Note: This is a reference cited in *AP 42, Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources.* AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

The file name refers to the reference number, the AP42 chapter and section. The file name "ref02_c01s02.pdf" would mean the reference is from AP42 chapter 1 section 2. The reference may be from a previous version of the section and no longer cited. The primary source should always be checked.

Commonwealth of Pennsylvania
Environmental Resources
September 22, 1988

Subject: Source Test Review

To: Data File
Herbert R. Imbt, Inc.
Marion Township, Centre County

From: Thomas P. Bianca
Air Pollution Control Engineer
Division of Technical Services and Monitoring
Bureau of Air Quality Control

Through: Chief, Source Testing and Monitoring Section

Herbert R. Imbt, Inc. operates a batch asphalt plant in Marion Township, Centre County. Aggregate is transported from storage bins by belt conveyors to a rotary dryer. The hot aggregate is discharged into a hot bucket elevator and transported to hot screens where the aggregate is separated by size into hot holding bins. The material is then weighed according to product specification into a pug mill where heated asphaltic oil is added and mixed. The product is either discharged directly into trucks or may be conveyed to heated storage silos.

Heat is supplied to the dryer through the combustion of No. 2 fuel oil. The oil firing rate is approximately 600 gallons per hour.

Effluent is drawn by a 200 HP induced draft fan from various points in the plant, through a knockout box and into an Astec Industries, Inc. baghouse consisting of a single compartment with 832 Nomex woven bags. The effluent is then exhausted to the atmosphere through a stack having a discharge point approximately 31 feet above grade. The material captured by the knockout box and the baghouse is transported to a fines silo. The fines are then used in the process as needed. The fines not utilized in the process are unloaded via an elephant trunk into a covered truck for disposal.

Three particulate emission test runs were conducted by Mease Engineering Associates for New Source Performance Standards compliance and observed by Richard Maxwell, Jr. of the Williamsport Regional Office. Due to a rainstorm which terminated a paving project, Run No. 3 was aborted; however, an additional test run (Run No. 4) was conducted the following day. BCBC and G-Top were being produced during all four test runs.

The tests were conducted in accordance with the preapproved test protocol. The calculations are correct and the results appear to be valid.

COMMONWEALTH OF PENNSYLVANIA

September 12, 1988

SUBJECT: Test Report Review
Herbert R. Imbt, Inc.
Marion Township, Centre County
14-303-006

TO: L. Blaine DeHaven
Chief, Source Testing & Monitoring Section

FROM: Richard L. Maxwell, Jr.
Chief, Engineering Services
Bureau of Air Quality Control
Williamsport Regional Office

Enclosed is a test report for particulate stack sampling performed by Mease Associates on July 26 and 27, 1988 on a batch asphalt concrete plant. Would you please have someone on your staff review the report for Chapter 139 conformance, etc.

Also enclosed is a copy of my test observation memo.

The respective plant is subject to NSPS Subpart I (but don't worry about the absence of opacity observations).

RLM/skb

cc: File

COMMONWEALTH OF PENNSYLVANIA

August 1, 1988

SUBJECT: Herbert R. Imbt, Inc.
Marion Township, Centre County
14-303-006

TO: Files

FROM: Richard L. Maxwell, Jr.
Chief, Engineering Services
Williamsport Regional Office

On July 26 and 27, 1988 particulate stack testing was performed by Mease Engineering Associates on Imbt's new batch asphalt plant.

The first of three planned tests was just being concluded as I arrived at approximately 10 a.m. on the 26th. I did not observe the final leak check. The second test was started at 10:20 and concluded at approximately 1:15 after having been interrupted from approximately 11:09 to 12:25 due to the breakdown of the top oil distributor truck at the job site taking the majority of the plant's production. I observed the final leak check (approximately .003 cfm at 15 inches Hg). An attempt was made to perform a third test on the 26th but it had to be scrubbed part way through due to thundershowers at the main job site. The third test was conducted early on the morning of the 27th. I arrived at the plant site just in time to observe the conclusion of the test at approximately 9:20. The leak rate during the final leak check of the third test was observed to be approximately .001 cfm at 15 inches Hg.

The plant was running mostly base on the 26th and a mixture of top and base on the 27th. Production during the first test appeared to be approximately 250 TPH and during the second and third tests, approximately 230 TPH. According to the plant superintendent, the maximum possible production rate for the plant is approximately 320 TPH (if processing relatively dry stone and producing BCBC). The plant is apparently physically capable of a higher production rate but is limited by its computer controls to 320 TPH.

Other items worthy of note were:

- The collector pressure drop remained at approximately 2 inches throughout both days.

- The stack had zero opacity on the 26th. Although the background was bad (foggy) and the exhaust had some associated water vapor on the morning of the 27th, the stack also appeared to have zero opacity at that time. At no time were any fugitive emissions observed from any point in the plant.

- During the testing on the 26th, the secondary burner's blower was not operating due to a malfunctionfng motor. This was repaired prior to the third test on the 27th.

- The filters for the first two tests were very clean in appearance. The filter for the third test, although dirtier, was still relatively clean.

- There was a slight deviation from the test plan in that each point was sampled for only 4 minutes instead of 5. The test team was still pulling in excess of 50 cfm per test however.

- The temporary plywood stack extension appeared to be approximately 5 feet in height, making the distance from the sampling ports to the stack exit approximately 6½ feet.

- The scavenger system consisted of a blower and pickups at the hot elevator (halfway up), the screens and the weigh hopper/pugmill area (two pickups). This duct enters the collector separately from the dryer exhaust duct.

- All fines collected in the knockout box feed into the hot elevator boot. There are no provisions for alternate disposal. The collector fines can either be screw conveyed into the hot elevator boot or pneumatically conveyed to a fines silo. The fines silo is vented to the collector via a separate duct from either the dryer duct or the scavenger system duct. The fines silo is unloaded via a screw conveyor to the plant hot bin/weigh hopper area or, alternately, through a canvas sock-equipped chute into trucks. The plant superintendent claims that almost all of the fines are being recycled to the plant ("loading out only 1%"). If it ever becomes necessary to load out to trucks on a frequent basis, the current arrangement would not be adequate.

- The plant does not have hot asphalt silos. It must, therefore, mix on an immediate demand basis. This means that the times on the attached production records (which actually represent truck loading times) are also representive of mix times.

RLM:lm

PRODUCTION 7/26/88

8:23 AM	39,185	lbs	26-BCBC-75
8:28	45,107	"	"
8:33	45,125	"	"
8:38	45,088	"	"
8:43	45,098	"	"
8:48	45,087	"	"
8:53	45,042	"	"
8:59	44,974	"	"
9:05	45,118	"	"
9:10	45,190	"	"
9:17	45,076	"	"
9:19	9973	"	01-G-TOP
9:25	45,074	"	26-BCBC-75
9:31	45,020	"	"
9:36	45,080	"	"
9:41	45,059	"	"
9:46	44,981	"	"
9:51	45,117	"	"
9:56	44,943	"	"
10:01	45,051	"	"
10:06	17,943	"	01-G-TOP
10:11	44,976	"	26-BCBC-75
10:15	45,095	"	"
10:19	39,005	"	"
10:24	45,096	"	"
10:29	44,953	"	"
10:33	45,117	"	"
10:38	17,980	"	01-G-TOP
10:42	31,913	"	01-G-TOP

NOTE: THERE IS 460 lbs OF LIQUID ASPHALT IN EACH 11250 lb DROP OF 26-BCBC-75 AND 530 lbs IN EACH 8975 lb DROP OF 01-G-TOP

Prodcton 7/26/88

10:45	18,020	lbs	01-6-Top
10:51	18,002	"	"
10:56	44,962	"	26-BCBC-75
11:01	45,001	"	"
11:07	45,009	"	"
12:29	45,026	"	"
12:33	44,986	"	"
12:38	45,016	"	"
12:43	44,997	"	"
12:48	45:012	"	"
12:55	44,953	"	"
1:02	45,102	"	"
1:07	44,990	"	"
1:13	44;989	"	"
1:18	44,916	"	"
1:23	45,035	"	"
1:28	44,974	"	"
1:33	44,991	"	"
1:39	39,010	"	"
1:44	45 006	"	"
1:51	44 985	"	"
1:55	44 984	"	"
2:08	45,048	"	"
2:14	45,011	"	"

Production 7/27/88

5:37	44,908	lbs	03-6-TOP
5:43	45,001	"	"
5:48	44,924	"	"
5:53	45,199	"	"
6:05	45,108	"	"
6:09	44,837	"	"
6:16	44,761	"	"
6:22	44,635	"	"
6:32	44,746	"	"
6:37	44,693	"	" 3RD TEST STARTED @ 6:40
6:42	44,606	"	"
6:47	44,707	"	"
6:59	44,880	"	"
7:03	44,675	"	"

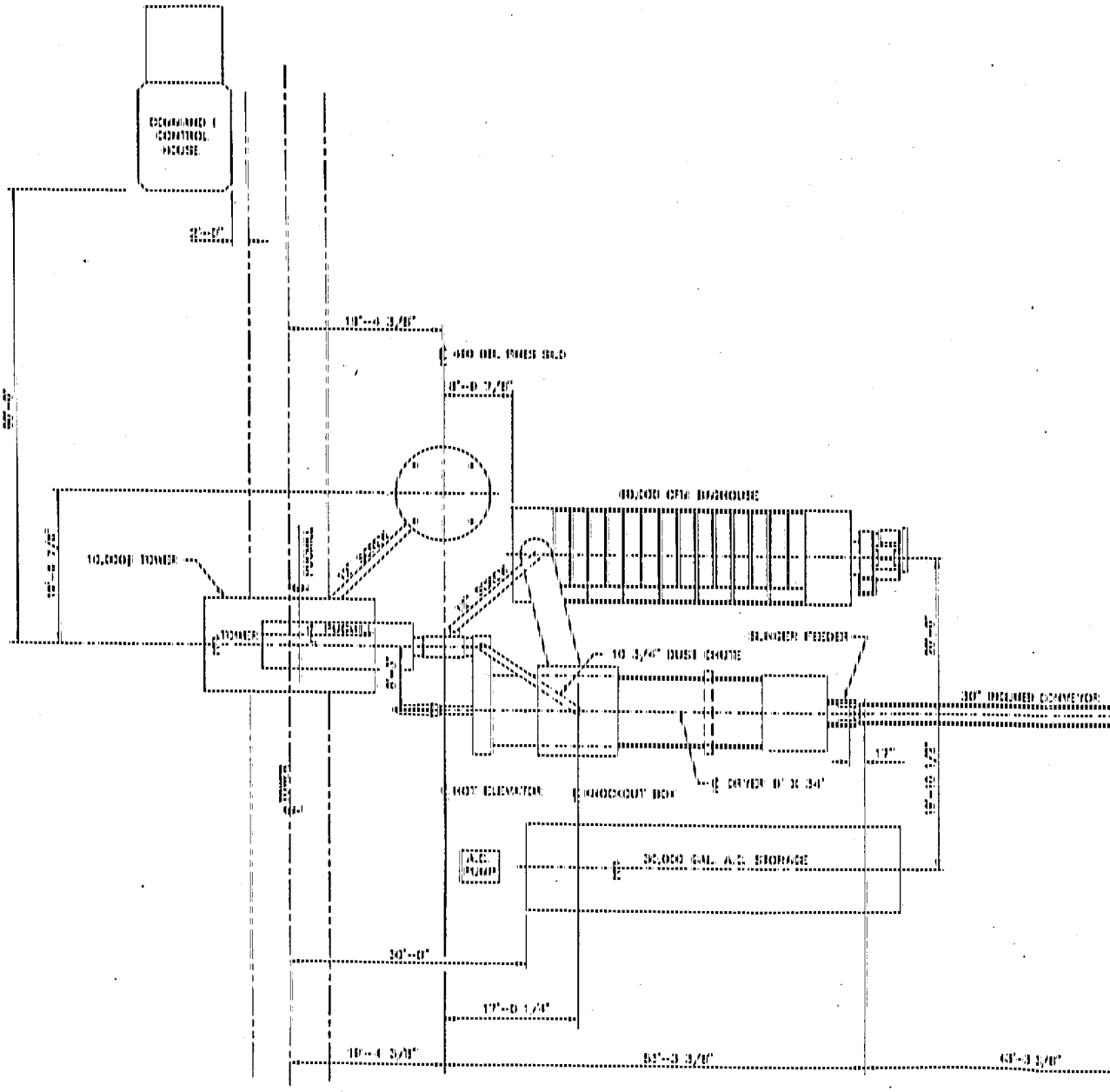
NOTE: THERE ARE 675 lbs OF GOOD ASPHALT IN EACH LOAD to DROP OF 03-6 TOP, 400 lbs IN EACH 1250 DROP OF 23-BCBC AND 400 lbs IN EACH 1250 DROP OF 26-BCBC-75.

Production STOPPED FROM APPROX. 7:10 - 8:10 DUE TO FAULTY PLUNGER SEAL IN GOOD ASPHALT WEIGH HOPPER

8:08	44,704	"	"
8:12	44,742	"	"
8:17	44,688	"	"
8:27	44,687	"	"
8:41	45,003	"	23-BCBC
8:46	45,058	"	"
8:51	45,008	"	"
8:55	45,002	"	26-BCBC-75
8:59	45,021	"	"
9:04	44,992	"	"
9:07	39,041	"	"
9:11	39,094	"	"
9:16	44,885	"	"

Production 7/27/08

9:22	45006	lbs	23-Bobc
9:27	45,034	"	"


COMMAND I CONTROL HOUSE
2'-0"
19'-4 3/8"
400 BBL FINES SILO
8'-0 7/8"
40,000 CFM BAGHOUSE
10,000# TOWER
TOWER
PUSHBELL
10 3/4" DUST CHUTE
SLINGER FEEDER
30" INCLINED CONVEYOR
17"
HOT ELEVATOR
KNOCKOUT BOX
DRYER 8' X 34'
A.C. PUMP
30,000 GAL. A.C. STORAGE
30'-0"
17'-0 1/4"
19'-4 3/8"
53'-3 3/8"
63'-3 3/8"

Lloyd Manda

RECEIVED
SEP 09 1988
DER-AIR QUALITY CONTROL
WILLIAMSPORT REGION

SOURCE TEST REPORT

Particulate Emissions

Herbert R. Imbt, Inc.
Bellefonte, Pennsylvania
July, 1988

Client: Herbert R. Imbt, Inc.
P.O. Box 155
State College, Pennsylvania

Testing Firm: Mease Engineering Associates
P.O. Box 721
State College, Pennsylvania

CONTENTS

1.0 Summary of Results

2.0 Lab & Field Data

3.0 Test Procedures

4.0 Calibrations

5.0 Calculations

SECTION 1.0

Summary of Results

CLIENT:	Herbert R. Imbt, Inc. P.O. Box 155 State College, Pennsylvania 16804-0155
TEST LOCATION:	Herbert R. Imbt, Inc. I-80 Interchange @ Exit 24 Bellefonte, Pennsylvania 16823
UNIT TESTED:	Asphalt Dryer/Baghouse
TEST PURPOSE:	Determine the particulate emission rate as required by the Pennsylvania Department of Environmental Resources to determine compliance with applicable air pollution emission regulations.
TEST EQUIPMENT:	Research Appliance Company "STAKSAMPLR" Portable Gas Sampler, Model #2343.
TEST METHODS:	Environmental Protection Agency Method 5 and as modified by the Pennsylvania Dept. Environmental Resources 'Source Testing Manual'
TEST OBSERVER:	Mr. Richard Maxwell Pennsylvania Department of Environmental Resources
TEST PERSONNEL:	Michael J. Mease Tim Lockard
TESTING FIRM:	Mease Engineering Associates P.O. Box 721 State College, PA 16804
TEST ENGINEER:	

Michael J. Mease
Pennsylvania Professional Engineer No. 26809-E

TEST DATA SUMMARY

Process: Asphalt Dryer/Baghouse

	Run #1	Run #2	Run #4
Test Date and Times	07-26-88 8:09- 9:53 am	07-26-88 10:19am- 1:15 pm	07-27-88 6:45 - 9:25 am
Stack Area, Square Feet	11.000	11.000	11.000
Sampling Nozzle Diameter, Inches	0.189	0.189	0.189
Testing Time, Minutes	96	96	96
Stack Gas Volume Sampled, ACF	61.383	59.329	58.707
Stack Gas Volume Sampled, SCF @ 70 deg. F., 29.92 in.Hg.,dry	57.4	54.9	55.7
Stack Gas Temperature, deg. F.	232	242	234
Stack Gas Moisture Content, %	23.0	25.5	27.5
Stack Gas Composition,			
%CO2	6.17	5.90	5.03
%O2	14.9	14.8	14.9
Stack Gas Molecular Weight	26.9	26.6	26.3
Stack Gas Velocity, Ft./Sec.	80.7	79.8	83.8
Stack Gas Flowrate, ACFM	53,200	52,700	55,300
Stack Gas Flowrate, SCFM @ 70 deg. F., 29.92 in.Hg.,dry	31,500	29,800	30,600
Particulate Captured, Grams (Front Half & Back Insoluble)	0.0400	0.0420	0.0461
Particulate Concentration,			
Grains/SCF	0.011	0.012	0.013
Grains/ACF	0.006	0.007	0.007
Particulate Mass Rate, Lb./Hr.	2.90	3.01	3.34
Percent Isokinetic of Test	107	108	107

TEST PROCEDURE SUMMARY

The sampling ports on the rectangular stack were located approximately 177 inches downstream (4.5 diameters) from a flow disturbance and approximately 24 inches (0.61 diameters) from an upstream flow disturbance (top of the steel stack). At the request of D.E.R., a 60 inch stack extension was added to these dimensions. The stack measured 33 inches by 48 inches, with six sampling ports on the 48 inch side. Six separate traverses of four points each were sampled for a total of twenty-four sampling points. The sampling points were located at the following distances, in inches, from the inside stack walls: 4.13, 12.38, 20.63, and 28.88.

Each point was sampled for a period of four minutes each for a total test time of ninety six minutes. Three separate tests were conducted.

The tests followed the EPA Method 5 procedures and those procedures as required by the Pennsylvania Department of Environmental Resources. These included washing the probe with both acetone and distilled water and the analysis of impinger solutions as outlined in Section 3.0 of this report.

Test No. 1:

The test began at 8:09 am and concluded at 9:53 am without interruption.

TEST PROCEDURE SUMMARY

Test No. 2:

Test No. 2 began at 10:19 am on July 26, 1988 and was interrupted at 11:09 am when the process shut down due to a shut down of the paving project (distributor truck breakdown). The process resumed and the test re-started at 12:26 pm and continued until completion at 1:15 pm.

Test No. 3:

Test No. 3 began at 1:49 pm on July 26, 1988. At approximately 2:15 pm the plant shut down due to a rain storm which terminated the paving project. The test was aborted and the sample box was cleaned and re-built for Test No. 4.

Test No. 4:

Test No. 4 began at 6:45 am on July 27, 1988. At 7:10 am the plant shut down. The problem was solved, the plant re-started, and the test resumed at 8:10 and continued, without interruption, until completion at 9:25 am.

SAMPLE RESULTS SUMMARY

Process emissions were calculated by using the front half of the sampling train and the insoluble portion of the rear half of the sampling train. The captured particulate was a light yellowish-brown color, barely visible on the white fiberglass filters.

The average particulate concentration was determined to be 0.012 grains per standard cubic foot. The average particulate emission rate was determined to be 3.08 pounds per hour.

IMBT
Herbert R. Imbt, Inc.

A SUBSIDIARY OF KOPPERS COMPANY, INC.

1750 West College Avenue, P.O. Box 155, State College, PA 16804-0155
(814) 238-5071

August 15, 1988

Mr. Michael J. Mease, P.E., P.L.S., President
Mease Engineering Associates
Post Office Box 721
State College, PA 16804-0721

Re: Herbert R. Imbt, Inc.
Plant 103 - Asphalt
Plant Stack Test

Dear Mr. Mease:

I have completed my review of the preliminary Source Test Report for Plant 103 and have found it to be satisfactory. The process weight rates for the plant during the test periods was 220 TPH on 7/26/88 and 250 TPH on 7/27/88. I have enclosed a process description and a flow diagram so that the final report may be completed.

If you have any questions, please contact me at (814) 238-5071.

Sincerely,

HERBERT R. IMBT, INC.

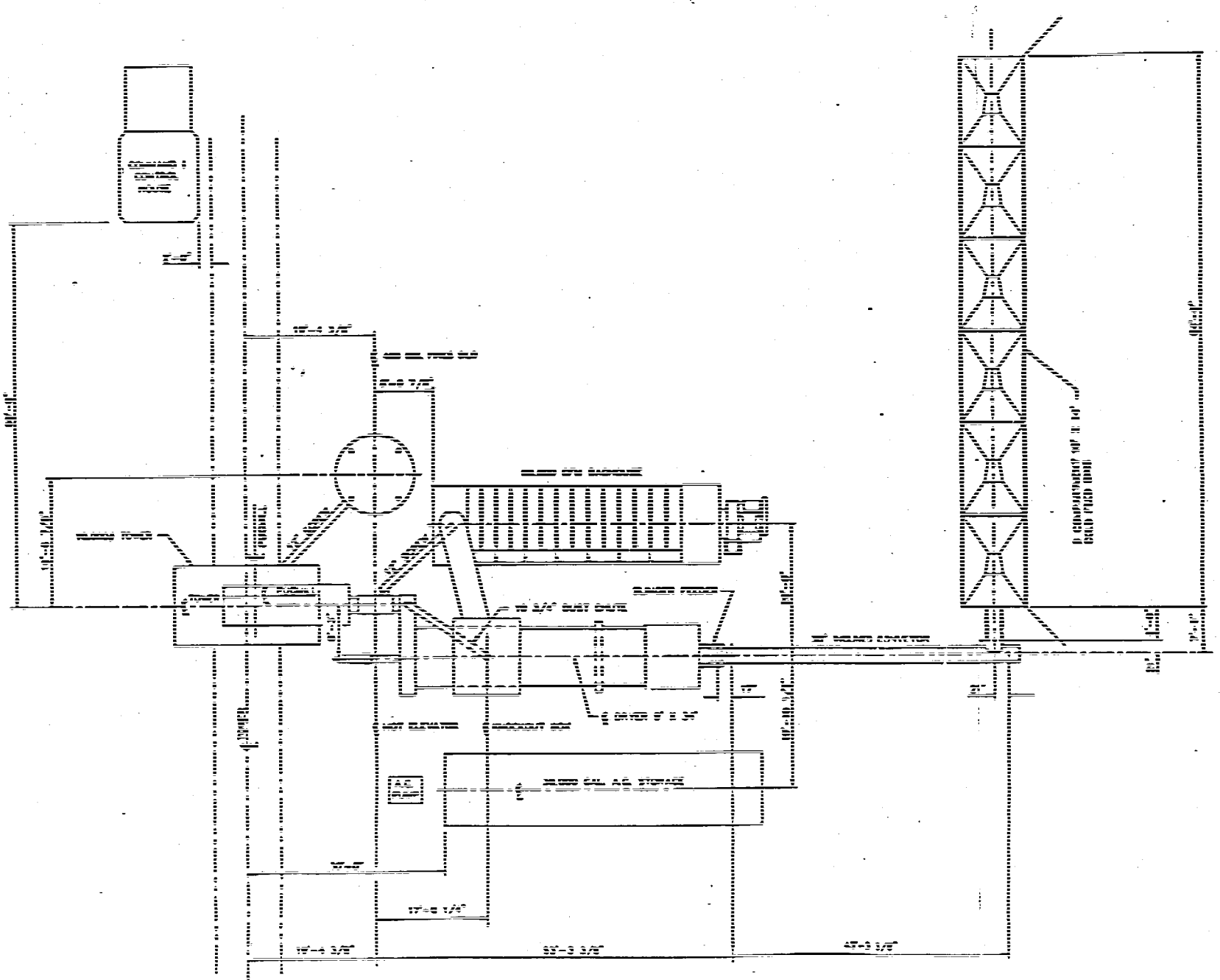
Lloyd Manda

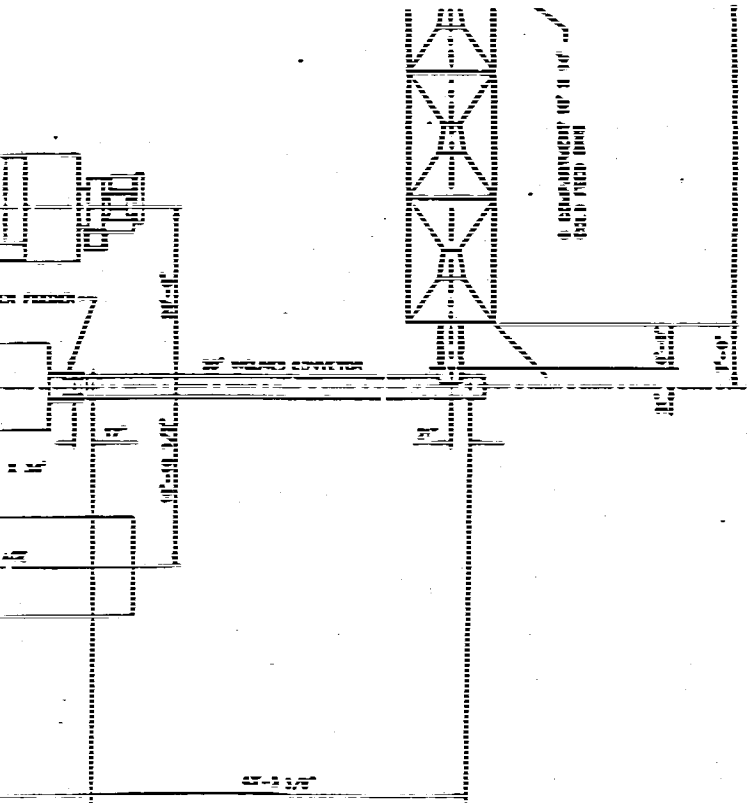
LM:mw
Enclosures

My records indicate a 250 TPH for both test 1 period and test 2 period.

PROCESS DESCRIPTION

Plant 103 is a 10,000# hot-mix asphalt batch plant with a rated capacity of 400 TPH. The plant burns No. 2 fuel oil and has a 9' x 34' dryer with an air volume of 56,000 ACFM @ 200°F. The hot elevator and hot bins are enclosed. Temperature controls are on the material chute, exhaust stack, and baghouse. Fines are directed back to the pugmill. The plant has a knockout box and an 832-bag baghouse with a gas volume of 60,000 ACFM @ 200°F. High and low temperature controls protect the bags during start-up and plant operation.





NOTE:

NO	REVISION	APPR	BY	DATE
3	COMPLETED & BROUGHT UP TO DATE		B.K.	[illegible]
2	RE-LOCATED BAGHOUSE, A.C. STORAGE TANK, PINES SILO & CONTROL HOUSE		B.K.	[illegible]
1	RE-LOCATED BAGHOUSE, A.C. STORAGE TANK, PINES SILO & SOLID FEED BIN		B.K.	[illegible]

ASTEC INDUSTRIES, INC.

HERBERT R. IMBT, INC.

PLANT LAYOUT

5' DRYER

87-224		87-224-1	3

SECTION 2.0

Lab & Field Data

Mease Engineering Associates

Environmental Consultants

LABORATORY WORKSHEET

Client: Exxon

Run No. & Date: 1 7-24-88

Process: Asphalt Plant 103

Sample Box No.: 1

Filter Analysis:

Filter Wt., grams	0.6524
Filter Tare, gms	0.6343
Part. Increase, gms	0.0181

Impinger Water Increase:

Silica Gel Impinger (#4):

Final Wt., gms	211.3
Tare Wt., gms	174.3
H_2O Increase	37.0

Total Water Volume Increase:

Impinger #1	124 ml
Impinger #2	105 ml
Impinger #3	62 ml
Impinger #4	37.1 ml
TOTAL INCREASE	364.1 ml

Impinger Analysis:

Wash Bottle No.	1
Filter Wt., gms	0.2179
Filter Tare, gms	0.2157
Total Insoluble	0.0019
Final Beaker Wt.	150.2273
Tare Wt. (No. ___)	150.2236
Total Soluble	0.0037

Particulate Weight Summary:

Filter	0.0181
Probe Wash	0.0202
Impingers (Sol.)	
Impingers (Insol.)	0.0019
Total (w/Imp.)	0.0402 grams
Total (w/o Imp.)	grams

Signature: Wesley O. Mease

Date: 7-29-88

Probe Wash Analysis:

Wash Volume, ml.	
Acetone Density, mg/ml.	
Blank Volume, ml	

Insoluble Residue-Water Rinse

Final Wt.	0.0235
Filter Tare Wt.	0.0163
Insol. Part. Wt.	0.0072

Water Wash Analysis, Bottle No. 1

Beaker Wt., gms	157.5315
Tare Wt. (No. ___)	157.5293
Soluble Part. Wt., gms	0.0022

Acetone/Front Half/Soluble

Wash Bottle No.	FP-1
Beaker Wt., Gms.	152.9598
Tare Wt., Gms.	152.9592
Soluble Wt. Gms.	0.0006

Acetone/Back Half/Soluble

Wash Bottle No.	
Beaker Wt., Gms.	154.2824
Tare Wt., Gms.	154.2771
Soluble Wt, Gms.	0.0054

Mease Engineering Associates

Environmental Consultants

LABORATORY WORKSHEET

Client: H.R. IMBT

Run No. & Date: 2 7-26-88

Process: ASPHALT PLANT 103

Sample Box No.: 2

Filter Analysis:

Filter Wt., grams	0.6658
Filter Tare, gms	0.6359
Part. Increase, gm.	0.0299

Impinger Water Increase:

Silica Gel Impinger (#4):

Final Wt., gms	773.6
Tare Wt., gms	756.5
H_2O Increase	17.1

Total Water Volume Increase:

Impinger #1	236 ml
Impinger #2	142 ml
Impinger #3	3 ml
Impinger #4	17.1 ml
TOTAL INCREASE	398.1 ml

Impinger Analysis:

Wash Bottle No.	2
Filter Wt., gms	0.0179
Filter Tare, gms	0.0162
Total Insoluble	0.0017
Final Beaker Wt.	148.8232
Tare Wt. (No.___)	148.8182
Total Soluble	0.0050

Particulate Weight Summary:

Filter	0.0299
Probe Wash	0.0104
Impingers (Sol.)	
Impingers (Insol.)	0.0017
Total (w/imp.)	0.0420 grams
Total (w/o imp.)	0 grams

Probe Wash Analysis:

Wash Volume, ml.	
Acetone Density, mg/ml	
Blank Volume, ml	

Insoluble Residue-Water Rinse

Final Wt.	0.0211
Filter Tare Wt.	0.0161
Insol. Part. Wt.	0.0050

Water Wash Analysis, Bottle No. 2/2

Beaker Wt., gms	146.2332
Tare Wt. (No.___)	146.2318
Soluble Part. Wt., gms	0.0014

Acetone/Front Half/Soluble

Wash Bottle No.	21
Beaker Wt., Gms.	155.7171
Tare Wt., Gms.	155.7131
Soluble Wt. Gms.	0.0040

Acetone/Back Half/Soluble

Wash Bottle No.	
Beaker Wt., Gms.	144.2139
Tare Wt., Gms.	144.2108
Soluble Wt, Gms.	0.0031

Signature: Michael J. Mease

Date: 7-29-88

Mease Engineering Associates

Environmental Consultants

LABORATORY WORKSHEET

Client: H.F. IMST

Process: ASPHALT PLANT 103

Run No. & Date: 4 7-27-88

Sample Box No.: 3-A

Filter Analysis:

Filter Wt., grams	0.6621
Filter Tare, gms	0.6331
Part. Increase, gm.	0.0290

Impinger Water Increase:

Silica Gel Impinger (#4):

Final Wt., gms	924.3
Tare Wt., gms	906.0
H_2O Increase	18.3

Total Water Volume Increase:

Impinger #1	220 ml
Impinger #2	206 ml
Impinger #3	5 ml
Impinger #4	18.3 ml
TOTAL INCREASE	449.3 ml

Impinger Analysis:

Wash Bottle No.	3-A
Filter Wt., gms	0.0183
Filter Tare, gms	0.0161
Total Insoluble	0.0022
Final Beaker Wt.	156.6239
Tare Wt. (No.____)	156.6169
Total Soluble	0.0070

Particulate Weight Summary:

Filter	0.0290
Probe Wash	0.0149
Impingers (Sol.)	
Impingers (Insol.)	0.0022
Total (w/imp.)	0.0461 grams
Total (w/o imp.)	grams

Signature: Michael J. Mease

Date: 7-29-88

Probe Wash Analysis:

Wash Volume, ml.	
Acetone Density, mg/ml	
Blank Volume, ml	

Insoluble Residue-Water Rinse

Final Wt.	0.0219
Filter Tare Wt.	0.0164
Insol. Part. Wt.	0.0055

Water Wash Analysis, Bottle No. 3

Beaker Wt., gms	149.1954
Tare Wt. (No.___)	149.1932
Soluble Part. Wt., gms	0.0022

Acetone/Front Half/Soluble

Wash Bottle No.	3/3
Beaker Wt., Gms.	158.1822
Tare Wt., Gms.	58.1750
Soluble Wt. Gms.	0.0072

Acetone/Back Half/Soluble

Wash Bottle No.	3-A-R
Beaker Wt., Gms.	152.7355
Tare Wt., Gms.	152.7311
Soluble Wt, Gms.	0.0044

MEASE ENGINEERING ASSOCIATES

FIELD DATA

Run no. 1
Location N.R. DMBT
Date 7-26-88
Operator MEASE/HOLLAND
Sample box no. 1

K Factor 1.03
C_p 0.84
C_M 1.008
Stack dimen.
Stack press., in. H_2O −0.42
Gas composition, % O_2 16.4 14.5 6.95
% CO_2 4.0 5.6 13.7
% N_2
Time, start 8:09 AM
Time, finish 9:53 AM

Ambient Temp., °F 80
Bar. press., in. hg. 30.06
Assumed moisture, % 15-17
Probe tip diameter, in. 3/16
Probe length 3'SS
Probe heater setting SS
Box heater setting 225
Leak checks, pre: 0.014 @ PAGE 25 in-Hg
post: 0.004 @ PAGE 12 in-Hg
Wash bottle no. WATER: 1/1 ACE: POT-1

Initial dry gas meter reading 116.919

Notes:

Point	Clock time	Dry gas meter	Pitot in. H_2O ΔP	Orifice in. H_2O ΔH	Dry gas temp. °F Inlet	Dry gas temp. °F Outlet	Stack temp. °F	Pump vacuum in. Hg.	Impinger temp. °F	Box temp. °F
1	4	119.798	1.65	1.65	97	95	224	8.0	<50	210
2	4	123.183	2.35	2.40	111	99	221	11.0	<50	220
3	4	124.500	2.30	2.13	121	102	219	11.0	<50	225
4	4	129.416	1.90	1.65	125	105	223	9.5	<50	220
5	4	132.477	2.40	2.08	121	105	222	10.0	<50	225
6	4	135.397	2.45	2.11	125	107	230	10.5	<50	220
7	4	138.291	1.95	1.67	123	107	237	10.0	54	225
8	4	140.711	1.28	1.10	124	109	232	8.0	56	225
9	4	143.772	2.31	1.90	121	110	231	9.5	58	220
10	4	146.676	1.97	1.68	123	111	235	9.0	62	225
11	4	149.092	1.30	1.11	125	111	235	8.0	64	230
12	4	151.170	0.92	0.80	124	113	228	7.0	63	225
13	4	154.103	2.00	1.72	121	111	228	10.0	64	230
14	4	156.702	1.48	1.28	124	114	231	8.0	63	230
15	4	158.806	0.91	0.78	125	115	233	6.5	62	225
16	4	160.666	0.70	0.60	124	114	242	6.0	62	215
17	4	163.392	1.90	1.63	120	115	239	9.0	60	205
18	4	166.953	1.42	1.21	123	115	241	8.0	61	225
19	4	167.971	0.91	0.78	124	116	239	7.0	60	215
20	4	169	0.64	0.53	124	116	237	6.0	60	210
21	4	172.114	1.31	1.12	121	116	237	8.0	60	220
22	4	174.036	1.28	1.10	123	117	237	8.0	62	210
23	4	176.049	0.94	0.80	125	117	237	7.0	61	205
24	4	178.302	0.69	0.59	126	118	238	6.5	60	210
	96	59.383	1.214	1.0417	576.208	114.208	692.208	232.209		

MEASE ENGINEERING ASSOCIATES

FIELD DATA

Run no. 2
Location HR IMBT ASPHALT PLANT
Date 7-26-88
Operator MEASE/LOCKEED
Sample box no. 2

Initial dry gas meter reading 178.540

K Factor 1.03
C_p
C_M
Stack dimen.
Stack press., in. H_2O -0.42
Gas composition, % O_2 14.5 15.3 14.7
% CO_2 6.5 5.5 5.7
% N_2
Time, start 10:19 AM
Time, finish 11:15 PM

Ambient Temp., °F
Bar. press., in. hg. 30.06
Assumed moisture, % 15-17
Probe tip diameter, in. 3/16
Probe length 3'SS
Probe heater setting
Box heater setting
Leak checks, pre: 0.003 CFM @ 15" H_g
post: 0.004 CFM @ 15" H_g
Wash bottle no. WATER 2/2 ACE 29

Notes: 60" PLUMBED EXTENSION
* PLANT SHUT DOWN AT 11:09
RESUMED AT 12:24

Point	Clock time	Dry gas meter	Pitot in. H_2O ΔP	Orifice in. H_2O ΔH	Dry gas temp. °F Inlet	Dry gas temp. °F Outlet	Stack temp. °F	Pump vacuum in. Hg	Impinger temp. °F	Box temp. °F	
1	4	180.911	1.28	1.10	117	113	232	7.5	<50	225	
2	4	183.188	1.18	1.01	124	119	239	8.5	<50	230	
3	4	185.264	0.92	0.79	129	120	241	7.0	<50	235	
4	4	187.056	0.68	0.58	131	120	242	6.0	<50	230	
5	4	189.628	1.60	1.36	126	119	248	8.0	<50	225	
6	4	192.021	1.31	1.10	131	121	256	7.5	52	230	
7	4	194.116	0.97	0.81	132	122	260	7.0	54	230	
8	4	196.046	0.81	0.68	133	123	260	6.5	52	245	
9	4	198.958	2.02	1.69	131	123	261	9.0	54	220	
10	4		1.64	1.39	133	123	257	8.5	58	225	
11	4	203.897	1.15	0.97	133	124	256	7.5	56	220	
12	4	205.825	0.78	0.67	131	125	250	7.0	54	225	
13	4	208.288	1.45	1.23	110	110	234	8.0	<50	220	*
14	4	211.148	1.90	1.63	117	115	231	9.0	<50	225	
15	4	213.487	1.32	1.65	123	115	234	8.0	<50	220	
16	4	215.371	0.82	0.71	122	116	233	6.5	<50	225	
17	4	218.497	2.30	1.97	115	114	230	10.5	52	230	
18	4	221.674	2.42	2.07	121	115	231	11.0	54	235	
19	4	224.556	1.98	1.70	126	116	238	9.5	56	230	
20	4	226.841	1.15	0.99	128	117	236	7.5	57	225	
21	4	229.694	1.26	1.08	126	117	237	7.5	52	200	
22	4	232.	1.84	1.59	129	118	231	9.0	54	210	
23	4	235.063	2.28	2.07	127	120	230	11.5	56	220	
24	3	237.859	1.81	1.56	128	121	228	9.5	54	225	
		59.319	1.1186	1.2419	582.19	122.19	7101.708	241.708			

MEASE ENGINEERING ASSOCIATES

FIELD DATA

Run no. 4
Location H.R. IMBT - DUCT 103
Date 7-27-88
Operator MEASE/HOLLAND
Sample box no. 3-A

K Factor .097
C_p 0.84
C_M 1.008
Stack dimen.
Stack press., in. H_2O -0.38
Gas composition, % O_2 16.0 14.8 13.9
% CO_2 4.9 5.2 5.6
% N_2
Time, start 6:45 AM
Time, finish 9:25 AM

Initial dry gas meter reading 257.608

Ambient Temp., °F 80
Bar. press., in. hg. 29.94
Assumed moisture, % 17
Probe tip diameter, in. 3/16
Probe length 3'6S
Probe heater setting 60
Box heater setting 225
Leak checks, pre: 0.012 CFM @ 25" Hg
post: 0.001 CFM @ 15" Hg
Wash bottle no. WATER 3 ACE: 3/5

Notes: 7:10 PROBES DOWN
8:10 RESUMED

Point	Clock time	Dry gas meter	Pitot in. H_2O ΔP	Orifice in. H_2O ΔH	Dry gas temp. °F Inlet	Dry gas temp. °F Outlet	Stack temp. °F	Pump vacuum in. Hg.	Impinger temp. °F	Box temp. °F	
1	4'	259.80	1.30	1.01	96	94	235	8.0	<50	200	
2	4	262.621	2.12	1.63	106	98	249	12.0	<50	210	
3	4	265.7	2.44	1.87	113	98	254	13.0	<50	210	
4	4	268.643	2.45	1.90	117	101	253	13.0	52	205	
5	4	271.436	2.00	1.53	113	102	249	12.5	54	210	
6	4	274.463	2.39	1.84	120	106	260	13.5	56	220	
7	4	277.456	2.46	1.92	95	95	214	14.0	<50	215	
8	4	279.744	1.31	1.07	102	98	202	9.0	<50	226	
9	4	282.546	2.16	1.72	102	98	221	12.0	<50	225	
10	4	285.297	1.92	1.56	107	98	218	11.0	54	220	
11	4	288.031	1.94	1.56	109	99	220	11.0	56	215	
12	4	289.928	0.84	0.67	111	99	225	8.0	54	210	
13	4	291.550	1.86	1.50	106	99	215	11.0	56	210	
14	4	295.191	1.77	1.41	109	99	229	11.5	56	210	
15	4	297.331	1.41	0.88	110	100	232	8.5	54	205	
16	4	299.137	0.72	0.57	111	101	231	7.0	55	210	
17	4	301.831	1.96	1.55	106	100	231	11.5	54	215	
18	4	304.211	1.92	1.52	110	101	234	9.5	56	215	
19	4	306.177	0.92	0.73	111	103	236	8.0	54	215	
20	4	307.913	2.71	0.56	111	103	237	7.0	56	220	
21	4	310.	1.40	1.10	110	103	241	9.0	55	215	
22	4	312.427	1.31	1.02	111	103	243	9.0	52	210	
23	4	314.404	0.99	0.78	111	103	246	8.0	53	210	
24	4	316.315	0.98	0.69	112	104	244	7.5	52	215	
			1.3214	1.2576	53.46	100.46	234.375	47.775			

SECTION 3.0

Test Procedures

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES
Post Office Box 2063
Harrisburg, Pennsylvania 17120

July 8, 1988

Bureau of Air Quality Control

Mr. Michael J. Mease
Mease Engineering Associates
P.O. Box 721
State College, PA 16804

Dear Mr. Meases

The particulate test protocol submitted for the Herbert R. Imbt batch asphalt facility located in Marion Township, Centre County is acceptable to the Department with one minor revision. The sketch of the sampling ports and points indicate that the sections of equal areas to be 6 inches by 8.25 inches. They should read 8 inches by 8.25 inches.

Although the downstream location of the sampling ports is satisfactory, the upstream location is minimal and could result in interferences depending upon the atmospheric conditions at the time of the test program. I would recommend that either a 4.5-5 feet stack extension be attached to the existing stack or the sampling ports be lowered by three to four feet.

Final exceptance of the test report will be contingent upon fulfilling all of the applicable sections of the Department of Environmental Resources' Rules and Regulations and the Source Testing Manual. If you should need any further assistance regarding this matter, please feel free to contact me.

Very truly yours,

Richard St. Louis, Chief
Source Testing Unit

Mease Engineering Associates

Engineers & Surveyors

June 17, 1988

Mr. Richard Maxwell
Bureau of Air Quality Control
Pennsylvania Department of Environmental Resources
200 Pine Street
Williamsport, PA 17701

Re: Source Test Protocol
Herbert R. Imbt Asphalt Plant
Bellefonte, PA

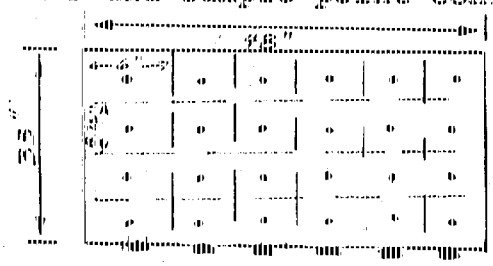
Dear Mr. Maxwell:

We hereby propose to perform a series of particulate source emission tests at the subject facility with the following test procedures:

Three particulate tests of approximately two hours each will be conducted using the DER procedures (back half analysis of test train included) on an asphalt dryer/baghouse process.

The vertical stack is rectangular, approximately 33 inches by 48 inches by forty feet high. The six sampling ports are located on the 48 inch side approximately 177 inches from a downstream flow disturbance (damper; 4.5 diameters) and 24 inches from an upstream flow disturbance (top of stack; 0.61 diameters). We anticipate sampling twenty four sampling points (four per traverse) at five minutes each for a total test time of one hundred twenty minutes. We propose to perform three tests, with a minimum sample volume of 50 DSCF per emission test.

The sampling ports and sample point configurations are:



= SAMPLE PORTS

P.O. BOX 721 • STATE COLLEGE, PENNSYLVANIA 16804 • PHONE 814-692-4225

Sampling points will be located at the following points:

Point	Location (In. from stack wall)
1	4.13
2	12.38
3	20.63
4	28.88

Stack gas composition will be determined with several grab samples using a Fyrite Analyzer at the stack sampling ports.

The emission test train will use the standard Research Appliance Company "STAKSAMPLR", model #2343, with a stainless steel probe. Should cyclonic flow be evident, the test procedures will be discussed with D.E.R. officials prior to the commencement of tests.

We anticipate one test day to complete the tests. We will perform test equipment preparations and flowrate checks the day before testing and begin testing early the following morning. The typical uneven operation of asphalt plants may require a second day of testing. The tests are tentatively scheduled for the week of July 25, 1988. We certainly will call with the exact test date and time.

Very truly yours,

MEASE ENGINEERING ASSOCIATES

Michael J. Mease, P.E.
President

MJM: epa
ccs: Mr. Lloyd Manda
Herbert R. Imbt

ATTACHMENT NO. 2
DER ANALYTICAL PROCEDURES

DETERMINATION OF PARTICULATE EMISSIONS FROM SOURCE TESTS

I. Introduction

This procedure determines gravimetrically the particulate captured on collection surfaces and in solutions during source testing. The sampling train should be analyzed within a maximum of 48 hours after collection.

II. Pretest Preparation

A. Field Materials

1. Glass fiber filters, Gelman type A, or equal.
2. Alundum thimbles, Norton grades AL788, AL899, AL485, or equal.
3. Triple distilled and deionized water.
4. Acetone, reagent grade.
5. Silica gel, indicating type, 6-16 mesh.

B. Glass Fiber Filters

1. Heat the filter to 900°F for one hour then desiccate for 24 hours.
2. Identify all filters sequentially using a five-digit number. The first digit equals the diameter of the filters e.g., "30079" signifies the 79th 3" filter weighed.
3. Weigh the filter to the nearest 0.1 mg. Record the weight, the identification number and the date.
4. Place the filter in a clean, dry container (petri dish) which is identified with the number of the enclosed filter and seal the container. DO NOT FOLD FILTERS.

C. Alundum Filters

1. Sand the lip and outside of the filter (thimble) to remove loose particles. Check the thimble to assure a proper seal in the filter holder.
2. Wash the thimble a minimum of four times in clean distilled water using an ultrasonic cleaner. Use clean water each time.
3. Air dry the thimble.
4. Identify the thimbles sequentially using Coors ceramic ink. Use an alpha numeric system of five characters. The first is the letter A; e.g., "A0079" signifies the 79th alundum filter weighed.

5. Place the thimble in a cold muffle furnace and heat to 600°F at a rate not to exceed 200°F per hour. Increase the temperature to 1200°F and hold for four hours minimum.

6. Cool in a desiccator for 24 hours and weigh to the nearest 0.1 mg. Record the weight, identification number and date.

7. Place the thimble in a clean, dry container which is identified with the number of the enclosed thimble and seal the container.

D. Distilled Water, Acetone, and Silica Gel

1. Provide triple distilled, deionized water for the collection train and cleanup procedures and acetone for cleanup.

2. Store each in a sealable, clean container.

3. Retain a sample of each for a blank determination.

4. Dry approximately 300gm of silica gel at a temperature of 105°C for approximately 12 hours. Desiccate until cool and place in an air-tight container.

III. Particulate Analysis

A. Procedure:

1. Remove the used glass fiber or alundum filters carefully to prevent loss of collected particulate or filter material and store in their original, relabeled, clean containers (separate petri dishes).

2. Measure to the nearest ml the volume of liquid in each impinger and record.

3. Place the impinger solutions in a labeled container and wash any residue in the impingers into the container using distilled water.

4. Add the washings from the back-half of the filter holder and interconnecting glassware to step 3.

5. Wash the nozzle, probe, front-half of the filter holder, and the cyclone or cyclone bypass into a labeled container using distilled water. NOTE: any dry material in the cyclone is brushed onto the glass fiber filter.

6. Wash with acetone the impingers and the components in step 4 into a labeled container.

7. Wash with acetone the components in step 5 into a labeled container.

NOTE:

Steps III.A.1 through 7 are the responsibility of the source test team leader. When multiple tests are conducted and it is necessary to clean the sampling train in the field, proceed in accordance with these steps. Store the samples in an airtight, cool or refrigerated condition.

8. Identify and desiccate for 24 hours, a sufficient number of 0.22μ membrane filters to filter all liquid collections and washings.

9. Weigh and record the weights of the membrane filters.

10. Filter the solutions from (step 4) and (step 5) separately using preweighed and identified membrane filter(s). It may be necessary to start with an 0.8μ filter then finally the 0.22μ filter.

11. Measure the two filtrates from step 10 to the nearest ml and record the volumes.

12. Air dry, then desiccate for 24 hours, all membrane filters used in the above steps. Weigh to the nearest 0.1 mg and record the weights.

13. Identify and dry for two hours at 105° ± 5°C sufficient evaporating dishes to evaporate the filtrates. Desiccate until cool and weigh to the nearest 0.1 mg. Record the weights with their identification numbers.

14. Using the evaporating dishes, evaporate 300 ml of the filtrates from step 11 and 300 ml of the distilled water (blank) at a constant temperature of 105° ± 5°C. Desiccate the residue until cool, weigh until constant weights are achieved to the nearest 0.1 mg and record the final weight. THE WASHINGS FROM EACH INDIVIDUAL COLLECTION TRAIN HALF ARE TO BE KEPT SEPARATE.

15. Quantitatively transfer an equal volume of acetone washing (from steps 6 and 7) into separate preweighed evaporating dishes after measuring and recording each volume of acetone. AS ABOVE, KEEP EACH COLLECTION TRAIN HALF SEPARATE.

16. Place a measured quantity of unused acetone, equal to the transferred volume of acetone washing, into a preweighed evaporating dish for use as a blank.

17. Evaporate both the blank and the washings from steps 15 and 16 in a vacuum at 60°C.

18. Desiccate to constant weight, reweigh and record.

19. Handle the used glass fiber or alundum filters carefully to prevent loss of material.

20. Air dry the used alundum and glass fiber filters if necessary, desiccate 24 hours and weigh. Record the weights and the identification numbers.

21. Weigh and record the spent silica gel to the nearest 0.5gm.

22. Dry the spent silica gel at a temperature of 105°C for 12 hours.

23. Desiccate until cool then reweigh to the nearest 0.5gm and record.

B. Calculations

1. Front or Back-Half Water Wash

For each:

a. Insoluble Particulate

membrane filter weight - membrane filter tare weight

b. Soluble Particulate

(filtrate dish wt.-tare wt.) - (water blank wt.-tare wt.) x $\frac{\text{final wash vol.}}{\text{aliquot}}$

2. Front- or Back-Half Acetone Wash

For each:

a. Soluble Particulate

(washings dish wt.-tare wt.) - (acetone blank wt.-tare wt.) x $\frac{\text{final acetone}}{\text{aliquot}}$

3. Glass Fiber Filter or Alundum Filter

a. Insoluble Particulate

used filter weight - filter tare weight

4. Water Vapor

a. Silica gel

weight of spent silica gel - weight of dried silica gel

b. Impinger solution

final impinger volumes - initial impinger volumes

SAMPLING TRAIN COMPONENTS, METHOD OF USE, AND ANALYTICAL TECHNIQUES

A. Components

1. Stainless steel or glass probe with minimum 3/16 inch diameter opening, heated above the dew point of the gas stream to be sampled.

2. Glass cyclone efficient for removal of particles of 5 microns or greater, and cyclone collection flask. In cases of low particulate loadings, a glass cyclone eliminator may be substituted.

3. In-line filter of 0.3 micron porosity.

4. Heated chamber for maintaining glass fiber filter and cyclone above the dew point of the gas stream to be sampled.

5. Impingers placed in the following order:

   a. A 500 ml. modified Greenburg-Smith impinger filled with 100 mls. of distilled deionized water.

   b. A 500 ml. Greenburg-Smith impinger filled with 100 mls. of distilled deionized water.

   c. A 500 ml. modified Greenburg-Smith impinger left dry to act as a water trap to remove entrained water.

   d. A 500 ml. modified Greenburg-Smith impinger containing approximately 200 grams of precisely weighed silica gel.

6. An ice bath in which the impingers are partially submerged to maintain exit temperature well below the dew point of the gas to be sampled.

7. Dry gas meter equipped with a vacuum gage registering up to 30 inches of mercury, and a calibrated orifice.

B. General Sampling Procedure

1. Starting with clean equipment, a leak check is performed by drawing a vacuum of 15 inches on system as indicated on the vacuum gage. Leak checks are also performed post-test and corrections may be necessary to account for increases in the leakage rate.

2. The sample is collected at isokinetic rates based upon a velocity profile determined with the use of an "S" type pitot tube.

3. Samples are taken at multiple points across the gas stream representing equal areas of cross-sectional flow, and each point is sampled for as long a time as is feasible.

4. Moisture content of the gas stream is determined by the condensation method, using a series of cooled impingers described above (A-5).

5. The duration of the test depends on the number of sample points and the time required to equally sample each point. In no case will the sample time be less than that required to collect a sufficient sample for complete analysis.

C. Analytical Techniques

1. Before use, the filter is desiccated for a period of 24 hours and weighed to the nearest 0.1 mg.

2. When processing the sample, any material deposited inside the sample probe, glass cyclone (or cyclone eliminator) and the front half of the filter holder is washed into a container using acetone, or other suitable solvent, evaporated to dryness at either ambient conditions or below the boiling point of acetone (55°C), desiccated for a period of 25 hours, and weighed to the nearest 0.1 mg.

3. After sampling, the in-line glass fiber filter is desiccated for a period of 24 hours and weighed to the nearest 0.1 mg.

4. The moisture content is determined by collecting the liquid in the impingers described above and measuring. The difference between 200 ml. and the measurement is recorded as increase in water. The spent silica gel is weighed to the nearest 0.1 gram and the increase is included in the moisture content determination.

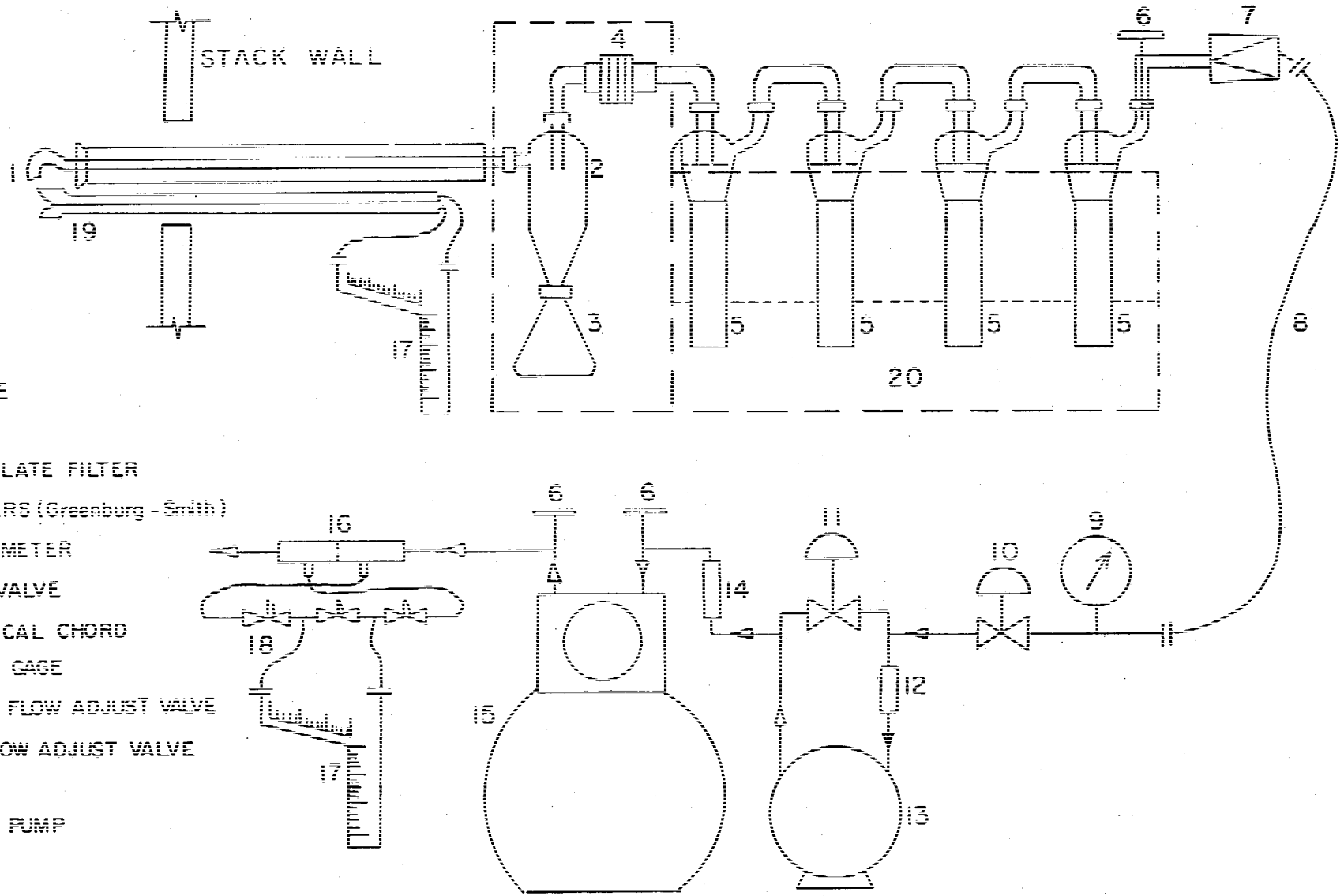
5. The liquid in the impingers may be analyzed for particulate matter and the weights may be included in the particulate catch.

6. The total particulate in the system is the sum of that collected in Nos. 2,3 and possibly 5. The contribution of each portion shall be individually identified. The inclusion of the impinger particulate catch is to be considered on an individual basis.

7. The emission rate and calculations are made from suitable measurements of gas temperature, moisture content, velocities and materials collected. In order for a test to be considered valid, isokinetic sampling rates shall be between 90% and 110%.

8. All equipment, including orifice meter, probe tip nozzles, dry gas meter, and temperature measuring devices is calibrated on a regular basis, dependent on the frequency of equipment use.

9. The stack gas content is determined by collecting a sample of stack gas and analyzing the contents with an Orsat analyzer or Fyrite analyzer.



LEGEND

1. PROBE
2. CYCLONE
3. FLASK
4. PARTICULATE FILTER
5. IMPINGERS (Greenburg - Smith)
6. THERMOMETER
7. CHECK VALVE
8. UMBRILICAL CHORD
9. VACUUM GAGE
10. COURSE FLOW ADJUST VALVE
11. FINE FLOW ADJUST VALVE
12. OILER
13. VACUUM PUMP
14. FILTER
15. DRY GAS METER
16. ORFICE TUBE
17. INCLINE MANOMETER
18. SOLENOID VALVES
19. PITOT
20. ICE BATH

MEASE ENGINEERING ASSOC.
GENERAL ARRANGEMENT
SOURCE SAMPLING TRAIN

SECTION 4.0

Calibrations

This is to certify that the undersigned checked for Mease Engineering

Ainsworth, Model TC Balance Number 18185 on December 15, 1986

The following readings were obtained:

Sensitivity reciprocal unloaded	.8 Mg.		Readability	.1 Mg.	
Sensitivity reciprocal at 100 Gm.	.73 Mg.		Optical scale	NA Gm.	NA Mg.
Arm length error	4 PPM		Reading at half scale	NA	NA Mg.
Chain weight	NA Mg.	NA Mg.	Taring device error	NA Mg.	
Rider	10 Mg.	20 Mg.			

Traceability is through National Bureau of Standards Test No. 732/221797 and/or New Jersey Test No. NJ 82419

Dated: December 30, 1986
MATAWAN, NEW JERSEY

OMEGA BALANCE SERVICE, INC.

Mease Engineering Associates

Environmental Consultants

DRY GAS METER AND ORIFICE METER CALIBRATION

Model Number 2343

Serial Number 1895

Meter Box No. 7

Wet Test Meter No. 4-20 14524

Calibration Date 7-1-88

Signature Charles G. Mease

Barometric Pressure, Pb _____

Orifice Manometer ΔH in. H_2O	Gas Volume Wet V_w ft³	Gas Volume Dry V_d ft³	Temperature Wet t_w °F	Temperature Dry In t_{d1} °F	Temperature Dry Out t_{d2} °F	Time θ Min.	Y	$\Delta H_@$
0.5	5.000	4.757	84	75	63	2.45	1.021	1.75
1.0	5.000	4.923	84	82	74	2.50	1.008	1.81
2.0	10.000	10.112	84	97	85	3.33	0.997	2.02
3.0	15.500	15.768	84	96	94	3.98	1.005	1.96
							AVERAGE	
							1.005	1.89

$$Y = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$$

$$\Delta H_@ = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\,\theta}{V_w}\right]^2$$

PITOT TUBE CALIBRATION

All pitot tubes are geometrically aligned and within the limits as prescribed in the Federal Register. Therefore, they are assigned a value of 0.84. In the event that a pitot tube tip is altered during transport, and the geometric qualifications cannot be met, the pitot tube is calibrated according to the Federal Register. In this case, the new calibration factor is listed in the report and used in the calculations.

TEMPERATURE SENSING DEVICE CALIBRATIONS

All temperature sensing devices used during a test series, including thermocouples and thermometers are calibrated after each test series, as specified in the Federal Register. In the event that these calibration factors fall within the limits as specied, no corrections are necessary. In the evnt that a device is outside the limits, as specified, the correction factor is listed and used in the calculations.

SAMPLING NOZZLE CALIBRATION

The sampling nozzle used during the test series is determined after each test series using a micrometer on several diameters as specified in the Federal Register.

SECTION 5.0

Calculations

SOURCE SAMPLING CALCULATIONS: NOMENCLATURE

An	=	Nozzle Area, $ft.^2$
As	=	Stack Area, $ft.^2$
Bwo	=	Water Vapor Proportion, by volume, dimensionless
Cm	=	Meter Correction Factor, dimensionless
Cp	=	Pitot Coefficient, dimensionless
Cs	=	Particulate Concentration, units specified
$\Delta H_{avg.}$	=	Average Pressure Drop Across Orifice, $in.H_2O$
$\%H_2O$	=	Water Vapor Content, dimensionless
Is	=	Percent Isokinetic of Test, dimensionless
Kp	=	85.48, unit correction
Md	=	Molecular Weight of Dry Gas
Mn	=	Total Particulate Catch, grams
Ms	=	Molecular Weight of Stack Gas
$(\sqrt{\Delta P})_{avg}$	=	Average of the Square Roots of the Velocity Head
Pbar	=	Barometric Pressure, in. Hg.
pmr	=	Pollutant Mass Rate, lb./hr.
θ	=	Time, minutes
Pstd	=	29.92 in. Hg.
Qs	=	Stack Gas Flowrate, actual cubic feet per minute
(Qs)std.	=	Stack Gas Flowrate, standard cubic feet per minute
Ts	=	Stack Gas Temperature, ^oR
Tstd	=	530^oR
Vfc	=	Increase in Liquid Volume in Impingers, ml.
Vm	=	Volume Sampled at Meter Conditions, $ft.^3$
Vmstd	=	Volume of Air Metered at Standard Conditions
Vs	=	Stack Gas Velocity, ft./sec.
Vsstd	=	Stack Gas Velocity, standard conditions, ft./min.
Vwc	=	Volume of Liquid Collected, cubic feet

SAMPLE CALCULATIONS: Run #1

1. Volume of Water Collected

$$Vwc = (0.04707)(Vfc)$$
$$= (0.04707)(364.1))$$
$$= 17.138$$

2. Volume of Air Metered

$$Vmstd = \frac{(Vm)(Tstd)(Pbar + \frac{\Delta H}{13.6})(Cm)}{(Tm)\quad(Pstd)}$$
$$= \frac{(61.383)(530)(30.06 + \frac{1.3477}{13.6})(1.008)}{(576.208)(29.92)}$$
$$= 57.367 \text{ SCF}$$

3. Moisture Content

$$Bwo = \frac{Vwc}{(Vwc + Vmstd)}$$
$$= \frac{17.138}{17.138 + 57.367}$$
$$= 0.2300$$

4. Molecular Weights

$$Md = (\%CO_2 \times 0.44) + (\%O_2 \times 0.32) + ((\%N_2 + \%CO) \times 0.28)$$
$$= (6.17 \times 0.44) + (14.87 \times 0.32) + (78.96 \times 0.28)$$
$$= 29.582$$

$$Ms = Md(1 - Bwo) + 18(Bwo)$$
$$= (29.582)(1 - 0.23) + 18(0.23)$$
$$= 26.918$$

5. Velocity of Exit Gases

$$Vs = (Kp)(Cp)\sqrt{\frac{Ts}{(Ps)(Ms)}}\quad\sqrt{(\Delta P)}\text{avg.}$$
$$= (85.48)(0.84)\sqrt{\frac{692.208}{(30.03)(26.918)}}\quad(1.214)$$
$$= 80.67 \text{ FT/SEC.}$$

SAMPLE CALCULATIONS: Run #1, Continued

6. Flowrates

$$Qs = (Vs)(As)(60)$$
$$= (90.67)(11.000)(60)$$
$$= 53,240 \text{ Acfm}$$

$$Qs_{std} = \frac{(Qs)(Ps)(Tstd)(1-Bws)}{(Pstd)(Ts)}$$
$$= \frac{(53,240)(30.03)(530)(1-0.23)}{(29.92)(692.208)}$$
$$= 31,501 \text{ scfm}$$

7. Particulate Concentration

$$Cs = \frac{(Mn)(15.43)}{Vmstd}$$
$$= \frac{(0.0400)(15.43)}{57.367}$$
$$= 0.0108 \text{ grams/scf}$$

8. Particulate Emission Rate

$$pmr = \frac{(Mn)(Qs_{std})(60)}{(Vmstd)(454)}$$
$$= \frac{(0.0400)(31,501)(60)}{(57.367)(454)}$$
$$= 2.96 \text{ lb/hr}$$

9. Isokinetics

$$I_s = \frac{Vmstd}{(An)(\theta)(Vs_{avg})} \qquad \text{where } Vs_{avg} = \frac{Qs_{act}}{As} = \frac{53,240}{11.000} = 4843.6$$
$$= \frac{57.367}{(0.00095)(98)(4843.6)}$$
$$= 1.071 \text{ or } 107.1\%$$