

**Section 114 Information
Collection Request
Engineering Emissions
Test Report**

Ash Grove Cement Company
Leamington Cement Plant
EPA Registry ID: 110056953523
Main Kiln Stack
UT-132
Leamington, Utah
Report No. M234904A





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**Report Submittal Date:
March 4, 2024**

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1.0 INTRODUCTION

Mostardi Platt conducted an air emissions test program for Ash Grove Cement Company at the Leamington Cement Plant located in Leamington, Utah. 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 Leamington Cement Plant includes a single kiln (Main Kiln) ~1,000,000 TPY preheater/pre-calciner having an in-line raw mill. There is a single separate line calciner. The kiln system employs a SNCR and ACI as needed to control NO_x and mercury and has a baghouse fabric filtration. 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.

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

Location	Address	Contact
Test Coordinator	Ash Grove Cement Company UT-132 Leamington, UT 84638	Mr. Cody Watkins Environmental Manager (435) 857-1212 Cody.watkins@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

2.0 TEST REQUIREMENTS

Testing was performed at the kiln 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 Stack Mill On	Hydrogen Fluoride (HF)	≤ 0.10 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.19 ppmvd @7% O ₂	
		≤ 0.07 lb/hr	
		≤ 0.0006 lb/ton clinker	
	HF ¹	≤ 0.15 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.24 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
		≤ 0.07 ppmvd @7% O ₂	
		≤ 0.08 lb/hr	
		≤ 0.0007 lb/ton clinker	
	Hydrogen Cyanide (HCN)	≤ 0.39 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.75 ppmvd @7% O ₂	
≤ 0.35 lb/hr			
≤ 0.0031 lb/ton clinker			
Oxygen (O ₂)	12.3 % (dry)	USEPA Method 3A, 40CFR60, Appendix A	
Carbon Dioxide (CO ₂)	13.8 % (dry)	USEPA Method 320, 40CFR63, Appendix A	
Moisture (H ₂ O)	16.6 %	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 Cl₂ Method 26A results are reported as the average from Train A and Train B.

Source	Parameter Tested	Test Results	Method/Regulation Citation
Kiln Stack Mill Off	Hydrogen Fluoride (HF)	≤ 0.10 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.16 ppmvd @7% O ₂	
		≤ 0.05 lb/hr	
		≤ 0.0005 lb/ton clinker	
	HF ²	≤ 0.12 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.17 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Chlorine (Cl ₂) ²	≤ 0.03 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Hydrogen Cyanide (HCN)	1.01 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		1.61 ppmvd @7% O ₂	
0.74 lb/hr			
0.0067 lb/ton clinker			
Oxygen (O ₂)	10.8 % (dry)	USEPA Method 3A, 40CFR60, Appendix A	
Carbon Dioxide (CO ₂)	16.2 % (dry)	USEPA Method 320, 40CFR63, Appendix A	
Moisture (H ₂ O)	13.3 %	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	

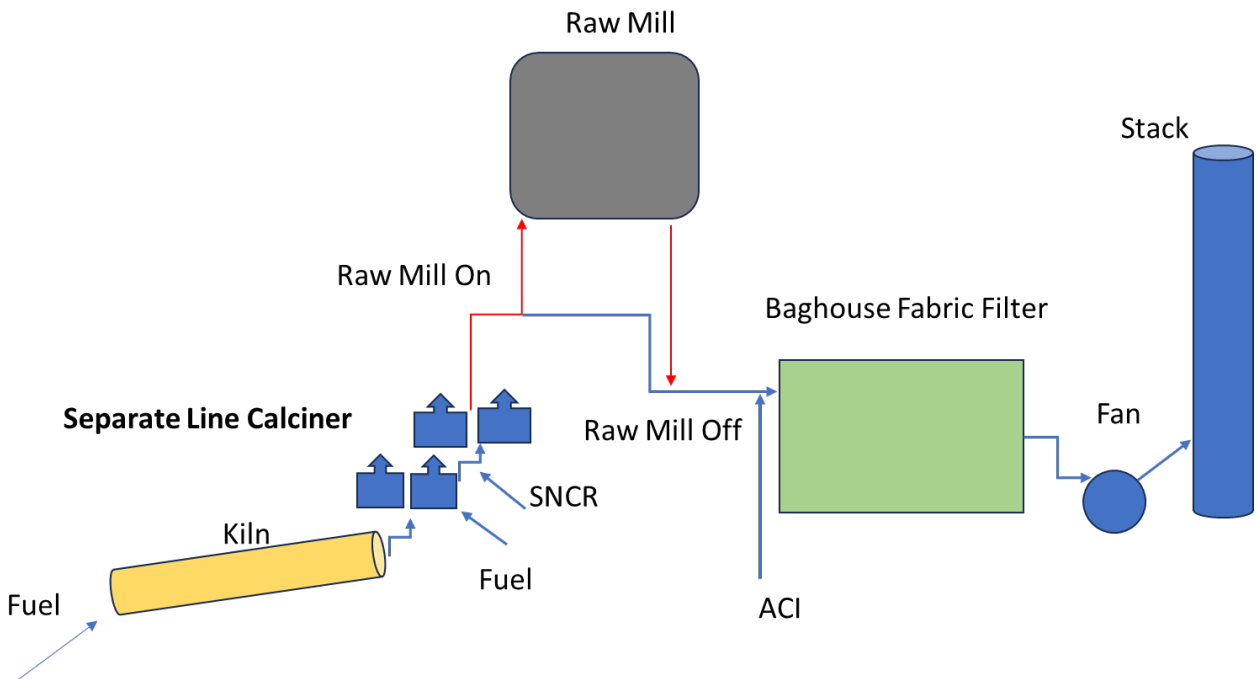
² HF and Cl₂ Method 26A results are reported as the average from Train A and Train B.

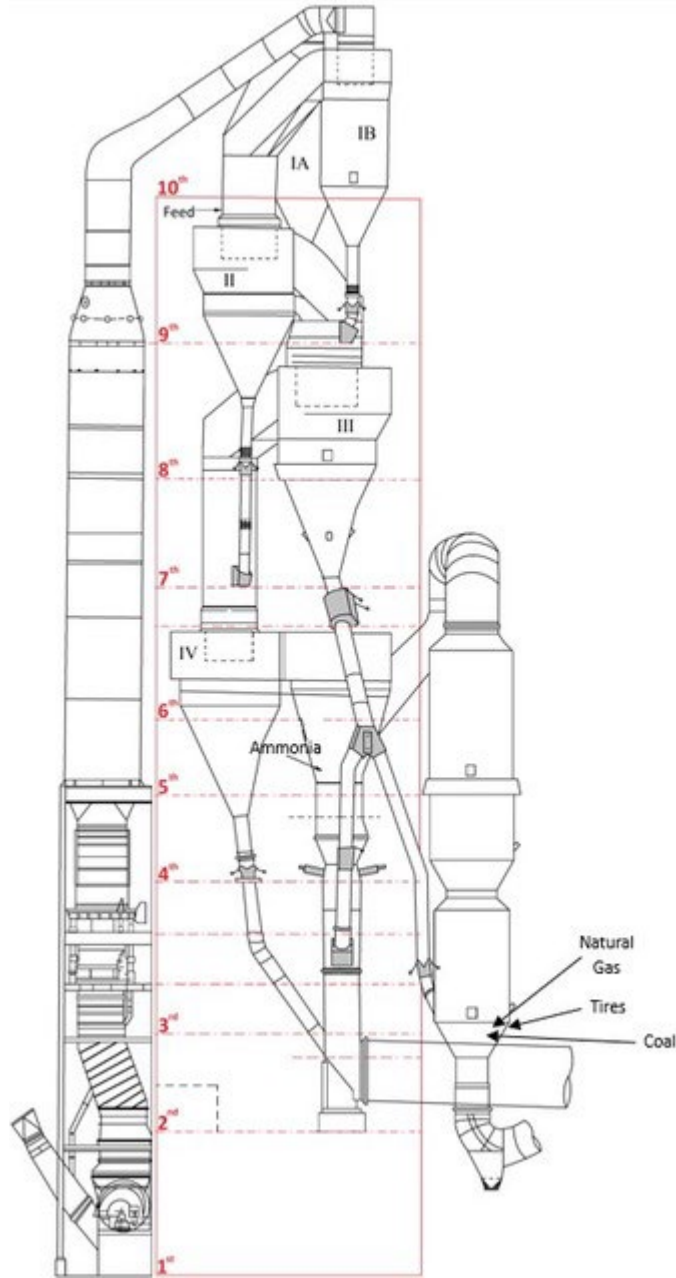
3.0 QA SPECIFICATIONS AND PROCESS DIAGRAM

3-1 QA/QC Specifications

Parameter	Method	QA/QC Specification	Acceptance Criteria	Actual Result
HCN	320	Method Detection Limit	0.5 ppm	0.1 ppmvw
		SNR	>2500 at 64 scans	6706 (Run 1 Average)
		S Beam	>0.9	1.367 (Run 1 Average)
		Direct HCN Analysis	±5% of tag value	2.2%
		Dynamic Spike Analysis	≤10% of total sample volume	7.8%
			Spike gas ~twice native concentration or 3-4 ppm addition to native concentration	+3.6 ppm
		Residuals	≤±20% of expected value or ≤±0.5 ppm, whichever is less restrictive	≤±20% of expected value
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

3-2 Process Flow Diagram





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
Main Kiln	11 Feet	7.0 Inches	4.1 Diameters	5.5 Diameters	HF/Cl ₂ (26A)	24
					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/Cl₂ 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 (O₂) and Carbon Dioxide (CO₂) Determination

O₂ and CO₂ concentrations were determined in accordance with Method 3A, 40CFR60, Appendix A and Method 320, 40CFR63, Appendix A, respectively. A Servomex analyzer was used to determine O₂ concentrations while the MKS 2030 analyzer was used to determine CO₂ concentrations. The O₂ instrument has a paramagnetic detector and operates in a nominal range of 0-25%.

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 (Cl₂) Determination

HF and Cl₂ 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 twenty-four (24) test points were sampled per run at the Kiln 4 stack. The sample was extracted isokinetically from the gas stream and passed through dilute sulfuric acid (0.1N H₂SO₄). HF was collected in the dilute acid. Cl₂ 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 H₂SO₄, 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 H₂SO₄ impinger catch samples were analyzed for HF while the 0.1N NaOH impinger catch samples were analyzed for Cl₂. The method detection limit (MDL) was determined for both HF and Cl₂ using the "Definition and Procedure for the Determination of the Method Detection Limit, Revision 2". A value of 150 µg was used for both compounds. 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. The Method 320 sampling system vaporizes water droplets similar to Method 26A. The difference is that Method 320 is an extractive method that calculates concentration based on compounds continuously flowing through the FTIR gas cell where the Method 26A captures water vapor in an impinger train. Calculating Method 320 concentrations on a dry basis uses the water vapor contained in the FTIR gas cell. In order to calculate lb/hr, the dry FTIR concentration is used in combination with the dry stack gas volumetric flow rate.

All sampling system components were heated to 375°F +/- 25°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: N₂, O₂, H₂, 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.

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."

5.0 TEST RESULTS SUMMARIES

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Test Method: 26A Combined Trains

	Source Condition	Mill On	Mill On	Mill On	
	Date	1/16/24	1/16/24	1/16/24	
	Start Time	9:30	11:08	12:40	
	End Time	10:45	12:23	13:55	
	Run 1	Run 2	Run 3	Average	
Stack Conditions					
Average Gas Velocity, ft/sec	46.894	45.796	45.233	45.974	
Gas Volumetric Flow Rate, acfm	267,386	261,130	257,916	262,144	
Gas Volumetric Flow Rate, dscfm	180,157	176,113	176,609	177,626	
Gas Volumetric Flow Rate, scfm	218,755	213,854	211,439	214,682	
Average %CO ₂ by volume, dry basis	13.4	14.0	14.0	13.8	
Average %O ₂ by volume, dry basis	12.3	12.3	12.3	12.3	
Clinker Production, ton/hr	110.6	111.5	111.5	111.2	
Chlorine (Cl₂) Emissions					
ppm ≤	0.04	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04
ppm@7%O ₂ ≤	0.07	≤ 0.07	≤ 0.07	≤ 0.07	≤ 0.07
lb/hr ≤	0.08	≤ 0.08	≤ 0.08	≤ 0.08	≤ 0.08
lb/ton of clinker ≤	0.0007	≤ 0.0007	≤ 0.0008	≤ 0.0007	≤ 0.0007
Hydrogen Fluoride (HF) Emissions					
ppm ≤	0.15	≤ 0.15	≤ 0.15	≤ 0.15	≤ 0.15
ppm@7%O ₂ ≤	0.24	≤ 0.24	≤ 0.24	≤ 0.24	≤ 0.24
lb/hr ≤	0.08	≤ 0.08	≤ 0.08	≤ 0.08	≤ 0.08
lb/ton of clinker ≤	0.0007	≤ 0.0007	≤ 0.0007	≤ 0.0007	≤ 0.0007

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Train A

	Source Condition Date	Mill On 1/16/24	Mill On 1/16/24	Mill On 1/16/24				
	Start Time	9:30	11:08	12:40				
	End Time	10:45	12:23	13:55				
		Run 1A	Run 2A	Run 3A	Average			
Stack Conditions								
Average Gas Temperature, °F		194.3	193.8	193.5	193.9			
Flue Gas Moisture, percent by volume		17.4%	17.0%	16.7%	17.0%			
Average Flue Pressure, in. Hg		30.33	30.33	30.33	30.33			
Gas Sample Volume, dscf		48,794	47,868	47,599	48,087			
Average Gas Velocity, ft/sec		46.600	45.479	45.195	45.758			
Gas Volumetric Flow Rate, acfm		265,714	259,322	257,700	260,912			
Gas Volumetric Flow Rate, dscfm		179,549	176,230	175,863	177,214			
Gas Volumetric Flow Rate, scfm		217,401	212,333	211,085	213,606			
Average %CO ₂ by volume, dry basis		13.4	14.0	14.0	13.8			
Average %O ₂ by volume, dry basis		12.3	12.3	12.3	12.3			
Isokinetic Variance		103.7	103.6	103.2	103.5			
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	≤	0.13	≤	0.13	≤	0.13

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Train B

Source Condition	Mill On	Mill On	Mill On
Date	1/16/24	1/16/24	1/16/24
Start Time	9:30	11:08	12:40
End Time	10:45	12:23	1:55

	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	194.3	194.4	193.1	193.9
Flue Gas Moisture, percent by volume	17.9%	18.3%	16.3%	17.5%
Average Flue Pressure, in. Hg	30.33	30.37	30.37	30.36
Gas Sample Volume, dscf	39,536	38,880	38,302	38,906
Average Gas Velocity, ft/sec	47.187	46.113	45.271	46.190
Gas Volumetric Flow Rate, acfm	269,058	262,938	258,132	263,376
Gas Volumetric Flow Rate, dscfm	180,764	175,996	177,354	178,038
Gas Volumetric Flow Rate, scfm	220,108	215,375	211,792	215,758
Average %CO ₂ by volume, dry basis	13.4	14.0	14.0	13.8
Average %O ₂ by volume, dry basis	12.3	12.3	12.3	12.3
Isokinetic Variance	100.9	101.9	99.6	100.8

Chlorine (Cl₂) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.05	≤ 0.05	≤ 0.05	≤ 0.05

Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.16	≤ 0.16	≤ 0.17	≤ 0.16

Ash Grove Cement Company Leamington Cement Plant Main Kiln Stack Mill On Reference Method Test Data									
Test No.	Date	Start Time	End Time	O ₂ % (dry)	Moisture %	HCN ppmvw	HCN ppmvd @ 7% O ₂	HF ppmvw	HF ppmvd @ 7% O ₂
1	1/16/2024	9:30	10:29	12.3	16.3%	0.44	0.86	≤ 0.10	≤ 0.19
2	1/16/2024	11:08	12:07	12.3	16.7%	≤ 0.40	≤ 0.77	≤ 0.10	≤ 0.19
3	1/16/2024	12:40	13:39	12.3	16.9%	≤ 0.32	≤ 0.61	≤ 0.10	≤ 0.19
Average				12.3	16.6%	≤ 0.39	≤ 0.75	≤ 0.10	≤ 0.19

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	1/16/2024	9:30	10:29	180,157	110.4	0.40	0.0036	≤ 0.07	≤ 0.0006
2	1/16/2024	11:08	12:07	176,113	111.5	≤ 0.35	≤ 0.0032	≤ 0.07	≤ 0.0006
3	1/16/2024	12:40	13:39	176,609	111.5	≤ 0.28	≤ 0.0025	≤ 0.07	≤ 0.0006
Average				177,626	111.1	≤ 0.35	≤ 0.0031	≤ 0.07	≤ 0.0006

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Combined Trains

	Source Condition	Mill Off	Mill Off	Mill Off		
	Date	1/17/24	1/17/24	1/17/24		
	Start Time	9:30	11:05	12:40		
	End Time	10:45	12:23	13:55		
		Run 1	Run 2	Run 3	Average	
Stack Conditions						
Average Gas Velocity, ft/sec		58.066	57.956	57.987	58.003	
Gas Volumetric Flow Rate, acfm		331,093	330,462	330,638	330,731	
Gas Volumetric Flow Rate, dscfm		152,095	153,406	150,316	151,939	
Gas Volumetric Flow Rate, scfm		174,150	173,220	172,773	173,381	
Average %CO ₂ by volume, dry basis		16.1	16.2	16.3	16.2	
Average %O ₂ by volume, dry basis		10.9	10.8	10.8	10.8	
Clinker Production, ton/hr		111.5	111.3	110.6	111.1	
Chlorine (Cl₂) Emissions						
ppm	≤	0.03	≤	0.03	≤	0.03
ppm@7%O ₂	≤	0.05	≤	0.05	≤	0.05
lb/hr	≤	0.0571	≤	0.0576	≤	0.0564
lb/ton of clinker	≤	0.0005	≤	0.0005	≤	0.0005
Hydrogen Fluoride (HF) Emissions						
ppm	≤	0.12	≤	0.12	≤	0.12
ppm@7%O ₂	≤	0.17	≤	0.17	≤	0.17
lb/hr	≤	0.0569	≤	0.0574	≤	0.0567
lb/ton of clinker	≤	0.0005	≤	0.0005	≤	0.0005

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Train A

	Source Condition	Mill Off	Mill Off	Mill Off				
	Date	1/17/24	1/17/24	1/17/24				
	Start Time	9:30	11:05	12:40				
	End Time	10:45	12:23	13:55				
		Run 1A	Run 2A	Run 3A	Average			
Stack Conditions								
Average Gas Temperature, °F		363.1	365.5	369.0	365.9			
Flue Gas Moisture, percent by volume		12.7%	11.9%	13.3%	12.6%			
Average Flue Pressure, in. Hg		24.23	24.23	24.23	24.23			
Gas Sample Volume, dscf		51.306	51.416	50.905	51.209			
Average Gas Velocity, ft/sec		57.967	58.133	57.968	58.023			
Gas Volumetric Flow Rate, acfm		330,528	331,476	330,532	330,845			
Gas Volumetric Flow Rate, dscfm		149,897	151,302	147,876	149,692			
Gas Volumetric Flow Rate, scfm		171,721	171,718	170,507	171,315			
Average %CO ₂ by volume, dry basis		16.1	16.2	16.3	16.2			
Average %O ₂ by volume, dry basis		10.9	10.8	10.8	10.8			
Isokinetic Variance		101.5	100.8	102.1	101.5			
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	≤	0.12	≤	0.12	≤	0.13	≤	0.12

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Train B

Source Condition	Mill Off	Mill Off	Mill Off
Date	1/17/24	1/17/24	1/17/24
Start Time	9:30	11:05	12:40
End Time	10:45	12:20	13:55
	Run 1B	Run 2B	Run 3B

Stack Conditions				
Average Gas Temperature, °F	364.2	367.4	369.2	366.9
Flue Gas Moisture, percent by volume	12.6%	11.0%	12.7%	12.1%
Average Flue Pressure, in. Hg	24.87	24.87	24.87	24.87
Gas Sample Volume, dscf	55.011	54.631	54.440	54.694
Average Gas Velocity, ft/sec	58.165	57.778	58.005	57.983
Gas Volumetric Flow Rate, acfm	331,658	329,448	330,744	330,617
Gas Volumetric Flow Rate, dscfm	154,292	155,509	152,756	154,186
Gas Volumetric Flow Rate, scfm	176,578	174,721	175,038	175,446
Average %CO ₂ by volume, dry basis	16.1	16.2	16.3	16.2
Average %O ₂ by volume, dry basis	10.9	10.8	10.8	10.8
Isokinetic Variance	101.8	100.3	101.8	101.3

Chlorine (Cl ₂) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 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

Ash Grove Cement Company Leamington Cement Plant Main Kiln Stack Mill Off Reference Method Test Data									
Test No.	Date	Start Time	End Time	O ₂ % (dry)	Moisture %	HCN ppmvw	HCN ppmvd @ 7% O ₂	HF ppmvw	HF ppmvd @ 7% O ₂
1	1/17/2024	9:30	10:29	10.9	13.2%	1.03	1.64	≤ 0.10	≤ 0.16
2	1/17/2024	11:05	12:04	10.8	13.3%	1.00	1.59	≤ 0.10	≤ 0.16
3	1/17/2024	12:40	13:39	10.8	13.2%	1.00	1.58	≤ 0.10	≤ 0.16
Average				10.8	13.3%	1.01	1.61	≤ 0.10	≤ 0.16

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	1/17/2024	9:30	10:29	152,095	111.5	0.76	0.0068	≤ 0.05	≤ 0.0005
2	1/17/2024	11:05	12:04	153,406	111.4	0.75	0.0067	≤ 0.06	≤ 0.0005
3	1/17/2024	12:40	13:39	150,316	110.7	0.73	0.0066	≤ 0.05	≤ 0.0005
Average				151,939	111.2	0.74	0.0067	≤ 0.05	≤ 0.0005

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



Richard J. Sollars II

Project Manager



Chet A. Gutwein

Quality Assurance

APPENDICES

Appendix A – Plant Operating Data

RUN 1
 1 hr test 9:30-10:29
 Method 26A 9:30-10:45

Test Avg
 110.4
 110.6

Date/Time	CLINKER (TNHR) Expression Value
01/16/2024 09:30	110.4
01/16/2024 09:31	110.3
01/16/2024 09:32	109.8
01/16/2024 09:33	109.5
01/16/2024 09:34	109.6
01/16/2024 09:35	109.9
01/16/2024 09:36	110.2
01/16/2024 09:37	109.9
01/16/2024 09:38	109.9
01/16/2024 09:39	110.1
01/16/2024 09:40	109.9
01/16/2024 09:41	110.2
01/16/2024 09:42	110.5
01/16/2024 09:43	109.9
01/16/2024 09:44	109.8
01/16/2024 09:45	110.5
01/16/2024 09:46	109.7
01/16/2024 09:47	109.3
01/16/2024 09:48	109.1
01/16/2024 09:49	109.6
01/16/2024 09:50	109.5
01/16/2024 09:51	109.3
01/16/2024 09:52	109.5
01/16/2024 09:53	109.4
01/16/2024 09:54	109.8
01/16/2024 09:55	110.8
01/16/2024 09:56	110.4
01/16/2024 09:57	109.9
01/16/2024 09:58	109.7
01/16/2024 09:59	109.5
01/16/2024 10:00	109.9
01/16/2024 10:01	110.4
01/16/2024 10:02	110.2
01/16/2024 10:03	110.4
01/16/2024 10:04	110.6
01/16/2024 10:05	110.6
01/16/2024 10:06	110.8
01/16/2024 10:07	110.2
01/16/2024 10:08	110.6
01/16/2024 10:09	110.6
01/16/2024 10:10	110.2
01/16/2024 10:11	111.0
01/16/2024 10:12	110.5
01/16/2024 10:13	111.0
01/16/2024 10:14	110.7
01/16/2024 10:15	110.8
01/16/2024 10:16	110.8
01/16/2024 10:17	111.6
01/16/2024 10:18	111.1
01/16/2024 10:19	111.9
01/16/2024 10:20	111.7
01/16/2024 10:21	111.9
01/16/2024 10:22	111.5
01/16/2024 10:23	110.4
01/16/2024 10:24	111.0
01/16/2024 10:25	111.7
01/16/2024 10:26	111.5
01/16/2024 10:27	112.3
01/16/2024 10:28	111.8
01/16/2024 10:29	111.7
01/16/2024 10:30	111.2
01/16/2024 10:31	111.5
01/16/2024 10:32	112.1
01/16/2024 10:33	111.7
01/16/2024 10:34	111.5
01/16/2024 10:35	111.1
01/16/2024 10:36	111.2
01/16/2024 10:37	111.1
01/16/2024 10:38	111.4
01/16/2024 10:39	111.8
01/16/2024 10:40	111.4
01/16/2024 10:41	111.0
01/16/2024 10:42	111.1
01/16/2024 10:43	111.4
01/16/2024 10:44	111.7
01/16/2024 10:45	112.5

RUN 2
 1 hr test 11:08-12:07
 Method 26A 11:08-12:13

Test Avg
 111.5
 111.5

Date/Time	CLINKER (TNHR) Expression Value
01/16/2024 11:08	111.1
01/16/2024 11:09	111.6
01/16/2024 11:10	111.6
01/16/2024 11:11	111.9
01/16/2024 11:12	111.8
01/16/2024 11:13	112.0
01/16/2024 11:14	111.8
01/16/2024 11:15	111.2
01/16/2024 11:16	111.4
01/16/2024 11:17	111.1
01/16/2024 11:18	111.8
01/16/2024 11:19	111.1
01/16/2024 11:20	111.5
01/16/2024 11:21	111.3
01/16/2024 11:22	111.4
01/16/2024 11:23	111.5
01/16/2024 11:24	111.5
01/16/2024 11:25	111.4
01/16/2024 11:26	111.6
01/16/2024 11:27	111.4
01/16/2024 11:28	112.0
01/16/2024 11:29	112.0
01/16/2024 11:30	111.7
01/16/2024 11:31	111.4
01/16/2024 11:32	111.5
01/16/2024 11:33	111.5
01/16/2024 11:34	111.7
01/16/2024 11:35	111.8
01/16/2024 11:36	111.6
01/16/2024 11:37	111.6
01/16/2024 11:38	112.2
01/16/2024 11:39	111.6
01/16/2024 11:40	111.5
01/16/2024 11:41	111.8
01/16/2024 11:42	111.0
01/16/2024 11:43	111.4
01/16/2024 11:44	110.3
01/16/2024 11:45	110.6
01/16/2024 11:46	111.0
01/16/2024 11:47	110.8
01/16/2024 11:48	111.0
01/16/2024 11:49	111.5
01/16/2024 11:50	112.5
01/16/2024 11:51	112.1
01/16/2024 11:52	111.8
01/16/2024 11:53	112.0
01/16/2024 11:54	111.7
01/16/2024 11:55	112.2
01/16/2024 11:56	111.2
01/16/2024 11:57	111.0
01/16/2024 11:58	111.1
01/16/2024 11:59	111.4
01/16/2024 12:00	111.1
01/16/2024 12:01	111.2
01/16/2024 12:02	110.4
01/16/2024 12:03	111.2
01/16/2024 12:04	111.4
01/16/2024 12:05	111.4
01/16/2024 12:06	112.4
01/16/2024 12:07	112.6
01/16/2024 12:08	112.1
01/16/2024 12:09	111.9
01/16/2024 12:10	111.8
01/16/2024 12:11	111.8
01/16/2024 12:12	111.2
01/16/2024 12:13	111.7

RUN 3
 1 hr test 12:40-13:39
 Method 26A 12:40-13:55

Test Avg
 111.5
 111.5

Date/Time	CLINKER (TNHR) Expression Value
01/16/2024 12:40	111.4
01/16/2024 12:41	111.4
01/16/2024 12:42	112.1
01/16/2024 12:43	112.2
01/16/2024 12:44	111.9
01/16/2024 12:45	111.6
01/16/2024 12:46	112.6
01/16/2024 12:47	111.9
01/16/2024 12:48	111.7
01/16/2024 12:49	111.4
01/16/2024 12:50	111.2
01/16/2024 12:51	111.2
01/16/2024 12:52	111.0
01/16/2024 12:53	111.5
01/16/2024 12:54	111.5
01/16/2024 12:55	111.8
01/16/2024 12:56	111.8
01/16/2024 12:57	111.7
01/16/2024 12:58	111.5
01/16/2024 12:59	111.4
01/16/2024 13:00	111.4
01/16/2024 13:01	110.5
01/16/2024 13:02	111.0
01/16/2024 13:03	111.6
01/16/2024 13:04	111.4
01/16/2024 13:05	112.2
01/16/2024 13:06	112.2
01/16/2024 13:07	111.4
01/16/2024 13:08	111.2
01/16/2024 13:09	111.1
01/16/2024 13:10	111.8
01/16/2024 13:11	111.7
01/16/2024 13:12	111.5
01/16/2024 13:13	111.4
01/16/2024 13:14	111.5
01/16/2024 13:15	111.1
01/16/2024 13:16	111.0
01/16/2024 13:17	111.0
01/16/2024 13:18	111.2
01/16/2024 13:19	111.0
01/16/2024 13:20	111.2
01/16/2024 13:21	111.3
01/16/2024 13:22	111.8
01/16/2024 13:23	111.5
01/16/2024 13:24	111.8
01/16/2024 13:25	111.8
01/16/2024 13:26	111.8
01/16/2024 13:27	110.8
01/16/2024 13:28	111.0
01/16/2024 13:29	111.7
01/16/2024 13:30	112.2
01/16/2024 13:31	111.1
01/16/2024 13:32	110.8
01/16/2024 13:33	110.8
01/16/2024 13:34	111.5
01/16/2024 13:35	111.4
01/16/2024 13:36	112.0
01/16/2024 13:37	112.2
01/16/2024 13:38	112.0
01/16/2024 13:39	112.0
01/16/2024 13:40	111.7
01/16/2024 13:41	111.6
01/16/2024 13:42	111.5
01/16/2024 13:43	111.5
01/16/2024 13:44	111.5
01/16/2024 13:45	111.5
01/16/2024 13:46	112.0
01/16/2024 13:47	112.4
01/16/2024 13:48	111.5
01/16/2024 13:49	111.1
01/16/2024 13:50	110.8
01/16/2024 13:51	112.0
01/16/2024 13:52	111.6
01/16/2024 13:53	111.2
01/16/2024 13:54	111.0
01/16/2024 13:55	111.0

RUN 1		Test Avg
1 hr test	9:30-10:29	111.5
Method 26A	9:30-10:45	111.5

Date/Time	CLINKER (TNHR) Expression Value
01/17/2024 09:30	111.6
01/17/2024 09:31	111.1
01/17/2024 09:32	110.2
01/17/2024 09:33	111.0
01/17/2024 09:34	110.5
01/17/2024 09:35	111.4
01/17/2024 09:36	111.6
01/17/2024 09:37	112.2
01/17/2024 09:38	111.5
01/17/2024 09:39	111.2
01/17/2024 09:40	111.1
01/17/2024 09:41	111.5
01/17/2024 09:42	111.4
01/17/2024 09:43	111.2
01/17/2024 09:44	111.4
01/17/2024 09:45	111.8
01/17/2024 09:46	111.5
01/17/2024 09:47	111.1
01/17/2024 09:48	111.4
01/17/2024 09:49	111.6
01/17/2024 09:50	112.2
01/17/2024 09:51	111.9
01/17/2024 09:52	112.6
01/17/2024 09:53	111.7
01/17/2024 09:54	110.6
01/17/2024 09:55	111.0
01/17/2024 09:56	110.1
01/17/2024 09:57	111.0
01/17/2024 09:58	111.0
01/17/2024 09:59	113.1
01/17/2024 10:00	112.1
01/17/2024 10:01	111.8
01/17/2024 10:02	111.1
01/17/2024 10:03	112.4
01/17/2024 10:04	112.7
01/17/2024 10:05	112.0
01/17/2024 10:06	111.8
01/17/2024 10:07	111.9
01/17/2024 10:08	112.1
01/17/2024 10:09	111.6
01/17/2024 10:10	110.8
01/17/2024 10:11	110.3
01/17/2024 10:12	111.1
01/17/2024 10:13	111.4
01/17/2024 10:14	112.1
01/17/2024 10:15	112.7
01/17/2024 10:16	112.2
01/17/2024 10:17	111.2
01/17/2024 10:18	110.6
01/17/2024 10:19	110.9
01/17/2024 10:20	111.4
01/17/2024 10:21	111.3
01/17/2024 10:22	111.8
01/17/2024 10:23	112.4
01/17/2024 10:24	111.3
01/17/2024 10:25	111.7
01/17/2024 10:26	111.6
01/17/2024 10:27	112.3
01/17/2024 10:28	111.3
01/17/2024 10:29	111.5
01/17/2024 10:30	111.6
01/17/2024 10:31	111.6
01/17/2024 10:32	111.2
01/17/2024 10:33	111.3
01/17/2024 10:34	110.7
01/17/2024 10:35	110.9
01/17/2024 10:36	111.5
01/17/2024 10:37	111.9
01/17/2024 10:38	111.5
01/17/2024 10:39	112.3
01/17/2024 10:40	111.9
01/17/2024 10:41	111.1
01/17/2024 10:42	112.0
01/17/2024 10:43	111.8
01/17/2024 10:44	111.4
01/17/2024 10:45	112.1

RUN 2		Test Avg
1 hr test	11:05-12:04	111.4
Method 26A	11:05-12:20	111.3

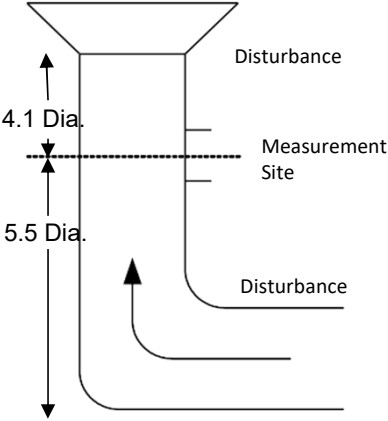
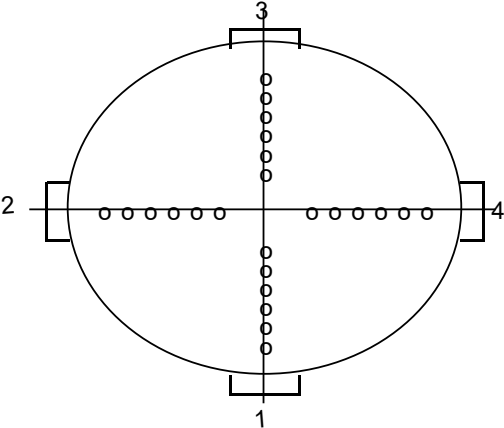
Date/Time	CLINKER (TNHR) Expression Value
01/17/2024 11:05	111.1
01/17/2024 11:06	111.6
01/17/2024 11:07	111.7
01/17/2024 11:08	110.6
01/17/2024 11:09	111.6
01/17/2024 11:10	111.6
01/17/2024 11:11	110.9
01/17/2024 11:12	111.6
01/17/2024 11:13	111.1
01/17/2024 11:14	111.8
01/17/2024 11:15	111.0
01/17/2024 11:16	111.1
01/17/2024 11:17	112.0
01/17/2024 11:18	111.1
01/17/2024 11:19	111.4
01/17/2024 11:20	111.6
01/17/2024 11:21	112.6
01/17/2024 11:22	112.4
01/17/2024 11:23	111.5
01/17/2024 11:24	112.2
01/17/2024 11:25	112.0
01/17/2024 11:26	112.2
01/17/2024 11:27	111.6
01/17/2024 11:28	111.2
01/17/2024 11:29	110.9
01/17/2024 11:30	111.2
01/17/2024 11:31	111.1
01/17/2024 11:32	111.4
01/17/2024 11:33	111.1
01/17/2024 11:34	111.7
01/17/2024 11:35	111.2
01/17/2024 11:36	111.9
01/17/2024 11:37	112.0
01/17/2024 11:38	112.3
01/17/2024 11:39	112.1
01/17/2024 11:40	111.4
01/17/2024 11:41	111.2
01/17/2024 11:42	111.2
01/17/2024 11:43	111.6
01/17/2024 11:44	111.5
01/17/2024 11:45	110.8
01/17/2024 11:46	111.2
01/17/2024 11:47	111.4
01/17/2024 11:48	111.2
01/17/2024 11:49	111.2
01/17/2024 11:50	111.1
01/17/2024 11:51	111.3
01/17/2024 11:52	111.3
01/17/2024 11:53	111.6
01/17/2024 11:54	111.5
01/17/2024 11:55	110.5
01/17/2024 11:56	110.4
01/17/2024 11:57	110.8
01/17/2024 11:58	111.2
01/17/2024 11:59	110.8
01/17/2024 12:00	111.1
01/17/2024 12:01	110.8
01/17/2024 12:02	110.5
01/17/2024 12:03	111.7
01/17/2024 12:04	110.1
01/17/2024 12:05	110.6
01/17/2024 12:06	111.3
01/17/2024 12:07	111.5
01/17/2024 12:08	111.7
01/17/2024 12:09	111.2
01/17/2024 12:10	110.5
01/17/2024 12:11	110.9
01/17/2024 12:12	110.7
01/17/2024 12:13	111.6
01/17/2024 12:14	111.6
01/17/2024 12:15	111.1
01/17/2024 12:16	110.5
01/17/2024 12:17	110.8
01/17/2024 12:18	111.1
01/17/2024 12:19	111.6
01/17/2024 12:20	110.6

RUN 3		Test Avg
1 hr test	12:40-13:39	110.7
Method 26A	12:40-13:55	110.6

Date/Time	CLINKER (TNHR) Expression Value
01/17/2024 12:40	110.5
01/17/2024 12:41	110.8
01/17/2024 12:42	110.8
01/17/2024 12:43	110.3
01/17/2024 12:44	109.9
01/17/2024 12:45	110.1
01/17/2024 12:46	110.2
01/17/2024 12:47	110.4
01/17/2024 12:48	110.5
01/17/2024 12:49	110.4
01/17/2024 12:50	110.5
01/17/2024 12:51	110.6
01/17/2024 12:52	110.9
01/17/2024 12:53	110.8
01/17/2024 12:54	111.1
01/17/2024 12:55	110.9
01/17/2024 12:56	110.9
01/17/2024 12:57	110.9
01/17/2024 12:58	111.1
01/17/2024 12:59	110.8
01/17/2024 13:00	111.1
01/17/2024 13:01	112.3
01/17/2024 13:02	111.4
01/17/2024 13:03	111.2
01/17/2024 13:04	111.0
01/17/2024 13:05	109.8
01/17/2024 13:06	109.7
01/17/2024 13:07	109.9
01/17/2024 13:08	110.7
01/17/2024 13:09	110.7
01/17/2024 13:10	111.0
01/17/2024 13:11	111.0
01/17/2024 13:12	110.7
01/17/2024 13:13	111.6
01/17/2024 13:14	112.2
01/17/2024 13:15	111.1
01/17/2024 13:16	110.9
01/17/2024 13:17	110.5
01/17/2024 13:18	110.1
01/17/2024 13:19	110.8
01/17/2024 13:20	109.9
01/17/2024 13:21	110.7
01/17/2024 13:22	109.9
01/17/2024 13:23	110.3
01/17/2024 13:24	110.5
01/17/2024 13:25	110.6
01/17/2024 13:26	110.4
01/17/2024 13:27	110.7
01/17/2024 13:28	110.2
01/17/2024 13:29	110.6
01/17/2024 13:30	110.8
01/17/2024 13:31	110.9
01/17/2024 13:32	110.8
01/17/2024 13:33	111.5
01/17/2024 13:34	110.6
01/17/2024 13:35	110.9
01/17/2024 13:36	111.4
01/17/2024 13:37	111.4
01/17/2024 13:38	110.8
01/17/2024 13:39	110.4
01/17/2024 13:40	110.4
01/17/2024 13:41	110.3
01/17/2024 13:42	110.6
01/17/2024 13:43	110.0
01/17/2024 13:44	109.8
01/17/2024 13:45	109.5
01/17/2024 13:46	109.8
01/17/2024 13:47	110.4
01/17/2024 13:48	110.7
01/17/2024 13:49	110.4
01/17/2024 13:50	110.8
01/17/2024 13:51	109.9
01/17/2024 13:52	110.2
01/17/2024 13:53	110.5
01/17/2024 13:54	110.6
01/17/2024 13:55	111.4

Appendix B – Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS



Client: Ash Grove Cement Company

Facility: Leamington Cement Plant

Test Location: Main Kiln Stack

Date: January 16 and 17, 2024

Diameter (Feet): 11.000

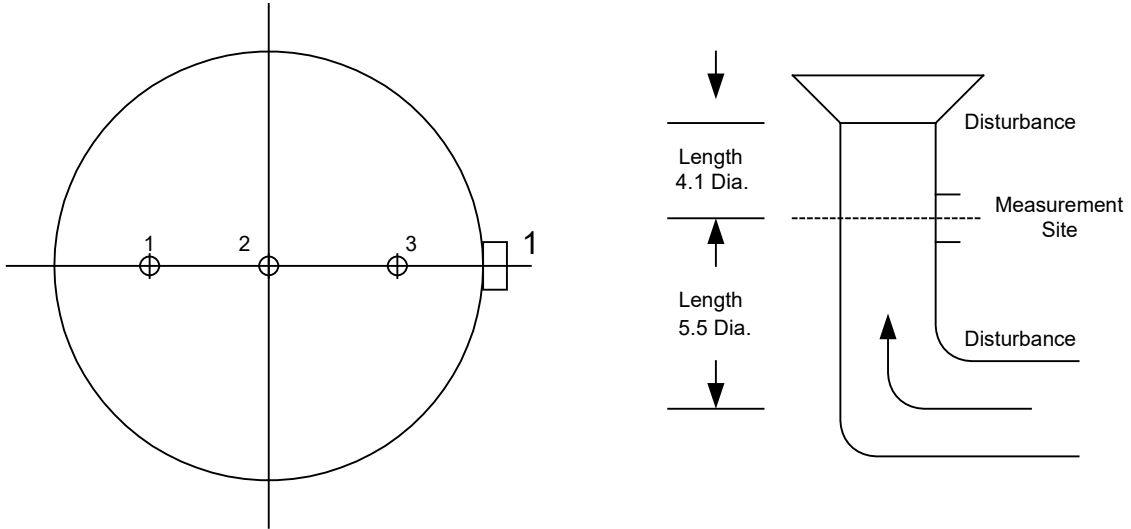
Port Length (In): 7.00

Ports Sampled: 4

Points/Port: 6

	Point Markings	
	From inside wall (in.)	% of Diameter
1	2.77	2.10
2	8.84	6.70
3	15.58	11.80
4	23.36	17.70
5	33.00	25.00
6	46.99	35.60

STRATIFICATION TEST FOR ROUND DUCTS



Job: Ash Grove Cement Company
Leamington Cement Plant
Leamington, Utah

Test Location: Main Kiln

Stack Diameter: 11.0 Feet

Stack Area: 95.033 Square Feet

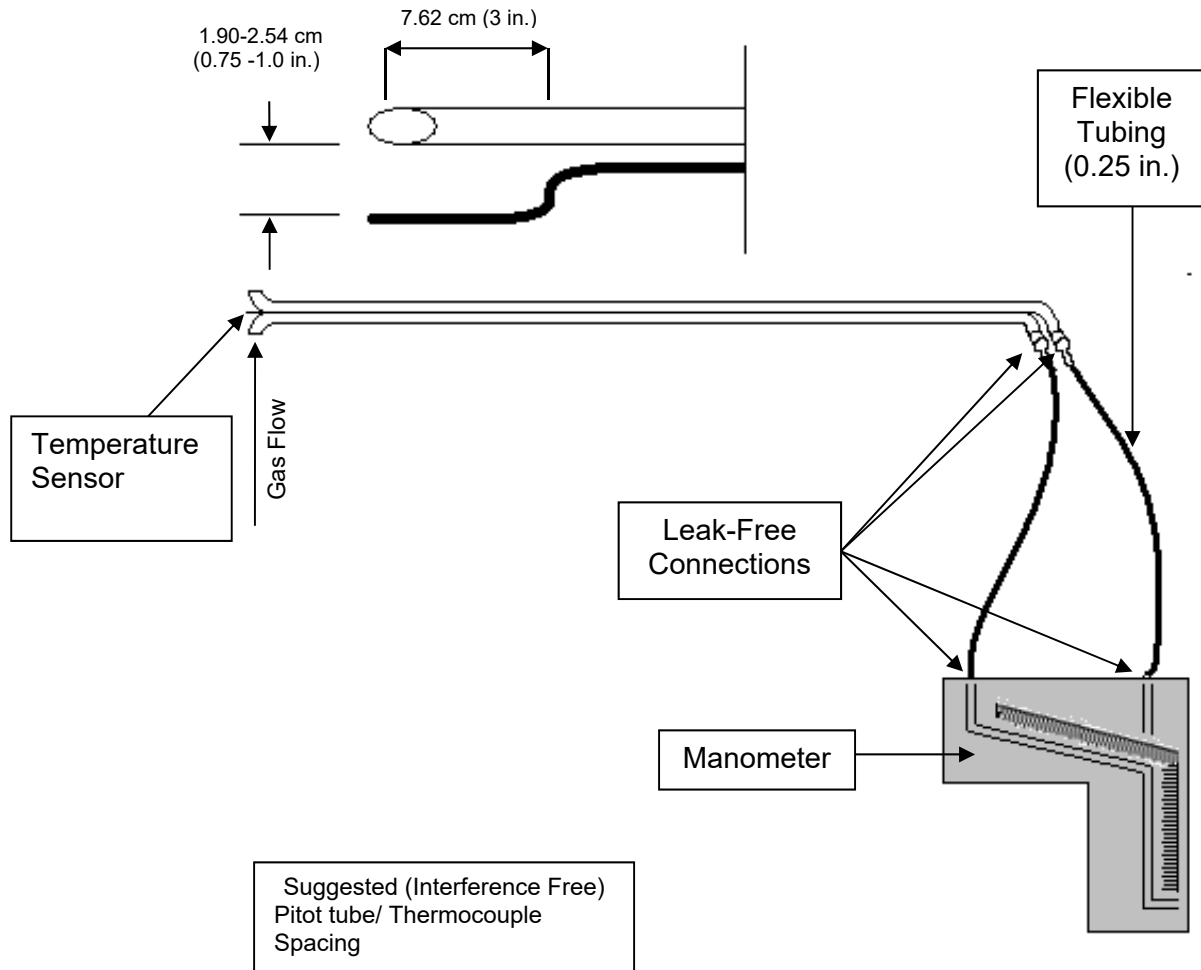
No. Sample Points: 3

Distance from Inside Wall
To Traverse Point:

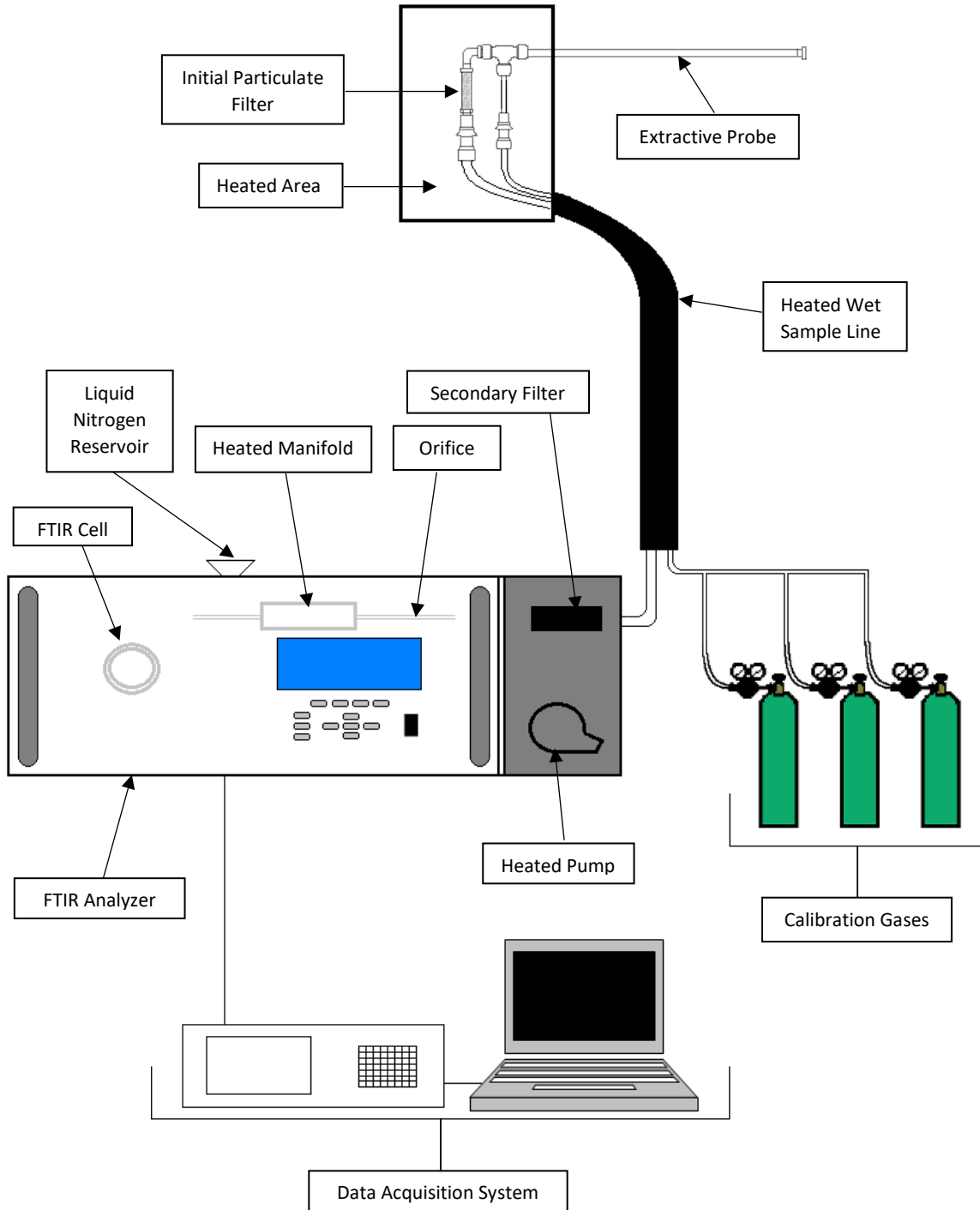
1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix C – Sample Train Diagrams

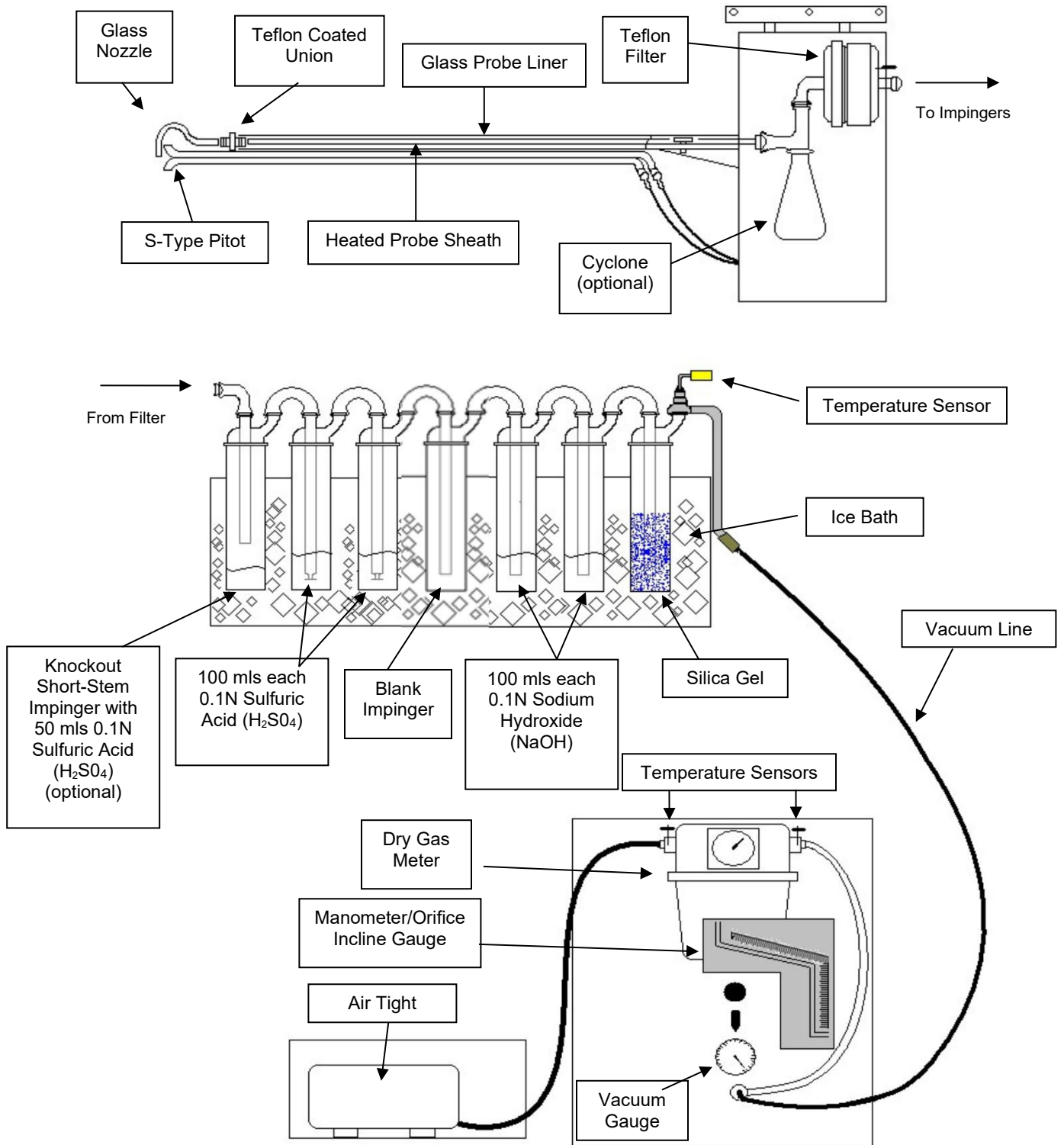
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



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



USEPA Method 26A – HF and Cl₂ Sample Train Diagram



Appendix D – Calculation Nomenclature and Formulas

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Run: 1
Date: 1/16/2024
Method: 26A
Source Condition: Mill On

Dry Molecular Weight

$$Md = 0.44 \times (\%CO_2) + 0.32 \times (\%O_2) + 0.28 \times \%N_2$$

$\%CO_2 = \underline{13.4}$ $\%O_2 = \underline{12.3}$ $\%N_2 = \underline{74.3}$
 $Md = \underline{30.636}$

Wet Molecular Weight

$$Ms = Md \times (1 - Bws) + (18.0 \times Bws)$$

$Md = \underline{30.636}$ $Bws = \underline{0.174}$
 $Ms = \underline{28.436}$

Meter Volume at Standard Conditions

$$Vm(std) = 17.647 \times Y \times Vm \times \frac{(Pbar + DH/13.6)}{Tm}$$

$Y = \underline{0.999}$ $Vm = \underline{47.863}$ $Pbar = \underline{30.4}$
 $DH = \underline{2.1}$ $Tm = \underline{67.8}$

$$Vm(std) = \underline{48.794}$$

Volume of Water Vapor Condensed

$$Vw(std) = 0.0471 \times (\text{net H}_2\text{O gain})$$

$\text{Net H}_2\text{O} = \underline{218.4}$
 $Vw(std) = \underline{10.287}$

Moisture Content

$$Bws = \frac{Vw(std)}{Vw(std) + Vm(std)}$$

$Vw(std) = \underline{10.287}$ $Vm(std) = \underline{48.794}$
 $Bws = \underline{0.174}$

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Run: 1
Date: 1/16/2024
Method: 26A
Source Condition: Mill On

Average Duct Velocity

$$V_s = 85.49 \times C_p \times \text{Sqrt DP (avg)} \times (T_s \text{ (avg)} + 460 / (P_s \times M_s))^{1/2}$$

$C_p = \frac{0.820}{30.33}$	$T_s \text{ (avg)} = \frac{194.3}{28.436}$	$\text{Sqrt DP (avg)} = \underline{0.763}$
$P_s = \underline{30.33}$	$M_s = \underline{28.436}$	
$V_s = \underline{46.600}$		

Volumetric Flow Rate (Actual Basis)

$$Q = V_s \times A \times 60$$

$V_s = \underline{46.600}$	$A = \underline{95.033}$
$Q = \underline{265,714}$	

Volumetric Flow Rate (Standard Basis)

$$Q_{std} = 17.647 \times Q \times \frac{P_s}{T_s \text{ (avg)} + 460}$$

$Q = \underline{265,714}$	$P_s = \underline{30.33}$	$T_s \text{ (avg)} = \underline{194.3}$
$Q_{std} = \underline{217,401}$		

Volumetric Flow Rate (Standard Dry Basis)

$$Q_{std(dry)} = Q_{std} \times (1 - B_{ws})$$

$Q_{std} = \underline{217,401}$	$B_{ws} = \underline{0.174}$
$Q_{std(dry)} = \underline{179,549}$	

Isokinetic Variation:

$$\%ISO = \frac{0.0945 \times (T_s + 460) \times V_m(std)}{V_s \times \theta \times A_n \times P_s \times (1 - B_{ws})}$$

$T_s = \underline{194.3}$	$V_m(std) = \underline{48.794}$	$V_s = \underline{46.600}$
$A_n = \underline{0.0004155}$	$\theta = \underline{60}$	$P_s = \underline{30.33}$
$B_{ws} = \underline{0.174}$		
$\%ISO = \underline{103.7}$		

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Run: 1
Date: 1/16/2024
Method: 26A
Source Condition: Mill On

Chloride (Cl2) Concentration:

$$\text{mg/m}^3 = \frac{\text{mg of Chloride (Cl}_2\text{)}}{\text{Vm(std) x 0.02832 m}^3/\text{ft}^3}$$

$$\text{mg} = \underline{0.15} \quad \text{Vm(std)} = \underline{48.794}$$

$$\text{mg/m}^3 = \underline{0.11}$$

Chloride (Cl2) Emission Rate:

$$\text{lb of Chloride (Cl}_2\text{)} = \frac{\mu\text{g of sample x } 10^6 \text{ grams}/\mu\text{g}}{453.6 \text{ grams/lb}}$$

$$\text{Emission Rate lb/hr} = \frac{\text{lb of Chloride (Cl}_2\text{)}}{\text{Vm(std)}} \times \text{dscfm} \times 60 \text{ min/hr}$$

$$\text{lb of Chloride (Cl}_2\text{)} = \underline{3.31\text{E-}10} \quad \text{dscfm} = \underline{179,549}$$

$$\text{Emission Rate lb/hr} = \underline{0.0730}$$

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Project #: M234904
Test Location: Main Kiln Stack
Date: 1/16/24

Sample Calculations

$$(12.38 \% - 0.06 \%) \times \frac{\text{O2 \% (dry)} \quad 12.04 \%}{12.13 \% - 0.06 \%} = 12.30 \%$$

$$C_{\text{gas}} = (C - C_0) \times \frac{C_{\text{ma}}}{C_{\text{m}} - C_0}$$

where:

C_{gas} = Effluent gas concentration, dry basis, ppm or %

C = Average gas concentration indicated by gas analyzer, dry basis, ppm or %

C_0 = Average of initial and final system calibration bias check responses for the zero gas, ppm or %

C_{m} = Average of initial 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 %

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/16/24

FTIR Sample Calculations

Direct Recovery % of Calibration Transfer Standard

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

$$Cma = \underline{101.4}$$

$$D_{cts} = \underline{101.4}$$

$$DR_{cts} = \underline{100.0\%}$$

Recovery % with Calibration Transfer Standard System Purge

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

$$Sys_{cts} = \underline{101.7}$$

$$D_{cts} = \underline{101.4}$$

$$R_{cts} = \underline{100\%}$$

Direct Recovery % of Analyte Spike Gas

SF6

$$DR_{sf6} = \frac{D_{sf6}}{Cma} \times 100$$

$$Cma = \underline{5.0}$$

$$D_{sf6} = \underline{4.9}$$

$$DR_{sf6} = \underline{97\%}$$

HCN

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

$$Cma = \underline{49.6}$$

$$D_{asg} = \underline{50.6}$$

$$DR_{asg} = \underline{102.2\%}$$

Dilution Factor for Analyte Spiking

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

$$Spk_{sf6} = \underline{0.370}$$

$$D_{sf6} = \underline{4.860}$$

$$DF = \underline{0.076}$$

Recovery % for Analyte Spike With HCN

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

$$Spk_x = \underline{4.0}$$

$$N_x = \underline{0.4}$$

$$DF = \underline{0.076}$$

$$D_{asg} = \underline{50.6}$$

$$R_x = \underline{95.7} \quad \%$$

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

MOSTARDI PLATT

Moisture Calculations

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

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

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

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

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, $0.048137 \text{ (in. Hg)(ft}^3\text{)/(g-mole)(}^\circ\text{R)} =$
 $[21.8348 \text{ (in. Hg)(ft}^3\text{)/(lb-mole)(}^\circ\text{R)}] / 453.592 \text{ g-mole/lb-mole}$

T_m = Absolute average dry gas meter temperature, $^\circ\text{R}$

T_{std} = Standard absolute temperature, 528 $^\circ\text{R}$

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

MOSTARDI PLATT

Volumetric Flow Nomenclature

- A = Cross-sectional area of stack or duct, ft²
- B_{ws} = Water vapor in gas stream, proportion by volume
- C_p = Pitot tube coefficient, dimensionless
- 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
- P_{bar} = Barometric pressure at testing site, in. Hg
- P_g = Static pressure of gas, in. Hg (in. H₂O/13.6)
- DH = Static pressure of gas, in. H₂O
- P_s = Absolute pressure of gas, in. Hg = P_{bar} + P_g
- P_{std} = Standard absolute pressure, 29.92 in. Hg
- A_{cfm} = Actual volumetric gas flow rate
- Sc_{fm} = Volumetric gas flow rate, corrected to standard conditions
- D_{scfm} = Standard volumetric flow rate, corrected to dry conditions
- R = Ideal gas constant, 21.85 in. Hg-ft³/°R-lb-mole
- T_s = Average stack gas temperature, °F
- T_m = Average dry gas meter temperature, °F
- T_{std} = Standard absolute temperature, 528°R
- v_s = Gas velocity, ft/sec
- V_{m(std)} = Volume of gas sampled, corrected to standard conditions, scf
- V_{w(std)} = Volume of water vapor in gas sample, corrected to standard conditions, scf
- V_{lc} = 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)

MOSTARDI PLATT

Volumetric Air Flow Calculations

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

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

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

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

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

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

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

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

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

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

MOSTARDI PLATT

Isokinetic Calculation Formulas

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MOSTARDI PLATT

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_{act} = 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
K₁ = 17.647 °R/in. Hg
K₂ = 0.04707 ft³/ml
K₄ = 0.09450/100 = 0.000945
K_p = Pitot tube constant, $85.49 \frac{ft}{sec} \left[\frac{(lb/lb-mole)(in. Hg)}{(^{\circ}R)(in. H_2O)} \right]^{1/2}$
%EA = Percent excess air
%CO₂ = Percent carbon dioxide by volume, dry basis
%O₂ = Percent oxygen by volume, dry basis
%CO = Percent carbon monoxide by volume, dry basis
%N₂ = Percent nitrogen by volume, dry basis
0.264 = Ratio of O₂ to N₂ in air, v/v
28 = Molecular weight of N₂ or CO
32 = Molecular weight of O₂
44 = Molecular weight of CO₂
13.6 = Specific gravity of mercury (Hg)

MOSTARDI PLATT

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

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

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

$$\text{lbs HF /dscf} \times \text{dscfm} \times 60 \text{ min/hr} = \text{lbs/hr HF}$$

MOSTARDI PLATT

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.

Appendix E- Laboratory Sample Analysis

Chain-of-Custody Form						
Project Number: M234904				Date Results Required:		
Client: AGC Leamington				TAT Required:		
Plant/Test Location: Main Kiln				Project Supervisor: RICHS		
Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
001	1/16/24	#1A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
002	1/16/24	#1A 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
003	1/16/24	#2A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
004	1/16/24	#2A 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
005	1/16/24	#3A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
006	1/16/24	#3A 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
007	1/16/24	#1B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
008	1/16/24	#1B 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
009	1/16/24	#2B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
010	1/16/24	#2B 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
011	1/16/24	#3B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
012	1/16/24	#3B 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
013	1/17/24	#1A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
014	1/17/24	#1A 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
015	1/17/24	#2A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
016	1/17/24	#2A 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
017	1/17/24	#3A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
018	1/17/24	#3A 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
019	1/17/24	#1B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
020	1/17/24	#1B 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
021	1/17/24	#2B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
022	1/17/24	#2B 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
023	1/17/24	#3B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
024	1/17/24	#3B 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	

025	1/16/24	A Train Field Blank 0.1N H2SO4	1		M26A (HF)	
026	1/16/24	A Train Field Blank 0.1N NaOH	1		M26A (Cl ₂)	
027	1/16/24	B Train Field Blank 0.1N H2SO4	1		M26A (HF)	
028	1/16/24	B Train Field Blank 0.1N NaOH	1		M26A (Cl ₂)	
029	1/16/24	0.1N H2SO4 Reagent Blank	1		M26A (HF)	
030	1/16/24	0.1N NaOH Reagent Blank	1		M26A (Cl ₂)	
031	1/16/24	DI Water Reagent Blank	1		M26A (HF and Cl ₂)	
Delivered to Lab by: Date/Time:		Received by: Date/Time:		Processed by: Date/Time:		

Laboratory Notes:

Main Kiln-Mill On

Client: Ash Grove	Analysis Date: 2/9/2024
Facility: Leamington	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill On	Analyst: JMG
Project Number: M234904	
Method: 26A	
Date Samples Received: 1/20/2024	

Train A

Sampling Date		1/16/2024	1/16/2024	1/16/2024	1/16/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	531	531		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/16/2024	1/16/2024	1/16/2024			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	Train Blank A		RDL	MDL
Sulfuric Acid Volume	ml	555	522	300			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		1/16/2024	1/16/2024	1/16/2024	1/16/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	558	558		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/16/2024	1/16/2024	1/16/2024			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	Train Blank B		RDL	MDL
Sulfuric Acid Volume	ml	518	502	300			
Hydrofluoric Acid	ug	<150	<150	316		150	15

Client:	Ash Grove	Analysis Date:	2/9/2024											
Facility:	Leamington	Analysis Location:	Elmhurst											
Test Location:	Main Kiln-Mill On	Analyst:	JMG											
Project Number:	M234904													
Method:	26A													
Date Samples Received:	1/20/2024													
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve										
1	0.2286	0.2286	0.97	0.2349										
2	0.4501	0.2251	1.92											
5	1.1625	0.2325	4.95	Response Factor Ave										
8	1.9177	0.2397	8.17	0.2346										
10	2.4728	0.2473	10.53											
Lot Number	Ricca 830603B													
	R ²	0.9990												
Sample Number	Sample Date	Sample ID	Sample Area	PPM F	PPM X Dilution Factor	Dilution Factor	Total ml	mg F in soln	mg HF in soln	mg HF in soln avg	ug HF in soln			
031	1/16/2024	DI Reagent Blank	0.0006	0.0026	0.0026	1	200	0.0005	0.0005					
031	1/16/2024	DI Reagent Blank	0.0006	0.0026	0.0026	1	200	0.0005	0.0005	0.0005	0.538161385			
029	1/16/2024	H2SO4 Reagent Blank	0.0010	0.0043	0.0043	1	200	0.0009	0.0009					
029	1/16/2024	H2SO4 Reagent Blank	0.0025	0.0106	0.0106	1	200	0.0021	0.0022	0.0016	1.569637372			
001	1/16/2024	Test 1A H2SO4 Imp	0.0412	0.1754	0.1754	1	531	0.0932	0.0981					
001	1/16/2024	Test 1A H2SO4 Imp	0.0327	0.1392	0.1392	1	531	0.0739	0.0779	0.0880	87.9914045			
001	1/16/2024	Test 1A H2SO4 Imp	0.0365	0.1554	0.1554	1	531	0.0825	0.0869					
001	1/16/2024	Test 1A H2SO4 Imp	0.0364	0.1550	0.1550	1	531	0.0823	0.0867	0.0868	86.80072244			
003	1/16/2024	Test 2A H2SO4 Imp	0.0115	0.0490	0.0490	1	555	0.0272	0.0286					
003	1/16/2024	Test 2A H2SO4 Imp	0.0131	0.0558	0.0558	1	555	0.0310	0.0326	0.0306	30.61465577			
005	1/16/2024	Test 3A H2SO4 Imp	0.0229	0.0975	0.0975	1	522	0.0509	0.0536					
005	1/16/2024	Test 3A H2SO4 Imp	0.0231	0.0984	0.0984	1	522	0.0513	0.0541	0.0538	53.84304654			
025	1/16/2024	Train Blank A	0.0165	0.0703	0.0703	1	300	0.0211	0.0217					
025	1/16/2024	Train Blank A	0.0195	0.0830	0.0830	1	300	0.0249	0.0256	0.0236	23.64107026			
					Expected Value	% Difference								
		Run 1 H2SO4 Spike W/ 2ppm	0.2318	0.9870	1.0369									
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2384	1.0151	1.0369	3.46%								
CCV ppm F	Area	PPM F												
1 ppm ICV	0.2346	0.9989												
5 ppm CCV	1.1374	4.8429												
5 ppm CCV	1.1411	4.8587												
5 ppm CCV	1.1337	4.8271												
Standard ppm F	Area	Difference												
1	0.2157	2.99%												
2	0.4482	0.21%												
5	1.1510	0.50%												
8	1.8709	1.25%												
10	2.4323	0.83%												

Main Kiln-Mill On

Client: Ash Grove	Analysis Date: 2/9/2024
Facility: Leamington	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill On	Analyst: JMG
Project Number: M234904	
Method: 26A	
Date Samples Received: 1/20/2024	

Train A

Sampling Date		1/16/2024	1/16/2024	1/16/2024	1/16/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	314	314		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/16/2024	1/16/2024	1/16/2024		
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train A Blank	RDL	MDL
Sodium Hydroxide Volume	ml	298	353	268		
Chlorine	ug	<150	<150	<150	150	15

Train B

Sampling Date		1/16/2024	1/16/2024	1/16/2024	1/16/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	309	309		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/16/2024	1/16/2024	1/16/2024		
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train B Blank	RDL	MDL
Sodium Hydroxide Volume	ml	349	342	300		
Chlorine	ug	<150	<150	<150	150	15

Client:	Ash Grove	Analysis Date:	2/9/2024										
Facility:	Leamington	Analysis Location:	Elmhurst Lab										
Test Location:	Main Kiln-Mill On	Analyst:	JMG										
Project Number:	M234904												
Method:	26A												
Date Samples Received:	1/20/2024												
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve									
1	0.1245	0.1245	0.97	0.1280									
2	0.2437	0.1219	1.90										
5	0.6437	0.1287	5.03	Response Factor Ave									
8	1.0478	0.1310	8.18	0.1280									
10	1.3382	0.1338	10.45										
Lot Number	Ricca 8209004												
	R²	0.9996											
Sample Number	Sample Date	Sample ID	Sample Area	PPM Cl	PPM X Dilution Factor	Dilution Factor	Total ml	mg Cl in soln	mg Cl2 in soln avg	ug Cl2 in soln			
031	1/16/2024	DI Reagent Blank	0.0054	0.0422	0.0422	1	200	0.0084					
031	1/16/2024	DI Reagent Blank	0.0018	0.0141	0.0141	1	200	0.0028	0.0056	5.623684928			
030	1/16/2024	NaOH Reagent Blank	0.0012	0.0094	0.0094	1	200	0.0019					
030	1/16/2024	NaOH Reagent Blank	0.0010	0.0078	0.0078	1	200	0.0016	0.0017	1.718348173			
008	1/16/2024	Test 1B NaOH Imp	0.0208	0.1625	0.1625	1	309	0.0502					
008	1/16/2024	Test 1B NaOH Imp	0.0163	0.1273	0.1273	1	309	0.0393	0.0448	44.77039003			
008	1/16/2024	Test 1B NaOH Imp	0.0177	0.1382	0.1382	1	309	0.0427					
008	1/16/2024	Test 1B NaOH Imp	0.0151	0.1179	0.1179	1	309	0.0364	0.0396	39.58136909			
010	1/16/2024	Test 2B NaOH Imp	0.0342	0.2671	0.2671	1	349	0.0932					
010	1/16/2024	Test 2B NaOH Imp	0.0333	0.2604	0.2604	1	349	0.0909	0.0921	92.05448912			
012	1/16/2024	Test 3B NaOH Imp	0.0116	0.0906	0.0906	1	342	0.0310					
012	1/16/2024	Test 3B NaOH Imp	0.0104	0.0812	0.0812	1	342	0.0278	0.0294	29.38375375			
028	1/16/2024	Train B Train Blank	0.0009	0.0070	0.0070	1	300	0.0021					
028	1/16/2024	Train B Train Blank	0.0015	0.0117	0.0117	1	300	0.0035	0.0028	2.811842464			
CCV ppm Cl	Area	PPM Cl											
5 ppm ICV	0.6438	5.0285											
5 ppm CCV	0.644	5.0301											
5 ppm CCV	0.6512	5.0863											

Main Kiln-Mill Off

Client: Ash Grove	Analysis Date: 2/9/2024
Facility: Leamington	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill Off	Analyst: JMG
Project Number: M234904	
Method: 26A	
Date Samples Received: 1/20/2024	

Train A

Sampling Date		1/16/2024	1/16/2024	1/17/2024	1/17/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	438	438		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/17/2024	1/17/2024				
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3			RDL	MDL
Sulfuric Acid Volume	ml	470	468				
Hydrofluoric Acid	ug	<150	<150			150	15

Train B

Sampling Date		1/16/2024	1/16/2024	1/16/2024	1/17/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	489	489		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/17/2024	1/17/2024				
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3			RDL	MDL
Sulfuric Acid Volume	ml	440	445				
Hydrofluoric Acid	ug	<150	<150			150	15

Client: Ash Grove	Analysis Date: 2/9/2024																				
Facility: Leamington	Analysis Location: Elmhurst																				
Test Location: Main Kiln-Mill Off	Analyst: JMG																				
Project Number: M234904																					
Method: 26A																					
Date Samples Received: 1/20/2024																					
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve																	
1	0.2286	0.2286	0.97	0.2349																	
2	0.4501	0.2251	1.92																		
5	1.1625	0.2325	4.95	Response Factor Ave																	
8	1.9177	0.2397	8.17	0.2346																	
10	2.4728	0.2473	10.53																		
Lot Number	Ricca 830603B																				
	R ²	0.9990																			
Sample Number	Sample Date	Sample ID	Sample Area	PPM F	PPM X Dilution Factor	Dilution Factor	Total ml	mg F in soln	mg HF in soln	mg HF in soln avg	ug HF in soln										
031	1/16/2024	DI Reagent Blank	0.0006	0.0026	0.0026	1	200	0.0005	0.0005												
031	1/16/2024	DI Reagent Blank	0.0006	0.0026	0.0026	1	200	0.0005	0.0005	0.0005	0.538161385										
029	1/16/2024	H2SO4 Reagent Blank	0.0010	0.0043	0.0043	1	200	0.0009	0.0009												
029	1/16/2024	H2SO4 Reagent Blank	0.0025	0.0106	0.0106	1	200	0.0021	0.0022	0.0016	1.569637372										
013	1/17/2024	Test 1A H2SO4 Imp	0.0221	0.0941	0.0941	1	438	0.0412	0.0434												
013	1/17/2024	Test 1A H2SO4 Imp	0.0216	0.0920	0.0920	1	438	0.0403	0.0424	0.0429	42.91971583										
013	1/17/2024	Test 1A H2SO4 Imp	0.0182	0.0775	0.0775	1	438	0.0339	0.0358												
013	1/17/2024	Test 1A H2SO4 Imp	0.0184	0.0783	0.0783	1	438	0.0343	0.0361	0.0359	35.94648969										
015	1/17/2024	Test 2A H2SO4 Imp	0.0229	0.0975	0.0975	1	470	0.0458	0.0483												
015	1/17/2024	Test 2A H2SO4 Imp	0.0222	0.0945	0.0945	1	470	0.0444	0.0468	0.0475	47.53086196										
017	1/17/2024	Test 3A H2SO4 Imp	0.0160	0.0681	0.0681	1	468	0.0319	0.0336												
017	1/17/2024	Test 3A H2SO4 Imp	0.0172	0.0732	0.0732	1	468	0.0343	0.0361	0.0348	34.84056805										
					Expected Value	% Difference															
		Run 1 H2SO4 Spike W/ 2ppm	0.2213	0.9423	1.0048																
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2304	0.9810	1.0048	4.29%															
CCV ppm F	Area	PPM F																			
1 ppm ICV	0.2346	0.9989																			
5 ppm CCV	1.1374	4.8429																			
5 ppm CCV	1.1411	4.8587																			
5 ppm CCV	1.1337	4.8271																			
Standard ppm F	Area	Difference																			
1	0.2157	2.99%																			
2	0.4482	0.21%																			
5	1.1510	0.50%																			
8	1.8709	1.25%																			
10	2.4323	0.83%																			

Client:	Ash Grove	Analysis Date:	2/9/2024										
Facility:	Leamington	Analysis Location:	Elmhurst										
Test Location:	Main Kiln-Mill Off	Analyst:	JMG										
Project Number:	M234904												
Method:	26A												
Date Samples Received:	1/20/2024												
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve									
1	0.2286	0.2286	0.97	0.2349									
2	0.4501	0.2251	1.92										
5	1.1625	0.2325	4.95	Response Factor Ave									
8	1.9177	0.2397	8.17	0.2346									
10	2.4728	0.2473	10.53										
Lot Number	Ricca 8209004												
	R ²	0.9990											
Sample Number	Sample Date	Sample ID	Sample Area	PPM F	PPM X Dilution Factor	Dilution Factor	Total ml	mg F in soln	mg HF in soln	mg HF in soln avg	ug HF in soln		
031	1/16/2024	DI Reagent Blank	0.0006	0.0026	0.0026	1	200	0.0005	0.0005				
031	1/16/2024	DI Reagent Blank	0.0006	0.0026	0.0026	1	200	0.0005	0.0005	0.0005	0.538161385		
029	1/16/2024	H2SO4 Reagent Blank	0.0010	0.0043	0.0043	1	200	0.0009	0.0009				
029	1/16/2024	H2SO4 Reagent Blank	0.0025	0.0106	0.0106	1	200	0.0021	0.0022	0.0016	1.569637372		
019	1/17/2024	Test 1B H2SO4 Imp	0.0202	0.0860	0.0860	1	489	0.0421	0.0443				
019	1/17/2024	Test 1B H2SO4 Imp	0.0201	0.0856	0.0856	1	489	0.0419	0.0441	0.0442	44.189104		
019	1/17/2024	Test 1B H2SO4 Imp	0.0217	0.0924	0.0924	1	489	0.0452	0.0476				
019	1/17/2024	Test 1B H2SO4 Imp	0.0205	0.0873	0.0873	1	489	0.0427	0.0450	0.0463	46.27246126		
021	1/17/2024	Test 2B H2SO4 Imp	0.0304	0.1294	0.1294	1	440	0.0670	0.0600				
021	1/17/2024	Test 2B H2SO4 Imp	0.0255	0.1086	0.1086	1	440	0.0478	0.0503	0.0552	55.15257258		
023	1/17/2024	Test 3B H2SO4 Imp	0.0339	0.1443	0.1443	1	445	0.0642	0.0677				
023	1/17/2024	Test 3B H2SO4 Imp	0.0336	0.1431	0.1431	1	445	0.0637	0.0671	0.0674	67.3542608		
CCV ppm F	Area	PPM F											
1 ppm ICV	0.2346	0.9889											
5 ppm CCV	1.1374	4.8429											
5 ppm CCV	1.1411	4.8587											
5 ppm CCV	1.1337	4.8271											
Standard ppm F	Area	Difference											
1	0.2157	2.99%											
2	0.4482	0.21%											
5	1.1510	0.50%											
8	1.8709	1.25%											
10	2.4323	0.83%											

Main Kiln-Mill Off

Client: Ash Grove	Analysis Date: 2/9/2024
Facility: Leamington	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill Off	Analyst: JMG
Project Number: M234904	
Method: 26A	
Date Samples Received: 1/20/2024	

Train A

Sampling Date		1/16/2024	1/16/2024	1/17/2024	1/17/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	314	314		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/17/2024	1/17/2024				
	UNITS	M26A- NaOH R2	M26A- NaOH R3			RDL	MDL
Sodium Hydroxide Volume	ml	298	353				
Chlorine	ug	<150	<150			150	15

Train B

Sampling Date		1/17/2024	1/16/2024	1/17/2024	1/17/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	309	309		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/17/2024	1/17/2024				
	UNITS	M26A- NaOH R2	M26A- NaOH R3			RDL	MDL
Sodium Hydroxide Volume	ml	349	342				
Chlorine	ug	<150	<150			150	15

Client:	Ash Grove	Analysis Date:	2/9/2024																	
Facility:	Leamington	Analysis Location:	Elmhurst Lab																	
Test Location:	Main Kiln-Mill Off	Analyst:	JMG																	
Project Number:	M234904																			
Method:	26A																			
Date Samples Received:	1/20/2024																			
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve																
1	0.1245	0.1245	0.97	0.1280																
2	0.2437	0.1219	1.90																	
5	0.6437	0.1287	5.03	Response Factor Ave																
8	1.0478	0.1310	8.18	0.1280																
10	1.3382	0.1338	10.45																	
Lot Number	Ricca 830603B																			
	R²	0.9996																		
Sample Number	Sample Date	Sample ID	Sample Area	PPM Cl	PPM X Dilution Factor	Dilution Factor	Total ml	mg Cl in soln	ug Cl2 in soln	ug Cl2 in soln										
031	1/16/2024	DI Reagent Blank	0.0054	0.0422	0.0422	1	200	0.0084												
031	1/16/2024	DI Reagent Blank	0.0018	0.0141	0.0141	1	200	0.0028		0.0056										5.623684928
030	1/16/2024	NaOH Reagent Blank	0.0012	0.0094	0.0094	1	200	0.0019												
030	1/16/2024	NaOH Reagent Blank	0.0010	0.0078	0.0078	1	200	0.0016		0.0017										1.718348173
014	1/17/2024	Test 1A NaOH Imp	0.0121	0.0945	0.0945	1	314	0.0297												
014	1/17/2024	Test 1A NaOH Imp	0.0096	0.0750	0.0750	1	314	0.0235		0.0266										26.61018359
014	1/17/2024	Test 1A NaOH Imp	0.0092	0.0719	0.0719	1	314	0.0226												
014	1/17/2024	Test 1A NaOH Imp	0.0090	0.0703	0.0703	1	314	0.0221		0.0223										22.31821849
016	1/17/2024	Test 2A NaOH Imp	0.0146	0.1140	0.1140	1	298	0.0340												
016	1/17/2024	Test 2A NaOH Imp	0.0135	0.1054	0.1054	1	298	0.0314		0.0327										32.70250893
018	1/17/2024	Test 3A NaOH Imp	0.0175	0.1367	0.1367	1	353	0.0483												
018	1/17/2024	Test 3A NaOH Imp	0.0166	0.1297	0.1297	1	353	0.0458		0.0470										47.00971013
					Expected Value	% Difference														
		Run 1 H2SO4 Spike W/ 2ppm	0.1371	1.0708	0.9941															
		Run 1 H2SO4 Spike W/ 2ppm	0.1367	1.0677	0.9941	7.56%														
CCV ppm Cl	Area	PPM Cl																		
5 ppm ICV	0.6438	5.0285																		
5 ppm CCV	0.644	5.0301																		
5 ppm CCV	0.6512	5.0863																		
Standard ppm Cl	Area	Difference																		
1	0.1359	4.19%																		
2	0.2502	1.30%																		
5	0.6435	0.02%																		
8	1.0354	0.60%																		
10	1.3210	0.65%																		

Appendix F - Reference Method Test Data

Client:	Ash Grove Cement Company
Facility:	Leamington Cement Plant
Test Location:	Main Kiln Stack
Project #:	M234904
Test Method:	26A
Test Engineer:	DV
Test Technician:	AMS

	<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>
Temp ID:	CM23	CM23	CM23
Meter ID:	CM23	CM23	CM23
Pitot ID:	S8-031A	S8-031A	S8-031A
Nozzle Diameter (Inches):	0.276	0.276	0.276
Meter Calibration Date:	10/26/2023	10/26/2023	10/26/2023
Meter Calibration Factor (Y):	0.999	0.999	0.999
Meter Orifice Setting (Delta H):	1.790	1.790	1.790
Nozzle Kit ID Number and Material:	321 Quartz	321 Quartz	321 Quartz
Pitot Tube Coefficient:		0.820	
Probe Length (Feet):		6.0	
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	
Duct Area (Square Feet):		95.033	
Upstream Diameters:		4.1	
Downstream Diameters:		5.5	
Number of Ports Sampled:		4	
Number of Points per Port:		6	
Minutes per Point:		2.5	
Minutes per Reading:		2.5	
Total Number of Traverse Points:		24	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill On	
Diluent Model/Serial Number:		CAI 700	
Moisture Balance ID:		LV4	
# of Runs		3	

Run 1A - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On

Date: 1/16/24
 Start Time: 9:30
 End Time: 10:45

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.07	in. H ₂ O	Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	67.8	°F	Flue Pressure (Ps):	30.33	in. Hg. abs.
Sqrt ΔP:	0.763	in. H ₂ O	Carbon Dioxide:	13.40	%
Stack Temperature, Ts:	194.3	°F	Oxygen:	12.30	%
Meter Volume, Vm:	47.863	ft ³	Nitrogen:	74.30	%
Meter Volume, Vmstd:	48.794	dscf	Gas Weight dry, Md:	30.636	lb/lb mole
Meter Volume, Vwstd:	10.287	wscf	Gas Weight wet, Ms:	28.436	lb/lb mole
Isokinetic Variance:	103.7	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	46.600	fps
Nozzle Diameter:	0.276	in inches	Volumetric Flow:	265,714	acfm
Barometric Pressure:	30.37	in Hg	Volumetric Flow:	179,549	dscfm
			Volumetric Flow:	217,401	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3677.0	ml	Silica Initial Wt.	873.1	grams
Final Impinger Content:	3886.8	ml	Silica Final Wt.	881.7	grams
Impinger Difference:	209.8	ml	Silica Difference:	8.6	grams
Total Water Gain:	218.4		Moisture, Bws:	0.174	Supersaturation Value, Bws: 0.686

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	9:30:00	0.65	2.30	1.635	193	68	63	261	260	36
1-2	9:32:30	0.60	2.12	3.720	193	68	63	260	260	34
1-3	9:35:00	0.60	2.12	5.755	193	68	63	260	260	34
1-4	9:37:30	0.58	2.05	7.770	193	68	63	260	260	34
1-5	9:40:00	0.57	2.01	9.760	193	68	63	260	260	34
1-6	9:42:30	0.55	1.94	11.715	194	69	63	260	260	35
	9:45:00			13.645						
2-1	9:50:00	0.60	2.12	13.645	195	69	64	260	259	35
2-2	9:52:30	0.60	2.12	15.655	195	69	64	260	259	35
2-3	9:55:00	0.56	1.98	17.695	195	69	64	260	259	35
2-4	9:57:30	0.55	1.94	19.630	195	69	64	260	259	35
2-5	10:00:00	0.58	2.05	21.550	195	69	64	260	259	35
2-6	10:02:30	0.54	1.91	23.535	195	69	64	260	259	35
	10:05:00			25.473						
3-1	10:10:00	0.65	2.30	25.473	194	72	64	260	260	36
3-2	10:12:30	0.59	2.09	27.585	194	72	64	260	260	36
3-3	10:15:00	0.59	2.09	29.600	194	72	64	260	260	36
3-4	10:17:30	0.60	2.13	31.605	194	72	64	260	260	36
3-5	10:20:00	0.56	1.99	33.605	194	72	65	260	260	36
3-6	10:22:30	0.55	1.96	35.565	193	72	65	260	260	36
	10:25:00			37.515						
4-1	10:30:00	0.60	2.14	37.515	195	75	67	260	260	36
4-2	10:32:30	0.59	2.10	39.540	195	75	67	260	260	36
4-3	10:35:00	0.59	2.10	41.570	195	75	67	260	260	36
4-4	10:37:30	0.57	2.03	43.575	195	75	67	260	260	36
4-5	10:40:00	0.57	2.03	45.555	195	75	67	260	260	36
4-6	10:42:30	0.55	1.96	47.555	195	75	67	260	260	36
	10:45:00			49.498						

Total	1:00:00			47.863		71.0	64.6			
Average			2.07		194.3	67.8				
Min			1.91		193.0	63.0				
Max			2.30		195.0	75.0				

Impinger Weight Sheet - Run 1A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/16/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/16/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	903.2	755.2	148.0
0.1N H2SO4	799.0	764.6	34.4
Empty	670.9	654.9	16.0
0.1N NaOH	767.0	757.2	9.8
0.1N NaOH	746.7	745.1	1.6
Silica Gel	881.7	873.1	8.6

<u>3,886.8</u> Liquid Final	<u>3,677.0</u> Liquid Initial	<u>209.8</u> Liquid Gain
<u>881.7</u> Silica Final	<u>873.1</u> Silica Initial	<u>8.6</u> Silica Gain

Run 2A - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On

Date: 1/16/24
 Start Time: 11:08
 End Time: 12:23

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.58	In. H ₂ O	Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	76.1	°F	Flue Pressure (Ps):	30.33	in. Hg. abs.
Sqrt ΔP:	0.747	In. H ₂ O	Carbon Dioxide:	14.00	%
Stack Temperature, Ts:	193.8	°F	Oxygen:	12.30	%
Meter Volume, Vm:	47.631	ft ³	Nitrogen:	73.7	%
Meter Volume, Vmstd:	47.868	dscf	Gas Weight dry, Md:	30.732	lb/lb mole
Meter Volume, Vwstd:	9.806	wscf	Gas Weight wet, Ms:	28.567	lb/lb mole
Isokinetic Variance:	103.6	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	45.479	fps
Nozzle Diameter:	0.276	in inches	Volumetric Flow:	259,322	acfm
Barometric Pressure:	30.37	in Hg	Volumetric Flow:	176,230	dscfm
			Volumetric Flow:	212,333	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3582.8	ml	Silica Initial Wt.	901.3	grams
Final Impinger Content:	3779.6	ml	Silica Final Wt.	912.7	grams
Impinger Difference:	196.8	ml	Silica Difference:	11.4	grams
Total Water Gain:	208.2		Moisture, Bws:	0.170	Supersaturation Value, Bws: 0.679

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	11:08:00	0.63	2.91	74.891	193	72	68	260	262	38
1-2	11:10:30	0.58	2.68	76.970	193	72	68	260	262	38
1-3	11:13:00	0.58	2.68	78.995	193	72	69	260	262	38
1-4	11:15:30	0.55	2.54	80.995	193	74	69	259	261	38
1-5	11:18:00	0.53	2.45	82.915	193	74	69	259	261	38
1-6	11:20:30	0.53	2.45	84.860	193	74	69	259	261	38
	11:23:00			86.782						
2-1	11:28:00	0.61	2.82	86.782	195	80	70	256	258	39
2-2	11:30:30	0.58	2.68	88.840	195	80	70	256	258	39
2-3	11:33:00	0.56	2.59	90.875	195	80	70	256	258	39
2-4	11:35:30	0.55	2.54	92.835	195	80	70	262	257	39
2-5	11:38:00	0.53	2.45	94.795	195	80	70	262	257	39
2-6	11:40:30	0.53	2.45	96.755	195	80	70	262	257	39
	11:43:00			98.676						
3-1	11:48:00	0.58	2.68	98.676	193	83	73	260	261	39
3-2	11:50:30	0.58	2.68	100.695	193	83	73	260	261	39
3-3	11:53:00	0.55	2.54	102.745	193	83	73	260	260	39
3-4	11:55:30	0.54	2.49	104.725	193	83	73	260	260	39
3-5	11:58:00	0.51	2.36	106.660	193	83	73	260	260	39
3-6	12:00:30	0.51	2.36	108.575	193	83	73	260	260	39
	12:03:00			110.481						
4-1	12:08:00	0.61	2.82	110.481	194	85	76	260	260	40
4-2	12:10:30	0.59	2.73	112.560	194	85	76	260	260	40
4-3	12:13:00	0.56	2.59	114.635	194	85	76	260	260	40
4-4	12:15:30	0.56	2.59	116.630	194	85	76	260	260	40
4-5	12:18:00	0.53	2.45	118.620	194	85	76	260	260	40
4-6	12:20:30	0.52	2.40	120.575	194	85	76	260	259	40
	12:23:00			122.522						

Total	1:00:00			47.631		80.3	71.9			
Average			2.58		193.8	76.1				
Min			2.36		193.0	68.0				
Max			2.91		195.0	85.0				

Impinger Weight Sheet - Run 2A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/16/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/16/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	854.9	730.0	124.9
0.1N H2SO4	793.1	734.1	59.0
Empty	663.5	656.3	7.2
0.1N NaOH	747.3	742.4	4.9
0.1N NaOH	720.8	720.0	0.8
Silica Gel	912.7	901.3	11.4

3,779.6	3,582.8	196.8
Liquid Final	Liquid Initial	Liquid Gain
912.7	901.3	11.4
Silica Final	Silica Initial	Silica Gain

Run 3A - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On

Date: 1/16/24
 Start Time: 12:40
 End Time: 13:55

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.55	In. H ₂ O	Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	83.9	°F	Flue Pressure (Ps):	30.33	in. Hg. abs.
Sqrt ΔP:	0.743	In. H ₂ O	Carbon Dioxide:	14.00	%
Stack Temperature, Ts:	193.5	°F	Oxygen:	12.30	%
Meter Volume, Vm:	48.055	ft ³	Nitrogen:	73.7	%
Meter Volume, Vmstd:	47.599	dscf	Gas Weight dry, Md:	30.732	lb/lb mole
Meter Volume, Vwstd:	9.533	wscf	Gas Weight wet, Ms:	28.608	lb/lb mole
Isokinetic Variance:	103.2	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	45.195	fps
Nozzle Diameter:	0.276	in inches	Volumetric Flow:	257,700	acfm
Barometric Pressure:	30.37	in Hg	Volumetric Flow:	175,863	dscfm
			Volumetric Flow:	211,085	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3725.6	ml	Silica Initial Wt.	881.7	grams
Final Impinger Content:	3921.2	ml	Silica Final Wt.	888.5	grams
Impinger Difference:	195.6	ml	Silica Difference:	6.8	grams
Total Water Gain:	202.4		Moisture, Bws:	0.167	Supersaturation Value, Bws: 0.675

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:40:00	0.60	2.77	41.409	193	84	81	261	261	36
1-2	12:42:30	0.57	2.63	43.500	193	84	81	261	261	36
1-3	12:45:00	0.57	2.63	45.535	193	84	81	261	261	36
1-4	12:47:30	0.54	2.49	47.560	193	84	81	261	261	36
1-5	12:50:00	0.53	2.45	49.545	193	84	81	261	261	36
1-6	12:52:30	0.52	2.40	51.465	193	84	81	261	261	36
	12:55:00			53.424						
2-1	13:00:00	0.61	2.82	53.424	194	85	80	260	259	37
2-2	13:02:30	0.60	2.77	55.535	194	85	80	260	259	37
2-3	13:05:00	0.53	2.45	57.585	194	85	80	260	259	37
2-4	13:07:30	0.53	2.45	59.545	194	85	80	260	259	37
2-5	13:10:00	0.52	2.40	61.500	194	85	80	260	259	37
2-6	13:12:30	0.51	2.36	63.465	194	85	80	260	259	37
	13:15:00			65.377						
3-1	13:20:00	0.59	2.73	65.377	193	89	81	261	260	44
3-2	13:22:30	0.59	2.73	67.435	193	89	81	261	260	44
3-3	13:25:00	0.54	2.49	69.545	193	89	81	261	260	44
3-4	13:27:30	0.53	2.45	71.500	193	89	81	261	260	44
3-5	13:30:00	0.51	2.36	73.470	193	89	81	260	260	44
3-6	13:32:30	0.50	2.31	75.410	193	89	81	260	260	44
	13:35:00			77.317						
4-1	13:40:00	0.62	2.86	77.317	194	89	82	260	259	43
4-2	13:42:30	0.61	2.82	79.435	194	89	82	260	259	43
4-3	13:45:00	0.55	2.54	81.555	194	89	82	260	259	43
4-4	13:47:30	0.53	2.45	83.555	194	89	82	260	259	43
4-5	13:50:00	0.54	2.49	85.505	194	89	82	260	259	43
4-6	13:52:30	0.52	2.40	87.505	194	89	82	260	259	43
	13:55:00			89.464						

Total	1:00:00			48.055		86.8	81.0			
Average			2.55		193.5	83.9				
Min			2.31		193.0	80.0				
Max			2.86		194.0	89.0				

Impinger Weight Sheet - Run 3A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/16/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/16/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	860.5	766.2	94.3
0.1N H2SO4	854.2	786.5	67.7
Empty	675.7	656.2	19.5
0.1N NaOH	780.4	770.8	9.6
0.1N NaOH	750.4	745.9	4.5
Silica Gel	888.5	881.7	6.8

<u>3,921.2</u>	<u>3,725.6</u>	<u>195.6</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>888.5</u>	<u>881.7</u>	<u>6.8</u>
Silica Final	Silica Initial	Silica Gain

Client:	Ash Grove Cement Company
Facility:	Leamington Cement Plant
Test Location:	Main Kiln Stack
Project #:	M234904
Test Method:	26A
Test Engineer:	RMF
Test Technician:	AMS

	<u>Run 1B</u>	<u>Run 2B</u>	<u>Run 3B</u>
Temp ID:	CM54	CM54	CM54
Meter ID:	CM54	CM54	CM54
Pitot ID:	S8-032A	S8-032A	S8-032A
Nozzle Diameter (Inches):	0.251	0.251	0.251
Meter Calibration Date:	12/1/2023	12/1/2023	12/1/2023
Meter Calibration Factor (Y):	0.988	0.988	0.988
Meter Orifice Setting (Delta H):	1.694	1.694	1.694
Nozzle Kit ID Number and Material:	954 Glass	954 Glass	954 Glass
Pitot Tube Coefficient:		0.822	
Probe Length (Feet):		6.0	
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	
Duct Area (Square Feet):		95.033	
Upstream Diameters:		4.1	
Downstream Diameters:		5.5	
Number of Ports Sampled:		4	
Number of Points per Port:		6	
Minutes per Point:		2.5	
Minutes per Reading:		2.5	
Total Number of Traverse Points:		24	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill On	
Diluent Model/Serial Number:		CAI 700	
Moisture Balance ID:		LV4	
# of Runs		3	

Run 1B - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On

Date: 1/16/24
 Start Time: 9:30
 End Time: 10:45

DRY GAS METER CONDITIONS

ΔH:	1.27	in. H ₂ O
Meter Temperature, Tm:	59.3	°F
Sqrt ΔP:	0.770	in. H ₂ O
Stack Temperature, Ts:	194.3	°F
Meter Volume, Vm:	38.654	ft ³
Meter Volume, Vmstd:	39.536	dscf
Meter Volume, Vwstd:	8.605	wscf
Isokinetic Variance:	100.9	%I
Test Length:	60.00	in mins.
Nozzle Diameter:	0.251	in inches
Barometric Pressure:	30.37	in Hg

STACK CONDITIONS

Static Pressure	-0.50	in. H ₂ O
Flue Pressure (Ps):	30.33	in. Hg. abs.
Carbon Dioxide:	13.40	%
Oxygen:	12.30	%
Nitrogen:	74.30	%
Gas Weight dry, Md:	30.636	lb/lb mole
Gas Weight wet, Ms:	28.377	lb/lb mole
Excess Air:	---	%
Gas Velocity, Vs:	47.187	fps
Volumetric Flow:	269,058	acfm
Volumetric Flow:	180,764	dscfm
Volumetric Flow:	220,108	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3647.9	ml	Silica Initial Wt.	838.0	grams
Final Impinger Content:	3822.5	ml	Silica Final Wt.	846.1	grams
Impinger Difference:	174.6	ml	Silica Difference:	8.1	grams

Total Water Gain: 182.7 Moisture, Bws: 0.179 Supersaturation Value, Bws: 0.687

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	9:30:00	0.59	1.26	688.384	193	58	58	254	255	36
1-2	9:32:30	0.59	1.26	690.000	194	58	58	254	255	36
1-3	9:35:00	0.56	1.20	691.575	194	59	59	254	256	35
1-4	9:37:30	0.56	1.20	693.145	193	59	59	254	256	35
1-5	9:40:00	0.58	1.24	694.715	193	59	59	254	255	35
1-6	9:42:30	0.56	1.20	696.310	193	59	59	253	255	35
	9:45:00			697.874						
2-1	9:50:00	0.62	1.33	697.874	193	59	59	254	257	34
2-2	9:52:30	0.59	1.26	699.520	194	59	59	254	253	37
2-3	9:55:00	0.56	1.20	701.145	194	59	59	254	254	37
2-4	9:57:30	0.56	1.20	702.690	194	59	59	254	255	38
2-5	10:00:00	0.58	1.24	704.250	194	59	59	254	254	36
2-6	10:02:30	0.57	1.22	705.845	195	59	59	254	254	36
	10:05:00			707.422						
3-1	10:10:00	0.61	1.30	707.422	195	59	59	254	256	36
3-2	10:12:30	0.61	1.30	709.050	195	59	59	254	254	37
3-3	10:15:00	0.60	1.28	710.700	195	59	59	254	253	35
3-4	10:17:30	0.62	1.33	712.320	195	60	60	254	251	35
3-5	10:20:00	0.60	1.28	713.945	195	60	60	254	252	35
3-6	10:22:30	0.62	1.33	715.575	195	60	60	254	254	36
	10:25:00			717.230						
4-1	10:30:00	0.60	1.28	717.230	195	60	60	254	255	36
4-2	10:32:30	0.61	1.30	718.865	195	60	60	254	256	36
4-3	10:35:00	0.61	1.30	720.505	195	60	60	254	256	36
4-4	10:37:30	0.62	1.33	722.120	195	60	60	254	257	36
4-5	10:40:00	0.61	1.30	723.775	195	60	60	254	257	36
4-6	10:42:30	0.61	1.30	725.410	195	60	60	254	257	36
	10:45:00			727.038						

Total	1:00:00			38.654		59.3	59.3			
Average			1.27		194.3	59.3				
Min			1.20		193.0	58.0				
Max			1.33		195.0	60.0				

Impinger Weight Sheet - Run 1B

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/16/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/16/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	855.4	748.1	107.3
0.1N H2SO4	803.1	747.4	55.7
Empty	653.0	646.3	6.7
0.1N NaOH	765.5	760.6	4.9
0.1N NaOH	745.5	745.5	0.0
Silica Gel	846.1	838.0	8.1

3,822.5	3,647.9	174.6
Liquid Final	Liquid Initial	Liquid Gain
846.1	838.0	8.1
Silica Final	Silica Initial	Silica Gain

Run 2B - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On

Date: 1/16/24
 Start Time: 11:08
 End Time: 12:23

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.35	In. H ₂ O	Static Pressure	0.05	in. H ₂ O
Meter Temperature, Tm:	63.1	°F	Flue Pressure (Ps):	30.37	in. Hg. abs.
Sqrt ΔP:	0.753	In. H ₂ O	Carbon Dioxide:	14.00	%
Stack Temperature, Ts:	194.4	°F	Oxygen:	12.30	%
Meter Volume, Vm:	38.194	ft ³	Nitrogen:	73.7	%
Meter Volume, Vmstd:	38.880	dscf	Gas Weight dry, Md:	30.732	lb/lb mole
Meter Volume, Vwstd:	8.699	wscf	Gas Weight wet, Ms:	28.404	lb/lb mole
Isokinetic Variance:	101.9	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	46.113	fps
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	262,938	acfm
Barometric Pressure:	30.37	in Hg	Volumetric Flow:	175,996	dscfm
			Volumetric Flow:	215,375	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3677.0	ml	Silica Initial Wt.	863.3	grams
Final Impinger Content:	3853.1	ml	Silica Final Wt.	871.9	grams
Impinger Difference:	176.1	ml	Silica Difference:	8.6	grams
Total Water Gain:	184.7		Moisture, Bws:	0.183	
			Supersaturation Value, Bws:	0.687	

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	11:08:00	0.60	2.50	754.346	197	60	60	254	251	42
1-2	11:10:30	0.60	2.40	755.965	197	60	60	254	251	39
1-3	11:13:00	0.58	2.30	757.595	197	60	60	254	253	40
1-4	11:15:30	0.57	2.40	759.195	195	61	61	254	251	42
1-5	11:18:00	0.56	2.40	760.785	195	61	61	254	251	42
1-6	11:20:30	0.55	2.30	762.340	194	61	61	255	257	44
	11:23:00			763.905						
2-1	11:28:00	0.58	2.30	763.905	194	61	61	255	257	44
2-2	11:30:30	0.59	2.40	765.520	194	61	61	255	256	45
2-3	11:33:00	0.59	2.40	767.110	194	62	62	254	253	42
2-4	11:35:30	0.57	2.30	768.725	194	62	62	254	254	43
2-5	11:38:00	0.56	2.30	770.345	194	63	63	254	251	46
2-6	11:40:30	0.56	2.40	771.900	194	63	63	253	250	46
	11:43:00			773.497						
3-1	11:48:00	0.60	2.40	773.497	193	63	63	254	252	47
3-2	11:50:30	0.57	2.30	775.140	193	63	63	254	253	46
3-3	11:53:00	0.56	2.30	776.730	194	63	63	253	253	48
3-4	11:55:30	0.56	2.40	778.300	194	64	64	253	253	49
3-5	11:58:00	0.55	2.40	779.905	194	64	64	253	251	52
3-6	12:00:30	0.53	2.30	781.455	194	65	65	252	252	52
	12:03:00			783.010						
4-1	12:08:00	0.59	2.30	783.010	194	65	65	252	252	52
4-2	12:10:30	0.58	2.30	784.625	194	65	65	252	252	52
4-3	12:13:00	0.57	2.30	786.235	194	66	66	253	251	53
4-4	12:15:30	0.55	2.40	787.845	193	67	67	253	252	53
4-5	12:18:00	0.54	2.30	789.420	194	67	67	252	253	54
4-6	12:20:30	0.52	2.40	791.005	195	68	68	254	252	56
	12:23:00			792.540						

Total	1:00:00			38.194		63.1	63.1			
Average			2.35		194.4	63.1				
Min			2.30		193.0	60.0				
Max			2.50		197.0	68.0				

Impinger Weight Sheet - Run 2B

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/16/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/16/2024
Scale Calibration Check (see QS-6.05C for procedure)

must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	844.6	767.6	77.0
0.1N H2SO4	806.5	743.8	62.7
Empty	669.9	644.5	25.4
0.1N NaOH	774.4	764.5	9.9
0.1N NaOH	757.7	756.6	1.1
Silica Gel	871.9	863.3	8.6

<u>3,853.1</u> Liquid Final	<u>3,677.0</u> Liquid Initial	<u>176.1</u> Liquid Gain
<u>871.9</u> Silica Final	<u>863.3</u> Silica Initial	<u>8.6</u> Silica Gain

Run 3B - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On

Date: 1/16/24
 Start Time: 12:40
 End Time: 1:55

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.65	In. H ₂ O	Static Pressure	-0.05	in. H ₂ O
Meter Temperature, Tm:	74.6	°F	Flue Pressure (Ps):	30.37	in. Hg. abs.
Sqrt ΔP:	0.744	In. H ₂ O	Carbon Dioxide:	14.00	%
Stack Temperature, Ts:	193.1	°F	Oxygen:	12.30	%
Meter Volume, Vm:	38.518	ft ³	Nitrogen:	73.7	%
Meter Volume, Vmstd:	38.302	dscf	Gas Weight dry, Md:	30.732	lb/lb mole
Meter Volume, Vwstd:	7.437	wscf	Gas Weight wet, Ms:	28.662	lb/lb mole
Isokinetic Variance:	99.6	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	45.271	fps
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	258,132	acfm
Barometric Pressure:	30.37	in Hg	Volumetric Flow:	177,354	dscfm
			Volumetric Flow:	211,792	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3672.8	ml	Silica Initial Wt.	846.1	grams
Final Impinger Content:	3825.7	ml	Silica Final Wt.	851.1	grams
Impinger Difference:	152.9	ml	Silica Difference:	5.0	grams
Total Water Gain:	157.9		Moisture, Bws:	0.163	Supersaturation Value, Bws: 0.669

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:40:00	0.58	1.80	807.866	192	70	70	250	253	40
1-2	12:42:30	0.57	1.80	809.485	192	70	70	251	254	40
1-3	12:45:00	0.56	1.70	811.110	193	72	72	250	254	39
1-4	12:47:30	0.54	1.60	812.705	193	72	72	251	254	40
1-5	12:50:00	0.52	1.60	814.295	194	72	72	253	254	40
1-6	12:52:30	0.51	1.50	815.845	194	72	72	253	254	40
	12:55:00			817.390						
2-1	1:00:00	0.59	1.60	817.390	194	74	74	254	258	41
2-2	1:02:30	0.57	1.70	819.025	194	74	74	253	257	41
2-3	1:05:00	0.56	1.60	820.680	193	74	74	253	253	40
2-4	1:07:30	0.54	1.60	822.290	193	74	74	254	254	40
2-5	1:10:00	0.52	1.70	823.870	193	74	74	254	254	39
2-6	1:12:30	0.51	1.60	825.430	194	75	75	253	254	39
	1:15:00			826.956						
3-1	1:20:00	0.59	1.80	826.956	194	75	75	254	255	40
3-2	1:22:30	0.58	1.60	828.615	194	75	75	253	254	38
3-3	1:25:00	0.57	1.70	830.250	193	76	76	254	252	39
3-4	1:27:30	0.56	1.70	831.875	193	76	76	253	253	39
3-5	1:30:00	0.55	1.60	833.505	193	77	77	254	251	39
3-6	1:32:30	0.53	1.70	835.115	193	77	77	253	252	40
	1:35:00			836.708						
4-1	1:40:00	0.59	1.60	836.708	193	77	77	252	251	39
4-2	1:42:30	0.57	1.60	838.380	193	77	77	252	252	39
4-3	1:45:00	0.57	1.70	840.000	192	77	77	251	257	37
4-4	1:47:30	0.55	1.60	841.665	192	77	77	253	253	37
4-5	1:50:00	0.53	1.60	843.265	192	77	77	253	254	37
4-6	1:52:30	0.52	1.55	844.855	194	77	77	254	252	39
	1:55:00			846.384						

Total	1:00:00			38.518		74.6	74.6			
Average			1.65		193.1	74.6				
Min			1.50		192.0	70.0				
Max			1.80		194.0	77.0				

Impinger Weight Sheet - Run 3B

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/16/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/16/2024
Scale Calibration Check (see QS-6.05C for procedure)

must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	839.9	758.9	81.0
0.1N H2SO4	806.9	752.2	54.7
Empty	657.9	646.5	11.4
0.1N NaOH	762.6	759.3	3.3
0.1N NaOH	758.4	755.9	2.5
Silica Gel	851.1	846.1	5.0

<u>3,825.7</u> Liquid Final	<u>3,672.8</u> Liquid Initial	<u>152.9</u> Liquid Gain
<u>851.1</u> Silica Final	<u>846.1</u> Silica Initial	<u>5.0</u> Silica Gain

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/16/24

Run 1

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
MILLON_R1_000271.LAB	9:30	16.00	11.00	0.38	≤ 0.10	190.79	0.86	12.24
MILLON_R1_000272.LAB	9:31	16.07	11.01	0.36	≤ 0.10	190.76	0.86	12.15
MILLON_R1_000273.LAB	9:32	15.81	11.04	0.45	≤ 0.10	190.73	0.86	12.51
MILLON_R1_000274.LAB	9:33	16.34	11.12	0.37	≤ 0.10	190.84	0.86	12.48
MILLON_R1_000275.LAB	9:34	15.56	11.30	0.38	≤ 0.10	190.92	0.86	12.34
MILLON_R1_000276.LAB	9:35	16.32	11.09	0.43	≤ 0.10	190.94	0.86	12.20
MILLON_R1_000277.LAB	9:36	16.02	11.06	0.39	≤ 0.10	190.95	0.86	12.15
MILLON_R1_000278.LAB	9:37	15.58	11.15	0.41	≤ 0.10	190.95	0.86	12.19
MILLON_R1_000279.LAB	9:38	16.34	11.14	0.44	≤ 0.10	190.94	0.86	12.25
MILLON_R1_000280.LAB	9:39	17.05	11.04	0.43	≤ 0.10	190.89	0.86	12.41
MILLON_R1_000281.LAB	9:40	15.80	11.21	0.26	≤ 0.10	190.94	0.86	12.32
MILLON_R1_000282.LAB	9:41	16.62	11.10	0.45	≤ 0.10	190.95	0.86	12.26
MILLON_R1_000283.LAB	9:42	16.37	11.05	0.46	≤ 0.10	190.92	0.86	12.24
MILLON_R1_000284.LAB	9:43	16.07	11.01	0.39	≤ 0.10	190.87	0.86	12.26
MILLON_R1_000285.LAB	9:44	16.23	11.01	0.46	≤ 0.10	190.93	0.86	12.30
MILLON_R1_000286.LAB	9:45	15.85	11.03	0.42	≤ 0.10	190.89	0.86	12.33
MILLON_R1_000287.LAB	9:46	16.25	11.21	0.48	≤ 0.10	190.89	0.86	12.38
MILLON_R1_000288.LAB	9:47	15.82	11.35	0.45	≤ 0.10	190.92	0.86	12.49
MILLON_R1_000289.LAB	9:48	16.25	11.16	0.43	≤ 0.10	190.89	0.86	12.34
MILLON_R1_000290.LAB	9:49	16.49	11.08	0.40	≤ 0.10	190.87	0.86	12.45
MILLON_R1_000291.LAB	9:50	16.56	11.09	0.51	≤ 0.10	190.86	0.86	12.50
MILLON_R1_000292.LAB	9:51	15.56	11.12	0.50	≤ 0.10	190.88	0.86	12.51
MILLON_R1_000293.LAB	9:52	16.02	11.20	0.45	≤ 0.10	190.92	0.86	12.50
MILLON_R1_000294.LAB	9:53	16.63	10.97	0.51	≤ 0.10	190.85	0.86	12.50
MILLON_R1_000295.LAB	9:54	15.78	11.19	0.47	≤ 0.10	190.87	0.86	12.54
MILLON_R1_000296.LAB	9:55	16.60	11.10	0.50	≤ 0.10	190.85	0.86	12.47
MILLON_R1_000297.LAB	9:56	16.06	11.20	0.44	≤ 0.10	190.86	0.86	12.50
MILLON_R1_000298.LAB	9:57	16.14	11.17	0.47	≤ 0.10	190.83	0.86	12.45
MILLON_R1_000299.LAB	9:58	16.52	11.22	0.48	≤ 0.10	190.79	0.86	12.44
MILLON_R1_000300.LAB	9:59	16.10	11.14	0.50	≤ 0.10	190.86	0.86	12.46
MILLON_R1_000301.LAB	10:00	15.57	11.24	0.47	≤ 0.10	190.91	0.86	12.42
MILLON_R1_000302.LAB	10:01	16.72	11.21	0.48	≤ 0.10	190.93	0.86	12.51
MILLON_R1_000303.LAB	10:02	16.07	11.33	0.52	≤ 0.10	190.96	0.86	12.49
MILLON_R1_000304.LAB	10:03	16.91	11.25	0.49	≤ 0.10	191.03	0.86	12.41
MILLON_R1_000305.LAB	10:04	16.57	11.34	0.53	≤ 0.10	191.03	0.86	12.40
MILLON_R1_000306.LAB	10:05	15.88	11.35	0.52	≤ 0.10	191.05	0.86	12.38
MILLON_R1_000307.LAB	10:06	16.66	11.21	0.51	≤ 0.10	191.03	0.86	12.32
MILLON_R1_000308.LAB	10:07	16.22	11.19	0.45	≤ 0.10	190.92	0.86	12.38
MILLON_R1_000309.LAB	10:08	16.26	11.22	0.47	≤ 0.10	190.94	0.86	12.44
MILLON_R1_000310.LAB	10:09	16.48	11.24	0.43	≤ 0.10	190.94	0.86	12.50
MILLON_R1_000311.LAB	10:10	16.21	11.26	0.50	≤ 0.10	190.94	0.86	12.47
MILLON_R1_000312.LAB	10:11	16.26	11.28	0.49	≤ 0.10	190.95	0.86	12.48
MILLON_R1_000313.LAB	10:12	16.59	11.21	0.44	≤ 0.10	190.90	0.86	12.44
MILLON_R1_000314.LAB	10:13	16.09	11.36	0.47	≤ 0.10	190.88	0.86	12.40
MILLON_R1_000315.LAB	10:14	16.49	11.33	0.50	≤ 0.10	190.91	0.86	12.43
MILLON_R1_000316.LAB	10:15	16.43	11.43	0.48	≤ 0.10	190.94	0.86	12.42
MILLON_R1_000317.LAB	10:16	16.64	11.29	0.49	≤ 0.10	190.99	0.86	12.33
MILLON_R1_000318.LAB	10:17	16.80	11.29	0.41	≤ 0.10	190.98	0.86	12.35
MILLON_R1_000319.LAB	10:18	16.60	11.35	0.46	≤ 0.10	191.00	0.86	12.30
MILLON_R1_000320.LAB	10:19	16.11	11.49	0.42	≤ 0.10	191.02	0.86	12.32
MILLON_R1_000321.LAB	10:20	16.89	11.41	0.43	≤ 0.10	190.94	0.86	12.37
MILLON_R1_000322.LAB	10:21	16.87	11.39	0.50	≤ 0.10	190.93	0.86	12.34
MILLON_R1_000323.LAB	10:22	16.80	11.41	0.43	≤ 0.10	190.88	0.86	12.31
MILLON_R1_000324.LAB	10:23	16.27	11.45	0.40	≤ 0.10	190.76	0.86	12.33
MILLON_R1_000325.LAB	10:24	16.80	11.27	0.41	≤ 0.10	190.69	0.86	12.31
MILLON_R1_000326.LAB	10:25	15.80	11.37	0.38	≤ 0.10	190.71	0.86	12.31
MILLON_R1_000327.LAB	10:26	16.78	11.32	0.40	≤ 0.10	190.71	0.86	12.36
MILLON_R1_000328.LAB	10:27	16.60	11.42	0.44	≤ 0.10	190.74	0.86	12.42
MILLON_R1_000329.LAB	10:28	17.00	11.36	0.27	≤ 0.10	190.77	0.86	12.47
MILLON_R1_000330.LAB	10:29	16.25	11.52	0.42	≤ 0.10	190.86	0.86	12.39
Average		16.31	11.22	0.44	≤ 0.10	190.89	0.86	12.38

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/16/24

Run 2

Spectrum	Time	FTIR Data					Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw				
MILLON_R2_000407.LAB	11:08	16.98	11.5	0.49	≤ 0.10	9.7	1.02	12.48	
MILLON_R2_000408.LAB	11:09	16.71	11.5	0.51	≤ 0.10	9.9	0.98	12.53	
MILLON_R2_000409.LAB	11:10	16.85	11.4	0.43	≤ 0.10	9.7	0.94	12.56	
MILLON_R2_000410.LAB	11:11	16.56	11.4	0.43	≤ 0.10	9.8	0.89	12.55	
MILLON_R2_000411.LAB	11:12	17.04	11.4	0.54	≤ 0.10	9.8	0.89	12.54	
MILLON_R2_000412.LAB	11:13	15.74	11.6	≤ 0.20	≤ 0.10	9.8	0.92	12.53	
MILLON_R2_000413.LAB	11:14	16.50	11.5	0.46	≤ 0.10	9.8	0.88	12.55	
MILLON_R2_000414.LAB	11:15	17.43	11.4	0.42	≤ 0.10	9.8	0.94	12.56	
MILLON_R2_000415.LAB	11:16	15.90	11.6	0.28	≤ 0.10	9.9	0.95	12.49	
MILLON_R2_000416.LAB	11:17	16.80	11.5	0.43	≤ 0.10	9.8	0.99	12.54	
MILLON_R2_000417.LAB	11:18	16.94	11.4	0.47	≤ 0.10	9.9	0.96	12.56	
MILLON_R2_000418.LAB	11:19	16.35	11.5	0.46	≤ 0.10	9.9	0.86	12.55	
MILLON_R2_000419.LAB	11:20	15.96	11.7	0.45	≤ 0.10	9.9	0.89	12.49	
MILLON_R2_000420.LAB	11:21	15.91	11.6	0.49	≤ 0.10	10.0	0.87	12.46	
MILLON_R2_000421.LAB	11:22	18.12	11.2	0.48	≤ 0.10	9.7	0.91	12.51	
MILLON_R2_000422.LAB	11:23	16.01	11.7	0.30	≤ 0.10	9.9	0.95	12.46	
MILLON_R2_000423.LAB	11:24	16.94	11.5	0.42	≤ 0.10	9.9	0.97	12.44	
MILLON_R2_000424.LAB	11:25	16.55	11.6	0.55	≤ 0.10	9.9	1.00	12.45	
MILLON_R2_000425.LAB	11:26	16.74	11.6	0.48	≤ 0.10	9.9	0.96	12.46	
MILLON_R2_000426.LAB	11:27	16.52	11.6	0.51	≤ 0.10	10.0	0.93	12.48	
MILLON_R2_000427.LAB	11:28	16.29	11.6	0.48	≤ 0.10	9.9	0.87	12.40	
MILLON_R2_000428.LAB	11:29	16.89	11.6	0.43	≤ 0.10	9.9	0.90	12.41	
MILLON_R2_000429.LAB	11:30	16.63	11.5	0.50	≤ 0.10	10.0	0.92	12.44	
MILLON_R2_000430.LAB	11:31	16.90	11.6	0.48	≤ 0.10	10.0	0.96	12.45	
MILLON_R2_000431.LAB	11:32	16.52	11.7	0.49	≤ 0.10	10.0	1.00	12.45	
MILLON_R2_000432.LAB	11:33	16.66	11.5	0.47	≤ 0.10	10.0	0.98	12.44	
MILLON_R2_000433.LAB	11:34	16.65	11.5	0.41	≤ 0.10	9.9	0.95	12.54	
MILLON_R2_000434.LAB	11:35	15.94	11.6	0.49	≤ 0.10	10.0	0.92	12.62	
MILLON_R2_000435.LAB	11:36	16.76	11.4	0.47	≤ 0.10	9.8	0.93	12.63	
MILLON_R2_000436.LAB	11:37	17.07	11.5	0.47	≤ 0.10	9.8	0.99	12.58	
MILLON_R2_000437.LAB	11:38	16.65	11.5	0.33	≤ 0.10	9.9	1.02	12.57	
MILLON_R2_000438.LAB	11:39	16.35	11.6	0.50	≤ 0.10	10.0	0.90	12.57	
MILLON_R2_000439.LAB	11:40	16.71	12.0	0.47	≤ 0.10	10.6	0.89	12.47	
MILLON_R2_000440.LAB	11:41	16.83	11.8	0.48	≤ 0.10	10.1	0.93	12.07	
MILLON_R2_000441.LAB	11:42	17.24	11.7	0.39	≤ 0.10	10.0	0.92	12.23	
MILLON_R2_000442.LAB	11:43	16.88	11.8	0.44	≤ 0.10	10.1	1.01	12.28	
MILLON_R2_000443.LAB	11:44	17.04	11.7	0.27	≤ 0.10	10.1	0.98	12.23	
MILLON_R2_000444.LAB	11:45	17.15	11.7	0.23	≤ 0.10	10.1	0.88	12.26	
MILLON_R2_000445.LAB	11:46	16.86	11.7	0.20	≤ 0.10	9.9	0.94	12.23	
MILLON_R2_000446.LAB	11:47	16.78	11.7	0.37	≤ 0.10	10.2	0.94	12.31	
MILLON_R2_000447.LAB	11:48	16.89	11.7	0.36	≤ 0.10	10.2	0.95	12.29	
MILLON_R2_000448.LAB	11:49	17.24	11.6	0.44	≤ 0.10	10.0	0.90	12.31	
MILLON_R2_000449.LAB	11:50	16.92	11.8	0.23	≤ 0.10	10.0	0.91	12.36	
MILLON_R2_000450.LAB	11:51	16.39	11.9	0.40	≤ 0.10	10.0	0.85	12.35	
MILLON_R2_000451.LAB	11:52	16.89	11.9	0.40	≤ 0.10	10.1	0.93	12.29	
MILLON_R2_000452.LAB	11:53	16.73	11.9	0.41	≤ 0.10	10.3	1.01	12.21	
MILLON_R2_000453.LAB	11:54	17.19	11.8	0.25	≤ 0.10	10.0	0.90	12.18	
MILLON_R2_000454.LAB	11:55	16.61	11.8	0.40	≤ 0.10	10.2	0.85	12.20	
MILLON_R2_000455.LAB	11:56	17.14	11.7	0.33	≤ 0.10	10.2	0.97	12.24	
MILLON_R2_000456.LAB	11:57	16.74	11.8	≤ 0.20	≤ 0.10	10.2	0.96	12.30	
MILLON_R2_000457.LAB	11:58	16.36	11.8	0.47	≤ 0.10	10.4	0.93	12.28	
MILLON_R2_000458.LAB	11:59	17.13	11.7	0.34	≤ 0.10	10.1	0.90	12.23	
MILLON_R2_000459.LAB	12:00	16.86	11.7	≤ 0.20	≤ 0.10	10.0	0.82	12.25	
MILLON_R2_000460.LAB	12:01	16.65	11.8	0.39	≤ 0.10	10.2	0.83	12.30	
MILLON_R2_000461.LAB	12:02	16.41	11.8	0.32	≤ 0.10	10.3	0.89	12.32	
MILLON_R2_000462.LAB	12:03	17.41	11.7	0.30	≤ 0.10	10.3	0.99	12.27	
MILLON_R2_000463.LAB	12:04	16.38	11.7	≤ 0.20	≤ 0.10	10.3	0.95	12.28	
MILLON_R2_000464.LAB	12:05	16.83	11.7	0.34	≤ 0.10	10.1	0.88	12.31	
MILLON_R2_000465.LAB	12:06	16.26	11.7	0.32	≤ 0.10	10.2	0.90	12.33	
MILLON_R2_000466.LAB	12:07	17.38	11.6	≤ 0.20	≤ 0.10	10.0	0.86	12.33	
Average		16.72	11.63	≤ 0.40	≤ 0.10	10.01	0.93	12.40	

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/16/24

Run 3

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
MILLON_R3_000525.LAB	12:40	17.06	11.7	0.45	≤ 0.10	190.64	0.86	12.30
MILLON_R3_000526.LAB	12:41	16.45	11.8	≤ 0.20	≤ 0.10	190.65	0.86	12.27
MILLON_R3_000527.LAB	12:42	17.10	11.7	0.43	≤ 0.10	190.71	0.86	12.28
MILLON_R3_000528.LAB	12:43	16.68	11.7	0.25	≤ 0.10	190.69	0.86	12.28
MILLON_R3_000529.LAB	12:44	17.06	11.7	0.42	≤ 0.10	190.65	0.86	12.29
MILLON_R3_000530.LAB	12:45	17.01	11.7	0.23	≤ 0.10	190.65	0.86	12.32
MILLON_R3_000531.LAB	12:46	17.21	11.7	0.45	≤ 0.10	190.62	0.86	12.31
MILLON_R3_000532.LAB	12:47	16.42	11.7	0.26	≤ 0.10	190.71	0.86	12.32
MILLON_R3_000533.LAB	12:48	17.05	11.7	0.37	≤ 0.10	190.74	0.86	12.29
MILLON_R3_000534.LAB	12:49	16.91	11.6	0.40	≤ 0.10	190.65	0.86	12.37
MILLON_R3_000535.LAB	12:50	16.45	11.8	0.39	≤ 0.10	190.64	0.86	12.36
MILLON_R3_000536.LAB	12:51	16.41	11.7	0.36	≤ 0.10	190.61	0.86	12.40
MILLON_R3_000537.LAB	12:52	17.34	11.6	≤ 0.20	≤ 0.10	190.51	0.86	12.34
MILLON_R3_000538.LAB	12:53	16.51	11.8	0.34	≤ 0.10	190.48	0.86	12.30
MILLON_R3_000539.LAB	12:54	17.28	11.5	0.28	≤ 0.10	190.61	0.86	12.40
MILLON_R3_000540.LAB	12:55	17.37	11.7	≤ 0.20	≤ 0.10	190.68	0.86	12.40
MILLON_R3_000541.LAB	12:56	16.50	11.8	≤ 0.20	≤ 0.10	190.68	0.86	12.30
MILLON_R3_000542.LAB	12:57	17.25	11.6	≤ 0.20	≤ 0.10	190.59	0.86	12.35
MILLON_R3_000543.LAB	12:58	16.72	11.7	0.38	≤ 0.10	190.51	0.86	12.33
MILLON_R3_000544.LAB	12:59	17.06	11.6	0.34	≤ 0.10	190.53	0.86	12.32
MILLON_R3_000545.LAB	13:00	16.79	11.7	0.29	≤ 0.10	190.56	0.86	12.35
MILLON_R3_000546.LAB	13:01	16.54	11.8	0.39	≤ 0.10	190.64	0.86	12.32
MILLON_R3_000547.LAB	13:02	16.46	11.7	0.38	≤ 0.10	190.66	0.86	12.28
MILLON_R3_000548.LAB	13:03	17.01	11.6	0.30	≤ 0.10	190.66	0.86	12.41
MILLON_R3_000549.LAB	13:04	17.07	11.6	0.32	≤ 0.10	190.65	0.86	12.38
MILLON_R3_000550.LAB	13:05	16.97	11.7	0.30	≤ 0.10	190.56	0.86	12.39
MILLON_R3_000551.LAB	13:06	17.21	11.6	0.25	≤ 0.10	190.55	0.86	12.36
MILLON_R3_000552.LAB	13:07	17.10	11.7	≤ 0.20	≤ 0.10	190.58	0.85	12.33
MILLON_R3_000553.LAB	13:08	16.59	11.7	≤ 0.20	≤ 0.10	190.55	0.86	12.32
MILLON_R3_000554.LAB	13:09	16.48	11.7	0.27	≤ 0.10	190.53	0.85	12.33
MILLON_R3_000555.LAB	13:10	17.47	11.6	0.23	≤ 0.10	190.52	0.86	12.34
MILLON_R3_000556.LAB	13:11	16.43	11.8	≤ 0.20	≤ 0.10	190.53	0.86	12.32
MILLON_R3_000557.LAB	13:12	17.25	11.7	0.37	≤ 0.10	190.53	0.86	12.26
MILLON_R3_000558.LAB	13:13	16.75	11.7	≤ 0.20	≤ 0.10	190.54	0.85	12.29
MILLON_R3_000559.LAB	13:14	16.66	11.7	0.39	≤ 0.10	190.52	0.86	12.27
MILLON_R3_000560.LAB	13:15	17.21	11.6	0.25	≤ 0.10	190.53	0.86	12.32
MILLON_R3_000561.LAB	13:16	17.11	11.7	≤ 0.20	≤ 0.10	190.54	0.86	12.37
MILLON_R3_000562.LAB	13:17	16.42	11.7	≤ 0.20	≤ 0.10	190.53	0.86	12.36
MILLON_R3_000563.LAB	13:18	16.71	11.7	0.32	≤ 0.10	190.55	0.86	12.30
MILLON_R3_000564.LAB	13:19	16.99	11.7	0.37	≤ 0.10	190.61	0.86	12.34
MILLON_R3_000565.LAB	13:20	16.72	11.6	0.37	≤ 0.10	190.59	0.86	12.35
MILLON_R3_000566.LAB	13:21	16.92	11.6	0.32	≤ 0.10	190.54	0.86	12.36
MILLON_R3_000567.LAB	13:22	16.84	11.6	0.33	≤ 0.10	190.54	0.86	12.41
MILLON_R3_000568.LAB	13:23	17.08	11.6	≤ 0.20	≤ 0.10	190.54	0.86	12.41
MILLON_R3_000569.LAB	13:24	16.59	11.7	0.33	≤ 0.10	190.53	0.85	12.38
MILLON_R3_000570.LAB	13:25	17.02	11.5	0.26	≤ 0.10	190.55	0.86	12.38
MILLON_R3_000571.LAB	13:26	16.57	11.5	0.40	≤ 0.10	190.62	0.86	12.41
MILLON_R3_000572.LAB	13:27	16.42	11.5	0.37	≤ 0.10	190.64	0.85	12.50
MILLON_R3_000573.LAB	13:28	16.79	11.4	0.37	≤ 0.10	190.56	0.85	12.60
MILLON_R3_000574.LAB	13:29	16.67	11.5	0.34	≤ 0.10	190.54	0.85	12.66
MILLON_R3_000575.LAB	13:30	16.53	11.8	0.36	≤ 0.10	190.51	0.85	12.73
MILLON_R3_000576.LAB	13:31	17.00	11.8	0.36	≤ 0.10	190.54	0.85	12.62
MILLON_R3_000577.LAB	13:32	16.97	12.2	0.43	≤ 0.10	190.61	0.85	12.42
MILLON_R3_000578.LAB	13:33	16.89	12.0	0.38	≤ 0.10	190.65	0.86	12.34
MILLON_R3_000579.LAB	13:34	16.47	11.6	0.41	≤ 0.10	190.58	0.85	11.98
MILLON_R3_000580.LAB	13:35	17.13	11.5	0.40	≤ 0.10	190.53	0.85	11.98
MILLON_R3_000581.LAB	13:36	16.66	11.6	≤ 0.20	≤ 0.10	190.47	0.85	12.41
MILLON_R3_000582.LAB	13:37	16.92	11.5	0.37	≤ 0.10	190.48	0.86	12.44
MILLON_R3_000583.LAB	13:38	16.81	11.7	0.40	≤ 0.10	190.53	0.86	12.42
MILLON_R3_000584.LAB	13:39	17.05	11.7	0.39	≤ 0.10	190.55	0.86	12.46
Average		16.85	11.67	≤ 0.32	≤ 0.10	190.58	0.86	12.36

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Test Method: 26A
Test Engineer: DV
Test Technician: AMS

	<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>
Temp ID:	CM23	CM23	CM23
Meter ID:	CM23	CM23	CM23
Pitot ID:	S8-031A	S8-031A	S8-031A
Nozzle Diameter (Inches):	0.313	0.313	0.313
Meter Calibration Date:	10/26/2023	10/26/2023	10/26/2023
Meter Calibration Factor (Y):	0.999	0.999	0.999
Meter Orifice Setting (Delta H):	1.790	1.790	1.790
Nozzle Kit ID Number and Material:	Quartz #14 (320)	Quartz #14 (320)	Quartz #14 (320)
Pitot Tube Coefficient:		0.820	
Probe Length (Feet):		6.0	
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	
Duct Area (Square Feet):		95.033	
Upstream Diameters:		4.1	
Downstream Diameters:		5.5	
Number of Ports Sampled:		4	
Number of Points per Port:		6	
Minutes per Point:		2.5	
Minutes per Reading:		2.5	
Total Number of Traverse Points:		24	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill Off	
Diluent Model/Serial Number:		CAI 700	
Moisture Balance ID:		LV4	
# of Runs		3	

Run 1A - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/17/24
 Start Time: 9:30
 End Time: 10:45

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.87	in. H ₂ O	Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	63.9	°F	Flue Pressure (Ps):	24.23	in. Hg. abs.
Sqrt ΔP:	0.769	in. H ₂ O	Carbon Dioxide:	16.10	%
Stack Temperature, Ts:	363.1	°F	Oxygen:	10.90	%
Meter Volume, Vm:	62.284	ft ³	Nitrogen:	73.00	%
Meter Volume, Vmstd:	51.306	dscf	Gas Weight dry, Md:	31.012	lb/lb mole
Meter Volume, Vwstd:	7.470	wscf	Gas Weight wet, Ms:	29.358	lb/lb mole
Isokinetic Variance:	101.5	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	57.967	fps
Nozzle Diameter:	0.313	in inches	Volumetric Flow:	330,528	acfm
Barometric Pressure:	24.27	in Hg	Volumetric Flow:	149,897	dscfm
			Volumetric Flow:	171,721	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3630.9	ml	Silica Initial Wt.	856.6	grams
Final Impinger Content:	3783.4	ml	Silica Final Wt.	862.7	grams
Impinger Difference:	152.5	ml	Silica Difference:	6.1	grams
Total Water Gain:	158.6		Moisture, Bws:	0.127	

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	9:30:00	0.65	3.16	98.767	361	60	58	260	260	39
1-2	9:32:30	0.63	3.06	101.480	361	60	58	260	260	39
1-3	9:35:00	0.60	2.91	104.115	361	60	58	260	260	39
1-4	9:37:30	0.55	2.67	106.720	362	60	58	260	260	39
1-5	9:40:00	0.53	2.57	109.215	362	60	58	261	261	39
1-6	9:42:30	0.50	2.43	111.625	362	60	58	261	261	39
	9:45:00			114.001						
2-1	9:50:00	0.64	3.11	114.001	363	66	60	261	260	43
2-2	9:52:30	0.60	2.91	116.695	363	66	60	261	260	43
2-3	9:55:00	0.60	2.91	119.325	363	66	60	261	260	43
2-4	9:57:30	0.57	2.77	121.925	363	67	60	261	260	43
2-5	10:00:00	0.55	2.67	124.470	363	67	60	261	260	44
2-6	10:02:30	0.53	2.57	126.970	363	67	60	261	260	44
	10:05:00			129.423						
3-1	10:10:00	0.69	3.35	129.423	365	70	62	259	258	43
3-2	10:12:30	0.65	3.16	132.240	365	70	62	259	258	43
3-3	10:15:00	0.66	3.20	134.945	365	70	62	259	258	43
3-4	10:17:30	0.59	2.86	137.715	365	70	62	259	258	43
3-5	10:20:00	0.55	2.67	140.335	365	70	62	259	258	43
3-6	10:22:30	0.55	2.67	142.820	365	70	62	259	258	43
	10:25:00			145.343						
4-1	10:30:00	0.66	3.20	145.343	363	72	63	261	259	43
4-2	10:32:30	0.63	3.06	148.115	363	72	63	261	259	43
4-3	10:35:00	0.63	3.06	150.810	363	72	63	261	260	43
4-4	10:37:30	0.57	2.77	153.510	363	72	63	261	260	43
4-5	10:40:00	0.55	2.67	156.055	363	72	63	261	260	43
4-6	10:42:30	0.53	2.57	158.600	363	72	63	261	260	43
	10:45:00			161.051						

Total	1:00:00			62.284		67.1	60.8			
Average			2.87		363.1	63.9				
Min			2.43		361.0	58.0				
Max			3.35		365.0	72.0				

Impinger Weight Sheet - Run 1A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/17/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/17/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	844.7	722.3	122.4
0.1N H2SO4	768.9	744.3	24.6
Empty	657.6	654.1	3.5
0.1N NaOH	780.0	778.9	1.1
0.1N NaOH	732.2	731.3	0.9
Silica Gel	862.7	856.6	6.1

<u>3,783.4</u>	<u>3,630.9</u>	<u>152.5</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>862.7</u>	<u>856.6</u>	<u>6.1</u>
Silica Final	Silica Initial	Silica Gain

Run 2A - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/17/24
 Start Time: 11:05
 End Time: 12:23

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.89	In. H ₂ O	Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	77.0	°F	Flue Pressure (Ps):	24.23	in. Hg. abs.
Sqrt ΔP:	0.771	In. H ₂ O	Carbon Dioxide:	16.20	%
Stack Temperature, Ts:	365.5	°F	Oxygen:	10.80	%
Meter Volume, Vm:	63.970	ft ³	Nitrogen:	73.0	%
Meter Volume, Vmstd:	51.416	dscf	Gas Weight dry, Md:	31.024	lb/lb mole
Meter Volume, Vwstd:	6.938	wscf	Gas Weight wet, Ms:	29.476	lb/lb mole
Isokinetic Variance:	100.8	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	58.133	fps
Nozzle Diameter:	0.313	in inches	Volumetric Flow:	331,476	acfm
Barometric Pressure:	24.27	in Hg	Volumetric Flow:	151,302	dscfm
			Volumetric Flow:	171,718	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3696.5	ml	Silica Initial Wt.	888.1	grams
Final Impinger Content:	3838.3	ml	Silica Final Wt.	893.6	grams
Impinger Difference:	141.8	ml	Silica Difference:	5.5	grams
Total Water Gain:	147.3		Moisture, Bws:	0.119	

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	11:05:00	0.65	3.16	42.110	365	76	74	260	263	48
1-2	11:07:30	0.63	3.06	44.880	365	76	74	260	262	48
1-3	11:10:00	0.59	2.86	47.625	365	76	74	260	262	48
1-4	11:12:30	0.55	2.67	50.250	365	76	74	260	262	48
1-5	11:15:00	0.53	2.57	52.810	365	76	74	260	262	48
1-6	11:17:30	0.50	2.43	55.330	365	76	74	260	262	48
	11:20:00			57.758						
2-1	11:25:00	0.64	3.11	57.758	366	79	74	260	259	48
2-2	11:27:30	0.62	3.01	60.515	366	79	74	260	259	48
2-3	11:30:00	0.59	2.86	63.250	366	79	74	260	258	48
2-4	11:32:30	0.57	2.77	65.890	366	79	74	260	258	48
2-5	11:35:00	0.55	2.67	68.475	366	79	74	260	258	48
2-6	11:37:30	0.55	2.67	71.065	366	79	74	260	258	48
	11:40:00			73.625						
3-1	11:45:00	0.69	3.35	73.625	365	80	75	261	261	48
3-2	11:47:30	0.66	3.20	76.495	365	80	75	261	261	48
3-3	11:50:00	0.64	3.11	79.300	365	80	75	261	261	48
3-4	11:52:30	0.59	2.86	82.065	365	80	75	261	261	48
3-5	11:55:00	0.55	2.67	84.735	365	80	75	261	261	48
3-6	11:57:30	0.53	2.57	87.300	365	80	75	261	261	48
	12:00:00			89.905						
4-1	12:05:00	0.69	3.35	89.905	366	83	75	260	260	53
4-2	12:07:30	0.66	3.20	92.665	366	83	75	260	260	53
4-3	12:10:00	0.64	3.11	95.500	366	83	75	260	260	53
4-4	12:12:30	0.60	2.91	98.290	366	83	75	260	260	53
4-5	12:15:00	0.56	2.72	100.965	366	83	75	260	260	53
4-6	12:17:30	0.53	2.57	103.560	366	83	75	260	260	53
	12:20:00			106.080						

Total	1:00:00			63.970		79.5	74.5			
Average			2.89		365.5	77.0				
Min			2.43		365.0	74.0				
Max			3.35		366.0	83.0				

Impinger Weight Sheet - Run 2A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/17/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/17/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	844.5	780.9	63.6
0.1N H2SO4	825.8	771.3	54.5
Empty	669.4	654.7	14.7
0.1N NaOH	762.9	756.4	6.5
0.1N NaOH	735.7	733.2	2.5
Silica Gel	893.6	888.1	5.5

<u>3,838.3</u>	<u>3,696.5</u>	<u>141.8</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>893.6</u>	<u>888.1</u>	<u>5.5</u>
Silica Final	Silica Initial	Silica Gain

Run 3A - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/17/24
 Start Time: 12:40
 End Time: 13:55

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.85	In. H ₂ O	Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	87.4	°F	Flue Pressure (Ps):	24.23	in. Hg. abs.
Sqrt ΔP:	0.765	In. H ₂ O	Carbon Dioxide:	16.30	%
Stack Temperature, Ts:	369.0	°F	Oxygen:	10.80	%
Meter Volume, Vm:	64.571	ft ³	Nitrogen:	72.9	%
Meter Volume, Vmstd:	50.905	dscf	Gas Weight dry, Md:	31.040	lb/lb mole
Meter Volume, Vwstd:	7.790	wscf	Gas Weight wet, Ms:	29.309	lb/lb mole
Isokinetic Variance:	102.1	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	57.968	fps
Nozzle Diameter:	0.313	in inches	Volumetric Flow:	330,532	acfm
Barometric Pressure:	24.27	in Hg	Volumetric Flow:	147,876	dscfm
			Volumetric Flow:	170,507	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3609.9	ml	Silica Initial Wt.	862.7	grams
Final Impinger Content:	3768.3	ml	Silica Final Wt.	869.7	grams
Impinger Difference:	158.4	ml	Silica Difference:	7.0	grams
Total Water Gain:	165.4		Moisture, Bws:	0.133	

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:40:00	0.67	3.25	93.351	367	85	82	261	264	41
1-2	12:42:30	0.65	3.16	96.220	367	85	82	262	264	41
1-3	12:45:00	0.60	2.91	99.030	367	85	82	262	264	41
1-4	12:47:30	0.58	2.82	101.736	367	85	82	262	264	41
1-5	12:50:00	0.56	2.72	104.400	367	86	82	262	264	41
1-6	12:52:30	0.53	2.57	107.013	367	86	82	262	264	41
	12:55:00			109.560						
2-1	13:00:00	0.60	2.91	109.560	370	92	83	260	261	46
2-2	13:02:30	0.58	2.82	112.290	370	92	83	260	261	46
2-3	13:05:00	0.55	2.67	114.960	370	92	83	260	261	46
2-4	13:07:30	0.54	2.62	117.566	370	92	83	260	261	46
2-5	13:10:00	0.51	2.48	120.145	370	92	83	260	261	46
2-6	13:12:30	0.50	2.43	122.655	370	92	83	260	261	46
	13:15:00			125.139						
3-1	13:20:00	0.69	3.35	125.139	369	94	84	259	261	49
3-2	13:22:30	0.66	3.20	128.069	369	94	84	259	261	49
3-3	13:25:00	0.64	3.11	130.935	369	94	84	259	261	49
3-4	13:27:30	0.60	2.91	133.755	369	94	84	259	261	49
3-5	13:30:00	0.56	2.72	136.488	369	94	84	259	261	49
3-6	13:32:30	0.55	2.67	139.118	369	94	84	259	261	49
	13:35:00			141.734						
4-1	13:40:00	0.67	3.25	141.734	370	95	84	261	261	47
4-2	13:42:30	0.63	3.06	144.625	370	95	84	261	261	47
4-3	13:45:00	0.60	2.91	147.420	370	95	84	261	261	47
4-4	13:47:30	0.57	2.77	150.150	370	95	84	261	261	47
4-5	13:50:00	0.54	2.62	152.813	370	95	84	261	261	47
4-6	13:52:30	0.51	2.48	155.410	370	95	84	261	261	47
	13:55:00			157.922						

Total	1:00:00			64.571		91.6	83.3			
Average			2.85		369.0	87.4				
Min			2.43		367.0	82.0				
Max			3.35		370.0	95.0				

Impinger Weight Sheet - Run 3A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/17/2024
Test Method: 26A
Weighed/Measured By: RICHS
Balance ID: LV4

Scale Calibration Check Date: 1/17/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	847.2	735.7	111.5
0.1N H2SO4	775.0	737.3	37.7
Empty	660.3	654.7	5.6
0.1N NaOH	757.7	755.7	2.0
0.1N NaOH	728.1	726.5	1.6
Silica Gel	869.7	862.7	7.0

3,768.3	3,609.9	158.4
Liquid Final	Liquid Initial	Liquid Gain
869.7	862.7	7.0
Silica Final	Silica Initial	Silica Gain

Client:	Ash Grove Cement Company
Facility:	Leamington Cement Plant
Test Location:	Main Kiln Stack
Project #:	M234904
Test Method:	26A
Test Engineer:	RMF
Test Technician:	AMS

	<u>Run 1B</u>	<u>Run 2B</u>	<u>Run 3B</u>
Temp ID:	CM54	CM54	CM54
Meter ID:	CM54	CM54	CM54
Pitot ID:	S8-032A	S8-032A	S8-032A
Nozzle Diameter (Inches):	0.319	0.319	0.319
Meter Calibration Date:	12/1/2023	12/1/2023	12/1/2023
Meter Calibration Factor (Y):	0.988	0.988	0.988
Meter Orifice Setting (Delta H):	1.694	1.694	1.694
Nozzle Kit ID Number and Material:	953 Glass	953 Glass	953 Glass
Pitot Tube Coefficient:		0.822	
Probe Length (Feet):		6.0	
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	
Duct Area (Square Feet):		95.033	
Upstream Diameters:		4.1	
Downstream Diameters:		5.5	
Number of Ports Sampled:		4	
Number of Points per Port:		6	
Minutes per Point:		2.5	
Minutes per Reading:		2.5	
Total Number of Traverse Points:		24	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill Off	
Diluent Model/Serial Number:		CAI 700	
Moisture Balance ID:		LV4	
# of Runs		3	

Run 1B - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/17/24
 Start Time: 9:30
 End Time: 10:45

DRY GAS METER CONDITIONS

ΔH: 2.95 in. H₂O
 Meter Temperature, Tm: 60.0 °F
 Sqrt ΔP: 0.779 in. H₂O
 Stack Temperature, Ts: 364.2 °F
 Meter Volume, Vm: 65.405 ft³
 Meter Volume, Vmstd: 55.011 dscf
 Meter Volume, Vwstd: 7.946 wscf
 Isokinetic Variance: 101.8 %
 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.319 in inches
 Barometric Pressure: 24.87 in Hg

STACK CONDITIONS

Static Pressure -0.05 in. H₂O
 Flue Pressure (Ps): 24.87 in. Hg. abs.
 Carbon Dioxide: 16.10 %
 Oxygen: 10.90 %
 Nitrogen: 73.00 %
 Gas Weight dry, Md: 31.012 lb/lb mole
 Gas Weight wet, Ms: 29.370 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 58.165 fps
 Volumetric Flow: 331.658 acfm
 Volumetric Flow: 154.292 dscfm
 Volumetric Flow: 176.578 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3664.7 ml
 Final Impinger Content: 3825.6 ml
 Impinger Difference: 160.9 ml
 Silica Initial Wt. 872.2 grams
 Silica Final Wt. 880.0 grams
 Silica Difference: 7.8 grams
 Total Water Gain: 168.7
 Moisture, Bws: 0.126

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	9:30:00	0.65	3.19	856.716	362	55	55	261	261	36
1-2	9:32:30	0.62	3.00	859.620	363	55	55	261	260	40
1-3	9:35:00	0.60	2.90	862.280	363	56	56	259	260	41
1-4	9:37:30	0.57	2.70	864.930	363	56	56	258	258	43
1-5	9:40:00	0.57	2.70	867.540	362	56	56	258	258	43
1-6	9:42:30	0.55	2.70	870.160	362	57	57	259	258	44
	9:45:00			872.791						
2-1	9:50:00	0.64	3.10	872.791	364	58	58	258	259	44
2-2	9:52:30	0.62	3.00	875.620	364	58	58	263	259	44
2-3	9:55:00	0.61	2.90	878.340	364	58	58	263	259	45
2-4	9:57:30	0.59	2.90	881.230	364	59	59	262	259	45
2-5	10:00:00	0.58	2.80	883.780	363	59	59	261	259	45
2-6	10:02:30	0.56	2.70	886.890	364	59	59	263	260	44
	10:05:00			889.021						
3-1	10:10:00	0.66	3.20	889.021	365	61	61	259	262	44
3-2	10:12:30	0.65	3.20	891.870	365	61	61	259	262	44
3-3	10:15:00	0.65	3.20	894.690	365	61	61	259	263	44
3-4	10:17:30	0.62	3.00	897.520	365	61	61	259	262	44
3-5	10:20:00	0.61	3.00	900.310	364	62	62	260	262	44
3-6	10:22:30	0.58	2.80	902.990	364	62	62	261	261	44
	10:25:00			905.661						
4-1	10:30:00	0.65	3.20	905.661	365	63	63	260	259	44
4-2	10:32:30	0.64	3.10	908.510	366	64	64	260	259	44
4-3	10:35:00	0.62	3.00	911.320	366	64	64	260	259	44
4-4	10:37:30	0.59	2.90	914.120	366	65	65	261	258	44
4-5	10:40:00	0.59	2.90	916.780	366	65	65	261	259	44
4-6	10:42:30	0.56	2.70	919.520	366	66	66	260	259	44
	10:45:00			922.121						

Total #REF! 65.405 60.0 60.0
 Average 2.95 364.2 60.0
 Min 2.70 362.0 55.0
 Max 3.20 366.0 66.0

Impinger Weight Sheet - Run 1B

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/17/2023
Test Method: 26A
Weighed/Measured By: AMS
Balance ID: LV4

Scale Calibration Check Date: 1/17/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	807.7	751.1	56.6
0.1N H2SO4	808.6	740.8	67.8
Empty	669.5	645.3	24.2
0.1N NaOH	783.1	773.6	9.5
0.1N NaOH	756.7	753.9	2.8
Silica Gel	880.0	872.2	7.8

<u>3,825.6</u>	<u>3,664.7</u>	<u>160.9</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>880.0</u>	<u>872.2</u>	<u>7.8</u>
Silica Final	Silica Initial	Silica Gain

Run 2B - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/17/24
 Start Time: 11:05
 End Time: 12:20

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.98	In. H ₂ O	Static Pressure	-0.05	in. H ₂ O
Meter Temperature, Tm:	71.5	°F	Flue Pressure (Ps):	24.87	in. Hg. abs.
Sqrt ΔP:	0.775	In. H ₂ O	Carbon Dioxide:	16.20	%
Stack Temperature, Ts:	367.4	°F	Oxygen:	10.80	%
Meter Volume, Vm:	66.385	ft ³	Nitrogen:	73.0	%
Meter Volume, Vmstd:	54.631	dscf	Gas Weight dry, Md:	31.024	lb/lb mole
Meter Volume, Vwstd:	6.749	wscf	Gas Weight wet, Ms:	29.592	lb/lb mole
Isokinetic Variance:	100.3	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	57.778	fps
Nozzle Diameter:	0.319	in inches	Volumetric Flow:	329,448	acfm
Barometric Pressure:	24.87	in Hg	Volumetric Flow:	155,509	dscfm
			Volumetric Flow:	174,721	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3594.7	ml	Silica Initial Wt.	850.7	grams
Final Impinger Content:	3732.3	ml	Silica Final Wt.	856.4	grams
Impinger Difference:	137.6	ml	Silica Difference:	5.7	grams
Total Water Gain:	143.3		Moisture, Bws:	0.110	

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	11:05:00	0.64	3.10	922.786	367	69	69	258	251	42
1-2	11:07:30	0.63	3.10	925.930	367	69	69	259	256	43
1-3	11:10:00	0.61	3.00	928.460	367	69	69	260	258	44
1-4	11:12:30	0.57	2.80	931.220	366	69	69	262	261	44
1-5	11:15:00	0.57	2.80	933.890	366	69	69	262	261	44
1-6	11:17:30	0.55	2.70	936.610	367	69	69	262	261	44
	11:20:00			939.231						
2-1	11:25:00	0.65	3.20	939.231	367	71	71	258	261	50
2-2	11:27:30	0.63	3.10	943.030	367	71	71	258	261	50
2-3	11:30:00	0.63	3.10	944.990	367	71	71	258	261	50
2-4	11:32:30	0.61	3.00	947.780	367	71	71	259	261	51
2-5	11:35:00	0.58	2.90	950.550	367	71	71	259	261	51
2-6	11:37:30	0.56	2.80	953.240	367	71	71	259	261	51
	11:40:00			955.920						
3-1	11:45:00	0.66	3.30	955.920	368	72	72	262	261	47
3-2	11:47:30	0.63	3.10	958.870	368	72	72	262	261	47
3-3	11:50:00	0.62	3.10	961.640	368	72	72	262	261	47
3-4	11:52:30	0.59	2.90	964.470	368	72	72	261	261	46
3-5	11:55:00	0.59	2.90	967.210	368	72	72	261	260	46
3-6	11:57:30	0.54	2.70	969.990	368	73	73	261	260	46
	12:00:00			972.612						
4-1	12:05:00	0.64	3.20	972.612	368	74	74	260	260	50
4-2	12:07:30	0.63	3.10	975.480	368	74	74	260	260	50
4-3	12:10:00	0.60	3.00	978.360	368	74	74	260	260	50
4-4	12:12:30	0.59	2.90	981.120	368	74	74	260	260	52
4-5	12:15:00	0.56	2.80	983.840	368	74	74	261	260	52
4-6	12:17:30	0.56	2.80	986.510	368	74	74	261	260	52
	12:20:00			989.171						

Total	1:00:00			66.385		71.5	71.5			
Average			2.98		367.4	71.5				
Min			2.70		366.0	69.0				
Max			3.30		368.0	74.0				

Impinger Weight Sheet - Run 2B

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/17/2023
Test Method: 26A
Weighed/Measured By: AMS
Balance ID: LV4

Scale Calibration Check Date: 1/17/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	794.7	746.3	48.4
0.1N H2SO4	782.8	735.8	47.0
Empty	668.1	645.7	22.4
0.1N NaOH	749.0	735.0	14.0
0.1N NaOH	737.7	731.9	5.8
Silica Gel	856.4	850.7	5.7

<u>3,732.3</u>	<u>3,594.7</u>	<u>137.6</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>856.4</u>	<u>850.7</u>	<u>5.7</u>
Silica Final	Silica Initial	Silica Gain

Run 3B - Method 26A

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/17/24
 Start Time: 12:40
 End Time: 13:55

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.98	In. H ₂ O	Static Pressure	-0.05	in. H ₂ O
Meter Temperature, Tm:	77.5	°F	Flue Pressure (Ps):	24.87	in. Hg. abs.
Sqrt ΔP:	0.775	In. H ₂ O	Carbon Dioxide:	16.30	%
Stack Temperature, Ts:	369.2	°F	Oxygen:	10.80	%
Meter Volume, Vm:	66.899	ft ³	Nitrogen:	72.9	%
Meter Volume, Vmstd:	54.440	dscf	Gas Weight dry, Md:	31.040	lb/lb mole
Meter Volume, Vwstd:	7.941	wscf	Gas Weight wet, Ms:	29.380	lb/lb mole
Isokinetic Variance:	101.8	%I	Excess Air:	---	%
Test Length:	60.00	in mins.	Gas Velocity, Vs:	58.005	fps
Nozzle Diameter:	0.319	in inches	Volumetric Flow:	330,744	acfm
Barometric Pressure:	24.87	in Hg	Volumetric Flow:	152,756	dscfm
			Volumetric Flow:	175,038	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3630.1	ml	Silica Initial Wt.	880.0	grams
Final Impinger Content:	3790.3	ml	Silica Final Wt.	888.4	grams
Impinger Difference:	160.2	ml	Silica Difference:	8.4	grams
Total Water Gain:	168.6		Moisture, Bws:	0.127	

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:40:00	0.66	3.27	989.248	368	76	76	260	260	54
1-2	12:42:30	0.63	3.12	992.190	368	76	76	261	260	49
1-3	12:45:00	0.63	3.12	995.030	368	76	76	261	260	50
1-4	12:47:30	0.59	2.92	997.910	368	76	76	261	260	50
1-5	12:50:00	0.57	2.82	1000.630	368	76	76	261	260	50
1-6	12:52:30	0.56	2.77	1003.360	368	76	76	261	260	50
	12:55:00			1006.021						
2-1	13:00:00	0.65	3.22	1006.021	369	76	76	259	261	50
2-2	13:02:30	0.62	3.07	1008.920	369	77	77	259	261	50
2-3	13:05:00	0.62	3.07	1011.780	370	77	77	259	261	50
2-4	13:07:30	0.60	2.97	1014.570	370	77	77	260	261	51
2-5	13:10:00	0.56	2.77	1017.310	370	77	77	260	260	51
2-6	13:12:30	0.56	2.77	1019.010	370	77	77	260	260	51
	13:15:00			1022.721						
3-1	13:20:00	0.64	3.17	1022.721	370	78	78	259	259	52
3-2	13:22:30	0.63	3.12	1025.630	370	78	78	259	259	52
3-3	13:25:00	0.61	3.02	1028.510	370	78	78	260	259	52
3-4	13:27:30	0.57	2.82	1031.280	370	78	78	260	259	53
3-5	13:30:00	0.55	2.72	1034.020	370	78	78	261	260	52
3-6	13:32:30	0.55	2.72	1036.650	370	78	78	260	260	53
	13:35:00			1039.311						
4-1	13:40:00	0.65	3.22	1039.311	369	79	79	260	260	53
4-2	13:42:30	0.63	3.12	1042.240	369	79	79	260	261	52
4-3	13:45:00	0.62	3.07	1045.090	369	79	79	260	260	52
4-4	13:47:30	0.59	2.92	1047.930	369	79	79	259	260	52
4-5	13:50:00	0.58	2.87	1050.720	369	80	80	260	260	52
4-6	13:52:30	0.55	2.72	1053.450	369	80	80	260	260	52
	13:55:00			1056.147						

Total	1:00:00			66.899		77.5	77.5			
Average			2.98		369.2	77.5				
Min			2.72		368.0	76.0				
Max			3.27		370.0	80.0				

Impinger Weight Sheet - Run 3B

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Project #: M234904
Date: 1/17/2023
Test Method: 26A
Weighed/Measured By: AMS
Balance ID: LV4

Scale Calibration Check Date: 1/17/2024
Scale Calibration Check (see QS-6.05C for procedure)
 must be within $\pm 0.5g$ of certified mass

<u>Certified Weight, grams</u>	<u>Result, grams</u>
250	<u>250.0</u>
500	<u>500.0</u>
750	<u>750.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	812.1	743.0	69.1
0.1N H2SO4	791.2	727.4	63.8
Empty	664.1	645.9	18.2
0.1N NaOH	767.6	761.9	5.7
0.1N NaOH	755.3	751.9	3.4
Silica Gel	888.4	880.0	8.4

<u>3,790.3</u>	<u>3,630.1</u>	<u>160.2</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>888.4</u>	<u>880.0</u>	<u>8.4</u>
Silica Final	Silica Initial	Silica Gain

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/17/24

Run 1

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
MILLOFF_R1_000933.LAB	9:30	13.08	13.96	1.08	≤ 0.10	190.74	0.85	10.90
MILLOFF_R1_000934.LAB	9:31	13.49	13.98	0.99	≤ 0.10	190.76	0.85	10.83
MILLOFF_R1_000935.LAB	9:32	12.79	14.01	1.09	≤ 0.10	190.75	0.85	10.87
MILLOFF_R1_000936.LAB	9:33	13.46	13.80	1.00	≤ 0.10	190.77	0.85	10.96
MILLOFF_R1_000937.LAB	9:34	13.17	13.81	1.06	≤ 0.10	190.73	0.85	10.93
MILLOFF_R1_000938.LAB	9:35	13.19	13.93	1.03	≤ 0.10	190.74	0.85	10.91
MILLOFF_R1_000939.LAB	9:36	13.20	13.97	1.01	≤ 0.10	190.79	0.85	10.85
MILLOFF_R1_000940.LAB	9:37	13.55	13.85	0.97	≤ 0.10	190.81	0.85	10.85
MILLOFF_R1_000941.LAB	9:38	13.12	13.98	1.07	≤ 0.10	190.81	0.85	10.85
MILLOFF_R1_000942.LAB	9:39	12.79	14.02	1.08	≤ 0.10	190.83	0.85	10.85
MILLOFF_R1_000943.LAB	9:40	13.55	13.78	0.99	≤ 0.10	190.79	0.85	10.92
MILLOFF_R1_000944.LAB	9:41	13.25	13.89	1.01	≤ 0.10	190.74	0.85	10.95
MILLOFF_R1_000945.LAB	9:42	12.59	13.97	1.12	≤ 0.10	190.74	0.85	10.91
MILLOFF_R1_000946.LAB	9:43	14.04	13.63	0.76	≤ 0.10	190.77	0.85	10.96
MILLOFF_R1_000947.LAB	9:44	12.56	13.97	0.81	≤ 0.10	190.79	0.85	10.95
MILLOFF_R1_000948.LAB	9:45	13.64	13.88	1.02	≤ 0.10	190.84	0.85	10.92
MILLOFF_R1_000949.LAB	9:46	12.67	14.01	0.77	≤ 0.10	190.83	0.85	10.87
MILLOFF_R1_000950.LAB	9:47	13.35	13.95	1.08	≤ 0.10	190.84	0.85	10.88
MILLOFF_R1_000951.LAB	9:48	13.65	13.83	1.07	≤ 0.10	190.84	0.85	10.89
MILLOFF_R1_000952.LAB	9:49	12.54	13.95	0.79	≤ 0.10	190.97	0.85	10.95
MILLOFF_R1_000953.LAB	9:50	13.09	13.91	1.08	≤ 0.10	191.04	0.85	10.94
MILLOFF_R1_000954.LAB	9:51	13.34	13.90	1.09	≤ 0.10	190.93	0.85	10.98
MILLOFF_R1_000955.LAB	9:52	13.60	13.82	1.02	≤ 0.10	190.84	0.85	10.99
MILLOFF_R1_000956.LAB	9:53	12.83	13.95	1.04	≤ 0.10	190.84	0.85	11.01
MILLOFF_R1_000957.LAB	9:54	12.94	14.01	1.05	≤ 0.10	190.85	0.85	11.06
MILLOFF_R1_000958.LAB	9:55	13.77	14.02	1.02	≤ 0.10	190.84	0.85	11.02
MILLOFF_R1_000959.LAB	9:56	13.17	14.27	1.11	≤ 0.10	190.84	0.85	10.82
MILLOFF_R1_000960.LAB	9:57	13.28	14.02	0.99	≤ 0.10	190.79	0.85	10.58
MILLOFF_R1_000961.LAB	9:58	13.40	13.96	1.06	≤ 0.10	190.75	0.85	10.80
MILLOFF_R1_000962.LAB	9:59	13.02	14.07	1.07	≤ 0.10	190.72	0.85	10.89
MILLOFF_R1_000963.LAB	10:00	13.66	13.92	1.05	≤ 0.10	190.76	0.85	10.90
MILLOFF_R1_000964.LAB	10:01	13.07	14.07	1.14	≤ 0.10	190.78	0.85	10.89
MILLOFF_R1_000965.LAB	10:02	13.46	13.94	1.02	≤ 0.10	190.79	0.85	10.85
MILLOFF_R1_000966.LAB	10:03	13.07	14.00	1.08	≤ 0.10	190.83	0.85	10.80
MILLOFF_R1_000967.LAB	10:04	13.13	13.89	1.09	≤ 0.10	190.81	0.85	10.89
MILLOFF_R1_000968.LAB	10:05	13.17	14.07	1.04	≤ 0.10	190.76	0.85	10.95
MILLOFF_R1_000969.LAB	10:06	13.54	13.95	1.07	≤ 0.10	190.79	0.85	10.91
MILLOFF_R1_000970.LAB	10:07	13.59	13.87	0.79	≤ 0.10	190.81	0.85	10.80
MILLOFF_R1_000971.LAB	10:08	13.01	14.06	1.05	≤ 0.10	190.75	0.85	10.84
MILLOFF_R1_000972.LAB	10:09	13.36	14.11	1.01	≤ 0.10	190.73	0.85	10.87
MILLOFF_R1_000973.LAB	10:10	13.27	14.00	1.07	≤ 0.10	190.69	0.85	10.77
MILLOFF_R1_000974.LAB	10:11	13.10	13.87	1.09	≤ 0.10	190.70	0.85	10.73
MILLOFF_R1_000975.LAB	10:12	13.23	13.89	1.06	≤ 0.10	190.70	0.85	10.75
MILLOFF_R1_000976.LAB	10:13	13.53	13.99	1.14	≤ 0.10	190.73	0.85	10.91
MILLOFF_R1_000977.LAB	10:14	13.20	14.11	1.14	≤ 0.10	190.76	0.85	10.95
MILLOFF_R1_000978.LAB	10:15	13.71	14.08	1.00	≤ 0.10	190.82	0.85	10.84
MILLOFF_R1_000979.LAB	10:16	12.98	14.12	0.84	≤ 0.10	190.84	0.85	10.79
MILLOFF_R1_000980.LAB	10:17	13.60	13.87	0.84	≤ 0.10	190.84	0.85	10.73
MILLOFF_R1_000981.LAB	10:18	13.00	14.03	1.12	≤ 0.10	190.83	0.85	10.75
MILLOFF_R1_000982.LAB	10:19	13.11	14.00	1.13	≤ 0.10	190.84	0.85	10.84
MILLOFF_R1_000983.LAB	10:20	13.31	14.06	1.12	≤ 0.10	190.84	0.85	10.87
MILLOFF_R1_000984.LAB	10:21	13.57	14.06	1.11	≤ 0.10	190.81	0.85	10.82
MILLOFF_R1_000985.LAB	10:22	12.73	14.18	1.17	≤ 0.10	190.85	0.85	10.78
MILLOFF_R1_000986.LAB	10:23	13.89	13.84	0.81	≤ 0.10	190.87	0.85	10.75
MILLOFF_R1_000987.LAB	10:24	13.48	13.92	0.84	≤ 0.10	190.85	0.85	10.72
MILLOFF_R1_000988.LAB	10:25	13.22	13.88	1.10	≤ 0.10	190.81	0.85	10.82
MILLOFF_R1_000989.LAB	10:26	12.87	13.86	1.23	≤ 0.10	190.73	0.85	10.86
MILLOFF_R1_000990.LAB	10:27	13.30	13.98	1.14	≤ 0.10	190.72	0.85	10.90
MILLOFF_R1_000991.LAB	10:28	13.13	14.06	1.12	≤ 0.10	190.79	0.85	10.93
MILLOFF_R1_000992.LAB	10:29	13.04	14.09	1.09	≤ 0.10	190.86	0.85	10.99
Average		13.24	13.96	1.03	≤ 0.10	190.80	0.85	10.87

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/17/24

Run 2

Spectrum	Time	FTIR Data					Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw				
MILLOFF_R2_001084.LAB	11:05	13.74	13.9	1.09	≤ 0.10	2.8	0.95	10.78	
MILLOFF_R2_001085.LAB	11:06	13.03	14.1	1.20	≤ 0.10	2.8	0.94	10.74	
MILLOFF_R2_001086.LAB	11:07	13.05	14.2	1.13	≤ 0.10	2.8	0.91	10.70	
MILLOFF_R2_001087.LAB	11:08	13.49	14.1	1.03	≤ 0.10	2.8	0.90	10.64	
MILLOFF_R2_001088.LAB	11:09	13.43	14.1	1.05	≤ 0.10	2.8	0.86	10.70	
MILLOFF_R2_001089.LAB	11:10	13.20	14.1	1.07	≤ 0.10	2.8	0.88	10.72	
MILLOFF_R2_001090.LAB	11:11	13.11	14.2	1.05	≤ 0.10	2.7	0.89	10.72	
MILLOFF_R2_001091.LAB	11:12	13.96	14.1	0.74	≤ 0.10	2.7	0.84	10.62	
MILLOFF_R2_001092.LAB	11:13	13.03	14.0	0.81	≤ 0.10	2.7	0.83	10.73	
MILLOFF_R2_001093.LAB	11:14	13.19	14.0	1.05	≤ 0.10	2.6	0.83	10.81	
MILLOFF_R2_001094.LAB	11:15	13.17	14.0	1.01	≤ 0.10	2.6	0.92	10.93	
MILLOFF_R2_001095.LAB	11:16	13.45	14.0	0.96	≤ 0.10	2.6	0.96	10.84	
MILLOFF_R2_001096.LAB	11:17	12.97	14.1	1.03	≤ 0.10	2.7	0.92	10.93	
MILLOFF_R2_001097.LAB	11:18	13.70	14.2	1.07	≤ 0.10	3.1	0.87	10.61	
MILLOFF_R2_001098.LAB	11:19	13.75	13.9	0.80	≤ 0.10	2.8	0.85	10.66	
MILLOFF_R2_001099.LAB	11:20	12.89	14.1	0.71	≤ 0.10	2.8	0.85	10.78	
MILLOFF_R2_001100.LAB	11:21	13.39	14.0	1.04	≤ 0.10	2.8	0.83	10.73	
MILLOFF_R2_001101.LAB	11:22	13.29	14.2	1.05	≤ 0.10	2.9	0.83	10.80	
MILLOFF_R2_001102.LAB	11:23	13.43	14.2	1.07	≤ 0.10	3.0	0.85	10.64	
MILLOFF_R2_001103.LAB	11:24	13.61	14.1	0.77	≤ 0.10	3.3	0.84	10.68	
MILLOFF_R2_001104.LAB	11:25	13.18	14.3	1.05	≤ 0.10	3.1	0.88	10.65	
MILLOFF_R2_001105.LAB	11:26	13.61	14.1	0.99	≤ 0.10	2.8	0.90	10.58	
MILLOFF_R2_001106.LAB	11:27	13.41	14.1	0.97	≤ 0.10	2.7	0.91	10.67	
MILLOFF_R2_001107.LAB	11:28	13.08	14.1	1.00	≤ 0.10	2.6	0.90	10.73	
MILLOFF_R2_001108.LAB	11:29	13.58	14.0	0.95	≤ 0.10	2.6	0.91	10.77	
MILLOFF_R2_001109.LAB	11:30	12.93	14.1	0.98	≤ 0.10	2.6	0.78	10.78	
MILLOFF_R2_001110.LAB	11:31	13.23	14.1	1.02	≤ 0.10	2.7	0.85	10.78	
MILLOFF_R2_001111.LAB	11:32	13.38	14.0	1.04	≤ 0.10	2.7	0.82	10.72	
MILLOFF_R2_001112.LAB	11:33	13.49	14.0	0.99	≤ 0.10	2.6	0.83	10.81	
MILLOFF_R2_001113.LAB	11:34	13.48	14.2	0.98	≤ 0.10	2.7	0.91	10.84	
MILLOFF_R2_001114.LAB	11:35	13.57	14.2	1.03	≤ 0.10	2.9	0.87	10.77	
MILLOFF_R2_001115.LAB	11:36	13.31	14.2	1.04	≤ 0.10	2.8	0.91	10.64	
MILLOFF_R2_001116.LAB	11:37	12.82	14.2	1.09	≤ 0.10	2.8	0.88	10.70	
MILLOFF_R2_001117.LAB	11:38	13.45	14.1	1.03	≤ 0.10	2.7	0.84	10.72	
MILLOFF_R2_001118.LAB	11:39	13.08	14.2	1.06	≤ 0.10	2.6	0.83	10.79	
MILLOFF_R2_001119.LAB	11:40	13.70	14.2	0.72	≤ 0.10	2.8	0.82	10.85	
MILLOFF_R2_001120.LAB	11:41	13.55	14.2	1.14	≤ 0.10	2.8	0.82	10.76	
MILLOFF_R2_001121.LAB	11:42	13.50	14.1	0.98	≤ 0.10	2.6	0.78	10.68	
MILLOFF_R2_001122.LAB	11:43	12.82	14.1	1.05	≤ 0.10	2.7	0.90	10.69	
MILLOFF_R2_001123.LAB	11:44	14.07	13.9	0.98	≤ 0.10	2.7	0.96	10.79	
MILLOFF_R2_001124.LAB	11:45	12.83	14.1	0.76	≤ 0.10	2.7	0.87	10.81	
MILLOFF_R2_001125.LAB	11:46	13.00	14.1	1.06	≤ 0.10	2.7	0.88	10.81	
MILLOFF_R2_001126.LAB	11:47	13.06	14.0	1.03	≤ 0.10	2.7	0.87	10.78	
MILLOFF_R2_001127.LAB	11:48	13.28	14.0	1.00	≤ 0.10	2.7	0.88	10.76	
MILLOFF_R2_001128.LAB	11:49	13.14	14.0	1.06	≤ 0.10	2.7	0.84	10.83	
MILLOFF_R2_001129.LAB	11:50	13.53	14.0	1.08	≤ 0.10	2.7	0.84	10.81	
MILLOFF_R2_001130.LAB	11:51	13.03	14.0	1.08	≤ 0.10	2.7	0.84	10.81	
MILLOFF_R2_001131.LAB	11:52	12.96	14.1	1.02	≤ 0.10	2.7	0.88	10.77	
MILLOFF_R2_001132.LAB	11:53	13.70	13.9	1.00	≤ 0.10	2.6	0.89	10.85	
MILLOFF_R2_001133.LAB	11:54	13.55	13.7	0.73	≤ 0.10	2.6	0.94	10.81	
MILLOFF_R2_001134.LAB	11:55	12.88	13.9	1.12	≤ 0.10	2.6	0.93	10.79	
MILLOFF_R2_001135.LAB	11:56	13.18	13.8	1.00	≤ 0.10	2.5	0.86	11.05	
MILLOFF_R2_001136.LAB	11:57	13.38	13.9	1.10	≤ 0.10	2.5	0.79	11.06	
MILLOFF_R2_001137.LAB	11:58	13.61	14.3	1.08	≤ 0.10	3.0	0.79	11.13	
MILLOFF_R2_001138.LAB	11:59	13.33	14.8	1.15	≤ 0.10	3.2	0.79	11.06	
MILLOFF_R2_001139.LAB	12:00	13.85	14.0	0.76	≤ 0.10	2.7	0.77	10.80	
MILLOFF_R2_001140.LAB	12:01	13.41	13.9	1.01	≤ 0.10	2.7	0.92	10.29	
MILLOFF_R2_001141.LAB	12:02	13.39	13.9	1.06	≤ 0.10	2.6	0.90	10.52	
MILLOFF_R2_001142.LAB	12:03	12.96	14.0	1.11	≤ 0.10	2.7	0.88	10.82	
MILLOFF_R2_001143.LAB	12:04	13.18	13.9	1.12	≤ 0.10	2.6	0.84	10.93	
Average		13.33	14.07	1.00	≤ 0.10	2.75	0.87	10.76	

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Test Location: Main Kiln Stack
 Date: 1/17/24



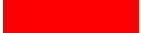
Run 3




Spectrum	Time	FTIR Data				HF ppmvw	Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmvw					
MILLOFF_R3_001215.LAB	12:40	13.15	14.2	1.13	≤ 0.10	190.68	0.85	10.71	
MILLOFF_R3_001216.LAB	12:41	13.14	14.1	1.07	≤ 0.10	190.66	0.85	10.72	
MILLOFF_R3_001217.LAB	12:42	13.17	14.0	1.09	≤ 0.10	190.71	0.85	10.80	
MILLOFF_R3_001218.LAB	12:43	13.29	13.9	1.11	≤ 0.10	190.82	0.85	10.90	
MILLOFF_R3_001219.LAB	12:44	13.26	14.1	1.07	≤ 0.10	190.84	0.85	10.85	
MILLOFF_R3_001220.LAB	12:45	12.61	14.2	1.13	≤ 0.10	190.84	0.85	10.80	
MILLOFF_R3_001221.LAB	12:46	13.39	14.1	1.01	≤ 0.10	190.85	0.85	10.84	
MILLOFF_R3_001222.LAB	12:47	13.00	14.0	1.10	≤ 0.10	190.87	0.85	10.79	
MILLOFF_R3_001223.LAB	12:48	13.02	14.1	1.06	≤ 0.10	190.85	0.85	10.79	
MILLOFF_R3_001224.LAB	12:49	13.01	14.0	1.01	≤ 0.10	190.84	0.85	10.83	
MILLOFF_R3_001225.LAB	12:50	12.96	14.1	1.10	≤ 0.10	190.68	0.85	10.82	
MILLOFF_R3_001226.LAB	12:51	12.82	14.1	1.00	≤ 0.10	190.64	0.85	10.78	
MILLOFF_R3_001227.LAB	12:52	13.07	14.2	1.11	≤ 0.10	190.66	0.85	10.83	
MILLOFF_R3_001228.LAB	12:53	12.39	14.2	1.07	≤ 0.10	190.66	0.85	10.76	
MILLOFF_R3_001229.LAB	12:54	13.76	13.9	0.99	≤ 0.10	190.59	0.85	10.82	
MILLOFF_R3_001230.LAB	12:55	12.43	14.2	0.71	≤ 0.10	190.58	0.85	10.84	
MILLOFF_R3_001231.LAB	12:56	13.17	14.0	1.06	≤ 0.10	190.62	0.85	10.84	
MILLOFF_R3_001232.LAB	12:57	13.65	14.0	0.96	≤ 0.10	190.65	0.85	10.83	
MILLOFF_R3_001233.LAB	12:58	12.49	14.2	1.06	≤ 0.10	190.64	0.85	10.81	
MILLOFF_R3_001234.LAB	12:59	13.20	14.1	1.05	≤ 0.10	190.57	0.85	10.76	
MILLOFF_R3_001235.LAB	13:00	13.71	14.0	0.96	≤ 0.10	190.67	0.85	10.76	
MILLOFF_R3_001236.LAB	13:01	12.50	14.3	0.70	≤ 0.10	190.59	0.85	10.82	
MILLOFF_R3_001237.LAB	13:02	13.59	14.2	0.95	≤ 0.10	190.49	0.85	10.69	
MILLOFF_R3_001238.LAB	13:03	12.93	14.4	1.03	≤ 0.10	190.42	0.85	10.69	
MILLOFF_R3_001239.LAB	13:04	13.57	14.1	0.90	≤ 0.10	190.45	0.85	10.64	
MILLOFF_R3_001240.LAB	13:05	13.48	14.0	0.95	≤ 0.10	190.52	0.85	10.67	
MILLOFF_R3_001241.LAB	13:06	12.93	13.9	0.96	≤ 0.10	190.53	0.85	10.75	
MILLOFF_R3_001242.LAB	13:07	13.24	14.0	0.96	≤ 0.10	190.53	0.85	10.83	
MILLOFF_R3_001243.LAB	13:08	13.60	14.0	0.95	≤ 0.10	190.54	0.85	10.86	
MILLOFF_R3_001244.LAB	13:09	13.26	14.0	0.95	≤ 0.10	190.54	0.85	10.78	
MILLOFF_R3_001245.LAB	13:10	13.23	14.2	1.00	≤ 0.10	190.54	0.85	10.86	
MILLOFF_R3_001246.LAB	13:11	12.94	14.1	1.03	≤ 0.10	190.55	0.85	10.84	
MILLOFF_R3_001247.LAB	13:12	13.59	14.1	1.05	≤ 0.10	190.55	0.85	10.78	
MILLOFF_R3_001248.LAB	13:13	13.20	14.3	0.99	≤ 0.10	190.69	0.85	10.79	
MILLOFF_R3_001249.LAB	13:14	13.35	14.3	1.04	≤ 0.10	190.67	0.85	10.70	
MILLOFF_R3_001250.LAB	13:15	13.08	14.3	1.02	≤ 0.10	190.66	0.85	10.66	
MILLOFF_R3_001251.LAB	13:16	13.50	14.2	0.90	≤ 0.10	190.67	0.85	10.65	
MILLOFF_R3_001252.LAB	13:17	13.32	14.2	1.02	≤ 0.10	190.73	0.85	10.69	
MILLOFF_R3_001253.LAB	13:18	13.05	14.0	0.96	≤ 0.10	190.94	0.85	10.68	
MILLOFF_R3_001254.LAB	13:19	13.28	14.0	1.02	≤ 0.10	191.22	0.85	10.71	
MILLOFF_R3_001255.LAB	13:20	13.38	14.2	1.11	≤ 0.10	191.35	0.85	10.80	
MILLOFF_R3_001256.LAB	13:21	13.53	14.5	1.01	≤ 0.10	191.36	0.85	10.94	
MILLOFF_R3_001257.LAB	13:22	13.54	14.4	1.04	≤ 0.10	191.39	0.85	10.88	
MILLOFF_R3_001258.LAB	13:23	13.04	14.2	0.95	≤ 0.10	191.43	0.85	10.57	
MILLOFF_R3_001259.LAB	13:24	13.53	14.1	0.95	≤ 0.10	191.38	0.85	10.55	
MILLOFF_R3_001260.LAB	13:25	13.05	14.0	1.01	≤ 0.10	191.32	0.85	10.66	
MILLOFF_R3_001261.LAB	13:26	13.34	14.1	0.99	≤ 0.10	191.28	0.85	10.81	
MILLOFF_R3_001262.LAB	13:27	13.43	14.3	1.05	≤ 0.10	191.26	0.85	10.79	
MILLOFF_R3_001263.LAB	13:28	13.48	14.2	1.00	≤ 0.10	191.09	0.85	10.89	
MILLOFF_R3_001264.LAB	13:29	13.09	14.3	0.95	≤ 0.10	190.74	0.85	10.76	
MILLOFF_R3_001265.LAB	13:30	13.07	14.3	0.97	≤ 0.10	190.52	0.85	10.70	
MILLOFF_R3_001266.LAB	13:31	13.07	14.2	0.97	≤ 0.10	190.35	0.85	10.70	
MILLOFF_R3_001267.LAB	13:32	13.59	14.1	0.98	≤ 0.10	190.34	0.85	10.65	
MILLOFF_R3_001268.LAB	13:33	13.04	14.3	1.01	≤ 0.10	190.33	0.85	10.67	
MILLOFF_R3_001269.LAB	13:34	13.01	14.2	1.03	≤ 0.10	190.33	0.85	10.74	
MILLOFF_R3_001270.LAB	13:35	13.13	14.1	0.93	≤ 0.10	190.28	0.85	10.77	
MILLOFF_R3_001271.LAB	13:36	13.11	14.2	1.00	≤ 0.10	190.33	0.85	10.66	
MILLOFF_R3_001272.LAB	13:37	13.34	14.2	0.92	≤ 0.10	190.33	0.85	10.72	
MILLOFF_R3_001273.LAB	13:38	12.70	14.1	0.94	≤ 0.10	190.34	0.85	10.76	
MILLOFF_R3_001274.LAB	13:39	13.33	14.1	0.84	≤ 0.10	190.38	0.85	10.76	
Average		13.18	14.14	1.00	≤ 0.10	190.71	0.85	10.76	

Stratification Test Results Summary
Ash Grove Cement Company
Leamington Cement Plant
Main Kiln Stack
January 16, 2024

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

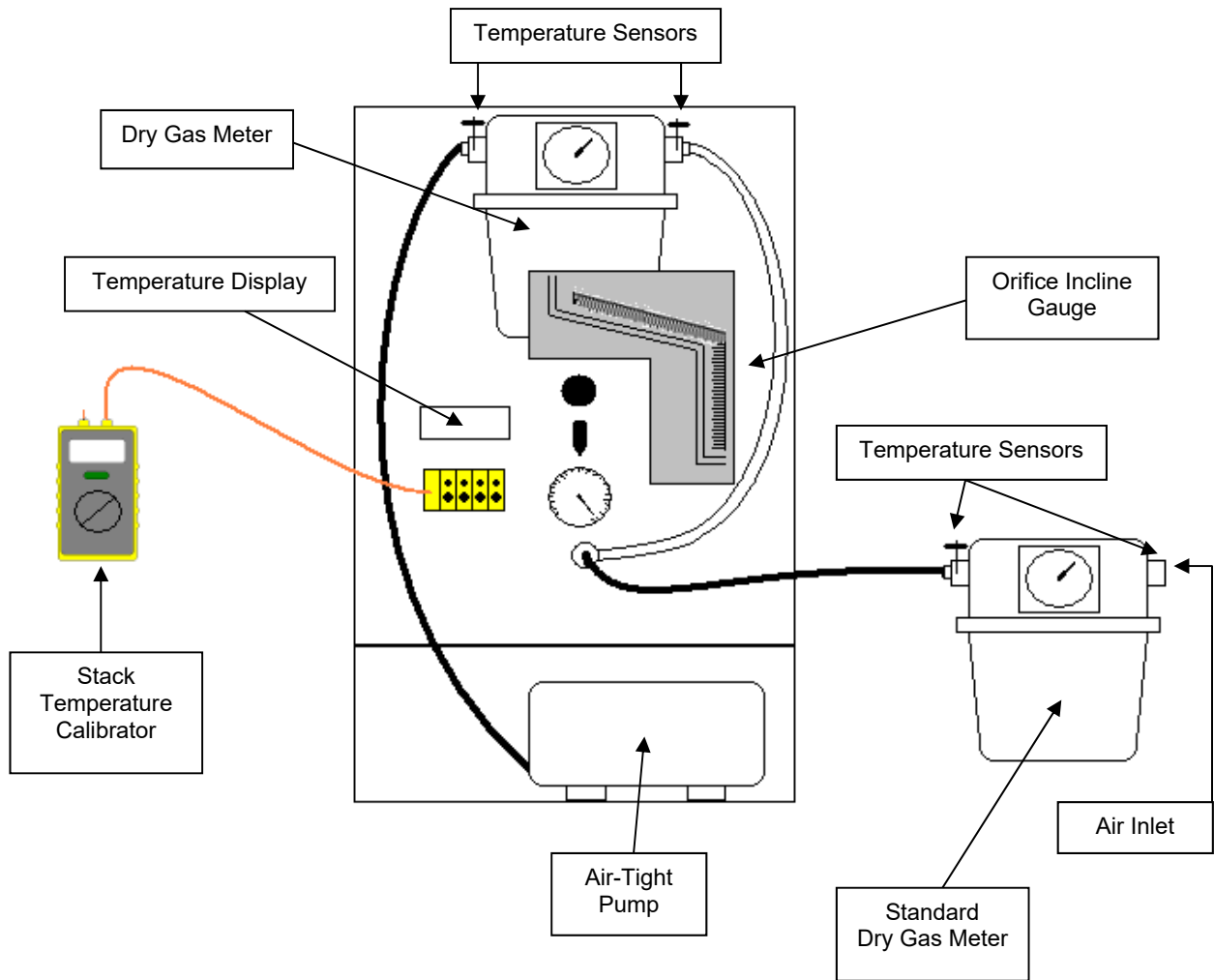
Port No.	Point No.	Time	O ₂ %	Actual % Difference O ₂ %	Mean Difference O ₂ %
1	1	9:12	12.25	0.08	0.01
	2	9:20	12.14	0.82	0.10
	3	9:25	12.33	0.74	0.09
Average			12.24		

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 O₂ 
Twelve point traverse (Method 1 points) >0.5% mean difference for O₂ 

Appendix G - Calibration Data

Dry Gas Meter/Control Module Calibration Diagram



Meter Box Calibration

Dry Gas Meter Calibration Data

Dry Gas Meter No. CM23
 Standard Meter No. 18654530
 Standard Meter (Y) 0.99730

Date: October 26, 2023
 Calibrated By: ER
 Barometric Pressure: 28.01

Run Number	Orifice Setting in H ₂ O 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		80.713	50.815	70	73	73					
Initial		75.708	45.760	70	71	71					
Difference	1 0.20	5.005	5.055	70	72	72	72	18	25	0.991	1.635
Final		85.747	55.885	70	75	75					
Initial		80.713	50.815	70	73	73					
Difference	2 0.50	5.034	5.070	70	74	74	74	12	15	0.996	1.781
Final		90.789	60.960	70	75	75					
Initial		85.747	55.885	70	75	75					
Difference	3 0.70	5.042	5.075	70	75	75	75	10	25	0.998	1.794
Final		95.885	65.984	70	75	75					
Initial		90.789	60.960	70	75	75					
Difference	4 0.90	5.096	5.024	70	75	75	75	9	15	1.019	1.780
Final		100.892	71.025								
Initial		95.885	65.984	70	75	75					
Difference	5 1.20	5.007	5.041	70	75	75	75	8	15	0.997	1.956
Final		75.708	45.760	70	71	71					
Initial		70.675	40.735	70	71	71					
Difference	6 2.00	5.033	5.025	70	71	71	71	6	8	0.996	1.797

Average 0.999 1.790

Stack Temperature Sensor Calibration			
Temperature ID :	100769	Name :	ER
Ambient Temperature, °F :	71.9	Date :	10/26/2023

Temperature Calibrator			
Model # :	CL23A	Certification Date:	May 1,2023
Serial # :	T-285668	Expiration Date:	May 2,2024

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	251	0.1
600	601	0.1
1200	1205	0.3

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

Meter Box Calibration

Dry Gas Meter Calibration Data

Dry Gas Meter No. CM54
 Standard Meter No. 18654530
 Standard Meter (Y) 0.99730

Date: December 1, 2023
 Calibrated By: ER
 Barometric Pressure: 28.09

Run Number	Orifice Setting in H ₂ O 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		85.075	50.792	63	62	62					
Initial		80.075	45.760	62	61	61					
Difference	1 0.20	5.000	5.032	63	62	62	62	18	10	0.989	1.576
Final		90.083	55.842	63	64	64					
Initial		85.075	50.792	63	62	62					
Difference	2 0.50	5.008	5.050	63	63	63	63	12	5	0.988	1.736
Final		95.085	60.901	64	65	65					
Initial		90.083	55.842	63	64	64					
Difference	3 0.70	5.002	5.059	64	65	65	65	10	0	0.986	1.667
Final		100.343	66.210	64	66	66					
Initial		95.085	60.901	64	65	65					
Difference	4 0.90	5.258	5.309	64	66	66	66	9	15	0.988	1.659
Final		105.348	71.269	64	67	67					
Initial		100.343	66.210	64	66	66					
Difference	5 1.20	5.005	5.059	64	67	67	67	8	0	0.988	1.823
Final		80.075	45.760	62	61	61					
Initial		75.060	40.748	61	61	61					
Difference	6 2.00	5.015	5.012	62	61	61	61	6	0	0.992	1.704

Average 0.988 1.694

Stack Temperature Sensor Calibration

Meter Box # : CM54 Name : ER

Ambient Temperature : 63.5 °F Date : December 1, 2023

Calibrator Model # : CL940

Serial # : 526

Date Of Certification : December 28, 2022

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	1	0.2
250	252	0.3
600	602	0.2
1200	1205	0.3

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

Ref. Temp., °F + 460

Meter Box Calibration

Dry Gas Meter Calibration Data

Dry Gas Meter No. CM54
 Standard Meter No. 18654530
 Standard Meter (Y) 0.99730

Date: February 9, 2024
 Calibrated By: ER
 Barometric Pressure: 28.12

Run Number	Orifice Setting in H ₂ O 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		82.665	56.678	67	67	66					
Initial		77.610	51.623	67	67	65					
Difference	1 0.20	5.055	5.055	67	67	66	66	18	45	0.995	1.654
Final		77.610	51.623	67	67	65					
Initial		72.585	46.533	66	67	65					
Difference	2 0.50	5.025	5.090	67	67	65	66	12	0	0.982	1.712
Final		72.585	46.533	66	67	65					
Initial		67.500	41.410	66	66	65					
Difference	3 0.70	5.085	5.123	66	67	65	66	10	30	0.988	1.789
Final		67.500	41.410	66	66	65					
Initial		62.490	36.388	65	66	65					
Difference	4 0.90	5.010	5.022	66	66	65	66	9	0	0.993	1.738
Final		62.490	36.388	65	67	64					
Initial		57.412	31.312	65	66	63					
Difference	5 1.20	5.078	5.076	65	67	64	65	8	0	0.995	1.781
Final		57.412	31.312	65	65	63					
Initial		52.360	26.221	64	64	63					
Difference	6 2.00	5.052	5.091	65	65	63	64	6	10	0.983	1.783

Average **0.989** **1.743**

Stack Temperature Sensor Calibration

Meter Box # : CM54 Name : ER

Ambient Temperature : 65 °F Date : February 9, 2024

Calibrator Model # : CL23A

Serial # : T-285668

Date Of Certification : May 1, 2023

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	251	0.1
600	602	0.2
1200	1203	0.2

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

Ref. Temp., °F + 460

Meter Box Calibration

Dry Gas Meter Calibration Data

Dry Gas Meter No. CM23
 Standard Meter No. 18654530
 Standard Meter (Y) 0.99730

Date: February 9, 2024
 Calibrated By: ER
 Barometric Pressure: 28.12

Run Number	Orifice Setting in H ₂ O 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		73.745	92.486	71	72	70					
Initial		68.700	87.420	70	71	70					
Difference	1 0.20	5.045	5.066	71	72	70	71	18	45	0.993	1.668
Final		68.700	87.420	71	71	70					
Initial		63.664	82.333	70	71	70					
Difference	2 0.50	5.036	5.087	71	71	70	71	12	10	0.986	1.763
Final		63.664	82.333	70	71	70					
Initial		58.611	77.295	70	70	70					
Difference	3 0.70	5.053	5.038	70	71	70	70	10	15	0.999	1.738
Final		58.611	77.295	69	70	70					
Initial		53.577	72.250	68	70	70					
Difference	4 0.90	5.034	5.045	69	70	70	70	9	5	0.996	1.759
Final		53.577	72.250	68	70	70					
Initial		48.520	67.212	68	68	69					
Difference	5 1.20	5.057	5.038	68	69	70	69	8	0	1.000	1.802
Final		48.520	67.212	68	68	69					
Initial		43.480	62.185	67	68	68					
Difference	6 2.00	5.040	5.027	68	68	69	68	6	0	0.996	1.701

Average **0.995** **1.738**

Stack Temperature Sensor Calibration			
Temperature ID :	100769	Name :	ER
Ambient Temperature, °F :	71.9	Date :	2/9/2024

Temperature Calibrator			
Model # :	CL23A	Certification Date:	May 1, 2023
Serial # :	T-285668	Expiration Date:	May 2, 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	251	0.1
600	600	0.0
1200	1202	0.1

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



Airflow Sciences Corporation

Probe Calibration for Method 2

Wind Tunnel Facility: Airflow Sciences Corporation
 Wind Tunnel Location: Livonia, MI
 Probe Type: S-Type Pitot
 Probe ID: S8-031-A
 Probe Calibration Date: 07/10/17
 Test Point Location: center
 Ambient Temperature (°F): 77.8
 Barometric Pressure ("Hg): 29.23

Repetition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (°)	
1	60	0.81	77.8	1.18	0	0.82
2	60	0.80	77.8	1.18	0	0.82
3	60	0.81	77.8	1.18	0	0.82
Average (C _{p(avg-low)})						0.82

Repetition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (deg)	
1	90	1.81	77.8	2.63	0	0.82
2	90	1.81	77.8	2.62	0	0.82
3	90	1.81	77.8	2.63	0	0.82
Average (C _{p(avg-high)})						0.82

$$\% \text{ Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.49\%}} \quad \text{Pass}$$

Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.820



Airflow Sciences Corporation

Probe Calibration for Method 2

Wind Tunnel Facility: Airflow Sciences Corporation
 Wind Tunnel Location: Livonia, MI
 Probe Type: S-Type Pitot
 Probe ID: S8-031-B
 Probe Calibration Date: 07/10/17
 Test Point Location: center
 Ambient Temperature (°F): 77.5
 Barometric Pressure ("Hg): 29.23

Repetition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (°)	
1	60	0.81	77.5	1.19	0	0.82
2	60	0.81	77.5	1.19	0	0.82
3	60	0.81	77.5	1.19	0	0.82
Average (C _{p(avg-low)})						0.82

Repetition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (deg)	
1	90	1.81	77.5	2.65	0	0.82
2	90	1.81	77.5	2.64	0	0.82
3	90	1.81	77.5	2.64	0	0.82
Average (C _{p(avg-high)})						0.82

$$\% \text{ Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.55\%}} \quad \text{Pass}$$

Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.818



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 6/8/2017
 Temperature (°F): 72.2
 Pressure ("Hg): 29.33
 Personnel: wgj
 Probe: S8-031-A

Wind Tunnel Target DP [I.W.C]	Wind Tunnel Actual DP [I.W.C]	S-Probe DP [I.W.C.]	C _p	C _{p(avg)}	C _p -C _{p(avg)}	σ _{max}	
0.81	0.81	1.19	0.818	0.818	0.000	0.001	Pass
0.81	0.81	1.19	0.818		0.000		
0.81	0.81	1.19	0.817		-0.001		
1.81	1.82	2.63	0.823	0.822	0.001	0.001	Pass
1.81	1.82	2.64	0.822		0.000		
1.81	1.81	2.64	0.820		-0.001		



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 6/8/2017
 Temperature (°F): 72.0
 Pressure ("Hg): 29.33
 Personnel: wgj
 Probe: S8-031-B

Wind Tunnel Target DP [I.W.C]	Wind Tunnel Actual DP [I.W.C]	S-Probe DP [I.W.C.]	C_p	$C_{p(avg)}$	$C_p - C_{p(avg)}$	σ_{max}	
0.81	0.81	1.19	0.817	0.816	0.000	0.001	Pass
0.81	0.81	1.19	0.817		0.000		
0.81	0.81	1.19	0.816		-0.001		
1.81	1.82	2.65	0.820	0.820	0.000	0.000	Pass
1.81	1.82	2.65	0.820		0.000		
1.81	1.82	2.64	0.820		0.000		



Airflow Sciences Corporation

Probe Calibration for Method 2

Wind Tunnel Facility: Airflow Sciences Corporation
 Wind Tunnel Location: Livonia, MI
 Probe Type: S-Type Pitot
 Probe ID: S8-031-A
 Probe Calibration Date: 06/08/17
 Test Point Location: center
 Ambient Temperature (°F): 72.2
 Barometric Pressure ("Hg): 29.33

Repetition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (°)	
1	60	0.81	72.2	1.19	0	0.82
2	60	0.81	72.2	1.19	0	0.82
3	60	0.81	72.2	1.19	0	0.82
Average (C _{p(avg-low)})						0.82

Repetition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (deg)	
1	90	1.82	72.2	2.63	0	0.82
2	90	1.82	72.2	2.64	0	0.82
3	90	1.81	72.2	2.64	0	0.82
Average (C _{p(avg-high)})						0.82

$$\% \text{ Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.51\%}} \quad \text{Pass}$$

Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3%.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.820



Airflow Sciences Corporation

Probe Calibration for Method 2

Wind Tunnel Facility: Airflow Sciences Corporation
 Wind Tunnel Location: Livonia, MI
 Probe Type: S-Type Pitot
 Probe ID: S8-031-B
 Probe Calibration Date: 06/08/17
 Test Point Location: center
 Ambient Temperature (°F): 72.0
 Barometric Pressure ("Hg): 29.33

Repetition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (°)	
1	60	0.81	72.0	1.19	0	0.82
2	60	0.81	72.0	1.19	0	0.82
3	60	0.81	72.0	1.19	0	0.82
Average (C _{p(avg-low)})						0.82

Repetition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (deg)	
1	90	1.82	72.0	2.65	0	0.82
2	90	1.82	72.0	2.65	0	0.82
3	90	1.82	72.0	2.64	0	0.82
Average (C _{p(avg-high)})						0.82

$$\% \text{ Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.45\%}} \quad \text{Pass}$$

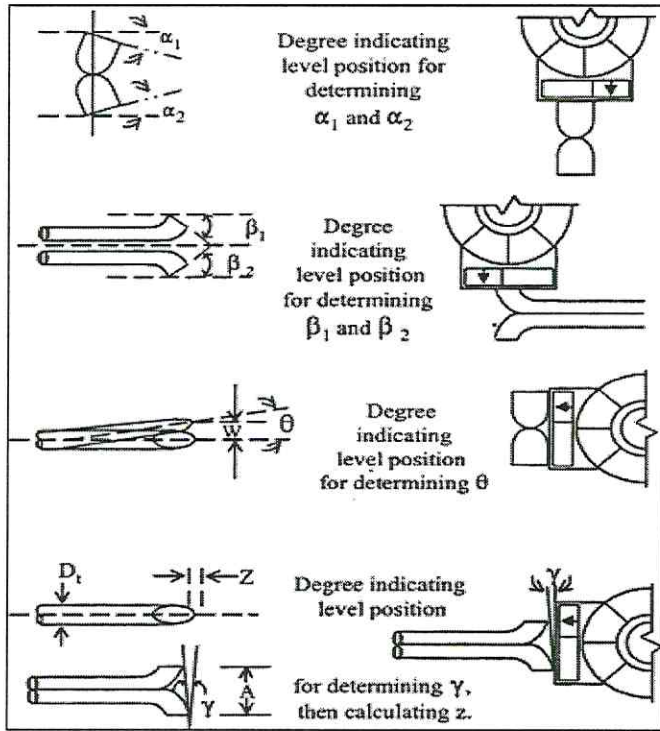
Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.818

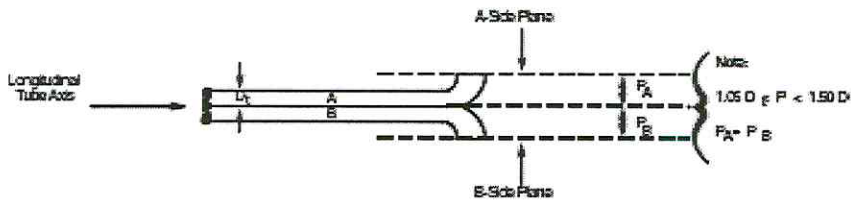


Airflow Sciences Corporation

Probe Inspection for Method 2



α_1	0.8 (°)	Pass
α_2	0.3 (°)	Pass
β_1	0.3 (°)	Pass
β_2	1.1 (°)	Pass
D_t	0.375 (")	Pass
P_a	0.459 (")	Pass
P_b	0.459 (")	Pass
z	<0.02 (")	Pass
w	0.005 (")	Pass



Certification

I certify that Type S probe ID **S8-031** meets or exceeds all specifications, criteria, and applicable design features.

Certified by: Craig Rood

Date: 6/8/2017



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 8/31/2017
Temperature (°F): 73.7
Pressure ("Hg): 29.43
Personnel: wgj
Probe: S8-032-A

Wind Tunnel Target DP [I.W.C.]	Wind Tunnel Actual DP [I.W.C.]	S-Probe DP [I.W.C.]	C _p	C _{p(avg)}	C _p -C _{p(avg)}	σ _{max}	
0.81	0.81	1.18	0.820	0.821	0.000	0.000	Pass
0.81	0.81	1.18	0.821		0.000		
0.81	0.81	1.18	0.821		0.000		
1.81	1.82	2.62	0.825	0.824	0.000	0.000	Pass
1.81	1.82	2.63	0.824		0.000		
1.81	1.82	2.63	0.824		0.000		



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 8/31/2017
 Temperature (°F): 74.5
 Pressure ("Hg): 29.43
 Personnel: wgj
 Probe: S8-032-B

Wind Tunnel Target DP [I.W.C.]	Wind Tunnel Actual DP [I.W.C.]	S-Probe DP [I.W.C.]	C _p	C _{p(avg)}	C _p -C _{p(avg)}	σ _{max}	
0.81	0.81	1.19	0.819	0.819	0.000	0.000	Pass
0.81	0.81	1.19	0.819		0.000		
0.81	0.81	1.19	0.820		0.000		
1.81	1.81	2.63	0.823	0.823	0.000	0.000	Pass
1.81	1.82	2.63	0.823		0.000		
1.81	1.82	2.63	0.823		0.000		



Airflow Sciences Corporation

Probe Calibration for Method 2

Wind Tunnel Facility: Airflow Sciences Corporation
 Wind Tunnel Location: Livonia, MI
 Probe Type: S-Type Pitot
 Probe ID: S8-032-A
 Probe Calibration Date: 08/31/17
 Test Point Location: center
 Ambient Temperature (°F): 73.7
 Barometric Pressure ("Hg): 29.43

Repetition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (°)	
1	60	0.81	73.7	1.18	0	0.82
2	60	0.81	73.7	1.18	0	0.82
3	60	0.81	73.7	1.18	0	0.82
Average (C _{p(avg-low)})						0.82

Repetition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (deg)	
1	90	1.82	73.7	2.62	0	0.82
2	90	1.82	73.7	2.63	0	0.82
3	90	1.82	73.7	2.63	0	0.82
Average (C _{p(avg-high)})						0.82

$$\% \text{ Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.46\%}} \quad \text{Pass}$$

Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.822

Airflow Sciences Corporation

Probe Calibration for Method 2

Wind Tunnel Facility: Airflow Sciences Corporation
Wind Tunnel Location: Livonia, MI
Probe Type: S-Type Pitot
Probe ID: S8-032-B
Probe Calibration Date: 08/31/17
Test Point Location: center
Ambient Temperature (°F): 74.5
Barometric Pressure ("Hg): 29.43

Repetition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (°)	
1	60	0.81	74.5	1.19	0	0.82
2	60	0.81	74.5	1.19	0	0.82
3	60	0.81	74.5	1.19	0	0.82
Average (C _{p(avg-low)})						0.82

Repetition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C _p
		DP _{std} ("H ₂ O)	Temperature (°F)	DP ("H ₂ O)	Yaw Angle (deg)	
1	90	1.81	74.5	2.63	0	0.82
2	90	1.82	74.5	2.63	0	0.82
3	90	1.82	74.5	2.63	0	0.82
Average (C _{p(avg-high)})						0.82

$$\text{\% Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.43\%}} \quad \text{Pass}$$

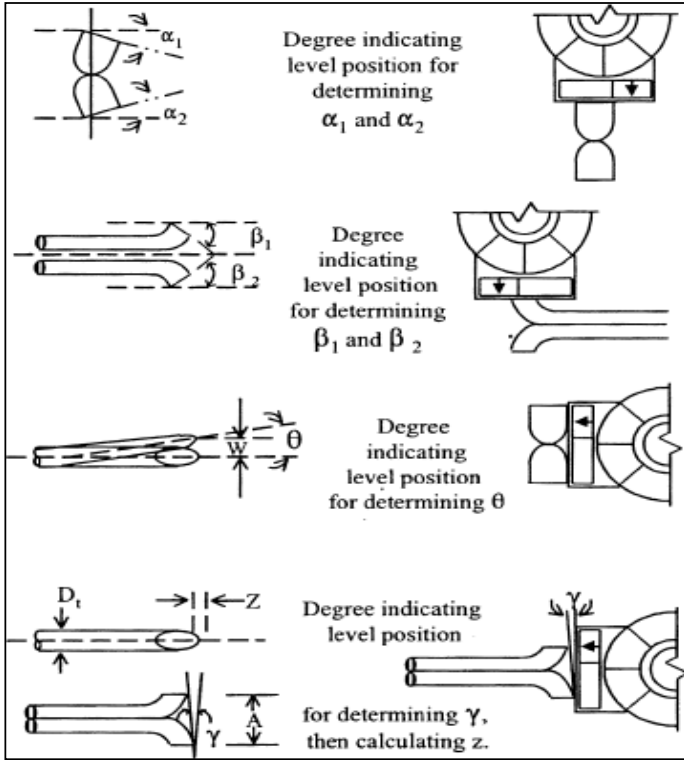
Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.821

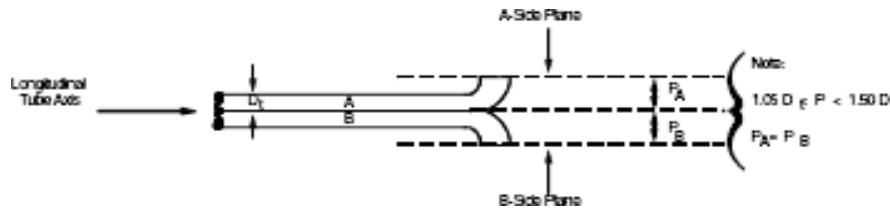


Airflow Sciences Corporation

Probe Inspection for Method 2



α_1	1.1 (°)	Pass
α_2	1.8 (°)	Pass
β_1	1.0 (°)	Pass
β_2	1.5 (°)	Pass
D_t	0.375 (")	Pass
P_a	0.481 (")	Pass
P_b	0.481 (")	Pass
z	<0.02 (")	Pass
w	0.008 (")	Pass



Certification

I certify that Type S probe ID **S8-032** meets or exceeds all specifications, criteria, and applicable design features.

Certified by: wgj

Date: 8/31/2017

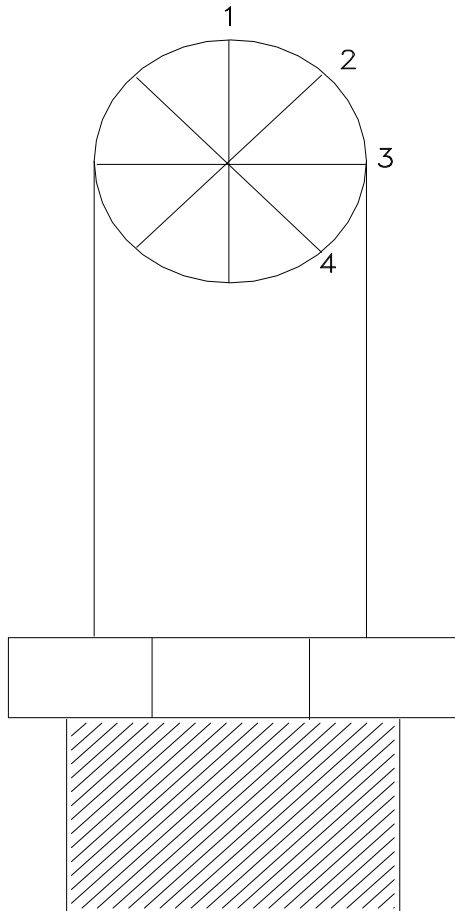
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 954

Analyst: RB

Material/Type: Glass



0.251	1
0.251	2
0.251	3
0.250	4

Valid Data

Average
<u>0.251</u>

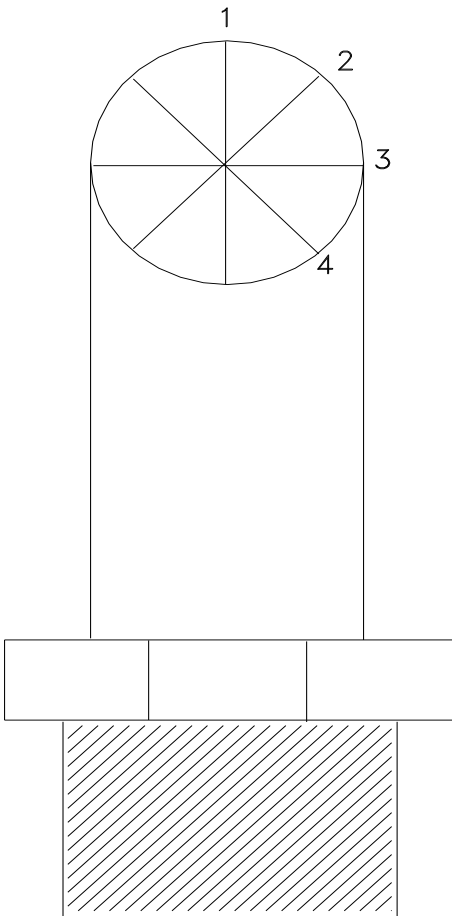
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 320

Analyst: RB

Material/Type: Quartz



0.313 1

0.313 2

0.313 3

0.314 4

Valid Data

Average

0.313

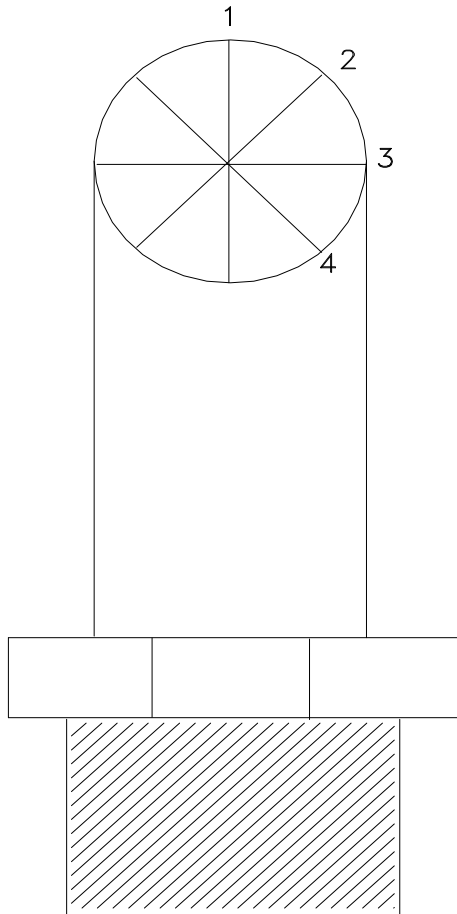
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 321

Analyst: RB

Material/Type: Quartz



0.276	1
0.276	2
0.276	3
0.277	4

Valid Data

Average
<u>0.276</u>

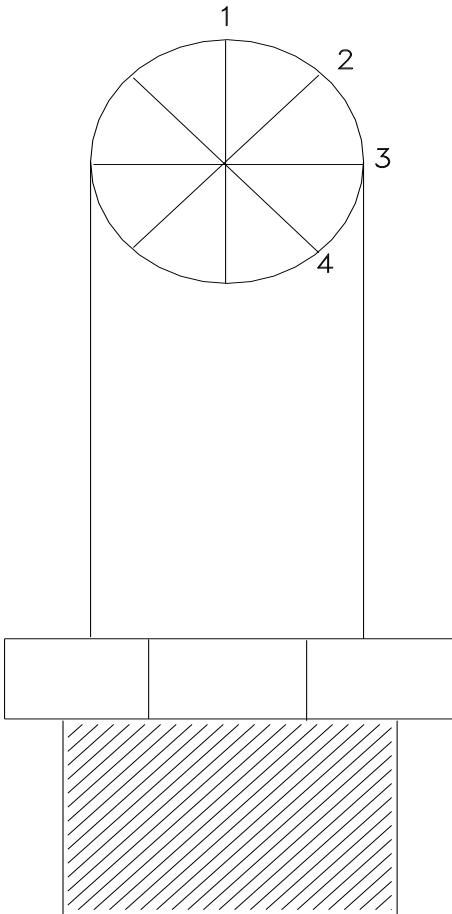
Nozzle Calibration

Date: 10/10/2023

Nozzle ID No.: 53A

Analyst: SWK

Material/Type: S.S.



0.319	1
0.318	2
0.318	3
0.319	4

Valid Data

Average
0.319

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Project #: M234904
Test Location: Main Kiln Stack
Date: 1/16/2024
Operator: RICHES
Operating Condition: Mill On

Sample System: FTIR
Probe Length: 8.0 ft
Probe Type: FTIR
Sample Plane: Horizontal
Port Length: 7 in.
Port Size (diameter): 2 in.
Port Type: Flange
Duct Shape: Circular
Diameter: 11 ft
Duct Area: 95.03 Sq. Ft.
Upstream Diameters: 4.10
Downstream Diameters: 5.50
Number of Ports Sampled: 1
Number of Points per Port: 1
Total Number of Traverse Points: 1

Minimum Upstream Distance: 5.5 Feet
 Minimum Downstream Distance: 22.0 Feet
 Ideal Upstream Distance: 22.0 Feet
 Ideal Downstream Distance: 88.0 Feet

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder	Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	-0.03	0.14%	N/A		1500
	Mid	CC195925	12.04	12.10	-0.27%	4/24/2031	54.43%	1000
	High	CC308342	22.12	22.23	-0.50%	5/25/2031		800

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	Nitrogen	Zero Nitrogen	0.0	N/A	1500
Calibration Transfer Standard	Ethylene	AAL072815	101.4	9/5/2031	1000
Analyte Spike Gas	HCN	CC768241	49.55	3/11/2024	1400
	SF6		5.001		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAL 700	2211018	25	22.12
HF ppmvw	MKS 2030	110161896	10	N/A
HCN ppmvw	MKS 2030	110161896	200	N/A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Project #: M234904
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 1/16/24
Operator: RICHS
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	12.04	12.14	12.11	0.03	0.09	0.06	12.13	12.38	12.3	-0.05	-0.14	-0.54	0.27
2	12.04	12.11	12.16	0.09	0.07	0.08	12.14	12.40	12.3	-0.27	0.23	-0.45	-0.09
3	12.04	12.16	12.13	0.07	0.01	0.04	12.15	12.36	12.3	-0.14	-0.14	-0.18	-0.27

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 ppmw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	1/16/24	9:30	10:29	16.31%	12.30	11.22	13.41	0.44	0.86	0.10	0.19
2	1/16/24	11:08	12:07	16.72%	12.31	11.63	13.96	0.40	0.77	0.10	0.19
3	1/16/24	12:40	13:39	16.85%	12.25	11.67	14.04	0.32	0.61	0.10	0.19

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Date: 1/16/24
Project #: M234904

Linearity Cal/Pre 1 Cal

<u>Time</u>	<u>O2 % (dry)</u>	
7:47	-0.02	
7:48	-0.03	iz
7:49	2.69	
7:50	-0.01	
7:51	6.27	
7:52	0.06	
7:53	7.27	
7:54	22.27	
7:55	22.23	ih
7:56	17.54	
7:57	12.11	
7:58	12.10	im
7:59	13.95	
8:00	20.99	
8:01	20.60	
8:02	0.75	
8:03	2.15	
8:04	20.88	
8:05	21.08	
8:06	21.10	
8:07	21.10	
8:08	21.11	
8:09	21.12	
8:10	21.13	
8:11	18.69	
8:12	12.87	
8:13	12.77	
8:14	12.56	
8:15	12.34	
8:16	10.75	
8:17	11.44	
8:18	11.59	
8:19	11.73	
8:20	11.78	
8:21	11.17	
8:22	4.10	
8:23	0.07	
8:24	0.04	
8:25	0.03	z
8:26	0.67	
8:27	11.86	
8:28	12.13	
8:29	12.14	m

Client: Ash Grove Cement Company

Facility: Leamington Cement Plant

Project #: M234904

Test Location: Main Kiln Stack

Date: 1/16/24

Post 1/Pre 2			Post 2/Pre 3		
<u>Time</u>	<u>O2 % (dry)</u>		<u>Time</u>	<u>O2 % (dry)</u>	
10:51	4.07		12:17	4.96	
10:52	0.12		12:18	12.06	
10:53	0.10		12:19	12.16	m
10:54	0.09	z	12:20	8.64	
10:55	8.27		12:21	0.11	
10:56	12.09		12:22	0.07	z
10:57	12.11	m	12:23	6.83	

Post 3		
<u>Time</u>	<u>O2 % (dry)</u>	
14:01	1.86	
14:02	0.05	
14:03	0.02	
14:04	0.01	z
14:05	12.71	
14:06	12.12	
14:07	12.13	m

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill On

Test Location: Main Kiln Stack
 Date: 1/16/2024
 Operator: RICHS
 FTIR s/n: 110161896

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_DIR_00003.LAB	1/16/24	7:44:22	0.0	0.0	0.0	191.3	0.85	0.2	0.0	-0.002
N2_DIR_000048KG.LAB	1/16/24	7:46:38	0.0	0.0	0.0	191.2	0.85	0.0	0.0	0.000
N2_DIR_000005.LAB	1/16/24	7:46:52	0.0	0.0	0.0	191.1	0.85	0.0	0.0	0.008
N2_DIR_000006.LAB	1/16/24	7:47:00	0.0	0.0	0.0	191.1	0.85	0.1	0.1	0.004
N2_DIR_000007.LAB	1/16/24	7:47:07	0.0	0.0	0.0	191.1	0.85	-0.3	0.0	0.004
N2_DIR_000008.LAB	1/16/24	7:47:15	0.0	0.0	0.0	191.1	0.85	-0.1	-0.1	0.002
N2_DIR_000009.LAB	1/16/24	7:47:23	0.0	0.0	0.1	191.1	0.85	0.0	0.2	0.005
N2_DIR_000010.LAB	1/16/24	7:47:31	0.0	0.0	0.0	191.0	0.85	0.0	0.1	-0.002
N2_DIR_000011.LAB	1/16/24	7:47:39	0.0	0.0	0.0	191.1	0.85	-0.1	0.0	-0.001

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_DIR_000024.LAB	1/16/24	7:50:05	0.0	0.0	0.0	191.0	0.85	101.3	0.2	-0.015	99.9%
CTS_DIR_000025.LAB	1/16/24	7:50:13	0.0	0.0	0.1	191.1	0.85	101.1	0.0	-0.020	99.7%
CTS_DIR_000026.LAB	1/16/24	7:50:21	0.0	0.0	0.0	191.1	0.85	101.4	-0.1	-0.020	100.0%
CTS_DIR_000027.LAB	1/16/24	7:50:29	0.0	0.0	0.0	191.0	0.85	101.3	0.1	-0.017	99.9%
CTS_DIR_000028.LAB	1/16/24	7:50:37	0.0	0.0	0.0	191.0	0.85	101.5	0.0	-0.026	100.1%
CTS_DIR_000029.LAB	1/16/24	7:50:44	0.0	0.0	0.0	191.0	0.85	101.4	0.1	-0.015	100.0%
CTS_DIR_000030.LAB	1/16/24	7:50:52	0.0	0.0	0.1	191.0	0.85	101.5	0.1	-0.018	100.1%
Average								101.4			100.0%

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_DIR_000034.LAB	1/16/24	7:52:01	0.0	0.0	0.0	191.1	0.85	-0.6	50.6	4.861	102.1%
HCN_DIR_000035.LAB	1/16/24	7:52:09	0.0	0.0	0.0	191.1	0.85	-0.5	50.5	4.851	101.9%
HCN_DIR_000036.LAB	1/16/24	7:52:17	0.0	0.0	0.0	191.1	0.85	-0.3	50.5	4.867	101.9%
HCN_DIR_000037.LAB	1/16/24	7:52:25	0.0	0.0	0.0	191.1	0.85	-0.5	50.6	4.859	102.1%
HCN_DIR_000038.LAB	1/16/24	7:52:32	0.0	0.0	0.0	191.1	0.85	-0.6	50.6	4.867	102.1%
HCN_DIR_000039.LAB	1/16/24	7:52:40	0.0	0.0	0.1	191.1	0.85	-0.5	50.7	4.858	102.3%
HCN_DIR_000040.LAB	1/16/24	7:52:48	0.0	0.0	0.1	191.1	0.85	-0.4	50.7	4.866	102.3%
HCN_DIR_000041.LAB	1/16/24	7:52:56	0.0	0.0	0.0	191.1	0.85	-0.4	50.9	4.855	102.8%
Average									50.6	4.860	102.2%

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
CTS_RT_000046.LAB	1/16/24	8:01:51	0.1	0.0	0.0	191.1	0.86	101.4	-0.1	-0.015	100.0%
CTS_RT_000047.LAB	1/16/24	8:01:59	0.0	0.0	0.0	191.1	0.86	101.7	-0.1	-0.017	100.3%
CTS_RT_000048.LAB	1/16/24	8:02:07	0.0	0.0	0.0	191.1	0.86	101.7	0.1	-0.016	100.3%
CTS_RT_000049.LAB	1/16/24	8:02:15	0.0	0.0	0.0	191.1	0.86	101.8	0.0	-0.006	100.4%
CTS_RT_000050.LAB	1/16/24	8:02:23	0.0	0.0	0.0	191.1	0.86	102.1	0.1	-0.008	100.7%
CTS_RT_000051.LAB	1/16/24	8:02:30	0.0	0.0	0.0	191.0	0.86	102.1	-0.1	-0.009	100.7%
CTS_RT_000052.LAB	1/16/24	8:02:38	0.0	0.0	0.1	191.0	0.86	101.8	0.1	-0.017	100.4%
CTS_RT_000053.LAB	1/16/24	8:02:46	0.0	0.0	0.0	191.0	0.86	102.3	0.0	-0.010	100.8%

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_RT_000044.LAB	1/16/24	8:01:35	0.3	0.0	0.0	191.1	0.86	0.0	-0.2	0.006	-
CTS_RT_000045.LAB	1/16/24	8:01:43	0.2	0.0	0.0	191.1	0.86	48.0	-0.1	-0.019	15.889
CTS_RT_000046.LAB	1/16/24	8:01:51	0.1	0.0	0.0	191.1	0.86	101.4	-0.1	-0.015	23.889
CTS_RT_000047.LAB	1/16/24	8:01:59	0.0	0.0	0.0	191.1	0.86	101.7	-0.1	-0.017	
CTS_RT_000048.LAB	1/16/24	8:02:07	0.0	0.0	0.0	191.1	0.86	101.7	0.1	-0.016	
CTS_RT_000049.LAB	1/16/24	8:02:15	0.0	0.0	0.0	191.1	0.86	101.8	0.0	-0.006	
CTS_RT_000050.LAB	1/16/24	8:02:23	0.0	0.0	0.0	191.1	0.86	102.1	0.1	-0.008	
CTS_RT_000051.LAB	1/16/24	8:02:30	0.0	0.0	0.0	191.0	0.86	102.1	-0.1	-0.009	
CTS_RT_000052.LAB	1/16/24	8:02:38	0.0	0.0	0.1	191.0	0.86	101.8	0.1	-0.017	

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill On

Test Location: Main Kiln Stack
 Date: 1/16/2024
 Operator: RICHS
 FTIR s/n: 110161896

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
AMBIENT_STACK_000149.LAB	1/16/24	8:15:49	17.2	11.2	-0.3	190.9	0.86	0.8	0.4	-0.001
AMBIENT_STACK_000150.LAB	1/16/24	8:15:57	16.6	11.2	-0.2	191.0	0.86	0.7	0.3	-0.006
AMBIENT_STACK_000151.LAB	1/16/24	8:16:05	16.4	11.2	-0.2	191.0	0.86	0.7	0.4	0.000
									0.4	-0.003

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
PRE1_SPK_000162.LAB	1/16/24	8:18:24	14.2	10.4	-0.3	191.0	0.86	0.5	4.0	0.370	0.076	95.7%
PRE1_SPK_000163.LAB	1/16/24	8:18:32	13.9	10.5	-0.2	191.0	0.86	0.4	4.0	0.375	0.077	93.8%
PRE1_SPK_000164.LAB	1/16/24	8:18:40	13.7	10.6	-0.3	191.0	0.86	0.8	3.9	0.368	0.076	94.7%
PRE1_SPK_000165.LAB	1/16/24	8:18:48	13.6	10.6	-0.3	191.0	0.86	0.9	3.8	0.360	0.074	94.1%
PRE1_SPK_000166.LAB	1/16/24	8:18:56	13.8	10.6	-0.2	191.0	0.86	0.7	3.9	0.368	0.076	94.1%
PRE1_SPK_000167.LAB	1/16/24	8:19:03	15.1	10.4	-0.2	191.0	0.86	0.6	3.9	0.366	0.075	95.3%
PRE1_SPK_000168.LAB	1/16/24	8:19:11	15.1	10.5	-0.2	191.0	0.86	0.7	3.8	0.364	0.075	91.5%
PRE1_SPK_000169.LAB	1/16/24	8:19:19	16.1	10.3	-0.3	191.0	0.86	0.5	3.7	0.372	0.076	89.2%

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
MILLON_R1_000339.LAB	1/16/24	10:42:07	15.6	11.4	-0.3	191.0	0.86	1.3	0.5	0.000
MILLON_R1_000340.LAB	1/16/24	10:43:11	17.5	11.1	-0.3	191.0	0.86	1.2	0.4	-0.002
MILLON_R1_000341.LAB	1/16/24	10:44:13	15.6	11.3	-0.3	191.0	0.86	1.2	0.4	-0.003
									0.4	-0.002

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
POST1_SPK_000350.LAB	1/16/24	10:46:33	14.9	10.6	-0.3	190.9	0.86	1.0	4.1	0.400	0.082	90.1%
POST1_SPK_000351.LAB	1/16/24	10:46:41	14.8	10.4	-0.2	190.9	0.86	1.1	4.1	0.396	0.082	90.2%
POST1_SPK_000352.LAB	1/16/24	10:46:50	15.4	10.3	-0.3	190.9	0.86	1.0	4.1	0.397	0.082	91.2%
POST1_SPK_000353.LAB	1/16/24	10:46:57	15.2	10.3	-0.2	190.9	0.86	1.2	4.0	0.397	0.082	89.0%
POST1_SPK_000354.LAB	1/16/24	10:47:05	14.9	10.4	-0.4	190.9	0.86	1.1	4.1	0.401	0.082	89.1%
POST1_SPK_000355.LAB	1/16/24	10:47:13	15.2	10.5	-0.3	190.9	0.86	1.2	4.0	0.396	0.081	87.6%
POST1_SPK_000356.LAB	1/16/24	10:47:21	14.9	10.6	-0.3	190.9	0.86	1.0	4.1	0.395	0.081	91.6%
POST1_SPK_000357.LAB	1/16/24	10:47:29	14.7	10.6	-0.3	190.9	0.86	1.2	4.1	0.390	0.080	91.3%

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
POST1_CTS_000365.LAB	1/16/24	10:49:24	1.6	0.0	0.0	190.9	0.86	100.6	0.0	-0.012	99.3%
POST1_CTS_000366.LAB	1/16/24	10:49:32	1.4	0.0	0.0	190.9	0.86	101.0	0.0	-0.011	99.6%
POST1_CTS_000367.LAB	1/16/24	10:49:40	1.3	0.0	0.0	190.9	0.86	101.3	-0.1	-0.009	99.9%
POST1_CTS_000368.LAB	1/16/24	10:49:48	1.2	0.0	-0.1	190.9	0.86	101.5	0.1	-0.019	100.1%
POST1_CTS_000369.LAB	1/16/24	10:49:56	1.1	0.0	0.0	190.9	0.86	101.3	0.2	-0.014	99.9%
POST1_CTS_000370.LAB	1/16/24	10:50:04	1.0	0.0	0.0	190.9	0.86	101.3	0.1	-0.014	99.9%
POST1_CTS_000371.LAB	1/16/24	10:50:12	1.0	0.0	0.0	190.9	0.86	101.4	0.0	-0.009	100.0%
POST1_CTS_000372.LAB	1/16/24	10:50:19	0.9	0.0	0.0	190.9	0.86	101.6	-0.2	-0.018	100.2%

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill On

Test Location: Main Kiln Stack
 Date: 1/16/2024
 Operator: RICHS
 FTIR s/n: 110161896

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
MILLON_R2_000466.LAB	1/16/24	12:09:59	17.4	11.6	-0.3	190.7	0.86	1.4	0.1	0.006
MILLON_R2_000467.LAB	1/16/24	12:11:02	16.8	11.6	-0.3	190.8	0.86	1.4	0.2	0.002
MILLON_R2_000468.LAB	1/16/24	12:12:05	16.6	11.8	-0.3	190.9	0.86	1.3	0.4	0.001
									0.2	0.003

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
POST2_SPK_000472.LAB	1/16/24	12:13:32	15.2	10.9	-0.3	190.9	0.86	1.1	3.9	0.380	0.078	92.8%
POST2_SPK_000473.LAB	1/16/24	12:13:40	15.1	10.9	-0.3	190.9	0.86	1.2	3.9	0.376	0.077	93.6%
POST2_SPK_000474.LAB	1/16/24	12:13:47	15.2	10.9	-0.3	190.9	0.86	1.1	3.8	0.379	0.078	92.6%
POST2_SPK_000475.LAB	1/16/24	12:13:55	15.2	10.9	-0.3	190.9	0.86	1.2	4.0	0.375	0.077	96.2%
POST2_SPK_000476.LAB	1/16/24	12:14:03	15.4	11.0	-0.3	190.9	0.86	1.3	3.8	0.377	0.078	93.0%
POST2_SPK_000477.LAB	1/16/24	12:14:11	15.4	10.9	-0.3	190.8	0.86	1.2	4.0	0.369	0.076	98.3%
POST2_SPK_000478.LAB	1/16/24	12:14:19	16.1	10.8	-0.3	190.8	0.86	1.3	3.8	0.379	0.078	92.4%
POST2_SPK_000479.LAB	1/16/24	12:14:27	15.8	10.8	-0.3	190.8	0.86	1.2	3.9	0.371	0.076	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
POST2_CTS_000487.LAB	1/16/24	12:16:17	1.7	0.0	-0.1	190.7	0.86	100.8	-1.0	-0.001	99.4%
POST2_CTS_000488.LAB	1/16/24	12:16:25	1.7	0.0	0.0	190.7	0.86	101.1	-1.2	-0.006	99.8%
POST2_CTS_000489.LAB	1/16/24	12:16:33	1.5	0.0	-0.1	190.7	0.86	101.2	-1.1	-0.002	99.9%
POST2_CTS_000490.LAB	1/16/24	12:16:41	1.4	0.0	-0.1	190.7	0.86	101.3	-0.9	-0.006	99.9%
POST2_CTS_000491.LAB	1/16/24	12:16:49	1.3	0.0	0.0	190.7	0.86	101.1	-1.1	0.004	99.7%
POST2_CTS_000492.LAB	1/16/24	12:16:56	1.1	0.0	0.0	190.7	0.86	101.4	-1.2	-0.005	100.0%
POST2_CTS_000493.LAB	1/16/24	12:17:05	1.0	0.0	0.0	190.7	0.86	101.7	-1.2	-0.002	100.4%
POST2_CTS_000494.LAB	1/16/24	12:17:12	0.9	0.0	0.0	190.7	0.86	102.0	-1.2	-0.006	100.6%

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
MILLON_R3_000594.LAB	1/16/24	13:52:35	17.1	11.8	-0.3	190.5	0.85	0.8	0.3	-0.005
MILLON_R3_000595.LAB	1/16/24	13:53:37	16.4	11.8	-0.3	190.6	0.85	0.8	0.1	-0.010
MILLON_R3_000596.LAB	1/16/24	13:54:40	16.8	11.8	-0.3	190.7	0.85	0.8	0.3	-0.005
									0.2	-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
POST3_SPK_000599.LAB	1/16/24	13:56:17	15.4	11.0	-0.3	190.6	0.85	0.7	3.9	0.357	0.073	90.0%
POST3_SPK_000600.LAB	1/16/24	13:56:25	15.3	11.0	-0.4	190.6	0.85	0.6	3.6	0.346	0.071	95.0%
POST3_SPK_000601.LAB	1/16/24	13:56:33	15.3	11.0	-0.4	190.6	0.85	0.9	3.9	0.350	0.072	99.6%
POST3_SPK_000602.LAB	1/16/24	13:56:41	15.3	11.0	-0.3	190.6	0.85	0.7	3.7	0.348	0.072	96.0%
POST3_SPK_000603.LAB	1/16/24	13:56:49	15.3	10.9	-0.3	190.6	0.85	0.7	3.5	0.352	0.072	90.4%
POST3_SPK_000604.LAB	1/16/24	13:56:57	15.3	10.8	-0.3	190.6	0.86	0.7	3.5	0.346	0.071	91.7%
POST3_SPK_000605.LAB	1/16/24	13:57:05	15.4	10.9	-0.4	190.5	0.85	0.8	3.6	0.345	0.071	95.1%
POST3_SPK_000606.LAB	1/16/24	13:57:12	15.4	11.0	-0.3	190.5	0.85	0.6	3.5	0.348	0.072	91.7%

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
POST3_CTS_000621.LAB	1/16/24	13:59:55	1.3	0.0	0.1	190.5	0.86	100.2	0.1	-0.019	98.8%
POST3_CTS_000622.LAB	1/16/24	14:00:02	1.2	0.0	0.0	190.4	0.86	100.2	0.1	-0.028	98.9%
POST3_CTS_000623.LAB	1/16/24	14:00:10	1.1	0.0	0.0	190.4	0.85	100.5	0.1	-0.032	99.1%
POST3_CTS_000624.LAB	1/16/24	14:00:18	1.0	0.0	0.0	190.4	0.85	100.8	0.0	-0.017	99.4%
POST3_CTS_000625.LAB	1/16/24	14:00:26	0.8	0.0	0.0	190.4	0.86	100.6	0.1	-0.026	99.3%
POST3_CTS_000626.LAB	1/16/24	14:00:34	0.8	0.0	-0.1	190.5	0.86	101.0	-0.2	-0.028	99.7%
POST3_CTS_000627.LAB	1/16/24	14:00:41	0.7	0.0	0.0	190.4	0.86	100.9	0.0	-0.019	99.6%
POST3_CTS_000628.LAB	1/16/24	14:00:49	0.7	0.0	0.0	190.5	0.85	101.2	0.0	-0.022	99.8%

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill On

Test Location: Main Kiln Stack
 Date: 1/16/2024
 Operator: RICHS
 FTIR s/n: 110161896

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
CTS_DIR_000655.LAB	1/16/24	14:10:11	0.0	0.0	0.0	190.7	0.85	101.0	0.1	-0.027	99.7%
CTS_DIR_000656.LAB	1/16/24	14:10:19	0.0	0.0	0.1	190.7	0.85	101.2	0.0	-0.024	99.8%
CTS_DIR_000657.LAB	1/16/24	14:10:26	0.0	0.0	0.0	190.7	0.85	101.0	0.0	-0.020	99.6%
CTS_DIR_000658.LAB	1/16/24	14:10:34	0.0	0.0	0.0	190.7	0.85	101.3	-0.3	-0.026	100.0%
CTS_DIR_000659.LAB	1/16/24	14:10:42	0.0	0.0	0.0	190.7	0.85	100.8	-0.3	-0.028	99.5%
CTS_DIR_000660.LAB	1/16/24	14:10:50	0.0	0.0	0.1	190.7	0.85	100.9	-0.1	-0.021	99.5%
CTS_DIR_000661.LAB	1/16/24	14:10:58	0.0	0.0	0.0	190.7	0.85	101.3	-0.1	-0.030	100.0%
CTS_DIR_000662.LAB	1/16/24	14:11:05	0.0	0.0	-0.1	190.7	0.85	101.1	0.0	-0.030	99.8%
Average								101.1			

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
N2_DIR_000664.LAB	1/16/24	14:14:02	0.0	0.0	0.0	190.7	0.85	0.0	-0.4	-0.002
N2_DIR_000665.LAB	1/16/24	14:16:08	0.0	0.0	0.0	190.5	0.85	0.0	-0.4	-0.001
N2_DIR_000666.LAB	1/16/24	14:18:13	0.0	0.0	0.0	190.5	0.85	0.0	-0.5	0.000

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Project #: M234904
Test Location: Main Kiln Stack
Date: 1/17/2024
Operator: RICH S
Operating Condition: Mill Off

Sample System: FTIR
Probe Length: 8.0 ft
Probe Type: FTIR
Sample Plane: Horizontal
Port Length: 7 in.
Port Size (diameter): 2 in.
Port Type: Flange
Duct Shape: Circular
Diameter: 11 ft
Duct Area: 95.03 Sq. Ft.
Upstream Diameters: 4.10
Downstream Diameters: 5.50
Number of Ports Sampled: 1
Number of Points per Port: 1
Total Number of Traverse Points: 1

Minimum Upstream Distance: 5.5 Feet
 Minimum Downstream Distance: 22.0 Feet
 Ideal Upstream Distance: 22.0 Feet
 Ideal Downstream Distance: 88.0 Feet

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder	Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	0.02	-0.09%	N/A		1500
	Mid	CC195925	12.04	12.13	-0.41%	4/24/2031	54.43%	1000
	High	CC308342	22.12	22.24	-0.54%	5/25/2031		800

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	Nitrogen	Zero Nitrogen	0.0	N/A	1500
Calibration Transfer Standard	Ethylene	AAL072815	101.4	9/5/2031	1000
Analyte Spike Gas	HCN	CC768241	49.55	3/11/2024	1400
	SF6		5.001		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAL 700	2211018	25	22.12
HF ppmvw	MKS 2030	110161896	10	N/A
HCN ppmvw	MKS 2030	110161896	200	N/A

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Project #: M234904
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 1/17/24
Operator: RICHS
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	12.04	12.12	11.99	0.07	0.03	0.05	12.06	10.87	10.9	0.63	-0.59	-0.05	-0.18
2	12.04	11.99	11.98	0.03	0.06	0.05	11.99	10.76	10.8	0.68	-0.05	-0.18	0.14
3	12.04	11.98	11.97	0.06	0.02	0.04	11.98	10.76	10.8	0.72	-0.05	0.00	-0.18

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	1/17/24	9:30	10:29	13.24%	10.85	13.96	16.10	1.03	1.64	0.10	0.16
2	1/17/24	11:05	12:04	13.33%	10.81	14.07	16.23	1.00	1.59	0.10	0.16
3	1/17/24	12:40	13:39	13.18%	10.82	14.14	16.29	1.00	1.58	0.10	0.16

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Test Location: Main Kiln Stack
Date: 1/17/24
Project #: M234904

Linearity Cal/Pre 1 Cal

<u>Time</u>	<u>O2 % (dry)</u>	
8:20	0.03	
8:21	0.02	
8:22	0.01	
8:23	0.02	iz
8:24	3.50	
8:25	0.00	
8:26	-0.01	
8:27	15.05	
8:28	22.25	
8:29	22.24	ih
8:30	20.86	
8:31	12.18	
8:32	12.13	im
8:33	9.81	
8:34	0.08	
8:35	0.20	
8:36	18.80	
8:37	17.63	
8:38	0.17	
8:39	0.07	z
8:40	9.26	
8:41	12.09	
8:42	12.12	m
8:43	18.09	
8:44	21.06	

Client: Ash Grove Cement Company
Facility: Leamington Cement Plant
Project #: M234904
Test Location: Main Kiln Stack
Date: 1/17/24

Post 1/Pre 2			Post 2/Pre 3		
<u>Time</u>	<u>O2 % (dry)</u>		<u>Time</u>	<u>O2 % (dry)</u>	
10:53	10.56		12:28	5.54	
10:54	11.97		12:29	11.92	
10:55	11.99	m	12:30	11.98	m
10:56	9.23		12:31	9.11	
10:57	0.11		12:32	0.12	
10:58	0.06		12:33	0.07	
10:59	0.05		12:34	0.06	z
11:00	0.03	z	12:35	2.57	

Post 3		
<u>Time</u>	<u>O2 % (dry)</u>	
14:01	6.68	
14:02	11.94	
14:03	11.97	m
14:04	12.15	
14:05	0.19	
14:06	0.04	
14:07	0.02	z

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill Off

Test Location: Main Kiln Stack
 Date: 1/17/2024
 Operator: RICHS
 FTIR s/n: 110161896

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_DIR_0006698K.LAB	1/17/24	8:23:15	0.0	0.0	0.0	191.1	0.84	0.0	0.0	0.000
N2_DIR_000670.LAB	1/17/24	8:23:29	0.0	0.0	0.0	191.4	0.84	0.0	0.1	-0.002
N2_DIR_000671.LAB	1/17/24	8:23:37	0.0	0.0	0.0	191.4	0.84	0.1	-0.2	0.002
N2_DIR_000672.LAB	1/17/24	8:23:44	0.0	0.0	0.0	191.4	0.84	0.1	0.1	-0.002
N2_DIR_000673.LAB	1/17/24	8:23:52	0.0	0.0	-0.1	191.4	0.84	0.1	-0.1	-0.002
N2_DIR_000674.LAB	1/17/24	8:24:00	0.0	0.0	0.0	191.4	0.84	-0.1	0.1	0.002
N2_DIR_000675.LAB	1/17/24	8:24:08	0.0	0.0	0.0	191.4	0.84	-0.1	-0.1	0.008
N2_DIR_000676.LAB	1/17/24	8:24:16	0.0	0.0	0.0	191.4	0.84	0.2	0.0	-0.003
N2_DIR_000677.LAB	1/17/24	8:24:24	0.0	0.0	0.0	191.3	0.84	0.0	0.1	0.000

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_DIR_000710.LAB	1/17/24	8:29:33	0.0	0.0	0.0	190.7	0.84	102.6	0.1	-0.012	101.2%	
CTS_DIR_000711.LAB	1/17/24	8:29:41	0.0	0.0	0.0	190.6	0.84	102.5	0.0	-0.012	101.1%	
CTS_DIR_000712.LAB	1/17/24	8:29:49	0.0	0.0	0.0	190.6	0.84	102.4	-0.2	-0.019	101.0%	
CTS_DIR_000713.LAB	1/17/24	8:29:56	0.0	0.0	0.0	190.6	0.84	102.6	0.0	-0.017	101.2%	
CTS_DIR_000714.LAB	1/17/24	8:30:04	0.0	0.0	0.0	190.6	0.84	102.5	0.0	-0.021	101.1%	
CTS_DIR_000715.LAB	1/17/24	8:30:12	0.0	0.0	0.0	190.6	0.84	102.3	0.1	-0.019	100.9%	
CTS_DIR_000716.LAB	1/17/24	8:30:20	0.0	0.0	0.0	190.6	0.84	102.3	-0.1	-0.024	100.9%	
Average												
								102.5				101.1%

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_DIR_000728.LAB	1/17/24	8:38:50	0.0	0.0	0.0	190.8	0.84	0.0	4.897	51.0	102.9%	
HCN_DIR_000729.LAB	1/17/24	8:38:58	0.0	0.0	0.0	190.8	0.84	-0.2	51.1	4.897	103.2%	
HCN_DIR_000730.LAB	1/17/24	8:39:06	0.0	0.0	0.0	190.8	0.84	0.0	51.2	4.888	103.4%	
HCN_DIR_000731.LAB	1/17/24	8:39:14	0.0	0.0	0.0	190.8	0.84	-0.2	51.2	4.876	103.4%	
HCN_DIR_000732.LAB	1/17/24	8:39:21	0.0	0.0	0.0	190.8	0.84	-0.2	51.4	4.860	103.6%	
HCN_DIR_000733.LAB	1/17/24	8:39:29	0.0	0.0	0.0	190.9	0.84	-0.5	51.2	4.882	103.3%	
HCN_DIR_000734.LAB	1/17/24	8:39:37	0.0	0.0	0.0	190.9	0.84	-0.5	51.1	4.872	103.1%	
HCN_DIR_000735.LAB	1/17/24	8:39:45	0.0	0.0	0.0	190.9	0.84	-0.3	51.2	4.866	103.3%	
Average												
									51.2	4.880		103.3%

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_RT_000744.LAB	1/17/24	8:42:43	0.1	0.0	0.0	190.8	0.85	101.9	-0.2	-0.012	100.5%
CTS_RT_000745.LAB	1/17/24	8:42:50	0.1	0.0	0.0	190.8	0.85	102.0	0.1	-0.021	100.6%
CTS_RT_000746.LAB	1/17/24	8:42:59	0.0	0.0	0.0	190.7	0.85	102.0	-0.1	-0.021	100.6%
CTS_RT_000747.LAB	1/17/24	8:43:06	0.0	0.0	0.0	190.8	0.85	101.9	0.0	-0.018	100.5%
CTS_RT_000748.LAB	1/17/24	8:43:14	0.0	0.0	0.0	190.8	0.85	102.3	-0.2	-0.012	100.9%
CTS_RT_000749.LAB	1/17/24	8:43:22	0.0	0.0	0.0	190.8	0.85	102.3	0.1	-0.015	100.9%
CTS_RT_000750.LAB	1/17/24	8:43:30	0.0	0.0	0.0	190.8	0.85	102.4	0.1	-0.013	101.0%
CTS_RT_000751.LAB	1/17/24	8:43:38	0.0	0.0	0.0	190.7	0.85	102.3	0.0	-0.011	100.9%

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_RT_000742.LAB	1/17/24	8:42:27	0.8	0.1	-0.1	190.8	0.85	0.2	-0.1	0.003	-
CTS_RT_000743.LAB	1/17/24	8:42:35	0.5	0.0	0.0	190.8	0.85	46.5	1.6	0.141	15.596
CTS_RT_000744.LAB	1/17/24	8:42:43	0.1	0.0	0.0	190.8	0.85	101.9	-0.2	-0.012	23.596
CTS_RT_000745.LAB	1/17/24	8:42:50	0.1	0.0	0.0	190.8	0.85	102.0	0.1	-0.021	
CTS_RT_000746.LAB	1/17/24	8:42:59	0.0	0.0	0.0	190.7	0.85	102.0	-0.1	-0.021	
CTS_RT_000747.LAB	1/17/24	8:43:06	0.0	0.0	0.0	190.8	0.85	101.9	0.0	-0.018	
CTS_RT_000748.LAB	1/17/24	8:43:14	0.0	0.0	0.0	190.8	0.85	102.3	-0.2	-0.012	
CTS_RT_000749.LAB	1/17/24	8:43:22	0.0	0.0	0.0	190.8	0.85	102.3	0.1	-0.015	
CTS_RT_000750.LAB	1/17/24	8:43:30	0.0	0.0	0.0	190.8	0.85	102.4	0.1	-0.013	

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill Off

Test Location: Main Kiln Stack
 Date: 1/17/2024
 Operator: RICHS
 FTIR s/n: 110161896

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
AMBIENT_STACK_000878.LAB	1/17/24	9:04:24	12.4	13.7	-0.3	190.7	0.85	1.0	1.0	-0.004
AMBIENT_STACK_000879.LAB	1/17/24	9:04:32	12.5	13.8	-0.3	190.7	0.85	1.2	1.4	0.000
AMBIENT_STACK_000880.LAB	1/17/24	9:04:40	13.5	13.7	-0.3	190.7	0.85	1.2	1.2	-0.009
									1.2	-0.004

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
PRE1_SPK_000904.LAB	1/17/24	9:08:51	11.8	12.9	-0.3	190.9	0.85	1.1	4.4	0.353	0.072	91.5%
PRE1_SPK_000905.LAB	1/17/24	9:08:59	11.8	12.9	-0.3	190.9	0.85	1.2	4.6	0.345	0.071	97.8%
PRE1_SPK_000906.LAB	1/17/24	9:09:06	11.8	13.0	-0.3	190.9	0.85	1.0	4.5	0.348	0.071	93.5%
PRE1_SPK_000907.LAB	1/17/24	9:09:14	11.7	13.0	-0.3	190.9	0.85	0.9	4.5	0.348	0.071	94.2%
PRE1_SPK_000908.LAB	1/17/24	9:09:22	11.8	12.9	-0.3	190.9	0.85	1.3	4.6	0.350	0.072	95.3%
PRE1_SPK_000909.LAB	1/17/24	9:09:30	11.8	12.9	-0.2	190.9	0.85	1.2	4.5	0.349	0.071	93.4%
PRE1_SPK_000910.LAB	1/17/24	9:09:38	14.0	12.5	-0.2	190.9	0.85	1.1	4.3	0.355	0.073	87.9%
PRE1_SPK_000911.LAB	1/17/24	9:09:46	14.1	12.6	-0.3	190.9	0.85	1.0	4.3	0.347	0.071	89.8%

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
MILLOFF_R1_001002.LAB	1/17/24	10:42:43	13.6	14.5	-0.3	190.7	0.85	1.0	0.8	-0.009
MILLOFF_R1_001003.LAB	1/17/24	10:43:45	13.4	14.1	-0.3	190.7	0.85	0.9	1.1	-0.007
MILLOFF_R1_001004.LAB	1/17/24	10:44:49	13.9	14.0	-0.3	190.7	0.85	1.0	1.1	-0.003
									1.0	-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
POST1_SPK_001020.LAB	1/17/24	10:48:34	13.2	13.0	-0.3	190.7	0.85	0.8	4.6	0.374	0.077	94.7%
POST1_SPK_001021.LAB	1/17/24	10:48:42	12.6	13.0	-0.3	190.7	0.85	0.9	4.8	0.372	0.076	99.5%
POST1_SPK_001022.LAB	1/17/24	10:48:50	12.4	13.0	-0.3	190.6	0.85	0.8	4.7	0.375	0.077	97.5%
POST1_SPK_001023.LAB	1/17/24	10:48:58	12.3	13.1	-0.3	190.7	0.85	0.7	4.5	0.369	0.076	94.4%
POST1_SPK_001024.LAB	1/17/24	10:49:06	12.3	13.1	-0.3	190.7	0.85	0.6	4.7	0.373	0.076	96.5%
POST1_SPK_001025.LAB	1/17/24	10:49:13	12.3	13.1	-0.2	190.7	0.85	0.8	4.6	0.368	0.075	96.3%
POST1_SPK_001026.LAB	1/17/24	10:49:21	12.1	13.1	-0.2	190.7	0.85	0.7	4.4	0.371	0.076	91.3%
POST1_SPK_001027.LAB	1/17/24	10:49:29	12.1	13.1	-0.2	190.6	0.85	0.7	4.7	0.366	0.075	99.3%

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
POST1_SPK_001037.LAB	1/17/24	10:51:29	1.6	0.0	0.0	190.7	0.85	100.2	0.3	-0.020	98.8%
POST1_SPK_001038.LAB	1/17/24	10:51:37	1.4	0.0	0.0	190.7	0.85	100.6	0.4	-0.012	99.2%
POST1_SPK_001039.LAB	1/17/24	10:51:45	1.2	0.0	-0.1	190.7	0.85	100.6	0.1	0.000	99.2%
POST1_SPK_001040.LAB	1/17/24	10:51:53	1.0	0.0	0.0	190.7	0.85	100.8	-0.1	-0.013	99.4%
POST1_SPK_001041.LAB	1/17/24	10:52:01	0.8	0.0	0.0	190.6	0.85	101.2	0.2	-0.009	99.8%
POST1_SPK_001042.LAB	1/17/24	10:52:08	0.7	0.0	-0.1	190.7	0.85	101.3	-0.1	-0.006	99.9%
POST1_SPK_001043.LAB	1/17/24	10:52:17	0.7	0.0	-0.1	190.7	0.85	100.8	0.1	-0.029	99.4%
POST1_SPK_001044.LAB	1/17/24	10:52:24	0.6	0.0	0.0	190.7	0.85	101.3	-0.1	-0.011	99.9%

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill Off

Test Location: Main Kiln Stack
 Date: 1/17/2024
 Operator: RICHS
 FTIR s/n: 110161896

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
MILLOFF_R2_001156.LAB	1/17/24	12:20:55	13.0	14.2	-0.3	190.7	0.85	0.5	1.1	-0.011
MILLOFF_R2_001157.LAB	1/17/24	12:21:59	13.0	14.2	-0.3	190.7	0.85	0.5	1.1	-0.009
MILLOFF_R2_001158.LAB	1/17/24	12:23:01	13.4	14.1	-0.3	190.9	0.85	0.5	1.1	-0.012
									1.1	-0.011

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
POST2_SPK_001164.LAB	1/17/24	12:24:40	12.4	13.1	-0.3	190.8	0.85	0.4	4.8	0.371	0.076	97.7%
POST2_SPK_001165.LAB	1/17/24	12:24:48	12.3	13.1	-0.3	190.8	0.85	0.6	4.7	0.365	0.075	97.8%
POST2_SPK_001166.LAB	1/17/24	12:24:56	12.3	13.0	-0.3	190.8	0.85	0.4	4.8	0.365	0.075	99.2%
POST2_SPK_001167.LAB	1/17/24	12:25:04	12.3	13.0	-0.3	190.8	0.85	0.6	4.7	0.367	0.075	96.7%
POST2_SPK_001168.LAB	1/17/24	12:25:12	12.3	13.0	-0.3	190.8	0.85	0.3	4.6	0.369	0.076	94.9%
POST2_SPK_001169.LAB	1/17/24	12:25:19	12.4	13.0	-0.3	190.8	0.85	0.3	4.7	0.372	0.076	95.1%
POST2_SPK_001170.LAB	1/17/24	12:25:27	12.2	13.0	-0.3	190.8	0.85	0.5	4.8	0.371	0.076	98.7%
POST2_SPK_001171.LAB	1/17/24	12:25:36	12.3	13.0	-0.3	190.8	0.85	0.6	4.8	0.368	0.075	98.6%

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
POST2_CTS_001177.LAB	1/17/24	12:26:56	1.6	0.1	-0.1	190.7	0.85	99.4	-0.8	-0.019	97.0%
POST2_CTS_001178.LAB	1/17/24	12:27:03	1.5	0.0	0.0	190.8	0.85	99.4	-1.2	-0.019	97.1%
POST2_CTS_001179.LAB	1/17/24	12:27:11	1.3	0.0	0.0	190.8	0.85	99.9	-1.0	-0.024	97.5%
POST2_CTS_001180.LAB	1/17/24	12:27:19	1.1	0.0	0.0	190.7	0.85	100.0	-0.9	-0.019	97.6%
POST2_CTS_001181.LAB	1/17/24	12:27:27	1.0	0.0	-0.1	190.7	0.85	100.5	-1.2	-0.021	98.1%
POST2_CTS_001182.LAB	1/17/24	12:27:35	0.8	0.0	0.0	190.7	0.85	100.5	-0.7	-0.028	98.1%
POST2_CTS_001183.LAB	1/17/24	12:27:42	0.7	0.0	0.0	190.7	0.85	100.2	-1.1	-0.025	97.8%
POST2_CTS_001184.LAB	1/17/24	12:27:50	0.6	0.0	0.0	190.7	0.85	100.2	-1.1	-0.025	97.8%

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
MILLOFF_R3_001283.LAB	1/17/24	13:52:07	13.1	14.1	-0.3	190.6	0.85	0.8	1.0	-0.012
MILLOFF_R3_001284.LAB	1/17/24	13:53:10	13.7	14.0	-0.3	190.6	0.85	0.8	0.9	-0.011
MILLOFF_R3_001285.LAB	1/17/24	13:54:12	12.9	14.1	-0.3	190.6	0.85	0.8	1.1	-0.011
									1.0	-0.011

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
POST3_SPK_001300.LAB	1/17/24	13:57:33	12.8	13.1	-0.2	190.6	0.85	0.7	4.1	0.352	0.072	88.9%
POST3_SPK_001301.LAB	1/17/24	13:57:41	12.3	13.1	-0.3	190.6	0.85	0.6	5.0	0.408	0.084	96.5%
POST3_SPK_001302.LAB	1/17/24	13:57:49	12.2	13.2	-0.3	190.5	0.85	0.7	4.9	0.414	0.085	92.2%
POST3_SPK_001303.LAB	1/17/24	13:57:57	12.0	13.2	-0.3	190.5	0.85	0.7	5.0	0.411	0.084	94.7%
POST3_SPK_001304.LAB	1/17/24	13:58:05	11.8	13.1	-0.3	190.5	0.85	0.5	5.1	0.413	0.085	97.5%
POST3_SPK_001305.LAB	1/17/24	13:58:12	11.6	12.9	-0.3	190.6	0.85	0.8	5.3	0.412	0.085	100.9%
POST3_SPK_001306.LAB	1/17/24	13:58:20	11.6	12.9	-0.3	190.6	0.85	0.5	5.2	0.410	0.084	98.6%
POST3_SPK_001307.LAB	1/17/24	13:58:28	12.1	12.7	-0.3	190.6	0.85	0.7	4.9	0.407	0.083	94.5%

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
POST3_CTS_001310.LAB	1/17/24	14:00:05	1.5	0.1	0.0	190.5	0.85	100.0	0.3	-0.030	97.6%
POST3_CTS_001311.LAB	1/17/24	14:00:12	1.4	0.0	0.0	190.5	0.85	99.9	0.0	-0.026	97.5%
POST3_CTS_001312.LAB	1/17/24	14:00:20	1.2	0.0	0.0	190.6	0.85	100.1	0.1	-0.038	97.7%
POST3_CTS_001313.LAB	1/17/24	14:00:28	1.1	0.0	0.0	190.6	0.85	100.1	0.1	-0.029	97.7%
POST3_CTS_001314.LAB	1/17/24	14:00:36	1.0	0.0	0.0	190.6	0.85	100.6	0.2	-0.025	98.2%
POST3_CTS_001315.LAB	1/17/24	14:00:44	1.0	0.0	0.0	190.6	0.85	100.3	0.0	-0.034	97.9%
POST3_CTS_001316.LAB	1/17/24	14:00:52	0.9	0.0	0.0	190.6	0.85	100.6	0.1	-0.037	98.2%
POST3_CTS_001317.LAB	1/17/24	14:01:00	0.8	0.0	0.0	190.6	0.85	100.7	0.1	-0.026	98.3%

Client: Ash Grove Cement Company
 Facility: Leamington Cement Plant
 Project #: M234904
 Operating Condition: Mill Off

Test Location: Main Kiln Stack
 Date: 1/17/2024
 Operator: RICHS
 FTIR s/n: 110161896

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
CTS_DIR_001343.LAB	1/17/24	14:09:51	0.0	0.0	0.0	190.7	0.84	100.7	-0.3	-0.041	98.3%
CTS_DIR_001344.LAB	1/17/24	14:09:59	0.0	0.0	0.0	190.7	0.84	100.5	-0.1	-0.041	98.1%
CTS_DIR_001345.LAB	1/17/24	14:10:06	0.0	0.0	0.1	190.7	0.84	101.2	0.1	-0.036	98.7%
CTS_DIR_001346.LAB	1/17/24	14:10:15	0.0	0.0	0.1	190.7	0.84	100.9	0.0	-0.034	98.5%
CTS_DIR_001347.LAB	1/17/24	14:10:23	0.0	0.0	0.0	190.7	0.84	100.8	-0.1	-0.042	98.4%
CTS_DIR_001348.LAB	1/17/24	14:10:30	0.0	0.0	0.0	190.7	0.84	100.8	0.0	-0.040	98.4%
CTS_DIR_001349.LAB	1/17/24	14:10:38	0.0	0.0	0.0	190.7	0.84	100.7	0.0	-0.035	98.2%
CTS_DIR_001350.LAB	1/17/24	14:10:46	0.0	0.0	0.0	190.7	0.84	101.1	0.1	-0.038	98.6%
Average								100.8			

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
N2_DIR_001351.LAB	1/17/24	14:13:50	0.0	0.0	0.0	190.8	0.84	-0.1	-0.2	-0.008
N2_DIR_001352.LAB	1/17/24	14:15:56	0.0	0.0	0.0	190.7	0.84	-0.2	-0.2	-0.011
N2_DIR_001353.LAB	1/17/24	14:18:01	0.0	0.0	0.0	190.7	0.84	-0.1	-0.2	-0.011

**Zero Gas and In-Stack Detection Limit Study
Ash Grove Cement Company
Leamington Cement Plant
Main Kiln Stack
1/16/2024**

Time	DL summary - zero gas		Time	DL summary - in stack	
	HF ppm (10) 191C	HCN (100) 191C		HF ppm (10) 191C	HCN (100) 191C
7:48:02 AM	0.04	-0.05	9:34:03 AM	-0.26	0.37
7:48:10 AM	0.05	-0.02	9:35:05 AM	-0.26	0.38
7:48:18 AM	-0.01	-0.09	9:36:08 AM	-0.27	0.43
7:48:26 AM	0.03	-0.07	9:37:11 AM	-0.26	0.39
7:48:34 AM	0.01	-0.06	9:38:14 AM	-0.26	0.41
7:48:42 AM	0.01	-0.06	9:39:17 AM	-0.26	0.44
7:48:50 AM	-0.01	0.06	9:40:20 AM	-0.25	0.43
Standard Deviation	0.02	0.05	Standard Deviation	0.01	0.02
3x = DL	0.06	0.14	3x = DL	0.02	0.07

Appendix H - Gas Cylinder Certifications

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X02NI99C15A1268	Reference Number:	48-402834277-1
Cylinder Number:	AAL072815	Cylinder Volume:	144.0 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
Analysis Date:	Sep 05, 2023	Valve Outlet:	350
Lot Number:	48-402834277-1		

Expiration Date: Sep 05, 2031

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	101.4 PPM	+/- 2%
NITROGEN	Balance		



Signature on file

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number: E02NI88E15A3424	Reference Number: 54-402721112-1
Cylinder Number: CC195925	Cylinder Volume: 146.0 CF
Laboratory: 124 - Chicago (SAP) - IL	Cylinder Pressure: 2015 PSIG
PGVP Number: B12023	Valve Outlet: 590
Gas Code: O2,BALN	Certification Date: Apr 24, 2023

Expiration Date: Apr 24, 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
OXYGEN	12.00 %	12.04 %	G1	+/- 0.5% NIST Traceable	04/24/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	8010239	K026333	23.20 % OXYGEN/NITROGEN	+/- 0.4%	Jun 01, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
O2-1 HORIBA VA-5003 YH82Y07B	PARAMAGNETIC	Mar 30, 2023

Triad Data Available Upon Request



Signature on file

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number: E03NI56E15A1055	Reference Number: 48-402752988-1
Cylinder Number: CC308342	Cylinder Volume: 162.0 CF
Laboratory: 124 - Los Angeles (SAP) - CA	Cylinder Pressure: 2015 PSIG
PGVP Number: B32023	Valve Outlet: 590
Gas Code: CO2,O2,BALN	Certification Date: May 25, 2023

Expiration Date: May 25, 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	22.00 %	22.58 %	G1	+/- 0.6% NIST Traceable	05/25/2023
OXYGEN	22.00 %	22.12 %	G1	+/- 1.1% NIST Traceable	05/25/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061520	CC354777	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024
NTRM	08010228	K016648	23.20 % OXYGEN/NITROGEN	+/- 0.2%	Jun 01, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Apr 26, 2023
SIEMENS OXYMAT 6	PARAMAGNETIC	May 22, 2023

Triad Data Available Upon Request



Signature on file

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Customer:	MOSTARDI PLATT	Reference Number:	160-402841635-1
Part Number:	X03NI99C15AC0W8	Cylinder Volume:	144.4 CF
Cylinder Number:	CC768241	Cylinder Pressure:	2015 PSIG
Laboratory:	124 - Plumsteadville - PA	Valve Outlet:	350SS
Analysis Date:	Sep 11, 2023		
Lot Number:	160-402841635-1		

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	5.001 PPM	+/- 1.3%
HYDROGEN CYANIDE	50.00 PPM	49.55 PPM	+/- 5%
NITROGEN	Balance		



Signature on file

END OF THE REPORT