

Section 114 Information Collection Request Emissions Test Report

Ash Grove Cement Company
Seattle Cement Plant
EPA Registry ID: 110000897085
Main Kiln Stack
3801 E Marginal Way S
Seattle, Washington
Report No. M234007A





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

**Ash Grove Cement Company
Seattle Cement Plant
EPA Registry ID: 110000897085
Main Kiln Stack
3801 E Marginal Way S
Seattle, WA 98134**

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

© Copyright 2024
All rights reserved in
Mostardi Platt

Report No. M234007A

TABLE OF CONTENTS

1.0 INTRODUCTION	1
2.0 TEST REQUIREMENTS	2
3.0 QA SPECIFICATIONS AND PROCESS DIAGRAM	4
3-1 QA/QC Specifications.....	4
3-2 Process Flow Diagram	4
4.0 TEST PROCEDURES	5
4.1 Method 1 Sample and Velocity Traverse Determination	5
4.2 Method 2 Volumetric Flow Rate Determination	5
4.3 Method 3A Oxygen (O ₂) and Carbon Dioxide (CO ₂) Determination.....	5
4.4 Method 26A Hydrogen Fluoride (HF) and Chlorine (Cl ₂) Determination	6
4.5 Method 320 Speciated Flue Gas Concentration Determinations	6
5.0 TEST RESULTS SUMMARIES.....	8
6.0 CERTIFICATION.....	14
APPENDICES	
Appendix A – Plant Operating Data.....	16
Appendix B – Test Section Diagrams.....	23
Appendix C – Sample Train Diagrams	26
Appendix D – Calculation Nomenclature and Formulas.....	30
Appendix E – Laboratory Sample Analysis	43
Appendix F – Reference Method Test Data	58
Appendix G – Calibration Data	94
Appendix H – Gas Cylinder Certifications	135

1.0 INTRODUCTION

Mostardi Platt conducted an air emissions test program for Ash Grove Cement Company at the Seattle Cement Plant located in Seattle, Washington. 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 Seattle Cement Plant includes a single kiln (Main Kiln) ~1,000,000 TPY preheater/pre-caliner having an in-line raw mill. There is a single in-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 Seattle Cement Plant 3801 E Marginal Way S Seattle, WA 98134	Mr. Marty Johnson Environmental Manager (206) 694-6232 marty.johnson@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
		≤ 0.17 ppmvd @7% O ₂	
		≤ 0.05 lb/hr	
		≤ 0.0006 lb/ton clinker	
	HF ¹	≤ 0.13 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.19 ppmvd @7% O ₂	
		≤ 0.0540 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Chlorine (Cl ₂) ¹	≤ 0.04 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O ₂	
		≤ 0.0539 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Hydrogen Cyanide (HCN)	1.81 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		3.06 ppmvd @7% O ₂	
		1.20 lb/hr	
		0.0139lb/ton clinker	
	Oxygen (O ₂)	11.1 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO ₂)	15.2 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H ₂ O)	15.8 %	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
		≤ 0.15 ppmvd @7% O ₂	
		≤ 0.04 lb/hr	
		≤ 0.0005 lb/ton clinker	
	HF ²	≤ 0.14 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.18 ppmvd @7% O ₂	
		≤ 0.0526 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Chlorine (Cl ₂) ²	≤ 0.04 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O ₂	
		≤ 0.0528 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Hydrogen Cyanide (HCN)	2.30 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		3.44 ppmvd @7% O ₂	
		1.33 lb/hr	
		0.0149 lb/ton clinker	
	Oxygen (O ₂)	10.2 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO ₂)	17.2 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H ₂ O)	13.0 %	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

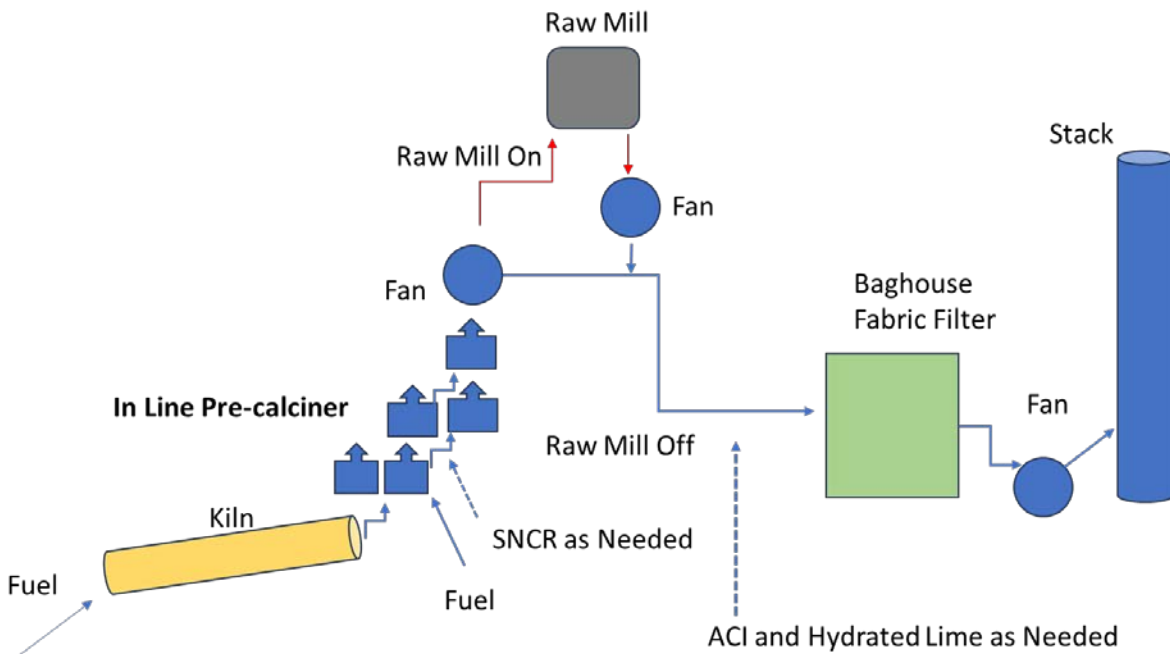
² HF and Cl₂ Method 26A results are reported as the average from Train A and Train B.

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	6527 (Run 1 Average)
		S Beam	>0.9	1.293 (Run 1 Average)
		Direct HCN Analysis	±5% of tag value	0.7%
		Dynamic Spike Analysis	≤10% of total sample volume	8.5%
			Spike gas ~twice native concentration or 3-4 ppm addition to native concentration	+3.6 ppm
			≤±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	13 Feet	9 Inches	9.2 Diameters	10.8 Diameters	HF/Cl ₂ (26A)	12
					O ₂ (3A)	3 (stratification)
					HCN/HF/CO ₂ (320/3A)	1

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

4.2 Method 2 Volumetric Flow Rate Determination

The gas velocity and volumetric flowrate were determined using Method 2, 40CFR60, Appendix A, as an integrated part of the HF/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: Seattle Cement Plant
Test Location: Main Kiln Stack
Test Method: 26A - Combined Trains

Source Condition	Mill On	Mill On	Mill On	
Date	1/10/24	1/10/24	1/10/24	
Start Time	6:50	8:25	10:00	
End Time	8:05	9:40	11:15	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Velocity, ft/sec	48.874	48.446	48.536	48.618
Gas Volumetric Flow Rate, acfm	203,418	200,794	202,166	202,126
Gas Volumetric Flow Rate, dscfm	132,421	130,561	132,771	131,917
Gas Volumetric Flow Rate, scfm	158,017	156,623	156,661	157,100
Average %CO ₂ by volume, dry basis	15.1	15.4	15.0	15.2
Average %O ₂ by volume, dry basis	11.1	11.1	11.2	11.1
Clinker Production, ton/hr	85.7	86.6	86.1	86.1
Chlorine (Cl₂) Emissions				
ppm ≤	0.04	≤ 0.04	≤ 0.04	≤ 0.04
ppm@7%O ₂ ≤	0.05	≤ 0.05	≤ 0.05	≤ 0.05
lb/hr ≤	0.0534	≤ 0.0541	≤ 0.0542	≤ 0.0539
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006
Hydrogen Fluoride (HF) Emissions				
ppm ≤	0.13	≤ 0.13	≤ 0.13	≤ 0.13
ppm@7%O ₂ ≤	0.19	≤ 0.19	≤ 0.19	≤ 0.19
lb/hr ≤	0.0538	≤ 0.0537	≤ 0.0544	≤ 0.0540
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006

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

Source Condition	Mill On	Mill On	Mill On	
Date	1/10/24	1/10/24	1/10/24	
Start Time	6:50	8:25	10:00	
End Time	8:05	9:40	11:15	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	207.0	204.5	208.8	206.8
Flue Gas Moisture, percent by volume	16.0%	16.4%	16.0%	16.1%
Average Flue Pressure, in. Hg	29.39	29.39	29.39	29.39
Gas Sample Volume, dscf	52.073	51.665	50.989	51.576
Average Gas Velocity, ft/sec	26.079	25.768	25.592	25.813
Gas Volumetric Flow Rate, acfm	207,689	205,213	203,809	205,570
Gas Volumetric Flow Rate, dscfm	135,680	133,966	132,819	134,155
Gas Volumetric Flow Rate, scfm	161,513	160,187	158,081	159,927
Average %CO ₂ by volume, dry basis	15.1	15.4	15.0	15.2
Average %O ₂ by volume, dry basis	11.1	11.1	11.2	11.1
Isokinetic Variance	101.9	102.4	101.9	102.1
Chlorine (Cl₂) Emissions				
ug of sample collected ≤	150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm ≤	0.03	≤ 0.04	≤ 0.04	≤ 0.03
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: Seattle Cement Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill On	Mill On	Mill On	
Date	1/10/24	1/10/24	1/10/24	
Start Time	6:50	8:25	10:00	
End Time	8:05	9:40	11:15	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	208.5	205.5	210.0	208.0
Flue Gas Moisture, percent by volume	16.4%	16.9%	14.5%	15.9%
Average Flue Pressure, in. Hg	29.39	29.39	29.39	29.39
Gas Sample Volume, dscf	45.674	45.226	46.083	45.661
Average Gas Velocity, ft/sec	25.006	24.658	25.179	24.948
Gas Volumetric Flow Rate, acfm	199,146	196,375	200,522	198,681
Gas Volumetric Flow Rate, dscfm	129,161	127,156	132,722	129,680
Gas Volumetric Flow Rate, scfm	154,521	153,058	155,241	154,273
Average %CO ₂ by volume, dry basis	15.1	15.4	15.0	15.2
Average %O ₂ by volume, dry basis	11.1	11.1	11.2	11.1
Isokinetic Variance	102.1	102.6	100.2	101.6
Chloride (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	≤ 0.14	≤ 0.14	≤ 0.14	≤ 0.14

Ash Grove Cement Company Seattle 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	1/10/2024	6:50	7:49	11.1	15.8%	1.80	3.03	≤ 0.10	≤ 0.17
2	1/10/2024	8:25	9:24	11.1	15.9%	1.81	3.05	≤ 0.10	≤ 0.17
3	1/10/2024	10:00	10:59	11.2	15.8%	1.83	3.11	≤ 0.10	≤ 0.17
Average				11.1	15.8%	1.81	3.06	≤ 0.10	≤ 0.17

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	1/10/2024	6:50	7:49	132,421	85.7	1.19	0.0139	≤ 0.05	≤ 0.0006
2	1/10/2024	8:25	9:24	130,561	86.6	1.18	0.0136	≤ 0.05	≤ 0.0006
3	1/10/2024	10:00	10:59	132,771	86.1	1.22	0.0141	≤ 0.05	≤ 0.0006
Average				131,918	86.1	1.20	0.0139	≤ 0.05	≤ 0.0006

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

Source Condition	Mill Off	Mill Off	Mill Off	
Date	1/10/24	1/10/24	1/10/24	
Start Time	11:45	13:20	14:55	
End Time	13:00	14:35	16:10	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Velocity, ft/sec	44.657	46.436	43.907	45.000
Gas Volumetric Flow Rate, acfm	210,356	211,884	209,652	210,630
Gas Volumetric Flow Rate, dscfm	121,683	118,762	116,463	118,969
Gas Volumetric Flow Rate, scfm	139,533	137,321	134,819	137,224
Average %CO ₂ by volume, dry basis	17.3	17.0	17.2	17.2
Average %O ₂ by volume, dry basis	10.5	9.9	10.2	10.2
Clinker Production, ton/hr	86.5	91.0	90.6	89.4
Chloride (Cl₂) Emissions				
ppm ≤	0.04	≤ 0.04	≤ 0.04	≤ 0.04
ppm@7%O ₂ ≤	0.05	≤ 0.05	≤ 0.05	≤ 0.05
lb/hr ≤	0.0544	≤ 0.0511	≤ 0.0527	≤ 0.0528
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006
Hydrogen Fluoride (HF) Emissions				
ppm ≤	0.14	≤ 0.14	≤ 0.15	≤ 0.14
ppm@7%O ₂ ≤	0.19	≤ 0.17	≤ 0.19	≤ 0.18
lb/hr ≤	0.0542	≤ 0.0509	≤ 0.0526	≤ 0.0526
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006

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

Source Condition	Mill Off	Mill Off	Mill Off	
Date	1/10/24	1/10/24	1/10/24	
Start Time	11:45	13:20	14:55	
End Time	13:00	14:35	16:10	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	324.0	339.5	345.5	336.3
Flue Gas Moisture, percent by volume	13.3%	14.4%	13.7%	13.8%
Average Flue Pressure, in. Hg	29.39	29.39	29.39	29.39
Gas Sample Volume, dscf	47.138	49.641	46.312	47.697
Average Gas Velocity, ft/sec	26.811	27.286	26.568	26.888
Gas Volumetric Flow Rate, acfm	213,524	217,308	211,583	214,138
Gas Volumetric Flow Rate, dscfm	122,473	120,674	117,530	120,226
Gas Volumetric Flow Rate, scfm	141,270	140,986	136,249	139,502
Average %CO ₂ by volume, dry basis	17.3	17.0	17.2	17.2
Average %O ₂ by volume, dry basis	10.5	9.9	10.2	10.2
Isokinetic Variance	102.2	109.2	104.6	105.3
Chloride (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 ≤	0.14	≤ 0.13	≤ 0.14	≤ 0.13

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

Source Condition	Mill Off	Mill Off	Mill Off	
Date	1/10/24	1/10/24	1/10/24	
Start Time	11:45	13:20	14:55	
End Time	13:00	14:35	16:10	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	319.9	341.3	347.8	336.3
Flue Gas Moisture, percent by volume	12.3%	12.6%	13.5%	12.8%
Average Flue Pressure, in. Hg	29.39	29.39	29.39	29.39
Gas Sample Volume, dscf	42.176	43.231	41.501	42.303
Average Gas Velocity, ft/sec	26.016	25.924	26.083	26.008
Gas Volumetric Flow Rate, acfm	207,188	206,459	207,720	207,122
Gas Volumetric Flow Rate, dscfm	120,893	116,850	115,395	117,713
Gas Volumetric Flow Rate, scfm	137,795	133,655	133,389	134,946
Average %CO ₂ by volume, dry basis	17.3	17.0	17.2	17.2
Average %O ₂ by volume, dry basis	10.5	9.9	10.2	10.2
Isokinetic Variance	101.8	107.9	104.9	104.9
Chloride (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	≤ 0.15	≤ 0.15	≤ 0.15	≤ 0.15

Ash Grove Cement Company Seattle 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	1/10/2024	11:45	12:44	10.5	13.4%	2.37	3.68	≤ 0.10	≤ 0.15
2	1/10/2024	13:20	14:19	9.9	13.1%	2.38	3.46	≤ 0.10	≤ 0.15
3	1/10/2024	14:55	15:54	10.2	12.5%	2.15	3.19	≤ 0.10	≤ 0.15
Average				10.2	13.0%	2.30	3.44	≤ 0.10	≤ 0.15

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	1/10/2024	11:45	12:44	121,683	86.5	1.40	0.0162	≤ 0.04	≤ 0.0005
2	1/10/2024	13:20	14:19	118,762	91.0	1.37	0.0150	≤ 0.04	≤ 0.0005
3	1/10/2024	14:55	15:54	116,463	90.6	1.20	0.0133	≤ 0.04	≤ 0.0005
Average				118,969	89.4	1.33	0.0149	≤ 0.04	≤ 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

	KILN: CLINKER (TNHR) Expression Value
Date/Time	

Run 1 RTR Mill On

01/10/2024 06:50	85.5
01/10/2024 06:51	85.4
01/10/2024 06:52	84.7
01/10/2024 06:53	84.7
01/10/2024 06:54	86.2
01/10/2024 06:55	87.2
01/10/2024 06:56	84.6
01/10/2024 06:57	84.5
01/10/2024 06:58	84.7
01/10/2024 06:59	84.4
01/10/2024 07:00	83.8
01/10/2024 07:01	85.8
01/10/2024 07:02	86.9
01/10/2024 07:03	84.9
01/10/2024 07:04	83.0
01/10/2024 07:05	83.5
01/10/2024 07:06	83.8
01/10/2024 07:07	85.6
01/10/2024 07:08	86.0
01/10/2024 07:09	85.6
01/10/2024 07:10	89.8
01/10/2024 07:11	83.7
01/10/2024 07:12	84.1
01/10/2024 07:13	84.4
01/10/2024 07:14	85.8
01/10/2024 07:15	86.5
01/10/2024 07:16	86.9
01/10/2024 07:17	86.2
01/10/2024 07:18	84.8
01/10/2024 07:19	84.5
01/10/2024 07:20	85.6
01/10/2024 07:21	86.3
01/10/2024 07:22	85.9
01/10/2024 07:23	85.5
01/10/2024 07:24	85.9
01/10/2024 07:25	85.8
01/10/2024 07:26	84.6
01/10/2024 07:27	83.8
01/10/2024 07:28	85.0
01/10/2024 07:29	84.9
01/10/2024 07:30	86.9
01/10/2024 07:31	86.6
01/10/2024 07:32	86.6
01/10/2024 07:33	86.0
01/10/2024 07:34	85.4
01/10/2024 07:35	87.5
01/10/2024 07:36	87.6
01/10/2024 07:37	85.2
01/10/2024 07:38	85.0
01/10/2024 07:39	86.2
01/10/2024 07:40	85.7
01/10/2024 07:41	87.5
01/10/2024 07:42	87.8
01/10/2024 07:43	86.5
01/10/2024 07:44	86.0
01/10/2024 07:45	85.8
01/10/2024 07:46	85.4
01/10/2024 07:47	88.1
01/10/2024 07:48	87.3
01/10/2024 07:49	86.0
01/10/2024 07:50	85.1
Average	85.7

	KILN: CLINKER (TNHR) Expression Value
Date/Time	

Run 2 RTR Mill On

01/10/2024 08:25	86.3
01/10/2024 08:26	86.8
01/10/2024 08:27	88.2
01/10/2024 08:28	86.9
01/10/2024 08:29	87.9
01/10/2024 08:30	84.8
01/10/2024 08:31	86.3
01/10/2024 08:32	85.8
01/10/2024 08:33	85.9
01/10/2024 08:34	83.6
01/10/2024 08:35	89.0
01/10/2024 08:36	87.8
01/10/2024 08:37	85.9
01/10/2024 08:38	85.3
01/10/2024 08:39	86.8
01/10/2024 08:40	88.1
01/10/2024 08:41	83.2
01/10/2024 08:42	87.7
01/10/2024 08:43	82.8
01/10/2024 08:44	88.2
01/10/2024 08:45	87.8
01/10/2024 08:46	84.6
01/10/2024 08:47	87.7
01/10/2024 08:48	85.7
01/10/2024 08:49	89.0
01/10/2024 08:50	87.1
01/10/2024 08:51	87.4
01/10/2024 08:52	87.0
01/10/2024 08:53	86.3
01/10/2024 08:54	85.4
01/10/2024 08:55	90.3
01/10/2024 08:56	84.3
01/10/2024 08:57	87.2
01/10/2024 08:58	88.2
01/10/2024 08:59	88.6
01/10/2024 09:00	85.5
01/10/2024 09:01	85.2
01/10/2024 09:02	85.3
01/10/2024 09:03	91.1
01/10/2024 09:04	86.6
01/10/2024 09:05	87.3
01/10/2024 09:06	85.9
01/10/2024 09:07	86.3
01/10/2024 09:08	89.5
01/10/2024 09:09	83.8
01/10/2024 09:10	88.1
01/10/2024 09:11	86.3
01/10/2024 09:12	87.1
01/10/2024 09:13	85.0
01/10/2024 09:14	88.4
01/10/2024 09:15	87.9
01/10/2024 09:16	87.2
01/10/2024 09:17	84.0
01/10/2024 09:18	85.1
01/10/2024 09:19	88.0
01/10/2024 09:20	83.1
01/10/2024 09:21	88.8
01/10/2024 09:22	86.3
01/10/2024 09:23	88.3
01/10/2024 09:24	84.9
01/10/2024 09:25	85.5
Average	86.6

	KILN: CLINKER (TNHR) Expression Value
Date/Time	

Run 3 RTR Mill On

01/10/2024 10:00	85.7
01/10/2024 10:01	85.5
01/10/2024 10:02	87.0
01/10/2024 10:03	86.8
01/10/2024 10:04	87.1
01/10/2024 10:05	86.9
01/10/2024 10:06	86.2
01/10/2024 10:07	86.3
01/10/2024 10:08	85.9
01/10/2024 10:09	86.0
01/10/2024 10:10	85.3
01/10/2024 10:11	87.4
01/10/2024 10:12	85.9
01/10/2024 10:13	87.7
01/10/2024 10:14	86.8
01/10/2024 10:15	89.4
01/10/2024 10:16	86.0
01/10/2024 10:17	84.3
01/10/2024 10:18	86.8
01/10/2024 10:19	85.6
01/10/2024 10:20	86.8
01/10/2024 10:21	86.9
01/10/2024 10:22	86.6
01/10/2024 10:23	86.6
01/10/2024 10:24	86.2
01/10/2024 10:25	85.8
01/10/2024 10:26	87.4
01/10/2024 10:27	86.6
01/10/2024 10:28	86.9
01/10/2024 10:29	84.6
01/10/2024 10:30	86.3
01/10/2024 10:31	85.5
01/10/2024 10:32	86.5
01/10/2024 10:33	86.6
01/10/2024 10:34	85.9
01/10/2024 10:35	87.2
01/10/2024 10:36	87.9
01/10/2024 10:37	88.5
01/10/2024 10:38	86.7
01/10/2024 10:39	85.3
01/10/2024 10:40	84.7
01/10/2024 10:41	86.7
01/10/2024 10:42	86.6
01/10/2024 10:43	87.6
01/10/2024 10:44	86.5
01/10/2024 10:45	86.0
01/10/2024 10:46	85.9
01/10/2024 10:47	85.8
01/10/2024 10:48	85.8
01/10/2024 10:49	87.7
01/10/2024 10:50	87.3
01/10/2024 10:51	85.8
01/10/2024 10:52	85.3
01/10/2024 10:53	84.6
01/10/2024 10:54	84.0
01/10/2024 10:55	83.4
01/10/2024 10:56	83.7
01/10/2024 10:57	82.8
01/10/2024 10:58	84.3
01/10/2024 10:59	85.3
01/10/2024 11:00	84.9
Average	86.1

	KILN: CLINKER (TNHR) Expression Value
Date/Time	

Run 1 RTR Mill Off

01/10/2024 11:45	87.3
01/10/2024 11:46	88.0
01/10/2024 11:47	88.0
01/10/2024 11:48	87.4
01/10/2024 11:49	86.7
01/10/2024 11:50	87.2
01/10/2024 11:51	86.3
01/10/2024 11:52	86.7
01/10/2024 11:53	87.1
01/10/2024 11:54	86.3
01/10/2024 11:55	86.2
01/10/2024 11:56	85.9
01/10/2024 11:57	85.8
01/10/2024 11:58	86.1
01/10/2024 11:59	86.8
01/10/2024 12:00	87.7
01/10/2024 12:01	85.0
01/10/2024 12:02	86.5
01/10/2024 12:03	86.0
01/10/2024 12:04	85.9
01/10/2024 12:05	84.9
01/10/2024 12:06	84.9
01/10/2024 12:07	85.9
01/10/2024 12:08	85.7
01/10/2024 12:09	85.8
01/10/2024 12:10	85.0
01/10/2024 12:11	84.1
01/10/2024 12:12	84.1
01/10/2024 12:13	86.6
01/10/2024 12:14	88.1
01/10/2024 12:15	86.6
01/10/2024 12:16	86.1
01/10/2024 12:17	88.2
01/10/2024 12:18	85.8
01/10/2024 12:19	85.2
01/10/2024 12:20	86.3
01/10/2024 12:21	88.4
01/10/2024 12:22	87.4
01/10/2024 12:23	86.0
01/10/2024 12:24	84.8
01/10/2024 12:25	87.5
01/10/2024 12:26	86.9
01/10/2024 12:27	86.5
01/10/2024 12:28	86.8
01/10/2024 12:29	86.4
01/10/2024 12:30	87.0
01/10/2024 12:31	85.0
01/10/2024 12:32	86.3
01/10/2024 12:33	87.0
01/10/2024 12:34	86.7
01/10/2024 12:35	87.1
01/10/2024 12:36	86.6
01/10/2024 12:37	85.8
01/10/2024 12:38	83.1
01/10/2024 12:39	90.3
01/10/2024 12:40	88.3
01/10/2024 12:41	88.8
01/10/2024 12:42	86.9
01/10/2024 12:43	85.8
01/10/2024 12:44	89.2
01/10/2024 12:45	87.5
Average	86.5

	KILN: CLINKER (TNHR) Expression Value
Date/Time	

Run 2 RTR Mill Off

01/10/2024 13:20	88.7
01/10/2024 13:21	88.6
01/10/2024 13:22	89.3
01/10/2024 13:23	89.0
01/10/2024 13:24	89.2
01/10/2024 13:25	88.2
01/10/2024 13:26	88.2
01/10/2024 13:27	89.6
01/10/2024 13:28	89.4
01/10/2024 13:29	90.2
01/10/2024 13:30	91.6
01/10/2024 13:31	91.1
01/10/2024 13:32	91.4
01/10/2024 13:33	91.8
01/10/2024 13:34	91.2
01/10/2024 13:35	91.9
01/10/2024 13:36	91.0
01/10/2024 13:37	91.8
01/10/2024 13:38	91.6
01/10/2024 13:39	90.5
01/10/2024 13:40	91.1
01/10/2024 13:41	91.1
01/10/2024 13:42	91.5
01/10/2024 13:43	90.6
01/10/2024 13:44	91.5
01/10/2024 13:45	91.8
01/10/2024 13:46	91.9
01/10/2024 13:47	92.5
01/10/2024 13:48	90.9
01/10/2024 13:49	91.9
01/10/2024 13:50	91.6
01/10/2024 13:51	91.8
01/10/2024 13:52	91.8
01/10/2024 13:53	91.3
01/10/2024 13:54	90.5
01/10/2024 13:55	90.3
01/10/2024 13:56	91.1
01/10/2024 13:57	90.3
01/10/2024 13:58	91.8
01/10/2024 13:59	92.2
01/10/2024 14:00	92.2
01/10/2024 14:01	91.7
01/10/2024 14:02	89.4
01/10/2024 14:03	91.2
01/10/2024 14:04	93.6
01/10/2024 14:05	91.3
01/10/2024 14:06	90.9
01/10/2024 14:07	90.5
01/10/2024 14:08	91.4
01/10/2024 14:09	92.4
01/10/2024 14:10	91.2
01/10/2024 14:11	90.1
01/10/2024 14:12	90.5
01/10/2024 14:13	92.7
01/10/2024 14:14	92.1
01/10/2024 14:15	92.1
01/10/2024 14:16	90.2
01/10/2024 14:17	91.5
01/10/2024 14:18	91.4
01/10/2024 14:19	90.3
01/10/2024 14:20	90.9
Average	91.0

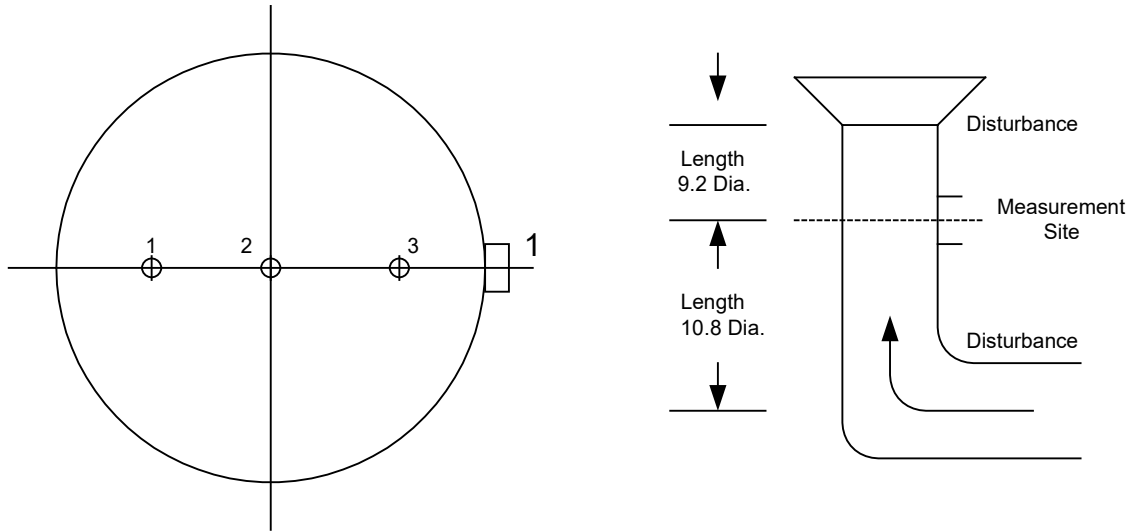
	KILN: CLINKER (TNHR) Expression Value
Date/Time	

Run 3 RTR Mill Off

01/10/2024 14:55	92.6
01/10/2024 14:56	91.9
01/10/2024 14:57	92.4
01/10/2024 14:58	91.9
01/10/2024 14:59	91.3
01/10/2024 15:00	92.1
01/10/2024 15:01	92.5
01/10/2024 15:02	92.0
01/10/2024 15:03	92.5
01/10/2024 15:04	92.0
01/10/2024 15:05	94.2
01/10/2024 15:06	93.5
01/10/2024 15:07	93.5
01/10/2024 15:08	92.4
01/10/2024 15:09	90.2
01/10/2024 15:10	91.1
01/10/2024 15:11	91.5
01/10/2024 15:12	92.1
01/10/2024 15:13	91.0
01/10/2024 15:14	90.5
01/10/2024 15:15	91.5
01/10/2024 15:16	94.2
01/10/2024 15:17	92.8
01/10/2024 15:18	92.3
01/10/2024 15:19	92.1
01/10/2024 15:20	91.8
01/10/2024 15:21	91.2
01/10/2024 15:22	90.8
01/10/2024 15:23	91.6
01/10/2024 15:24	91.9
01/10/2024 15:25	91.8
01/10/2024 15:26	92.3
01/10/2024 15:27	91.4
01/10/2024 15:28	87.8
01/10/2024 15:29	88.4
01/10/2024 15:30	88.4
01/10/2024 15:31	88.7
01/10/2024 15:32	89.2
01/10/2024 15:33	88.9
01/10/2024 15:34	88.4
01/10/2024 15:35	88.3
01/10/2024 15:36	91.3
01/10/2024 15:37	89.9
01/10/2024 15:38	89.1
01/10/2024 15:39	90.4
01/10/2024 15:40	87.5
01/10/2024 15:41	89.4
01/10/2024 15:42	89.4
01/10/2024 15:43	89.8
01/10/2024 15:44	89.0
01/10/2024 15:45	88.5
01/10/2024 15:46	87.9
01/10/2024 15:47	86.8
01/10/2024 15:48	89.7
01/10/2024 15:49	90.8
01/10/2024 15:50	88.4
01/10/2024 15:51	89.2
01/10/2024 15:52	89.9
01/10/2024 15:53	89.3
01/10/2024 15:54	87.5
01/10/2024 15:55	87.7
Average	90.6

Appendix B – Test Section Diagrams

STRATIFICATION TEST FOR ROUND DUCTS



Job: Ash Grove Cement Company
Seattle Plant
Seattle, Washington

Distance from Inside Wall
To Traverse Point:

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

Test Location: Main Kiln Stack

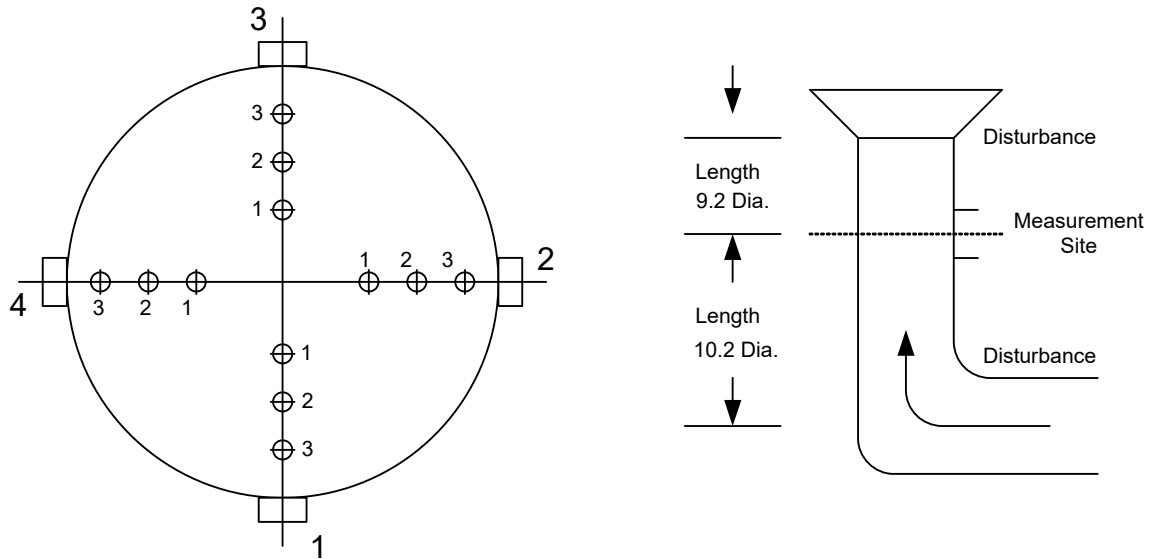
Stack Diameter: 13.0 Feet

Stack Area: 132.732 Square Feet

No. Sample Points: 3

Port Length: 9.0 Inches

EQUAL AREA TRAVERSE FOR ROUND DUCTS



Job: Ash Grove Cement Company
Seattle Plant
Seattle, Washington

Test Location: Main Kiln Stack

Duct Diameter: 13.0 Feet

Duct Area: 132.732 Square Feet

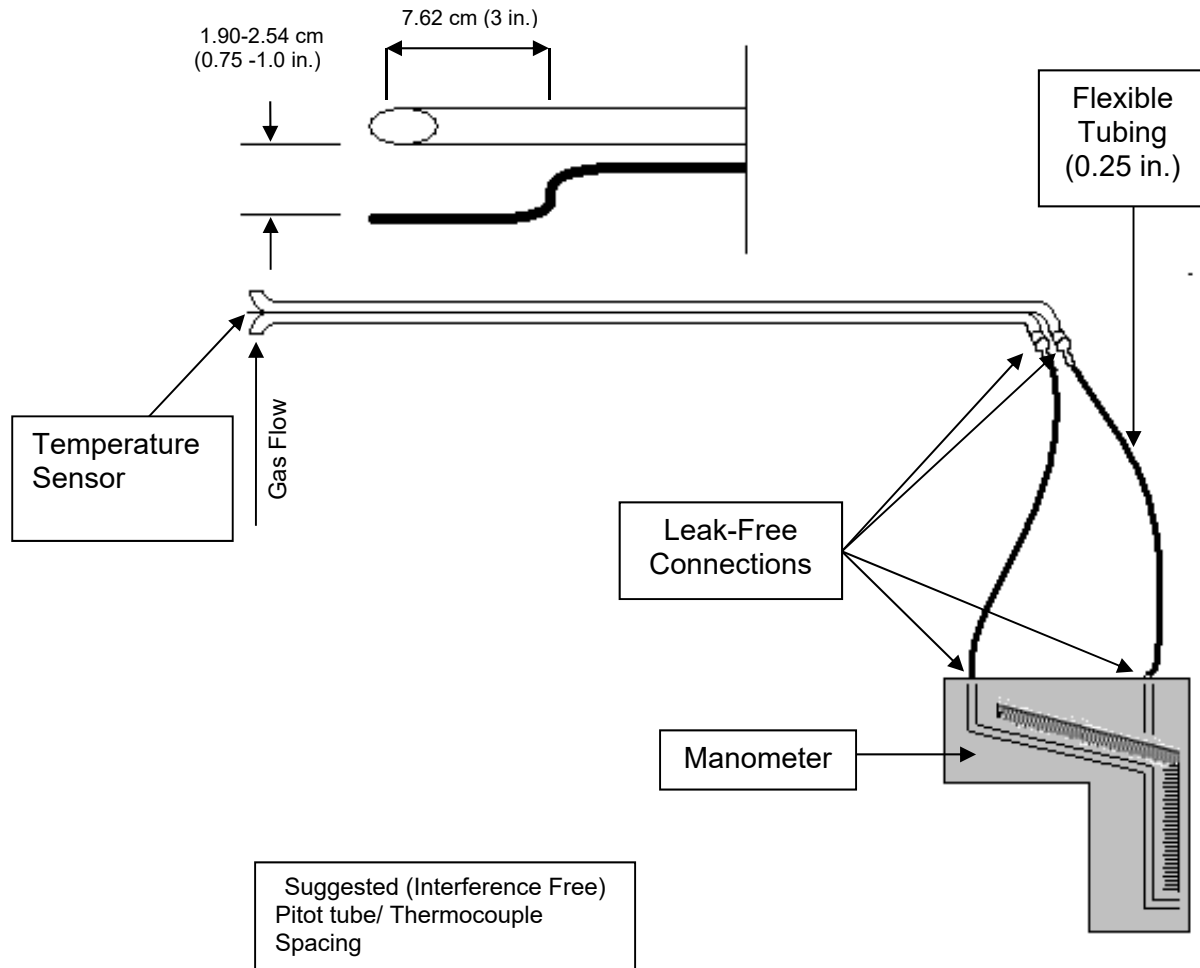
No. Points Across Diameter: 6

No. of Ports: 4

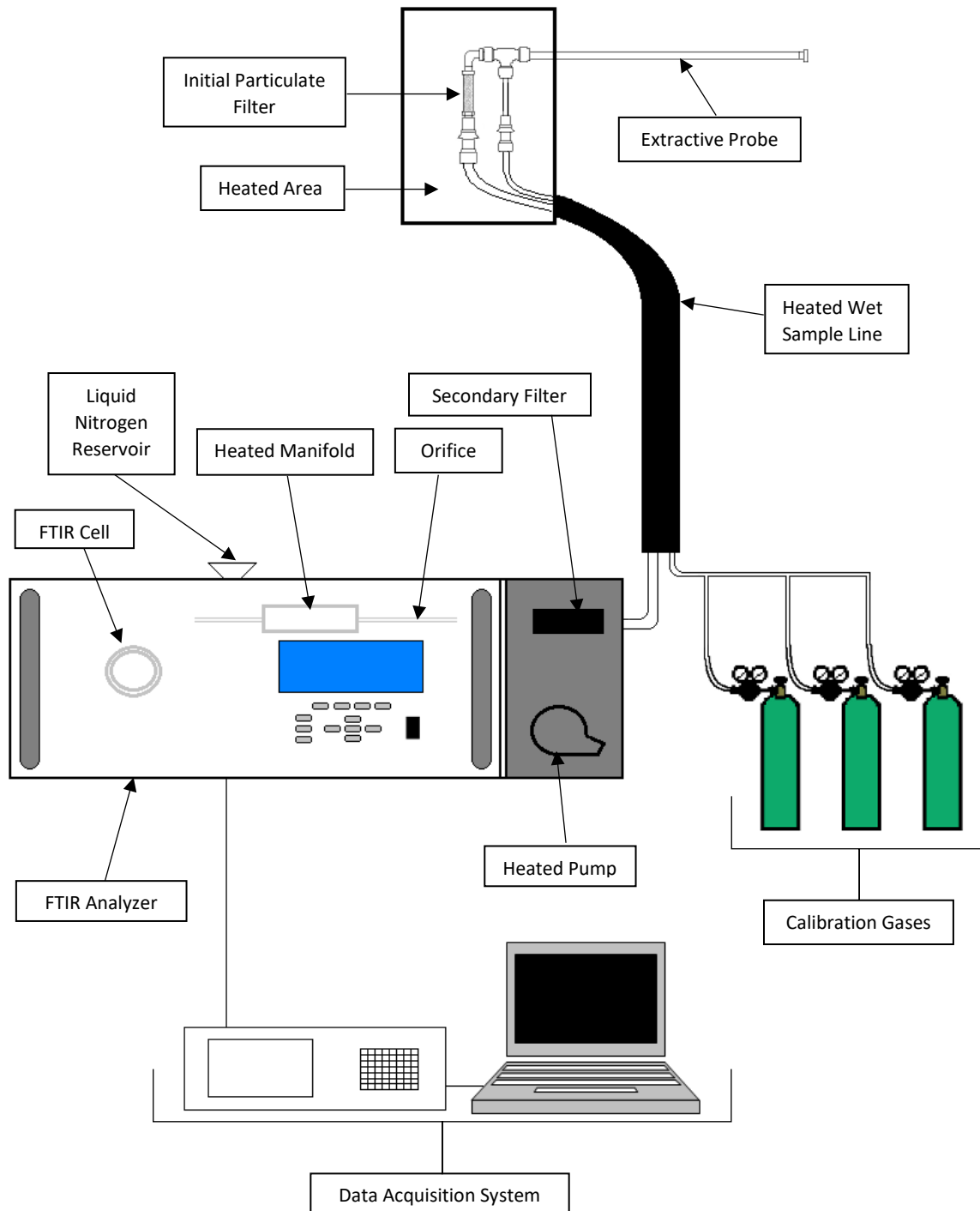
Port Length: 9.0 Inches

Appendix C – Sample Train Diagrams

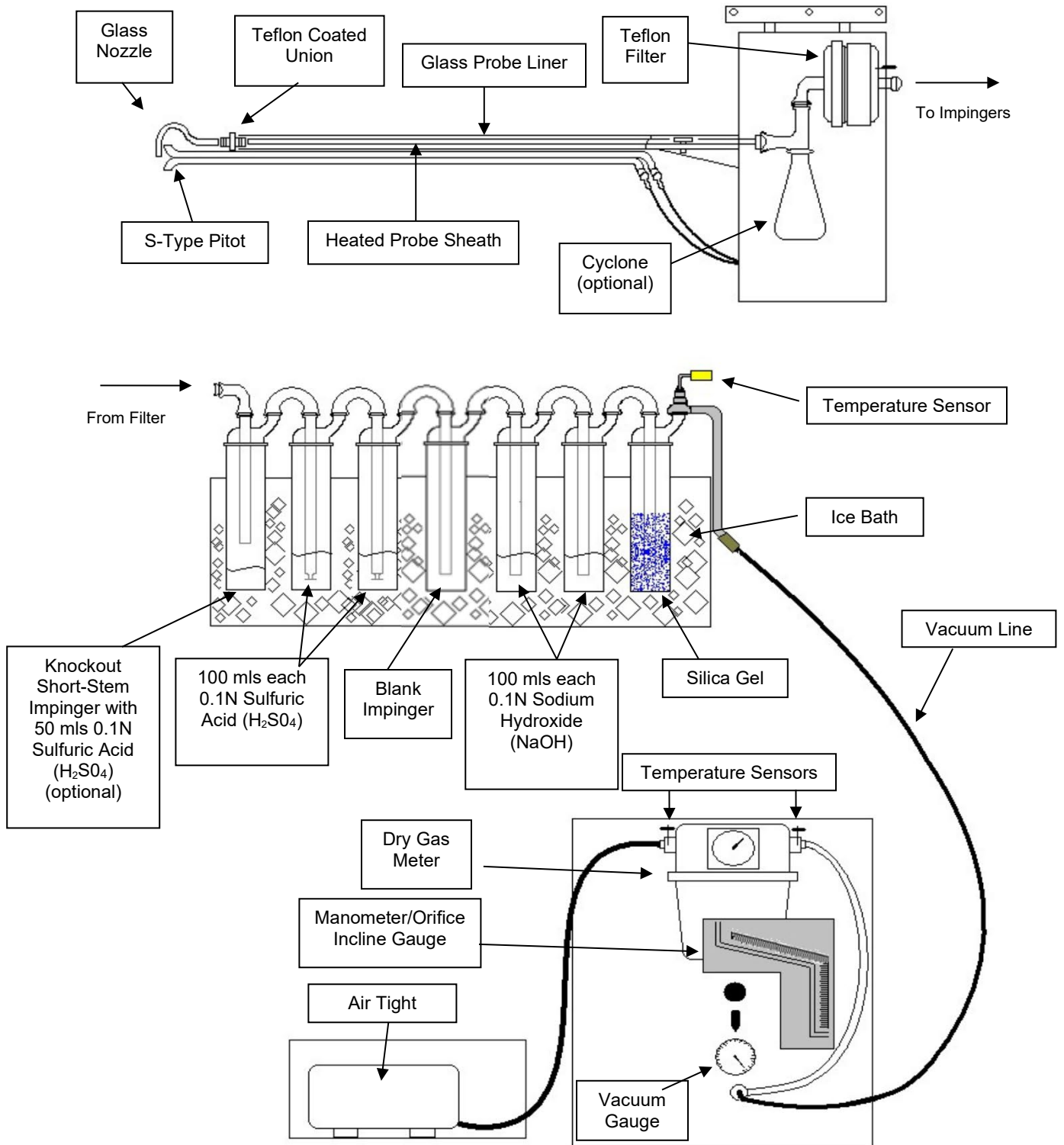
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



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: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Run: 1
 Date: 1/10/2024
 Method: 26A
 Source Condition: Mill On

Dry Molecular Weight

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

$$\%CO_2 = \underline{15.1} \quad \%O_2 = \underline{11.1} \quad \%N_2 = \underline{73.8}$$

$$Md = \underline{30.860}$$

Wet Molecular Weight

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

$$Md = \underline{30.860} \quad Bws = \underline{0.160}$$

$$Ms = \underline{28.803}$$

Meter Volume at Standard Conditions

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

$$Y = \underline{0.999} \quad Vm = \underline{52.273} \quad Pbar = \underline{29.4}$$

$$DH = \underline{2.3} \quad Tm = \underline{63.8}$$

$$Vm(std) = \underline{52.073}$$

Volume of Water Vapor Condensed

$$Vw(std) = 0.0471 \times (\text{net } H_2O \text{ gain})$$

$$\text{Net } H_2O = \underline{210.5}$$

$$Vw(std) = \underline{9.915}$$

Moisture Content

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

$$Vw(std) = \underline{9.915} \quad Vm(std) = \underline{52.073}$$

$$Bws = \underline{0.160}$$

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Run: 1
 Date: 1/10/2024
 Method: 26A
 Source Condition: Mill On

Average Duct Velocity

$$Vs = 85.49 \times Cp \times \text{Sqrt DP (avg)} \times (Ts \text{ (avg)} + 460 / (Ps \times Ms))^{1/2}$$

$$Cp = \frac{0.840}{29.39} \quad Ts \text{ (avg)} = \frac{207.0}{28.803} \quad \text{Sqrt DP (avg)} = \frac{0.409}{28.803}$$

$$Vs = \frac{26.079}{28.803}$$

Volumetric Flow Rate (Actual Basis)

$$Q = Vs \times A \times 60$$

$$Vs = \frac{26.079}{132.732} \quad A = \frac{132.732}{132.732}$$

$$Q = \frac{207,689}{132.732}$$

Volumetric Flow Rate (Standard Basis)

$$Qstd = 17.647 \times Q \times \frac{Ps}{Ts \text{ (avg)} + 460}$$

$$Q = \frac{207,689}{29.39} \quad Ps = \frac{29.39}{29.39} \quad Ts \text{ (avg)} = \frac{207.0}{29.39}$$

$$Qstd = \frac{161,513}{29.39}$$

Volumetric Flow Rate (Standard Dry Basis)

$$Qstd(\text{dry}) = Qstd \times (1 - Bws)$$

$$Qstd = \frac{161,513}{0.160} \quad Bws = \frac{0.160}{0.160}$$

$$Qstd(\text{dry}) = \frac{135,680}{0.160}$$

Isokinetic Variation:

$$\%ISO = \frac{0.0945 \times (Ts + 460) \times Vm(\text{std})}{Vs \times \theta \times An \times Ps \times (1 - Bws)}$$

$$Ts = \frac{207.0}{52.073} \quad Vm(\text{std}) = \frac{52.073}{60} \quad Vs = \frac{26.079}{29.39}$$

$$An = \frac{0.0008338}{0.160} \quad \theta = \frac{60}{60}$$

$$Bws = \frac{0.160}{0.160}$$

$$\%ISO = \frac{101.9}{101.9}$$

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Run: 1
 Date: 1/10/2024
 Method: 26A
 Source Condition: Mill On

Chlorine (Cl₂) Concentration:

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

$$\text{mg} = \underline{0.15} \quad \text{Vm(std)} = \underline{52.073}$$

$$\text{mg/m}^3 = \underline{0.10}$$

Chlorine (Cl₂) Emission Rate:

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

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

$$\text{lb of Chlorine (Cl}_2\text{)} = \underline{3.31\text{E-}10} \quad \text{dscfm} = \underline{135,680}$$

$$\text{Emission Rate lb/hr} = \underline{0.0517}$$

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Test Location: Main Kiln Stack
Date: 1/10/24

Sample Calculations

$$(11.17\% - 0.11\%) \times \frac{\text{O2 \% (dry)} \quad 12.04\%}{12.13\% - 0.11\%} = 11.08\%$$

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

where:

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

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

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

C_m = Average of 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: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

FTIR Sample Calculations

Direct Recovery % of Calibration Transfer Standard

$$DR_{cts} = \frac{D_{cts}}{C_{ma}} \times 100$$

$$C_{ma} = \underline{101.4}$$

$$D_{cts} = \underline{100.6}$$

$$DR_{cts} = \underline{99.2\%}$$

Recovery % with Calibration Transfer Standard System Purge

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

$$Sys_{cts} = \underline{101.2}$$

$$D_{cts} = \underline{100.6}$$

$$R_{cts} = \underline{101\%}$$

Direct Recovery % of Analyte Spike Gas

SF6

$$DR_{sf6} = \frac{D_{sf6}}{C_{ma}} \times 100$$

$$C_{ma} = \underline{5.0}$$

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

$$DR_{sf6} = \underline{99\%}$$

HCN

$$DR_{asg} = \frac{D_{asg}}{C_{ma}} \times 100$$

$$C_{ma} = \underline{49.6}$$

$$D_{asg} = \underline{49.2}$$

$$DR_{asg} = \underline{99.3\%}$$

Dilution Factor for Analyte Spiking

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

$$Spk_{sf6} = \underline{0.425}$$

$$D_{sf6} = \underline{4.932}$$

$$DF = \underline{0.086}$$

Recovery % for Analyte Spike With HCN

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

$$Spk_x = \underline{5.4}$$

$$N_x = \underline{1.7}$$

$$DF = \underline{0.086}$$

$$D_{asg} = \underline{49.2}$$

$$R_x = \underline{92.2} \quad \%$$

where:

DR_{cts} = Recovery % of the calibration transfer standard directly to the analyzer

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

MOSTARDI PLATT

Volumetric Air Flow Calculations

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

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

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

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

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

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

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

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

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

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

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, $85.49 \frac{ft}{sec} \left[\frac{(lb/lb-mole)(in. Hg)}{(°R)(in. H_2O)} \right]^{1/2}$
%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

Main Kiln-Mill On

Client:	Ash Grove	Analysis Date:	1/31/2024
Facility:	Seattle	Analysis Location:	Elmhurst
Test Location:	Main Kiln-Mill On	Analyst:	JMG
Project Number:	M234007		
Method:	26A		
Date Samples Received:	1/22/2024		

Train A

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	479	479		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024				
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	M26A- H2SO4 R4		RDL	MDL
Sulfuric Acid Volume	ml	426	498				
Hydrofluoric Acid	ug	<150	<150			150	15

Train B

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	420	420		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/0/1900			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	M26A- H2SO4 R4		RDL	MDL
Sulfuric Acid Volume	ml	426	498	200			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Client: Ash Grove		Analysis Date: 1/31/2024									
Facility: Seattle		Analysis Location: Elmhurst									
Test Location: Main Kiln-Mill On		Analyst: JMG									
Project Number: M234007											
Method: 26A											
Date Samples Received: 1/22/2024											
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.2162	0.2162	0.93	0.2323							
2	0.4466	0.2233	1.92								
5	1.1731	0.2346	5.05	Response Factor Ave							
8	1.9204	0.2401	8.27	0.2322							
10	2.4690	0.2469	10.63								
Lot Number	Ricca 830603B										
	R ²	0.9994									
	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
	1/10/2024	DI Reagent Blank	0.0021	0.0090	0.0090	1	200	0.0018	0.0019		
	1/10/2024	DI Reagent Blank	0.0014	0.0060	0.0060	1	200	0.0012	0.0013	0.0016	1.586615092
	1/10/2024	H2SO4 Reagent Blank	0.0058	0.0250	0.0250	1	200	0.0050	0.0053		
	1/10/2024	H2SO4 Reagent Blank	0.0064	0.0275	0.0275	1	200	0.0055	0.0058	0.0055	5.530486892
	1/10/2024	Test 1A H2SO4 Imp	0.0124	0.0534	0.0534	1	479	0.0256	0.0269		
	1/10/2024	Test 1A H2SO4 Imp	0.0100	0.0430	0.0430	1	479	0.0206	0.0217	0.0243	24.31963613
	1/10/2024	Test 1A H2SO4 Imp	0.0104	0.0448	0.0448	1	479	0.0214	0.0226		
	1/10/2024	Test 1A H2SO4 Imp	0.0099	0.0426	0.0426	1	479	0.0204	0.0215	0.0220	22.03967024
	1/10/2024	Test 2A H2SO4 Imp	0.0150	0.0646	0.0646	1	426	0.0275	0.0290		
	1/10/2024	Test 2A H2SO4 Imp	0.0114	0.0491	0.0491	1	426	0.0209	0.0220	0.0255	25.49101139
	1/10/2024	Test 3A H2SO4 Imp	0.0091	0.0392	0.0392	1	498	0.0195	0.0205		
	1/10/2024	Test 3A H2SO4 Imp	0.0073	0.0314	0.0314	1	498	0.0156	0.0165	0.0185	18.51171826
	1/10/2024	Train Blank A	0.0068	0.0293	0.0293	1	200	0.0059	0.0060		
	1/10/2024	Train Blank A	0.0077	0.0331	0.0331	1	200	0.0066	0.0068	0.0064	6.416727948
					Expected Value	% Difference					
		Run 1 H2SO4 Spike W/ 2ppm	0.2374	1.0218	0.9852						
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2392	1.0295	0.9852	4.11%					
CCV ppm CI		Area	PPM CI								
1 ppm ICV		0.2333	1.0041								
5 ppm CCV		1.1579	4.9835								
5 ppm CCV		1.1324	4.8738								
5 ppm CCV		1.1771	5.0661								
5 ppm CCV		1.1794	5.0760								
Standard ppm CI		Area	Difference								
1		0.2222	1.35%								
2		0.4492	0.29%								
5		1.1710	0.09%								
8		1.9341	0.35%								
10		2.4858	0.34%								

Client: Ash Grove		Analysis Date: 1/31/2024									
Facility: Seattle		Analysis Location: Elmhurst									
Test Location: Main Kiln-Mill On		Analyst: JMG									
Project Number: M234007											
Method: 26A											
Date Samples Received: 1/22/2024											
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.2162	0.2162	0.93	0.2323							
2	0.4466	0.2233	1.92								
5	1.1731	0.2346	5.05	Response Factor Ave							
8	1.9204	0.2401	8.27	0.2322							
10	2.4690	0.2469	10.63								
Lot Number	Ricca 830603B										
	R²	0.9994									
	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
	1/10/2024	DI Reagent Blank	0.0021	0.0090	0.0090	1	200	0.0018	0.0019		
	1/10/2024	DI Reagent Blank	0.0014	0.0060	0.0060	1	200	0.0012	0.0013	0.0016	1.586615092
	1/10/2024	H2SO4 Reagent Blank	0.0058	0.0250	0.0250	1	200	0.0050	0.0053		
	1/10/2024	H2SO4 Reagent Blank	0.0064	0.0275	0.0275	1	200	0.0055	0.0058	0.0055	5.530486892
	1/10/2024	Test 1B H2SO4 Imp	0.0134	0.0577	0.0577	1	420	0.0242	0.0255		
	1/10/2024	Test 1B H2SO4 Imp	0.0133	0.0572	0.0572	1	420	0.0240	0.0253	0.0254	25.41757377
	1/10/2024	Test 1B H2SO4 Imp	0.0144	0.0620	0.0620	1	420	0.0260	0.0274		
	1/10/2024	Test 1B H2SO4 Imp	0.0138	0.0594	0.0594	1	420	0.0249	0.0263	0.0268	26.84552736
	1/10/2024	Test 2B H2SO4 Imp	0.0259	0.1115	0.1115	1	399	0.0445	0.0468		
	1/10/2024	Test 2B H2SO4 Imp	0.0232	0.0999	0.0999	1	399	0.0398	0.0420	0.0444	44.40459658
	1/10/2024	Test 3B H2SO4 Imp	0.0088	0.0379	0.0379	1	391	0.0148	0.0156		
	1/10/2024	Test 3B H2SO4 Imp	0.0058	0.0250	0.0250	1	391	0.0098	0.0103	0.0129	12.93907274
	1/0/1900	Train Blank B	0.0068	0.0293	0.0293	1	200	0.0059	0.0062		
	1/0/1900	Train Blank B	0.0077	0.0331	0.0331	1	200	0.0066	0.0070	0.0066	6.573119667
CCV ppm F	Area	PPM CI									
1 ppm ICV	0.2333	1.0041									
5 ppm CCV	1.1579	4.9835									
5 ppm CCV	1.1324	4.8738									
5 ppm CCV	1.1771	5.0661									
5 ppm CCV	1.1794	5.0760									
Standard ppm CI	Area	Difference									
1	0.2222	1.35%									
2	0.4492	0.29%									
5	1.1710	0.09%									
8	1.9341	0.35%									
10	2.4858	0.34%									

Main Kiln-Mill On

Client: Ash Grove	Analysis Date: 1/31/2024
Facility: Seattle	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill On	Analyst: JMG
Project Number: M234007	
Method: 26A	
Date Samples Received: 1/22/2024	

Train A

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	229	229		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/10/2024			
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train A Blank		RDL	MDL
Sodium Hydroxide Volume	ml	253	245	200			
Chlorine	ug	<150	<150	#REF!		150	15

Train B

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	275	275		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/0/1900			
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train B Blank		RDL	MDL
Sodium Hydroxide Volume	ml	255	243	200			
Chlorine	ug	<150	<150	<150		150	15

Client:	Ash Grove	Analysis Date:									
Facility:	Seattle	Analysis Location:	Elmhurst Lab								
Test Location:	Main Kiln-Mill On	Analyst:	JMG								
Project Number:	M234007										
Method:	26A										
Date Samples Received:	1/22/2024										
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.1234	0.1234	0.96	0.1288							
2	0.2495	0.1248	1.94								
5	0.6414	0.1283	4.98	Response Factor Ave							
8	1.0556	0.1320	8.20	0.1287							
10	1.3512	0.1351	10.49								
Lot Number	Ricca 830603B										
	R ²	0.9994									
	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	
	1/10/2024	DI Reagent Blank	0.0025	0.0194	0.0194	1	200	0.0039			
	1/10/2024	DI Reagent Blank	0.0016	0.0124	0.0124	1	200	0.0025	0.0032	3.183824277	
	1/10/2024	NaOH Reagent Blank	0.0133	0.1033	0.1033	1	200	0.0207			
	1/10/2024	NaOH Reagent Blank	0.0137	0.1064	0.1064	1	200	0.0213	0.0210	20.96664768	
	1/10/2024	Test 1A NaOH Imp	0.0447	0.3471	0.3471	1	229	0.0795			
	1/10/2024	Test 1A NaOH Imp	0.0452	0.3510	0.3510	1	229	0.0804	0.0799	79.9337912	
	1/10/2024	Test 1A NaOH Imp	0.0446	0.3463	0.3463	1	229	0.0793			
	1/10/2024	Test 1A NaOH Imp	0.0450	0.3494	0.3494	1	229	0.0800	0.0797	79.66704885	
	1/10/2024	Test 2A NaOH Imp	0.0373	0.2897	0.2897	1	253	0.0733			
	1/10/2024	Test 2A NaOH Imp	0.0399	0.3098	0.3098	1	253	0.0784	0.0758	75.83558812	
	1/10/2024	Test 3A NaOH Imp	0.0262	0.2035	0.2035	1	245	0.0498			
	1/10/2024	Test 3A NaOH Imp	0.0261	0.2027	0.2027	1	245	0.0497	0.0498	49.75113705	
	1/10/2024	Train Blank	0.0227	0.1763	0.1763	1	200	0.0353			
	1/10/2024	Train Blank	0.0214	0.1662	0.1662	1	200	0.0332	0.0342	34.24552454	
		Run 1 H2SO4 Spike W/ 2ppm	0.1524	1.1835	1.1433						
		Run 1 H2SO4 Spike W/ 2ppm	0.1362	1.0577	1.1433	1.99%					
CCV ppm Cl	Area	PPM Cl									
5 ppm ICV	0.6440	5.0009									
5 ppm CCV	0.648	5.0320									
5 ppm CCV	0.6496	5.0444									
5 ppm CCV	0.6449	5.0079									
Standard ppm Cl	Area	Difference									
1	0.1209	1.03%									
2	0.2479	0.32%									
5	0.6507	0.71%									
8	1.0606	0.24%									
10	1.3617	0.39%									

Client:	Ash Grove	Analysis Date:	1/0/1900								
Facility:	Seattle	Analysis Location:	Elmhurst Lab								
Test Location:	Main Kiln-Mill On	Analyst:	JMG								
Project Number:	M234007										
Method:	26A										
Date Samples Received:	1/22/2024										
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.1234	0.1234	0.96	0.1288							
2	0.2495	0.1248	1.94								
5	0.6414	0.1283	4.98	Response Factor Ave							
8	1.0556	0.1320	8.20	0.1287							
10	1.3512	0.1351	10.49								
Lot Number	Ricca 830603B										
	R ²	0.9994									
	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	
	1/10/2024	DI Reagent Blank	0.0025	0.0194	0.0194	1	200	0.0039			
	1/10/2024	DI Reagent Blank	0.0016	0.0124	0.0124	1	200	0.0025	0.0032	3.183824277	
	1/10/2024	NaOH Reagent Blank	0.0133	0.1033	0.1033	1	200	0.0207			
	1/10/2024	NaOH Reagent Blank	0.0137	0.1064	0.1064	1	200	0.0213	0.0210	20.96664768	
	1/10/2024	Test 1B NaOH Imp	0.0250	0.1941	0.1941	1	275	0.0534			
	1/10/2024	Test 1B NaOH Imp	0.0280	0.2174	0.2174	1	275	0.0598	0.0566	56.59053517	
	1/10/2024	Test 1B NaOH Imp	0.0245	0.1903	0.1903	1	275	0.0523			
	1/10/2024	Test 1B NaOH Imp	0.0244	0.1895	0.1895	1	275	0.0521	0.0522	52.21277679	
	1/10/2024	Test 2B NaOH Imp	0.0091	0.0707	0.0707	1	255	0.0180			
	1/10/2024	Test 2B NaOH Imp	0.0097	0.0753	0.0753	1	255	0.0192	0.0186	18.61372389	
	1/10/2024	Test 3B NaOH Imp	0.0336	0.2609	0.2609	1	243	0.0634			
	1/10/2024	Test 3B NaOH Imp	0.0395	0.3067	0.3067	1	243	0.0745	0.0690	68.96978754	
	1/0/1900	Train B Train Blank	0.0227	0.1763	0.1763	1	200	0.0353			
	1/0/1900	Train B Train Blank	0.0214	0.1662	0.1662	1	200	0.0332	0.0342	34.24552454	
CCV ppm Cl	Area	PPM Cl									
5 ppm ICV	0.6440	5.0009									
5 ppm CCV	0.648	5.0320									
5 ppm CCV	0.6496	5.0444									
5 ppm CCV	0.6449	5.0079									
Standard ppm Cl	Area	Difference									
1	0.1209	1.03%									
2	0.2479	0.32%									
5	0.6507	0.71%									
8	1.0606	0.24%									
10	1.3617	0.39%									

Main Kiln-Mill Off

Client:	Ash Grove	Analysis Date:	1/31/2024
Facility:	Seattle	Analysis Location:	Elmhurst
Test Location:	Main Kiln-Mill Off	Analyst:	JMG
Project Number:	M234007		
Method:	26A		
Date Samples Received:	1/22/2024		

Train A

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	378	378		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/10/2024			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	Train A Blank		RDL	MDL
Sulfuric Acid Volume	ml	363	345	200			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	200	334	334		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/10/2024			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	Train B Blank		RDL	MDL
Sulfuric Acid Volume	ml	363	345	200			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Client: Ash Grove		Analysis Date: 1/31/2024									
Facility: Seattle		Analysis Location: Elmhurst									
Test Location: Main Kiln-Mill Off		Analyst: JMG									
Project Number: M234007											
Method: 26A											
Date Samples Received: 1/22/2024											
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.2162	0.2162	0.93	0.2323							
2	0.4466	0.2233	1.92								
5	1.1731	0.2346	5.05	Response Factor Ave							
8	1.9204	0.2401	8.27	0.2322							
10	2.4690	0.2469	10.63								
Lot Number	Ricca 830603B										
	R ²	0.9994									
	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
	1/10/2024	DI Reagent Blank	0.0021	0.0090	0.0090	1	200	0.0018	0.0019		
	1/10/2024	DI Reagent Blank	0.0014	0.0060	0.0060	1	200	0.0012	0.0013	0.0016	1.586615092
	1/10/2024	H2SO4 Reagent Blank	0.0058	0.0250	0.0250	1	200	0.0050	0.0053		
	1/10/2024	H2SO4 Reagent Blank	0.0064	0.0275	0.0275	1	200	0.0055	0.0058	0.0055	5.530486892
	1/10/2024	Test 1A H2SO4 Imp	0.0054	0.0232	0.0232	1	378	0.0088	0.0093		
	1/10/2024	Test 1A H2SO4 Imp	0.0042	0.0181	0.0181	1	378	0.0068	0.0072	0.0082	8.225012637
	1/10/2024	Test 1A H2SO4 Imp	0.0040	0.0172	0.0172	1	378	0.0065	0.0069		
	1/10/2024	Test 1A H2SO4 Imp	0.0042	0.0181	0.0181	1	378	0.0068	0.0072	0.0070	7.025531628
	1/10/2024	Test 2A H2SO4 Imp	0.0028	0.0121	0.0121	1	363	0.0044	0.0046		
	1/10/2024	Test 2A H2SO4 Imp	0.0032	0.0138	0.0138	1	363	0.0050	0.0053	0.0049	4.936639529
	1/10/2024	Test 3A H2SO4 Imp	0.0038	0.0164	0.0164	1	345	0.0056	0.0059		
	1/10/2024	Test 3A H2SO4 Imp	0.0033	0.0142	0.0142	1	345	0.0049	0.0052	0.0056	5.552019526
	1/10/2024	Train Blank A	0.0068	0.0293	0.0293	1	200	0.0059	0.0060		
	1/10/2024	Train Blank A	0.0077	0.0331	0.0331	1	200	0.0066	0.0068	0.0064	6.416727948
					Expected Value	% Difference					
		Run 1 H2SO4 Spike W/ 2ppm	0.2100	0.9038	0.9714						
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2128	0.9159	0.9714	6.34%					
CCV ppm CI	Area	PPM CI									
1 ppm ICV	0.2333	1.0041									
5 ppm CCV	1.1579	4.9835									
5 ppm CCV	1.1324	4.8738									
5 ppm CCV	1.1771	5.0661									
5 ppm CCV	1.1794	5.0760									
Standard ppm CI	Area	Difference									
1	0.2222	1.35%									
2	0.4492	0.29%									
5	1.1710	0.09%									
8	1.9341	0.35%									
10	2.4858	0.34%									

Client: Ash Grove		Analysis Date: 1/31/2024									
Facility: Seattle		Analysis Location: Elmhurst									
Test Location: Main Kiln-Mill Off		Analyst: JMG									
Project Number: M234007											
Method: 26A											
Date Samples Received: 1/22/2024											
Standard ppm HF	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.2162	0.2162	0.93	0.2323							
2	0.4466	0.2233	1.92								
5	1.1731	0.2346	5.05	Response Factor Ave							
8	1.9204	0.2401	8.27	0.2322							
10	2.4690	0.2469	10.63								
Lot Number	Ricca 830603B										
	R²	0.9994									
	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
	1/10/2024	DI Reagent Blank	0.0021	0.0090	0.0090	1	200	0.0018	0.0019		
	1/10/2024	DI Reagent Blank	0.0014	0.0060	0.0060	1	200	0.0012	0.0013	0.0016	1.586615092
	1/10/2024	H2SO4 Reagent Blank	0.0058	0.0250	0.0250	1	200	0.0050	0.0053		
	1/10/2024	H2SO4 Reagent Blank	0.0064	0.0275	0.0275	1	200	0.0055	0.0058	0.0055	5.530486892
	1/10/2024	Test 1B H2SO4 Imp	0.0076	0.0327	0.0327	1	334	0.0109	0.0115		
	1/10/2024	Test 1B H2SO4 Imp	0.0097	0.0417	0.0417	1	334	0.0139	0.0147	0.0131	13.09682761
	1/10/2024	Test 1B H2SO4 Imp	0.0087	0.0374	0.0374	1	334	0.0125	0.0132		
	1/10/2024	Test 1B H2SO4 Imp	0.0094	0.0405	0.0405	1	334	0.0135	0.0142	0.0137	13.70246125
	1/10/2024	Test 2B H2SO4 Imp	0.0071	0.0306	0.0306	1	396	0.0121	0.0127		
	1/10/2024	Test 2B H2SO4 Imp	0.0075	0.0323	0.0323	1	396	0.0128	0.0135	0.0131	13.10453402
	1/10/2024	Test 3B H2SO4 Imp	0.0080	0.0344	0.0344	1	378	0.0130	0.0137		
	1/10/2024	Test 3B H2SO4 Imp	0.0075	0.0323	0.0323	1	378	0.0122	0.0129	0.0133	13.27996832
	1/0/1900	Train Blank B	0.0068	0.0293	0.0293	1	200	0.0059	0.0062		
	1/0/1900	Train Blank B	0.0077	0.0331	0.0331	1	200	0.0066	0.0070	0.0066	6.573119667
CCV ppm F	Area	PPM CI									
1 ppm ICV	0.2333	1.0041									
5 ppm CCV	1.1579	4.9835									
5 ppm CCV	1.1324	4.8738									
5 ppm CCV	1.1771	5.0661									
5 ppm CCV	1.1794	5.0760									
Standard ppm CI	Area	Difference									
1	0.2222	1.35%									
2	0.4492	0.29%									
5	1.1710	0.09%									
8	1.9341	0.35%									
10	2.4858	0.34%									

Main Kiln-Mill Off

Client:	Ash Grove	Analysis Date:	1/31/2024
Facility:	Seattle	Analysis Location:	Elmhurst
Test Location:	Main Kiln-Mill Off	Analyst:	JMG
Project Number:	M234007		
Method:	26A		
Date Samples Received:	1/22/2024		

Train A

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	225	225		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/10/2024			
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train A Blank		RDL	MDL
Sodium Hydroxide Volume	ml	279	286	200			
Chlorine	ug	<150	<150	<150		150	15

Train B

Sampling Date		1/10/2024	1/10/2024	1/10/2024	1/10/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	200	244	244		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/10/2024	1/10/2024	1/0/1900			
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train B Blank		RDL	MDL
Sodium Hydroxide Volume	ml	250	254	200			
Chlorine	ug	<150	<150	<150		150	15

Client:	Ash Grove	Analysis Date:									
Facility:	Seattle	Analysis Location:	Elmhurst Lab								
Test Location:	Main Kiln-Mill Off	Analyst:	JMG								
Project Number:	M234007										
Method:	26A										
Date Samples Received:	1/22/2024										
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve							
1	0.1234	0.1234	0.96	0.1288							
2	0.2495	0.1248	1.94								
5	0.6414	0.1283	4.98	Response Factor Ave							
8	1.0556	0.1320	8.20	0.1287							
10	1.3512	0.1351	10.49								
Lot Number	Ricca 830603B										
	R ²	0.9994									
	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	
	1/10/2024	DI Reagent Blank	0.0025	0.0194	0.0194	1	200	0.0039			
	1/10/2024	DI Reagent Blank	0.0016	0.0124	0.0124	1	200	0.0025	0.0032	3.183824277	
	1/10/2024	NaOH Reagent Blank	0.0133	0.1033	0.1033	1	200	0.0207			
	1/10/2024	NaOH Reagent Blank	0.0137	0.1064	0.1064	1	200	0.0213	0.0210	20.96664768	
	1/11/2024	Test 1A NaOH Imp	0.0554	0.4302	0.4302	1	225	0.0968			
	1/11/2024	Test 1A NaOH Imp	0.0687	0.5335	0.5335	1	225	0.1200	0.1084	108.4150407	
	1/11/2024	Test 1A NaOH Imp	0.0763	0.5925	0.5925	1	225	0.1333			
	1/11/2024	Test 1A NaOH Imp	0.0659	0.5117	0.5117	1	225	0.1151	0.1242	124.2273875	
	1/11/2024	Test 2A NaOH Imp	0.0436	0.3386	0.3386	1	279	0.0945			
	1/11/2024	Test 2A NaOH Imp	0.0404	0.3137	0.3137	1	279	0.0875	0.0910	90.99525093	
	1/11/2024	Test 3A NaOH Imp	0.0171	0.1328	0.1328	1	286	0.0380			
	1/11/2024	Test 3A NaOH Imp	0.0249	0.1934	0.1934	1	286	0.0553	0.0466	46.63914295	
	1/10/2024	Train Blank	0.0227	0.1763	0.1763	1	200	0.0353			
	1/10/2024	Train Blank	0.0214	0.1662	0.1662	1	200	0.0332	0.0342	34.24552454	
		Run 1 H2SO4 Spike W/ 2ppm	0.1590	1.2347	1.2097						
		Run 1 H2SO4 Spike W/ 2ppm	0.1616	1.2549	1.2097	2.90%					
CCV ppm Cl	Area	PPM Cl									
5 ppm ICV	0.6440	5.0009									
5 ppm CCV	0.648	5.0320									
5 ppm CCV	0.6496	5.0444									
5 ppm CCV	0.6449	5.0079									
Standard ppm Cl	Area	Difference									
1	0.1209	1.03%									
2	0.2479	0.32%									
5	0.6507	0.71%									
8	1.0606	0.24%									
10	1.3617	0.39%									

Client:	Ash Grove	Analysis Date:	1/0/1900							
Facility:	Seattle	Analysis Location:	Elmhurst Lab							
Test Location:	Main Kiln-Mill Off	Analyst:	JMG							
Project Number:	M234007									
Method:	26A									
Date Samples Received:	1/22/2024									
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve						
1	0.1234	0.1234	0.96	0.1288						
2	0.2495	0.1248	1.94							
5	0.6414	0.1283	4.98	Response Factor Ave						
8	1.0556	0.1320	8.20	0.1287						
10	1.3512	0.1351	10.49							
Lot Number	Ricca 830603B									
	R ²	0.9994								
	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
	1/10/2024	DI Reagent Blank	0.0025	0.0194	0.0194	1	200	0.0039		
	1/10/2024	DI Reagent Blank	0.0016	0.0124	0.0124	1	200	0.0025	0.0032	3.183824277
	1/10/2024	NaOH Reagent Blank	0.0133	0.1033	0.1033	1	200	0.0207		
	1/10/2024	NaOH Reagent Blank	0.0137	0.1064	0.1064	1	200	0.0213	0.0210	20.96664768
	1/10/2024	Test 1B NaOH Imp	0.0136	0.1056	0.1056	1	244	0.0258		
	1/10/2024	Test 1B NaOH Imp	0.0190	0.1475	0.1475	1	244	0.0360	0.0309	30.88464858
	1/10/2024	Test 1B NaOH Imp	0.0186	0.1444	0.1444	1	244	0.0352		
	1/10/2024	Test 1B NaOH Imp	0.0222	0.1724	0.1724	1	244	0.0421	0.0387	38.65317981
	1/10/2024	Test 2B NaOH Imp	0.0195	0.1514	0.1514	1	250	0.0379		
	1/10/2024	Test 2B NaOH Imp	0.0225	0.1747	0.1747	1	250	0.0437	0.0408	40.7684816
	1/10/2024	Test 3B NaOH Imp	0.0140	0.1087	0.1087	1	254	0.0276		
	1/10/2024	Test 3B NaOH Imp	0.0110	0.0854	0.0854	1	254	0.0217	0.0247	24.65522459
	1/0/1900	Train B Train Blank	0.0227	0.1763	0.1763	1	200	0.0353		
	1/0/1900	Train B Train Blank	0.0214	0.1662	0.1662	1	200	0.0332	0.0342	34.24552454
CCV ppm Cl	Area	PPM Cl								
5 ppm ICV	0.6440	5.0009								
5 ppm CCV	0.648	5.0320								
5 ppm CCV	0.6496	5.0444								
5 ppm CCV	0.6449	5.0079								
Standard ppm Cl	Area	Difference								
1	0.1209	1.03%								
2	0.2479	0.32%								
5	0.6507	0.71%								
8	1.0606	0.24%								
10	1.3617	0.39%								

Chain-of-Custody Form						
Project Number: M234007				Date Results Required:		
Client: AGC Seattle				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	1/10/24	#1A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
002	1/10/24	#1A 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
003	1/10/24	#2A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
004	1/10/24	#2A 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
005	1/10/24	#3A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
006	1/10/24	#3A 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
007	1/10/24	#1B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
008	1/10/24	#1B 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
009	1/10/24	#2B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
010	1/10/24	#2B 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
011	1/10/24	#3B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
012	1/10/24	#3B 26A Mill on 0.1N NaOH	1		M26A (Cl ₂)	
013	1/10/24	#1A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
014	1/10/24	#1A 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
015	1/10/24	#2A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
016	1/10/24	#2A 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
017	1/10/24	#3A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
018	1/10/24	#3A 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
019	1/10/24	#1B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
020	1/10/24	#1B 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
021	1/10/24	#2B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
022	1/10/24	#2B 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	
023	1/10/24	#3B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
024	1/10/24	#3B 26A Mill off 0.1N NaOH	1		M26A (Cl ₂)	

025	1/10/24	A Train Field Blank 0.1N H ₂ SO ₄	1		M26A (HF)	
026	1/10/24	A Train Field Blank 0.1N NaOH	1		M26A (Cl ₂)	
027	1/10/24	B Train Field Blank 0.1N H ₂ SO ₄	1		M26A (HF)	
028	1/10/24	B Train Field Blank 0.1N NaOH	1		M26A (Cl ₂)	
029	1/10/24	0.1N H ₂ SO ₄ Reagent Blank	1		M26A (HF)	
030	1/10/24	0.1N NaOH Reagent Blank	1		M26A (Cl ₂)	
031	1/10/24	DI Water Reagent Blank	1		M26A (HF and Cl ₂)	
Delivered to Lab by: Date/Time: 1/15/2024 			Received by: Date/Time:		Processed by: Date/Time:	

Laboratory Notes:

Appendix F - Reference Method Test Data

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Test Location: Main Kiln Stack
Project #: M234007-02
Test Method: 26A
Test Engineer: DV
Test Technician: EROD

	<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>
Meter ID:	CM23	CM23	CM23
Pitot ID:	2829	2829	2829
Nozzle Diameter (Inches):	0.391	0.391	0.391
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:	14 Glass	14 Glass	14 Glass

Leak Checks

Pre Pitot Leak Check	0.0 @ 6.0 "H ₂ O	0.0 @ 6.0 "H ₂ O	0.0 @ 7.0 "H ₂ O
Post Pitot Leak Check	0.0 @ 5.0 "H ₂ O	0.0 @ 5.0 "H ₂ O	0.0 @ 9.0 "H ₂ O
Pre Nozzle Leak Check	0.0000 @ 15 "Hg	0.0000 @ 16 "Hg	0.0000 @ 16 "Hg
Post Nozzle Leak Check	0.0000 @ 12 "Hg	0.0000 @ 12 "Hg	0.0000 @ 13 "Hg

Pitot Tube Coefficient: 0.840
Probe Length (Feet): 6.0
Probe Liner Material: Quartz
Sample Plane: Horizontal
Port Length (Inches): 9.00
Port Size (Diameter, Inches): 6.00
Port Type: Flange
Duct Shape: Circular
Diameter (Feet): 13
Duct Area (Square Feet): 132.732
Upstream Diameters: 9.2
Downstream Diameters: 10.8
Number of Ports Sampled: 4
Number of Points per Port: 3
Minutes per Point: 5.0
Minutes per Reading: 5.0
Total Number of Traverse Points: 12
Test Length (Minutes): 60
Train Type: Anderson Box
Source Condition: Mill On
Moisture Balance ID: LV1
of Runs 3

Run 1A - Method 26A

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

Date: 1/10/24
 Start Time: 6:50
 End Time: 8:05

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	2.31	in. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	63.8	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.409	in. H ₂ O		Carbon Dioxide:	15.10	%
Stack Temperature, Ts:	207.0	°F		Oxygen:	11.10	%
Meter Volume, Vm:	52.273	ft ³		Nitrogen:	73.80	%
Meter Volume, Vmstd:	52.073	dscf		Gas Weight dry, Md:	30.860	lb/lb mole
Meter Volume, Vwstd:	9.915	wscf		Gas Weight wet, Ms:	28.803	lb/lb mole
Isokinetic Variance:	101.9	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	26.079	fps
Nozzle Diameter:	0.391	in inches		Volumetric Flow:	207,689	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	135,680	dscfm
				Volumetric Flow:	161,513	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3654.5	ml	Silica Initial Wt.	872.7	grams
Final Impinger Content:	3856.3	ml	Silica Final Wt.	881.4	grams
Impinger Difference:	201.8	ml	Silica Difference:	8.7	grams
Total Water Gain:	210.5		Moisture, Bws:	0.160	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	6:50:00	0.21	2.89	51.710	207	61	59	5	260	258	39
1-2	6:55:00	0.18	2.47	56.558	207	62	59	5	260	260	40
1-3	7:00:00	0.16	2.20	61.040	207	61	59	5	260	258	40
	7:05:00			65.273							
2-1	7:10:00	0.19	2.61	65.273	208	63	59	5	260	259	41
2-2	7:15:00	0.17	2.34	69.889	208	63	59	5	260	258	41
2-3	7:20:00	0.14	1.92	74.250	208	63	59	5	260	258	41
	7:25:00			78.206							
3-1	7:30:00	0.20	2.75	78.206	206	70	63	5	260	253	41
3-2	7:35:00	0.17	2.34	82.999	206	70	63	5	260	253	41
3-3	7:40:00	0.15	2.06	87.416	206	70	63	5	260	257	42
	7:45:00			91.563							
4-1	7:50:00	0.18	2.47	91.563	207	71	64	5	260	256	42
4-2	7:55:00	0.15	2.06	96.115	207	71	64	5	260	260	42
4-3	8:00:00	0.12	1.65	100.266	207	71	65	5	260	260	42
	8:05:00			103.983							

Total	1:00:00			52.273		66.3	61.3				
Average			2.31		207.0	63.8		5			
Min			1.65		206.0	59.0		5			
Max			2.89		208.0	71.0		5			

Impinger Weight Sheet - Run 1A

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: center;"><u>Certified Weight, grams</u></th> <th style="text-align: center;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center;"><u>250.0</u></td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center;"><u>500.0</u></td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center;"><u>750.0</u></td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	<u>250.0</u>	500	<u>500.0</u>	750	<u>750.0</u>
<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		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		877.4		760.8		116.6	
0.1N H2SO4		812.2		746.1		66.1	
Empty		654.1		640.0		14.1	
0.1N NaOH		746.2		742.5		3.7	
0.1N NaOH		766.4		765.1		1.3	
Silica Gel		881.4		872.7		8.7	

<u>3,856.3</u> Liquid Final	<u>3,654.5</u> Liquid Initial	<u>201.8</u> Liquid Gain
<u>881.4</u> Silica Final	<u>872.7</u> Silica Initial	<u>8.7</u> Silica Gain

Run 2A - Method 26A

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

Date: 1/10/24
 Start Time: 8:25
 End Time: 9:40

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	2.27	in. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	70.7	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.405	in. H ₂ O		Carbon Dioxide:	15.40	%
Stack Temperature, Ts:	204.5	°F		Oxygen:	11.10	%
Meter Volume, Vm:	52.546	ft ³		Nitrogen:	73.5	%
Meter Volume, Vmstd:	51.665	dscf		Gas Weight dry, Md:	30.908	lb/lb mole
Meter Volume, Vwstd:	10.112	wscf		Gas Weight wet, Ms:	28.795	lb/lb mole
Isokinetic Variance:	102.4	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	25.768	fps
Nozzle Diameter:	0.391	in inches		Volumetric Flow:	205,213	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	133,966	dscfm
				Volumetric Flow:	160,187	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3661.5	ml	Silica Initial Wt.	881.9	grams
Final Impinger Content:	3865.4	ml	Silica Final Wt.	892.7	grams
Impinger Difference:	203.9	ml	Silica Difference:	10.8	grams

Total Water Gain: 214.7 Moisture, Bws: 0.164

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	8:25:00	0.20	2.75	8.651	204	71	67	5	260	262	40
1-2	8:30:00	0.18	2.47	13.476	204	71	67	5	260	262	40
1-3	8:35:00	0.15	2.06	18.051	204	71	67	5	260	262	40
	8:40:00			22.228							
2-1	8:45:00	0.19	2.61	22.228	205	72	67	5	260	256	41
2-2	8:50:00	0.16	2.20	26.933	205	72	67	5	260	256	41
2-3	8:55:00	0.14	1.92	31.245	205	72	67	5	260	256	41
	9:00:00			35.282							
3-1	9:05:00	0.20	2.75	35.282	203	71	67	5	260	258	42
3-2	9:10:00	0.17	2.34	40.110	203	71	67	5	260	258	42
3-3	9:15:00	0.12	1.65	44.560	203	71	67	5	260	258	42
	9:20:00			48.298							
4-1	9:25:00	0.18	2.47	48.298	206	80	71	5	260	259	44
4-2	9:30:00	0.16	2.20	52.920	206	79	71	5	260	259	44
4-3	9:35:00	0.13	1.79	57.276	206	79	71	5	260	259	44
	9:40:00			61.197							

Total	1:00:00			52.546		73.3	68.0				
Average			2.27		204.5	70.7		5			
Min			1.65		203.0	67.0		5			
Max			2.75		206.0	80.0		5			

Impinger Weight Sheet - Run 2A

Client:	Ash Grove Cement Company	Scale Calibration Check Date:	<u>1/10/2024</u>
Facility:	Seattle Cement Plant	<u>Scale Calibration Check (see QS-6.05C for procedure)</u>	
Test Location:	Main Kiln Stack	must be within $\pm 0.5g$ of certified mass	
Project #:	M234007-02	<u>Certified Weight, grams</u>	<u>Result, grams</u>
Date:	1/10/2024	250	<u>250.0</u>
Test Method:	26A		
Weighed/Measured By:	RODS	500	<u>500.0</u>
Balance ID:	LV1	750	<u>750.0</u>

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		918.4		755.4		163.0	
0.1N H2SO4		775.1		744.4		30.7	
Empty		646.9		641.0		5.9	
0.1N NaOH		760.0		757.4		2.6	
0.1N NaOH		765.0		763.3		1.7	
Silica Gel		892.7		881.9		10.8	

<u>3,865.4</u>	<u>3,661.5</u>	<u>203.9</u>
Liquid Final	Liquid Initial	Liquid Gain
 <u>892.7</u>	 <u>881.9</u>	 <u>10.8</u>
Silica Final	Silica Initial	Silica Gain

Run 3A - Method 26A

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

Date: 1/10/24
 Start Time: 10:00
 End Time: 11:15

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	2.22	In. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	73.4	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.401	In. H ₂ O		Carbon Dioxide:	15.00	%
Stack Temperature, Ts:	208.8	°F		Oxygen:	11.20	%
Meter Volume, Vm:	52.129	ft ³		Nitrogen:	73.8	%
Meter Volume, Vmstd:	50.989	dscf		Gas Weight dry, Md:	30.848	lb/lb mole
Meter Volume, Vwstd:	9.698	wscf		Gas Weight wet, Ms:	28.795	lb/lb mole
Isokinetic Variance:	101.9	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	25.592	fps
Nozzle Diameter:	0.391	in inches		Volumetric Flow:	203,809	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	132,819	dscfm
				Volumetric Flow:	158,081	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3623.0	ml	Silica Initial Wt.	881.4	grams
Final Impinger Content:	3818.9	ml	Silica Final Wt.	891.4	grams
Impinger Difference:	195.9	ml	Silica Difference:	10.0	grams

Total Water Gain: 205.9 Moisture, Bws: 0.160

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:00:00	0.19	2.61	65.152	209	73	73	5	250	260	43
1-2	10:05:00	0.17	2.34	69.873	209	73	73	5	250	260	43
1-3	10:10:00	0.15	2.06	74.336	209	73	73	5	250	260	43
	10:15:00			78.524							
2-1	10:20:00	0.18	2.47	78.524	207	74	73	5	250	260	42
2-2	10:25:00	0.15	2.06	83.129	207	74	73	5	250	260	42
2-3	10:30:00	0.12	1.65	87.338	207	74	73	5	250	260	42
	10:35:00			91.093							
3-1	10:40:00	0.20	2.75	91.093	209	76	71	5	250	256	51
3-2	10:45:00	0.18	2.47	95.940	209	76	71	5	250	256	51
3-3	10:50:00	0.16	2.20	100.538	209	76	71	5	250	256	51
	10:55:00			104.873							
4-1	11:00:00	0.17	2.34	104.873	210	76	71	5	250	257	51
4-2	11:05:00	0.15	2.06	109.339	210	76	71	5	250	257	51
4-3	11:10:00	0.12	1.65	113.529	210	76	71	5	250	257	51
	11:15:00			117.281							

Total	1:00:00			52.129		74.8	72.0				
Average			2.22		208.8	73.4		5			
Min			1.65		207.0	71.0		5			
Max			2.75		210.0	76.0		5			

Impinger Weight Sheet - Run 3A

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Certified Weight, grams</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center; border-bottom: 1px solid black;">250.0</td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center; border-bottom: 1px solid black;">500.0</td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center; border-bottom: 1px solid black;">750.0</td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	250.0	500	500.0	750	750.0
<u>Certified Weight, grams</u>	<u>Result, grams</u>								
250	250.0								
500	500.0								
750	750.0								

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		838.2		739.3		98.9	
0.1N H2SO4		850.0		780.0		70.0	
Empty		664.1		644.2		19.9	
0.1N NaOH		732.7		726.7		6.0	
0.1N NaOH		733.9		732.8		1.1	
Silica Gel		891.4		881.4		10.0	

<u>3,818.9</u> Liquid Final	<u>3,623.0</u> Liquid Initial	<u>195.9</u> Liquid Gain
<u>891.4</u> Silica Final	<u>881.4</u> Silica Initial	<u>10.0</u> Silica Gain

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Test Location: Main Kiln Stack
Project #: M234007-02
Test Method: 26A
Test Engineer: RB
Test Technician: RS

	<u>Run 1B</u>	<u>Run 2B</u>	<u>Run 3B</u>
Meter ID:	CM54	CM54	CM54
Pitot ID:	6969	6969	6969
Nozzle Diameter (Inches):	0.375	0.375	0.375
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:	GLASS SET #38	GLASS SET #38	GLASS SET #38

Leak Checks

Pre Pitot Leak Check	0.0 @ 4.0 "H ₂ O	0.0 @ 3.0 "H ₂ O	0.0 @ 4.0 "H ₂ O
Post Pitot Leak Check	0.0 @ 5.0 "H ₂ O	0.0 @ 4.0 "H ₂ O	0.0 @ 5.0 "H ₂ O
Pre Nozzle Leak Check	0.0000 @ 15 "Hg	0.0000 @ 15 "Hg	0.0000 @ 17 "Hg
Post Nozzle Leak Check	0.0000 @ 17 "Hg	0.0000 @ 16 "Hg	0.0000 @ 16 "Hg

Pitot Tube Coefficient: 0.840
 Probe Length (Feet): 6.0
 Probe Liner Material: Quartz
 Sample Plane: Horizontal
 Port Length (Inches): 9.00
 Port Size (Diameter, Inches): 6.00
 Port Type: Flange
 Duct Shape: Circular
 Diameter (Feet): 13
 Duct Area (Square Feet): 132.732
 Upstream Diameters: 9.2
 Downstream Diameters: 10.8
 Number of Ports Sampled: 4
 Number of Points per Port: 3
 Minutes per Point: 5.0
 Minutes per Reading: 5.0
 Total Number of Traverse Points: 12
 Test Length (Minutes): 60
 Train Type: Anderson Box
 Source Condition: Mill On
 Diluent Model/Serial Number: CAI 700
 Moisture Balance ID: LV1
 # of Runs: 3

Run 1B - Method 26A

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

Date: 1/10/24
 Start Time: 6:50
 End Time: 8:05

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.69	in. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	49.3	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.392	in. H ₂ O		Carbon Dioxide:	15.10	%
Stack Temperature, Ts:	208.5	°F		Oxygen:	11.10	%
Meter Volume, Vm:	45.139	ft ³			-0.5	%
Meter Volume, Vmstd:	45.674	dscf		Gas Weight dry, Md:	30.860	lb/lb mole
Meter Volume, Vwstd:	8.968	wscf		Gas Weight wet, Ms:	28.749	lb/lb mole
Isokinetic Variance:	102.1	%l		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	25.006	fps
Nozzle Diameter:	0.375	in inches		Volumetric Flow:	199,146	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	129,161	dscfm
				Volumetric Flow:	154,521	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3681.9	ml	Silica Initial Wt.	870.0	grams
Final Impinger Content:	3863.5	ml	Silica Final Wt.	878.8	grams
Impinger Difference:	181.6	ml	Silica Difference:	8.8	grams
Total Water Gain:	190.4		Moisture, Bws:	0.164	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	6:50:00	0.19	2.09	9.993	209	47	47	4	257	261	38
1-2	6:55:00	0.17	1.87	14.150	209	47	47	4	260	260	39
1-3	7:00:00	0.14	1.54	18.100	209	47	47	4	255	261	39
	7:05:00			21.682							
2-1	7:10:00	0.18	1.98	21.682	208	48	48	4	260	261	39
2-2	7:15:00	0.15	1.65	25.740	208	48	48	4	262	259	39
2-3	7:20:00	0.12	1.32	29.460	208	48	48	4	265	259	39
	7:25:00			32.785							
3-1	7:30:00	0.17	1.87	32.785	209	50	50	4	259	259	38
3-2	7:35:00	0.14	1.54	36.740	209	50	50	4	259	260	38
3-3	7:40:00	0.12	1.32	40.340	209	50	50	4	261	254	38
	7:45:00			43.682							
4-1	7:50:00	0.18	1.98	43.682	208	52	52	4	251	259	38
4-2	7:55:00	0.16	1.76	47.770	208	52	52	4	258	260	38
4-3	8:00:00	0.13	1.43	51.640	208	52	52	4	259	261	38
	8:05:00			55.132							

Total	1:00:00			45.139		49.3	49.3				
Average			1.69		208.5	49.3		4			
Min			1.32		208.0	47.0		4			
Max			2.09		209.0	52.0		4			

Impinger Weight Sheet - Run 1B

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Certified Weight, grams</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center; border-bottom: 1px solid black;">250.0</td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center; border-bottom: 1px solid black;">500.0</td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center; border-bottom: 1px solid black;">750.0</td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	250.0	500	500.0	750	750.0
<u>Certified Weight, grams</u>	<u>Result, grams</u>								
250	250.0								
500	500.0								
750	750.0								

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		783.2		763.1		20.1	
0.1N H2SO4		892.1		753.5		138.6	
Empty		667.0		649.0		18.0	
0.1N NaOH		747.7		744.6		3.1	
0.1N NaOH		773.5		771.7		1.8	
Silica Gel		878.8		870.0		8.8	

<u>3,863.5</u> Liquid Final	<u>3,681.9</u> Liquid Initial	<u>181.6</u> Liquid Gain
<u>878.8</u> Silica Final	<u>870.0</u> Silica Initial	<u>8.8</u> Silica Gain

Run 2B - Method 26A

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

Date: 1/10/24
 Start Time: 8:25
 End Time: 9:40

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.66	In. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	56.2	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.387	In. H ₂ O		Carbon Dioxide:	15.40	%
Stack Temperature, Ts:	205.5	°F		Oxygen:	11.10	%
Meter Volume, Vm:	45.307	ft ³		Nitrogen:	73.5	%
Meter Volume, Vmstd:	45.226	dscf		Gas Weight dry, Md:	30.908	lb/lb mole
Meter Volume, Vwstd:	9.213	wscf		Gas Weight wet, Ms:	28.724	lb/lb mole
Isokinetic Variance:	102.6	%l		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	24.658	fps
Nozzle Diameter:	0.375	in inches		Volumetric Flow:	196,375	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	127,156	dscfm
				Volumetric Flow:	153,058	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3671.0	ml	Silica Initial Wt.	880.7	grams
Final Impinger Content:	3857.3	ml	Silica Final Wt.	890.0	grams
Impinger Difference:	186.3	ml	Silica Difference:	9.3	grams

Total Water Gain: 195.6

Moisture, Bws: 0.169

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	8:25:00	0.19	2.09	56.115	206	55	55	4	255	259	40
1-2	8:30:00	0.16	1.76	60.350	206	55	55	4	254	260	40
1-3	8:35:00	0.14	1.54	64.250	206	55	55	4	260	260	41
	8:40:00			67.902							
2-1	8:45:00	0.17	1.87	67.902	205	55	55	4	254	258	42
2-2	8:50:00	0.15	1.65	71.910	205	55	55	4	254	260	42
2-3	8:55:00	0.12	1.32	75.690	205	55	55	4	255	261	43
	9:00:00			79.070							
3-1	9:05:00	0.18	1.98	79.070	205	56	56	4	253	259	42
3-2	9:10:00	0.14	1.54	83.200	205	56	56	4	254	260	42
3-3	9:15:00	0.11	1.21	86.860	205	56	56	4	254	263	42
	9:20:00			90.100							
4-1	9:25:00	0.19	2.09	90.100	206	58	58	4	260	258	43
4-2	9:30:00	0.15	1.65	94.360	206	59	59	4	259	261	43
4-3	9:35:00	0.11	1.21	98.160	206	59	59	4	255	260	43
	9:40:00			101.422							

Total	1:00:00			45.307		56.2	56.2				
Average			1.66		205.5	56.2		4			
Min			1.21		205.0	55.0		4			
Max			2.09		206.0	59.0		4			

Impinger Weight Sheet - Run 2B

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: center; border-bottom: 1px solid black;"><u>Certified Weight, grams</u></th> <th style="text-align: center; border-bottom: 1px solid black;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center; border-bottom: 1px solid black;">250.0</td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center; border-bottom: 1px solid black;">500.0</td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center; border-bottom: 1px solid black;">750.0</td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	250.0	500	500.0	750	750.0
<u>Certified Weight, grams</u>	<u>Result, grams</u>								
250	250.0								
500	500.0								
750	750.0								

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		891.7		786.4		105.3	
0.1N H2SO4		778.7		720.7		58.0	
Empty		664.5		649.3		15.2	
0.1N NaOH		768.8		763.8		5.0	
0.1N NaOH		753.6		750.8		2.8	
Silica Gel		890.0		880.7		9.3	

<u>3,857.3</u> Liquid Final	<u>3,671.0</u> Liquid Initial	<u>186.3</u> Liquid Gain
<u>890.0</u> Silica Final	<u>880.7</u> Silica Initial	<u>9.3</u> Silica Gain

Run 3B - Method 26A

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

Date: 1/10/24
 Start Time: 10:00
 End Time: 11:15

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.73	In. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	61.8	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.395	In. H ₂ O		Carbon Dioxide:	15.00	%
Stack Temperature, Ts:	210.0	°F		Oxygen:	11.20	%
Meter Volume, Vm:	46.656	ft ³		Nitrogen:	73.8	%
Meter Volume, Vmstd:	46.083	dscf		Gas Weight dry, Md:	30.848	lb/lb mole
Meter Volume, Vwstd:	7.819	wscf		Gas Weight wet, Ms:	28.984	lb/lb mole
Isokinetic Variance:	100.2	%l		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	25.179	fps
Nozzle Diameter:	0.375	in inches		Volumetric Flow:	200,522	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	132,722	dscfm
				Volumetric Flow:	155,241	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3561.8	ml	Silica Initial Wt.	878.8	grams
Final Impinger Content:	3718.8	ml	Silica Final Wt.	887.8	grams
Impinger Difference:	157.0	ml	Silica Difference:	9.0	grams
Total Water Gain:	166.0		Moisture, Bws:	0.145	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:00:00	0.20	2.20	3.056	209	61	61	4	260	260	38
1-2	10:05:00	0.16	1.76	7.440	209	61	61	4	261	261	38
1-3	10:10:00	0.13	1.43	11.370	209	61	61	4	259	261	38
	10:15:00			14.925							
2-1	10:20:00	0.19	2.09	14.925	210	61	61	4	261	258	49
2-2	10:25:00	0.16	1.76	19.190	210	61	61	4	260	260	49
2-3	10:30:00	0.12	1.32	23.130	210	61	61	4	259	260	49
	10:35:00			26.535							
3-1	10:40:00	0.18	1.98	26.535	210	62	62	4	260	261	51
3-2	10:45:00	0.15	1.65	30.700	210	62	62	4	262	259	51
3-3	10:50:00	0.12	1.32	34.510	210	62	62	4	265	261	51
	10:55:00			37.927							
4-1	11:00:00	0.19	2.09	37.927	211	63	63	4	258	261	52
4-2	11:05:00	0.16	1.76	42.210	211	63	63	4	260	259	52
4-3	11:10:00	0.13	1.43	46.150	211	63	63	4	260	260	52
	11:15:00			49.712							

Total	1:00:00			46.656		61.8	61.8				
Average			1.73		210.0	61.8		4			
Min			1.32		209.0	61.0		4			
Max			2.20		211.0	63.0		4			

Impinger Weight Sheet - Run 3B

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Certified Weight, grams</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center; border-bottom: 1px solid black;">250.0</td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center; border-bottom: 1px solid black;">500.0</td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center; border-bottom: 1px solid black;">750.0</td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	250.0	500	500.0	750	750.0
<u>Certified Weight, grams</u>	<u>Result, grams</u>								
250	250.0								
500	500.0								
750	750.0								

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		793.1		716.1		77.0	
0.1N H2SO4		785.9		712.7		73.2	
Empty		678.9		683.5		-4.6	
0.1N NaOH		738.3		729.0		9.3	
0.1N NaOH		722.6		720.5		2.1	
Silica Gel		887.8		878.8		9.0	

<u>3,718.8</u> Liquid Final	<u>3,561.8</u> Liquid Initial	<u>157.0</u> Liquid Gain
<u>887.8</u> Silica Final	<u>878.8</u> Silica Initial	<u>9.0</u> Silica Gain

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

Run 1

Spectrum	Time	FTIR Data				Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmww	HF ppmww			
MILLON_RUN1_000556.LAB	6:50	15.83	13.09	1.74	≤ 0.10	190.92	1.00	11.01
MILLON_RUN1_000557.LAB	6:51	15.51	13.18	1.69	≤ 0.10	190.86	1.00	10.88
MILLON_RUN1_000558.LAB	6:52	15.44	13.41	1.76	≤ 0.10	190.86	1.00	10.93
MILLON_RUN1_000559.LAB	6:53	16.02	13.26	1.76	≤ 0.10	190.94	1.00	10.83
MILLON_RUN1_000560.LAB	6:54	15.73	13.33	1.77	≤ 0.10	190.94	1.00	10.85
MILLON_RUN1_000561.LAB	6:55	15.41	12.99	1.74	≤ 0.10	190.89	1.00	11.03
MILLON_RUN1_000562.LAB	6:56	15.67	12.66	1.78	≤ 0.10	190.85	1.00	11.18
MILLON_RUN1_000563.LAB	6:57	15.51	12.71	1.69	≤ 0.10	190.85	1.00	11.19
MILLON_RUN1_000564.LAB	6:58	15.72	12.77	1.70	≤ 0.10	190.83	1.00	11.09
MILLON_RUN1_000565.LAB	6:59	15.87	12.67	1.76	≤ 0.10	190.79	1.00	11.05
MILLON_RUN1_000566.LAB	7:00	15.78	12.85	1.77	≤ 0.10	190.84	1.00	11.08
MILLON_RUN1_000567.LAB	7:01	15.77	12.99	1.76	≤ 0.10	190.85	1.00	11.02
MILLON_RUN1_000568.LAB	7:02	15.89	12.80	1.83	≤ 0.10	190.84	1.00	10.97
MILLON_RUN1_000569.LAB	7:03	15.60	12.79	1.77	≤ 0.10	190.84	1.00	11.01
MILLON_RUN1_000570.LAB	7:04	15.60	12.86	1.73	≤ 0.10	190.84	1.00	11.11
MILLON_RUN1_000571.LAB	7:05	16.46	12.66	1.82	≤ 0.10	190.84	1.00	11.05
MILLON_RUN1_000572.LAB	7:06	15.43	12.58	1.78	≤ 0.10	190.89	1.00	11.10
MILLON_RUN1_000573.LAB	7:07	15.95	12.39	1.82	≤ 0.10	190.92	1.00	11.19
MILLON_RUN1_000574.LAB	7:08	15.40	12.65	1.78	≤ 0.10	190.79	1.00	11.28
MILLON_RUN1_000575.LAB	7:09	15.66	12.63	1.86	≤ 0.10	190.63	1.00	11.21
MILLON_RUN1_000576.LAB	7:10	15.54	12.46	1.84	≤ 0.10	190.54	1.00	11.17
MILLON_RUN1_000577.LAB	7:11	15.41	12.33	1.82	≤ 0.10	190.68	1.00	11.28
MILLON_RUN1_000578.LAB	7:12	15.67	12.32	1.73	≤ 0.10	190.80	1.00	11.34
MILLON_RUN1_000579.LAB	7:13	15.47	12.69	1.85	≤ 0.10	190.95	1.00	11.35
MILLON_RUN1_000580.LAB	7:14	15.94	13.09	1.83	≤ 0.10	190.93	1.00	11.23
MILLON_RUN1_000581.LAB	7:15	15.85	13.16	1.86	≤ 0.10	190.87	1.00	11.00
MILLON_RUN1_000582.LAB	7:16	16.21	12.66	1.85	≤ 0.10	190.83	1.00	11.01
MILLON_RUN1_000583.LAB	7:17	15.89	12.79	1.83	≤ 0.10	190.93	1.00	11.13
MILLON_RUN1_000584.LAB	7:18	16.17	12.56	1.79	≤ 0.10	191.03	1.00	11.18
MILLON_RUN1_000585.LAB	7:19	15.94	12.53	1.79	≤ 0.10	190.98	1.00	11.09
MILLON_RUN1_000586.LAB	7:20	15.49	12.65	1.78	≤ 0.10	191.05	1.00	11.27
MILLON_RUN1_000587.LAB	7:21	15.87	12.38	1.83	≤ 0.10	191.13	1.00	11.25
MILLON_RUN1_000588.LAB	7:22	15.51	12.36	1.80	≤ 0.10	191.13	1.00	11.27
MILLON_RUN1_000589.LAB	7:23	15.37	12.44	1.82	≤ 0.10	191.09	1.00	11.40
MILLON_RUN1_000590.LAB	7:24	15.89	12.56	1.78	≤ 0.10	191.05	1.00	11.42
MILLON_RUN1_000591.LAB	7:25	15.53	12.78	1.90	≤ 0.10	191.04	1.00	11.36
MILLON_RUN1_000592.LAB	7:26	16.32	12.58	1.80	≤ 0.10	191.00	1.00	11.21
MILLON_RUN1_000593.LAB	7:27	15.78	12.73	1.75	≤ 0.10	191.07	1.00	11.13
MILLON_RUN1_000594.LAB	7:28	15.79	12.77	1.79	≤ 0.10	191.11	1.00	11.23
MILLON_RUN1_000595.LAB	7:29	15.57	12.67	1.75	≤ 0.10	191.05	1.00	11.20
MILLON_RUN1_000596.LAB	7:30	15.85	12.62	1.87	≤ 0.10	191.05	1.00	11.18
MILLON_RUN1_000597.LAB	7:31	16.02	12.56	1.84	≤ 0.10	191.05	1.00	11.23
MILLON_RUN1_000598.LAB	7:32	15.74	12.41	1.82	≤ 0.10	191.02	1.00	11.23
MILLON_RUN1_000599.LAB	7:33	16.45	12.25	1.83	≤ 0.10	190.98	1.00	11.26
MILLON_RUN1_000600.LAB	7:34	16.55	12.48	1.85	≤ 0.10	190.94	1.00	11.34
MILLON_RUN1_000601.LAB	7:35	15.74	12.66	1.81	≤ 0.10	190.92	1.00	11.35
MILLON_RUN1_000602.LAB	7:36	16.45	12.68	1.81	≤ 0.10	190.90	1.00	11.27
MILLON_RUN1_000603.LAB	7:37	15.85	12.81	1.86	≤ 0.10	190.94	1.00	11.21
MILLON_RUN1_000604.LAB	7:38	15.87	12.55	1.83	≤ 0.10	190.75	1.00	11.20
MILLON_RUN1_000605.LAB	7:39	16.05	12.46	1.79	≤ 0.10	190.53	1.00	11.12
MILLON_RUN1_000606.LAB	7:40	16.32	12.70	1.84	≤ 0.10	190.49	1.00	11.25
MILLON_RUN1_000607.LAB	7:41	15.89	12.84	1.80	≤ 0.10	190.52	1.00	11.44
MILLON_RUN1_000608.LAB	7:42	15.80	13.00	1.87	≤ 0.10	190.51	1.00	11.36
MILLON_RUN1_000609.LAB	7:43	16.07	12.65	1.83	≤ 0.10	190.53	1.00	11.21
MILLON_RUN1_000610.LAB	7:44	15.45	12.75	1.81	≤ 0.10	190.56	1.00	11.12
MILLON_RUN1_000611.LAB	7:45	16.16	12.81	1.81	≤ 0.10	190.72	1.00	11.22
MILLON_RUN1_000612.LAB	7:46	15.91	12.77	1.85	≤ 0.10	190.74	1.00	11.30
MILLON_RUN1_000613.LAB	7:47	15.55	12.64	1.80	≤ 0.10	190.74	1.00	11.23
MILLON_RUN1_000614.LAB	7:48	16.01	12.76	1.81	≤ 0.10	190.74	1.00	11.20
MILLON_RUN1_000615.LAB	7:49	15.68	12.66	1.82	≤ 0.10	190.70	1.00	11.18
Average		15.81	12.71	1.80	≤ 0.10	190.86	1.00	11.17

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

Run 2

Spectrum	Time	H2O %	FTIR Data			Cell Temp	Pressure	Analyzer Data O2 % (dry)
			CO2 % (wet)	HCN ppmvw	HF ppmvw			
RUN2_000686.LAB	8:25	15.93	12.8	1.96	≤ 0.10	3.1	1.27	11.35
RUN2_000687.LAB	8:26	15.50	13.2	1.89	≤ 0.10	3.2	1.26	11.24
RUN2_000688.LAB	8:27	15.81	13.1	1.89	≤ 0.10	3.2	1.26	11.21
RUN2_000689.LAB	8:28	15.85	13.0	1.86	≤ 0.10	3.2	1.34	11.21
RUN2_000690.LAB	8:29	15.58	12.6	1.89	≤ 0.10	3.1	1.21	11.35
RUN2_000691.LAB	8:30	16.00	12.3	1.85	≤ 0.10	3.1	1.20	11.40
RUN2_000692.LAB	8:31	15.70	12.3	1.84	≤ 0.10	3.0	1.27	11.51
RUN2_000693.LAB	8:32	15.75	12.4	1.78	≤ 0.10	3.1	1.27	11.49
RUN2_000694.LAB	8:33	15.67	12.5	1.82	≤ 0.10	3.1	1.24	11.37
RUN2_000695.LAB	8:34	16.13	12.3	1.84	≤ 0.10	3.0	1.23	11.37
RUN2_000696.LAB	8:35	15.94	12.4	1.86	≤ 0.10	3.0	1.24	11.54
RUN2_000697.LAB	8:36	15.90	12.7	1.86	≤ 0.10	3.2	1.24	11.43
RUN2_000698.LAB	8:37	16.08	12.5	1.82	≤ 0.10	3.1	1.22	11.29
RUN2_000699.LAB	8:38	15.56	12.4	1.80	≤ 0.10	3.1	1.21	11.40
RUN2_000700.LAB	8:39	16.06	12.3	1.81	≤ 0.10	3.0	1.21	11.43
RUN2_000701.LAB	8:40	15.78	12.4	1.87	≤ 0.10	3.0	1.21	11.48
RUN2_000702.LAB	8:41	16.13	12.5	1.83	≤ 0.10	3.0	1.19	11.50
RUN2_000703.LAB	8:42	15.67	12.9	1.83	≤ 0.10	3.2	1.25	11.42
RUN2_000704.LAB	8:43	16.40	12.8	1.81	≤ 0.10	3.1	1.20	11.27
RUN2_000705.LAB	8:44	15.85	12.7	1.75	≤ 0.10	3.1	1.22	11.24
RUN2_000706.LAB	8:45	15.98	12.7	1.79	≤ 0.10	3.1	1.25	11.32
RUN2_000707.LAB	8:46	15.92	12.7	1.80	≤ 0.10	3.1	1.27	11.33
RUN2_000708.LAB	8:47	15.71	12.7	1.80	≤ 0.10	3.0	1.28	11.29
RUN2_000709.LAB	8:48	16.06	12.5	1.79	≤ 0.10	3.0	1.27	11.41
RUN2_000710.LAB	8:49	15.91	12.4	1.79	≤ 0.10	3.0	1.27	11.43
RUN2_000711.LAB	8:50	16.12	12.4	1.80	≤ 0.10	3.0	1.24	11.54
RUN2_000712.LAB	8:51	15.79	12.6	1.80	≤ 0.10	3.1	1.22	11.50
RUN2_000713.LAB	8:52	15.89	13.0	1.78	≤ 0.10	3.2	1.29	11.40
RUN2_000714.LAB	8:53	15.77	13.0	1.76	≤ 0.10	3.2	1.22	11.21
RUN2_000715.LAB	8:54	15.87	13.0	1.81	≤ 0.10	3.2	1.26	11.23
RUN2_000716.LAB	8:55	15.84	13.0	1.76	≤ 0.10	3.2	1.23	11.20
RUN2_000717.LAB	8:56	15.99	13.0	1.76	≤ 0.10	3.3	1.23	11.23
RUN2_000718.LAB	8:57	16.18	13.4	1.76	≤ 0.10	3.6	1.21	11.20
RUN2_000719.LAB	8:58	15.90	13.0	1.78	≤ 0.10	3.3	1.25	11.04
RUN2_000720.LAB	8:59	16.51	13.2	1.81	≤ 0.10	3.4	1.24	10.91
RUN2_000721.LAB	9:00	15.58	13.2	1.78	≤ 0.10	3.4	1.27	11.12
RUN2_000722.LAB	9:01	15.51	13.0	1.80	≤ 0.10	3.2	1.29	10.96
RUN2_000723.LAB	9:02	16.16	13.0	1.82	≤ 0.10	3.3	1.29	11.10
RUN2_000724.LAB	9:03	15.69	13.0	1.75	≤ 0.10	3.3	1.26	11.25
RUN2_000725.LAB	9:04	16.10	13.1	1.79	≤ 0.10	3.4	1.27	11.18
RUN2_000726.LAB	9:05	15.65	13.2	1.74	≤ 0.10	3.5	1.32	11.16
RUN2_000727.LAB	9:06	16.04	13.1	1.69	≤ 0.10	3.4	1.36	11.06
RUN2_000728.LAB	9:07	15.96	13.0	1.76	≤ 0.10	3.4	1.31	11.03
RUN2_000729.LAB	9:08	15.87	13.3	1.71	≤ 0.10	3.5	1.35	11.03
RUN2_000730.LAB	9:09	15.75	13.0	1.81	≤ 0.10	3.5	1.34	11.11
RUN2_000731.LAB	9:10	16.05	13.1	1.84	≤ 0.10	3.5	1.32	10.93
RUN2_000732.LAB	9:11	15.88	13.1	1.77	≤ 0.10	3.4	1.26	10.97
RUN2_000733.LAB	9:12	16.34	13.2	1.76	≤ 0.10	3.5	1.26	10.98
RUN2_000734.LAB	9:13	15.33	13.5	1.84	≤ 0.10	3.6	1.32	10.99
RUN2_000735.LAB	9:14	16.23	13.4	1.80	≤ 0.10	3.7	1.30	11.00
RUN2_000736.LAB	9:15	16.02	13.3	1.80	≤ 0.10	3.5	1.32	10.82
RUN2_000737.LAB	9:16	15.93	13.3	1.84	≤ 0.10	3.5	1.26	10.75
RUN2_000738.LAB	9:17	15.86	13.2	1.76	≤ 0.10	3.5	1.35	10.83
RUN2_000739.LAB	9:18	15.81	13.3	1.82	≤ 0.10	3.5	1.33	10.90
RUN2_000740.LAB	9:19	15.83	13.3	1.76	≤ 0.10	3.6	1.29	10.93
RUN2_000741.LAB	9:20	15.73	13.6	1.82	≤ 0.10	3.7	1.31	10.98
RUN2_000742.LAB	9:21	16.27	13.2	1.84	≤ 0.10	3.7	1.32	10.92
RUN2_000743.LAB	9:22	15.49	13.4	1.83	≤ 0.10	3.7	1.30	10.84
RUN2_000744.LAB	9:23	15.35	13.3	1.78	≤ 0.10	3.7	1.36	10.76
RUN2_000745.LAB	9:24	15.92	13.2	1.79	≤ 0.10	3.5	1.35	10.81
Average		15.88	12.91	1.81	≤ 0.10	3.28	1.27	11.19

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

Run 3

Spectrum	Time	FTIR Data				Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmww	HF ppmww			
RUN3_000818.LAB	10:00	16.27	13.5	1.85	≤ 0.10	190.96	1.00	10.57
RUN3_000819.LAB	10:01	15.97	13.6	1.85	≤ 0.10	190.88	1.00	10.71
RUN3_000820.LAB	10:02	15.61	13.5	1.80	≤ 0.10	190.75	1.00	10.78
RUN3_000821.LAB	10:03	16.06	13.2	1.89	≤ 0.10	190.76	1.00	10.85
RUN3_000822.LAB	10:04	17.09	12.7	1.83	≤ 0.10	190.90	1.00	10.84
RUN3_000823.LAB	10:05	15.16	12.6	1.83	≤ 0.10	190.95	1.00	11.21
RUN3_000824.LAB	10:06	15.41	11.8	1.80	≤ 0.10	190.98	1.00	11.46
RUN3_000825.LAB	10:07	15.44	11.4	1.78	≤ 0.10	191.05	1.00	11.82
RUN3_000826.LAB	10:08	14.87	11.5	1.74	≤ 0.10	191.03	1.00	11.92
RUN3_000827.LAB	10:09	15.53	11.8	1.76	≤ 0.10	191.00	1.00	11.81
RUN3_000828.LAB	10:10	15.66	12.1	1.75	≤ 0.10	191.02	1.00	11.54
RUN3_000829.LAB	10:11	16.04	12.6	1.81	≤ 0.10	190.96	1.00	11.35
RUN3_000830.LAB	10:12	15.92	13.0	1.84	≤ 0.10	190.93	1.00	11.12
RUN3_000831.LAB	10:13	16.01	12.8	1.81	≤ 0.10	190.85	1.00	11.02
RUN3_000832.LAB	10:14	15.97	13.1	1.91	≤ 0.10	190.91	1.00	11.17
RUN3_000833.LAB	10:15	16.11	13.3	1.86	≤ 0.10	190.94	1.00	11.01
RUN3_000834.LAB	10:16	15.89	13.5	1.82	≤ 0.10	190.86	1.00	10.91
RUN3_000835.LAB	10:17	15.63	13.5	1.86	≤ 0.10	190.93	1.00	10.86
RUN3_000836.LAB	10:18	15.66	13.4	1.78	≤ 0.10	190.94	1.00	10.80
RUN3_000837.LAB	10:19	16.10	13.7	1.91	≤ 0.10	191.07	1.00	10.92
RUN3_000838.LAB	10:20	15.96	13.5	1.89	≤ 0.10	191.14	1.00	10.78
RUN3_000839.LAB	10:21	16.36	13.1	1.90	≤ 0.10	191.18	1.00	10.82
RUN3_000840.LAB	10:22	16.21	13.3	1.88	≤ 0.10	191.16	1.00	10.94
RUN3_000841.LAB	10:23	16.06	13.2	1.85	≤ 0.10	191.13	1.00	10.89
RUN3_000842.LAB	10:24	15.95	12.7	1.86	≤ 0.10	191.13	1.00	10.82
RUN3_000843.LAB	10:25	16.07	12.7	1.90	≤ 0.10	191.10	1.00	11.01
RUN3_000844.LAB	10:26	15.57	12.7	1.81	≤ 0.10	191.10	1.00	11.16
RUN3_000845.LAB	10:27	16.08	12.7	1.79	≤ 0.10	191.05	1.00	11.11
RUN3_000846.LAB	10:28	15.93	12.8	1.80	≤ 0.10	190.96	1.00	11.12
RUN3_000847.LAB	10:29	15.42	12.6	1.80	≤ 0.10	190.94	1.00	11.08
RUN3_000848.LAB	10:30	16.00	12.7	1.78	≤ 0.10	190.81	1.00	11.08
RUN3_000849.LAB	10:31	16.21	12.7	1.81	≤ 0.10	190.70	1.00	11.17
RUN3_000850.LAB	10:32	15.74	12.7	1.77	≤ 0.10	190.89	1.00	11.04
RUN3_000851.LAB	10:33	16.51	12.8	1.81	≤ 0.10	190.94	1.00	11.10
RUN3_000852.LAB	10:34	15.60	12.8	1.83	≤ 0.10	190.89	1.00	11.09
RUN3_000853.LAB	10:35	15.87	12.8	1.79	≤ 0.10	190.63	1.00	11.01
RUN3_000854.LAB	10:36	16.04	13.0	1.83	≤ 0.10	190.48	1.00	11.05
RUN3_000855.LAB	10:37	15.78	12.8	1.81	≤ 0.10	190.61	1.00	11.07
RUN3_000856.LAB	10:38	15.76	12.7	1.87	≤ 0.10	190.86	1.00	11.03
RUN3_000857.LAB	10:39	15.81	12.8	1.77	≤ 0.10	190.94	1.00	11.08
RUN3_000858.LAB	10:40	15.91	12.6	1.86	≤ 0.10	191.02	1.00	11.16
RUN3_000859.LAB	10:41	15.70	12.8	1.82	≤ 0.10	191.11	1.00	11.18
RUN3_000860.LAB	10:42	15.61	12.8	1.87	≤ 0.10	191.13	1.00	11.19
RUN3_000861.LAB	10:43	16.24	12.5	1.81	≤ 0.10	191.10	1.00	11.14
RUN3_000862.LAB	10:44	15.96	12.6	1.85	≤ 0.10	190.84	1.00	11.11
RUN3_000863.LAB	10:45	16.03	12.2	1.84	≤ 0.10	190.84	1.00	11.13
RUN3_000864.LAB	10:46	15.72	11.8	1.87	≤ 0.10	190.93	1.00	11.22
RUN3_000865.LAB	10:47	15.97	11.5	1.81	≤ 0.10	191.08	1.00	11.39
RUN3_000866.LAB	10:48	15.54	11.5	1.87	≤ 0.10	191.12	1.00	11.62
RUN3_000867.LAB	10:49	15.70	11.3	1.90	≤ 0.10	191.03	1.00	11.72
RUN3_000868.LAB	10:50	15.36	11.3	1.86	≤ 0.10	190.97	1.00	11.84
RUN3_000869.LAB	10:51	15.52	11.3	1.85	≤ 0.10	190.95	1.00	11.81
RUN3_000870.LAB	10:52	16.15	11.4	1.83	≤ 0.10	190.95	1.00	11.88
RUN3_000871.LAB	10:53	15.15	11.8	1.83	≤ 0.10	190.99	1.00	11.87
RUN3_000872.LAB	10:54	15.39	11.8	1.84	≤ 0.10	190.82	1.00	11.88
RUN3_000873.LAB	10:55	16.30	11.7	1.76	≤ 0.10	190.78	1.00	11.81
RUN3_000874.LAB	10:56	15.85	12.1	1.85	≤ 0.10	190.82	1.00	11.72
RUN3_000875.LAB	10:57	15.31	12.7	1.83	≤ 0.10	190.58	1.00	11.72
RUN3_000876.LAB	10:58	16.20	13.0	1.84	≤ 0.10	190.50	1.00	11.78
RUN3_000877.LAB	10:59	15.63	13.0	1.87	≤ 0.10	190.54	1.00	11.65
Average		15.84	12.59	1.83	≤ 0.10	190.92	1.00	11.23

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Test Location: Main Kiln Stack
Project #: M234007-02
Test Method: 26A
Test Engineer: DV
Test Technician: RODS

	<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>
Meter ID:	CM23	CM23	CM23
Pitot ID:	S8-031A	S8-031A	S8-031A
Filter ID:	N/A	N/A	N/A
Filter Pre-Weight (grams):	N/A	N/A	N/A
Nozzle Diameter (Inches):	0.391	0.391	0.391
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:	14 Glass	14 Glass	14 Glass

Leak Checks

Pre Pitot Leak Check	0.0 @ 6.0 "H ₂ O	0.0 @ 8.0 "H ₂ O	0.0 @ 5.0 "H ₂ O
Post Pitot Leak Check	0.0 @ 7.0 "H ₂ O	0.0 @ 9.0 "H ₂ O	0.0 @ 7.0 "H ₂ O
Pre Nozzle Leak Check	0.0000 @ 13 "Hg	0.0000 @ 13 "Hg	0.0000 @ 15 "Hg
Post Nozzle Leak Check	0.0000 @ 15 "Hg	0.0000 @ 15 "Hg	0.0000 @ 16 "Hg
Pitot Tube Coefficient:	0.820		
Probe Length (Feet):	6.0		
Probe Liner Material:	Quartz		
Sample Plane:	Horizontal		
Port Length (Inches):	9.00		
Port Size (Diameter, Inches):	6.00		
Port Type:	Flange		
Duct Shape:	Circular		
Diameter (Feet):	13		
Duct Area (Square Feet):	132.732		
Upstream Diameters:	9.2		
Downstream Diameters:	10.8		
Number of Ports Sampled:	4		
Number of Points per Port:	3		
Minutes per Point:	5.0		
Minutes per Reading:	5.0		
Total Number of Traverse Points:	12		
Test Length (Minutes):	60		
Train Type:	Anderson Box		
Source Condition:	Mill Off		
Diluent Model/Serial Number:	CAI 700		
Moisture Balance ID:	LV3		
# of Runs	3		

Run 1A - Method 26A

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

Date: 1/10/24
 Start Time: 11:45
 End Time: 13:00

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.98	in. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	80.4	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.402	in. H ₂ O		Carbon Dioxide:	17.30	%
Stack Temperature, Ts:	324.0	°F		Oxygen:	10.50	%
Meter Volume, Vm:	48.854	ft ³		Nitrogen:	72.20	%
Meter Volume, Vmstd:	47.138	dscf		Gas Weight dry, Md:	31.188	lb/lb mole
Meter Volume, Vwstd:	7.235	wscf		Gas Weight wet, Ms:	29.433	lb/lb mole
Isokinetic Variance:	102.2	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	26.811	fps
Nozzle Diameter:	0.391	in inches		Volumetric Flow:	213,524	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	122,473	dscfm
				Volumetric Flow:	141,270	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3570.5	ml	Silica Initial Wt.	857.9	grams
Final Impinger Content:	3714.7	ml	Silica Final Wt.	867.3	grams
Impinger Difference:	144.2	ml	Silica Difference:	9.4	grams
Total Water Gain:	153.6		Moisture, Bws:	0.133	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	11:45:00	0.21	2.56	17.571	319	80	79	6	260	257	42
1-2	11:50:00	0.18	2.19	22.225	319	80	79	6	260	257	42
1-3	11:55:00	0.15	1.83	26.525	319	80	79	6	260	257	42
	12:00:00			30.459							
2-1	12:05:00	0.17	2.07	30.459	322	81	79	6	260	259	42
2-2	12:10:00	0.14	1.71	34.640	322	81	79	6	260	259	42
2-3	12:15:00	0.12	1.46	38.433	322	81	79	6	260	259	42
	12:20:00			41.946							
3-1	12:25:00	0.20	2.44	41.946	322	80	78	6	260	262	42
3-2	12:30:00	0.17	2.07	46.473	322	80	78	6	260	262	42
3-3	12:35:00	0.14	1.71	50.644	322	80	78	6	260	262	42
	12:40:00			54.428							
4-1	12:45:00	0.18	2.19	54.428	333	86	80	5	261	257	45
4-2	12:50:00	0.16	1.95	58.725	333	86	80	5	261	257	45
4-3	12:55:00	0.13	1.58	62.774	333	86	80	5	261	257	45
	13:00:00			66.425							

Total	1:00:00			48.854		81.8	79.0				
Average			1.98		324.0	80.4		6			
Min			1.46		319.0	78.0		5			
Max			2.56		333.0	86.0		6			

Impinger Weight Sheet - Run 1A

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Certified Weight, grams</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center; border-bottom: 1px solid black;">250.0</td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center; border-bottom: 1px solid black;">500.0</td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center; border-bottom: 1px solid black;">750.0</td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	250.0	500	500.0	750	750.0
<u>Certified Weight, grams</u>	<u>Result, grams</u>								
250	250.0								
500	500.0								
750	750.0								

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		865.2		739.4		125.8	
0.1N H2SO4		749.4		733.5		15.9	
Empty		646.8		645.4		1.4	
0.1N NaOH		720.0		718.9		1.1	
0.1N NaOH		733.3		733.3		0.0	
Silica Gel		867.3		857.9		9.4	

<u>3,714.7</u> Liquid Final	<u>3,570.5</u> Liquid Initial	<u>144.2</u> Liquid Gain
<u>867.3</u> Silica Final	<u>857.9</u> Silica Initial	<u>9.4</u> Silica Gain

Run 2A - Method 26A

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

Date: 1/10/24
 Start Time: 13:20
 End Time: 14:35

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	2.29	In. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	91.5	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.403	In. H ₂ O		Carbon Dioxide:	17.00	%
Stack Temperature, Ts:	339.5	°F		Oxygen:	9.90	%
Meter Volume, Vm:	52.467	ft ³		Nitrogen:	73.1	%
Meter Volume, Vmstd:	49.641	dscf		Gas Weight dry, Md:	31.116	lb/lb mole
Meter Volume, Vwstd:	8.356	wscf		Gas Weight wet, Ms:	29.226	lb/lb mole
Isokinetic Variance:	109.2	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	27.286	fps
Nozzle Diameter:	0.391	in inches		Volumetric Flow:	217,308	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	120,674	dscfm
				Volumetric Flow:	140,986	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3588.1	ml	Silica Initial Wt.	879.0	grams
Final Impinger Content:	3752.6	ml	Silica Final Wt.	891.9	grams
Impinger Difference:	164.5	ml	Silica Difference:	12.9	grams

Total Water Gain: 177.4 Moisture, Bws: 0.144

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	13:20:00	0.20	2.79	69.390	339	88	85	3	260	258	46
1-2	13:25:00	0.18	2.51	74.196	339	88	85	3	260	258	46
1-3	13:30:00	0.15	2.09	78.755	339	88	85	3	260	259	46
	13:35:00			82.911							
2-1	13:40:00	0.17	2.37	82.911	340	93	87	3	257	260	51
2-2	13:45:00	0.14	1.95	87.366	340	93	87	3	257	260	51
2-3	13:50:00	0.12	1.67	91.409	340	93	87	3	257	260	51
	13:55:00			95.150							
3-1	14:00:00	0.19	2.65	95.150	339	98	90	3	259	259	55
3-2	14:05:00	0.16	2.23	99.899	339	98	90	3	259	259	55
3-3	14:10:00	0.11	1.53	104.252	339	98	90	3	259	259	55
	14:15:00			107.864							
4-1	14:20:00	0.21	2.93	107.864	340	98	93	3	260	263	56
4-2	14:25:00	0.18	2.51	112.866	340	98	93	3	260	263	56
4-3	14:30:00	0.16	2.23	117.496	340	98	93	3	260	263	56
	14:35:00			121.857							

Total	1:00:00			52.467		94.3	88.8				
Average			2.29		339.5	91.5		3			
Min			1.53		339.0	85.0		3			
Max			2.93		340.0	98.0		3			

Impinger Weight Sheet - Run 2A

Client:	Ash Grove Cement Company	Scale Calibration Check Date:	1/10/2024
Facility:	Seattle Cement Plant	<u>Scale Calibration Check (see QS-6.05C for procedure)</u>	
Test Location:	Main Kiln Stack	must be within $\pm 0.5g$ of certified mass	
Project #:	M234007-02	<u>Certified Weight, grams</u>	<u>Result, grams</u>
Date:	1/10/2024	250	250.0
Test Method:	26A		
Weighed/Measured By:	RODS	500	500.0
Balance ID:	LV1	750	750.0

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		875.4		738.6		136.8	
0.1N H2SO4		747.7		726.7		21.0	
Empty		647.2		644.0		3.2	
0.1N NaOH		745.9		744.9		1.0	
0.1N NaOH		736.4		733.9		2.5	
Silica Gel		891.9		879.0		12.9	

3,752.6	3,588.1	164.5
<u>Liquid Final</u>	<u>Liquid Initial</u>	<u>Liquid Gain</u>
891.9	879.0	12.9
<u>Silica Final</u>	<u>Silica Initial</u>	<u>Silica Gain</u>

Run 3A - Method 26A

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

Date: 1/10/24
 Start Time: 14:55
 End Time: 16:10

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	2.01	in. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	97.1	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.392	in. H ₂ O		Carbon Dioxide:	17.20	%
Stack Temperature, Ts:	345.5	°F		Oxygen:	10.20	%
Meter Volume, Vm:	49.482	ft ³		Nitrogen:	72.6	%
Meter Volume, Vmstd:	46.312	dscf		Gas Weight dry, Md:	31.160	lb/lb mole
Meter Volume, Vwstd:	7.376	wscf		Gas Weight wet, Ms:	29.352	lb/lb mole
Isokinetic Variance:	104.6	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	26.568	fps
Nozzle Diameter:	0.391	in inches		Volumetric Flow:	211,583	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	117,530	dscfm
				Volumetric Flow:	136,249	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3599.1	ml	Silica Initial Wt.	832.6	grams
Final Impinger Content:	3742.6	ml	Silica Final Wt.	845.7	grams
Impinger Difference:	143.5	ml	Silica Difference:	13.1	grams
Total Water Gain:	156.6		Moisture, Bws:	0.137	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	14:55:00	0.19	2.46	23.691	345	96	98	7	262	259	50
1-2	15:00:00	0.15	1.94	28.275	345	96	98	7	262	259	50
1-3	15:05:00	0.13	1.68	32.346	345	96	98	7	262	259	50
	15:10:00			36.137							
2-1	15:15:00	0.17	2.20	36.137	346	96	98	7	261	259	51
2-2	15:20:00	0.14	1.81	40.469	346	96	98	7	261	259	51
2-3	15:25:00	0.11	1.42	44.399	346	96	98	7	261	259	51
	15:30:00			47.887							
3-1	15:35:00	0.20	2.59	47.887	345	96	98	7	260	260	53
3-2	15:40:00	0.17	2.20	52.890	345	96	98	7	260	260	53
3-3	15:45:00	0.15	1.94	56.920	345	96	98	7	260	260	53
	15:50:00			60.996							
4-1	15:55:00	0.18	2.33	60.996	346	97	98	7	259	259	53
4-2	16:00:00	0.15	1.94	65.459	346	97	98	7	259	259	53
4-3	16:05:00	0.12	1.55	69.533	346	97	98	7	259	259	53
	16:10:00			73.173							

Total	1:00:00			49.482		96.3	98.0				
Average			2.01		345.5	97.1		7			
Min			1.42		345.0	96.0		7			
Max			2.59		346.0	98.0		7			

Impinger Weight Sheet - Run 3A

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV1	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: center;"><u>Certified Weight, grams</u></th> <th style="text-align: center;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center;"><u>250.0</u></td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center;"><u>500.0</u></td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center;"><u>750.0</u></td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	<u>250.0</u>	500	<u>500.0</u>	750	<u>750.0</u>
<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		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		865.8		744.2		121.6	
0.1N H2SO4		749.4		733.5		15.9	
Empty		654.0		652.1		1.9	
0.1N NaOH		723.9		722.3		1.6	
0.1N NaOH		749.5		747.0		2.5	
Silica Gel		845.7		832.6		13.1	

<u>3,742.6</u> Liquid Final	<u>3,599.1</u> Liquid Initial	<u>143.5</u> Liquid Gain
<u>845.7</u> Silica Final	<u>832.6</u> Silica Initial	<u>13.1</u> Silica Gain

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Test Location: Main Kiln Stack
Project #: M234007-02
Test Method: 26A
Test Engineer: RB
Test Technician: RS

	<u>Run 1B</u>	<u>Run 2B</u>	<u>Run 3B</u>
Meter ID:	CM54	CM54	CM54
Pitot ID:	S8-032A	S8-032A	S8-032A
Filter ID:			
Filter Pre-Weight (grams):			
Nozzle Diameter (Inches):	0.373	0.373	0.373
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:	GLASS SET #38	GLASS SET #38	GLASS SET #38

Leak Checks

Pre Pitot Leak Check	0.0 @ 3.0 "H ₂ O	0.0 @ 4.0 "H ₂ O	0.0 @ 5.0 "H ₂ O
Post Pitot Leak Check	0.0 @ 4.0 "H ₂ O	0.0 @ 3.0 "H ₂ O	0.0 @ 4.0 "H ₂ O
Pre Nozzle Leak Check	0.0000 @ 15 "Hg	0.0000 @ 16 "Hg	0.0000 @ 15 "Hg
Post Nozzle Leak Check	0.0000 @ 17 "Hg	0.0000 @ 17 "Hg	0.0000 @ 15 "Hg
Pitot Tube Coefficient:	0.822		
Probe Length (Feet):	6.0		
Probe Liner Material:	Quartz		
Sample Plane:	Horizontal		
Port Length (Inches):	9.00		
Port Size (Diameter, Inches):	6.00		
Port Type:	Flange		
Duct Shape:	Circular		
Diameter (Feet):	13		
Duct Area (Square Feet):	132.732		
Upstream Diameters:	9.2		
Downstream Diameters:	10.8		
Number of Ports Sampled:	4		
Number of Points per Port:	3		
Minutes per Point:	5.0		
Minutes per Reading:	5.0		
Total Number of Traverse Points:	12		
Test Length (Minutes):	60		
Train Type:	Anderson Box		
Source Condition:	Mill Off		
Diluent Model/Serial Number:	CAI 700		
Moisture Balance ID:	LV3		
# of Runs	3		

Run 1B - Method 26A

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

Date: 1/10/24
 Start Time: 11:45
 End Time: 13:00

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.46	in. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	65.8	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.391	in. H ₂ O		Carbon Dioxide:	17.30	%
Stack Temperature, Ts:	319.9	°F		Oxygen:	10.50	%
Meter Volume, Vm:	43.057	ft ³		Nitrogen:	72.20	%
Meter Volume, Vmstd:	42.176	dscf		Gas Weight dry, Md:	31.188	lb/lb mole
Meter Volume, Vwstd:	5.897	wscf		Gas Weight wet, Ms:	29.570	lb/lb mole
Isokinetic Variance:	101.8	%l		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	26.016	fps
Nozzle Diameter:	0.373	in inches		Volumetric Flow:	207,188	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	120,893	dscfm
				Volumetric Flow:	137,795	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3658.4	ml	Silica Initial Wt.	869.2	grams
Final Impinger Content:	3774.1	ml	Silica Final Wt.	878.7	grams
Impinger Difference:	115.7	ml	Silica Difference:	9.5	grams
Total Water Gain:	125.2		Moisture, Bws:	0.123	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	11:45:00	0.18	1.70	49.999	315	65	65	4	260	258	41
1-2	11:50:00	0.14	1.33	53.890	315	65	65	4	259	258	41
1-3	11:55:00	0.11	1.04	57.340	315	65	65	4	258	260	41
	12:00:00			60.395							
2-1	12:05:00	0.19	1.80	60.395	318	65	65	4	260	261	43
2-2	12:10:00	0.16	1.52	64.390	319	65	65	4	260	263	43
2-3	12:15:00	0.13	1.23	68.060	319	65	65	4	261	260	43
	12:20:00			71.370							
3-1	12:25:00	0.18	1.70	71.370	320	66	66	4	261	259	44
3-2	12:30:00	0.15	1.42	75.260	321	66	66	4	259	258	44
3-3	12:35:00	0.11	1.04	78.820	322	66	66	4	255	259	45
	12:40:00			81.860							
4-1	12:45:00	0.20	1.89	81.860	324	67	67	4	259	260	46
4-2	12:50:00	0.17	1.61	85.960	325	67	67	4	260	261	46
4-3	12:55:00	0.13	1.23	89.740	326	67	67	4	260	263	48
	13:00:00			93.056							

Total	1:00:00			43.057		65.8	65.8				
Average			1.46		319.9	65.8		4			
Min			1.04		315.0	65.0		4			
Max			1.89		326.0	67.0		4			

Impinger Weight Sheet - Run 1B

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Project #: M234007-02
 Date: 1/10/2024
 Test Method: 26A
 Weighed/Measured By: RODS
 Balance ID: LV3

Scale Calibration Check Date: 1/10/2024

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	FINAL	INITIAL	GAIN
CONTENTS	MLS / GRAMS	MLS / GRAMS	MLS / GRAMS
0.1N H2SO4	806.5	751.5	55.0
0.1N H2SO4	766.0	733.6	32.4
Empty	707.4	684.0	23.4
0.1N NaOH	743.6	740.0	3.6
0.1N NaOH	750.6	749.3	1.3
Silica Gel	878.7	869.2	9.5

3,774.1	3,658.4	115.7
Liquid Final	Liquid Initial	Liquid Gain
878.7	869.2	9.5
Silica Final	Silica Initial	Silica Gain

Run 2B - Method 26A

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

Date: 1/10/24
 Start Time: 13:20
 End Time: 14:35

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.61	In. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	71.5	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.384	In. H ₂ O		Carbon Dioxide:	17.00	%
Stack Temperature, Ts:	341.3	°F		Oxygen:	9.90	%
Meter Volume, Vm:	44.601	ft ³		Nitrogen:	73.1	%
Meter Volume, Vmstd:	43.231	dscf		Gas Weight dry, Md:	31.116	lb/lb mole
Meter Volume, Vwstd:	6.217	wscf		Gas Weight wet, Ms:	29.467	lb/lb mole
Isokinetic Variance:	107.9	%l		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	25.924	fps
Nozzle Diameter:	0.373	in inches		Volumetric Flow:	206,459	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	116,850	dscfm
				Volumetric Flow:	133,655	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3595.7	ml	Silica Initial Wt.	887.7	grams
Final Impinger Content:	3717.5	ml	Silica Final Wt.	897.9	grams
Impinger Difference:	121.8	ml	Silica Difference:	10.2	grams
Total Water Gain:	132.0		Moisture, Bws:	0.126	

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	13:20:00	0.18	1.95	95.385	340	70	70	4	260	260	40
1-2	13:25:00	0.14	1.52	99.480	340	70	70	4	260	254	42
1-3	13:30:00	0.11	1.19	103.100	340	70	70	4	261	260	43
	13:35:00			106.310							
2-1	13:40:00	0.19	2.06	106.310	341	71	71	4	261	254	43
2-2	13:45:00	0.16	1.73	110.520	341	71	71	4	259	254	45
2-3	13:50:00	0.13	1.41	114.400	341	71	71	4	259	255	45
	13:55:00			117.890							
3-1	14:00:00	0.18	1.95	117.890	342	72	72	4	259	253	46
3-2	14:05:00	0.15	1.62	122.010	342	72	72	4	260	254	47
3-3	14:10:00	0.12	1.30	125.750	342	72	72	4	254	254	47
	14:15:00			129.122							
4-1	14:20:00	0.17	1.84	129.122	342	73	73	4	259	260	48
4-2	14:25:00	0.14	1.52	133.120	342	73	73	4	260	259	49
4-3	14:30:00	0.11	1.19	136.760	342	73	73	4	261	255	49
	14:35:00			139.986							

Total	1:00:00			44.601		71.5	71.5				
Average			1.61		341.3	71.5		4			
Min			1.19		340.0	70.0		4			
Max			2.06		342.0	73.0		4			

Impinger Weight Sheet - Run 2B

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Project #: M234007-02
 Date: 1/10/2024
 Test Method: 26A
 Weighed/Measured By: RODS
 Balance ID: LV3

Scale Calibration Check Date: 1/10/2024

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	FINAL	INITIAL	GAIN
CONTENTS	MLS / GRAMS	MLS / GRAMS	MLS / GRAMS
0.1N H2SO4	763.7	707.1	56.6
0.1N H2SO4	771.9	735.9	36.0
Empty	678.6	657.5	21.1
0.1N NaOH	739.6	735.9	3.7
0.1N NaOH	763.7	759.3	4.4
Silica Gel	897.9	887.7	10.2

3,717.5	3,595.7	121.8
Liquid Final	Liquid Initial	Liquid Gain
897.9	887.7	10.2
Silica Final	Silica Initial	Silica Gain

Run 3B - Method 26A

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

Date: 1/10/24
 Start Time: 14:55
 End Time: 16:10

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	1.49	In. H ₂ O		Static Pressure	-0.50	in. H ₂ O
Meter Temperature, Tm:	77.8	°F		Flue Pressure (Ps):	29.39	in. Hg. abs.
Sqrt ΔP:	0.384	In. H ₂ O		Carbon Dioxide:	17.20	%
Stack Temperature, Ts:	347.8	°F		Oxygen:	10.20	%
Meter Volume, Vm:	43.331	ft ³		Nitrogen:	72.6	%
Meter Volume, Vmstd:	41.501	dscf		Gas Weight dry, Md:	31.160	lb/lb mole
Meter Volume, Vwstd:	6.472	wscf		Gas Weight wet, Ms:	29.385	lb/lb mole
Isokinetic Variance:	104.9	%l		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	26.083	fps
Nozzle Diameter:	0.373	in inches		Volumetric Flow:	207,720	acfm
Barometric Pressure:	29.43	in Hg		Volumetric Flow:	115,395	dscfm
				Volumetric Flow:	133,389	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3629.5	ml	Silica Initial Wt.	878.7	grams
Final Impinger Content:	3756.4	ml	Silica Final Wt.	889.2	grams
Impinger Difference:	126.9	ml	Silica Difference:	10.5	grams

Total Water Gain: 137.4

Moisture, Bws: 0.135

Port- Point No.	Clock Time	Velocity Head Δp in. H ₂ O	Orifice ΔH in. H ₂ O	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	14:55:00	0.18	1.81	42.068	346	77	77	4	262	261	50
1-2	15:00:00	0.14	1.41	46.050	346	77	77	4	262	261	50
1-3	15:05:00	0.11	1.11	49.570	346	77	77	4	260	260	50
	15:10:00			52.697							
2-1	15:15:00	0.19	1.91	52.697	348	77	77	4	260	255	51
2-2	15:20:00	0.15	1.51	56.780	348	77	77	4	259	258	52
2-3	15:25:00	0.12	1.21	60.420	348	77	77	4	258	259	52
	15:30:00			63.684							
3-1	15:35:00	0.18	1.81	63.684	349	78	78	4	255	262	53
3-2	15:40:00	0.16	1.61	67.660	349	78	78	4	258	262	53
3-3	15:45:00	0.13	1.31	71.430	349	78	78	4	259	260	54
	15:50:00			74.828							
4-1	15:55:00	0.17	1.71	74.828	348	79	79	4	260	259	55
4-2	16:00:00	0.14	1.41	78.700	348	79	79	4	262	258	55
4-3	16:05:00	0.11	1.13	82.240	348	79	79	4	262	259	56
	16:10:00			85.399							

Total	1:00:00			43.331		77.8	77.8				
Average			1.49		347.8	77.8		4			
Min			1.11		346.0	77.0		4			
Max			1.91		349.0	79.0		4			

Impinger Weight Sheet - Run 3B

Client: Ash Grove Cement Company Facility: Seattle Cement Plant Test Location: Main Kiln Stack Project #: M234007-02 Date: 1/10/2024 Test Method: 26A Weighed/Measured By: RODS Balance ID: LV3	Scale Calibration Check Date: <u>1/10/2024</u> Scale Calibration Check (see QS-6.05C for procedure) must be within $\pm 0.5g$ of certified mass <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="text-align: left; border-bottom: 1px solid black;"><u>Certified Weight, grams</u></th> <th style="text-align: left; border-bottom: 1px solid black;"><u>Result, grams</u></th> </tr> <tr> <td style="text-align: center;">250</td> <td style="text-align: center; border-bottom: 1px solid black;">250.0</td> </tr> <tr> <td style="text-align: center;">500</td> <td style="text-align: center; border-bottom: 1px solid black;">500.0</td> </tr> <tr> <td style="text-align: center;">750</td> <td style="text-align: center; border-bottom: 1px solid black;">750.0</td> </tr> </table>	<u>Certified Weight, grams</u>	<u>Result, grams</u>	250	250.0	500	500.0	750	750.0
<u>Certified Weight, grams</u>	<u>Result, grams</u>								
250	250.0								
500	500.0								
750	750.0								

IMPINGER		FINAL		INITIAL		GAIN	
CONTENTS		MLS / GRAMS		MLS / GRAMS		MLS / GRAMS	
0.1N H2SO4		839.6		794.0		45.6	
0.1N H2SO4		768.8		721.3		47.5	
Empty		677.2		654.0		23.2	
0.1N NaOH		741.5		734.6		6.9	
0.1N NaOH		729.3		725.6		3.7	
Silica Gel		889.2		878.7		10.5	

<u>3,756.4</u> Liquid Final	<u>3,629.5</u> Liquid Initial	<u>126.9</u> Liquid Gain
<u>889.2</u> Silica Final	<u>878.7</u> Silica Initial	<u>10.5</u> Silica Gain

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

Run 1

Spectrum	Time	FTIR Data				Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmww	HF ppmww	Cell Temp	Pressure
MILLOFF_RUN1_000961.LAB	11:45	13.51	14.77	2.17	≤ 0.10	191.22	1.00
MILLOFF_RUN1_000962.LAB	11:46	13.43	14.62	2.19	≤ 0.10	191.36	1.00
MILLOFF_RUN1_000963.LAB	11:47	13.21	15.04	2.25	≤ 0.10	191.41	1.00
MILLOFF_RUN1_000964.LAB	11:48	13.77	15.38	2.27	≤ 0.10	191.39	1.00
MILLOFF_RUN1_000965.LAB	11:49	13.36	14.97	2.23	≤ 0.10	191.31	1.00
MILLOFF_RUN1_000966.LAB	11:50	13.28	14.78	2.25	≤ 0.10	191.27	1.00
MILLOFF_RUN1_000967.LAB	11:51	13.38	15.18	2.18	≤ 0.10	191.31	1.00
MILLOFF_RUN1_000968.LAB	11:52	13.40	15.24	2.23	≤ 0.10	191.28	1.00
MILLOFF_RUN1_000969.LAB	11:53	13.04	14.76	2.28	≤ 0.10	191.15	1.00
MILLOFF_RUN1_000970.LAB	11:54	13.20	15.31	2.23	≤ 0.10	190.89	1.00
MILLOFF_RUN1_000971.LAB	11:55	13.31	15.16	2.26	≤ 0.10	190.90	1.00
MILLOFF_RUN1_000972.LAB	11:56	13.39	15.09	2.25	≤ 0.10	191.08	1.00
MILLOFF_RUN1_000973.LAB	11:57	13.35	15.16	2.30	≤ 0.10	191.18	1.00
MILLOFF_RUN1_000974.LAB	11:58	13.36	15.24	2.31	≤ 0.10	191.27	1.00
MILLOFF_RUN1_000975.LAB	11:59	13.20	14.86	2.29	≤ 0.10	191.23	1.00
MILLOFF_RUN1_000976.LAB	12:00	12.85	14.76	2.26	≤ 0.10	191.05	1.00
MILLOFF_RUN1_000977.LAB	12:01	12.94	14.69	2.29	≤ 0.10	190.90	1.00
MILLOFF_RUN1_000978.LAB	12:02	13.03	14.84	2.24	≤ 0.10	190.72	1.00
MILLOFF_RUN1_000979.LAB	12:03	13.32	14.93	2.30	≤ 0.10	190.84	1.00
MILLOFF_RUN1_000980.LAB	12:04	13.55	14.52	2.29	≤ 0.10	191.00	1.00
MILLOFF_RUN1_000981.LAB	12:05	12.82	14.54	2.34	≤ 0.10	190.92	1.00
MILLOFF_RUN1_000982.LAB	12:06	12.94	14.20	2.34	≤ 0.10	190.86	1.00
MILLOFF_RUN1_000983.LAB	12:07	12.96	14.62	2.36	≤ 0.10	190.95	1.00
MILLOFF_RUN1_000984.LAB	12:08	13.19	14.77	2.28	≤ 0.10	190.72	1.00
MILLOFF_RUN1_000985.LAB	12:09	13.33	15.57	2.38	≤ 0.10	190.55	1.00
MILLOFF_RUN1_000986.LAB	12:10	13.54	15.34	2.37	≤ 0.10	190.75	1.00
MILLOFF_RUN1_000987.LAB	12:11	13.14	15.04	2.39	≤ 0.10	191.03	1.00
MILLOFF_RUN1_000988.LAB	12:12	13.19	15.28	2.50	≤ 0.10	190.98	1.00
MILLOFF_RUN1_000989.LAB	12:13	12.94	15.13	2.45	≤ 0.10	190.87	1.00
MILLOFF_RUN1_000990.LAB	12:14	13.40	15.25	2.42	≤ 0.10	191.03	1.00
MILLOFF_RUN1_000991.LAB	12:15	13.12	14.98	2.35	≤ 0.10	191.05	1.00
MILLOFF_RUN1_000992.LAB	12:16	13.23	15.16	2.46	≤ 0.10	190.94	1.00
MILLOFF_RUN1_000993.LAB	12:17	12.78	14.23	2.46	≤ 0.10	190.85	1.00
MILLOFF_RUN1_000994.LAB	12:18	13.23	14.48	2.47	≤ 0.10	190.91	1.00
MILLOFF_RUN1_000995.LAB	12:19	13.12	14.62	2.45	≤ 0.10	190.95	1.00
MILLOFF_RUN1_000996.LAB	12:20	13.31	14.67	2.45	≤ 0.10	191.11	1.00
MILLOFF_RUN1_000997.LAB	12:21	13.48	15.03	2.41	≤ 0.10	191.32	1.00
MILLOFF_RUN1_000998.LAB	12:22	13.54	15.62	2.48	≤ 0.10	191.34	1.00
MILLOFF_RUN1_000999.LAB	12:23	13.36	15.44	2.41	≤ 0.10	191.27	1.00
MILLOFF_RUN1_001000.LAB	12:24	13.52	15.51	2.50	≤ 0.10	191.21	1.00
MILLOFF_RUN1_001001.LAB	12:25	13.76	15.08	2.50	≤ 0.10	191.12	1.00
MILLOFF_RUN1_001002.LAB	12:26	13.65	14.65	2.49	≤ 0.10	191.04	1.00
MILLOFF_RUN1_001003.LAB	12:27	13.28	14.44	2.55	≤ 0.10	190.90	1.00
MILLOFF_RUN1_001004.LAB	12:28	13.52	14.91	2.45	≤ 0.10	190.70	1.00
MILLOFF_RUN1_001005.LAB	12:29	13.77	14.90	2.39	≤ 0.10	190.54	1.00
MILLOFF_RUN1_001006.LAB	12:30	13.72	14.99	2.48	≤ 0.10	190.48	1.00
MILLOFF_RUN1_001007.LAB	12:31	13.21	14.63	2.51	≤ 0.10	190.60	1.00
MILLOFF_RUN1_001008.LAB	12:32	13.63	15.01	2.48	≤ 0.10	190.75	1.00
MILLOFF_RUN1_001009.LAB	12:33	14.12	14.91	2.43	≤ 0.10	190.74	1.00
MILLOFF_RUN1_001010.LAB	12:34	13.72	15.16	2.56	≤ 0.10	190.68	1.00
MILLOFF_RUN1_001011.LAB	12:35	13.97	15.33	2.50	≤ 0.10	190.62	1.00
MILLOFF_RUN1_001012.LAB	12:36	13.61	15.21	2.44	≤ 0.10	190.74	1.00
MILLOFF_RUN1_001013.LAB	12:37	13.08	15.43	2.47	≤ 0.10	190.90	1.00
MILLOFF_RUN1_001014.LAB	12:38	14.19	15.16	2.49	≤ 0.10	190.71	1.00
MILLOFF_RUN1_001015.LAB	12:39	13.46	15.14	2.51	≤ 0.10	190.51	1.00
MILLOFF_RUN1_001016.LAB	12:40	13.78	15.16	2.51	≤ 0.10	190.64	1.00
MILLOFF_RUN1_001017.LAB	12:41	14.15	14.87	2.56	≤ 0.10	191.02	1.00
MILLOFF_RUN1_001018.LAB	12:42	14.30	14.52	2.35	≤ 0.10	191.09	1.00
MILLOFF_RUN1_001019.LAB	12:43	13.30	14.03	2.24	≤ 0.10	191.14	1.00
MILLOFF_RUN1_001020.LAB	12:44	13.39	14.04	2.22	≤ 0.10	191.18	1.00
Average		13.39	14.94	2.37	≤ 0.10	190.97	1.00

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

Run 2

Spectrum	Time	FTIR Data				Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw			
RUN2_001111.LAB	13:20	12.95	14.6	2.36	≤ 0.10	3.5	1.47	10.06
RUN2_001112.LAB	13:21	13.82	14.5	2.39	≤ 0.10	3.6	1.41	9.95
RUN2_001113.LAB	13:22	13.24	14.6	2.35	≤ 0.10	3.5	1.40	9.97
RUN2_001114.LAB	13:23	13.12	14.6	2.41	≤ 0.10	3.5	1.40	10.02
RUN2_001115.LAB	13:24	13.37	14.6	2.37	≤ 0.10	3.5	1.46	10.02
RUN2_001116.LAB	13:25	13.56	14.5	2.36	≤ 0.10	3.5	1.42	10.02
RUN2_001117.LAB	13:26	13.09	14.7	2.36	≤ 0.10	3.6	1.50	10.03
RUN2_001118.LAB	13:27	13.36	14.8	2.38	≤ 0.10	3.7	1.52	10.01
RUN2_001119.LAB	13:28	13.30	14.6	2.46	≤ 0.10	3.6	1.46	9.98
RUN2_001120.LAB	13:29	13.27	14.6	2.41	≤ 0.10	3.6	1.41	10.07
RUN2_001121.LAB	13:30	13.15	14.8	2.39	≤ 0.10	3.7	1.46	10.00
RUN2_001122.LAB	13:31	13.37	14.7	2.43	≤ 0.10	3.7	1.47	9.91
RUN2_001123.LAB	13:32	13.26	14.6	2.37	≤ 0.10	3.5	1.43	9.98
RUN2_001124.LAB	13:33	13.46	14.5	2.39	≤ 0.10	3.5	1.40	10.08
RUN2_001125.LAB	13:34	13.24	14.8	2.43	≤ 0.10	3.7	1.45	10.12
RUN2_001126.LAB	13:35	13.44	14.7	2.41	≤ 0.10	3.7	1.47	9.94
RUN2_001127.LAB	13:36	13.29	14.9	2.44	≤ 0.10	4.1	1.50	9.94
RUN2_001128.LAB	13:37	13.36	14.8	2.39	≤ 0.10	3.8	1.56	9.87
RUN2_001129.LAB	13:38	13.63	14.4	2.42	≤ 0.10	3.5	1.47	9.89
RUN2_001130.LAB	13:39	12.89	14.6	2.44	≤ 0.10	3.5	1.41	10.11
RUN2_001131.LAB	13:40	13.26	14.8	2.39	≤ 0.10	3.7	1.45	10.12
RUN2_001132.LAB	13:41	13.22	14.9	2.42	≤ 0.10	3.8	1.44	9.99
RUN2_001133.LAB	13:42	13.19	14.9	2.38	≤ 0.10	3.8	1.47	9.92
RUN2_001134.LAB	13:43	13.25	14.8	2.40	≤ 0.10	3.7	1.43	9.89
RUN2_001135.LAB	13:44	13.34	14.9	2.40	≤ 0.10	3.9	1.44	9.93
RUN2_001136.LAB	13:45	13.34	15.0	2.43	≤ 0.10	4.7	1.46	9.94
RUN2_001137.LAB	13:46	13.23	15.1	2.37	≤ 0.10	5.3	1.45	9.81
RUN2_001138.LAB	13:47	13.53	15.0	2.37	≤ 0.10	4.0	1.44	9.74
RUN2_001139.LAB	13:48	13.22	14.8	2.43	≤ 0.10	3.7	1.42	9.76
RUN2_001140.LAB	13:49	12.90	14.4	2.40	≤ 0.10	3.5	1.38	9.91
RUN2_001141.LAB	13:50	13.19	14.4	2.39	≤ 0.10	3.6	1.39	10.09
RUN2_001142.LAB	13:51	13.29	14.9	2.42	≤ 0.10	4.6	1.46	10.18
RUN2_001143.LAB	13:52	13.38	15.1	2.42	≤ 0.10	5.9	1.48	10.04
RUN2_001144.LAB	13:53	13.23	15.1	2.36	≤ 0.10	4.3	1.47	9.75
RUN2_001145.LAB	13:54	12.94	14.9	2.35	≤ 0.10	3.8	1.46	9.72
RUN2_001146.LAB	13:55	12.98	14.7	2.30	≤ 0.10	3.6	1.33	9.81
RUN2_001147.LAB	13:56	13.13	14.8	2.36	≤ 0.10	3.8	1.33	9.91
RUN2_001148.LAB	13:57	13.35	14.8	2.39	≤ 0.10	3.8	1.38	10.05
RUN2_001149.LAB	13:58	13.20	14.8	2.38	≤ 0.10	3.7	1.34	9.90
RUN2_001150.LAB	13:59	12.97	14.7	2.41	≤ 0.10	3.5	1.30	9.90
RUN2_001151.LAB	14:00	13.16	14.8	2.38	≤ 0.10	3.6	1.36	9.94
RUN2_001152.LAB	14:01	13.17	14.8	2.33	≤ 0.10	3.7	1.40	10.06
RUN2_001153.LAB	14:02	12.91	14.9	2.37	≤ 0.10	3.6	1.31	10.00
RUN2_001154.LAB	14:03	13.06	15.0	2.38	≤ 0.10	3.8	1.43	9.98
RUN2_001155.LAB	14:04	12.84	15.0	2.36	≤ 0.10	3.8	1.33	10.01
RUN2_001156.LAB	14:05	13.09	14.9	2.36	≤ 0.10	3.7	1.43	9.98
RUN2_001157.LAB	14:06	12.95	14.7	2.33	≤ 0.10	3.6	1.40	9.99
RUN2_001158.LAB	14:07	12.80	14.7	2.35	≤ 0.10	3.7	1.42	9.96
RUN2_001159.LAB	14:08	13.01	14.7	2.32	≤ 0.10	3.6	1.36	10.04
RUN2_001160.LAB	14:09	12.81	14.7	2.37	≤ 0.10	3.5	1.33	10.04
RUN2_001161.LAB	14:10	12.83	14.7	2.34	≤ 0.10	3.6	1.27	10.01
RUN2_001162.LAB	14:11	12.88	14.7	2.34	≤ 0.10	3.7	1.34	10.04
RUN2_001163.LAB	14:12	12.69	14.9	2.38	≤ 0.10	3.6	1.37	10.14
RUN2_001164.LAB	14:13	12.96	15.0	2.31	≤ 0.10	3.9	1.38	10.02
RUN2_001165.LAB	14:14	12.93	14.8	2.29	≤ 0.10	3.7	1.34	10.05
RUN2_001166.LAB	14:15	12.61	14.9	2.35	≤ 0.10	3.6	1.27	10.03
RUN2_001167.LAB	14:16	12.62	14.8	2.31	≤ 0.10	3.5	1.38	9.91
RUN2_001168.LAB	14:17	12.62	14.6	2.33	≤ 0.10	3.5	1.35	10.08
RUN2_001169.LAB	14:18	12.55	14.7	2.28	≤ 0.10	3.5	1.36	10.09
RUN2_001170.LAB	14:19	12.89	14.6	2.26	≤ 0.10	3.4	1.30	10.14
Average		13.13	14.76	2.38	≤ 0.10	3.77	1.41	9.98

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Project #: M234007-02
 Test Location: Main Kiln Stack
 Date: 1/10/24

Run 3

Spectrum	Time	FTIR Data				Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmww	HF ppmww			
RUN3_001253.LAB	14:55	12.69	15.5	2.26	≤ 0.10	191.48	1.00	9.89
RUN3_001254.LAB	14:56	12.80	15.5	2.27	≤ 0.10	191.41	1.00	9.79
RUN3_001255.LAB	14:57	12.92	15.6	2.22	≤ 0.10	191.26	1.00	9.90
RUN3_001256.LAB	14:58	12.93	15.7	2.15	≤ 0.10	191.09	1.00	9.79
RUN3_001257.LAB	14:59	12.76	15.2	2.25	≤ 0.10	191.19	1.00	9.90
RUN3_001258.LAB	15:00	12.60	15.1	2.27	≤ 0.10	191.34	1.00	10.10
RUN3_001259.LAB	15:01	12.64	15.2	2.26	≤ 0.10	191.35	1.00	10.12
RUN3_001260.LAB	15:02	12.70	15.0	2.20	≤ 0.10	191.33	1.00	10.09
RUN3_001261.LAB	15:03	12.69	15.1	2.23	≤ 0.10	191.28	1.00	10.16
RUN3_001262.LAB	15:04	12.76	15.0	2.24	≤ 0.10	191.22	1.00	10.11
RUN3_001263.LAB	15:05	12.87	15.2	2.18	≤ 0.10	191.24	1.00	10.09
RUN3_001264.LAB	15:06	12.93	15.2	2.20	≤ 0.10	191.12	1.00	10.03
RUN3_001265.LAB	15:07	12.86	15.1	2.19	≤ 0.10	190.96	1.00	10.02
RUN3_001266.LAB	15:08	12.92	15.1	2.25	≤ 0.10	190.92	1.00	10.14
RUN3_001267.LAB	15:09	12.83	14.8	2.21	≤ 0.10	190.87	1.00	10.14
RUN3_001268.LAB	15:10	12.78	15.0	2.23	≤ 0.10	190.94	1.00	10.23
RUN3_001269.LAB	15:11	12.82	15.2	2.20	≤ 0.10	190.87	1.00	10.22
RUN3_001270.LAB	15:12	12.76	15.1	2.21	≤ 0.10	190.84	1.00	10.11
RUN3_001271.LAB	15:13	12.68	14.9	2.22	≤ 0.10	190.89	1.00	10.09
RUN3_001272.LAB	15:14	12.70	15.1	2.20	≤ 0.10	191.02	1.00	10.21
RUN3_001273.LAB	15:15	12.63	15.3	2.29	≤ 0.10	191.10	1.00	10.21
RUN3_001274.LAB	15:16	12.59	15.0	2.24	≤ 0.10	191.18	1.00	10.11
RUN3_001275.LAB	15:17	12.69	15.0	2.22	≤ 0.10	191.15	1.00	10.21
RUN3_001276.LAB	15:18	12.75	15.1	2.23	≤ 0.10	191.14	1.00	10.12
RUN3_001277.LAB	15:19	12.77	15.3	2.16	≤ 0.10	191.14	1.00	10.14
RUN3_001278.LAB	15:20	12.76	15.0	2.19	≤ 0.10	191.04	1.00	10.10
RUN3_001279.LAB	15:21	12.50	14.6	2.22	≤ 0.10	191.04	1.00	10.16
RUN3_001280.LAB	15:22	12.51	14.7	2.18	≤ 0.10	191.07	1.00	10.29
RUN3_001281.LAB	15:23	12.35	14.9	2.17	≤ 0.10	191.09	1.00	10.51
RUN3_001282.LAB	15:24	12.18	14.9	2.08	≤ 0.10	191.13	1.00	10.42
RUN3_001283.LAB	15:25	12.36	15.0	2.14	≤ 0.10	191.15	1.00	10.44
RUN3_001284.LAB	15:26	12.44	14.7	2.10	≤ 0.10	191.14	1.00	10.47
RUN3_001285.LAB	15:27	12.33	14.8	2.10	≤ 0.10	191.07	1.01	10.38
RUN3_001286.LAB	15:28	12.12	15.0	2.10	≤ 0.10	191.03	1.00	10.44
RUN3_001287.LAB	15:29	12.07	15.1	2.07	≤ 0.10	191.05	1.00	10.49
RUN3_001288.LAB	15:30	12.27	14.9	2.06	≤ 0.10	191.02	1.01	10.50
RUN3_001289.LAB	15:31	12.42	14.9	2.05	≤ 0.10	190.96	1.00	10.39
RUN3_001290.LAB	15:32	12.50	14.9	2.05	≤ 0.10	190.95	1.01	10.40
RUN3_001291.LAB	15:33	12.32	15.1	2.03	≤ 0.10	190.97	1.01	10.46
RUN3_001292.LAB	15:34	12.05	15.0	2.05	≤ 0.10	191.05	1.01	10.45
RUN3_001293.LAB	15:35	12.21	15.0	2.05	≤ 0.10	191.10	1.00	10.36
RUN3_001294.LAB	15:36	12.46	15.1	2.06	≤ 0.10	191.08	1.01	10.37
RUN3_001295.LAB	15:37	12.37	15.0	2.07	≤ 0.10	191.08	1.00	10.40
RUN3_001296.LAB	15:38	12.10	14.5	2.07	≤ 0.10	191.03	1.00	10.39
RUN3_001297.LAB	15:39	12.13	14.3	2.08	≤ 0.10	191.00	1.01	10.37
RUN3_001298.LAB	15:40	12.24	14.7	2.09	≤ 0.10	190.95	1.01	10.49
RUN3_001299.LAB	15:41	12.46	14.7	2.10	≤ 0.10	190.98	1.01	10.72
RUN3_001300.LAB	15:42	12.36	14.8	2.05	≤ 0.10	190.95	1.01	10.62
RUN3_001301.LAB	15:43	12.11	14.6	2.07	≤ 0.10	190.95	1.01	10.45
RUN3_001302.LAB	15:44	12.15	15.1	2.15	≤ 0.10	190.96	1.01	10.41
RUN3_001303.LAB	15:45	12.59	15.0	2.10	≤ 0.10	190.96	1.00	10.42
RUN3_001304.LAB	15:46	12.12	15.0	2.15	≤ 0.10	190.95	1.01	10.52
RUN3_001305.LAB	15:47	12.49	15.3	2.10	≤ 0.10	191.01	1.01	10.33
RUN3_001306.LAB	15:48	12.02	14.9	2.11	≤ 0.10	191.05	1.01	10.40
RUN3_001307.LAB	15:49	12.83	14.6	2.11	≤ 0.10	191.06	1.01	10.45
RUN3_001308.LAB	15:50	12.63	14.9	2.12	≤ 0.10	191.03	1.01	10.28
RUN3_001309.LAB	15:51	12.44	14.8	2.12	≤ 0.10	190.98	1.01	10.46
RUN3_001310.LAB	15:52	12.51	14.9	2.11	≤ 0.10	190.93	1.01	10.56
RUN3_001311.LAB	15:53	12.70	15.0	2.02	≤ 0.10	190.82	1.01	10.47
RUN3_001312.LAB	15:54	13.11	15.0	2.10	≤ 0.10	190.75	1.01	10.52
Average		12.54	15.00	2.15	≤ 0.10	191.06	1.00	10.28

Stratification Test Results Summary
Ash Grove Cement Company
Seattle Cement Plant
Main Kiln Stack
January 10, 2024

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

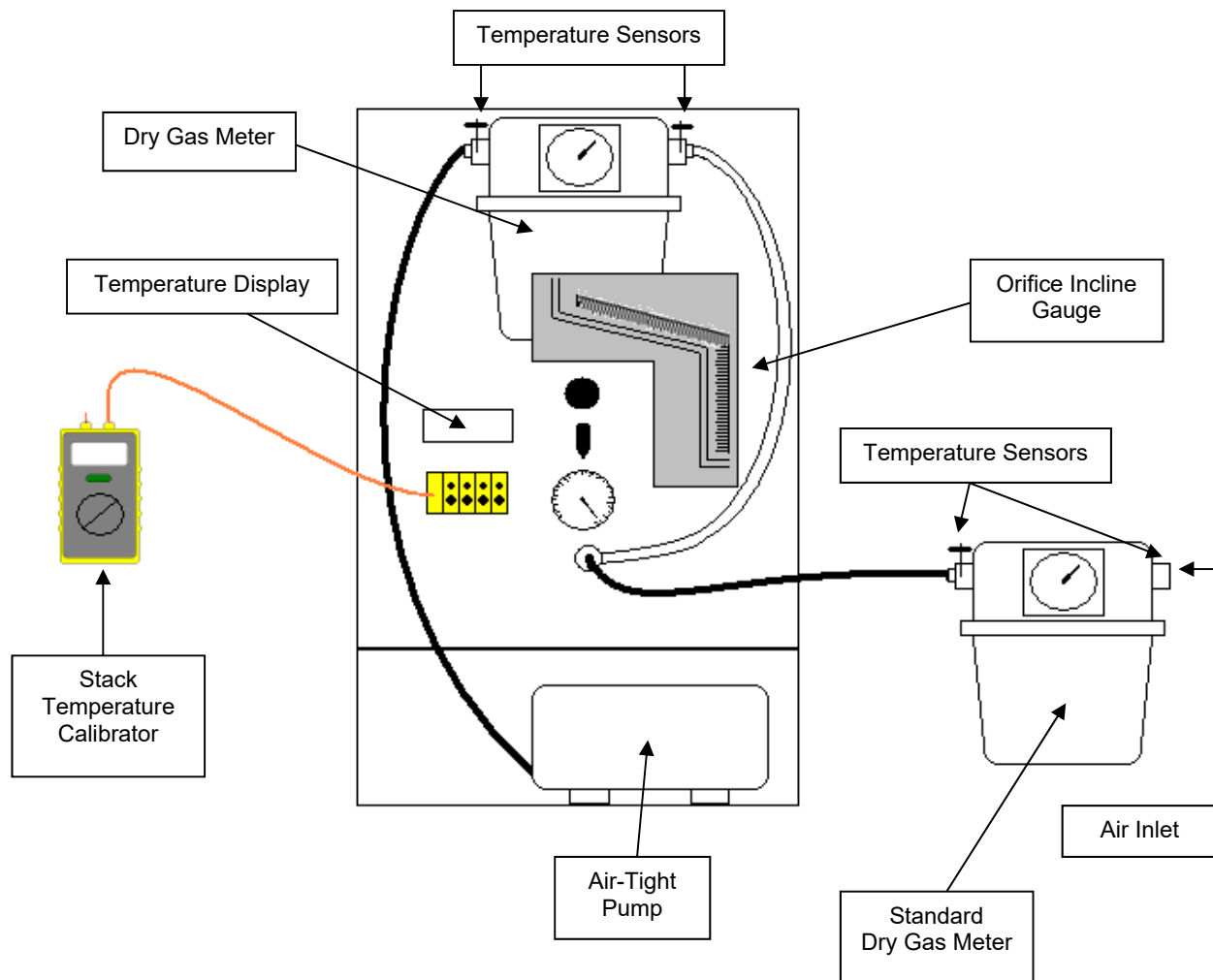
Port No.	Point No.	Time	O ₂ %	Actual % Difference O ₂ %	Mean Difference O ₂ %
1	1	6:55	11.03	0.87	0.10
	2	7:15	11.00	1.14	0.13
	3	7:35	11.35	2.01	0.22
Average			11.13		

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

One point traverse (<0.3% mean difference)	
Three point traverse (0.4, 1.2, and 2.0 meters), < 0.5% mean difference for O ₂	
Twelve point traverse (Method 1 points) >0.5% mean difference for O ₂	

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

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

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A
 Meter ID: CM23

Alternative Method 5 Post Test Calibration

	Run Time (min):	Vm (dscf):	Tm (oR):	Pbar ("Hg):	DHavg ("H2O):	Md:	Orifice DH@:	Meter Yi:	Ycp:	Calibration Status:
Test Run 1	60	52.07	523.83	29.43	2.31	30.86	1.79	0.9990	0.954	Pass
Test Run 2	60	51.67	530.67	29.43	2.27	30.908	1.79	0.9990	0.958	
Test Run 3	60	50.99	533.38	29.43	2.22	30.848	1.79	0.9990	0.964	
								0.9990	0.959	

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

Client: Ash Grove Cement Company
 Facility: Seattle Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A
 Meter ID: CM54

Alternative Method 5 Post Test Calibration - ALT-009

	Run Time (min):	Vm (dscf):	Tm (oR):	Pbar ("Hg):	DHavg ("H2O):	Md:	Orifice DH@:	Meter Y1:	Ycp:	Calibration Status:
Test Run 1	60	45.67	509.25	29.43	1.69	30.86	1.694	0.9880	0.944	Pass
Test Run 2	60	45.23	516.17	29.43	1.66	30.908	1.694	0.9880	0.949	
Test Run 3	60	46.08	521.75	29.43	1.73	30.848	1.694	0.9880	0.957	
								0.9880	0.950	

S TYPE PITOT TUBE INSPECTION WORKSHEET

Pitot Tube No: 6969

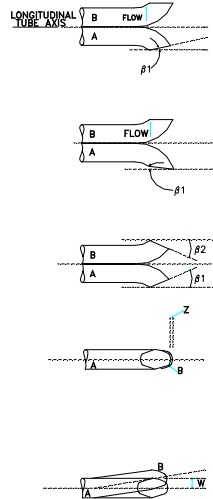
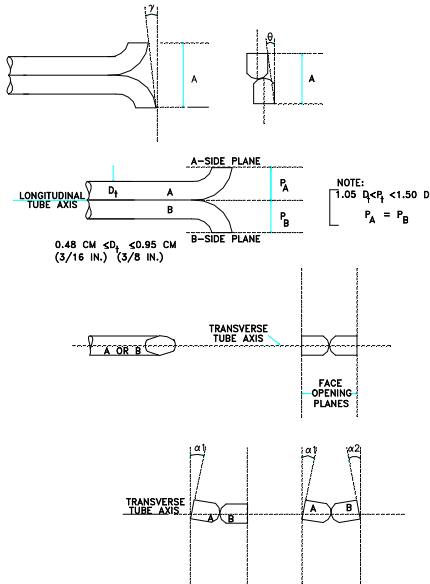
Date: 9/20/2023

Inspectors Name: IMB

Type of Probe: (circle one)

M2	M5	M17
	X	

Probe Length: 3 ft.



Pitot tube assembly level? yes no

Pitot tube openings damaged? yes (explain below) no

$$a_1 = \underline{2}^{\circ} (\leq 10^{\circ}) \quad a_2 = \underline{0}^{\circ} (\leq 10^{\circ}) \quad z = A \sin \gamma = \underline{0.017} \text{ (in.)}; (\leq 0.125 \text{ in.})$$

$$b_1 = \underline{1}^{\circ} (\leq 5^{\circ}) \quad b_2 = \underline{0}^{\circ} (\leq 5^{\circ}) \quad w = A \sin \theta = \underline{0.00000} \text{ (in.)}; (\leq 0.03125 \text{ in.})$$

$$\gamma = \underline{1}^{\circ} \quad \theta = \underline{0}^{\circ} \quad A = \underline{0.974} \text{ (in.)} \quad P_A = \underline{0.487} \text{ (in.)}, P_B = \underline{0.487} \text{ (in.)}, D_t = \underline{0.375} \text{ (in.)}$$

Calibration required? yes X no

S TYPE PITOT TUBE INSPECTION WORKSHEET

Pitot Tube No: 6969

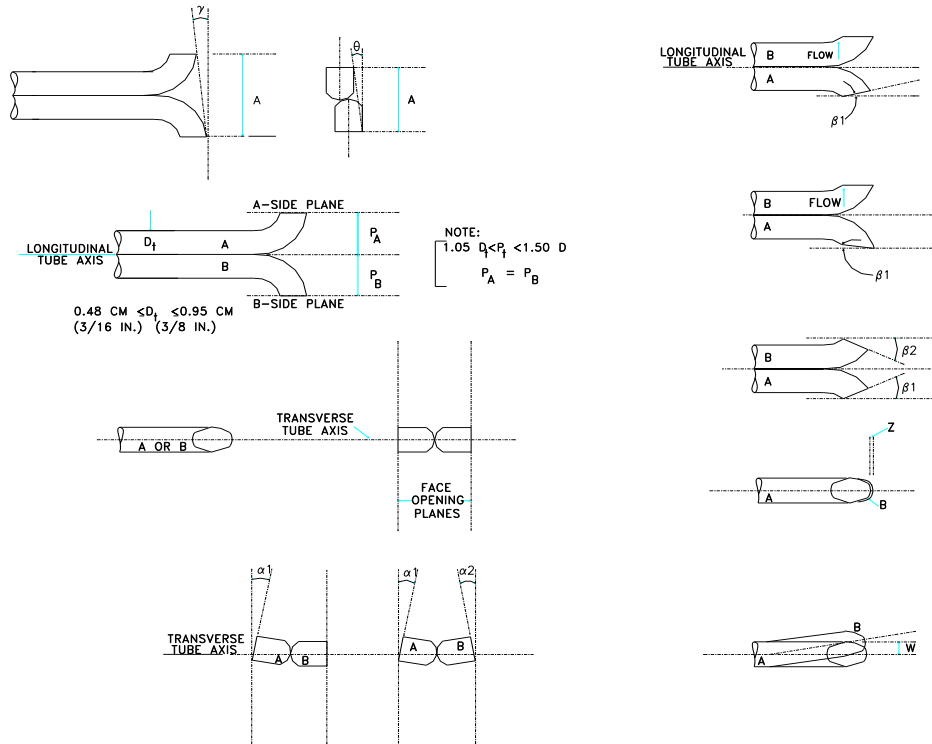
Date: 2/7/2024

Inspectors Name: _____

Type of Probe: (mark one)

M2	M5	M17
	X	

Probe Length: 5 ft.



Pitot tube assembly level? X yes _____ no

Pitot tube openings damaged? _____ yes (explain below) X no

$a_1 =$ 5 $^{\circ}$ ($\leq 10^{\circ}$)

$a_2 =$ 1 $^{\circ}$ ($\leq 10^{\circ}$)

$z = A \sin \gamma =$ 0.000 (in.); (≤ 0.125 in.)

$b_1 =$ 0.5 $^{\circ}$ ($\leq 5^{\circ}$)

$b_2 =$ 0.5 $^{\circ}$ ($\leq 5^{\circ}$)

$w = A \sin \theta =$ 0.00000 (in.); (≤ 0.03125 in.)

$\gamma =$ 0 $^{\circ}$ $\theta =$ 0 $^{\circ}$ $A =$ 0.893 (in.)

$P_A =$ 0.447 (in.), $P_B =$ 0.447 (in.), $D_t =$ 0.375 (in.)

Calibration required? _____ yes X no



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

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

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

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

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

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

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

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

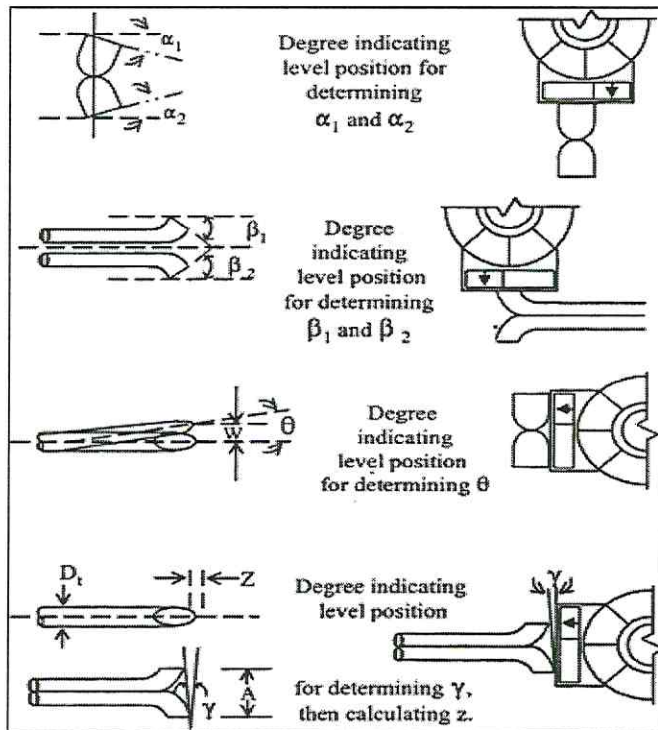
Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

$C_p = 0.818$

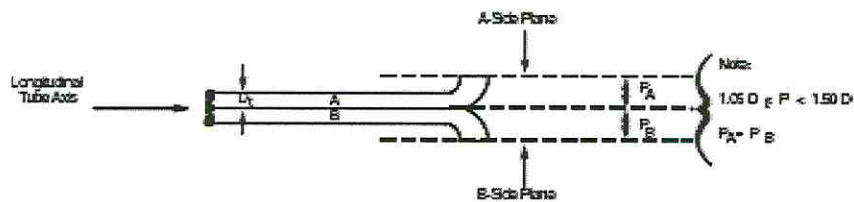


Airflow Sciences Corporation

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

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

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

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

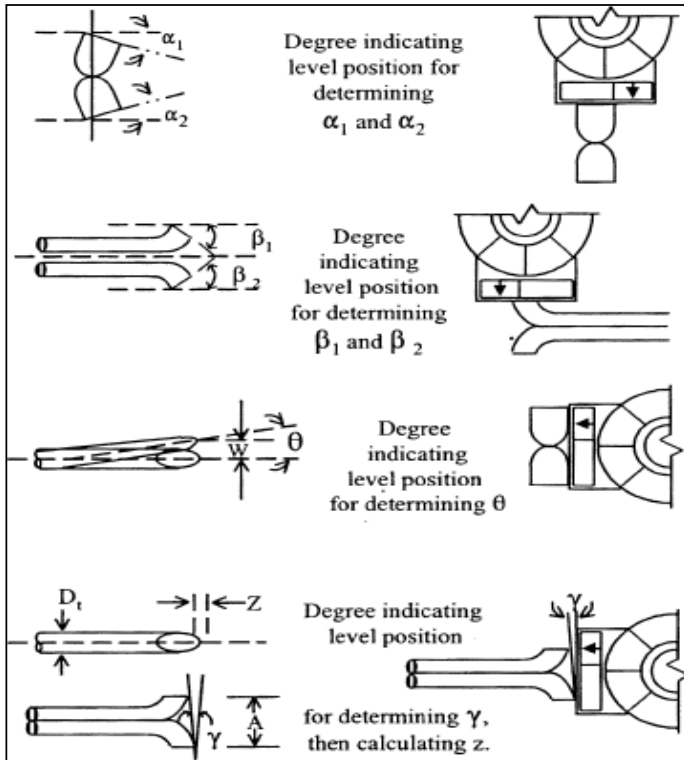
Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3 %.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

$C_p = 0.821$

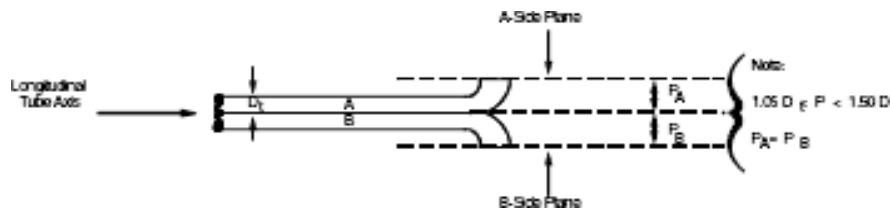


Airflow Sciences Corporation

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

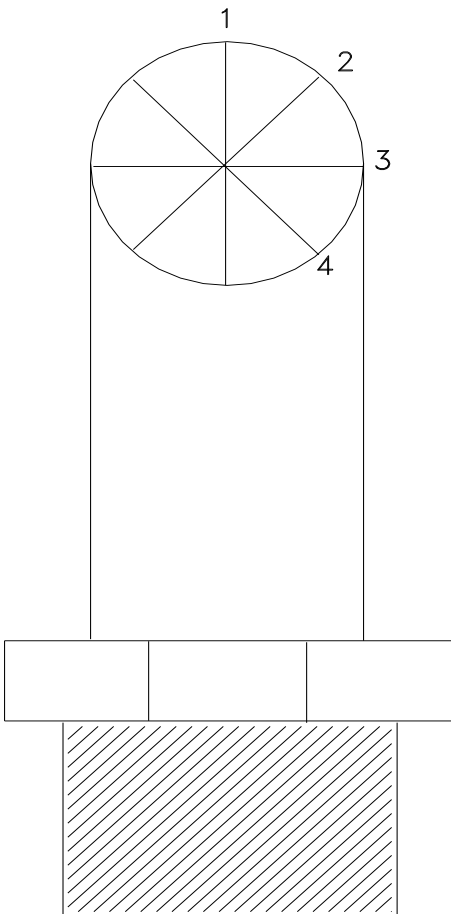
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 319

Analyst: RB

Material/Type: Quartz



0.390 1

0.391 2

0.390 3

0.391 4

Valid Data

Average

0.391

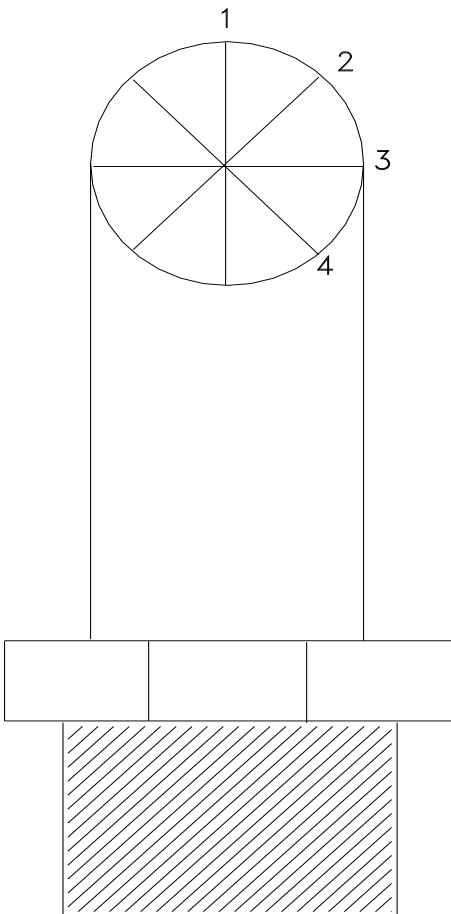
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 945

Analyst: RB

Material/Type: Glass



0.376 1

0.375 2

0.374 3

0.374 4

Valid Data

Average

0.375

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHS
Operating Condition Mill On

Sample System:	FTIR		
Probe Length:	8.0	ft	
Probe Type:	FTIR		
Sample Plane:	Horizontal		
Port Length:	9	in.	
Port Size (diameter):	4	in.	
Port Type:	Flange		
Duct Shape:	Circular		
Diameter:	13	ft	
Duct Area:	132.73	Sq. Ft.	
Upstream Diameters:	9.20		Minimum Upstream Distance 6.5 Feet
Downstream Diameters:	10.80		Minimum Downstream Distance 26.0 Feet
Number of Ports Sampled:	1		Ideal Upstream Distance 26.0 Feet
Number of Points per Port:	1		Ideal Downstream Distance 104.0 Feet
Total Number of Traverse Points:	1		

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder	Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	0.08	-0.36%	N/A		1500
	Mid	CC195925	12.04	12.22	-0.81%	4/24/2031	54.43%	1000
	High	CC308342	22.12	22.48	-1.63%	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)	CAI 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: Seattle Cement Plant
Project #: M234007-02
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 1/10/24
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	12.14	0.12	0.09	0.11	12.13	11.17	11.1	0.36	0.09	-0.05	-0.14
2	12.04	12.14	12.06	0.09	0.14	0.12	12.10	11.19	11.1	0.72	-0.36	-0.27	0.23
3	12.04	12.06	12.12	0.14	0.08	0.11	12.09	11.23	11.2	0.45	0.27	0.00	-0.27

Concentration of Cal Gas
 erage Pre and Post Span

C = Average value of test
 Cgas = Corrected gas value of test

Co=Average Pre and Post Zero

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	1/10/24	6:50	7:49	15.81%	11.08	12.71	15.10	1.80	3.03	0.10	0.17
2	1/10/24	8:25	9:24	15.88%	11.13	12.91	15.35	1.81	3.05	0.10	0.17
3	1/10/24	10:00	10:59	15.84%	11.18	12.59	14.95	1.83	3.11	0.10	0.17

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Test Location: Main Kiln Stack
Date: 1/10/24
Project #: M234007-02

Linearity Cal/Pre 1 Cal		
<u>Time</u>	<u>O2 % (dry)</u>	
6:01	0.22	
6:02	0.08	
6:03	0.08	iz
6:04	10.76	
6:05	22.47	
6:06	22.48	ih
6:07	17.95	
6:08	12.12	
6:09	12.22	im
6:10	10.61	
6:11	10.59	
6:40	10.48	
6:41	10.85	
6:42	4.31	
6:43	0.12	
6:44	0.12	z
6:45	9.76	
6:46	12.09	
6:47	12.12	m
6:48	11.26	

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Test Location: Main Kiln Stack
Date: 1/10/24

Post 1/Pre 2		
<u>Time</u>	<u>O2 % (dry)</u>	
8:15	2.87	
8:16	0.09	
8:17	0.09	z
8:18	4.74	
8:19	11.99	
8:20	12.13	
8:21	12.14	m

Post 2/Pre 3		
<u>Time</u>	<u>O2 % (dry)</u>	
9:49	2.64	
9:50	0.14	
9:51	0.14	z
9:52	2.77	
9:53	11.97	
9:54	12.06	m

Post 3		
<u>Time</u>	<u>O2 % (dry)</u>	
11:25	1.66	
11:26	0.09	
11:27	0.08	z
11:28	5.33	
11:29	12.11	
11:30	12.12	m

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHES
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_000353.LAB	1/10/24	6:04:55	0.0	0.0	0.0	190.5	1.00	-0.2	0.2	0.007
N2_DIR_000354BK.G.LAB	1/10/24	6:07:12	0.0	0.0	0.0	190.5	1.00	0.0	0.0	0.000
N2_DIR_000355.LAB	1/10/24	6:07:26	0.0	0.0	0.0	190.5	1.00	0.1	0.1	-0.001
N2_DIR_000356.LAB	1/10/24	6:07:34	0.0	0.0	0.0	190.5	1.00	-0.1	0.0	0.003
N2_DIR_000357.LAB	1/10/24	6:07:42	0.0	0.0	0.0	190.5	1.00	-0.2	0.0	0.001
N2_DIR_000358.LAB	1/10/24	6:07:50	0.0	0.0	0.0	190.4	1.00	0.1	-0.1	-0.004
N2_DIR_000359.LAB	1/10/24	6:07:58	0.0	0.0	0.0	190.4	1.00	0.0	0.1	0.003
N2_DIR_000360.LAB	1/10/24	6:08:05	0.0	0.0	0.0	190.4	1.00	-0.1	0.2	-0.002
N2_DIR_000361.LAB	1/10/24	6:08:13	0.0	0.0	0.0	190.4	1.00	0.1	0.1	0.003

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_000371.LAB	1/10/24	6:10:16	0.0	0.0	0.0	190.4	1.00	100.6	-0.1	-0.015	99.2%
CTS_DIR_000372.LAB	1/10/24	6:10:24	0.0	0.0	0.0	190.4	1.00	100.7	0.0	-0.008	99.3%
CTS_DIR_000373.LAB	1/10/24	6:10:32	0.0	0.0	0.0	190.4	1.00	100.6	0.1	-0.013	99.2%
CTS_DIR_000374.LAB	1/10/24	6:10:40	0.0	0.0	0.0	190.4	1.00	100.7	-0.1	-0.011	99.3%
CTS_DIR_000375.LAB	1/10/24	6:10:48	0.0	0.0	0.0	190.4	1.00	100.8	0.0	-0.006	99.4%
CTS_DIR_000376.LAB	1/10/24	6:10:55	0.0	0.0	0.0	190.4	1.00	100.6	0.1	-0.014	99.2%
CTS_DIR_000377.LAB	1/10/24	6:11:04	0.0	0.0	0.0	190.5	1.00	100.5	-0.1	-0.007	99.1%
		Average						100.6		-0.007	99.2%

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_000394.LAB	1/10/24	6:15:45	0.0	0.0	0.0	190.7	1.00	-0.3	49.2	4.921	99.3%
HCN_DIR_000395.LAB	1/10/24	6:15:53	0.0	0.0	0.0	190.7	1.00	-0.2	49.1	4.927	99.2%
HCN_DIR_000396.LAB	1/10/24	6:16:01	0.0	0.0	0.0	190.7	1.00	-0.2	49.1	4.923	99.1%
HCN_DIR_000397.LAB	1/10/24	6:16:09	0.0	0.0	0.0	190.7	1.00	-0.2	49.1	4.924	99.1%
HCN_DIR_000398.LAB	1/10/24	6:16:16	0.0	0.0	0.0	190.7	1.00	-0.4	49.3	4.938	99.5%
HCN_DIR_000399.LAB	1/10/24	6:16:24	0.0	0.0	0.0	190.8	1.00	-0.1	49.1	4.935	99.1%
HCN_DIR_000400.LAB	1/10/24	6:16:32	0.0	0.0	0.0	190.7	1.00	-0.1	49.4	4.933	99.6%
HCN_DIR_000401.LAB	1/10/24	6:16:40	0.0	0.0	0.1	190.7	1.00	0.0	49.2	4.953	99.4%
		Average							49.2	4.932	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
CTS_RT_000407.LAB	1/10/24	6:20:02	0.0	0.0	0.0	190.6	1.00	101.3	0.1	-0.005	99.9%
CTS_RT_000408.LAB	1/10/24	6:20:10	0.0	0.0	0.0	190.7	1.00	101.2	0.0	-0.009	99.8%
CTS_RT_000409.LAB	1/10/24	6:20:18	0.0	0.0	0.0	190.6	1.00	101.2	0.0	-0.008	99.8%
CTS_RT_000410.LAB	1/10/24	6:20:26	0.0	0.0	0.0	190.6	1.00	101.3	-0.1	-0.016	99.9%
CTS_RT_000411.LAB	1/10/24	6:20:34	0.0	0.0	0.0	190.7	1.00	101.4	0.0	-0.003	100.0%
CTS_RT_000412.LAB	1/10/24	6:20:42	0.0	0.0	0.0	190.8	1.00	101.3	0.1	-0.001	99.9%
CTS_RT_000413.LAB	1/10/24	6:20:50	0.0	0.0	0.0	190.9	1.00	101.1	0.0	-0.008	99.7%
CTS_RT_000414.LAB	1/10/24	6:20:58	0.0	0.0	0.0	190.8	1.00	101.5	0.0	-0.011	100.1%

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_000403.LAB	1/10/24	6:19:31	0.7	0.0	0.0	190.6	1.00	0.1	-0.1	-0.003	-
CTS_RT_000404.LAB	1/10/24	6:19:39	0.6	0.0	0.0	190.6	1.00	14.8	1.3	0.130	15.895
CTS_RT_000405.LAB	1/10/24	6:19:47	0.1	0.0	0.0	190.7	1.00	99.3	0.3	0.006	23.895
CTS_RT_000406.LAB	1/10/24	6:19:55	0.1	0.0	0.0	190.7	1.00	100.9	-0.1	-0.003	
CTS_RT_000407.LAB	1/10/24	6:20:02	0.0	0.0	0.0	190.6	1.00	101.3	0.1	-0.005	
CTS_RT_000408.LAB	1/10/24	6:20:10	0.0	0.0	0.0	190.7	1.00	101.2	0.0	-0.009	
CTS_RT_000409.LAB	1/10/24	6:20:18	0.0	0.0	0.0	190.6	1.00	101.2	0.0	-0.008	
CTS_RT_000410.LAB	1/10/24	6:20:26	0.0	0.0	0.0	190.6	1.00	101.3	-0.1	-0.016	
CTS_RT_000411.LAB	1/10/24	6:20:34	0.0	0.0	0.0	190.7	1.00	101.4	0.0	-0.003	

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHES
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
AMB_STACK_000488.LAB	1/10/24	6:31:01	13.4	14.0	-0.1	191.0	1.00	3.8	1.8	-0.006
AMB_STACK_000489.LAB	1/10/24	6:31:09	13.7	13.8	-0.1	191.1	1.00	3.8	1.7	-0.006
AMB_STACK_000490.LAB	1/10/24	6:31:16	13.9	13.8	-0.2	191.0	1.00	3.6	1.7	-0.004
									1.7	-0.005

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_000492.LAB	1/10/24	6:32:49	16.1	11.9	-0.1	191.0	1.00	3.3	5.4	0.425	0.086	92.2%
PRE1_SPK_000493.LAB	1/10/24	6:32:57	15.7	11.9	-0.1	190.9	1.00	3.2	5.5	0.421	0.085	94.2%
PRE1_SPK_000494.LAB	1/10/24	6:33:05	15.4	11.9	-0.2	191.0	1.00	3.3	5.3	0.415	0.084	92.6%
PRE1_SPK_000495.LAB	1/10/24	6:33:13	15.2	11.9	-0.2	190.9	1.00	3.2	5.5	0.419	0.085	94.5%
PRE1_SPK_000496.LAB	1/10/24	6:33:21	15.1	11.9	-0.1	190.9	1.00	3.3	5.5	0.416	0.084	96.0%
PRE1_SPK_000497.LAB	1/10/24	6:33:29	15.2	11.9	-0.1	191.0	1.00	3.5	5.4	0.419	0.085	93.2%
PRE1_SPK_000498.LAB	1/10/24	6:33:36	15.2	11.9	-0.1	190.9	1.00	3.5	5.3	0.413	0.084	92.6%
PRE1_SPK_000499.LAB	1/10/24	6:33:44	15.2	11.8	-0.1	190.9	1.00	3.2	5.4	0.418	0.085	93.9%

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_RUN1_000625.LAB	1/10/24	8:02:39	15.6	12.8	-0.2	191.0	1.00	3.1	1.9	-0.015
MILLON_RUN1_000626.LAB	1/10/24	8:03:42	16.2	12.6	-0.2	191.1	1.00	3.0	1.9	-0.013
MILLON_RUN1_000627.LAB	1/10/24	8:04:44	15.9	12.5	-0.2	191.0	1.00	3.1	1.8	-0.012
									1.8	-0.013

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_HCNBPK_000639.LAB	1/10/24	8:10:41	14.5	11.7	-0.2	191.0	1.00	2.8	5.2	0.398	0.081	91.8%
POST1_HCNBPK_000640.LAB	1/10/24	8:10:49	14.1	11.7	-0.2	191.0	1.00	2.7	5.4	0.403	0.082	93.9%
POST1_HCNBPK_000641.LAB	1/10/24	8:10:57	13.9	11.8	-0.2	191.0	1.00	2.8	5.4	0.398	0.081	95.0%
POST1_HCNBPK_000642.LAB	1/10/24	8:11:05	14.1	11.8	-0.2	191.1	1.00	2.8	5.3	0.400	0.081	93.3%
POST1_HCNBPK_000643.LAB	1/10/24	8:11:13	14.4	11.8	-0.2	191.1	1.00	2.6	5.3	0.402	0.082	93.3%
POST1_HCNBPK_000644.LAB	1/10/24	8:11:20	14.3	11.8	-0.2	191.1	1.00	2.7	5.4	0.399	0.081	95.0%
POST1_HCNBPK_000645.LAB	1/10/24	8:11:28	15.5	11.6	-0.2	191.1	1.00	2.8	5.2	0.401	0.081	92.0%
POST1_HCNBPK_000646.LAB	1/10/24	8:11:36	15.3	11.5	-0.2	191.1	1.00	2.8	5.5	0.393	0.080	98.5%

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
POST1_CTS_000653.LAB	1/10/24	8:13:20	1.5	0.0	0.0	191.2	1.01	99.2	0.4	-0.014	97.8%
POST1_CTS_000654.LAB	1/10/24	8:13:28	1.4	0.0	0.0	191.2	1.00	99.1	0.3	-0.010	97.7%
POST1_CTS_000655.LAB	1/10/24	8:13:36	1.2	0.0	0.0	191.1	1.01	99.3	0.1	-0.012	98.0%
POST1_CTS_000656.LAB	1/10/24	8:13:44	1.1	0.0	0.0	191.1	1.01	99.4	0.3	-0.017	98.0%
POST1_CTS_000657.LAB	1/10/24	8:13:52	1.0	0.0	0.0	191.1	1.00	100.1	0.2	-0.010	98.7%
POST1_CTS_000658.LAB	1/10/24	8:14:00	0.9	0.0	0.0	191.1	1.00	99.6	0.2	-0.015	98.2%
POST1_CTS_000659.LAB	1/10/24	8:14:08	0.8	0.0	0.0	191.1	1.00	99.8	0.1	-0.009	98.4%
POST1_CTS_000660.LAB	1/10/24	8:14:15	0.7	0.0	0.0	191.1	1.01	100.0	0.2	-0.015	98.6%

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICH S
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
RUN2_000755.LAB	1/10/24	9:37:39	15.9	13.1	-0.2	191.1	1.00	3.2	0.6	-0.012
RUN2_000756.LAB	1/10/24	9:38:42	15.8	12.9	-0.2	190.9	1.00	3.2	0.6	-0.013
RUN2_000757.LAB	1/10/24	9:39:45	15.8	12.9	-0.2	190.9	1.00	3.2	0.6	-0.014
									0.6	-0.013

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_HCNPK_000759.LAB	1/10/24	9:41:17	14.2	12.3	-0.2	190.6	1.00	3.1	3.9	0.356	0.072	94.7%
POST2_HCNPK_000760.LAB	1/10/24	9:41:25	14.3	12.3	-0.2	190.6	1.00	3.0	3.8	0.365	0.074	91.9%
POST2_HCNPK_000761.LAB	1/10/24	9:41:33	14.4	12.3	-0.2	190.7	1.01	3.0	3.8	0.351	0.071	92.8%
POST2_HCNPK_000762.LAB	1/10/24	9:41:41	14.3	12.3	-0.2	190.8	1.00	3.0	4.0	0.353	0.072	97.2%
POST2_HCNPK_000763.LAB	1/10/24	9:41:49	14.4	12.3	-0.2	190.8	1.00	3.0	3.8	0.348	0.071	93.5%
POST2_HCNPK_000764.LAB	1/10/24	9:41:57	14.5	12.3	-0.2	190.8	1.00	3.1	3.7	0.354	0.072	91.1%
POST2_HCNPK_000765.LAB	1/10/24	9:42:04	14.6	12.3	-0.2	190.8	1.00	3.1	3.7	0.345	0.070	93.2%
POST2_HCNPK_000766.LAB	1/10/24	9:42:13	14.7	12.2	-0.2	190.9	1.00	3.2	3.6	0.342	0.069	91.9%

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_000785.LAB	1/10/24	9:47:45	1.4	0.0	-0.1	191.1	1.00	99.1	-1.0	-0.022	98.4%
POST2_CTS_000786.LAB	1/10/24	9:47:53	1.3	0.0	0.0	191.1	1.00	99.4	-1.0	-0.022	98.8%
POST2_CTS_000787.LAB	1/10/24	9:48:00	1.1	0.0	0.0	191.1	1.00	99.6	-1.1	-0.014	98.9%
POST2_CTS_000788.LAB	1/10/24	9:48:09	1.0	0.0	0.0	191.1	1.00	99.9	-1.1	-0.023	99.3%
POST2_CTS_000789.LAB	1/10/24	9:48:16	0.9	0.0	0.0	191.0	1.01	99.1	-1.0	-0.019	98.5%
POST2_CTS_000790.LAB	1/10/24	9:48:24	0.8	0.0	0.0	191.1	1.00	100.0	-1.3	-0.023	99.4%
POST2_CTS_000791.LAB	1/10/24	9:48:32	0.7	0.0	0.0	191.0	1.01	99.9	-1.1	-0.023	99.2%
POST2_CTS_000792.LAB	1/10/24	9:48:40	0.6	0.0	0.0	191.0	1.00	100.5	-1.1	-0.023	99.8%

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
RUN3_000887.LAB	1/10/24	11:12:54	15.8	13.5	-0.2	190.7	1.00	3.3	0.8	-0.011
RUN3_000888.LAB	1/10/24	11:13:57	14.4	13.7	-0.2	190.9	1.00	3.3	0.9	-0.010
RUN3_000889.LAB	1/10/24	11:14:59	14.6	13.2	-0.2	191.1	1.00	3.2	0.9	-0.010
									0.9	-0.010

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHES
FTIR s/n: 110161896

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_HCN5PK_000902.LAB	1/10/24	11:20:10	11.8	12.6	-0.2	191.4	1.00	2.9	4.1	0.337	0.068	99.3%
POST3_HCN5PK_000903.LAB	1/10/24	11:20:18	14.3	12.2	-0.2	191.3	1.00	3.1	3.8	0.332	0.067	92.6%
POST3_HCN5PK_000904.LAB	1/10/24	11:20:26	12.2	12.5	-0.1	191.3	1.00	2.9	3.8	0.333	0.067	91.5%
POST3_HCN5PK_000905.LAB	1/10/24	11:20:34	11.2	12.8	-0.2	191.3	1.00	3.0	3.9	0.326	0.066	95.4%
POST3_HCN5PK_000906.LAB	1/10/24	11:20:42	10.8	12.9	-0.2	191.2	1.00	3.1	3.9	0.334	0.068	94.4%
POST3_HCN5PK_000907.LAB	1/10/24	11:20:50	10.6	13.1	-0.2	191.1	1.00	3.0	4.0	0.326	0.066	98.3%
POST3_HCN5PK_000908.LAB	1/10/24	11:20:58	10.7	13.2	-0.2	191.1	1.01	3.1	3.8	0.324	0.066	94.1%
POST3_HCN5PK_000909.LAB	1/10/24	11:21:05	10.7	13.2	-0.2	191.1	1.01	3.2	3.8	0.325	0.066	95.2%

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
POST3_CTS_000919.LAB	1/10/24	11:23:14	1.5	0.0	0.0	191.0	1.01	99.3	-0.7	-0.021	98.7%
POST3_CTS_000920.LAB	1/10/24	11:23:22	1.4	0.0	0.0	191.0	1.00	99.3	-0.7	-0.027	98.7%
POST3_CTS_000921.LAB	1/10/24	11:23:30	1.3	0.0	0.1	191.0	1.01	99.3	-0.7	-0.021	98.7%
POST3_CTS_000922.LAB	1/10/24	11:23:37	1.2	0.0	0.0	191.1	1.01	99.6	-0.7	-0.020	99.0%
POST3_CTS_000923.LAB	1/10/24	11:23:45	1.2	0.0	0.0	191.1	1.00	99.9	-0.8	-0.021	99.2%
POST3_CTS_000924.LAB	1/10/24	11:23:53	1.1	0.0	0.0	191.0	1.01	99.9	-0.8	-0.017	99.2%
POST3_CTS_000925.LAB	1/10/24	11:24:01	1.1	0.0	0.0	191.0	1.01	99.7	-0.8	-0.018	99.1%
POST3_CTS_000926.LAB	1/10/24	11:24:09	1.0	0.0	0.0	191.0	1.01	99.7	-0.9	-0.028	99.1%

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_001398.LAB	1/10/24	16:25:18	0.0	0.0	0.0	191.1	1.00	100.7	0.0	-0.020	100.1%
CTS_DIR_001399.LAB	1/10/24	16:25:26	0.0	0.0	0.0	191.1	1.00	100.7	0.2	-0.024	100.1%
CTS_DIR_001400.LAB	1/10/24	16:25:33	0.0	0.0	0.0	191.1	1.00	100.6	-0.1	-0.023	99.9%
CTS_DIR_001401.LAB	1/10/24	16:25:41	0.0	0.0	0.0	191.1	1.00	100.4	0.1	-0.023	99.8%
CTS_DIR_001402.LAB	1/10/24	16:25:49	0.0	0.0	0.0	191.1	1.00	100.6	0.0	-0.029	99.9%
CTS_DIR_001403.LAB	1/10/24	16:25:57	0.0	0.0	0.0	191.1	1.00	100.5	-0.1	-0.023	99.9%
CTS_DIR_001404.LAB	1/10/24	16:26:05	0.0	0.0	0.0	191.1	1.00	100.8	0.1	-0.026	100.1%
CTS_DIR_001405.LAB	1/10/24	16:26:13	0.0	0.0	0.0	191.1	1.00	100.7	0.1	-0.030	100.0%
Average								100.6			

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_001408.LAB	1/10/24	16:29:20	0.0	0.0	0.0	191.0	1.00	-0.1	0.0	-0.007
N2_DIR_001409.LAB	1/10/24	16:31:25	0.0	0.0	0.0	190.9	1.00	-0.1	0.0	-0.007
N2_DIR_001410.LAB	1/10/24	16:33:31	0.0	0.0	0.0	190.9	1.00	-0.2	0.0	-0.009

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHS
Operating Condition Mill Off

Sample System:	FTIR		
Probe Length:	8.0	ft	
Probe Type:	FTIR		
Sample Plane:	Horizontal		
Port Length:	9	in.	
Port Size (diameter):	4	in.	
Port Type:	Flange		
Duct Shape:	Circular		
Diameter:	13	ft	
Duct Area:	132.73	Sq. Ft.	
Upstream Diameters:	9.20		Minimum Upstream Distance 6.5 Feet
Downstream Diameters:	10.80		Minimum Downstream Distance 26.0 Feet
Number of Ports Sampled:	1		Ideal Upstream Distance 26.0 Feet
Number of Points per Port:	1		Ideal Downstream Distance 104.0 Feet
Total Number of Traverse Points:	1		

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder	Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	0.08	-0.36%	N/A		1500
	Mid	CC195925	12.04	12.22	-0.81%	4/24/2031	54.43%	1000
	High	CC308342	22.12	22.48	-1.63%	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)	CAI 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: Seattle Cement Plant
Project #: M234007-02
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 1/10/24
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	12.11	0.08	0.09	0.09	12.12	10.61	10.5	0.50	-0.05	-0.05	0.05
2	12.04	12.11	12.12	0.09	0.14	0.12	12.12	9.98	9.9	0.45	0.05	-0.27	0.23
3	12.04	12.12	12.15	0.14	0.10	0.12	12.14	10.28	10.2	0.32	0.14	-0.09	-0.18

Concentration of Cal Gas
 erage Pre and Post Span

C = Average value of test
 Cgas = Corrected gas value of test

Co=Average Pre and Post Zero

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	1/10/24	11:45	12:44	13.39%	10.53	14.94	17.25	2.37	3.68	0.10	0.15
2	1/10/24	13:20	14:19	13.13%	9.90	14.76	17.00	2.38	3.46	0.10	0.15
3	1/10/24	14:55	15:54	12.54%	10.18	15.00	17.15	2.15	3.19	0.10	0.15

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Test Location: Main Kiln Stack
Date: 1/10/24
Project #: M234007-02

Linearity Cal/Pre 1 Cal		
<u>Time</u>	<u>O2 % (dry)</u>	
6:01	0.22	
6:02	0.08	
6:03	0.08	iz
6:04	10.76	
6:05	22.47	
6:06	22.48	ih
6:07	17.95	
6:08	12.12	
6:09	12.22	im
6:10	10.61	
6:11	10.59	
6:40	10.48	
6:41	10.85	
6:42	4.31	
6:43	0.12	
6:44	0.12	
6:45	9.76	
6:46	12.09	
6:47	12.12	
6:48	11.26	
11:25	1.66	
11:26	0.09	
11:27	0.08	z
11:28	5.33	
11:29	12.11	
11:30	12.12	m

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Test Location: Main Kiln Stack
Date: 1/10/24

Post 1/Pre 2			Post 2/Pre 3		
<u>Time</u>	<u>O2 % (dry)</u>		<u>Time</u>	<u>O2 % (dry)</u>	
13:12	3.15		14:44	2.68	
13:13	0.10		14:45	0.14	
13:14	0.09	z	14:46	0.14	z
13:15	4.94		14:47	2.28	
13:16	12.11		14:48	12.03	
13:17	12.11	m	14:49	12.12	m

Post 3		
<u>Time</u>	<u>O2 % (dry)</u>	
16:17	5.97	
16:18	0.16	
16:19	0.10	z
16:20	2.69	
16:21	12.15	
16:22	12.15	m

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICH S
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_000353.LAB	1/10/24	6:04:55	0.0	0.0	0.0	190.5	1.00	-0.2	0.2	0.007
N2_DIR_000354BKG.LAB	1/10/24	6:07:12	0.0	0.0	0.0	190.5	1.00	0.0	0.0	0.000
N2_DIR_000355.LAB	1/10/24	6:07:26	0.0	0.0	0.0	190.5	1.00	0.1	0.1	-0.001
N2_DIR_000356.LAB	1/10/24	6:07:34	0.0	0.0	0.0	190.5	1.00	-0.1	0.0	0.003
N2_DIR_000357.LAB	1/10/24	6:07:42	0.0	0.0	0.0	190.5	1.00	-0.2	0.0	0.001
N2_DIR_000358.LAB	1/10/24	6:07:50	0.0	0.0	0.0	190.4	1.00	0.1	-0.1	-0.004
N2_DIR_000359.LAB	1/10/24	6:07:58	0.0	0.0	0.0	190.4	1.00	0.0	0.1	0.003
N2_DIR_000360.LAB	1/10/24	6:08:05	0.0	0.0	0.0	190.4	1.00	-0.1	0.2	-0.002
N2_DIR_000361.LAB	1/10/24	6:08:13	0.0	0.0	0.0	190.4	1.00	0.1	0.1	0.003

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_000371.LAB	1/10/24	6:10:16	0.0	0.0	0.0	190.4	1.00	100.6	-0.1	-0.015	99.2%
CTS_DIR_000372.LAB	1/10/24	6:10:24	0.0	0.0	0.0	190.4	1.00	100.7	0.0	-0.008	99.3%
CTS_DIR_000373.LAB	1/10/24	6:10:32	0.0	0.0	0.0	190.4	1.00	100.6	0.1	-0.013	99.2%
CTS_DIR_000374.LAB	1/10/24	6:10:40	0.0	0.0	0.0	190.4	1.00	100.7	-0.1	-0.011	99.3%
CTS_DIR_000375.LAB	1/10/24	6:10:48	0.0	0.0	0.0	190.4	1.00	100.8	0.0	-0.006	99.4%
CTS_DIR_000376.LAB	1/10/24	6:10:55	0.0	0.0	0.0	190.4	1.00	100.6	0.1	-0.014	99.2%
CTS_DIR_000377.LAB	1/10/24	6:11:04	0.0	0.0	0.0	190.5	1.00	100.5	-0.1	-0.007	99.1%
		Average						100.6			99.2%

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_000394.LAB	1/10/24	6:15:45	0.0	0.0	0.0	190.7	1.00	-0.3	49.2	4.921	99.3%
HCN_DIR_000395.LAB	1/10/24	6:15:53	0.0	0.0	0.0	190.7	1.00	-0.2	49.1	4.927	99.2%
HCN_DIR_000396.LAB	1/10/24	6:16:01	0.0	0.0	0.0	190.7	1.00	-0.2	49.1	4.923	99.1%
HCN_DIR_000397.LAB	1/10/24	6:16:09	0.0	0.0	0.0	190.7	1.00	-0.2	49.1	4.924	99.1%
HCN_DIR_000398.LAB	1/10/24	6:16:16	0.0	0.0	0.0	190.7	1.00	-0.4	49.3	4.938	99.5%
HCN_DIR_000399.LAB	1/10/24	6:16:24	0.0	0.0	0.0	190.8	1.00	-0.1	49.1	4.935	99.1%
HCN_DIR_000400.LAB	1/10/24	6:16:32	0.0	0.0	0.0	190.7	1.00	-0.1	49.4	4.933	99.6%
HCN_DIR_000401.LAB	1/10/24	6:16:40	0.0	0.0	0.1	190.7	1.00	0.0	49.2	4.953	99.4%
		Average							49.2	4.932	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
CTS_RT_000407.LAB	1/10/24	6:20:02	0.0	0.0	0.0	190.6	1.00	101.3	0.1	-0.005	99.9%
CTS_RT_000408.LAB	1/10/24	6:20:10	0.0	0.0	0.0	190.7	1.00	101.2	0.0	-0.009	99.8%
CTS_RT_000409.LAB	1/10/24	6:20:18	0.0	0.0	0.0	190.6	1.00	101.2	0.0	-0.008	99.8%
CTS_RT_000410.LAB	1/10/24	6:20:26	0.0	0.0	0.0	190.6	1.00	101.3	-0.1	-0.016	99.9%
CTS_RT_000411.LAB	1/10/24	6:20:34	0.0	0.0	0.0	190.7	1.00	101.4	0.0	-0.003	100.0%
CTS_RT_000412.LAB	1/10/24	6:20:42	0.0	0.0	0.0	190.8	1.00	101.3	0.1	-0.001	99.9%
CTS_RT_000413.LAB	1/10/24	6:20:50	0.0	0.0	0.0	190.9	1.00	101.1	0.0	-0.008	99.7%
CTS_RT_000414.LAB	1/10/24	6:20:58	0.0	0.0	0.0	190.8	1.00	101.5	0.0	-0.011	100.1%

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHS
FTIR s/n: 110161896

Response Time Test

Spectrum	Date	Time	H2O%	CO2	HF	FTIR Gas Cell Temperature	FTIR Gas Cell Pressure	Ethylene	HCN	SF6	Response Time (sec)
			%v	%v wet	ppmv wet	deg C	atm	ppmv wet	ppmv wet	ppmv wet	
CTS_RT_000403.LAB	1/10/24	6:19:31	0.7	0.0	0.0	190.6	1.00	0.1	-0.1	-0.003	-
CTS_RT_000404.LAB	1/10/24	6:19:39	0.6	0.0	0.0	190.6	1.00	14.8	1.3	0.130	15.895
CTS_RT_000405.LAB	1/10/24	6:19:47	0.1	0.0	0.0	190.7	1.00	99.3	0.3	0.006	23.895
CTS_RT_000406.LAB	1/10/24	6:19:55	0.1	0.0	0.0	190.7	1.00	100.9	-0.1	-0.003	
CTS_RT_000407.LAB	1/10/24	6:20:02	0.0	0.0	0.0	190.6	1.00	101.3	0.1	-0.005	
CTS_RT_000408.LAB	1/10/24	6:20:10	0.0	0.0	0.0	190.7	1.00	101.2	0.0	-0.009	
CTS_RT_000409.LAB	1/10/24	6:20:18	0.0	0.0	0.0	190.6	1.00	101.2	0.0	-0.008	
CTS_RT_000410.LAB	1/10/24	6:20:26	0.0	0.0	0.0	190.6	1.00	101.3	-0.1	-0.016	
CTS_RT_000411.LAB	1/10/24	6:20:34	0.0	0.0	0.0	190.7	1.00	101.4	0.0	-0.003	

Pre 1 Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O%	CO2	HF	FTIR Gas Cell Temperature	FTIR Gas Cell Pressure	Ethylene	HCN	SF6
			%v	%v wet	ppmv wet	deg C	atm	ppmv wet	ppmv wet	ppmv wet
RUN3_000887.LAB	1/10/24	11:12:54	15.8	13.5	-0.2	190.7	1.00	3.3	1.8	-0.011
RUN3_000888.LAB	1/10/24	11:13:57	14.4	13.7	-0.2	190.9	1.00	3.3	1.9	-0.010
RUN3_000889.LAB	1/10/24	11:14:59	14.6	13.2	-0.2	191.1	1.00	3.2	1.9	-0.010
									1.9	-0.010

Pre 1 Effluent Spike Using Analyte

Spectrum	Date	Time	H2O%	CO2	HF	FTIR Gas Cell Temperature	FTIR Gas Cell Pressure	Ethylene	HCN	SF6	Dilution Factor	Recovery %
			%v	%v wet	ppmv wet	deg C	atm	ppmv wet	ppmv wet	ppmv wet		HCN
POST3_HCN5PK_000902.LAB	1/10/24	11:20:10	11.8	12.6	-0.2	191.4	1.00	2.9	5.1	0.337	0.068	100.8%
POST3_HCN5PK_000903.LAB	1/10/24	11:20:18	14.3	12.2	-0.2	191.3	1.00	3.1	4.8	0.332	0.067	95.3%
POST3_HCN5PK_000904.LAB	1/10/24	11:20:26	12.2	12.5	-0.1	191.3	1.00	2.9	4.8	0.333	0.067	94.4%
POST3_HCN5PK_000905.LAB	1/10/24	11:20:34	11.2	12.8	-0.2	191.3	1.00	3.0	4.9	0.326	0.066	97.6%
POST3_HCN5PK_000906.LAB	1/10/24	11:20:42	10.8	12.9	-0.2	191.2	1.00	3.1	4.9	0.334	0.068	96.8%
POST3_HCN5PK_000907.LAB	1/10/24	11:20:50	10.6	13.1	-0.2	191.1	1.00	3.0	5.0	0.326	0.066	99.9%
POST3_HCN5PK_000908.LAB	1/10/24	11:20:58	10.7	13.2	-0.2	191.1	1.01	3.1	4.8	0.324	0.066	96.5%
POST3_HCN5PK_000909.LAB	1/10/24	11:21:05	10.7	13.2	-0.2	191.1	1.01	3.2	4.8	0.325	0.066	97.4%

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O%	CO2	HF	FTIR Gas Cell Temperature	FTIR Gas Cell Pressure	Ethylene	HCN	SF6
			%v	%v wet	ppmv wet	deg C	atm	ppmv wet	ppmv wet	ppmv wet
MILLOFF_RUN1_001026.LAB	1/10/24	12:53:54	13.4	12.1	-0.2	190.8	1.00	3.5	2.2	-0.008
MILLOFF_RUN1_001027.LAB	1/10/24	12:54:57	14.1	11.8	-0.3	190.8	1.00	3.3	2.1	-0.009
MILLOFF_RUN1_001028.LAB	1/10/24	12:56:00	14.1	11.5	-0.2	191.0	1.00	3.2	2.2	-0.009
									2.2	-0.009

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O%	CO2	HF	FTIR Gas Cell Temperature	FTIR Gas Cell Pressure	Ethylene	HCN	SF6	Dilution Factor	Recovery %
			%v	%v wet	ppmv wet	deg C	atm	ppmv wet	ppmv wet	ppmv wet		HCN
POST1_HCN5PK_001049.LAB	1/10/24	13:04:08	12.1	13.4	-0.2	190.7	1.00	3.6	6.5	0.482	0.098	96.6%
POST1_HCN5PK_001050.LAB	1/10/24	13:04:15	12.0	13.3	-0.2	190.7	1.00	3.4	6.6	0.477	0.097	99.0%
POST1_HCN5PK_001051.LAB	1/10/24	13:04:23	11.9	13.3	-0.2	190.6	1.00	3.7	6.7	0.475	0.096	100.3%
POST1_HCN5PK_001052.LAB	1/10/24	13:04:31	12.4	13.2	-0.2	190.6	1.00	3.6	6.6	0.477	0.097	98.9%
POST1_HCN5PK_001053.LAB	1/10/24	13:04:39	12.9	13.1	-0.2	190.7	1.00	3.5	6.5	0.477	0.097	97.3%
POST1_HCN5PK_001054.LAB	1/10/24	13:04:47	12.5	13.2	-0.2	190.7	1.00	3.5	6.6	0.471	0.096	98.6%
POST1_HCN5PK_001055.LAB	1/10/24	13:04:55	12.3	13.3	-0.2	190.7	1.00	3.6	6.5	0.474	0.096	97.9%
POST1_HCN5PK_001056.LAB	1/10/24	13:05:03	12.4	13.3	-0.2	190.7	1.00	3.6	6.4	0.474	0.096	95.9%

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICHS
FTIR s/n: 110161896

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_001077.LAB	1/10/24	13:10:16	1.7	0.0	0.0	190.8	1.00	99.6	0.3	-0.012	98.2%
POST1_CTS_001078.LAB	1/10/24	13:10:24	1.6	0.0	0.0	190.9	1.00	99.4	0.3	-0.016	98.0%
POST1_CTS_001079.LAB	1/10/24	13:10:32	1.5	0.0	0.0	190.9	1.01	99.8	0.2	-0.014	98.4%
POST1_CTS_001080.LAB	1/10/24	13:10:39	1.4	0.0	0.0	190.9	1.00	100.0	0.4	-0.016	98.6%
POST1_CTS_001081.LAB	1/10/24	13:10:47	1.3	0.0	0.0	191.0	1.00	100.1	0.1	-0.017	98.7%
POST1_CTS_001082.LAB	1/10/24	13:10:55	1.2	0.0	0.0	191.1	1.00	99.9	0.3	-0.015	98.6%
POST1_CTS_001083.LAB	1/10/24	13:11:03	1.1	0.0	0.0	191.2	1.00	100.3	0.2	-0.024	99.0%
POST1_CTS_001084.LAB	1/10/24	13:11:11	1.1	0.0	0.0	191.2	1.00	100.4	0.1	-0.026	99.0%

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
RUN2_001180.LAB	1/10/24	14:32:46	12.7	14.9	-0.2	191.7	1.00	3.5	1.1	-0.003
RUN2_001181.LAB	1/10/24	14:33:49	12.5	14.7	-0.2	191.8	1.00	3.5	1.1	-0.007
RUN2_001182.LAB	1/10/24	14:34:52	12.6	14.9	-0.2	191.6	1.00	3.6	1.0	-0.004
									1.1	-0.005

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_HCNPK_001207.LAB	1/10/24	14:40:10	11.7	13.9	-0.2	191.2	1.00	3.2	4.5	0.406	0.082	89.9%
POST2_HCNPK_001208.LAB	1/10/24	14:40:18	11.7	14.1	-0.2	191.3	1.00	3.2	4.5	0.398	0.081	90.6%
POST2_HCNPK_001209.LAB	1/10/24	14:40:26	11.7	14.1	-0.2	191.2	1.00	3.2	4.4	0.402	0.081	88.4%
POST2_HCNPK_001210.LAB	1/10/24	14:40:34	11.8	14.0	-0.2	191.2	1.00	3.4	4.5	0.406	0.082	89.0%
POST2_HCNPK_001211.LAB	1/10/24	14:40:42	11.8	14.0	-0.2	191.2	1.00	3.3	4.6	0.405	0.082	90.7%
POST2_HCNPK_001212.LAB	1/10/24	14:40:49	11.8	13.9	-0.2	191.2	1.00	3.2	4.6	0.399	0.081	91.6%
POST2_HCNPK_001213.LAB	1/10/24	14:40:57	11.7	13.8	-0.2	191.2	1.00	3.2	4.4	0.401	0.081	88.9%
POST2_HCNPK_001214.LAB	1/10/24	14:41:05	11.7	13.9	-0.2	191.4	1.00	3.1	4.6	0.393	0.080	94.4%

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_001219.LAB	1/10/24	14:42:44	0.6	0.0	0.0	191.6	1.00	100.5	-1.0	-0.016	99.8%
POST2_CTS_001220.LAB	1/10/24	14:42:52	0.5	0.0	-0.1	191.6	1.00	100.6	-1.2	-0.010	100.0%
POST2_CTS_001221.LAB	1/10/24	14:42:59	0.4	0.0	0.0	191.6	1.00	100.6	-1.3	-0.016	99.9%
POST2_CTS_001222.LAB	1/10/24	14:43:07	0.3	0.0	0.0	191.5	1.00	100.7	-1.3	-0.015	100.0%
POST2_CTS_001223.LAB	1/10/24	14:43:15	0.3	0.0	0.0	191.5	1.00	100.6	-1.1	-0.015	99.9%
POST2_CTS_001224.LAB	1/10/24	14:43:23	0.2	0.0	0.0	191.5	1.00	100.5	-1.3	-0.019	99.9%
POST2_CTS_001225.LAB	1/10/24	14:43:31	0.2	0.0	0.0	191.5	1.00	101.0	-1.3	-0.016	100.4%
POST2_CTS_001226.LAB	1/10/24	14:43:39	0.2	0.0	0.0	191.5	1.00	100.8	-1.2	-0.014	100.1%

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
RUN3_001322.LAB	1/10/24	16:07:58	12.5	14.8	-0.2	191.0	1.01	3.5	1.2	-0.010
RUN3_001323.LAB	1/10/24	16:09:01	12.5	15.1	-0.2	191.1	1.01	3.5	1.2	-0.012
RUN3_001324.LAB	1/10/24	16:10:03	12.5	15.1	-0.2	191.1	1.01	3.6	1.1	-0.011
									1.1	-0.011

Client: Ash Grove Cement Company
Facility: Seattle Cement Plant
Project #: M234007-02
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 1/10/2024
Operator: RICH S
FTIR s/n: 110161896

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_HCNPK_001329.LAB	1/10/24	16:11:51	11.5	13.8	-0.2	190.9	1.00	3.3	5.2	0.451	0.091	93.1%
POST3_HCNPK_001330.LAB	1/10/24	16:11:58	11.5	14.0	-0.2	190.9	1.01	3.3	5.0	0.438	0.089	93.4%
POST3_HCNPK_001331.LAB	1/10/24	16:12:06	11.5	14.1	-0.2	190.9	1.01	3.4	4.9	0.442	0.090	90.6%
POST3_HCNPK_001332.LAB	1/10/24	16:12:14	11.4	14.1	-0.2	190.9	1.01	3.3	5.1	0.434	0.088	95.6%
POST3_HCNPK_001333.LAB	1/10/24	16:12:22	11.4	14.1	-0.2	190.9	1.01	3.4	5.0	0.439	0.089	92.0%
POST3_HCNPK_001334.LAB	1/10/24	16:12:30	11.4	14.2	-0.2	191.0	1.01	3.4	5.1	0.432	0.088	95.7%
POST3_HCNPK_001335.LAB	1/10/24	16:12:38	11.3	14.2	-0.2	191.1	1.01	3.3	5.1	0.440	0.089	93.1%
POST3_HCNPK_001336.LAB	1/10/24	16:12:46	11.3	14.2	-0.2	191.1	1.01	3.3	5.2	0.431	0.087	96.9%

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_001367.LAB	1/10/24	16:18:59	0.6	0.0	0.0	190.9	1.01	100.5	-0.9	-0.028	99.8%
POST3_CTS_001368.LAB	1/10/24	16:19:07	0.5	0.0	0.0	190.9	1.01	100.5	-0.8	-0.021	99.9%
POST3_CTS_001369.LAB	1/10/24	16:19:15	0.5	0.0	0.0	190.9	1.01	100.7	-0.8	-0.019	100.0%
POST3_CTS_001370.LAB	1/10/24	16:19:23	0.5	0.0	0.0	190.9	1.01	100.5	-1.0	-0.026	99.9%
POST3_CTS_001371.LAB	1/10/24	16:19:31	0.5	0.0	0.0	190.9	1.01	100.7	-0.9	-0.028	100.0%
POST3_CTS_001372.LAB	1/10/24	16:19:39	0.4	0.0	0.0	190.9	1.01	100.5	-0.9	-0.017	99.9%
POST3_CTS_001373.LAB	1/10/24	16:19:46	0.4	0.0	0.0	190.9	1.01	100.4	-1.0	-0.029	99.8%
POST3_CTS_001374.LAB	1/10/24	16:19:54	0.4	0.0	0.0	190.9	1.01	100.5	-1.0	-0.018	99.8%

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_001398.LAB	1/10/24	16:25:18	0.0	0.0	0.0	191.1	1.00	100.7	0.0	-0.030	100.1%
CTS_DIR_001399.LAB	1/10/24	16:25:26	0.0	0.0	0.0	191.1	1.00	100.7	0.2	-0.024	100.1%
CTS_DIR_001400.LAB	1/10/24	16:25:33	0.0	0.0	0.0	191.1	1.00	100.6	-0.1	-0.023	99.9%
CTS_DIR_001401.LAB	1/10/24	16:25:41	0.0	0.0	0.0	191.1	1.00	100.4	0.1	-0.023	99.8%
CTS_DIR_001402.LAB	1/10/24	16:25:49	0.0	0.0	0.0	191.1	1.00	100.6	0.0	-0.029	99.9%
CTS_DIR_001403.LAB	1/10/24	16:25:57	0.0	0.0	0.0	191.1	1.00	100.5	-0.1	-0.023	99.9%
CTS_DIR_001404.LAB	1/10/24	16:26:05	0.0	0.0	0.0	191.1	1.00	100.8	0.1	-0.026	100.1%
CTS_DIR_001405.LAB	1/10/24	16:26:13	0.0	0.0	0.0	191.1	1.00	100.7	0.1	-0.030	100.0%
		Average						100.6			

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_001408.LAB	1/10/24	16:29:20	0.0	0.0	0.0	191.0	1.00	-0.1	0.0	-0.007
N2_DIR_001409.LAB	1/10/24	16:31:25	0.0	0.0	0.0	190.9	1.00	-0.1	0.0	-0.007
N2_DIR_001410.LAB	1/10/24	16:33:31	0.0	0.0	0.0	190.9	1.00	-0.2	0.0	-0.009

Zero Gas and In-Stack Detection Limit Study
 Ash Grove Cement Company
 Seattle Cement Plant
 Main Kiln Stack
 1/10/2024

Time	DL summary - zero gas		Time	DL summary - in stack	
	HF ppm (10) 191C	HCN (100) 191C		HF ppm (10) 191C	HCN (100) 191C
6:07:34 AM	0.00	0.03	7:07:08 AM	-0.17	1.78
6:07:42 AM	0.03	-0.04	7:08:11 AM	-0.17	1.82
6:07:50 AM	0.00	-0.08	7:09:13 AM	-0.18	1.78
6:07:58 AM	-0.01	0.10	7:10:16 AM	-0.18	1.86
6:08:05 AM	0.00	0.15	7:11:19 AM	-0.17	1.84
6:08:13 AM	0.04	0.08	7:12:22 AM	-0.17	1.82
6:08:21 AM	0.02	0.04	Time	HF ppm (10) 191C	CN PCA 191c R1 191
Standard Deviation	0.02	0.07	Standard Deviation	0.00	0.03
3x = DL	0.05	0.22	3x = DL	0.01	0.09

Appendix H - Gas Cylinder Certifications

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

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: 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