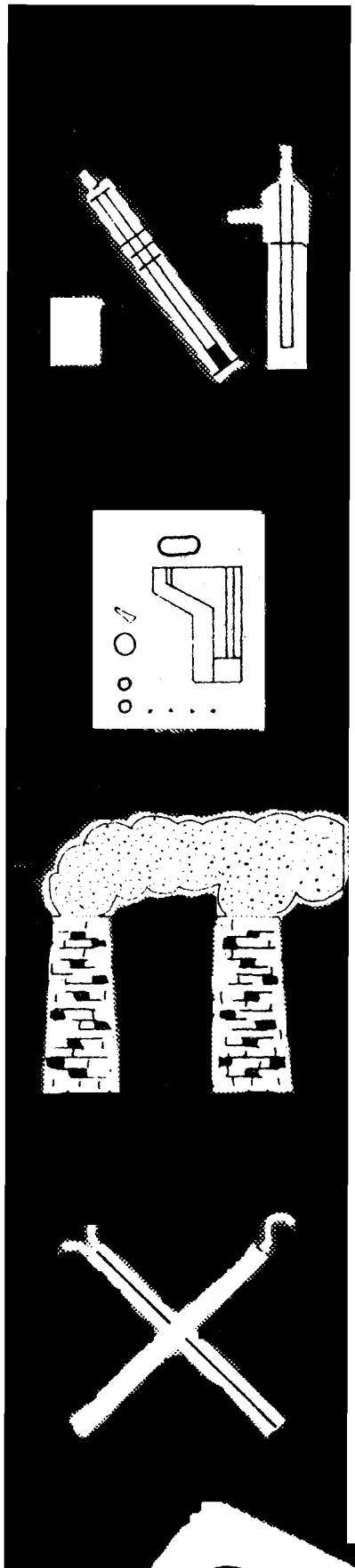
Report No. 77-NMM-5



AIR POLLUTION EMISSION TEST

PFIZER, INC.

VICTORVILLE, CALIFORNIA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air and Waste Management
Office of Air Quality Planning and Standards
Emission Measurement Branch
Research Triangle Park, North Carolina

EMISSION SOURCE TEST FROM A BAGHOUSE SERVING A TALC GRINDING MILL

AT

PFIZER, INC.
Victorville, California

Task Order #12
Contract No. 68-02-1405

July, 1977

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I. INTRODUCTION

Source tests were performed on the talc grinding facility operated by Pfizer, Inc. located in Victorville, California. Sampling took place on June 20, 21, 22, 1977 by Pacific Environmental Services, Inc. (PES) for particulates using EPA Method 17 (see Appendix F), particle size, and opacity (EPA Method 9). The source test team consisted of Robert Norton, Bob Bakshi, Keith Duval and Ron Holliday all of PES. PES personnel were accompanied on site by EPA observers Bob Martin and Jim Eddinger.

The facility tested consisted of a pebble grinding mill exhausting into a pulse-jet baghouse. Samples were taken both at the inlet and outlet of the baghouse for particulate grain loading, at the inlet for particle size data. Opacity observations were performed at the outlet. A more detailed description of the process can be found in Section III and of the sampling procedures in Section V.

All field data sheets and sample calculations can be found attached to this report.

II. SUMMARY OF RESULTS

Tabular data on results from all tests can be found in this section, (Tables II-1 and II-2). The average baghouse outlet grain loading found for the four test runs was 0.0285 grains/standard cubic foot. The baghouse inlet grain loading was found to be 6.18 grains/standard cubic foot. This yields an average baghouse efficiency of 99.54%.

Tabular results for the particle size breakdown can be found in Table II-3.

Table II-1

DATA SUMMARY

Run Number	Outlet #1	Outlet #2	Outlet #3
Test Date	6-20-77	6-21-77	6-21-77
Sampling Time, 24-hour clock	1300	0800	1200
D_n Sampling Nozzle Diameter, in.	0.25	0.25 (0.1875)	0.25 (0.1875)
T_t Net Time of Test, Min.	120	120	120
P_b Barometric Pressure, in. Hg Absolute	27.26	27.32	27.30
P_m Average Orifice Pressure Drop, in. H_2O	1.92	1.87	1.60
V_m Volume of Dry Gas Sampled at Meter Conditions, DCF	87.946	85.776	80.824
T_m Average Gas Meter Temperature, ^oF	134.9	117.0	140.0
$V_{m_{std}}$ Volume of Dry Gas Sampled at Standard Conditions[a], DSCF	71.50	72.04	65.17
V_w Total H_2O Collected in Impingers and Silica Gel, ml	17.9	26.3	19.1
w_{gas} Volume of Water Vapor Collected at Standard Conditions, SCF	0.84	1.24	0.90
%M % Moisture in Stack Gas, by Volume	1.17	1.69	1.36
M_d Mole Fraction of Dry Gas	0.9883	0.9831	0.9864
% CO_2 Volume % Dry	0	0	0
% O_2 Volume % Dry	18.75	19.5	19.5
% CO Volume % Dry	0	0	0
% N_2 Volume % Dry	81.25	80.5	80.5
% EA Percent Excess Air	-	-	-
MW_d Molecular Weight of Stack Gas, Dry Basis	28.75	28.78	28.78

[a]Standard Conditions - 20°C, 760 mmHg.

Table II-1 (continued)

DATA SUMMARY

Run Number		Outlet #1	Outlet #2	Outlet #3
MW	Molecular Weight of Stack Gas, Wet Basis	28.62	28.60	28.64
C_p	Pitot Tube Coefficient	0.87	0.87	0.87
T_s	Average Stack Temperature ^oF	143.0	135.3	152.3
N_p	Net Sampling Points	24	24	24
P_{st}	Static Pressure of Stack Gas, in. Hg	0	0	0
P_s	Stack Gas Pressure, in. Hg Absolute	27.26	27.32	27.30
V_s	Stack Gas Velocity at Stack Conditions, fps	45.64	49.42	44.56
A_s	Stack Area, ft^2	1.54	1.54	1.54
Q_d	Dry Stack Gas Volumetric Flow Rate at Standard Conditions DSCFM	3325.1	3636.5	3195.6
Q_a	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	4216.8	4566.7	4112.8
% I	Percent Isokinetic	81	89*	91*
% O	Percent Opacity	0.21	0.75	2.01
Particulates - probe, and filter catch				
mg		100.6	112.1	115.2
gr/DSCF		0.022	0.024	0.027
gr/ACF		0.018	0.020	0.022
lb/hr		0.62	0.75	0.75

*These samples required use of two different nozzle sizes because of the wide range of velocities encountered in the duct.

Table II-1 (continued)

DATA SUMMARY

Run Number	Outlet #1	Outlet #2	Outlet #3
Date	6-20-77	6-21-77	6-21-77
Volume of Gas Sampled - Nm^3 (a)	2.02	2.04	1.85
Average Stack Temperature - ^oC	61.7	57.4	66.8
Stack Volumetric Flow Rate - Nm^3/min (b)	94.17	102.99	90.50
Stack Volumetric Flow Rate - m^3/min (c)	119.42	129.33	116.47
Particulates - probe, cyclone, and filter catch			
mg	100.6	112.1	115.2
mg/Nm^3	49.8	55.0	62.3
mg/m^3	40.5	46.2	50.2
kg/hr	0.28	0.34	0.34

[a]Dry normal cubic meter at 20 ^oC, 760mm Hg.

[b]Dry normal cubic meters per minute at 20 ^oC, 760mm Hg.

[c]Actual cubic meters per minute

Table II-2

DATA SUMMARY

Run Number	Outlet #4	Inlet #1	Particle Sizing Inlet #2
Test Date	6-22-77	6-22-77	6-22-77
Sampling Time, 24-hour clock	0750	1130	1230
D_n Sampling Nozzle Diameter, in.	0.25 (0.1875)	0.1875	0.1875
T_t Net Time of Test, Min.	120	24	30
P_b Barometric Pressure, in. Hg Absolute	27.37	27.37	27.37
P_m Average Orifice Pressure Drop, in. H_2O	1.93	1.07	1.6
V_m Volume of Dry Gas Sampled at Meter Conditions, DCF	89.188	14.194	20.317
T_m Average Gas Meter Temperature, ^oF	119.3	120.2	128.4
$V_{m_{std}}$ Volume of Dry Gas Sampled at Standard Conditions, DSCF	74.76	11.85	16.75
V_w Total H_2O Collected in Impingers and Silica Gel, ml	26.2	3.4	6.7
w_{gas} Volume of Water Vapor Collected at Standard Conditions, SCF	1.24	0.16	0.32
%M %Moisture in Stack Gas, by Volume	1.63	1.34	1.85
M_d Mole Fraction of Dry Gas	0.9837	0.9866	0.9815
$\%CO_2$ Volume % Dry	0	0	0
$\%O_2$ Volume % Dry	19.5	19.5	19.5
%CO Volume % Dry	0	0	0
$\%N_2$ Volume % Dry	80.5	80.5	80.5
%EA Percent Excess Air	-	-	-
MW_d Molecular Weight of Stack Gas, Dry Basis	28.78	28.78	28.78

Table II-2 (continued)

DATA SUMMARY

Run Number		Outlet #4	Inlet #1	Particle Sizing Inlet #2
MW	Molecular Weight of Stack Gas, Wet Basis	28.60	28.64	28.58
C_p	Pitot Tube Coefficient	0.87	0.87	0.87
T_s	Average Stack Temperature ^oF	136.8	165.7	164.7
N_p	Net Sampling Points	24	12	1
P_{st}	Static Pressure of Stack Gas, in. Hg	0	-0.29	-0.29
P_s	Stack Gas Pressure, in. Hg Absolute	27.37	27.08	27.08
V_s	Stack Gas Velocity at Stack Conditions, fpm	49.56	58.43	70.07
A_s	Stack Area, ft^2	1.54	1.23	1.23
Q_d	Dry Stack Gas Volumetric Flow Rate at Standard Conditions,[c] DSCFM	3646.2	3250.3	3883.5
Q_a	Stack Gas Volumetric Flow Rate at Stack Conditions, ACFM	4579.4	4312.3	5171.3
% I	Percent Isokinetic	95*	97	92
% O	Percent Opacity	1.28	-	-
Particulates - probe and filter catch				N.A.
mg		199.5	4742.2	
gr/DSCF		0.041	6.18	
gr/ACF		0.034	5.16	
lb/hr		1.29	172.06	

*This sample was collected using two different nozzle sizes because of the wide range of velocities encountered in the duct.

Table II-2 (continued)

DATA SUMMARY

Run Number	Outlet #4	Inlet #1	Inlet #2
Date	6-22-77	6-22-77	6-22-77
Volume of Gas Sampled - Nm^3[a]	2.53	0.40	0.58
Average Stack Temperature - ^oC	58.2	74.3	73.7
Stack Volumetric Flow Rate - Nm^3/min[b]	103.26	92.05	109.98
Stack Volumetric Flow Rate - m^3/min[c]	129.69	122.12	146.45
Particulates - probe and filter catch			
mg	199.5	4742.2	
mg/Nm^3	78.9	11,855.5	
kg/hr	66.1	9897.7	
kg/Mton	0.59	78.05	
Particulates - total catch			
mg			
mg/Nm^3			
mg/m^3			
kg/hr			
kg/Mton			
Percent impinger catch			

[a]Dry normal cubic meter at 20°C, 760 mm Hg.

[b]Dry normal cubic meter per minute at 20°C, 760mm Hg.

[c]Actual cubic meters per minute

Table III-3. PARTICLE SIZE DATA

Particle Size Range	Sample #1 Particle Count	Sample #1 % of Total	Sample #2 Particle Count	Sample #2 % of Total	Average Particle Count	Average % of Total
1-5	2925	36.8	3181	37.3	3053	37.1
5-10	1855	23.3	1898	22.3	1876	22.8
10-15	1024	12.9	998	11.7	1011	12.3
15-20	759	9.5	895	10.5	827	10.0
20-25	476	6.0	497	5.8	486	5.9
25-30	334	4.2	366	4.3	350	4.2
30-35	210	2.6	229	2.7	220	2.7
35-40	139	1.7	142	1.7	140	1.7
40-45	87	1.1	104	1.2	96	1.2
45-50	67	0.8	94	1.1	80	1.0
50-55	34	0.4	45	0.5	40	0.5
55-60	21	0.3	36	0.4	28	0.3
60-65	12	0.2	15	0.2	14	0.2
65-70	9	0.1	9	0.1	9	0.1
70-75	7	0.1	11	0.1	9	0.1
Total Count	7959	100	8520	100	8239	100

III. PROCESS DESCRIPTION AND OPERATION

A. GENERAL

The talc ore is trucked to the processing plant from both underground mines and surface quarries. At the plant, the raw ore is first reduced in size by a primary crusher. A secondary crusher is used to further reduce the ore. After crushing, the ore is conveyed to one of three grinding lines for product sizing.

B. PEBBLE MILL

The pebble mill is a cylindrical, horizontal, slow-speed rotating drum containing a mass of pebbles as the grinding media.

The baghouse controlling particulate emissions from the pebble mill was manufactured by Mikro Pul and contains 96 bags. The bags are cleaned by a pulse air system every fifteen seconds. New bags were installed two weeks prior to testing. The baghouse is designed for an air-to-cloth ratio of 7:1. The dust collected by the baghouse is recycled back to the process.

C. PROCESS OPERATION

During the testing, the operation of the process was normal according to the operators. Since only a few process meters or instruments were available to monitor, discussions with plant personnel were used to determine if the process was operating normally during the testing. In addition, a pressure drop meter was installed across the baghouse. The pressure drop across the baghouse ranged from 2 inches of water (outlet run No. 1) to 9 inches of water (outlet run No. 3). During the testing, three different product grades were processed by the pebble mill.

IV. SAMPLING PORT LOCATION

At the outlet the Pebble mill baghouse, sampling could not be conducted in the existing stack. The stack consisted of a four foot rectangular extension attached directly to the blower with a weather cover attached (see Figure IV-1). A flow control damper was located at the exit point of the stack. Because of these existing sampling conditions, a temporary stack extension was constructed and attached at 90^{0} to the existing stack (see Figure IV-2). A flow diverter was installed to make a more gentler flow bend and reduce the problem of particle impingement on the stack walls. Sampling was conducted in the rectangular stack approximately four stack diameters downstream from the flow diverter and one stack diameter upstream from the stack exit. Using Figure I-1 from Method 1 (Federal Register, Tuesday June 8, 1976) and the curve for small ducts (stack equivalent diameter 15 inches), twenty-four sampling points were used. The sampling points used are shown in Figure IV-3.

Sampling ports were installed in the baghouse inlet duct in a straight section of ducting (15 inches in diameter) located inside the mill building. This location was selected because of the length of straight ducting between the disturbances. The location of the sampling ports are shown in Figure IV-4. Twelve sampling points (six on a diameter) were used as suggested by the EPA Project Officer, Mr. Bob Martin. By using twelve sampling points and sampling two minutes at each point, the sampling could include a complete traverse of the duct before the pressure drop, due to the high grain loading, adversely effected the operation of the test. The sampling points used are shown in Figure IV-5. The particle sizing sample was taken for thirty minutes on the inlet at one sampling point[9(16)].

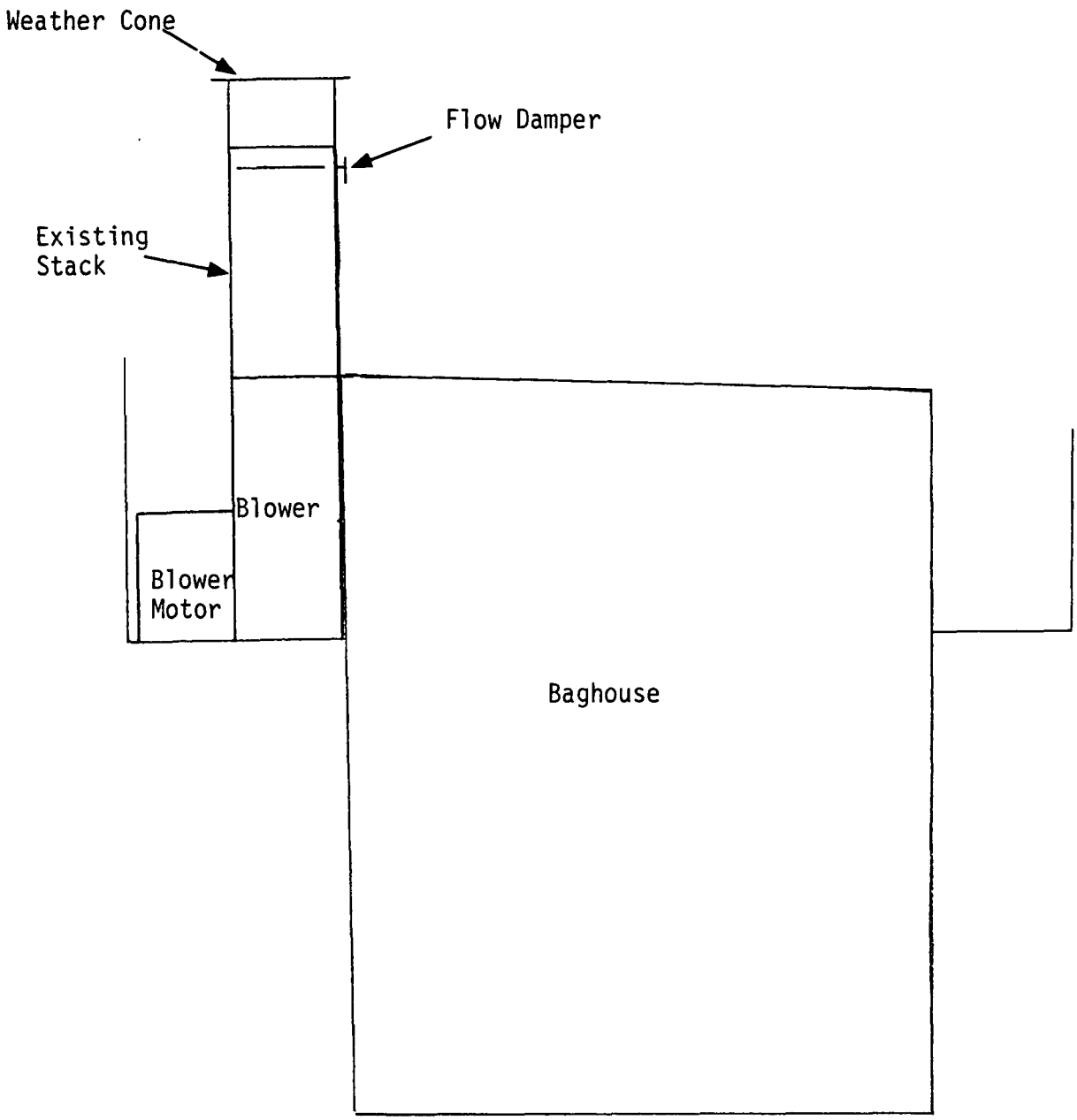


Figure IV-1. EXISTING STACK

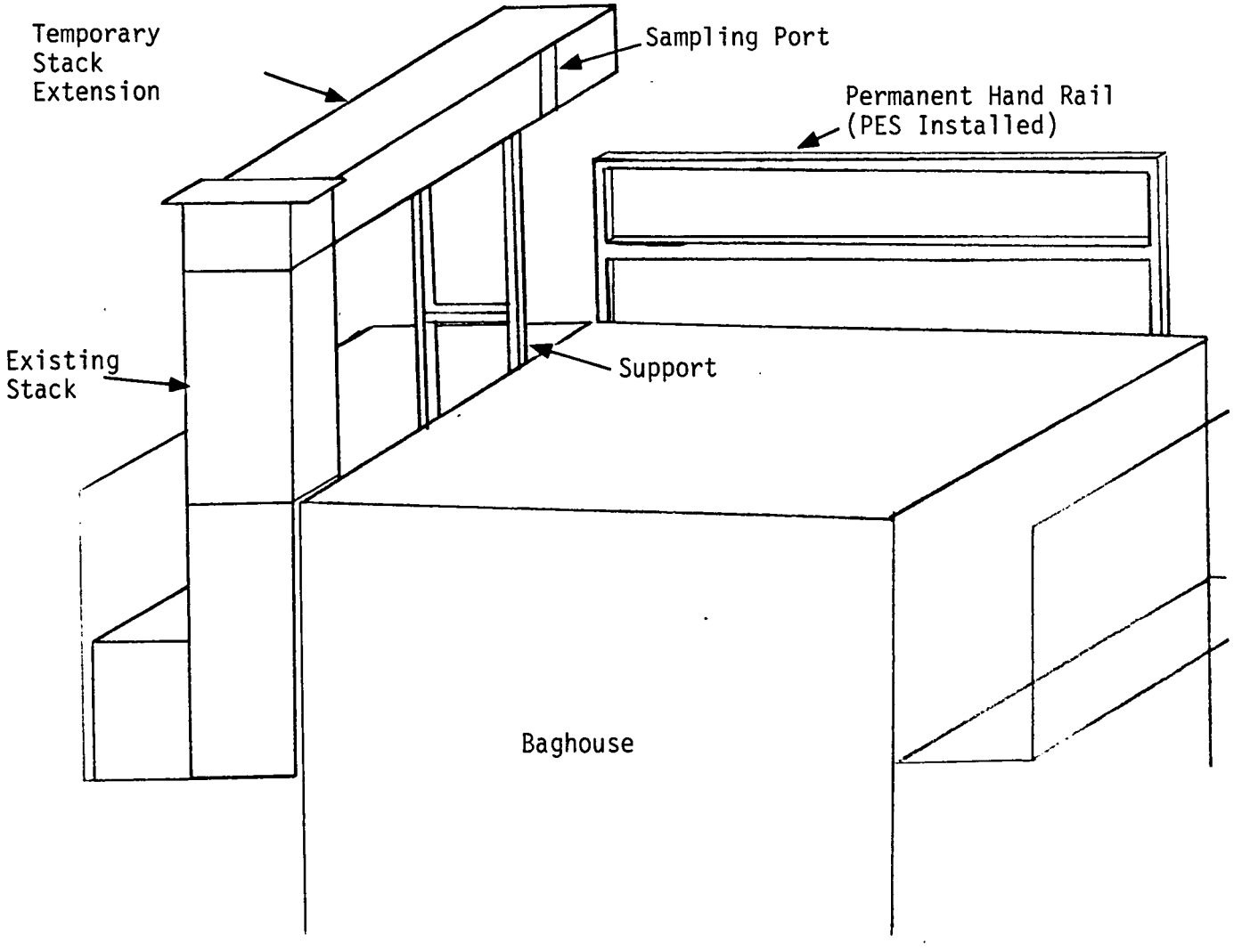
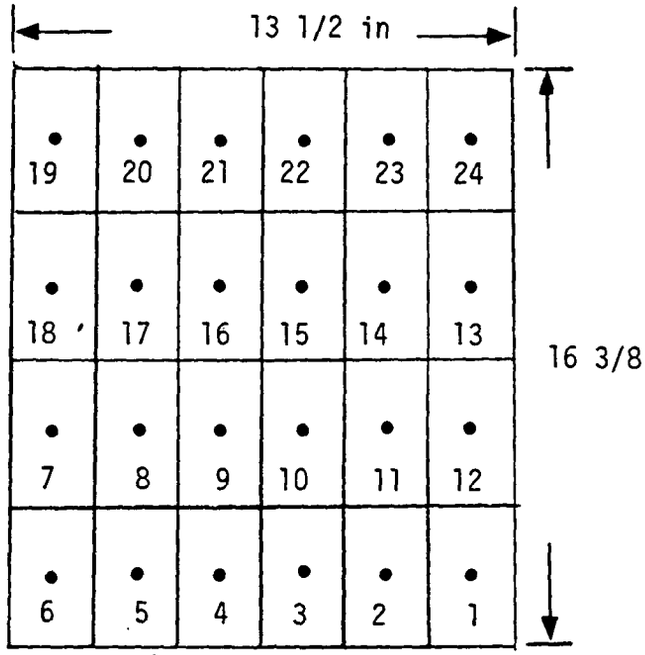
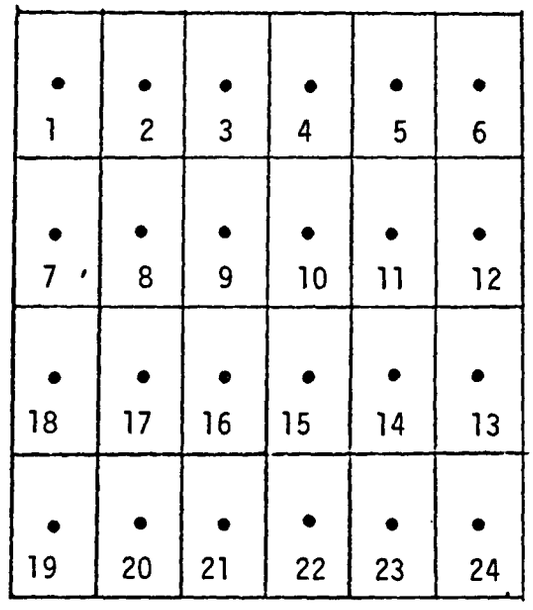


Figure IV-2. TEMPORARY STACK EXTENSION



a) Runs Outlet #1, 2, 4.



(b) Run Outlet #3

Figure IV-3. OUTLET SAMPLING POINTS

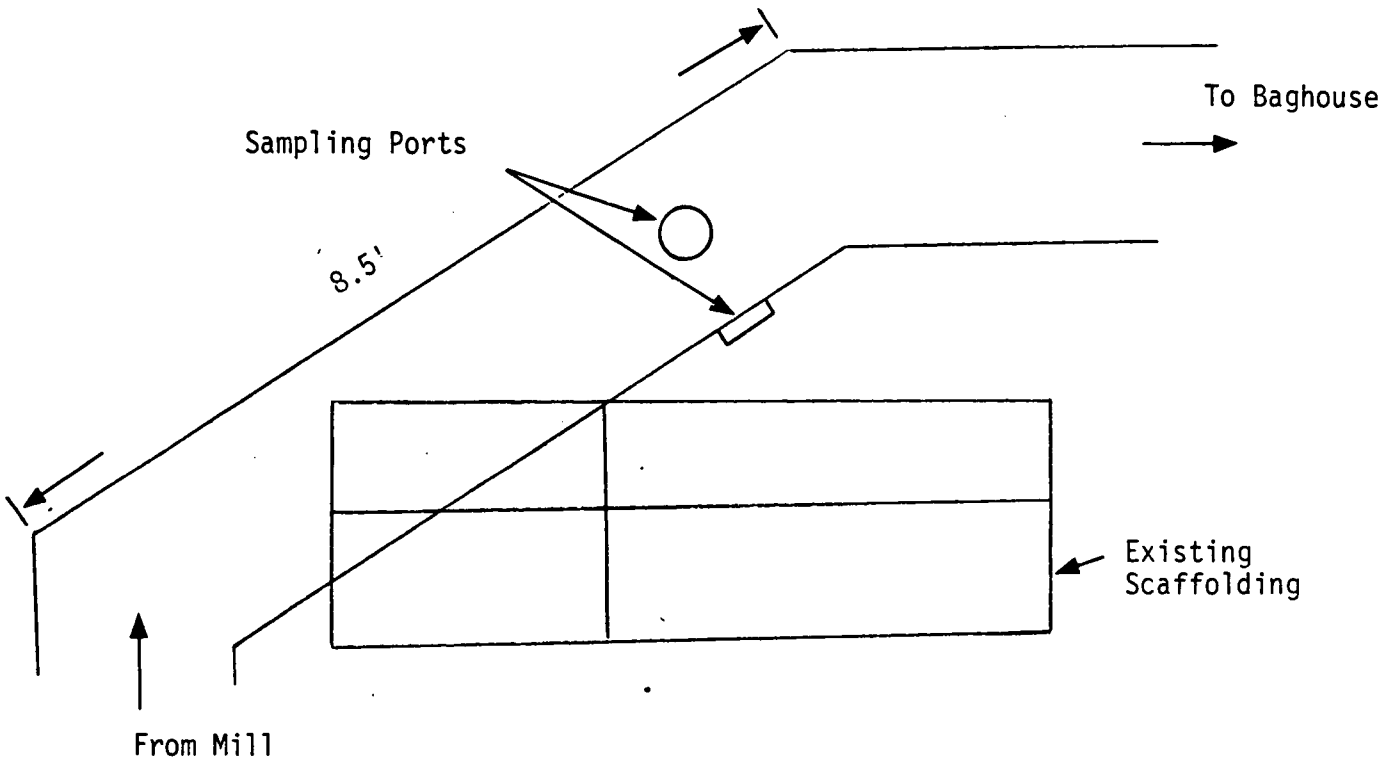


Figure IV-4. INLET SAMPLING PORTS

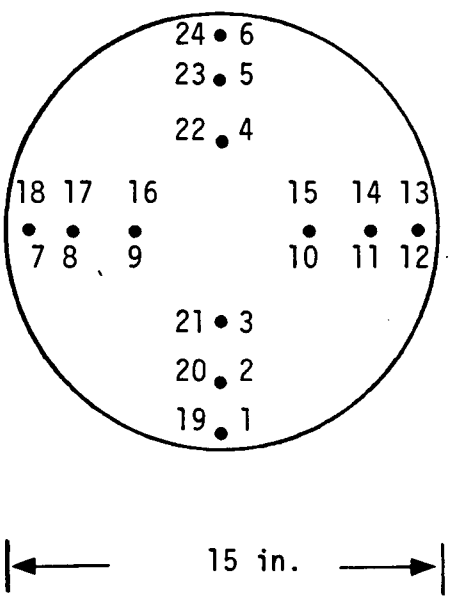


Figure IV-5. INLET SAMPLING POINTS

V. SAMPLING PROCEDURES

A. SUMMARY

Particulate samples were obtained using EPA Method 17 (Federal Register, September 14, 1976) which included an in-stack filter. Fiber glass thimbles (19 x 90 mm) were used for both inlet and outlet mass loadings and an alundum thimble was used for the particle sizing sample. Opacity observations were made using EPA Method 9 (Federal Register, December 23, 1971).

B. EQUIPMENT

Flow control sampling equipment used for the Pfizer, Inc. source test was manufactured by Microchemical Specialties Company (Misco) and consisted of a Model 7200 CM control module (modified with magnehelic gages instead of manometers). Stack temperatures were measured using an iron-constantan thermocouple and a portable potentiometer manufactured by Thermo Electric ("Minimite" Model 31101). Flue gas analyses were performed using a Fyrite test kit manufactured by Bacharach Instruments (#10-5,000).

Alundum thimbles of 0.1 micron porosity were used for the particle sizing sample (Western Precipitation RA-84). The fiberglass thimbles used for the mass loading samples were obtained from BGI, Inc. (Schleicher & Schuell, BGI No. 603GV/19 x 90).

Isokinetic conditions were maintained using a stainless steel nomograph from Nutech Corporation (Model 211-2).

C. SAMPLING PROCEDURES

The PES test crew arrived on site on Monday, June 20, 1977 and installed all temporary stack extensions, supports etc. PES also made arrangements to have a welder on site to install sampling ports in the inlet ductwork and to assemble and install a safety handrail

atop the baghouse where most work was to take place. Sampling at the outlet using EPA Method 17 began in the afternoon of June 20, 1977 when Outlet run #1 consisting of sampling twenty-four points at a rate of six minutes per point (total sample time = two hours) was conducted.

Outlet runs #2 and #3 were performed on Tuesday, June 21, 1977 and differed from Outlet #1 in that two nozzles had to be used. Both a 0.25 inch diameter and 0.1875 inch diameter nozzle were used because the installed flow diverter resulted in an uneven flow pattern in the duct. The 0.25 inch diameter nozzle was used for three traverses across the duct while the 0.1875 inch diamter nozzle was used for the one traverse nearest the top of the duct where the velocity was highest (see data sheets Appendix B). Leak checks were performed during each test as described in EPA Method 17 which included leak checking the in-stack filter system in the stack after it had reached a temperature equilibrium.

Outlet test #4, inlet test #1 and inlet test #2 (particle sizing sample) were all performed on Wednesday, June 22, 1977. The outlet sample was fun for two hours as all previous tests and used two sampling nozzles as in outlet tests #2 and #3. Inlet test #1 was run for twenty-four minutes (two minutes per point) because it was feared the high grain loading would result in a rapid increase in pressure drop which would exceed the capacity of the sampling apparatus. The particle sizing sample was taken for thirty minutes at a point selected which was approximately the average flow encountered in the previous inlet test.

Sample recovery procedures were performed on site in a laboratory located in the mill building. The filter thimbles were removed from the thimble holder and carefully placed in a sample container. The nozzle and all parts of the thimble holder, located before the filter, were washed with acetone and the washings placed in a teflon-capped glass sample bottle. Both the acetone washings

and thimble sample containers were labeled using EPA labels and logged on an EPA Sample Identification Log.

The moisture collected in the impingers was measured and recorded and the water was then discarded. The silica gel moisture trap was also weighed on site and the silica gel was retained for regeneration.

Field data sheets for all sampling runs can be found in Appendix B.

D. OPACITY OBSERVATIONS

Opacity observations were made during each particulate test at the baghouse outlet by two members of the test crew. Each crew member took part in the opacity observations and all members were certified as visible emissions evaluators by the California Air Resources Board. Dates of the last certification can be found in Appendix D.

Opacity observations were performed simultaneously, by two crew members during the two hour test with opacity observations made every fifteen seconds. The average opacity for each test run was as follows:

Test #1 - 0.21
Test #2 - 0.75
Test #3 - 2.01
Test #4 - 1.28

Figures V-1 illustrates the average observed opacity versus time for the four outlet particulate tests.

E. LABORATORY ANALYSIS

Analyses for mass loading of the particulate matter were performed in the PES laboratory. The acetone washings were transferred to a tared drying dish and allowed to evaporate at room

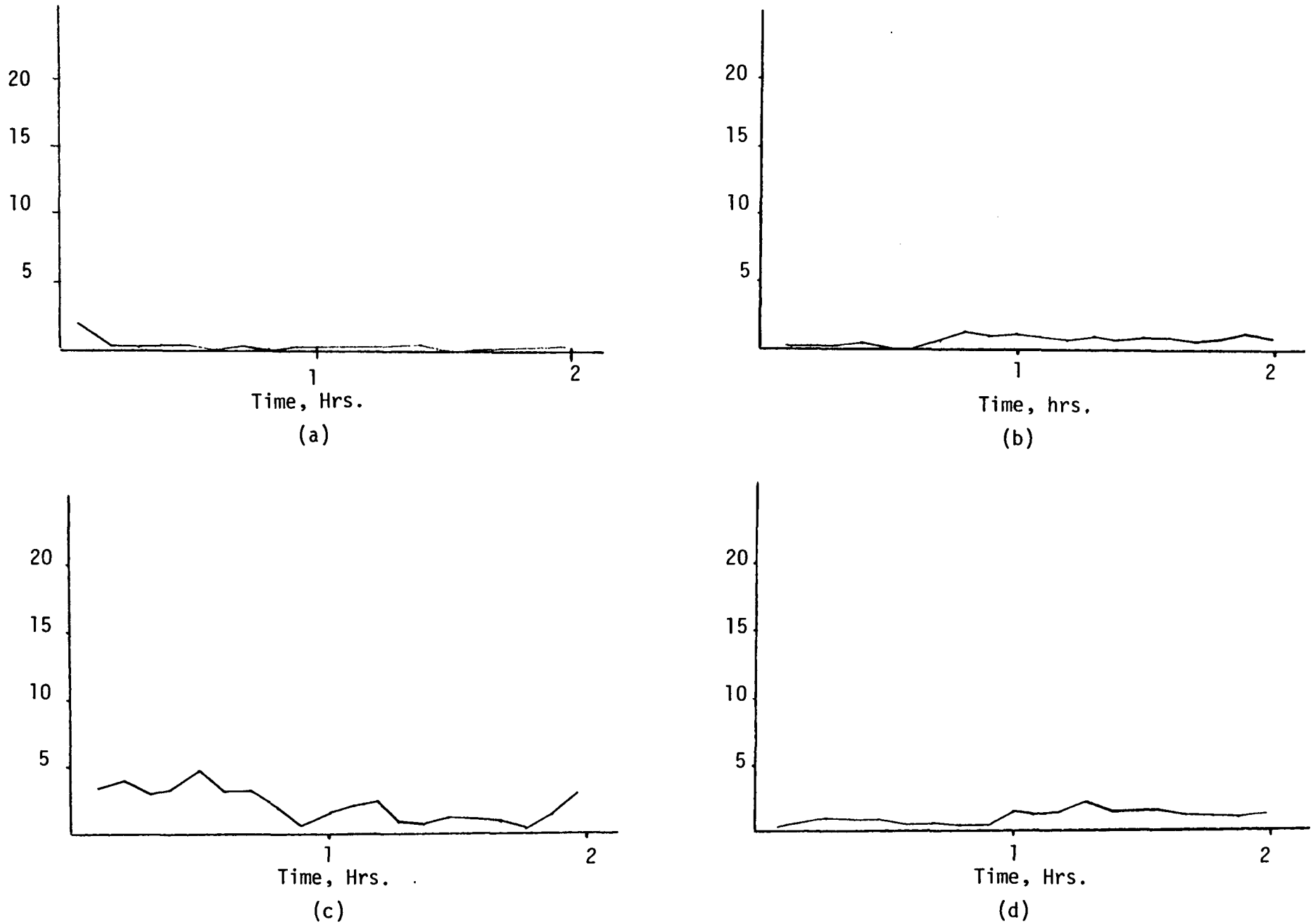


Figure V-1. OPACITY VERSUS TIME [a) Outlet Test #1 b) Outlet Test #2 c) Outlet Test #3 d) Outlet Test #4]

temperature in a laboratory hood. The sample was then desiccated for twenty-four hours, weighed, and the weight increase noted. The fiber glass filter thimbles were placed in the desiccator, dried for twenty-four hours, weighed and the particulate weight noted. The particulate found on the filter was added to that from the acetone wash to yield the total particulate catch. All laboratory weighings were performed on a Torbal analytical balance to the nearest 0.1 mg.

The particle sizing sample was obtained in an alundum thimble and brought back to the PES laboratory for sample preparation. The thimble was washed thoroughly with isopropyl alcohol to remove the particulate matter and to place the particles into solution. This solution was then sent to Spectrex Corporation where the particle size range determinations were performed using a scanning laser beam particle counter (Spectrex Prototron Particle Counter Model ILI 1000). The number of particles in each of fifteen five micron ranges (from 1 to 75 microns) were obtained as the results.