PM10 & PM2.5 AIR EMISSIONS TEST
MAIN OUTLET STACK

ASH GROVE CEMENT COMPANY
SEATTLE, WASHINGTON

May 15 & 19, 2001

Prepared for
Ash Grove Cement Company

By
Valid Results, Inc.
Seattle, WA

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ABSTRACT

On May 15th and 19th, 2001, air emissions tests for Particulate Matter less than ten microns in diameter (PM10) and Particulate Matter less than two and one-half microns in diameter (PM2.5) were performed on the main outlet stack of the rotary cement kiln located at the Ash Grove Cement Company facility in Seattle, Washington.

This testing included concurrent measurement of the stack gas moisture, volumetric flow rate and gaseous diluent Oxygen (O_2) and Carbon Dioxide (CO_2) concentrations.

Testing was conducted under the direction of Mr. Tracy Prevo with Valid Results. The unit was operated under the direction of Mr. Gerald Brown with the Ash Grove Cement Company.

All tests were performed using the procedures set forth in the Title 40, Chapter I, Code of Federal Regulations, Part 60 (40CFR60), Appendix A, Test Methods 1, 2, 3 and 4 along with Part 75 (40CFR75), Appendix M, Test Methods 201A and 202.

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INTRODUCTION

On May 15th and 19th, 2001, air emissions tests for Particulate Matter less than ten microns in diameter (PM10) and Particulate Matter less than two and one-half microns in diameter (PM2.5) were performed on the main outlet stack (Emission Unit OA) of the rotary cement kiln located at the Ash Grove Cement Company facility in Seattle, Washington.

This testing included concurrent measurement of the stack gas moisture, volumetric flow rate and gaseous diluent Oxygen (O_2) and Carbon Dioxide (CO_2) concentrations.

EPA Test Methods:

Test Method	Test Parameter	Test Description
• EPA 1	Sample Point Locations	Up & Down stream distances from flow disturbances
• EPA 2	Outlet Flow Rate	S-Type Pitot Tube & Type-K Thermocouple
• EPA 3	Molecular Weight	3 two-hour runs, Fyrite - O_2 & CO_2
• EPA 4	Moisture Content	3 two-hour runs, PM10 back-half impinger H_2O weight gain
• EPA 201A	PM10	3 two-hour runs, >PM10, PM10 front-half Acetone and Filter
• EPA 201A*	PM2.5	3 two-hour runs, >PM2.5, PM2.5 front-half Acetone and Filter
• EPA 202	Condensible PM	3 two-hour runs, PM2.5 back-half impinger organic extraction

The testing was performed in accordance with the test methods provided in Appendices A and M of the Code of Federal Regulations, Title 40, Chapter I, Parts 60 (40CFR60) and 51 (40CFR51), respectively.

Two independent sample trains were utilized. Method 201A and 4 were combined to measure PM10. Method 201A* and 202 were combined to measure PM2.5.

* A combined cyclone was not used for PM2.5 measurement. The math for the PM2.5 test was extracted from the equations in the non-promulgated combined PM10 and PM2.5 cyclone test method.

Table 1

SOURCE EMISSIONS SUMMARY

(Raw Mill On and Raw Mill Off at >90% of Full Load)

Client: Ash Grove Cement Company
Location: Seattle, Washington
Source: Main Stack Outlet
Fuel: Mixed

		Raw Mill On		5/19/01		Raw Mill Off		5/15/01	
	Units	Run 1	Run 2	Run 3	Average	Run 1	Run 2	Run 3	Average
% FH PM10	lbs/hr basis	70.9%	40.8%	66.3%	**59.3%**	41.5%	45.3%	30.3%	**39.0%**
FH PM10	mg	25.0	24.1	33.1	**27.4**	3.4	2.5	3.5	**3.1**
	dscm	1.262	1.270	1.274	**1.269**	1.427	1.419	1.401	**1.416**
	mg/dscm	19.81	18.98	25.98	**21.59**	2.38	1.76	2.50	**2.21**
	grains/dscf	0.00866	0.00829	0.01135	**0.00943**	0.00104	0.00077	0.00109	**0.00097**
	lbs/hr	9.21	8.92	12.33	**10.15**	1.00	0.77	1.01	**0.93**
	tons/month	3.36	3.26	4.50	**3.71**	0.37	0.28	0.37	**0.34**
	tons/year	40.34	39.07	54.01	**44.47**	4.38	3.37	4.42	**4.06**
% FH PM2.5	lbs/hr basis	10.5%	9.0%	1.1%	**10.2%**	2.5%	1.8%	2.4%	**2.2%**
FH PM2.5	mg	1.6	1.3	2.8	**1.9**	2.5	2.0	2.0	**2.2**
	dscm	1.068	1.062	1.087	**1.072**	1.171	1.258	1.248	**1.226**
	mg/dscm	1.50	1.22	2.58	**1.77**	2.13	1.59	1.60	**1.77**
	grains/dscf	0.00065	0.00054	0.00113	**0.00077**	0.00093	0.00069	0.00070	**0.00077**
	lbs/hr	0.69	0.58	1.22	**0.83**	0.85	0.68	0.64	**0.72**
	tons/month	0.25	0.21	0.45	**0.30**	0.31	0.25	0.23	**0.26**
	tons/year	3.02	2.54	5.34	**3.63**	3.72	2.98	2.80	**3.17**
Total PM2.5	mg	15.1	14.6	25.3	**18.3**	100.4	108.5	85.1	**98.0**
	dscm	1.068	1.062	1.087	**1.072**	1.171	1.258	1.248	**1.226**
	mg/dscm	14.14	13.75	23.28	**17.06**	85.74	86.25	68.19	**80.06**
	grains/dscf	0.00618	0.00601	0.01017	**0.00745**	0.03746	0.03769	0.02979	**0.03498**
	lbs/hr	6.58	6.46	11.02	**8.02**	34.09	36.99	27.12	**32.73**
	tons/month	2.40	2.36	4.02	**2.93**	12.44	13.50	9.90	**11.95**
	tons/year	28.82	28.29	48.27	**35.13**	149.31	162.02	118.79	**143.37**

where:

mg = milligrams
dscm = dry standard cubic meter
mg/dscm = milligrams per dry standard cubic meter
grains/dscf = grains per dry standard cubic foot
lbs/hr = pounds per hour

Table 2

VALID RESULTS, INC.: 201A PM-10 Emission Rate Calculation

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.000	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

	Symbol	Dimension	Run 1	Run 2	Run 3	<Averages>
Test Date			5/19/01	5/19/01	5/19/01	
Test Time			11:17-13:17	14:14-16:14	17:18-19:18	
D_{50} value ($9 \le D_{50} \le 11$)	D_{50}	microns	10.00052	9.99972	10.00025	
Percentage PM 10	%PM10	lbs/hr basis	70.9%	40.8%	66.3%	59.3%
Total Emission Rate	$ER_{(T)}$	tons/yr	56.90	95.83	81.47	<78.07>
Total Emission Rate	$ER_{(tmo)}$	tons/month	4.74	7.99	6.79	<6.51>
Total Emission Rate	$ER_{(t)}$	lbs/hour	12.99	21.88	18.60	<17.82>
Total Emission Rate	$Er_{(t)}$	grains/dscf	0.01222	0.02034	0.01712	<0.01656>
Total Emission Rate	$er_{(t)}$	mg/dscm	27.97	46.54	39.17	<37.89>
Total sample weight gain	Tmg	milligrams	35.3	59.1	49.9	<48.1>
PM-10 Emission Rate	$ER_{(F)}$	tons/yr	40.34	39.07	54.01	<44.47>
PM-10 Emission Rate	$ER_{(fmo)}$	tons/month	3.36	3.26	4.50	<3.71>
PM-10 Emission Rate	$ER_{(f)}$	lbs/hour	9.21	8.92	12.33	<10.15>
PM-10 Emission Rate	$Er_{(f)}$	grains/dscf	0.00866	0.00829	0.01135	<0.00943>
PM-10 Emission Rate	$er_{(f)}$	mg/dscm	19.81	18.98	25.98	<21.59>
Front Half weight gain	FHmg	milligrams	25.0	24.1	33.1	<27.4>
Corrected Sample Volume	$V_{m(std)}$	dscf	44.560	44.830	44.979	<44.790>
Corrected Sample Volume		dscm	1.262	1.270	1.274	<1.269>
Stack Gas Flow Rate	$Q_{s(std)}$	dscf/min	124,015	125,506	126,737	<125,419>
Stack Gas Flow Rate	$Q_{s(Act)}$	acf/min	168,916	170,509	175,526	<171,650>
Stack Gas Moisture	B_{ws}	%/100	0.0744	0.0664	0.0760	<0.0712>
Stack Gas Velocity	V_s	feet/sec	21.21	21.41	22.04	<21.55>
Stack Pressure	P_s	inches Hg	30.07	30.09	30.08	<30.08>
Stack Temperature	T_s	°R	669.0	673.5	679.3	<673.9>
Stack Oxygen	$\%O_2$	%	5.80	5.70	5.50	<5.7>
Isokinetic Sample Rate	ISOK	%	142.5	141.6	140.7	<141.6>

Where:

tons/year = (lbs/hr)*(24 hours/day)*(365 days/year)*(1 ton/ 2,000 lbs)

tons/month = (tons/year)*(1 year/12 months)

lbs/hour = (grains/dscf)*(dscf/minute)*(60 minutes/hour)*(1 lb/ 7,000 grains)

grains/dscf = (0.001 grams/milligram)*(15.43 grains/gram)*(mg)/($V_{m(std)}$)

milligrams/dscm = (35.31 dscf/dscm)*(mg)/($V_{m(std)}$)

dscf/min = 3,600*(hour/60 minutes)*(1-B_{ws})*V_s*A_s*T_{std}*P_s/(T_s*P_{std})

acf/min = V_s*A_s*(60 sec/minute)

Stack Gas Velocity (V_s) is calculated on each individual test run isokinetic calculation form.

Table 3

VALID RESULTS, INC.: 201A PM-10 Emission Rate Calculation

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.000	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

	Symbol	Dimension	Run 1	Run 2	Run 3	<Averages>
Test Date			5/15/01	5/15/01	5/15/01	
Test Time			8:10-10:10	11:45-13:45	15:35-17:35	
D_{50} value ($9 \le D_{50} \le 11$)	D_{50}	microns	10.00015	10.00023	10.00004	
Percentage PM 10	%PM10	lbs/hr basis	41.5%	45.3%	30.3%	39.0%
Total Emission Rate	$ER_{(T)}$	tons/yr	10.56	7.45	14.59	<10.87>
Total Emission Rate	$ER_{(tmo)}$	tons/month	0.88	0.62	1.22	<0.91>
Total Emission Rate	$ER_{(t)}$	lbs/hour	2.41	1.70	3.33	<2.48>
Total Emission Rate	$Er_{(t)}$	grains/dscf	0.00251	0.00169	0.00359	<0.00260>
Total Emission Rate	$er_{(t)}$	mg/dscm	5.75	3.88	8.21	<5.95>
Total sample weight gain	Tmg	milligrams	8.2	5.5	11.5	<8.4>
PM-10 Emission Rate	$ER_{(F)}$	tons/yr	4.38	3.37	4.42	<4.06>
PM-10 Emission Rate	$ER_{(fmo)}$	tons/month	0.37	0.28	0.37	<0.34>
PM-10 Emission Rate	$ER_{(f)}$	lbs/hour	1.00	0.77	1.01	<0.93>
PM-10 Emission Rate	$Er_{(f)}$	grains/dscf	0.00104	0.00077	0.00109	<0.00097>
PM-10 Emission Rate	$er_{(f)}$	mg/dscm	2.38	1.76	2.50	<2.21>
Front Half weight gain	FHmg	milligrams	3.4	2.5	3.5	<3.1>
Corrected Sample Volume	$V_{m(std)}$	dscf	50.404	50.101	49.475	<49.993>
Corrected Sample Volume		dscm	1.427	1.419	1.401	<1.416>
Stack Gas Flow Rate	$Q_{s(std)}$	dscf/min	111,867	117,382	108,196	<112,482>
Stack Gas Flow Rate	$Q_{s(Act)}$	acf/min	201,967	212,479	200,931	<205,126>
Stack Gas Moisture	B_{ws}	%/100	0.0664	0.0598	0.0696	<0.0647>
Stack Gas Velocity	V_s	feet/sec	25.36	26.68	25.23	<25.76>
Stack Pressure	P_s	inches Hg	29.78	29.77	29.70	<29.75>
Stack Temperature	T_s	°R	885.8	894.1	905.6	<895.2>
Stack Oxygen	$\%O_2$	%	7.40	7.10	7.40	<7.3>
Isokinetic Sample Rate	ISOK	%	178.6	169.2	181.3	<176.4>

Where:

tons/year = (lbs/hr)*(24 hours/day)*(365 days/year)*(1 ton/ 2,000 lbs)

tons/month = (tons/year)*(1 year/12 months)

lbs/hour = (grains/dscf)*(dscf/minute)*(60 minutes/hour)*(1 lb/ 7,000 grains)

grains/dscf = (0.001 grams/milligram)*(15.43 grains/gram)*(mg)/($V_{m(std)}$)

milligrams/dscm = (35.31 dscf/dscm)*(mg)/($V_{m(std)}$)

dscf/min = 3,600*(hour/60 minutes)*(1-B_{ws})*V_s*A_s*T_{std}*P_s/(T_s*P_{std})

acf/min = V_s*A_s*(60 sec/minute)

Stack Gas Velocity (V_s) is calculated on each individual test run isokinetic calculation form.

Table 4

VALID RESULTS, INC.: 201A* PM-2.5 Emission Rate Calculation

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

	Symbol	Dimension	Run 1	Run 2	Run 3	<Averages>
Test Date			5/19/01	5/19/01	5/19/01	
Test Time			11:14-13:14	14:17-16:17	17:20-19:20	
D_{50} value ($2.25 \le D_{50} \le 2.75$)	D_{50}	microns	2.50023	2.50017	2.50022	
Percentage PM 2.5	%PM2.5	lbs/hr basis	10.5%	9.0%	11.1%	10.2%
Total Emission Rate	$ER_{(T)}$	tons/yr	28.82	28.29	48.27	<35.13>
Total Emission Rate	$ER_{(tmo)}$	tons/month	2.40	2.36	4.02	<2.93>
Total Emission Rate	$ER_{(t)}$	lbs/hour	6.58	6.46	11.02	<8.02>
Total Emission Rate	$Er_{(t)}$	grains/dscf	0.00618	0.00601	0.01017	<0.00745>
Total Emission Rate	$er_{(t)}$	mg/dscm	14.14	13.75	23.28	<17.06>
Total sample weight gain	Tmg	milligrams	15.1	14.6	25.3	<18.3>
PM-2.5 Emission Rate	$ER_{(F)}$	tons/yr	3.02	2.54	5.34	<3.63>
PM-2.5 Emission Rate	$ER_{(fmo)}$	tons/month	0.25	0.21	0.45	<0.30>
PM-2.5 Emission Rate	$ER_{(f)}$	lbs/hour	0.69	0.58	1.22	<0.83>
PM-2.5 Emission Rate	$Er_{(f)}$	grains/dscf	0.00065	0.00054	0.00113	<0.00077>
PM-2.5 Emission Rate	$er_{(f)}$	mg/dscm	1.50	1.22	2.58	<1.77>
Front Half weight gain	FHmg	milligrams	1.6	1.3	2.8	<1.9>
Corrected Sample Volume	$V_{m(std)}$	dscf	37.714	37.484	38.373	<37.857>
Corrected Sample Volume		dscm	1.068	1.062	1.087	<1.072>
Stack Gas Flow Rate	$Q_{s(std)}$	dscf/min	124,211	125,323	126,419	<125,318>
Stack Gas Flow Rate	$Q_{s(Act)}$	acf/min	168,836	170,588	175,048	<171,491>
Stack Gas Moisture	B_{ws}	%/100	0.0725	0.0682	0.0758	<0.0720>
Stack Gas Velocity	V_s	feet/sec	21.20	21.42	21.98	<21.53>
Stack Pressure	P_s	inches Hg	30.07	30.09	30.08	<30.08>
Stack Temperature	T_s	°R	669.0	673.5	679.3	<673.9>
Stack Oxygen	$\%O_2$	%	5.80	5.70	5.50	<5.7>
Isokinetic Sample Rate	ISOK	%	150.6	148.4	150.6	<149.9>

Where:

tons/year = (lbs/hr)*(24 hours/day)*(365 days/year)*(1 ton/ 2,000 lbs)

tons/month = (tons/year)*(1 year/12 months)

lbs/hour = (grains/dscf)*(dscf/minute)*(60 minutes/hour)*(1 lb/ 7,000 grains)

grains/dscf = (0.001 grams/milligram)*(15.43 grains/gram)*(mg)/($V_{m(std)}$)

milligrams/dscm = (35.31 dscf/dscm)*(mg)/($V_{m(std)}$)

dscf/min = 3,600*(hour/60 minutes)*(1-B_{ws})*V_s*A_s*T_{std}*P_s/(T_s*P_{std})

acf/min = V_s*A_s*(60 sec/minute)

Stack Gas Velocity (V_s) is calculated on each individual test run isokinetic calculation form.

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Table 5

VALID RESULTS, INC.: 201A* PM-2.5 Emission Rate Calculation

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

	Symbol	Dimension	Run 1	Run 2	Run 3	<Averages>
Test Date			5/15/01	5/15/01	5/15/01	
Test Time			8:14-10:14	11:51-13:51	15:38-17:38	
D_{50} value ($2.25 \le D_{50} \le 2.75$)	D_{50}	microns	2.50017	2.49982	2.50012	
Percentage PM 2.5	%PM10	lbs/hr basis	2.5%	1.8%	2.4%	2.2%
Total Emission Rate	$ER_{(T)}$	tons/yr	149.31	162.02	118.79	<143.37>
Total Emission Rate	$ER_{(tmo)}$	tons/month	12.44	13.50	9.90	<11.95>
Total Emission Rate	$ER_{(t)}$	lbs/hour	34.09	36.99	27.12	<32.73>
Total Emission Rate	$Er_{(t)}$	grains/dscf	0.03746	0.03769	0.02979	<0.03498>
Total Emission Rate	$er_{(t)}$	mg/dscm	85.74	86.25	68.19	<80.06>
Total sample weight gain	Tmg	milligrams	100.4	108.5	85.1	<98.0>
PM-2.5 Emission Rate	$ER_{(F)}$	tons/yr	3.72	2.98	2.80	<3.17>
PM-2.5 Emission Rate	$ER_{(fmo)}$	tons/month	0.31	0.25	0.23	<0.26>
PM-2.5 Emission Rate	$ER_{(f)}$	lbs/hour	0.85	0.68	0.64	<0.72>
PM-2.5 Emission Rate	$Er_{(f)}$	grains/dscf	0.00093	0.00069	0.00070	<0.00077>
PM-2.5 Emission Rate	$er_{(f)}$	mg/dscm	2.13	1.59	1.60	<1.77>
Front Half weight gain	FHmg	milligrams	2.5	2.0	2.0	<2.2>
Corrected Sample Volume	$V_{m(std)}$	dscf	41.360	44.421	44.081	<43.287>
Corrected Sample Volume		dscm	1.171	1.258	1.248	<1.226>
Stack Gas Flow Rate	$Q_{s(std)}$	dscf/min	106,173	114,486	106,201	<108,953>
Stack Gas Flow Rate	$Q_{s(Act)}$	acf/min	209,771	213,833	201,728	<208,444>
Stack Gas Moisture	B_{ws}	%/100	0.0891	0.0888	0.0925	<0.0907>
Stack Gas Velocity	V_s	feet/sec	26.34	26.85	25.33	<26.17>
Stack Pressure	P_s	inches Hg	29.78	29.77	29.77	<29.77>
Stack Temperature	T_s	°R	945.8	894.1	905.6	<915.2>
Stack Oxygen	$\%O_2$	%	7.40	7.10	7.40	<7.3>
Isokinetic Sample Rate	ISOK	%	193.2	192.5	205.9	<197.2>

Where:

tons/year = (lbs/hr)*(24 hours/day)*(365 days/year)*(1 ton/ 2,000 lbs)

tons/month = (tons/year)*(1 year/12 months)

lbs/hour = (grains/dscf)*(dscf/minute)*(60 minutes/hour)*(1 lb/ 7,000 grains)

grains/dscf = (0.001 grams/milligram)*(15.43 grains/gram)*(mg)/($V_{m(std)}$)

milligrams/dscm = (35.31 dscf/dscm)*(mg)/($V_{m(std)}$)

dscf/min = 3,600*(hour/60 minutes)*(1-B_{ws})*V_s*A_s*T_{std}*P_s/(T_s*P_{std})

acf/min = V_s*A_s*(60 sec/minute)

Stack Gas Velocity (V_s) is calculated on each individual test run isokinetic calculation form.

DISCUSSION OF RESULTS

Results from each of the test runs performed on the main outlet exhaust stack provide valid representations of the actual emissions from the rotary cement kiln. The cut velocity (D50) for each PM10 and PM2.5 test run were within specifications. The isokinetic sampling rates (ISOK) for each PM10 test run was within specifications. The isokinetic sampling rates (ISOK) for each PM2.5 test run exceeded the specifications. The PM-2.5 sampler comes with a calibration for a standard set of nozzles. The nozzle needed to maintain ISOK and D50 was outside of the calibration curve range for the PM-2.5 sampler. A judgement call had to be made in the field. The PM-2.5 cut velocity was determined to be more important than the isokinetic sample rate.

Table 1 summarizes the PM10 and PM2.5 test concentration and emission rate results for the Raw Mill On and the Raw Mill Off operating conditions. Tables 2 and 3 summarize the main stack outlet PM10 (M201A and 4) concentration and emission rate test results for the raw mill on and off operating conditions, respectively. Tables 4 and 5 summarize the main stack outlet PM2.5 (M201A* and 202) concentration and emission rate test results for the raw mill on and off operating conditions, respectively.

PM10 and PM2.5 test results are presented in concentration units of milligrams per dry standard cubic meter (mg/dscm) and grains per dry standard cubic feet (grains/dscf) and emission rate units of pounds per hour (lbs/hour), tons per month (tons/month) and tons per year (tons/year). O_2 and CO_2 test results are presented in concentration units of percent by volume (%).

Velocity traverses were performed prior to each PM10 and PM2.5 test run. The sample point dwell times and cyclone cut velocities were calculated from these preliminary velocity traverses, utilizing an assumed moisture content.

A concurrent mirror image PM10 test run was performed with each PM2.5 test run. The moisture content of the stack gas was obtained for each individual test run. The volumetric flow rate (Q_{std}) for each test run was determined from the velocity measurement performed prior to each test run and the moisture obtained during the test run. The lbs/hr emission rates for PM10 and PM2.5 were calculated using each test runs Q_{std}.

Copies of all the field data sheets and strip chart recordings are provided in Appendix D.

DESCRIPTION OF SAMPLING LOCATION

The four main outlet sampling ports are located 90 degrees apart on the exhaust stack of the rotary cement kiln. The inside diameter of the outlet stack is 156.0 inches (in). The ports are located approximately 120 ft (9.2 stack diameters) downstream from the nearest disturbance and approximately 140 ft (10.8 stack diameters) upstream from the stack exit. The ports, which are located approximately 148 ft above the ground, are accessed using a stack mounted platform, freight elevator and access ladder. The stack height is approximately 280 ft.

The dimensions for the location of the test ports and sampling points, and a diagram showing the port locations for the main stack are provided in Appendix A.

DESCRIPTION OF TESTS

Valid Results performed Environmental Protection Agency (EPA), Title 40, Chapter I, Code of Federal Regulations, Part 60 (40CFR60), Appendix A, Test Methods 1, 2, 3 and 4 along with Part 75 (40CFR75), Appendix M, Test Methods 201A, 201A* and 202.

All tests were performed in triplicate over the time durations specified below.

Testing was conducted under the direction of Mr. Tracy Prevo with Valid Results. The unit was operated under the direction of Mr. Gerald Brown with the Ash Grove Cement Company.

EPA Test Methods:

Method	Parameter	Duration	Description
• 1	Sample Points	once	sample port distances from flow disturbances
• 2	Flow Rate	3 15-minute	S-Type Pitot Tube & Type-K Thermocouple
• 3	O_2, CO_2	3 two-hour	Fyrite - O_2 & CO_2
• 4	Moisture	3 two-hour	ratio of impinger moisture gain to sample volume
• 201A	PM10	3 two-hour	PM10 cyclone
• 201A*	PM2.5	3 two-hour	PM2.5 cyclone
• 202	BH PM2.5	3 two-hour	back-half organic extraction

where:

O_2 = oxygen
CO_2 = carbon dioxide
PM10 = particulate matter less than ten microns in diameter
PM2.5 = particulate matter less than two point five microns in diameter
BH PM2.5 = back-half condensible particulate matter

SAMPLE ANALYSIS

Valid Results, Inc. was responsible for the collection and analysis of all samples during the PM10 and PM2.5 air emission tests performed on the main outlet stack.

Valid Results, Inc. was responsible for the analysis of the PM10 and PM2.5 samples. The >PM10, PM10, >PM2.5, PM2.5 and PM2.5 Condensible acetone rinses were evaporated to dryness, desiccated and weighed per EPA Method 5 requirements as described in Appendix E. The PM back half impinger water was extracted with methylene chloride, creating back-half organic and water fractions. A final rinse of the impingers, separation funnel and sample jars generated the back-half acetone fraction (PM2.5 Condensible). The three back-half water samples were then evaporated to dryness, desiccated, weighed and reported as condensible PM2.5.

Test Method	Parameter	Instrumentation	~Detection Limit
M3A	O_2, CO_2	Fyrite	0.1 %
M5	Particulate Matter	Analytical Balance	1 mg/dscm
M201A	PM10	Analytical Balance	1 mg/dscm
M201A*	PM2.5	Analytical Balance	1 mg/dscm
M202	BH PM2.5	Analytical Balance	1 mg/dscm

Definitions:

O_2	oxygen
CO_2	carbon dioxide
PM10	particulate matter less than 10 microns in diameter
PM2.5	particulate matter less than 2.5 microns in diameter
BH PM2.5	back-half particulate matter less than 2.5 microns in diameter
mg/dscm	milligrams per dry standard cubic meter
%	percent by volume

REPORT CERTIFICATION

The testing, sample recovery, PM sample analysis and emission rate calculations for this report were carried out under my direction and supervision. In addition, I have reviewed all analysis and test results, and certify that, to the best of my knowledge, these tests meet EPA requirements.

Date: 10/15/01 Signed: Tracy A. Prevo

Valid Results, Inc.
Tracy Prevo

I have reviewed all analysis and test results, and certify that, to the best of my knowledge, these tests meet EPA requirements.

Date: 10/15/01 Signed: _____

Valid Results, Inc.
Scott Chesnut

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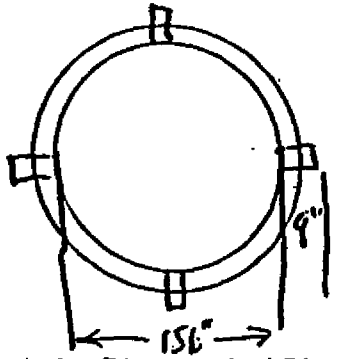
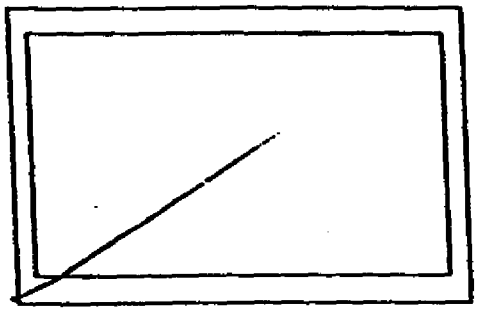
APPENDIX A

LOCATION OF SAMPLING POINTS

VALID RESULTS, INC.: EPA Method 1 & 2 - Sample Point Location and Volumetric Flow Rate Field Data Sheet

Client:	Ash Grove Cement	Stack Diameter (D_1 or D_2):	156"
Date:	8/5/97	Upstream (A):	140'
Operator:	T Hold	Downstream (B):	120'
Plant Location:	Seattle, WA	Minimum # Points:	12
Source:	Rotary Kiln	Pitot Tube ID#:	96A-72A
Fuel Type:	Mixed	Pitot Tube Coeff. (C_p):	0.84
Load Rating:	75 TPH	Pitot Cal. Date:	6/5/97
Barometric Pressure (P_{bar}):	—	Stack Temp. TC ID#:	96A-72A
Standard Temperature (t_{std}):	68	TC Cal. Date:	6/5/97
Standard Pressure (P_{std}):	29.92	% Oxygen (%O_2):	/
Stack Static Pressure (P_{static}):	-0.45	% Carbon Dioxide (%CO_2):	/
Time:	13:30	Moisture Content (%H_2O):	/



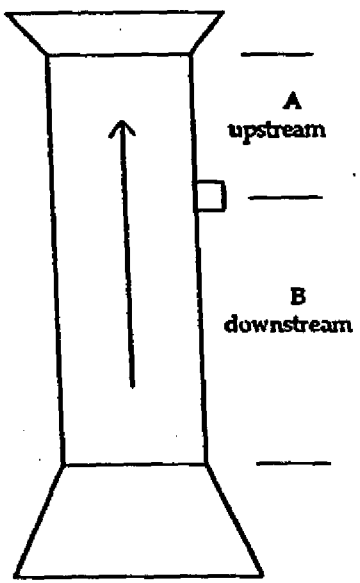


Equivalent Diameter = Stack Diameter (D_1) OR (D_2) $2*D_1*D_2/(D_1 + D_2)$

Stack Area (A_s) = $((1/4*144)*3.1416*(D_1)*(D_2))$ OR $((D_1)*(D_2)/144)$

Stack Pressure (P_s) = $P_{bar} + (P_{static}/13.6)$

Run #	Pre-Test:	Equipment Checklist:			Pitot Tube Leak Check:			
Port ID#	Point #	% Stack ID	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube Δ P	Stack Temp. t_s °F	√Δ P
	6	35.6	9	64.5	0			
	5	25.0	↓	46.0	↓			
	4	17.7		36.6				
	3	11.8		27.4				
	2	6.7		19.5				
	1	2.1		12.3				
<Average>								
Post-Test:	Pitot Tube Leak Check:							



Molecular Weight Wet (MW_s) = $((0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%CO + \%N_2))*(1-\%H_2O) + 18(\%H_2O))$

Stack Gas Velocity (V_s) = $(85.49*C_p*(\sqrt{\Delta P})*(t_s + 460)/(P_s*MW_s))$

Stack Gas Volumetric Flowrate = $(60*(1-\%H_2O)*V_s*A_s*((t_{std} + 460)/((t_s + 460))*(P_s/P_{std}))$

APPENDIX B

CALCULATIONS

VALID RESULTS, INC.: EPA Method 201A PM-10 Test Isokinetic Sample Rate Calculations

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limit:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Test Date: 5/19/01

Calculated Parameters:

Name:	Symbol:	Run 1 Value:	Run 2 Value:	Run 3 Value:	Units:
Isokinetic Sampling Rate	Isokinetics	142.45	141.61	140.70	%
Standard Meter Volume	$V_{m(std)}$	44.560	44.830	44.979	dry standard cubic feet
Stack Gas Velocity	V_s	21.21	21.41	22.04	feet/second
Wet Molecular Weight	M_s	31.07	31.21	31.07	gram/gram-mole
Dry Molecular Weight	M_d	32.12	32.15	32.14	gram/gram-mole
Stack Gas Moisture	B_{ws}	0.0744	0.0664	0.0760	%/100
Standard Water Volume	$V_{wc(std)}$	3.583	3.187	3.701	dry standard cubic feet
Nozzle Area	A_n	0.000279	0.000279	0.000279	square feet

Measured Parameters:

Name:	Symbol:	Value:	Value:	Value:	Units:
Standard Temperature	T_{std}	528	528	528	°Rankine
Standard Pressure	P_{std}	29.92	29.92	29.92	inches Hg
Barometric Pressure	P_{bar}	30.1	30.12	30.11	inches Hg
Stack Static Pressure	P_{static}	-0.41	-0.39	-0.4	inches water
Pitot Tube Coefficient	C_p	0.84	0.84	0.84	dimensionless
Nozzle Diameter	D_n	0.226	0.226	0.226	inches
Meter Coefficient	Y	0.9975	0.9975	0.9975	dimensionless
Meter Volume	V_m	44.302	45.252	44.765	cubic feet
Sample Time	Time	120	120	120	minutes
Avg. SQRT Pitot Pressure	$<\sqrt{(\Delta P)}>$	0.349	0.352	0.360	inches water
Avg. Orifice Pressure	$<\Delta H>$	0.47	0.48	0.48	inches water
Avg. Stack Temperature	$<T_{stk}>$	209.0	213.5	219.3	°Fahrenheit
Avg. Meter Temperature	$<T_m>$	67.3	75.9	68.2	°Fahrenheit
Stack Temperature	T_s	669.0	673.5	679.3	°Rankine
Stack Pressure	P_s	30.07	30.09	30.08	inches Hg
Meter Temperature	T_m	527.3	535.9	528.2	°Rankine
Meter Pressure	P_m	30.13	30.16	30.15	inches Hg
Oxygen	$\%O_2$	5.8	5.7	5.5	%
Carbon Dioxide	$\%CO_2$	24.3	24.5	24.5	%
Nitrogen/Carbon Monoxide	$\%N_2 + \%CO$	69.9	69.8	70	%
Impinger Water	Imp ml	68.3	57.2	64.6	milliliters
Silica Water	Silica ml	7.8	10.5	14	milliliters

where:

$$\text{isokinetics} = 100*T_s*V_{m(std)}*P_{std}/(60*T_{std}*V_s*Time*A_n*P_s*(1-B_{ws}))$$
$$V_{m(std)} = V_m*Y*P_m*T_{std}/(P_{std}*T_m)$$
$$V_s = 85.49*C_p*<\sqrt{(\Delta P)}>*\sqrt{(T_s/(P_s*M_s))}$$
$$M_s = M_d*(1-B_{ws}) + 18.0*B_{ws}$$
$$M_d = 0.44*(\%CO_2) + 0.32*(\%O_2) + 0.28*(\%N_2 + \%CO)$$
$$B_{ws} = V_{wc(std)}/(V_{wc(std)} + V_{m(std)})$$
$$V_{wc(std)} = 0.04707*(\text{Imp ml}) + 0.04715*(\text{Silica ml})$$
$$A_n = (3.1416*(D_n/2)*(D_n/2))/144$$
$$T_{std(°Rankine)} = <T_{stk}> + 460$$
$$P_s = P_{bar} + (P_{static}/13.6)$$
$$T_{m(°Rankine)} = <T_m> + 460$$
$$P_m = P_{bar} + (<\Delta H>/13.6)$$

VALID RESULTS, INC.: EPA Method 201A PM-10 Test Isokinetic Sample Rate Calculations

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.000	inches
Permit Limit:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Test Date: 5/15/01

Calculated Parameters:

Name:	Symbol:	Run 1 Value:	Run 2 Value:	Run 3 Value:	Units:
Isokinetic Sampling Rate	Isokinetics	178.63	169.21	181.29	%
Standard Meter Volume	$V_{m(std)}$	50.404	50.101	49.475	dry standard cubic feet
Stack Gas Velocity	V_s	25.36	26.68	25.23	feet/second
Wet Molecular Weight	M_s	31.08	31.10	30.96	gram/gram-mole
Dry Molecular Weight	M_d	32.01	31.93	31.93	gram/gram-mole
Stack Gas Moisture	B_{ws}	0.0664	0.0598	0.0696	%/100
Standard Water Volume	$V_{wc(std)}$	3.583	3.187	3.701	dry standard cubic feet
Nozzle Area	A_n	0.000279	0.000279	0.000279	square feet

Measured Parameters:

Name:	Symbol:	Value:	Value:	Value:	Units:
Standard Temperature	T_{std}	528	528	528	°Rankine
Standard Pressure	P_{std}	29.92	29.92	29.92	inches Hg
Barometric Pressure	P_{bar}	29.81	29.80	29.72	inches Hg
Stack Static Pressure	P_{static}	-0.35	-0.35	-0.24	inches water
Pitot Tube Coefficient	C_p	0.84	0.84	0.84	dimensionless
Nozzle Diameter	D_n	0.226	0.226	0.226	inches
Meter Coefficient	Y	0.9975	0.9975	0.9975	dimensionless
Meter Volume	V_m	50.869	50.628	50.668	cubic feet
Sample Time	Time	120	120	120	minutes
Avg. SQRT Pitot Pressure	$<\sqrt{(\Delta P)}>$	0.361	0.378	0.354	inches water
Avg. Orifice Pressure	$<\Delta H>$	0.60	0.60	0.61	inches water
Avg. Stack Temperature	$<T_{stk}>$	425.8	434.1	445.6	°Fahrenheit
Avg. Meter Temperature	$<T_m>$	70.3	70.8	76.5	°Fahrenheit
Stack Temperature	T_s	885.8	894.1	905.6	°Rankine
Stack Pressure	P_s	29.78	29.77	29.70	inches Hg
Meter Temperature	T_m	530.3	530.8	536.5	°Rankine
Meter Pressure	P_m	29.85	29.84	29.76	inches Hg
Oxygen	$\%O_2$	7.4	7.1	7.4	%
Carbon Dioxide	$\%CO_2$	23.2	22.8	22.7	%
Nitrogen/Carbon Monoxide	$\%N_2 + \%CO$	69.4	70.1	69.9	%
Impinger Water	Imp ml	68.3	57.2	64.6	milliliters
Silica Water	Silica ml	7.8	10.5	14	milliliters

where:

$\text{isokinetics} = 100*T_s*V_{m(std)}*P_{std}/(60*T_{std}*V_s*\text{Time}*A_n*P_s*(1-B_{ws}))$

$V_{m(std)} = V_m*Y*P_m*T_{std}/(P_{std}*T_m)$

$V_s = 85.49*C_p*<\sqrt{(\Delta P)}>*\sqrt{(T_s/(P_s*M_s))}$

$M_s = M_d*(1-B_{ws}) + 18.0*B_{ws}$

$M_d = 0.44*(\%CO_2) + 0.32*(\%O_2) + 0.28*(\%N_2 + \%CO)$

$B_{ws} = V_{wc(std)}/(V_{wc(std)} + V_{m(std)})$

$V_{wc(std)} = 0.04707*(\text{Imp ml}) + 0.04715*(\text{Silica ml})$

$A_n = (3.1416*(D_n/2)*(D_n/2))/144$

$T_{stk(°Rankine)} = <T_{stk}> + 460$

$P_s = P_{bar} + (P_{static}/13.6)$

$T_{m(°Rankine)} = <T_m> + 460$

$P_m = P_{bar} + (<\Delta H>/13.6)$

VALID RESULTS, INC.: EPA Method 201A* PM-2.5 Test Isokinetic Sample Rate Calculations

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limit:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Test Date: 5/19/01

Calculated Parameters:

Name:	Symbol:	Run 1 Value:	Run 2 Value:	Run 3 Value:	Units:
Isokinetic Sampling Rate	Isokinetics	150.60	148.36	150.56	%
Standard Meter Volume	$V_{m(std)}$	37.714	37.484	38.373	dry standard cubic feet
Stack Gas Velocity	V_s	21.20	21.42	21.98	feet/second
Wet Molecular Weight	M_s	31.10	31.18	31.07	gram/gram-mole
Dry Molecular Weight	M_d	32.12	32.15	32.14	gram/gram-mole
Stack Gas Moisture	B_{ws}	0.0725	0.0682	0.0758	%/100
Standard Water Volume	$V_{wc(std)}$	2.947	2.744	3.145	dry standard cubic feet
Nozzle Area	A_n	0.000223	0.000223	0.000223	square feet

Measured Parameters:

Name:	Symbol:	Value:	Value:	Value:	Units:
Standard Temperature	T_{std}	528	528	528	°Rankine
Standard Pressure	P_{std}	29.92	29.92	29.92	inches Hg
Barometric Pressure	P_{bar}	30.1	30.12	30.11	inches Hg
Stack Static Pressure	P_{static}	-0.41	-0.39	-0.4	inches water
Pitot Tube Coefficient	C_p	0.84	0.84	0.84	dimensionless
Nozzle Diameter	D_n	0.202	0.202	0.202	inches
Meter Coefficient	Y	0.9566	0.9566	0.9566	dimensionless
Meter Volume	V_m	38.831	39.379	39.791	cubic feet
Sample Time	Time	120	120	120	minutes
Avg. SQRT Pitot Pressure	$<\sqrt{(\Delta P)}>$	0.349	0.352	0.359	inches water
Avg. Orifice Pressure	$<\Delta H>$	0.36	0.36	0.37	inches water
Avg. Stack Temperature	$<T_{stk}>$	209.0	213.5	219.3	°Fahrenheit
Avg. Meter Temperature	$<T_m>$	63.7	74.7	67.6	°Fahrenheit
Stack Temperature	T_s	669.0	673.5	679.3	°Rankine
Stack Pressure	P_s	30.07	30.09	30.08	inches Hg
Meter Temperature	T_m	523.7	534.7	527.6	°Rankine
Meter Pressure	P_m	30.13	30.15	30.14	inches Hg
Oxygen	$\%O_2$	5.8	5.7	5.5	%
Carbon Dioxide	$\%CO_2$	24.3	24.5	24.5	%
Nitrogen/Carbon Monoxide	$\%N_2 + \%CO$	69.9	69.8	70	%
Impinger Water	Imp ml	57.4	55.1	62.5	milliliters
Silica Water	Silica ml	5.2	3.2	4.3	milliliters

where:

$$\text{isokinetics} = 100*T_s*V_{m(std)}*P_{std}/(60*T_{std}*V_s*Time*A_n*P_s*(1-B_{ws}))$$
$$V_{m(std)} = V_m*Y*P_m*T_{std}/(P_{std}*T_m)$$
$$V_s = 85.49*C_p*<\sqrt{(\Delta P)}>*\sqrt{(T_s/(P_s*M_s))}$$
$$M_s = M_d*(1-B_{ws}) + 18.0*B_{ws}$$
$$M_d = 0.44*(\%CO_2) + 0.32*(\%O_2) + 0.28*(\%N_2 + \%CO)$$
$$B_{ws} = V_{wc(std)}/(V_{wc(std)} + V_{m(std)})$$
$$V_{wc(std)} = 0.04707*(\text{Imp ml}) + 0.04715*(\text{Silica ml})$$
$$A_n = (3.1416*(D_n/2)*(D_n/2))/144$$
$$T_{stk(°Rankine)} = <T_{stk}> + 460$$
$$P_s = P_{bar} + (P_{static}/13.6)$$
$$T_{m(°Rankine)} = <T_m> + 460$$
$$P_m = P_{bar} + (<\Delta H>/13.6)$$

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VALID RESULTS, INC.: EPA Method 201A* PM-2.5 Test Isokinetic Sample Rate Calculations

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limit:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Test Date: 5/15/01

Calculated Parameters:

Name:	Symbol:	Run 1 Value:	Run 2 Value:	Run 3 Value:	Units:
Isokinetic Sampling Rate	Isokinetics	193.22	192.45	205.88	%
Standard Meter Volume	$V_{m(std)}$	41.360	44.421	44.081	dry standard cubic feet
Stack Gas Velocity	V_s	26.34	26.85	25.33	feet/second
Wet Molecular Weight	M_s	30.76	30.69	30.64	gram/gram-mole
Dry Molecular Weight	M_d	32.01	31.93	31.93	gram/gram-mole
Stack Gas Moisture	B_{ws}	0.0891	0.0888	0.0925	%/100
Standard Water Volume	$V_{wc(std)}$	4.048	4.331	4.491	dry standard cubic feet
Nozzle Area	A_n	0.000223	0.000223	0.000223	square feet

Measured Parameters:

Name:	Symbol:	Value:	Value:	Value:	Units:
Standard Temperature	T_{std}	528	528	528	°Rankine
Standard Pressure	P_{std}	29.92	29.92	29.92	inches Hg
Barometric Pressure	P_{bar}	29.81	29.80	29.72	inches Hg
Stack Static Pressure	P_{static}	-0.35	-0.35	0.74	inches water
Pitot Tube Coefficient	C_p	0.84	0.84	0.84	dimensionless
Nozzle Diameter	D_n	0.202	0.202	0.202	inches
Meter Coefficient	Y	0.9566	0.9566	0.9566	dimensionless
Meter Volume	V_m	43.008	46.605	46.724	cubic feet
Sample Time	Time	120	120	120	minutes
Avg. SQRT Pitot Pressure	$<\sqrt{(\Delta P)}>$	0.361	0.378	0.354	inches water
Avg. Orifice Pressure	$<\Delta H>$	0.45	0.51	0.52	inches water
Avg. Stack Temperature	$<T_{stk}>$	485.8	434.1	445.6	°Fahrenheit
Avg. Meter Temperature	$<T_m>$	63.8	68.5	72.5	°Fahrenheit
Stack Temperature	T_s	945.8	894.1	905.6	°Rankine
Stack Pressure	P_s	29.78	29.77	29.77	inches Hg
Meter Temperature	T_m	523.8	528.5	532.5	°Rankine
Meter Pressure	P_m	29.84	29.84	29.76	inches Hg
Oxygen	$\%O_2$	7.4	7.1	7.4	%
Carbon Dioxide	$\%CO_2$	23.2	22.8	22.7	%
Nitrogen/Carbon Monoxide	$\%N_2 + \%CO$	69.4	70.1	69.9	%
Impinger Water	Imp ml	83.2	82.9	88.8	milliliters
Silica Water	Silica ml	2.8	9.1	6.6	milliliters

where:

$$\text{isokinetics} = 100*T_s*V_{m(std)}*P_{std}/(60*T_{std}*V_s*Time*A_n*P_s*(1-B_{ws}))$$
$$V_{m(std)} = V_m*Y*P_m*T_{std}/(P_{std}*T_m)$$
$$V_s = 85.49*C_p*<\sqrt{(\Delta P)}>*\sqrt{(T_s/(P_s*M_s))}$$
$$M_s = M_d*(1-B_{ws}) + 18.0*B_{ws}$$
$$M_d = 0.44*(\%CO_2) + 0.32*(\%O_2) + 0.28*(\%N_2 + \%CO)$$
$$B_{ws} = V_{wc(std)}/(V_{wc(std)} + V_{m(std)})$$
$$V_{wc(std)} = 0.04707*(\text{Imp ml}) + 0.04715*(\text{Silica ml})$$
$$A_n = (3.1416*(D_n/2)*(D_n/2))/144$$
$$T_{stk(°Rankine)} = <T_{stk}> + 460$$
$$P_s = P_{bar} + (P_{static}/13.6)$$
$$T_{m(°Rankine)} = <T_m> + 460$$
$$P_m = P_{bar} + (<\Delta H>/13.6)$$

VALID RESULTS, INC.: PM-10 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill On
Run 1

P_{bar}	30.1	
P_{static}	-0.41	
t_s	209	
t_m	67.3	
ΔH@	1.9020	
$\%CO_2$	24.3	
$\%O_2$	5.8	
$\%N_2+\%CO$	69.9	
B_{ws}	0.0744	
M_d	32.12	
M_w	31.07	
P_s	30.07	
viscosity =	204.73	
cyclone flow rate Q_s	0.5263	ft3/min
pressure head needed ΔH	0.5557	inches h2o
ΔH at 50 less ts	0.6491	
ΔH at 50 more	0.4811	
nozzle diameter (guess)	0.2260	
nozzle velocity V_n	31.4898	
V_{min}	17.1004	
V_{max}	32.6703	
Δp min	0.0792	
Δp max	0.2891	

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.110	0.332	t1	9.51	9.50	9.50
11	0.129	0.359	t2	10.28	10.25	19.75
10	0.135	0.367		10.51	10.50	30.25
9	0.120	0.346		9.91	10.00	40.25
8	0.128	0.358		10.25	10.25	50.50
7	0.130	0.361		10.34	10.25	60.75
6	0.109	0.330		9.45	9.50	70.25
5	0.130	0.361		10.34	10.25	80.50
4	0.135	0.367		10.51	10.50	91.00
3	0.100	0.316		9.05	9.00	100.00
2	0.119	0.345		9.88	10.00	110.00
1	0.120	0.346		9.91	10.00	120.00
average*	0.12	0.349		119.9		

D_{50} = 10.00052

VALID RESULTS, INC.: PM-10 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill On
Run 2

P_{bar}	30.12	
P_{static}	-0.39	
t_s	213.5	
t_m	75.9	
ΔH@	1.9020	
$\%CO_2$	24.5	
$\%O_2$	5.7	
$\%N_2+\%CO$	69.8	
B_{ws}	0.0664	
M_d	32.15	
M_w	31.21	
P_s	30.09	
viscosity =	206.48	
cyclone flow rate Q_s	0.5311	ft3/min
pressure head needed ΔH	0.5782	inches h2o
ΔH at 50 less ts	0.6747	
ΔH at 50 more	0.5011	
nozzle diameter (guess)	0.2260	
nozzle velocity V_n	31.7770	
V_{min}	17.2630	
V_{max}	32.9716	
Δp min	0.0806	
Δp max	0.2940	

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.109	0.330	t1	9.38	9.50	9.50
11	0.121	0.348	t2	9.89	10.00	19.50
10	0.123	0.351		9.98	10.00	29.50
9	0.116	0.341		9.69	9.75	39.25
8	0.140	0.374		10.63	10.50	49.75
7	0.132	0.363		10.32	10.25	60.00
6	0.110	0.332		9.44	9.50	69.50
5	0.140	0.374		10.63	10.50	80.00
4	0.130	0.361		10.26	10.25	90.25
3	0.110	0.332		9.44	9.50	99.75
2	0.125	0.354		10.06	10.00	109.75
1	0.130	0.361		10.26	10.25	120.00
average*	0.12	0.352		120.0		

D_{50} = 9.99972

VALID RESULTS, INC.: PM-10 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill On
Run 3

P_{bar}	30.11	
P_{static}	-0.4	
t_s	219.3	
t_m	68.2	
ΔH@	1.9020	
$\%CO_2$	24.5	
$\%O_2$	5.5	
$\%N_2+\%CO$	70	
B_{ws}	0.076	
M_d	32.14	
M_w	31.07	
P_s	30.08	
viscosity =	207.23	
cyclone flow rate Q_s	0.5351	ft3/min
pressure head needed ΔH	0.5567	inches h2o
ΔH at 50 less ts	0.6487	
ΔH at 50 more	0.4830	
nozzle diameter (guess)	0.2260	
nozzle velocity V_n	32.0163	
V_{min}	17.4384	
V_{max}	33.2428	
Δp min	0.0812	
Δp max	0.2949	

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.118	0.344	t1	9.56	9.50	9.50
11	0.132	0.363	t2	10.09	10.00	19.50
10	0.137	0.370		10.28	10.25	29.75
9	0.125	0.354		9.84	9.75	39.50
8	0.138	0.371		10.31	10.25	49.75
7	0.140	0.374		10.39	10.50	60.25
6	0.105	0.324		9.00	9.00	69.25
5	0.129	0.359		9.98	10.00	79.25
4	0.140	0.374		10.39	10.50	89.75
3	0.120	0.346		9.62	9.50	99.25
2	0.135	0.367		10.20	10.25	109.50
1	0.140	0.374		10.39	10.50	120.00
average*	0.13	0.360		120.1		

D_{50} = 10.00025

VALID RESULTS, INC.: EPA Method 201A - PM-10 Air Emissions Test Data

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	>90%
Barometric Pressure (P_{bar}):	30.10
Stack Diameter (D_e):	156.0
Test Run #:	1

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/19/01	D_n =	0.226
Pitot Tube:	316 SS	72A	4/15/01	C_p =	0.84
Stack TC:	316 SS	72A	4/15/01	Y_d =	0.9975
Meter:		Nutech #2	11/24/00	ΔH@=	1.9020
Filter:	Glass Fiber	VR2"179			

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	675.4	609.3	66.1	DI H_2O
2	696.2	695.1	1.1	DI H_2O
3	512.9	511.8	1.1	empty
4	658.3	650.5	7.8	Silica Gel

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	5.8
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	24.3
Stack Static Pressure (P_{static}):	-0.41	Stack Moisture (%H_2O):	7.44

Impinger Water Weight Gain =	68.3
Silica Gel Weight Gain =	7.8

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE5	0.0	235.000	0.110	208	65	65	0.47	0.3317	0.19
NE3	10.0	238.427	0.129	209	66	64	0.47	0.3592	0.19
NE2	20.0	242.150	0.135	210	69	66	0.47	0.3674	0.19
SE5	30.0	245.978	0.120	207	71	65	0.47	0.3464	0.19
SE3	40.0	249.693	0.128	209	72	65	0.47	0.3578	0.19
SE2	50.0	253.497	0.130	210	74	66	0.47	0.3606	0.19
SW5	60.0	257.251	0.109	208	74	66	0.47	0.3302	0.19
SW3	70.0	260.773	0.130	209	69	65	0.47	0.3606	0.19
SW2	80.0	264.591	0.135	210	69	65	0.47	0.3674	0.19
NW5	90.0	268.487	0.100	209	68	65	0.47	0.3162	0.19
NW3	100.0	271.864	0.119	209	69	65	0.47	0.3450	0.19
NW2	110.0	275.588	0.120	210	68	63	0.47	0.3464	0.19
	120.0	279.302							
Averages	120.0	44.302		<209.0>	<67.3>		<0.47>	<0.349>	<0.19>

VALID RESULTS, INC.: EPA Method 201A - PM-10 Air Emissions Test Data

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	>90%
Barometric Pressure (P_{bar}):	30.12
Stack Equiv. Diameter (D_e):	156.0
Test Run #:	2

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/19/01	D_n =	0.226
Pitot Tube:	316 SS	72A	4/15/01	C_p =	0.84
Stack TC:	316 SS	72A	4/15/01	Y_d =	0.9975
Meter:		Nutech #2	11/24/00	ΔH@=	1.9020
Filter:	Glass Fiber	VR2"186			

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	5.7
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	24.5
Stack Static Pressure (P_{static}):	-0.39	Stack Moisture (%H_2O):	6.64

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	620.5	564.1	56.4	DI H_2O
2	613.2	612.5	0.7	DI H_2O
3	476.2	476.1	0.1	empty
4	634.8	624.3	10.5	Silica Gel

Impinger Weight Gain =	57.2
Silica Gel Weight Gain =	10.5

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE5	0.0	280.884	0.109	210	75	72	0.48	0.3302	0.19
NE3	10.0	284.421	0.121	212	75	73	0.48	0.3479	0.19
NE2	20.0	288.228	0.123	212	78	75	0.48	0.3507	0.19
SE5	30.0	292.023	0.116	213	81	75	0.48	0.3406	0.19
SE3	40.0	295.802	0.140	214	86	77	0.48	0.3742	0.19
SE2	50.0	299.774	0.132	214	85	76	0.48	0.3633	0.19
SW5	60.0	303.632	0.110	214	81	77	0.48	0.3317	0.19
SW3	70.0	307.136	0.140	215	77	75	0.48	0.3742	0.19
SW2	80.0	311.114	0.130	216	75	74	0.48	0.3606	0.19
NW5	90.0	314.973	0.110	213	74	71	0.48	0.3317	0.19
NW3	100.0	318.538	0.125	214	74	71	0.48	0.3536	0.19
NW2	110.0	322.298	0.130	215	73	71	0.48	0.3606	0.19
	120.0	326.136							
Averages	120.0	45.252		<213.5>	<75.9>		<0.48>	<0.352>	<0.19>

VALID RESULTS, INC.: EPA Method 201A - PM-10 Air Emissions Test Data

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	>90%
Barometric Pressure (P_{bar}):	30.11
Stack Equiv. Diameter (D_e):	156.0
Test Run #:	3

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/19/01	D_n =	0.226
Pitot Tube:	316 SS	72A	4/15/01	C_p =	0.84
Stack TC:	316 SS	72A	4/15/01	Y_d =	0.9975
Meter:		Nutech #2	11/24/00	ΔH@=	1.9020
Filter:	Glass Fiber	VR2"187			

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	5.5
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	24.5
Stack Static Pressure (P_{static}):	-0.40	Stack Moisture (%H_2O):	7.60

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	661.6	599.0	62.6	DI H_2O
2	657.7	655.5	2.2	DI H_2O
3	496.2	496.4	-0.2	empty
4	670.6	656.6	14.0	Silica Gel

Total Impinger Water Weight Gain = 64.6

Total Silica Gel Weight Gain = 14

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE5	0.0	326.986	0.118	218	65	61	0.48	0.3435	0.19
NE3	10.0	330.381	0.132	220	66	65	0.48	0.3633	0.19
NE2	20.0	334.102	0.137	220	69	66	0.48	0.3701	0.19
SE5	30.0	337.906	0.125	218	74	68	0.48	0.3536	0.19
SE3	40.0	341.574	0.138	220	73	68	0.48	0.3715	0.19
SE2	50.0	345.398	0.140	220	71	68	0.48	0.3742	0.19
SW5	60.0	349.309	0.105	219	69	68	0.48	0.3240	0.19
SW3	70.0	352.693	0.129	221	69	68	0.48	0.3592	0.19
SW2	80.0	356.441	0.140	220	69	69	0.48	0.3742	0.19
NW5	90.0	360.386	0.120	218	70	69	0.48	0.3464	0.19
NW3	100.0	363.977	0.135	219	68	68	0.48	0.3674	0.19
NW2	110.0	367.823	0.140	219	68	68	0.48	0.3742	0.19
	120.0	371.751							
Averages	120.0	44.765		<219.3>	<68.2>		<0.48>	<0.360>	<0.19>

VALID RESULTS, INC.: PM-10 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill Off
Run 1

P_{bar}	29.81	
P_{static}	-0.35	
t_s	425.8	
t_m	70.3	
ΔH@	1.9020	
$\%CO_2$	23.2	
$\%O_2$	7.4	
$\%N_2+\%CO$	69.4	
B_{ws}	0.0664	
M_d	32.01	
M_w	31.08	
P_s	29.78	
viscosity =	265.96	
cyclone flow rate Q_s	0.7448	ft3/min
pressure head needed ΔH	0.6410	inches h2o
ΔH at 50 less ts	0.7200	
ΔH at 50 more	0.5743	
nozzle diameter (guess)	0.2260	
nozzle velocity V_n	44.5632	
V_{min}	25.4827	
V_{max}	46.9011	
Δp min	0.1316	
Δp max	0.4458	

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.120	0.346	t1	9.58	9.50	9.50
11	0.125	0.354	t2	9.80	10.00	19.50
10	0.139	0.373		10.33	10.25	29.75
9	0.128	0.358		9.91	10.00	39.75
8	0.138	0.371		10.27	10.25	50.00
7	0.141	0.375		10.38	10.25	60.25
6	0.119	0.345		9.55	9.50	69.75
5	0.130	0.361		10.00	10.00	79.75
4	0.140	0.374		10.36	10.50	90.25
3	0.110	0.332		9.19	9.25	99.50
2	0.138	0.371		10.27	10.25	109.75
1	0.141	0.375		10.38	10.50	120.25
average*	0.13	0.361		120.0		

D_{50} = 10.00015

VALID RESULTS, INC.: PM-10 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill Off
Run 2

P_{bar}	29.80	
P_{static}	-0.35	
t_s	434.1	
t_m	70.8	
ΔH@	1.9020	
$\%CO_2$	22.8	
$\%O_2$	7.1	
$\%N_2+\%CO$	70.1	
B_{ws}	0.0598	
M_d	31.93	
M_w	31.10	
P_s	29.77	
viscosity =	268.64	
cyclone flow rate Q_s	0.7543	ft3/min
pressure head needed ΔH	0.6532	inches h2o
ΔH at 50 less ts	0.7329	
ΔH at 50 more	0.5859	
nozzle diameter (guess)	0.2260	
nozzle velocity V_n	45.1316	
V_{min}	25.8444	
V_{max}	47.5191	
Δp min	0.1342	
Δp max	0.4535	

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.129	0.359	t1	9.50	9.50	9.50
11	0.149	0.386	t2	10.21	10.25	19.75
10	0.151	0.389		10.29	10.25	30.00
9	0.125	0.354		9.37	9.50	39.50
8	0.150	0.387		10.24	10.25	49.75
7	0.155	0.394		10.43	10.50	60.25
6	0.130	0.361		9.55	9.50	69.75
5	0.159	0.399		10.56	10.50	80.25
4	0.165	0.406		10.74	10.75	91.00
3	0.119	0.345		9.13	9.00	100.00
2	0.135	0.367		9.71	9.75	109.75
1	0.155	0.394		10.43	10.50	120.25
average*	0.14	0.378		120.2		

D_{50} = 10.00023

VALID RESULTS, INC.: PM-10 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9975	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill Off
Run 3

P_{bar}	29.72	
P_{static}	-0.24	
t_s	445.6	
t_m	76.5	
ΔH@	1.9020	
$\%CO_2$	22.7	
$\%O_2$	7.4	
$\%N_2+\%CO$	69.9	
B_{ws}	0.0696	
M_d	31.93	
M_w	30.96	
P_s	29.70	
viscosity =	271.33	
cyclone flow rate Q_s	0.7663	ft3/min
pressure head needed ΔH	0.6491	inches h2o
ΔH at 50 less ts	0.7272	
ΔH at 50 more	0.5830	
nozzle diameter (guess)	0.2260	
nozzle velocity V_n	45.8496	
V_{min}	26.3368	
V_{max}	48.3189	
Δp min	0.1366	
Δp max	0.4598	

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.109	0.330	t1	9.32	9.25	9.25
11	0.125	0.354	t2	10.00	10.00	19.25
10	0.132	0.363		10.25	10.25	29.50
9	0.115	0.339		9.57	9.50	39.00
8	0.135	0.367		10.36	10.25	49.25
7	0.140	0.374		10.56	10.50	59.75
6	0.119	0.345		9.74	9.75	69.50
5	0.129	0.359		10.14	10.25	79.75
4	0.125	0.354		10.00	10.00	89.75
3	0.115	0.339		9.57	9.50	99.25
2	0.128	0.358		10.11	10.00	109.25
1	0.130	0.361		10.20	10.25	119.50
average*	0.13	0.354		119.8		

D_{50} = 10.00004

VALID RESULTS, INC.: EPA Method 201A - PM-10 Air Emissions Test Data

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	>90%
Barometric Pressure (P_{bar}):	29.81
Stack Diameter (D_e):	156.0
Test Run #:	1

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/15/01	D_n =	0.226
Pitot Tube:	316 SS	72A	4/25/01	C_p =	0.84
Stack TC:	316 SS	72A	4/25/01	Y_d =	0.9975
Meter:		Nutech #2	11/24/00	ΔH@=	1.9020
Filter:	Glass Fiber	VR2"176			

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	7.4
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	23.2
Stack Static Pressure (P_{static}):	-0.35	Stack Moisture (%H_2O):	6.64

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	675.4	609.3	66.1	DI H_2O
2	696.2	695.1	1.1	DI H_2O
3	512.9	511.8	1.1	empty
4	658.3	650.5	7.8	Silica Gel

Impinger Water Weight Gain =	68.3
Silica Gel Weight Gain =	7.8

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE5	0.0	75.173	0.120	420.0	65	64	0.60	0.3464	0.24
NE3	10.0	79.561	0.125	425.0	68	65	0.60	0.3536	0.24
NE2	20.0	83.732	0.139	425.0	69	67	0.60	0.3728	0.24
SE5	30.0	87.006	0.128	428.0	70	68	0.60	0.3578	0.24
SE3	40.0	92.144	0.138	427.0	72	69	0.60	0.3715	0.24
SE2	50.0	96.429	0.141	423.0	74	69	0.60	0.3755	0.24
SW5	60.0	100.778	0.119	425.0	75	69	0.60	0.3450	0.24
SW3	70.0	104.776	0.130	429.0	75	71	0.60	0.3606	0.24
SW2	80.0	108.977	0.140	429.0	74	70	0.60	0.3742	0.24
Nw5	90.0	113.398	0.110	423.0	73	71	0.60	0.3317	0.24
NW3	100.0	117.344	0.138	427.0	72	72	0.60	0.3715	0.24
NW2	110.0	121.635	0.141	429.0	74	70	0.60	0.3755	0.24
	120.0	126.042							
Averages	120.0	50.869		<425.8>	<70.3>		<0.60>	<0.361>	<0.24>

VALID RESULTS, INC.: EPA Method 201A - PM-10 Air Emissions Test Data

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	>90%
Barometric Pressure (P_{bar}):	29.80
Stack Equiv. Diameter (D_e):	156.0
Test Run #:	2

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/15/01	D_n =	0.226
Pitot Tube:	316 SS	72A	4/25/01	C_p =	0.84
Stack TC:	316 SS	72A	4/25/01	Y_d =	0.9975
Meter:		Nutech #2	11/24/00	ΔH@=	1.9020
Filter:	Glass Fiber	VR2"177			

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	620.5	564.1	56.4	DI H_2O
2	613.2	612.5	0.7	DI H_2O
3	476.2	476.1	0.1	empty
4	634.8	624.3	10.5	Silica Gel

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	7.1
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	22.8
Stack Static Pressure (P_{static}):	-0.35	Stack Moisture (%H_2O):	5.98

Impinger Weight Gain =	57.2
Silica Gel Weight Gain =	10.5

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE5	0.0	129.654	0.129	431	65	64	0.60	0.3592	0.24
NE3	10.0	133.709	0.149	435	65	65	0.60	0.3860	0.24
NE2	20.0	138.002	0.151	436	66	65	0.60	0.3886	0.24
SE5	30.0	142.269	0.125	431	65	65	0.60	0.3536	0.24
SE3	40.0	146.274	0.150	434	68	67	0.60	0.3873	0.24
SE2	50.0	150.567	0.155	435	72	70	0.60	0.3937	0.24
SW5	60.0	154.938	0.130	433	69	69	0.60	0.3606	0.24
SW3	70.0	158.944	0.159	436	74	72	0.60	0.3987	0.24
SW2	80.0	163.336	0.165	436	76	74	0.60	0.4062	0.24
Nw5	90.0	167.863	0.119	432	79	75	0.60	0.3450	0.24
NW3	100.0	171.761	0.135	435	80	75	0.60	0.3674	0.24
NW2	110.0	175.873	0.155	435	83	76	0.60	0.3937	0.24
	120.0	180.282							
Averages	120.0	50.628		<434.1>	<70.8>		<0.60>	<0.378>	<0.24>

VALID RESULTS, INC.: EPA Method 201A - PM-10 Air Emissions Test Data

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement	Equipment	Material	ID#	Cal Date		Value	Impinger Weight Gain			Net	Charge
Date:	5/15/01	Nozzle	316 SS	6mm-A	5/15/01	D_n =	0.226	#	Vfinal	Vinitial	Gain	Solution
Operator:	T. Prevo	Pitot Tube:	316 SS	72A	4/25/01	C_p =	0.84	1	661.6	599.0	62.6	DI H_2O
Plant Location:	Seattle, WA	Stack TC:	316 SS	72A	4/25/01	Y_d =	0.9975	2	657.7	655.5	2.2	DI H_2O
Source:	Main Stack Outlet	Meter:		Nutech #2	11/24/00	ΔH@=	1.9020	3	496.2	496.4	-0.2	empty
Fuel Type:	Mixed	Filter:	Glass Fiber	VR2"178				4	670.6	656.6	14.0	Silica Gel
Load Rating:	>90%	Probe Liner: Quartz Glass										
Barometric Pressure (P_{bar}):	29.72	Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	7.4			Total Impinger Water Weight Gain =	64.6			
Stack Equiv. Diameter (D_e):	156.0	Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	22.7			Total Silica Gel Weight Gain =	14			
Test Run #:	3	Stack Static Pressure (P_{static}):	-0.24	Stack Moisture (%H_2O):	6.96							

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	T_m - out	ΔH	√ΔP	CFM
NE5	0.0	182.214	0.109	441	73	71	0.61	0.3302	0.24
NE3	10.0	186.128	0.125	445	74	72	0.61	0.3536	0.24
NE2	20.0	190.283	0.132	446	75	74	0.61	0.3633	0.24
SE5	30.0	194.592	0.115	443	77	76	0.61	0.3391	0.24
SE3	40.0	198.717	0.135	447	80	75	0.61	0.3674	0.24
SE2	50.0	203.023	0.140	448	84	75	0.61	0.3742	0.24
SW5	60.0	207.476	0.119	442	86	75	0.61	0.3450	0.24
SW3	70.0	211.643	0.129	447	80	75	0.61	0.3592	0.24
SW2	80.0	216.972	0.125	447	79	76	0.61	0.3536	0.24
Nw5	90.0	220.896	0.115	443	78	75	0.61	0.3391	0.24
NW3	100.0	224.273	0.128	448	82	74	0.61	0.3578	0.24
NW2	110.0	228.511	0.130	450	78	72	0.61	0.3606	0.24
	120.0	232.882							
Averages	120.0	50.668		<445.6>	<76.5>		<0.61>	<0.354>	<0.24>

VALID RESULTS, INC.: PM-2.5 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill On
Run 3

P_{bar}	30.11	
P_{static}	-0.4	
t_s	219.3	
t_m	67.6	
ΔH@	1.9348	
$\%CO_2$	24.5	
$\%O_2$	5.5	
$\%N_2+\%CO$	70	
B_{ws}	0.0758	
M_d	32.14	
M_w	31.07	
P_s	30.08	
viscosity =	203.9191	
cyclone flow rate $Q_{s\,(4<3162)}$	0.4592	ft3/min
cyclone flow rate $Q_{s\,(4>=3162)}$	1.1822	
C	1.0725	
RE<3162	2676.795	
RE>=3162	6891.349	
pressure head needed ΔH <3162	0.4167	inches h2o
ΔH at 50 less ts	0.4856	
ΔH at 50 more	0.3616	
pressure head needed ΔH >=3162	2.7622	inches h2o
ΔH at 50 less ts	3.2185	
ΔH at 50 more	2.3964	
nozzle diameter (guess)	0.2020	
nozzle velocity V_n	34.3916	
$V_{min\ RE<3162}$	20.7955	
$V_{max\ RE<3162}$	36.8240	
$V_{min\ RE>=3162}$	13.4394	
$V_{max\ RE>=3162}$	33.6189	

Δp min RE<3162	0.1154
Δp max RE<3162	0.3619
Δp min	0.0482
Δp max	0.3016

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.140	0.374	t1	10.42	10.50	10.50
11	0.129	0.359	t2	10.00	10.00	20.50
10	0.105	0.324		9.03	9.00	29.50
9	0.140	0.374		10.42	10.50	40.00
8	0.135	0.367		10.22	10.25	50.25
7	0.120	0.346		9.64	9.75	60.00
6	0.127	0.356		9.92	10.00	70.00
5	0.132	0.363		10.11	10.00	80.00
4	0.118	0.344		9.58	9.50	89.50
3	0.140	0.374		10.42	10.50	100.00
2	0.138	0.371		10.34	10.25	110.25
1	0.125	0.354		9.86	9.75	120.00
average*	0.129	0.359		120.0		

D_{50} RE<3162 = 2.50022

VALID RESULTS, INC.: PM-2.5 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill On
Run 1

P_{bar}	30.10	
P_{static}	0.41	
t_s	209	
t_m	63.7	
ΔH@	1.9348	
$\%CO_2$	24.3	
$\%O_2$	5.8	
$\%N_2+\%CO$	69.9	
B_{ws}	0.073	
M_d	32.12	
M_w	31.10	
P_s	30.13	
viscosity =	201.7041	
cyclone flow rate $Q_{s\ (4<3162)}$	0.4498	ft3/min
cyclone flow rate $Q_{s\ (4>=3162)}$	1.1624	
D50 2.5	33186.2499	
D50 C4	2.5003	
Cr	1.0710	
C	1.0710	
RE<3162	2698.683	
RE>=3162	6974.098	
D50 C4 RE	2.5003	
pressure head needed ΔH <3162	0.4130	inches h2o
ΔH at 50 less ts	0.4824	
ΔH at 50 more	0.3575	
pressure head needed ΔH >=3162	2.7579	inches h2o
ΔH at 50 less ts	3.2214	
ΔH at 50 more	2.3876	
nozzle diameter (guess)	0.2020	
nozzle velocity V_n	33.6876	
$V_{min\ RE<3162}$	20.2874	
$V_{max\ RE<3162}$	36.0230	
$V_{min\ RE>=3162}$	12.7578	
$V_{max\ RE>=3162}$	32.8242	

Δp min RE<3162	0.1118
Δp max RE<3162	0.3525
Δp min	0.0442
Δp max	0.2927

		sample time		120	calculated	actual	actual
		number points		12	sample	sample	elapsed
	Δp	sqrtΔp			time	time	time
12	0.135	0.367	t1		10.52	10.50	10.50
11	0.130	0.361	t2		10.35	10.25	20.75
10	0.109	0.330			9.46	9.50	30.25
9	0.120	0.346			9.92	10.00	40.25
8	0.119	0.345			9.89	10.00	50.25
7	0.100	0.316			9.06	9.00	59.25
6	0.135	0.367			10.52	10.50	69.75
5	0.129	0.359			10.29	10.25	80.00
4	0.110	0.332			9.52	9.50	89.50
3	0.130	0.361			10.35	10.25	99.75
2	0.128	0.358			10.26	10.25	110.00
1	0.120	0.346			9.92	10.00	120.00
average*	0.12	0.349			120.1		

D_{50} RE<3162 = 2.50035

VALID RESULTS, INC.: PM-2.5 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.0	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill On
Run 1

P_{bar}	30.10	
P_{static}	-0.41	
t_s	209	
t_m	63.7	
ΔH@	1.9348	
$\%CO_2$	24.3	
$\%O_2$	5.8	
$\%N_2+\%CO$	69.9	
B_{ws}	0.073	
M_d	32.12	
M_w	31.10	
P_s	30.07	
viscosity =	201.7041	
cyclone flow rate $Q_{s\ (4<3162)}$	0.4503	ft3/min
cyclone flow rate $Q_{s\ (4>=3162)}$	1.1632	
D50 2.5	33146.2974	
D50 C4	2.5002	
Cr	1.0712	
C	1.0712	
RE<3162	2696.303	
RE>=3162	6965.000	
D50 C4 RE	2.5002	
pressure head needed ΔH <3162	0.4122	inches h2o
ΔH at 50 less ts	0.4815	
ΔH at 50 more	0.3569	
pressure head needed ΔH >=3162	2.7507	inches h2o
ΔH at 50 less ts	3.2130	
ΔH at 50 more	2.3814	
nozzle diameter (guess)	0.2020	
nozzle velocity V_n	33.7250	
$V_{min\ RE<3162}$	20.3194	
$V_{max\ RE<3162}$	36.0684	
$V_{min\ RE>=3162}$	12.8201	
$V_{max\ RE>=3162}$	32.8728	

Δp min RE<3162	0.1119
Δp max RE<3162	0.3527
Δp min	0.0446
Δp max	0.2930

		sample time	120	calculated	actual	actual
		number points	12	sample	sample	elapsed
	Δp	sqrtΔp		time	time	time
12	0.135	0.367	t1	10.52	10.50	10.50
11	0.130	0.361	t2	10.35	10.25	20.75
10	0.109	0.330		9.46	9.50	30.25
9	0.120	0.346		9.92	10.00	40.25
8	0.119	0.345		9.89	10.00	50.25
7	0.100	0.316		9.06	9.00	59.25
6	0.135	0.367		10.52	10.50	69.75
5	0.129	0.359		10.29	10.25	80.00
4	0.110	0.332		9.52	9.50	89.50
3	0.130	0.361		10.35	10.25	99.75
2	0.128	0.358		10.26	10.25	110.00
1	0.120	0.346		9.92	10.00	120.00
average*	0.12	0.349		120.1		

D_{50} RE<3162 = 2.50023

VALID RESULTS, INC.: EPA Method 201A* - PM-2.5 Air Emissions Test Data

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Natural Gas
Load Rating:	>90%
Barometric Pressure (P_{bar}):	30.10
Stack Diameter (D_s):	156.0
Test Run #:	1

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	5mm-A	5/19/01	D_n =	0.202
Pitot Tube:	316 SS	72A	4/15/01	C_p =	0.84
Stack TC:	316 SS	72A	4/15/01	Y_d =	0.9566
Meter:		Nutech #1	11/24/00	ΔH@=	1.9348
Filter:	Glass Fiber	VR2"183			

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	5.8
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	24.3
Stack Static Pressure (P_{static}):	-0.41	Stack Moisture (%H_2O):	7.25

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	727.7	672.4	55.3	DI H_2O
2	687.5	685.2	2.3	DI H_2O
3	542.5	542.7	-0.2	empty
4	757.3	752.1	5.2	Silica Gel

Impinger Water Weight Gain =	57.4
Silica Gel Weight Gain =	5.2

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE6	0.0	904.281	0.135	210	66	64	0.36	0.3674	0.14
NE4	10.0	907.856	0.130	209	63	61	0.36	0.3606	0.14
NE2	20.0	911.123	0.109	208	63	60	0.36	0.3302	0.14
SE6	30.0	914.125	0.120	210	68	66	0.36	0.3464	0.14
SE4	40.0	917.398	0.119	209	65	63	0.36	0.3450	0.14
SE2	50.0	920.553	0.100	209	66	63	0.36	0.3162	0.14
SW6	60.0	923.486	0.135	210	65	61	0.36	0.3674	0.14
SW4	70.0	926.783	0.129	209	68	69	0.36	0.3592	0.14
SW2	80.0	930.071	0.110	208	67	62	0.36	0.3317	0.14
NW6	90.0	933.158	0.130	210	66	62	0.36	0.3606	0.14
NW4	100.0	936.475	0.128	209	63	59	0.36	0.3578	0.14
NW2	110.0	939.828	0.120	207	61	58	0.36	0.3464	0.14
	120.0	943.112							
Averages	120.0	38.831		<209.0>	<63.7>		<0.36>	<0.349>	<0.14>

VALID RESULTS, INC.: EPA Method 201A* - PM-2.5 Air Emissions Test Data

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement	Equipment	Material	ID#	Cal Date		Value	Impinger Weight Gain			Net	Charge
Date:	5/19/01	Nozzle	316 SS	5mm-A	5/19/01	D_n =	0.202	#	Vfinal	Vinitial	Gain	Solution
Operator:	T. Prevo	Pitot Tube:	316 SS	72A	4/15/01	C_p =	0.84	1	654.1	597.8	56.3	DI H_2O
Plant Location:	Seattle, WA	Stack TC:	316 SS	72A	4/15/01	Y_d =	0.9566	2	590.5	591.4	-0.9	DI H_2O
Source:	Main Stack Outlet	Meter:		Nutech #1	11/24/00	ΔH@=	1.9348	3	520.9	521.2	-0.3	empty
Fuel Type:	Natural Gas	Filter:	Glass Fiber	VR2"184				4	729.0	725.8	3.2	Silica Gel

Load Rating:	>90%	Probe Liner: Quartz Glass					
Barometric Pressure (P_{bar}):	30.12	Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	5.7	Impinger Weight Gain =	55.1
Stack Equiv. Diameter (D_e):	156.0	Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	24.5	Silica Gel Weight Gain =	3.2
Test Run #:	2	Stack Static Pressure (P_{static}):	-0.39	Stack Moisture (%H_2O):	6.82		

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
NE6	0.0	945.068	0.130	216	71	69	0.36	0.3606	0.14
NE4	10.0	948.511	0.140	215	72	67	0.36	0.3742	0.14
NE2	20.0	951.958	0.110	214	74	71	0.36	0.3317	0.14
SE6	30.0	955.127	0.130	215	71	70	0.36	0.3606	0.14
SE4	40.0	958.514	0.125	214	77	73	0.36	0.3536	0.14
SE2	50.0	961.793	0.110	213	76	75	0.36	0.3317	0.14
SW6	60.0	964.918	0.123	212	78	75	0.36	0.3507	0.14
SW4	70.0	968.196	0.121	212	76	75	0.36	0.3479	0.14
SW2	80.0	971.462	0.109	210	76	79	0.36	0.3302	0.14
NW6	90.0	974.557	0.132	214	82	75	0.36	0.3633	0.14
NW4	100.0	977.878	0.140	214	80	75	0.36	0.3742	0.14
NW2	110.0	981.262	0.116	213	79	76	0.36	0.3406	0.14
	120.0	984.447							
Averages	120.0	39.379		<213.5>	<74.7>		<0.36>	<0.352>	<0.14>

STR01511

VALID RESULTS, INC.: EPA Method 201A* - PM-2.5 Air Emissions Test Data

Seattle, WA - Raw Mill On

Client:	Ash Grove Cement	Equipment	Material	ID#	Cal Date		Value	Impinger Weight Gain			Net	Charge
Date:	5/19/01	Nozzle	316 SS	5mm-A	5/19/01	D_n =	0.202	#	Vfinal	Vinitial	Gain	Solution
Operator:	T. Prevo	Pitot Tube:	316 SS	72A	4/15/01	C_p =	0.84	1	693.8	631.3	62.5	DI H_2O
Plant Location:	Seattle, WA	Stack TC:	316 SS	72A	4/15/01	Y_d =	0.9566	2	613.4	614.8	-1.4	DI H_2O
Source:	Main Stack Outlet	Meter:		Nutech #1	11/24/00	ΔH@=	1.9348	3	478.8	477.4	1.4	empty
Fuel Type:	Natural Gas	Filter:	Glass Fiber	VR2"185				4	734.2	729.9	4.3	Silica Gel
Load Rating:	>90%	Probe Liner: Quartz Glass										
Barometric Pressure (P_{bar}):	30.11	Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	5.5			Total Impinger Water Weight Gain =	62.5			
Stack Equiv. Diameter (D_e):	156.0	Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	24.5			Total Silica Gel Weight Gain =	4.3			
Test Run #:	3	Stack Static Pressure (P_{static}):	-0.40	Stack Moisture (%H_2O):	7.58							

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	T_m - out	ΔH	√ΔP	CFM
NE6	0.0	985.630	0.140	220	65	64	0.37	0.3742	0.14
NE4	10.0	989.153	0.129	221	67	64	0.37	0.3592	0.14
NE2	20.0	992.431	0.105	219	69	66	0.37	0.3240	0.14
SE6	30.0	995.417	0.140	219	69	69	0.37	0.3742	0.14
SE4	40.0	998.879	0.135	219	72	70	0.37	0.3674	0.14
SE2	50.0	1002.278	0.120	218	72	70	0.37	0.3464	0.14
SW6	60.0	1005.497	0.127	220	69	65	0.37	0.3564	0.14
SW4	70.0	1008.799	0.132	220	68	64	0.37	0.3633	0.14
SW2	80.0	1012.131	0.118	218	69	65	0.37	0.3435	0.14
NW6	90.0	1015.276	0.140	220	68	65	0.37	0.3742	0.14
NW4	100.0	1018.752	0.138	220	68	65	0.37	0.3715	0.14
NW2	110.0	1022.171	0.125	218	68	71	0.37	0.3536	0.14
	120.0	1025.421							
Averages	120.0	39.791		<219.3>	<67.6>		<0.37>	<0.359>	<0.14>

AGCS2M1000215
S4000658

VALID RESULTS, INC.: PM-2.5 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.000	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill Off
Run 1

P_{bar}	29.81	
P_{static}	-0.35	
t_s	485.8	
t_m	63.8	
ΔH@	1.9348	
$\%CO_2$	23.2	
$\%O_2$	7.4	
$\%N_2+\%CO$	69.4	
B_{ws}	0.089	
M_d	32.01	
M_w	30.76	
P_s	29.78	
viscosity =	273.1478	
cyclone flow rate $Q_{s\ (4<3162)}$	0.7402	ft3/min
cyclone flow rate $Q_{s\ (4>=3162)}$	1.7647	
D50 2.5	40667.6532	
D50 C4	2.5002	
Cr	1.1163	
C	1.1164	
RE<3162	2267.654	
RE>=3162	5406.281	
D50 C4 RE	2.5003	
pressure head needed ΔH <3162	0.5313	inches h2o
ΔH at 50 less ts	0.5923	
ΔH at 50 more	0.4793	
pressure head needed ΔH >=3162	3.0198	inches h2o
ΔH at 50 less ts	3.3664	
ΔH at 50 more	2.7242	
nozzle diameter (guess)	0.2020	
nozzle velocity V_n	55.4370	
$V_{min\ RE<3162}$	35.7263	
$V_{max\ RE<3162}$	60.6698	
$V_{min\ RE>=3162}$	29.1405	
$V_{max\ RE>=3162}$	57.0415	

Δp min RE<3162	0.2398
Δp max RE<3162	0.6915
Δp min	0.1595
Δp max	0.6112

sample time	120
number points	12

	Δp	sqrtΔp	
12	0.140	0.374	t1
11	0.130	0.361	t2
10	0.119	0.345	
9	0.141	0.375	
8	0.138	0.371	
7	0.110	0.332	
6	0.139	0.373	
5	0.125	0.354	
4	0.120	0.346	
3	0.141	0.375	
2	0.138	0.371	
1	0.128	0.358	
average*	0.13	0.361	

D_{50} RE<3162 = 2.50017

VALID RESULTS, INC.: PM-2.5 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.000	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill Off
Run 2

P_{bar}	29.80	
P_{static}	-0.35	
t_s	434.1	
t_m	68.5	
ΔH@	1.9348	
$\%CO_2$	22.8	
$\%O_2$	7.1	
$\%N_2+\%CO$	70.1	
B_{ws}	0.0888	
M_d	31.93	
M_w	30.69	
P_s	29.77	
viscosity =	259.2193	
cyclone flow rate $Q_{s\ (4<3162)}$	0.6835	ft3/min
cyclone flow rate $Q_{s\ (4>=3162)}$	1.6492	
C	1.1075	
RE<3162	2327.955	
RE>=3162	5617.064	
pressure head needed ΔH <3162	0.5102	inches h2o
ΔH at 50 less ts	0.5725	
ΔH at 50 more	0.4576	
pressure head needed ΔH >=3162	2.9707	inches h2o
ΔH at 50 less ts	3.3330	
ΔH at 50 more	2.6643	
nozzle diameter (guess)	0.2020	
nozzle velocity V_n	51.1905	
$V_{min\ RE<3162}$	32.7241	
$V_{max\ RE<3162}$	55.8599	
$V_{min\ RE>=3162}$	26.1802	
$V_{max\ RE>=3162}$	52.3295	
Δp min RE<3162	0.2122	
Δp max RE<3162	0.6185	
Δp min	0.1358	
Δp max	0.5428	
sample time	120	
number points	12	

	Δp	sqrtΔp	
12	0.165	0.406	t1
11	0.159	0.399	t2
10	0.130	0.361	
9	0.155	0.394	
8	0.135	0.367	
7	0.119	0.345	
6	0.151	0.389	
5	0.149	0.386	
4	0.129	0.359	
3	0.155	0.394	
2	0.150	0.387	
1	0.125	0.354	
average*	0.14	0.378	

D_{50} RE<3162 = 2.49982

VALID RESULTS, INC.: PM-2.5 Emission Rate Calculation Form

Client:	Valid Results, Inc.	Standard Temperature:	528	°Rankine
Operator:	T. Prevo	Standard Pressure:	29.92	inches mercury
Plant Location:	Seattle, WA	Pitot Tube Coefficient (C_p):	0.84	dimensionless
Source:	Main Stack Outlet	Meter Coefficient (Y_d):	0.9566	dimensionless
Control Equip:	Baghouse	Stack Diameter:	156.000	inches
Permit Limits:	N/A	Stack Outlet Area (A_s):	132.733	square feet

Seattle, WA - Raw Mill Off
Run 3

P_{bar}	29.72	
P_{static}	0.74	
t_s	445.6	
t_m	72.5	
ΔH@	1.9348	
$\%CO_2$	22.7	
$\%O_2$	7.4	
$\%N_2+\%CO$	69.9	
B_{ws}	0.0925	
M_d	31.93	
M_w	30.64	
P_s	29.77	
viscosity =	262.1555	
cyclone flow rate $Q_{s\ (4<3162)}$	0.6964	ft3/min
cyclone flow rate $Q_{s\ (4>=3162)}$	1.6751	
C	1.1095	
RE<3162	2311.770	
RE>=3162	5560.664	
pressure head needed ΔH <3162	0.5174	inches h2o
ΔH at 50 less ts	0.5796	
ΔH at 50 more	0.4647	
pressure head needed ΔH >=3162	2.9936	inches h2o
ΔH at 50 less ts	3.3537	
ΔH at 50 more	2.6885	
nozzle diameter (guess)	0.2020	
nozzle velocity V_n	52.1566	
$V_{min\ RE<3162}$	33.4163	
$V_{max\ RE<3162}$	56.9596	
$V_{min\ RE>=3162}$	26.8806	
$V_{max\ RE>=3162}$	53.4128	

Δp min RE<3162	0.2182
Δp max RE<3162	0.6338
Δp min	0.1412
Δp max	0.5574

sample time	120
number points	12

	Δp	sqrtΔp	
12	0.125	0.354	t1
11	0.129	0.359	t2
10	0.119	0.345	
9	0.130	0.361	
8	0.128	0.358	
7	0.115	0.339	
6	0.132	0.363	
5	0.125	0.354	
4	0.109	0.330	
3	0.140	0.374	
2	0.135	0.367	
1	0.115	0.339	
average*	0.125	0.354	

D_{50} RE<3162 = 2.50012

STR01511

VALID RESULTS, INC.: EPA Method 201A* - PM-2.5 Air Emissions Test Data

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Natural Gas
Load Rating:	>90%
Barometric Pressure (P_{bar}):	29.81
Stack Diameter (D_e):	156.0
Test Run #:	1

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/15/01	D_n =	0.202
Pitot Tube:	316 SS	72A	4/25/01	C_p =	0.84
Stack TC:	316 SS	72A	4/25/01	Y_d =	0.9566
Meter:		Nutech #1	11/24/00	ΔH@=	1.9348
Filter:	Glass Fiber	VR2"180			

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	7.4
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	23.2
Stack Static Pressure (P_{static}):	-0.35	Stack Moisture (%H_2O):	8.91

Impinger Weight Gain				
#	Vfinal	Vinitial	Net Gain	Charge Solution
1	704.4	630.6	73.8	DI H_2O
2	647.8	639.0	8.8	DI H_2O
3	479.0	478.4	0.6	empty
4	688.7	685.9	2.8	Silica Gel

Impinger Water Weight Gain = 83.2
Silica Gel Weight Gain = 2.8

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
SW2	0.0	758.874	0.140	489	64	60	0.45	0.3742	0.17
SW3	10.0	762.367	0.130	489	63	61	0.45	0.3606	0.17
SW5	20.0	765.817	0.119	485	64	63	0.45	0.3450	0.17
NW2	30.0	769.203	0.141	489	63	62	0.45	0.3755	0.17
NW3	40.0	773.208	0.138	487	65	63	0.45	0.3715	0.17
NW5	50.0	776.742	0.110	483	66	63	0.45	0.3317	0.17
NE2	60.0	780.077	0.139	485	66	62	0.45	0.3728	0.17
NE3	70.0	783.794	0.125	485	66	63	0.45	0.3536	0.17
NE5	80.0	787.292	0.120	480	67	62	0.45	0.3464	0.17
SE2	90.0	790.727	0.141	488	66	63	0.45	0.3755	0.17
SE3	100.0	794.549	0.138	487	66	64	0.45	0.3715	0.17
SE5	110.0	798.256	0.128	483	66	63	0.45	0.3578	0.17
	120.0	801.882							
Averages	120.0	43.008		<485.8>	<63.8>		<0.45>	<0.361>	<0.17>

AGCS2M000219
S4000662

VALID RESULTS, INC.: EPA Method 201A* - PM-2.5 Air Emissions Test Data

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Natural Gas
Load Rating:	>90%
Barometric Pressure (P_{bar}):	29.80
Stack Equiv. Diameter (D_e):	156.0
Test Run #:	2

Equipment	Material	ID#	Cal Date		Value
Nozzle	316 SS	6mm-A	5/15/01	D_n =	0.202
Pitot Tube:	316 SS	72A	4/25/01	C_p =	0.84
Stack TC:	316 SS	72A	4/25/01	Y_d =	0.9566
Meter:		Nutech #1	1/28/98	ΔH@=	1.9348
Filter:	Glass Fiber	VR2"181			

Probe Liner: Quartz Glass

Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	7.1
Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	22.8
Stack Static Pressure (P_{static}):	-0.35	Stack Moisture (%H_2O):	8.88

Impinger Weight Gain			Net	Charge
#	Vfinal	Vinitial	Gain	Solution
1	708.7	640.7	68.0	DI H_2O
2	717.6	703.1	14.5	DI H_2O
3	478.8	478.4	0.4	empty
4	664.9	655.8	9.1	Silica Gel

Impinger Weight Gain =	82.9
Silica Gel Weight Gain =	9.1

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
SW2	0.0	804.866	0.165	436	61	60	0.51	0.4062	0.20
SW3	10.0	808.027	0.159	436	64	61	0.51	0.3987	0.20
SW5	20.0	813.083	0.130	433	68	60	0.51	0.3606	0.20
NW2	30.0	816.769	0.155	435	69	62	0.51	0.3937	0.20
NW3	40.0	820.836	0.135	435	72	68	0.51	0.3674	0.20
NW5	50.0	824.631	0.119	432	69	67	0.51	0.3450	0.20
NE2	60.0	828.089	0.151	436	73	69	0.51	0.3886	0.20
NE3	70.0	832.057	0.149	435	71	69	0.51	0.3860	0.20
NE5	80.0	836.031	0.129	431	74	72	0.51	0.3592	0.20
SE2	90.0	839.738	0.155	435	72	70	0.51	0.3937	0.20
SE3	100.0	843.824	0.150	434	75	72	0.51	0.3873	0.20
SE5	110.0	847.813	0.125	431	74	71	0.51	0.3536	0.20
	120.0	851.471							
Averages	120.0	46.605		<434.1>	<68.5>		<0.51>	<0.378>	<0.20>

STR01511

VALID RESULTS, INC.: EPA Method 201A* - PM-2.5 Air Emissions Test Data

Seattle, WA - Raw Mill Off

Client:	Ash Grove Cement	Equipment	Material	ID#	Cal Date		Value	Impinger Weight Gain			Net	Charge
Date:	5/15/01	Nozzle	316 SS	6mm-A	5/15/01	D_n =	0.202	#	Vfinal	Vinitial	Gain	Solution
Operator:	T. Prevo	Pitot Tube:	316 SS	72A	4/25/01	C_p =	0.84	1	752.7	675.5	77.2	DI H_2O
Plant Location:	Seattle, WA	Stack TC:	316 SS	72A	4/25/01	Y_d =	0.9566	2	591.6	580.7	10.9	DI H_2O
Source:	Main Stack Outlet	Meter:		Nutech #1	1/28/98	ΔH@=	1.9348	3	497.3	496.6	0.7	empty
Fuel Type:	Natural Gas	Filter:	Glass Fiber	VR2"182				4	692.3	685.7	6.6	Silica Gel
Load Rating:	>90%	Probe Liner: Quartz Glass										
Barometric Pressure (P_{bar}):	29.72	Standard Temperature (T_{std}):	68	Stack Oxygen (%O_2):	7.4	Total Impinger Water Weight Gain =	88.8					
Stack Equiv. Diameter (D_e):	156.0	Standard Pressure (P_{std}):	29.92	Stack Carbon Dioxide (%CO_2):	22.7	Total Silica Gel Weight Gain =	6.6					
Test Run #:	3	Stack Static Pressure (P_{static}):	0.74	Stack Moisture (%H_2O):	9.25							

Port ID & Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. T_m - in	Meter Temp. T_m - out	ΔH	√ΔP	CFM
SW2	0.0	852.688	0.125	447	73	71	0.52	0.3536	0.20
SW3	10.0	856.619	0.129	447	74	72	0.52	0.3592	0.20
SW5	20.0	860.496	0.119	442	73	71	0.52	0.3450	0.20
NW2	30.0	864.312	0.130	450	74	71	0.52	0.3606	0.20
NW3	40.0	868.343	0.128	448	74	72	0.52	0.3578	0.20
NW5	50.0	872.214	0.115	443	74	72	0.52	0.3391	0.20
NE2	60.0	875.899	0.132	446	75	72	0.52	0.3633	0.20
NE3	70.0	879.932	0.125	445	75	74	0.52	0.3536	0.20
NE5	80.0	883.842	0.109	441	77	75	0.52	0.3302	0.20
SE2	90.0	887.496	0.140	448	74	68	0.52	0.3742	0.20
SE3	100.0	891.543	0.135	447	74	66	0.52	0.3674	0.20
SE5	110.0	895.656	0.115	443	73	67	0.52	0.3391	0.20
	120.0	899.412							
Averages	120.0	46.724		<445.6>	<72.5>		<0.52>	<0.354>	<0.20>

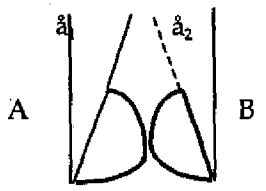
AGC S2M000221
10/2/01
S4000664

APPENDIX C

CALIBRATIONS

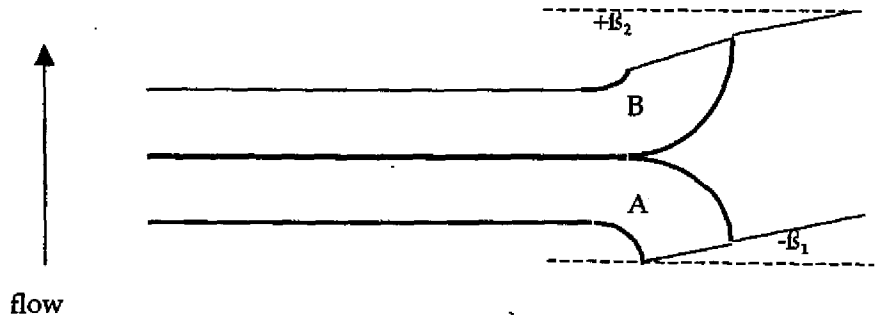
VALID RESULTS, INC.: Pitot Tube Calibration

Date: 4/25/01
Operator: T. Prewo
Pitot Tube ID: 72A



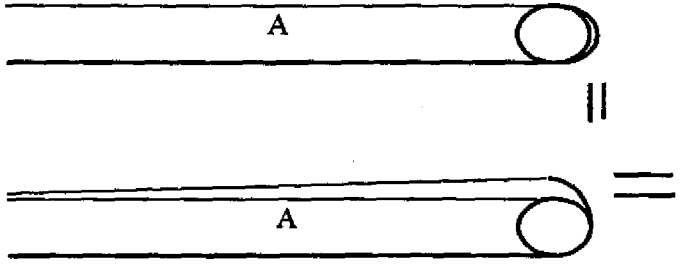
å1 = 1° ≤ 10°

å2 = Ø° ≤ 10°



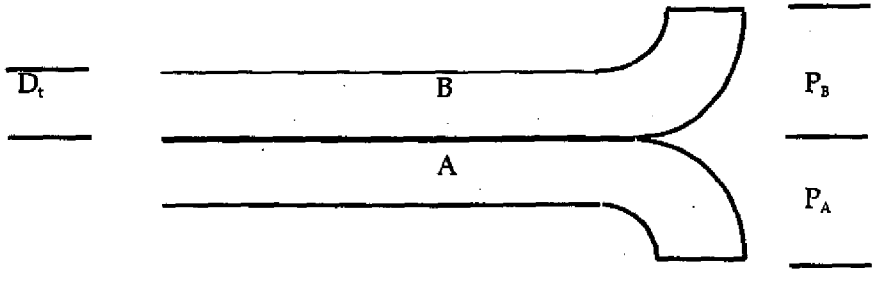
ß2 = 1° ≤ 5°

ß1 = Ø ≤ 5°



Z = Ø" ≤ 1/8"

W = Ø ≤ 1/32"



Dt = 0.386" 1.05*Dt ≤ P ≤ 1.50*Dt

PB = 0.485"

✓ PA = PB

PA = 0.485"

STR01511

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AGCS2M000223 10/2/01

S4000666

VALID RESULTS, INC.: Type-K Stack Thermocouple Calibration

Date: 4/25/07
Operator: T. Parvo
Reference Thermometer: Hg
Barometric Pressure:

Thermocouple #	Identification	Reference Point	TC Reading °F	Ref Therm Reading °F	Difference	% Difference
72A	Stack	Ice Water	37	36	1	0.2
		Boiling Water	219	217	2	0.3
		Boiling Oil	338	334	4	0.5

STR01511

DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

ENVIRONMENTAL SUPPLY COMPANY

1) Select three critical orifices to calibrate the dry gas meter.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 11/21/00 | METER SERIAL #: 80855 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.69, FINAL 29.69, AVG (P_{bar}) 29.69

METER PART #: Nut #1 | CRITICAL ORIFICE SET SERIAL #: 1301

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	dH@	dH@ VAR
34	1	0.9417	15	972.0	984.254	12.254	60	52	52	51	46	50.25	10.00	4.99	12.7409	12.2645	0.9628		1.9661	
	2	0.9417	15	984.254	996.533	12.279	59	52	52	48	46	49	10.00	4.99	12.7983	12.2783	0.9592		1.9672	
	3	0.9417	15	996.533	1,008.808	12.276	59	52	52	48	46	49	10.00	4.99	12.7952	12.2783	0.9594		1.9674	
																AVG =	0.9604	0.06	1.9669	0.01
30	1	0.8081	16	810.0	820.376	10.376	54	52	52	53	46	50.75	10.00	3.69	10.7435	10.5858	0.9853		1.9374	
	2	0.8081	16	820.376	830.778	10.402	55	52	51	46	47	49	10.00	3.69	10.8074	10.5755	0.9785		1.9479	
	3	0.8081	16	830.778	841.899	11.121	58	51	50	47	46	48.5	10.00	3.69	11.5658	10.5449	0.9117		1.9611	
																AVG =	0.9585	-0.11	1.9488	-0.01
23	1	0.6095	18	852.0	859.964	7.964	58	52	51	45	44	48	10.00	2.11	8.2586	7.9533	0.9630		1.9580	
	2	0.6095	18	859.964	867.944	7.980	59	51	50	44	45	47.5	10.00	2.11	8.2833	7.9457	0.9592		1.9637	
	3	0.6095	18	867.944	875.924	7.980	59	50	48	45	44	46.75	10.00	2.11	8.2956	7.9457	0.9578		1.9685	
																AVG =	0.960	0.04	1.9627	0.00

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9596

Average Delta H@ = 1.9595

(1) $V_m(std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}(std) = K' \sqrt{\frac{P_{bar}\,\theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr}(std)}{V_m(std)}$ = DGM calibration factor

AGCS2M000225 10/2/01

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DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 11/21/00 | METER SERIAL #: 80855 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.69, FINAL 29.69, AVG (P_{bar}) 29.69

METER PART #: Nut #1 | CRITICAL ORIFICE SET SERIAL #: 1301

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	dH@	dH@ VAR
30	1	0.8081	18	810.0	820.376	10.376	54	52	52	53	46	50.75	10.00	3.69	10.7435	10.5858	0.9853		1.9374	
	2	0.8081	18	820.376	830.778	10.402	55	52	51	46	47	49	10.00	3.69	10.8074	10.5755	0.9785		1.9479	
	3	0.8081	18	830.778	841.899	11.121	58	51	50	47	46	48.5	10.00	3.69	11.5658	10.5449	0.9117		1.9611	
																AVG =	0.9585	0.18	1.9488	0.01
23	1	0.8095	18	852.0	859.984	7.984	58	52	51	45	44	48	10.00	2.11	8.2586	7.9533	0.9630		1.9580	
	2	0.8095	18	859.984	867.944	7.960	59	51	50	44	45	47.5	10.00	2.11	8.2833	7.9457	0.9592		1.9637	
	3	0.8095	18	867.944	875.924	7.980	59	50	48	45	44	46.75	10.00	2.11	8.2958	7.9457	0.9578		1.9665	
																AVG =	0.960	0.33	1.9627	0.02
17	1	0.4545	20	912.0	917.996	5.996	58	49	48	44	45	46.5	10.00	1.14	6.2213	5.9307	0.9533		1.9988	
	2	0.4545	20	917.996	923.993	5.997	59	48	47	45	44	46	10.00	1.14	6.2285	5.9250	0.9513		1.9043	
	3	0.4545	20	923.993	929.984	5.991	59	47	47	44	44	45.5	10.00	1.14	6.2284	5.9250	0.9513		1.9062	
																AVG =	0.95197	-0.50	1.9031	-0.04

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9568 | Average Delta H@ = 1.9382

(1) $V_m(std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions
K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)
T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}(std) = K' \frac{P_{bar}\,\theta}{SQRT(T_{amb})}$ Volume of gas sample passed through the critical orifice, corrected to standard conditions
T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)
K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr}(std)}{V_m(std)}$ = DGM calibration factor

DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 11/21/00
METER PART #: Nut #1
METER SERIAL #: 80855
CRITICAL ORIFICE SET SERIAL #: 1301

BAROMETRIC PRESSURE (in Hg):	INITIAL	FINAL	AVG (P_{bar})
	29.69	29.67	29.68
Orifice #12 Pbar	29.99	29.99	29.99

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT³) INITIAL	DGM READINGS (FT³) FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	dH@	dH@ VAR
23	1	0.6095	18	852.0	859.964	7.964	58	52	51	45	44	48	10.00	2.11	8.2558	7.9507	0.9630		1.9587	
	2	0.6095	18	859.964	867.944	7.980	59	51	50	44	45	47.5	10.00	2.11	8.2805	7.9430	0.9592		1.9644	
	3	0.6095	18	867.944	875.924	7.980	59	50	48	45	44	46.75	10.00	2.11	8.2928	7.9430	0.9578		1.9672	
																AVG =	0.960	0.69	1.9634	0.06
17	1	0.4545	20	912.0	917.996	5.996	58	49	48	44	45	46.5	10.00	1.14	6.2192	5.9287	0.9533		1.8995	
	2	0.4545	20	917.996	923.993	5.997	59	48	47	45	44	46	10.00	1.14	6.2264	5.9230	0.9513		1.9049	
	3	0.4545	20	923.993	929.984	5.991	59	47	47	44	44	45.5	10.00	1.14	6.2263	5.9230	0.9513		1.9069	
																AVG =	0.95197	-0.15	1.9038	0.00
12	1	0.3174	22	938.00	942.204	4.204	58	49	48	48	46	47.75	10.00	0.548	4.3887	4.1836	0.9533		1.8427	
	2	0.3174	22	942.204	946.413	4.209	60	49	47	46	45	46.5	10.00	0.547	4.4048	4.1755	0.9479		1.8514	
	3	0.3174	22	946.413	950.635	4.222	61	47	47	45	45	46	10.00	0.549	4.4228	4.1715	0.9432		1.8633	
																AVG =	0.9481	-0.56	1.8525	-0.05

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9534

Average Delta H@ = 1.9066

(1) V_m (std) = $K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) V_{cr} (std) = $K' \frac{P_{bar}\,\theta}{T_{amb}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr}(std)}{V_m(std)}$ = DGM calibration factor

DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 11/24/00
METER PART #: Nut #2
METER SERIAL #: 60857
CRITICAL ORIFICE SET SERIAL #: 1301

BAROMETRIC PRESSURE (in Hg): INITIAL 29.95 | FINAL 29.8 | AVG (P_{bar}) 29.875

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT³) INITIAL	DGM READINGS (FT³) FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	dH@	dH@ VAR
23	1	0.6095	20	261.0	269.137	8.137	77	90	89	86	82	86.75	10.00	2.15	7.8890	7.860	0.9963		1.9099	
	2	0.6095	20	269.137	277.275	8.138	77	89	87	82	82	85	10.00	2.15	7.9153	7.860	0.9930		1.9159	
	3	0.6095	20	277.275	285.409	8.134	77	87	87	82	82	84.5	10.00	2.15	7.9187	7.860	0.9926		1.9176	
																AVG =	0.9940	-0.02	1.9145	0.04
17	1	0.4545	22	295.0	302.057	6.057	73	78	86	83	81	82	10.00	1.18	5.9098	5.8831	0.9955		1.8783	
	2	0.4545	22	302.057	308.118	6.061	78	88	86	81	82	83.75	10.00	1.18	5.8847	5.8557	0.9934		1.8898	
	3	0.4545	22	308.118	314.162	6.044	77	86	85	82	83	84	10.00	1.18	5.8754	5.8611	0.9976		1.8854	
																AVG =	0.9955	0.13	1.8845	0.01
12	1	0.3174	23	316.0	320.238	4.238	78	85	84	83	83	83.75	10.00	0.559	4.1154	4.0893	0.9937		1.8300	
	2	0.3174	23	320.238	324.477	4.239	78	84	84	83	83	83.5	10.00	0.559	4.1183	4.0893	0.9930		1.8309	
	3	0.3174	23	324.477	328.716	4.239	78	84	84	83	83	83.5	10.00	0.559	4.1183	4.0893	0.9930		1.8309	
																AVG =	0.9932	-0.10	1.8306	-0.05

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9942

Average Delta H@ = 1.8765

(1) V_m (std) = $K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) V_{cr} (std) = $K' \frac{P_{bar}\,\theta}{T_{amb}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) Y = $\frac{V_{cr}\,(std)}{V_m\,(std)}$ = DGM calibration factor

STR01511
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DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

1) Select three critical orifices to calibrate the dry gas meter.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 11/24/00
METER PART #: Nut #2
METER SERIAL #: 80857
CRITICAL ORIFICE SET SERIAL #: 1301

BAROMETRIC PRESSURE (in Hg): INITIAL 29.95 | FINAL 29.95 | AVG (P_{bar}) 29.71

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	dH@	dH@ VAR
30	1	0.8081	17	220.0	230.665	10.665	76	86	87	86	87	86.5	10.00	3.75	10.3283	10.3829	1.0053		1.9142	
	2	0.8081	17	230.665	241.353	10.688	75	87	92	87	91	89.25	10.00	3.75	10.2988	10.3829	1.0082		1.9046	
	3	0.8081	17	241.353	252.044	10.691	77	92	92	91	93	92	10.00	3.75	10.2503	10.3835	1.0110		1.9025	
																AVG =	1.0082	0.90	1.9071	0.00
23	1	0.6095	20	261.0	269.137	8.137	77	90	89	86	82	86.75	10.00	2.15	7.8456	7.8165	0.9963		1.9265	
	2	0.6095	20	269.137	277.275	8.138	77	89	87	82	82	85	10.00	2.15	7.8718	7.8165	0.9930		1.9266	
	3	0.6095	20	277.275	285.409	8.134	77	87	87	82	82	84.5	10.00	2.15	7.8752	7.8165	0.9925		1.9287	
																AVG =	0.9939	-0.53	1.9253	0.02
17	1	0.4545	22	296.0	302.057	6.057	73	78	86	83	81	82	10.00	1.18	5.8773	5.8506	0.9955		1.8887	
	2	0.4545	22	302.057	308.118	6.061	79	85	88	81	82	83.75	10.00	1.18	5.8622	5.8233	0.9934		1.9003	
	3	0.4545	22	308.118	314.162	6.044	77	86	85	82	83	84	10.00	1.18	5.8431	5.8287	0.9975		1.8962	
																AVG =	0.9955	-0.37	1.8951	-0.01

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9992

Average Delta H@ = 1.9092

(1) $V_m(std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}(std) = K' \frac{P_{bar}\,\theta}{SQRT(T_{amb})}$ Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr}(std)}{V_m(std)}$ = DGM calibration factor

STR01511

DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

ENVIRONMENTAL SUPPLY COMPANY

1) Select three critical orifices to calibrate the dry gas meter.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 11/24/00 | METER SERIAL #: 80857 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.95, FINAL 29.95, AVG (P_{bar}) 29.95

METER PART #: Nut #2 | CRITICAL ORIFICE SET SERIAL #: 1301

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)	dH@	dH@ VAR
34	1	0.9417	16	153.0	165.266	12.266	69	72	75	70	72	72.25	10.00	5.15	12.3585	12.2662	0.9943		1.9628	
	2	0.9417	16	165.266	177.564	12.298	71	75	78	72	72	73.75	10.00	5.15	12.3339	12.2430	0.9928		1.9648	
	3	0.9417	16	177.564	189.877	12.313	71	76	83	72	78	77.5	10.00	5.15	12.2628	12.2430	0.9984		1.9509	
																AVG =	0.9951	-0.40	1.9595	0.04
30	1	0.8081	17	220.0	230.665	10.665	75	86	87	88	87	86.5	10.00	3.75	10.4110	10.4667	1.0054		1.8985	
	2	0.8081	17	230.665	241.353	10.688	75	87	92	87	91	89.25	10.00	3.75	10.3812	10.4667	1.0082		1.8893	
	3	0.8081	17	241.353	252.044	10.691	77	92	92	91	93	92	10.00	3.75	10.3323	10.4472	1.0114		1.8869	
																AVG =	1.0082	0.91	1.8916	-0.03
23	1	0.6095	20	261.0	269.137	8.137	77	90	89	88	82	86.75	10.00	2.15	7.9087	7.8797	0.9963		1.9051	
	2	0.6095	20	269.137	277.275	8.138	77	89	87	82	82	85	10.00	2.15	7.9351	7.8797	0.9930		1.9112	
	3	0.6095	20	277.275	285.409	8.134	77	87	87	82	82	84.5	10.00	2.15	7.9384	7.8797	0.9926		1.9128	
																AVG =	0.9940	-0.51	1.9097	-0.01

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = 0.9991 | Average Delta H@ = 1.9203

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are

(1) $V_m\,(std) = K_1 V_m \dfrac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}\,(std) = K' \sqrt{\dfrac{P_{bar}\,\theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \dfrac{V_{cr}\,(std)}{V_m\,(std)}$ = DGM calibration factor

AGC/SAM000230
S4000673

APPENDIX D

FIELD DATA

AGCS2M000231
S4000674

VALID RESULTS, INC.: EPA Method 2 - Volumetric Flow Rate Field Data Sheet 101

Client: Ashgrove Cement	Barometric Pressure (P_{bar}): 30.10	Pitot Tube Coeff. (C_p): 0.84
Date: 5-19-01	Standard Temperature (t_{std}): 68	% Oxygen (%O_2):
Operator: A. H.	Standard Pressure (P_{std}): 29.92	% Carbon Dioxide (%CO_2):
Location: Seattle, WA.	Stack Static Pressure (P_{static}): ✓ 0.410	Moisture Content (%H_2O):
Source: Main Stack Outlet	Fuel Type: RM ON mixed	Stack Diameter (D_e\D_s):
Run # 1	Time: 10:40	Load Rating: >90%	Pre-Test Pitot Tube Leak Check: ✓

RM ON

Port ID#	Point #	% Stack Inside Diam.	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube (ΔP)	Stack Temp. (t_s) °F	√ΔP
N.E.	1					0.140	210	
	2					0.135	210	
	3					0.129	209	
	4					0.120	209	
	5					0.110	208	
	6					0.070	204	
S.E.	1					0.135	210	
	2					0.130	210	
	3					0.128	209	
	4					0.139	209	
	5					0.120	207	
	6					0.070	203	
S.W.	1					0.140	210	
	2					0.135	210	
	3					0.130	209	
	4					0.125	210	
	5					0.109	208	
	6					0.070	205	
N.W.	1					0.130	210	
	2					0.120	210	
	3					0.119	209	
	4					0.115	208	
	5					0.100	209	
	6					0.070	200	
<Average>			Post-Test Pitot Tube Leak Check: ✓					

Molecular Weight Wet (MW_s) = ((0.44*(%CO_2) + 0.32*(%O_2) + 0.28*(%CO + %N_2))*(100-%H_2O) + 0.18*(%H_2O))

MW_s = _____ *lbs/lb-mole*

Stack Gas Velocity (V_s) = (85.49*C_p*(√ΔP)*(√((t_s + 460)/((P_{bar} + P_{static}/13.6)*MW_s)))

V_s = _____ *feet per second*

Corrected Stack Gas Volumetric Flow Rate ($Q_{s(corr)}$) = (60*((100-%H_2O)/100)*V_s*A_s*((t_{std} + 460)/(t_s + 460))*(P_s/P_{std}))

$Q_{s(corr)}$ = _____ *standard dry cubic feet per minute*

Actual Cubic Feet per Second ($Q_{s(actual)}$) = (60*V_s*A_s)

$Q_{s(actual)}$ = _____ *actual cubic feet per minute*

VALID RESULTS, INC.: EPA Method 2 - Volumetric Flow Rate Field Data Sheet

Client: Ashgrove Cement	Barometric Pressure (P_{bar}): 30.12	Pitot Tube Coeff. (C_p): 0.84
Date: 5/19/01	Standard Temperature (t_{std}): 68	% Oxygen (%O_2):
Operator: T. Rowe, A. H.	Standard Pressure (P_{std}): 29.92	% Carbon Dioxide (%CO_2):
Location: Seattle WA	Stack Static Pressure (P_{static}): −0.39	Moisture Content (%H_2O):
Source: Main Stack Outlet	Fuel Type: mixed	Stack Diameter (D_e\D_s):
Run # 2 RMON Time: 13:00	Load Rating: 79%	Pre-Test Pitot Tube Leak Check: ✓

RM ON

Port ID#	Point #	% Stack Inside Diam.	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube (ΔP)	Stack Temp. (t_s) °F	√ΔP
NE	1					0.128	212	
	2					0.123	212	
	3					0.121	212	
	4					0.123	211	
	5					0.109	210	
	6					0.083	206	
SE	1					0.134	214	
	2					0.132	214	
	3					0.140	214	
	4					0.137	~~215~~ 214	
	5					0.116	213	
	6					0.088	210	
SW	1					0.135	216	
	2					0.130	216	
	3					0.140	215	
	4					0.125	215	
	5					0.110	214	
	6					0.075	207	
NW	1					0.135	215	
	2					0.130	215	
	3					0.125	214	
	4					0.115	214	
	5					0.110	213	
	6					0.075	201	
<Average>			Post-Test Pitot Tube Leak Check: ✓					

Molecular Weight Wet (MW_s) = ((0.44*(%CO_2) + 0.32*(%O_2) + 0.28*(%CO + %N_2))*(100-%H_2O) + 0.18*(%H_2O))

MW_s = _____ *lbs/lb-mole*

Stack Gas Velocity (V_s) = (85.49*C_p*(√ΔP)*(√((t_s + 460)/((P_{bar} + P_{static}/13.6)*MW_s)))

V_s = _____ *feet per second*

Corrected Stack Gas Volumetric Flow Rate ($Q_{s(corr)}$) = (60*((100-%H_2O)/100)*V_s*A_s*((t_{std} + 460)/(t_s + 460))*(P_s/P_{std}))

$Q_{s(corr)}$ = _____ *standard dry cubic feet per minute*

Actual Cubic Feet per Second ($Q_{s(actual)}$) = (60*V_s*A_s)

$Q_{s(actual)}$ = _____ *actual cubic feet per minute*

VALID RESULTS, INC.: EPA Method 2 - Volumetric Flow Rate Field Data Sheet

Client: Ash Grove Cement		Barometric Pressure (P_{bar}): 30.11		Pitot Tube Coeff. (C_p):	0.84
Date: 5/19/01		Standard Temperature (t_{std}):	68	% Oxygen (%O_2):	
Operator: T.P./A.H.		Standard Pressure (P_{std}):	29.92	% Carbon Dioxide (%CO_2):	
Location: Seattle, WA.		Stack Static Pressure (P_{static}):	-0.40	Moisture Content (%H_2O):	
Source: Main Stack Outlet		Fuel Type:	mixed	Stack Diameter (D_s\D_s):	
Run # 3	Time: 16:00	Load Rating:	70%	Pre-Test Pitot Tube Leak Check:	✓

RM ON

Port ID#	Point #	% Stack Inside Diam.	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube (ΔP)	Stack Temp. (t_s) °F	√ΔP
NE 1	1				6	0.140	220	
	2					0.127	220	
	3					0.132	220	
	4					0.129	219	
	5					0.118	218	
	6					0.082	212	
SE	1					0.145	220	
	2					0.140	220	
	3					0.138	220	
	4					0.130	219	
	5					0.125	218	
	6					0.100	215	
SW	1					0.150	220	
	2					0.140	220	
	3					0.129	221	
	4					0.131	220	
	5					0.105	219	
	6					0.090	215	
NW	1					0.150	220	
	2					0.140	219	
	3					0.135	219	
	4					0.130	218	
	5					0.120	218	
	6					0.090	212	
<Average>.			Post-Test Pitot Tube Leak Check:			✓		

Molecular Weight Wet (MW_s) = ((0.44*(%CO_2) + 0.32*(%O_2) + 0.28*(%CO + %N_2))*(100-%H_2O) + 0.18*(%H_2O))

MW_s = _____ *lbs/lb-mole*

Stack Gas Velocity (V_s) = (85.49*C_p*(√ΔP)*(√((t_s + 460)/((P_{bar} + P_{static}/13.6)*MW_s)))

V_s = _____ *feet per second*

Corrected Stack Gas Volumetric Flow Rate ($Q_{s(corr)}$) = (60*((100-%H_2O)/100)*V_s*A_s*((t_{std} + 460)/(t_s + 460))*(P_s/P_{std}))

$Q_{s(corr)}$ = _____ *standard dry cubic feet per minute*

Actual Cubic Feet per Second ($Q_{s(actual)}$) = (60*V_s*A_s)

$Q_{s(actual)}$ = _____ *actual cubic feet per minute*

AGCS2M000234
S4000677

VALID RESULTS, INC.: EPA Method 2 - Volumetric Flow Rate Field Data Sheet

Client: Ashland Chemical		Barometric Pressure (P_{bar}): 29.81		Pitot Tube Coeff. (C_p):	0.84
Date: 5/5/01		Standard Temperature (t_{std}):	68	% Oxygen (%O_2):	8.5
Operator: T. Ruro		Standard Pressure (P_{std}):	29.92	% Carbon Dioxide (%CO_2):	21.9
Location: Seattle, WA		Stack Static Pressure (P_{static}):	-0.35	Moisture Content (%H_2O):	7.3
Source: Main Stack Outlet		Fuel Type: Raw mill OFF		Stack Diameter (D_e\D_s):	156"
Run # 1	Time: 07:30	Load Rating: 710 t		Pre-Test Pitot Tube Leak Check:	✓

RM OFF

Port ID #	Point #	% Stack Inside Diam.	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube (ΔP)	Stack Temp. (t_s) °F	√ΔP
N.E.	1		9"	60.5"		0.140	426	
	2			48.0"		0.139	425	
	3			36.6"		0.135	425	
	4			27.4"		0.122	423	
	5			19.5"		0.120	420	
	6			12.3"		0.070	405	
S.E.	1					0.160	429	
	2					0.141	428	
	3					0.138	427	
	4					0.130	425	
	5					0.128	423	
	6					0.081	412	
S.W.	1					0.148	430	
	2					0.140	429	
	3					0.130	429	
	4					0.122	427	
	5					0.119	425	
	6					0.070	416	
N.W.	1					0.142	430	
	2					0.141	429	
	3					0.138	427	
	4					0.131	426	
	5					0.110	423	
	6					0.070	410	
<Average>			Post-Test Pitot Tube Leak Check:			✓		

Molecular Weight Wet (MW_s) = ((0.44*(%CO_2) + 0.32*(%O_2) + 0.28*(%CO + %N_2))*(100-%H_2O) + 0.18*(%H_2O))

MW_s = _____ *lbs/lb-mole*

Stack Gas Velocity (V_s) = (85.49*C_p*(√ΔP)*(√((t_s + 460)/((P_{bar} + P_{static}/13.6)*MW_s)))

V_s = _____ *feet per second*

Corrected Stack Gas Volumetric Flow Rate ($Q_{s(corr)}$) = (60*((100-%H_2O)/100)*V_s*A_s*((t_{std} + 460)/(t_s + 460))*(P_s/P_{std}))

$Q_{s(corr)}$ = _____ *standard dry cubic feet per minute*

Actual Cubic Feet per Second ($Q_{s(actual)}$) = (60*V_s*A_s)

$Q_{s(actual)}$ = _____ *actual cubic feet per minute*

AGCS2M000235

S4000678

VALID RESULTS, INC.: EPA Method 2 - Volumetric Flow Rate Field Data Sheet

Client: Ashgrove Cement	Barometric Pressure (P_{bar}): 29.80	Pitot Tube Coeff. (C_p): 0.84
Date: 5-15-01	Standard Temperature (t_{std}): 68	% Oxygen (%O_2):
Operator: A.H.	Standard Pressure (P_{std}): 29.92	% Carbon Dioxide (%CO_2):
Location: Seattle, WA.	Stack Static Pressure (P_{static}): -0.35	Moisture Content (%H_2O):
Source: Main stack outlet	Fuel Type: mixed	Stack Diameter (D_e\D_s):
Run # 2 / Time: 10:45	Load Rating: 79%	Pre-Test Pitot Tube Leak Check: ✓

RM OFF

Port ID#	Point #	% Stack Inside Diam.	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube (ΔP)	Stack Temp. (t_s) °F	√ΔP
N.E.								
	1					0.162	436	
	2					0.151	436	
	3					0.149	435	
	4					0.139	433	
	5					0.129	431	
	6					0.070	413	
S.E	1					0.160	436	
	2					0.155	435	
	3					0.150	434	
	4					0.139	432	
	5					0.125	431	
	6					0.090	420	
S.W.	1					0.179	437	
	2					0.165	436	
	3					0.159	436	
	4					0.149	435	
	5					0.130	433	
	6					0.081	417	
N.W.	1					0.160	437	
	2					0.155	435	
	3					0.135	435	
	4					0.129	433	
	5					0.119	432	
	6					0.070	403	
<Average>			Post-Test Pitot Tube Leak Check: ✓					

Molecular Weight Wet (MW_s) = ((0.44*(%CO_2) + 0.32*(%O_2) + 0.28*(%CO + %N_2))*(100-%H_2O) + 0.18*(%H_2O))

MW_s = _____ *lbs/lb-mole*

Stack Gas Velocity (V_s) = (85.49*C_p*(√ΔP)*(√((t_s + 460)/((P_{bar} + P_{static}/13.6)*MW_s)))

V_s = _____ *feet per second*

Corrected Stack Gas Volumetric Flow Rate ($Q_{s(corr)}$) = (60*((100-%H_2O)/100)*V_s*A_s*((t_{std} + 460)/(t_s + 460))*(P_s/P_{std}))

$Q_{s(corr)}$ = _____ *standard dry cubic feet per minute*

Actual Cubic Feet per Second ($Q_{s(actual)}$) = (60*V_s*A_s)

$Q_{s(actual)}$ = _____ *actual cubic feet per minute*

VALID RESULTS, INC.: EPA Method 2 - Volumetric Flow Rate Field Data Sheet

Client: Ashgrove Cement	Barometric Pressure (P_{bar}): 29.72	Pitot Tube Coeff. (C_p): 0.84
Date: 5-15-01	Standard Temperature (t_{std}): 68	% Oxygen (%O_2):
Operator: A.H.	Standard Pressure (P_{std}): 29.92	% Carbon Dioxide (%CO_2):
Location: Seattle, WA.	Stack Static Pressure (P_{static}): - 0.74	Moisture Content (%H_2O):
Source: Main Stack Outlet	Fuel Type: mixed	Stack Diameter (D_s\D_s):
Run # 3	Time: 15:09 / Load Rating: 79MW	Pre-Test Pitot Tube Leak Check: ✓

RM OFF

Port ID#	Point #	% Stack Inside Diam.	Port Depth	Probe Marks	Cyclonic Zero Angle	Pitot Tube (ΔP)	Stack Temp. (t_s) °F	√ΔP
N.E.	1					0.139	447	
	2					0.132	446	
	3					0.125	445	
	4					0.115	442	
	5					0.109	441	
	6					0.075	403	
S.E.	1					0.130	448	
	2					0.140	448	
	3					0.135	447	
	4					0.125	445	
	5					0.115	443	
	6					0.060	367	
S.W.	1					0.130	448	
	2					0.125	447	
	3					0.129	447	
	4					0.125	446	
	5					0.119	442	
	6					0.065	429	
N.W.	1					0.132	451	
	2					0.130	450	
	3					0.128	448	
	4					0.125	448	
	5					0.115	443	
	6					0.080	427	
<Average>			Post-Test Pitot Tube Leak Check: ✓					

Molecular Weight Wet (MW_s) = ((0.44*(%CO_2) + 0.32*(%O_2) + 0.28*(%CO + %N_2))*(100-%H_2O) + 0.18*(%H_2O))

MW_s = _____ *lbs/lb-mole*

Stack Gas Velocity (V_s) = (85.49*C_p*(√ΔP)*(√((t_s + 460)/((P_{bar} + P_{static}/13.6)*MW_s)))

V_s = _____ *feet per second*

Corrected Stack Gas Volumetric Flow Rate ($Q_{s(corr)}$) = (60*((100-%H_2O)/100)*V_s*A_s*((t_{std} + 460)/(t_s + 460))*(P_s/P_{std}))

$Q_{s(corr)}$ = _____ *standard dry cubic feet per minute*

Actual Cubic Feet per Second ($Q_{s(actual)}$) = (60*V_s*A_s)

$Q_{s(actual)}$ = _____ *actual cubic feet per minute*

AGCS2M000237

S4000680

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-10) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/14/01 5/19/01
Operator:	Tatharo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	mixed
Load Rating:	79072 Raw Mill ON
Barometric Pressure (P_{bar}):	30.10
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	
Run #	PM10/4

Equipment	Material	ID#	Cal. Date	Value
Nozzle	31655	6mm-A	5/10/01	D_n = 0.226
Pitot Tube:	1	72A	4/15/01	C_p = 0.84
Stack TC:	1	72A	4/15/01	Y_d = 0.9975
Meter:		Met #2	11/29/00	Δ H@= 1.9020
Filter:	Quartz 2"	179		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	675.4	603.2		H_2O
2	696.2	633.9		H_2O
3	512.9	512.5		empty
4	658.3	658.1		silica

609.3
695.1
511.8
650.5

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___,

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): @ -.410

O_2 5.8

CO_2 24.3

Moisture Weight Gain = ____ g TP recharge impinger

$V_{wc(std)} = 0.04707"(V_{final}-V_{initial})$ = ____ ft³

Silica Gel Weight Gain = ____ g

$V_{wsg(std)} = 0.04715"(W_{final}-W_{initial})$ = ____ ft³

Total Weight Gain = ____ g

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.002 @ 16 "Hg, Post-Test ___@___"Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	0 11:17	235.000											
NE 5	9.50	238.427	0.110	208	65	65	0.47			Stdy	N/A	52	3
3	19.75	242.150	0.129	209	66	64							
2	30.25	245.970	0.135	210	69	66							
		245.978											
SE 5	40.25	249.693	0.120	207	71	65						52	3
3	50.50	253.497	0.128	209	72	65							
2	60.75	257.251	0.130	210	74	66							
		257.251											
SW 5	70.25	260.773	0.109	209	74	66						52	3
3	80.50	264.591	0.130	209	69	65							
2	91.00	268.487	0.135	210	69	65							
		268.487											
NW 5	100.00	271.864	0.100	209	68	65						52	3
3	110.00	275.588	0.119	209	69	65							
2	120.00	279.302	0.120	210	68	63						52	3
	13:17												
<Average>													

STR01511

59

AGCS2M000238
10/2/01
S4000681

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-10) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Pluro
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	70% Raw Mill On
Barometric Pressure (P_{bar}):	30.12
Stack Equiv. Diameter (D_e):	163.15
Stack Moisture (%H_2O):	
Run #	2 PM 10/4

Equipment	Material	ID#	Cal. Date	Value
Nozzle				D_n = 0.226
Pitot Tube:				C_p = 0.84
Stack TC:				Y_d = 0.9975
Meter:		Nut#2		Δ H@= 1.9020
Filter:		186		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	620.5	584.1		H_2O
2	613.2	612.5		H_2O
3	476.2	476.1		empty
4	634.8	624.3		silica

Probe Liner: 316 SS ✓, Pyrex Glass ___, Quartz Glass ___

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): -.39

O_2 5.7

CO_2 24.5

Moisture Weight Gain = ___ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft³

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft³

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ___ VREPAM1,2 ___ Sample Train Leak Check: Pre-Test 0.002 @ 16 "Hg, Post-Test ___ @ ___ "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
NE 5	9.50	284.421	0.109	210	75	72	0.48			Stack	N/A	53	3
3	19.50	288.228	0.121	212	75	73							
2	29.50	292.023	0.123	212	78	75						52	3
		292.023											
SE 6	39.25	295.802	0.116	213	81	75							
3	49.75	299.774	0.140	214	86	77						52	3
2	60.00	303.632	0.132	214	~~89~~ 85	~~78~~ 76							
		303.632											
SW 5	69.50	307.136	0.110	214	81	77						51	3
3	80.00	311.114	0.140	215	77	75							
2	90.25	314.973	0.130	216	75	74							
		314.973											
NW 5	99.75	318.538	0.110	213	74	71						52	3
3	109.75	322.298	0.125	214	74	71							
2	120.00	326.136	0.130	215	73	71							
	16:14												
<Average>													

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-10) Concentration and Air Emission Rate Field Data Sheet

Client: Ash Grove Cement	Equipment	Material	ID#	Cal. Date	Value	Impinger Weight Gain			Net	Charge
Date: 5/19/01	Nozzle				D_n = 0.226	#	V_{final}	$V_{initial}$	Gain	Solution
Operator: T. Pluto	Pitot Tube:				C_p = 0.84	1	661.6	599.0		H_2O
Plant Location: Seattle, WA	Stack TC:				Y_d = 0.9975	2	657.7	655.5		H_2O
Source: Main Stack Outlet	Meter:				$\Delta H@$ = 1.9020	3	496.2	496.4		Empty
Fuel Type: mixed	Filter:		187			4	670.6	656.6		Silica

Load Rating: >90% RMON

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___

Barometric Pressure (P_{bar}): 30.11

Moisture Weight Gain = ___ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft^3

Stack Equiv. Diameter (D_e):

Standard Temperature (t_{std}): 68

Silica Gel Weight Gain = ___ g

Stack Moisture (%H_2O):

Standard Pressure (P_{std}): 29.92

O_2 5.5

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft^3

Run # 3 PM10 4

Stack Static Pressure (P_{static}): −40

CO_2 24.5

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.001 @ 14 "Hg, Post-Test ___ @ ___ "Hg

Port ID# Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	17:18	326.986											
NE 5	9.50	330.381	0.118	218	65	64	0.48			<Stack	NA	52	2
3	19.50	334.102	0.132	220	66	65							
2	29.75	337.906	0.137	220	69	66							
		337.906											
SE 5	39.50	341.574	0.125	218	74	68						52	2.5
3	49.75	345.398	0.138	220	73	68							
2	60.25	349.309	0.140	220	71	68							
		349.309											2.5
SW 5	69.25	352.693	0.105	219	69	68						52	
3	79.25	356.441	0.129	221	69	68							
2	89.75	360.386	0.140	220	69	69							
		360.386											
NW 5	99.25	363.977	0.120	218	70	69						52	2.5
3	109.50	367.823	0.135	219	68	68							
2	120.00	371.751	0.140	219	68	68							
	19:18												
<Average>													

VALID RESULTS INC : EPA Method 201A - Particulate Matter (PM-10) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Rivero
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	mixed Neo; Coal
Load Rating:	70% Raw Mill Off
Barometric Pressure (P_{bar}):	29.81
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	~~7.5~~ 8.5
Run #	1 PM10/4

Equipment	Material	ID#	Cal. Date	Value
Nozzle	316SS	6mm A	5/15/01	D_n = 0.226
Pitot Tube:	↓	72A	4/25/01	C_p = 0.84
Stack TC:	↓	72A	4/25/01	Y_d = 0.9975
Meter:		Meter # 2	11/24/00	$\Delta H@$ = 1.020
Filter:	glass	23	176	

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	675.4	609.3		H_2O
2	669.2	695.1		H_2O
3	512.9	511.8		empty
4	658.3	652.5		silica gel

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): -0.35

CO_2 2.9 2.0 2.2

O_2 7.4 ~~7.5~~ ~~8.5~~

Moisture Weight Gain = ___ g

$V_{w(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft³

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft³

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ___ VREPAM1,2 ___ Sample Train Leak Check: Pre-Test 0.002 @ 16 "Hg, Post-Test 0.001 @ 16 "Hg pitot train only

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	8:10	~~75.173~~											
NE 5	9.50	79.561	0.120	480	65	64	0.60			Stack	N/A	54	4"
3	19.50	83.732	0.125	485	68	65							
2	29.75	87.006	0.139	485	69	67						53	4"
		87.006											
SE 5	39.75	92.144	0.128	488	70	68						53	4"
3	50.00	96.429	0.138	487	72	69							
2	60.25	100.778	0.141	483	74	69						53	4"
		100.778											
SW 5	69.75	104.776	0.119	485	75	69						53	4"
3	79.75	108.977	0.130	489	75	71							
2	90.25	113.398	0.140	489	74	70						53	4"
		113.398											
NW 5	99.50	117.344	0.110	483	73	71							
3	109.75	121.635	0.138	487	72	72						53	4"
2	120.25	126.042	0.141	489	74	70							4.5"
				10°↑									
	10:11												
<Average>													

201A PM10

VALID RESULTS, INC.: EPA Method 5 - Particulate Matter Concentration and Air Emission Rate Field Data Sheet

Client:	Ashbrook Cement
Date:	5/15/01
Operator:	[illegible]
Plant Location:	Seattle, WA
Source:	Main Stack Out
Fuel Type:	wood
Load Rating:	90% RMOFF
Barometric Pressure (P_{bar}):	29.80
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	7
Run #	2 PM10

Equipment	Material	ID#	Cal. Date	Value
Nozzle		1		D_n = 0.226
Pitot Tube:	Cyprun			C_p = 0.84
Stack TC:				Y_d = 0.9975
Meter:		Wet #2		$\Delta H@$ = 1.9020
Filter:		177		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	620.5	564.1		H_2O
2	613.2	612.5		H_2O
3	476.2	476.1		empty
4	634.8	624.3		Silicagel

Probe Liner: 316 SS ___, Pyrex Glass ___, Quartz Glass ___,

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): -0.35

O_2 7.1

CO_2 22.8

Moisture Weight Gain = ___ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft^3

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft^3

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.001 @ 15 "Hg, Post-Test 0.001 @ 15 "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	11:45	129.654											
NE 5	950	133.709	0.129	431	65	64	~~0.44~~			Stack	N/A	52	4
3	19.75	138.002	0.149	435	65	65	0.60						
2	30.00	142.269	0.151	436	66	65						52	4
		142.269											
SE 5	39.50	146.274	0.125	431	65	65						52	4
3	49.76	150.567	0.150	434	68	67							
2	60.25	154.938	0.155	435	72	70						52	4
		154.938											
SW 5	69.75	158.944	0.130	433	69	69							
3	80.25	163.336	0.159	436	74	72						53	4
2	91.00	167.863	0.165	436	76	74							
		167.863										53	4
NW 5	100.00	171.761	0.119	432	79	75							
3	109.75	175.873	0.135	435	80	75						52	4
2	120.25	180.282	0.155	435	83	76							
	13:45												
<Average>													

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-10) Concentration and Air Emission Rate Field Data Sheet

Client:	Ashgrove Cement
Date:	5/15/01
Operator:	T Rhero
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	mixed
Load Rating:	290% Raw Mill OFF
Barometric Pressure (P_{bar}):	29.72
Stack Equiv. Diameter (D_s):	156"
Stack Moisture (%H_2O):	7
Run #	R3 PM10/4

Equipment	Material	ID#	Cal. Date	Value
Nozzle				D_n = 0.226
Pitot Tube:		1		C_p = 0.84
Stack TC:				Y_d = 0.9975
Meter:		No #2		$\Delta H@$ = 1.9020
Filter:		178		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	661.6	599.0		H_2O
2	657.7	655.5		H_2O
3	496.2	496.4		empty
4	670.6	656.6		Silica gel

Probe Liner: 316 SS ___, Pyrex Glass ___, Quartz Glass ___,

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): -0.24

O_2 7.4

CO_2 22.7

Moisture Weight Gain = ___ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft³

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft³

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.002 @ 15 "Hg, Post-Test 0.002 @ 15 "Hg Vacuum

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	ø 15:35	182.214											
NE 5	9.25	186.128	0.109	441	73	71	0.61			stack	NA	52	3
3	19.25	190.283	0.125	445	74	72							
2	29.50	194.592	0.132	446	75	74						52	3
		194.592											
SE 5	39.00	198.717	0.115	443	77	76						52	3
3	49.25	203.023	0.135	447	80	75							
2	59.75	207.476	0.140	448	84	75						52	3
		207.476											
SW 5	69.50	211.643	0.119	442	86	75						52	3.5
3	79.75	216.972	0.129	447	80	75							
2	89.75	220.896	0.125	447	79	76						52	3
		220.896											
NW 5	99.25	224.273	0.115	445	78	75						52	3.4
3	109.25	228.511	0.128	449	82	74							
2	119.50	232.882	0.130	450	78	72							
127.35													
<Average>													

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-~~10~~ 2.5) Concentration and Air Emission Rate Field Data Sheet

Client:	Ashgrove Cement
Date:	5/19/01
Operator:	T. Pavo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	mixed
Load Rating:	790% Raw mill ON
Barometric Pressure (P_{bar}):	30.10
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	
Run #	1 PM 2.5/202

Equipment	Material	ID#	Cal. Date	Value
Nozzle	316SS	5mm-A	5/19/01	D_n = 0.202
Pitot Tube:	-	72A	4/15/01	C_p = 0.84
Stack TC:		72A	4/15/01	Y_d = 0.9566
Meter:		Nut #1	11/24/00	$\Delta H@$ = 1.9348
Filter:	glass 2"	183		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution	
1	727.8	669.4		HPLC DI	672.4
2	687.5	678.0		HPLC DI	685.2
3	542.5	507.7		empty	542.7
4	757.3	753.8		silica	752.1

Probe Liner: 316 SS ___, Pyrex Glass ___, Quartz Glass ___

Standard Temperature (t_{std}):

Standard Pressure (P_{std}):

Stack Static Pressure (P_{static}): ~~+0.09~~ -.40

O_2 5.8

CO_2 21.3

Moisture Weight Gain = ___ g (Tare reading impingers)

$V_{wc(std)} = 0.04707"(V_{final}-V_{initial})$ = ___ ft³

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715"(W_{final}-W_{initial})$ = ___ ft³

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.02 @ 16 "Hg, Post-Test ___ @ ___ "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
SW 2	10.50	907.856	0.135	210	66	64	0.36			Stuck	N/A	54	2
3	20.75	911.123	0.130	209	63	61							
5	30.25	914.225	0.109	208	63	60							
		914.125											
NW 2	40.25	917.398	0.120	210	68	66						54	2
3	50.25	920.553	0.119	209	65	63							
5	59.25	923.486	0.100	209	66	63							
		923.486											
NE 2	69.75	926.783	0.135	210	65	61						54	2.5
3	80.00	930.071	0.129	209	68	64							
5	89.50	933.158	0.110	208	67	62							
		933.158											
SE 2	99.75	936.475	0.130	210	66	62						53	2.5
3	110.00	939.828	0.128	209	63	59							
5	120.00	943.112	0.120	207	61	58						53	3
	13:14												
<Average>													

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-2.5) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Rivero
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	mixed
Load Rating:	79%
Barometric Pressure (P_{bar}):	30.12
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	
Run #	2 PM2.5/202

Equipment	Material	ID#	Cal. Date	Value
Nozzle				D_n = 0.202
Pitot Tube:				C_p = 0.84
Stack TC:	See			Y_d = 0.9566
Meter:		Not #1		$\Delta H@$ = 1.9348
Filter:		184		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	654.1	597.8		HPLC H_2O
2	590.5	591.4		HPLC H_2O
3	520.9	521.2		dry
4	729.0	725.8		silicagel

Probe Liner: 316 SS ___, Pyrex Glass ___, Quartz Glass ___,

Standard Temperature (t_{std}):

Standard Pressure (P_{std}):

Stack Static Pressure (P_{static}): -1.39

O_2 5.7

CO_2 24.5

Moisture Weight Gain = ___ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft³

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft³

Total Weight Gain = ___ g

Pre-Test: Equipment Checklist: ___ VREPAM1,2 ___ Sample Train Leak Check: Pre-Test 0.001 @ 16 "Hg, Post-Test ___ @ ___ "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
SW 2	10.25	948.511	0.130	216	71	69	0.36			Stack	N/A	52	2
3	20.25	951.958	0.140	215	72	67							
5	30.25	955.127	0.110	214	74	71							
		955.127										52	2
NW 2	40.50	958.514	0.130	215	71	70							
3	50.50	961.793	0.125	214	77	73							
5	60.00	964.918	0.110	213	76	75							
		964.918										52	2
NE 2	70.00	968.196	0.123	212	78	75							
3	80.00	971.462	0.121	212	76	75							
5	89.50	974.557	0.109	210	76	79							
		974.557											
SE 2	95.75	977.878	0.132	214	82	75						52	2
3	110.25	981.262	0.140	214	80	75							
5	120.00	984.447	0.116	213	79	76							
	16.17												
<Average>													

VALID RESULTS, INC.: EPA Method 201A Particulate Matter (PM-10) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/19/01
Operator:	T. Prevo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	Mixed
Load Rating:	79% RMCN
Barometric Pressure (P_{bar}):	30.11
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	
Run #	3 PM2.5/202

Equipment	Material	ID#	Cal. Date	Value
Nozzle				D_n = 0.202
Pitot Tube:				C_p = 0.84
Stack TC:				Y_d = 0.9566
Meter:				$\Delta H@$ = 1.9348
Filter:		185		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	693.8	631.3		HPLC H_2O
2	613.4	614.8		HPLC H_2O
3	478.8	477.4		empty
4	734.2	729.9		silica gel

Probe Liner: 316 SS ___, Pyrex Glass ___, Quartz Glass ___

Moisture Weight Gain = ____ g

$V_{wc(std)} = 0.04707"(V_{final}-V_{initial})$ = ____ ft^3

Silica Gel Weight Gain = ____ g

$V_{wsg(std)} = 0.04715"(W_{final}-W_{initial})$ = ____ ft^3

Total Weight Gain = ____ g

Standard Temperature (t_{std}):	68
Standard Pressure (P_{std}):	29.92
Stack Static Pressure (P_{static}):	-.40

O_2 6.5

CO_2 24.5

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.001 @ 19 "Hg, Post-Test ___ @ ___ "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	@ 17:20	985.630											
SW 2	10.50	989.153	0.140	220	65	64	0.37			Stack	N/A	52	2
3	20.50	992.431	0.129	221	67	64							
5	29.50	995.417	0.105	219	69	66							
		995.417											
NW 2	40.00	998.879	0.140	219	69	69						52	2
3	50.25	1002.278	0.135	219	72	70							
5	60.00	1005.497	0.120	218	72	70							
		1005.497											
NE 2	70.00	1008.799	0.127	220	69	65						52	2
3	80.00	1012.131	0.132	220	68	64							
5	89.50	1015.276	0.118	218	69	65							
		1015.276											
SE 2	100.00	1018.752	0.140	220	68	65						52	2
3	110.25	1022.171	0.138	220	68	65							
5	120.00	1025.421	0.125	218	68	71							
	19:20												
<Average>													

VALID RESULTS, INC.: EPA Method 201A - Particulate Matter (PM-2.5) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Pharo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	mixed
Load Rating:	79% Raw Mill OFF
Barometric Pressure (P_{bar}):	29.91
Stack Equiv. Diameter (D_e):	156"
Stack Moisture (%H_2O):	~~7.7%~~ 9.5
Run #	1 PM2.5/202

Equipment	Material	ID#	Cal. Date	Value
Nozzle	316SS	5mm-A	5/15/01	D_n = 0.202
Pitot Tube:		72A	4/05/01	C_p = 0.84
Stack TC:	↓	72A	4/15/01	Y_d = 0.9566
Meter:		Nut #1	4/24/00	Δ H@= 1.9348
Filter:	glass 2"	180		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	704.4	630.6		HPLC H_2O
2	647.8	639.0		HPLC H_2O
3	479.0	478.4		empty
4	688.7	685.9		silicagel

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___,

Moisture Weight Gain = ___ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ___ ft³

Silica Gel Weight Gain = ___ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ___ ft³

Total Weight Gain = ___ g

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): -0.35

O_2 7.4

CO_2 23.2

Pre-Test: Equipment Checklist: ___ VREPAM1,2 ___ Sample Train Leak Check: Pre-Test 0.001 @ 16 "Hg, Post-Test ___@___"Hg

Port ID# Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
SW 2	10.25	762.367	0.140	489	64	60	0.45			Stack	N/A	54	3
3	20.25	765.817	0.130	489	63	61							
5	29.75	769.203	0.119	485	64	63						54	3
		769.203											
NW 2	40.25	773.208	0.141	489	63	62						52	3.5
3	50.50	776.742	0.138	487	65	63							
5	59.75	780.077	0.110	483	66	63						52	3.5
		780.077											
NE 2	70.00	783.794	0.139	485	66	62						53	3.5
3	79.75	787.292	0.125	485	66	63							
5	89.25	790.727	0.120	480	67	62							
		790.727											
SE 2	99.75	794.549	0.141	488	66	63						52	3.5
3	110.00	798.256	0.138	487	66	64							
5	120.00	801.882	0.128	483	66	63							
	10:16												
<Average>													

STR01511

68

AGCS2M000247

10/2/01

S4000690

201A # PM 2.5/202

VALID RESULTS, INC.: EPA Method 5 - Particulate Matter Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	Thurs
Plant Location:	Seattle WA
Source:	Main Stack Outlet
Fuel Type:	mixed
Load Rating:	90% Auto/MOFF
Barometric Pressure (P_{bar}):	29.80
Stack Equiv. Diameter (D_s):	156"
Stack Moisture (%H_2O):	
Run #2 PM 2.5/202	

Equipment	Material	ID#	Cal. Date	Value
Nozzle		1		D_n = 0.202
Pitot Tube:				C_p = 0.84
Stack TC:	Sel per			Y_d = 0.9566
Meter:		Nx#1		$\Delta H@$ = 1.9398
Filter:		181		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	708.7	640.7	68	HPLC H_2O
2	717.6	703.7	[redacted]	HPLC H_2O
3	478.8	478.4		empty
4	664.9	655.8	[redacted]	silica

Probe Liner: 316 SS X, Pyrex Glass ___, Quartz Glass ___

Moisture Weight Gain = [redacted] g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = _____ ft^3

Silica Gel Weight Gain = _____ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = _____ ft^3

Total Weight Gain = _____ g

Standard Temperature (t_{std}):	68
Standard Pressure (P_{std}):	29.92
Stack Static Pressure (P_{static}):	-0.35

O_2 7.1 CO_2 22.8

Pre-Test: Equipment Checklist: _____ VREPAM1,2 _____ Sample Train Leak Check: Pre-Test 0.002 @ 15 "Hg, Post-Test ___ @ ___ "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	11:51	804.866											
SW 2	10.75	809.027	0.165	436	61	60	0.52			Stack	N/A	52	2.5
3	21.25	813.083	0.159	436	64	61							
5	30.75	816.769	0.130	433	68	60						52	3
		816.769											
NW 2	41.25	820.836	0.155	435	69	62						52	3
3	51.00	824.631	0.135	435	72	68							
5	60.00	828.089	0.119	432	69	67						52	3
		828.089											
NE 2	70.25	832.057	0.151	436	73	69							
3	80.50	836.031	0.149	435	71	69						53	3
5	90.00	839.738	0.129	431	74	72							
		839.738										53	3
SE 2	100.50	843.824	0.155	435	72	70							
3	110.75	847.813	0.150	434	75	72						53	3.5
5	120.00	851.471	0.0990.125	431	74	71							
	13:51												
<Average>													

VALID RESULTS, INC.: EPA Method 201A & Particulate Matter (PM-2.5) Concentration and Air Emission Rate Field Data Sheet

Client:	Ash Grove Cement
Date:	5/15/01
Operator:	T. Rivo
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Fuel Type:	meal
Load Rating:	290% low mill off
Barometric Pressure (P_{bar}):	29.72
Stack Equiv. Diameter (D_e):	156
Stack Moisture (%H_2O):	8.5
Run #	3 PM2.5/202

Equipment	Material	ID#	Cal. Date	Value
Nozzle	316SS			D_n = 0.202
Pitot Tube:				C_p = 0.84
Stack TC:				Y_d = 0.9566
Meter:		Nutl #1		Δ H@= 1.9348
Filter:	glass 2"	182		

Impinger Weight Gain #	V_{final}	$V_{initial}$	Net Gain	Charge Solution
1	752.7	675.5		HPLC H_2O
2	591.6	580.7		HPLC H_2O
3	497.3	496.6		empty
4	692.3	685.7		Silica

Probe Liner: 316 SS ___, Pyrex Glass ___, Quartz Glass ___,

Moisture Weight Gain = ____ g

$V_{wc(std)} = 0.04707*(V_{final}-V_{initial})$ = ____ ft³

Silica Gel Weight Gain = ____ g

$V_{wsg(std)} = 0.04715*(W_{final}-W_{initial})$ = ____ ft³

Total Weight Gain = ____ g

Standard Temperature (t_{std}): 68

Standard Pressure (P_{std}): 29.92

Stack Static Pressure (P_{static}): ~~.74~~ -0.35

O_2 7.4

CO_2 22.7

Pre-Test: Equipment Checklist: ____ VREPAM1,2 ____ Sample Train Leak Check: Pre-Test 0.01 @ 13 "Hg, Post-Test ___ @ ___ "Hg

Port ID# / Point #	Time:	Meter Value:	Pitot Tube ΔP	Stack Temp. °F	Meter Temp. Tm_{in}	Meter Temp. Tm_{out}	ΔH	√ΔP	cfm	Filter Temp.	Probe Temp.	Imp. Temp.	Pump Vacuum
	15:38	852.688											
SW 2	10	856.619	0.125	447	73	71	0.52			Stack	N/A	52	3
3	20.25	860.496	0.129	447	74	72							
5	30	864.312	0.119	442	73	71						52	2.5
		864.312											
NW 2	40.25	868.343	0.130	450	74	71						52	2.5
3	50.25	872.214	0.128	448	74	72							
5	59.75	875.899	0.115	448	74	72							
		875.899											
NE 2	70	879.932	0.132	446	75	72						53	2.5
3	80	883.842	0.125	445	75	74							
5	89.35	887.496	0.109	441	77	75						52	2.5
		887.496											
SE 2	99.75	891.543	0.140	448	74	68							3
3	110.25	895.656	0.135	447	74	66							
6	119.75	899.412	0.115	443	73	67							
	17:38												
<Average>													

APPENDIX E

ANALYTICAL DATA

VALID RESULTS, INC.: EPA Method 201A PM-10 Sample Weight Gain Summary Data Sheet

Client:	Ash Grove Cement
Test Date:	5/19/01
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Operating Condition:	Raw Mill On
Recovery Date:	5/19/01
Analysis Dates:	5/21/01 - 6/1/01

Total and Front Half Particulate Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Percent PM-10	**70.8%**		**40.8%**		**66.3%**		**59.3%**	average
Total Particulate	35.3	mg	59.1	mg	49.9	mg	-1.8	mg
PM-10	25.0	mg	24.1	mg	33.1	mg	-0.9	mg

Particulate Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Cyclone PM Acetone	11.2	mg	35.9	mg	17.7	mg	0.9	mg*
PM-10 Acetone	23.9	mg	24.6	mg	33.9	mg	0.9	mg*
PM-10 Filter	2.0	mg	0.4	mg	0.1	mg	0.0	mg*
Total Blank Correction	-1.8	mg	-1.8	mg	-1.8	mg	1.8	mg

* maximum allowable blank correction (detection limit or 10% of sample weight gain)

VALID RESULTS, INC.: EPA Method 201A PM-10 Sample Weight Gain Summary Data Sheet

Client:	Ash Grove Cement
Test Date:	5/15/01
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Operating Condition:	Raw Mill Off
Recovery Date:	5/15/01
Analysis Dates:	5/21/01 - 5/30/01

Total and Front Half Particulate Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Percent PM-10	**41.5%**		**45.5%**		**30.4%**		**39.1%**	average
Total Particulate	8.2	mg	5.5	mg	11.5	mg	-0.4	mg
PM-10	3.4	mg	2.5	mg	3.5	mg	-0.1	mg

Particulate Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Cyclone >PM-10 Acetone	5.1	mg	3.3	mg	8.3	mg	0.3	mg*
PM-10 Acetone	2.6	mg	2.2	mg	2.5	mg	0.2	mg*
PM-10 Filter	0.9	mg	0.4	mg	1.1	mg	-0.1	mg
Total Blank Correction	-0.4	mg	-0.4	mg	-0.4	mg	0.4	mg

* maximum allowable blank correction (detection limit or 10% of sample weight gain)

VALID RESULTS, INC.: EPA Method 201A* PM-2.5 Sample Weight Gain Summary Data Sheet

Client:	Ash Grove Cement
Test Date:	5/19/01
Plant Location:	Seattle, WA
Source:	Main Stack Outlet
Operating Condition:	Raw Mill On
Recovery Date:	5/19/01
Analysis Dates:	5/21/01 - 6/1/01

Total PM & PM-2.5 Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Percent FH PM-10	**10.6%**		**8.9%**		**11.1%**		**10.2%**	average
Total Particulate	15.1	mg	14.6	mg	25.3	mg	-0.8	mg
Front-Half PM-2.5	1.6	mg	1.3	mg	2.8	mg	-0.1	mg
Total PM-2.5	12.4	mg	9.4	mg	10.5	mg	-0.5	mg

Particulate Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Cyclone >PM-2.5 Acetone	2.6	mg	5.1	mg	14.7	mg	0.3	mg*
PM-2.5 Acetone	1.9	mg	2.6	mg	2.7	mg	0.2	mg*
PM-2.5 Filter	-0.2	mg	-1.2	mg	0.2	mg	-0.1	mg
PM-2.5 BH Ace	3.1	mg	2.9	mg	2.9	mg	0.3	mg*
PM-2.5 BH Organics	6.7	mg	3.8	mg	3.7	mg	0.3	mg*
PM-2.5 BH Water	1.4	mg	1.8	mg	1.5	mg	-0.2	mg
Total Blank Correction	-0.4	mg	-0.4	mg	-0.4	mg	0.4	mg

* maximum allowable blank correction (detection limit or 10% of sample weight gain)

VALID RESULTS, INC.: EPA Method 201A* PM-2.5 Sample Weight Gain Summary Data Sheet

Client:	Ash Grove Cement
Test Date:	5/15/01
Plant Location:	Seattle, WA
Source:	Seattle, WA
Operating Condition:	Raw Mill Off
Recovery Date:	5/15/01
Analysis Dates:	5/21/01 - 5/30/01

Total PM & PM-2.5 Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Percent FH PM-2.5	2.5%		1.8%		2.4%		2.2%	average
Total Particulate	100.4	mg	108.5	mg	85.1	mg	-2.1	mg
Front-Half PM-2.5	2.5	mg	2.0	mg	2.0	mg	0.0	mg
Total PM-2.5	91.1	mg	100.2	mg	79.5	mg	-1.7	mg

Particulate Sample Weight Gain Summary

	Run 1		Run 2		Run 3		Run 4	
Cyclone >PM-2.5 Acetone	8.0	mg	7.0	mg	4.3	mg	0.4	mg*
PM-2.5 Acetone	1.5	mg	0.9	mg	1.5	mg	0.0	mg*
PM-2.5 Filter	1.0	mg	1.1	mg	0.5	mg	0.0	mg*
PM-2.5 BH Ace	12.0	mg	7.0	mg	11.7	mg	0.7	mg*
PM-2.5 BH Organics	78.0	mg	88.2	mg	65.8	mg	1.0	mg
PM-2.5 BH Water	0.3	mg	4.7	mg	1.7	mg	0.0	mg*
Total Blank Correction	-0.4	mg	-0.4	mg	-0.4	mg	0.4	mg

* maximum allowable blank correction (detection limit or 10% of sample weight gain)

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1 FH>PM-10 Raw Mill On	T749	10/25/00	2.3468	5/28/01	2.3580	<0.0112>	125
				11/9/00	2.3469	5/29/01	2.3581		
				11/10/00	2.3470	5/30/01	2.3581		
<Averages>					<2.3469>		<2.3581>		
Ash Grove Cement Seattle, WA	5/19/01	R2 FH>PM-10 Raw Mill On	T750	10/25/00	2.3470	5/28/01	2.3833	<0.0359>	125
				11/9/00	2.3472	5/29/01	2.3829		
				11/10/00	2.3472	5/30/01	2.3829		
<Averages>					<2.3471>		<2.3830>		
Ash Grove Cement Seattle, WA	5/19/01	R3 FH>PM-10 Raw Mill On	T751	10/25/00	2.3531	5/28/01	2.3709	<0.0177>	125
				11/9/00	2.3533	5/29/01	2.3709		
				11/10/00	2.3533	5/30/01	2.3709		
<Averages>					<2.3532>		<2.3709>		
Ash Grove Cement Seattle, WA	5/19/01	R4 FH>PM-10 Raw Mill On	T696	10/25/00	2.3568	5/28/01	2.3576	<0.0009>	125
				11/9/00	2.3567	5/29/01	2.3576		
				11/10/00	2.3566	5/30/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1FH PM10 Raw Mill Off	T758	4/9/01	2.3430	5/28/01	2.3456	<0.0026>	125
				4/10/01	2.3429	5/29/01	2.3455		
				4/11/01	2.3429	5/30/01	2.3455		
<Averages>					<2.3429>		<2.3455>		
Ash Grove Cement Seattle, WA	5/15/01	R2FH PM10 Raw Mill Off	T759	4/9/01	2.3620	5/28/01	2.3642	<0.0022>	125
				4/10/01	2.3622	5/29/01	2.3643		
				4/11/01	2.3620	5/30/01	2.3643		
<Averages>					<2.3621>		<2.3643>		
Ash Grove Cement Seattle, WA	5/15/01	R3FH PM10 Raw Mill Off	T760	4/9/01	2.3455	5/28/01	2.3479	<0.0025>	125
				4/10/01	2.3454	5/29/01	2.3479		
				4/11/01	2.3453	5/30/01	2.3479		
<Averages>					<2.3454>		<2.3479>		
Ash Grove Cement Seattle, WA	5/15/01	R4FH PM10 Raw Mill Off	T696	4/9/01	2.3568	5/28/01	2.3576	<0.0009>	125
				4/10/01	2.3567	5/29/01	2.3576		
				4/11/01	2.3566	5/30/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1 FH PM-10 Raw Mill On	T734	9/29/98	2.3799	4/25/00	2.3818	<0.0019>	125
				10/18/99	2.3800	4/26/00	2.3818		
				10/21/99	2.3799	4/27/00	2.3817		
<Averages>					<2.3799>		<2.3818>		
Ash Grove Cement Seattle, WA	5/19/01	R2 FH PM-10 Raw Mill On	T735	10/18/99	2.3634	4/25/00	2.3660	<0.0026>	125
				10/21/99	2.3634	4/26/00	2.3660		
				10/22/99	2.3634	4/27/00	2.3660		
<Averages>					<2.3634>		<2.3660>		
Ash Grove Cement Seattle, WA	5/19/01	R3 FH PM-10 Raw Mill On	T736	10/18/99	2.3467	4/25/00	2.3494	<0.0027>	125
				10/21/99	2.3467	4/26/00	2.3494		
				10/22/99	2.3467	4/27/00	2.3494		
<Averages>					<2.3467>		<2.3494>		
Ash Grove Cement Seattle, WA	5/19/01	R4 FH PM-10 Raw Mill On	T696	11/25/00	2.3568	5/22/01	2.3576	<0.0009>	125
				11/9/00	2.3567	5/24/01	2.3576		
				11/10/00	2.3566	5/25/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1FH>PM10 Raw Mill Off	T740	10/25/00	2.3510	5/21/01	2.3590	<0.0080>	125
				11/9/00	2.3510	5/22/01	2.3590		
				11/10/00	2.3510	5/23/01	2.3590		
<Averages>					<2.3510>		<2.3590>		
Ash Grove Cement Seattle, WA	5/15/01	R2FH>PM10 Raw Mill Off	T741	10/25/00	2.3585	5/21/01	2.3655	<0.0070>	125
				11/9/00	2.3585	5/22/01	2.3655		
				11/10/00	2.3584	5/23/01	2.3655		
<Averages>					<2.3585>		<2.3655>		
Ash Grove Cement Seattle, WA	5/15/01	R3FH>PM10 Raw Mill Off	T742	10/25/00	2.3702	5/21/01	2.3745	<0.0043>	125
				11/9/00	2.3702	5/22/01	2.3744		
				11/10/00	2.3702	5/23/01	2.3745		
<Averages>					<2.3702>		<2.3745>		
Ash Grove Cement Seattle, WA	5/15/01	R4FH>PM10 Raw Mill Off	T696	10/25/00	2.3668	5/21/01	2.3676	<0.0009>	125
				11/9/00	2.3667	5/22/01	2.3675		
				11/10/00	2.3666	5/23/01	2.3676		
<Averages>					<2.3667>		<2.3676>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1FH PM-10 Raw Mill On	T752	10/25/00	2.3343	5/22/01	2.3581	<0.0239>	125
				11/9/00	2.3342	5/23/01	2.3581		
				11/10/00	2.3340	5/24/01	2.3581		
<Averages>					<2.3342>		<2.3581>		
Ash Grove Cement Seattle, WA	5/19/01	R2FH PM-10 Raw Mill On	T753	10/25/00	2.3399	5/22/01	2.3642	<0.0246>	125
				11/9/00	2.3396	5/23/01	2.3643		
				11/10/00	2.3396	5/24/01	2.3643		
<Averages>					<2.3397>		<2.3643>		
Ash Grove Cement Seattle, WA	5/19/01	R3FH PM-10 Raw Mill On	T754	9/29/98		5/22/01	2.3737	<0.0339>	125
				9/30/98	2.3396	5/23/01	2.3737		
				9/30/98	2.3398	5/24/01	2.3737		
				10/1/98	2.3399				
<Averages>					<2.3398>		<2.3737>		
Ash Grove Cement Seattle, WA	5/19/01	R4FH PM-10 Raw Mill On	T696	10/25/00	2.3568	5/28/01	2.3576	<0.0009>	125
				11/9/00	2.3567	5/29/01	2.3576		
				11/10/00	2.3566	5/30/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1FH>PM10 Raw Mill Off	T755	4/9/01	2.3636	5/28/01	2.3687	<0.0051>	125
				4/10/01	2.3636	5/29/01	2.3686		
				4/11/01	2.3636	5/30/01	2.3687		
<Averages>					<2.3636>		<2.3687>		
Ash Grove Cement Seattle, WA	5/15/01	R2FH>PM10 Raw Mill Off	T756	4/9/01	2.3528	5/28/01	2.3562	<0.0033>	125
				4/10/01	2.3528	5/29/01	2.3561		
				4/11/01	2.3528	5/30/01	2.3561		
<Averages>					<2.3528>		<2.3561>		
Ash Grove Cement Seattle, WA	5/15/01	R3FH>PM10 Raw Mill Off	T757	4/9/01	2.3548	5/28/01	2.3631	<0.0083>	125
				4/10/01	2.3546	5/29/01	2.3630		
				4/11/01	2.3548	5/30/01	2.3628		
<Averages>					<2.3547>		<2.3630>		
Ash Grove Cement Seattle, WA	5/15/01	R4FH>PM10 Raw Mill Off	T696	4/9/01	2.3568	5/28/01	2.3576	<0.0009>	125
				4/10/01	2.3567	5/29/01	2.3575		
				4/11/01	2.3566	5/30/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1 FH>PM-10 Raw Mill On	T731	11/25/00	2.3540	5/22/01	2.3566	<0.0026>	125
				11/9/00	2.3540	5/24/01	2.3566		
				11/10/00	2.3540	5/25/01	2.3566		
<Averages>					<2.3540>		<2.3566>		
Ash Grove Cement Seattle, WA	5/19/01	R2 FH>PM-10 Raw Mill On	T732	11/25/00	2.3816	5/22/01	2.3867	<0.0051>	125
				11/9/00	2.3815	5/24/01	2.3866		
				11/10/00	2.3815	5/25/01	2.3866		
<Averages>					<2.3815>		<2.3866>		
Ash Grove Cement Seattle, WA	5/19/01	R3 FH>PM-10 Raw Mill On	T733	11/25/00	2.3505	5/22/01	2.3652	<0.0147>	125
				11/9/00	2.3506	5/24/01	2.3653		
				11/10/00	2.3506	5/25/01	2.3653		
<Averages>					<2.3506>		<2.3653>		
Ash Grove Cement Seattle, WA	5/19/01	R4 FH>PM-10 Raw Mill On	T696	11/25/00	2.3568	5/22/01	2.3576	<0.0009>	125
				11/9/00	2.3567	5/24/01	2.3576		
				11/10/00	2.3566	5/25/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1FH PM10 Raw Mill Off	T743	10/25/00	2.3810	2/25/01	2.3824	<0.0015>	125
				11/9/00	2.3810	2/28/01	2.3825		
				11/10/00	2.3810	2/29/01	2.3825		
<Averages>					<2.3810>		<2.3825>		
Ash Grove Cement Seattle, WA	5/15/01	R2FH PM10 Raw Mill Off	T744	10/25/00	2.3589	2/25/01	2.3598	<0.0009>	125
				11/9/00	2.3589	2/28/01	2.3599		
				11/10/00	2.3589	2/29/01	2.3598		
<Averages>					<2.3589>		<2.3598>		
Ash Grove Cement Seattle, WA	5/15/01	R3FH PM10 Raw Mill Off	T745	10/25/00	2.3594	2/25/01	2.3609	<0.0015>	125
				11/9/00	2.3594	2/28/01	2.3609		
				11/10/00	2.3593	2/29/01	2.3609		
<Averages>					<2.3594>		<2.3609>		
Ash Grove Cement Seattle, WA	5/15/01	R4FH PM10 Raw Mill Off	T696	10/25/00	2.3668	5/21/01	2.3676	<0.0009>	125
				11/9/00	2.3667	5/22/01	2.3675		
				11/10/00	2.3666	5/23/01	2.3676		
<Averages>					<2.3667>		<2.3676>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 47 mm Glass Fiber Filters

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1 Filter Raw Mill On	VR2"179GF PM-10	3/28/98	0.1225	4/23/00	0.1244	<0.002>	
				3/29/98	0.1222	4/24/00	0.1244		
				3/30/98	0.1225	4/25/00	0.1244		
<Averages>					<0.1224>		<0.1244>		
Ash Grove Cement Seattle, WA	5/19/01	R2 Filter Raw Mill On	VR2"186GF PM-10	3/28/98	0.1243	4/23/00	0.1247	<0.0004>	
				3/29/98	0.1243	4/24/00	0.1247		
				3/30/98	0.1244	4/25/00	0.1247		
<Averages>					<0.1243>		<0.1247>		
Ash Grove Cement Seattle, WA	5/19/01	R3 Filter Raw Mill On	VR2"187GF PM-10	3/28/98	0.1211	4/23/00	0.1212	<0.0001>	
				3/29/98	0.1210	4/24/00	0.1212		
				3/30/98	0.1211	4/25/00	0.1212		
<Averages>					<0.1211>		<0.1212>		
Ash Grove Cement Seattle, WA	5/19/01	R4 Filter Raw Mill On	VR2"175GF PM-10	3/28/98	0.1234	4/23/00	0.124	<0.0005>	
				3/29/98	0.1236	4/24/00	0.1240		
				3/30/98	0.1235	4/25/00	0.1240		
<Averages>					<0.1235>		<0.1240>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 47 mm Glass Fiber Filters

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1 PM-10 Filter Raw Mill Off	VR2"176GF	4/16/01	0.1221	5/21/01	0.1231	<0.0009>	
				4/17/01	0.1222	5/22/01	0.1231		
				4/18/01	0.1223	5/23/01	0.1231		
<Averages>					<0.1222>		<0.1231>		
Ash Grove Cement Seattle, WA	5/15/01	R2 PM-10 Filter Raw Mill Off	VR2"177GF	4/16/01	0.1211	5/21/01	0.1215	<0.0004>	
				4/17/01	0.1212	5/22/01	0.1215		
				4/18/01	0.1211	5/23/01	0.1215		
						4/26/00			
<Averages>					<0.1211>		<0.1215>		
Ash Grove Cement Seattle, WA	5/15/01	R3 PM-10 Filter Raw Mill Off	VR2"178GF	4/16/01	0.1211	5/21/01	0.1223	<0.0011>	
				4/17/01	0.1212	5/22/01	0.1223		
				4/18/01	0.1212	5/23/01	0.1222		
<Averages>					<0.1212>		<0.1223>		
Ash Grove Cement Seattle, WA	5/15/01	R4 PM-10 Filter Raw Mill Off	VR2"175GF	4/16/01	0.1241	5/21/01	0.1240	-<0.0001>	
				4/17/01	0.1240	5/22/01	0.1240		
				4/18/01	0.1241	5/23/01	0.1240		
<Averages>					<0.1241>		<0.1240>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 47 mm Glass Fiber Filters

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1 Filter Raw Mill On	VR2"183GF PM-2.5	3/28/98	0.1225	4/23/00	0.1222	-<0.0002>	
				3/29/98	0.1222	4/24/00	0.1222		
				3/30/98	0.1225	4/25/00	0.1222		
<Averages>					<0.1224>		<0.1222>		
Ash Grove Cement Seattle, WA	5/19/01	R2 Filter Raw Mill On	VR2"184GF PM-2.5	3/28/98	0.1243	4/23/00	0.1231	-<0.0012>	
				3/29/98	0.1243	4/24/00	0.1231		
				3/30/98	0.1244	4/25/00	0.1231		
<Averages>					<0.1243>		<0.1231>		
Ash Grove Cement Seattle, WA	5/19/01	R3 Filter Raw Mill On	VR2"185GF PM-2.5	3/28/98	0.1211	4/23/00	0.1214	<0.0002>	
				3/29/98	0.1210	4/24/00	0.1213		
				3/30/98	0.1211	4/25/00	0.1213		
<Averages>					<0.1211>		<0.1213>		
Ash Grove Cement Seattle, WA	5/19/01	R4 Filter Raw Mill On	VR2"175GF PM-2.5	3/28/98	0.1241	4/23/00	0.1240	-<0.0001>	
				3/29/98	0.1240	4/24/00	0.1240		
				3/30/98	0.1241	4/25/00	0.1240		
<Averages>					<0.1241>		<0.1240>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 47 mm Glass Fiber Filters

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1Filter Raw Mill Off	VR2"180GF	4/16/01	0.1225	5/21/01	0.1235	<0.0010>	
				4/17/01	0.1225	5/22/01	0.1235		
				4/18/01	0.1225	5/23/01	0.1235		
<Averages>					<0.1225>		<0.1235>		
Ash Grove Cement Seattle, WA	5/15/01	R2Filter Raw Mill Off	VR2"181GF	4/16/01	0.1230	5/21/01	0.1241	<0.0011>	
				4/17/01	0.1230	5/22/01	0.1241		
				4/18/01	0.1230	5/23/01	0.1241		
<Averages>					<0.1230>		<0.1241>		
Ash Grove Cement Seattle, WA	5/15/01	R3Filter Raw Mill Off	VR2"182GF	4/16/01	0.1232	5/21/01	0.1237	<0.0005>	
				4/17/01	0.1231	5/22/01	0.1237		
				4/18/01	0.1232	5/23/01	0.1237		
<Averages>					<0.1232>		<0.1237>		
Ash Grove Cement Seattle, WA	5/15/01	R4Filter Raw Mill Off	VR2"175GF	4/16/01	0.1241	5/21/01	0.1240	-<0.0001>	
				4/17/01	0.1240	5/22/01	0.1240		
				4/18/01	0.1241	5/23/01	0.1240		
<Averages>					<0.1241>		<0.1240>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1BH Ace Raw Mill On	T737	11/29/96	2.3512	5/27/01	2.3543	<0.0031>	125
				11/30/96	2.3511	5/28/01	2.3543		
				12/2/96	2.3512	5/29/01	2.3542		
<Averages>					<2.3512>		<2.3543>		
Ash Grove Cement Seattle, WA	5/19/01	R2BH Ace Raw Mill On	T738	11/29/96	2.3317	5/27/01	2.3346	<0.0029>	125
				11/30/96	2.3317	5/28/01	2.3347		
				12/2/96	2.3317	5/29/01	2.3345		
<Averages>					<2.3317>		<2.3346>		
Ash Grove Cement Seattle, WA	5/19/01	R3BH Ace Raw Mill On	T739	11/29/96	2.3554	5/27/01	2.3583	<0.0029>	125
				11/30/96	2.3554	5/28/01	2.3584		
				12/2/96	2.3554	5/29/01	2.3583		
<Averages>					<2.3554>		<2.3583>		
Ash Grove Cement Seattle, WA	5/19/01	R4BH Ace Raw Mill On	T696	11/25/00	2.3568	5/22/01	2.3576	<0.0009>	125
				11/9/00	2.3567	5/24/01	2.3576		
				11/10/00	2.3566	5/25/01	2.3576		
<Averages>					<2.3567>		<2.3576>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - Aluminum Weighing Tins

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1BH Acetone Raw Mill Off	T746	10/25/00	2.3554	9/4/98	2.3672	<0.0120>	125
				11/9/00	2.3554	9/5/98	2.3674		
				11/10/00	2.3552	9/6/98	2.3673		
<Averages>					<2.3553>		<2.3673>		
Ash Grove Cement Seattle, WA	5/15/01	R2BH Acetone Raw Mill Off	T747	10/25/00	2.3714	9/4/98	2.3784	<0.0070>	125
				11/9/00	2.3714	9/5/98	2.3785		
				11/10/00	2.3714	9/6/98	2.3784		
<Averages>					<2.3714>		<2.3784>		
Ash Grove Cement Seattle, WA	5/15/01	R3BH Acetone Raw Mill Off	T748	10/25/00	2.3587	9/4/98	2.3704	<0.0117>	125
				11/9/00	2.3586	9/5/98	2.3704		
				11/10/00	2.3587	9/6/98	2.3703		
<Averages>					<2.3587>		<2.3704>		
Ash Grove Cement Seattle, WA	5/15/01	R4BH Acetone Raw Mill Off	T696	10/25/00	2.3668	5/21/01	2.3676	<0.0009>	125
				11/9/00	2.3667	5/22/01	2.3675		
				11/10/00	2.3666	5/23/01	2.3676		
<Averages>					<2.3667>		<2.3676>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 150 ml Glass Beakers

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1BH - Organic Raw Mill On	B429	4/21/98	54.4799	5/24/01	54.4866	<0.0067>	75
				5/5/98	54.4799	5/25/01	54.4866		
				5/14/98	54.4799	5/26/01	54.4866		
<Averages>					<54.4799>		<54.4866>		
Ash Grove Cement Seattle, WA	5/19/01	R2BH - Organic Raw Mill On	B430	4/21/98	51.6598	5/24/01	51.6637	<0.0038>	75
				5/5/98	51.6599	5/25/01	51.6636		
				5/14/98	51.6599	5/26/01	51.6638		
<Averages>					<51.6599>		<51.6637>		
Ash Grove Cement Seattle, WA	5/19/01	R3BH - Organic Raw Mill On	B431	4/21/98	49.9440	5/24/01	49.9479	<0.0037>	75
				5/5/98	49.9443	5/25/01	49.9479		
				5/14/98	49.9442	5/26/01	49.9479		
<Averages>					<49.9442>		<49.9479>		
Ash Grove Cement Seattle, WA	5/19/01	R4BH - Organic Raw Mill On	B432	4/21/98	48.3138	5/24/01	48.3148	<0.0010>	75
				5/5/98	48.3141	5/25/01	48.3150		
				5/14/98	48.3138	5/26/01	48.3149		
<Averages>					<48.3139>		<48.3149>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 150 ml Glass Beakers

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1BH - Organic Raw Mill Off	B436	4/21/98	48.2197	5/29/01	48.2982	<0.0780>	75
				5/5/98	48.2197	5/30/01	48.2986		
				5/14/98	48.2198	5/31/01	48.2964		
<Averages>					<48.2197>		<48.2977>		
Ash Grove Cement Seattle, WA	5/15/01	R2BH - Organic Raw Mill Off	B437	4/21/98	51.4868	5/29/01	51.5754	<0.0882>	75
				5/5/98	51.4869	5/30/01	51.5749		
				5/14/98	51.4872	5/31/01	51.5752		
<Averages>					<51.4870>		<51.5752>		
Ash Grove Cement Seattle, WA	5/15/01	R3BH - Organic Raw Mill Off	B438	4/21/98	52.8058	5/29/01	52.8718	<0.0658>	75
				5/5/98	52.8054	5/30/01	52.8713		
				5/14/98	52.8058	5/31/01	52.8714		
<Averages>					<52.8057>		<52.8715>		
Ash Grove Cement Seattle, WA	5/15/01	R4BH - Organic Raw Mill Off	B432	4/21/98	48.3138	5/29/01	48.3148	<0.0010>	75
				5/5/98	48.3141	5/30/01	48.3150		
				5/14/98	48.3138	5/31/01	48.3149		
<Averages>					<48.3139>		<48.3149>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 150 ml Glass Beakers

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/19/01	R1BH - H2O Raw Mill On	B425	4/21/98	53.3957	5/29/01	53.3971	<0.0014>	125
				5/5/98	53.3957	5/30/01	53.3969		
				5/14/98	53.3956	6/1/01	53.3972		
<Averages>					<53.3957>		<53.3971>		
Ash Grove Cement Seattle, WA	5/19/01	R2BH - H2O Raw Mill On	B426	4/21/98	48.1899	5/29/01	48.1916	<0.0018>	125
				5/5/98	48.1899	5/30/01	48.1916		
				5/14/98	48.1898	6/1/01	48.1920		
<Averages>					<48.1899>		<48.1917>		
Ash Grove Cement Seattle, WA	5/19/01	R3BH - H2O Raw Mill On	B427	4/21/98	52.8508	5/29/01	52.8522	<0.0015>	125
				5/5/98	52.8507	5/30/01	52.8523		
				5/14/98	52.8510	6/1/01	52.8523		
<Averages>					<52.8508>		<52.8523>		
Ash Grove Cement Seattle, WA	5/19/01	R4BH - H2O Raw Mill On	B428	4/21/98	50.6328	5/29/01	50.6328	-<0.0002>	125
				5/5/98	50.6329	5/30/01	50.6327		
				5/14/98	50.6329	6/1/01	50.6327		
<Averages>					<50.6329>		<50.6327>		

VALID RESULTS, INC.: Gravimetric Sample Analysis - 150 ml Glass Beakers

Client	Sampling Date	Sample ID	Media ID	Weight Date Initial	Initial Weights	Weight Date Final	Final Weights	Net Weight Gain (Final - Initial)	Total Volume
Ash Grove Cement Seattle, WA	5/15/01	R1BH - H2O Raw Mill Off	B433	4/21/98	53.2974	5/29/01	53.2977	<0.0003>	125
				5/5/98	53.2975	5/30/01	53.2979		
				5/14/98	53.2978	5/31/01	53.2982		
<Averages>					<53.2976>		<53.2979>		
Ash Grove Cement Seattle, WA	5/15/01	R2BH - H2O Raw Mill Off	B434	4/21/98	53.0017	5/29/01	53.0066	<0.0047>	125
				5/5/98	53.0019	5/30/01	53.0068		
				5/14/98	53.0020	5/31/01	53.0065		
<Averages>					<53.0019>		<53.0066>		
Ash Grove Cement Seattle, WA	5/15/01	R3BH - H2O Raw Mill Off	B435	4/21/98	51.3942	5/29/01	51.3960	<0.0017>	125
				5/5/98	51.3943	5/30/01	51.3956		
				5/14/98	51.3942	5/31/01	51.3960		
<Averages>					<51.3942>		<51.3959>		
Ash Grove Cement Seattle, WA	5/15/01	R4BH - H2O Raw Mill Off	B428	4/21/98	50.6328	5/29/01	50.6328	-<0.0001>	125
				5/5/98	50.6329	5/30/01	50.6328		
				5/14/98	50.6329	5/31/01	50.6327		
<Averages>					<50.6329>		<50.6328>		

APPENDIX F

TEST METHODS

Selection of Traverse Points

EPA Method 1 was used to determine the location of sample points for particulate, gaseous and volumetric flow rate sampling from four sample ports located 90° apart on the main exhaust stack. The specific number of sample points used at each location was determined by the number of equivalent inside stack diameters that the sample ports were located from the nearest upstream and downstream flow disturbances. The number of points used and their location are provided in Appendix A.

Stack gas Velocity and Volumetric Flow Rate Determination

EPA Method 2 was used to determine the outlet stack gas velocity and volumetric flow rate. Pressure and temperature reading were taken at the sample points determined by Method 1. Pressure readings were measured using a "S-type" Pitot tube and an inclined manometer connected to the Pitot tube through quarter inch tubing. Pitot tube leak checks were performed before and after every test run. The stack gas temperature was measured using a calibrated (+/- 1 degree Fahrenheit) type-K thermocouple attached to the Pitot to provide the sampling point temperature simultaneously with the pressure measurements.

During the velocity traverse a stack gas static pressure was taken by turning the pitot tube perpendicular to the gas flow (zero delta P) and disconnecting the appropriate side of the pitot tube (+ or -) from the manometer.

The other data necessary for the calculation of the volumetric flow rate are the barometric pressure, stack gas moisture content and the stack gas composition (O_2 and CO_2).

Molecular Weight Determination (Oxygen and Carbon Dioxide)

A Sample/Calibration Gas Control Module was used to direct and control the flow of sample and calibration gases to the analyzers. In addition to providing samples of the effluent gas to an analyzer, the Control Module permits direct (internal) calibration of the analyzers, or calibration of the analyzers through the sample system (external). The Control Module utilizes a by-pass valve to maintain a constant sample (or calibration gas) pressure to the sample manifold. Flow meters monitor bypass flows from the back-pressure regulator and the sample ports to each analyzer. The probe-to-manifold sample line consists of 3/8-inch Teflon® tubing. 1/4-inch Teflon® tubing delivers sample to the analyzers from the sample manifold.

Leak checks of the sample system were conducted before and after each test sequence. Leak checks were performed by capping the sample probe in front of the filter and using the sample pump to draw a vacuum on the sample system. Sample system integrity was verified by the total sample flow rate meter dropping to zero (except for the inherent sample pump oscillation).

The calibration of each analyzer (including the sample system) was verified before and after each test run using EPA Protocol 1 gases. A selector valve at the Gas Control Module directed the flow of each calibration gases to the front end of the sample probe or to the sample manifold as necessary. At the probe, a pressure activated valve was used to select either a gas sample from the sample probe or calibration gas supplied to the sample probe through a calibration gas line.

EPA Protocol 1 calibration gases were utilized with Method 3A to perform middle (40-60 % of the analyzer full scale value) and high (80-100% of the analyzer full scale value) range external (in front of the sample probe filter) calibrations for both the O_2 and CO_2 analyzers. Nitrogen was used for the "zero" gas.

Percent Moisture Determination

EPA Method 4 was used to determine the moisture content of the stack gas. A condenser assembly comprised of five glass impingers set in an ice bath was used to extract and collect the moisture from the effluent gas sample. The first and third impingers contained 100 ml of HPLC grade deionized water. The second and fourth impingers were tare weighed and left empty to collect any potential condensate carryover, and the fifth impinger contained a pre-weighed amount of silica gel to act as the "absolute" collector of residual condensate.

A known volume of effluent gas was passed through a heated probe into a condenser assembly for a specific period of time. After completion of the extraction, the amount of liquid (condensate) in the impingers was measured gravimetrically and the net weight gain determined. The total condensate gain of the condenser assembly was then determined and recorded along with the calculated volume of gas that had been directed through the system. The subsequent moisture content of the stack gas was then determined from these collected variables.

Particulate Matter less than Ten Microns in Diameter Determination

EPA 40CFR, Part 51, Appendix M, Method 201A was used to determine the ratio of particulate matter less than ten microns in diameter (PM-10) to particulate matter (PM) in the stack effluent. The Method 201A test was conducted independently from and concurrently with each Method 5 PM test. The sampling was performed utilizing a Nutech 2010 Isokinetic Stack Sampling System with an in-stack cyclone cutter and Gelman filter holder assembly.

Method 201A velocity profiles were taken from the preliminary traverses performed before every test run.

The sample collection and analysis was performed in the same manner as the Method 5 collection and analysis, without the back half condensible analysis.

Particulate Matter less than 2.5 Microns in Diameter Determination

EPA 40CFR, Part 51, Appendix M, Method 201A* was used to determine the ratio of particulate matter less than 2.5 microns in diameter (PM2.5) to particulate matter (PM) in the stack effluent. The Method 201A* test was conducted independently from and concurrently with each Method 201A PM10 test. The sampling was performed utilizing a Nutech 2010 Isokinetic Stack Sampling System with an in-stack cyclone cutter and 47 millimeter Gelman® filter holder assembly.

Method 201A* velocity profiles were taken from the preliminary traverses performed before every test run.

The sample collection and analysis was performed in the same manner as the Method 5 collection and analysis, including the Method 202 back half condensible analysis.

Condensible Particulate Matter less than 2.5 Microns in Diameter Determination

EPA 40CFR, Part 51, Appendix M, Method 202 was used to determine the concentration and emission rate of condensible PM2.5 in the stack effluent. The Method 202 organic extraction analysis was conducted on the back half impinger water catch of the Method 201A* PM2.5 test. The sampling was performed utilizing a Nutech 2010 Isokinetic Stack Sampling System with an in-stack cyclone cutter and 47 millimeter Gelman® filter holder assembly.

The "Back Half" Method 5 impinger water sample was recovered by extracting the organic compounds from the impinger water with methylene chloride. This methylene chloride fraction was then placed in a tare weighed glass beaker for evaporation at room temperature. The remaining impinger water was then placed in an additional tare weighed glass beaker and evaporated to dryness at 150 degrees Fahrenheit. The impingers and separation funnel was triple rinsed with acetone and placed into a tare weighed aluminum dish for evaporation.

The "Back half" condensible particulate emissions was calculated using the weight gain from the impinger water, final acetone impinger rinse and methylene chloride organic extraction fractions.