42-101-03185

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

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

AP-42 Section 11.30
Reference 8
Report Sect.
Reference

Source Sampling Report
Measurement of Particulates Rotary Dryer

March 18, 1992
AGES Project No. 42605.01
AGES Report No. 42605.01-01

For:
MDC Corporation
Collins and Willard Streets
Philadelphia, PA 19134

AGES® Applied Geotechnical and Environmental Service Corp.

Source Sampling Report
Measurement of Particulates Rotary Dryer
March 18, 1992
AGES Project No. 42605.01
AGES Report No. 42605.01-01

For:
MDC Corporation
Collins and Willard Streets
Philadelphia, PA 19134

By:

Frederick B. Higgins, Ph.D.

This report and the information contained herein constitute proprietary information which is the property of Applied Geotechnical & Environmental Services Corporation. This report must be returned upon request. It is loaned to the recipient as a means to present the technical data, conclusions, and recommendations and/or utilization of the conclusions and recommendations disclosed. It may not be copied in whole or in part, or used in any other way other than noted above, without the written permission of Applied Geotechnical & Environmental Services Corporation.

(c) APPLIED GEOTECHNICAL & ENVIRONMENTAL SERVICES CORPORATION 1992

AGES Applied Geotechnical and Environmental Service Corp.
Valley Forge, PA (215) 666-7404

TABLE OF CONTENTS

	Page
Introduction	1
Sampling Program	2
Results	3
Appendices	
A Field Data Sheets	
B Analytical Results - Blister	
C Calculations	
D Calibratiions and Barometric Pressure	

AGES

Introduction

The MDC Corporation plant on Castor Avenue processes and markets copper smelting slag for use as sand blasting grit. The principal equipment, with a potential for air pollution emissions, is a rotary dryer used to remove water from the grit prior to packaging and shipment. A new baghouse (fabric filter) was recently installed to collect particulate from the dryer exhaust. MDC wanted to determine whether or not particulate emissions from the dryer/baghouse system were acceptable under the applicable Philadelphia Code.

This report presents the sampling and analytical results.

Sampling Program

Two sampling ports were installed in the stack at a location approximately 20 feet above the breeching and 6 feet below the top. With the 41 inch ID stack, this produced clear zones of slightly less than 6 and 2 stack diameters upstream and downstream, respectively. A working platform was also added with a floor level about 4 feet below the ports.

On March 18, 1992, two particulate samples were collected using the EPA Method 5 procedure with the addition of filtration of the impinger contents, as specified by PA DER. During each particulate sample collection a series of 3 grab samples of stack gas were collected for carbon dioxide and oxygen determination using Fyrite analyzers.

MDC has no weighing facilities on site and empirically controls the dryer feed rate. During the test, the rate of dumping of front end loader buckets was monitored and one load was weighed using a Franklin Smelting scale. The estimated feed rate, by this technique, was 16,000 pounds/hour of wet grit. = 8 TON/HR

CO_2 NOT PRESENTED

AGES

Results

The field data, calculations and backup calibration information is contained in the Appendix. The dryer and baghouse operated normally during the test and it was apparent that emissions would be very low. The drying process would be expected to produce a relatively coarse dust that would be effectively collected by the fabric filter system.

The most essential results are summarized below. Based on a process weight of 16,000 lb/hr, the allowable emissions under Regulation II would be 13.74 lbs/hr. Actual emissions are well below this weight rate.

Sample No.	Stack Gas Flow scfmd	acfm	Particulate Emissions* gr/scfd	lb/hr.	
1	17,650	20,630	0.0008	0.12	.015 lb/ton
2	16,930	19,980	0.0007	0.11	.014 lb/ton

*No particulate was found in the impinger water. Emissions results are thus the same by EPA and DER definitions.

AGES®

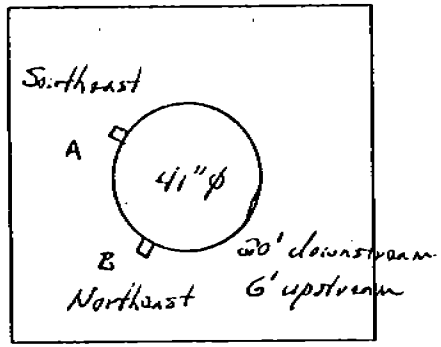
APPENDIX A

Field Data Sheets

AGE

AGES®
Applied Geotechnical and Environmental Service Corp.
1151 S. Trooper Road, Norristown, PA 19403

PLANT MDC
LOCATION Baghouse Exhaust
OPERATOR FBH
DATE 3/18/92
RUN NO. 1.B
METER BOX NO. 1586
METER ΔH@ 1.84
C FACTOR
PITOT TUBE COEFFICIENT, C_p .84



SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE ~ 38°F
BAROMETRIC PRESSURE 30.21
ASSUMED MOISTURE, % 5%
SILICA GEL 1
AVERAGE CALIBRATED NOZZLE DIAMETER, cm(in.) 0.247"
PROBE HEATER SETTING 70% 1
LEAK RATE, m^3/min.(cfm) 0.005 cfm
PROBE LINER MATERIAL glass
STATIC PRESSURE, mm Hg (in. Hg) +0.1" water
FILTER NO. A

T_s = 145
Thus So

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in.) Hg	STACK TEMPERATURE (T_s) °C (°F)	VELOCITY HEAD (ΔP_s) mm(in)H_2O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET °C (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET °C (°F)	FILTER HOLDER TEMPERATURE °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °C (°F)	
B1	1004	4"	145	.35	1.1	252.39	46	42	260°F	46°F	.5916
2	07		145	.35	1.1		46	44			.5916
3	10		145	.34	1.1		48	44			.5831
4	13		145	.37	1.2		50	44		46	.6083
5	16		145	.38	1.2		50	44			.6164
6	19	5"	145	.46	1.5		52	45			.6782
7	22		144	.46	1.5		53	45			.6782
8	25	4"	138	.42	1.35		53	46		50°F	.6481
9	28		145	.41	1.3		54	46			.6403
10	31		145	.32	1.0		53	46			.5657
34.5	34		145			270.82	52	46			
TOTAL	30						Avg. 50.8	Avg. 44.8			
AVERAGE			144		1.24	18.43	Avg. 47.8				.6202

AGES® Applied Geotechnical and Environmental Service Corp.
1151 S. Trooper Road, Norristown, PA 19403

PLANT MDC
LOCATION Baghouse Exhaust
OPERATOR FBH
DATE 3/18/92
RUN NO. 2A
METER BOX NO. 1586
METER ΔH@ 1.84
C FACTOR
PITOT TUBE COEFFICIENT, C_p 0.84

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE ~45°F
BAROMETRIC PRESSURE 30.23
ASSUMED MOISTURE, % 5%
SILICA GEL 2
AVERAGE CALIBRATED NOZZLE DIAMETER, cm(in.) 0.247"
PROBE HEATER SETTING 70%
LEAK RATE, m^3/min.(cfm) 0.004
PROBE LINER MATERIAL glass
STATIC PRESSURE, mm Hg (in. Hg) +0.1" H_2O
FILTER NO. 13

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in.) Hg	STACK TEMPERATURE (T_s) °C (°F)	VELOCITY HEAD (ΔP_s) mm(in)H_2O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET °C (°F)	OUTLET °C (°F)	FILTER HOLDER TEMPERATURE °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °C (°F)	
R1	1220		149	.38	1.2	289.63	49	49	260°F		.6164
2	23		151	.37	1.2		53	50		52°F	.6083
3	30		150	.43	1.3		56	50			.6325
4	33		150	.40	1.3		61	50			.6325
5	32		150	.41	1.33		66	52			.6403
6	35		149	.41	1.35		70	54			.6403
7	35		148	.37	1.25		74	54		55°F	.6345
8	41		145	.31	1.02		74	56			.5568
9	44		145	.32	1.06		73	57			.5657
10	47		144	.30	1.00		73	58			.5477
Stop	50		145			307.50	73	58			
TOTAL	30						Avg. 66.4	Avg. 53.5			
AVERAGE			148		1.20	18.26	Avg.	59.8			.6065

AGES® Applied Geotechnical and Environmental Service Corp.
1151 S. Trooper Road, Norristown, PA 19403

PLANT MDC
LOCATION Baghouse Exhaust
OPERATOR FBK
DATE 3/18/92
RUN NO. 1 A
METER BOX NO. 1586
METER ΔH@ 1.84
C FACTOR
PITOT TUBE COEFFICIENT, C_p .84

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
SILICA GEL
AVERAGE CALIBRATED NOZZLE DIAMETER, cm(in.)
PROBE HEATER SETTING
LEAK RATE, m^3/min.(cfm) 0.006 cfm
PROBE LINER MATERIAL
STATIC PRESSURE, mm Hg (in. Hg)
FILTER NO. 219 ml

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in.) Hg	STACK TEMPERATURE (T_s) °C (°F)	VELOCITY HEAD (ΔP_s) mm(in)H_2O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET °C (°F)	OUTLET °C (°F)	FILTER HOLDER TEMPERATURE °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °C (°F)	
A1	1047		142	.42	1.35	370.81	44	44			.6481
2	47		143	.42	1.35		47	46			.6481
3	50	4"	143	.43	1.4		53	46			.6557
4	53		143	.42	1.35		52	46			.6481
5	56		144	.40	1.30		57	46			.6325
6	59	4"	144	.45	1.45		57	47		50	.6708
7	1102		143	.44	1.40		59	45			.6633
8	1105		142	.40	1.3		60	48			.6325
9	08		143	.33	1.05		59	45			.5745
10	11		142	.25	0.80		55	49		50	.5000
Stop	14		142			389.34	55	47			
TOTAL	30						Avg. 54.6	Avg. 47.0			
AVERAGE			143		1.28	18.72	Avg. 50.85				.6274

AGES® Applied Geotechnical and Environmental Service Corp.
1151 S. Trooper Road, Norristown, PA 19403

PLANT MDC
LOCATION Baghouse Exhaust
OPERATOR FBH
DATE 3/18/92
RUN NO. 2B
METER BOX NO.
METER ΔH@
C FACTOR
PITOT TUBE COEFFICIENT, C_p

15-tons/hr.

SCHEMATIC OF STACK CROSS SECTION

AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
ASSUMED MOISTURE, %
SILICA GEL
AVERAGE CALIBRATED NOZZLE DIAMETER, cm(in.)
PROBE HEATER SETTING
LEAK RATE, m^3/min.(cfm) 0.008 cfm
PROBE LINER MATERIAL
STATIC PRESSURE, mm Hg (in. Hg)
FILTER NO. 222 mL

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	VACUUM mm Hg (in.) Hg	STACK TEMPERATURE (T_s) °C (°F)	VELOCITY HEAD (ΔP_s) mm(in)H_2O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H_2O (in. H_2O)	GAS SAMPLE VOLUME m^3 (ft^3)	GAS SAMPLE TEMPERATURE AT DRY GAS METER INLET °C (°F)	GAS SAMPLE TEMPERATURE AT DRY GAS METER OUTLET °C (°F)	FILTER HOLDER TEMPERATURE °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER °C (°F)	$\sqrt{\Delta P_s}$
B1	1257		144	.29	.97	307.80	62	56		50°F	.5385
2	1300		145	.33	1.10		66	59			.5745
3	03		146	.34	1.12		70	60			.5831
4	06	3"	146	.34	1.12		73	60			.5831
5	09		146	.35	1.15		75	61			.5916
6	12		146	.42	1.4		76	62		52	.6481
7	15		146	.40	1.32		76	62			.6325
8	18		146	.43	1.40		76	63			.6557
9	21		145	.40	1.32		78	63			.6325
10	24	3"	145	.29	0.97		76	64		53	.5385
Stop	27		144			326.31	76	64			
TOTAL	30						Avg. 73.5	Avg. 61.4			
AVERAGE			145.5		1.19	18.42	Avg. 67.5				.5978

APPENDIX B

Analytical Results

APPENDICES

AGS

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920876
Lot Number : 0282
Sample Number : 1 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Silica #1

Sample taken by AGES tech: PF/FH

Silica #1
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALY
Water Content	7.73	g	ASTM D95	03-20-1992	PJF

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920877
Lot Number : 0282
Sample Number : 2 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Silica #2

Sample taken by AGES tech: PF/FN

Silica #2
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALYS
Water Content	7.86	g	ASTM D95	03-20-1992	PJF

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920878
Lot Number : 0282
Sample Number : 3 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Impinger #1

Sample taken by AGES tech: PF/FH

Impinger H20 #1
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALYS
Particulates	< 1.0 *	mg	---	03-20-1992	PJF

COMMENTS:

* Volume-303 ml

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920879
Lot Number : 0282
Sample Number : 4 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Impinger #2

Sample taken by AGES tech: PF/FH

Impinger H20 #2
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALYS
Particulates	< 1.0 *	mg	---	03-20-1992	PJF

COMMENTS:

* Volume- 327 ml

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920880
Lot Number : 0282
Sample Number : 5 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Acetone Probe #1

Sample taken by AGES tech: PF/FH

Acetone Probe #1
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALY
Particulates	1.76 *	mg	---	03-20-1992	PJF

COMMENTS:

* Volume - 176 ml

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920881
Lot Number : 0282
Sample Number : 6 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC20232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Acetone Probe #2

Sample taken by AGES tech: PF/FH

Acetone Probe #2
03-18-1992.

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALY
Particulates	1.77 *	mg	---	03-20-1992	PJF

COMMENTS:

* Volume- 177 ml

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920882
Lot Number : 0282
Sample Number : 7 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Filter A #1

Sample taken by AGES tech: PF/FH

Filter A #1
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALY
Particulates	0.3	mg	---	03-20-1992	PJF

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

AGES® LABORATORIES
1151 S. Trooper Road, Norristown, PA 19403 (215) 666-7404
Engineering Consultants — Analytical Services

ANALYTICAL REPORT

AGES Client ID Number : 42605.01

AGES Corporation
1151 S. Trooper Road
Norristown, PA 19403

Attention: A.A. Fungaroli, President

AGES Sample ID Number : 920883
Lot Number : 0282
Sample Number : 8 of 8
Request for Services # :
Date Submitted : 03-18-1992
Date Reported : 03-23-1992
Chain of Custody : CC920232

Client P. O. Number : None

Client Sample Identification
Stack Sampling, Filter B #2

Sample taken by AGES tech: PF/FH

Filter B #2
03-18-1992

PARAMETER	RESULT	UNITS	ANALYTICAL METHOD	DATE	ANALYS
Particulates	< .1	mg	---	03-20-1992	PJF

Respectfully submitted,
AGES Laboratories

Jane Clarke James
Laboratory Manager

APPENDIX C

Calculations

MDC
Philadelphia
Rotary Dryer
April18,1992

> = Use

Page 1
PARTICULATE CA

		RUN 1	RUN 2
1. Vm Actual Meter Volume, ft3	>	37.15	36.68
		37.150	36.680
2. Vmcorr Corrected Meter Vol.,VmxFm= Meter Conditions. Fm = _____	>	1.000	1.000
3. dHavg Avg Orifice dP, "WG	>	1.26	1.2
	>	30.21	30.23
5. Pm Absolute Meter Pressure Pm=Pbar+(dHavg/13.6) = "Hg		30.30	30.32
6. Tmr Avg Meter Temp R, deg F TmR = TmF + 460 deg. R	>	49.3 509.3	63.7 523.7
7. Vmstd Dry Std Vol Metered, scfd Vmstd = (VmcorrxPmx17.64)/TmR		38.991	37.458
8. Vwci Std Vol H2O Vapor Imp's, scf Vwci=Vlc(gms)x0.04707 Ft3/ml,> mls	>	0.89 19	1.04 22
9. Vwcgel Std Vol H2O Silica Gel, scf Vwcgel=Vlc(gm)x.04715Ft3/gm,>gm	>	0.363 7.7	0.372 7.9
10. Vwc Sum H2O Vapor=Vwci+Vwcgel scf		1.257	1.408
11. Bwo %Water=100xVwc/(Vmstd+Vwc), %		3.12	3.62
12. %CO2 Carbon Dioxide (dry) %	>	0	0
13. %O2 Oxygen (dry) %	>	21	21
14. %CO Carbon Monoxide (dry), % Fo Apply?(Y/N) = N Fo=(20.9-O2)/CO2 =	>	0	0
15. %N2 Nitrogen=100-%CO2-%O2-%CO, %		0.995 79	0.995 79
16. Md Dry MW=.44CO2+.32O2+.28(N2+CO) g/g mol		28.84	28.84
17. Ms Wet MW Stack Gas g/gmol Ms= Mdx(1-Bwo/100) + 18(Bwo/100)		28.50	28.45
18. Cp Pitot Tube Coef, no units	>	0.84	0.84
19. TsR Avg. Stack Temp deg. F Deg R=Deg F+460 Absolute	>	143.5 603.5	146.8 606.8
20. Psg Static Press Stack, "H2O	>	0.1	0.1

3364

MDC
Philadelphia
Rotary Dryer

> = Use

Page 1

AGES

MDC
Philadelphia
Rotary Dryer
APR 18,92

		RUN 1	RUN 2
21. Ps Abs Stack Press=Pbar+(Psg/13.6) in Hg		30.22	30.24
22. Avg Sq Root Delta-p (sq rt "H2O)	>	0.6238	0.6022
23. Vs Velocity of Stack Gas, fps 85.49xCpx[SqRt(TsR/PsMs)]x[AvgSqRt(dp)]		37.50	36.32
24. Ds Stack Diameter, inches	>	41.00	41.00
As Stack Area sq. feet		9.168	9.168
25. Qs Actual Flow = AsxVsx60, acfm		20628	19981
26. Qsstd Std Flow Rate, Dry - scfmd Qsstd=17.64x(QsPs/TsR)(1-Bwo/100)		17651	16927
27. m Particulate Front Half, grams	>	0.0021	0.0018
Back Half, grams	>	0.0000	0.0000
Total, grams		0.0021	0.0018
28. Dn Nozzle Diameter, inches	>	0.2470	0.2470
An Nozzle Area, sq. inches		0.0479	0.0479
29. O Run Time, minutes	>	60	60
30. Cs Conc= mx15.43/Vmstd in gr/dscf Front		0.0008	0.0007
Back		0.0000	0.0000
Total		0.0008	0.0007
@7%O2 Frontx13.9/(20.9-%O2), gr/dscf		0.00	0.00
@12%CO@ Totalx12/%CO2 gr/dscf		ERR	ERR
		(PA Regulation - 1 Decim	
31. pmr(c) Mass Rate = 0.1323xmxQsstd/Vmstd (Regulatory Rate) Front #/Hr		0.12	0.11
Back #/Hr		0.00	0.00
Total #/Hr		0.12	0.11
32. pmr(a) Mass Rate (Area Ratio) Front or Tot. pmr(a)=19.048xmxAs/(OxAn), #/Hr.		0.13	0.11
33. I %Isokinetic=(pmr(a)/pmr(c))x100		101.43	101.61
		Permitted 90-100%	

JACA modeled PM 104.88 #/hr
+ Lead 0.112 #/hr

HT=48'
Dia=3.44'
Vel=2366.8 FPM
T° 260F

No model needed
Total Pb = .1 #/hr
If all Pb assumed - JACA modelled already.

Dryer
JACA STK #10 (8-10 are MACS)
UTM 492762.9 4425715 14/53? °K=399.82
m/sec=12.02 Dia=1.049 Bh=36.58m width 176.65m
(below pit?)

AGES

APPENDICES

APPENDIX D

Calibration Data

WESTON.

LONG/PRE DRY GAS METER CALIBRATION DATA FORM

Calibrator PM

Date 4/23/91 Meter Box Number S/N 1586 Plant Fred Higgins

Barometric pressure, P_b = 29.84 in. Hg Dry Gas Meter Number _____ Comments RAC (unit)

Setting	Gas volume		Temperatures							
Orifice manometer	Wet test meter	Dry gas meter	Wet test meter	Dry gas meter						
(Δ H) in. H_2O	(V_w) ft³	(V_d) ft³	(t_w) °F	Inlet (td_i) °F	Outlet (td_o) °F	Avg (t_d) °F	Time (θ), min	Y_i	ΔH @$_i$ in. H_2O
0.5	5	54.174 49.006	69	86, 87, 89	81, 81, 81	84	12.4	.9937	1.680
1.0	5	60.389 55.208	69	90, 91, 93	81, 81, 82	86	9.05	.9956	1.783
1.5	10	72.701 62.439	69	93, 97, 98	82, 83, 83	89	15.3	1.007	1.901
2.0	10	84.657 73.711	69	97, 99, 101	84, 85, 85	92	13.35	1.005	1.919
3.0	10	95.447 85.075	69	98, 101, 103	85, 85, 86	93	11	1.000	1.951
							Avg	Y .9998	Δ H @ 1.846

If there is only one thermometer on the dry gas meter, record the temperature under td_o.

(ΔH) in. H_2O	$\frac{\Delta H}{13.6}$	$Y_i = \frac{V_w P_b (t_d + 460)}{V_d \left(P_b + \frac{\Delta H}{13.6}\right)(t_w + 460)}$	$\Delta H@i = \frac{0.0317 \Delta H}{P_b (t_d + 460)} \left[\frac{(t_w + 460)\Theta}{V_w}\right]^2$
0.5	0.0368	$\frac{(5)(29.84)(84+460)}{(5.168)(29.84+.0368)(69+460)}$	$\frac{(.0317)(.5)}{(29.84)(84+460)} \left[\frac{(69+460)(12.4)}{5}\right]^2$
1.0	0.0735	$\frac{(5)(29.84)(86+460)}{(5.181)(29.84+.0735)(69+460)}$	$\frac{(.0317)(1.0)}{(29.84)(86+460)} \left[\frac{(69+460)(9.05)}{5}\right]^2$
1.5	0.110	$\frac{(10)(29.84)(89+460)}{(10.262)(29.84+.110)(69+460)}$	$\frac{(.0317)(1.5)}{(29.84)(89+460)} \left[\frac{(69+460)(15.3)}{10}\right]^2$
2.0	0.147	$\frac{(10)(29.84)(92+460)}{(10.326)(29.84+.147)(69+460)}$	$\frac{(.0317)(2.0)}{(29.84)(92+460)} \left[\frac{(69+460)(13.35)}{10}\right]^2$
3.0	0.221	$\frac{(10)(29.84)(93+460)}{[illegible]}$	$\frac{(.0317)(3.0)}{[illegible]} \left[\frac{(69+460)(11)}{10}\right]^2$

WESTON

Calibrator PM

POSTTEST DRY GAS METER CALIBRATION DATA FORM

Date 8/01/91 Meter box number S/N 1586 Plant Fred Higgins (RAC)

Barometric pressure, P_b = 30.31 in. Hg Dry gas meter number N/A Pretest Y .9939

Setting	Gas Volume		Temperature							Y_1 =
				Dry gas meter						
Orifice Manometer (ΔH) in. H_2O	Wet test meter (V_w) ft^3	Dry gas meter (V_d) ft^3	Wet test meter (t_w) °F	Inlet (td_i) °F	Outlet (td_o) °F	Average (t_d) °F	Time (θ), min.	Vacuum Setting, in. Hg.	Y_1	$\frac{V_w P_b (t_d+460)}{V_d\left(P_b+\frac{\Delta H}{13.6}\right)(t_w+460)}$
.8	10	553.107 542.837	72.5	87,90,92	76,78,81	84	20.4	4	.9927	
.8	10	563.443 553.107	72.5	89,92,94	82,83,84	87	20.4	4	.9918	
.8	10	573.900 563.443	72.5	94,95,95	84,85,86	90	20.3	4	.9857	
									Y = .9900	

If there is only one thermometer on the dry gas meter, record the temperature under td_o.

V_w = Gas volume passing through the wet test meter, ft^3.
V_d = Gas volume passing through the dry gas meter, ft^3.
t_w = Temperature of the gas in the wet test meter, °F.
td_i = Temperature of the inlet gas of the dry gas meter, °F.
td_o = Temperature of the outlet gas of the dry gas meter, °F.
t_d = Average temperature of the gas in the dry gas meter, $\frac{td_i + td_o}{2}$.

$$\Delta H@_1 = \frac{0.0317\Delta H}{P_b(t_d+460)}\left[\frac{(t_w+460)\theta}{V_w}\right]^2$$

ΔH = Pressure differential across orifice, in. H_2O.
Y_1 = Ratio of accuracy of wet test meter to dry gas meter for each run.
Y = Average ratio of accuracy of wet test meter to dry gas meter for all three runs; tolerance = pretest Y ± 0.05Y.
P_b = Barometric pressure, in. Hg.
θ = Time of calibration run, min.

AGES
Applied Geotechnical & Environmental Service Corporation
1151 S. Trooper Road, Norristown, PA 19403
(215) 666-7404

Date 4.27.92 Box No. P-3082

Barometric pressure, P_b = 29.91 in. Hg. Dry gas meter No. S/N - 1586

FRANKLIN/MDC POST-CALIBRATION

	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	Temperature: Wet test Meter, °F	Temperature: Dry gas meter Inlet, °F	Temperature: Dry gas meter Outlet, °F	Temperature: Dry gas meter Average, °F	Time θ, min	γ	$\Delta H_@$
(1)	0.5	5	397.875 392.70	→, → 66.5	77,79,80	91,95, -	86.33	(11.93) 11:55:80	1.0013	1.53
(4)	0.7	5	427.125 421.90	→, → 64.5	88 -, -	102, -, -	95.	(10.29) 10:17:75	1.0108	1.66
(2)	1.0	10	408.985 398.50	→, → 66.5	80,83,85	95,100,103	91.	(17.765) 17:45:90	0.9957	1.67
(3)	2.0	10	421.16 410.60	65, (65.5) 66.5	86,87,88	98,104,108	95.17	(12.61) 12:36.40	0.9955	1.55
		10								
		10								
								Average	1.0008	1.60

Calculations

ΔH	$\frac{\Delta H}{13.6}$	γ: $\frac{V_w P_b (t_d+460)}{V_d\left(P_b + \frac{\Delta H}{13.6}\right)(t_w+460)}$	$\Delta H_@$: $\frac{0.0317\ \Delta H}{P_b (t_d+460)}\left[\frac{(t_w+460)\,\theta}{V_w}\right]^2$
0.5	0.0368	1.0013	1.5307
1.0	0.0735	0.9957	1.6676
2.0	0.1471	0.9955	1.6766
0.7	0.0515	1.0108	1.5575
		PHILIP J FARRIS JR.	Philip J. Farris Jr.

γ = Ratio of accuracy of wet test meter to dry test meter. Tolerance = ± 0.01

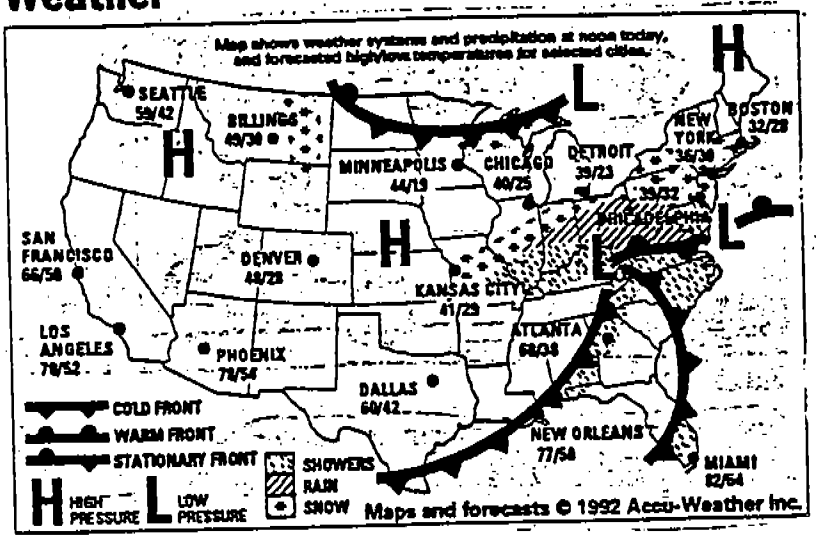
$\Delta H_@$ = Orifice pressure differential that gives 0.75 cfm of air at 70°F and 29.92 inches of mercury, in.H_2O. Tolerance = ± 0.15

NOZZLE CALIBRATION DATA

7/13/91
F.B.H

Nozzle No.	Diameter #1	Diameter #2	Diameter #3	Average Diameter
3/16" - #1	0.184"	0.185"	0.185"	0.185"
3/16" - #2	0.182"	0.182"	0.182"	0.182"
1/4" - #1	0.242"	0.242"	0.242"	0.242"
1/4" - #2	0.233"	0.232"	0.233"	0.233"
1/4" - #3	0.247"	0.247"	0.247"	0.247"
5/16" - #1	0.295"	0.296"	0.294"	0.295"

Weather



PHILADELPHIA ALMANAC

Temperatures

High yesterday	46 at 12:41 p.m.
Record high for yesterday	78 in 1989
Low yesterday	33 at 7:52 p.m.
Record low for yesterday	10 in 1916
Normal high/low	51/34

Yesterday's barometer

6 a.m.	30.17 rising
Noon	30.23 steady
6 p.m.	30.16 rising

Daylight sky conditions yesterday
70% clouds with 30% sunshine.

Precipitation

Yesterday	Trace
Month through yesterday	1.16 inches
Year through yesterday	3.34 inches
Normal, year through yest.	8.27 inches
Deficit, year through yest.	4.93 inches

Degree days for heating

Yesterday	25
Month through yesterday	416
Season through yesterday	3870
Last season through yesterday	3368

A degree day for heating is an index of energy consumption for heating. It indicates the number of degrees the mean temperature is below 65 degrees.

AGES®

3/23/92
F.B. Higgins
FSR & MDC

SAMPLE NOZZLE RECALIBRATION

Nozzle Size & No.	Diameter Measurements			Average
3/16 - #1	0.184"	0.185"	0.185"	0.185"
1/4 - #3	0.247	0.247	0.247	0.247"

Thermocouple Recalibration

5' - Type K Exposed Junction

	Thermometer	Thermocouple
Room Temp. - Water Bath	67°F	67.8°F
Boiling Water	212°F	213.2°F

NATIONAL 42-381 50 SHEETS 5 SQUARE 42-382 100 SHEETS 5 SQUARE 42-389 200 SHEETS 5 SQUARE

AGES®