Section 114 Information Collection Request Emissions Test Report

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Ash Grove Cement Company
Midlothian Cement Plant
EPA Registry ID: 110049749910
900 Gifco Road
Midlothian, Texas 76065
Report No. M235102A

mostardi platt

Section 114 Information Collection Request
Emissions Test Report

Ash Grove Cement Company
Midlothian Cement Plant
EPA Registry ID: 110049749910
900 Gifco Road
Midlothian, Texas 76065

Report Submittal Date:
March 4, 2024

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Mostardi Platt

Report No. M235102A

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1.0 INTRODUCTION

Mostardi Platt conducted an air emissions test program for Ash Grove Cement Company at the Midlothian Cement Plant located in Midlothian, Texas. All testing was performed as described in the *Code of Federal Regulations*, Title 40, Part 60, Appendix A (40CFR60), Methods 1, 2, 3A, 4, 26A, and 40CFR63, Appendix A, (40CFR63) Method 320.

The Ash Grove Midlothian Cement Plant includes a single Kiln (Kiln 3) ~900,000 TPY semi-dry kiln system with slurry feed unto a jot disk. There is a single in-line calciner. The kiln system employs a SNCR, ACI, and DSI as needed to control NO_x and other compounds. Emission testing was performed at the testing location used for all compliance testing at the kiln stack or the main stack.

This test program was completed to satisfy the requirements of the United States Environmental Protection Agency (USEPA) Section 114 Information Collection Request for Portland Cement Manufacturing facilities as described in "Attachment 3 Source Testing Request for Portland Cement: Reporting Requirements".

The identification of individuals associated with the test program is summarized below:

Location	**Address**	**Contact**
Test Coordinator	Ash Grove Cement Company 900 Gifco Road Midlothian, TX 76065	Mr. Francisco Pinto Manager of Community and Environmental Affairs (972) 723-7231 francisco.pinto@ashgrove.com
Test Company Representative	Mostardi Platt 7715 Commercial Way, Suite 155 Henderson, NV 89011	Mr. Richard J. Sollars II Regional Manager (630) 993-2100 rsollars@mp-mail.com

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2.0 TEST REQUIREMENTS

Testing was performed at the Kiln 3 stack. The following table presents a list of the parameters tested, the applicable methodologies utilized, and average test results:

Source	Parameter Tested	Test Results	Method/Regulation Citation
Kiln 3 Stack	Hydrogen Fluoride (HF)	≤ 0.20 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.35 ppmvd @7% O_2	
		≤ 0.21 lb/hr	
		≤ 0.0019 lb/ton clinker	
	HF[1]	≤ 0.12 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.13 ppmvd @7% O_2	
		≤ 0.08 lb/hr	
		≤ 0.0007 lb/ton clinker	
	Chlorine (Cl_2)[1]	≤ 0.04 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.04 ppmvd @7% O_2	
		≤ 0.08 lb/hr	
		≤ 0.0007 lb/ton clinker	
	Hydrogen Cyanide (HCN)	≤ 0.21 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.37 ppmvd @7% O_2	
		≤ 0.30 lb/hr	
		≤ 0.0027 lb/ton clinker	
	Oxygen (O_2)	8.1 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO_2)	15.4 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H_2O)	37.6 %	USEPA Method 320, 40CFR63, Appendix A
	Cyclonic Flow Determination	PASS	USEPA Method 1, 40CFR60, Appendix A, Section 11.4
	Three-point O_2 Stratification Determination	< 5 %	USEPA Method 3A, 40CFR60, Appendix A and Method 7E, Section 8.1.2

[1] HF and Cl_2 Method 26A results are reported as the average from Train A and Train B.

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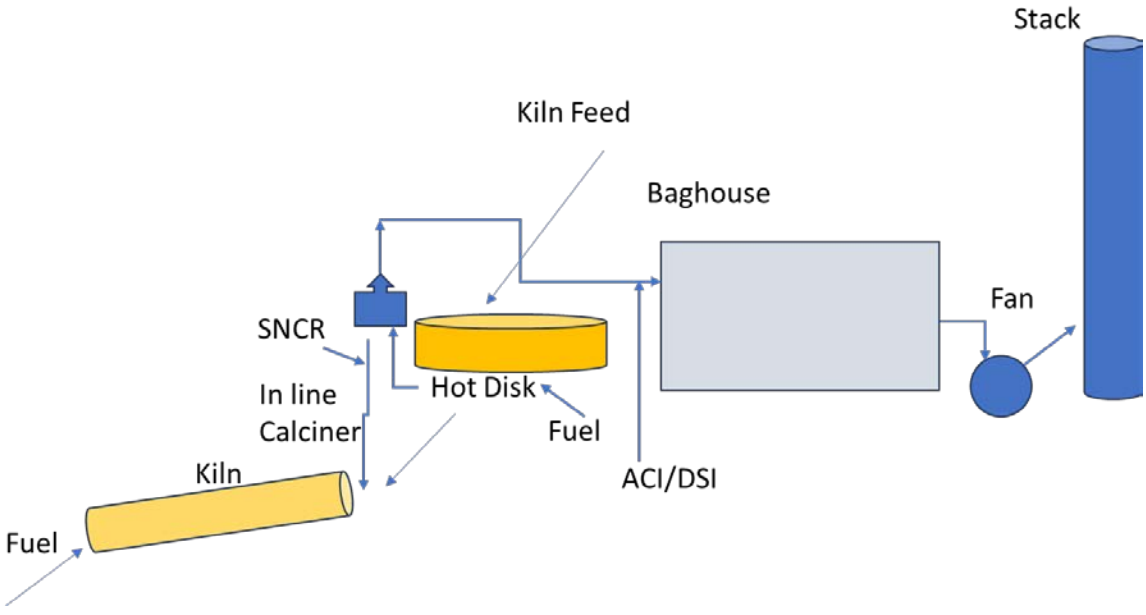
3.0 QA SPECIFICATIONS AND PROCESS DIAGRAM

Table 3-1 QA/QC Specifications

Parameter	Method	QA/QC Specification	Acceptance Criteria	Actual Result
HCN	320	Method Detection Limit	0.5 ppm	0.2 ppmvw
		SNR	>2500 at 64 scans	3459 (Run 1 Average)
		S Beam	>0.9	1.184 (Run 1 Average)
		Direct HCN Analysis	±5% of tag value	-4.9%
		Dynamic Spike Analysis	≤10% of total sample volume	8.8%
			Spike gas ~twice native concentration or 3-4 ppm addition to native concentration	+3.7 ppm
			≤±20% of expected value or ≤±0.5 ppm, whichever is less restrictive	≤±20% of expected value
		Residuals	≤±0.3 ppm, or ≤±5% of measured value, whichever is less restrictive	≤±0.3 ppm
Cl_2	26A	Method Detection Limit	300 µg	150 µg
		Paired Train Agreement	≤10% Relative Deviation or ≤0.2 ppm, whichever is less restrictive.	≤10% Relative Deviation

Table 3-2 Process Flow Diagram



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4.0 TEST PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed as described in the Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40CFR60), Methods 1, 2, 3A, 4, 26A, and 40CFR63, Appendix A, Method 320; and the latest revisions thereof. Where applicable, the *Quality Assurance Handbook for Air Pollution Measurement Systems*, Volume III, Stationary Source Specific Methods, United States Environmental Protection Agency (USEPA) 600/R-94/038c, September 1994 was used to supplement procedures in addition to the appended "Draft General Test Plan".

4.1 Method 1 Sample and Velocity Traverse Determination

Sample points for testing are determined using USEPA Test Method 1, 40CFR60, Appendix A. The characteristics of the measurement location is summarized below.

Sample Point Selection

Test Location	Stack Diameter	Port Length	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Kiln 3 Stack	11.502 Feet	7.0 Inches	16.8 Diameters	7.4 Diameters	HF/Cl_2 (26A)	12
					O_2 (3A)	3 (stratification)
					$HCN/HF/CO_2$ (320/3A)	1

A cyclonic flow check was performed in accordance with Section 11.4, which demonstrated it meets the criteria of an average value of less than 20° and therefore is considered to be a suitable testing location for flow rate measurements.

4.2 Method 2 Volumetric Flow Rate Determination

The gas velocity and volumetric flowrate were determined using Method 2, 40CFR60, Appendix A, as an integrated part of the HF/Cl_2 sampling system.

Velocity pressures were determined by traversing the duct with wind tunnel calibrated S-type pitot tube. Temperatures were measured using K-type thermocouples with calibrated digital temperature indicators. The molecular weight and moisture content of the gases were also determined to permit the calculation of the volumetric flowrate.

4.3 Method 3A Oxygen (O_2) and Carbon Dioxide (CO_2) Determination

O_2 and CO_2 concentrations were determined in accordance with Method 3A, 40CFR60, Appendix A and Method 320, 40CRR63, Appendix A, respectively. A Servomex analyzer was used to determine O_2 concentrations while the MKS 2030 analyzer was used to determine CO_2 concentrations. The O_2 instrument has a paramagnetic detector and operates in a nominal range of 0-25%.

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A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in the appendix of this report. Copies of calibration gas certifications are also appended.

4.4 Method 26A Hydrogen Fluoride (HF) and Chlorine (Cl_2) Determination

HF and Cl_2 concentrations and emission rates were determined in accordance with Method 26A, 40CFR60, Appendix A. Paired sampling trains were used to collect the samples. A total of twelve (12) test points were sampled per run on the Kiln 3 stack. The sample was extracted isokinetically from the gas stream and passed through dilute sulfuric acid (0.1N H_2SO_4). HF was collected in the dilute acid. Cl_2 was collected in the dilute sodium hydroxide (0.1N NaOH) solution. The sample train consisted of a Teflon coated nozzle, a heated borosilicate glass probe liner, a Teflon® filter placed on the outlet of the glass probe liner, and six impingers. The first two impingers contained the 0.1N H_2SO_4, the third remained empty (and was recovered with the first two impingers), the fourth and fifth impingers contained the 0.1N NaOH, while the sixth impinger contained silica gel to absorb any remaining moisture. A de-ionized water rinse was performed on each set of impingers, and samples were stored in Nalgene sample containers for transport. The 0.1N H_2SO_4 impinger catch samples were analyzed for HF while the 0.1N NaOH impinger catch samples were analyzed for Cl_2. A method detection limit (MDL) of 150 µg was determined for both HF and Cl_2 using the “Definition and Procedure for the Determination of the Method Detection Limit, Revision 2”. All equipment used was calibrated in accordance with the specifications of the method. Calibration data is appended.

Hand recorded field data sheets were reviewed and scans are retained on the Mostardi Platt network. Copies of this data is available upon request.

4.5 Method 320 Speciated Flue Gas Concentration Determinations

The sampling procedures for HCN and HF were performed in accordance with USEPA Method 320, 40CFR63, Appendix A. Data was continuously recorded with a data logging system throughout sampling, with brief interruption to properly label reference spectra.

The average gas effluent concentrations were determined from the average gas concentration displayed by the MKS 2030 analyzer.

All sampling system components were heated to 375^{o}F +/- 25^{o}F, including: stainless steel sample probe, stainless steel calibration tee, in line glass fiber particulate filter, Teflon® sample line, heated head sample pump, and FTIR detector cell. The sample pump distributes the gas sample to the instrument at a steady sample flow rate (+/- 10%). All components of the sampling system are constructed of stainless steel, glass, or Teflon®.

FTIR technology works on the principle that most gases absorb infrared light. This is true for all compounds except for homonuclear diatomic molecules and noble gases such as: N_2, O_2, H_2, He, Ne, and Ar. Vibrations, stretches, bends, and rotations within the bonds of a molecule determine the infrared absorption distinctiveness. The absorption creates a “fingerprint" which is unique for each given compound. The quantity of infrared light absorbed is proportional to the gas concentration. Most compounds have absorbencies at different infrared frequencies, thus allowing the simultaneous analysis of multiple compounds at one time. The FTIR software compares each sample spectrum to a user-selected list of calibration references and concentration data is generated.

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FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer. Data was generated at 0.5 cm^{-1}. Each Spectra was derived from the coaddition of 62-64 scans with a new data point generated approximately every minute. HCN analyte spiking assured the ability of the FTIR to quantify HCN in the presence of effluent gas. All analyte spikes were introduced using an instrument grade stainless steel rotameter. All QA/QC procedures were within the acceptance criteria allowance of the applicable methodology and the “General Test Plan.”

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5.0 TEST RESULTS SUMMARIES

Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Test Location: Kiln 3
Test Method: 26A - Combined Results

Source Condition		**Normal**		**Normal**		**Normal**		
Date		**1/4/24**		**1/4/24**		**1/4/24**		
Start Time		**10:50**		**12:25**		**14:17**		
End Time		**12:03**		**13:39**		**15:30**		
		Run 1		**Run 2**		**Run 3**		**Average**
Stack Conditions								
Average Gas Velocity, ft/sec		79.233		78.922		79.352		79.169
Gas Volumetric Flow Rate, acfm		493,963		492,023		494,699		493,562
Gas Volumetric Flow Rate, dscfm		207,668		207,610		211,366		208,881
Gas Volumetric Flow Rate, scfm		321,977		325,496		323,879		323,784
Average %CO_2 by volume, dry basis		14.9		15.4		16.0		15.4
Average %O_2 by volume, dry basis		8.4		8.1		7.8		8.1
Clinker Production, ton/hr		107.5		110.4		110.4		109.4
Chlorine (Cl2) Emissions								
ppm	≤	0.04	≤	0.04	≤	0.04	≤	0.04
ppm@7%O2	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/hr	≤	0.08	≤	0.08	≤	0.08	≤	0.08
lb/ton	≤	0.0007	≤	0.0007	≤	0.0007	≤	0.0007
Hydrogen Fluoride (HF) Emissions								
ppm	≤	0.12	≤	0.12	≤	0.12	≤	0.12
ppm@7%O2	≤	0.14	≤	0.13	≤	0.13	≤	0.13
lb/hr	≤	0.08	≤	0.08	≤	0.08	≤	0.08
lb/ton	≤	0.0007	≤	0.0007	≤	0.0007	≤	0.0007

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Test Location: Kiln 3
Test Method: 26A - A Train

Source Condition		**Normal**		**Normal**		**Normal**		
Date		**1/4/24**		**1/4/24**		**1/4/24**		
Start Time		**10:50**		**12:25**		**14:17**		
End Time		**12:03**		**13:39**		**15:30**		
		Run 1A		**Run 2A**		**Run 3A**		**Average**
Stack Conditions								
Average Gas Temperature, °F		327.6		316.6		324.3		322.8
Flue Gas Moisture, percent by volume		35.0%		35.9%		33.4%		34.8%
Average Flue Pressure, in. Hg		29.11		29.11		29.11		29.11
Gas Sample Volume, dscf		51.756		52.792		52.855		52.468
Average Gas Velocity, ft/sec		79.154		79.275		79.643		79.357
Gas Volumetric Flow Rate, acfm		493,471		494,222		496,517		494,737
Gas Volumetric Flow Rate, dscfm		209,334		209,428		216,521		211,761
Gas Volumetric Flow Rate, scfm		321,826		326,881		325,189		324,632
Average %CO_2 by volume, dry basis		14.9		15.4		16.0		15.4
Average %O_2 by volume, dry basis		8.4		8.1		7.8		8.1
Isokinetic Variance		99.5		101.4		98.2		99.7
Chlorine (Cl2) Emissions								
ug of sample collected	≤	150.00	≤	150.00	≤	150.00	≤	150.00
ppm	≤	0.04	≤	0.03	≤	0.03	≤	0.03
Hydrogen Fluoride (HF) Emissions								
ug of sample collected	≤	150.00	≤	150.00	≤	150.00	≤	150.00
ppm	≤	0.12	≤	0.12	≤	0.12	≤	0.12

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Test Location: Kiln 3
Test Method: 26A - B Train

Source Condition	**Normal**	**Normal**	**Normal**	
Date	**1/4/24**	**1/4/24**	**1/4/24**	
Start Time	**10:50**	**12:25**	**14:17**	
End Time	**12:03**	**13:39**	**15:30**	
	Run 1B	**Run 2B**	**Run 3B**	**Average**
Stack Conditions				
Average Gas Temperature, °F	328.4	316.3	324.8	323.2
Flue Gas Moisture, percent by volume	36.0%	36.5%	36.1%	36.2%
Average Flue Pressure, in. Hg	29.11	29.11	29.11	29.11
Gas Sample Volume, dscf	50.909	51.635	51.627	51.390
Average Gas Velocity, ft/sec	79.312	78.569	79.060	78.980
Gas Volumetric Flow Rate, acfm	494,455	489,823	492,881	492,386
Gas Volumetric Flow Rate, dscfm	206,001	205,792	206,210	206,001
Gas Volumetric Flow Rate, scfm	322,127	324,111	322,568	322,935
Average %CO_2 by volume, dry basis	14.9	15.4	16.0	15.4
Average %O_2 by volume, dry basis	8.4	8.1	7.8	8.1
Isokinetic Variance	99.4	101.0	100.7	100.4
Chlorine (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.13	≤ 0.12	≤ 0.12	≤ 0.12

Ash Grove Cement Company
Midlothian Cement Plant
Kiln 3 Stack
Normal Operations/>90% Production
Reference Method Test Data

Test No.	Date	Start Time	End Time	O2 % (dry)	Moisture %	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	1/4/2024	10:50	11:49	8.4	39.1%	≤ 0.21	≤ 0.38	0.23	0.41
2	1/4/2024	12:25	13:24	8.1	37.0%	≤ 0.20	≤ 0.35	≤ 0.21	≤ 0.37
3	1/4/2024	14:17	15:16	7.8	36.6%	≤ 0.22	≤ 0.37	≤ 0.17	≤ 0.28
Average				**8.1**	**37.6%**	**≤ 0.21**	**≤ 0.37**	**≤ 0.20**	**≤ 0.35**

Test No.	Date	Start Time	End Time	Volumetric Flow, DSCFM	Clinker Production, ton/hr	HCN lb/hr	HCN lb/ton	HF lb/hr	HF lb/ton
1	1/4/2024	10:50	11:49	207,668	107.5	≤ 0.30	≤ 0.0028	0.24	0.0022
2	1/4/2024	12:25	13:24	207,610	110.4	≤ 0.28	≤ 0.0026	≤ 0.22	≤ 0.0020
3	1/4/2024	14:17	15:16	211,366	110.4	≤ 0.31	≤ 0.0028	≤ 0.18	≤ 0.0016
Average				**208,881**	**109.4**	**≤ 0.30**	**≤ 0.0027**	**≤ 0.21**	**≤ 0.0019**

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6.0 CERTIFICATION

Mostardi Platt is pleased to have been of service to Ash Grove Cement Company If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

As project manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results, and the test program was performed in accordance with the methods specified in this test report.

MOSTARDI PLATT

Project Manager

Aaron Benninghoff

Quality Assurance

Chet A. Gutwein

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APPENDICES

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Appendix A – Plant Operating Data

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	KILN: CLINKER (TNHR)
Date/Time	Expression Value
1/4/2024 10:50	106.3
1/4/2024 10:51	106.3
1/4/2024 10:52	106.2
1/4/2024 10:53	106.3
1/4/2024 10:54	106.4
1/4/2024 10:55	106.4
1/4/2024 10:56	105.2
1/4/2024 10:57	104.7
1/4/2024 10:58	105.3
1/4/2024 10:59	105.7
1/4/2024 11:00	105.6
1/4/2024 11:01	106.2
1/4/2024 11:02	106.2
1/4/2024 11:03	106.3
1/4/2024 11:04	106.3
1/4/2024 11:05	106.3
1/4/2024 11:06	106.3
1/4/2024 11:07	106.3
1/4/2024 11:08	106.3
1/4/2024 11:09	106.3
1/4/2024 11:10	106.3
1/4/2024 11:11	106.4
1/4/2024 11:12	106.3
1/4/2024 11:13	106
1/4/2024 11:14	105.3
1/4/2024 11:15	105.6
1/4/2024 11:16	105.5
1/4/2024 11:17	104.9
1/4/2024 11:18	105.4
1/4/2024 11:19	105.5
1/4/2024 11:20	105.9
1/4/2024 11:21	106
1/4/2024 11:22	106.1
1/4/2024 11:23	106.2
1/4/2024 11:24	106.2
1/4/2024 11:25	103.1
1/4/2024 11:26	103.6
1/4/2024 11:27	105.2
1/4/2024 11:28	106
1/4/2024 11:29	106.9
1/4/2024 11:30	107.3
1/4/2024 11:31	101.6
1/4/2024 11:32	106.1
1/4/2024 11:33	105.9
1/4/2024 11:34	106.2
1/4/2024 11:35	106.1
1/4/2024 11:36	106.2
1/4/2024 11:37	106.1
1/4/2024 11:38	109.4
1/4/2024 11:39	114.7
1/4/2024 11:40	112.6
1/4/2024 11:41	111.9
1/4/2024 11:42	111.3
1/4/2024 11:43	111.1
1/4/2024 11:44	110.8
1/4/2024 11:45	110.6
1/4/2024 11:46	110.5
1/4/2024 11:47	110.5
1/4/2024 11:48	110.6
1/4/2024 11:49	110.4
1/4/2024 11:50	110.5
1/4/2024 11:51	110.5
1/4/2024 11:52	110.4
1/4/2024 11:53	110.5
1/4/2024 11:54	110.4
1/4/2024 11:55	109.2
1/4/2024 11:56	109.5
1/4/2024 11:57	109.8
1/4/2024 11:58	110.1
1/4/2024 11:59	110.3
1/4/2024 12:00	110.3
1/4/2024 12:01	110.2
1/4/2024 12:02	110.5
1/4/2024 12:03	110.5
Average	**107.5**

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	KILN: CLINKER (TNHR)
Date/Time	Expression Value
1/4/2024 12:25	110.5
1/4/2024 12:26	110.4
1/4/2024 12:27	110.4
1/4/2024 12:28	110.4
1/4/2024 12:29	110.4
1/4/2024 12:30	110.3
1/4/2024 12:31	108.6
1/4/2024 12:32	109.4
1/4/2024 12:33	109.8
1/4/2024 12:34	110.1
1/4/2024 12:35	110.2
1/4/2024 12:36	110.2
1/4/2024 12:37	110.3
1/4/2024 12:38	110.4
1/4/2024 12:39	110.5
1/4/2024 12:40	110.4
1/4/2024 12:41	110.4
1/4/2024 12:42	110.5
1/4/2024 12:43	110.4
1/4/2024 12:44	110.4
1/4/2024 12:45	110.4
1/4/2024 12:46	110.2
1/4/2024 12:47	110.6
1/4/2024 12:48	110.5
1/4/2024 12:49	110.4
1/4/2024 12:50	110.6
1/4/2024 12:51	110.5
1/4/2024 12:52	110.6
1/4/2024 12:53	110.4
1/4/2024 12:54	110.5
1/4/2024 12:55	110.4
1/4/2024 12:56	110.4
1/4/2024 12:57	110.4
1/4/2024 12:58	110.5
1/4/2024 12:59	111.8
1/4/2024 13:00	111.4
1/4/2024 13:01	111
1/4/2024 13:02	110.8
1/4/2024 13:03	110.7
1/4/2024 13:04	110.6
1/4/2024 13:05	110.5
1/4/2024 13:06	110.5
1/4/2024 13:07	110.5
1/4/2024 13:08	110.5
1/4/2024 13:09	110.5
1/4/2024 13:10	110.4
1/4/2024 13:11	110.4
1/4/2024 13:12	110.5
1/4/2024 13:13	110.4
1/4/2024 13:14	110.4
1/4/2024 13:15	110.4
1/4/2024 13:16	110.5
1/4/2024 13:17	110.4
1/4/2024 13:18	110.4
1/4/2024 13:19	110.4
1/4/2024 13:20	110.4
1/4/2024 13:21	110.5
1/4/2024 13:22	110.4
1/4/2024 13:23	110.4
1/4/2024 13:24	110.4
1/4/2024 13:25	110.4
1/4/2024 13:26	110.4
1/4/2024 13:27	110.4
1/4/2024 13:28	110.4
1/4/2024 13:29	110.4
1/4/2024 13:30	110.4
1/4/2024 13:31	110.1
1/4/2024 13:32	110.5
1/4/2024 13:33	110.5
1/4/2024 13:34	110.5
1/4/2024 13:35	110.4
1/4/2024 13:36	110.5
1/4/2024 13:37	110.4
1/4/2024 13:38	110.5
1/4/2024 13:39	110.4
Average	**110.4**

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	KILN: CLINKER (TNHR)
Date/Time	Expression Value
1/4/2024 14:17	110.4
1/4/2024 14:18	110.5
1/4/2024 14:19	110.5
1/4/2024 14:20	110.4
1/4/2024 14:21	110.4
1/4/2024 14:22	110.4
1/4/2024 14:23	110.4
1/4/2024 14:24	110.4
1/4/2024 14:25	110.4
1/4/2024 14:26	110.5
1/4/2024 14:27	110.4
1/4/2024 14:28	110.4
1/4/2024 14:29	110.5
1/4/2024 14:30	110.5
1/4/2024 14:31	110.4
1/4/2024 14:32	110.4
1/4/2024 14:33	110.5
1/4/2024 14:34	110.5
1/4/2024 14:35	110.4
1/4/2024 14:36	110.5
1/4/2024 14:37	110.4
1/4/2024 14:38	110.4
1/4/2024 14:39	110.4
1/4/2024 14:40	110.5
1/4/2024 14:41	110.4
1/4/2024 14:42	110.4
1/4/2024 14:43	110.5
1/4/2024 14:44	110.4
1/4/2024 14:45	110.4
1/4/2024 14:46	110.4
1/4/2024 14:47	110.4
1/4/2024 14:48	110.4
1/4/2024 14:49	110.4
1/4/2024 14:50	110.5
1/4/2024 14:51	110.4
1/4/2024 14:52	110.4
1/4/2024 14:53	110.4
1/4/2024 14:54	110.4
1/4/2024 14:55	110.5
1/4/2024 14:56	110.4
1/4/2024 14:57	110.4
1/4/2024 14:58	110.4
1/4/2024 14:59	110.4
1/4/2024 15:00	110.4
1/4/2024 15:01	110.4
1/4/2024 15:02	110.3
1/4/2024 15:03	110.5
1/4/2024 15:04	110.5
1/4/2024 15:05	110.5
1/4/2024 15:06	110.4
1/4/2024 15:07	110.5
1/4/2024 15:08	110.4
1/4/2024 15:09	110.5
1/4/2024 15:10	110.4
1/4/2024 15:11	110.4
1/4/2024 15:12	110.5
1/4/2024 15:13	110.4
1/4/2024 15:14	110.5
1/4/2024 15:15	110.4
1/4/2024 15:16	110.3
1/4/2024 15:17	110.4
1/4/2024 15:18	110.4
1/4/2024 15:19	110.5
1/4/2024 15:20	110.4
1/4/2024 15:21	110.5
1/4/2024 15:22	110.4
1/4/2024 15:23	110.4
1/4/2024 15:24	110.4
1/4/2024 15:25	110.4
1/4/2024 15:26	110.4
1/4/2024 15:27	110.4
1/4/2024 15:28	110.4
1/4/2024 15:29	110.5
1/4/2024 15:30	110.4
Average	**110.4**

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Appendix B – Test Section Diagrams

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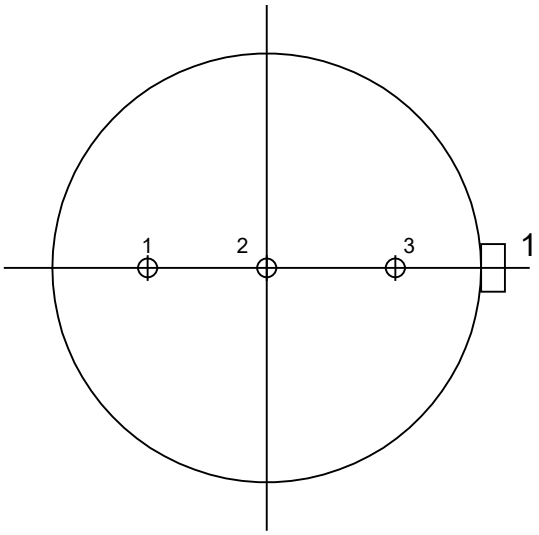
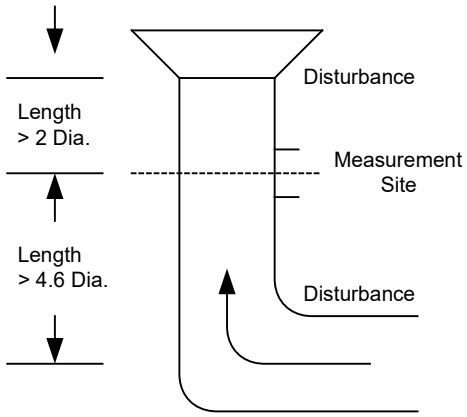
STRATIFICATION TEST FOR ROUND DUCTS





Job: Ash Grove Cement Company
Midlothian Cement Plant
Midlothian, Texas

Test Location: Kiln 3 Stack

Stack Diameter: 11.50 Feet

Stack Area: 103.91 Square Feet

No. Sample Points: 3

Port Length: 7.0 Inches

Distance from Inside Wall
To Traverse Point:

1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

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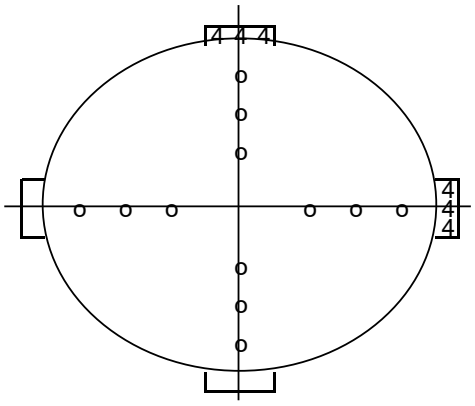
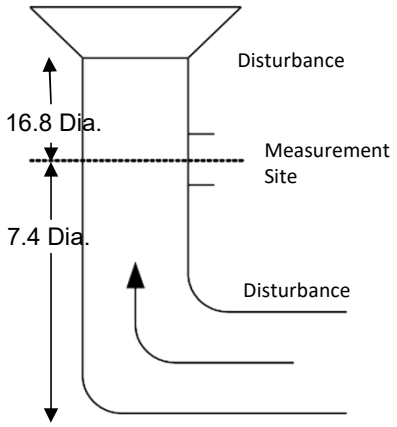
EQUAL AREA TRAVERSE FOR ROUND DUCTS





Client: Ash Grove Cement Company

Facility: Midlothian Cement Plant

Test Location: Kiln 3

Date: 01/04/24

Diameter (Feet): 11.502

Port Length (In): 7.00

Ports Sampled: 4

Points/Port: 3

Point Markings

	From inside wall (in.)	% of Diameter
1	6.07	4.40
2	20.15	14.60
3	40.86	29.60

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Appendix C – Sample Train Diagrams

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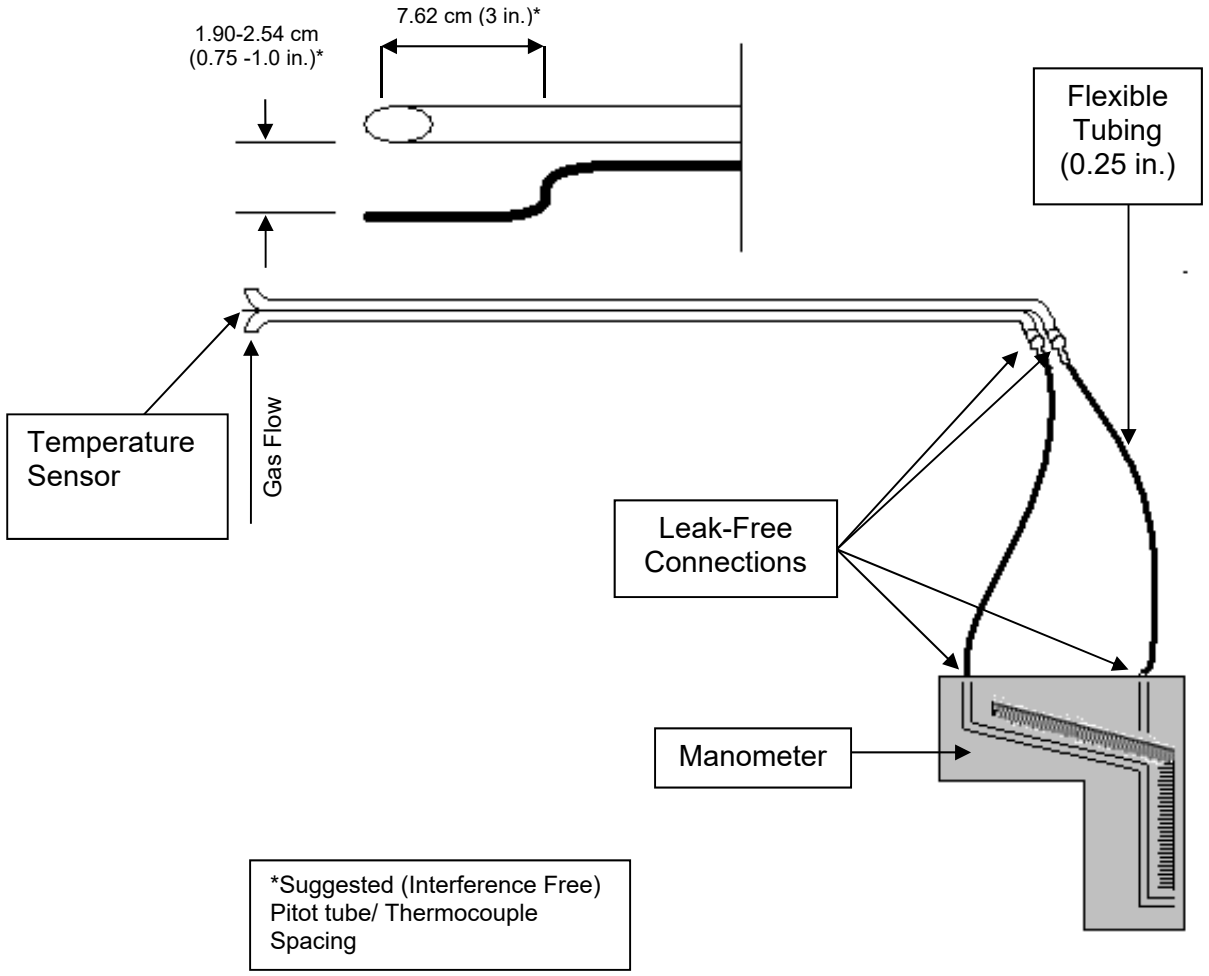
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



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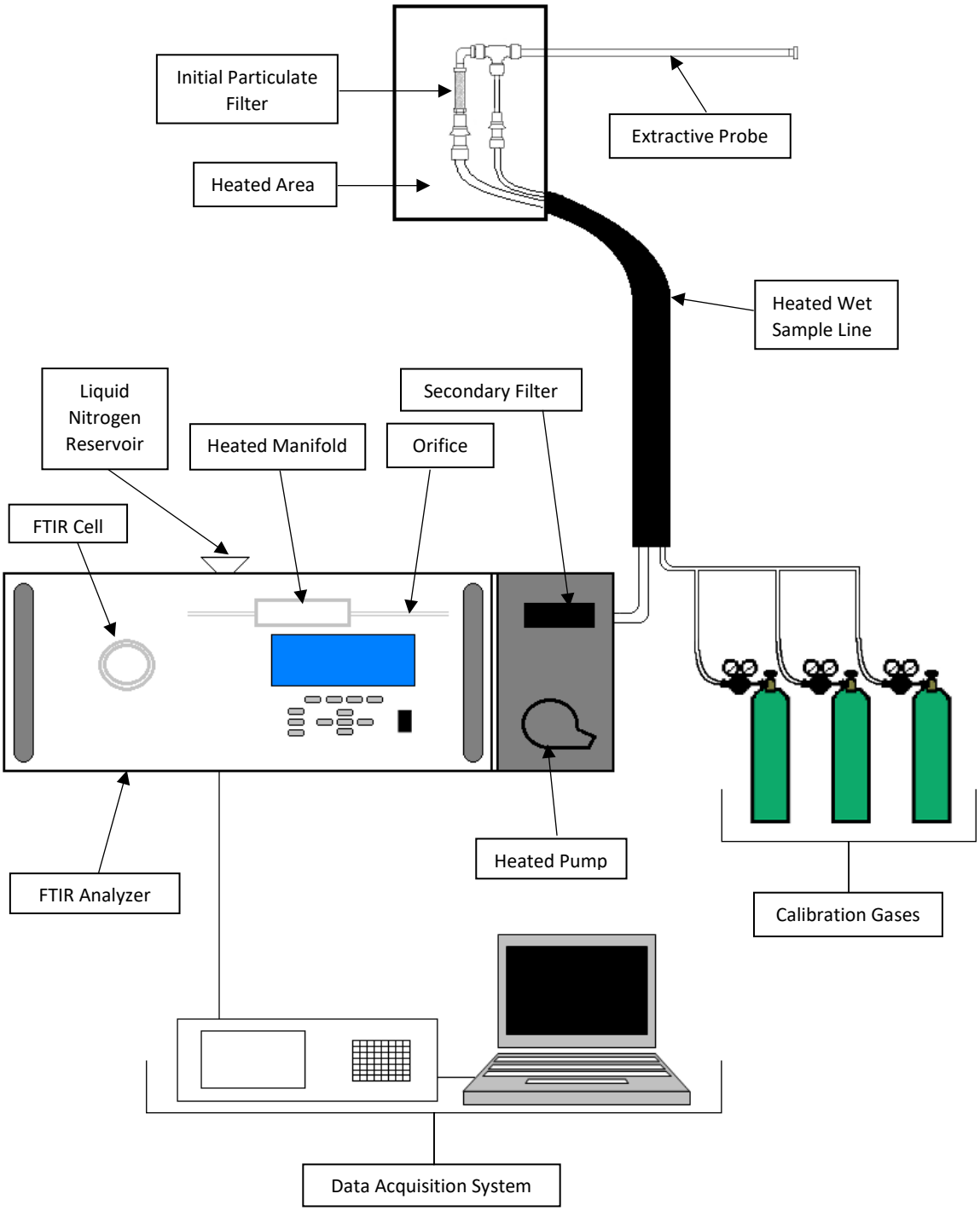
USEPA Method 320 – Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared (FTIR) Spectroscopy Sample Train Diagram



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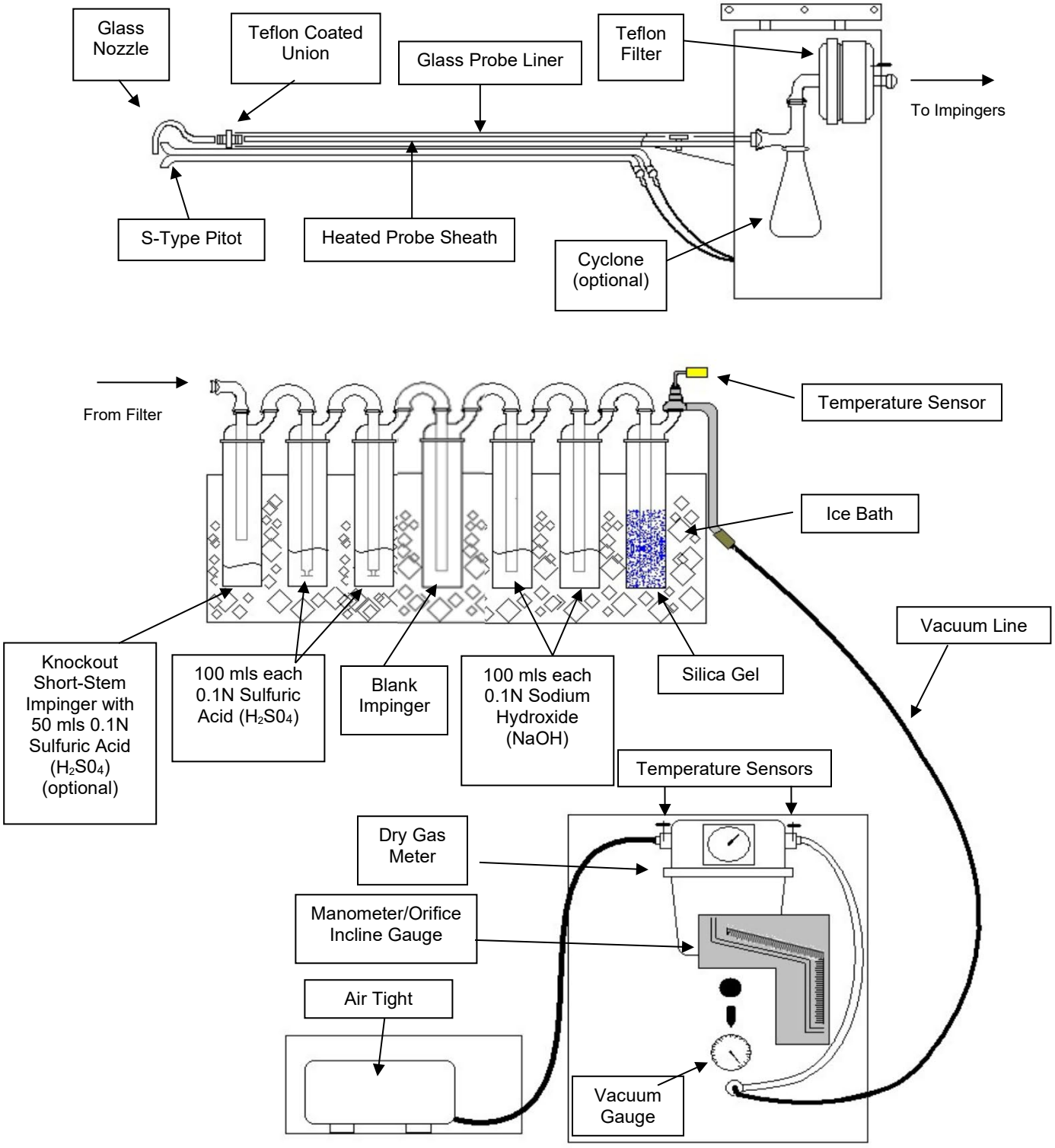
USEPA Method 26A – HF and Cl_2 Sample Train Diagram



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Appendix D – Calculation Nomenclature and Formulas

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location: Kiln 3 Stack
Date: 1/4/24

Sample Calculations

$$(8.63\ \% - 0.36\ \%) \times \frac{\textbf{O2 \% (dry)}\ 11.95\ \%}{12.11\ \% - 0.36\ \%} = 8.42\ \%$$

$$C_{gas} = (C - C_o) \times \frac{C_{ma}}{C_m - C_o}$$

where:
C_{gas} = Effluent gas concentration, dry basis, ppm or %
C = Average gas concentration indicated by gas analyzer, dry basis, ppm or %
C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm or %
C_m = Average of inititial and final system calibration bias check responses for the upscale calibration gas, ppm or %
C_{ma} = Actual concentration of the upscale calibration gas, ppm or %

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location: Kiln 3 Stack
Date: 1/4/24

FTIR Sample Calculations

Direct Recovery % of Calibration Transfer Standard

$$DR_{cts} = \frac{D_{cts}}{Cma} \times 100$$

Cma= 100.4 D_{cts} = 99.9

DR_{cts} = 99.5%

Recovery % with Calibration Transfer Standard System Purge

$$R_{cts} = \frac{Sys_{cts}}{D_{cts}} \times 100$$

Sys_{cts} = 97.1 D_{cts} = 99.9

R_{cts} = 97%

Direct Recovery % of Analyte Spike Gas

SF6			HCN		
$DR_{sf6} = \frac{D_{sf6}}{Cma} \times 100$			$DR_{asg} = \frac{D_{asg}}{Cma} \times 100$		
Cma= 5.0	D_{sf6} = 5.0		Cma= 49.3	D_{asg} = 46.9	
DR_{sf6} = 101%			DR_{asg} = 95.1%		

Dilution Factor for Analyte Spiking

$$DF = \frac{Spk_{sf6}}{D_{sf6}}$$

Spk_{sf6} = 0.400 D_{sf6} = 5.036

DF = 0.079

Recovery % for Analyte Spike With HCN

$$R_x = \frac{Spk_x}{(N_x \times (1-DF) + D_{asg} \times DF)}$$

Spk_x = 2.8 N_x = -0.7

DF = 0.079 D_{asg} = 46.9

R_x = 90.2 %

where:

DR_{cts} = Recovery % of the calibration transfer standard directly to the analyzer
Cma = certified concentration of calibration gas, ppm
D_{cts} = Concentration of the calibration transfer standard gas directly to the analyzer, ppm
R_{cts} = Recovery % of the calibration transfer standard through the sampling system
Sys_{cts} = Concentration of the calibration transfer standard gas through the system, ppm
DF = Dilution Factor of analyte spike gas
Spk_{sf6} = SF6 concentration in effluent during spiking
Spk_x = Analyte concentration in effluent during spiking
D_{asg} = Concentration of the analyte spike gas directly to the analyzer, ppm
D_{sf6} = Concentration of the SF6 directly to the analyzer, ppm
R_x = Recovery % of the analyte spike gas
N_x = Native effluent (HCN) concentration prior to analyte spike

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Moisture Calculations

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w R T_{std}}{P_{std} M_w} = 0.04707(V_f - V_i)$$

$$V_{wsg(std)} = \frac{(W_f - W_i)\rho_w R T_{std}}{P_{std} M_w} = 0.04715(W_f - W_i)$$

$$V_{m(std)} = 17.64\, V_m Y \frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Where:

B_{ws} = Water vapor in gas stream, proportion by volume
M_w = Molecular weight of water, 18.015 lb/lb-mole
P_{bar} = Barometric pressure at the testing site, in. Hg
P_{std} = Standard absolute pressure, 29.92 in. Hg
R = Ideal gas constant, 0.048137 (in. Hg)(ft^3)/(g-mole)(°R) = [21.8348(in. Hg)(ft^3)/(lb-mole)(°R)]/453.592 g-mole/lb-mole
T_m = Absolute average dry gas meter temperature, °R
T_{std} = Standard absolute temperature, 528 °R
V_f = Final volume of condenser water, ml
V_i = Initial volume of condenser water, ml
V_m = Dry gas volume measured by dry gas meter, dcf
$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, scf
$V_{wc(std)}$ = Volume of condensed water vapor, corrected to standard conditions, scf
$V_{wsg(std)}$ = Volume of water vapor collected in silica gel, corrected to standard conditions, scf
W_f = Final weight of silica gel, g
W_i = Initial weight of silica gel, g
Y = Dry gas meter calibration factor
ΔH = Average pressure exerted on dry gas meter outlet by gas sample bag, in. H_2O
ρ_w = Density of water, 0.9982 g/ml
13.6 = Specific gravity of mercury (Hg)
17.64 = T_{std}/P_{std}
0.04707 = ft^3/ml 0.04715 = ft^3/g

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Volumetric Flow Nomenclature

A = Cross-sectional area of stack or duct, ft2
Bws = Water vapor in gas stream, proportion by volume
Cp = Pitot tube coefficient, dimensionless
Md = Dry molecular weight of gas, lb/lb-mole
Ms = Molecular weight of gas, wet basis, lb/lb-mole
Mw = Molecular weight of water, 18.0 lb/lb-mole
Pbar = Barometric pressure at testing site, in. Hg
Pg = Static pressure of gas, in. Hg (in. H2O/13.6)
DH= Static pressure of gas, in.H2O
Ps = Absolute pressure of gas, in. Hg = Pbar + Pg
Pstd = Standard absolute pressure, 29.92 in. Hg
Acfm = Actual volumetric gas flow rate
Scfm= Volumetric gas flow rate, corrected to standard conditions
Dscfm = Standard volumetric flow rate, corrected to dry conditions
R = Ideal gas constant, 21.85 in. Hg-ft3/°R-lb-mole
Ts = Average stack gas temperature, °F
Tm = Average dry gas meter temperature, oF
Tstd = Standard absolute temperature, 528°R
vs = Gas velocity, ft/sec
Vm(std)= Volume of gas sampled, corrected to standard conditions, scf
Vw(std) = Volume of water vapor in gas sample, corrected to standard conditions, scf
Vlc= Volume of liquid collected
Y = Dry gas meter calibration factor
Δp = Velocity head of gas, in. H2O
K1 = 17.647 °R/in. Hg
%EA = Percent excess air
%CO2 = Percent carbon dioxide by volume, dry basis
%O2 = Percent oxygen by volume, dry basis
%N2 = Percent nitrogen by volume, dry basis
0.264 = Ratio of O2 to N2 in air, v/v
0.28 = Molecular weight of N2 or CO, divided by 100
0.32 = Molecular weight of O2 divided by 100
0.44 = Molecular weight of CO2 divided by 100
13.6 = Specific gravity of mercury (Hg)

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Volumetric Air Flow Calculations

$$Vm\ (std) = 17.647 \times Vm \times \left[\frac{\left(P_{bar} + \left[\frac{DH}{13.6}\right]\right)}{(460 + Tm)}\right] \times Y$$

$$Vw\ (std) = 0.0471 \times Vlc$$

$$Bws = \left[\frac{Vw\ (std)}{Vw\ (std) + Vm\ (std)}\right]$$

$$Md = (0.44 \times \%CO_2) + (0.32 \times \%O_2) + [0.28 \times (100 - \%CO_2 - \%O_2)]$$

$$Ms = Md \times (1 - Bws) + (18 \times Bws)$$

$$Vs = \sqrt{\frac{(Ts + 460)}{Ms \times Ps}} \times \sqrt{DP} \times Cp \times 85.49$$

$$Acfm = Vs \times Area\ (of\ stack\ or\ duct) \times 60$$

$$Scfm = Acfm \times 17.647 \times \left[\frac{Ps}{(460 + Ts)}\right]$$

$$Scfh = Scfm \times 60\frac{min}{hr}$$

$$Dscfm = Scfm \times (1 - Bws)$$

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Isokinetic Calculation Formulas

1. $V_{w(std)} = V_{lc}\left(\frac{\rho_w}{M_w}\right)\left(\frac{RT_{std}}{P_{std}}\right) = K_2 V_{lc}$

2. $V_{m(std)} = V_m Y \left(\frac{T_{std}}{T_m}\right)\left(\frac{(P_{bar} + (\frac{\Delta H}{13.6}))}{P_{std}}\right) = K_1\, V_m\, Y \frac{(P_{bar} + (\frac{\Delta H}{13.6}))}{T_m}$

3. $B_{ws} = \frac{V_{w(std)}}{(V_{m(std)} + V_{w(std)})}$

4. $M_d = 0.44(\%CO_2) + 0.32(\%O_2) + 0.28(\%N_2)$

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

6. $C_a = \frac{m_a}{V_a \rho_a}$

7. $W_a = C_a V_{aw} \rho_a$

8. $C_{acf} = 15.43 K_i\left(\frac{m_n P_s}{V_{w(std)} + V_{m(std)}\, T_s}\right)$

9. $C_S = (15.43\ \text{grains/gram})\,(m_n / V_{m(std)})$

10. $v_s = K_p C_p \sqrt{\frac{\Delta P\, T_s}{P_s M_s}}$

11. $Q_{acfm} = v_s A(60_{sec/min})$

12. $Q_{sd} = (3600_{sec/hr})(1 - B_{ws})\, v_s \left(\frac{T_{std} P_s}{T_s P_{std}}\right) A$

13. $E\,(\text{emission rate, lbs/hr}) = Q_{std}\left(C_s / 7000\ \text{grains/lb}\right)$

14. $IKV = \frac{T_s V_{m(std)} P_{std}}{T_{std} v_s \theta A_n P_s 60(1 - B_{ws})} = K_4 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1 - B_{ws})}$

15. $\%EA = \left(\frac{\%O_2 - (0.5\,\%CO)}{0.264\,\%N_2 - (\%O_2 - 0.5\,\%CO)}\right) \times 100$

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Isokinetic Nomenclature

A = Cross-sectional area of stack or duct, square feet
A_n = Cross-sectional area of nozzle, square feet
B_{ws} = Water vapor in gas stream, by volume
C_a = Acetone blank residue concentration, g/g
C_{acf} = Concentration of particulate matter in gas stream at actual conditions, gr/acf
C_p = Pitot tube coefficient
C_s = Concentration of particulate matter in gas stream, dry basis, corrected to standard conditions, gr/dscf
IKV = Isokinetic sampling variance, must be 90.0 % ≤ IKV ≤ 110.0%
M_d = Dry molecular weight of gas, lb/lb-mole
M_s = Molecular weight of gas, wet basis, lb/lb-mole
M_w = Molecular weight of water, 18.0 lb/lb-mole
m_a = Mass of residue of acetone after evaporation, grams
P_{bar} = Barometric pressure at testing site, inches mercury
P_g = Static pressure of gas, inches mercury (inches water/13.6)
P_s = Absolute pressure of gas, inches mercury = $P_{bar} + P_g$
P_{std} = Standard absolute pressure, 29.92 inches mercury
Q_{acfm} = Actual volumetric gas flow rate, acfm
Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, dscfh
R = Ideal gas constant, 21.85 inches mercury cubic foot/°R-lb-mole
T_m = Dry gas meter temperature, °R
T_s = Gas temperature, °R
T_{std} = Absolute temperature, 528°R
V_a = Volume of acetone blank, ml
V_{aw} = Volume of acetone used in wash, ml
W_a = Weight of residue in acetone wash, grams
m_n = Total amount of particulate matter collected, grams
V_{1c} = Total volume of liquid collected in impingers and silica gel, ml
V_m = Volume of gas sample as measured by dry gas meter, dcf
$V_{m(std)}$ = Volume of gas sample measured by dry gas meter, corrected to standard conditions, dscf
v_s = Gas velocity, ft/sec
$V_{w(std)}$ = Volume of water vapor in gas sample, corrected to standard conditions, scf
Y = Dry gas meter calibration factor
ΔH = Average pressure differential across the orifice meter, inches water
Δp = Velocity head of gas, inches water
ρ_a = Density of acetone, 0.7855 g/ml (average)
ρ_w = Density of water, 0.002201 lb/ml
θ = Total sampling time, minutes
K_1 = 17.647 °R/in. Hg
K_2 = 0.04707 ft^3/ml
K_4 = 0.09450/100 = 0.000945
K_p = Pitot tube constant, $85.49 \frac{ft}{sec}\left[\frac{(lb/lb-mole)(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$
%EA = Percent excess air
$\%CO_2$ = Percent carbon dioxide by volume, dry basis
$\%O_2$ = Percent oxygen by volume, dry basis
%CO = Percent carbon monoxide by volume, dry basis
$\%N_2$ = Percent nitrogen by volume, dry basis
0.264 = Ratio of O_2 to N_2 in air, v/v
28 = Molecular weight of N_2 or CO
32 = Molecular weight of O_2
44 = Molecular weight of CO_2
13.6 = Specific gravity of mercury (Hg)

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Calculations for Hydrogen Fluoride By Method 26 or 26A

Concentration

$$\frac{\text{lbs HF}}{\text{dscf}} = \frac{\mu\text{g HF in sample}}{4.536 \times 10^{8} \times \text{dscf}}$$

where:

$4.536 \times 10^{8} = \mu\text{g/lb}$

dscf = Volume of gas sampled

$$\mu g\text{/lb HF} = \mu\text{g F} \times \frac{20.008}{19.000}$$

Parts Per Million

$$\text{ppm HF} = \frac{\text{lbs HF}}{\text{dscf}} \div \frac{20.008}{385 \times 10^{6}}$$

where:

385 = Volume of 1 lb mole of gas at 68°F and 29.92 in. Hg

106 = Conversion of ppm v/v

Emission Rate

lbs HF /dscf × dscfm × 60 min/hr = lbs/hr HF

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Pollutant Concentration Correction 7% for Percent Oxygen

$$C_{adj} = C_d \frac{20.9 - 7\%}{20.9 - \%O_2}$$

where:

C_{adj} = Pollutant concentration corrected to percent O_2

20.9 - 7% = Percent O_2, the defined O_2 correction value, percent

20.9 = Percent O_2 in air

$\%O_2$ = Measured O_2 concentration dry basis, percent

C_d = Pollutant concentration measured, dry basis, ppm.

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Appendix E- Laboratory Sample Analysis

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Chain-of-Custody Form

Project Number: M235102	Date Results Required:
Client: Ash Grove Midlothian	TAT Required:
Plant/Test Location: Main Kiln Stack	Project Supervisor: Aaron Benninghoff
PO#:	

Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
001	1/4/24	#1A KILN M26A H2SO4 Part 1	1		HF	602.7
002	1/4/24	#1A KILN M26A H2SO4 Part 2	1		HF	292.1
003	1/4/24	#1A KILN M26A NaOH	1		Cl2	380.9
004	1/4/24	#1B KILN H2SO4 Part 1	1		HF	587.2
005	1/4/24	#1B KILN M26A H2SO4 Part 2	1		HF	319.0
006	1/4/24	#1B KILN M26A NaOH	1		Cl2	435.2
007	1/4/24	#2A KILN M26A H2SO4 Part 1	1		HF	577.9
008	1/4/24	#2A KILN M26A H2SO4 Part 2	1		HF	478.4
009	1/4/24	#2A KILN M26A NaOH	1		Cl2	394.2
010	1/4/24	#2B KILN M26A H2SO4 Part 1	1		HF	540.3
011	1/4/24	#2B KILN M26A H2SO4 Part 2	1		HF	410.0
012	1/4/24	#2B KILN M26A NaOH	1		Cl2	453.6
013	1/4/24	#3A KILN M26A H2SO4 Part 1	1		HF	580.7
014	1/4/24	#3A KILN H2SO4 Part 2	1		HF	360.0
015	1/4/24	#3A KILN M26A NaOH	1		Cl2	365.7
016	1/4/24	#3B KILN M26A H2SO4 Part 1	1		HF	564.5
017	1/4/24	#3B KILN M26A H2SO4 Part 2	1		HF	433.2
018	1/4/24	#3B KILN M26A NaOH	1		Cl2	423.5
019	1/4/24	A Train Blank H2SO4	1		HF	383.0
020	1/4/24	A Train Blank NaOH	1		Cl2	352.7
021	1/4/24	DI Reagent Blank	1		HF/Cl2	117.2

Delivered to Lab by: Date/Time:	Received by: Date/Time:	Processed by: Date/Time:

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Appendix F - Reference Method Test Data

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Client:	Ash Grove Cement Company														
Facility:	Midlothian Cement Plant														
Test Location:	Kiln 3														
Project #:	M235102														
Test Method:	26A														
Test Engineer:	CLC1														
Test Technician:	BRD1														
	Run 1A					**Run 2A**					**Run 3A**				
Temp ID:	CM28					CM28					CM28				
Meter ID:	CM28					CM28					CM28				
Pitot ID:	P-1278					P-1278					P-1278				
Nozzle Diameter (Inches):	0.281					0.281					0.281				
Meter Calibration Date:	12/8/2023					12/8/2023					12/8/2023				
Meter Calibration Factor (Y):	0.984					0.984					0.984				
Meter Orifice Setting (Delta H):	1.878					1.878					1.878				
Nozzle Kit ID Number and Material:	Glass 11					Glass 11					Glass 11				
	Leak Checks														
Pre Pitot Leak Check	**0.0**	**@**	**4.0**	**"H_2O**		**0.0**	**@**	**3.8**	**"H_2O**		**0.0**	**@**	**4.1**	**"H_2O**	
Post Pitot Leak Check	**0.0**	**@**	**4.2**	**"H_2O**		**0.0**	**@**	**4.0**	**"H_2O**		**0.0**	**@**	**3.8**	**"H_2O**	
Pre Nozzle Leak Check	**0.0000**	**@**	**13**	**"Hg**		**0.0000**	**@**	**15**	**"Hg**		**0.0000**	**@**	**13**	**"Hg**	
Post Nozzle Leak Check	**0.0000**	**@**	**12**	**"Hg**		**0.0000**	**@**	**10**	**"Hg**		**0.0000**	**@**	**10**	**"Hg**	
Pitot Tube Coefficient:	0.832														
Probe Length (Feet):	5.0														
Probe Liner Material:	Glass														
Sample Plane:	Horizontal														
Port Length (Inches):	7.00														
Port Size (Diameter, Inches):	6.00														
Port Type:	Flange														
Duct Shape:	Circular														
Diameter (Feet):	11.502														
Duct Area (Square Feet):	103.905														
Upstream Diameters:	16.8														
Downstream Diameters:	7.4														
Number of Ports Sampled:	4														
Number of Points per Port:	3														
Minutes per Point:	5.0														
Minutes per Reading:	5.0														
Total Number of Traverse Points:	12														
Test Length (Minutes):	60														
Train Type:	Anderson Box														
Source Condition:	Normal														
Diluent Model/Serial Number:	Servomex 1440 and MKS 2030														
Moisture Balance ID:	D-01														
# of Runs	3														

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Run 1A - Method 26A

Client: Ash Grove Cement Company | **Date: 1/4/24**

Facility: Midlothian Cement Plant | **Start Time: 10:50**

Test Location: Kiln 3 | **End Time: 12:03**

Source Condition: Normal

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.28	in. H_2O	Static Pressure	-2.50	in. H_2O
Meter Temperature, Tm:	61.3	°F	Flue Pressure (Ps):	29.11	in. Hg. abs.
Sqrt ΔP:	1.097	in. H_2O	Carbon Dioxide:	14.91	%
Stack Temperature, Ts:	327.6	°F	Oxygen:	8.42	%
Meter Volume, Vm:	52.749	ft^3	Nitrogen:	76.67	%
Meter Volume, Vmstd:	51.756	dscf	Gas Weight dry, Md:	30.722	lb/lb mole
Meter Volume, Vwstd:	27.813	wscf	Gas Weight wet, Ms:	26.275	lb/lb mole
Isokinetic Variance:	99.5	%I	Excess Air:	71.230	%
			Gas Velocity, Vs:	79.154	fps
Test Length:	60.00	in mins.	Volumetric Flow:	493,471	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	209,334	dscfm
Barometric Pressure:	29.29	in Hg	Volumetric Flow:	321,826	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3623.4	ml	Silica Initial Wt.	849.5	grams
Final Impinger Content:	4193.9	ml	Silica Final Wt.	869.5	grams
Impinger Difference:	570.5	ml	Silica Difference:	20.0	grams
Total Water Gain:	590.5		Moisture, Bws:	0.350	

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:50:00	1.40	2.60	23.056	331	57	59	5	255	260	60
1-2	10:55:00	1.30	2.40	27.690	330	57	59	5	252	259	57
1-3	11:00:00	1.00	1.80	32.130	329	57	59	6	252	260	60
	11:05:00			36.211							
2-1	11:09:00	1.40	2.60	36.211	329	58	60	7	250	260	61
2-2	11:14:00	1.20	2.50	40.950	328	58	60	7	251	260	62
2-3	11:19:00	1.00	1.80	45.320	327	60	62	7	252	259	62
	11:24:00			49.317							
3-1	11:29:00	1.40	2.60	49.317	330	60	62	7	251	259	59
3-2	11:34:00	1.20	2.30	54.230	328	62	64	7	250	261	58
3-3	11:39:00	1.00	1.90	58.610	327	64	64	7	250	259	59
	11:44:00			62.582							
4-1	11:48:00	1.40	2.60	62.582	326	64	65	7	254	262	57
4-2	11:53:00	1.20	2.30	67.320	324	64	66	7	257	261	57
4-3	11:58:00	1.00	1.90	71.770	322	64	67	7	260	259	57
	12:03:00			75.805							
Total	1:00:00			52.749		60.4	62.3				
Average			2.28		327.6	61.3		7			
Min			1.80		322.0	57.0		5			
Max			2.60		331.0	67.0		7			

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Impinger Weight Sheet - Run 1A

Client:	**Ash Grove Cement Company**
Facility:	**Midlothian Cement Plant**
Test Location:	**Kiln 3**
Project #:	**M235102**
Date:	**1/4/2024**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**D-01**

Scale Calibration Check Date: **1/3/2024**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	1,005.6	780.8	224.8
0.1N H2SO4	971.5	738.6	232.9
Empty	685.8	610.1	75.7
0.1N NaOH	779.3	749.3	30.0
0.1N NaOH	751.7	744.6	7.1
Silica Gel	869.5	849.5	20.0
	4,193.9 Liquid Final	3,623.4 Liquid Initial	570.5 Liquid Gain
	869.5 Silica Final	849.5 Silica Initial	20.0 Silica Gain

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Run 2A - Method 26A

Client: Ash Grove Cement Company | **Date: 1/4/24**

Facility: Midlothian Cement Plant | **Start Time: 12:25**

Test Location: Kiln 3 | **End Time: 13:39**

Source Condition: Normal

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.35	In. H_2O	Static Pressure	-2.50	in. H_2O
Meter Temperature, Tm:	72.6	°F	Flue Pressure (Ps):	29.11	in. Hg. abs.
Sqrt ΔP:	1.104	In. H_2O	Carbon Dioxide:	15.44	%
Stack Temperature, Ts:	316.6	°F	Oxygen:	8.14	%
Meter Volume, Vm:	54.956	ft^3	Nitrogen:	76.4	%
Meter Volume, Vmstd:	52.792	dscf	Gas Weight dry, Md:	30.796	lb/lb mole
Meter Volume, Vwstd:	29.607	wscf	Gas Weight wet, Ms:	26.198	lb/lb mole
Isokinetic Variance:	101.4	%I	Excess Air:	67.637	%
			Gas Velocity, Vs:	79.275	fps
Test Length:	60.00	in mins.	Volumetric Flow:	494,222	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	209,428	dscfm
Barometric Pressure:	29.29	in Hg	Volumetric Flow:	326,881	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3621.7	ml	Silica Initial Wt.	862.2	grams
Final Impinger Content:	4232.5	ml	Silica Final Wt.	880.0	grams
Impinger Difference:	610.8	ml	Silica Difference:	17.8	grams

Total Water Gain: 628.6 Moisture, Bws: 0.359

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	12:25:00	1.40	2.70	76.541	320	70	71	5	258	260	50
1-2	12:30:00	1.20	2.30	81.420	319	70	71	5	257	260	51
1-3	12:35:00	1.00	1.90	85.980	318	71	72	5	260	259	52
	12:40:00			90.012							
2-1	12:45:00	1.40	2.70	90.012	318	72	72	5	260	258	51
2-2	12:50:00	1.20	2.30	94.940	317	73	72	5	261	261	51
2-3	12:55:00	1.10	2.20	99.620	318	74	72	5	258	259	52
	13:00:00			103.861							
3-1	13:04:00	1.40	2.70	103.861	316	75	72	5	256	262	52
3-2	13:09:00	1.30	2.50	108.810	315	75	72	5	261	261	53
3-3	13:14:00	1.00	1.90	113.520	314	75	72	5	260	259	54
	13:19:00			117.713							
4-1	13:24:00	1.40	2.70	117.713	316	75	72	5	260	257	56
4-2	13:29:00	1.30	2.40	122.730	315	75	72	5	258	260	58
4-3	13:34:00	1.00	1.90	127.480	313	75	72	5	259	261	59
	13:39:00			131.497							
Total	1:00:00			54.956		73.3	71.8				
Average			2.35		316.6	72.6		5			
Min			1.90		313.0	70.0		5			
Max			2.70		320.0	75.0		5			

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Impinger Weight Sheet - Run 2A

Client:	**Ash Grove Cement Company**
Facility:	**Midlothian Cement Plant**
Test Location:	**Kiln 3**
Project #:	**M235102**
Date:	**1/4/2024**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**D-01**

Scale Calibration Check Date: **1/3/2024**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	901.2	735.7	165.5
0.1N H2SO4	937.6	747.2	190.4
Empty	888.4	643.2	245.2
0.1N NaOH	744.7	738.3	6.4
0.1N NaOH	760.6	757.3	3.3
Silica Gel	880.0	862.2	17.8
	4,232.5	3,621.7	610.8
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	880.0	862.2	17.8
	Silica Final	**Silica Initial**	**Silica Gain**

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Run 3A - Method 26A

Client: Ash Grove Cement Company | **Date: 1/4/24**

Facility: Midlothian Cement Plant | **Start Time: 14:17**

Test Location: Kiln 3 | **End Time: 15:30**

Source Condition: Normal

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.32	In. H_2O	Static Pressure	-2.50	in. H_2O
Meter Temperature, Tm:	74.2	°F	Flue Pressure (Ps):	29.11	in. Hg. abs.
Sqrt ΔP:	1.112	In. H_2O	Carbon Dioxide:	15.97	%
Stack Temperature, Ts:	324.3	°F	Oxygen:	7.82	%
Meter Volume, Vm:	55.194	ft^3	Nitrogen:	76.21	%
Meter Volume, Vmstd:	52.855	dscf	Gas Weight dry, Md:	30.868	lb/lb mole
Meter Volume, Vwstd:	26.527	wscf	Gas Weight wet, Ms:	26.568	lb/lb mole
Isokinetic Variance:	98.2	%I	Excess Air:	63.580	%
			Gas Velocity, Vs:	79.643	fps
Test Length:	60.00	in mins.	Volumetric Flow:	496,517	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	216,521	dscfm
Barometric Pressure:	29.29	in Hg	Volumetric Flow:	325,189	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3634.2	ml	Silica Initial Wt.	874.7	grams
Final Impinger Content:	4176.9	ml	Silica Final Wt.	895.2	grams
Impinger Difference:	542.7	ml	Silica Difference:	20.5	grams

Total Water Gain: 563.2 Moisture, Bws: 0.334

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	14:17:00	1.40	2.70	32.410	315	75	72	5	258	260	60
1-2	14:22:00	1.30	2.30	37.410	317	75	72	5	258	260	61
1-3	14:27:00	1.00	1.90	42.180	318	75	72	5	259	261	62
	14:32:00			46.292							
2-1	14:36:00	1.40	2.70	46.292	322	75	72	5	260	259	62
2-2	14:41:00	1.30	2.30	51.210	324	75	72	5	259	261	62
2-3	14:46:00	1.10	2.10	55.980	320	76	72	5	260	260	63
	14:51:00			60.213							
3-1	14:55:00	1.40	2.70	60.213	328	76	72	5	261	260	63
3-2	15:00:00	1.30	2.30	65.015	330	77	72	5	259	260	63
3-3	15:05:00	1.00	1.90	69.950	331	77	72	5	261	260	63
	15:10:00			73.931							
4-1	15:15:00	1.40	2.70	73.931	330	77	73	5	258	260	63
4-2	15:20:00	1.30	2.30	78.810	329	78	73	5	260	259	64
4-3	15:25:00	1.00	1.90	83.530	327	78	73	5	261	260	63
	15:30:00			87.604							
Total	1:00:00			55.194		76.2	72.3				
Average			2.32		324.3	74.2		5			
Min			1.90		315.0	72.0		5			
Max			2.70		331.0	78.0		5			

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Impinger Weight Sheet - Run 3A

Client:	**Ash Grove Cement Company**
Facility:	**Midlothian Cement Plant**
Test Location:	**Kiln 3**
Project #:	**M235102**
Date:	**1/4/2024**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**D-01**

Scale Calibration Check Date: **1/4/2024**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	1,039.2	783.2	256.0
0.1N H2SO4	994.3	740.4	253.9
Empty	635.8	613.6	22.2
0.1N NaOH	758.6	750.0	8.6
0.1N NaOH	749.0	747.0	2.0
Silica Gel	895.2	874.7	20.5
	4,176.9	3,634.2	542.7
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	895.2	874.7	20.5
	Silica Final	**Silica Initial**	**Silica Gain**

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Client:	Ash Grove Cement Company											
Facility:	Midlothian Cement Plant											
Test Location:	Kiln 3											
Project #:	M235102											
Test Method:	26A											
Test Engineer:	JVC											
Test Technician:	BRD1											
	Run 1B				**Run 2B**				**Run 3B**			
Temp ID:	CM44				CM44				CM44			
Meter ID:	CM44				CM44				CM44			
Pitot ID:	P-1279				P-1279				P-1279			
Filter ID:	B				B				B			
Nozzle Diameter (Inches):	0.281				0.281				0.281			
Meter Calibration Date:	12/11/2023				12/11/2023				12/11/2023			
Meter Calibration Factor (Y):	0.994				0.994				0.994			
Meter Orifice Setting (Delta H):	1.801				1.801				1.801			
Nozzle Kit ID Number and Material:	Glass #32				Glass #32				Glass #32			
	Leak Checks											
Pre Pitot Leak Check	**0.0**	**@**	**4.0**	**"H_2O**	**0.0**	**@**	**4.5**	**"H_2O**	**0.0**	**@**	**5.0**	**"H_2O**
Post Pitot Leak Check	**0.0**	**@**	**4.5**	**"H_2O**	**0.0**	**@**	**3.5**	**"H_2O**	**0.0**	**@**	**4.0**	**"H_2O**
Pre Nozzle Leak Check	**0.0000**	**@**	**11**	**"Hg**	**0.0050**	**@**	**20**	**"Hg**	**0.0100**	**@**	**20**	**"Hg**
Post Nozzle Leak Check	**0.0000**	**@**	**17**	**"Hg**	**0.0050**	**@**	**19**	**"Hg**	**0.0100**	**@**	**16**	**"Hg**
Pitot Tube Coefficient:	0.833											
Probe Length (Feet):	5.0											
Probe Liner Material:	Glass											
Sample Plane:	Horizontal											
Port Length (Inches):	7.00											
Port Size (Diameter, Inches):	6.00											
Port Type:	Flange											
Duct Shape:	Circular											
Diameter (Feet):	11.502											
Duct Area (Square Feet):	103.905											
Upstream Diameters:	16.8											
Downstream Diameters:	7.4											
Number of Ports Sampled:	4											
Number of Points per Port:	3											
Minutes per Point:	5.0											
Minutes per Reading:	5.0											
Total Number of Traverse Points:	12											
Test Length (Minutes):	60											
Train Type:	Anderson Box											
Source Condition:	Normal											
Diluent Model/Serial Number:	Servomex 1440 and MKS 2030											
Moisture Balance ID:	D-01											
# of Runs	3											

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Run 1B - Method 26A

Client: Ash Grove Cement Company | **Date: 1/4/24**

Facility: Midlothian Cement Plant | **Start Time: 10:50**

Test Location: Kiln 3 | **End Time: 12:03**

Source Condition: Normal

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.31	in. H_2O	Static Pressure	-2.50	in. H_2O
Meter Temperature, Tm:	56.0	°F	Flue Pressure (Ps):	29.11	in. Hg. abs.
Sqrt ΔP:	1.094	in. H_2O	Carbon Dioxide:	14.91	%
Stack Temperature, Ts:	328.4	°F	Oxygen:	8.42	%
Meter Volume, Vm:	50.834	ft^3	Nitrogen:	76.67	%
Meter Volume, Vmstd:	50.909	dscf	Gas Weight dry, Md:	30.722	lb/lb mole
Meter Volume, Vwstd:	28.698	wscf	Gas Weight wet, Ms:	26.136	lb/lb mole
Isokinetic Variance:	99.4	%I	Excess Air:	71.230	%
			Gas Velocity, Vs:	79.312	fps
Test Length:	60.00	in mins.	Volumetric Flow:	494,455	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	206,001	dscfm
Barometric Pressure:	29.29	in Hg	Volumetric Flow:	322,127	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3582.1	ml	Silica Initial Wt.	897.8	grams
Final Impinger Content:	4174.3	ml	Silica Final Wt.	914.9	grams
Impinger Difference:	592.2	ml	Silica Difference:	17.1	grams

Total Water Gain: 609.3 Moisture, Bws: 0.360

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:50:00	1.30	2.50	40.651	331	53	53	5	260	259	55
1-2	10:55:00	1.10	2.10	45.110	330	54	54	5	264	261	55
1-3	11:00:00	0.98	1.90	49.190	328	54	54	5	262	257	56
	11:05:00			52.850							
2-1	11:09:00	1.40	2.70	52.850	329	55	55	6	256	258	56
2-2	11:14:00	1.30	2.50	57.480	331	56	56	5	259	260	57
2-3	11:19:00	0.95	1.80	61.880	333	56	56	5	259	257	57
	11:24:00			65.564							
3-1	11:29:00	1.40	2.70	65.564	332	56	56	6	260	262	59
3-2	11:34:00	1.20	2.30	70.220	329	56	56	5	261	260	61
3-3	11:39:00	1.00	1.90	74.440	327	56	56	5	258	260	62
	11:44:00			78.246							
4-1	11:48:00	1.40	2.70	78.246	324	58	58	7	263	259	64
4-2	11:53:00	1.30	2.50	82.810	324	59	59	6	259	258	64
4-3	11:58:00	1.10	2.10	87.390	323	59	59	5	258	259	65
	12:03:00			91.485							
Total	1:00:00			50.834		56.0	56.0				
Average			2.31		328.4	56.0		5			
Min			1.80		323.0	53.0		5			
Max			2.70		333.0	59.0		7			

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Impinger Weight Sheet - Run 1B

Client:	**Ash Grove Cement Company**
Facility:	**Midlothian Cement Plant**
Test Location:	**Kiln 3**
Project #:	**M235102**
Date:	**1/4/2024**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**D-01**

Scale Calibration Check Date: **1/3/2024**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	871.3	778.4	92.9
0.1N H2SO4	903.1	710.0	193.1
Empty	834.7	612.8	221.9
0.1N NaOH	818.7	745.5	73.2
0.1N NaOH	746.5	735.4	11.1
Silica Gel	914.9	897.8	17.1
	4,174.3	3,582.1	592.2
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	914.9	897.8	17.1
	Silica Final	**Silica Initial**	**Silica Gain**

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Run 2B - Method 26A

Client: Ash Grove Cement Company | **Date: 1/4/24**
Facility: Midlothian Cement Plant | **Start Time: 12:25**
Test Location: Kiln 3 | **End Time: 13:39**
Source Condition: Normal

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.37	In. H_2O	Static Pressure	-2.50	in. H_2O
Meter Temperature, Tm:	60.4	°F	Flue Pressure (Ps):	29.11	in. Hg. abs.
Sqrt ΔP:	1.092	In. H_2O	Carbon Dioxide:	15.44	%
Stack Temperature, Ts:	316.3	°F	Oxygen:	8.14	%
Meter Volume, Vm:	51.993	ft^3	Nitrogen:	76.4	%
Meter Volume, Vmstd:	51.635	dscf	Gas Weight dry, Md:	30.796	lb/lb mole
Meter Volume, Vwstd:	29.687	wscf	Gas Weight wet, Ms:	26.125	lb/lb mole
Isokinetic Variance:	101.0	%I	Excess Air:	67.637	%
			Gas Velocity, Vs:	78.569	fps
Test Length:	60.00	in mins.	Volumetric Flow:	489,823	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	205,792	dscfm
Barometric Pressure:	29.29	in Hg	Volumetric Flow:	324,111	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3330.1	ml	Silica Initial Wt.	784.7	grams
Final Impinger Content:	3943.9	ml	Silica Final Wt.	801.2	grams
Impinger Difference:	613.8	ml	Silica Difference:	16.5	grams

Total Water Gain: 630.3 Moisture, Bws: 0.365

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	12:25:00	1.30	2.50	94.221	319	59	59	4	260	258	57
1-2	12:30:00	1.30	2.50	98.610	318	59	59	4	260	265	58
1-3	12:35:00	1.10	2.20	103.220	316	59	59	4	260	261	58
	12:40:00			107.338							
2-1	12:45:00	1.40	2.70	107.338	317	59	59	4	255	264	58
2-2	12:50:00	1.30	2.60	112.050	319	60	60	4	260	259	59
2-3	12:55:00	1.00	2.00	116.580	317	61	61	4	257	261	59
	13:00:00			120.543							
3-1	13:04:00	1.30	2.60	120.543	312	61	61	5	259	257	61
3-2	13:09:00	1.20	2.40	125.140	317	62	62	4	260	262	62
3-3	13:14:00	0.96	1.90	129.490	314	62	62	4	258	259	62
	13:19:00			133.424							
4-1	13:24:00	1.30	2.60	133.424	316	61	61	5	260	264	64
4-2	13:29:00	1.20	2.40	137.890	316	61	61	4	255	261	63
4-3	13:34:00	1.00	2.00	142.380	314	61	61	4	260	261	64
	13:39:00			146.214							
Total	1:00:00			51.993		60.4	60.4				
Average			2.37		316.3	60.4		4			
Min			1.90		312.0	59.0		4			
Max			2.70		319.0	62.0		5			

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Impinger Weight Sheet - Run 2B

Client:	**Ash Grove Cement Company**
Facility:	**Midlothian Cement Plant**
Test Location:	**Kiln 3**
Project #:	**M235102**
Date:	**1/4/2024**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**D-01**

Scale Calibration Check Date: **1/3/2024**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	864.6	690.5	174.1
0.1N H2SO4	772.1	614.1	158.0
Empty	790.8	605.3	185.5
0.1N NaOH	818.4	732.4	86.0
0.1N NaOH	698.0	687.8	10.2
Silica Gel	801.2	784.7	16.5
	3,943.9	3,330.1	613.8
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	801.2	784.7	16.5
	Silica Final	**Silica Initial**	**Silica Gain**

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Run 3B - Method 26A

Client: Ash Grove Cement Company | **Date: 1/4/24**

Facility: Midlothian Cement Plant | **Start Time: 14:17**

Test Location: Kiln 3 | **End Time: 15:30**

Source Condition: Normal

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.40	In. H_2O	Static Pressure	-2.50	in. H_2O
Meter Temperature, Tm:	61.6	°F	Flue Pressure (Ps):	29.11	in. Hg. abs.
Sqrt ΔP:	1.095	In. H_2O	Carbon Dioxide:	15.97	%
Stack Temperature, Ts:	324.8	°F	Oxygen:	7.82	%
Meter Volume, Vm:	52.097	ft^3	Nitrogen:	76.21	%
Meter Volume, Vmstd:	51.627	dscf	Gas Weight dry, Md:	30.868	lb/lb mole
Meter Volume, Vwstd:	29.131	wscf	Gas Weight wet, Ms:	26.226	lb/lb mole
Isokinetic Variance:	100.7	%I	Excess Air:	63.580	%
			Gas Velocity, Vs:	79.060	fps
Test Length:	60.00	in mins.	Volumetric Flow:	492,881	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	206,210	dscfm
Barometric Pressure:	29.29	in Hg	Volumetric Flow:	322,568	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3606.0	ml	Silica Initial Wt.	873.7	grams
Final Impinger Content:	4208.2	ml	Silica Final Wt.	890.0	grams
Impinger Difference:	602.2	ml	Silica Difference:	16.3	grams

Total Water Gain: 618.5 Moisture, Bws: 0.361

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	14:17:00	1.30	2.60	46.694	315	61	61	5	259	258	56
1-2	14:22:00	1.10	2.20	51.270	317	61	61	5	260	265	57
1-3	14:27:00	0.94	1.90	55.470	314	61	61	4	262	263	57
	14:32:00			59.346							
2-1	14:36:00	1.40	2.80	59.346	323	61	61	6	260	258	58
2-2	14:41:00	1.20	2.40	64.110	326	62	62	5	262	255	58
2-3	14:46:00	1.10	2.20	68.300	324	62	62	5	263	257	60
	14:51:00			72.489							
3-1	14:55:00	1.40	2.70	72.489	333	61	61	6	259	262	62
3-2	15:00:00	1.30	2.60	77.210	330	62	62	5	262	264	63
3-3	15:05:00	1.00	2.00	81.690	327	62	62	4	264	260	63
	15:10:00			85.683							
4-1	15:15:00	1.30	2.60	85.683	331	62	62	6	264	261	63
4-2	15:20:00	1.30	2.60	90.150	330	62	62	5	262	263	64
4-3	15:25:00	1.10	2.20	94.640	328	62	62	5	262	262	65
	15:30:00			98.791							
Total	1:00:00			52.097		61.6	61.6				
Average			2.40		324.8	61.6		5			
Min			1.90		314.0	61.0		4			
Max			2.80		333.0	62.0		6			

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Impinger Weight Sheet - Run 3B

Client:	**Ash Grove Cement Company**
Facility:	**Midlothian Cement Plant**
Test Location:	**Kiln 3**
Project #:	**M235102**
Date:	**1/4/2024**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**D-01**

Scale Calibration Check Date: **1/4/2024**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	928.6	781.6	147.0
0.1N H2SO4	887.2	716.8	170.4
Empty	821.3	616.6	204.7
0.1N NaOH	793.1	752.4	40.7
0.1N NaOH	778.0	738.6	39.4
Silica Gel	890.0	873.7	16.3
	4,208.2	3,606.0	602.2
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	890.0	873.7	16.3
	Silica Final	**Silica Initial**	**Silica Gain**

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location: Kiln 3 Stack
Date: 1/4/24

Run 1

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN1_0927.LAB	10:50	81.06	2.89	≤ 0.20	0.40	191.26	1.00	8.82
RUN1_0928.LAB	10:51	64.96	5.24	≤ 0.20	0.41	191.27	1.02	8.82
RUN1_0929.LAB	10:52	59.03	6.04	≤ 0.20	0.31	191.27	1.02	8.87
RUN1_0930.LAB	10:53	49.36	7.38	≤ 0.20	0.25	191.27	1.03	8.84
RUN1_0931.LAB	10:54	45.87	7.89	0.28	0.24	191.27	1.03	8.77
RUN1_0932.LAB	10:55	42.97	8.42	≤ 0.20	0.23	191.26	1.03	8.74
RUN1_0933.LAB	10:56	41.73	8.64	≤ 0.20	0.17	191.26	1.04	8.67
RUN1_0934.LAB	10:57	39.83	8.91	≤ 0.20	0.15	191.26	1.04	8.60
RUN1_0935.LAB	10:58	39.51	9.06	0.22	0.16	191.27	1.04	8.48
RUN1_0936.LAB	10:59	39.81	9.29	≤ 0.20	0.18	191.26	1.04	8.40
RUN1_0937.LAB	11:00	38.97	9.26	≤ 0.20	0.21	191.26	1.04	8.31
RUN1_0938.LAB	11:01	39.01	9.13	0.23	0.23	191.27	1.04	8.35
RUN1_0939.LAB	11:02	38.15	9.29	0.25	0.17	191.27	1.04	8.31
RUN1_0940.LAB	11:03	38.44	9.19	0.20	0.16	191.27	1.04	8.50
RUN1_0941.LAB	11:04	37.36	9.10	0.25	0.19	191.27	1.04	8.85
RUN1_0942.LAB	11:05	36.52	8.96	≤ 0.20	0.15	191.26	1.04	9.16
RUN1_0943.LAB	11:06	36.22	9.00	0.23	0.27	191.26	1.04	9.11
RUN1_0944.LAB	11:07	39.52	8.61	≤ 0.20	0.16	191.26	1.03	9.03
RUN1_0945.LAB	11:08	36.81	9.21	≤ 0.20	0.11	191.26	1.04	8.85
RUN1_0946.LAB	11:09	35.26	9.50	0.20	0.11	191.27	1.04	8.77
RUN1_0947.LAB	11:10	38.89	8.94	≤ 0.20	0.23	191.27	1.03	8.75
RUN1_0948.LAB	11:11	35.28	9.56	≤ 0.20	0.19	191.26	1.04	8.51
RUN1_0949.LAB	11:12	37.76	9.36	≤ 0.20	0.23	191.27	1.03	8.37
RUN1_0950.LAB	11:13	37.10	9.60	0.35	0.23	191.26	1.03	8.41
RUN1_0951.LAB	11:14	34.44	9.85	≤ 0.20	0.23	191.26	1.04	8.35
RUN1_0952.LAB	11:15	33.81	9.74	≤ 0.20	0.17	191.27	1.04	8.63
RUN1_0953.LAB	11:16	38.22	8.67	≤ 0.20	0.19	191.27	1.03	9.23
RUN1_0954.LAB	11:17	33.79	9.28	≤ 0.20	0.19	191.27	1.04	9.34
RUN1_0955.LAB	11:18	37.61	8.89	≤ 0.20	0.26	191.27	1.04	9.25
RUN1_0956.LAB	11:19	36.62	9.13	≤ 0.20	0.13	191.27	1.03	9.09
RUN1_0957.LAB	11:20	34.36	9.79	≤ 0.20	0.17	191.27	1.04	8.88
RUN1_0958.LAB	11:21	38.06	9.27	≤ 0.20	0.35	191.26	1.03	8.66
RUN1_0959.LAB	11:22	35.40	9.51	≤ 0.20	0.22	191.26	1.04	8.55
RUN1_0960.LAB	11:23	37.01	9.49	0.21	0.25	191.27	1.03	8.50
RUN1_0961.LAB	11:24	36.31	9.41	≤ 0.20	0.28	191.26	1.03	8.62
RUN1_0962.LAB	11:25	37.52	9.42	≤ 0.20	0.28	191.26	1.03	8.64
RUN1_0963.LAB	11:26	36.32	9.42	≤ 0.20	0.27	191.26	1.03	8.64
RUN1_0964.LAB	11:27	34.39	9.67	≤ 0.20	0.18	191.26	1.04	8.69
RUN1_0965.LAB	11:28	37.56	9.14	≤ 0.20	0.26	191.27	1.03	8.75
RUN1_0966.LAB	11:29	37.10	9.44	≤ 0.20	0.19	191.27	1.03	8.70
RUN1_0967.LAB	11:30	35.41	9.71	≤ 0.20	0.21	191.27	1.03	8.65
RUN1_0968.LAB	11:31	37.10	9.41	≤ 0.20	0.28	191.27	1.03	8.65
RUN1_0969.LAB	11:32	37.36	9.44	≤ 0.20	0.23	191.26	1.03	8.59
RUN1_0970.LAB	11:33	35.25	9.68	≤ 0.20	0.28	191.30	1.04	8.60
RUN1_0971.LAB	11:34	39.70	9.14	≤ 0.20	0.35	191.27	1.03	8.56
RUN1_0972.LAB	11:35	35.01	10.05	0.23	0.17	191.26	1.04	8.43
RUN1_0973.LAB	11:36	37.49	9.59	≤ 0.20	0.26	191.26	1.03	8.35
RUN1_0974.LAB	11:37	37.90	9.74	≤ 0.20	0.19	191.28	1.03	8.31
RUN1_0975.LAB	11:38	35.30	10.00	≤ 0.20	0.21	191.26	1.03	8.21
RUN1_0976.LAB	11:39	39.26	9.26	≤ 0.20	0.27	191.26	1.03	8.41
RUN1_0977.LAB	11:40	34.80	9.83	≤ 0.20	0.20	191.26	1.03	8.49
RUN1_0978.LAB	11:41	36.77	9.60	≤ 0.20	0.20	191.26	1.03	8.51
RUN1_0979.LAB	11:42	35.84	9.83	≤ 0.20	0.29	191.26	1.03	8.41
RUN1_0980.LAB	11:43	36.77	9.70	≤ 0.20	0.31	191.26	1.03	8.43
RUN1_0981.LAB	11:44	38.36	9.53	≤ 0.20	0.23	191.26	1.03	8.36
RUN1_0982.LAB	11:45	35.77	9.72	0.37	0.21	191.26	1.04	8.45
RUN1_0983.LAB	11:46	37.65	9.51	≤ 0.20	0.22	191.26	1.03	8.50
RUN1_0984.LAB	11:47	36.76	9.72	≤ 0.20	0.27	191.26	1.03	8.42
RUN1_0985.LAB	11:48	35.33	9.76	≤ 0.20	0.16	191.27	1.03	8.38
RUN1_0986.LAB	11:49	38.69	9.40	≤ 0.20	0.24	191.26	1.03	8.50
Average		**39.07**	**9.09**	**≤ 0.21**	**0.23**	**191.27**	**1.03**	**8.63**

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location: Kiln 3 Stack
Date: 1/4/24

Run 2

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN 2_1078.LAB	12:25	30.81	10.6	≤ 0.20	0.16	-0.1	-0.55	7.97
RUN 2_1079.LAB	12:26	38.06	9.6	≤ 0.20	0.17	-0.4	-0.61	8.12
RUN 2_1080.LAB	12:27	37.13	9.9	≤ 0.20	0.31	-0.5	-0.61	8.43
RUN 2_1081.LAB	12:28	33.77	10.4	≤ 0.20	0.22	-0.4	-0.54	8.57
RUN 2_1082.LAB	12:29	38.71	9.5	≤ 0.20	0.18	-0.5	-0.73	8.61
RUN 2_1083.LAB	12:30	34.10	10.2	≤ 0.20	0.10	-0.4	-0.46	8.54
RUN 2_1084.LAB	12:31	39.90	9.2	≤ 0.20	0.30	-0.6	-0.69	8.47
RUN 2_1085.LAB	12:32	37.85	9.4	≤ 0.20	0.29	-0.6	-0.70	8.29
RUN 2_1086.LAB	12:33	36.21	9.6	≤ 0.20	0.16	-0.5	-0.55	8.12
RUN 2_1087.LAB	12:34	35.91	9.8	≤ 0.20	0.27	-0.4	-0.62	7.99
RUN 2_1088.LAB	12:35	35.89	9.9	≤ 0.20	0.23	-0.4	-0.52	7.91
RUN 2_1089.LAB	12:36	39.38	9.4	≤ 0.20	0.27	-0.5	-0.58	8.08
RUN 2_1090.LAB	12:37	35.65	10.3	≤ 0.20	0.15	-0.4	-0.61	8.14
RUN 2_1091.LAB	12:38	39.25	9.7	≤ 0.20	0.29	-0.6	-0.55	8.12
RUN 2_1092.LAB	12:39	35.40	10.1	≤ 0.20	0.31	-0.5	-0.79	8.13
RUN 2_1093.LAB	12:40	37.79	9.7	≤ 0.20	0.17	-0.4	-0.66	8.29
RUN 2_1094.LAB	12:41	35.73	10.0	≤ 0.20	0.19	-0.4	-0.71	8.31
RUN 2_1095.LAB	12:42	35.55	9.9	≤ 0.20	0.21	-0.5	-0.62	8.17
RUN 2_1096.LAB	12:43	38.37	9.5	≤ 0.20	0.26	-0.5	-0.69	8.17
RUN 2_1097.LAB	12:44	38.10	9.5	≤ 0.20	0.24	-0.5	-0.68	8.29
RUN 2_1098.LAB	12:45	36.29	9.8	≤ 0.20	0.29	-0.4	-0.74	8.45
RUN 2_1099.LAB	12:46	37.20	9.8	≤ 0.20	0.23	-0.4	-0.67	8.48
RUN 2_1100.LAB	12:47	38.55	9.4	≤ 0.20	0.22	-0.4	-0.56	8.51
RUN 2_1101.LAB	12:48	38.42	9.4	≤ 0.20	0.26	-0.5	-0.72	8.47
RUN 2_1102.LAB	12:49	35.68	9.8	≤ 0.20	0.21	-0.5	-0.55	8.48
RUN 2_1103.LAB	12:50	39.18	9.2	≤ 0.20	0.25	-0.5	-0.53	8.37
RUN 2_1104.LAB	12:51	35.44	9.8	≤ 0.20	0.17	-0.5	-0.71	8.36
RUN 2_1105.LAB	12:52	37.84	9.4	0.23	0.26	-0.5	-0.78	8.30
RUN 2_1106.LAB	12:53	36.19	9.7	≤ 0.20	0.21	-0.4	-0.55	8.19
RUN 2_1107.LAB	12:54	37.80	9.5	≤ 0.20	0.17	-0.5	-0.58	8.08
RUN 2_1108.LAB	12:55	35.05	10.0	≤ 0.20	0.15	-0.4	-0.62	8.09
RUN 2_1109.LAB	12:56	37.65	9.6	≤ 0.20	0.16	-0.5	-0.77	8.13
RUN 2_1110.LAB	12:57	40.11	9.4	≤ 0.20	0.37	-0.5	-0.44	8.11
RUN 2_1111.LAB	12:58	35.39	10.1	≤ 0.20	0.15	-0.4	-0.60	8.09
RUN 2_1112.LAB	12:59	37.78	9.7	≤ 0.20	0.22	-0.4	-0.67	8.30
RUN 2_1113.LAB	13:00	37.78	9.6	≤ 0.20	0.30	-0.5	-0.68	8.43
RUN 2_1114.LAB	13:01	35.00	10.1	≤ 0.20	0.14	-0.4	-0.58	8.51
RUN 2_1115.LAB	13:02	38.53	9.5	≤ 0.20	0.27	-0.4	-0.76	8.34
RUN 2_1116.LAB	13:03	35.50	9.8	0.23	0.17	-0.5	-0.63	8.15
RUN 2_1117.LAB	13:04	38.33	9.3	≤ 0.20	0.31	-0.4	-0.64	8.06
RUN 2_1118.LAB	13:05	37.97	9.5	≤ 0.20	0.27	-0.4	-0.56	8.00
RUN 2_1119.LAB	13:06	35.30	10.2	≤ 0.20	≤ 0.10	-0.5	-0.60	7.98
RUN 2_1120.LAB	13:07	37.75	9.8	≤ 0.20	0.23	-0.3	-0.62	8.12
RUN 2_1121.LAB	13:08	35.90	10.1	≤ 0.20	0.25	-0.4	-0.50	8.15
RUN 2_1122.LAB	13:09	41.13	9.3	0.35	0.15	-0.5	-0.57	8.16
RUN 2_1123.LAB	13:10	35.58	10.0	0.21	0.15	-0.3	-0.60	8.45
RUN 2_1124.LAB	13:11	38.50	9.5	≤ 0.20	0.20	-0.6	-0.78	8.62
RUN 2_1125.LAB	13:12	36.70	9.9	≤ 0.20	0.28	-0.5	-0.60	8.51
RUN 2_1126.LAB	13:13	36.72	9.7	≤ 0.20	0.16	-0.4	-0.70	8.44
RUN 2_1127.LAB	13:14	35.31	9.7	≤ 0.20	0.15	-0.4	-0.44	8.31
RUN 2_1128.LAB	13:15	35.43	9.8	≤ 0.20	0.15	-0.4	-0.58	8.33
RUN 2_1129.LAB	13:16	41.77	8.9	≤ 0.20	0.24	-0.5	-0.54	8.31
RUN 2_1130.LAB	13:17	35.50	10.0	≤ 0.20	0.14	-0.4	-0.45	8.25
RUN 2_1131.LAB	13:18	38.28	9.5	≤ 0.20	0.20	-0.4	-0.57	8.24
RUN 2_1132.LAB	13:19	34.65	10.1	≤ 0.20	0.14	-0.4	-0.68	8.33
RUN 2_1133.LAB	13:20	38.03	9.6	≤ 0.20	0.18	-0.5	-0.62	8.34
RUN 2_1134.LAB	13:21	37.35	9.8	≤ 0.20	0.12	-0.4	-0.66	8.29
RUN 2_1135.LAB	13:22	37.12	9.6	0.23	0.19	-0.5	-0.69	8.30
RUN 2_1136.LAB	13:23	37.80	9.6	≤ 0.20	0.24	-0.4	-0.78	8.28
RUN 2_1137.LAB	13:24	36.71	9.8	≤ 0.20	0.27	-0.4	-0.76	8.32
Average		**37.02**	**9.73**	**≤ 0.20**	**≤ 0.21**	**-0.44**	**-0.62**	**8.27**

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location: Kiln 3 Stack
Date: 1/4/24

Run 3

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN 3 _1315.LAB	14:17	38.46	9.6	≤ 0.20	0.14	191.26	1.03	8.20
RUN 3 _1316.LAB	14:18	38.64	9.7	≤ 0.20	0.27	191.26	1.03	8.15
RUN 3 _1317.LAB	14:19	36.27	10.0	≤ 0.20	0.13	191.26	1.04	8.15
RUN 3 _1318.LAB	14:20	37.05	9.8	≤ 0.20	≤ 0.10	191.26	1.03	8.15
RUN 3 _1319.LAB	14:21	35.61	10.1	≤ 0.20	0.13	191.26	1.04	8.11
RUN 3 _1320.LAB	14:22	38.50	9.7	≤ 0.20	0.24	191.26	1.03	8.05
RUN 3 _1321.LAB	14:23	37.66	9.8	0.36	0.13	191.26	1.03	7.99
RUN 3 _1322.LAB	14:24	35.87	10.1	0.26	0.18	191.26	1.04	8.05
RUN 3 _1323.LAB	14:25	38.73	9.6	≤ 0.20	≤ 0.10	191.26	1.03	8.21
RUN 3 _1324.LAB	14:26	34.19	10.7	≤ 0.20	≤ 0.10	191.26	1.03	7.91
RUN 3 _1325.LAB	14:27	39.33	9.8	0.43	0.17	191.27	1.03	7.80
RUN 3 _1326.LAB	14:28	35.36	10.6	0.26	0.21	191.27	1.04	7.81
RUN 3 _1327.LAB	14:29	37.08	10.0	≤ 0.20	0.11	191.26	1.03	7.87
RUN 3 _1328.LAB	14:30	34.66	10.4	≤ 0.20	0.14	191.26	1.03	7.91
RUN 3 _1329.LAB	14:31	39.28	9.9	≤ 0.20	≤ 0.10	191.25	1.03	7.83
RUN 3 _1330.LAB	14:32	35.71	10.5	0.21	0.18	191.26	1.04	7.88
RUN 3 _1331.LAB	14:33	37.77	10.0	≤ 0.20	0.16	191.26	1.03	8.00
RUN 3 _1332.LAB	14:34	34.68	10.3	≤ 0.20	0.14	191.26	1.03	8.11
RUN 3 _1333.LAB	14:35	34.20	10.4	≤ 0.20	≤ 0.10	191.26	1.04	8.10
RUN 3 _1334.LAB	14:36	40.20	9.3	≤ 0.20	0.31	191.26	1.03	8.16
RUN 3 _1335.LAB	14:37	35.01	10.4	≤ 0.20	0.12	191.26	1.03	8.11
RUN 3 _1336.LAB	14:38	36.46	10.0	≤ 0.20	≤ 0.10	191.26	1.03	8.17
RUN 3 _1337.LAB	14:39	34.60	10.2	≤ 0.20	≤ 0.10	191.33	1.04	8.13
RUN 3 _1338.LAB	14:40	38.01	10.0	≤ 0.20	0.20	191.28	1.03	7.96
RUN 3 _1339.LAB	14:41	36.11	10.4	0.20	0.13	191.26	1.03	7.70
RUN 3 _1340.LAB	14:42	34.88	10.6	0.24	0.11	191.27	1.04	7.72
RUN 3 _1341.LAB	14:43	34.30	10.7	≤ 0.20	0.17	191.26	1.04	7.72
RUN 3 _1342.LAB	14:44	39.67	9.7	0.23	0.16	191.26	1.03	7.81
RUN 3 _1343.LAB	14:45	34.54	10.5	≤ 0.20	0.19	191.26	1.04	7.88
RUN 3 _1344.LAB	14:46	36.63	10.1	0.29	0.16	191.26	1.03	7.91
RUN 3 _1345.LAB	14:47	36.63	10.2	0.32	≤ 0.10	191.25	1.03	7.96
RUN 3 _1346.LAB	14:48	36.19	10.2	0.43	≤ 0.10	191.26	1.03	7.86
RUN 3 _1347.LAB	14:49	35.60	10.2	≤ 0.20	0.15	191.26	1.03	7.95
RUN 3 _1348.LAB	14:50	36.01	10.2	≤ 0.20	0.19	191.26	1.03	7.96
RUN 3 _1349.LAB	14:51	35.65	10.2	≤ 0.20	≤ 0.10	191.26	1.03	8.01
RUN 3 _1350.LAB	14:52	36.93	9.9	≤ 0.20	0.21	191.26	1.03	8.07
RUN 3 _1351.LAB	14:53	36.76	10.0	≤ 0.20	0.13	191.26	1.03	8.19
RUN 3 _1352.LAB	14:54	34.34	10.7	≤ 0.20	0.12	191.26	1.03	7.84
RUN 3 _1353.LAB	14:55	39.24	9.9	≤ 0.20	≤ 0.10	191.26	1.03	7.74
RUN 3 _1354.LAB	14:56	36.68	10.3	0.24	0.13	191.26	1.03	7.70
RUN 3 _1355.LAB	14:57	34.01	10.5	0.24	0.15	191.26	1.03	7.75
RUN 3 _1356.LAB	14:58	39.63	9.7	≤ 0.20	0.16	191.26	1.03	7.80
RUN 3 _1357.LAB	14:59	35.02	10.5	≤ 0.20	≤ 0.10	191.26	1.04	7.76
RUN 3 _1358.LAB	15:00	37.48	10.1	≤ 0.20	≤ 0.10	191.26	1.03	7.64
RUN 3 _1359.LAB	15:01	37.15	10.3	≤ 0.20	≤ 0.10	191.26	1.03	7.65
RUN 3 _1360.LAB	15:02	34.68	10.6	≤ 0.20	≤ 0.10	191.26	1.04	7.93
RUN 3 _1361.LAB	15:03	37.66	9.9	≤ 0.20	≤ 0.10	191.26	1.03	7.92
RUN 3 _1362.LAB	15:04	35.12	10.3	≤ 0.20	0.15	191.26	1.03	8.20
RUN 3 _1363.LAB	15:05	37.33	10.0	≤ 0.20	≤ 0.10	191.26	1.03	8.17
RUN 3 _1364.LAB	15:06	34.95	10.4	≤ 0.20	0.22	191.25	1.03	8.10
RUN 3 _1365.LAB	15:07	40.40	9.4	0.26	0.35	191.26	1.03	8.15
RUN 3 _1366.LAB	15:08	37.06	9.9	0.30	0.33	191.26	1.03	8.12
RUN 3 _1367.LAB	15:09	34.92	10.3	≤ 0.20	0.20	191.26	1.03	7.99
RUN 3 _1368.LAB	15:10	38.18	10.0	0.21	0.29	191.26	1.03	7.91
RUN 3 _1369.LAB	15:11	35.07	10.6	≤ 0.20	0.29	191.26	1.03	7.73
RUN 3 _1370.LAB	15:12	37.08	10.3	0.20	0.32	191.25	1.03	7.62
RUN 3 _1371.LAB	15:13	39.58	9.9	0.22	0.39	191.26	1.03	7.62
RUN 3 _1372.LAB	15:14	34.43	10.5	≤ 0.20	0.21	191.26	1.03	7.72
RUN 3 _1373.LAB	15:15	34.66	10.3	≤ 0.20	0.27	191.26	1.03	8.05
RUN 3 _1374.LAB	15:16	38.29	9.5	≤ 0.20	0.32	191.27	1.03	8.26
Average		**36.60**	**10.12**	**≤ 0.22**	**≤ 0.17**	**191.26**	**1.03**	**7.95**

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Method 1 and 2 Cyclonic Flow Check Data

Project Number	M235102	**Source Condition:**	Normal
Client:	Ash Grove Cement Company	**Run No.:**	1
Facility:	Midlothian Cement Plant	**Date:**	1/3/2024
Location:	Kiln 3	**Start Time:**	15:05
Pitot ID:	P-1279	**End Time:**	15:15
Pitot Coefficient:	0.833	**RM Testers:**	JVC/BRD1
Probe Length:	5	**Port Length:**	7.00

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (^oF)	Yaw Angle (o)	DP (in. H2O) at Null Point Angle	Velocity (V)	Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (^oF)	Yaw Angle (o)	DP (in. H2O) at Null Point Angle	Velocity (V)
A	1	1.40	1.1832	339.0	4.0	0.00	85.85	C	1	1.40	1.1832	336.0	9.0	0.00	85.69
A	2	1.20	1.0954	332.0	6.0	0.00	79.14	C	2	1.20	1.0954	337.0	12.0	0.00	79.39
A	3	0.98	0.9899	335.0	7.0	0.00	71.65	C	3	1.10	1.0488	338.0	4.0	0.00	76.05
B	1	1.40	1.1832	327.0	8.0	0.00	85.21	D	1	1.40	1.1832	334.0	6.0	0.00	85.59
B	2	1.30	1.1402	335.0	10.0	0.00	82.52	D	2	1.30	1.1402	336.0	8.0	0.00	82.58
B	3	1.00	1.0000	337.0	5.0	0.00	72.47	D	3	0.97	0.9849	337.0	3.0	0.00	71.37

Average Yaw Angle 6.8 °

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Stratification Test Results Summary
Ash Grove Cement Company
Midlothian Cement Plant
Kiln 3 Stack
January 4, 2024

Number of Ports Sampled:	1
Number of Points per Port:	3
Total Number of Traverse Points:	3

Port No.	Point No.	Time	O_2%	Actual % Difference O_2%	Mean Difference O_2%
1	1	10:50	8.70	0.46	0.04
	2	11:00	8.73	0.11	0.01
	3	11:10	8.79	0.57	0.05
Average			**8.74**		

One point traverse (<5% difference)
Three point traverse (0.4, 1.2, and 2.0 meters), <10% difference
Twelve point traverse (Method 1 points) >10% difference

One point traverse (<0.3% mean difference)
Three point traverse (0.4, 1.2, and 2.0 meters), < 0.5% mean difference for O_2
Twelve point traverse (Method 1 points) >0.5% mean difference for O_2

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Appendix G - Calibration Data

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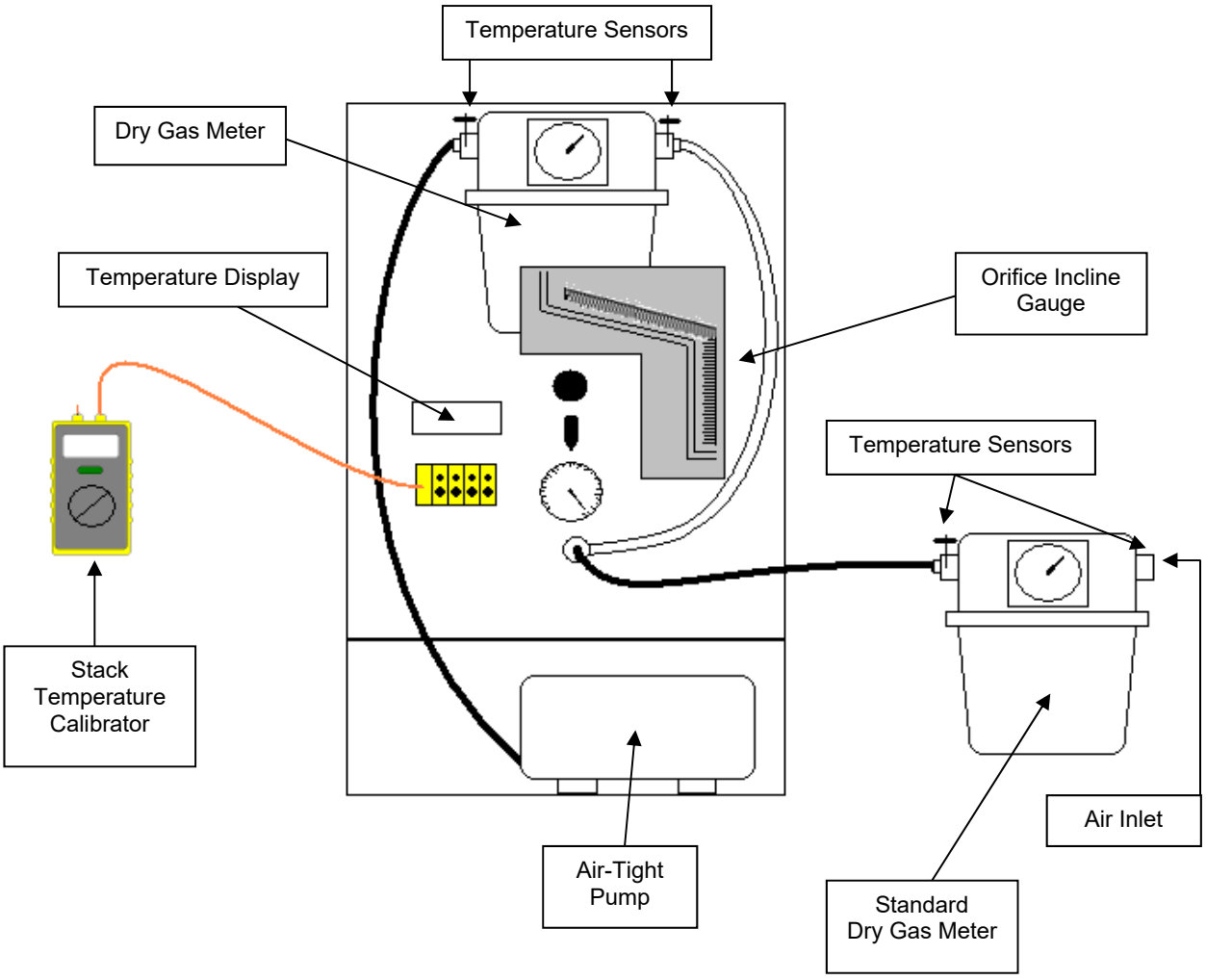
Dry Gas Meter/Control Module Calibration Diagram



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Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM28*	*Date:*	*December 8, 2023*
Standard Meter No.	*18654513*	*Calibrated By:*	*DCS*
Standard Meter (Y)	*1.00630*	*Barometric Pressure:*	*24.60*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F° tr	Dry Gas Meter Inlet Temp. F° tdi	Dry Gas Meter Outlet Temp. F° tdo	Dry Gas Meter Avg. Temp. F° td	Time Min	Time Sec	Y	Chg (H)
Final			57.185	101.169	65	70	70					
Initial			52.124	95.968	65	70	69					
Difference	1	0.20	5.061	5.201	65	70	70	70	19	10	0.987	1.908
Final			62.280	106.441	67	73	71					
Initial			57.185	101.169	65	70	70					
Difference	2	0.50	5.095	5.272	66	72	71	71	12	0	0.980	1.848
Final			67.284	111.601	68	74	72					
Initial			62.280	106.441	67	73	71					
Difference	3	0.70	5.004	5.160	68	74	72	73	10	10	0.983	1.931
Final			72.382	116.871	69	76	73					
Initial			67.284	111.601	68	74	72					
Difference	4	0.90	5.098	5.270	69	75	73	74	9	10	0.980	1.947
Final			77.722	122.374	69	78	74					
Initial			72.382	116.871	69	76	73					
Difference	5	1.20	5.340	5.503	69	77	74	75	8	15	0.985	1.915
Final			52.124	95.968	64	70	69					
Initial			46.850	90.574	65	68	70					
Difference	6	2.00	5.274	5.394	65	69	70	69	6	0	0.987	1.721
										Average	***0.984***	***1.878***

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Stack Temperature Sensor Calibration			
Temperature ID :	170198981	Name :	DCS
Ambient Temperature, °F :	63.7	Date :	December 8, 2023

Temperature Calibrator			
Model # :	CL23A	Certification Date:	October 19, 2023
Serial # :	T-314718	Expiration Date:	October 19, 2024

Primary Standards Directly Traceable National Institute of Standards and Technology (NIST)

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	0	0.0
250	248	0.3
600	596	0.4
1200	1196	0.2

$$\frac{(\text{Ref. Temp., °F} + 460) - (\text{Test Therm. Temp., °F} + 460)}{\text{Ref. Temp., °F} + 460} * 100 <= 1.5\ \%$$

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Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM28*	*Date:*	*January 8, 2024*
Standard Meter No.	*18654513*	*Calibrated By:*	*PJC1*
Standard Meter (Y)	*1.00630*	*Barometric Pressure:*	*24.64*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			408.818	466.380	69	71	71					
Initial			403.508	461.020	69	71	71					
Difference	1	0.20	5.310	5.360	69	71	71	71	18	0	1.000	1.546
Final			414.394	471.972	69	73	72					
Initial			408.818	466.380	69	71	71					
Difference	2	0.50	5.576	5.592	69	72	72	72	12	0	1.007	1.556
Final			419.843	477.466	69	72	72					
Initial			414.394	471.972	69	73	72					
Difference	3	0.70	5.449	5.494	69	73	72	72	10	0	1.002	1.582
Final			424.913	482.503	68	72	72					
Initial			419.843	477.466	69	72	72					
Difference	4	0.90	5.070	5.037	69	72	72	72	9	0	1.017	1.901
Final			430.222	487.878	68	73	71					
Initial			424.913	482.503	68	72	72					
Difference	5	1.20	5.309	5.375	68	73	72	72	8	0	0.998	1.823
Final			403.508	461.020	69	71	71					
Initial			398.348	455.826	69	71	71					
Difference	6	2.00	5.160	5.194	69	71	71	71	6	0	0.998	1.819

Average	***1.004***	***1.705***

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Stack Temperature Sensor Calibration			
Temperature ID :	CM28	Name :	PJC1
Ambient Temperature, °F :	70.2	Date :	January 8, 2024

Temperature Calibrator			
Model # :	CL23A	Certification Date:	October 19, 2023
Serial # :	T-314718	Expiration Date:	October 18, 2024

Primary Standards Directly Traceable National Institute of Standards and Technology (NIST)

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	0	0.0
250	248	0.3
600	596	0.4
1200	1197	0.2

$$\frac{(\text{Ref. Temp., }^{o}\text{F} + 460) - (\text{Test Therm. Temp., }^{o}\text{F} + 460)}{\text{Ref. Temp., }^{o}\text{F} + 460} * 100 <= 1.5\ \%$$

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Dry Gas Meter Calibration Data

Dry Gas Meter No.	CM44	Date:	December 8, 2023
Standard Meter No.	15788714	Calibrated By:	DCS
Standard Meter (Y)	0.98570	Barometric Pressure:	24.60

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			235.191	613.064	72	70	70					
Initial			229.915	607.829	69	68	68					
Difference	1	0.20	5.276	5.235	71	69	69	69	18	31	0.990	1.747
Final			240.612	618.410	71	71	71					
Initial			235.191	613.064	71	71	71					
Difference	2	0.50	5.421	5.346	71	71	71	71	12	1	0.998	1.739
Final			245.956	623.773	72	72	72					
Initial			240.612	618.410	71	71	71					
Difference	3	0.70	5.344	5.363	72	72	72	72	10	22	0.980	1.866
Final			262.898	640.323	73	73	73					
Initial			257.511	635.027	73	73	73					
Difference	4	0.90	5.387	5.296	73	73	73	73	9	0	1.000	1.785
Final			257.511	635.027	73	73	73					
Initial			251.943	629.549	72	72	72					
Difference	5	1.20	5.568	5.478	73	73	73	73	8	16	0.998	1.877
Final			229.915	607.829	69	68	68					
Initial			224.144	602.180	69	67	67					
Difference	6	2.00	5.771	5.649	69	68	68	68	6	30	0.998	1.794

Average	**0.994**	**1.801**

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Stack Temperature Sensor Calibration			
Temperature ID :	170198981	Name :	DCS
Ambient Temperature, °F :	63.7	Date :	December 8, 2023

Temperature Calibrator			
Model # :	CL23A	Certification Date:	October 19, 2023
Serial # :	T-314718	Expiration Date:	October 19, 2024

Primary Standards Directly Traceable National Institute of Standards and Technology (NIST)

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	0	0.0
250	249	0.1
600	597	0.3
1200	1197	0.2

$$\frac{(\text{Ref. Temp., }^{o}\text{F} + 460) - (\text{Test Therm. Temp., }^{o}\text{F} + 460)}{\text{Ref. Temp., }^{o}\text{F} + 460} * 100 <= 1.5\ \%$$

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Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM44*	*Date:*	*January 9, 2024*
Standard Meter No.	*18654513*	*Calibrated By:*	*PJC1*
Standard Meter (Y)	*1.00630*	*Barometric Pressure:*	*24.54*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			*441.479*	*810.254*	*70*	*69*	*69*					
Initial			*436.387*	*805.136*	*69*	*68*	*68*					
Difference	*1*	*0.20*	*5.092*	*5.118*	*70*	*69*	*69*	*69*	*18*	*0*	*0.999*	*1.700*
Final			*446.620*	*815.420*	*70*	*70*	*70*					
Initial			*441.479*	*810.254*	*70*	*69*	*69*					
Difference	*2*	*0.50*	*5.141*	*5.166*	*70*	*70*	*70*	*70*	*12*	*0*	*0.999*	*1.853*
Final			*451.781*	*820.597*	*70*	*71*	*71*					
Initial			*446.620*	*815.420*	*70*	*70*	*70*					
Difference	*3*	*0.70*	*5.161*	*5.177*	*70*	*71*	*71*	*71*	*10*	*0*	*1.002*	*1.784*
Final			*457.093*	*825.938*	*70*	*71*	*71*					
Initial			*451.781*	*820.597*	*70*	*71*	*71*					
Difference	*4*	*0.90*	*5.312*	*5.341*	*70*	*71*	*71*	*71*	*9*	*3*	*1.000*	*1.771*
Final			*462.516*	*831.405*	*70*	*72*	*72*					
Initial			*457.093*	*825.938*	*70*	*71*	*71*					
Difference	*5*	*1.20*	*5.423*	*5.467*	*70*	*72*	*72*	*72*	*8*	*0*	*0.997*	*1.769*
Final			*436.387*	*805.136*	*69*	*68*	*68*					
Initial			*431.061*	*799.815*	*69*	*68*	*68*					
Difference	*6*	*2.00*	*5.326*	*5.321*	*69*	*68*	*68*	*68*	*6*	*12*	*0.999*	*1.841*

Average	***0.999***	***1.786***

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Stack Temperature Sensor Calibration			
Temperature ID :	CM44	Name :	PJC1
Ambient Temperature, °F :	72.4	Date :	January 9, 2024

Temperature Calibrator			
Model # :	CL23A	Certification Date:	October 19, 2023
Serial # :	T-314718	Expiration Date:	October 18, 2024

Primary Standards Directly Traceable National Institute of Standards and Technology (NIST)

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	0	0.0
250	249	0.1
600	597	0.3
1200	1197	0.2

$$\frac{(\text{Ref. Temp., }^{o}\text{F} + 460) - (\text{Test Therm. Temp., }^{o}\text{F} + 460)}{\text{Ref. Temp., }^{o}\text{F} + 460} * 100 <= 1.5\ \%$$

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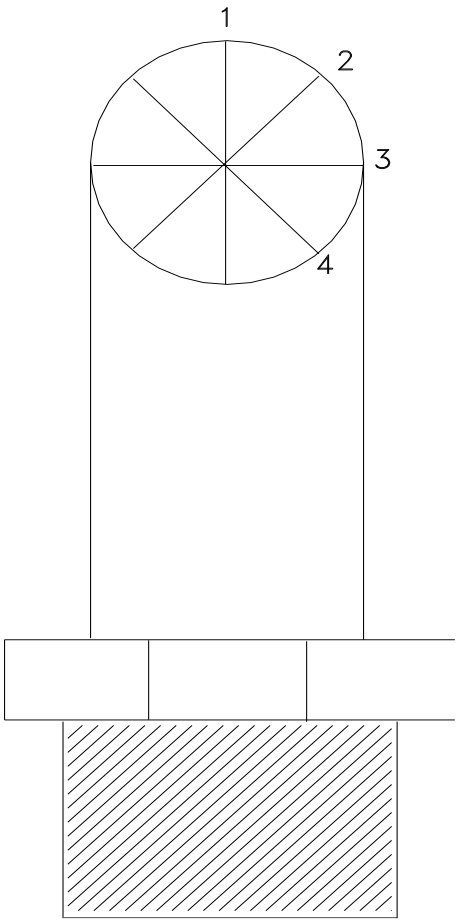
Nozzle Calibration

Date: 10/13/2023

Nozzle ID No.: 899

Analyst: EOS

Material/Type: Glass



0.280	1
0.282	2
0.281	3
0.282	4

Valid Data

Average
0.281

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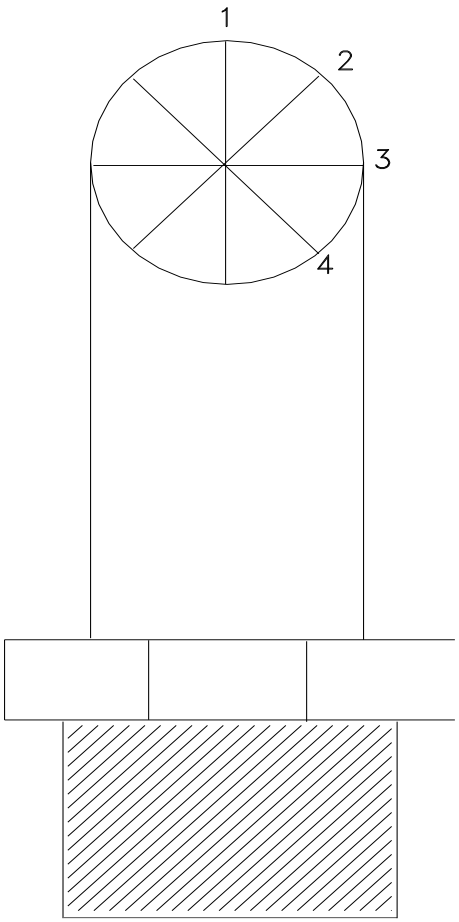
Nozzle Calibration

Date: 4/25/2023

Nozzle ID No.: 981

Analyst: WAP

Material/Type: Glass



0.281	1
0.281	2
0.281	3
0.281	4

Average
0.281

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location Kiln 3 Stack
Date: 1/4/2024
Operator: AWB
Operating Condition Normal Operations/>90% Production

Sample System:	FTIR	
Probe Length:	5.0	**ft**
Probe Type:	FTIR	
Sample Plane:	Horizontal	
Port Length:	7	**in.**
Port Size (diameter):	6	**in.**
Port Type:	Flange	
Duct Shape:	Circular	
Diameter:	11.502	**ft**

Duct Area:	103.91	**Sq. Ft.**			
Upstream Diameters:	16.80		Minimum Upstream Distance	5.8	Feet
Downstream Diameters:	7.40		Minimum Downstream Distance	23.0	Feet
Number of Ports Sampled:	1		Ideal Upstream Distance	23.0	Feet
Number of Points per Port:	1		Ideal Downstream Distance	92.0	Feet
Total Number of Traverse Points:	1				

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder		Final Bottle Pressure,
	Zero	Zero Nitrogen	0.0	-0.03	0.14%	N/A			>500
O2	**Mid**	EB0162460	11.95	11.72	1.04%	7/19/2031	54.29%		>500
% (dry)	**High**	EB0162461	22.01	22.18	-0.77%	11/9/2031			>500

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	**Nitrogen**	Zero Nitrogen	0.0	N/A	>500
Calibration Transfer Standard	**Ethylene**	EB0091181	100.4	7/10/2026	>500
Analyte Spike	**HCN**	CC768228	49.30	3/11/2024	>500
Gas	**SF6**		5.009		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	Servomex	01440D1/4385	25	22.01
HF ppmvw	MKS 2030	19088195	10	N/A
HCN ppmvw	MKS 2030	19088196	200	N/A

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Diluent: O2 %

Test Location: Kiln 3 Stack
Date: 1/4/24
Operator: AWB
O2 % Correction: 7

O2 % (dry) Correction Data

Run #	Cma	Precal	Postcal	Pre zero	Post zero	Co	Cm	C	Cgas	Span Bias	Span Drift	Zero Bias	Zero Drift
1	11.95	12.17	12.04	0.40	0.32	0.36	12.11	8.63	8.4	-1.45	-0.59	-1.59	-0.36
2	11.95	12.04	11.96	0.32	0.32	0.32	12.00	8.27	8.1	-1.09	-0.36	-1.59	0.00
3	11.95	11.96	11.97	0.32	0.34	0.33	11.97	7.95	7.8	-1.14	0.05	-1.68	0.09

Concentration of Cal Gas C = Average value of test Co=Average Pre and Post Zero
erage Pre and Post Span Cgas = Corrected gas value of test

Calibration Corrected and Calculated Data

Run #	Run Date	Start Time	End Time	Moisture %	O2 % (dry)	CO2 % (wet)	CO2 % (dry)	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	1/4/24	10:50	11:49	39.07%	8.42	9.09	14.91	0.20	0.37	0.36	0.67
2	1/4/24	12:25	13:24	37.02%	8.14	9.73	15.44	0.20	0.35	0.38	0.66
3	1/4/24	14:17	15:16	36.60%	7.82	10.12	15.97	0.20	0.34	0.31	0.52

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Test Location: Kiln 3 Stack
Date: 1/4/24
Project #: M235102

Linearity Cal/Pre 1 Cal

Time	O2 % (dry)	
7:28	-0.03	iz
7:29	-0.03	
7:31	22.18	ih
7:32	22.21	
7:34	11.72	im
7:35	11.74	
10:10	0.41	
10:11	0.40	z
10:16	12.17	m
10:17	12.19	

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Test Location: Kiln 3 Stack
Date: 1/4/24

Post 1/Pre 2			Post 2/Pre 3		
Time	**O2 % (dry)**		**Time**	**O2 % (dry)**	
12:09	0.33		13:56	0.32	**z**
12:10	0.32	**z**	13:57	0.31	
12:18	12.04	**m**	13:59	11.96	**m**
12:19	12.06		14:00	12.01	

Post 3		
Time	**O2 % (dry)**	
15:39	0.34	**z**
15:40	0.32	
15:43	11.97	**m**
15:44	11.99	

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Operating Condition: Normal Operations/>90% Production

Test Location: Kiln 3 Stack
Date: 1/4/2024
Operator: AWB
FTIR s/n: 19088195

System Leak Check: 0.0 mL/min

Nitrogen (Zero) Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
N2 DIRECT_0001.LAB	1/4/24	7:40:30	0.6	0.1	0.1	191.2	1.12	-0.9	0.6	0.074
N2 DIRECT_0002.LAB	1/4/24	7:40:38	0.0	0.0	0.0	191.2	1.31	0.4	0.2	-0.034
N2 DIRECT_0003.LAB	1/4/24	7:40:46	0.0	0.0	0.0	191.3	1.31	0.8	0.0	-0.064
N2 DIRECT_0004.LAB	1/4/24	7:40:54	0.0	0.0	0.0	191.2	1.31	0.7	0.0	0.012
N2 DIRECT_0005.LAB	1/4/24	7:41:02	-0.1	0.0	0.1	191.2	1.31	-2.2	0.1	0.017
N2 DIRECT_0006.LAB	1/4/24	7:41:10	-0.1	0.0	0.0	191.3	1.31	-0.9	0.3	-0.070
N2 DIRECT_0007.LAB	1/4/24	7:41:18	0.0	0.0	0.0	191.3	1.31	0.2	0.2	0.002
N2 DIRECT_0008.LAB	1/4/24	7:41:26	0.1	0.0	0.0	191.2	1.31	0.2	0.2	-0.006
N2 DIRECT_0009.LAB	1/4/24	7:41:34	0.0	0.0	0.0	191.3	1.31	1.3	0.2	-0.015

Calibration Transfer Standard (CTS), Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS DIRECT_0023.LAB	1/4/24	7:48:31	0.0	0.0	0.0	191.3	1.02	99.5	0.2	-0.018	**99.1%**
CTS DIRECT_0024.LAB	1/4/24	7:48:39	0.0	0.0	0.0	191.3	1.02	99.5	0.6	-0.012	**99.1%**
CTS DIRECT_0025.LAB	1/4/24	7:48:47	0.0	0.0	0.0	191.3	1.01	100.2	0.4	-0.009	**99.8%**
CTS DIRECT_0026.LAB	1/4/24	7:48:55	0.0	0.0	0.0	191.3	1.02	100.1	0.5	-0.011	**99.7%**
CTS DIRECT_0027.LAB	1/4/24	7:49:03	0.0	0.0	0.0	191.3	1.02	100.1	0.4	-0.014	**99.7%**
CTS DIRECT_0028.LAB	1/4/24	7:49:11	0.0	0.0	0.1	191.3	1.02	100.1	0.6	-0.012	**99.7%**
CTS DIRECT_0029.LAB	1/4/24	7:49:19	0.0	0.0	0.0	191.3	1.02	100.1	0.5	-0.018	**99.7%**
	Average							**99.9**			**99.5%**

Analyte Spike Gas (HCN) Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % HCN
HCN DIRECT_0033.LAB	1/4/24	7:50:55	0.0	0.0	0.0	191.3	1.02	0.0	47.0	5.029	**95.2%**
HCN DIRECT_0034.LAB	1/4/24	7:51:03	0.0	0.0	0.0	191.3	1.03	-0.1	46.7	5.031	**94.7%**
HCN DIRECT_0035.LAB	1/4/24	7:51:11	0.0	0.0	-0.1	191.3	1.03	-0.1	46.8	5.034	**95.0%**
HCN DIRECT_0036.LAB	1/4/24	7:51:19	0.0	0.0	0.0	191.3	1.03	0.2	47.0	5.036	**95.3%**
HCN DIRECT_0037.LAB	1/4/24	7:51:27	0.0	0.0	0.0	191.3	1.03	0.0	46.8	5.040	**95.0%**
HCN DIRECT_0038.LAB	1/4/24	7:51:35	0.0	0.0	0.0	191.3	1.03	0.2	47.0	5.035	**95.4%**
HCN DIRECT_0039.LAB	1/4/24	7:51:43	0.0	0.0	0.0	191.3	1.03	0.0	46.7	5.045	**94.8%**
HCN DIRECT_0040.LAB	1/4/24	7:51:51	0.0	0.0	0.0	191.3	1.03	0.0	47.1	5.041	**95.5%**
	Average								**46.9**	**5.036**	**95.1%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS REMOTE_0744.LAB	1/4/24	10:06:12	2.8	0.0	0.0	191.4	1.05	96.2	0.0	-0.013	**95.8%**
CTS REMOTE_0745.LAB	1/4/24	10:06:20	2.4	0.0	0.0	191.3	1.05	96.5	0.0	-0.020	**96.1%**
CTS REMOTE_0746.LAB	1/4/24	10:06:28	2.1	0.0	-0.1	191.3	1.05	97.1	0.2	-0.012	**96.7%**
CTS REMOTE_0747.LAB	1/4/24	10:06:36	1.8	0.0	0.0	191.5	1.05	97.5	0.1	-0.014	**97.1%**
CTS REMOTE_0748.LAB	1/4/24	10:06:44	1.5	0.0	0.0	191.4	1.05	97.8	-0.2	-0.005	**97.4%**
CTS REMOTE_0749.LAB	1/4/24	10:06:52	1.4	0.0	0.0	191.3	1.05	97.8	-0.3	-0.017	**97.4%**
CTS REMOTE_0750.LAB	1/4/24	10:07:00	1.3	0.0	0.0	191.3	1.05	98.1	-0.4	-0.020	**97.7%**
CTS REMOTE_0751.LAB	1/4/24	10:07:08	1.3	0.0	0.0	191.3	1.05	97.9	-0.2	-0.011	**97.5%**

Response Time Test

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Response Time (sec)
CTS REMOTE_0777.LAB	1/4/24	10:12:50	0.5	0.0	-0.1	191.3	1.04	0.1	-0.5	-0.003	-
CTS REMOTE_0778.LAB	1/4/24	10:12:57	5.2	3.8	0.1	191.3	1.04	0.4	0.3	-0.010	**15**
CTS REMOTE_0779.LAB	1/4/24	10:13:04	12.1	4.4	0.1	191.3	1.04	19.1	-0.1	-0.020	**23**
CTS REMOTE_0780.LAB	1/4/24	10:13:11	5.2	0.1	0.1	191.3	1.04	92.0	0.3	-0.016	
CTS REMOTE_0781.LAB	1/4/24	10:13:18	3.8	0.0	0.0	191.3	1.04	95.0	0.0	-0.020	
CTS REMOTE_0782.LAB	1/4/24	10:13:25	2.5	0.0	0.0	191.3	1.05	96.2	0.2	-0.019	
CTS REMOTE_0783.LAB	1/4/24	10:13:32	1.7	0.0	0.0	191.3	1.05	97.3	0.1	-0.013	
CTS REMOTE_0784.LAB	1/4/24	10:13:39	1.3	0.0	0.1	191.3	1.04	97.4	-0.2	-0.020	
CTS REMOTE_0785.LAB	1/4/24	10:13:46	1.2	0.0	-0.1	191.3	1.05	97.6	-0.4	-0.012	

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Operating Condition: Normal Operations/>90% Production

Test Location: Kiln 3 Stack
Date: 1/4/2024
Operator: AWB
FTIR s/n: 19088195

Pre 1 Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
NATIVE REMOTE_0825.LAB	1/4/24	10:21:15	30.4	9.8	0.4	191.3	1.04	0.5	-0.4	-0.006
NATIVE REMOTE_0826.LAB	1/4/24	10:21:23	39.2	8.6	0.4	191.3	1.03	0.0	-0.8	-0.014
NATIVE REMOTE_0827.LAB	1/4/24	10:21:31	49.7	7.2	0.6	191.3	1.02	-0.2	-0.9	-0.009
									-0.7	**-0.009**

Pre 1 Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
SPIKE REMOTE_0904.LAB	1/4/24	10:32:48	31.1	8.6	0.2	191.3	1.04	0.5	2.8	0.400	**0.079**	**90.2%**
SPIKE REMOTE_0905.LAB	1/4/24	10:32:56	31.1	8.6	0.3	191.3	1.04	0.4	3.0	0.439	**0.087**	**86.1%**
SPIKE REMOTE_0906.LAB	1/4/24	10:33:04	31.2	8.5	0.3	191.3	1.04	0.5	2.8	0.437	**0.087**	**82.0%**
SPIKE REMOTE_0907.LAB	1/4/24	10:33:12	31.6	8.5	0.3	191.3	1.04	0.4	3.0	0.448	**0.089**	**85.6%**
SPIKE REMOTE_0908.LAB	1/4/24	10:33:20	31.4	8.6	0.3	191.3	1.04	0.4	3.0	0.450	**0.089**	**85.1%**
SPIKE REMOTE_0909.LAB	1/4/24	10:33:28	30.6	8.8	0.3	191.3	1.04	0.4	3.0	0.447	**0.089**	**85.0%**
SPIKE REMOTE_0910.LAB	1/4/24	10:33:36	30.2	9.0	0.2	191.3	1.04	0.6	3.0	0.447	**0.089**	**84.5%**
SPIKE REMOTE_0911.LAB	1/4/24	10:33:44	30.0	9.0	0.3	191.3	1.04	0.4	2.9	0.450	**0.089**	**82.3%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN1 _0984.LAB	1/4/24	11:59:57	36.8	9.7	0.4	191.3	1.03	0.5	-1.2	-0.006
RUN1 _0985.LAB	1/4/24	12:00:58	35.3	9.8	0.3	191.3	1.03	0.5	-0.9	-0.007
RUN1 _0986.LAB	1/4/24	12:01:59	38.7	9.4	0.4	191.3	1.03	0.4	-1.1	-0.008
									-1.1	**-0.007**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST R1 SPIKE_1003.LAB	1/4/24	12:05:46	32.9	9.1	0.4	191.3	1.03	0.6	2.7	0.424	**0.084**	**92.1%**
POST R1 SPIKE_1004.LAB	1/4/24	12:05:54	32.6	9.1	0.3	191.3	1.03	0.5	2.6	0.451	**0.090**	**80.6%**
POST R1 SPIKE_1005.LAB	1/4/24	12:06:02	32.2	9.1	0.3	191.3	1.04	0.4	2.6	0.451	**0.090**	**81.8%**
POST R1 SPIKE_1006.LAB	1/4/24	12:06:10	32.0	9.2	0.6	191.3	1.03	0.4	2.7	0.462	**0.092**	**82.2%**
POST R1 SPIKE_1007.LAB	1/4/24	12:06:18	32.1	9.0	0.3	191.3	1.04	0.5	2.6	0.495	**0.098**	**71.3%**
POST R1 SPIKE_1008.LAB	1/4/24	12:06:26	34.1	8.7	0.0	191.3	1.04	0.4	3.3	0.484	**0.096**	**93.4%**
POST R1 SPIKE_1009.LAB	1/4/24	12:06:34	43.5	7.5	0.4	191.3	1.03	0.0	2.5	0.429	**0.085**	**83.4%**
POST R1 SPIKE_1010.LAB	1/4/24	12:06:42	43.1	7.3	0.5	191.3	1.03	0.2	3.0	0.493	**0.098**	**83.6%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST R1 CTS_1033.LAB	1/4/24	12:10:20	3.3	0.0	-0.1	191.3	1.05	95.7	0.2	-0.015	**95.3%**
POST R1 CTS_1034.LAB	1/4/24	12:10:27	3.1	0.0	-0.2	191.3	1.05	96.0	0.3	-0.014	**95.7%**
POST R1 CTS_1035.LAB	1/4/24	12:10:34	2.9	0.0	0.2	191.3	1.04	96.4	0.1	-0.012	**96.0%**
POST R1 CTS_1036.LAB	1/4/24	12:10:41	2.6	0.0	0.0	191.3	1.04	96.9	0.4	-0.011	**96.5%**
POST R1 CTS_1037.LAB	1/4/24	12:10:48	2.3	0.0	-0.1	191.3	1.04	97.3	0.0	-0.012	**96.9%**
POST R1 CTS_1038.LAB	1/4/24	12:10:55	2.0	0.0	0.1	191.3	1.05	97.0	0.1	-0.019	**96.6%**
POST R1 CTS_1039.LAB	1/4/24	12:11:02	1.9	0.0	-0.1	191.3	1.04	97.5	0.0	-0.012	**97.1%**
POST R1 CTS_1040.LAB	1/4/24	12:11:09	1.7	0.0	0.0	191.3	1.05	97.3	-0.4	-0.012	**96.9%**

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Operating Condition: Normal Operations/>90% Production

Test Location: Kiln 3 Stack
Date: 1/4/2024
Operator: AWB
FTIR s/n: 19088195

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN 2_1152.LAB	1/4/24	13:36:00	38.2	9.7	0.3	191.3	1.03	0.6	-2.5	-0.007
RUN 2_1153.LAB	1/4/24	13:37:00	37.7	9.6	0.3	191.3	1.03	0.5	-2.2	-0.005
RUN 2_1154.LAB	1/4/24	13:38:00	37.2	9.7	0.3	191.3	1.03	0.6	-2.5	-0.005
									-2.4	**-0.006**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST 2 SPIKE_1191.LAB	1/4/24	13:46:54	31.9	9.2	0.3	191.3	1.03	0.6	1.4	0.419	**0.083**	**79.9%**
POST 2 SPIKE_1192.LAB	1/4/24	13:47:02	32.5	9.2	0.2	191.3	1.03	0.8	1.7	0.418	**0.083**	**102.4%**
POST 2 SPIKE_1194.LAB	1/4/24	13:47:10	46.3	7.2	0.3	191.3	1.02	0.2	1.1	0.384	**0.076**	**82.0%**
POST 2 SPIKE_1203.LAB	1/4/24	13:47:18	33.0	8.7	0.3	191.3	1.03	0.7	1.7	0.485	**0.096**	**74.4%**
POST 2 SPIKE_1207.LAB	1/4/24	13:47:26	32.4	9.4	0.2	191.3	1.04	0.7	1.5	0.414	**0.082**	**89.5%**
POST 2 SPIKE_1211.LAB	1/4/24	13:47:34	32.0	9.1	0.3	191.3	1.04	0.5	1.5	0.458	**0.091**	**71.2%**
POST 2 SPIKE_1215.LAB	1/4/24	13:47:42	32.3	9.0	0.2	191.3	1.03	0.6	1.5	0.449	**0.089**	**74.1%**
POST 2 SPIKE_1216.LAB	1/4/24	13:47:50	34.4	8.9	0.0	191.3	1.03	0.4	1.6	0.438	**0.087**	**82.2%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST 2 CTS_1268.LAB	1/4/24	13:54:59 PM	3.1	0.0	-0.2	191.3	1.05	96.0	-0.9	-0.009	**96.0%**
POST 2 CTS_1269.LAB	1/4/24	13:55:07 PM	2.9	0.0	-0.1	191.3	1.05	96.1	-0.9	-0.011	**96.1%**
POST 2 CTS_1270.LAB	1/4/24	13:54:59 PM	2.6	0.0	0.1	191.3	1.05	97.1	-0.9	-0.012	**97.1%**
POST 2 CTS_1271.LAB	1/4/24	13:55:07 PM	2.2	0.0	-0.1	191.3	1.05	97.1	-0.9	-0.018	**97.2%**
POST 2 CTS_1272.LAB	1/4/24	13:54:59 PM	2.1	0.0	0.0	191.3	1.05	97.2	-0.9	-0.019	**97.2%**
POST 2 CTS_1273.LAB	1/4/24	13:55:07 PM	1.9	0.0	0.0	191.3	1.05	97.5	-1.4	-0.020	**97.6%**
POST 2 CTS_1274.LAB	1/4/24	13:54:59 PM	1.9	0.0	-0.2	191.3	1.05	97.5	-1.0	-0.013	**97.5%**
POST 2 CTS_1275.LAB	1/4/24	13:55:07 PM	1.8	0.0	-0.1	191.3	1.05	97.6	-1.5	-0.016	**97.6%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN 3 _1385.LAB	1/4/24	15:27:00	38.0	9.4	0.3	191.3	1.03	0.6	-2.5	-0.005
RUN 3 _1386.LAB	1/4/24	15:28:00	35.2	10.0	0.2	191.3	1.03	0.8	-2.4	-0.006
RUN 3 _1387.LAB	1/4/24	15:29:00	38.7	10.1	0.3	191.3	1.03	0.6	-2.5	-0.006
									-2.5	**-0.006**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST R3 SPIKE_1408.LAB	1/4/24	15:34:48	31.2	9.4	0.2	191.3	1.04	0.6	2.1	0.499	**0.099**	**86.9%**
POST R3 SPIKE_1409.LAB	1/4/24	15:34:56	31.4	9.5	0.2	191.2	1.04	0.6	2.0	0.486	**0.096**	**88.7%**
POST R3 SPIKE_1410.LAB	1/4/24	15:35:04	32.7	9.2	0.4	191.3	1.04	0.7	2.0	0.476	**0.095**	**89.8%**
POST R3 SPIKE_1411.LAB	1/4/24	15:35:12	33.1	9.0	0.1	191.3	1.03	0.8	2.0	0.494	**0.098**	**83.6%**
POST R3 SPIKE_1412.LAB	1/4/24	15:35:20	32.4	9.1	0.2	191.3	1.04	0.7	2.1	0.481	**0.095**	**94.7%**
POST R3 SPIKE_1413.LAB	1/4/24	15:35:28	32.0	9.2	0.2	191.3	1.04	0.7	2.1	0.484	**0.096**	**91.3%**
POST R3 SPIKE_1414.LAB	1/4/24	15:35:36	32.1	9.2	0.2	191.3	1.04	0.7	1.9	0.487	**0.097**	**82.5%**
POST R3 SPIKE_1415.LAB	1/4/24	15:35:44	33.1	9.1	0.2	191.3	1.04	0.7	2.0	0.488	**0.097**	**84.6%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST R3 CTS_1443.LAB	1/4/24	15:40:36	2.5	0.0	-0.1	191.3	1.05	96.3	-1.3	-0.020	**96.4%**
POST R3 CTS_1444.LAB	1/4/24	15:40:44	2.5	0.0	-0.1	191.3	1.05	97.1	-0.7	-0.011	**97.1%**
POST R3 CTS_1445.LAB	1/4/24	15:40:52	2.4	0.0	-0.1	191.3	1.05	96.7	-0.7	-0.013	**96.8%**
POST R3 CTS_1446.LAB	1/4/24	15:41:00	2.3	0.0	-0.2	191.2	1.05	96.8	-1.2	-0.014	**96.9%**
POST R3 CTS_1447.LAB	1/4/24	15:41:08	2.1	0.0	-0.1	191.3	1.05	97.1	-0.6	-0.009	**97.1%**
POST R3 CTS_1448.LAB	1/4/24	15:41:16	2.0	0.0	0.0	191.3	1.05	97.2	-1.4	-0.022	**97.2%**
POST R3 CTS_1449.LAB	1/4/24	15:41:24	1.9	0.0	-0.2	191.3	1.04	97.7	-0.9	-0.016	**97.7%**
POST R3 CTS_1450.LAB	1/4/24	15:41:32	1.8	0.0	-0.2	191.3	1.05	97.2	-1.5	-0.019	**97.3%**

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Client: Ash Grove Cement Company
Facility: Midlothian Cement Plant
Project #: M235102
Operating Condition: Normal Operations/>90% Production

Test Location: Kiln 3 Stack
Date: 1/4/2024
Operator: AWB
FTIR s/n: 19088195

Post Test CTS, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST R3 CTS_1489.LAB	1/4/24	15:50:00	0.8	0.0	0.0	191.3	1.11	99.6	-1.6	-0.019	**99.6%**
POST R3 CTS_1490.LAB	1/4/24	15:50:08	0.6	0.0	0.1	191.3	1.07	99.7	-1.6	-0.023	**99.8%**
POST R3 CTS_1491.LAB	1/4/24	15:50:16	0.4	0.0	0.0	191.3	1.07	99.6	-1.2	-0.020	**99.6%**
POST R3 CTS_1492.LAB	1/4/24	15:50:24	0.4	0.0	0.2	191.3	1.07	99.3	-1.2	-0.016	**99.3%**
POST R3 CTS_1493.LAB	1/4/24	15:50:32	0.3	0.0	-0.1	191.6	1.07	99.6	-1.8	-0.015	**99.6%**
POST R3 CTS_1494.LAB	1/4/24	15:50:40	0.2	0.0	0.1	191.3	1.07	99.6	-1.4	-0.018	**99.6%**
POST R3 CTS_1495.LAB	1/4/24	15:50:48	0.2	0.0	0.1	191.3	1.07	99.4	-1.3	-0.017	**99.5%**
POST R3 CTS_1496.LAB	1/4/24	15:50:56	0.2	0.0	0.1	191.3	1.07	99.6	-1.2	-0.022	**99.7%**
	Average							**99.5**			

Post Test N2, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
POST R3 N2_1498.LAB	1/4/24	15:54:07	0.0	0.0	0.0	191.3	1.05	0.1	-1.1	-0.003
POST R3 N2_1499.LAB	1/4/24	15:56:13	0.0	0.0	0.0	191.3	1.05	0.1	-1.0	-0.002
POST R3 N2_1500.LAB	1/4/24	15:58:18	0.0	0.0	0.0	191.3	1.05	0.1	-0.9	-0.004

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Zero Gas and In-Stack Detection Limit Study
Ash Grove Cement Company
Midlothian Cement Plant
Kiln 3 Stack
1/4/2024

	DL summary - zero gas			DL summary - in stack	
Time	HF ppm (10) 191C	HCN (100) 191C	Time	HF ppm (10) 191C	HCN (100) 191C
7:41:02 AM	0.06	-0.09	10:16:09 AM	-0.01	-0.36
7:41:10 AM	0.05	0.08	10:16:16 AM	-0.02	-0.25
7:41:18 AM	0.00	0.10	10:16:23 AM	0.00	-0.23
7:41:26 AM	0.01	-0.07	10:16:30 AM	0.00	-0.26
7:41:34 AM	0.00	-0.12	10:16:37 AM	-0.03	-0.40
7:41:42 AM	0.01	-0.06	10:16:44 AM	-0.08	-0.40
			10:16:51 AM	0.01	-0.27
Standard Deviation	**0.02**	**0.08**	**Standard Deviation**	**0.03**	**0.07**
3x = DL	**0.07**	**0.25**	**3x = DL**	**0.08**	**0.20**

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Appendix H - Gas Cylinder Certifications

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Airgas Specialty Gases
Airgas USA LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E03NI78E15A1066	Reference Number:	153-402794083-1
Cylinder Number:	EB0162460	Cylinder Volume:	151.1 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72023	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Jul 19, 2023

Expiration Date: Jul 19, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	9.897 %	G1	+/- 0.8% NIST Traceable	07/19/2023
OXYGEN	12.00 %	11.95 %	G1	+/- 0.9% NIST Traceable	07/19/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060405	CC411744	7.489 % CARBON DIOXIDE/NITROGEN	0.6%	May 14, 2025
NTRM	98051010	SG9161286BAL	12.05 % OXYGEN/NITROGEN	0.7%	Dec 14, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Jun 28, 2023
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (DIXON)	Jun 29, 2023

Triad Data Available Upon Request

Signature on file
Approved for Release

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Airgas Specialty Gases
Airgas USA LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E03NI59E15A3452	Reference Number:	153-402886633-1
Cylinder Number:	EB0162461	Cylinder Volume:	159.0 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72023	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 09, 2023

Expiration Date: Nov 09, 2031

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted. The results relate only to the items tested. The report shall not be reproduced except in full without approval of the laboratory. Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	19.00 %	18.64 %	G1	+/- 0.8% NIST Traceable	11/09/2023
OXYGEN	22.00 %	22.01 %	G1	+/- 0.5% NIST Traceable	11/09/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060802	CC415397	24.04 % CARBON DIOXIDE/NITROGEN	0.6%	Dec 11, 2025
NTRM	09061434	CC282492	22.53 % OXYGEN/NITROGEN	0.4%	May 13, 2025

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Oct 17, 2023
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (DIXON)	Oct 17, 2023

Triad Data Available Upon Request

Signature on file
Approved for Release

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Airgas Specialty Gases
Airgas USA LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X02NI99C15A1268	Reference Number:	153-402780689-1
Cylinder Number:	EB0091181	Cylinder Volume:	144.0 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
Analysis Date:	Jul 10, 2023	Valve Outlet:	350
Lot Number:	153-402780689-1		

Expiration Date: Jul 10, 2026

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
ETHYLENE	100.0 PPM	100.4 PPM	+/- 2%
NITROGEN	Balance		

Signature on file
Approved for Release

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Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Customer:	MOSTARDI PLATT		
Part Number:	X03NI99C15AC0W8	Reference Number:	160-402841639-1
Cylinder Number:	CC768228	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
Analysis Date:	Sep 11, 2023	Valve Outlet:	350SS
Lot Number:	160-402841639-1		

Expiration Date: Mar 11, 2024

Product composition verified by direct comparison to calibration standards traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
SULFUR HEXAFLUORIDE	5.000 PPM	5.009 PPM	+/- 5%
HYDROGEN CYANIDE	50.00 PPM	49.30 PPM	+/- 5%
NITROGEN	Balance		

Signature on file
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END OF THE REPORT

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