	1.170	A_s
		2.509900		2.519920			
0.69670	VOLw					551.780000	Q_o
		0.012		0.012			
		625		630		530	T_{std}
2.401500	M	2.738612		2.749545		635	T_s
						29.61	P_{sn}
0.975905	MF	0.0125		0.015			
20.05	Wd	620		625		423.601264	Q_{oi}
		2.783882		3.061862			
28.509437	Ww						
		0.01		0.015		635	T_s
1.006205	Cd	630		620		530	T_{std}
29.61	Psn	2.509900		3.049590		29.61	P_{sn}
						60	T
1.005220	Cs	0.0125		0.012		0.00136	A_n
		630		625			
		2.806243		2.738612		7.174276	V_n
						24.711514	i
		0.015		0.012			
		620		625		72.5	P_t
		3.049590		2.738612		0.039429	C_o
		0.012		0.015			
		611		620		0.2	N
		2.707766		3.049590		2.365740	C
		0.01		0.015			
		635		610		0.144171	PM
		2.617250		3.004896		72.5	P_t
						1.170	A_s
		0.015				60	T
		680				0.00136	A_n
		3.193743					
						0.137301	Pi
		0.02					
		605				0.141126	pi
		2.701351					
						0.2	N
						0.004465	C

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SUBJECT FIREPLACE EMISSIONS RUN #8 73-5

32.059	VOLm
29.61	Pm
530	Tstd
567	Tm
29.656479	VOLstd
0.59	VOLw
1.950600	M
0.980494	MF
28.88	Wd
28.667774	Ww
1.004909	Cd
29.55	Psn
1.006241	Cs

0.012	VH
635	Ts
2.760434	
0.01	VH
620	Ts
2.489979	
0.01	
620	
2.489979	
0.015	
650	
3.122498	
0.01	
620	
2.489979	
0.015	
670	
3.170173	
0.0175	
650	
3.372684	
0.020	
650	
3.605551	
0.012	
700	
2.898275	
0.015	
690	
3.217141	
0.020	
645	
3.591656	

0.015	VH
630	Ts
3.074085	
0.015	VH
695	Ts
3.228776	
0.0175	
670	
3.424178	
0.0175	
670	
3.424178	
0.022	
685	
3.882009	
0.01	
660	
2.569046	
0.0125	
635	
2.817356	
0.0175	
620	
3.293933	
0.015	
610	
3.024696	

3.097340	K_a
0.823	C_p
7.475070	V_o
1.170	A_s
524.749860	Q_o
530	T_{std}
651	T_s
29.55	P_{sn}
413.702407	Q_{os}
651	T_s
530	T_{std}
29.55	P_{sn}
60	T
0.00136	A_n
7.683198	V_n
102.784294	I
70.5	P_t
0.036609	C_o
0.433	N
1.014568	C
0.129809	PMRp
70.5	P_t
1.170	A_s
60	T
0.00136	A_n
0.133591	PMR_{ar}
0.131700	PMRavg
0.433	N
1.029208	C'

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SUBJECT FIREPLACE EMISSIONS RUN #9 74

22.657	VOLm	0.0005	VH	0.0125	VH		
29.76	Pm	645	Ts	640	Ts	2.246009	K_1
530	Tstd	0.567890		2.920427			
535	Tm					0.04	C_p
		0.0075	VH	0.005	VH	5.518616	V_0
22.325224	VOLstd	710	Ts	675	Ts	1.170	A_s
		2.307596		1.837117			
0.53008	VOLw					387.406800	Q_1
		0.012		0.0075			
2.322700	M	670		655		530	T_s
		2.835489		2.216416		642	T_s
0.976773	MF					29.72	P_s
28.90	Wd	0.012		0.012			
		620		645		310.305120	Q
28.646825	Ww	2.727636		2.782085			
						642	T_1
		0.0075		0.01		530	T_s
1.005277	Cd	590		635		29.72	P_s
29.72	Psn	2.103568		2.519920		60	T
						0.00136	A
1.003358	Cs	0.005		0.005			
		590		630		5.692879	V_1
		1.717556		1.774823		103.157730	I
		0.012		0.005			
		625		625		87.4	P_1
		2.738612		1.767766		0.060288	C
		0.016		0.005			
		670		605		0.6	N
		3.274141		1.739252		1.205760	C
		0.0075		0.0075		0.160343	PM
		670		615		87.4	P_1
		2.241651		2.147673		1.170	A_s
						60	T
		0.0075				0.00136	A_n
		665					
		2.233271				0.165619	PM
		0.01				0.162979	PM
		655					
		2.559296					
						0.6	N
						1.225516	C'

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SUBJECT FIREPLACE EMISSIONS RUN # 10 75-5

32.641	VOLm	0.01	VH	0.02	VH		
29.76	Pm	670	Ts	665	Ts	7.314011	K_a
530	Tstd	2.588435		3.646916			
546	Tm					0.822	C_p
		0.012	VH	0.01	VH	7.972363	V_o
31.515051	VOLstd	665	Ts	635	Ts	1.17	A_s
		2.824889		2.519920			
0.72048	VOLw					559.659840	Q_o
		0.015		0.012			
2.235000	M	670		630		530	T_{std}
		3.170173		2.749545		690	T_s
0.977650	MF					29.7	P_{sn}
28.08	Wd	0.02		0.02			
		690		680		417.185481	Q_{os}
28.636832	Ww	3.714835		3.687817			
		0.0175		0.022		690	T_s
1.005452	Cd	710		665		530	T_{std}
29.7	Psn	3.524911		3.824918		29.7	P_{sn}
						60	T
1.003696	Cs	0.0125		0.015		0.00136	A_n
		695		800			
		2.947456		3.464101		8.635171	V_n
						108.313821	I
		0.0175		0.022			
		670		770		113.8	P_t
		3.424178		4.115823		0.055608	C_o
		0.0175		0.02			
		650		740			
		3.372684		3.847076		0.4	N
						1.668240	C
		0.01		0.02			
		675		705		0.198837	PMRp
		2.598076		3.754996		113.8	P_t
						1.17	A_s
		0.015				60	T
		690				0.00136	A_n
		3.217141					
						0.215642	PMRar
		0.015					
		720				0.207239	PMRavg
		3.286335					
						0.4	N
						1.738642	C'

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SUBJECT FIREPLACE EMISSIONS RUN # 11 76·

31·296	VOLm	0·01	VH	0·0175	VH				
29·75	Pm	665	Ts	635	Ts	3·013409	K_a		
530	Tstd	2·578759		3·333541					
550	Tm					0·04	C_p		
		0·012	VH	0·015	VH	7·427095	V_o		
29·555751	VOLstd	660	Ts	600	Ts	1·17	A_s		
		2·314249		3·193743					
0·531	VOLw					522·084060	Q_o		
		0·015		0·015					
		650		665		530	T_{st}		
1·764800	M	3·122498		3·158322		651	T_s		
						29·7	P_{sn}		
0·002352	MF	0·015		0·015					
20·6	Wd	640		660		414·474014	Q_o		
		3·098386		3·146426					
28·410031	Ww								
		0·01		0·015		651	T_s		
1·009406	Cd	675		665		530	T_{st}		
29·7	Psn	2·598076		3·158322		29·7	P_{sn}		
						60	T		
1·003696	Cs	0·0125		0·01		0·00136	A_n		
		650		665					
		2·850438		2·578759		7·604019	V_n		
						102·244478	I		
		0·0175		0·01					
		640		650		10·1	P_f		
		3·346640		2·549509		0·005262	C_o		
		0·02		0·015					
		635		635			N		
		3·563705		3·086259		0·5	C		
						0·126280			
		0·0125		0·0125					
		650		625		0·010693	P_h		
		2·850430		2·795034		10·1	P_f		
						1·17	A_s		
		0·015				60	T		
		640				0·00136	A_n		
		3·098386							
						0·010130	PH		
		0·0175							
		640				0·010915	Pl		
		3·346640							
						0·5	N		
						0·127700	C		

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UBJECT FIREPLACE EMISSIONS RUN #12 77-5

27.027	VOLm	0.01	VH	0.014	VH		
30.265	Pm	632	Ts	630	Ts	2.822736	Ka
530	Tstd	2.513961		2.969840			
538	Tm					0.84	Cp
		0.012	VH	0.01	VH	6.881424	Vo
26.932118	VOLstd	630	Ts	644	Ts	1.170	As
		2.749545		2.537715			
0.53562	VOLw					483.075960	Qo
		0.014		0.01			
		625		643			
1.949900	M	2.959039		2.535744		530	Tstd
						636	Ts
0.980501	MF	0.013		0.014		30.22	Psn
28.83	Wd	625		642			
		2.850438		2.997999		398.671408	Qos
28.618825	Ww						
		0.01		0.016		636	Ts
1.005768	Cd	635		645		530	Tstd
30.22	Psn	2.519920		3.212475		30.22	Psn
						60	T
0.995023	Cs	0.011		0.013		0.00136	An
		640		645			
		2.653299		2.895686		6.665441	Vn
						96.861361	I
		0.015		0.013			
		640		645		78.8	Pt
		3.098386		2.895686		0.045058	Co
		0.015		0.014			
		637		642			
		3.091116		2.997999		0.2	N
						2.703480	C
		0.01		0.015			
		630		637		0.153963	PMRp
		2.509980		3.091116		78.8	Pt
						1.17	As
		0.01				60	T
		632				0.00136	An
		2.513961					
						0.149319	PMRar
		0.013					
		630				0.151641	PMRavg
		2.861817					
						0.2	N
						2.662560	C'

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SUBJECT FIREPLACE EMISSIONS RUN #13 78-5

22.229	VOLm
30.26	Pm
530	Tstd
550	Tm
29.060725	VOLstd
0.450	VOLw
1.534700	M
0.984753	MF
28.37	Wd
28.704265	Ww
1.004270	Cd
30.22	Psn
0.995023	Cs

0.01	VH
625	Ts
2.500000	
0.01	VH
625	Ts
2.500000	
0.01	
620	
2.489979	
0.012	
615	
2.716615	
0.01	
622	
2.493992	
0.014	
635	
2.981610	
0.016	
637	
3.192491	
0.014	
640	
2.993325	
0.014	
630	
2.969048	
0.012	
630	
2.749545	
0.015	
630	
3.074055	

0.016	VH
627	Ts
3.187333	
0.015	VH
620	Ts
3.049599	
0.013	
620	
2.639013	
0.013	
620	
2.639013	
0.015	
620	
3.049599	
0.014	
620	
2.946183	
0.01	
620	
2.489979	
0.014	
625	
2.958039	
0.014	
627	
2.962768	

0.041149	K_a
0.930	C_p
0.016500	V_o
1.170	A_s
485.540220	Q_o
530	T_{std}
625	T_s
30.22	P_{sn}
409.525779	Q_o
625	T_s
530	T_{st}
30.22	P_{sn}
60	T
0.00136	A_n
7.037830	V_n
101.753790	I
46	P_t
0.024074	C_o
0.3	N
0.974960	C
0.005553	PM
46	P_t
1.17	A_s
60	T
0.00136	A_n
0.007160	PM
0.046389	PM
0.3	N
0.014003	C'

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SUBJECT FIREPLACE EMISSIONS RUN # 14 79-5

25.503	VOLm
29.69	Pm
530	Tstd
541	Tm
24.792395	VOLstd
0.69678	VOLw
2.733600	M
0.972664	MF
28.88	Wd
28.582584	Ww
1.006406	Cd
29.65	Psn
1.004542	Cs

0.005	VH
605	Ts
1.739252	
0.005	VH
625	Ts
1.767766	
0.008	
630	
2.244994	
0.006	
610	
1.913112	
0.01	
645	
2.539685	
0.012	
635	
2.760434	
0.013	
625	
2.850438	
0.016	
670	
3.274141	
0.008	
675	
2.323790	
0.014	
665	
3.051229	
0.014	
660	
3.039736	

0.015	VH
660	Ts
3.146426	
0.01	VH
680	Ts
2.607680	
0.011	
640	
2.653299	
0.013	
645	
2.895686	
0.011	
640	
2.653299	
0.01	
645	
2.539685	
0.011	
655	
2.684213	
0.011	
650	
2.673948	
0.01	
645	
2.539685	

2.594924	K_a
0.84	C_p
6.390621	V_o
1.17	A_s
448.621560	Q_o
530	T_{std}
646	T_s
29.65	P_{sn}
354.772086	Q_{os}
646	T_s
530	T_{std}
29.65	P_{sn}
60	T
0.00136	A_n
6.403345	V_n
100.199104	I
99.5	P_t
0.061805	C_o
0.4	N
1.854150	C
0.187933	PMRp
99.5	P_t
1.17	A_s
60	T
0.00136	A_n
0.188544	PMR_{ar}
0.188239	PMRavg
0.4	N
1.857057	C'

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SUBJECT FIREPLACE EMISSIONS RUN #15 80-5

30.331	VOLm	0.01	VH	0.017	VH		
29.74	Pm	710	Ts	660	Ts	3.100870	K_a
530	Tstd	2.664502		3.349626			
556	Tm					0.031	C_p
		0.010	VH	0.015	VH	7.356127	V_o
28.736704	VOLstd	690	Ts	630	Ts	1.17	A_s
		2.877498		3.074005			
0.6797	VOLw	0.01		0.015		516.400000	Q_o
		700		655		530	T_{std}
2.310400	M	2.645751		3.134435		658	T_s
0.976896	MF	0.01		0.015		29.68	P_{sn}
28.92	Wd	670		640		403.075976	Q_{os}
28.667704	Ww	2.588435		3.093396			
		0.011		0.015		658	T_s
1.004911	Cd	655		638		530	T_{std}
29.68	Psn	2.684213		3.093541		29.60	P_{sn}
						60	T
1.004034	Cs	0.013		0.015		0.00136	A_n
		660		645			
		2.929163		3.110466		7.500122	V_n
						102.029366	I
		0.014		0.015			
		655		650		93.7	P_t
		3.028200		3.122408		0.050210	C_o
		0.016		0.016			
		635		655		0.4	N
		3.187475		3.237282		1.596300	C
		0.013		0.015			
		640		665		0.173463	PM
		2.884441		3.158322		93.7	P_t
						1.17	A_s
		0.013				60	T
		645				0.00136	A_n
		2.895606					
						0.177554	PN
		0.016					
		655				0.175500	PM
		3.237282					
						0.4	N
						1.000975	C'

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SUBJECT FIREPLACE EMISSIONS RUN #16 81-5

24.538	VOLm	0.008	VH	0.014	VH		
29.74	Pm	634	Ts	640	Ts	2.590457	K_a
530	Tstd	2.252110		2.993325			
537	Tm					0.823	C_p
		0.01	VH	0.006	VH	6.243933	V_o
24.072440	VOLstd	648	Ts	650	Ts	1.170	A_s
		2.545584		1.974841			
0.694	VOLw					438.324060	Q_o
		0.012		0.01			
2.802100	M	636		649		530	T_{std}
		2.766947		2.547547		640	T_s
0.971979	MF					29.70	P_{sn}
28.90	Wd	0.011		0.012			
		629		647		350.221615	Q_{os}
28.594571	Ww	2.630399		2.786395			
						640	T_s
1.006195	Cd	0.007		0.012		530	T_{std}
29.70	Psn	615		650		29.70	P_{sn}
		2.074849		2.792848		60	T
1.003696	Cs					0.00136	A_n
		0.013		0.007			
		650		645		6.153615	V_n
		2.906888		2.124852		98.553507	I
		0.015		0.009		69.4	P_t
		640		640		0.044397	C_o
		3.098386		2.400000			
		0.014		0.009		0.567	N
		638		630		0.939619	C
		2.988645		2.381176			
		0.008		0.012		0.133268	PMRp
		638		633		69.4	P_t
		2.259203		2.756084		1.170	A_s
						60	T
		0.011				0.00136	A_n
		638					
		2.649150				0.131507	PMR_{ar}
		0.013				0.132387	PMR_{avg}
		638					
		2.879930				0.567	N
						0.933354	C'

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SUBJECT IMPACTOR RUN # 17

0.777	VOLm	0.02	VH	0.015	VH		
29.72	Pm	635	Ts	650	Ts	3.000546	Ka
530	Tstd	3.771351		3.122490			
539	Tm					0.042	Cp
		0.018	VH	0.013	VH	7.900260	Vo
0.731018	VOLstd	685	Ts	640		1.17	As
		3.511409		3.884441	Ts		
0.005	VOLw					555.230500	Qo
		0.016		0.015			
1.064900	M	600		641		530	Tstd
		3.298404		3.100006		656	Ts
						29.72	Psn
0.007381	MF			0.014			
29.95	Wd	0.018		640			
		670		2.993385			Qos
29.011403	Ww	3.472751				439.950082	
				0.015			
		0.016		635		656	Ts
1.000400	Cd	660		3.066259		530	Tstd
29.72	Psn	3.249615				29.72	Psn
						30	T
1.000350	Cs	0.015		0.015		0.000085	An
		655		637			
		3.134485		3.091116		22.534313	Vn
						284.910221	I
							Pt
							Co
							N
							C
							PMI
							Pt
							As
							T
							An
							PM
							PM
							N
							C'

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SUBJECT FIREPLACE EMISSIONS RUN NO. 18 83-5

33.73	VOLm
29.77	Pm
530	Tstd
560	Tm
31.762993	VOLstd
0.78684	VOLw
2.417300	M
0.975827	MF
28.87	Wd
28.607239	Ww
1.005972	Cd
29.70	Psn
1.003696	Cs

0.005	VH
640	Ts
1.788854	
0.014	VH
650	Ts
3.016620	
0.015	
650	
3.122498	
0.015	
660	
3.146426	
0.013	
630	
2.861817	
0.014	
635	
2.981610	
0.017	
660	
3.349626	
0.019	
662	
3.546547	
0.014	
662	
3.044339	
0.015	
660	
3.146426	
0.018	
660	
3.446737	

0.020	VH
665	Ts
3.646916	
0.02	VH
660	Ts
3.633130	
0.019	
660	
3.541186	
0.021	
658	
3.717257	
0.021	
645	
3.680353	
0.015	
655	
3.134485	
0.017	
665	
3.362290	
0.015	
656	
3.141655	
0.016	
660	
3.249615	

3.227921	K_a
0.863	C_p
3.156797	V_o
1.17	A_s
572.607120	Q_o
530	T_{std}
655	T_s
29.7	P_{sn}
448.806360	Q_{os}
655	T_s
530	T_{std}
29.70	P_{sn}
60	T
0.00136	A_n
8.277083	V_n
101.474671	I
99.5	P_t
0.048241	C_o
0.4	N
1.447230	C
0.185569	PMRp
99.5	P_t
1.17	A_s
60	T
0.00136	A_n
0.188544	PMR_{ar}
0.187056	PMR_{avg}
0.4	N
1.450747	C'

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SUBJECT *FIREPLACE EMISSIONS RUN # 19* *84-5*

26.706	VOLm
29.03	Pm
530	T std
533	Tm
26.273712	VOL std
0.815	VOLw
0.03690	M
0.969914	MF
28.84	Wd
28.513867	Ww
1.007610	Cd
29.02	Psn
1.001675	Cs

0.006	VH
735	Ts
2.56696	
0.016	VH
677	Ts
2.015440	
0.02	
750	
3.872937	
0.02	
735	
3.834057	
0.011	
605	
2.744995	
0.021	
740	
3.942000	
0.025	
745	
4.015669	
0.025	
730	
4.272001	
0.013	
717	
3.050131	
0.015	
690	
3.217141	
.022	
795	
4.133104	

0.021	VH
709	Ts
4.047221	
0.016	VH
720	Ts
3.394112	
0.016	
705	
3.350571	
0.017	
605	
3.412477	
0.016	
675	
3.286335	
0.008	
695	
2.357963	
0.011	
705	
2.784700	
0.01	
695	
2.676205	

0.304410	K_a
0.863	C_p
0.346024	V_o
1.17	A_s
505.054060	Q_o
530	T_{std}
717	T_s
29.02	P_{sn}
419.696719	Q_{os}
717	T_s
530	T_{std}
29.02	P_{sn}
57	T
0.00136	A_n
7.005330	V_n
94.709500	I
04.4	P_t
0.049460	C_o
0.0	N
2.960140	C
0.177526	PMR
4.1	P_t
1.17	A_s
57	T
0.0 176	A_n
.11034	PMR
0.172037	PMR
.0	N
0.091207	C′

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SUBJECT FIREPLACE EMISSIONS RUN # 20 85-5

18.337	VOLm	0.01	VH	0.015	VH		
29.9	Pm	680	Ts	672	Ts	3.052695	Ka
530	Tstd	2.607680		3.174901			
540	Tm					0.823	Cp
		0.014	VH	0.01	VH	7.414636	Vo
17.985395	VOLstd	680	Ts	705	Ts	1.17	As
		3.085449		2.655183			
0.559	VOLw					520.507440	Qo
		0.015		0.013			
		685		720		530	Tstd
3.014300	M	3.205464		3.059411		608	Ts
						29.85	Psn
0.969857	MF	0.016		0.016			
28.33	Wd	680		720		387.975966	Qos
		3.298484		3.394112			
28.018622	Ww						
		0.011		0.016		608	Ts
1.016484	Cd	667		710		530	Tstd
29.85	Psn	2.708689		3.370459		29.85	Psn
						40	T
1.001171	Cs	0.015		0.009		0.00136	An
		680		685			
		3.193743		2.482941		7.392500	Vn
						99.701455	I
		0.023		0.011			
		695		670		70.8	Pt
		3.998124		2.714774		0.060622	Co
		0.021		0.013			
		710		695		0.8	N
		3.861346		3.005827		3.637320	C
		0.01		0.011			
		677		669		0.201588	PMRp
		2.601922		2.712747		70.8	Pt
						1.17	As
		0.011				40	T
		677				0.00136	An
		2.728919					
						0.201240	PMRar
		0.015					
		680				0.201414	PMRavg
		3.193743					
						0.8	N
						3.633980	C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME *EPA FIREPLACE* DATE *19 AUGUST 1975*

PREPARED BY *SWANSON* APPROVED ______ PAGE *1* OF *1*

SUBJECT *FIREPLACE EMISSIONS RUN # 21* *86-5*

21.9	**VOLm**
29.67	**Pm**
530	**Tstd**
547	**Tm**
21.163013	**VOLstd**
1.522	**VOLw**
2.718500	**M**
0.972815	**MF**
28.58	**Wd**
28.292302	**Ww**
1.011554	**Cd**
29.02	**Psn**
1.001675	**Cs**

0.007	**VH**	0.015	**VH**
690	**Ts**	[illegible]	**Ts**
2.197726		3.189643	
0.01	**VH**	0.011	**VH**
670	**Ts**	665	**Ts**
2.588405		2.704625	
0.011		0.011	
660		650	
2.694430		2.673040	
0.015		0.014	
665		670	
3.158322		3.062670	
0.01		0.015	
690		685	
2.626785		3.205464	
0.014		0.008	
695		665	
3.119294		2.306510	
0.014		0.010	
680		625	
3.085449		2.857915	
0.014		0.012	
675		710	
3.074005		2.910973	
0.01		0.013	
665		710	
2.578759		3.038091	
0.01			
660			
2.562046			
0.015			
690			
3.017141			

[illegible]	K_a
0.833	C_p
7.05101	V_o
1.17	A_s
491.758007	Q_o
530	T_{std}
679	T_s
29.02	P_{sn}
372.163611	Q_{os}
679	T_s
530	T_{std}
29.02	P_{sn}
50	T
0.00136	A_n
6.660625	V_n
97.237560	I
	P_t
	C_o
	N
	C
	PMR
	P_t
	A_s
	T
	A_n
	PMR
	PMR
	N
	C′

ALENTINE, FISHER & TOMLINSON
ONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

)B NAME E.P.A. FIREPLACE DATE 20 AUGUST 1975

IEPARED BY SWANSON APPROVED PAGE 1 OF 1

)BJECT FIREPLACE EMISSIONS RUN #22 87-5

20.301	VOLm
30.23	Pm
530	Tstd
536	Tm
20.281733	VOLstd
0.692	VOLw
3.299300	M
0.967007	MF
28.95	Wd
28.588726	Ww
1.006298	Cd
30.2	Psn
0.995353	Cs

0.005	VH
640	Ts
1.789854	
0.008	VH
665	Ts
2.306512	
0.01	
645	
2.539685	
0.008	
770	
2.481934	
0.008	
760	
2.465765	
0.008	
755	
2.457641	
0.009	
745	
2.589401	
0.011	
735	
2.843413	
0.008	
730	
2.416609	
0.009	
707	
2.522498	
0.01	
745	
2.729468	

0.011	VH
740	Ts
2.853068	
0.008	VH
772	Ts
2.485155	
0.011	
750	
2.872281	
0.01	
745	
2.729468	
0.009	
750	
2.598076	
0.006	
730	
2.092844	
0.006	
710	
2.063976	
0.007	
820	
2.395829	
0.009	
825	
2.724885	

2.497868	K_a
0.838	C_p
6.080160	V_o
1.17	A_s
426.827220	Q_o
530	T_{std}
737	T_s
30.20	P_{sn}
290.595619	Q_{os}
737	T_s
530	T_{std}
30.2	P_{sn}
60	T
0.00136	A_n
5.901740	V_n
97.065537	I
171.3	P_t
0.130068	C_o
1.0	N
1.560816	C
0.333993	PMRp
171.3	P_t
1.17	A_s
60	T
0.00136	A_n
0.324599	PMR_{ar}
0.329296	PMRavg
1.0	N
1.530788	C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME E.P.A. FIREPLACE DATE 20 AUGUST, 1975

PREPARED BY SWANSON APPROVED PAGE 1 OF 1

SUBJECT FIREPLACE EMISSIONS RUN #23 88-5

22.270	VOLm	0.01	VH	0.015	VH		
29.96	Pm	670	Ts	662	Ts	0.014449	Ka
530	Tstd	0.588435		3.151190			
546	Tm					0.84	Cp
		0.012	VH	0.011	VH	7.157500	Vo
21.501790	VOLstd	665	Ts	710	Ts	1.17	As
		0.824089		3.794637			
0.616	VOLw					502.462620	Qo
		0.013		0.016			
0.775000	M	660		730		530	Tstd
		0.929163		3.417601		661	Ts
0.972050	MF					29.81	Psn
28.09	Wd	0.014		0.016			
		657		735			
29.587802	Ww	3.032820		3.429285		370.000770	Qos
1.006314	Cd	0.009		0.015		661	Ts
29.81	Psn	645		720		530	Tstd
		0.409356		3.286335		29.81	Psn
1.001843	Cs					50	T
		0.011		0.009		0.00136	An
		630		695			
		0.632409		0.500999		7.016495	Vn
						98.028763	I
		0.016		0.01			
		695		695		70.3	Pt
		3.334666		2.636235		0.050163	Co
		0.017		0.01			
		685		685		0.5	N
		3.412477		0.617250		1.000912	C
		0.011		0.01			
		680		677		0.162864	PMRp
		0.734958		0.601922		70.3	Pt
						1.17	As
		0.011				50	T
		665				0.00136	An
		0.704625					
						0.150055	PMRd
		0.016					
		660				.161355	PMRd
		3.249615					
						0.5	N
						1.190724	C'

VALENTINE, FISHER & TOMLINSON
CONSULTING ENGINEERS

COMPUTER PRINT-OUT OF ATMOSPHERIC EMISSION DATA

JOB NAME EPA FIREPLACE DATE

PREPARED BY D. ALGUARD APPROVED PAGE OF

SUBJECT IMPACTOR PARTICLE SIZE RUN #24

2.416	VOLm	0.014	VH	0.014	VH		
29.792	Pm	695	Ts	665	Ts	3.001042	K_a
530	Tstd	3.119294		3.051229			
540	Tm					0.838	C_p
		0.015	VH	0.014	VH	7.353021	V_o
2.326646	VOLstd	697	Ts	657	Ts	1.17	A_s
		3.233419		3.032020			
0.0758	VOLw					516.182040	Q_o
		0.015		0.013			
3.155100	M	688		655			
		3.212475		2.918047		530	T_{std}
						667	T_s
0.968449	MF	0.014		0.012		29.79	P_{sn}
28.95	Wd	688		647			
		3.103546		2.786395		395.492810	Q_{os}
28.604516	Ww						
		0.014		0.012		667	T_s
1.006020	Cd	675		642		530	T_{std}
29.79	Psn	3.074085		2.775608		29.79	P_{sn}
						30	T
1.002179	Cs	0.014		0.011		0.0000852	A_n
		670		635			
		3.062678		2.642915		19.800665	V_n
						269.286120	I
							P_t
							C_o
							N
							C
							PMRp
							P_t
							A_s
							T
							A_n
							PMR_{ar}
							PMR_{avg}
							N
							C′

APPENDIX L

Data Sheets

This appendix contains Field Data Sheets with corresponding Moisture Determination Sheet, Laboratory Analysis and Total Particulate Sheet, and Oreat Data and Calculation Sheet for all particulate and POM samples. Field Data and Moisture Determination Sheets for the particle sizing runs are included also.

Pages are ordered by run number.

PARTICULATE SAMPLES	RUN NO.	PAGE NO.
Alder	1, 2, 3, 4	83-98
Douglas Fir	7, 8, 9, 10	106-121
Coal	12, 13	126-133
Locust	14, 15, 16, 18	134-145, 148-151
Pine	19, 20, 22 (Glass Front), 23	152-159, 163-170

IMPACTOR SAMPLES	RUN NO.	PAGE NO.
Alder	5	99-100
Locust	17	146-147
Pine	24	171-172

POM SAMPLES	RUN NO.	PAGE NO.
Alder	6	101-105
Douglas Fir	11	122-125
Pine	21	160-162

Start Up & Stable

64-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION Stack Extension
DATE 29 July
OPERATOR/S SWANSON/AAGUARD
RUN NO. 1 ALDER
SAMPLE & METER BOX NUMBERS YEL &
METER BOX ΔH 1.7897
FILTER NO. 22-5 @ TARE 423.9 mg
CLEAN-UP NO. 15 ; BLANKS &
BOX & PROBE HEATER SETTING 300 & 50

LEAK CHECK 0.016 cfm @ 23.5" Hg Vac @ 11:25

WOOD –
8 lb. 11:25
2 lb 11:35
5 lb. 11:50
8-0 10-5 177.0
3 lb – 12:00
3 lb – 12:20 → 9 lb. remaining @ 12:34

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 30.25 "Hg
AMBIENT CONDITIONS Overcast
PORT PRESSURE (P_S) 0.0 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ 30.25 "Hg
ASSUMED MOISTURE 2.0 %
C FACTOR .84
REF. ΔP .045 .045 (B-4) .09
STACK DIMENSIONS 84 x 14 5/8" AREA 1.170 F^2
PROBE NOZZLE DIA. 1/2" IN; A_N .00136 F^2
PROBE LENGTH Probe #4 5.0 FT. 2 ft IN.

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
1145	0	596.157	73	72	210	60	A-1	.011	.45	.45	1.5	180	[illegible]	.005
1147	2	597.07	76	73	225	50	A-2	.02	.92	.80	2.0	185		.005
11:49	4	598.15	78	73	225	50	A-3	.02	.82	.82	2.0	190		.005
1151	6	599.31	79	73	240	50	A-4	.02	.82	.82	2.0	205		.005
1153	8	600.11	80	74	250	50	B-1	.015	.62	.70	1.9	205		.075
1155	10	601.46	80	74	250	50	B-2	.015	.62	.62	2.0	205		.075
1157	12	602.45	81	74	240	48	B-3	.02	.82	.82	2.0	190		.075
11.59	14	603.59	85	75	225	50	B-4	.02	.82	.82	2.0	175		.005
1203	16	604.69	85	75	230	50	C-1	.01	.43	.40	2.0	200		.005
12.05	18	605.75	85	77	260	51	C-2	.015	.625	.60	2.0	200	15	.005
12.07	20	606.65	86	77	215	50	C-3	.015	.625	.62	2.0	180	1	.005
12.09	22	607.77	87	78	240	52	C-4	.02	.86	.80	2.1	175	.05	.005
1215	24	608.88	87	79	250	58	D-1	.01	.43	.47	1.5	170		.005
1217	26	609.725	89	80	230	55	D-2	.01	.43	.43	1.5	165		.005
1219	28	610.56	89	80	215	54	D-3	.015	.55	.57	2.0	160	[illegible]	[illegible]
1221	30	611.55	90	81	225	55	D-4	.015	.65	.65	2.0	160		[illegible]
1223	32	612.580	91	82	275	56	E-1	.01	.45	.48	1.5	180		[illegible]
1223	34	613.71	90	83	250	55	E-2	.01	.75	.75	1.5	160	.01	[illegible]
1230	36	614.37	91	84	250	55	E-3	.015	.69	.60	2.0	190		[illegible]
1232	38	615.27	92	84	265	55	E-4	.015	.69	.69	2.0	180		[illegible]
1234	40	616.776	92	84	270	55								
TOTAL	40	20.319	1738	1632			20			12.61 "H_2O		3600		
AVERAGE			81 °F = 541 °R						.63 "H_2O = .046 "Hg			180		

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

64-5

CLIENT EPA FIREPLACE

RUN NO. 1

LOCATION AVERAGE FIREPLACE

CleanupNO. _____

OPERATOR SWANSON/ALGUARD

DATE 7/27/75

SAMPLE BOX YEL

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)		395.7	2.5
IMPINGER (#2 W/APPROX. 100 ml WATER)		432.4	1.0
BUBBLER (#3 DRY)		341.4	.6
H_2O ABSORBED BY SILICA GEL, ml		610.4	6.1
TOTAL H_2O COLLECTED, ml			10.2
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.48348
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 7-29-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 1

EVALUATION DATE 7-29-75 CLEAN-UP SET NO. 64-5

I. EVAPORATION OF 90 (ml) OF ACETONE

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

FINAL 77406.1 (mg) - TARE 77398.8 (mg)

-BLANK ((.0057 mg/ml) (90 ml) = .5 mg) = 6.8

II. FILTER CATCH MSA 1106 BH (Media Type)

FINAL 437.7 (mg) - TARE 423.9 (mg) = 13.3

BACK-UP 183.4 mg - 177.0 mg = 6.4

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

FINAL 66283.5 (mg) - TARE 66273.2 (mg)

-BLANK (1.8 mg) = 8.5

IV. PARTICULATE FROM EVAPORATION OF 210 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 78345.7 (mg) - TARE 78331.8 (mg)

-BLANK ((.4 mg/ml) (210 ml initial

- 10.2 ml CONDENSED = 199.8 ml) = .6 mg) = 13.3

V. PARTICULATE FROM 155 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 77401.1 (mg) - TARE 77385.7 (mg)

-BLANK ((.0057 mg/ml) (155 ml) = .9 mg) = 14.5

VI. TOTAL PARTICULATE = I + II + III + IV + V = 63.3

BLANKS

ACETONE = .8 mg/ 140 ml = .0057 mg/ml FINAL 78536.6 TARE 78535.8

ETHER-CHLOROFORM = 1.8 mg.(FINAL 79207 mg - TARE 79203.7

WATER = .4 mg/ 140 ml = .00286 mg/ml. FINAL 75973.4 TARE 75973.0

VFT/AP9A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE EVAL

SAMPLING POINT LOCATION CHIMNEY OUTLET DURING VELOCITY TRAVERSE

DATE 7/28/75 RUN NO. ONE HOW COLLECTED GREEN BAG

TIME OF SAMPLE COLLECTION 2:30-3:30 7/28/75 TIME OF ANALYSIS 7:30 7/29/75

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.1	0.0	0.1	
$CO_2 + O_2$	21.0	21.0	21.0	
$CO_2 + O_2 + CO$	21.0	21.0	21.0	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.1	0	.1		.067	44/100	.029
O_2	20.9	21.0	20.9		20.67	32/100	6.614
CO	0	0	0			28/100	0
N_2 (100-Above)	79.1	79.0	79.1		79.067	28/100	22.139
						AVG. MOLECULAR WT. DRY STACK GAS	28.78

VFT/AP4B

Leak rate .02 /min

GRAB BAG #2

65-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET
IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION outside expansion
DATE 24 July 1985
OPERATOR/S [illegible]
RUN NO. 2 ALDER
SAMPLE & METER BOX NUMBERS Gru &
METER BOX ΔH 1.1807
FILTER NO. 23-5 GLASS @ TARE 4170 mg BU 12-5 1761.2mg
CLEAN-UP NO. 13 ; BLANKS &
BOX & PROBE HEATER SETTING 300 & 50

Approx. 5 lb. remaining from torch
Wood – 2" – 7 lb   4 lb. @ 16[illegible]
2[illegible] 8 lb.   4.5 @ 16[illegible]
15[illegible] – 3 lb.   6.5 @ 163[illegible]
15[illegible] – 7 lb — Remaining
15[illegible] – 3 lb — Added   8.5 lb. remaining @ 1645
15[illegible] 6 lb. — "

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 30.2[illegible] "Hg
AMBIENT CONDITIONS [illegible]
PORT PRESSURE (P_S) .01 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ 30.25 "Hg
ASSUMED MOISTURE 2 %
C FACTOR .85
REF. ΔP .12 .45 .9131 .15
STACK DIMENSIONS [illegible]; AREA 1.170 F^2
PROBE NOZZLE DIA. [illegible] IN; A_N .00136 F^2
PROBE LENGTH 3 FT. ____ IN.

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
1530	0	618.507	78	77	230	49								
1533	3	620.02	80	77	275	43	A-1	.021	.44	.45	1.1	230	[illegible]	.015
1536	6	621.59	82	78	275	43	A-2	.0215	.66	.66	2.0	240		.015
1539	9	623.007	84	78	260	44	A-3	.0215	.62	.63	2.0	230	[illegible]	.015
1542/44	12	624.445	84	79	260	44	A-4	.0125	.56	.52	1.5	210	[illegible]	.015
1547	15	625.92	87	80	250	46	B-1	.0215	.66	.60	2.0	250		.015
1551	18	627.47	89	80	260	48	B-2	.0215	.66	.66	2.0	250	[illegible]	.015
1553 38	21	629.09	91	82	280	50	B-3	.0275	.70	.70	2.0	250		.015
1557/59	24	630.315	94	83	240	52	B-4	.02	.83	.84	2.2	230		.010
1602	27	632.48	93	84	215	50	C-1	.021	.42	.45	1.5	215	[illegible]	.010
1605	30	633.69	94	86	215	50	C-2	.011	.42	.42	1.5	215	[illegible]	.010
1608	33	635.21	96	87	225	51	C-3	.015	.62	.61	2.0	207	[illegible]	.010
1611/157	36	636.745	97	87	305	50	C-4	.015	.62	.62	2.0	190		.010
1617	39	637.59	96	89	295	51	D-1	.01	.42	.42	1.5	230		.015
1620	42	639.05	99	90	250	48	D-2	.015	.62	.62	2.0	217		.010
1623	45	640.51	100	90	216	44	D-3	.015	.62	.62	2.0	215		.010
1626/31	48	642.24	99	92	250	48	D-4	.02	.84	.84	2.5	245	[illegible]	.010
1633	51	643.16	99	92	230	44	E-1	.005	.20	.20	1.0	217	[illegible]	.010
1636	54	643.92	99	93	230	42	E-2	.005	.20	.20	1.0	210	[illegible]	.010
1639	57	644.90	100	94	240	43	E-3	.005	.20	.20	1.0	210		.010
1642	60	646.049	100	94	250	43	E-4	.01	.41	.42	2.0	260		.010
TOTAL	60	27.542	1941	1792			20			10.67 "H_2O		4526		
AVERAGE			89 °F = 549 °R						.53 "H_2O = .03[illegible] "Hg			226		

$P_m = P_B + \Delta H$ = 30.29 "Hg

686 °R

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT F.M.C. FIBERBOARD — RUN NO. 2

LOCATION ALBAGH FURNACE — NO. 65-5

OPERATOR SWANSON / ALLARD — DATE 7/29/75

SAMPLE BOX GRN

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	451.0	447.5	3.5
IMPINGER (#2 W/APPROX. 100 ml WATER)	446.6	445.2	1.4
BUBBLER (#3 DRY)	327.4	~~320~~ 326.6	0.8
H_2O ABSORBED BY SILICA GEL, ml	650.2	642.5	7.7
TOTAL H_2O COLLECTED, ml			13.4
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.63516
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT E.P.A. FIREPLACE DATE OF ANALYSIS 7-29-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 2

EVALUATION DATE 7-29-75 CLEAN-UP SET NO. 65-5

I. EVAPORATION OF 145 (ml) OF ACETONE

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

FINAL 78843.2 (mg) - TARE 78825.8 (mg)

-BLANK ((.0057 mg/ml) (145 ml) = 0.8 mg) = 16.6

II. FILTER CATCH 1106 MSA (Media Type)

FINAL 419.4 (mg) - TARE 417.0 (mg) = 2.4

BACK UP - 177.5 mg - 176.2 mg = 1.3

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

FINAL 79454.9 (mg) - TARE 79445.9 (mg)

-BLANK (1.8 mg) = 7.2

IV. PARTICULATE FROM EVAPORATION OF 290 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77418.3 (mg) - TARE 77400.6 (mg)

-BLANK ((.00286 mg/ml) (290 ml initial

- 13.4 ml CONDENSED = 276.6 ml) = 0.8 mg) = 16.9

V. PARTICULATE FROM 155 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 76732.6 (mg) - TARE 76720.4 (mg)

-BLANK ((.0057 mg/ml) (155 ml) = 0.9 mg) = 11.3

VI. TOTAL PARTICULATE = I + II + III + IV + V = 55.7

BLANKS

ACETONE = .8 mg/ 140 ml = .0057 mg/ml FINAL 78536.6 TARE 78525.8

ETHER-CHLOROFORM = 1.8 mg.(FINAL 79280.7 mg - TARE 79272.7

WATER = .4 mg/ 140 ml = .00286 mg/ml. FINAL 79973.4 TARE 79973.0

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACES

SAMPLING POINT LOCATION STACK - AVERAGE FIREPLACE

DATE 7-29-75 RUN NO. TWO HOW COLLECTED GRAB BAG

TIME OF SAMPLE COLLECTION 1530 - 1642 TIME OF ANALYSIS 7/30/75 16:00

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.7	0.6	0.6	
$CO_2 + O_2$	20.8	20.7	20.7	
$CO_2 + O_2 + CO$	20.8	20.8	20.7	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.7	0.6	0.6		.633	44/100	.279
O_2	20.1	20.1	20.1		20.1	32/100	6.432
CO	0	.1	0		.033	28/100	.009
N_2 (100-Above)	79.2	79.2	79.3		79.233	28/100	22.185
						AVG. MOLECULAR WT. DRY STACK GAS	28.90

VFT/AP4B

Leak rate .001 /min

GRAB BAG # 3

66-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE

PORT LOCATION Outside Extension

DATE 29 July 1975

OPERATOR/S Schanavsei / McGuard

RUN NO. 3 - Smolder ALDER

SAMPLE & METER BOX NUMBERS RED &

METER BOX ΔH 1.4897

FILTER NO. 20-5 GLASS; TARE 433.0 mg

CLEAN-UP NO. 14; BLANKS ____ & ____

BOX & PROBE HEATER SETTING 300 & 50

8 lb. left @ 17⁰³

4 lb remaining @ 18²⁴

BU 11-5 TARE 1785 mg

Probe # 2 side B+

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 30.25 "Hg

AMBIENT CONDITIONS Cloudy

PORT PRESSURE (P_S) 0.0 "H_2O = ____ "Hg

$P_{SN} = P_B + P_S$ 30.25 "Hg

ASSUMED MOISTURE 2.0 %

C FACTOR .85

REF. ΔP .010 .0035 MIN

STACK DIMENSIONS 83" x 19¾"; AREA 1.170 F^2

PROBE NOZZLE DIA. ½" Ø IN; A_N .00136 F^2

PROBE LENGTH ____ FT. ____ IN.

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)
1703	0	646.704	96	94	245	56
1705	2	647.49	96	94	260	56
1707	4	648.11	96	94	275	56
1709	6	648.87	96	94	235	48
1711/14	8	649.765	96	94	215	48
1716	10	650.31	96	94	210	48
1718	12	651.07	96	94	275	48
1720	14	651.96	97	94	300	49
1722/23	16	652.815	97	94	220	47
1725	18	653.41	99	94	240	46
1727	20	654.13	98	94	265	46
1729	22	654.89	98	94	275	44
1731/4	24	655.69	97	94	250	51
1735	26	656.29	97	95	272	49
1740	28	656.71	97	95	300	50
1742	30	657.53	97	95	245	47
1744/48	32	658.30	97	95	220	45
1750	34	658.71	97	95	220	50
1752	36	659.56	97	95	295	50
1754	38	660.33	98	95	256	49
1756	40	661.132	98	95	260	48
TOTAL	40	14.428	2035	1982		
AVERAGE			96 °F = 556 °R			

AVERAGE VALUES READ WITHIN THE TIME INTERVAL

POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
E-1	.335	.225	.30	2.5	185	0, 0	.001
E-2	.005	.225	.20	2.0	175		.001
E-3	.0075	.35	.35	2.0	185		.001
E-4	.0075	.35	.35	2.0	180	0, 0	.001
D-1	.005	.225	.25	1.0	170		.001
D-2	.0075	.35	.35	1.5	165		.001
D-3	.01	.46	.46	1.5	160	0, 0	.001
D-4	.01	.46	.46	1.5	165		.001
C-1	.005	.225	.225	1.0	162		.001
C-2	.0075	.345	.33	1.0	155		.001
C-3	.0075	.345	.345	1.0	155		.001
C-4	.0075	.345	.345	1.0	150		.001
B-1	.005	.225	.225	1.0	141	.2, 0	.001
B-2	.005	.225	.225	1.0	141		.001
B-3	.005	.225	.225	1.0	136	.3, 0	.001
B-4	.0075	.345	.33	1.0	134		.001
A-1	.005	.24	.24	1.0	126	.3, 0	.001
A-2	.005	.24	.24	1.0	125		.005
A-3	.0075	.36	.36	1.0	123		.005
A-4	.0075	.36	.36	1.0	120		.005
TOTAL			6.17 "H_2O		3053		
AVERAGE		.31 "H_2O = .023 "Hg			153		

$P_m = P_B + \Delta H$ = 30.27 "Hg

613 °R

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACE — RUN NO. 3

LOCATION AVOCADO FIREPLACE — NO. 66-5

OPERATOR SWANSON / ALLARD — DATE 7/29/75

SAMPLE BOX EED

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	431.9	435.2	-3.3
IMPINGER (#2 W/APPROX. 100 ml WATER)	448.9	443.2	5.7
BUBBLER (#3 DRY)	365.8	364.3	1.5
H_2O ABSORBED BY SILICA GEL, ml	665.3	661.3	4.0
TOTAL H_2O COLLECTED, ml			0.37446
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			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 7-29-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 3

EVALUATION DATE 7-29-75 CLEAN-UP SET NO. 66-5

I. EVAPORATION OF 80 (ml) OF ACETONE

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

FINAL 77431.4 (mg) - TARE 77426.3 (mg)

-BLANK ((.0057 mg/ml) (80 ml) = 0.4 mg) = 4.7 mg

II. FILTER CATCH 1106 MSA (Media Type)

FINAL 448.2 (mg) - TARE 433.0 (mg) = 15.2 mg

BACK UP - 182.9 mg. - 178.5 mg. = 4.4 mg

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

FINAL 77497.4 (mg) - TARE 77494.3 (mg)

-BLANK (1.8 mg) = 1.3 mg

IV. PARTICULATE FROM EVAPORATION OF 240 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77423.6 (mg) - TARE 77420.9 (mg)

-BLANK ((.00286 mg/ml) (240 ml initial

- 4.0 ml CONDENSED = 236 ml) = 0.7 mg) = 2.0 mg

V. PARTICULATE FROM 90 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 80279.7 (mg) - TARE 80273.2 (mg)

-BLANK ((.0057 mg/ml) (90 ml) = 0.5 mg) = 6.0 mg

VI. TOTAL PARTICULATE = I + II + III + IV + V = 33.6 mg

BLANKS

ACETONE = .8 mg/ 140 ml = .0057 mg/ml FINAL 78536.6 mg TARE 78535.2 mg

ETHER-CHLOROFORM = 1.8 mg.(FINAL 79280.7 mg - TARE 79278.9 mg

WATER = .4 mg/ 140 ml = .00286 mg/ml. FINAL 76973.4 mg TARE 76973.0 mg

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION METER DISCHARGE

DATE 29 July 1975 RUN NO. THREE HOW COLLECTED GRAB BAG

TIME OF SAMPLE COLLECTION 1703-1756 TIME OF ANALYSIS 30 July 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.1	0.0	0.1	
$CO_2 + O_2$	20.7	20.7	20.6	
$CO_2 + O_2 + CO$	20.7	20.7	20.6	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.1	0.0	0.1		.067	44/100	.029
O_2	20.6	20.7	20.5		20.6	32/100	6.592
CO	0.0	0.0	0.0		0.0	28/100	0
N_2 (100-Above)	79.3	79.3	79.4		79.333	28/100	22.213
						AVG. MOLECULAR WT. DRY STACK GAS	28.83

VTL/AP4B

START UP OF FIRE — GRAB BAG NO. 4

LEAK RATE .02 @ 24"

68-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT: EPA Fire Place
PORT LOCATION: Stack extension
DATE: July 30, 1975
OPERATOR/S: Swanson / Alguard
RUN NO.: 4 — ALDER START UP
SAMPLE & METER BOX NUMBERS: GRN & 1
METER BOX ΔH: 1.4897
FILTER NO.: 24-5 @ TARE: B.U. #14-5 ~~426mg~~ mg — 180.2mg
CLEAN-UP NO. ______; BLANKS ______ & ______
BOX & PROBE HEATER SETTING ______ & ______

[illegible]
11.5 lb. @ 10:15
7.0 @ 10:22
5.0 @ 10:35
3.0 @ 10:48
5.0 @ 11:03
12.0 remaining @ completion of run

BAROMETRIC PRESSURE (P_B): 29.81 "Hg
AMBIENT CONDITIONS: Cloudy 65°
PORT PRESSURE (P_S): 0 "H_2O = 0 "Hg
$P_{SN} = P_B + P_S$: 29.81 "Hg
ASSUMED MOISTURE: 1½ %
C FACTOR: .82
REF. ΔP: [illegible] .012 .046
STACK DIMENSIONS: 8¾ × 15¼; AREA 1.170 F^2 — Probe 2, Side 1
PROBE NOZZLE DIA.: 1/2 IN; A_N .00136 F^2
PROBE LENGTH: 3 FT. ______ IN.

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)
1015	0	661.621	67	64	215	45
1017	2	662.23	67	64	250	43
1019	4	662.88	68	64	265	42
1021	6	663.75	69	65	275	42
1021/25	8	664.51	70	65	240	43
1027	10	665.29	71	65	210	43
1029	12	666.12	72	65	210	42
1031	14	667.30	74	66	235	42
1033/35	16	668.325	75	67	300	43
1037	18	668.85	75	68	290	43
1039	20	669.89	76	69	265	43
1041	22	670.61	77	70	232	45
1043/47	24	671.61	78	71	200	50
1049	26	672.23	79	72	205	48
1051	28	672.91	79	73	250	43
1053	30	673.68	80	73	280	46
1055/56	32	674.42	80	75	300	49
1058	34	674.93	81	75	290	46
1100	36	675.64	82	76	265	47
1102	38	676.34	83	77	240	47
1104	40	677.042	83	77	250	47
TOTAL	40	15.421	1586	1461		
AVERAGE			72 °F = 532 °R			

AVERAGE VALUES READ WITHIN THE TIME INTERVAL

POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	"REF" PITOT C2
A-1	.0025	.225	.225	1.0	220	.5	.001
A-2	.0075	.32	.30	1.0	230		.001
A-3	.0075	.32	.32	1.0	240		.015
A-4	.015	.61	.58	1.5	250	.5	.01
B-1	.01	.41	.41	1.2	200		.01
B-2	.01	.41	.41	1.2	230	.6	.012
B-3	.02	.82	.80	2.0	294	.5	.012
B-4	.02	.82	.82	2.1	275		.015
C-1	.0075	.3	.3	1.0	195		.015
C-2	.0075	.3	.3	1.5	290	.1	.015
C-3	.0125	.5	.5	1.5	235		.01
C-4	.015	.62	.60	2.0	235	.1	.01
D-1	.0075	.3	.3	1.2	310		.01
D-2	.005	.2	.22	1.0	250		.01
D-3	.012	.485	.480	1.5	235		.01
D-4	.0075	.3	.31	1.2	215	.5	.01
E-1	.005	.2	.2	1.2	250	.6	.01
E-2	.0075	.31	.30	1.0	230	.4	.01
E-3	.0075	.31	.31	1.2	215		.01
E-4	.0075	.31	.31	1.2	210	.5	.01
TOTAL 20			8.0 "H_2O		4744		
AVERAGE		0.4 "H_2O = .03 "Hg			237		
		$P_m = P_B + \Delta H$ = 29.84 "Hg			697 °R		

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA / [illegible] RUN NO. 4

LOCATION RUBBAGE FURNACE NO. 68-5

OPERATOR SWANSON / ACKWARD DATE 7/30/75

SAMPLE BOX GALLEY

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	431.2	428.1	3.1
IMPINGER (#2 W/APPROX. 100 ml WATER)	452.6	451.6	1.0
BUBBLER (#3 DRY)	350.2	~~434.1~~ 330.1	0.1
H_2O ABSORBED BY SILICA GEL, ml	654.7	650.2	4.5
TOTAL H_2O COLLECTED, ml			8.7
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.41238
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 7-30-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 4

EVALUATION DATE 7-30-75 CLEAN-UP SET NO. 68-5

I. EVAPORATION OF 45 (ml) OF ACETONE

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

FINAL 77124.4 (mg) - TARE 77117.6 (mg)

-BLANK ((.0057 mg/ml) (45 ml) = 0.2 mg) = 6.6 mg.

II. FILTER CATCH MSA 1106 BH (Media Type)

FINAL 439.8 (mg) - TARE 426.6 (mg) = 13.2 mg.

Back up 193.8 mg - 180.2 mg = 13.6 mg.

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

FINAL 65461.6 (mg) - TARE 65440.1 (mg)

-BLANK (1.8 mg) = 19.7 mg.

IV. PARTICULATE FROM EVAPORATION OF 210 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 76796.2 (mg) - TARE 76784.4 (mg)

-BLANK ((.00286 mg/ml) (210 ml initial

- 8.7 ml CONDENSED = 201.3 ml) = .6 mg) = 11.2 mg.

V. PARTICULATE FROM 80 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 78286.2 (mg) - TARE 78243.9 (mg)

-BLANK ((.0057 mg/ml) (80 ml) = .4 mg) = 41.9 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 106.2 mg.

BLANKS

ACETONE = .8 mg/ 140 ml = .0057 mg/ml FINAL 78536.6 mg. TARE 78537.8 mg.

ETHER-CHLOROFORM = 1.8 mg.(FINAL 79207 mg - TARE 79278.9 mg)

WATER = .4 mg/ 140 ml = .00286 mg/ml. FINAL 76973.4 mg. TARE 76[illegible]3.0 mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA. FIREPLACE

SAMPLING POINT LOCATION METER DISCHARGE

DATE JULY 30, 1975 RUN NO. 4 HOW COLLECTED GRAB BAG

TIME OF SAMPLE COLLECTION 10^15 - 11^01 TIME OF ANALYSIS JULY 31, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.7	0.5	0.6	0.7
$CO_2 + O_2$	20.6	20.6	20.6	20.6
$CO_2 + O_2 + CO$	20.6	20.6	20.6	20.6

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.7	.5	.6	.7	.625	44/100	.275
O_2	19.9	20.1	20.0	19.9	19.975	32/100	6.392
CO	0.0	0.0	0.0	0.0	0.0	28/100	0.0
N_2 (100-Above)	79.4	79.4	79.4	79.4	79.4	28/100	22.232
						AVG. MOLECULAR WT. DRY STACK GAS	28.90

IMPACTOR

67-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON
TRAVERSE SAMPLING DATA SHEET
IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION AVERAGE FIREPLACE & HOUSEHOLDER RESIDENCE
DATE 7/30/75
OPERATOR/S SWANSON, ALCORN
RUN NO. 4 PART SIZE 5 ALDER
SAMPLE & METER BOX NUMBERS ORG & 1
METER BOX ΔH 1.4897
FILTER NO. 13-5 & 16-5 ASS TARE ____ mg BLK 3-45
CLEAN-UP NO 67-5; BLANKS — & ____
BOX & PROBE HEATER SETTING 300 & 60

START WOOD 10# @ 1:05
TEST START @ 1:30
+4# 1:35
STOP 7# REGULAR &

BAROMETRIC PRESSURE (P_B) 29.81 "Hg
AMBIENT CONDITIONS CLOUDY 70°
PORT PRESSURE (P_S) 0 "H_2O = 0 "Hg
$P_{SN} = P_B + P_S$ ____ "Hg
ASSUMED MOISTURE 1½ %
C FACTOR — NOT KNOWN
REF. ΔP —
STACK DIMENSIONS 8¾ DIA; AREA 1.170 F2
PROBE NOZZLE DIA. ⅜ IN; A_N .000852 F2
PROBE LENGTH 3 FT. ____ IN.

SCHEMATIC OF TRAVERSE POINT LAYOUT

#4 5-1+
C-3 .015
.02
.02
.02
.02
.02
.02
.015
.015
.015
.015

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL						
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
1330	0	677.42	74	72	235		B3	.018	—	-03	5.0	170	
1332	2	677.67	74	72	236	56	"	.013		.04	5.0	165	
1334	4	677.9	74	72	235	56	"	.013		.04	5.0	176	
1336	6	678.13	73	72	250	56	"	.02		.04	5.0	227	
1338	8	678.37	75	73	259	55	"	.015		.04	5.0	227	
1340	10	678.6	74	72	255	55	"	.018		.04	5.0	215	
1342	12	678.82	74	73	260	54	"	.013		.04	5.0	210	
1344	14	679.03	74	73	250	54	"	.018		.04	5.0	200	
1346	16	679.25	74	74	250	54	"	.015		.03	5.0	190	
1348	18	679.48	74	71	250	54	"	.015		.04	5.0	187	
1350	20	679.70	74	74	255	54						HOSE	
TOTAL	20	2.28	812	801			1			-38 "H_2O		1967	
AVERAGE			73 °F = 533 °R							.04 "H_2O = .003 "Hg		197	

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

INFICTOC

CLIENT EPA Florence RUN NO. 5

LOCATION Florence Florence NO. 67-5

OPERATOR Johnson - Nicholas DATE 7/30/75

SAMPLE BOX Orange

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	415.0	415.3	-.3
IMPINGER (#2 W/APPROX. 100 ml WATER)	435.4	435.7	-.3
BUBBLER (#3 DRY)	334.8	334.7	0.1
H_2O ABSORBED BY SILICA GEL, ml	636.4	635.3	1.1
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			

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

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

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

VFT/AP3C

TOM - DON'T USE 130 F

GB - OUT OF INCH.

69-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION OUTSIDE EXTENSION
DATE July 30, 1975
OPERATOR/S SWANSON
RUN NO. 6 ALDER
SAMPLE & METER BOX NUMBERS 1 & No. 1
METER BOX ΔH 1.4397
FILTER NO. 69-5 & TARE 395.5 mg
CLEAN-UP NO. 695 ; BLANKS ____ & ____
BOX & PROBE HEATER SETTING 300 & 60

WOOD
2.5 lb. remaining @ 14.35
7.0 lb. @ 14.35
5.25 lb. @ 14.35
2.5 lb. @ 15.11
6.0 lb. @ 15.30
2.0 lb. @ 15.56

4 lb remaining @ 1605

Probe-1
Side-2

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 30.62 "Hg
AMBIENT CONDITIONS Partly Cloudy
PORT PRESSURE (P_S) 0 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ 30.62 "Hg
ASSUMED MOISTURE 1.5 %
C FACTOR .83
REF. ΔP .91, .44 (0-1) 43 (0-1) in (A-1)
STACK DIMENSIONS 83¾"/11; AREA 6.170 F^2
PROBE NOZZLE DIA. ½" ϕ IN; A_N .00136 F^2
PROBE LENGTH ____ FT. ____ IN.

Ref. 101 @ Pg. 83

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

AVERAGE VALUES READ WITHIN THE TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
1500	0	679.81	79	78	310	70	E-1	.015	.59	.59	3.0	215		.01
1503	3	681.25	80	78	270	65	E-2	.015	.59	.59	8.5	220		.01
1506	6	682.69	82	79	235	60	E-3	.0175	.68	.68	9.5	205		.01
1509	9	684.19	84	79	260	58	E-4	.015	.59	.60	9.0	195		.01
1512/14	12	685.725	85	80	292	60	D-1	.01	.39	.39	6.2	207		.01
1517	15	686.92	85	80	240	60	D-2	.015	.59	.59	8.5	201		.015
1520	18	688.39	87	81	275	60	D-3	.0125	.53	.52	8.0	200		.01
1523	21	689.74	89	82	290	60	D-4	.015	.64	.64	9.0	200		.01
1526/28	24	691.28	91	84	230	63	C-1	.01	.42	.43	7.0	180		.01
1531	27	692.57	92	85	265	62	C-2	.015	.64	.64	9.0	230		.01
1534	30	693.97	95	86	300	60	C-3	.027	1.12	1.0	14.0	232		.01
1537	33	695.77	91	88	300	60	C-4	.02	.85	.85	12.0	240		.01
1540/44	36	697.59	101	90	240	62	B-1	.015	.32	.35	5.5	200		.01
1547	39	698.76	100	92	265	62	B-2	.012	.53	.52	8.0	190		.01
1549	42	700.22	102	94	270	62	B-3	.015	.66	.65	10.0	222		.01
1552	45	701.62	103	94	235	60	B-4	.02	.85	.84	11.0	210		.01
1555/56	48	703.185	103	95	265	62	A-1	.01	.33	.34	1.0	230		.01
1559	51	704.62	105	97	261	61	A-2	.012	.52	.50	7.0	207		.01
1602	54	706.21	106	98	265	61	A-3	.015	.650	.62	5.0	195		.01
1605	57	707.51	107	100	228	61	A-4	.015	.65	.65	10.0	192		.01
1608	60	709.117	109	101	278	61								
TOTAL	60	29.307	1978	1841			20			12.08 "H_2O		1208		
AVERAGE			91 °F = 551 °R						0.6 "H_2O = .044 "Hg			210		

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA Fireplace — Pomona RUN NO. 6

LOCATION Average Fireplace in Sampling Extension NO. 69-5

OPERATOR Simpson-Allard DATE Dec 3 1975

SAMPLE BOX Train

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)		Absorber	
IMPINGER (#2 W/APPROX. 100 ml WATER)	735.2		1.7
BUBBLER (#3 DRY)	342.6		.6
H_2O ABSORBED BY SILICA GEL, ml	626.6		10.1
TOTAL H_2O COLLECTED, ml			12.4
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.58776 ~~0.6076~~
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION AT STACK EXTENSION

DATE July 30, 1975 RUN NO. 6-a HOW COLLECTED GRAB BAG FROM STACK

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS Jul. 31, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	.4	.5	.6	.5
$CO_2 + O_2$	20.8	20.8	20.8	20.8
$CO_2 + O_2 + CO$	20.8	20.8	20.8	20.8

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.4	.5	.6	.5	.5	44/100	.22
O_2	20.4	20.3	20.2	20.3	20.3	32/100	6.49
CO	0.0	0.0	0.0	0.0	0.0	28/100	0
N_2 (100-Above)	79.2	79.2	79.2	79.2	79.2	28/100	22.176
						AVG. MOLECULAR WT. DRY STACK GAS	28.89

VFT/AP4B

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION METER DISCHARGE

DATE 7/30/75 RUN NO. 6 b HOW COLLECTED GRAB BAG @ Meter Outlet

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS 7/31/75

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.0	0.0	0.0	
$CO_2 + O_2$	21.0	21.0	20.8	
$CO_2 + O_2 + CO$	21.0	21.0	20.8	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0	0	0			44/100	0.0
O_2	21.0	21.0	20.8		20.933	32/100	6.699
CO	0.0	0.0	0.0		0.0	28/100	0.0
N_2 (100-Above)	79.0	79.0	79.2		79.067	28/100	22.139
						AVG. MOLECULAR WT. DRY STACK GAS	28.84

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 7-30-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 6

EVALUATION DATE 7-30-75 CLEAN-UP SET NO. 69-5

I. EVAPORATION OF 70 (ml) OF ACETONE

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

FINAL 776721 (mg) - TARE 776640 (mg)

-BLANK ((.0057 mg/ml) (70 ml) = .4 mg) = 7.7 mg.

II. FILTER CATCH _____ # ___ (Media Type & #)

FINAL 399.51 (mg) - TARE 395.5 (mg) = 4.01 mg.

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

FINAL _____ (mg) - TARE _____ (mg)

-BLANK (_____mg) = — mg.

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

FINAL _____ (mg) - TARE _____ (mg)

-BLANK ((_____ mg/ml) (_____ ml initial

- _____ml CONDENSED = _____ ml) = _____ mg) = — mg.

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

FINAL _____ (mg) - TARE _____ (mg)

-BLANK ((_____ mg/ml) (_____ml) = _____ mg) = — mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 11.71 mg.

BLANKS

ACETONE = _____ mg/_____ml = _____mg/ml FINAL _____mg. TARE _____ mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

11.71

Stable Burning

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET
IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIRE PLACE
PORT LOCATION OUTSIDE EXTENSION
DATE AUG 4 1978
OPERATOR/S SWANSON / VALENTINE
RUN NO. 7 DOUG FIR
SAMPLE & METER BOX NUMBERS BLK & No. 3
METER BOX ΔH 1.872
FILTER NO. 28-5 @ TARE 427.4 mg
CLEAN-UP NO. 22-5 ; BLANKS ____ & ____
BOX & PROBE HEATER SETTING ____ & ____

Wood
6 5/16 @ 12 23
8 16 @ 12 39
8 16 @ 13 1"

316 remaining @ 13 59

→ Back up 17-5

Probe 1 Side 2

BAROMETRIC PRESSURE (P_B) 29.61 "Hg
AMBIENT CONDITIONS Clear
PORT PRESSURE (P_S) 0 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ 29.61 "Hg
ASSUMED MOISTURE 2.5 %
C FACTOR 1.03
REF. ΔP .035 (A 4) .033 .035 (C-4) ; .033 E-4
STACK DIMENSIONS 33 1/2" ; AREA 1.170 F^2
PROBE NOZZLE DIA. 1/2" IN; A_N .00136 F^2
PROBE LENGTH 3 FT. 3 IN.

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL							Ref pt C-3 V11
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
1240	0	633.189	74	71	225	50	A-1	.075	.39	.39	1.2	165		.01
1243	3	634.23	76	71	230	49	A 2	.01	.53	.52	1.5	170		.01
1246	6	635.43	79	71	220	52	A 3	.012	.64	.62	2.0	165		.01
1249	9	636.79	82	72	280	40	A 4	.0125	.70	.70	2.2	160		.01
1252	12	638.91	81/82	72/73	295	44	B-1	.01	.56	.51	1.5	170		.015
1258	15	642.51	85	74	230	44	B 2	.0125	.70	.69	2.0	170		.015
1301	18	644.95	93	75	255	44	B 3	.015	.85	.83	2.2	160		.01
1304	21	647.48	92	76	250	44	B 4	.012	.67	.68	2.0	150		.01
1311	24	648.64	93/91	77/79	215	50	C 1	.01	.57	.57	1.5	225		.015
1314	27	695.28	94	80	290	46	C 2	.015	.85	.83	2.0	220		.015
1317	30	696.86	97	80	215	46	C 3	.02	1.15	1.10	2.0	225		.015
1321	33	698.79	101	82	280	46	C 4	.022	1.17	1.15	2.5	205		.015
1324/30	36	650.74	104/98	83/84	240	50	D 1	.01	.53	.54	1.5	175		.01
1333	39	652.23	100	85	260	48	D 2	.012	.64	.64	2.0	170		.01
1336	42	653.39	101	86	250	48	D 3	.015	.81	.81	2.0	165		.01
1339	45	655.01	102	87	220	48	D 4	.015	.81	.81	2.0	160		.01
1342/47	48	656.64	106/103	88/89	275	50	E 1	.012	.64	.64	2.0	165		.01
1350	51	658.08	104	90	245	50	E 2	.012	.64	.64	2.0	165		.01
1353	54	659.49	106	91	260	50	E 3	.015	.79	.78	2.1	160		.01
1356	57	661.12	109	91	245	50	E 4	.015	.84	.84	2.1	150		.01
1359	60	662.724	111	92	225	50								
TOTAL	60	[illegible]	[illegible]	[illegible]			20			1 "H_2O				
AVERAGE			85 °F = 545 °R						.72 "H_2O = [illegible] "Hg			174		
								Pm = P_B + ΔH = [illegible] "Hg				[illegible] °R		

VFT/AP12

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACE — RUN NO. 7

LOCATION OUTSIDE EXTENSION — NO. 72-5

OPERATOR SWANSON — DATE AUG 4 1975

SAMPLE BOX BCK

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	419.8	416.6	3.2
IMPINGER (#2 W/APPROX. 100 ml WATER)	438.2	435.8	2.4
BUBBLER (#3 DRY)	335.6	334.5	1.1
H_2O ABSORBED BY SILICA GEL, ml	675.3	666.3	9.0
TOTAL H_2O COLLECTED, ml			14.7
VOL. OF H_2O VAPOR @ 70°F, AND 1 ATM, = 0.0474 x TOTAL H_2O			0.69678
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA [illegible] DATE OF ANALYSIS 9-4-75

EVALUATION LOCATION AVERAGE EMISSIONS RUN NO. 7

EVALUATION DATE 8-3-75 CLEAN-UP SET NO. 72-5

I. EVAPORATION OF 90 (ml) OF ACETONE

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

FINAL 76957.1 (mg) - TARE 76950.6 (mg)

-BLANK ((.0057 mg/ml) (90 ml) = 0.5 mg) = 6.5 mg.

II. FILTER CATCH MSA 1106BH (Media Type)

FINAL 443.7 (mg) - TARE 427.4 (mg) = 16.3 mg.

BACK UP 189.3 mg - 179.5 mg = 8.8 mg.

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

FINAL 77569.6 (mg) - TARE 77557.3 (mg)

-BLANK (1.8 mg) = 10.5 mg.

IV. PARTICULATE FROM EVAPORATION OF 210 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77908.4 (mg) - TARE 77897.2 (mg)

-BLANK ((.00236 mg/ml) (210 ml initial

- 9.0 ml CONDENSED = 201 ml) = 0.6 mg) = 10.6 mg.

V. PARTICULATE FROM 80 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 78786.4 (mg) - TARE 78766.1 (mg)

-BLANK ((.0057 mg/ml) (80 ml) = .4 mg) = 19.8 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 72.5 mg.

BLANKS

ACETONE = .8 mg/140 ml = .0057 mg/ml FINAL 78532.0 mg. TARE 78512.2 mg.

ETHER-CHLOROFORM = 1.8 mg. (FINAL 79280.7 mg - TARE 79277.9 mg)

WATER = .4 mg/140 ml = [illegible] mg/ml. FINAL 76973.4 mg. TARE 76973.0 mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

72-5

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION EXTENSION ON STACK

DATE Aug 4, 1975 RUN NO. 7 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION $12^{29} - 13^{30}$ TIME OF ANALYSIS Aug 5, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.2	0.2	0.2	
$CO_2 + O_2$	20.6	20.6	20.7	
$CO_2 + O_2 + CO$	20.6	20.6	20.7	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.2	0.2	0.2		.2	44/100	.088
O_2	20.4	20.4	20.5		20.433	32/100	6.539
CO	0.0	0.0	0.0		0.0	28/100	0.0
N_2 (100-Above)	79.4	79.4	79.3		79.367	28/100	22.222
						AVG. MOLECULAR WT. DRY STACK GAS	28.85

Leak Rate: .02 ft³/min. @ 24" Hg.

Stable Burning Doug Fir Grab Bag from stack

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE

PORT LOCATION OUTSIDE EXTENSION

DATE 4 AUG 1975

OPERATOR/S SWANSON / VALENTINE

RUN NO. 8 Doug Fir

SAMPLE & METER BOX NUMBERS BLU & 3

METER BOX ΔH 1.842

(18-5 BVP)

FILTER NO. 29-5 @ TARE 422.4 mg

CLEAN-UP NO. 73-5; BLANKS ______ & ______

BOX & PROBE HEATER SETTING ______ & ______

Wood:
5 lb. @ 14:20
4 lb. @ 14:40
6 lb. @ 15:18
6.5 lb. @ 15:52

3 lb. remaining @ completion

Thermo # 4
Sink # 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 29.55 "Hg

AMBIENT CONDITIONS Clear

PORT PRESSURE (P_S) 0 "H_2O = ______ "Hg

$P_{SN} = P_B + P_S$ 29.55 "Hg

ASSUMED MOISTURE 2.5 %

C FACTOR 1.075

REF. ΔP .39

STACK DIMENSIONS 8¾ x 13½ AREA 1.17[illegible] F²

PROBE NOZZLE DIA. .250 IN; A_N .00[illegible] F²

PROBE LENGTH 3 FT. 0 IN.

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)
1500	0	663.025	95	90	230	60
1503	3	664.44	98	92	235	55
1506	6	665.73	99	90	245	50
1509	9	667.06	101	91	260	55
1512/16	12	668.697	104/103	92/91	260	55
1519	15	669.99	105	93	275	55
1521	18	671.58	109	97	275	50
1523	21	673.32	112	95	280	50
1526/35	24	675.22	115/111	97/99	260	65
1538	27	676.68	113	100	240	55
1541	30	678.28	115	100	250	50
1544	33	680.13	119	101	260	50
1547/55	36	681.87	120/115	102/103	280	60
1558	39	683.43	118	104	245	55
1601	42	685.22	121	105	225	55
1604	45	686.88	123	105	245	50
1607/10	48	688.74	126/123	106/107	260	60
1613	51	690.23	123	107	270	55
1616	54	691.71	124	108	270	55
1619	57	693.38	126	109	275	55
1622	60	695.084	127	109	273	55
TOTAL	60	31.059	2845	2488		
AVERAGE			107 °F = 567 °R			

AVERAGE VALUES READ WITHIN THE TIME INTERVAL

POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	Rel. Pr. C-3 VH
E-1	.012	.65	.65	1.75	175		.01
E-2	.01	.55	.55	1.5	160		.01
E-3	.01	.55	.55	1.5	160		.009
E-4	.015	.83	.82	2.0	190		.01
D-1	.01	.55	.56	1.5	160		—
D-2	.015	.83	.82	2.1	210		.01
D-3	.0175	.94	.92	2.1	190		.01
D-4	.020	1.1	1.1	2.5	190		.01
C-1	.012	.66	.66	2.0	240		.01
C-2	.015	.83	.83	2.0	230		.01
C-3	.020	1.1	1.0	2.5	185		.01
C-4	.015	.83	.84	2.0	170		.01
B-1	.015	.83	.82	2.0	235		.015
B-2	.0175	.94	.93	2.2	210		.015
B-3	.0175	.94	.94	2.1	210		.015
B-4	.022	1.2	1.1	3.0	225		.015
A-1	.01	.54	.54	1.5	200		.015
A-2	.0125	.68	.68	2.0	175		.015
A-3	.0175	.94	.93	2.2	160		.015
A-4	.015	.82	.82	2.0	150		.015
TOTAL 20			16.06 "H_2O		3822		
AVERAGE			.80 "H_2O = .059 "Hg		191		

$P_m = P_B + \Delta H$ = 29.61 "Hg

651 °R

VFT/APIE

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EP A FIREPLACE RUN NO. 8 ~~73-5~~

LOCATION OUTSIDE EXTENSION NO. _____

OPERATOR SWANSON DATE 4 AUG 75

SAMPLE BOX BLUE

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	430.7	427.1	3.6
IMPINGER (#2 W/APPROX. 100 ml WATER)	446.6	445.8	0.8
BUBBLER (#3 DRY)	337.9	337.7	0.2
H_2O ABSORBED BY SILICA GEL, ml	618.6	610.8	7.8
TOTAL H_2O COLLECTED, ml			12.4
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.59
MOISTURE IN STACK GAS, %			1.8
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-4-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 8

EVALUATION DATE 8-3-75 CLEAN-UP SET NO. 73-5

I. EVAPORATION OF 90 (ml) OF ACETONE

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

FINAL 77266.7 (mg) - TARE 77260.9 (mg)

-BLANK ((.0057 mg/ml) (90 ml) =0.5 mg) = 5.8 mg.

II. FILTER CATCH MSA 1106 B H (Media Type)

FINAL 432.8 (mg) - TARE 422.4 (mg) = 10.4 mg.

BACK UP 193.9 (mg) - 180.2 (mg) = 13.7 mg.

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

FINAL 76912.1 (mg) - TARE 76900.7 (mg)

-BLANK (1.8 mg) = 9.6 mg.

IV. PARTICULATE FROM EVAPORATION OF 240 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 79201.2 (mg) - TARE 79190.2 (mg)

-BLANK ((.00296 mg/ml) (240 ml initial

- 12.4 ml CONDENSED = ~~227.6 ml~~) =0.7 mg) = 10.3 mg.

V. PARTICULATE FROM 70 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 79665.9 (mg) - TARE 79644.8 (mg)

-BLANK ((.0057 mg/ml) (70 ml) =0.4 mg) = 20.7 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 70.5 mg.

BLANKS

ACETONE = 0.8 mg/140 ml = .0057 mg/ml FINAL 78535.6 mg. TARE 78535.8 mg.

ETHER-CHLOROFORM = 1.8 mg.(FINAL 7990.7 mg - TARE 7978.9 mg)

WATER = .4 mg/140 ml = .00285 mg/ml. FINAL 76973.4 mg. TARE 76973.6 mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

73-5

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION EXTENSION ON STACK

DATE AUG 4, 1975 RUN NO. 8 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION $14^{00} - 16^{00}$ TIME OF ANALYSIS AUG 5, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.4	0.5	0.4	
$CO_2 + O_2$	20.8	20.8	20.8	
$CO_2 + O_2 + CO$	20.8	20.8	20.8	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.4	0.5	0.4		0.433	44/100	.191
O_2	20.4	20.3	20.4		20.367	32/100	6.517
CO	0.0	0.0	0.0		0.0	28/100	
N_2 (100-Above)	79.2	79.2	79.2		79.2	28/100	22.176
						AVG. MOLECULAR WT. DRY STACK GAS	28.88

VFT/AP4B

START UP CONDITIONS WITH DOUGLAS FIR — 74-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET
IMPORTANT: FILL IN ALL BLANKS

CLIENT: EPA FIREPLACE
PORT LOCATION: OUTSIDE EXTENSION
DATE: 6 AUG 75 AMBIENT CONDITIONS: Overcast
OPERATOR/S: SWANSON/VALENTINE
RUN NO.: 9
SAMPLE & METER BOX NUMBERS: BCK & 3
METER BOX ΔH: 1.842
FILTER NO.: 32-5 (BU-22-5) @ TARE: 359.0 mg
CLEAN-UP NO.: 24.5; BLANKS ____ & ____
BOX & PROBE HEATER SETTING: 320 & 50

Wood
3½ lb. Kindling (Alder) @ 950
13½ lb. Doug Fir @ 950
2½ lb. @ 1011
2 lb. @ 1020
10 lb. @ 1027
Approx. 9 lb. remaining @ end 1103

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B): 29.42 "Hg
LEAK RATE: .02 CFM @ 25 "HG
PORT PRESSURE (P_S): 0 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$: 29.42 "Hg
ASSUMED MOISTURE: 2.0 % MAX VH ____ "H_2O
C FACTOR: 1.04
REF. ΔP: .33
STACK DIMENSIONS: 9 x 17 ½ AREA: 1.170 F²
PROBE NOZZLE DIA: ½" Ø IN; A_N: .00136 F²
PROBE LENGTH: 3' NUMBER 1 SIDE 2

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL — AVERAGE VALUES: READ WITHIN THE TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	Rel. ΔH @ Pt. C-3
952	0	695.699	61	58	225	34	A-1	.005	.23	.23	1.0	135		.01
955	3	696.430	62	58	265	32	A-2	.0075	.42	.42	1.5	250		.015
958	6	697.48	64	58	270	30	A-3	.012	.68	.68	2.0	210		.01
1001	9	698.79	68	59	240	30	A-4	.012	.68	.68	2.0	160		.005
1004/06	12	700.208	71/72	60/60	275	32	B-1	.0075	.42	.43	1.5	230		.005
1009	15	701.26	72	61	280	30	B-2	.005	.23	.30	1.0	130		.005
1012	18	702.14	73	62	230	32	B-3	.012	.68	.61	2.0	165		.01
1015	21	703.49	77	63	265	32	B-4	.016	.91	.90	2.2	210		.01
1018/21	24	705.108	78/79	65/66	265	36	C-1	.0075	.42	.43	1.5	210		.01
1024	27	706.19	90	77	245	34	C-2	.0075	.42	.42	1.5	225		.01
1027	30	707.25	92	68	240	34	C-3	.01	.56	.55	1.75	195		.01
1030	33	708.48	85	70	265	34	C-4	.0125	.71	.70	2.0	180		.01
1033/37	36	709.71	88/85	71/72	275	40	D-1	.005	.23	.23	1.0	215		.01
1040	39	710.73	85	73	220	40	D-2	.0075	.42	.41	1.2	195		.01
1043	42	711.82	87	74	290	40	D-3	.012	.68	.63	2.0	195		.01
1046	45	713.21	90	75	225	40	D-4	.01	.57	.57	2.0	175		.01
1049/51	48	714.52	92/90	77/77	240	44	E-1	.005	.23	.23	1.2	170		.01
1054	51	715.41	90	78	280	42	E-2	.005	.23	.23	1.2	165		.01
1057	54	716.25	91	79	245	44	E-3	.005	.23	.23	1.0	145		.01
1100	57	717.14	92	80	260	46	E-4	.0075	.42	.42	1.5	135		.01
1103	60	718.266	94	81	275	46								
TOTAL	60	22.567	2009	1722			20			[illegible] "H_2O		[illegible]		
AVERAGE			75 °F = 535 °R						.48 "H_2O = [illegible] "Hg			182		

$P_m = P_B + \Delta H$ = 29.76 "Hg — 642 °R

* Added Kindling to improve starting

VFT/AP17

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACES RUN NO. 9

LOCATION OUTSIDE EXTENTION NO. 74-5

OPERATOR SWANSON DATE 6 AUG 75

SAMPLE BOX BLK

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	429.1	425.9	3.3
IMPINGER (#2 W/APPROX. 100 ml WATER)	449.6	447.6	2.0
BUBBLER (#3 DRY)	335.5	334.4	1.1
H_2O ABSORBED BY SILICA GEL, ml	670.6	665.8	4.3
TOTAL H_2O COLLECTED, ml			11.2
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.53033
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-7-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 9

EVALUATION DATE 8-6-75 CLEAN-UP SET NO. 74-5

I. EVAPORATION OF 100 (ml) OF ACETONE

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

FINAL 78780.3 (mg) - TARE 78770.8 (mg)

-BLANK ((.0057 mg/ml) (100 ml) = .6 mg) = 8.9 mg.

II. FILTER CATCH MSH 1106 B4 (Media Type)

FINAL 372.0 (mg) - TARE 359.0 (mg) = 13 mg.

BACKUP - 193.5 (mg) - 175.7 (mg) = 17.8 mg.

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

FINAL 79567.5 (mg) - TARE 79557.5 (mg)

-BLANK (1.8 mg) = 8.2 mg.

IV. PARTICULATE FROM EVAPORATION OF 251 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77068.3 (mg) - TARE 77050.4 (mg)

-BLANK ((.00286 mg/ml) (251 ml initial

- 11.2 ml CONDENSED = 239.8 ml) = .7 mg) = 17.2 mg.

V. PARTICULATE FROM 105 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 78119.7 (mg) - TARE 78096.8 (mg)

-BLANK ((.0057 mg/ml) (105 ml) = .6 mg) = 22.3 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 87.4 mg.

BLANKS

ACETONE = 0.8 mg/ 140 ml = 0.0057 mg/ml FINAL 78536.6 mg. TARE 78536.8 mg.

ETHER-CHLOROFORM = 1.8 mg.(FINAL 79280.7 mg - TARE 79278.9 mg)

WATER = .4 mg/ 140 ml = .00286 mg/ml. FINAL 76973.4 mg. TARE 76973.0 mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

74-5

CLIENT E.P.A. FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG. 6, 1975 RUN NO. 9 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION 952-1103 TIME OF ANALYSIS AUG. 7, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.5	0.6	0.6	
$CO_2 + O_2$	20.9	20.8	20.8	
$CO_2 + O_2 + CO$	21.0	21.0	21.0	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.5	0.6	0.6		0.567	44/100	.249
O_2	20.4	20.2	20.2		20.267	32/100	6.485
CO	.1	.2	.2		.167	28/100	.047
N_2 (100-Above)	79.0	79.0	79.0		79.0	28/100	22.12
						AVG. MOLECULAR WT. DRY STACK GAS	28.90

STABLE BURNING DOUG. FIR

75-5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION EXTENSION
DATE 6 Aug. 75 AMBIENT CONDITIONS Partly Cloudy
OPERATOR/S SWANSON, VALENTINE
RUN NO. 10
SAMPLE & METER BOX NUMBERS PCOE & 3
METER BOX ΔH 1.842
FILTER NO. 31-5 @ TARE 3621 mg
CLEAN-UP NO. 75-5; BLANKS ___ & ___
BOX & PROBE HEATER SETTING 200 & 250

Wood
6 lb remaining @ 12:23
8 lb Doug Fir @ 12:25
7 lb. " @ 13:17
7 lb. " @ 13:45
4 lb. remaining @ 1400

BAROMETRIC PRESSURE (P_B) 29.70 "Hg
LEAK RATE .02 CFM @ 25 "HG
PORT PRESSURE (P_S) 0 "H_2O = ___ "Hg
$P_{SN} = P_B + P_S$ 29.70 "Hg
ASSUMED MOISTURE 2.0 % MAX VH ___ "H_2O
C FACTOR 1.05
REF. ΔP .037 .037 .039 .024
STACK DIMENSIONS ___ AREA ___ F2
PROBE NOZZLE DIA. .3" IN; A_N ___ F2
PROBE LENGTH 3' NUMBER 14 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL | AVERAGE VALUES READ WITHIN THE TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO2	Ref. M. @ C-3
1248	0	718.084	74	70	210	55	E-1	.01	.55	.55	1.5	210		.015
1251	3	719.79	75	70	215	50	E-2	.012	.66	.65	1.5	205		.015
1254	6	721.17	78	70	220	50	E-3	.015	.84	.84	2.0	210		.015
1257	9	722.72	81	71	230	45	E-4	.020	1.1	1.1	2.2	230		.015
1300/1304	12	724.58	82/82	71/71	250	50	D-1	.0175	.94	.92	2.0	250		.020
1307	15	726.18	86	73	250	45	D-2	.0125	.69	.70	1.5	235		.015
1310	18	727.63	88	73	255	45	D-3	.0175	.94	.94	2.0	210		.015
1313	21	729.31	91	74	260	45	D-4	.0175	.95	.95	2.0	190		.015
1316/17	24	731.03	91/91	75/75	250	55	C-1	.01	.55	.55	1.5	215		.020
1320	27	732.22	92	76	260	50	C-2	.015	.84	.84	2.0	230		.015
1323	30	733.83	95	77	250	50	C-3	.015	.84	.84	2.0	260		.015
1326	33	735.46	93	79	260	50	C-4	.02	1.0	1.0	2.2	200		.015
1329/33	36	737.23	100/96	80/80	260	55	B-1	.01	.55	.55	1.5	175		.015
1336	39	738.54	97	81	260	50	B-2	.012	.66	.66	2.0	170		.01
1339	42	739.93	99	82	265	50	B-3	.02	1.1	1.0	2.5	220		.015
1342	45	741.32	102	83	260	50	B-4	.022	1.3	1.2	2.5	205		.015
1345/48	48	743.84	106/101	84/85	265	60	A-1	.015	.82	.82	2.0	370		.02
1351	51	745.42	103	85	265	55	A-2	.022	1.02	1.0	2.1	310		.02
1354	54	747.23	105	86	275	55	A-3	.020	.94	.96	2.5	230		.015
1357	57	749.06	107	87	270	55	A-4	.020	.94	.94	2.5	245		.015
1400	60	750.725	103	88	265	55								
TOTAL	60	32.641	[illegible]	[illegible]			20			17.01 "H_2O		4595		
AVERAGE			86 °F = 546 °R						.85 "H_2O = .062 "Hg			[illegible]		

$P_m = P_B + \Delta H$ = 29.76 "Hg

690 °R

8

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACE

RUN NO. 10

LOCATION EXTENSION

NO. 75-5

OPERATOR SWANSON

DATE 6 AUG 75

SAMPLE BOX BLUE

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	448.	444.0	4.0
IMPINGER (#2 W/APPROX. 100 ml WATER)	447.8	445.1	2.7
BUBBLER (#3 DRY)	349.8	348.9	.9
H_2O ABSORBED BY SILICA GEL, ml	635.5	627.9	7.6
TOTAL H_2O COLLECTED, ml			15.2
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.72048
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-7-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 10

EVALUATION DATE 8-6-75 CLEAN-UP SET NO. 75-5

I. EVAPORATION OF 107 (ml) OF ACETONE

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

FINAL 79840.4 (mg) - TARE 79832.8 (mg)

-BLANK ((.0057 mg/ml) (107 ml) = .6 mg) = 7.6 mg.

II. FILTER CATCH MSA 1106 BH (Media Type)

FINAL 382.6 (mg) - TARE 367.1 (mg) = 15.5 mg.

BACKUP 208.7 (mg) - 181.0 (mg) = 27.7 mg.

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

FINAL 77538.3 (mg) - TARE 77523.9 (mg)

-BLANK (1.8 mg) = 12.6 mg.

IV. PARTICULATE FROM EVAPORATION OF 260 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 78606.9 (mg) - TARE 78583.8 (mg)

-BLANK ((.00286 mg/ml) (260 ml initial

- 7.6 ml CONDENSED = 252.4 ml) = .7 mg) = 22.4 mg.

V. PARTICULATE FROM 129 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 77897.6 (mg) - TARE 77868.9 (mg)

-BLANK ((.0057 mg/ml) (129 ml) = .7 mg) = 28 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 113.8 mg.

BLANKS

ACETONE = 0.8 mg/140 ml = 0.0057 mg/ml FINAL 78536.6 mg. TARE 78553.8 mg.

ETHER-CHLOROFORM = 1.8 mg.(FINAL 79280.7 mg - TARE 79278.9 mg)

WATER = 0.4 mg/140 ml = .00286 mg/ml. FINAL 76273.9 mg. TARE 76973.0 mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

75-5

CLIENT E.P.A. FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG 6, 1975 RUN NO. 10 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION 12^48 - 14^00 TIME OF ANALYSIS AUG. 7

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.4	0.3	0.4	
$CO_2 + O_2$	20.8	20.8	20.8	
$CO_2 + O_2 + CO$	21.0	21.0	21.0	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.4	0.3	0.4		0.4	44/100	.176
O_2	20.4	20.5	20.4		20.4	32/100	6.528
CO	0.2	0.2	0.2		0.2	28/100	.056
A					0.93	39.5 /n	.367
N_2 (100-Above)	79.0	79	79.0		79.0	28/100	22.12
						AVG. MOLECULAR WT. DRY STACK GAS	28.38

RUN COOLANT TEMP 130° F

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION EXTENSION
DATE 8/6/75 AMBIENT CONDITIONS
OPERATOR/S JANSON / VALENTINE
RUN NO. ~~EX~~ 11
SAMPLE & METER BOX NUMBERS 4FC & 3
METER BOX ΔH .842
FILTER NO. 605 @ TARE 320.5 mg
CLEAN-UP NO. ____; BLANKS ____ & ____
BOX & PROBE HEATER SETTING 300 & 50

416. remaining @ 1405
~~416. F~~ @ 1430
416. " @ 1448
616. " @ 1525
21[illegible] remaining @ 1602

BAROMETRIC PRESSURE (P_B) 29.67 "Hg
LEAK RATE .015 CFM @ 25 "HG
PORT PRESSURE (P_S) 0 "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ 29.70 "Hg
ASSUMED MOISTURE 2.0 % MAX VH ____ "H_2O
C FACTOR 1.1
REF. ΔP .33
STACK DIMENSIONS 23¼" x 19½" AREA 1.170 F^2
PROBE NOZZLE DIA. ½" Ø IN; A_N ____ F^2
PROBE LENGTH 3 NUMBER 1 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES: READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	Ref. ΔH @ Pt. C-3
1457	0	750.966	87	82	190	50	A-1	.01	.56	.53	6.0	205		.015
1500	3	752.21	88	82	225	48	A-2	.012	.68	.68	6.1	200		.015
1503	6	753.63	91	82	255	38	A-3	.015	.85	.85	7.5	190		.015
1506	9	755.26	94	82	270	40	A-4	.015	.35	.35	7.5	180		.010
1509/13	12	756.89	97/95	83/83	185	42	B-1	.01	.56	.56	5.5	215		.015
1516	15	758.19	96	84	225	36	B-2	.0125	.71	.70	6.5	190		.010
1519	18	759.64	97	85	260	36	B-3	.0175	.97	.97	8.0	180		.020
1522	21	761.35	104	86	215	36	B-4	.02	1.12	1.10	9.5	175		.010
1525/28	24	763.25	106/103	86/88	250	42	C-1	.0125	.71	.71	6.5	190		.010
1531	27	764.75	105	88	210	40	C-2	.015	.85	.90	7.5	180		.015
1534	30	766.34	108	89	215	38	C-3	.0175	.97	.97	8.0	180		.015
1537	33	768.09	110	90	250	38	C-4	.0175	.97	.97	8.0	175		.010
1540/43	36	769.875	112/110	92/92	255	46	D-1	.015	.86	.86	7.2	220		.010
1546	39	771.49	112	94	240	40	D-2	.015	.96	.82	7.5	205		.010
1549	42	773.13	114	95	270	40	D-3	.015	.86	.96	7.5	200		.010
1552	45	774.74	115	96	295	40	D-4	.015	.96	.96	7.5	205		.010
1555/1600	48	776.48	117/113	97/98	290	50	E-1	.010	.56	.56	5.5	205		.010
1603	51	777.29	114	99	285	44	E-2	.010	.56	.56	5.5	190		.010
1606	54	779.08	45	100	240	42	E-3	.015	.86	.86	7.5	175		.010
1609	57	780.69	117	100	250	40	E-4	.0125	.71	.71	6.5	165		.010
1612	60	782.261	119	101	245	42								
TOTAL	60	31.295	2641	2254						15.78 "H_2O		3825		
AVERAGE			118 °F = 578°R						.79 "H_2O = .06 "Hg			191		
								Pm = P_B + ΔH = 29.75 "Hg				651 °R		

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIRE PLACE

RUN NO. 11

LOCATION EXTENSION

NO. 76-5

OPERATOR SWANSON

DATE 8-6-75

SAMPLE BOX YELLOW

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)		Pom	
IMPINGER (#2 W/APPROX. 100 ml WATER)	434.2	433.8	.4
BUBBLER (#3 DRY)	342.6	341.4	1.2
H_2O ABSORBED BY SILICA GEL, ml	656.4	646.8	9.6
TOTAL H_2O COLLECTED, ml			11.2
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.531
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-7-75

EVALUATION LOCATION AVERAGE FIRE PLACE RUN NO. 11

EVALUATION DATE 8-6-75 CLEAN-UP SET NO. 76-5

I. EVAPORATION OF 106 (ml) OF ACETONE

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

FINAL 78 719.0 (mg) - TARE 78 713.1 (mg)

-BLANK ((0.0057 mg/ml) (106 ml) = 0.6 mg) = 5.3 mg.

II. FILTER CATCH MSA 1106 B4 # ___ (Media Type & #)

FINAL 375.3 (mg) - TARE 370.5 (mg) = 4.8 mg.

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

FINAL _____ (mg) - TARE _____ (mg)

-BLANK (_____mg) = ____ mg.

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

FINAL _____ (mg) - TARE _____ (mg)

-BLANK ((_____ mg/ml) (_____ ml initial

- _____ml CONDENSED = _____ ml) = _____ mg) = ____ mg.

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

FINAL _____ (mg) - TARE _____ (mg)

-BLANK ((_____ mg/ml) (_____ml) = _____ mg) = ____ mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 10.1 mg.

BLANKS

ACETONE = .8 mg/140 ml = .0057 mg/ml FINAL 78536.6 mg. TARE 78535.8 mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

76-5

CLIENT E.P.A. FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG. 6, 1975 RUN NO. 11 HOW COLLECTED INTEGRATED GRAB B

TIME OF SAMPLE COLLECTION 1457 - 1612 TIME OF ANALYSIS AUG. 7

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.6	0.5	0.5	
$CO_2 + O_2$	20.6	20.6	20.6	
$CO_2 + O_2 + CO$	20.8	20.8	20.7	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.6	0.5	0.5		0.5	44/100	.22
O_2	20.0	20.1	20.1		20.1	32/100	6.432
CO	0.2	0.2	0.1		0.2	28/100	.056
N_2 (100-Above)	78.2	78.2	78.3		78.2	28/100	21.89%
						AVG. MOLECULAR WT. DRY STACK GAS	28.60

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA Fire Duke
PORT LOCATION EXTENSION
DATE 8/6/75 AMBIENT CONDITIONS
OPERATOR/S ALGUARD/SWANSON
RUN NO. 12
SAMPLE & METER BOX NUMBERS BLUE & 3
METER BOX ΔH 1.892 @ 21.5°C
FILTER NO. 33-5 @ TARE 356.7 mg
CLEAN-UP NO. 5 ; BLANKS ____ & ____
BOX & PROBE HEATER SETTING 250° & 302

START 9# COAL
Add 2# @ 9:53
1# @ 10:09
2# @ 10:20
STOP 8# LEFT @ 10:50

BAROMETRIC PRESSURE (P_B) 30.215 "Hg
LEAK RATE .01 CFM @ 25 "HG
PORT PRESSURE (P_S) 0 "H_2O = 0 "Hg
$P_{SN} = P_B + P_S$ 30.215 "Hg
ASSUMED MOISTURE 12½ % MAX VII ____ "H_2O
C FACTOR 1.01
REF. ΔP .036
STACK DIMENSIONS 3'0" x 1'4" AREA 4.0 F²
PROBE NOZZLE DIA. ½ IN; AN .0013 F²
PROBE LENGTH 3' NUMBER 1 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

"S" Type C-3

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES: READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY GR %CO_2	
9:38	0	782.435	62	59	250		A1	.01	.5	.5	2.0	172		
	3	789.86	65	59	255	40	2	.012	0.6	0.6	2.0	170		.011
	6	784.8	66	60	240	40	3	.014	0.7	0.7	3.0	165		.01
	9	786.3	70	60	255	40	4	.013	0.66	0.66	2.5	165		.01
9:54	12	787.65	70/71	60/60	262	45	B1	.01	0.5	0.5	3.0	175		.01
9:57	15	788.69	79	62	262	45	2	.011	0.55	0.55	2.0	180		.01
	18	790.0	76	62	255	40	3	.015	0.8	0.8	3.0	180		.01
	21	791.45	80	67	265	40	4	.015	0.8	0.8	3.0	177		.012
10:00	24	792.8	84/82	65/65	270	45	C1	.01	0.5	0.5	2.0	170		.01
10:10	27	744.12	83	67	270	45	2	.01	0.5	0.5	2.2	172		
	30	795.29	84	68	267	45	3	0.013	0.7	0.7	3.0	170		
	33	796.67	88	70	270	45	4	0.014	0.74	0.74	3.0	170		
10:21	36	798.14	90/88	71/72	270	52	D1	0.01	0.5	0.5	2.2	169		.01
10:24	39	749 35	90	73	275	45	2	0.01	0.5	0.5	2.5	165		.01
27	42	800.55	92	75	275	45	3	0.014	0.74	0.74	3.1	162		.01
30	45	802.0	94/94	76/77	275	45	4	0.016	0.85	0.85	4.0	165		.01
36	48	803.6	94/94	77/77	272	50	E1	0.013	0.7	0.7	3.2	165		.011
10:31	51	805.C	96	79	270	52	2	0.013	0.7	0.7		165		.012
10:40	54	806.A	98	80	267	45	3	0.014	0.75	0.75	3.6	182		.011
10:43	57	807.9	99	80	265	45	4	0.015	0.8	0.8	4.0	177		.01
10:46	60	809.462	101	81	250	48								
TOTAL	60	27.027	2183	1722						14.85 "H_2O		3529		
AVERAGE			78 °F = 538°R						.74 "H_2O = .05 "Hg			176		
								Pm = P_B + ΔH = 30.265 "Hg				636 °R		

VFT/APTE

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACES — RUN NO. 12

LOCATION EXTENSION — NO. 77-5

OPERATOR ALGUARD — DATE 8-8-75

SAMPLE BOX BLUE

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	431.4	429.4	2.0
IMPINGER (#2 W/APPROX. 100 ml WATER)	451.0	447.6	3.4
BUBBLER (#3 DRY)	336.9	336.3	0.6
H_2O ABSORBED BY SILICA GEL, ml	632.2	626.9	5.3
TOTAL H_2O COLLECTED, ml			11.3
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.53562
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-9-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 12

EVALUATION DATE 8-8-75 CLEAN-UP SET NO. 77-5

I. EVAPORATION OF 98 (ml) OF ACETONE

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

FINAL 77043.6(mg) - TARE 77038.8 (mg)

-BLANK ((.0057mg/ml) (98 ml) = .6 mg) = 4.2 mg.

II. FILTER CATCH MSA 1106 BH (Media Type)

FINAL 404.7 (mg) - TARE 356.7 (mg) = 48 mg.

BACK-UP 182.4 (mg) 179.3 (mg) = 3.1 mg

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

FINAL 77947.1 (mg) - TARE 77944.5 (mg)

-BLANK (1.8 mg) = 0.8 mg.

IV. PARTICULATE FROM EVAPORATION OF 215 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77256.7 (mg) - TARE 77239.6 (mg)

-BLANK ((.00286 mg/ml) (215 ml initial

- 11.3 ml CONDENSED = 203.7 ml) = .6 mg) = 16.5 mg.

V. PARTICULATE FROM 130 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 77082.2 (mg) - TARE 77073.3 (mg)

-BLANK ((.0057 mg/ml) (130 ml) = .7 mg) = 8.2 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 78.8 mg.

BLANKS RUN #1

ACETONE = .8 mg/140 ml = 0.0057 mg/ml FINAL 79536.6 mg. TARE 79535.8 mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____ mg/_____ ml = _____ mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACES 77-5

SAMPLING POINT LOCATION CHIMNEY OUTLET

DATE 8/8/75 RUN NO. 12-COAL HOW COLLECTED INTEGRATED IN BAG

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS 8/11 '75

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.3	0.2	0.2	
$CO_2 + O_2$	20.9	20.8	20.8	
$CO_2 + O_2 + CO$	20.9	20.9	20.9	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.3	0.2	0.2		0.2	44/100	.088
O_2	20.7	20.6	20.6		20.6	32/100	6.592
CO	0	0	0.1		0	28/100	0
N_2 (100-Above)	79.1	79.2	79.1		79.1	28/100	22.148
						AVG. MOLECULAR WT. DRY STACK GAS	28.83

VFT/AP4B

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIRE RAKE
PORT LOCATION Honeycutt Residence
DATE 2/2/75 AMBIENT CONDITIONS Cloudy 65°
OPERATOR/S Alyward / Swanson
RUN NO. 13
SAMPLE & METER BOX NUMBERS RLK & 3
METER BOX ΔH 1.84.2
FILTER NO. 34-5 @ TARE 362.9 mg
CLEAN-UP NO. 76-5; BLANKS — & —
BOX & PROBE HEATER SETTING 250 & 300

START 10# COAL
Add 2# 11:49
2½# 12:07
1½# 12:26
FINISH 9# LEFT

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 30.215 "Hg
LEAK RATE .02 CFM @ 25 "HG
PORT PRESSURE (P_S) .00 "H_2O = .00 "Hg
$P_{SN} = P_B + P_S$ 30.22 "Hg
ASSUMED MOISTURE 1.5 % MAX VH ____ "H_2O
C FACTOR 1.1
REF. ΔP .30 .32
STACK DIMENSIONS ____ AREA ____ F^2
PROBE NOZZLE DIA. ½ IN; A_N ____ F^2
PROBE LENGTH 3 NUMBER 14 SIDE 1

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES: READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	$\sqrt{\Delta P}$ REF C 3
11:24	0	809.822	85	80	200	50	E 1	.01	0.6	0.6	2.0	165		
	3	811.1	88	80	230	50	2	.01	0.56	0.56	2.0	165		.01
	6	812.45	90	80	260	50	3	.01	0.56	0.56	2.0	160		
	9	813.73	91	80	250	50	4	.012	0.62	0.62	2.1	155		.01
11:48	12	815.12	93/92	80/80	235	50	D 1	.01	0.56	0.56	2.0	162		
	15	816.37	93	81	250	50	2	.014	0.8	0.8	2.5	175		
	18	817.93	96	82	195	50	3	.016	0.92	0.92	3.0	177		.01
	21		99	80	280	50	4	.014	0.8	0.8	2.7	180		
11:53	24	821.17	100/99	85/83	205	50	C 1	.014	0.8	0.8	2.8	170		
	27	822.75	101	84	255	48	2	.012	0.7	0.7	2.2	170		
	30	824.2	102	85	222	50	3	.015	0.84	0.84	3.0	170		
	33	825.77	104	85	250	50	4	.016	0.92	0.92	3.0	167		
	36	827.45	105/102	86/86	250	50	B 1	.015	0.85	0.85	3.0	160		
12	39	829.0	105	87	270	50	2	.013	0.75	0.75	2.5	160		.01
	42	830.6	106	88	220	50	3	.013	0.75	0.75	2.6	160		
	45	832.1	106	88	275	50	4	.015	0.85	0.85	3.0	160		
12:02	48	833.72	108/104	89/89	235	52	A 1	.014	0.8	0.8	3.0	160		
	51	835.26	107	89	260	52	2	.01	0.58	0.58	2.1	160		.01
	54	836.7	108	89	250	52	3	.014	0.8	0.8	3.0	165		
	57	838.1	109	90	255	52	4	.014	0.8	0.8	3.0	167		.01
12:11	60	839.751	110	90	255	52								
TOTAL	60	29.929	2505	2116						1.86 "H_2O		7208		
AVERAGE			92 °F = 552 °R						.143 "H_2O = .05 "Hg			165		
								Pm = P_B + ΔH = 30.26 "Hg				167 °R		

VFT/APIE

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

COAL

CLIENT EPA FIELD TEST RUN NO: 13

LOCATION HAVERHILL RESIDENCE - ALLEGHENY FIELD TEST NO. 78-5

OPERATOR RICHARD SWANSON DATE 8/8/75

SAMPLE BOX BLACK

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	435.1	433.4	1.7
IMPINGER (#2 W/APPROX. 100 ml WATER)	447.8	445.4	2.4
BUBBLER (#3 DRY)	327.0	326.7	.3
H_2O ABSORBED BY SILICA GEL, ml	607.1	602.0	5.1
TOTAL H_2O COLLECTED, ml			9.5
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.450
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT E.P.A. FIRETA ACT DATE OF ANALYSIS 8-8-75

EVALUATION LOCATION ALEXANDER FIREPLACE RUN NO. 13

EVALUATION DATE 8-8-75 CLEAN-UP SET NO. 75-5

I. EVAPORATION OF 117 (ml) OF ACETONE

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

FINAL 80146.7 (mg) - TARE 80138.9 (mg)

-BLANK ((.0057 mg/ml) (117 ml) = .7 mg) = 7.1 mg.

II. FILTER CATCH MSA 1106 BH # ___ (Media Type & #)

FINAL 378.2 (mg) - TARE 362.9 (mg) = 15.3 mg.

BACK UP 185.3 (mg) 183.1 (mg) = 2.2 mg.

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

FINAL 76573.4 (mg) - TARE 76571.0 (mg)

-BLANK (1.8 mg) = 0.6 mg.

IV. PARTICULATE FROM EVAPORATION OF 215 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77845.2 (mg) - TARE 778296 (mg)

-BLANK ((.00286 mg/ml) (215 ml initial

- 9.5 ml CONDENSED = 205.5 ml) = .6 mg) = 15 mg.

V. PARTICULATE FROM 120 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 77392.9 (mg) - TARE 77386.4 (mg)

-BLANK ((.0057 mg/ml) (120 ml) = .7 mg) = 5.8 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 46 mg.

BLANKS Run No 1.

ACETONE = _____ mg/_____ml = _____mg/ml FINAL _____ mg. TARE _____ mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACES

SAMPLING POINT LOCATION CHIMNEY OUTLET

DATE 3/9/75 RUN NO. 13-COM HOW COLLECTED INTEGRATED w/ SRS

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS 3/11/75

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.3	0.3	0.3	
$CO_2 + O_2$	20.9	20.9	20.9	
$CO_2 + O_2 + CO$	20.9	20.9	20.9	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.3	0.3	0.3		0.3	44/100	.132
O_2	20.6	20.6	20.6		20.6	32/100	6.592
CO	0	0	0		0	28/100	0
N_2 (100-Above)	79.1	79.1	79.1		79.1	28/100	22.148
						AVG. MOLECULAR WT. DRY STACK GAS	28.87

VFT/AP4B

START UP

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON
TRAVERSE SAMPLING DATA SHEET
IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION [illegible] RESIDENCE OUTSIDE EXTEN
DATE 8/[illegible] AMBIENT CONDITIONS [illegible] 70°
OPERATOR/S [illegible] & STANTON
RUN NO. 11
SAMPLE & METER BOX NUMBERS 3 & BLACK
METER BOX ΔH 1.[illegible]
FILTER NO. 36-5 @ TARE 365.9 mg
CLEAN-UP NO. 29-5; BLANKS [illegible] & [illegible]
BOX & PROBE HEATER SETTING 250 &

SMALL FL. 24-5

START 17# LOAD
ADD 11# @ 11 30
3# @ 11:50
8# @ 12.05
9# @ 12:20
FINISH 15# LEFT

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) [illegible] "Hg
LEAK RATE .01 CFM @ [illegible] "HG
PORT PRESSURE (P_S) 0 "H_2O = 0 "Hg
P_{SN} = P_B + P_S [illegible] "Hg
ASSUMED MOISTURE [illegible] % MAX VH [illegible] "H_2O
C FACTOR 1.1
REF. ΔP .03
STACK DIMENSIONS [illegible] AREA [illegible] F^2
PROBE NOZZLE DIA. 1/2 IN; A_N [illegible] F^2
PROBE LENGTH 3' NUMBER 1 SIDE 2

REF PIPE C-3C

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)
11:22	0	840.052	70	65	210	58
[illegible]	3		71	66		
[illegible]	6	841.74	71	66	210	61
[illegible]	9	842.7	73	66	240	54
11:[illegible]	12	843.6	76	68	255	60
	15	844.8	78	69	240	52
	18	846.45	81	70	270	56
	21	847.7	86	71	280	66
[illegible]	24	849.2	87	72/72	285	61
	27	850.4	87	73	255	59
	30	851.8	91	75	280	60
	33	853.4	93	76	250	66
[illegible]	36	854.45	95 [illegible]	77 [illegible]	250	[illegible]
	39	856.2	93	80	270	60
	42	857.5	96	80	245	58
	45	858.95	98	81	275	57
[illegible]	48	860.3	99 [illegible]	81 [illegible]	255	59
	51	861.7	98	84	265	59
	54	862.96	100	85	280	58
	57	864.3	[illegible]	85	250	58
	60	865.355	100	86		
TOTAL	60	25.303	2189	1826		
AVERAGE			83.3 °F = 541 °R			

AVERAGE VALUES: READ WITHIN THE TIME INTERVAL

POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
A 1	.005	.28	[illegible]	1.0	[illegible]	
2	.005	.22	.28	1.0	165	
3	.008	.45	.45	1.5	170	
4	.006	.34	.34	1.9	155	
B 1	.01	.56	.56	2.0	185	
2	.012	.69	.69	2.0	175	
3	.013	.75	.73	2.0	165	
4	.016	.92	.92	2.1	210	
C 1	.008	.45	.45	2.0	205	
2	.014	.8	.8	2.2	200	
3	.014	.8	.8	2.2	200	
4	.015	.85	.85	2.5	200	
D 1	.01	.56	.56	1.5	200	
2	.011	.62	.62	2.0	180	
3	.013	.72	.72	2.2	185	
4	.011	.56	.56	2.1	180	
E 1	.01	.56	.56	2.0	175	
2	.011	.62	.62	2.0	195	
3	.011	.62	.62	2.0	190	
4	.01	.56	.56	2.0	185	
TOTAL 20			11.99 "H_2O		3,700	
AVERAGE		0.60 "H_2O = .04 "Hg			185	

P_m = P_B + ΔH = [illegible] "Hg

[illegible] °R

.01
.008
.008
.01
.01
.012
.015
.01
.01
.01
.01
.01
.01
.01
.01

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VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA Fly-Plant RUN NO. 79-5

LOCATION Arcadia Florida CLEAN-UP NO. 79-5

OPERATOR Alcoard-Stanton DATE 8-12 75

SAMPLE BOX Black Box

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	450.9	446.1	4.8
IMPINGER (#2 W/APPROX. 100 ml WATER)	449.0	447.1	1.9
BUBBLER (#3 DRY)	349.5	348.0	1.5
H_2O ABSORBED BY SILICA GEL, ml	649.3	642.8	6.5
TOTAL H_2O COLLECTED, ml			14.7
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.69678
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-12-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 14

EVALUATION DATE 8-12-75 CLEAN-UP SET NO. 79-5

I. EVAPORATION OF 118 (ml) OF ACETONE

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

FINAL 77103.7 (mg) - TARE 77094.3 (mg)

-BLANK ((.0057 mg/ml) (118 ml) = .7 mg) = 8.7 mg.

II. FILTER CATCH MSA 1106 BH # ___ (Media Type & #)

FINAL 389.5 (mg) - TARE 365.9 (mg) = 23.6 mg.

BACK UP 190.3 (mg) - 183.9 mg = 12.4 mg

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

FINAL 779223.3 (mg) - TARE 7792080 (mg)

-BLANK (1.8 mg) = 13.5 mg.

IV. PARTICULATE FROM EVAPORATION OF 253 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 78803.4 (mg) - TARE 78783.0 (mg)

-BLANK ((.00286 mg/ml) (253 ml initial

- 14.7 ml CONDENSED = 238.3 ml) = .7 mg) = 19.7 mg.

V. PARTICULATE FROM 117 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 77789.0 (mg) - TARE 7770.7 (mg)

-BLANK ((.0057 mg/ml) (117 ml) = .7 mg) = 21.6 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 99.5 mg.

BLANKS. Run No. 1

ACETONE = ____ mg/____ml = ____mg/ml FINAL ____mg. TARE ____mg.

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

WATER = ____mg/____ml = ____mg/ml. FINAL ____mg. TARE ____mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT E.P.A. FURNACE - LOCUST WOOD

SAMPLING POINT LOCATION HOMEVCHURC - EES

DATE 8/12/75 RUN NO. 14 HOW COLLECTED [illegible]

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS [illegible]

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.4	0.3	0.4	
$CO_2 + O_2$	20.8	20.8	20.9	
$CO_2 + O_2 + CO$	20.8	20.8	21.0	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.4	0.3	0.4		0.4	44/100	.176
O_2	20.4	20.5	20.5		20.5	32/100	6.56
CO	0	0	0.1		0	28/100	0
N_2 (100-Above)	79.2	79.2	79.0		79.1	28/100	22.148
						AVG. MOLECULAR WT. DRY STACK GAS	28.38

VFT/AP4B

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT E.P.A. TIMBERLAKE

PORT LOCATION LONGVIEW/KELSO RDS.

DATE 8/12/75 AMBIENT CONDITIONS CLEAR 75°

OPERATOR/S ACCARDO & STANTON

RUN NO. 15

SAMPLE & METER BOX NUMBERS Blue & 3

METER BOX ΔH 1.842 Bu-23-5

FILTER NO. 35-5 @ TARE 352.1 mg

CLEAN-UP NO. ____; BLANKS ____ & ____

BOX & PROBE HEATER SETTING 250° & 300°

Locust

START 15#

ADD 11# @ 9:51

ADD 4# @ 10:05

FINISH 9# LEFT

BAROMETRIC PRESSURE (P_B) 29.[illegible] "Hg

LEAK RATE .01 CFM @ 25 "HG

PORT PRESSURE (P_S) 0 "H_2O = ____ "Hg

$P_{SN} = P_B + P_S$ 29.[illegible] "Hg

ASSUMED MOISTURE 11½ % MAX VH ____ "H_2O

C FACTOR 1.11

REF. ΔP .051 .054

STACK DIMENSIONS 8'-10¼" AREA 1.170 F^2

PROBE NOZZLE DIA. ½ IN; A_N = .00136 F^2

PROBE LENGTH 3' NUMBER 14 SIDE 1

SCHEMATIC OF TRAVERSE POINT LAYOUT

"ΔP" REF. C-3

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES: READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
13.201	0	865.737	90	85	207									
	3	867.1	92	85	220	45	E1	.01	.6	.6	3.1	250	.5	.02
	6	868.5	94	84	235	45	2	.012	.66	.66	2.1	230		
	9	869.73	95	84	245	45	3	.01	.54	.54	2.0	210		.014
	12	871.75	96/95	85/85	255	55	4	.01	.54	.54	2.0	210		.015
	15	872.9	98	85	260	54	D1	.011	.6	.6	2.0	195	.25	.012
	18	873.8	100	86	270	50	2	.013	.7	.7	2.2	200		.01
	21	875.3	101	86	270	50	3	.014	.75	.75	2.5	195		.01
	24	876.915	104/100	88/87	278	50	4	.016	.85	.85	2.6	175	.5	.01
	27	878.57	103	88	285	50	C1	.015	.7	.7	2.4	190		
	30	880.1	105	89	285	50	2	.013	.7	.7	2.5	185	.5	.01
	33	881.5	101	89	287	49	3	.016	.87	.87	2.8	195		
	36	883.2	101/101	90/90	295	51	4	.017	.92	.92	3.0	200		
	39	884.9	108	91	290	54	B1	.015	.81	.81	3.0	170		.01
	42	886.5	107	90	295	52	2	.015	.81	.81	3.0	175		01
	45	888.1	109	92	295	53	3	.015	.81	.81	2.8	180		.011
	48	889.69	110/108	92/93	295	60	4	.015	.81	.81	2.8	175		.012
	51	891.25	110	93	297	54	A1	.015	.81	.81	2.5	175		.013
	54	892.3	111	94	293	55	2	.015	.81	.81	3.0	190		.012
	57	893.9	112	95	295	54	3	.016	.85	.85	3.0	195		.013
	60	896.068	114	95			4	.015	.81	.81	3.0	205		.012
TOTAL	60	82.331	2,8[illegible]	[illegible]						[illegible] "H_2O		39[illegible]		
AVERAGE			9[illegible] °F = 4[illegible] °R						.75 "H_2O = .06 "Hg			[illegible]		
								Pm = P_B + ΔH = 29.74 "Hg				6[illegible] °R		

VFT/APLE

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA Florence — RUN NO. 15

LOCATION Honeywell Florence — NO. 80-5

OPERATOR Richard Simon — DATE 8/12/75

SAMPLE BOX Blue

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	437.1	432.9	4.2
IMPINGER (#2 W/APPROX. 100 ml WATER)	451.9	450.06	1.84
BUBBLER (#3 DRY)	336.9	336.8	.1
H_2O ABSORBED BY SILICA GEL, ml	641.4	632.2	8.2
TOTAL H_2O COLLECTED, ml			14.34
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.6797
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-12-75

EVALUATION LOCATION AIRPLACE FIREPLACE RUN NO. 15

EVALUATION DATE 8-12-75 CLEAN-UP SET NO. 20-5

I. EVAPORATION OF 115 (ml) OF ACETONE

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

FINAL 77282.2 (mg) - TARE 77278.0 (mg)

-BLANK ((.0057 mg/ml) (115 ml) = .7 mg) = 3.5 mg.

II. FILTER CATCH 1954 1105 54 # ___ (Media Type & #)

FINAL 376.6 (mg) - TARE 355.1 (mg) = 20.5 mg.

BACK-UP 198.2 (mg) 182.6 mg) = 15.6 mg.

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

FINAL 790329 (mg) - TARE 790128 (mg)

-BLANK (1.8 mg) = 18.3 mg.

IV. PARTICULATE FROM EVAPORATION OF 250 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 76800.7 (mg) - TARE 76780.7 (mg)

-BLANK ((.00286 mg/ml) (250 ml initial

- 14.34 ml CONDENSED = 235.66 ml) = 0.7 mg) = 19.3 mg.

V. PARTICULATE FROM 115 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 78755.2 (mg) - TARE 78748.1 (mg)

-BLANK ((.0057 mg/ml) (115 ml) = 0.6 mg) = 16.5 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 93.7 mg.

BLANKS. Run No 1.

ACETONE = ____ mg/____ml = ____mg/ml FINAL ____mg. TARE ____mg.

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

WATER = ____mg/____ml = ____mg/ml. FINAL ____ mg. TARE ____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA Engineering - Scott Paper

SAMPLING POINT LOCATION Primary Inc. - Secondary Recovery

DATE 3/12/75 RUN NO. 15 HOW COLLECTED Integrated Bag

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS 3/13/75 2:24PM

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.2	0.3	0.4	0.4
$CO_2 + O_2$	20.8	20.9	21.0	20.9
$CO_2 + O_2 + CO$	20.8	20.9	21.0	20.9
	1.10			

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2		0.3	0.4	0.4	0.4	44/100	.176
O_2		20.6	20.6	20.5	20.6	32/100	6.592
CO		0	0	0	0	28/100	
N_2 (100-Above)		79.1	79	79.1	79.1	28/100	22.148
						AVG. MOLECULAR WT. DRY STACK GAS	28.92

VFT/AP4B

81-5

START-UP - STABLE

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA
PORT LOCATION HAYDENBURGH GAS
DATE 8/13/75 AMBIENT CONDITIONS CLEAR 70°
OPERATOR/S ALGUARD & STANTON
RUN NO. 16
SAMPLE & METER BOX NUMBERS BLUE & 3
METER BOX ΔH 1.892
FILTER NO. 81-5 @ TARE _____ mg
CLEAN-UP NO. 81-5; BLANKS _____ & _____
BOX & PROBE HEATER SETTING 250 & 307

START 0000: 18#
ADD @ 10:40 5#
ADD @ 11:02 8#
FINISH 17# LEFT
R.O. 26.5

BAROMETRIC PRESSURE (P_B) 29.70 "Hg
LEAK RATE .02 CFM @ 25 "HG
PORT PRESSURE (P_S) 0 "H_2O - _____ "Hg
$P_{SN} = P_B + P_S$ _____ "Hg
ASSUMED MOISTURE 1 % MAX VH _____ "H_2O
C FACTOR 1.1
REF. ΔP .034 .032
STACK DIMENSIONS _____ AREA _____ F^2
PROBE NOZZLE DIA. 1/2 IN; AN _____ F^2
PROBE LENGTH 3' NUMBER 14 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES: READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	REF N. "P" TYPE PITOT C-3
1027	0	896.312	64	62	192	66	A 1	.008	42	42	1.2	174		.011
	3	897.35	66	62	218	53	2	.01	.54	.54	2.0	188		.01
	6	898.5	69	64	224	50	3	.012	.65	.65	2.0	178		.012
	9	899.8	72	63	235	49	4	.011	.6	.6	2.0	169		.011
1044	12	901.1	74/78	63/64	240	54	B 1	.007	.38	.38	1.5	155		.011
	15	901.8	75	65	245	51	2	.013	.7	.7	2.0	190		.011
	18	903.15	78	65	240	50	3	.015	.83	.83	2.0	180		.011
	21	904.55	83	67	240	50	4	.014	.78	.78	2.2	178		
1059	24	906.07	84/86	68/69	246	58	C 1	.008	.45	.45	1.4	176		
	27	907.2	85	70	250	52	2	.011	.61	.61	2.0	178		
	30		85	71	249	51	3	.013	.72	.72	2.0	172		
	33	909.9	89	72	248	50	4	.014	.8	.8	2.1	180		
	36	911.4	91/88	64/74	250	61	D 1	.006	.33	.33	1.2	170		.011
	39	912.3	90	75	255	55	2	.01	.55	.55	1.5	189		.01
	42	913.5	91	76	250	53	3	.012	.66	.66	2.0	184		.01
	45	914.9	93	78	257	53	4	.012	.66	.66	2.0	190		.01
1134/1102	48	916.25	96/92	71/80	260	64	E 1	.007	.39	.39	1.2	185		.01
	51	917.3	93	80	260	58	2	.009	.5	.5	1.8	180		.01
	54	918.4	97	81	260	57	3	.009	.5	.5	1.7	170		.011
	57	919.6	96	82	261	57	4	.012	.67	.67	2.0	173		
	60	920.830	91	80										
TOTAL	60	21.538	2018	1771			20			11.72 "H_2O				
AVERAGE			71 °F = 531 °R						.59 "H_2O = .04 "Hg			180		
								Pm = P_B + ΔH = 29.74 "Hg				640 °R		

VALENTINE, FISHER & TOMLIN
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT E.P.A. RUN NO. 1

LOCATION HAMMERSCHURCH RES NO. 81-5

OPERATOR ALLRED / STANTON DATE 2-[illegible]-[illegible]

SAMPLE BOX BLUE

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	436.5	430.9	5.6
IMPINGER (#2 W/APPROX. 100 ml WATER)	485	473.1	1.4
BUBBLER (#3 DRY)	336.8	335.9	0.9
H_2O ABSORBED BY SILICA GEL, ml	576.9	571.1	5.8
TOTAL H_2O COLLECTED, ml			13.7
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.649
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)

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VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIPEDLA 5 DATE OF ANALYSIS 9-14-75

EVALUATION LOCATION AVCO - [illegible] RUN NO. 16

EVALUATION DATE 8-13-75 CLEAN-UP SET NO. 81-5

I. EVAPORATION OF 112 (ml) OF ACETONE

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

FINAL 77702.3 (mg) - TARE 77695.4 (mg)

-BLANK ((.0057 mg/ml) (112 ml) = .6 mg) = 6.3 mg.

II. FILTER CATCH MSA 1106 BH # ___ (Media Type & #)

FINAL 358.6 (mg) - TARE 351.8 (mg) = 6.8 * mg.

BACK UP 201.7 mg - 170.6 mg = 25.1 * mg

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

FINAL 798789 (mg) - TARE 798396 (mg)

-BLANK (1.8 mg) = 2.5 mg.

IV. PARTICULATE FROM EVAPORATION OF 290 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 79036 (mg) - TARE 79090.7 (mg)

-BLANK ((.00286 mg/ml) (290 ml initial

- 13.7 ml CONDENSED = 276.3 ml) = .8 mg) = 12.1 mg.

V. PARTICULATE FROM 126 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 77161.2 (mg) - TARE 77149.9 (mg)

-BLANK ((.0057 mg/ml) (126 ml) = .7 mg) = 10.6 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 69.4 mg.

BLANKS - Run 15 1.

ACETONE = _____ mg/_____ml = _____mg/ml FINAL _____mg. TARE _____ mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

* FRONT FILTER LEAKED
BACK-UP FILTER CAUGHT THE LEAKAGE

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT E.P.A. FIRE PLACE

SAMPLING POINT LOCATION CHIMNEY EXPANSION

DATE 8/13/75 RUN NO. 16 HOW COLLECTED GRAB BAG

TIME OF SAMPLE COLLECTION 10:27-11:39 TIME OF ANALYSIS 8/14/75

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	.6	.6	.5	
$CO_2 + O_2$	20.8	21.0	20.9	
$CO_2 + O_2 + CO$	20.8	21.0	20.9	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.6	.6	.5		.567	44/100	.249
O_2	20.2	20.9	20.9		20.33	32/100	6.506
CO	0	0	0		0	28/100	0
N_2 (100-Above)	79.2	79	79.1		79.1	28/100	22148
							28.90

AVG. MOLECULAR

WT. DRY STACK GAS

VFT/AP42

02-3

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

START 16"

FINS 90 LEFT

CLIENT EPA EMERGENCY
PORT LOCATION HONEYCOMB CO BASE LINE EXTENSION
DATE 2-13-75 AMBIENT CONDITIONS CLEAR 75°
OPERATOR/S ACCARD & STANTON
RUN NO. 17
SAMPLE & METER BOX NUMBERS CKC & _____
METER BOX ΔH 1.842
FILTER NO. 225 SAME @ TARE 1801.1 mg
CLEAN-UP NO. _____; BLANKS _____ & _____
BOX & PROBE HEATER SETTING 250° & 30%

BAROMETRIC PRESSURE (P_B) 29.72 "Hg
LEAK RATE .02 CFM @ 24.5" "HG
PORT PRESSURE (P_S) 0 "H_2O = _____ "Hg
$P_{SN} = P_B + P_S$ 29.72 "Hg
ASSUMED MOISTURE 1 % MAX VH _____ "H_2O
C FACTOR _____
REF. ΔP _____
STACK DIMENSIONS 54"ø AREA 1.770 F^2
PROBE NOZZLE DIA. 1/2 IN; A_N _____ F^2
PROBE LENGTH 3' NUMBER 1 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES: READ WITHIN THE TIME INTERVAL						
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
13:43	0	921.526	78	75	255		C-3	.02		.05	5.0	225	
	2½		78	76	261	72	"	.018		.05	5.0	225	
	5	922.05	78	75	255	60	"	.016		.05	5.0	220	
	7½	922.27	79	76	230	61	"	.018		.05	5.0	210	
	10	922.501	80	76	230	60	"	.016		.045	5.0	200	
	12½	922.74	80	76	235	58	"	.015		.045	5.0	185	
	15	922.98	81	77	245	60	"	.015		.05	5.0	190	
	17½	923.185	81	78	250	61	"	.013		.05	5.0	180	
	20	923.425	82	74	260	60	"	.015		.05	5.0	181	
	22½	923.66	83	80	270	59	"	.014		.04	5.0	180	
	25	923.881	84	80	260	58	"	.015		.045	5.0	175	
	27½	924.105	84	82	265	57	"	.015		.04	5.0	177	
	30	924.323	85	84	265	58							
TOTAL	30	.797	1003	1002			1			.665 "H_2O		2253	
AVERAGE			19 °F = 539 °R						.05 "H_2O = .003 "Hg			180	
								Pm = P_B + ΔH = 29.723 "Hg				656 °R	

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT E.P.A. RUN NO. 17

LOCATION HONEYCHURCH CES NO. 82-5

OPERATOR ASSUED / STANTON DATE 5-13-75

SAMPLE BOX ORANGE

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	412.9	413.1	−0.2
IMPINGER (#2 W/APPROX. 100 ml WATER)	442.3	442.4	−0.1
BUBBLER (#3 DRY)	341.5	341.1	0.4
H_2O ABSORBED BY SILICA GEL, ml	619.8	593.8	26
TOTAL H_2O COLLECTED, ml			26.1
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			1.237
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)

VFT/AP3C

83-5   116 5

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

CLIENT EPA FIREPLACE
PORT LOCATION HONEYCHURCH RES.
DATE 8/13/7? AMBIENT CONDITIONS 80°
OPERATOR/S ALGUARD & STANTON
RUN NO. 18
SAMPLE & METER BOX NUMBERS BLL & 3MB
METER BOX ΔH 1.842
FILTER NO. [illegible] @ TARE 351.6 mg   B.C. 1739.5 / 1751.6 mg
CLEAN-UP NO. ____; BLANKS ____ & ____
BOX & PROBE HEATER SETTING 250° & 30%

TRAVERSE SAMPLING DATA SHEET
IMPORTANT: FILL IN ALL BLANKS

START LOCUST 16# / ADD @ 11 / ADD @ / LEFT 12#

A B C D E

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 29.70 "Hg
LEAK RATE .02 CFM @ 26 "HG
PORT PRESSURE (P_S) ____ "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ ____ "Hg
ASSUMED MOISTURE 1 % MAX VH ____ "H_2O
C FACTOR [redacted] 1.1
REF. ΔP .032
STACK DIMENSIONS ____ AREA ____ F^2
PROBE NOZZLE DIA. ____ IN; A_N ____ F^2
PROBE LENGTH 3' NUMBER 1 SIDE 1

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	
2:58	0	924.56	86	82	240	63								
3:01	3	925.59	88	82	220	60	A 1	.005	.32	.32	1.5	180		.0013
3:04	6	926.94	92	82	240	60	2	.014	.80	.80	3.0	190		.016
3:07	9	928.53	94	83	210	60	3	.015	.87	.87	3.2	190		.017
3/0 3:15	12	930.13	94/96	83/84	230	60	4	.015	.87	.87	3.2	200		.012
3:18	15	931.65	99	85	220	60	B 1	.013	.76	.76	3.0	170		
3:21	18	933.25	102	86	200	60	2	.014	.82	.82	3.5	125		
3:24	24	934.85	106	89	240	60	3	.017	.95	.95	3.5	200		
27/3:28	24	936.44	104/107	89/88	260	60	4	.019	1.1	1.1	3.9	202		
3:31	27	938.15	108	89	270	58	C 1	.014	.80	.80	3.1	202		
3:34	30	939.78	112	91	250	58	2	.015	.87	.87	3.3	200		
3:37	33	941.63	114	92	215	59	3	.018	1.02	1.02	4.1	200		
3:42	36	943.61	114/112	92/94	220	59	4	.020	1.17	1.17	4.5	205		
3:45	39	945.60	118	95	230	59	D 1	.02	1.17	1.17	4.5	200		.01
[illegible]	42	947.54	121	96	240	58	2	.019	1.1	1.1	4.1	200		.009
3:51	45	949.53	122	98	255	59	3	.021	1.21	1.21	4.2	198		.010
4:05	48	951.57	116 122	101/98	265	60	4	.021	1.21	1.21	4.2	185		.010
4:08	51	953.18	118	102	240	60	E 1	.015	.78	.78	4.3	195		.011
4:11	54	954.99	119	106	220	60	2	.017	.95	.95	4.5	205		.010
4:14	57	956.58	121	103	250	60	3	.015	.87	.87	4.2	198		
4:17	60	958.240	122	103	280	60	4	.016	.93	.93	4.4	200		
TOTAL	60	33.73	2709	2289			20			18.6 "H_2O		[illegible]		
AVERAGE			100 °F = 560 °R						.93 "H_2O = .07 "Hg			195		

$P_m = P_B + \Delta H$ = 29.77 "Hg   655 °R

93.8 cs / 93.1 cs

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VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA

RUN NO. 18

LOCATION HONEY CHURCH VES.

NO. 83-5

OPERATOR ALGIARD STANTON

DATE AUG. 13 1975

SAMPLE BOX BLK

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	449.2	445.2	4.0
IMPINGER (#2 W/APPROX. 100 ml WATER)	451.7	447.4	2.3
BUBBLER (#3 DRY)	350.0	348.9	1.1
H_2O ABSORBED BY SILICA GEL, ml	643.2	634.0	9.2
TOTAL H_2O COLLECTED, ml			16.6
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.78684
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)

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA RIPPLEMERE DATE OF ANALYSIS 8-19-75

EVALUATION LOCATION [illegible] RUN NO. 18

EVALUATION DATE 8-13-75 CLEAN-UP SET NO. 83-5

I. EVAPORATION OF 77 (ml) OF ACETONE

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

FINAL 79781.1 (mg) - TARE 79775.3 (mg)

-BLANK ((.0057 mg/ml) (77 ml) = .4 mg) = 5.4 mg.

II. FILTER CATCH GELMAN 1102 37 # ___ (Media Type & #)

FINAL 337.0 (mg) - TARE 351.6 (mg) = 35.4 mg.

BACK UP 182.7 mg - 175.6 mg = 7.1 mg.

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

FINAL 79386.6 (mg) - TARE 79372.2 (mg)

-BLANK (1.8 mg) = 13.6 mg.

IV. PARTICULATE FROM EVAPORATION OF 325 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 76730.5 (mg) - TARE 76711.7 (mg)

-BLANK ((.00286 mg/ml) (325 ml initial

- 16.6 ml CONDENSED = 308.4 ml) = .9 mg) = 17.9 mg.

V. PARTICULATE FROM 140 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 79223.2 (mg) - TARE 79202.3 (mg)

-BLANK ((.0057 mg/ml) (140 ml) = .8 mg) = 20.1 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 92.5 mg.

BLANKS. Run #1

ACETONE = ___ mg/___ml = ___mg/ml FINAL ___mg. TARE ___mg.

ETHER-CHLOROFORM = ___ mg.(FINAL ___ mg - TARE ___ mg)

WATER = ___mg/___ml = ___mg/ml. FINAL ___mg. TARE ___mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT E.P.A. FIREPLACE

SAMPLING POINT LOCATION AVERAGE FIREBRICK

DATE 8/13/75 RUN NO. 18 HOW COLLECTED GRAB BAG

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS 8/14/75

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	.4	.4	0.8	
$CO_2 + O_2$	20.6	20.6	20.6	
$CO_2 + O_2 + CO$	20.6	20.7	20.7	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.4	0.4	0.3		0.4	44/100	0.176
O_2	20.2	20.2	20.3		20.2	32/100	6.464
CO	0	0.1	0.1		0.1	28/100	0.028
N_2 (100-Above)	79.4	79.3	79.3		79.3	28/100	22.204
						AVG. MOLECULAR WT. DRY STACK GAS	28.87

VFT/AP42

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FIREPLACE
PORT LOCATION Honeychurch Res.
DATE 8-19-75 AMBIENT CONDITIONS 65° cloudy
OPERATOR/S Allard / Swanson
RUN NO. 19
SAMPLE & METER BOX NUMBERS BLK & 3
METER BOX ΔH 1.642
FILTER NO. 40-5 @ TARE 368.1 mg B.U.# 28-5 176.4 mg
CLEAN-UP NO. ____; BLANKS ____ & ____
BOX & PROBE HEATER SETTING ____ & ____

START	22#	PINE
ADD	4½#	11:52
	6½#	12:03
	5#	12:19
	4#	12:41
FINISH	14#	

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) 29.3[illegible] "Hg
LEAK RATE [illegible] CFM @ [illegible] "HG
PORT PRESSURE (P_S) ____ "H_2O = ____ "Hg
$P_{SN} = P_B + P_S$ [illegible] "Hg
ASSUMED MOISTURE 3 % MAX VH ____ "H_2O
C FACTOR 1.01
REF. ΔP .38 .41 .39 .3[illegible]
STACK DIMENSIONS [illegible] AREA [illegible] F^2
PROBE NOZZLE DIA. ½ IN; A_N [illegible] F^2
PROBE LENGTH [illegible] NUMBER 1 SIDE 1

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL / AVERAGE VALUES: READ WITHIN THE TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO2	
11:45	0	958.722	64	62	290	45	A 1	.006	.28	.28	1.6	245		.03
[illegible]	3	959.65	66	62	260	42	2	.006	.28	.28	1.7	217		.02
[illegible]	6		69	62	220	42	3	.006	.28	.28	[illegible]	210		.02
[illegible]	9	962.[illegible]	72	62	217	40	4	.00[illegible]	.28	.28	[illegible]	215		.02
[illegible]	12	963.61	75½	63½	255	42	B 1	.011	.52	.52	[illegible]	[illegible]		.018
[illegible]	15	964.77	75	64	230	42	2	.021	1.1	1.1	4.0	260		.02
[illegible]	18	966.31	81	65	260	40	3	.023	1.3	1.3	5.0	285		.02
[illegible]	21	968.31	85/86	66/66	215	40	4	.025	1.3	1.3	5.0	270		.018
[illegible]	24		87/86	67/66	270	40	C 1	.013	.64	.64	3.0	257		.016
[illegible]	27	971.52	88	68	240	40	2	.015	.7	.7	[illegible]	330		.015
[illegible]	30	972.90	90	70	270	40	3	.022	1.01	1.01	4.2	335		.01
[illegible]	33	974.61	94	71	240	40	4	.021	1.0	1.0	4.0	320		.02
[illegible]	36	976.2[illegible]	94/93	73/73	235	40	D 1	.016	.76	.76	3.[illegible]	260		.018
[illegible]	39	977.12	95	75	215	40	2	.016	.76	.76	3.7	245		.017
[illegible]	42	979.2	96	76	260	40	3	.017	.8	.8	4.0	2[illegible]		.017
[illegible]	45	980.0[illegible]	98	77	255	40	4	.016	.8	.8	[illegible]	2[illegible]		.016
[illegible]	48	982.17[illegible]	99/96	78/79	280	40	E 1	.008	.39	.39	8	[illegible]		.016
[illegible]	51		97	81	270	40	2	.011	.52	.52	15	245		.012
[illegible]	54	984.31	96	81	310	40	3	.01	.48	.41	17.0	235		.014
[illegible]	57	985.438	97	82	310	40	4				20.0			
12:4[illegible]	60													
TOTAL	57	[illegible]	2056	1688			20			[illegible] "H_2O		4[illegible]		
AVERAGE			78 °F = 538 °R						.76 "H_2O = .06 "Hg			2[illegible]		

$P_m = P_B + \Delta H$ = 29.[illegible] "Hg

7[illegible] °R

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA

RUN NO. 19

LOCATION AVERAGE FIREBRICK

NO. 84-5

OPERATOR ALGUARD SWANSON

DATE 8-15-75

SAMPLE BOX BLACK

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	459.3	451.5	7.8
IMPINGER (#2 W/APPROX. 100 ml WATER)	470.8	467.9	2.9
BUBBLER (#3 DRY)	318.3	318.1	.2
H_2O ABSORBED BY SILICA GEL, ml	649.5	643.2	6.3
TOTAL H_2O COLLECTED, ml			17.2
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.815
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)

C/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-20-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 19

EVALUATION DATE 8-19-75 CLEAN-UP SET NO. 84-5

I. EVAPORATION OF 160 (ml) OF ACETONE

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

FINAL 77952.0 (mg) - TARE 77935.1 (mg)

-BLANK ((.0057 mg/ml) (160 ml) = .9 mg) = 16 mg.

II. FILTER CATCH MSA 1106 211 # ___ (Media Type & #)

FINAL 407.0 (mg) - TARE 368.1 (mg) = 38.9 mg.

BACKUP 177.5 mg - 176.4 mg = 1.1 mg.

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

FINAL 76609.8 (mg) - TARE 76601.1 (mg)

-BLANK (1.8 mg) = 6.9 mg.

IV. PARTICULATE FROM EVAPORATION OF 230 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 76863.1 (mg) - TARE 76851.2 (mg)

-BLANK ((.00236 mg/ml) (230 ml initial

- 17.2 ml CONDENSED = 212.8 ml) = .6 mg) = 11.3 mg.

V. PARTICULATE FROM 139 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 79034.9 (mg) - TARE 79023.9 (mg)

-BLANK ((.0057 mg/ml) (139 ml) = .8 mg) = 10.2 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 84.4 mg.

BLANKS Run #1

ACETONE = _____ mg/_____ml = _____mg/ml FINAL _____ mg. TARE _____ mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG. 19, 1975 RUN NO. 19 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS AUG. 20, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	.02	0.2	0.3	
$CO_2 + O_2$	20.4	20.4	20.4	
$CO_2 + O_2 + CO$	20.4	20.4	20.4	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	0.2	0.2	0.3		0.233	44/100	.103
O_2	20.2	20.2	20.1		20.167	32/100	6.453
CO	0	0	0		0	28/100	0
N_2 (100-Above)	79.6	79.6	79.6		79.6	28/100	22.288
						AVG. MOLECULAR WT. DRY STACK GAS	28.84

VFT/AP43

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT [illegible]
PORT LOCATION [illegible]
DATE [illegible] AMBIENT CONDITIONS 69° cloudy
OPERATOR/S [illegible] / [illegible]
RUN NO. 20
SAMPLE & METER BOX NUMBERS Blue & 3
METER BOX ΔH 1.842
FILTER NO. 42-5 @ TARE 350.6 mg (84-29-5 @ 176.4)
CLEAN-UP NO. 85-5; BLANKS ______ & ______
BOX & PROBE HEATER SETTING 250 & 300

Start 22# fine
Add 5# 14:55
Add 6½# 15:10
Finish 11# [illegible]

BAROMETRIC PRESSURE (P_B) [illegible] "Hg
LEAK RATE .01 CFM @ 25 "HG
PORT PRESSURE (P_S) [illegible] "H_2O = ______ "Hg
$P_{SN} = P_B + P_S$ [illegible] "Hg
ASSUMED MOISTURE 2 % MAX VH ______ "H_2O
C FACTOR 1.05
REF. ΔP .056
STACK DIMENSIONS [illegible] AREA [illegible] F^2
PROBE NOZZLE DIA. ½ IN; A_N [illegible] F^2
PROBE LENGTH 5' NUMBER 17 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL | AVERAGE VALUES READ WITHIN THE TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2	VCF
14:15	0	985.603	72	69	220	54	A1	.01	.5	.5	2.3	220		.015
[illegible]	2	986.39	74	69	225	45	2	.014	.7	.7	3.1	220		.015
[illegible]	4	98[illegible].30	76	69	230	45	3	.015	.77	.77	3.2	225		.015
[illegible]	6	988.28	78	69	235	42	4	.016	.8	.8	3.2	220		.015
[illegible]	8	989.27	79/79	69/69	240	45	B1	.011	.55	.55	2.2	209		.015
[illegible]	10	990.07	80	70	245	45	2	.015	.77	.77	3.0	225		.015
[illegible]	12	991.0[illegible]	83	70	250	45	3	.02[illegible]	1.2	1.2	3.0	235		.016
[illegible]	14	992.20	85/	70/	250	45	4	.021	1.1	1.1	3.0	250		.015
[illegible]	16	993.387	81/81	71/71	252	45	C1	.01	.5	.5	2.2	217		.015
[illegible]	18	994.12	81	72	250	47	2	.011	.55	.55	2.0	217		.017
[illegible]	20	994.98	88	72	250	47	3	.015	.77	.77	2.0	220		.015
[illegible]	22	995.97	90	73	255	47	4	.015	.77	.77	2.0	212		.015
[illegible] 12	24	996.736	91/90	74/74	255	50	D1	.01	.5	.5	1.5	215		.015
14	26	997.70	92	75	255	50	2	.013	.66	.66	1.6	200		.016
16	28	998.6	93	75	255	50	3	.016	.8	.8	2.0	200		.016
18	30	999.61	95	77	257	50	4	.016	.8	.8	2.0	250		.015
[illegible] 21	32	000.622	96/95	77/78	255	52	E1	.009	.45	.45	1.5	225		.015
[illegible]	34	1.37	95	79	260	60	2	.011	.55	.55	1.5	210		.015
[illegible]	36	2.16	96	80	260	50	3	.013	.66	.66	2.0	235		.014
[illegible]	38	3.1	97	80	250	45	4	.011	.55	.55	1.6	209		.015
[illegible]	40	3.990	98	80										
TOTAL	40	19.337	2183	[illegible]			20			13.[illegible] "H_2O		4[illegible]		
AVERAGE			80 °F = 540 °R						.70 "H_2O = [illegible] "Hg			228		

$P_m = P_B + \Delta H =$ [illegible] "Hg

[illegible] °R

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACE — RUN NO. 20

LOCATION AVERAGE FIREPLACE — NO. 85.

OPERATOR ALGUACO SWANSON — DATE 8/19/75

SAMPLE BOX Blue

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	445.6	440.0	5.6
IMPINGER (#2 W/APPROX. 100 ml WATER)	444.9	443.4	1.5
BUBBLER (#3 DRY)	326.9	326.8	0.1
H_2O ABSORBED BY SILICA GEL, ml	577.5	572.9	4.6
TOTAL H_2O COLLECTED, ml			11.8
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.559
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)

V. T/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-20-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 20

EVALUATION DATE 8-19-75 CLEAN-UP SET NO. 85-5

I. EVAPORATION OF 155 (ml) OF ACETONE

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

FINAL 76884.4 (mg) - TARE 76869.6 (mg)

-BLANK ((.0057 mg/ml) (155 ml) = .9 mg) = 13.9 mg.

II. FILTER CATCH MSA 1106 BH # ___ (Media Type & #)

FINAL 361.8 (mg) - TARE 350.6 (mg) = 11.2 mg.

BACK-UP 188.4 - 176.4 = 12 mg

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

FINAL 777225 (mg) - TARE 777188 (mg)

-BLANK (1.8 mg) = 6.9 mg.

IV. PARTICULATE FROM EVAPORATION OF 230 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 792886 (mg) - TARE 79279.1 (mg)

-BLANK ((.00286 mg/ml) (230 ml initial

- 11.8 ml CONDENSED = 218.2 ml) = .6 mg) = 8.9 mg.

V. PARTICULATE FROM 139 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 766072 (mg) - TARE 76588.5 (mg)

-BLANK ((.0057 mg/ml) (139 ml) = .8 mg) = 17.9 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 70.8 mg.

BLANKS Run #1

ACETONE = _____ mg/_____ml = _____mg/ml FINAL _____mg. TARE _____mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____ mg. TARE _____ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG. 19, 1975 RUN NO. 20 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION _____ TIME OF ANALYSIS AUG, 20, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.2	0.2	0.2	
$CO_2 + O_2$	20.3	20.3	20.3	
$CO_2 + O_2 + CO$	20.3	20.3	20.3	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.2	.2	.2		.2	44/100	.088
O_2	20.1	20.1	20.1		20.1	32/100	6.432
CO	0.0	0.0	0.0		0.0	28/100	0.0
N_2 (100-Above)	77.9				77.9	28/100	21.812
						AVG. MOLECULAR WT. DRY STACK GAS	28.33

VFT/AP42

CLIENT [illegible]

PORT LOCATION [illegible] - OUTSIDE EXTENSION

DATE [illegible] AMBIENT CONDITIONS [illegible] 69°

OPERATOR/S [illegible] / [illegible]

RUN NO. 21

SAMPLE & METER BOX NUMBERS YEL & 3

METER BOX ΔH 1.[illegible]

FILTER NO. 41-5 @ TARE 353.4 mg

CLEAN-UP NO. ____; BLANKS ____ & ____

BOX & PROBE HEATER SETTING ____ & ____

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

POM

WATER TEMP 130° F

START 10# PINE

6# @ 16 28

2# @ 16 :45

2# 16 :54

3# 17 :03

10# LEFT @ FINISH

SCHEMATIC OF TRAVERSE POINT LAYOUT

BAROMETRIC PRESSURE (P_B) [illegible] "Hg

LEAK RATE .02 CFM @ [illegible] "HG

PORT PRESSURE (P_S) [illegible] "H_2O = ____ "Hg

$P_{SN} = P_B + P_S$ [illegible] "Hg

ASSUMED MOISTURE 2 % MAX VH ____ "H_2O

C FACTOR 1.0[illegible]

REF. Δ P .03[illegible] .034 .0[illegible]

STACK DIMENSIONS [illegible] AREA [illegible] F^2

PROBE NOZZLE DIA. 1/2 IN; A_N [illegible] F^2

PROBE LENGTH 3' NUMBER 14 SIDE 1

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL

CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)
16:19	0	[illegible]4.070	83	80	290	42
	2½	4.85	83	77	240	40
	5	5.8	84	77	205	40
	7½	6.82	86	77	245	40
/16:30	10	8.044	88/8[illegible]	77/77	280	40
	12½	9.05	88	78	295	40
	15	10.20	90	78	260	40
	17½	11.42	92	78	230	40
16:4[illegible]	20	12.605	94/92	78/79	270	40
16:43½	22½	13 58	93	79	285	40
	25	14 58	94	80	23[illegible]	40
	27½	15.85	97	80	245	40
/16 5[illegible]	30	17.15	98/96	80/81	285	40
	32½	18 0[illegible]	97	81	275	40
	35	19 23	99	82	235	40
	37½	20.44	100	83	240	40
/17[illegible]	40	21.722	101/99	8[illegible]/85	270	40
[illegible]	42½	22 6	100	8[illegible]	240	40
[illegible]	45	23 71	101	85	230	40
[illegible]	47½		103	86	230	40
[illegible]	50	25 970	103	86		
TOTAL	50	21.9	2218	2010		
AVERAGE			87 °F = 547 °R			

AVERAGE VALUES READ WITHIN THE TIME INTERVAL

POINT	PITOT VH ("H_2O)	ORIFICE Δ H ("H_2O) DESIRED	ORIFICE Δ H ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR $\%CO_2$	
A1	.0[illegible]7	.35	.3[illegible]	5.5	230		.015
2	.01	.5	.5	7.8	210		.015
3	.01[illegible]	.58	.58	8.1	2[illegible]		.015
4	.015	.8	.8	11.0	2[illegible]		.015
B1	.01	.51	.51	8.0	230		.016
2	.014	.71	.71	10.5	23[illegible]		.018
3	.014	.73	.73	10.6	22[illegible]		.017
4	.014	.73	.73	11.0	21[illegible]		.018
C1	.01	.51	.51	8.1	2[illegible]		.015
2	.01	.51	.51	8.0	[illegible]		.015
3	.015	.8	.8	10.0	250		.017
4	.015	.8	.8	10.0	[illegible]18		.016
D1	.011	.5[illegible]	.59	8.[illegible]	205		.016
2	.011	.65	.65	9.0	190		.017
3	.014	.74	.74	10.5	210		.017
4	.015	.80	.80	11.0	[illegible]		.017
E1	.008	.42	.42	6.5	20[illegible]		.016
2	.012	.65	.65	9.8	235		.017
3	.012	.62	.62	9.5	250		.016
4	.013	.66	.66	10.0	250		.017
TOTAL 20			12.66 "H_2O		4388		
AVERAGE		.63 "H_2O = .0[illegible] "Hg			219		

$P_m = P_B + \Delta H$ = 29.[illegible] "Hg

[illegible] °R

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VFT/APIE

VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA Fireplace — RUN NO. 5-1

LOCATION Wiscasset Fireplace — NO. 86-5

OPERATOR Acton - Johnson — DATE 5/1/86

SAMPLE BOX YELLOW

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)		POM	
IMPINGER (#2 W/APPROX. 100 ml WATER)	439.8	433.9	4.9
BUBBLER (#3 DRY)	333.2	332.0	1.2
H_2O ABSORBED BY SILICA GEL, ml	647.8	641.4	6.4
TOTAL H_2O COLLECTED, ml			12.5
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.592
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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

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

VFT/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-20-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 21

EVALUATION DATE 8-19-75 CLEAN-UP SET NO. 8?-5

I. EVAPORATION OF ______(ml) OF ______

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

FINAL ______(mg) - TARE 76518.0 (mg)

-BLANK ((______mg/ml) (______ ml) = ______ mg) = ______ mg.

II. FILTER CATCH ______ # ____ (Media Type & #)

FILTER LOST IN ANALYSIS - PETRI DISH BROKEN / SAMPLE ...

FINAL ______ (mg) - TARE 353.4 (mg) = ______ mg.

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

FINAL ______ (mg) - TARE ______ (mg)

-BLANK (______mg) = ______ mg.

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

FINAL ______ (mg) - TARE ______ (mg)

-BLANK ((______ mg/ml) (______ ml initial

- ______ml CONDENSED = ______ ml) = ______ mg) = ______ mg.

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

FINAL ______ (mg) - TARE ______ (mg)

-BLANK ((______ mg/ml) (______ml) = ______ mg) = ______ mg.

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

BLANKS Run #1

ACETONE = ______ mg/______ml = ______mg/ml FINAL ______mg. TARE ______ mg.

ETHER-CHLOROFORM = ______ mg.(FINAL ______ mg - TARE ______ mg)

WATER = ______mg/______ml = ______mg/ml. FINAL ______ mg. TARE ______ mg.

VFT/AP9 A

START UP — STAGE

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

87-5

START 16th PINE
7½ @ 11:30
8" @ 11:50

FINISH 18 @ LEFT @ 11:54
START 3rd MIN ELAPSED TIME 18# @ 12:20
ADD 5# 12:42
FINISH 10# LEFT

BU # 50-5

CLIENT EPA FIREPLACE
PORT LOCATION HONEYCHURCH RES
DATE 12-20-15 AMBIENT CONDITIONS CLEAR 65°
OPERATOR/S ALGUARD / SULLIVAN
RUN NO. 22 GLASS FRONT
SAMPLE & METER BOX NUMBERS RED & 3
METER BOX ΔH 1.892
FILTER NO. 43-5 TARE 359.9 mg
CLEAN-UP NO. 87-5; BLANKS ____ & ____
BOX & PROBE HEATER SETTING 250° & 30%

BAROMETRIC PRESSURE (P_B) 30.20 "Hg
LEAK RATE .01/.01 CFM @ 2.5/25 "HG
PORT PRESSURE (P_S) 0 "H_2O = 0 "Hg
$P_{SN} = P_B + P_S$ 30.20 "Hg
ASSUMED MOISTURE 5 % MAX VH ____ "H_2O
C FACTOR .98
REF. ΔP .038/2.30 .036/2.00 .042/3.00 .04/2.70 .044/3.20
STACK DIMENSIONS 8¾" x 19¼" AREA 1.179 FT^2
PROBE NOZZLE DIA. ½ IN; A_N = .00136 FT^2
PROBE LENGTH 3' NUMBER 14 SIDE 1

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL						
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
11:18	0	26.143	69	62	250	64	A1	.005	.25	.25	1.2	180	
11:21	3	26.99	66	62	200	55	2	.008	.4	.4	1.5	205	
1124	6	27.95	67	62	240	54	3	.01	.51	.51	1.6	185	
1127	9	29.05	70	63	230	50	4	.008	.45	.45	1.5	210	
1130/1135	12	30.99	72	63	220	52	B1	.008	.45	.45	2.0	300	
1138	15	31.20	74	64	230	52	2	.008	.45	.45	1.9	295	
1141	18	32.26	76	65	235	52	3	.009	.39	.39	1.4	285	
1144	21	33.24	76	66	240	52	4	.011	.49	.49	2.0	275	
1147/1149	24	34.352	81	68	220	58	C1	.008	.35	.35	1.6	270	
1152	27	35.36	82	70	210	56	2	.009	.41	.41	2.0	247	
1155	30	36.35	81	71	240	55	3	.01	.45	.45	1.9	285	
1158/1200	33	* 37.405/37.552	86/82	72/77	270	62	4	.011	.49	.49	1.5	280	
1223/26	36	38.715	84	77	300	54	D1	.008	.36	.36	1.2	312	
1229	39	39.70	86	77	280	54	2	.011	.48	.48	2.0	290	
1232	42	40.80	88	77	250	52	3	.01	.44	.44	1.5	285	
1235	45	41.91	89	78	280	50	4	.009	.4	.4	1.6	290	
1238/1241	48	42.982	90	79	250	55	E1	.006	.26	.26	1.2	270	
1244	51	43.85	90	80	180	54	2	.006	.26	.26	1.2	250	
1247	54	44.68	91	80	220	55	3	.007	.31	.31	1.2	360	
1252	57	45.57	92	82	255	54	4	.009	.36	.36	1.5	365	
1253	60	46.591	93	82	250	54							
TOTAL	60	20.301	1785	1577			20			7.94 "H_2O		5539	
AVERAGE			76 °F = 536 °R						.397 "H_2O = .03 "Hg			277	
								$P_m = P_B + \Delta H$ = 30.23 "Hg				737 °R	

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C-3 .005 .006 .006 .006 .005 .006 .006 .006 .005 .005 .005 .005 .006 .005

87-5

VALENTINE, FISHEL & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA FIREPLACE — RUN NO. 22

LOCATION AVERAGE FIREPLACE — NO. 87-5

OPERATOR RICHARD SWANSON — DATE 5/22/75

SAMPLE BOX RED

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, 1 ml = 1 gm			
BUBBLER (1st W/APPROX. 100 ml WATER)	744.6	436.3	3.3
IMPINGER (2nd W/APPROX. 100 ml WATER)	446.1	445.0	1.1
BUBBLER (3rd DRY)	316.4	315.6	0.8
H_2O ABSORBED BY SILICA GEL, ml	642.3	637.9	4.4
TOTAL H_2O COLLECTED, ml			14.6
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.692
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)

T/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8-21-75

EVALUATION LOCATION AVERAGE FIREPLACE RUN NO. 22

EVALUATION DATE 8-20-75 CLEAN-UP SET NO. 87-5

I. EVAPORATION OF 150 (ml) OF ACETONE

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

FINAL 76658.8 (mg) - TARE 76626.2 (mg)

-BLANK ((.0057 mg/ml) (150 ml) = .9 mg) = 31.7 mg.

II. FILTER CATCH MSA 1106 3H # ___ (Media Type & #)

FINAL 400.9 (mg) - TARE 365.5 (mg) = 35.4 = 45.0 mg.

BACK UP 182.9 mg - 180.7 mg = 2.2 mg.

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

FINAL 67268.7 (mg) - TARE 67256.1 (mg)

-BLANK (1.8 mg) = 10.8 mg.

IV. PARTICULATE FROM EVAPORATION OF 205 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 77108.9 (mg) - TARE 77088.9 (mg)

-BLANK ((.00286 mg/ml) (205 ml initial

- 14.6 ml CONDENSED = 190.4 ml) = .5 mg) = 19.5 mg.

V. PARTICULATE FROM 100 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 78906.4 (mg) - TARE 78877.9 (mg)

-BLANK ((.0057 mg/ml) (100 ml) = .6 mg) = 28.9 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 171.3 mg.

BLANKS Run #1

ACETONE = _____ mg/_____ml = _____mg/ml FINAL _____mg. TARE _____mg.

ETHER-CHLOROFORM = _____ mg.(FINAL _____ mg - TARE _____ mg)

WATER = _____mg/_____ml = _____mg/ml. FINAL _____mg. TARE _____mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG. 20, 1975 RUN NO. 22 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION 11^00-12^00 TIME OF ANALYSIS AUG 21, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	1.0	1.0	1.0	
$CO_2 + O_2$	20.8	20.8	20.8	
$CO_2 + O_2 + CO$	21.0	21.0	21.0	
	—			

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	1.0	1.0	1.0		1.0	44/100	.44
O_2	19.8	19.8	19.8		19.8	32/100	6.336
CO	0.2	0.2	0.2		0.2	28/100	.056
N_2 (100-Above)	79.0	79.0	79.0		79.0	28/100	22.120
						AVG. MOLECULAR WT. DRY STACK GAS	28.95

VFT/AP42

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

TRAVERSE SAMPLING DATA SHEET

IMPORTANT: FILL IN ALL BLANKS

CLIENT EPA FINDLAY
PORT LOCATION HONEYMOON #ES
DATE 8/20/88 AMBIENT CONDITIONS Clear
OPERATOR/S ALGUARD / SCHNEIDER
RUN NO. 23 88-5
SAMPLE & METER BOX NUMBERS GRN & 3
METER BOX ΔH 1.512
FILTER NO. 15-5 @ TARE 3675 mg BOTH 31-5 @ 180.1mg
CLEAN-UP NO. ____ ; BLANKS ____ & ____
BOX & PROBE HEATER SETTING ____ & ____

START ADD — 18TH PINE 4TH IS 01 6TH 15 22 10TH LEFT C FINISH

BAROMETRIC PRESSURE (P_B) 29.81 "Hg
LEAK RATE .02 CFM @ 25 "Hg
PORT PRESSURE (P_S) .0 "H_2O = .0 "Hg
$P_{SN} = P_B + P_S$ 29.81 "Hg
ASSUMED MOISTURE 3 % MAX VH ____ "H_2O
C FACTOR 1.05
REF. ΔP .036 .041 .033 .036
STACK DIMENSIONS 23 x 23½ AREA 3.122 F^2
PROBE NOZZLE DIA. ½ IN; A_N .00136 F^2
PROBE LENGTH 3 NUMBER 12 SIDE 2

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL							
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO2	REF. METHOD 3 %CO2
14:46	0	46.783	76	73	200	70	A 1	.01	.5	.5	1.5	210	~~210~~	.01
	2½	47.9	78	73	220	66	2	.012	.6	.6	2.0	205		.009
	5	48.84	80	73	240	60	3	.013	.66	.66	2.0	200		
	7½	49.99	82	73	250	60	4	.014	.75	.75	2.0	197		.009
14:57	10	51.194	84/—	75/—	270	60	B 1	.009	.48	.48	1.5	185		.008
	12½	52.12	85	74	280	58	2	.011	.58	.58	2.0	170		.007
	15	53.15	87	75	290	56	3	.016	.85	.85	2.1	235		.009
	17½	54.40	90	75	270	56	4	.017	.86	.86	2.1	225		.01
15:08	20	55.71	91	76			C 1	.011	.58	.58	2.0	220		.009
	22½	56.76	92	77	210	56	2	.011	.58	.58	2.0	205		.008
	25	57.85	94	78	240	56	3	.016	.86	.86	2.1	200		.011
	27½	58.98	97	79	270	56	4	.015	.83	.83	2.2	202		.012
15:19	30	60.3	97	80	260	60	D 1	.011	.55	.55	2.0	250		.016
	32½	61.44	99	81	230	60	2	.016	.77	.77	2.0	270		.015
	35	62.67	100	81			3	.016	.77	.77	2.0	275		.016
	37½	63.90	103	83	195	56	4	.015	.73	.73	2.0	260		.018
	40	65.14	104/103	83/84	235	60	E 1	.009	.45	.45	1.5	235		.016
	42½	66.05	103	83	200	60	2	.01	.52	.52	1.6	230		.013
	45	67.02	104	86	230	58	3	.01	.52	.52	1.8	225		.011
	47½	68.09	105	87	220	56	4	.01	.52	.52	1.8	217		.011
15:40	50	69.201	106	87	230	56								
TOTAL	50	22.418	2060	1736			20			12.96 "H_2O		4421		
AVERAGE			86 °F = 546 °R						.648 "H_2O = .05 "Hg			221		
									$P_m = P_B + \Delta H$ = 29.86 "Hg			681 °R		

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WALDEN HE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA Fireplaces RUN NO. 23

LOCATION Avenue Fireplace NO. 88-5

OPERATOR Richard Samson DATE 8/20/75

SAMPLE BOX Green

	CONTAINER WEIGHTS (gm) FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm) BUBBLER (#1 W/APPROX. 100 ml WATER)	446.2	440.0	6.2
IMPINGER (# W/APPROX. 100 ml WATER)	434.2	433.3	.9
BUBBLER (#3 DRY)	337.3	336.2	1.1
H_2O ABSORBED BY SILICA GEL, ml	686.1	631.3	4.8
TOTAL H_2O COLLECTED, ml			13
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			0.616
MOISTURE IN STACK GAS, %			
MOLE FRACTION OF DRY GAS			
MOLECULAR WT. OF STACK GAS			

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

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)

/AP3C

VALENTINE, FISHER & TOMLINSON
LABORATORY ANALYSIS AND TOTAL PARTICULATE SHEET

CLIENT EPA FIREPLACE DATE OF ANALYSIS 8/21/75

EVALUATION LOCATION LIEPAGE FIREPLACE RUN NO. 23

EVALUATION DATE 8/20/75 CLEAN-UP SET NO. 88-5

I. EVAPORATION OF 70 (ml) OF ACETONE

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

FINAL 77226.0 (mg) - TARE 77217.3 (mg)

-BLANK ((.0057 mg/ml) (70 ml) = .4 mg) = 8.3 mg.

II. FILTER CATCH MSA 1106 BH # ___ (Media Type & #)

FINAL 392.6 (mg) - TARE 367.5 (mg) = 25.1 mg.

BACK UP 186.1 mg - 180.1 mg = 6 mg.

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

FINAL 773687 (mg) - TARE 773633 (mg)

-BLANK (1.8 mg) = 3.6 mg.

IV. PARTICULATE FROM EVAPORATION OF 205 (ml) WATER IN IMPINGER AND BUBBLERS FOLLOWING EXTRACTION -

FINAL 789792 (mg) - TARE 789685 (mg)

-BLANK ((.00286 mg/ml) (205 ml initial

- 13 ml CONDENSED = 192 ml) = .5 mg) = 10.2 mg.

V. PARTICULATE FROM 125 (ml) OF ACETONE RINSE OF IMPINGER, BUBBLERS, AND CONNECTORS AFTER FILTER:

FINAL 770650 (mg) - TARE 770472 (mg)

-BLANK ((.0057 mg/ml) (125 ml) = .7 mg) = 17.1 mg.

VI. TOTAL PARTICULATE = I + II + III + IV + V = 70.3 mg.

BLANKS Run #1

ACETONE = ___ mg/___ml = ___mg/ml FINAL ___mg. TARE ___mg.

ETHER-CHLOROFORM = ___ mg.(FINAL ___ mg - TARE ___ mg)

WATER = ___mg/___ml = ___mg/ml. FINAL ___ mg. TARE ___ mg.

VFT/AP9 A

VALENTINE, FISHER & TOMLINSON
ORSAT DATA AND CALCULATION SHEET

CLIENT EPA FIREPLACE

SAMPLING POINT LOCATION OUTSIDE EXTENSION

DATE AUG 20, 1975 RUN NO. 23 HOW COLLECTED INTEGRATED GRAB BAG

TIME OF SAMPLE COLLECTION 1:30 - 2:30 TIME OF ANALYSIS AUG. 21, 1975

CUMULATIVE % BY VOL.(DRY)	ANALYSIS #1	ANALYSIS #2	ANALYSIS #3	ANALYSIS #4
CO_2	0.5	0.4	0.5	
$CO_2 + O_2$	20.8	20.7	20.8	
$CO_2 + O_2 + CO$	20.9	20.8	20.9	

COMPONENT % BY VOL.(DRY)	#1	#2	#3	#4	AVG.	RATIO MOLE WT	WT./MOLE (DRY)
CO_2	.5	.4	.5		.467	44/100	.205
O_2	20.3	20.3	20.3		20.3	32/100	6.496
CO	0.1	0.1	0.1		0.1	28/100	.028
N_2 (100-Above)	79.1	79.2	79.1		79.133	28/100	22.157
						AVG. MOLECULAR WT. DRY STACK GAS	28.39

VFT/AP43

IMPACTOR

VALENTINE FISHER & TOMLINSON
SEATTLE, WASHINGTON

89-5

CLIENT Local Alliance

PORT LOCATION Weyerhaeuser Pres-Outside Extension TRAVERSE SAMPLING DATA SHEET

DATE 9/20/95 AMBIENT CONDITIONS Clear

IMPORTANT: FILL IN ALL BLANKS

OPERATOR/S Allard/Swanson

RUN NO. 24

SAMPLE & METER BOX NUMBERS OC6 & 3

METER BOX ΔH 1.842

FILTER NO. 32-5 SMALL @ TARE 1812 mg

CLEAN-UP NO. 89-5 ; BLANKS _____ & _____

BOX & PROBE HEATER SETTING 255 & 60

START 22# PINE

FINISH 7# LEFT

BAROMETRIC PRESSURE (P_B) 29.77 "Hg

LEAK RATE .00 CFM @ 2.19 "HG

PORT PRESSURE (P_S) 0 "H_2O = 0 "Hg

$P_{SN} = P_B + P_S$ 29.79 "Hg

ASSUMED MOISTURE _____ % MAX VH _____ "H_2O

C FACTOR — _____ _____ _____

REF. ΔP — _____ _____ _____

STACK DIMENSIONS 33" x 111" AREA 6.170 F^2

PROBE NOZZLE DIA. 1/8 IN; A_N .00668 F^2

PROBE LENGTH 3' NUMBER 14 SIDE 1+

SCHEMATIC OF TRAVERSE POINT LAYOUT

INSTANTANEOUS READINGS: RECORDED @ BEGINNING OF TIME INTERVAL							AVERAGE VALUES READ WITHIN THE TIME INTERVAL						
CLOCK TIME (24 HRS)	ELAP. TIME (MIN)	DRY GAS METER (CUBIC FEET)	DRY GAS TEMP. (°F) INLET	DRY GAS TEMP. (°F) OUTLET	BOX TEMP. (°F)	IMPINGER TEMP. (°F)	POINT	PITOT VH ("H_2O)	ORIFICE ΔH ("H_2O) DESIRED	ORIFICE ΔH ("H_2O) ACTUAL	PUMP VACUUM ("Hg GA)	STACK TEMP. (°F)	OPACITY OR %CO_2
16:29	0	69.387	90	85	235		C-3	.014		.04	5.0	235	
	2½	69.63	89	85	240			.013		.045	5.0	237	
	5	69.834	87	83	250			.015		.04	5.0	225	
	7½		89	84	245	55		.014		.04	5.0	222	
	10	70.25	89	84	245	55		.011		.04	5.0	215	
	12½	70.474	89	84	250	50		.014		.04	5.0	210	
	15	70.69	89	85	240	55		.011		.04	5.0	205	
	17½	70.84	90	85	245	55		.014		.04	5.0	197	
	20	71.03	90	86	240	55		.013		.04	5.0	195	
	22½	71.225	90	86	240	55		.012		.04	5.0	187	
	25	71.415	90	87	240	55		.012		.04	5.0	182	
	27½	71.610	91	87	240	55		.011		.04	5.0	175	
16:59	30	71 800	91	88	245								
TOTAL	30	2.116	1166	1109			1			.485 "H_2O		2482	
AVERAGE			88 °F = 548 °R							.04 "H_2O = .002"Hg		207	

$P_m = P_B + \Delta H$ = 29.792 "Hg

207 °F

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VALENTINE, FISHER & TOMLINSON
STACK MOISTURE CONTENT DATA AND CALCULATIONS

CLIENT EPA Emission Inventory — RUN NO. 2A

LOCATION Allegheny Ludlum — NO. 89-5

OPERATOR Accuracy Surveys — DATE 8/24/75

SAMPLE BOX ORANGE

	CONTAINER WEIGHTS (gm)		
	FINAL	INITIAL	NET
H_2O CONDENSED, ml (1 ml = 1 gm)			
BUBBLER (#1 W/APPROX. 100 ml WATER)	448.8	448.2	0.6
IMPINGER (#2 W/APPROX. 100 ml WATER)	433.6	433.7	-0.1
BUBBLER (#3 DRY)	364.5	364.2	0.3
H_2O ABSORBED BY SILICA GEL, ml	569.4	568.6	0.8
TOTAL H_2O COLLECTED, ml			1.6
VOL. OF H_2O VAPOR @ 70°F. AND 1 ATM. = 0.0474 x TOTAL H_2O			.0758
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 = VOL. DRY MOL. WT. OF GAS x MOLE FRACTION + % x (1-MOLE FRACTION)

EPA/APTD

TECHNICAL REPORT DATA
(Please read Instructions on the reverse before completing)

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4. TITLE AND SUBTITLE
Source Sampling Residential Fireplaces For Emission Factor Development

5. REPORT DATE
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15. SUPPLEMENTARY NOTES

16. ABSTRACT

One typical residential fireplace was source sampled for particulate (both filterable and condensible), polycyclic organic materials (POM), volatile hydrocarbons, and carbon monoxide emissions. Testing was conducted using alder, Douglas Fir, Locust, pine, and coal. Particulate was sampled and analyzed utilizing EPA Method 5. POM was collected on a TENAX adsorbent and analyzed by GC-MS methods. A rough energy balance on wood combustion in fireplaces was performed.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
TENAX Emissions Particulates POM Fireplace		

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