Commonwealth of Pennsylvania
Environmental Resources
January 22, 1988

Subject: Source Test Review

To: Data File
McMinn's Asphalt Co., Inc.
East Hempfield Township, Lancaster County

From: Timothy R. Brooks
Air Quality Program Specialist
Division of Technical Services and Monitoring
Bureau of Air Quality Control

Through: Chief, Source Testing and Monitoring Section

McMinn's Asphalt Company, Inc. operates a batch asphalt plant at the above location designated the East Petersburg plant. The facility is a McCarter Corporation model M-300-18 rated at 300 tons per hour and equipped with a knock out box for primary particulate removal. A McCarter Corporation model MCC-648-5 fabric collector follows the knock out box. This baghouse utilizes Nomex bags with a 6.0:1 air to cloth ratio and is rated at 56,000 actual cubic feet per minute.

Gilbert/Commonwealth, Inc. conducted three particulate tests on the baghouse outlet in order to determine compliance with NSPS requirements. The first two test runs were performed in accordance with Chapter 139 of the Department of Environmental Resource's Rules and Regulations. The third run was shortened because of reduced product demand and resulted in approximately 46 dry standard cubic feet of sample collected instead of the required 50 dry standard cubic feet. This discrepancy will not affect the test results; therefore, all three tests are acceptable to the Department.

The following information was extracted from the test reports:

Run Number	1	2	3
Volumetric Flow Rate (DSCFM)	29,600	30,500	29,400
Process Rate (Tons/hr.)	235	250	250
Particulate Emission Rate (lbs./hr.)	3.17	1.10	1.07
Particulate Concentration (gr./dscf)	0.013	0.004	0.004
Allowable Concentration* (gr./dscf)	0.04	0.04	0.04

* As per permit requirement - verified by Region

Environmental Resources
December 22, 1997

SUBJECT: Source Test Review
McMinn's Asphalt Co., Inc.
East Petersburg Plant
East Hempfield Township, Lancaster County

TO: L. Blaine DeHaven, Chief
Source Test and Monitoring Section
Division of Technical Services and Monitoring

FROM: Richard D. Roller RDR
Air Pollution Control Engineer
Harrisburg Regional Office

Please review the following source test report. Source testing was conducted as required by Conditions 7 through 13 of Plan Approval No. 36-303-021. Tim Brooks reviewed and accepted the pretest procedures.

The following should be considered when reviewing this report:

1. The test was performed to demonstrate compliance with Subpart I of the NSPS.

2. I was present during the testing which was performed by Gilbert/Commonwealth. If you have any questions feel free to contact either myself, Marv Lownsbery of McMinn's or David Hofmann of Gilbert/Commonwealth.

3. I briefly scanned the report and noticed the following:

   a. Although Gilbert/Commonwealth stated that the analysis of the backhalf solubles were included in the test report (Appendix 2.3), I can not find these results.

   b. The laboratory analysis sheets (Appendix 4) only show the analytical results. No raw data is given.

   c. The operating data, as submitted, is inadequate. I have contacted Mr. Hofmann who has agreed to send this information (item 3.c.) directly to me. I do, however, agree with the operating rate during the testing as listed in Table 1, Summary of Test Results.

(over)

August 10, 1987

Marvin L. Lownsbery
Plant Superintendent
McMinn's Asphalt Co., Inc.
P.O. Box 4688
Lancaster, PA 17604

Dear Mr. Lownsbery:

I have reviewed the pretest procedures submitted by Gilbert/Commonwealth, Inc. for NSPS particulate and opacity testing of your batch asphalt plant located at East Petersburg, Pennsylvania. The test procedures are acceptable provided the impingers are washed with acetone and not with nitric acid as stated in the pretest procedure. The following information must also be submitted with the test reports:

1. Collector parameters including, pressure drop, pulsing interval and pulse pressure.

2. Type and gallons of fuel oil burned per test period.

3. Number of batches per test including type of mix (ID 2 top preferred), formula weight (sand, stone and asphaltic oil), total aggregate feed and a sieve analysis for each test.

4. Operating parameters of the dryer including temperature.

Final acceptance of a stack test report is contingent upon its meeting all requirements of Chapter 139 of the Commonwealth of Pennsylvania, Department of Environmental Resources' Rules and Regulations. Please contact me if there are any questions regarding this matter.

Sincerely,

Timothy R. Brooks
Air Quality Program Specialist
Division of Technical Services and Monitoring
Bureau of Air Quality Control

cc: Richard D. Roller, Harrisburg Regional Office
File No. 36-303-021
Reading File
David J. Hofmann

TRB:lc

DER
AIR QUALITY CONTROL

AUG 12 1987

Gilbert/Commonwealth engineers and consultants

GILBERT/COMMONWEALTH, INC., P.O. Box 1498, Reading, PA 19603-1498/Tel. 215 775-2600/Cable Gilasco/Telex 836-431

January 22, 1988

DER
AIR QUALITY CONTROL

JAN 26 1988

HARRISBURG REGION

Commonwealth of Pennsylvania DER
1 Ararat Boulevard
Harrisburg, Pennsylvania 17110

Attention: Mr. Richard Roller

RE: Submittal of Operating Data
McMinn's Asphalt Company
G/C, Inc. Report R-10-0595-000-1

Data to be attached to stack test report

Dear Mr. Roller:

Attached with this letter is a copy of the operating data for the stack test completed on October 9, 1987, in East Petersburg, Pennsylvania.

1. Operating Data
2. Sieve Analysis

If there are any questions, please contact the writer at your convenience.

Very truly yours,

David J. Hofmann
Testing Supervisor
Testing Services Group

DJH:tlb

Attachment

OPERATING DATA

McMinnn Asphalt
East Petersburg Facility

TEST M-1 235 Tons/Hr.	399.190	aggregate
	16.755	asphalt
TEST M-2 250 Tons/Hr.	426.213	aggregate
	18.871	asphalt
TEST M-3 250 Tons/Hr.	336.225	aggregate
	15.098	asphalt

IMMEREX EXTRACTION

Wt. of original Sample = 1097.4
- Wt. of extracted Sample = 1040.4
Wt. of extraction loss or (wt. of Bitumen & Fines) = 57.0

Wt. of bitumanometer and extract liquid = 1099.6
- Wt. of bitumanometer = 322.3
Wt. of extract liquid = 967.3

Wt. of extract liquid = 967.3
- Wt. of extraction loss (Bitumen & Fines) = 57.0
Wt. of Solvent = 910.4

÷ Wt. of Solvent (910.4) = 701.9
Sp. Gr. of Solvent (1.297)

Vol. of Bitumanometer = 269.2
- Vol. of Solvent = 261.9
Vol. of extraction loss of vol. of Bitumen & Fines = 7.3

Vol. of extraction loss = 7.3
× Sp. Gr. of aggregate = 2.700
Algebraic term Wt. of extraction loss = 19.7

Algebraic term Wt. of extraction loss = 19.7
- Wt. of extraction loss = 57.0
Algebraic term Wt. of Bitumen = 37.3

Sp. Gr. of Aggregate = 2.700
- Sp. Gr. of Bitumen = 1.040
Algebraic term Sp. Gr. of bitumen = 1.660

÷ Algebraic term Wt. of bitumen (37.3) = 22.4
Algebraic term Sp. Gr. of bitumen (1.660)

Volume of bitumen in sample = 22.4
× Sp. Gr. of Bitumen = 1.040
Wt. of Bitumen in sample = 23.3

÷ Wt. of bitumen in sample (23.7) × 100 = 4.0
Wt. of original sample (1097.4)

Wt. of original sample = 1097.4
- Wt. of bitumen = 43.7
Wt. of total aggregate in sample = 1053.7
1037.0

Wt. of extraction loss (Bitumen & Fines) =
- Wt. of bitumen =
Wt. of fines in sample =

Pulv. No.
Route No.
Date 12-29-72
County
Job Location
Lake-Mad
Spec. Sec. Det.

Vol. of Solvent in Bitumanometer

Vol. of Bitumen in sample

% of bitumen in sample

	WTS.	FINES	WTS. & FINES	%	DESIGN	TOLs.	SPEC.
200	28.7	14.7	43.4	4.1			
100	40.8		55.5	5			
50	26.6		75.3	7			
30	26.8		102.5	10			
16	23.4		125.9	12			
8	29.3		155.2	15			
4	38.2		193.4	18			
3/8	65.2		258.6	25			
1/2	23.9		282.5	27			
3/4	59.7	✓	342.2	32			
1	103.0		445.2	42			
1 1/2	123.0		568.2	54			
2							
A.C.							

Total wt. of mix, bag, & basket = 7729
Wt. of bag & basket = 645.5
Wt. of extracted sample, bag, basket, & tray = 2192
Wt. of tray = 728.7
Wt. of liquid & [illegible] = 1690.6

1/2 Batch - Marcia Lagstone

Loose Loaded Sep wts.

1B's - 225 lbs.
1B's (1½") - 33 lbs.
¾" - 60 lbs.
Sand - 279 lbs.
asphaltic cd. - 95 lbs.

Batch

Loose Loaded Sep wts.

1B's - 225 lbs.
¾" - 400 lbs.
Sand - 361 lbs.
asphaltic cd. - 93 lbs.

16
15
14
13
12
11
10
9
8
0
100
200
300
400
500
Start 3:30
Finish 4:55
Start 2:20
Finish 3:45
Start 12:45
Finish
Start
Finish
KENT PROCESS CONTROL, INC.
CHART NO. KPC/005/500/7/7/AT
PRESS PSIG

Stress Temp

SOURCE SAMPLING REPORT FOR MEASUREMENT OF PARTICULATE AND VISIBLE EMISSIONS

McMINNS ASPHALT COMPANY
EAST PETERSBURG FACILITY
ASPHALT BATCH PLANT

Contact
Paul Lancaster
(717) 397-0351

LANCASTER, PA
G/C, INC. REPORT R-10-0595-000-1
OCTOBER, 1987

SOURCE SAMPLING REPORT FOR MEASUREMENT OF PARTICULATE AND VISIBLE EMISSIONS

McMINNS ASPHALT COMPANY
EAST PETERSBURG FACILITY
ASPHALT BATCH PLANT

LANCASTER, PA
G/C, INC. REPORT R-10-0595-000-1
OCTOBER, 1987

PREPARED BY

GILBERT/COMMONWEALTH, INC.
QUALITY ASSURANCE DIVISION
P.O. Box 1498
READING, PENNSYLVANIA 19603

DAVID J. HOFFMANN
PROJECT COORDINATOR
TESTING SERVICES GROUP

Gilbert/Commonwealth engineers and consultants

GILBERT/COMMONWEALTH, INC., P.O. Box 1498, Reading, PA 19603/Tel. 215 775-2600/Cable Gilasoc/Telex 836-431

December 7, 1987

McMinns Asphalt Co.
P.O. Box 4688
Lancaster, PA 17604

Attn: Mr. Marvin Lownsbery

RE: Submittal of Source Sampling Report
for Measurement of Particulate and
Visible Emissions
Asphalt Batch Plant
McMinns Asphalt Co.
East Petersburg Facility
G/C, Inc. Report R-10-0595-000-1

Gentlemen:

We are pleased to submit four copies of our Report R-10-0595-000-1, dated December 7, 1987. This report contains results of source sampling for particulate and visible emissions and determination of flue gas characteristics for the asphalt batch plant baghouse located at your East Petersburg facility, as conducted on October 9, 1987.

The source sampling program defined by this report incorporates standard sampling procedures. The results of the sampling program are representative of flue gas emissions at the stack outlet of the baghouse under referenced normal operating conditions.

Information contained in this report and the accompanying Appendices includes field data, laboratory analyses, and a computer printout of all results developed by the testing program. We have attempted to present this information in a form that is readily discernible and suitable for your continued use.

Gilbert/Commonwealth, Inc., is pleased to have been of service to McMinns Asphalt Co., and trusts that this report will meet your complete acceptance.

Very truly yours,

for

David Hofmann
Project Coordinator
Testing Services

DEH:tlb

FOREWORD

The source sampling program as defined by this report was confined to measurement of particulate and visible emissions and pertinent flue gas characteristics at the stack test location of the asphalt batch plant baghouse during referenced operating conditions.

TABLE OF CONTENTS

SECTION 1 - SUMMARY OF TEST RESULTS

A summary of test results from the source sampling program is presented in Table 1. As such, the results are considered representative of emission characteristics from the asphalt batch plant baghouse during referenced operating conditions. The results show the particulate emissions are well below the limit of 0.04 gr/SCF.

TABLE 1

SUMMARY OF TEST RESULTS
McMINNS ASPHALT COMPANY
ASPHALT BATCH PLANT

G/C, INC. REPORT R-10-0595-000-1

LOCATION	EXHAUST STACK		
DATE	10/9/86	10/9/86	10/9/86
RUN NO.	M-1	M-2	M-3
OPERATING DATA			
Material Processed, Tons/Hr.	235	250	250
FLUE GAS CHARACTERISTICS			
DSCFM	29,561	30,530	29,354
ACFM	43,666	45,780	44,325
Temperature, °F	258	239	237
Moisture Content, %	9.8	12.5	13.6
PARTICULATE EMISSIONS			
gr/dscf	0.0128	0.0042	0.0043
Allowable, gr/dscf	0.04	0.04	0.04
lbs/hr.	3.17	1.10	1.07
VISIBLE EMISSIONS			
Opacity, %	1.2	0.9	0.7

SECTION II - ANALYSIS

1. Introduction

The data presented in this report represents the results of source sampling exhaust emissions at the stack outlet location of the asphalt batch plant during referenced operating conditions.

Specific requirements of this source sampling program include the followings

a. Identification of final particulate and visible emissions from the asphalt batch plant baghouse control system.

b. Average flue gas temperature, moisture, and volume of flow at the sampling location.

c. Orsat analysis of flue gas conditions at the point of sampling.

d. Record of pertinent operating conditions during period of the test run.

The sampling program was completed on October 9, 1987 by the Gilbert field test crew, with the assistance of personnel assigned by McMinns Asphalt and witnessed by the PADER.

2. Description of Asphalt Batch Plant Exhaust System

The facility uses a McCarter Model M-300-18 asphalt plant rated at 300 tons per hour. The system uses a knock-out box followed downstream by a baghouse to control emissions.

3. Sampling Program Procedures

To satisfy the objectives established for this project, the sampling program was set-up on the basis of using an individual test train positioned at the stack and completing three separate test runs. All procedures for the determination of velocity, molecular weight, moisture content, particulate loading, and visible emissions of the exhaust flue gases were made according to standard test methods as referenced in Appendix 2.

The exception being run M-3. Richard Roller of the PADER permitted us a variance from the collection of the normal fifty cubic feet of sample. This was due to the limited amount of production needed by McMinns Asphalt to fill its orders at the end of the day.

The location and number of sampling ports and traverse points are detailed in Figure 1.

4. Operating Conditions

In the execution of this sampling program, an attempt was made to achieve near normal load for the asphalt batch plant. The amount of asphalt generated was recorded by the operator. This record is included in the summary table (see Table 1).

5. Results

Test data developed by each test run, together with analytical results from laboratory analysis of samples generated by the field sampling program, are reproduced in the Appendices included with this report. Information on basic gas characteristics developed by each test run is contained in the printout of the computer program included as Appendix B.

A summary of pertinent test results and essential information to evaluate test results developed for each test run is included with this report as Table 1.

6. Discussion

6.1 Sampling Conditions

All field sampling work was completed out of doors and subject to prevailing weather conditions; however, there were no interruptions in the operation of individual test trains due to equipment or weather problems.

During the completion of this test program, the asphalt batch plant was maintained near the normal load condition.

6.2 Exhaust Flue Gas Volume and Composition

Test data for measurement of exhaust flue gas volume and related velocities developed by traversing of the stack show that the measured gas volumes between tests were consistent with expected values. For purposes of this report, indicated emissions are based on these measured gas volumes.

6.3 Unit Operating Conditions

This sampling program was undertaken as a compliance test program for the new baghouse system on the asphalt batch plant during representative load operating conditions. In the execution of this program, all applicable operation conditions were referenced.

Operating conditions were monitored throughout the duration of the sampling program by McMinnn Asphalt personnel.

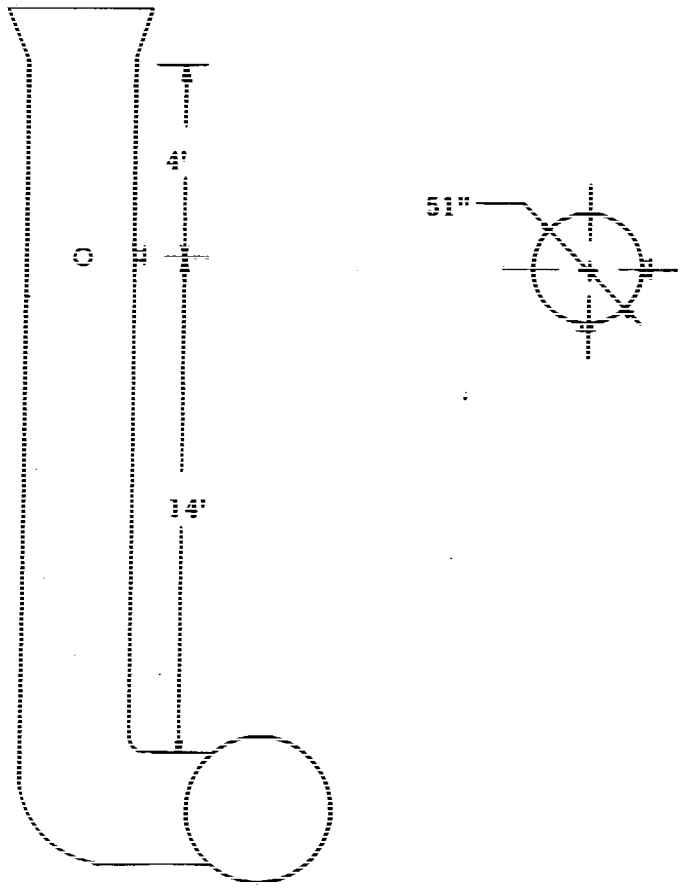
6.4 Emissions

6.4.1 Particulate

The reported particulate emissions as summarized in Table 1 are expressed as a concentration (grains/SCF) and emission rate (lbs/hour) as measured. The particulate emissions for all three runs are within any applicable limitations.

6.4.2 Visible

The reported visible emissions as summarized in Table 1 are expressed as a percent (%). The visible emissions for all three runs are within any applicable limitations.



Sample Point	Distance From Port, Inches
1	1.07
2	3.42
3	6.02
4	9.03
5	12.75
6	18.16
7	32.84
8	38.25
9	41.97
10	44.98
11	47.58
12	49.93

Figure 1
Sample Ports and Traverse Point Locations
Asphalt Batch Plant
McMinnn Asphalt Company
G/C, Inc. Report R-10-0595-000-1

SECTION III

APPENDICES

SECTION III - APPENDICES

TABLE OF CONTENTS

APPENDIX 1

PROJECT PARTICIPANTS

APPENDIX I
PROJECT PARTICIPANTS

The following members of Gilbert/Commonwealth's staff participated in the planning and execution of this project and preparation of this report.

Field Sampling Crew:

Dave Hofmann	Project Coordinator
Ed Burger	Engineering Technician
George Albright	Sr. Engineering Technician

Laboratory Participants:

Carl J. Wummer	Chemist
Vaughan O'Neill	Laboratory Technician

All field tests were completed with the assistance of technical personnel from McMinns Asphalt and witnessed by the PADER.

APPENDEX 2

TESTING AND ANALYTICAL PROCEDURES

2.1 STANDARD EPA TEST METHODS

2.2 ACTUAL SAMPLING PROCEDURES/PARTICULATES

2.3 ANALYTICAL METHODS/PARTICULATES

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.1 STANDARD EPA TEST METHODS

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.3 ACTUAL SAMPLING PROCEDURES/PARTICULATES

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.2 ACTUAL SAMPLING PROCEDURES/PARTICULATES

Particulate matter in the exhaust flue gas stream at the stack sampling location was sampled according to procedures and type of equipment as basically described in EPA Method 5 (see Appendix 2.1 for a complete description).

In place of the fragile glass material, the in-stack probe liner was constructed of high corrosion resistant Inconel stainless steel, which was enclosed in an outer protective sheath and heat traced to minimize condensation within the probe.

The basic test train consisted of a stainless steel nozzle followed by a heated Inconel probe liner, heated glass fiber filter, and glass impingers with all glass connectors.

The required sampling time for the compliance test, in terms of time per traverse point and overall sampling time per individual test run, was selected on the basis of maintaining a minimum sampling time of 4 minutes during the first two tests and 3 minutes for the last test at each of the traverse points at each sampling location.

The test program was completed with one test train located at the stack. All sampling activities were halted in the event of any test equipment malfunction or at the report of any operational problem. There was no planned interruption or extensive delay during the completion of the test runs.

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.3 ANALYTICAL METHODS/PARTICULATES

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.3 ANALYTICAL METHODS/PARTICULATES

The reported particulate emissions included the total particulate catch from the acetone wash of the nozzle and probe, plus accumulations on the glass fiber filter. The impinger water was filtered through a .22 micron filter. These results along with the probe wash and glass fiber filter are considered particulate emissions in the Commonwealth of Pennsylvania.

The soluable water from the impingers was dried down and weighed. This particulate weight is only reported and is not courted toward the particulate weight.

In the clean-up of the front half of the sampling equipment, the nozzle from the front of the probe was removed, brushed out, and washed with acetone. The probe liner was then brushed out and washed with water then acetone. All of the acetone wash solutions for the probe and filter holder were combined into a single sample for analysis. The glass fiber filter was removed from the fritted disc of the filter holder and replaced in its petri dish. All adhering filter particles were removed from the silicone rubber gasket and placed in the same petri dish prior to sealing for transport back to the Gilbert assigned laboratory for final analysis.

The clean-up procedure for the back half of the sampling train initially involved removal of the silica gel from the last impinger and replacement in its orginal container for final weighing to determine moisture pickup. Water collected in the impingers was measured for volume and transferred to sample bottles for analysis. The impingers and glass connectors were rinsed with water then acetone. This rinse was also placed in sample bottles to be analyzed.

Laboratory analysis of samples collected during the test run proceeded according to EPA Method 5 (Appendix 2.1).

All critical items of sampling or analytical equipment were certified and/or calibrated for accuracy and results considered within acceptable limits for source sampling operations (see Appendix 7).

APPENDIX 9

OPERATING DATA

OPERATING DATA

Run No. 1

Time	Minutes	Weight	Tons	Tons/Minute
1032--1037	5	55,849	27.9	5.58
1235--1250	15	175,880	87.9	5.86
1250--1252	2	23,356	11.7	5.84
1256--1259	6	68,174	34.1	5.68
1259--1311	11	132,740	66.4	6.04
Average				5.8

Run No. 2

0804--0811	7	94,695	47.3	6.76
0811--0824	13	126,313	63.2	4.86
--0857	15	180,246	90.1	6.01
0857--0903	6	59,782	29.9	4.98
0903--0911	7	65,999	33.0	4.71
--1010	8	93,670	46.8	5.85
1010--1026	16	176,337	88.2	5.51
1026--1028	2	23,540	11.77	5.89
Average				5.57

Run No. 3

Time	Minutes	Batch Weight	Tons	Tons/Minute
1235	4	43,875	21.9	5.48
1240	4	43,875	21.9	5.48
1245	4	43,813	21.9	5.46
1249	4	43,959	22.0	5.50
1253	4	44,117	22.1	5.53
1257	4	43,607	21.8	5.45
1301	4	44,030	22.0	5.50
1305	4	43,939	22.0	5.50
1310	4	44,464	22.2	5.55
1317	4	44,001	22.0	5.50
1340	4	43,923	22.0	5.50
1346	4	44,248	22.1	5.53
1352	4	43,388	21.9	5.48
1356	4	43,894	21.9	5.48
1401	4	43,910	22.0	5.50
1406	4	43,891	21.9	5.48
1411	4	43,969	22.0	5.50
Average				5.50

APPENDIX 4

ANALYTICAL RESULTS FOR PARTICULATES

(CLEAN-UP SHEETS)

GERBER ANALYTICAL, INC.
AIR POLLUTION CONTROL DEPT.
LABORATORY CLEAN UP AND REPORT SHEET

Set Date: 10/9/82
Set No.: 82-4
Sample Set No.: 5
Operator: Rodney

Client: Pacific Coast Grain
W. O. No.: 19829826
Plant: Portland Terminal
Sampling Location: Stack

Analysis

Back-Section Wash
Probe, Glass Liner, Cyclone Upper, Flask, Front Half Filter Holder-Section Wash

Initial Wt.	Lab No.	Gross Amount
		mg
		mg
		mg
		mg

Tare Wt. 1 gm

Laboratory Results

Lab No. _____ Residue _____ mg
Lab No. 10764 Residue 82 mg

Tabulate percentage weight _____ %

Final Wt.	Lab No.	Gross Amount
5.756	10764	mg
		mg
		mg
		mg

Filter percentage weight 1.6 %

FRONT HALF Sub Total 82 mg

BACK HALF

Impinger Contents and Probe Wash of Impingers Connectors and Back Half of Filter Holder

Lab No. 10765 Ether-Chloroform Insoluble _____ mg
Collected on C.E.M. Filter 324 mg
Aqueous Residue _____ mg

Impinger, Connectors and Back Half of Filter Holder - Acetone Wash

Lab No. _____ Residue _____ mg
BACK HALF Sub Total 324 mg
TOTAL CATCH 510 mg

CALCULATIONS

Impingers:

	78			
	246			
Final Volume	414			
Initial Volume	300			
Net Volume	114			

Moisture

Weight after cone:	252		
Weight before cone:	238		
Net Weight	14		
Concentration No.:	1. 6	2.	3.

TOTAL GRAIN-Silica Gel 2.2 gm
TOTAL VOLUME Impingers 114 ml
TOTAL MOISTURE _____ gm

Comments: Probe Set Up Vertical Upright Cyclone Used Probe Cut-Off

Lab: BACK RECEIVED 10/12/82
BACK REVIEWED 10/12/82

ANALYTICAL CHEMIST

RPB/APC 11/76

GEORGE ARMSTRONG, INC.
AIR POLLUTION CONTROL DEPT.
PARTICULATE CLEAN UP AND REPORT SHEET

Run Date: 4/25/72
Run No.: 4P-3
Sample Box No.: 1
Operator: Asbury

Client: Modern Asphalt
P. O. No.: 10958305
Plant: East Petersburg
Sampling Location: Stack

FRONT HALF

Acetone Wash
Probe, Nozzle Holder, Grease (Hypo), Plug, Front Half Filter Holder-Acetone Wash

Laboratory Results

Lab No. _____ Reading _____ mg
Lab No. 12625 Reading 6.2 mg

Initial Vol.	Lab No.	Total Lumber
		mg
		mg
		mg
		mg

Nozzle particulate weight _____ mg

Filter No.	Lab No.	Total Lumber
5-42P	12626	mg
		mg
		mg
		mg

Filter particulate weight 1.3 mg

FRONT HALF Sub Total 7.5 mg

BACK HALF

Impinger Contents and Water Wash of Impingers Connectors and Back Half of Filter Holder

Lab No. 12624 Ether-Chloroform Extract _____ mg
Collected on 0.22μ Filter 1.1 mg
Aqueous Residue _____ mg

Impingers, Connectors and Back Half of Filter Holder - Acetone Wash

Lab No. _____ Residue _____ mg
BACK HALF Sub Total 1.1 mg
TOTAL WEIGHT 1.64 mg

VOLUME

Impingers	126
	2.52
	3.4
Final Volume	
Initial Volume	3.99
Net Volume	

MOISTURE

Weight after test: 2.65
Weight before test: 2.52
Net Weight: .13
Container No.: 1. 4 2. 3. 4.

TOTAL WEIGHT-Filter Gel _____ gm
TOTAL VOLUME- Impingers _____ ml.
TOTAL MOISTURE _____ gm

Comments: _____

LAB: BACK REACTOR 12622
BACK REACTOR 12623

[signature]
ANALYTICAL CHEMIST

APB/AMC 12/76

CHEMEX ASSOCIATES, INC.
ASH FUSION CHECK SHEET
PARTICULATE CLOUD UP AND BEFORE SHEET

Run Date: 12/9/82
Run No.: 82-Sep-2
Sample Set No.: 2
Operator: Appleby

Client: Arizona Public Service
W. O. No.: 1855-389
Plant: Four Corners
Sampling Location: Stack

Laboratory Number

Double-Junction Bath
Pyro, Thimble Holder, Cyclone Oxygen),
Flux, Fume Roll Pitot Holder-Junction Bath

Thimble No.	Lab No.	Thimble Number
Acetone		

Lab No. 1626-3 Number 45.2

Thimble particulate weight

Filter No.	Lab No.	Filter Number
5-9959	1626-3	

Filter particulate weight 60.60

PROBE RINSE Sub Total 165

Impinger Contents and Rinse Vols of Impingers
Connectors and Back Half of Filter Holder

Lab No. 1626-3 Ether-Chloroform Extract

Collected on C.R.A. Filter 30.9

Aqueous Portion

Impingers, Connectors and Back Half of Filter Holder - Aqueous Wash

Lab No. Portion

BACK HALF Sub Total

TOTAL WEIGHT 1265

Initial: 224
Final: 219
Final Volume
Initial Volume 3.95
Net Volume

Weight after cone
Weight before cone 252
Net Weight 24
Container No.: 1. 5 2. 3. 4.

TOTAL WEIGHT-Filter Cut
TOTAL VOLUME Impingers
TOTAL SUSPENDED

Comments:

LAB: DATE RECEIVED 12/9/82
DATE REPORTED 12/10/82

ANALYTICAL CHEMIST

RDB/ABC 12/76

APPENDIX 5

RAW FIELD DATA

Client McMINN ASPHALT

PARTICULATE FIELD DATA (continued)

Sheet 2 of 2

W.O. No. 1ee[illegible]

Plant LANCASTER

Location STACK

Run No. M-1

Date 10/9/87

POINT	DISTANCE IN INCHES	CLOCK TIME ACTUAL	CLOCK TIME RUN	DRY GAS METER, CF	PITOT IN. H_2O ΔP	ORIFICE ΔH IN. H_2O DESIRED	ORIFICE ΔH IN. H_2O ACTUAL	DRY GAS TEMP. °F INLET	DRY GAS TEMP. °F OUTLET	PUMP VACUUM IN. Hg GAUGE	BOX TEMP °F	IMPINGER TEMP °F		STACK TEMP. °F
M-1		1036.	0.0	994.054	0.24		0.62	74.	67.	0	245			227.
2			4.0	996.8	0.30		0.99	75.	68.	1	250			230.
3			8.0	999.2	0.31		0.90	77.	69.	1	250			254.
4			12.0	999.7	0.29		0.95	76.	68.	1	250			254.
5			16.0	1001.8	0.31		0.80	76.	69.	1	255			257.
6			20.0	1003.8	0.37		0.96	75.	69.	1	260			282.
7			24.0	1005.7	0.64		1.40	75.	69.	2	260			286.
8			28.0	1008.5	0.78		1.80	77.	68.	3	255			265.
9			32.0	1011.3	0.85		2.20	80.	69.	4	255			280.
10			36.0	1014.3	0.89		2.05	81.	70.	4	255			272.
11			40.0	1017.6	0.84		2.10	79.	71.	4	270			265
12			44.0	1020.5	0.93		1.90	78.	72.	4	270			260.
STOP		1124.	77.0	1023.851										
END						0.75								
						0.73								

COMMENTS:

Leak Test at 7 0.001 / (0) 3.4 15.4

3.6 15.4

3.7 15.0

Sheet 1 of 2

Client McMINN ASPHALT

W. O. NO. 10057500

Plant LANCASTER

Run No. M-3

Location STACK

Date 10/9/02

Operator ALBRIGHT

Sample Box No. 1

Meter Box No. 1723

MeterΔH 1.90

C Factor C = 0.84 b = 0.67

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point

SKETCH

Pitot Calibration

Thimble No. AVENT

Filter No. S-95P

Ambient Temp. °F

Bar. Press. "Hg 30.14

Assumed Moisture % 11

Heater Box Setting, °F

Probe Tip Dia., In. 0.25

Probe Length 6'

Probe Heater Setting 165 V

Avg. ΔP Avg. ΔH

POINT	DISTANCE IN INCHES	CLOCK TIME ACTUAL	CLOCK TIME RUN	DRY GAS METER, CF	PITOT IN. H2O ΔP	ORIFICE ΔH IN. H2O DESIRED	ORIFICE ΔH IN. H2O ACTUAL	DRY GAS TEMP. °F INLET	DRY GAS TEMP. °F OUTLET	PUMP VACUUM IN. Hg GAUGE	BOX TEMP. °F	IMPINGER TEMP. °F	Flow	STACK TEMP. °F
A-1		1206	0.0	24.595	0.24		0.67	70.	69.	4	270	60	246	227.
2			4.0	26.4	0.31		0.87	72.	70.	4	265	55		234.
3			8.0	28.6	0.31		0.87	72.	70.	4	260	55		250.
4			12.0	30.9	0.33		0.93	72.	69.	5	270	53		255.
5			16.0	33.8	0.40		1.12	70.	69.	4	270	53		230.
6			20.0	34.9	0.43		1.22	72.	69.	6	280	55		242.
7			24.0	37.3	0.49		1.38	73.	69.	6	290	55		203.
8			28.0	40.1	0.72		2.45	75.	69.	6	285	55	245	242.
9			32.0	43.8	0.99		2.60	76.	69.	4	270	56		254.
10			36.0	46.9	0.85		2.45	77.	69.	6	260	56		260.
11			40.0	50.1	0.90		2.29	76.	70.	6	245	57	239	278.
12			44.0	53.2	0.75		2.15	75.	70.	6	270		245	272.
STOP		1254	48.0	56.390										

STATIC -0.64

3.4 11.6
1.0 19.0

Client M. MIAMI ASPHALT — PARTICULATE FIELD DATA (continued) — Sheet 2 of 2

W.O. No. 100595009

Plant LANCASTER — Location STACK

Run No. M-2 — Date 10/9/07

POINT	DISTANCE IN INCHES	CLOCK TIME ACTUAL	CLOCK TIME RUN	DRY GAS METER, CF	PITOT IN. H_2O ΔP	ORIFICE ΔH IN. H_2O DESIRED	ORIFICE ΔH IN. H_2O ACTUAL	DRY GAS TEMP. °F INLET	DRY GAS TEMP. °F OUTLET	PUMP VACUUM IN. Hg GAUGE	BOX TEMP °F	IMPINGER TEMP °F	STACK PRESS IN. Hg	STACK TEMP. °F
0-1		1250.	0.0	51.190	0.29		0.80	72.	69.	10	220			240
2			4.0	56.3	0.35		1.0	72.	70.	9	265			246.
3			8.0		0.72		1.20	74.	69.	4	245			239.
4			12.0	62.7	0.43		1.22	72.	69.	5	265			235.
5			16.0	65.2	0.45		1.27	74.	68.	5	245			234.
6			20.0	67.5	0.61		1.71	76.	69.	4	260			249.
7			24.0	70.3	0.88		2.45	77.	70.	4	265			256.
8			28.0	73.4	1.08		2.85	81.	71.	4	250			255.
9			32.0	77.0	1.45		3.30	83.	73.	4	260			250.
10			36.0	80.6	1.45		3.30	83.	73.	4	260			249.
11			40.0	84.2	0.97		2.20	83.	74.	5	255			245.
12			44.0	86.1	1.02		2.30	84.	74.	5	260			249.
STOP		1346.	47.0	88.490										
END		1346.												

COMMENTS:

$\Delta H_{@}$ = 0.94

LEAK TEST AT 5" 0.00

2.5 17.5

3.0 17.0

Client McMinn Asphalt

PARTICULATE FIELD DATA (continued)

Sheet 2 of 2

W.O. No. 10079500

Plant Lancaster

Location Steel

Run No. M-3

Date 10/9/87

POINT	DISTANCE IN INCHES	CLOCK TIME ACTUAL	CLOCK TIME RUN	DRY GAS METER, ft^3	PITOT IN. H_2O ΔP	ORIFICE ΔH IN. H_2O DESIRED	ORIFICE ΔH IN. H_2O ACTUAL	DRY GAS TEMP. °F INLET	DRY GAS TEMP. °F OUTLET	PUMP VACUUM IN. Hg GAUGE	BOX TEMP °F	IMPINGER TEMP °F	STACK PRESS. IN. Hg	STACK TEMP. °F
A 1		1500.	0.0	117.168	0.24		0.67	76.	73.	6	245	60		207.
2			3.0	115.5	0.29		0.77	77.	73.	6	245			218.
3			6.0	120.0	0.31		0.91	78.	78.	6	250			228.
4			9.0	121.5	0.34		0.99	77.	75.	6	240			232.
5			12.0	123.1	0.31		0.91	90.	76.	6	245			233.
6			15.0	124.9	0.36		1.07	80.	75.	6	245			238.
7			18.0	126.4	0.65		1.90	80.	75.	6	245			236.
8			21.0	128.7	0.80		2.25	80.	75.	6	250	61		238.
9			24.0	130.6	0.84		2.35	80.	75.	6	250			237.
10			27.0	133.1	0.85		2.40	72.	75.	6	245			234.
11			30.0	135.3	0.84		2.35	77.	74.	6	245			232.
12			33.0	138.0	0.77		2.20	74.	76.	6	245			236.
STOP		1536.	36.0	140.347										
END														

COMMENTS:

LEAK TEST AT 5" : 0.001 @ 3.0 IWG

@ 3.0 IWG

STATIC = 0.5"

APPENDIX 6

VISIBLE EMISSION DATA

APPENDIX 7

CALIBRATION DATA

METER BOX CALIBRATION

Date 10/20/87 Meter box number 123

Barometric pressure, P_b = 29.90 in Hg Calibrated by [illegible]

Orifice manometer setting (ΔH), in. H2O	Gas volume: Wet test meter (V_w), ft³	Gas volume: Dry gas meter (V_d), ft³	Temperatures: Wet test meter (t_w), °F	Temperatures: Dry gas meter Inlet (t_{d_i}), °F	Temperatures: Dry gas meter Outlet (t_{d_o}), °F	Temperatures: Dry gas meter Avg (t_d), °F	Time (θ), min	Y_i	ΔH@
0.5	5.0	5.191	69	84	79	81.5	12.92	.98	1.79
1.0	5.0	5.185	69	86	79	82.5	9.5	.99	1.95
1.5	10.0	10.353	69	89	81	85	15.82	.99	1.84
2.0	10.75	11.145	69	92	83	87.5	14.9	.99	1.90
3.0	11.25	11.740	69	93	83	88	12.95	.99	2.03
4.0	10.0	10.462	69	94	83	88.5	10.27	.98	2.06
							Avg	0.99	

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

0.5	0.1836	Y_i = [illegible]	= 0.98
1.0	0.222	Y_i = [illegible]	= 0.99
1.5	0.110	Y_i = [illegible]	= 0.99
2.0	0.167	Y_i = [illegible]	= 0.99
3.0	0.221	Y_i = [illegible]	= 0.99
4.0	0.29	Y_i = [illegible]	= 0.98

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CLIENT

PROJECT

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No. | PAGE

ENGINEER

DATE

SYSTEM

CALCULATION FOR

CHECKED BY

DATE

AH Box 1923

AH	$Q = \frac{C_d A_o \sqrt{2g(P_1 - P_2)}}{\sqrt{1 - (\beta)^4}}$ $K_m Q = \sqrt{(P_1)(\rho_2)}$ $\Delta H = \frac{\Delta P}{(\rho_m)}$	
0.5	$Q = \frac{5.29(58)}{\sqrt{1-(.5)^4}} \times K_m \times \sqrt{\frac{29.7}{538}} \quad (.98) = .77 \quad \Delta H = \frac{\Delta P}{(\rho_m)}$	= 1.79
1.0	$Q = \frac{3.78(55)}{\sqrt{1-(.5)^4}} \times K_m \times \sqrt{\frac{29.7}{534}} \quad (.98) = .68 \quad \Delta H = \frac{\Delta P}{(\rho_m)}$	= 1.55
1.5	$Q = \frac{10.35(54)}{\sqrt{1-(.5)^4}} \times K_m \times \sqrt{\frac{29.7}{541}} \quad (.98) = .672 \quad \Delta H = \frac{\Delta P}{(\rho_m)}$	= 2.04
2.0	$Q = \frac{11.45(54)}{\sqrt{1-(.5)^4}} \times K_m \times \sqrt{\frac{29.7}{543}} \quad (.98) = .663 \quad \Delta H = \frac{\Delta P}{(\rho_m)}$	= 2.10
2.5	$Q = \frac{12.78(54)}{\sqrt{1-(.5)^4}} \times K_m \times \sqrt{\frac{29.7}{543}} \quad (.98) = .672 \quad \Delta H = \frac{\Delta P}{(\rho_m)}$	= 2.13
3.0	$Q = \frac{14.02(54)}{\sqrt{1-(.5)^4}} \times K_m \times \sqrt{\frac{29.7}{543}} \quad (.98) = .638 \quad \Delta H = \frac{\Delta P}{(\rho_m)}$	= 2.26

HWS 1-66

METER BOX CALIBRATION

Date 9/15/87 Meter box number 1923

Barometric pressure, P_b = 30.00 in Hg Calibrated by Bueger/Dean

Orifice manometer setting (ΔH), in. H_2O	Gas volume: Wet test meter (V_w), ft^3	Gas volume: Dry gas meter (V_d), ft^3	Temperatures: Wet test meter (t_w), °F	Temperatures: Dry gas meter Inlet (t_{d_i}), °F	Temperatures: Dry gas meter Outlet (t_{d_o}), °F	Temperatures: Dry gas meter Avgd (t_d), °F	Time (θ), min.	Y_i	$\Delta H@$
0.5	5.0	5.172	71	86	80	83	12.03	.99	1.78
1.0	5.0	5.157	71	87	81	84	9.32	.99	1.91
1.5	10.0	10.229	71	91	83	87	15.26	1.0	2.02
2.0	10.0	10.314	71	94	84	89	13.20	1.0	2.01
3.0	10.0	10.376	71	96	85	90.5	11.4	.99	2.13
4.0	10.0	10.446	71	97	87	92	10.1	.99	2.23

Avg 0.99

$$\Delta H@ = \frac{H}{13.6} \qquad Y_i = \frac{V_w P_b (t_d + 460)}{V_d (P_b + \frac{\Delta H}{13.6})(t_w + 460)}$$

0.5	0.036	Y_i =	= 0.99
1.0	0.072	Y_i =	= 0.99
1.5	0.110	Y_i =	= 1.00
2.0	0.147	Y_i =	= 1.00
3.0	0.221	Y_i =	= 0.99
4.0	0.29	Y_i =	= 0.99

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PROJECT

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SUBJECT

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DATE

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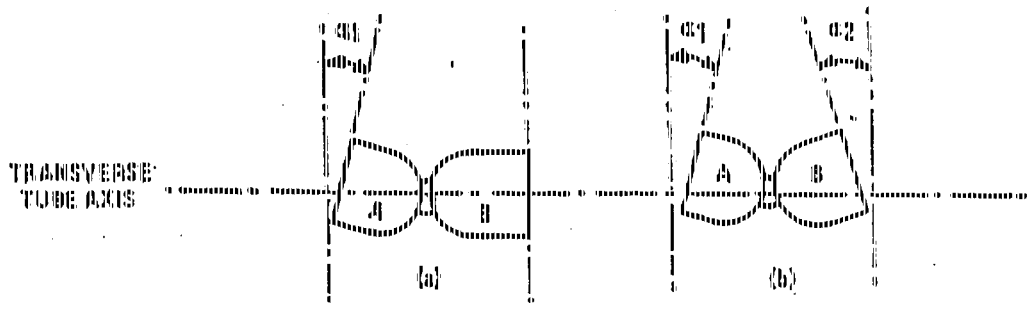
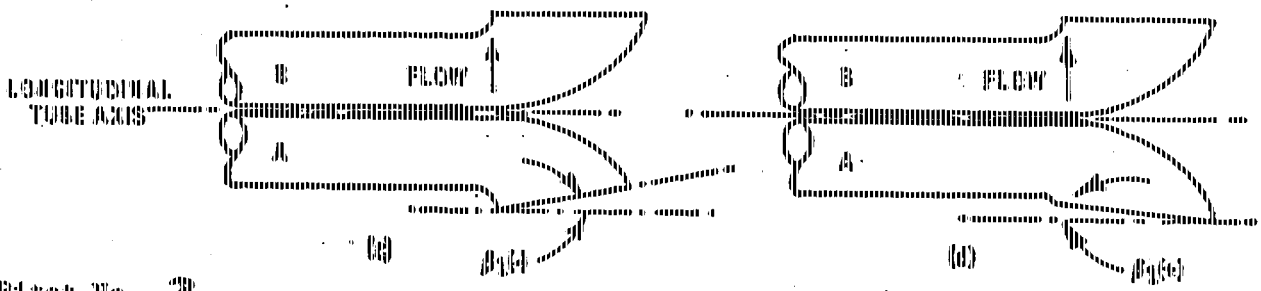
DATE

DESCRIPTION FOR AH Box 123

AH	$Q = \frac{CA\sqrt{2gh}}{\sqrt{1-(\frac{d}{D})^4}}$ $k = .60$ $Q = \frac{(.6)(.785)(.22)}{\sqrt{1-(\frac{.33}{.66})^4}}$ $AH = \frac{.334}{(.66)^2}$	
0.5	$Q = \frac{5.72(.50)}{283(.57)}$ $.90 k = .96$ $\sqrt{\frac{32}{.570}(.5)} = .22$ $AH = \frac{.334}{(.66)^2}$	= 1.28
1.0	$Q = \frac{5.72(.50)}{.937(.540)}$ $.526 k = .62$ $\sqrt{\frac{32}{.547}(.58)} = .64$ $AH = \frac{.334}{(.66)^2}$	= 1.91
1.5	$Q = \frac{10.29(.543)}{3.62(.547)}$ $.653 k = .65$ $\sqrt{\frac{32}{.543}(.63)} = .625$ $AH = \frac{.334}{(.66)^2}$	= 2.02
2.0	$Q = \frac{(.314)(.542)}{13.67 .545}$ $.298 k = .74$ $\sqrt{\frac{32}{.544}(.58)} = .669$ $AH = \frac{.334}{(.66)^2}$	= 2.06
3.0	$Q = \frac{1.037(.543)}{.117(.583)}$ $.90 k = .96$ $\sqrt{\frac{32}{.545}(.58)} = .652$ $AH = \frac{.334}{(.66)^2}$	= 2.13
4.0	$Q = \frac{(.0796)(.542)102}{10.7(.555)}$ $k = 1.02$ $\sqrt{\frac{32}{(.547)(.66)}} = .693$ $AH = \frac{.334}{(.66)^2}$	= 2.23





Pitot No. 3

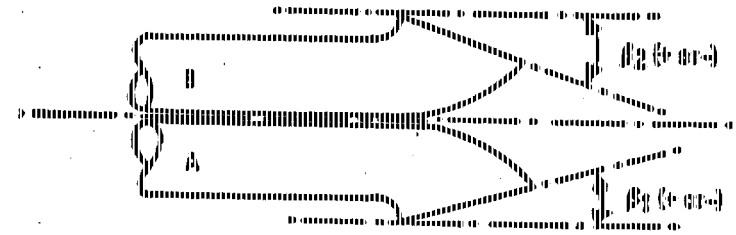
Reference	Side A	Side B
A_1	—	1°
A_2	—	—
B_1	3°	—
B_2	—	2°

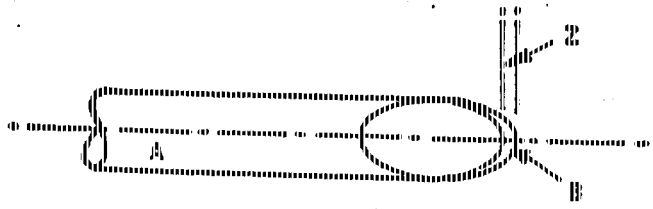
Reference	Inches
Z	0
W	0

$[C_p(\theta)_{ins}, \theta_{sphs}]$ C_p

0.0696 0.000

0.1987





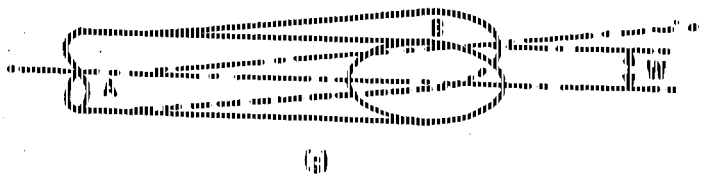


Figure 2-3. Types of face-opening misalignment that can result from field use or improper construction of Type S pitot tubes. These will not affect the baseline value of $C_p(s)$ so long as α_1 and $\alpha_2 < 10°$, β_1 and $\beta_2 < 5°$, $z < 0.32$ cm (1/8 in.) and $w < 0.08$ cm (1/32 in.) (citation 11 in Section 6).

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READING, PA.

CLIENT: McMinn Asphalt Co.

PROJECT: batch plant

FILING CODE: 10-6595-8C6

W.O. | PAGE: | OF

SYSTEM:

DOCUMENT:

DATE: 10/9/87

SUBJECT/FOR: Pot Meter-Thermocouple Calibration

REVIEWED BY:

DATE:

Pot Meter #	1
Thermocouple Type	K
Ice Bath Temperature °F	33
Certified Mercury Bulb °F	33
Ambient Temperature °F	70
Certified Mercury Bulb °F	70
Boiling H_2O °F	
Certified Mercury Bulb °F	
Hot Synthetic Oil °F	347
Certified Mercury Bulb °F	343

Remarks:

APPENDIX 8

COMPUTER PRINTOUT

(FLUE GAS CHARACTERISTICS, ISOKINETIC CALCULATIONS, AND TEST RESULTS FOR PARTICULATE EMISSIONS)

ISOKINETIC SAMPLING ANALYSIS

PROGRAM - 1005

CLIENT NAME - MOHINNS ASPHALT CO

PROCESS - ASPHALT BATCH

SAMPLING POINT- STACK

PLANT LOCATION - EAST PETERSBURG PA

CONTROL EQUIPMT - BAGHOUSE

POLLUTANTS - PARTICULATE

GILBERT ASSOCIATES, INC.
READING, PENNA.

100595000 10/26/87

RESULTS OF FLOW AND ISOKINETIC CALCULATIONS -

			M-1	M-2	M-3
RUN NUMBER =					
DATE OF RUN -			10-9-87	10-9-87	10-9-87
TIME AT BEGINNING OF RUN			944.0	1206.0	1419.0
TIME AT END OF RUN			1124.0	1346.0	1538.0
DN	SAMPLING NOZZLE DIAMETER	IN.	0.250	0.250	0.250
Y	DRY GAS METER FACTOR	=	1.000	1.000	1.000
PB	BAROMETRIC PRESSURE	IN. HG. ABS.	30.47	30.14	30.20
TT	NET TIME OF TEST	MIN.	96.0	96.0	72.0
VM	SAMPLED GAS VOLUME	CU. FT.	68.861	66.846	48.692
TM	AVG. GAS METER TEMPERATURE	DEGR. F.	68.	75.	76.
PM	AVG. ORIFICE PRESSURE DROP	IN. H20	1.54	1.85	1.75
VMSTD	VOLUME OF DRY GAS SAMPLED	DSCF	62.218	67.852	48.458
VW	H20 FROM IMPINGER, SILICA GEL	ML	144.0	205.0	142.0
VWGAS	H20 COLLECTED AT STD.COND.	STD. CU. FT.	6.782	9.561	7.458
M	STACK GAS MOISTURE BY VOLUME	PERCENT	9.8	12.5	13.4
	CO2 IN DRY STACK GASES	PERCENT	3.4	2.8	2.9
	O2 IN DRY STACK GASES	PERCENT	15.7	17.4	16.8
	CO IN DRY STACK GASES	PERCENT	0.0	0.0	0.0
	N2 IN DRY STACK GASES	PERCENT	80.9	80.6	80.3
MD	MOL FRACTION OF DRY GAS	=	0.90	0.88	0.86
MWD	MOL WGT. OF STACK GAS, DRY	-	29.17	29.02	29.14
EA	EXCESS AIR	PERCENT	277.5	448.4	381.9
MW	MOL WGT. OF STACK GAS, WET	=	28.07	27.64	27.63
AS	STACK AREA	SQ. IN.	2123.7	2123.7	2123.7
PST	STATIC PRESSURE OF STACK GAS	IN. HG.	-0.84	-0.85	-0.85
PS	STACK GAS PRESSURE	IN. HG. ABS.	30.43	30.09	30.15
TS	AVG. STACK TEMPERATURE	DEGR. F.	258.	239.	237.
CP	PITOT TUBE COEFFICIENT	-	0.840	0.840	0.840
VS	STACK GAS VELOC., STACK COND.	AFPM	2961.	3184.	3006.
QS	STACK GAS VOL., DRY STD. COND.	DSCFM	295841.	305330.	295584.
QA	STACK GAS VOLUMN, STACK COND.	ACFM	438664.	457800.	443225.
I	ISOKINETIC RATIO	PERCENT	94.6	98.7	99.3

GRAIN LOADING AND EMISSION CALCULATIONS -

RUN NUMBER -		R-1	R-2	R-3
DATE OF RUN =		10-9-87	10-9-87	10-9-87
PROBE AND CYCLONE	MILLIGRAMS	8.78	6.88	4.98
	GRAINS/ACF	0.0015	0.0009	0.0010
	GRAINS/SCF	0.0022	0.0014	0.0016
	LB/HR - CONC	0.55	0.38	0.39
	LB/HR - AREA	0.52	0.36	0.39
	LB/HR - AVG	0.53	0.36	0.39
FILTER	MILLIGRAMS	16.00	11.38	6.60
TOTAL - ABOVE ITEMS	MILLIGRAMS	24.78	17.38	11.58
	GRAINS/ACF	0.0041	0.0026	0.0024
	GRAINS/SCF	0.0061	0.0040	0.0036
	LB/HR - CONC	1.55	1.05	0.82
	LB/HR - AREA	1.47	1.03	0.91
	LB/HR - AVG	1.51	1.03	0.91
TOTAL - INCL. IMPINGER CATCH	MILLIGRAMS	51.88	18.48	13.58
	GRAINS/ACF	0.0086	0.0028	0.0028
	GRAINS/SCF	0.0128	0.0042	0.0043
	LB/HR - CONC	3.25	1.11	1.07
	LB/HR - AREA	3.08	1.10	1.07
	LB/HR - AVG	3.17	1.10	1.07

GILBERT ASSOC., INC. - INDUSTRIAL DIVISION - ISOKINETIC SAMPLING ANALYSIS 10/26/87 PAGE 4

LISTING OF FIELD DATA AND RESULTS AT EACH POINT

POINT NO.	POINT DISTANCE (IN)	CLOCK TIME	TIME INCRMT (MINS)	DRY GAS METER (CF)	ORIFICE DELTA H (IN. H2O)	GAS TEMPERATURES IN (DEGREES F)	GAS TEMPERATURES OUT (DEGREES F)	VELOCITY HEAD (IN. H2O)	STACK PRESS (IN. H2O)	STACK TEMP (DEGR. F)	(VEL. HD.)X (STACK TEMP.) (IN. H2O-DEG R)	SQR ROOT OF PREVIOUS RESULT	STACK GAS VEL (AFPM)
RUN NO. = M-1													
B-1	0.0	944.0	0.0	962.652	0.58	53.0	50.0	0.220	-0.55	245.0	155.10	12.45	1836.1
B-2	0.0	948.0	4.0	964.300	0.85	56.0	50.0	0.320	-0.55	250.0	227.20	15.07	2222.3
B-3	0.0	952.0	8.0	966.200	0.96	60.0	52.0	0.370	-0.55	292.0	278.24	16.68	2459.3
B-4	0.0	956.0	12.0	968.300	0.96	62.0	53.0	0.360	-0.55	299.0	273.24	16.53	2437.1
B-5	0.0	1000.0	16.0	970.300	0.97	65.0	54.0	0.390	-0.55	297.0	295.23	17.18	2533.3
B-6	0.0	1004.0	20.0	0.0	1.00	68.0	57.0	0.410	-0.55	284.0	305.04	17.47	2575.0
B-7	0.0	1008.0	24.0	974.000	1.50	70.0	58.0	0.600	-0.55	273.0	439.80	20.97	3091.9
B-8	0.0	1012.0	28.0	976.900	2.15	73.0	60.0	0.850	-0.55	267.0	617.95	24.86	3665.0
B-9	0.0	1016.0	32.0	980.100	2.75	75.0	62.0	1.100	-0.55	262.0	794.20	28.18	4154.9
B-10	0.0	1020.0	36.0	983.400	2.88	79.0	65.0	1.180	-0.55	260.0	849.60	29.15	4297.4
B-11	0.0	1024.0	40.0	987.300	2.80	80.0	66.0	1.100	-0.55	256.0	787.60	28.06	4137.6
B-12	0.0	1028.0	44.0	990.900	2.78	80.0	67.0	1.080	-0.55	243.0	759.24	27.55	4062.5
STOP		1032.0	48.0	994.056									
A-1	0.0	1036.0	0.0	994.056	0.62	74.0	67.0	0.240	-0.55	227.0	164.88	12.84	1893.1
A-2	0.0	1040.0	4.0	995.800	0.79	75.0	68.0	0.300	-0.55	230.0	207.00	14.39	2121.2
A-3	0.0	1044.0	8.0	997.800	0.80	77.0	68.0	0.310	-0.55	251.0	220.41	14.85	2188.8
A-4	0.0	1048.0	12.0	999.700	0.75	76.0	68.0	0.290	-0.55	274.0	212.86	14.59	2151.0
A-5	0.0	1052.0	16.0	1001.800	0.80	75.0	68.0	0.310	-0.55	285.0	230.95	15.20	2240.6
A-6	0.0	1056.0	20.0	1003.800	0.96	75.0	67.0	0.370	-0.55	287.0	276.39	16.62	2451.1
A-7	0.0	1100.0	24.0	1005.700	1.60	75.0	67.0	0.640	-0.55	286.0	477.44	21.85	3221.5
A-8	0.0	1104.0	28.0	1008.500	2.00	77.0	68.0	0.780	-0.55	265.0	565.50	23.78	3506.0
A-9	0.0	1108.0	32.0	1011.300	2.20	80.0	69.0	0.850	-0.55	230.0	586.50	24.22	3570.5
A-10	0.0	1112.0	36.0	1014.300	2.18	81.0	70.0	0.840	-0.55	212.0	564.48	23.76	3502.9
A-11	0.0	1116.0	40.0	1017.600	2.18	84.0	71.0	0.840	-0.55	205.0	558.60	23.63	3484.6
A-12	0.0	1120.0	44.0	1020.500	1.90	84.0	72.0	0.730	-0.55	210.0	489.10	22.12	3260.6
STOP		1124.0	48.0	1023.513									
OVERALL RESULTS			TT 96.0 (NET)	VM 60.861 (NET)	PM 1.54 (AVG)	TM 68.1 (AVG)		0.683 (AVG)	PST -0.55 (AVG)	TS 257.9 (AVG)	430.69 (AVG)	20.88 (AVG)	2961.0 (AVG)

LISTING OF FIELD DATA AND RESULTS AT EACH POINT

POINT NO.	POINT DISTANCE (IN)	CLOCK TIME	TIME INCREMT (MINS)	DRY GAS METER (CF)	ORIFICE DELTA H (IN. H2O)	GAS TEMPERATURES IN (DEGREES F)	GAS TEMPERATURES OUT (DEGREES F)	VELOCITY HEAD (IN. H2O)	STACK PRESS (IN. H2O)	STACK TEMP (DEGR. F)	(VEL. HD.)X (STACK TEMP.) (IN. H2O-DEG R)	SQR ROOT OF PREVIOUS RESULT	STACK GAS VEL (AFPM)
RUN NO. - M-2													
A-1	0.0	1204.0	0.0	24.595	0.67	70.0	69.0	0.240	-0.69	227.0	164.88	12.84	19118.7
A-2	0.0	1210.0	6.0	26.400	0.87	72.0	70.0	0.310	-0.69	234.0	215.16	14.67	21891.7
A-3	0.0	1214.0	10.0	28.500	0.87	72.0	70.0	0.310	-0.69	250.0	228.10	15.04	22146.4
A-4	0.0	1218.0	14.0	30.400	0.95	72.0	69.0	0.330	-0.69	255.0	235.95	15.36	22595.2
A-5	0.0	1222.0	18.0	32.600	1.12	70.0	69.0	0.400	-0.69	230.0	276.00	16.61	24802.4
A-6	0.0	1226.0	20.0	34.500	1.22	72.0	69.0	0.430	-0.69	212.0	288.96	17.00	25440.0
A-7	0.0	1230.0	24.0	37.300	1.42	73.0	69.0	0.490	-0.69	283.0	457.47	21.39	31695.9
A-8	0.0	1234.0	28.0	40.100	2.45	75.0	69.0	0.820	-0.69	217.0	555.34	23.56	35220.6
A-9	0.0	1238.0	32.0	43.0000	2.60	76.0	69.0	0.850	-0.69	251.0	623.68	25.01	37737.0
A-10	0.0	1242.0	36.0	46.0000	2.45	77.0	69.0	0.850	-0.69	268.0	612.00	24.74	37604.5
A-11	0.0	1246.0	40.0	50.1000	2.28	76.0	70.0	0.800	-0.69	271.0	584.88	24.19	36813.4
A-12	0.0	1250.0	44.0	53.2000	2.11	75.0	70.0	0.750	-0.69	274.0	550.50	23.46	35805.0
STOP		1254.0	48.0	56.3990									
B-1	0.0	1258.0	0.0	56.3990	0.80	72.0	69.0	0.290	-0.69	200.0	191.40	13.83	20647.2
B-2	0.0	1302.0	4.0	58.1300	1.00	72.0	70.0	0.350	-0.69	214.0	236.60	15.38	22900.4
B-3	0.0	1306.0	8.0	0.0	1.20	71.0	69.0	0.420	-0.69	231.0	290.22	17.04	25445.9
B-4	0.0	1310.0	12.0	62.7000	1.22	72.0	69.0	0.430	-0.69	235.0	298.80	17.29	25803.1
B-5	0.0	1314.0	16.0	65.2000	1.20	74.0	68.0	0.450	-0.69	234.0	315.20	17.76	26494.4
B-6	0.0	1318.0	20.0	67.5000	1.71	76.0	69.0	0.610	-0.69	244.0	426.44	20.72	30896.4
B-7	0.0	1322.0	24.0	70.3000	2.43	79.0	70.0	0.8800	-0.69	255.0	629.20	25.08	37408.1
B-8	0.0	1326.0	28.0	73.4000	2.93	81.0	71.0	1.000	-0.69	265.0	772.20	27.79	41452.2
B-9	0.0	1330.0	32.0	77.0000	3.30	83.0	73.0	1.150	-0.69	258.0	816.50	28.57	42609.8
B-10	0.0	1334.0	36.0	80.6000	3.30	83.0	73.0	1.150	-0.69	247.0	813.05	28.51	42508.6
B-11	0.0	1338.0	40.0	84.2000	2.80	83.0	74.0	0.970	-0.69	246.0	684.82	26.17	39018.2
B-12	0.0	1342.0	44.0	88.1000	2.00	84.0	74.0	1.020	-0.69	248.0	722.16	26.87	40115.4
STOP		1346.0	48.0	91.4491									
			TT	VM	PM	TM			PST	TS			
OVERALL RESULTS			96.0 (NET)	66.046 (NET)	1.85 (AVG)	72.7 (AVG)		0.650 (AVG)	-0.69 (AVG)	239.5 (AVG)	457.68 (AVG)	20.78 (AVG)	31094.4 (AVG)

LISTING OF FIELD DATA AND RESULTS AT EACH POINT

POINT NO.	POINT DISTANCE (IN)	CLOCK TIME	TIME INCRMT (MINS)	DRY GAS METER (CF)	ORIFICE DELTA H (IN. H2O)	GAS TEMPERATURES IN (DEGREES F)	GAS TEMPERATURES OUT (DEGREES F)	VELOCITY HEAD (IN. H2O)	STACK PRESS (IN. H2O)	STACK TEMP (DEGR. F)	(VEL. HD.)X (STACK TEMP.) (IN. H2O-DEG R)	SQR ROOT OF PREVIOUS RESULT	STACK GAS VEL (AFPM)
RUN NO. = M-3													
B-1	0.0	1419.0	0.0	91.655	0.80	69.0	68.0	0.280	-0.66	215.0	189.00	13.75	2052.6
B-2	0.0	1422.0	3.0	93.100	0.97	71.0	69.0	0.340	-0.66	226.0	233.24	15.27	2280.2
B-3	0.0	1425.0	6.0	94.700	1.10	72.0	69.0	0.380	-0.66	240.0	266.00	16.31	2435.1
B-4	0.0	1428.0	9.0	96.400	1.15	74.0	69.0	0.410	-0.66	250.0	291.10	17.06	2547.4
B-5	0.0	1431.0	12.0	98.100	1.20	76.0	70.0	0.420	-0.66	251.0	298.62	17.28	2580.1
B-6	0.0	1434.0	15.0	99.900	1.22	78.0	70.0	0.430	-0.66	260.0	309.60	17.60	2627.1
B-7	0.0	1437.0	18.0	101.500	1.80	80.0	71.0	0.630	-0.66	268.0	458.64	21.42	3197.5
B-8	0.0	1440.0	21.0	103.700	2.35	80.0	73.0	0.830	-0.66	268.0	604.24	24.58	3670.2
B-9	0.0	1443.0	24.0	106.200	3.10	80.0	73.0	1.100	-0.66	252.0	783.20	27.99	4178.5
B-10	0.0	1446.0	27.0	108.700	3.20	80.0	73.0	1.150	-0.66	242.0	807.30	28.41	4242.3
B-11	0.0	1449.0	30.0	111.400	3.10	80.0	74.0	1.100	-0.66	237.0	766.70	27.69	4134.2
B-12	0.0	1452.0	33.0	114.400	3.10	80.0	74.0	1.100	-0.66	232.0	761.20	27.59	4119.4
STOP		1455.0	36.0	117.168									
A-1	0.0	1500.0	0.0	117.168	0.60	76.0	73.0	0.240	-0.66	204.0	159.36	12.62	1884.8
A-2	0.0	1503.0	3.0	118.500	0.81	77.0	73.0	0.290	-0.66	218.0	196.62	14.02	2093.6
A-3	0.0	1506.0	6.0	120.000	0.91	78.0	74.0	0.310	-0.66	228.0	213.28	14.60	2180.5
A-4	0.0	1509.0	9.0	121.500	0.99	79.0	75.0	0.340	-0.66	232.0	235.28	15.34	2290.2
A-5	0.0	1512.0	12.0	123.100	0.91	80.0	76.0	0.310	-0.66	233.0	214.83	14.66	2188.4
A-6	0.0	1515.0	15.0	124.900	1.07	80.0	75.0	0.380	-0.66	238.0	265.24	16.29	2431.6
A-7	0.0	1518.0	18.0	126.400	1.90	80.0	75.0	0.650	-0.66	236.0	452.40	21.27	3175.7
A-8	0.0	1521.0	21.0	128.700	2.25	80.0	75.0	0.800	-0.66	232.0	553.60	23.53	3513.0
A-9	0.0	1524.0	24.0	130.600	2.35	81.0	75.0	0.840	-0.66	231.0	580.44	24.09	3597.1
A-10	0.0	1527.0	27.0	133.100	2.40	82.0	75.0	0.850	-0.66	231.0	587.35	24.24	3618.5
A-11	0.0	1530.0	30.0	135.300	2.35	84.0	76.0	0.840	-0.66	232.0	581.28	24.11	3599.7
A-12	0.0	1533.0	33.0	138.000	2.20	84.0	76.0	0.790	-0.66	235.0	549.05	23.43	3498.5
STOP		1536.0	36.0	140.347									
OVERALL RESULTS			TT 72.0 (NET)	VM 48.692 (NET)	PM 1.75 (AVG)	TM 75.7 (AVG)		0.617 (AVG)	PST -0.66 (AVG)	TS 237.1 (AVG)	431.56 (AVG)	20.13 (AVG)	3085.7 (AVG)

APPENDIX 9

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS

Particulate Isokinetic Sampling

1. Calculations for stack volume and Isokinetic Ratio

Time	Dry Gas Meter Ft^3	Pitot ΔP, In. H_2O	Orifice ΔH, In. H_2O	Dry Gas Temp °F In	Dry Gas Temp °F Out	Stack Static Pressure In. H_2O	Stack Temp °F
T	VM	ΔP	PM	TMI	TMO	PST	TS

1. DN = Nozzle Diameter, inches
2. PB = Barometric Pressure, inches Hg
3. TT = Net Sampling Time, minutes
4. VM = VM final - VM initial = Sample Gas Volume, Ft^3
5. TM = Average Dry Gas Temperature at Meter, °F

$$TM = \frac{Avg.\ TMI + Avg.\ TMO}{2}$$

6. PM = Average Orifice Pressure Drop, inches H_2O

$$PM = Avg.\ \Delta H$$

7. Volume of dry gas sampled at standard conditions[a], DSCF

$$VMSTD = \frac{17.65 \times VM \times Y \left(BP + \frac{PM}{13.6}\right)}{(TM + 460)}$$

8. VW = Total Water Collected = gm H_2O Silica gel + ml Imp. H_2O = ml
9. Volume of water vapor at standard conditions[b], SCF

$$VW\ gas = 0.0471 \times VW = SCF$$

10. Percent moisture in stack gas

$$\%\ M = \frac{100 \times VW\ gas}{VM\ STD + VW\ gas}$$

11. Mole fraction of dry gas

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

12. Molecular weight of dry stack gas

$$MWD = \left(\%CO_2 \times \frac{44}{100}\right) + \left(\%O_2 \times \frac{32}{100}\right) + \left[\left(\%CO + \%N_2\right) \times \frac{28}{100}\right]$$

12A. $XEA = \%\ \text{Excess Air} = \dfrac{[(\%\ O_2) - 0.5\ (\%CO)]}{0.264\ (\%N_2) - [(\%O_2) + 0.5\%\ (CO)]} \times 100$

13. Molecular weight of wet stack gas

$$MW = MWD \times MD + 18\ (1 - MD)$$

14. AS = Stack Area, square inches

15. PS = Stack Pressure, inches Hg

$$PS = PB \pm \text{Avg. PST}$$

NOTE: $\text{PST in. Hg.} = \dfrac{\text{PST in. } H_2O}{13.6}$

16. TS = Average Stack Temperature, °F

TS = Average TS

17. SDE = Average $\sqrt{\text{Velocity Head } (\Delta P) \times (\text{Stack Temperature} + 460)}$

(Calculated each line)

$$SDE = \text{Avg}\ \sqrt{\Delta P \times (TS + 460)}$$

18. Stack gas velocity at stack conditions, fpm

$$VS = 5130 \times Cp \times \text{Avg}(SDE) \times \left[\frac{1}{PS \times MW}\right]^{1/2} = FPM$$

Cp = pitot tube coefficient

19. Stack gas volumetric flow rate at standard conditions[c], DSCFM

$$Q_s = \frac{0.123 \times VS \times AS \times MD \times PS}{(TS + 460)} = \text{DSCFM}$$

20. Stack gas volumetric flow rate at stack conditions, ACFM

$$Q_a = \frac{.05667 \times QS\ (TS + 460)}{PS \times MD} = \text{ACFM}$$

21. Percent Isokinetic

$$XI = \frac{1.032 \times (TS + 460) \times VMSTD}{VS \times TT \times PS \times MD \times (DN)^2}$$

NOTES: [a]Dry standard cubic feet at 69°F, 29.92 in. Hg.

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

[c]Dry standard cubic feet per minute at 68°F, 29.92 in. Hg.

II. Calculations for grain loading and emission rates

22. Particulate, gr/DSCF

$$\text{gr/DSCF} = 0.01543 \times \frac{\text{mg}}{\text{VMSTD}}$$

23. Particulate at stack conditions, gr/ACF

$$\text{gr/ACF} = \frac{17.65 \text{ gr/DSCF} \times \text{PS} \times \text{MD}}{(\text{TS} + 460)}$$

24. Particulate, lb/hr conc. method

$$\text{lb/hr} = 0.000857 \times \text{gr/DSCF} \times \text{QS}$$

25. Particulate lb/hr area method $= 0.132 \times \frac{\text{gms particulate} \times \text{AS}}{\left(\frac{\text{DN}^2}{2}\right) \times \text{TT}}$

26. Particulate, combustion

$$\frac{\text{lb/hr}}{10^6 \text{ BTU/hr}}$$

27. Particulate, process lb/ton

$$\text{lb/ton} = \frac{\text{lb/hr}}{\text{tons/hr}}$$

28. Particulate, lb/MMBTU, F-Factor Method =

Using O_2 =

$$\frac{0.0154 \times \text{mg} \times \text{F-Factor} \times 20.9}{7000 \times \text{VMSTD} \times (20.9 - \%O_2)}$$

Using CO_2:

$$\frac{0.0154 \times \text{mg} \times \text{F-Factor} \times 100}{7000 \times \text{VMSTD} \times \% CO_2}$$

29. F-Factor, dscf/mmBtu

O_2 Format:

$$\text{F-Factor} = \frac{10^6(3.64(\%H) + 1.53(\%C) + 0.57(\%S) + 0.14(\%N) - 0.46(\%O_2))}{\text{GCV}}$$

CO_2 Format:

$$\frac{10^6(0.321)(\%C)}{\text{GCV}}$$