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

October 2, 2001

Report STR01511

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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%	11%	**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

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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.

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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.

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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.

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