Commonwealth of Pennsylvania
Environmental Resources
November 2, 1989

Subject: Stack Test Review

To: Data File
Highway Materials, Inc.
East Whiteland Township, Chester County

From: Rick Begley
Air Pollution Control Engineer
Division of Technical Services and Monitoring
Bureau of Air Quality Control

Through: Chief, Source Testing and Monitoring Section

Highway Materials, Inc., operates a 350 ton per hour natural gas fired McCarter Corporation Model No. M-350-18 batch asphalt plant at the above location. The effluent in the dryer is controlled by a McCarter Corporation Model McC 10X10 ECB knock-out box precleaner and a McCarter Corporation Model McC-864-8 pulse jet fabric collector. The effluent is then directed to the atmosphere through a 54 inch diameter stack having a discharge point approximately 33 feet above grade.

PADER approved EPA Method 5 Particulate Test and Visible Emissions Test per EPA Method 9 were conducted by Gilbert Commonwealth, Inc., on the outlet stack servicing the above facility. The tests were conducted in accordance with a pre-approved protocol and found to be acceptable to the Department.

During this review, it was noticed that the average production weight produced for run HM-2 was incorrectly calculated. The weighted average, using the data presented, should be 61 tons per hour instead of the reported 202 tons per hour. Gilbert/Commonwealth was contacted to explain this discrepency but did not adequately respond. The corrected average is included with the test results in this review.

November 2, 1989

cc: Jim Donnelly, Norristown Regional Office
15-303-014
Reading File

RBerjr

November 2, 1989

The following test results were extracted from the test reports:

Runs	HM-1	HM-2	HM-3
Volumetric Flow Rate (DSCFM)	42,403	43,317	43,147
Rated Capacity (T/hr.)	350	350	350
Tested Rate (T/hr.)	221	61	155
Actual Concentration (gr/DSCF)	0.009	0.011	0.009
Actual Emmission Rate (lb/hr.)	4.1	3.2	3.2
Allowable Emmission Rate (gr/DSCF)*	0.04	0.04	0.04
Actual Opacity (%)	0	0	0
Allowable Opacity (%)*	20	20	20

*Per New Source Performance Standards, Subpart I, 40CRF 60.90 - 60.93.

HIGHWAY MATERIALS, INC.
600 WEST CLINEY AVENUE
PHILADELPHIA, PENNSYLVANIA 19120
(215) 224-2400

BITUMINOUS PAVING MIXTURES
CRUSHED STONE AND SAND
STABILIZED BASE MIX
LAYKOLD SURFACES
PAVEMENT SEALER
ASPHALT SPECIALTIES

August 28, 1989

AUG 29 1989

CERTIFIED
P27 783283
MAIL

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Thomas J. McGinley,
Chief, Engineering Services
Bureau of Air Quality Control
Commonwealth of Pennsylvania
Department of Environmental Resources
1875 New Hope Street
Norristown, Pennsylvania 19401

Dear Mr. McGinely:

Subject: Application No. 15-303-014
Plant No. 13 - Malvern
East Whiteland Township

Enclosed please find three (3) copies of the completed Stack Testing report from our consultant, Gilbert Commonwealth, Inc. for the above referenced plant.

We trust that you will be issuing our Operating Permit for this location after your review of the attached.

THANK YOU for your cooperation.

Very truly yours,

HIGHWAY MATERIALS, INC.

Vincent P. Argento,
Vice President - Operations

VPA:mak

Encls.

Copy to: Mr. David Hoffman
Gilbert/ Commonwealth, Inc.
Quality Assurance Division
P. O. Box 1498
Reading, Pennsylvania 19603-1498

SOURCE SAMPLING REPORT FOR MEASUREMENT OF PARTICULATE EMISSIONS

HIGHWAY MATERIALS, INC.
MALVERN FACILITY
BATCH ASPHALT PLANT

G/C, Inc., REPORT R-10-0699-000-1
JULY, 1989

SOURCE SAMPLING REPORT FOR MEASUREMENT OF PARTICULATE EMISSIONS

HIGHWAY MATERIALS, INC.
MALVERN FACILITY
BATCH ASPHALT PLANT

G/C, INC., REPORT R-10-0699-000-1
JULY, 1989

PREPARED BY

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

DAVID J. HOFFMAN
PROJECT COORDINATOR
TESTING SERVICES GROUP

Gilbert/Commonwealth, Inc. engineers and consultants
P.O. Box 1498, Reading, PA 19603-1498/Telephone 215-775-2600 Cable Gilasoc/Telex 836-431

August 24, 1989

Mr. Vincent Angelo
Highway Materials, Inc.
800 W. Olney Avenue
Philadelphia, PA 19120

Re: Submittal of Source Sampling Report for
Measurement of Particulate Emissions
Highway Materials, Inc.
Malvern Facility
Batch Asphalt Plant
G/C, Inc., Report R-10-0699-000-1

Dear Mr. Angelo:

We are pleased to submit four copies of our Report R-10-0699-000-1, dated August 14, 1989. This report contains results of source sampling for particulate emissions and determination of flue gas characteristics for the Asphalt Batch Plant exhaust located at your Malvern facility, as conducted on July 26-27, 1989.

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 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 Highway Materials and trusts that this report will meet your complete acceptance.

Very truly yours,

David Hofmann
Project Coordinator
Testing Services Group

DH:tlb

FOREWORD

The source sampling program as defined by this report was confined to measurement of particulate emissions and pertinent flue gas characteristics at referenced operating conditions.

TABLE OF CONTENTS

TABLES AND FIGURES

Tables

Figures

SECTION I - 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. The results show the Asphalt Batch Plant has an average emission rate of 0.01 gr/dscf using PADER Method 5 procedures.

TABLE 1

SUMMARY OF TEST RESULTS
HIGHWAY MATERIALS
MALVERN FACILITY
MALVERN, PA

10-0699-000-1

DATE	7/26/89	7/27/89	7/27/89
LOCATION		Stack	
RUN NO.	HM-1	HM-2	HM-3
TIME	0933	0718	1118
OPERATING DATA			
	See Appendix 3		
FLUE GAS CHARACTERISTICS			
DSCFM	42,403	43,317	43,147
ACFM	64,510	63,429	62,736
Temperature, °F	206	192	191
Moisture, %	17.4	15.9	15.2
PARTICULATE EMISSIONS			
Gr/DSCF	0.009	0.011	0.009
Lbs/Hr			
Gr/DSCF, Average		0.010	
VISIBLE EMISSIONS			
Opacity, %	0	0	0

SECTION II - ANALYSIS

1. Introduction

The data presented in this report represents the results of source sampling exhaust emissions at the baghouse outlet location of the Asphalt Batch Plant during referenced operating conditions.

Specific requirements of this source sampling program include the following:

a. Identification of final particulate emissions from Asphalt Batch Plant.

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.

e. Visible Emission test during the particulate tests.

The sampling program was completed on July 26-27, 1989, by the Gilbert field test crew, with the assistance of personnel assigned by Highway Materials.

2. Sampling Program Procedures

To satisfy the objectives established for this project, the sampling program was set-up on a basis of using one test train positioned at the test location and completing three test runs at the location. A test run consisted of a particulate test using PADER approved EPA Method 5, and a visible emissions test using EPA Method 9.

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

3. Operating Conditions

In the execution of this sampling program, an attempt was made to achieve near normal load for the plant. The amount of product generated was recorded by the operator. This record is included in Appendix 3.

4. 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 7.

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.

5. Discussion

5.1 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 plant was maintained near the normal load condition.

5.2 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.

5.3 Unit Operating Conditions

This sampling program was undertaken as a compliance test program for the asphalt batch plant under 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 Highway Materials personnel.

5.4 Emissions

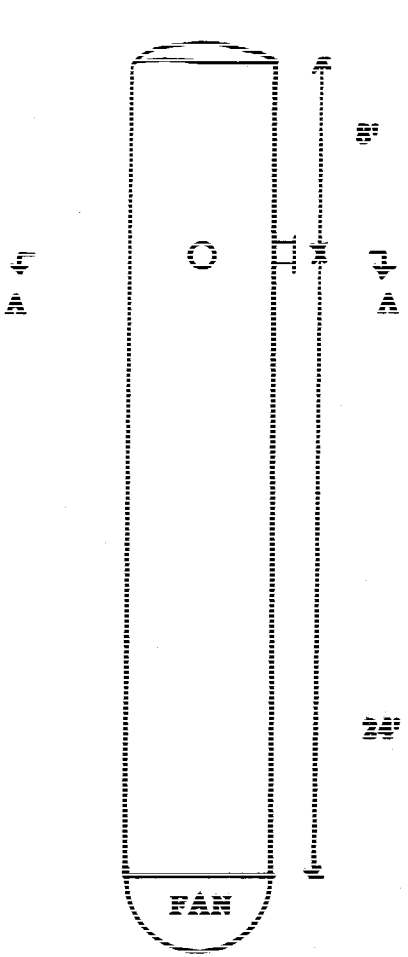
5.4.1 Particulate

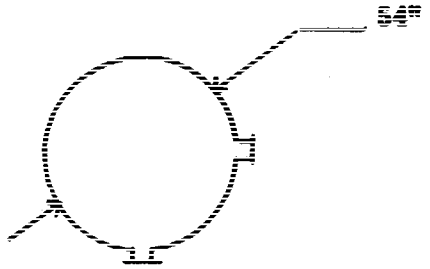
The reported particulate emissions as summarized in Tables 1, are expressed as a concentration (grains/SCF) and emission rate (lbs/hour) as measured.

5.4.2 Visible

The reported visible emissions as summarized in Table 1, are expressed as a percent.

SECTION A-A





Point No.	Distance From Point, Inches
1	1.13
2	3.62
3	6.37
4	9.56
5	13.50
6	19.22
7	34.78
8	40.50
9	44.44
10	47.64
11	50.38
12	52.87

FIGURE 1

SUMMARY OF TEST PORTS AND TRAVERSE POINTS
HIGHWAY MATERIALS
MALVERN FACILITY

SECTION III

APPENDICES

SECTION III - APPENDICES

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APPENDIX 1

PROJECT PARTICIPANTS

APPENDIX 1
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	Sr. Engineering Technician
Don Wary	Sr. Engineering Technician
Gary Helm	Engineering Technician

Laboratory Participants:

Carl J. Wurmser	Chemist
Vaughan O'Neill	Laboratory Technician

All field tests were completed with the assistance of technical personnel from Highway Materials.

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.1 STANDARD EPA TEST METHODS

2.2 ACTUAL SAMPLING PROCEDURES/PARTICULATE

2.3 ANALYTICAL METHODS/PARTICULATE

APPENDIX 2

TESTING AND ANALYTICAL PROCEDURES

2.1 STANDARD EPA TEST METHODS

APPENDIX 3

OPERATING DATA

GILBERT/COMMONWEALTH, INC.
TEST SERVICES GROUP

OPERATING DATA
HIGHWAY MATERIALS
PALMYRA FACILITY

DATE	RUN NO.	TIME	AGG1	AGG2	DR	AGG3	AGG4	ASP1	TOTAL
7/26/89	RR-1	905	1950	3270	3460	4774		273	5043
		**0943	4660	7660	7860	10930		628	11558
			6640	7570	7860	10940		622	11562
			6750	7630	7860	10710		616	11326
			6570	7610	7860	10910		628	11538
		952	3880	6410	6600	9190		524	9714
			3950	6380	6590	9210		520	9730
			3970	6350	6602	9160		527	9687
		955	2710	4700	4780	6630		391	7021
			2720	4610	4776	6640		383	7023
		1003	2410	3520	5850	6090	10850	396	11246
			2310	3520	5800	6090	10950	403	11353
			2310	3510	5860	6110	10940	403	11343
		1006	4650	7730	7960	11030		639	11669
			4630	7670	7958	10950		629	11579
			4610	7750	7940	11030		622	11652
		1008	1560	2090	2090	2920		178	3098
		1011	4270	7080	7270	10130		586	10716
			4190	7100	7190	10100		585	10685
			4200	7080	7260	10080		584	10664
		1013	2410	4000	4080	5730		324	6054
		1017	1860	3590	3990	4070	7710	343	8053
			1830	3580	3980	4110	7710	352	8062
		1021	6290	7090	7300	10120		585	10705
			6200	7090	7280	10070		588	10658
			6250	7060	7290	9970		586	10556
		1023	3750	6280	6490	9010		520	9530
			3920	6250	6480	9010		521	9531
		1028	4760	7920	8180	11430		639	12069
			4770	7940	8180	11330		656	11985
			4960	7930	8180	11350		644	11994
			4850	7890	8180	11310		649	11959
		1142	2410	4010	4090	5740		323	6063
		1202	4620	7740	7970	11080		638	11718
			4780	7650	7970	11080		637	11717
			4620	7740	7970	11012		630	11642
		1207	6940	7950	8180	11430		653	12083
			4750	7850	8170	11300		638	11938
			4740	7950	8180	11430		643	12073
		1209	3450	5590	5810	8130		465	8595
			3410	5650	5730	8120		466	8586
		1213	3350	5640	5810	8110		468	8578
			3510	5610	5820	8150		463	8613
		1215	2720	4620	4810	6670		382	7052
			2760	4630	4720	6670		382	7052
		1217	4090	6580	6850	9510		543	10053
			3940	6580	6850	9570		544	10114
		1220	4140	6660	6830	9580		547	9927

TOTAL WT. 0943-1028. 316,312
TONS 157
TONS/HR 210

TOTAL WT. 1202-1220. 150,761
TONS 75
TONS/HR 251

WEIGHTED AVERAGE TONS/HR 221
TOTAL WEIGHT/DAY(TONS) 568

TIME	DIFF. PRES. ("H20)	DRUM TEMP (F)	EXHAUST (F) HIGH	EXHAUST (F) LOW
	1.9	325	220	210
	1.9	325	220	210

GILBERT/COMMONWEALTH, INC.
TEST SERVICES GROUP

OPERATING DATA
HIGHWAY MATERIALS
MALVERN FACILITY

DATE	RUN NO.	TIME	AGG1	AGG2	DR	AGG3	AGG4	ASP1	TOTAL
7/27/89	HH-2	740	4630	7750	8010	11090		635	11725
			4630	7760	7980	11100		634	11734
			4680	7660	8030	11080		630	11710
		743	6060	6640	6900	9530		546	10075
			6100	6650	6920	9560		548	9888
		745	2750	6680	6780	6690		381	7071
		752	7250	6860	9270	9560	11360	573	11913
			4350	6870	9210	9660	11260	581	11841
			4460	6890	9280	9550	11440	582	12021
			4310	6810	9250	9550	11490	582	12032
		818	4750	7970	8220	11400		654	12054
			4810	7950	8210	11370		652	11960
			4730	7950	8220	11320		640	11960
		821	3330	5610	5830	8080		462	8542
			3330	5660	5820	8040		463	8503
		828	2990	4710	4780	6690		383	7073
		831	4370	7200	7520	10300		597	10897
		913	3360	5600	5850	8090		460	8550
			3370	5580	5820	8070		459	8529
		917	4520	7500	7750	10770		616	11386
			4680	7520	7740	10600		616	11216
			4520	7520	7740	10620		601	11221
		921	4190	7110	7190	10160		571	10751
			4190	7080	7280	9990		566	10566
			4190	7080	7280	1000		566	10583
		941	1850	2620	4010	6090	7710	317	8048
			1860	2610	4016	4128	7700	347	8047
		947	2310	3520	5900	6110	10990	387	11367
			2660	3470	5870	6180	10980	387	11367
			2300	3690	5870	6090	10980	408	11388
		949	3140	5290	5460	7600		440	8040
			3140	5300	5500	7610		432	8042
		952	3940	6660	6840	9690		547	10057
			3950	6640	6840	9530		562	10072

TOTAL WT. 740-921. (0 min)
TONS 263,782
TONS/HR 132
199

TOTAL WT. 941-952 (1 min)
TONS 96,400
TONS/HR 43
236

WEIGHTED AVERAGE TONS/HR 202

TOTAL WEIGHT/DAY (TONS) 599

TIME	DIFF. PRES. ("H2O)	DRUM TEMP (F)	EXHAUST (F) HIGH	EXHAUST (F) LOW
	1.2	325	220	220
	1.9	330	250	220

$\frac{13.1\text{T}}{70\text{min}} \times \frac{60\text{min}}{\text{hr}} = 18.47\text{T/hr}$

$\frac{4.5\text{T}}{7\text{min}} \times \frac{60\text{min}}{\text{hr}} = 38.57\text{T/hr}$

$\frac{10}{19}(18.4) + \frac{9}{19}(38.3) = 60.0\text{T/hr}$

GILBERT/COMMONWEALTH, INC.
TEST SERVICES GROUP

OPERATING DATA
HIGHWAY MATERIALS
MALVERN FACILITY

DATE	RUN NO.	TIME	AGG1	AGG2	DR	AGG3	AGG4	ASP1	TOTAL
7/27/89	RR-3	1103	3730	5930	6130	8520		490	9010
		1137	3950	6620	6805	9360		548.5	9909
			3930	6630	6800	9400		546	9946
		1140	2720	6640	6740	6720		383	7103
			2720	6630	6810	6600		386	6986
		1141	1670	2760	2750	3850		220	4070
		1149	2280	3510	6060	5900	10970	396	11366
			2290	3520	6000	5910	10970	402	11372
			2270	3500	6080	5880	10780	401	11181
		1152	2320	4100	4100	5740		328	6068
		1248	3690	6020	6090	8550		494	9044
			3730	5990	6080	8500		491	8991
		1311	3920	6690	6760	9470		546	10016
			3910	6670	6820	9360		541	9901
		1315	3900	6680	6760	9490		546	10036
			3900	6660	6840	9360		544	9886
			3910	6640	6840	9330		540	9870
		1330	4220	6900	9520	9300	11450	581	12031
			4340	6790	9510	9280	11450	500	12030
			4440	6890	9525	9230	11440	578	12018
			4240	6890	9520	9300	11430	578	12008
		1344	2410	4050	5570	5480	6670	340	7010
			2410	4060	5540	5450	6620	346	6966
		1346	3220	5250	5510	7620		437	8057
			3300	5300	5500	7470		440	7910
		1354	3910	6640	6860	9580		533	9113
			3890	6670	6750	9510		546	9856
		1357	2370	3330	3410	4860		278	5118
		1359	4740	7990	8200	11440		653	12093
		1402	900	1390	1660	1660	2060	101	2161
		1411	1740	2320	4300	4220	7610	274	7884
			1660	4210	4210	4210	7670	284	7954
		1508	3380	5440	7480	7410	9070	459	9529
			3420	5420	7450	7420	9100	460	9560
			3330	5450	7500	7380	9080	459	9539
			3540	5420	7530	7340	9070	455	9525

TOTAL WEIGHT 1137-1152. 77,999
TONS 39
TONS/HR 156

TOTAL WEIGHT 1311-1330. 97,796
TONS 49
TONS/HR 1564

WEIGHTED AVERAGE TONS/HR 159

TIME	DIFF. PRES. ("H20)	DRUM TEMP (F)	EXHAUST (F) HIGH	EXHAUST (F) LOW
	1.2	330	230	220
	1.9	325	230	220

77.34 $\frac{15}{34}(156) + \frac{19}{34}(154)$ =

APPENDIX 4

ANALYTICAL RESULTS FOR PARTICULATES

(CLEAN-UP SHEETS)

SPORTS, STANDARD AND DECOY, INC.
BOWDEN • FLANDERS • BOSWORTH

ANALYTICAL
LABORATORY
30 Noble Street
P.O. Box 6527
Reading PA 19611-0527
(215) 376-6581
FAX (215) 376-6950

CERTIFICATE OF ANALYSIS

CLIENT: GILBERT/COMMONWEALTH INC
P O BOX 1496
READING PA 19603

REPORT NO: 8922868
P.O. NO.: 52568
DATE REPORTED: August 8, 1989
DATE RECEIVED: July 31, 1989
WORK ORDER NO.: 13361-001

SAMPLING DATE: JULY 27, 1989 BY: CLIENT

SAMPLE DESCRIPTION: STACK

SAMPLE IDENTIFICATION: HIGHWAY MATERIAL
W.O. #10-0699-000

LAB NO.	RUN	PARTICULATE SOURCE	PARTICULATE WT (mg)
8922868-1	HM-1	Impinger Water	18.8
8922868-1	HM-1	Impinger Water (> 0.22 µm)	1.9
8922868-1	HM-1	Impinger Acetone	3.9
8922868-1	HM-1	Probe Acetone	15.5
8922868-1	HM-1	Probe Water	5.8
8922868-1	HM-1	Filter	5.1
8922868-2	HM-2	Impinger Water	7.0
8922868-2	HM-2	Impinger Water (> 0.22 µm)	1.5
8922868-2	HM-2	Impinger Acetone	3.9
8922868-2	HM-2	Probe Acetone	17.9
8922868-2	HM-2	Probe Water	7.8
8922868-2	HM-2	Filter	7.9
8922868-3	HM-3	Impinger Water	3.0
8922868-3	HM-3	Impinger Water (> 0.22 µm)	1.6
8922868-3	HM-3	Impinger Acetone	2.3
8922868-3	HM-3	Probe Acetone	16.4
8922868-3	HM-3	Probe Water	3.3
8922868-3	HM-3	Filter	5.9

Respectfully submitted,

CARL J. WUMMER - GROUP LEADER
LABORATORY SERVICES

cc: Steve Brockel

[illegible] ASSOCIATES, INC.
AIR [illegible] CORP.
PARTICULATE CLEAN UP AND WEIGHT SHEET

Run Date: 2/26/90
Run No.: BM-1
Sample Box No.:
Operator: OCW

Client: [illegible]
P. O. No.: 10059000
Plant: [illegible]
Sampling Location: Stack

FRONT HALF

Laboratory Results

Nozzle-Acetone Wash — Acetone — Lab No. 8608-1 — Residue 155 mg
Probe, Nozzle Holder, Cyclone (bypass), Flask, Front Half Filter Holder-Acetone Wash — H_2O — Lab No. 8608-1 — Residue 52 mg

Nozzle No.	Lab No.	Nozzle Results
		mg
		mg
		mg
		mg

Nozzle particulate weight ______ mg

Filter No.	Lab No.	Filter Results
5995	8608-1	mg
		mg
		mg
		mg

Filter particulate weight 56.4 mg

FRONT HALF Sub Total 26.4 mg ✓

BACK HALF

Impinger Contents and Water Wash of Impingers, Connectors and Back Half of Filter Holder — Lab No. 8608-1 — [illegible] Residue ______ mg

Collected on 0.2 [illegible] Filter 41 mg

Aqueous Residue 188 mg

Impinger, Connectors and Back Half of Filter Holder - Acetone Wash — Lab No. 8608-1 — Residue 39 mg

BACK HALF Sub Total 244 mg ✓

TOTAL WEIGHT 510 mg ✓

IMPINGERS

Contents: 244
251

Final Volume 502
Initial Volume 300
Net Volume 202 ✓

SILICA GEL

Weight after test 250
Weight before test 3[illegible]

Comments:

LAB: DATE RECEIVED 2/3/[illegible]
DATE ANALYZED [illegible]

[illegible] 12/84

GILBERT ASSOCIATES, INC.
AIR POLLUTION CONTROL DEPT.
PARTICULATE CLEAN UP AND WEIGHT SHEET

Run Date: 7/30/82
Run No.: PC-2
Sample Box No.:
Operator: [illegible]

Client: [illegible]
W. O. No.: [illegible]
Plant: [illegible]
Sampling Location: [illegible]

FRONT HALF

Laboratory Results

Nozzle-Acetone Wash	Acetone	Lab No. 8868-2	Residue 12.9 mg
Probe, Cyclone Holder, Cyclone (bypass), Flask, Front Half Filter Holder-Acetone Wash	H_2O	Lab No. 8868-8	Residue 7.8 mg

Cyclone No.	Lab No.	Weight Results
		mg
		mg
		mg
		mg

Cyclone particulate weight ______ mg

Filter No.	Lab No.	Weight Results
[illegible]	8868-8	mg
		mg
		mg
		mg

Filter particulate weight 7.2 mg

FRONT HALF Sub Total 33.6 mg

BACK HALF

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

Lab No. 8868-2 Ether-Chloroform Residue ______ mg

Collected on 0.22u Filter 1.5 mg

Aqueous Residue 2.0 mg

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

Lab No. 8868-2 Residue 3.9 mg

BACK HALF Sub Total 10.4 mg

TOTAL WEIGHT 46.0 mg

MOISTURE

Impingers: 248 / 247

Final Volume 472

Initial Volume 300

Net Volume 172

Silica Gel

Weight after test: 252

Weight before test: 232

Net Weight: 20.0

Total water vapor [illegible] 20 ml

[illegible] 192 ml

Comments:

LAB: DATE RECEIVED 7/31/82

DATE REPORTED [illegible]

RPL/APC 12/76

ENTROPY ASSOCIATES, INC.
AIR POLLUTION CONTROL DEPT.
PARTICULATE CLEAN UP AND REPORT FORM

Run Date: 2/22/85
Client: [illegible]
Run No.: BM-3
W. O. No.: [illegible]
Sample Box No.:
Plant: Malvern
Operator: [illegible]
Sampling Location: Stack

FRONT HALF

Laboratory Results

Acetone-Cyclone Wash — Acetone Lab No. 5568-3 — Residue 10.6 mg

Probe, Nozzle Holder, Cyclone (bypass), Flask, Front Half Filter Holder-Acetone Wash — H_2O Lab No. 5568-3 — Residue 3.3 mg

Nozzle No.	Lab No.	Nozzle Results
		mg
		mg
		mg
		mg

Nozzle particulate weight ________ mg

Filter No.	Lab No.	Filter Results
5-991	5568-3	mg
		mg
		mg
		mg

Filter particulate weight 57.9 mg

FRONT HALF Sub Total 256 mg

BACK HALF

Impinger Content and Water Wash of Impinger Connector and Back Half of Filter Holder — Lab No. 5568-3 Ether-Chloroform Extract ________ mg

Collected on 0.45μ Filter 1.6 mg

Aqueous Residue 3.0 mg

Impinger, Connector and Back Half of Filter Holder - Acetone Wash — Lab No. 5568-3 Residue 2.3 mg

BACK HALF Sub Total 6.9 mg

TOTAL WEIGHT 362.5 mg

MOISTURE

Impingers: 255, 277

Final Volume 469

Initial Volume 205

Net Volume 264

SILICA GEL

	1	2	3	4
Weight after test	257			
Weight before test	232			
Net Weight	22			
Container No.	1. 4	2.	3.	4.

TOTAL WEIGHT-Silica Gel 22 gm

TOTAL WEIGHT-Impinger 169 gm

TOTAL MOISTURE 191 gm

Comments:

Lab: DATE RECEIVED 2/27/85
DATE REPORTED 3/7/85

ANALYTICAL CHEMIST

APC/APC 12/76

APPENDEK 5

RAW FIELD DATA

Sheet 1 of 2

Client Highway Materials

W. O. No.

Plant Malvern

Run No. HM-1

Location stack

Date 7/24/89

Operator DCW

Sample Box No.

Meter Box No. 1385

Meter ΔH 2.13

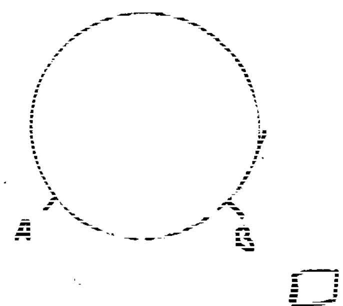
C Factor 1.00

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point

SKETCH



4'6" I.D.

Pitot Calibration .84

Thimble No.

Filter No. F-993

Ambient Temp. °F 80

Bar. Press. "Hg 30.08

Assumed Moisture % 15

Heater Box Setting, °F 250

Probe Tip Dia., In. .192

Probe Length

Probe Heater Setting

Avg. ΔP

Avg. ΔH

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	O_2	STACK TEMP. °F
B-1		0933.	0.0	801.607	0.31		0.35	84.	84.	–	240	54	–	176.
2			3.5	802.9	0.55		0.64	84.	84.	1	240		14.3	192.
3			7.0	804.6	0.70		0.80	84.	84.	1	240	53	14.6	194.
4			10.5	806.2	0.66		0.75	87.	84.	2	245		14.2	202.
5			14.0	808.0	0.88		0.92	98.	86.	2	245	53	13.9	210.
6			17.5	809.8	0.83		0.81	102.	87.		250		–	215.
7			21.0	811.6	1.10		1.20	106.	88.	4	250	54	–	215.
8			24.5	813.8	1.80		2.00	112.	89.	5	260		14.4	215.
9			28.0	816.5	1.90		2.10	114.	90.		265	55	15.0	217.
10			31.5	818.8	1.85		2.05	116.	92.		255		15.2	211.
11			35.0	821.5	1.90		2.10	120.	94.		250	55	15.6	210.
12			38.5	824.7	1.80		2.00	120.	95.		250		15.8	207.
Stop			42.0	827.470										

0.52 2.00 -1.0
0.90 1.90
1.50 145

-.90 402 Imp
183 cc

CO_2
3.6
3.0
2.8

PARTICULATE FIELD DATA
(continued)

Client Highway Materials

W.O. No. ______

Plant Malvern

Run No. HM-1

Location stack

Date 7/26/89

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	O_2	STACK TEMP. °F
A-1		1020.	0.0	827.470	0.78		0.88	105.	97.	2	255	56.	—	197.
2			3.5	829.6	0.88		0.98	109.	98.		250		—	205.
3			7.0	831.3	1.15		1.27	110.	97.	3	250	57	15.6	208.
4		1145.	10.5	833.563	1.20		1.32	106.	100.	3	240		—	177.
5			14.0	836.0	1.20		1.90	106.	100.	4	240	63	14.7	192.
6			17.5	838.7	1.25		1.48	107.	100		245		—	211.
7			21.0	841.0	1.15		1.38	113.	101		245	61	15.6	215.
8			24.5	842.9	1.10		1.32	114.	102.		245		16.1	216.
9			28.0	845.4	1.15		1.28	116.	102.		250	62	15.2	210.
10			31.5	847.6	0.87		0.97	118.	103.		250		15.5	219.
11			35.0	849.6	0.76		0.84	120.	104.		255	63	16.5	218.
12			38.5	851.6	0.82		0.91	118.	104.		250		—	218.
stop END			42.0	853.307										

LEAK 00 @ 7"

.55

COMMENTS:

stop 1036.5
start 1145.

2.6
2.5
2.8

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point

SKETCH

Client: [illegible]

W. O. No.:

Plant: [illegible]

Run No.: HM-2 [illegible]

Location: stack

Date: 7/25/89

Operator: DCW

Sample Box No.:

Meter Box No.: 1385

Meter ΔH:

C Factor:

Pitot Calibration: 0.84

Thimble No.:

Filter No.: J-994

Ambient Temp. °F: 95

Bar. Press. "Hg: 30.06

Assumed Moisture %: 15

Heater Box Setting, °F: 250

Probe Tip Dia., In.: .182

Probe Length:

Probe Heater Setting:

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	O_2	STACK TEMP. °F
A-1		0718	0.0	851.502	0.30		0.33	80.	80.	—	240	55	—	141.
2			[illegible]	854.7	0.62		0.68	81.	76.	1	240		—	152.
3			20	856.4	0.72		0.79	81	76.		245	54	15.5	176.
4			[illegible]	858.2	0.76		0.85	80.	76.	2	245		16.0	190.
5			[illegible]	860.0	0.78		0.86	81	77.		245	54	16.3	188.
6			[illegible]	862.0	0.90		0.98	86.	78.	2	250		14.9	177.
7			[illegible]	—	1.20		1.32	92.	79.	3	250	54	15.4	202.
8			[illegible]	866.8	1.50		1.64	96.	80.		250		15.3	204.
9		*	[illegible]	868.640	1.75		1.93	97.	83.	3	245	56	—	180.
10			[illegible]	871.1	1.80		2.00	92.	84.		245		14.9	183.
11			[illegible]	873.8	1.90		2.10	98.	85.		250	55	15.0	188.
12			[illegible]	876.6	1.85		2.04	102.	88.		250		15.5	189.
Stop			120	879.260										

[illegible]

* stop .0746
start .0853

Gel 20
Temp [illegible]

-.57

2.8
2.4
2.4

PARTICULATE FIELD DATA
(continued)

Client Highway Materials

W.O. No. ______

Plant Malvern

Location stack

Run No. HM-2

Date 7/27/89

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	O_2	STACK TEMP. °F
A-1		0911.	0.0	879.360	0.79		0.87	100.	88.	1	255	55	—	194.
2			3.5	881.2	0.91		1.00	102.	89.	2	260		—	201.
3			7.0	883.2	1.00		1.10	98.	93.		260	55	14.6	192.
4			10.5	885.4	1.25		1.38	98.	94.	3	255		14.8	198.
5			14.0	887.7	1.35		1.48	106.	95.		255	56	14.6	204.
6			17.5	890.1	1.20		1.32	110.	96.		250		14.6	206.
7			21.0	892.3	1.20		1.32	114.	97.		250	56	14.7	204.
8			24.5	894.7	1.15		1.26	116.	98.		250		14.5	203.
9			28.0	897.0	1.10		1.22	117.	99.		245	56	14.5	204.
10			31.5	899.1	0.85		0.93	115.	99.		245		14.6	209.
11			35.0	901.1	0.80		0.89	115.	100.		240		15.3	210.
12			38.5	903.0	0.84		0.93	116.	102.		240		—	202.
Stop			42.0	904.870										
END														

COMMENTS: 250 / 274

stop @ 0916. 882.030

start 0945.

[illegible] 54.006

-.490

3.0
3.0
2.8

PARTICULATE FIELD DATA

VERY IMPORTANT - FILL IN ALL BLANKS

Read and record at the start of each test point

SKETCH

Client: Highway Materials

W. O. No.: [illegible]

Plant: Malvern [illegible]

Run No.: HM-3

Location: [illegible]

Date: 7/27/89

Operator: DdW

Sample: [illegible]

Meter Box No.: 1385

Meter ΔH:

C Factor: [illegible]

Pitot Calibration: 0.84

Thimble No.:

Filter No.: 5-992

Ambient Temp. °F: 94

Bar. Press. "Hg: 29.78

Assumed Moisture %: 15

Heater Box Setting, °F: 250

Probe Tip Dia., In.: .192

Probe Length:

Probe Heater Setting:

Avg. ΔP:

Avg. ΔH:

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	O_2	STACK TEMP. °F
B-1		1119.	0.0	905.004	0.32		0.35	101.	98.	—	245	58	—	170.
2			3.5	906.3	0.60		0.67	101.	98.	1	250		13.9	172.
3			7.0	908.0	0.71		0.80	100.	99.		250	53	14.2	187.
4			10.5	909.9	0.67		0.76	102.	99.		250		15.0	176.
5			14.0	911.7	0.75		0.84	104.	99.	2	255	54	14.6	200.
6			17.5	913.6	0.77		0.85	110.	100.		255		14.0	200.
7			21.0	915.5	1.20		1.32	113.	100.		250	54	14.0	202.
8			24.5	917.683	1.55		1.69	97.	96.	3	249		—	171.
9			28.0	920.4	1.99		2.10	100.	95	4	260	57	15.1	172.
10			31.5	922.2	1.95		2.15	106.	95.		255		14.4	186.
11			35.0	924.0	1.80		2.00	110.	96.		255	56	15.2	182.
12			38.5	925.8	1.85		2.04	111	96.		250		—	185.
1200			42.0	931.925										

* Stop 1142.
Start 1152.

-.76

CO_2
3.0
3.0
2.8

PARTICULATE FIELD DATA
(continued)

Client Highway Materials

W.O. No.

Plant Malvern

Run No. 314M-3

Location stack

Date 7/23/87

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	O_2	STACK TEMP. °F
A-1		1337.	0.0	931.435	0.75		0.84	101.	95.	2	245	60	–	484.
2			3.5	933.4	0.85		0.94	100.	96.		240		16.0	494
3			7.0	935.4	0.80		0.88	100.	97.		240	57	15.0	492.
4			10.5	937.3	1.20		1.32	106.	98.	3	245		15.3	496.
5			14.0	939.5	1.30		1.44	110.	98.		245	59	15.3	496.
6			17.5	942.0	1.25		1.38	112.	98.		245		15.0	493.
7			21.0	944.3	1.20		1.32	113.	99.		250	57	15.3	492.
8			24.5	946.8	1.15		1.28	114.	100.		250		15.1	495.
9			28.0	948.0	1.10		1.22	115.	100.		250	57	15.1	502.
10			31.5	951.0	0.90		0.99	114.	100.		255		14.9	498.
11			35.0	953.3	0.80		0.88	114.	100.		250	60	14.9	492.
12			38.5	955.2	0.82		0.91	112.	101.		243		–	499.
Stop			42.0	956.968										
END														

COMMENTS: Leak test 5" .004

-42

2.6 24
2.6

169

53

APPENDIX 6

CALIBRATION DATA

Gilbert/Commonwealth Inc.
Testing Services Group
METER BOX CALIBRATION

DATE: 7/28/89 METER BOX NUMBER: 1385

BAROMETRIC PRESS. (Pb) = 30.20 in. Hg CALIBRATED BY: HELM

Orifice Manometer Setting (delta H) In. H2O	GAS VOLUME: Wet Test Meter (Vw) cu. ft.	GAS VOLUME: Dry Gas Meter (Vd) cu. ft.	TEMPERATURES: Wet Test Meter (Tw) deg. F	TEMPERATURES: Dry Gas Meter Inlet (Tdi) deg. F	TEMPERATURES: Dry Gas Meter Outlet (Tdo) deg. F	TEMPERATURES: Dry Gas Meter Average (Td) deg. F	Time min.	Yi	delta H@i
0.5	5.000	5.018	76.5	82.5	78.5	80.5	12.33	1.00	1.72
1.0	5.000	5.149	76.5	88.5	80.5	84.5	8.97	0.98	1.75
1.5	10.000	10.337	76.5	98	84.5	91.3	14.88	0.99	1.82
2.0	10.000	10.318	76.5	110	89	99.5	12.97	1.01	1.89
3.0	10.000	10.280	76.5	112	91	101.5	10.83	1.01	2.00
4.0	10.000	10.283	76.5	117.5	93	105.3	9.52	1.01	2.08
							AVERAGE Yi	1.00	

FORMULAS

$$Yi = \frac{(Vw)(Pb)(Td+460)}{(Vd)(Pb+(\Delta H/13.6))(Tw+460)}$$

$$\text{delta H@i} = \frac{0.921}{(Kn)(Kn)}$$

$$Kn = \Theta m \sqrt{\frac{(Pb)(29)}{(Tdo+460)(\text{delta H})}}$$

$$\Theta m = \frac{(Vd)(Tdo+460)}{(Time)(Td+460)}$$

Gilbert/Commonwealth Inc.
Testing Services Group
METER BOX CALIBRATION

DATE: 7/6/89 METER BOX NUMBER: 1385

BAROMETRIC PRESS. (Pb) = 29.90 in. Hg CALIBRATED BY: BURGER

	GAS VOLUME		TEMPERATURES						
				Dry Gas Meter					
Orifice Manometer Setting (delta H) In. H2O	Net Test Meter (Vm) cu. ft.	Dry Gas Meter (Vd) cu. ft.	Net Test Meter (Tm) deg. F	Inlet (Tdi) deg. F	Outlet (Tdo) deg. F	Average (Td) deg. F	Time min.	Yi	delta H@i
0.5	5.000	5.060	75	79	77	78.0	12.42	0.99	1.72
1.0	5.250	5.317	75	81	79	80.0	9.48	0.99	1.83
1.5	10.500	10.619	76	101	85	93.0	15.73	1.02	1.98
2.0	10.000	10.128	76	112	88	100.0	13.17	1.03	2.08
3.0	10.750	10.863	76	97	87	92.0	11.82	1.01	2.06
4.0	10.000	10.048	76	96	85	89.5	9.43	1.01	2.08
						AVERAGE Yi		1.01	

1.05 1.02

FORMULAS

$$Yi = \frac{(Vm)(Pb)(Tc+460)}{(Vd)(Pb+(H/13.6))(Tm+460)}$$

$$delta\ H@i = \frac{0.921}{(Km)(Km)}$$

$$Km = Gm \sqrt{\frac{(Pb)(29)}{(Tdo+460)(delta\ H)}}$$

$$Gm = \frac{(Vd)(Tdo+460)}{(Time)(Td+460)}$$

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS
READING, PA.

CLIENT

PROJECT

FILING CODE

W.O. | PAGE

BY

SYSTEM

ENGINEER

DATE 7/2/64

CALCULATION FOR

Pot Meter-Thermocouple Calibration

REVIEWED BY

DATE

Pot Meter #		8
Thermocouple Type		K
Ice Bath Temperature	°F	33.2
Certified Mercury Bulb	°F	33
Ambient Temperature	°F	76.2
Certified Mercury Bulb	°F	75
Boiling H_2O	°F	
Certified Mercury Bulb	°F	
Hot Synthetic Oil	°F	280.3
Certified Mercury Bulb	°F	280

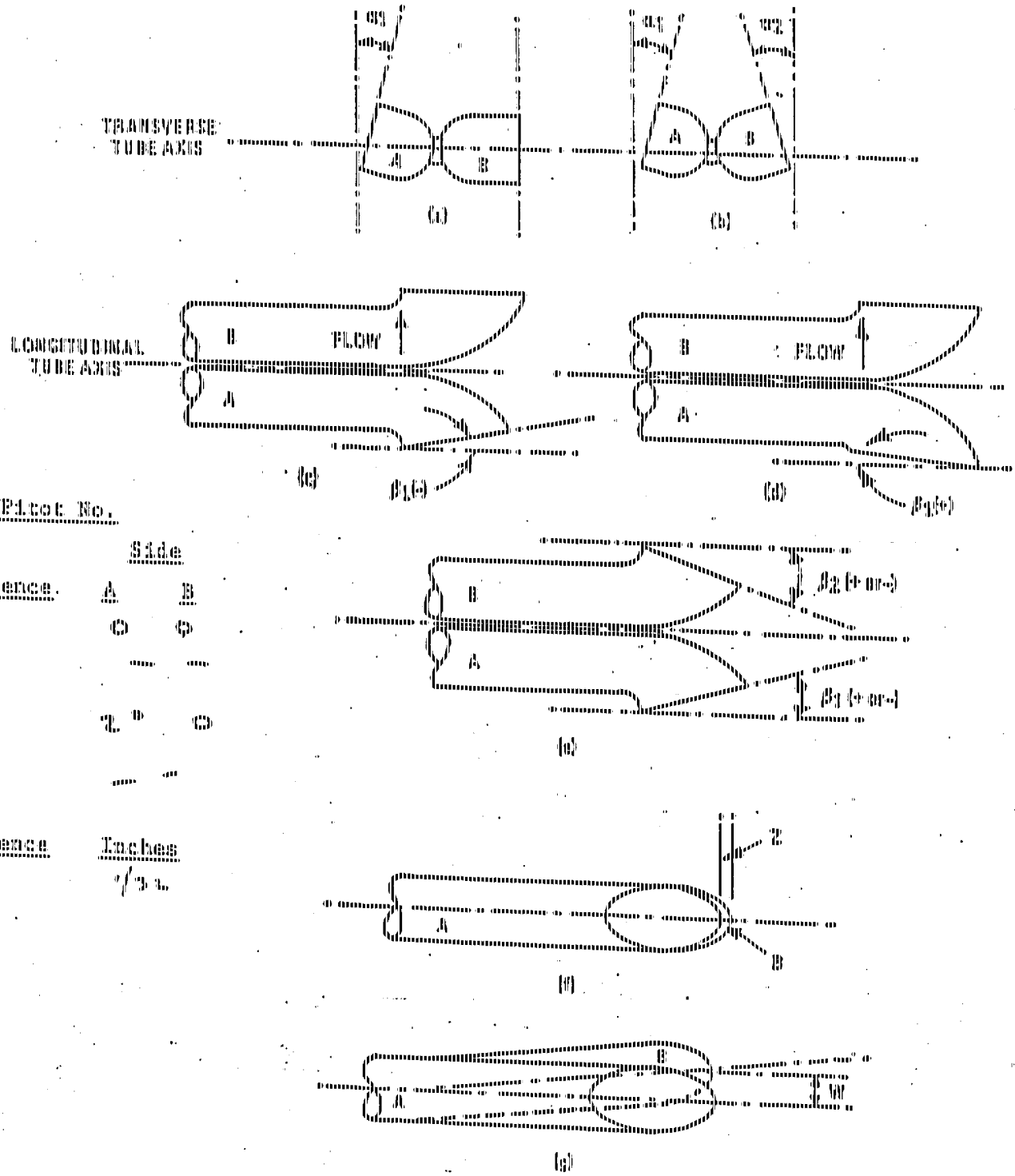
Remarks:

GILBERT ASSOCIATES, INC. ENGINEERS AND CONSULTANTS READING, PA.	CLIENT PROJECT	FILING CODE
		W.O. / PAGE ___ OF ___
SYSTEM		ENGINEER
		DATE 7/5/09
CALCULATION FOR		REVIEWED BY
Pot Meter-Thermocouple Calibration		DATE

Pot Meter #	8
Thermocouple Type	K
Ice Bath Temperature °F	32.4
Certified Mercury Bulb °F	33
Ambient Temperature °F	86.1
Certified Mercury Bulb °F	80
Boiling H_2O °F	
Certified Mercury Bulb °F	
Hot Synthetic Oil °F	3864
Certified Mercury Bulb °F	384

Remarks:

FILING CODE

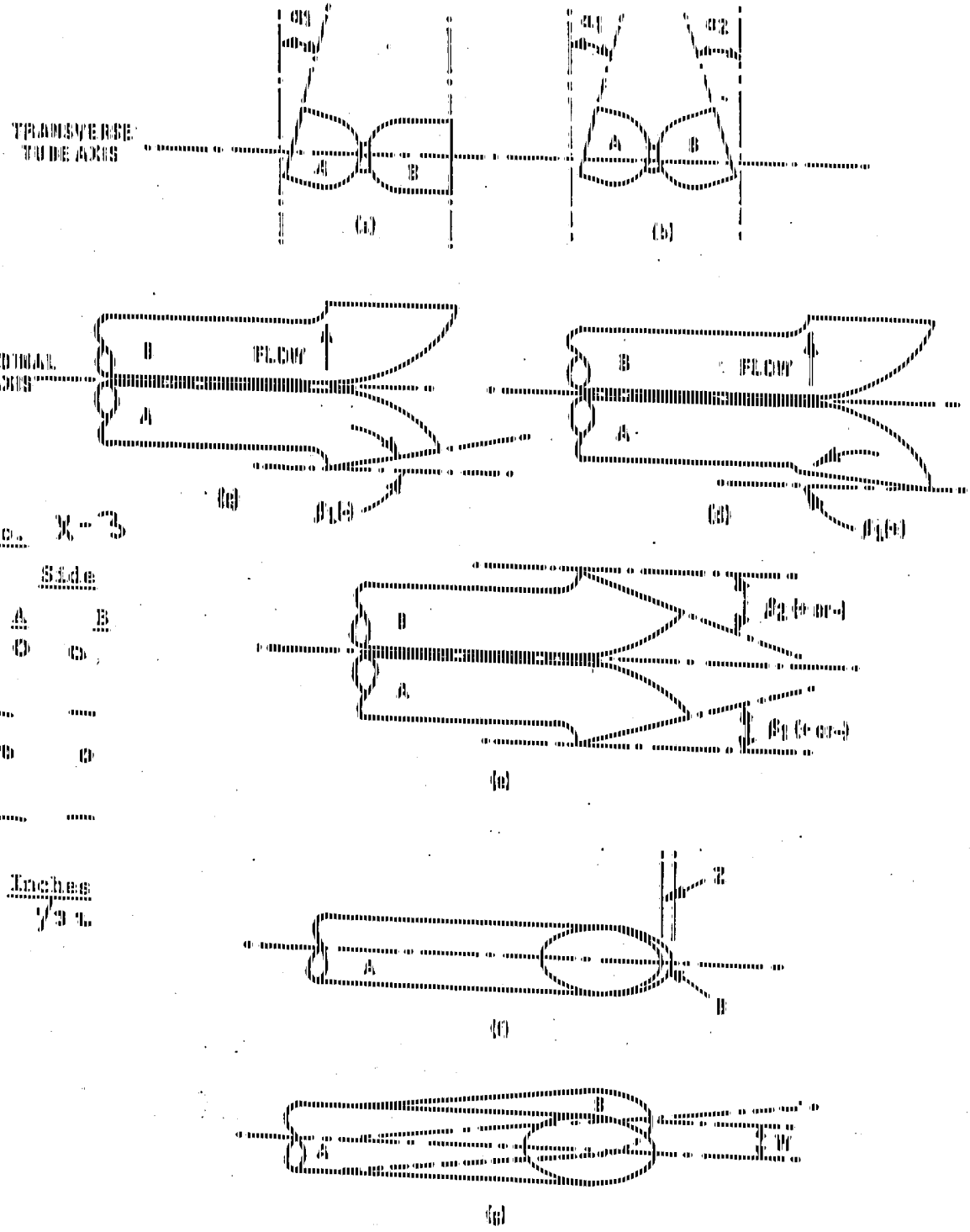


Pitot No.

Reference	Side A	Side B
A_1	C	C
A_2	---	---
B_1	C	C
B_2	---	---

Reference	Inches
Z	7/32
W	

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 $\alpha_2 < 10^\circ$, β_1 and $\beta_2 < 5^\circ$, $z < 0.32$ cm (1/8 in.) and $w < 0.08$ cm (1/32 in.) (citation 11 in Section 6).



Pitot No. X-3

Reference	Side A	Side B
A_1	0	0
A_2	—	—
B_1	2	0
B_2	—	—

Reference	Inches
z	1/32
w	

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 $\alpha_2 \leq 10°$, β_1 and $\beta_2 \leq 5°$, $z \leq 0.32$ cm (1/8 in.) and $w \leq 0.08$ cm (1/32 in.) (citation 11 in Section 6).

APPENDIX 7

COMPUTER PRINTOUT

(Flue Gas Characteristics, Isokinetic Calculations, and Test Results For Particulate Emissions)

GILBERT/COMMONWEALTH, INC.
TESTING SERVICES GROUP
ISOKINETIC SAMPLING SUMMARY SHEET

Client: HIGHWAY MATERIALS Plant:MALVERN, PA

Unit Tested: ASPHALT PLANT BAGHOUSE Pollut: PARTICULATES & FLOW

Sampling Location: STACK

DATE RUN NUMBER	1	2	3
DN - NOZZLE DIAMETER, IN.	0.192	0.192	0.192
PB - BAROMETRIC PRESS, IN. OF Hg	30.08	30.06	29.98
TT - NET SAMPLING TIME, MIN.	84.0	84.0	84.0
VM - VOLUME METERED, ACF	51.700	51.368	51.964
TM - AVG. METER TEMP., DEG. F	98	93	103
PM - AVG. DELTA H, IN. OF H2O	1.249	1.218	1.188
Y - GAS METER CALIB. FACTOR	1.00	1.00	1.00
VMSTD - STD. GAS VOL., SCF	49.350	49.406	49.025
VW - TOTAL WATER COLLECTED, ML.	220	199	187
%M - PERCENT MOISTURE	17.4	15.9	15.2
MD - MOLE FRACTION DRY	0.83	0.84	0.85
%CO2 - PERCENT CO2 DRY	2.9	2.7	2.7
%O2 - PERCENT O2 DRY	15.0	15.1	14.9
MWD - DRY MOLECULAR WEIGHT	29.06	29.04	29.03
MW - WET MOLECULAR WEIGHT	27.14	27.28	27.35
%EA - PERCENT EXCESS AIR	225.3	226.5	217.7
AS - STACK AREA, SQ. IN.	2,290.2	2,290.2	2,290.2
PST - STATIC PRESS., IN. OF H2O	-0.73	-0.49	-0.59
TS - STACK TEMP., DEG. F	206	192	191
CP - PITOT COEFFICIENT	0.84	0.84	0.84
VS - STACK GAS VELOCITY, AFPM	4,041	3,973	3,930
RMS - STD. DEV. OF VEL.	21.4	19.4	20.3
QS - STACK GAS FLOW, DSCFM	42,403	43,317	43,147
QA - STACK GAS FLOW, ACFM	64,510	63,429	62,736
KI - ISOKINETIC RATIO	109.3	107.1	106.7
F-FACTOR , DSCFM/MMBTU	0	0	0
GR/DSCF, PARTICULATE LOADING	0.009	0.011	0.009
LBS/HR, PARTICULATE EMISSIONS	3.21	4.06	3.16

GILBERT/COMMONWEALTH, INC.
TESTING SERVICES GROUP
ISOKINETIC SAMPLING ANALYSIS

Client: MIGNAGH MATERIALS Plant: MALVERN, PA

Unit Tested: ASPHALT PLANT BAGHOUSE Pollutants: PARTICULATES & FLOW

Sampling Location: STACK

Run No: RM-1 Date: 7/26/89 Start: 933 End: 1217

DATA

DN:	0.192	PB:	30.08	PST:	-0.73	AS:	2,290.2
O2%:	15.0	CO2%:	2.9	N2%:	82.1	Vm:	220
GAS METER Y-FACTOR:			1.00	E.A.%:	225.3		

SAMPLE POINT	TIME AT POINT	GAS METER	VELOCITY HEAD	STACK TEMP.	METER IN	TEMP. OUT	PM ORIFICE	SQE	O2	CO	VEL.
A-1	3.5	801.607	0.310	176	84	84	0.350	14.04			2,119
2	3.5	802.900	0.550	189	84	84	0.640	18.89	14.3		2,852
3	3.5	804.600	0.700	194	84	84	0.800	21.40	14.6		3,230
4	3.5	806.200	0.660	207	89	84	0.750	20.98	14.2		3,167
5	3.5	808.000	0.830	210	98	86	0.920	23.58	13.9		3,560
6	3.5	809.800	0.730	215	12	87	0.810	22.20			3,351
7	3.5	811.600	1.100	215	106	88	1.200	27.25			4,113
8	3.5	813.800	1.800	215	112	89	2.000	34.86	14.4		5,261
9	3.5	816.500	1.900	217	114	90	2.100	35.87	15.0		5,414
10	3.5	818.800	1.850	211	116	92	2.050	35.23	15.2		5,318
11	3.5	821.500	1.900	210	120	84	2.100	35.68	15.6		5,386
12	3.5	824.700	1.800	207	120	95	2.000	34.65	15.8		5,230
B-1	3.5	827.670	0.780	187	108	97	0.880	22.46			3,391
2	3.5	829.500	0.980	205	109	98	0.980	24.19			3,652
3	3.5	831.300	1.150	208	110	99	1.270	27.72			4,184
4	3.5	833.563	1.200	179	106	100	1.320	27.69	15.6		4,180
5	3.5	836.000	1.700	192	109	100	1.900	33.29			5,025
6	3.5	838.700	1.250	211	113	100	1.380	28.96	14.7		4,372
7	3.5	841.000	1.150	215	114	101	1.280	27.86			4,206
8	3.5	842.900	1.100	216	116	102	1.220	27.27	15.5		4,116
9	3.5	845.400	1.150	215	118	102	1.280	27.68	15.1		4,206
10	3.5	847.600	0.870	219	120	103	0.970	24.30	15.2		3,669
11	3.5	849.600	0.760	218	118	104	0.860	22.70	15.5		3,426
12	3.5	851.500	0.820	218	60	106	0.910	23.58	15.5		3,559
		853.307									

RESULTS	TT	VM	PIT	TS	TN	PM	SQE	O2	CO	VEL
	84.0	51.700	1.123	206	98	1.249	26.77	15.0	ERR	4,041
	net	net	avg	avg	avg	avg	avg	avg	avg	avg

PSM=	30.17	VMSTD=	49.350	VMGAS=	10.362	ZM=	17.4	RMS OF VELOCITIES = 21.4
MD=	0.83	MWD=	29.05	MW=	27.14	PS=	30.03	

STACK GAS VELOCITY = 4,041 AFPM
STACK GAS VOLUME = 42,403 DSCFM
STACK GAS VOLUME = 64,510 ACFM

STACK GAS VOLUME = 2.16E+05 LBS/HR
ISOKINETIC RATIO = 109.3

PARTICULATE EMISSIONS

F-FACTOR =

Weight, mg =	28.3 PADER (1)	51.0 (2)
GR/DSCF =	0.009	0.016
LBS/HR =	3.21	5.78

(1) INCLUDES PROBE WASH(WATER & ACETONE), FILTER, AND .22 MICRON FILTER.
(2) INCLUDES PROBE WASH(WATER & ACETONE), FILTER, .22 MICRON FILTER, AND IMPINGER WASH(WATER& ACETONE).

GILBERT/COMMONWEALTH, INC.
TESTING SERVICES GROUP
ISOKINETIC SAMPLING ANALYSIS

Client: HIGHWAY MATERIALS Plant: MALVERN, PA

Unit Tested: ASPHALT PLANT BAGHOUSE Pollutants: PARTICULATES & FLOW

Sampling Location: STACK

Run No: MM-2 Date: 7/27/89 Start: 718 End: 953

DATA

DN: 0.192 PB: 30.06 PST: -0.49 AS: 2,290.2
O2%: 15.1 CO2%: 2.7 N2%: 82.2 VW: 199
GAS METER Y-FACTOR: 1.00 E.A.%: 226.5

SAMPLE POINT	TIME AT POINT	GAS METER	VELOCITY HEAD	STACK TEMP.	METER IN	TEMP. OUT	PM ORIFICE	SQRT	O2	CO	VEL
B-1	3.5	853.500	0.300	141	80	80	0.330	13.43			2,022
2	3.5	854.700	0.620	152	81	76	0.680	19.48			2,933
3	3.5	856.400	0.720	174	81	76	0.790	21.37	15.5		3,217
4	3.5	858.200	0.760	180	80	76	0.850	22.05	16.0		3,321
5	3.5	860.000	0.760	188	81	77	0.860	22.48	16.3		3,385
6	3.5	862.000	0.900	197	86	78	0.980	24.32	14.9		3,661
7	3.5		1.200	202	92	78	1.320	28.19	15.4		4,244
8	3.5	865.800	1.500	204	96	80	1.640	31.56	15.3		4,752
9	3.5	868.540	1.750	180	92	83	1.930	33.47			5,039
10	3.5	871.100	1.800	183	92	84	2.000	34.02	14.9		5,123
11	3.5	873.800	1.900	188	96	85	2.100	35.09	15.0		5,283
12	3.5	876.600	1.850	189	102	88	2.040	34.65	15.5		5,217
A-1	3.5	879.260	0.790	194	100	88	0.870	22.73			3,423
2	3.5	881.200	0.910	201	102	89	1.000	24.53			3,693
3	3.5	883.200	1.000	192	98	93	1.100	25.53	14.6		3,845
4	3.5	885.400	1.250	198	98	94	1.380	28.68	14.8		4,318
5	3.5	887.700	1.350	204	106	95	1.480	29.94	14.6		4,508
6	3.5	890.100	1.200	206	110	96	1.320	28.27	14.6		4,257
7	3.5	892.300	1.200	204	114	97	1.320	28.23	14.7		4,250
8	3.5	894.700	1.250	203	116	98	1.260	27.61	14.5		4,158
9	3.5	897.000	1.100	204	117	99	1.220	27.05	14.5		4,069
10	3.5	899.100	0.850	209	115	99	0.930	23.85	14.6		3,591
11	3.5	901.100	0.800	210	115	100	0.890	23.15	15.3		3,486
12	3.5	903.000	0.840	207	116	100	0.930	23.67			3,564
		904.870									

RESULTS	TT	VM	PIT	TS	TM	PM	SQRT	O2	CO	VEL
	84.0	51.368	1.105	192	93	1.218	26.39	15.1	ERR	3,973
	net	net	avg	avg	avg	avg	avg	avg	avg	avg

PSM= 30.15 VMSTD= 49.406 ✓ VMGAS= 9.373 AN= 15.9 ✓ RMS OF VELOCITIES = 19.4
MD= 0.84 PMD= 29.04 ✓ MM= 27.28 ✓ PS= 30.02 ✓

STACK GAS VELOCITY = 3,973 AFPM
STACK GAS VOLUME = 43,317 DSCFM (43,317)
STACK GAS VOLUME = 63,429 ACFM

STACK GAS VOLUME = 2.18E+05 LBS/HR
ISOKINETIC RATIO = 107.1

PARTICULATE EMISSIONS

F-FACTOR =
Weight, mg = 35.1 PADER (1) 46.0 (2)

GR/DSCF = 0.011 ✓ 0.014
LBS/HR = 4.06 ✓ 5.32

(1) INCLUDES PROBE WASH(WATER & ACETONE), FILTER, AND .22 MICRON FILTER.
(2) INCLUDES PROBE WASH(WATER & ACETONE), FILTER, .22 MICRON FILTER, AND IMPINGER WASH(WATER& ACETONE).

GILBERT/COMMONWEALTH, INC.
TESTING SERVICES GROUP
ISOKINETIC SAMPLING ANALYSIS

Client: HIGHWAY MATERIALS Plant: MALVERN, PA

Unit Tested: ASPHALT PLANT BAGHOUSE Pollutant: PARTICULATES & FLOW

Sampling Location: STACK

Run No: M5-3 Date: 7/27/89 Start: 1118 End: 1419

DATA

DN: 0.192 PB: 29.96 PST: -0.59 AS: 2,290.2
O2%: 14.9 CO2%: 2.7 N2%: 82.4 VW: 1.87
GAS METER Y-FACTOR: 1.00 E.A.%: 217.7

SAMPLE POINT	TIME AT POINT	GAS METER	VELOCITY HEAD	STACK TEMP.	METER IN	TEMP. OUT	PM ORIFICE	SQE	O2	CO	VEL.
B-1	3.5	905.004	0.320	170	101	98	0.350	14.20			2,138
2	3.5	906.300	0.600	172	101	98	0.670	19.47	13.6		2,932
3	3.5	908.000	0.710	187	100	99	0.800	21.43	14.2		3,228
4	3.5	909.900	0.670	196	102	99	0.760	20.98	15.0		3,157
5	3.5	911.700	0.750	200	106	99	0.840	22.25	14.6		3,350
6	3.5	913.600	0.770	200	110	100	0.850	22.54	14.0		3,395
7	3.5	915.500	1.200	202	113	100	1.320	28.19	14.8		4,244
8	3.5	917.683	1.500	171	97	95	1.640	30.77			4,633
9	3.5	920.400	1.900	177	100	95	2.100	34.79	15.1		5,239
10	3.5	923.200	1.950	186	106	95	2.000	35.49	14.4		5,345
11	3.5	926.000	1.800	192	110	96	2.040	34.26	15.2		5,159
12	3.5	928.800	1.850	195	111	96	1.750	34.81			5,242
A-1	3.5	931.435	0.750	181	101	95	0.840	21.93	16.0		3,302
2	3.5	933.400	0.850	194	100	96	0.940	23.58	15.0		3,551
3	3.5	935.400	0.800	192	100	97	0.880	22.84	15.3		3,439
4	3.5	937.300	1.200	196	106	98	1.320	28.08	15.3		4,225
5	3.5	939.500	1.300	196	110	98	1.440	29.20	15.0		4,398
6	3.5	942.000	1.250	193	112	98	1.380	28.57	15.3		4,302
7	3.5	944.300	1.200	193	113	99	1.320	27.99	15.1		4,215
8	3.5	946.800	1.150	198	114	100	1.280	27.51	15.1		4,142
9	3.5	949.000	1.100	202	115	100	1.220	26.99	14.9		4,064
10	3.5	951.000	0.900	198	114	100	0.990	24.34	14.9		3,665
11	3.5	953.300	0.800	197	114	100	0.880	22.93			3,452
12	3.5	955.200	0.820	199	112	101	0.910	23.25			3,501
		956.968									

RESULTS	TT	VM	PIT	TS	TN	PM	SQE	O2	CO	VEL
	84.0	51.964	1.089	191	103	1.188	26.10	14.9	ERR	3,930
	net	net	avg	avg	avg	avg	avg	avg	avg	avg

PSM= 30.07 VMSTD= 49.025 VWGAS= 8.808 XM= 15.2 RMS OF VELOCITIES = 20.3
MD= 0.85 MWD= 29.03 MW= 27.35 PS= 29.94

STACK GAS VELOCITY = 3,930 AFPM
STACK GAS VOLUME = 43,147 DSCFM
STACK GAS VOLUME = 62,736 ACFM

STACK GAS VOLUME = 2.17E+05 LBS/HR
ISOKINETIC RATIO = 106.7

PARTICULATE EMISSIONS

F-FACTOR =

Weight, mg =	27.2 PADER (1)	32.5 (2)
GR/DSCF =	0.009	0.010
LBS/HR =	3.16	3.77

(1) INCLUDES PROBE WASH(WATER & ACETONE), FILTER, AND .22 MICRON FILTER.
(2) INCLUDES PROBE WASH(WATER & ACETONE), FILTER, .22 MICRON FILTER, AND IMPINGER WASH(WATER, ACETONE)

APPENDIX B

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	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. ΔH

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

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

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

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

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

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

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

21. Percent Isokinetic

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

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

$$\text{gr/DSCF} = 0.0154 \times \frac{\text{mg}}{\text{VMSTD}}$$

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

$$\text{lb/hr} = 0.00857 \times \text{gr/DSCF} \times \text{QS}$$

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

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 Formula:

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

CO_2 Formula:

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