

Section 114 Information Collection Request Emissions Test Report

Holcim (US) Inc.
Devils Slide Cement Plant
EPA Registry ID: 110012414128
6055 Croydon Road
Morgan, UT 84050
Report No. M234611A





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Emissions Test Report**

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**Report Submittal Date:
April 8, 2024**

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1.0 INTRODUCTION

Mostardi Platt conducted an air emissions test program for Holcim (US) Inc. at the Devils Slide Cement Plant located in Morgan, Utah. All testing was performed as described in the *Code of Federal Regulations*, Title 40, Part 60, Appendix A (40CFR60), Methods 1, 2, 3A, 4, 26A, and 40CFR63, Appendix A, (40CFR63) Method 320.

The Holcim US Devils Slide Cement Plant includes a single Kiln (Main Kiln) ~760,000 TPY preheater/pre-calciner having an in-line raw mill. Devils Slide Cement Plant Operates a 5 Stage preheater with an in-line calciner. The kiln system employs DSI as needed and has a baghouse fabric filtration system. Emissions exhaust to a common stack. Emission testing was performed at the common stack testing location.

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	Holcim (US) Inc. 6055 East Croydon Road Morgan, UT 84050	Clinton Badger Area Manager, Environmental and Public Affairs (385) 243-8867 clinton.badger@holcim.com
Test Company Representative	Mostardi Platt 888 Industrial Drive Elmhurst, IL 60126	Eric Ehlers VP, Field Operations (630) 993-2100 eehlers@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
Main Kiln Stack Mill On	Hydrogen Fluoride (HF)	≤ 0.10 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.17 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0006 lb/ton clinker	
	HF ¹	≤ 0.11 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.17 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Chlorine (Cl ₂) ¹	≤ 0.03 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Hydrogen Cyanide (HCN)	2.78 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		4.68 ppmvd @7% O ₂	
2.08 lb/hr			
0.0215 lb/ton clinker			
Oxygen (O ₂)	11.7 % (dry)	USEPA Method 3A, 40CFR60, Appendix A	
Carbon Dioxide (CO ₂)	16.5 % (dry)	USEPA Method 320, 40CFR63, Appendix A	
Moisture (H ₂ O)	10.4 %	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
Main Kiln Stack Mill Off	Hydrogen Fluoride (HF)	≤ 0.10 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.16 ppmvd @7% O ₂	
		≤ 0.05 lb/hr	
		≤ 0.0006 lb/ton clinker	
	HF ²	≤ 0.12 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.16 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Chlorine (Cl ₂) ²	≤ 0.03 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O ₂	
		≤ 0.06 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Hydrogen Cyanide (HCN)	3.27 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		5.09 ppmvd @7% O ₂	
2.37 lb/hr			
0.0245 lb/ton clinker			
Oxygen (O ₂)	11.1 % (dry)	USEPA Method 3A, 40CFR60, Appendix A	
Carbon Dioxide (CO ₂)	16.9 % (dry)	USEPA Method 320, 40CFR63, Appendix A	
Moisture (H ₂ O)	8.5 %	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.

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	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Main Kiln Stack	10.958'	2.5 Diameters	10.9 Diameters	HF/Cl ₂ (26A)	12
				O ₂ (3A)	3 (stratification)
				HCN/HF/O 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 twelve (12) test points were sampled per run on at Main Kiln stack location. 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. A method detection limit (MDL) of 150 µg was determined for both HF and Cl₂ using the "Definition and Procedure for the Determination of the Method Detection Limit, Revision 2". All equipment used was calibrated in accordance with the specifications of the method. Calibration data is appended.

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

4.5 Method 320 Speciated Flue Gas Concentration Determinations

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

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

All sampling system components were heated to 375°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: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Test Method: 26A - A Train

Source Condition	Mill On/>90% Production	Mill On/>90% Production	Mill On/>90% Production	Average
Date	1/23/24	1/23/24	1/23/24	
Start Time	9:00	10:35	12:15	
End Time	10:13	11:48	13:27	
	Run 1A	Run 2A	Run 3A	
Stack Conditions				
Average Gas Temperature, °F	249.8	251.3	251.0	250.7
Flue Gas Moisture, percent by volume	10.7%	9.6%	8.7%	9.7%
Average Flue Pressure, in. Hg	24.20	24.24	24.24	24.23
Gas Sample Volume, dscf	60.636	60.030	59.348	60.005
Average Gas Velocity, ft/sec	52.654	52.802	52.852	52.769
Gas Volumetric Flow Rate, acfm	298,053	298,893	299,174	298,707
Gas Volumetric Flow Rate, dscfm	160,171	162,519	164,265	162,318
Gas Volumetric Flow Rate, scfm	179,343	179,721	179,974	179,679
Average %CO ₂ by volume, dry basis	16.4	16.5	16.6	16.5
Average %O ₂ by volume, dry basis	11.7	11.9	11.4	11.7
Isokinetic Variance	107.3	104.7	102.4	104.8
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.11	≤ 0.11	≤ 0.11	≤ 0.11
Chlorine (Cl₂) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - B Train

Source Condition	Mill On/>90% Production	Mill On/>90% Production	Mill On/>90% Production	
Date	1/23/24	1/23/24	1/23/24	
Start Time	9:00	10:35	12:15	
End Time	10:13	11:48	13:27	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Temperature, °F	247.9	248.9	249.1	248.6
Flue Gas Moisture, percent by volume	10.8%	10.9%	9.4%	10.4%
Average Flue Pressure, in. Hg	24.21	24.21	24.21	24.21
Gas Sample Volume, dscf	55.633	55.483	54.811	55.309
Average Gas Velocity, ft/sec	51.020	51.210	50.725	50.985
Gas Volumetric Flow Rate, acfm	288,803	289,879	287,135	288,606
Gas Volumetric Flow Rate, dscfm	155,403	155,693	156,771	155,956
Gas Volumetric Flow Rate, scfm	174,296	174,699	173,004	174,000
Average %CO ₂ by volume, dry basis	16.4	16.5	16.6	16.5
Average %O ₂ by volume, dry basis	11.7	11.9	11.4	11.7
Isokinetic Variance	106.8	106.3	104.3	105.8
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.11	≤ 0.12	≤ 0.12	≤ 0.12
Chlorine (Cl₂) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Combined Results

Source Condition	Mill On/>90% Production	Mill On/>90% Production	Mill On/>90% Production	
Date	1/23/24	1/23/24	1/23/24	
Start Time	9:00	10:35	12:15	
End Time	10:13	11:48	13:27	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Velocity, ft/sec	51.837	52.006	51.789	51.877
Gas Volumetric Flow Rate, acfm	293,428	294,386	293,155	293,656
Gas Volumetric Flow Rate, dscfm	157,787	159,106	160,518	159,137
Gas Volumetric Flow Rate, scfm	176,820	177,210	176,489	176,840
Average %CO ₂ by volume, dry basis	16.4	16.5	16.6	16.5
Average %O ₂ by volume, dry basis	11.7	11.9	11.4	11.7
Clinker Production, ton/hr	96.9	96.9	96.9	96.9
Hydrogen Fluoride (HF) Emissions				
ppm ≤	0.11	≤ 0.11	≤ 0.11	≤ 0.11
ppm@7%O ₂ ≤	0.17	≤ 0.17	≤ 0.16	≤ 0.17
lb/hr ≤	0.05	≤ 0.06	≤ 0.06	≤ 0.06
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006
Chlorine (Cl₂) Emissions				
ppm ≤	0.03	≤ 0.03	≤ 0.03	≤ 0.03
ppm@7%O ₂ ≤	0.05	≤ 0.05	≤ 0.05	≤ 0.05
lb/hr ≤	0.05	≤ 0.05	≤ 0.06	≤ 0.06
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006

Holcim (US) Inc. Devils Slide Cement Plant Main Kiln Stack Mill On/>90% Production 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	1/23/2024	9:10	10:09	11.7	10.4%	2.67	4.50	≤ 0.10	≤ 0.17
2	1/23/2024	10:35	11:34	11.9	10.2%	2.80	4.82	≤ 0.10	≤ 0.17
3	1/23/2024	12:15	13:14	11.4	10.6%	2.88	4.71	≤ 0.10	≤ 0.16
Average				11.7	10.4%	2.78	4.68	≤ 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	1/23/2024	9:10	10:09	157,787	96.9	1.98	0.0204	≤ 0.05	≤ 0.0006
2	1/23/2024	10:35	11:34	159,106	96.9	2.09	0.0216	≤ 0.06	≤ 0.0006
3	1/23/2024	12:15	13:14	160,518	96.9	2.18	0.0225	≤ 0.06	≤ 0.0006
Average				159,137	96.9	2.08	0.0215	≤ 0.06	≤ 0.0006

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - A Train

Source Condition	Mill Off/>90% Production	Mill Off/>90% Production	Mill Off/>90% Production	
Date	1/24/24	1/24/24	1/24/24	
Start Time	11:00	12:30	14:00	
End Time	12:15	13:45	15:15	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	321.4	333.7	336.8	330.6
Flue Gas Moisture, percent by volume	7.2%	7.7%	8.5%	7.8%
Average Flue Pressure, in. Hg	24.35	24.35	24.35	24.35
Gas Sample Volume, dscf	56.812	56.650	56.554	56.672
Average Gas Velocity, ft/sec	55.412	56.083	56.368	55.954
Gas Volumetric Flow Rate, acfm	313,664	317,461	319,076	316,734
Gas Volumetric Flow Rate, dscfm	159,994	158,641	157,526	158,720
Gas Volumetric Flow Rate, scfm	172,489	171,883	172,089	172,154
Average %CO ₂ by volume, dry basis	16.8	17.0	17.0	16.9
Average %O ₂ by volume, dry basis	11.2	11.1	11.1	11.1
Isokinetic Variance	100.7	101.2	101.8	101.2
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.11	≤ 0.11	≤ 0.11	≤ 0.11
Chlorine (Cl₂) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - B Train

Source Condition	Mill off/ >90% Production	Mill off/ >90% Production	Mill off/ >90% Production	
Date	1/24/24	1/24/24	1/24/24	
Start Time	11:00	12:30	14:00	
End Time	12:15	13:45	15:15	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	315.7	332.0	333.9	327.2
Flue Gas Moisture, percent by volume	7.5%	6.5%	9.0%	7.7%
Average Flue Pressure, in. Hg	24.21	24.21	24.21	24.21
Gas Sample Volume, dscf	54.532	53.315	54.300	54.049
Average Gas Velocity, ft/sec	55.106	55.288	55.700	55.365
Gas Volumetric Flow Rate, acfm	311,933	312,962	315,298	313,398
Gas Volumetric Flow Rate, dscfm	158,885	157,888	154,418	157,064
Gas Volumetric Flow Rate, scfm	171,812	168,824	169,674	170,103
Average %CO ₂ by volume, dry basis	16.8	17.0	17.0	16.9
Average %O ₂ by volume, dry basis	11.2	11.1	11.1	11.1
Isokinetic Variance	102.4	100.7	104.9	102.7
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.12	≤ 0.12	≤ 0.12	≤ 0.12
Chlorine (Cl₂) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Test Method: 26A - Combined Trains

Source Condition	Mill Off/>90% Production	Mill Off/>90% Production	Mill Off/>90% Production	
Date	1/24/24	1/24/24	1/24/24	
Start Time	11:00	12:30	14:00	
End Time	12:15	13:45	15:15	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Velocity, ft/sec	55.259	55.686	56.034	55.660
Gas Volumetric Flow Rate, acfm	312,799	315,212	317,187	315,066
Gas Volumetric Flow Rate, dscfm	159,440	158,265	155,972	157,892
Gas Volumetric Flow Rate, scfm	172,151	170,354	170,882	171,129
Average %CO ₂ by volume, dry basis	16.8	17.0	17.0	16.9
Average %O ₂ by volume, dry basis	11.2	11.1	11.1	11.1
Clinker Production, ton/hr	96.9	96.9	96.9	96.9
Hydrogen Fluoride (HF) Emissions				
ppm ≤	0.12	≤ 0.12	≤ 0.12	≤ 0.12
mg/dscm ≤	0.16	≤ 0.16	≤ 0.16	≤ 0.16
lb/hr ≤	0.06	≤ 0.06	≤ 0.06	≤ 0.06
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006
Chlorine (Cl₂) Emissions				
ppm ≤	0.03	≤ 0.03	≤ 0.03	≤ 0.03
mg/dscm ≤	0.05	≤ 0.05	≤ 0.05	≤ 0.05
lb/hr ≤	0.06	≤ 0.06	≤ 0.06	≤ 0.06
lb/ton of clinker ≤	0.0006	≤ 0.0006	≤ 0.0006	≤ 0.0006

Holcim (US) Inc. Devils Slide Cement Plant Main Kiln Stack Mill Off/>90% Production 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	1/24/2024	11:00	11:59	11.2	8.6%	2.91	4.57	≤ 0.10	≤ 0.16
2	1/24/2024	12:30	13:29	11.1	8.5%	3.39	5.26	≤ 0.10	≤ 0.16
3	1/24/2024	14:00	14:59	11.1	8.5%	3.50	5.43	≤ 0.10	≤ 0.15
Average				11.1	8.5%	3.27	5.09	≤ 0.10	≤ 0.16

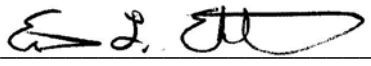
Test No.	Date	Start Time	End Time	Volumetric Flow, DSCFM	Clinker Production, ton/hr	HCN lb/hr	HCN lb/ton	HF lb/hr	HF lb/ton
1	1/24/2024	11:00	11:59	159,440	96.9	2.14	0.0221	≤ 0.05	≤ 0.0006
2	1/24/2024	12:30	13:29	158,265	96.9	2.47	0.0255	≤ 0.05	≤ 0.0006
3	1/24/2024	14:00	14:59	155,972	96.9	2.51	0.0259	≤ 0.05	≤ 0.0005
Average				157,892	96.9	2.37	0.0245	≤ 0.05	≤ 0.0006

6.0 CERTIFICATION


Mostardi Platt is pleased to have been of service to Holcim (US) Inc. 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


Eric L. Ehlers

Project Manager


Chet A. Gutwein

Quality Assurance

APPENDICES

Appendix A – Plant Operating Data

Mill ON		
Date/Time	CEMS: CLINKER_T OTAL (TON) Expression Value	KILN_FEED_ RATE (TNHR) Raw Value
01/23/2024 11:22	96.90	140.2
01/23/2024 11:23	96.90	140.2
01/23/2024 11:24	96.90	140.2
01/23/2024 11:25	96.90	140.2
01/23/2024 11:26	96.90	140.2
01/23/2024 11:27	96.90	140.2
01/23/2024 11:28	96.90	140.2
01/23/2024 11:29	96.90	140.2
01/23/2024 11:30	96.90	140.2
01/23/2024 11:31	96.90	140.3
01/23/2024 11:32	96.90	140.2
01/23/2024 11:33	96.90	140.2
01/23/2024 11:34	96.90	140.2
01/23/2024 11:35	96.90	140.2
01/23/2024 11:36	96.90	140.2
01/23/2024 11:37	96.90	140.3
01/23/2024 11:38	96.90	140.2
01/23/2024 11:39	96.90	140.2
01/23/2024 11:40	96.90	140.3
01/23/2024 11:41	96.90	140.2
01/23/2024 11:42	96.90	140.2
01/23/2024 11:43	96.90	140.2
01/23/2024 11:44	96.90	140.2
01/23/2024 11:45	96.90	140.2
01/23/2024 11:46	96.90	140.2
01/23/2024 11:47	96.90	140.2
01/23/2024 11:48	96.90	140.2
01/23/2024 11:49	96.90	140.3
01/23/2024 11:50	96.90	140.2
01/23/2024 11:51	96.90	140.2
01/23/2024 11:52	96.90	140.2
01/23/2024 11:53	96.90	140.2
01/23/2024 11:54	96.90	140.2
01/23/2024 11:55	96.90	140.2
01/23/2024 11:56	96.90	140.2
01/23/2024 11:57	96.90	140.2
01/23/2024 11:58	96.90	140.2
01/23/2024 11:59	96.90	140.2
01/23/2024 12:00	96.90	140.2
01/23/2024 12:01	96.90	140.2
01/23/2024 12:02	97.00	140.3
01/23/2024 12:03	96.90	140.2
01/23/2024 12:04	96.90	140.3
01/23/2024 12:05	96.90	140.2
01/23/2024 12:06	96.90	140.3
01/23/2024 12:07	96.90	140.2
01/23/2024 12:08	96.90	140.2
01/23/2024 12:09	96.90	140.2
01/23/2024 12:10	96.90	140.2
01/23/2024 12:11	96.90	140.2
01/23/2024 12:12	96.90	140.2
01/23/2024 12:13	96.90	140.2
01/23/2024 12:14	96.90	140.2
01/23/2024 12:15	96.90	140.2
01/23/2024 12:16	96.90	140.3
01/23/2024 12:17	96.90	140.2
01/23/2024 12:18	96.90	140.2
01/23/2024 12:19	96.90	140.2
01/23/2024 12:20	96.90	140.2
01/23/2024 12:21	96.90	140.2
01/23/2024 12:22	96.90	140.2
01/23/2024 12:23	96.90	140.2
01/23/2024 12:24	96.90	140.3
01/23/2024 12:25	96.90	140.2
01/23/2024 12:26	96.90	140.2
01/23/2024 12:27	96.90	140.2
01/23/2024 12:28	96.90	140.2
01/23/2024 12:29	96.90	140.2
01/23/2024 12:30	96.90	140.2
01/23/2024 12:31	96.90	140.2
01/23/2024 12:32	96.90	140.2

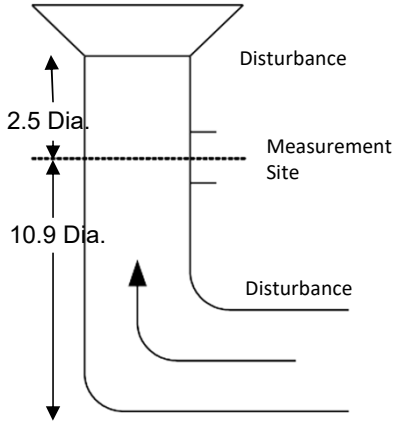
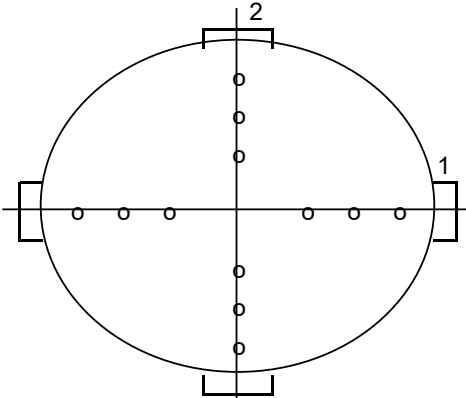
Mill Off		
Date/Time	CEMS: CLINKER_T OTAL (TON) Expression Value	KILN_FEED_ RATE (TNHR) Raw Value
01/24/2024 13:22	96.90	140.2
01/24/2024 13:23	96.90	140.2
01/24/2024 13:24	96.90	140.2
01/24/2024 13:25	96.90	140.3
01/24/2024 13:26	96.90	140.2
01/24/2024 13:27	96.90	140.3
01/24/2024 13:28	96.90	140.2
01/24/2024 13:29	96.90	140.2
01/24/2024 13:30	96.90	140.3
01/24/2024 13:31	96.90	140.2
01/24/2024 13:32	96.90	140.2
01/24/2024 13:33	96.90	140.2
01/24/2024 13:34	96.90	140.2
01/24/2024 13:35	96.90	140.2
01/24/2024 13:36	96.90	140.2
01/24/2024 13:37	96.90	140.2
01/24/2024 13:38	96.90	140.2
01/24/2024 13:39	96.90	140.2
01/24/2024 13:40	96.90	140.2
01/24/2024 13:41	96.90	140.2
01/24/2024 13:42	96.90	140.2
01/24/2024 13:43	96.90	140.2
01/24/2024 13:44	96.90	140.2
01/24/2024 13:45	96.90	140.2
01/24/2024 13:46	96.90	140.2
01/24/2024 13:47	96.90	140.3
01/24/2024 13:48	96.90	140.2
01/24/2024 13:49	96.90	140.2
01/24/2024 13:50	96.90	140.2
01/24/2024 13:51	96.90	140.2
01/24/2024 13:52	96.90	140.2
01/24/2024 13:53	96.90	140.2
01/24/2024 13:54	96.90	140.2
01/24/2024 13:55	96.90	140.2
01/24/2024 13:56	96.90	140.2
01/24/2024 13:57	96.90	140.2
01/24/2024 13:58	96.90	140.2
01/24/2024 13:59	96.90	140.2
01/24/2024 14:00	96.90	140.2
01/24/2024 14:01	96.90	140.2
01/24/2024 14:02	96.90	140.2
01/24/2024 14:03	96.90	140.2
01/24/2024 14:04	96.90	140.2
01/24/2024 14:05	96.90	140.2
01/24/2024 14:06	96.90	140.2
01/24/2024 14:07	96.90	140.2
01/24/2024 14:08	96.90	140.2
01/24/2024 14:09	96.90	140.2
01/24/2024 14:10	96.90	140.2
01/24/2024 14:11	96.90	140.2
01/24/2024 14:12	96.90	140.3
01/24/2024 14:13	96.90	140.2
01/24/2024 14:14	96.90	140.2
01/24/2024 14:15	96.90	140.2
01/24/2024 14:16	96.90	140.2
01/24/2024 14:17	96.90	140.2
01/24/2024 14:18	96.90	140.2
01/24/2024 14:19	96.90	140.2
01/24/2024 14:20	96.90	140.2
01/24/2024 14:21	96.90	140.2
01/24/2024 14:22	96.90	140.2
01/24/2024 14:23	96.90	140.3
01/24/2024 14:24	96.90	140.2
01/24/2024 14:25	96.90	140.2
01/24/2024 14:26	96.90	140.2
01/24/2024 14:27	96.90	140.2
01/24/2024 14:28	96.90	140.2
01/24/2024 14:29	96.90	140.2
01/24/2024 14:30	96.90	140.2
01/24/2024 14:31	96.90	140.2
01/24/2024 14:32	96.90	140.2

Mill ON		
Date/Time	CEMS: CLINKER_T OTAL (TON) Expression Value	KILN_FEED_ RATE (TNHR) Raw Value
01/23/2024 12:33	96.90	140.2
01/23/2024 12:34	96.90	140.2
01/23/2024 12:35	96.90	140.2
01/23/2024 12:36	96.90	140.2
01/23/2024 12:37	96.90	140.2
01/23/2024 12:38	96.90	140.2
01/23/2024 12:39	96.90	140.3
01/23/2024 12:40	96.90	140.2
01/23/2024 12:41	96.90	140.2
01/23/2024 12:42	96.90	140.3
01/23/2024 12:43	96.90	140.2
01/23/2024 12:44	96.90	140.2
01/23/2024 12:45	96.90	140.2
01/23/2024 12:46	96.90	140.2
01/23/2024 12:47	96.90	140.2
01/23/2024 12:48	96.90	140.3
01/23/2024 12:49	96.90	140.2
01/23/2024 12:50	96.90	140.3
01/23/2024 12:51	96.90	140.2
01/23/2024 12:52	96.90	140.2
01/23/2024 12:53	96.90	140.2
01/23/2024 12:54	96.90	140.2
01/23/2024 12:55	96.90	140.2
01/23/2024 12:56	96.90	140.3
01/23/2024 12:57	96.90	140.2
01/23/2024 12:58	96.90	140.2
01/23/2024 12:59	96.90	140.2
01/23/2024 13:00	96.90	140.3
01/23/2024 13:01	96.90	140.2
01/23/2024 13:02	96.90	140.3
01/23/2024 13:03	96.90	140.2
01/23/2024 13:04	96.90	140.2
01/23/2024 13:05	96.90	140.3
01/23/2024 13:06	96.90	140.2
01/23/2024 13:07	96.90	140.2
01/23/2024 13:08	96.90	140.2
01/23/2024 13:09	96.90	140.2
01/23/2024 13:10	96.90	140.2
01/23/2024 13:11	96.90	140.2
01/23/2024 13:12	96.90	140.2
01/23/2024 13:13	96.90	140.2
01/23/2024 13:14	96.90	140.2
01/23/2024 13:15	96.90	140.2
01/23/2024 13:16	96.90	140.2
01/23/2024 13:17	96.90	140.2
01/23/2024 13:18	96.90	140.2
01/23/2024 13:19	96.90	140.2
01/23/2024 13:20	96.90	140.2
01/23/2024 13:21	96.90	140.2
01/23/2024 13:22	96.90	140.2
01/23/2024 13:23	96.90	140.2
01/23/2024 13:24	96.90	140.2
01/23/2024 13:25	96.90	140.2
01/23/2024 13:26	96.90	140.2
01/23/2024 13:27	96.90	140.2

Mill Off		
Date/Time	CEMS: CLINKER_T OTAL (TON) Expression Value	KILN_FEED_ RATE (TNHR) Raw Value
01/24/2024 14:33	96.90	140.2
01/24/2024 14:34	96.90	140.2
01/24/2024 14:35	96.90	140.2
01/24/2024 14:36	96.90	140.2
01/24/2024 14:37	96.90	140.2
01/24/2024 14:38	96.90	140.2
01/24/2024 14:39	96.90	140.2
01/24/2024 14:40	96.90	140.2
01/24/2024 14:41	96.90	140.3
01/24/2024 14:42	96.90	140.2
01/24/2024 14:43	96.90	140.2
01/24/2024 14:44	96.90	140.2
01/24/2024 14:45	96.90	140.2
01/24/2024 14:46	96.90	140.2
01/24/2024 14:47	96.90	140.2
01/24/2024 14:48	96.90	140.2
01/24/2024 14:49	96.90	140.2
01/24/2024 14:50	96.90	140.3
01/24/2024 14:51	96.90	140.2
01/24/2024 14:52	96.90	140.2
01/24/2024 14:53	96.90	140.2
01/24/2024 14:54	96.90	140.2
01/24/2024 14:55	96.90	140.2
01/24/2024 14:56	96.90	140.3
01/24/2024 14:57	96.90	140.2
01/24/2024 14:58	96.90	140.2
01/24/2024 14:59	96.90	140.2
01/24/2024 15:00	96.90	140.2
01/24/2024 15:01	96.90	140.3
01/24/2024 15:02	96.90	140.2
01/24/2024 15:03	96.90	140.3
01/24/2024 15:04	96.90	140.2
01/24/2024 15:05	96.90	140.2
01/24/2024 15:06	96.90	140.2
01/24/2024 15:07	96.90	140.2
01/24/2024 15:08	96.90	140.2
01/24/2024 15:09	96.90	140.2
01/24/2024 15:10	96.90	140.2
01/24/2024 15:11	96.90	140.2
01/24/2024 15:12	96.90	140.2
01/24/2024 15:13	96.70	139.7
01/24/2024 15:14	95.50	138.2
01/24/2024 15:15	95.50	138.2

Appendix B – Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS



Client: Holcim Cement (US) Inc.

Facility: Devil's Slide Cement Plant

Test Location: Main Kiln Stack

Date: 01/23/24 and 01/24/2024

Diameter (Feet): 10.960

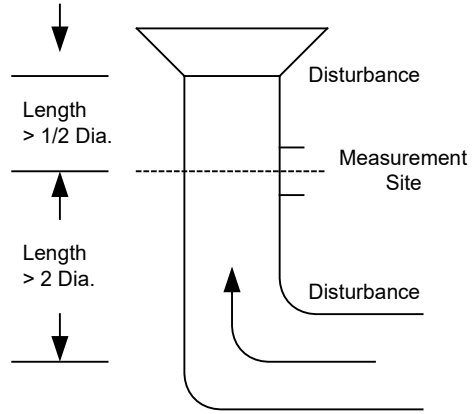
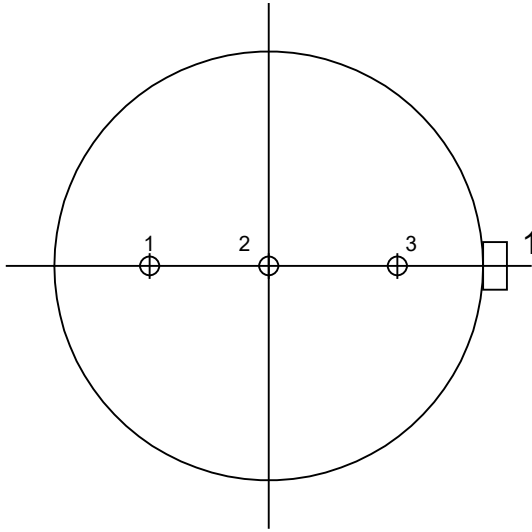
Port Length (In): 12.00

Ports Sampled: 4

Points/Port: 3

Point Markings		
	From inside wall (in.)	% of Diameter
1	5.79	4.40
2	19.20	14.60
3	38.93	29.60

STRATIFICATION TEST FOR ROUND DUCTS



Job: Holcim (US) Inc.
Devil's Slide Cement Plant

Test Location: Main Kiln Stack

Stack Diameter: 10.96 Feet

Stack Area: 94.343 Square Feet

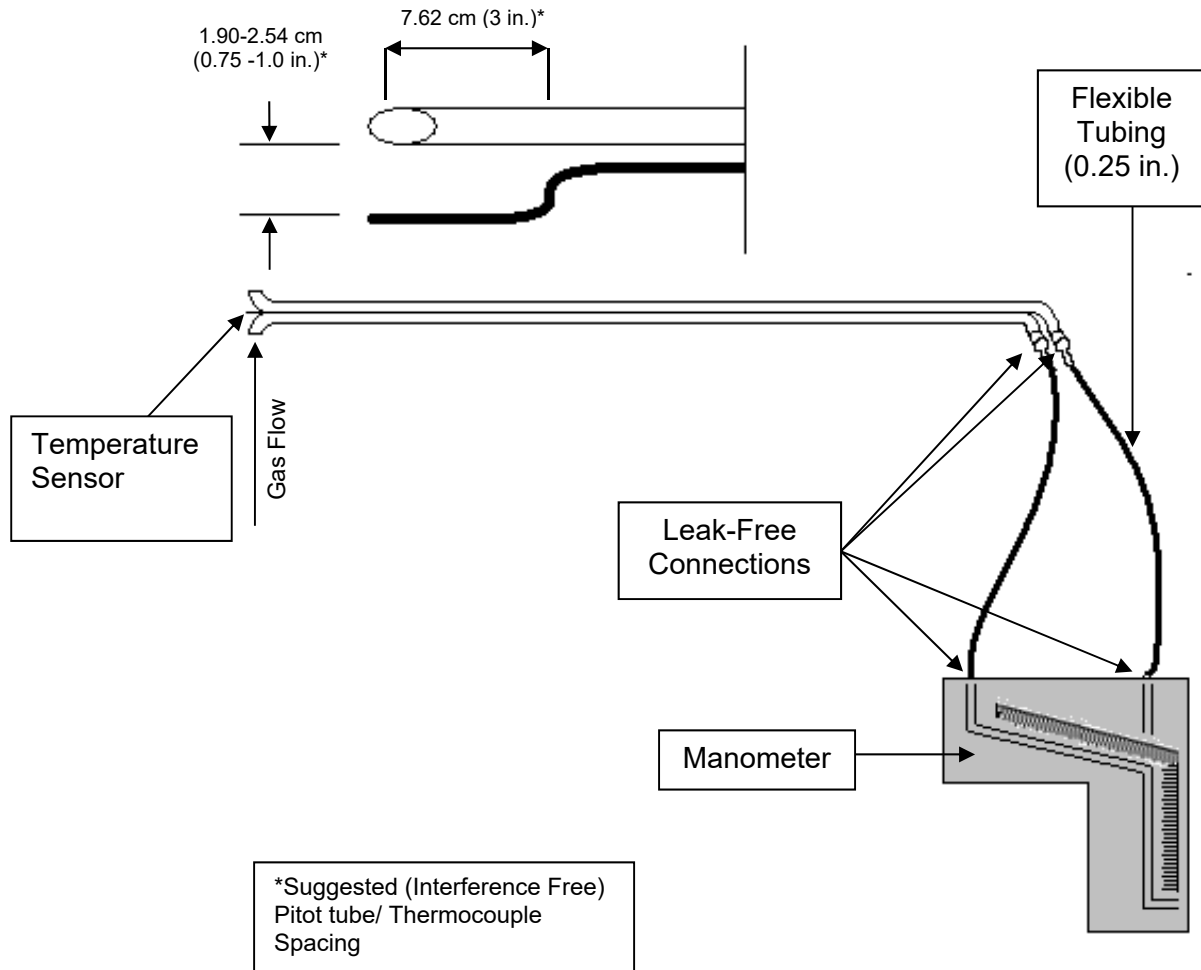
No. Sample Points: 3

Distance from Inside Wall
To Traverse Point:

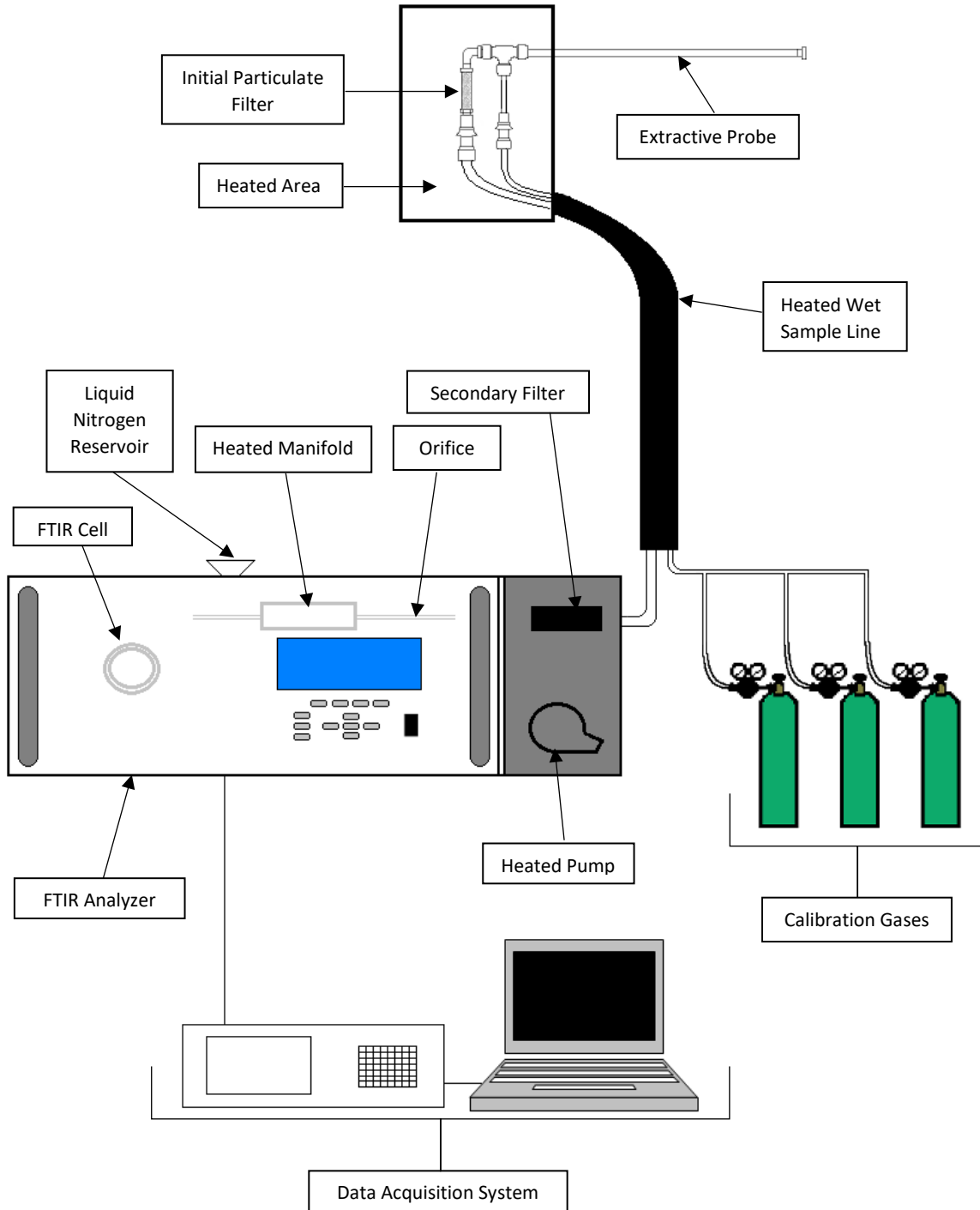
1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix C – Sample Train Diagrams

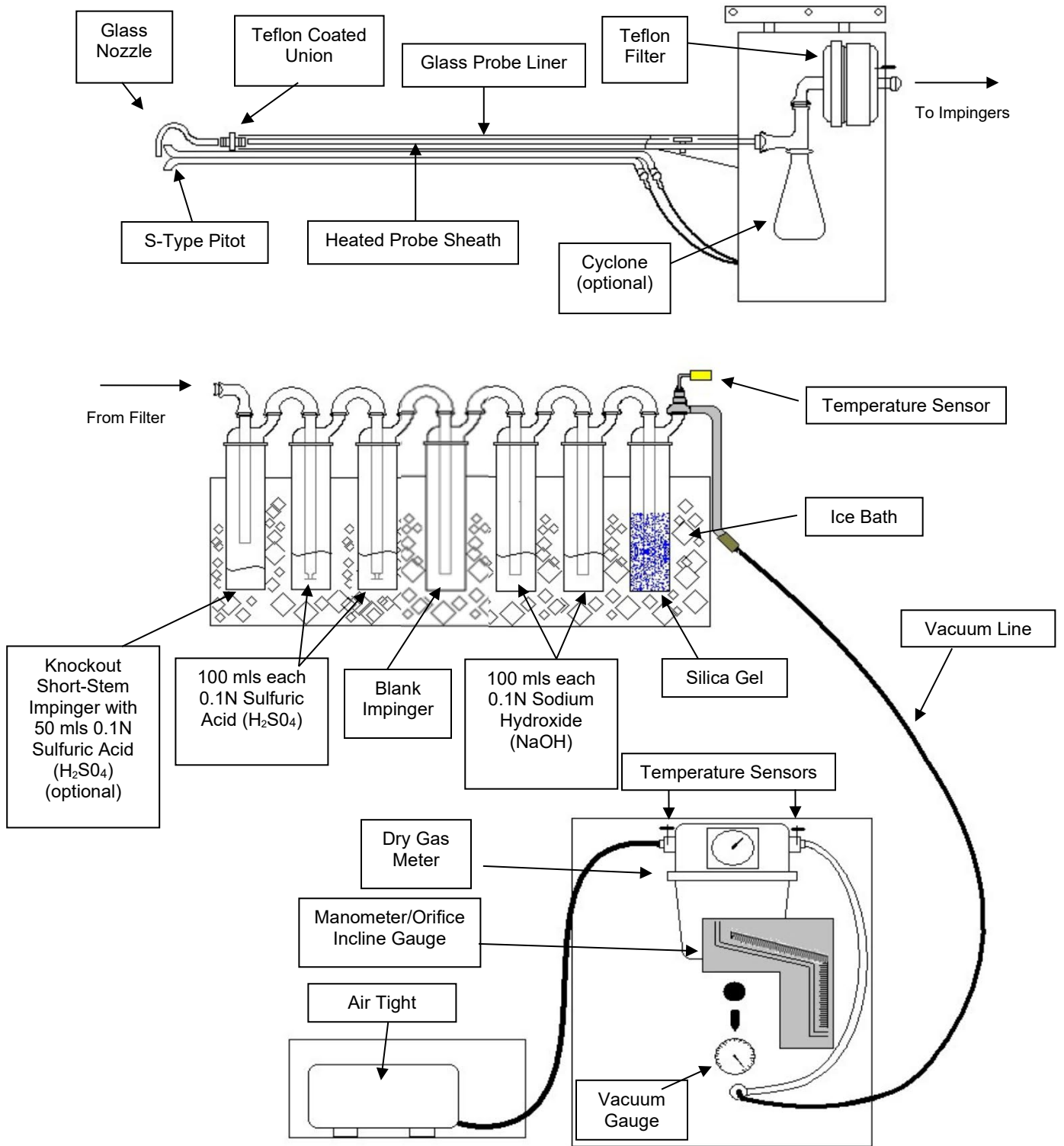
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



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



USEPA Method 26A – HF and Cl₂ Sample Train Diagram



Appendix D – Calculation Nomenclature and Formulas

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Run: 1A
Date: 1/23/2024
Method: 26A
Source Condition: Mill On/>90% Production

Dry Molecular Weight

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

$$\%CO_2 = \underline{16.4} \qquad \%O_2 = \underline{11.7} \qquad \%N_2 = \underline{71.9}$$

$$Md = \underline{31.096}$$

Wet Molecular Weight

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

$$Md = \underline{31.096} \qquad Bws = \underline{0.107}$$

$$Ms = \underline{29.696}$$

Meter Volume at Standard Conditions

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

$$Y = \underline{0.999} \qquad Vm = \underline{75.296} \qquad Pbar = \underline{24.2}$$

$$DH = \underline{4.0} \qquad Tm = \underline{76.8}$$

$$Vm(std) = \underline{60.636}$$

Volume of Water Vapor Condensed

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

$$\text{Net H}_2\text{O} = \underline{154.1}$$

$$Vw(std) = \underline{7.258}$$

Moisture Content

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

$$Vw(std) = \underline{7.258} \qquad Vm(std) = \underline{60.636}$$

$$Bws = \underline{0.107}$$

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Run: 1A
 Date: 1/23/2024
 Method: 26A
 Source Condition: Mill On/>90% Production

Average Duct Velocity

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

$$\begin{array}{l}
 C_p = \frac{0.834}{24.20} \quad T_s \text{ (avg)} = \frac{249.8}{29.696} \quad \text{Sqrt DP (avg)}: \underline{0.743} \\
 P_s = \underline{24.20} \quad M_s = \underline{29.696} \\
 V_s = \underline{52.654}
 \end{array}$$

Volumetric Flow Rate (Actual Basis)

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

$$\begin{array}{l}
 V_s = \underline{52.654} \quad A = \underline{94.343} \\
 Q = \underline{298,053}
 \end{array}$$

Volumetric Flow Rate (Standard Basis)

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

$$\begin{array}{l}
 Q = \underline{298,053} \quad P_s = \underline{24.20} \quad T_s \text{ (avg)} = \underline{249.8} \\
 Q_{std} = \underline{179,343}
 \end{array}$$

Volumetric Flow Rate (Standard Dry Basis)

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

$$\begin{array}{l}
 Q_{std} = \underline{179,343} \quad B_{ws} = \underline{0.107} \\
 Q_{std}(\text{dry}) = \underline{160,171}
 \end{array}$$

Isokinetic Variation:

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

$$\begin{array}{l}
 T_s = \underline{249.8} \quad V_m(\text{std}) = \underline{60.636} \quad V_s = \underline{52.654} \\
 A_n = \underline{0.0005550} \quad \theta = \underline{60} \quad P_s = \underline{24.20} \\
 B_{ws} = \underline{0.107} \\
 \%ISO = \underline{107.3}
 \end{array}$$

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Run: 1A
Date: 1/23/2024
Method: 26A
Source Condition: Mill On/>90% Production

Hydrogen Fluoride (HF) Concentration:

$$\text{mg/m}^3 = \frac{\text{mg of Hydrogen Fluoride (HF)}}{\text{Vm(std) x 0.02832 m}^3/\text{ft}^3}$$

$$\text{mg} = \underline{0.15} \quad \text{Vm(std)} = \underline{60.636}$$

$$\text{mg/m}^3 = \underline{0.09}$$

Hydrogen Fluoride (HF) Emission Rate:

$$\text{lb of Hydrogen Fluoride (HF)} = \frac{\mu\text{g of sample} \times 10^6 \text{ grams}/\mu\text{g}}{453.6 \text{ grams/lb}}$$

$$\text{Emission Rate lb/hr} = \frac{\text{lb of Hydrogen Fluoride (HF)}}{\text{Vm(std)}} \times \text{dscfm} \times 60 \text{ min/hr}$$

$$\text{lb of Hydrogen Fluoride (HF)} = \underline{3.31\text{E-}10} \quad \text{dscfm} = \underline{160,171}$$

$$\text{Emission Rate lb/hr} = \underline{0.0524}$$

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Project #: M234611
Test Location: Main Kiln Stack
Date: 1/23/24

Sample Calculations

$$(11.77\% - 0.13\%) \times \frac{\text{O2 \% (dry)} \quad 12.04\%}{12.10\% - 0.13\%} = 11.71\%$$

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

where:

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

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

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

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

C_{ma} = Actual concentration of the upscale calibration gas, ppm or %

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/23/24

FTIR Sample Calculations

Direct Recovery % of Calibration Transfer Standard

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

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

$$D_{cts} = \underline{100.7}$$

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

Recovery % with Calibration Transfer Standard System Purge

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

$$Sys_{cts} = \underline{100.4}$$

$$D_{cts} = \underline{100.7}$$

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

Direct Recovery % of Analyte Spike Gas

SF6

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

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

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

$$DR_{sf6} = \underline{98\%}$$

HCN

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

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

$$D_{asg} = \underline{51.8}$$

$$DR_{asg} = \underline{104.5\%}$$

Dilution Factor for Analyte Spiking

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

$$Spk_{sf6} = \underline{0.338}$$

$$D_{sf6} = \underline{4.899}$$

$$DF = \underline{0.069}$$

Recovery % for Analyte Spike With HCN

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

$$Spk_x = \underline{5.5}$$

$$N_x = \underline{1.8}$$

$$DF = \underline{0.069}$$

$$D_{asg} = \underline{51.8}$$

$$R_x = \underline{105.2} \quad \%$$

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
- B_{ws} = Water vapor in gas stream, proportion by volume
- C_p = Pitot tube coefficient, dimensionless
- M_d = Dry molecular weight of gas, lb/lb-mole
- M_s = Molecular weight of gas, wet basis, lb/lb-mole
- M_w = Molecular weight of water, 18.0 lb/lb-mole
- P_{bar} = Barometric pressure at testing site, in. Hg
- P_g = Static pressure of gas, in. Hg (in. H₂O/13.6)
- DH = Static pressure of gas, in. H₂O
- P_s = Absolute pressure of gas, in. Hg = P_{bar} + P_g
- P_{std} = Standard absolute pressure, 29.92 in. Hg
- A_{cfm} = Actual volumetric gas flow rate
- Sc_{fm} = Volumetric gas flow rate, corrected to standard conditions
- D_{scfm} = Standard volumetric flow rate, corrected to dry conditions
- R = Ideal gas constant, 21.85 in. Hg-ft³/°R-lb-mole
- T_s = Average stack gas temperature, °F
- T_m = Average dry gas meter temperature, °F
- T_{std} = Standard absolute temperature, 528°R
- v_s = Gas velocity, ft/sec
- V_{m(std)} = Volume of gas sampled, corrected to standard conditions, scf
- V_{w(std)} = Volume of water vapor in gas sample, corrected to standard conditions, scf
- V_{lc} = Volume of liquid collected
- Y = Dry gas meter calibration factor
- Δp = Velocity head of gas, in. H₂O
- K₁ = 17.647 °R/in. Hg
- %EA = Percent excess air
- %CO₂ = Percent carbon dioxide by volume, dry basis
- %O₂ = Percent oxygen by volume, dry basis
- %N₂ = Percent nitrogen by volume, dry basis
- 0.264 = Ratio of O₂ to N₂ in air, v/v
- 0.28 = Molecular weight of N₂ or CO, divided by 100
- 0.32 = Molecular weight of O₂ divided by 100
- 0.44 = Molecular weight of CO₂ divided by 100
- 13.6 = Specific gravity of mercury (Hg)

MOSTARDI PLATT

Volumetric Air Flow Calculations

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

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

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

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

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

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

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

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

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

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

MOSTARDI PLATT

Isokinetic Calculation Formulas

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MOSTARDI PLATT

Isokinetic Nomenclature

- A = Cross-sectional area of stack or duct, square feet
A_n = Cross-sectional area of nozzle, square feet
B_{ws} = Water vapor in gas stream, by volume
C_a = Acetone blank residue concentration, g/g
C_{act} = Concentration of particulate matter in gas stream at actual conditions, gr/acf
C_p = Pitot tube coefficient
C_s = Concentration of particulate matter in gas stream, dry basis, corrected to standard conditions, gr/dscf
IKV = Isokinetic sampling variance, must be 90.0 % ≤ IKV ≤ 110.0%
M_d = Dry molecular weight of gas, lb/lb-mole
M_s = Molecular weight of gas, wet basis, lb/lb-mole
M_w = Molecular weight of water, 18.0 lb/lb-mole
m_a = Mass of residue of acetone after evaporation, grams
P_{bar} = Barometric pressure at testing site, inches mercury
P_g = Static pressure of gas, inches mercury (inches water/13.6)
P_s = Absolute pressure of gas, inches mercury = P_{bar} + P_g
P_{std} = Standard absolute pressure, 29.92 inches mercury
Q_{acfm} = Actual volumetric gas flow rate, acfm
Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, dscfh
R = Ideal gas constant, 21.85 inches mercury cubic foot/°R-lb-mole
T_m = Dry gas meter temperature, °R
T_s = Gas temperature, °R
T_{std} = Absolute temperature, 528°R
V_a = Volume of acetone blank, ml
V_{aw} = Volume of acetone used in wash, ml
W_a = Weight of residue in acetone wash, grams
m_n = Total amount of particulate matter collected, grams
V_{1c} = Total volume of liquid collected in impingers and silica gel, ml
V_m = Volume of gas sample as measured by dry gas meter, dcf
V_{m(std)} = Volume of gas sample measured by dry gas meter, corrected to standard conditions, dscf
V_s = Gas velocity, ft/sec
V_{w(std)} = Volume of water vapor in gas sample, corrected to standard conditions, scf
Y = Dry gas meter calibration factor
ΔH = Average pressure differential across the orifice meter, inches water
Δp = Velocity head of gas, inches water
ρ_a = Density of acetone, 0.7855 g/ml (average)
ρ_w = Density of water, 0.002201 lb/ml
θ = Total sampling time, minutes
K₁ = 17.647 °R/in. Hg
K₂ = 0.04707 ft³/ml
K₄ = 0.09450/100 = 0.000945
K_p = Pitot tube constant, $85.49 \frac{ft}{sec} \left[\frac{(lb/lb-mole)(in. Hg)}{(°R)(in. H_2O)} \right]^{1/2}$
%EA = Percent excess air
%CO₂ = Percent carbon dioxide by volume, dry basis
%O₂ = Percent oxygen by volume, dry basis
%CO = Percent carbon monoxide by volume, dry basis
%N₂ = Percent nitrogen by volume, dry basis
0.264 = Ratio of O₂ to N₂ in air, v/v
28 = Molecular weight of N₂ or CO
32 = Molecular weight of O₂
44 = Molecular weight of CO₂
13.6 = Specific gravity of mercury (Hg)

MOSTARDI PLATT

Calculations for Hydrogen Fluoride By Method 26 or 26A

Concentration

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

where:

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

dscf = Volume of gas sampled

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

Parts Per Million

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

where:

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

106 = Conversion of ppm v/v

Emission Rate

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

MOSTARDI PLATT

Pollutant Concentration Correction 7% for Percent Oxygen

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

where:

C_{adj} = Pollutant concentration corrected to percent O_2

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

20.9 = Percent O_2 in air

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

C_d = Pollutant concentration measured, dry basis, ppm.

Appendix E- Laboratory Sample Analysis

Chain-of-Custody Form						
Project Number: M234611				Date Results Required:		
Client: Holcim (US) Cement				TAT Required:		
Plant/Test Location: Devils Slide/Main Kiln Stack				Project Supervisor: EE		
Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
001	1/23/24	#1A M26A H2SO4 Mill on	1		HF	
002	1/23/24	#1A M26A NaOH Mill on	1		Cl ₂	
003	1/23/24	#1B M26A H2SO4 Mill on	1		HF	
004	1/23/24	#1B M26A NaOH Mill on	1		Cl ₂	
005	1/23/24	#2A M26A H2SO4 Mill on	1		HF	
006	1/23/24	#2A M26A NaOH Mill on	1		Cl ₂	
007	1/23/24	#2B M26A H2SO4 Mill on	1		HF	
008	1/23/24	#2B M26A NaOH Mill on	1		Cl ₂	
009	1/23/24	#3A M26A H2SO4 Mill on	1		HF	
010	1/23/24	#3A M26A NaOH Mill on	1		Cl ₂	
011	1/23/24	#3B M26A H2SO4 Mill on	1		HF	
012	1/23/24	#3B M26A NaOH Mill on	1		Cl ₂	
013	1/23/24	A Train Blank H2SO4 Mill on	1		HF	
014	1/23/24	A Train Blank NaOH Mill on	1		Cl ₂	
015	1/24/24	#1A M26A H2SO4 Mill off	1		HF	
016	1/24/24	#1A M26A NaOH Mill off	1		Cl ₂	
017	1/24/24	#1B M26A H2SO4 Mill off	1		HF	
018	1/24/24	#1B M26A NaOH Mill off	1		Cl ₂	
019	1/24/24	#2A M26A H2SO4 Mill off	1		HF	
020	1/24/24	#2A M26A NaOH Mill off	1		Cl ₂	
Delivered to Lab by: Date/Time:		Received by: Date/Time:		Processed by: Date/Time:		

Laboratory Notes:

Chain-of-Custody Form						
Project Number: M234611				Date Results Required:		
Client: Holcim (US) Cement				TAT Required:		
Plant/Test Location: Devils Slide/Main Kiln Stack				Project Supervisor: EE		
Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
021	1/24/24	#2B M26A H2SO4 Mill off	1		HF	
022	1/24/24	#2B M26A NaOH Mill off	1		Cl ₂	
023	1/24/24	#3A M26A H2SO4 Mill off	1		HF	
024	1/24/24	#3A M26A NaOH Mill off	1		Cl ₂	
025	1/24/24	#3B M26A H2SO4 Mill off	1		HF	
026	1/24/24	#3B M26A NaOH Mill off	1		Cl ₂	
027	1/24/24	B Train Blank H2SO4 Mill off	1		HF	
028	1/24/24	B Train Blank NaOH Mill off	1		Cl ₂	
029	1/24/24	DI Reagent Blank	1		HF/Cl ₂	
030	1/24/24	H2SO4 Reagent Blank	1		HF	
031	1/24/24	NaOH Reagent Blank	1		Cl ₂	
Delivered to Lab by: _____		Date/Time: _____		Received by: _____		Date/Time: _____
				Processed by: _____		Date/Time: _____

Laboratory Notes:

Main Kiln-Mill On

Client: Holcim	Analysis Date: 2/13/2024
Facility: Devil's Slide	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill On	Analyst: JMG
Project Number: M234611	
Method: 26A	
Date Samples Received: 1/31/2023	

Train A

Sampling Date		1/23/2024	1/23/2024	1/23/2024	1/23/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	175	274	274		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/23/2024	1/23/2024	1/23/2024			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	Train A Field Blank		RDL	MDL
Sulfuric Acid Volume	ml	274	283	215			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		1/23/2024	1/23/2024	1/23/2024	1/23/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	175	322	322		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/23/2024	1/23/2024	1/24/2024			
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3	M26A- H2SO4 R4		RDL	MDL
Sulfuric Acid Volume	ml	269	277	157			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Main Kiln-Mill On

Client: Holcim	Analysis Date: 2/13/2024
Facility: Devil's Slide	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill On	Analyst: JMG
Project Number: M234611	
Method: 26A	
Date Samples Received: 1/31/2023	

Train A

Sampling Date		1/23/2024	1/23/2024	1/23/2024	1/23/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	172	208	208		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/23/2024	1/23/2024	1/23/2024			
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train A Blank		RDL	MDL
Sodium Hydroxide Volume	ml	207	176	227			
Chlorine	ug	<150	<150	<150		150	15

Train B

Sampling Date		1/23/2024	1/23/2024	1/23/2024	1/23/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	172	204	204		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/23/2024	1/23/2024	1/24/2024			
	UNITS	M26A- NaOH R2	M26A- NaOH R3	Train B Blank		RDL	MDL
Sodium Hydroxide Volume	ml	218	211	213			
Chlorine	ug	<150	<150	<150		150	15

Client:	Holcim	Analysis Date:	2/13/2024																	
Facility:	Devil's Slide	Analysis Location:	Elmhurst Lab																	
Test Location:	Main Kiln-Mill On	Analyst:	JMG																	
Project Number:	M234611																			
Method:	26A																			
Date Samples Received:	1/31/2023																			
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve																
1	0.1178	0.1178	1.02	0.1151																
2	0.2219	0.1110	1.93																	
5	0.5700	0.1140	4.95	Response Factor Ave																
8	0.9180	0.1148	7.97	0.1151																
10	1.1784	0.1178	10.23																	
Lot Number	Ricca 830603B																			
	R²	0.9994																		
Sample Number	Sample Date	Sample ID	Sample Area	PPM Cl	PPM X Dilution Factor	Dilution Factor	Total ml	mg Cl in soln	ug Cl2 in soln	ug Cl2 in soln										
029	1/23/2024	DI Reagent Blank	0.0006	0.0052	0.0052	1	200	0.0010												
029	1/23/2024	DI Reagent Blank	0.0002	0.0017	0.0017	1	200	0.0003	0.0007	0.694817061										
031	1/23/2024	NaOH Reagent Blank	0.0058	0.0504	0.0504	1	172	0.0087												
031	1/23/2024	NaOH Reagent Blank	0.0059	0.0512	0.0512	1	172	0.0088	0.0087	8.739061588										
002	1/23/2024	Test 1A NaOH Imp	0.0010	0.0087	0.0087	1	208	0.0018												
002	1/23/2024	Test 1A NaOH Imp	0.0006	0.0052	0.0052	1	208	0.0011	0.0014	1.445219487										
002	1/23/2024	Test 1A NaOH Imp	0.0007	0.0061	0.0061	1	208	0.0013												
002	1/23/2024	Test 1A NaOH Imp	0.0007	0.0061	0.0061	1	208	0.0013	0.0013	1.264567051										
006	1/23/2024	Test 2A NaOH Imp	0.0001	0.0009	0.0009	1	207	0.0002												
006	1/23/2024	Test 2A NaOH Imp	0.0001	0.0009	0.0009	1	207	0.0002	0.0002	0.179783915										
010	1/23/2024	Test 3A NaOH Imp	0.0013	0.0113	0.0113	1	176	0.0020												
010	1/23/2024	Test 3A NaOH Imp	0.0012	0.0104	0.0104	1	176	0.0018	0.0019	1.910746918										
014	1/23/2024	Train Blank	0.0106	0.0921	0.0921	1	227	0.0209												
014	1/23/2024	Train Blank	0.0107	0.0929	0.0929	1	227	0.0211	0.0210	20.99693733										
				Expected Value	% Difference															
		Run 1 H2SO4 Spike W/ 2ppm	0.1117	0.9701	0.9671															
		Run 1 H2SO4 Spike W/ 2ppm	0.1127	0.9788	0.9671	0.76%														
CCV ppm Cl	Area	PPM Cl																		
5 ppm ICV	0.5709	4.9584																		
5 ppm CCV	0.6006	5.2163																		
5 ppm CCV	0.5759	5.0018																		
5 ppm CCV	0.5908	5.1312																		
5 ppm CCV	0.5833	5.0661																		
Standard ppm Cl	Area	Difference																		
1	0.1173	0.21%																		
2	0.2058	3.91%																		
5	0.5905	1.74%																		
8	0.9832	3.32%																		
10	1.2221	1.79%																		

Main Kiln-Mill Off

Client: Holcim Facility: Devil's Slide Test Location: Main Kiln-Mill Off Project Number: M234611 Method: 26A Date Samples Received: 1/31/2024	Analysis Date: 2/13/2024 Analysis Location: Elmhurst Analyst: JMG
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Train A

Sampling Date		1/23/2024	1/23/2024	1/24/2024	1/24/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	175	327	327		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/24/2024	1/24/2024				
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3			RDL	MDL
Sulfuric Acid Volume	ml	253	253				
Hydrofluoric Acid	ug	<150	<150			150	15

Train B

Sampling Date		1/23/2024	1/23/2024	1/23/2024	1/24/2024		
	UNITS	M26A DI Blank	M26A H2SO4 Blank	M26A H2SO4-R1	M26A H2SO4-R1 Dup	RDL	MDL
Sulfuric Acid Volume	ml	200	175	293	293		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		1/24/2024	1/24/2024				
	UNITS	M26A- H2SO4 R2	M26A- H2SO4 R3			RDL	MDL
Sulfuric Acid Volume	ml	257	272				
Hydrofluoric Acid	ug	<150	<150			150	15

Main Kiln-Mill Off

Client: Holcim	Analysis Date: 2/13/2024
Facility: Devil's Slide	Analysis Location: Elmhurst
Test Location: Main Kiln-Mill Off	Analyst: JMG
Project Number: M234611	
Method: 26A	
Date Samples Received: 1/31/2024	

Train A

Sampling Date		1/23/2024	1/23/2024	1/24/2024	1/24/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	172	193	193		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/24/2024	1/24/2024				
	UNITS	M26A- NaOH R2	M26A- NaOH R3			RDL	MDL
Sodium Hydroxide Volume	ml	222	174				
Chlorine	ug	<150	<150			150	15

Train B

Sampling Date		1/24/2024	1/23/2024	1/24/2024	1/24/2024		
	UNITS	M26A DI Blank	M26A NaOH Blank	M26A NaOH-R1	M26A NaOH-R1 Dup	RDL	MDL
Sodium Hydroxide Volume	ml	200	172	209	209		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		1/24/2024	1/24/2024				
	UNITS	M26A- NaOH R2	M26A- NaOH R3			RDL	MDL
Sodium Hydroxide Volume	ml	223	170				
Chlorine	ug	<150	<150			150	15

Client:	Holcim	Analysis Date:	2/13/2024																		
Facility:	Devil's Slide	Analysis Location:	Elmhurst Lab																		
Test Location:	Main Kiln-Mill Off	Analyst:	JMG																		
Project Number:	M234611																				
Method:	26A																				
Date Samples Received:	1/31/2024																				
Standard ppm Cl	Area	Response Factor	Calculated Value	Slope of Regression Curve																	
1	0.1178	0.1178	1.02	0.1151																	
2	0.2219	0.1110	1.93																		
5	0.5700	0.1140	4.95	Response Factor Ave																	
8	0.9180	0.1148	7.97	0.1151																	
10	1.1784	0.1178	10.23																		
Lot Number	Ricca 830603B																				
	R²	0.9994																			
Sample Number	Sample Date	Sample ID	Sample Area	PPM Cl	PPM X Dilution Factor	Dilution Factor	Total ml	mg Cl in soln	ug Cl2 in soln	ug Cl2 in soln											
029	1/23/2024	DI Reagent Blank	0.0006	0.0052	0.0052	1	200	0.0010													
029	1/23/2024	DI Reagent Blank	0.0002	0.0017	0.0017	1	200	0.0003	0.0007	0.694817061											
031	1/23/2024	NaOH Reagent Blank	0.0058	0.0504	0.0504	1	172	0.0087													
031	1/23/2024	NaOH Reagent Blank	0.0059	0.0512	0.0512	1	172	0.0088	0.0087	8.739061588											
016	1/24/2024	Test 1A NaOH Imp	0.0200	0.1737	0.1737	1	193	0.0335													
016	1/24/2024	Test 1A NaOH Imp	0.0149	0.1294	0.1294	1	193	0.0250	0.0293	29.2504955											
016	1/24/2024	Test 1A NaOH Imp	0.0149	0.1294	0.1294	1	193	0.0250													
016	1/24/2024	Test 1A NaOH Imp	0.0141	0.1225	0.1225	1	193	0.0236	0.0243	24.30556932											
020	1/24/2024	Test 2A NaOH Imp	0.0004	0.0035	0.0035	1	222	0.0008													
020	1/24/2024	Test 2A NaOH Imp	0.0004	0.0035	0.0035	1	222	0.0008	0.0008	0.771246938											
024	1/24/2024	Test 3A NaOH Imp	0.0087	0.0756	0.0756	1	174	0.0131													
024	1/24/2024	Test 3A NaOH Imp	0.0109	0.0947	0.0947	1	174	0.0165	0.0148	14.81002566											
		Run 1 H2SO4 Spike W/ 2ppm	0.1191	1.0344	1.0394																
		Run 1 H2SO4 Spike W/ 2ppm	0.1193	1.0361	1.0394	0.40%															
CCV ppm Cl	Area	PPM Cl																			
5 ppm ICV	0.5709	4.9584																			
5 ppm CCV	0.6006	5.2163																			
5 ppm CCV	0.5759	5.0018																			
5 ppm CCV	0.5908	5.1312																			
5 ppm CCV	0.5833	5.0661																			
Standard ppm Cl	Area	Difference																			
1	0.1173	0.21%																			
2	0.2058	3.91%																			
5	0.5905	1.74%																			
8	0.9832	3.32%																			
10	1.2221	1.79%																			

Appendix F - Reference Method Test Data

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Test Method: 26A
Test Engineer: PPP
Test Technician: EC

	<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>
Temp ID:	CM23	CM23	CM23
Meter ID:	CM23	CM23	CM23
Pitot ID:	S8-058-A	S8-058-A	S8-058-A
Nozzle Diameter (Inches):	0.319	0.319	0.319
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:	Glass #39/ 953	Glass #39/ 954	Glass #39/ 955

Leak Checks

Pre Pitot Leak Check	0.0	@	3.4	"H ₂ O	0.0	@	3.3	"H ₂ O	0.0	@	3.2	"H ₂ O
Post Pitot Leak Check	0.0	@	3.3	"H ₂ O	0.0	@	3.5	"H ₂ O	0.0	@	3.3	"H ₂ O
Pre Nozzle Leak Check	0.0100	@	14	"Hg	0.0000	@	12	"Hg	0.0000	@	11	"Hg
Post Nozzle Leak Check	0.0000	@	10	"Hg	0.0000	@	12	"Hg	0.0000	@	12	"Hg

Pitot Tube Coefficient: 0.834
Probe Length (Feet): 8.0
Probe Liner Material: Glass
Sample Plane: Horizontal
Port Length (Inches): 12.00
Port Size (Diameter, Inches): 6.00
Port Type: Flange
Duct Shape: Circular
Diameter (Feet): 10.96
Duct Area (Square Feet): 94.343
Upstream Diameters: 2.5
Downstream Diameters: 10.9
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/>90% Production
Moisture Balance ID: S10-26
of Runs: 3

Run 1A - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On/>90% Production

Date: 1/23/24
 Start Time: 9:00
 End Time: 10:13

DRY GAS METER CONDITIONS

ΔH: 3.98 in. H₂O
 Meter Temperature, Tm: 76.8 °F
 Sqrt ΔP: 0.743 in. H₂O
 Stack Temperature, Ts: 249.8 °F
 Meter Volume, Vm: 75.296 ft³
 Meter Volume, Vmstd: 60.636 dscf
 Meter Volume, Vwstd: 7.258 wscf
 Isokinetic Variance: 107.3 %I
 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.319 in inches
 Barometric Pressure: 24.23 in Hg

STACK CONDITIONS

Static Pressure -0.40 in. H₂O
 Flue Pressure (Ps): 24.20 in. Hg. abs.
 Carbon Dioxide: 16.42 %
 Oxygen: 11.71 %
 Nitrogen: 71.87 %
 Gas Weight dry, Md: 31.096 lb/lb mole
 Gas Weight wet, Ms: 29.696 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 52.654 fps
 Volumetric Flow: 298,053 acfm
 Volumetric Flow: 160,171 dscfm
 Volumetric Flow: 179,343 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3585.2 ml Silica Initial Wt. 857.2 grams
 Final Impinger Content: 3718.1 ml Silica Final Wt. 878.4 grams
 Impinger Difference: 132.9 ml Silica Difference: 21.2 grams
 Total Water Gain: 154.1 Moisture, Bws: 0.107

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	9:00:00	0.57	4.10	976.100	251	75	74	5	260	259	45
1-2	9:05:00	0.55	3.90	982.620	249	74	74	5	261	261	45
1-3	9:10:00	0.52	3.70	988.710	249	74	74	5	260	260	46
	9:15:00			994.772							
2-1	9:19:00	0.58	4.20	994.772	250	75	73	5	260	259	47
2-2	9:24:00	0.54	3.90	1001.240	250	76	72	5	261	259	47
2-3	9:29:00	0.52	3.70	1007.430	250	78	73	5	260	259	48
	9:34:00			1013.520							
3-1	9:39:00	0.60	4.30	1013.520	250	78	73	5	260	259	50
3-2	9:44:00	0.56	4.00	1020.160	249	81	73	5	260	260	51
3-3	9:49:00	0.53	3.80	1026.380	250	84	74	5	260	260	52
	9:54:00			1032.453							
4-1	9:58:00	0.58	4.20	1032.453	250	84	78	5	260	260	54
4-2	10:03:00	0.55	4.00	1038.990	251	86	78	5	260	260	55
4-3	10:08:00	0.53	3.90	1045.180	248	86	77	5	260	259	55
	10:13:00			1051.396							

Total 1:00:00 75.296 79.3 74.4
 Average 3.98 249.8 76.8 5
 Min 3.70 248.0 72.0 5
 Max 4.30 251.0 86.0 5

Impinger Weight Sheet - Run 1A

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/23/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/23/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	745.5	727.7	17.8
0.1N H2SO4	786.4	729.0	57.4
Empty	679.0	652.5	26.5
0.1N NaOH	766.0	746.0	20.0
0.1N NaOH	741.2	730.0	11.2
Silica Gel	878.4	857.2	21.2

<u>3,718.1</u> Liquid Final	<u>3,585.2</u> Liquid Initial	<u>132.9</u> Liquid Gain
<u>878.4</u> Silica Final	<u>857.2</u> Silica Initial	<u>21.2</u> Silica Gain

Run 2A - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On/>90% Production

Date: 1/23/24
 Start Time: 10:35
 End Time: 11:48

DRY GAS METER CONDITIONS

ΔH: 4.03 in. H₂O
 Meter Temperature, Tm: 87.1 °F
 Sqrt ΔP: 0.747 in. H₂O
 Stack Temperature, Ts: 251.3 °F
 Meter Volume, Vm: 75.960 ft³
 Meter Volume, Vmstd: 60.030 dscf
 Meter Volume, Vwstd: 6.354 wscf
 Isokinetic Variance: 104.7 %I
 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.319 in inches
 Barometric Pressure: 24.23 in Hg

STACK CONDITIONS

Static Pressure 0.10 in. H₂O
 Flue Pressure (Ps): 24.24 in. Hg. abs.
 Carbon Dioxide: 16.50 %
 Oxygen: 11.89 %
 Nitrogen: 71.6 %
 Gas Weight dry, Md: 31.116 lb/lb mole
 Gas Weight wet, Ms: 29.860 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 52.802 fps
 Volumetric Flow: 298,893 acfm
 Volumetric Flow: 162,519 dscfm
 Volumetric Flow: 179,721 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3585.7 ml Silica Initial Wt. 859.6 grams
 Final Impinger Content: 3709.7 ml Silica Final Wt. 870.5 grams
 Impinger Difference: 124.0 ml Silica Difference: 10.9 grams
 Total Water Gain: 134.9 Moisture, Bws: 0.096

Port-Point No.	Clock Time	Velocity	Orifice	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp		Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
		Head Δp in. H ₂ O	ΔH in. H ₂ O			Inlet °F	Outlet °F				
1-1	10:35:00	0.60	4.40	51.520	251	83	78	5	256	255	62
1-2	10:40:00	0.56	4.10	58.130	251	85	78	5	260	259	60
1-3	10:45:00	0.53	3.90	64.560	251	88	79	5	259	258	60
	10:50:00			70.643							
2-1	10:54:00	0.59	4.30	70.643	251	89	81	5	260	259	57
2-2	10:59:00	0.55	4.00	77.340	251	91	83	5	260	262	59
2-3	11:04:00	0.52	3.80	83.630	252	91	83	5	260	264	60
	11:09:00			89.783							
3-1	11:14:00	0.59	4.30	89.783	251	91	85	5	260	260	65
3-2	11:19:00	0.56	4.10	96.410	252	92	91	5	260	260	65
3-3	11:24:00	0.54	3.90	102.830	252	92	86	5	260	258	65
	11:29:00			108.724							
4-1	11:33:00	0.58	4.10	108.724	251	93	88	5	262	259	66
4-2	11:38:00	0.56	3.90	115.320	251	94	88	5	261	263	65
4-3	11:43:00	0.52	3.60	121.560	252	94	88	5	261	263	66
	11:48:00			127.480							

Total 1:00:00 75.960 90.3 84.0
 Average 4.03 251.3 87.1 5
 Min 3.60 251.0 78.0 5
 Max 4.40 252.0 94.0 5

Impinger Weight Sheet - Run 2A

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/23/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/23/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	771.6	735.2	36.4
0.1N H2SO4	775.3	726.1	49.2
Empty	661.6	642.1	19.5
0.1N NaOH	748.7	735.4	13.3
0.1N NaOH	752.5	746.9	5.6
Silica Gel	870.5	859.6	10.9

<u>3,709.7</u> Liquid Final	<u>3,585.7</u> Liquid Initial	<u>124.0</u> Liquid Gain
<u>870.5</u> Silica Final	<u>859.6</u> Silica Initial	<u>10.9</u> Silica Gain

Run 3A - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On/>90% Production

Date: 1/23/24
 Start Time: 12:15
 End Time: 13:27

DRY GAS METER CONDITIONS

ΔH: 3.90 in. H₂O
 Meter Temperature, Tm: 87.7 °F
 Sqrt ΔP: 0.749 in. H₂O
 Stack Temperature, Ts: 251.0 °F
 Meter Volume, Vm: 75.207 ft³
 Meter Volume, Vmstd: 59.348 dscf
 Meter Volume, Vwstd: 5.676 wscf
 Isokinetic Variance: 102.4 %I

 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.319 in inches
 Barometric Pressure: 24.23 in Hg

STACK CONDITIONS

Static Pressure 0.10 in. H₂O
 Flue Pressure (Ps): 24.24 in. Hg. abs.
 Carbon Dioxide: 16.60 %
 Oxygen: 11.39 %
 Nitrogen: 72.01 %
 Gas Weight dry, Md: 31.112 lb/lb mole
 Gas Weight wet, Ms: 29.967 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 52.852 fps
 Volumetric Flow: 299,174 acfm
 Volumetric Flow: 164,265 dscfm
 Volumetric Flow: 179,974 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3596.3 ml Silica Initial Wt. 878.4 grams
 Final Impinger Content: 3708.3 ml Silica Final Wt. 886.9 grams
 Impinger Difference: 112.0 ml Silica Difference: 8.5 grams

 Total Water Gain: 120.5 Moisture, Bws: 0.087

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:15:00	0.59	4.10	128.410	251	90	88	5	260	260	55
1-2	12:20:00	0.55	3.80	134.930	251	91	88	5	261	260	56
1-3	12:25:00	0.53	3.70	141.270	251	92	88	5	261	261	54
	12:30:00			147.185							
2-1	12:34:00	0.60	4.20	147.185	251	91	86	5	260	260	53
2-2	12:39:00	0.56	3.90	153.740	251	91	86	5	260	259	52
2-3	12:44:00	0.52	3.60	160.120	251	91	85	5	260	260	54
	12:49:00			165.983							
3-1	12:53:00	0.59	4.10	165.983	251	89	84	5	261	260	55
3-2	12:58:00	0.57	3.90	172.430	251	90	84	5	261	260	56
3-3	13:03:00	0.54	3.70	178.760	251	90	84	5	261	259	57
	13:08:00			184.849							
4-1	13:12:00	0.60	4.17	184.849	251	89	84	5	261	261	59
4-2	13:17:00	0.56	3.90	191.450	252	88	84	5	261	261	60
4-3	13:22:00	0.53	3.69	197.660	250	88	84	5	260	260	62
	13:27:00			203.617							

Total 1:00:00 75.207 90.0 85.4
 Average 3.90 251.0 87.7 5
 Min 3.60 250.0 84.0 5
 Max 4.20 252.0 92.0 5

Impinger Weight Sheet - Run 3A

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/23/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/4/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	746.3	730.7	15.6
0.1N H2SO4	778.9	731.2	47.7
Empty	678.6	655.6	23.0
0.1N NaOH	767.4	750.0	17.4
0.1N NaOH	737.1	728.8	8.3
Silica Gel	886.9	878.4	8.5

<u>3,708.3</u> Liquid Final	<u>3,596.3</u> Liquid Initial	<u>112.0</u> Liquid Gain
<u>886.9</u> Silica Final	<u>878.4</u> Silica Initial	<u>8.5</u> Silica Gain

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Test Method: 26A
Test Engineer: NL
Test Technician: EC

	<u>Run 1B</u>	<u>Run 2B</u>	<u>Run 3B</u>
Temp ID:	CM54	CM54	CM54
Meter ID:	CM54	CM54	CM54
Pitot ID:	S8-059-B	S8-059-B	S8-059-B
Nozzle Diameter (Inches):	0.311	0.311	0.311
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 #38	Glass #39	Glass #40

Leak Checks

Pre Pitot Leak Check	0.0	@	3.4	"H ₂ O	0.0	@	3.7	"H ₂ O	0.0	@	3.1	"H ₂ O
Post Pitot Leak Check	0.0	@	3.7	"H ₂ O	0.0	@	3.1	"H ₂ O	0.0	@	3.5	"H ₂ O
Pre Nozzle Leak Check	0.0000	@	13	"Hg	0.0000	@	12	"Hg	0.0000	@	13	"Hg
Post Nozzle Leak Check	0.0000	@	8	"Hg	0.0000	@	10	"Hg	0.0000	@	10	"Hg
Pitot Tube Coefficient:	0.839											
Probe Length (Feet):	8.0											
Probe Liner Material:	Glass											
Sample Plane:	Horizontal											
Port Length (Inches):	12.00											
Port Size (Diameter, Inches):	6.00											
Port Type:	Flange											
Duct Shape:	Circular											
Diameter (Feet):	10.96											
Duct Area (Square Feet):	94.343											
Upstream Diameters:	2.5											
Downstream Diameters:	10.9											
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/>90% Production											
Moisture Balance ID:	S10-26											
# of Runs	3											

Run 1B - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On/>90% Production

Date: 1/23/24
 Start Time: 9:00
 End Time: 10:13

DRY GAS METER CONDITIONS

ΔH: 3.15 in. H₂O
 Meter Temperature, Tm: 73.5 °F
 Sqrt ΔP: 0.717 in. H₂O
 Stack Temperature, Ts: 247.9 °F
 Meter Volume, Vm: 69.591 ft³
 Meter Volume, Vmstd: 55.633 dscf
 Meter Volume, Vwstd: 6.764 wscf
 Isokinetic Variance: 106.8 %I
 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.311 in inches
 Barometric Pressure: 24.23 in Hg

STACK CONDITIONS

Static Pressure -0.27 in. H₂O
 Flue Pressure (Ps): 24.21 in. Hg. abs.
 Carbon Dioxide: 16.42 %
 Oxygen: 11.71 %
 Nitrogen: 71.87 %
 Gas Weight dry, Md: 31.096 lb/lb mole
 Gas Weight wet, Ms: 29.676 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 51.020 fps
 Volumetric Flow: 288,803 acfm
 Volumetric Flow: 155,403 dscfm
 Volumetric Flow: 174,296 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3675.5 ml Silica Initial Wt. 893.1 grams
 Final Impinger Content: 3810.8 ml Silica Final Wt. 901.4 grams
 Impinger Difference: 135.3 ml Silica Difference: 8.3 grams
 Total Water Gain: 143.6 Moisture, Bws: 0.108

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	9:00:00	0.55	3.40	58.014	249	72	72	3	260	260	47
1-2	9:05:00	0.53	3.20	64.010	248	72	72	3	260	260	47
1-3	9:10:00	0.49	3.00	69.980	248	72	72	3	260	259	46
	9:15:00			75.403							
2-1	9:19:00	0.54	3.30	75.403	248	73	73	3	260	260	48
2-2	9:24:00	0.50	3.10	81.240	248	73	73	3	260	260	49
2-3	9:29:00	0.47	2.90	87.020	248	73	73	3	260	260	49
	9:34:00			92.831							
3-1	9:39:00	0.57	3.50	92.831	248	73	73	3	260	260	51
3-2	9:44:00	0.51	3.10	98.340	247	74	74	3	259	261	53
3-3	9:49:00	0.47	2.90	104.690	247	75	75	3	259	261	52
	9:54:00			110.177							
4-1	9:58:00	0.55	3.40	110.177	248	75	75	3	260	261	54
4-2	10:03:00	0.54	3.30	116.280	248	75	75	3	260	261	54
4-3	10:08:00	0.45	2.70	122.190	248	75	75	2	260	260	54
	10:13:00			127.605							

Total 1:00:00 69.591 73.5 73.5
 Average 3.15 247.9 73.5 3
 Min 2.70 247.0 72.0 2
 Max 3.50 249.0 75.0 3

Impinger Weight Sheet - Run 1B

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/23/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/23/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	825.0	782.2	42.8
0.1N H2SO4	813.7	759.4	54.3
Empty	678.7	652.7	26.0
0.1N NaOH	756.3	746.8	9.5
0.1N NaOH	737.1	734.4	2.7
Silica Gel	901.4	893.1	8.3

<u>3,810.8</u>	<u>3,675.5</u>	<u>135.3</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>901.4</u>	<u>893.1</u>	<u>8.3</u>
Silica Final	Silica Initial	Silica Gain

Run 2B - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On/>90% Production

Date: 1/23/24
 Start Time: 10:35
 End Time: 11:48

DRY GAS METER CONDITIONS				STACK CONDITIONS			
ΔH:	3.18	In. H ₂ O		Static Pressure	-0.27	in. H ₂ O	
Meter Temperature, Tm:	78.4	°F		Flue Pressure (Ps):	24.21	in. Hg. abs.	
Sqrt ΔP:	0.719	In. H ₂ O		Carbon Dioxide:	16.50	%	
Stack Temperature, Ts:	248.9	°F		Oxygen:	11.89	%	
Meter Volume, Vm:	70.038	ft ³		Nitrogen:	71.6	%	
Meter Volume, Vmstd:	55.483	dscf		Gas Weight dry, Md:	31.116	lb/lb mole	
Meter Volume, Vwstd:	6.773	wscf		Gas Weight wet, Ms:	29.689	lb/lb mole	
Isokinetic Variance:	106.3	%I		Excess Air:	---	%	
Test Length:	60.00	in mins.		Gas Velocity, Vs:	51.210	fps	
Nozzle Diameter:	0.311	in inches		Volumetric Flow:	289,879	acfm	
Barometric Pressure:	24.23	in Hg		Volumetric Flow:	155,693	dscfm	
				Volumetric Flow:	174,699	scfm	

MOISTURE DETERMINATION

Initial Impinger Content:	3592.0	ml	Silica Initial Wt.	908.5	grams
Final Impinger Content:	3732.1	ml	Silica Final Wt.	912.2	grams
Impinger Difference:	140.1	ml	Silica Difference:	3.7	grams
Total Water Gain:	143.8		Moisture, Bws:	0.109	

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	10:35:00	0.56	3.40	130.314	249	75	75	5	260	260	53
1-2	10:40:00	0.53	3.20	136.270	249	76	76	5	263	262	53
1-3	10:45:00	0.47	2.90	141.630	249	76	76	5	261	261	53
	10:50:00			147.531							
2-1	10:54:00	0.57	3.50	147.531	249	77	77	5	260	260	54
2-2	10:59:00	0.52	3.20	153.700	249	77	77	5	260	260	56
2-3	11:04:00	0.48	3.00	159.720	249	78	78	5	260	260	56
	11:09:00			165.359							
3-1	11:14:00	0.57	3.50	165.359	248	79	79	5	260	261	63
3-2	11:19:00	0.50	3.10	171.560	249	79	79	5	260	261	63
3-3	11:24:00	0.49	3.00	177.250	249	79	79	5	260	260	61
	11:29:00			182.957							
4-1	11:33:00	0.55	3.40	182.957	249	81	81	5	260	260	60
4-2	11:38:00	0.51	3.10	188.820	249	81	81	5	260	260	58
4-3	11:43:00	0.46	2.80	194.830	249	83	83	5	260	260	57
	11:48:00			200.352							
Total	1:00:00			70.038		78.4	78.4				
Average			3.18		248.9	78.4		5			
Min			2.80		248.0	75.0		5			
Max			3.50		249.0	83.0		5			

Impinger Weight Sheet - Run 2B

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/23/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/23/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	749.3	736.4	12.9
0.1N H2SO4	785.0	746.2	38.8
Empty	673.7	648.0	25.7
0.1N NaOH	785.7	732.3	53.4
0.1N NaOH	738.4	729.1	9.3
Silica Gel	912.2	908.5	3.7

<u>3,732.1</u> Liquid Final	<u>3,592.0</u> Liquid Initial	<u>140.1</u> Liquid Gain
<u>912.2</u> Silica Final	<u>908.5</u> Silica Initial	<u>3.7</u> Silica Gain

Run 3B - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill On/>90% Production

Date: 1/23/24
 Start Time: 12:15
 End Time: 13:27

DRY GAS METER CONDITIONS

ΔH:	3.13	In. H ₂ O
Meter Temperature, Tm:	81.6	°F
Sqrt ΔP:	0.714	In. H ₂ O
Stack Temperature, Ts:	249.1	°F
Meter Volume, Vm:	69.607	ft ³
Meter Volume, Vmstd:	54.811	dscf
Meter Volume, Vwstd:	5.676	wscf
Isokinetic Variance:	104.3	%I
Test Length:	60.00	in mins.
Nozzle Diameter:	0.311	in inches
Barometric Pressure:	24.23	in Hg

STACK CONDITIONS

Static Pressure	-0.27	in. H ₂ O
Flue Pressure (Ps):	24.21	in. Hg. abs.
Carbon Dioxide:	16.60	%
Oxygen:	11.39	%
Nitrogen:	72.01	%
Gas Weight dry, Md:	31.112	lb/lb mole
Gas Weight wet, Ms:	29.881	lb/lb mole
Excess Air:	---	%
Gas Velocity, Vs:	50.725	fps
Volumetric Flow:	287,135	acfm
Volumetric Flow:	156,771	dscfm
Volumetric Flow:	173,004	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3596.3	ml	Silica Initial Wt.	878.4	grams
Final Impinger Content:	3708.3	ml	Silica Final Wt.	886.9	grams
Impinger Difference:	112.0	ml	Silica Difference:	8.5	grams
Total Water Gain:	120.5		Moisture, Bws:	0.094	

Port-Point No.	Clock Time	Velocity	Orifice	Actual Meter Vol. ft ³	Stack Temp °F	Meter Temp		Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
		Head Δp in. H ₂ O	ΔH in. H ₂ O			Inlet °F	Outlet °F				
1-1	12:15:00	0.55	3.40	204.321	248	82	82	4	260	260	52
1-2	12:20:00	0.52	3.20	210.380	248	82	82	4	260	260	51
1-3	12:25:00	0.48	2.90	216.290	248	83	83	4	260	260	51
	12:30:00			221.977							
2-1	12:34:00	0.57	3.50	221.977	249	82	82	4	260	261	51
2-2	12:39:00	0.51	3.10	227.900	249	82	82	4	260	259	51
2-3	12:44:00	0.46	2.80	233.640	248	81	81	4	260	260	53
	12:49:00			239.184							
3-1	12:53:00	0.55	3.40	239.184	250	82	82	4	260	260	53
3-2	12:58:00	0.49	3.00	245.170	250	81	81	4	260	259	55
3-3	13:03:00	0.48	2.90	250.830	250	81	81	4	260	260	55
	13:08:00			256.581							
4-1	13:12:00	0.54	3.30	256.581	250	81	81	4	260	260	56
4-2	13:17:00	0.51	3.10	262.620	250	81	81	4	260	260	57
4-3	13:22:00	0.47	2.90	268.400	249	81	81	4	260	260	57
	13:27:00			273.928							

Total	1:00:00			69.607		81.6	81.6				
Average			3.13		249.1	81.6		4			
Min			2.80		248.0	81.0		4			
Max			3.50		250.0	83.0		4			

Impinger Weight Sheet - Run 3B

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/23/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/23/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	746.3	730.7	15.6
0.1N H2SO4	778.9	731.2	47.7
Empty	678.6	655.6	23.0
0.1N NaOH	767.4	750.0	17.4
0.1N NaOH	737.1	728.8	8.3
Silica Gel	886.9	878.4	8.5

<u>3,708.3</u> Liquid Final	<u>3,596.3</u> Liquid Initial	<u>112.0</u> Liquid Gain
<u>886.9</u> Silica Final	<u>878.4</u> Silica Initial	<u>8.5</u> Silica Gain

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/23/24

Run 1

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN_1_028796.LAB	9:10	10.38	14.10	2.61	≤ 0.10	190.84	0.83	11.43
RUN_1_028797.LAB	9:11	10.38	14.24	2.88	≤ 0.10	190.90	0.83	11.43
RUN_1_028798.LAB	9:12	10.34	14.28	2.08	≤ 0.10	190.87	0.83	11.43
RUN_1_028799.LAB	9:13	10.31	14.33	2.23	≤ 0.10	190.89	0.83	11.43
RUN_1_028800.LAB	9:14	10.22	14.25	2.62	≤ 0.10	190.92	0.83	11.42
RUN_1_028801.LAB	9:15	10.16	13.99	2.19	≤ 0.10	190.86	0.83	11.42
RUN_1_028802.LAB	9:16	10.18	14.01	2.66	≤ 0.10	190.94	0.83	11.43
RUN_1_028803.LAB	9:17	10.23	14.26	2.21	≤ 0.10	190.94	0.83	11.44
RUN_1_028804.LAB	9:18	10.31	14.40	2.27	≤ 0.10	190.94	0.83	11.46
RUN_1_028805.LAB	9:19	10.36	14.34	2.27	≤ 0.10	190.89	0.83	11.49
RUN_1_028806.LAB	9:20	10.39	14.37	2.44	≤ 0.10	190.94	0.83	11.52
RUN_1_028807.LAB	9:21	10.36	14.44	2.34	≤ 0.10	190.94	0.83	11.56
RUN_1_028808.LAB	9:22	10.31	14.44	2.40	≤ 0.10	190.94	0.83	11.60
RUN_1_028809.LAB	9:23	10.28	14.44	2.53	≤ 0.10	190.94	0.83	11.64
RUN_1_028810.LAB	9:24	10.26	14.51	2.83	≤ 0.10	190.94	0.83	11.66
RUN_1_028811.LAB	9:25	10.23	14.62	2.90	≤ 0.10	190.99	0.83	11.69
RUN_1_028812.LAB	9:26	10.30	14.71	2.92	≤ 0.10	190.98	0.83	11.72
RUN_1_028813.LAB	9:27	10.37	14.85	2.79	≤ 0.10	190.94	0.83	11.77
RUN_1_028814.LAB	9:28	10.47	14.96	2.85	≤ 0.10	190.94	0.83	11.82
RUN_1_028815.LAB	9:29	10.57	15.00	3.00	≤ 0.10	190.94	0.83	11.88
RUN_1_028816.LAB	9:30	10.59	14.96	2.98	≤ 0.10	190.94	0.83	11.95
RUN_1_028817.LAB	9:31	10.56	14.98	2.93	≤ 0.10	190.94	0.83	12.00
RUN_1_028818.LAB	9:32	10.53	14.96	2.94	≤ 0.10	190.94	0.83	12.04
RUN_1_028819.LAB	9:33	10.31	14.94	2.53	≤ 0.10	190.94	0.83	12.07
RUN_1_028820.LAB	9:34	10.27	15.02	2.36	≤ 0.10	190.94	0.83	12.08
RUN_1_028821.LAB	9:35	10.34	14.99	2.96	≤ 0.10	190.94	0.83	12.07
RUN_1_028822.LAB	9:36	10.39	15.05	2.87	≤ 0.10	190.94	0.83	12.04
RUN_1_028823.LAB	9:37	10.40	15.08	3.04	≤ 0.10	190.94	0.83	11.99
RUN_1_028824.LAB	9:38	10.33	15.03	2.77	≤ 0.10	190.94	0.83	11.94
RUN_1_028825.LAB	9:39	10.32	14.87	2.80	≤ 0.10	190.94	0.83	11.88
RUN_1_028826.LAB	9:40	10.44	14.76	2.76	≤ 0.10	190.94	0.83	11.85
RUN_1_028827.LAB	9:41	10.42	14.79	2.44	≤ 0.10	190.94	0.83	11.83
RUN_1_028828.LAB	9:42	10.42	14.83	2.55	≤ 0.10	190.94	0.83	11.82
RUN_1_028829.LAB	9:43	10.40	14.97	2.76	≤ 0.10	190.94	0.83	11.82
RUN_1_028830.LAB	9:44	10.39	15.10	2.33	≤ 0.10	190.94	0.83	11.83
RUN_1_028831.LAB	9:45	10.46	14.95	2.73	≤ 0.10	190.94	0.83	11.85
RUN_1_028832.LAB	9:46	10.50	14.91	2.89	≤ 0.10	190.94	0.83	11.87
RUN_1_028833.LAB	9:47	10.43	14.80	2.86	≤ 0.10	190.94	0.83	11.90
RUN_1_028834.LAB	9:48	10.42	14.88	3.03	≤ 0.10	190.94	0.83	11.91
RUN_1_028835.LAB	9:49	10.35	14.86	2.80	≤ 0.10	190.94	0.83	11.93
RUN_1_028836.LAB	9:50	10.30	14.93	2.73	≤ 0.10	190.94	0.83	11.94
RUN_1_028837.LAB	9:51	10.35	15.14	2.89	≤ 0.10	190.94	0.83	11.94
RUN_1_028838.LAB	9:52	10.42	15.18	3.11	≤ 0.10	190.94	0.83	11.94
RUN_1_028839.LAB	9:53	10.39	15.05	3.09	≤ 0.10	190.94	0.83	11.93
RUN_1_028840.LAB	9:54	10.50	14.97	2.43	≤ 0.10	190.94	0.83	11.91
RUN_1_028841.LAB	9:55	10.43	14.86	2.66	≤ 0.10	190.94	0.83	11.86
RUN_1_028842.LAB	9:56	10.50	14.88	2.80	≤ 0.10	190.94	0.83	11.80
RUN_1_028843.LAB	9:57	10.56	14.94	2.78	≤ 0.10	190.94	0.83	11.75
RUN_1_028844.LAB	9:58	10.56	14.89	2.75	≤ 0.10	190.94	0.83	11.71
RUN_1_028845.LAB	9:59	10.56	14.85	2.38	≤ 0.10	190.94	0.83	11.68
RUN_1_028846.LAB	10:00	10.60	14.91	2.86	≤ 0.10	190.94	0.83	11.67
RUN_1_028847.LAB	10:01	10.70	15.07	2.92	≤ 0.10	190.94	0.83	11.68
RUN_1_028848.LAB	10:02	10.59	14.93	3.06	≤ 0.10	190.90	0.83	11.69
RUN_1_028849.LAB	10:03	10.50	14.76	2.46	≤ 0.10	190.93	0.83	11.72
RUN_1_028850.LAB	10:04	10.47	14.64	2.64	≤ 0.10	190.94	0.83	11.75
RUN_1_028851.LAB	10:05	10.30	14.45	2.60	≤ 0.10	190.92	0.83	11.78
RUN_1_028852.LAB	10:06	10.26	14.33	2.41	≤ 0.10	190.92	0.83	11.82
RUN_1_028853.LAB	10:07	10.29	14.26	2.50	≤ 0.10	190.94	0.83	11.85
RUN_1_028854.LAB	10:08	10.27	14.22	2.26	≤ 0.10	190.94	0.83	11.87
RUN_1_028855.LAB	10:09	10.30	14.24	2.37	≤ 0.10	190.94	0.83	11.87
Average		10.39	14.71	2.67	≤ 0.10	190.94	0.83	11.77

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/23/24

Run 2

Spectrum	Time	FTIR Data					Cell Temp	Pressure	Analyzer Data O2 % (dry)
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw				
RUN 2_028921.LAB	10:35	10.17	14.7	2.40	≤ 0.10	190.9	0.83	11.85	
RUN 2_028922.LAB	10:36	10.18	14.6	2.68	≤ 0.10	190.9	0.83	11.83	
RUN 2_028923.LAB	10:37	10.21	14.5	2.85	≤ 0.10	190.9	0.83	11.82	
RUN 2_028924.LAB	10:38	10.23	14.5	2.67	≤ 0.10	190.9	0.83	11.81	
RUN 2_028925.LAB	10:39	10.31	14.7	3.01	≤ 0.10	190.9	0.83	11.83	
RUN 2_028926.LAB	10:40	10.26	14.9	2.87	≤ 0.10	190.9	0.83	11.85	
RUN 2_028927.LAB	10:41	10.30	14.9	2.91	≤ 0.10	190.9	0.83	11.88	
RUN 2_028928.LAB	10:42	10.27	15.0	3.01	≤ 0.10	190.9	0.83	11.90	
RUN 2_028929.LAB	10:43	10.26	15.0	2.55	≤ 0.10	190.9	0.83	11.91	
RUN 2_028930.LAB	10:44	10.18	14.9	2.74	≤ 0.10	190.9	0.83	11.91	
RUN 2_028931.LAB	10:45	10.11	14.8	2.74	≤ 0.10	190.9	0.83	11.90	
RUN 2_028932.LAB	10:46	10.14	14.7	2.80	≤ 0.10	190.9	0.83	11.89	
RUN 2_028933.LAB	10:47	10.14	14.7	2.69	≤ 0.10	190.9	0.83	11.86	
RUN 2_028934.LAB	10:48	10.12	14.7	2.80	≤ 0.10	190.9	0.83	11.83	
RUN 2_028935.LAB	10:49	10.08	14.7	3.11	≤ 0.10	190.9	0.83	11.81	
RUN 2_028936.LAB	10:50	10.14	14.7	3.19	≤ 0.10	191.0	0.83	11.79	
RUN 2_028937.LAB	10:51	10.22	14.9	2.87	≤ 0.10	190.9	0.83	11.77	
RUN 2_028938.LAB	10:52	10.26	15.1	2.92	≤ 0.10	190.9	0.83	11.76	
RUN 2_028939.LAB	10:53	10.27	15.2	3.14	≤ 0.10	190.9	0.83	11.74	
RUN 2_028940.LAB	10:54	10.22	15.1	2.88	≤ 0.10	190.9	0.83	11.73	
RUN 2_028941.LAB	10:55	10.18	15.1	2.91	≤ 0.10	190.9	0.83	11.72	
RUN 2_028942.LAB	10:56	10.14	15.0	3.17	≤ 0.10	190.9	0.83	11.71	
RUN 2_028943.LAB	10:57	10.12	14.9	3.13	≤ 0.10	190.9	0.83	11.73	
RUN 2_028944.LAB	10:58	10.12	14.8	2.66	≤ 0.10	190.9	0.83	11.75	
RUN 2_028945.LAB	10:59	10.09	14.7	2.88	≤ 0.10	190.9	0.83	11.78	
RUN 2_028946.LAB	11:00	10.17	14.9	2.59	≤ 0.10	190.9	0.83	11.82	
RUN 2_028947.LAB	11:01	10.24	15.0	3.07	≤ 0.10	190.9	0.83	11.84	
RUN 2_028948.LAB	11:02	10.21	15.0	3.20	≤ 0.10	190.9	0.83	11.85	
RUN 2_028949.LAB	11:03	10.11	15.0	3.15	≤ 0.10	190.9	0.83	11.86	
RUN 2_028950.LAB	11:04	10.09	14.9	2.83	≤ 0.10	190.9	0.83	11.85	
RUN 2_028951.LAB	11:05	9.98	14.7	2.35	≤ 0.10	190.9	0.83	11.85	
RUN 2_028952.LAB	11:06	10.08	14.7	2.31	≤ 0.10	190.9	0.83	11.87	
RUN 2_028953.LAB	11:07	10.15	14.8	2.75	≤ 0.10	190.9	0.83	11.90	
RUN 2_028954.LAB	11:08	10.08	14.8	2.74	≤ 0.10	190.9	0.83	11.95	
RUN 2_028955.LAB	11:09	10.12	14.9	2.86	≤ 0.10	190.9	0.83	12.00	
RUN 2_028956.LAB	11:10	10.09	15.0	2.88	≤ 0.10	190.9	0.83	12.03	
RUN 2_028957.LAB	11:11	10.08	14.9	2.98	≤ 0.10	190.9	0.83	12.04	
RUN 2_028958.LAB	11:12	10.14	14.9	2.96	≤ 0.10	190.9	0.83	12.04	
RUN 2_028959.LAB	11:13	10.14	15.0	2.69	≤ 0.10	190.9	0.83	12.02	
RUN 2_028960.LAB	11:14	10.23	15.0	2.96	≤ 0.10	190.9	0.83	12.00	
RUN 2_028961.LAB	11:15	10.21	14.9	3.07	≤ 0.10	190.9	0.83	11.97	
RUN 2_028962.LAB	11:16	10.21	14.8	2.65	≤ 0.10	190.9	0.83	11.94	
RUN 2_028963.LAB	11:17	10.18	14.7	2.66	≤ 0.10	190.9	0.83	11.90	
RUN 2_028964.LAB	11:18	10.17	14.7	2.61	≤ 0.10	190.9	0.83	11.85	
RUN 2_028965.LAB	11:19	10.21	14.8	2.55	≤ 0.10	190.9	0.83	11.81	
RUN 2_028966.LAB	11:20	10.19	14.8	2.59	≤ 0.10	190.9	0.83	11.79	
RUN 2_028967.LAB	11:21	10.19	14.7	2.90	≤ 0.10	190.9	0.83	11.79	
RUN 2_028968.LAB	11:22	10.17	14.5	2.33	≤ 0.10	190.9	0.83	11.81	
RUN 2_028969.LAB	11:23	10.18	14.5	2.34	≤ 0.10	190.9	0.83	11.82	
RUN 2_028970.LAB	11:24	10.26	14.5	2.54	≤ 0.10	190.9	0.83	11.84	
RUN 2_028971.LAB	11:25	10.31	14.6	2.72	≤ 0.10	190.9	0.83	11.85	
RUN 2_028972.LAB	11:26	10.26	14.7	3.07	≤ 0.10	190.9	0.83	11.85	
RUN 2_028973.LAB	11:27	10.23	14.7	2.93	≤ 0.10	190.9	0.83	11.85	
RUN 2_028974.LAB	11:28	10.37	14.8	2.72	≤ 0.10	190.9	0.83	11.85	
RUN 2_028975.LAB	11:29	10.42	14.9	3.14	≤ 0.10	190.9	0.83	11.85	
RUN 2_028976.LAB	11:30	10.36	14.8	2.78	≤ 0.10	190.9	0.83	11.84	
RUN 2_028977.LAB	11:31	10.39	14.7	2.47	≤ 0.10	190.9	0.83	11.85	
RUN 2_028978.LAB	11:32	10.36	14.8	2.72	≤ 0.10	190.9	0.83	11.87	
RUN 2_028979.LAB	11:33	10.35	14.9	2.82	≤ 0.10	190.9	0.83	11.91	
RUN 2_028980.LAB	11:34	10.30	14.8	3.01	≤ 0.10	190.9	0.83	11.96	
Average		10.20	14.82	2.80	≤ 0.10	190.94	0.83	11.86	

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/23/24

Run 3

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN 3_029114.LAB	12:15	10.62	15.3	3.27	≤ 0.10	190.85	0.83	10.95
RUN 3_029115.LAB	12:16	10.79	15.1	3.18	≤ 0.10	190.91	0.83	11.23
RUN 3_029116.LAB	12:17	10.41	14.5	2.95	≤ 0.10	190.94	0.83	11.60
RUN 3_029117.LAB	12:18	10.21	14.7	2.85	≤ 0.10	190.95	0.83	11.33
RUN 3_029118.LAB	12:19	10.39	15.3	3.18	≤ 0.10	190.95	0.83	10.96
RUN 3_029119.LAB	12:20	10.38	14.9	2.98	≤ 0.10	190.94	0.83	11.35
RUN 3_029120.LAB	12:21	10.39	14.7	3.02	≤ 0.10	190.94	0.83	11.47
RUN 3_029121.LAB	12:22	10.49	14.6	2.81	≤ 0.10	190.98	0.83	11.46
RUN 3_029122.LAB	12:23	10.58	14.6	2.90	≤ 0.10	191.01	0.83	11.57
RUN 3_029123.LAB	12:24	10.54	14.7	2.82	≤ 0.10	191.00	0.83	11.23
RUN 3_029124.LAB	12:25	10.74	15.3	3.55	≤ 0.10	191.00	0.83	10.77
RUN 3_029125.LAB	12:26	10.76	15.2	3.22	≤ 0.10	190.95	0.83	11.08
RUN 3_029126.LAB	12:27	10.86	14.5	2.67	≤ 0.10	190.99	0.83	11.52
RUN 3_029127.LAB	12:28	10.60	14.6	2.81	≤ 0.10	191.05	0.83	11.47
RUN 3_029128.LAB	12:29	10.56	14.9	2.90	≤ 0.10	191.05	0.83	11.24
RUN 3_029129.LAB	12:30	10.73	14.9	2.79	≤ 0.10	191.07	0.83	11.27
RUN 3_029130.LAB	12:31	10.53	14.8	2.86	≤ 0.10	191.06	0.83	11.40
RUN 3_029131.LAB	12:32	10.30	14.7	2.89	≤ 0.10	191.04	0.83	11.41
RUN 3_029132.LAB	12:33	10.61	15.0	3.12	≤ 0.10	190.95	0.83	11.10
RUN 3_029133.LAB	12:34	10.64	14.9	2.99	≤ 0.10	190.94	0.83	11.22
RUN 3_029134.LAB	12:35	10.69	14.8	2.87	≤ 0.10	190.95	0.83	11.35
RUN 3_029135.LAB	12:36	10.60	14.8	2.74	≤ 0.10	191.02	0.83	11.37
RUN 3_029136.LAB	12:37	10.34	14.7	2.80	≤ 0.10	190.97	0.83	11.41
RUN 3_029137.LAB	12:38	10.52	15.1	2.97	≤ 0.10	190.95	0.83	11.16
RUN 3_029138.LAB	12:39	10.29	14.7	2.77	≤ 0.10	190.97	0.83	11.46
RUN 3_029139.LAB	12:40	10.54	14.7	2.79	≤ 0.10	190.98	0.83	11.51
RUN 3_029140.LAB	12:41	10.79	14.8	2.81	≤ 0.10	190.97	0.83	11.41
RUN 3_029141.LAB	12:42	10.89	15.2	2.88	≤ 0.10	190.96	0.83	11.09
RUN 3_029142.LAB	12:43	10.64	14.9	2.84	≤ 0.10	190.97	0.83	11.25
RUN 3_029143.LAB	12:44	10.48	14.7	2.67	≤ 0.10	190.99	0.83	11.39
RUN 3_029144.LAB	12:45	10.59	14.8	2.94	≤ 0.10	191.00	0.83	11.37
RUN 3_029145.LAB	12:46	10.64	14.8	2.78	≤ 0.10	191.00	0.83	11.38
RUN 3_029146.LAB	12:47	10.72	14.8	2.80	≤ 0.10	190.97	0.83	11.41
RUN 3_029147.LAB	12:48	10.74	15.1	2.86	≤ 0.10	190.98	0.83	11.17
RUN 3_029148.LAB	12:49	10.55	14.8	2.79	≤ 0.10	191.03	0.83	11.29
RUN 3_029149.LAB	12:50	10.41	14.8	2.82	≤ 0.10	191.01	0.83	11.46
RUN 3_029150.LAB	12:51	10.38	15.0	3.10	≤ 0.10	191.02	0.83	11.28
RUN 3_029151.LAB	12:52	10.36	14.9	2.83	≤ 0.10	190.96	0.83	11.34
RUN 3_029152.LAB	12:53	10.64	15.1	2.99	≤ 0.10	190.95	0.83	11.19
RUN 3_029153.LAB	12:54	10.63	15.0	2.95	≤ 0.10	190.95	0.83	11.17
RUN 3_029154.LAB	12:55	10.63	14.8	2.69	≤ 0.10	190.96	0.83	11.29
RUN 3_029155.LAB	12:56	10.43	14.6	2.65	≤ 0.10	190.96	0.83	11.51
RUN 3_029156.LAB	12:57	10.44	14.7	2.64	≤ 0.10	190.95	0.83	11.50
RUN 3_029157.LAB	12:58	10.36	15.0	2.95	≤ 0.10	191.00	0.83	11.23
RUN 3_029158.LAB	12:59	10.32	14.9	2.94	≤ 0.10	191.05	0.83	11.31
RUN 3_029159.LAB	13:00	10.46	14.9	2.78	≤ 0.10	191.07	0.83	11.34
RUN 3_029160.LAB	13:01	10.63	15.0	2.90	≤ 0.10	191.06	0.83	11.23
RUN 3_029161.LAB	13:02	10.46	14.8	2.83	≤ 0.10	191.04	0.83	11.23
RUN 3_029162.LAB	13:03	10.36	14.3	2.68	≤ 0.10	191.00	0.83	11.73
RUN 3_029163.LAB	13:04	10.57	15.0	2.91	≤ 0.10	190.99	0.83	11.38
RUN 3_029164.LAB	13:05	10.41	14.8	2.73	≤ 0.10	190.97	0.83	11.30
RUN 3_029165.LAB	13:06	10.53	15.1	2.85	≤ 0.10	190.96	0.83	11.29
RUN 3_029166.LAB	13:07	10.70	14.8	2.75	≤ 0.10	190.94	0.83	11.14
RUN 3_029167.LAB	13:08	10.65	14.2	2.61	≤ 0.10	190.95	0.83	11.76
RUN 3_029168.LAB	13:09	10.62	14.7	2.86	≤ 0.10	190.94	0.83	11.68
RUN 3_029169.LAB	13:10	10.57	15.0	2.99	≤ 0.10	190.95	0.83	11.35
RUN 3_029170.LAB	13:11	10.43	14.7	2.78	≤ 0.10	190.94	0.83	11.50
RUN 3_029171.LAB	13:12	10.72	14.8	2.86	≤ 0.10	190.94	0.83	11.37
RUN 3_029172.LAB	13:13	10.67	14.9	2.92	≤ 0.10	190.94	0.83	11.39
RUN 3_029173.LAB	13:14	10.67	14.8	2.76	≤ 0.10	190.94	0.83	11.35
Average		10.55	14.84	2.88	≤ 0.10	190.98	0.83	11.33

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Test Method: 26A
Test Engineer: PPP
Test Technician: EC

	<u>Run 1A</u>	<u>Run 2A</u>	<u>Run 3A</u>
Temp ID:	CM23	CM23	CM23
Meter ID:	CM23	CM23	CM23
Pitot ID:	S8-058-A	S8-058-A	S8-058-A
Nozzle Diameter (Inches):	0.319	0.319	0.319
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:	Glass #39/ 953	Glass #39/ 954	Glass #39/ 955

Leak Checks

Pre Pitot Leak Check	0.0	@	3.3	"H ₂ O	0.0	@	3.2	"H ₂ O	0.0	@	3.4	"H ₂ O
Post Pitot Leak Check	0.0	@	3.4	"H ₂ O	0.0	@	3.3	"H ₂ O	0.0	@	3.3	"H ₂ O
Pre Nozzle Leak Check	0.0000	@	12	"Hg	0.0150	@	14	"Hg	0.0010	@	13	"Hg
Post Nozzle Leak Check	0.0000	@	12	"Hg	0.0000	@	12	"Hg	0.0000	@	11	"Hg

Pitot Tube Coefficient: 0.834
Probe Length (Feet): 8.0
Probe Liner Material: Glass
Sample Plane: Horizontal
Port Length (Inches): 12.00
Port Size (Diameter, Inches): 6.00
Port Type: Flange
Duct Shape: Circular
Diameter (Feet): 10.96
Duct Area (Square Feet): 94.343
Upstream Diameters: 2.5
Downstream Diameters: 10.9
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
Moisture Balance ID: S10-26
of Runs 3

Run 1A - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/24/24
 Start Time: 11:00
 End Time: 12:15

DRY GAS METER CONDITIONS

STACK CONDITIONS

ΔH: 3.51 in. H₂O
 Meter Temperature, Tm: 79.0 °F
 Sqrt ΔP: 0.754 in. H₂O
 Stack Temperature, Ts: 321.4 °F
 Meter Volume, Vm: 70.494 ft³
 Meter Volume, Vmstd: 56.812 dscf
 Meter Volume, Vwstd: 4.437 wscf
 Isokinetic Variance: 100.7 %I
 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.319 in inches
 Barometric Pressure: 24.38 in Hg

Static Pressure -0.40 in. H₂O
 Flue Pressure (Ps): 24.35 in. Hg. abs.
 Carbon Dioxide: 16.79 %
 Oxygen: 11.19 %
 Nitrogen: 72.02 %
 Gas Weight dry, Md: 31.134 lb/lb mole
 Gas Weight wet, Ms: 30.183 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 55.412 fps
 Volumetric Flow: 313,664 acfm
 Volumetric Flow: 159,994 dscfm
 Volumetric Flow: 172,489 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3598.4 ml Silica Initial Wt. 917.7 grams
 Final Impinger Content: 3688.9 ml Silica Final Wt. 921.4 grams
 Impinger Difference: 90.5 ml Silica Difference: 3.7 grams
 Total Water Gain: 94.2 Moisture, Bws: 0.072

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	11:00:00	0.60	3.70	335.997	312	76	71	6	261	261	54
1-2	11:05:00	0.57	3.50	342.130	314	78	72	6	262	258	52
1-3	11:10:00	0.55	3.40	347.950	316	79	73	6	262	258	55
	11:15:00			353.652							
2-1	11:20:00	0.59	3.70	353.652	320	82	74	6	259	260	57
2-2	11:25:00	0.56	3.50	359.870	321	83	75	6	259	260	58
2-3	11:30:00	0.54	3.30	365.540	322	83	75	6	259	259	59
	11:35:00			371.193							
3-1	11:40:00	0.60	3.70	371.193	324	84	75	6	261	259	62
3-2	11:45:00	0.56	3.50	377.350	325	84	76	6	260	260	63
3-3	11:50:00	0.54	3.30	383.140	327	85	76	6	260	261	64
	11:55:00			388.781							
4-1	12:00:00	0.60	3.70	388.781	325	88	77	6	260	259	64
4-2	12:05:00	0.57	3.50	394.930	325	87	77	6	260	259	65
4-3	12:10:00	0.54	3.30	400.800	326	88	77	6	260	260	65
	12:15:00			406.491							

Total 1:00:00 70.494 83.1 74.8
 Average 3.51 321.4 79.0 6
 Min 3.30 312.0 71.0 6
 Max 3.70 327.0 88.0 6

Impinger Weight Sheet - Run 1A

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/24/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/24/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	765.5	739.1	26.4
0.1N H2SO4	778.3	736.4	41.9
Empty	663.5	650.5	13.0
0.1N NaOH	743.1	734.6	8.5
0.1N NaOH	738.5	737.8	0.7
Silica Gel	921.4	917.7	3.7

<u>3,688.9</u>	<u>3,598.4</u>	<u>90.5</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>921.4</u>	<u>917.7</u>	<u>3.7</u>
Silica Final	Silica Initial	Silica Gain

Run 2A - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/24/24
 Start Time: 12:30
 End Time: 13:45

DRY GAS METER CONDITIONS				STACK CONDITIONS			
ΔH:	3.57	In. H ₂ O		Static Pressure	-0.40	in. H ₂ O	
Meter Temperature, Tm:	92.4	°F		Flue Pressure (Ps):	24.35	in. Hg. abs.	
Sqrt ΔP:	0.756	In. H ₂ O		Carbon Dioxide:	16.95	%	
Stack Temperature, Ts:	333.7	°F		Oxygen:	11.11	%	
Meter Volume, Vm:	72.031	ft ³		Nitrogen:	71.9	%	
Meter Volume, Vmstd:	56.650	dscf		Gas Weight dry, Md:	31.156	lb/lb mole	
Meter Volume, Vwstd:	4.729	wscf		Gas Weight wet, Ms:	30.143	lb/lb mole	
Isokinetic Variance:	101.2	%I		Excess Air:	---	%	
Test Length:	60.00	in mins.		Gas Velocity, Vs:	56.083	fps	
Nozzle Diameter:	0.319	in inches		Volumetric Flow:	317,461	acfm	
Barometric Pressure:	24.38	in Hg		Volumetric Flow:	158,641	dscfm	
				Volumetric Flow:	171,883	scfm	

MOISTURE DETERMINATION

Initial Impinger Content:	3578.6	ml	Silica Initial Wt.	890.0	grams
Final Impinger Content:	3674.8	ml	Silica Final Wt.	894.2	grams
Impinger Difference:	96.2	ml	Silica Difference:	4.2	grams
Total Water Gain:	100.4		Moisture, Bws:	0.077	

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:30:00	0.60	3.70	408.014	332	91	86	5	262	262	58
1-2	12:35:00	0.57	3.60	414.340	332	92	86	5	262	261	56
1-3	12:40:00	0.54	3.30	420.240	333	94	87	5	262	260	57
	12:45:00			425.897							
2-1	12:50:00	0.61	3.80	425.897	333	95	88	5	260	261	58
2-2	12:55:00	0.58	3.60	432.350	334	96	88	5	260	260	58
2-3	13:00:00	0.55	3.40	438.240	334	96	88	5	260	260	57
	13:05:00			444.022							
3-1	13:10:00	0.60	3.70	444.022	334	97	89	5	260	261	59
3-2	13:15:00	0.56	3.50	450.360	334	97	89	5	260	259	57
3-3	13:20:00	0.54	3.40	456.230	334	98	90	5	260	259	57
	13:25:00			461.964							
4-1	13:30:00	0.61	3.80	461.964	334	99	90	5	260	260	55
4-2	13:35:00	0.57	3.60	468.340	335	100	90	5	261	258	55
4-3	13:40:00	0.54	3.40	474.260	335	100	91	5	260	259	54
	13:45:00			480.045							

Total	1:00:00			72.031		96.3	88.5				
Average			3.57		333.7	92.4		5			
Min			3.30		332.0	86.0		5			
Max			3.80		335.0	100.0		5			

Impinger Weight Sheet - Run 2A

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/24/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/24/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	763.9	725.1	38.8
0.1N H2SO4	766.4	729.2	37.2
Empty	667.0	656.3	10.7
0.1N NaOH	753.5	747.7	5.8
0.1N NaOH	724.0	720.3	3.7
Silica Gel	894.2	890.0	4.2

<u>3,674.8</u> Liquid Final	<u>3,578.6</u> Liquid Initial	<u>96.2</u> Liquid Gain
<u>894.2</u> Silica Final	<u>890.0</u> Silica Initial	<u>4.2</u> Silica Gain

Run 3A - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill Off

Date: 1/24/24
 Start Time: 14:00
 End Time: 15:15

DRY GAS METER CONDITIONS				STACK CONDITIONS			
ΔH:	3.47	In. H ₂ O		Static Pressure	-0.40	in. H ₂ O	
Meter Temperature, Tm:	78.9	°F		Flue Pressure (Ps):	24.35	in. Hg. abs.	
Sqrt ΔP:	0.758	In. H ₂ O		Carbon Dioxide:	16.95	%	
Stack Temperature, Ts:	336.8	°F		Oxygen:	11.10	%	
Meter Volume, Vm:	70.178	ft ³		Nitrogen:	71.95	%	
Meter Volume, Vmstd:	56.554	dscf		Gas Weight dry, Md:	31.156	lb/lb mole	
Meter Volume, Vwstd:	5.228	wscf		Gas Weight wet, Ms:	30.043	lb/lb mole	
Isokinetic Variance:	101.8	%I		Excess Air:	---	%	
Test Length:	60.00	in mins.		Gas Velocity, Vs:	56.368	fps	
Nozzle Diameter:	0.319	in inches		Volumetric Flow:	319,076	acfm	
Barometric Pressure:	24.38	in Hg		Volumetric Flow:	157,526	dscfm	
				Volumetric Flow:	172,089	scfm	

MOISTURE DETERMINATION

Initial Impinger Content:	3578.4	ml	Silica Initial Wt.	898.8	grams
Final Impinger Content:	3670.0	ml	Silica Final Wt.	918.2	grams
Impinger Difference:	91.6	ml	Silica Difference:	19.4	grams
Total Water Gain:	111.0		Moisture, Bws:	0.085	

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	14:00:00	0.60	3.70	482.212	336	80	81	6	262	259	55
1-2	14:05:00	0.57	3.40	488.340	336	81	80	6	260	263	55
1-3	14:10:00	0.55	3.30	494.230	337	80	79	6	260	261	56
	14:15:00			499.791							
2-1	14:20:00	0.61	3.70	499.791	336	80	78	6	260	264	59
2-2	14:25:00	0.58	3.50	505.930	336	80	79	6	260	260	58
2-3	14:30:00	0.55	3.30	511.840	336	80	78	6	259	260	57
	14:35:00			517.456							
3-1	14:40:00	0.60	3.60	517.456	337	80	77	6	260	258	57
3-2	14:45:00	0.58	3.50	523.640	337	80	77	6	259	261	57
3-3	14:50:00	0.54	3.20	529.320	337	80	77	6	259	263	57
	14:55:00			534.965							
4-1	15:00:00	0.61	3.70	534.965	337	80	76	6	260	258	56
4-2	15:05:00	0.56	3.40	541.130	338	80	75	6	260	257	57
4-3	15:10:00	0.54	3.30	546.820	338	80	76	6	261	259	57
	15:15:00			552.390							
Total	1:00:00			70.178		80.1	77.8				
Average			3.47		336.8	78.9		6			
Min			3.20		336.0	75.0		6			
Max			3.70		338.0	81.0		6			

Impinger Weight Sheet - Run 3A

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/24/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/4/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	772.9	738.8	34.1
0.1N H2SO4	770.2	735.5	34.7
Empty	656.7	645.1	11.6
0.1N NaOH	739.1	728.7	10.4
0.1N NaOH	731.1	730.3	0.8
Silica Gel	918.2	898.8	19.4

<u>3,670.0</u> Liquid Final	<u>3,578.4</u> Liquid Initial	<u>91.6</u> Liquid Gain
<u>918.2</u> Silica Final	<u>898.8</u> Silica Initial	<u>19.4</u> Silica Gain

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Test Method: 26A
Test Engineer: NL
Test Technician: EC

	<u>Run 1B</u>	<u>Run 2B</u>	<u>Run 3B</u>
Temp ID:	CM54	CM54	CM54
Meter ID:	CM54	CM54	CM54
Pitot ID:	S-59-B	S-59-B	S-59-B
Nozzle Diameter (Inches):	0.311	0.311	0.311
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 #38	Glass #38	Glass #38

Leak Checks

Pre Pitot Leak Check	0.0	@	3.0	"H ₂ O	0.0	@	3.4	"H ₂ O	0.0	@	3.9	"H ₂ O
Post Pitot Leak Check	0.0	@	3.4	"H ₂ O	0.0	@	3.9	"H ₂ O	0.0	@	3.2	"H ₂ O
Pre Nozzle Leak Check	0.0000	@	13	"Hg	0.0000	@	12	"Hg	0.0000	@	13	"Hg
Post Nozzle Leak Check	0.0000	@	10	"Hg	0.0000	@	9	"Hg	0.0000	@	8	"Hg

Pitot Tube Coefficient: 0.839
 Probe Length (Feet): 8.0
 Probe Liner Material: Glass
 Sample Plane: Horizontal
 Port Length (Inches): 12.00
 Port Size (Diameter, Inches): 6.00
 Port Type: Flange
 Duct Shape: Circular
 Diameter (Feet): 10.96
 Duct Area (Square Feet): 94.343
 Upstream Diameters: 2.5
 Downstream Diameters: 10.9
 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
 Moisture Balance ID: S10-26
 # of Runs: 3

Run 1B - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill off

Date: 1/24/24
 Start Time: 11:00
 End Time: 12:15

DRY GAS METER CONDITIONS

STACK CONDITIONS

ΔH: 2.98 in. H₂O
 Meter Temperature, Tm: 69.0 °F
 Sqrt ΔP: 0.745 in. H₂O
 Stack Temperature, Ts: 315.7 °F
 Meter Volume, Vm: 67.674 ft³
 Meter Volume, Vmstd: 54.532 dscf
 Meter Volume, Vwstd: 4.437 wscf
 Isokinetic Variance: 102.4 %I
 Test Length: 60.00 in mins.
 Nozzle Diameter: 0.311 in inches
 Barometric Pressure: 24.23 in Hg

Static Pressure -0.27 in. H₂O
 Flue Pressure (Ps): 24.21 in. Hg. abs.
 Carbon Dioxide: 16.79 %
 Oxygen: 11.19 %
 Nitrogen: 72.02 %
 Gas Weight dry, Md: 31.134 lb/lb mole
 Gas Weight wet, Ms: 30.146 lb/lb mole
 Excess Air: --- %
 Gas Velocity, Vs: 55.106 fps
 Volumetric Flow: 311,933 acfm
 Volumetric Flow: 158,885 dscfm
 Volumetric Flow: 171,812 scfm

MOISTURE DETERMINATION

Initial Impinger Content: 3598.4 ml Silica Initial Wt. 917.7 grams
 Final Impinger Content: 3688.9 ml Silica Final Wt. 921.4 grams
 Impinger Difference: 90.5 ml Silica Difference: 3.7 grams
 Total Water Gain: 94.2 Moisture, Bws: 0.075

Port- Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	11:00:00	0.61	3.30	395.346	308	69	69	5	265	260	49
1-2	11:05:00	0.57	3.10	401.370	311	69	69	4	265	260	48
1-3	11:10:00	0.53	2.80	407.150	311	69	69	4	263	260	48
	11:15:00			412.613							
2-1	11:20:00	0.58	3.10	412.613	313	69	69	4	263	260	45
2-2	11:25:00	0.55	2.90	418.310	315	69	69	4	262	262	45
2-3	11:30:00	0.52	2.80	423.790	315	69	69	4	262	262	43
	11:35:00			429.058							
3-1	11:40:00	0.59	3.20	429.058	317	69	69	4	260	261	44
3-2	11:45:00	0.54	2.90	435.010	317	69	69	4	260	261	45
3-3	11:50:00	0.53	2.80	440.680	318	69	69	4	260	260	45
	11:55:00			446.297							
4-1	12:00:00	0.60	3.20	446.297	320	69	69	5	260	261	48
4-2	12:05:00	0.54	2.90	452.220	321	69	69	4	260	261	48
4-3	12:10:00	0.51	2.70	457.660	322	69	69	4	260	260	50
	12:15:00			463.020							

Total 1:00:00 67.674 69.0 69.0
 Average 2.98 315.7 69 4
 Min 2.70 308.0 69.0 4
 Max 3.30 322.0 69.0 5

Impinger Weight Sheet - Run 1B

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/24/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/24/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	765.5	739.1	26.4
0.1N H2SO4	778.3	736.4	41.9
Empty	663.5	650.5	13.0
0.1N NaOH	743.1	734.6	8.5
0.1N NaOH	738.5	737.8	0.7
Silica Gel	921.4	917.7	3.7

<u>3,688.9</u> Liquid Final	<u>3,598.4</u> Liquid Initial	<u>90.5</u> Liquid Gain
<u>921.4</u> Silica Final	<u>917.7</u> Silica Initial	<u>3.7</u> Silica Gain

Run 2B - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill off

Date: 1/24/24
 Start Time: 12:30
 End Time: 13:45

DRY GAS METER CONDITIONS				STACK CONDITIONS		
ΔH:	2.94	In. H ₂ O		Static Pressure	-0.27	in. H ₂ O
Meter Temperature, Tm:	79.0	°F		Flue Pressure (Ps):	24.21	in. Hg. abs.
Sqrt ΔP:	0.742	In. H ₂ O		Carbon Dioxide:	16.95	%
Stack Temperature, Ts:	332.0	°F		Oxygen:	11.11	%
Meter Volume, Vm:	67.421	ft ³		Nitrogen:	71.9	%
Meter Volume, Vmstd:	53.315	dscf		Gas Weight dry, Md:	31.156	lb/lb mole
Meter Volume, Vwstd:	3.693	wscf		Gas Weight wet, Ms:	30.304	lb/lb mole
Isokinetic Variance:	100.7	%I		Excess Air:	---	%
Test Length:	60.00	in mins.		Gas Velocity, Vs:	55.288	fps
Nozzle Diameter:	0.311	in inches		Volumetric Flow:	312,962	acfm
Barometric Pressure:	24.23	in Hg		Volumetric Flow:	157,888	dscfm
				Volumetric Flow:	168,824	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3663.0	ml	Silica Initial Wt.	912.6	grams
Final Impinger Content:	3736.5	ml	Silica Final Wt.	917.5	grams
Impinger Difference:	73.5	ml	Silica Difference:	4.9	grams
Total Water Gain:	78.4		Moisture, Bws:	0.065	

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	12:30:00	0.58	3.10	163.650	329	76	76	4	261	260	50
1-2	12:35:00	0.54	2.90	169.670	329	77	77	4	260	260	49
1-3	12:40:00	0.50	2.70	174.730	330	77	77	4	260	261	49
	12:45:00			180.275							
2-1	12:50:00	0.57	3.00	180.275	332	79	79	4	260	260	49
2-2	12:55:00	0.54	2.90	186.020	332	79	79	4	260	260	50
2-3	13:00:00	0.51	2.70	191.550	333	80	80	4	260	260	50
	13:05:00			196.859							
3-1	13:10:00	0.60	3.20	196.859	333	80	80	4	260	261	50
3-2	13:15:00	0.56	3.00	202.750	333	80	80	4	260	261	50
3-3	13:20:00	0.53	2.80	208.410	333	80	80	4	260	261	50
	13:25:00			213.995							
4-1	13:30:00	0.60	3.30	213.995	333	80	80	4	260	260	50
4-2	13:35:00	0.55	2.90	219.920	333	80	80	4	262	260	50
4-3	13:40:00	0.53	2.80	225.510	334	80	80	4	262	260	50
	13:45:00			231.071							

Total	1:00:00			67.421		79.0	79.0				
Average			2.94		332.0	79.0		4			
Min			2.70		329.0	76.0		4			
Max			3.30		334.0	80.0		4			

Impinger Weight Sheet - Run 2B

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/24/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/24/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	813.1	773.3	39.8
0.1N H2SO4	794.8	768.8	26.0
Empty	660.4	654.8	5.6
0.1N NaOH	734.6	732.9	1.7
0.1N NaOH	733.6	733.2	0.4
Silica Gel	917.5	912.6	4.9

<u>3,736.5</u>	<u>3,663.0</u>	<u>73.5</u>
Liquid Final	Liquid Initial	Liquid Gain
<u>917.5</u>	<u>912.6</u>	<u>4.9</u>
Silica Final	Silica Initial	Silica Gain

Run 3B - Method 26A

Client: Holcim Cement (US) Inc.
 Facility: Devil's Slide Cement Plant
 Test Location: Main Kiln Stack
 Source Condition: Mill off

Date: 1/24/24
 Start Time: 14:00
 End Time: 15:15

DRY GAS METER CONDITIONS				STACK CONDITIONS			
ΔH:	2.96	In. H ₂ O		Static Pressure	-0.27	in. H ₂ O	
Meter Temperature, Tm:	69.0	°F		Flue Pressure (Ps):	24.21	in. Hg. abs.	
Sqrt ΔP:	0.742	In. H ₂ O		Carbon Dioxide:	16.95	%	
Stack Temperature, Ts:	333.9	°F		Oxygen:	11.10	%	
Meter Volume, Vm:	67.390	ft ³		Nitrogen:	71.95	%	
Meter Volume, Vmstd:	54.300	dscf		Gas Weight dry, Md:	31.156	lb/lb mole	
Meter Volume, Vwstd:	5.365	wscf		Gas Weight wet, Ms:	29.973	lb/lb mole	
Isokinetic Variance:	104.9	%I		Excess Air:	---	%	
Test Length:	60.00	in mins.		Gas Velocity, Vs:	55.700	fps	
Nozzle Diameter:	0.311	in inches		Volumetric Flow:	315,298	acfm	
Barometric Pressure:	24.23	in Hg		Volumetric Flow:	154,418	dscfm	
				Volumetric Flow:	169,674	scfm	

MOISTURE DETERMINATION

Initial Impinger Content:	3645.5	ml	Silica Initial Wt.	908.6	grams
Final Impinger Content:	3747.4	ml	Silica Final Wt.	920.6	grams
Impinger Difference:	101.9	ml	Silica Difference:	12.0	grams
Total Water Gain:	113.9		Moisture, Bws:	0.090	

Port-Point No.	Clock Time	Velocity	Orifice	Actual	Stack	Meter Temp		Pump	Probe	Filter	Impinger
		Head Δp in. H ₂ O	ΔH in. H ₂ O	Meter Vol. ft ³	Temp °F	Inlet °F	Outlet °F	Vacuum "Hg	Temp °F	Exit Temp °F	Exit Temp °F
1-1	14:00:00	0.57	3.00	232.675	333	70	70	4	266	262	53
1-2	14:05:00	0.54	2.90	238.490	334	70	70	4	263	262	52
1-3	14:10:00	0.52	2.80	243.990	334	70	70	4	261	260	52
	14:15:00			249.271							
2-1	14:20:00	0.61	3.30	249.271	334	69	69	5	260	261	51
2-2	14:25:00	0.56	3.00	255.370	334	69	69	4	260	261	49
2-3	14:30:00	0.53	2.80	260.880	334	70	70	4	260	260	49
	14:35:00			266.311							
3-1	14:40:00	0.59	3.20	266.311	334	68	68	4	260	261	46
3-2	14:45:00	0.54	2.90	272.190	334	68	68	4	260	261	46
3-3	14:50:00	0.50	2.70	277.620	334	68	68	4	260	261	48
	14:55:00			283.056							
4-1	15:00:00	0.59	3.20	283.056	334	68	68	4	260	261	48
4-2	15:05:00	0.55	2.90	288.740	334	69	69	4	260	260	48
4-3	15:10:00	0.52	2.80	294.650	334	69	69	4	260	260	49
	15:15:00			300.065							

Total	1:00:00			67.390		69.0	69.0				
Average			2.96		333.9	69.0		4			
Min			2.70		333.0	68.0		4			
Max			3.30		334.0	70.0		5			

Impinger Weight Sheet - Run 3B

Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Test Location: Main Kiln Stack
Project #: M234611
Date: 1/24/2024
Test Method: 26A
Weighed/Measured By: EE
Balance ID: S10-26

Scale Calibration Check Date: 1/24/2024
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>
200	<u>200.0</u>
500	<u>500.0</u>
700	<u>700.0</u>

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	796.8	773.5	23.3
0.1N H2SO4	810.6	758.4	52.2
Empty	668.7	655.3	13.4
0.1N NaOH	740.0	728.0	12.0
0.1N NaOH	731.3	730.3	1.0
Silica Gel	920.6	908.6	12.0

<u>3,747.4</u> Liquid Final	<u>3,645.5</u> Liquid Initial	<u>101.9</u> Liquid Gain
<u>920.6</u> Silica Final	<u>908.6</u> Silica Initial	<u>12.0</u> Silica Gain

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/24/24

Run 1

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN_1_029889.LAB	11:00	8.66	15.36	2.88	≤ 0.10	190.94	0.84	11.19
RUN_1_029890.LAB	11:01	8.64	15.32	2.67	≤ 0.10	190.95	0.84	11.04
RUN_1_029891.LAB	11:02	8.66	15.34	2.82	≤ 0.10	191.00	0.84	11.08
RUN_1_029892.LAB	11:03	8.68	14.89	2.47	≤ 0.10	191.05	0.84	11.07
RUN_1_029893.LAB	11:04	8.48	14.86	2.56	≤ 0.10	191.02	0.84	11.42
RUN_1_029894.LAB	11:05	8.36	14.77	2.60	≤ 0.10	191.02	0.84	11.56
RUN_1_029895.LAB	11:06	8.69	15.91	3.17	≤ 0.10	191.08	0.84	11.61
RUN_1_029896.LAB	11:07	8.76	15.90	3.28	≤ 0.10	191.04	0.84	10.75
RUN_1_029897.LAB	11:08	8.61	15.28	2.53	≤ 0.10	191.06	0.84	10.65
RUN_1_029898.LAB	11:09	8.53	15.06	2.65	≤ 0.10	191.07	0.84	11.16
RUN_1_029899.LAB	11:10	8.71	15.72	3.02	≤ 0.10	191.07	0.84	11.31
RUN_1_029900.LAB	11:11	8.71	15.67	3.05	≤ 0.10	191.10	0.84	10.87
RUN_1_029901.LAB	11:12	8.55	15.02	2.67	≤ 0.10	191.06	0.84	10.85
RUN_1_029902.LAB	11:13	8.65	15.02	2.72	≤ 0.10	191.07	0.84	11.20
RUN_1_029903.LAB	11:14	8.65	15.37	2.94	≤ 0.10	191.06	0.84	11.38
RUN_1_029904.LAB	11:15	8.58	15.29	2.65	≤ 0.10	191.08	0.84	11.12
RUN_1_029905.LAB	11:16	8.67	15.62	2.94	≤ 0.10	191.08	0.84	11.12
RUN_1_029906.LAB	11:17	8.55	15.00	2.82	≤ 0.10	191.14	0.84	10.95
RUN_1_029907.LAB	11:18	8.50	14.83	2.70	≤ 0.10	191.15	0.84	11.22
RUN_1_029908.LAB	11:19	8.63	15.60	2.97	≤ 0.10	191.15	0.84	11.53
RUN_1_029909.LAB	11:20	8.70	15.73	3.08	≤ 0.10	191.16	0.84	11.08
RUN_1_029910.LAB	11:21	8.68	15.34	2.81	≤ 0.10	191.14	0.84	10.84
RUN_1_029911.LAB	11:22	8.52	15.03	2.70	≤ 0.10	191.14	0.84	11.04
RUN_1_029912.LAB	11:23	8.55	15.20	2.76	≤ 0.10	191.14	0.84	11.31
RUN_1_029913.LAB	11:24	8.63	15.63	3.00	≤ 0.10	191.15	0.84	11.25
RUN_1_029914.LAB	11:25	8.65	15.53	3.33	≤ 0.10	191.14	0.84	11.04
RUN_1_029915.LAB	11:26	8.62	15.20	2.83	≤ 0.10	191.14	0.84	10.79
RUN_1_029916.LAB	11:27	8.46	14.59	2.56	≤ 0.10	191.13	0.84	11.04
RUN_1_029917.LAB	11:28	8.48	15.07	2.80	≤ 0.10	191.16	0.84	11.59
RUN_1_029918.LAB	11:29	8.61	15.34	2.78	≤ 0.10	191.14	0.84	11.46
RUN_1_029919.LAB	11:30	9.30	15.99	3.14	≤ 0.10	191.13	0.84	11.36
RUN_1_029920.LAB	11:31	9.05	15.92	3.35	≤ 0.10	191.11	0.84	10.80
RUN_1_029921.LAB	11:32	8.66	15.04	2.73	≤ 0.10	191.12	0.84	10.56
RUN_1_029922.LAB	11:33	8.84	15.64	2.99	≤ 0.10	191.13	0.84	11.26
RUN_1_029923.LAB	11:34	8.83	15.89	3.03	≤ 0.10	191.11	0.84	11.15
RUN_1_029924.LAB	11:35	8.48	14.82	2.63	≤ 0.10	191.12	0.84	10.60
RUN_1_029925.LAB	11:36	8.32	14.19	2.58	≤ 0.10	191.13	0.84	11.09
RUN_1_029926.LAB	11:37	8.47	14.98	2.78	≤ 0.10	191.14	0.84	11.73
RUN_1_029927.LAB	11:38	8.71	16.21	3.56	≤ 0.10	191.14	0.84	11.93
RUN_1_029928.LAB	11:39	8.71	15.98	3.29	≤ 0.10	191.14	0.84	10.97
RUN_1_029929.LAB	11:40	8.65	15.51	2.88	≤ 0.10	191.14	0.84	10.60
RUN_1_029930.LAB	11:41	8.50	14.89	2.64	≤ 0.10	191.07	0.84	10.89
RUN_1_029931.LAB	11:42	8.44	14.88	2.76	≤ 0.10	191.01	0.84	11.16
RUN_1_029932.LAB	11:43	8.65	15.59	3.26	≤ 0.10	191.06	0.84	11.56
RUN_1_029933.LAB	11:44	8.62	15.76	3.16	≤ 0.10	191.06	0.84	11.22
RUN_1_029934.LAB	11:45	8.60	15.58	3.06	≤ 0.10	191.07	0.84	10.94
RUN_1_029935.LAB	11:46	8.59	15.36	3.04	≤ 0.10	191.10	0.84	10.97
RUN_1_029936.LAB	11:47	8.48	14.98	2.72	≤ 0.10	191.08	0.84	11.02
RUN_1_029937.LAB	11:48	8.58	15.34	2.87	≤ 0.10	191.11	0.84	11.18
RUN_1_029938.LAB	11:49	8.64	15.43	3.07	≤ 0.10	191.10	0.84	11.40
RUN_1_029939.LAB	11:50	8.68	15.44	2.97	≤ 0.10	191.07	0.84	11.01
RUN_1_029940.LAB	11:51	8.45	14.79	2.83	≤ 0.10	191.08	0.84	11.05
RUN_1_029941.LAB	11:52	8.50	15.03	2.87	≤ 0.10	191.08	0.84	11.15
RUN_1_029942.LAB	11:53	8.67	15.80	3.12	≤ 0.10	191.10	0.84	11.56
RUN_1_029943.LAB	11:54	8.73	15.83	3.18	≤ 0.10	191.09	0.84	11.21
RUN_1_029944.LAB	11:55	8.63	15.13	3.04	≤ 0.10	191.08	0.84	10.84
RUN_1_029945.LAB	11:56	8.49	15.04	2.85	≤ 0.10	191.09	0.84	10.85
RUN_1_029946.LAB	11:57	8.48	15.20	2.92	≤ 0.10	191.13	0.84	11.39
RUN_1_029947.LAB	11:58	8.80	15.97	3.37	≤ 0.10	191.14	0.84	11.35
RUN_1_029948.LAB	11:59	8.75	15.80	3.36	≤ 0.10	191.14	0.84	11.20
Average		8.62	15.34	2.91	≤ 0.10	191.10	0.84	11.14

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/24/24

Run 2

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN 2_030014.LAB	12:30	8.66	15.6	3.22	≤ 0.10	191.1	0.84	11.13
RUN 2_030015.LAB	12:31	8.58	15.2	3.08	≤ 0.10	191.1	0.84	11.15
RUN 2_030016.LAB	12:32	8.52	15.2	3.04	≤ 0.10	191.1	0.84	11.19
RUN 2_030017.LAB	12:33	8.61	15.4	3.09	≤ 0.10	191.0	0.84	10.96
RUN 2_030018.LAB	12:34	8.56	15.4	3.11	≤ 0.10	191.0	0.84	11.15
RUN 2_030019.LAB	12:35	8.57	15.5	3.37	≤ 0.10	191.1	0.84	10.79
RUN 2_030020.LAB	12:36	8.66	15.8	3.19	≤ 0.10	191.0	0.84	10.83
RUN 2_030021.LAB	12:37	8.58	15.5	3.07	≤ 0.10	191.0	0.84	11.25
RUN 2_030022.LAB	12:38	8.46	15.0	2.90	≤ 0.10	191.0	0.84	11.36
RUN 2_030023.LAB	12:39	8.52	15.3	3.14	≤ 0.10	191.0	0.84	10.79
RUN 2_030024.LAB	12:40	8.70	16.0	3.40	≤ 0.10	191.0	0.84	10.85
RUN 2_030025.LAB	12:41	8.56	15.3	3.04	≤ 0.10	191.0	0.84	11.32
RUN 2_030026.LAB	12:42	8.43	14.9	3.13	≤ 0.10	191.0	0.84	11.38
RUN 2_030027.LAB	12:43	8.46	15.3	3.14	≤ 0.10	191.0	0.84	11.31
RUN 2_030028.LAB	12:44	8.43	15.1	3.14	≤ 0.10	191.0	0.84	11.26
RUN 2_030029.LAB	12:45	8.45	15.4	3.36	≤ 0.10	191.0	0.84	11.06
RUN 2_030030.LAB	12:46	8.66	15.8	3.63	≤ 0.10	191.1	0.84	10.82
RUN 2_030031.LAB	12:47	8.48	15.2	3.39	≤ 0.10	191.1	0.84	11.23
RUN 2_030032.LAB	12:48	8.47	15.1	3.32	≤ 0.10	191.1	0.84	11.34
RUN 2_030033.LAB	12:49	8.50	15.2	3.43	≤ 0.10	191.1	0.84	11.17
RUN 2_030034.LAB	12:50	8.53	15.5	3.53	≤ 0.10	191.1	0.84	10.99
RUN 2_030035.LAB	12:51	8.61	15.8	3.53	≤ 0.10	191.1	0.84	11.06
RUN 2_030036.LAB	12:52	8.50	15.2	3.43	≤ 0.10	191.1	0.84	11.22
RUN 2_030037.LAB	12:53	8.44	15.1	3.31	≤ 0.10	191.1	0.84	11.35
RUN 2_030038.LAB	12:54	8.50	15.3	3.51	≤ 0.10	191.1	0.84	11.22
RUN 2_030039.LAB	12:55	8.51	15.7	3.77	≤ 0.10	191.0	0.84	10.74
RUN 2_030040.LAB	12:56	8.59	16.0	3.97	≤ 0.10	191.0	0.84	10.81
RUN 2_030041.LAB	12:57	8.54	15.6	3.45	≤ 0.10	191.1	0.84	11.11
RUN 2_030042.LAB	12:58	8.37	15.0	3.32	≤ 0.10	191.1	0.84	11.32
RUN 2_030043.LAB	12:59	8.52	15.7	3.52	≤ 0.10	191.1	0.84	10.94
RUN 2_030044.LAB	13:00	8.65	16.0	3.92	≤ 0.10	191.1	0.84	10.69
RUN 2_030045.LAB	13:01	8.55	15.6	3.53	≤ 0.10	191.1	0.84	11.14
RUN 2_030046.LAB	13:02	8.42	15.0	3.27	≤ 0.10	191.1	0.84	11.43
RUN 2_030047.LAB	13:03	8.47	15.7	3.53	≤ 0.10	191.1	0.84	11.01
RUN 2_030048.LAB	13:04	8.48	15.8	3.29	≤ 0.10	191.1	0.84	10.97
RUN 2_030049.LAB	13:05	8.46	15.6	3.35	≤ 0.10	191.0	0.84	11.17
RUN 2_030050.LAB	13:06	8.48	15.4	3.37	≤ 0.10	191.0	0.84	11.14
RUN 2_030051.LAB	13:07	8.47	15.6	3.39	≤ 0.10	191.0	0.84	11.12
RUN 2_030052.LAB	13:08	8.55	15.8	3.58	≤ 0.10	191.1	0.84	10.84
RUN 2_030053.LAB	13:09	8.65	16.0	3.74	≤ 0.10	191.1	0.84	10.69
RUN 2_030054.LAB	13:10	8.54	15.6	3.42	≤ 0.10	191.0	0.84	11.00
RUN 2_030055.LAB	13:11	8.47	15.3	3.39	≤ 0.10	191.0	0.84	11.13
RUN 2_030056.LAB	13:12	8.56	15.6	3.28	≤ 0.10	191.0	0.84	10.99
RUN 2_030057.LAB	13:13	8.70	16.0	3.67	≤ 0.10	191.0	0.84	10.71
RUN 2_030058.LAB	13:14	8.50	15.4	3.35	≤ 0.10	191.0	0.84	10.99
RUN 2_030059.LAB	13:15	8.51	15.3	3.25	≤ 0.10	191.0	0.84	11.11
RUN 2_030060.LAB	13:16	8.52	15.5	3.26	≤ 0.10	191.0	0.84	11.05
RUN 2_030061.LAB	13:17	8.54	15.6	3.51	≤ 0.10	191.0	0.84	10.92
RUN 2_030062.LAB	13:18	8.63	15.9	3.55	≤ 0.10	191.0	0.84	10.83
RUN 2_030063.LAB	13:19	8.50	15.3	3.18	≤ 0.10	191.0	0.84	11.07
RUN 2_030064.LAB	13:20	8.51	15.4	3.26	≤ 0.10	191.0	0.84	11.14
RUN 2_030065.LAB	13:21	8.53	15.6	3.30	≤ 0.10	191.0	0.84	11.08
RUN 2_030066.LAB	13:22	8.65	16.0	3.70	≤ 0.10	191.0	0.84	10.78
RUN 2_030067.LAB	13:23	8.59	15.9	3.71	≤ 0.10	191.1	0.84	10.76
RUN 2_030068.LAB	13:24	8.44	15.2	3.34	≤ 0.10	191.1	0.84	11.15
RUN 2_030069.LAB	13:25	8.55	15.1	3.16	≤ 0.10	191.1	0.84	11.26
RUN 2_030070.LAB	13:26	8.62	15.7	3.68	≤ 0.10	191.1	0.84	11.05
RUN 2_030071.LAB	13:27	8.64	15.6	3.82	≤ 0.10	191.1	0.84	10.91
RUN 2_030072.LAB	13:28	8.73	16.2	3.80	≤ 0.10	191.1	0.84	10.67
RUN 2_030073.LAB	13:29	8.57	15.7	3.85	≤ 0.10	191.1	0.84	10.79
Average		8.54	15.50	3.39	≤ 0.10	191.06	0.84	11.05

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/24/24

Run 3

Spectrum	Time	FTIR Data					Analyzer Data	
		H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN 3_030139.LAB	14:00	8.47	15.7	3.37	≤ 0.10	190.99	0.83	10.96
RUN 3_030140.LAB	14:01	8.48	15.7	3.45	≤ 0.10	190.95	0.83	10.97
RUN 3_030141.LAB	14:02	8.23	14.9	3.15	≤ 0.10	190.99	0.83	11.46
RUN 3_030142.LAB	14:03	8.22	15.2	3.32	≤ 0.10	190.97	0.83	11.29
RUN 3_030143.LAB	14:04	8.53	16.2	3.80	≤ 0.10	191.04	0.83	10.60
RUN 3_030144.LAB	14:05	8.63	16.3	3.99	≤ 0.10	191.08	0.83	10.47
RUN 3_030145.LAB	14:06	8.34	15.3	3.36	≤ 0.10	191.10	0.84	11.14
RUN 3_030146.LAB	14:07	8.23	14.9	3.07	≤ 0.10	191.15	0.83	11.49
RUN 3_030147.LAB	14:08	8.35	15.7	3.36	≤ 0.10	191.20	0.83	11.00
RUN 3_030148.LAB	14:09	8.52	16.1	3.63	≤ 0.10	191.17	0.83	10.63
RUN 3_030149.LAB	14:10	8.31	15.2	3.31	≤ 0.10	191.20	0.83	11.19
RUN 3_030150.LAB	14:11	8.32	15.0	3.16	≤ 0.10	191.16	0.83	11.39
RUN 3_030151.LAB	14:12	8.28	15.4	3.52	≤ 0.10	191.09	0.83	11.24
RUN 3_030152.LAB	14:13	8.35	15.7	3.41	≤ 0.10	191.02	0.83	11.04
RUN 3_030153.LAB	14:14	8.53	16.1	3.79	≤ 0.10	191.00	0.83	10.64
RUN 3_030154.LAB	14:15	8.42	15.4	3.39	≤ 0.10	190.95	0.83	10.94
RUN 3_030155.LAB	14:16	8.31	14.9	3.29	≤ 0.10	190.97	0.83	11.41
RUN 3_030156.LAB	14:17	8.40	15.3	3.29	≤ 0.10	191.03	0.83	11.36
RUN 3_030157.LAB	14:18	8.53	16.0	3.52	≤ 0.10	191.09	0.83	10.89
RUN 3_030158.LAB	14:19	8.62	16.2	3.79	≤ 0.10	191.11	0.83	10.47
RUN 3_030159.LAB	14:20	8.48	15.4	3.42	≤ 0.10	191.10	0.83	10.89
RUN 3_030160.LAB	14:21	8.23	14.8	3.04	≤ 0.10	191.08	0.83	11.40
RUN 3_030161.LAB	14:22	8.36	15.3	3.26	≤ 0.10	191.11	0.83	11.35
RUN 3_030162.LAB	14:23	8.50	15.8	3.58	≤ 0.10	191.14	0.83	10.95
RUN 3_030163.LAB	14:24	8.70	15.9	3.68	≤ 0.10	191.06	0.83	10.82
RUN 3_030164.LAB	14:25	8.47	15.1	3.23	≤ 0.10	191.11	0.83	11.02
RUN 3_030165.LAB	14:26	8.38	15.1	3.37	≤ 0.10	191.14	0.83	11.40
RUN 3_030166.LAB	14:27	8.50	15.8	3.49	≤ 0.10	191.13	0.83	11.07
RUN 3_030167.LAB	14:28	8.56	15.9	3.47	≤ 0.10	191.14	0.83	10.86
RUN 3_030168.LAB	14:29	8.47	15.6	3.41	≤ 0.10	191.17	0.83	10.90
RUN 3_030169.LAB	14:30	8.49	15.4	3.34	≤ 0.10	191.23	0.83	10.98
RUN 3_030170.LAB	14:31	8.35	15.2	3.53	≤ 0.10	191.18	0.83	11.32
RUN 3_030171.LAB	14:32	8.49	15.9	3.85	≤ 0.10	191.24	0.83	11.04
RUN 3_030172.LAB	14:33	8.59	16.0	3.86	≤ 0.10	191.24	0.83	10.81
RUN 3_030173.LAB	14:34	8.47	15.4	3.43	≤ 0.10	191.25	0.83	10.87
RUN 3_030174.LAB	14:35	8.44	15.1	3.42	≤ 0.10	191.22	0.83	11.22
RUN 3_030175.LAB	14:36	8.41	15.2	3.53	≤ 0.10	191.22	0.83	11.41
RUN 3_030176.LAB	14:37	8.52	15.9	3.86	≤ 0.10	191.20	0.83	10.96
RUN 3_030177.LAB	14:38	8.67	16.2	3.85	≤ 0.10	191.21	0.83	10.71
RUN 3_030178.LAB	14:39	8.53	15.6	3.72	≤ 0.10	191.27	0.83	10.70
RUN 3_030179.LAB	14:40	8.44	15.2	3.39	≤ 0.10	191.26	0.83	11.15
RUN 3_030180.LAB	14:41	8.46	15.4	3.40	≤ 0.10	191.30	0.83	11.26
RUN 3_030181.LAB	14:42	8.45	15.5	3.54	≤ 0.10	191.26	0.83	11.12
RUN 3_030182.LAB	14:43	8.63	15.7	3.71	≤ 0.10	191.25	0.83	10.90
RUN 3_030183.LAB	14:44	8.59	15.8	3.65	≤ 0.10	191.25	0.83	10.98
RUN 3_030184.LAB	14:45	8.62	15.7	3.60	≤ 0.10	191.24	0.83	10.75
RUN 3_030185.LAB	14:46	8.47	15.2	3.23	≤ 0.10	191.20	0.83	11.03
RUN 3_030186.LAB	14:47	8.46	15.2	3.39	≤ 0.10	191.15	0.83	11.27
RUN 3_030187.LAB	14:48	8.59	15.9	3.79	≤ 0.10	191.20	0.83	11.01
RUN 3_030188.LAB	14:49	8.52	15.6	3.61	≤ 0.10	191.26	0.83	10.89
RUN 3_030189.LAB	14:50	8.31	14.9	3.36	≤ 0.10	191.29	0.83	10.98
RUN 3_030190.LAB	14:51	8.35	15.1	3.55	≤ 0.10	191.27	0.83	11.51
RUN 3_030191.LAB	14:52	8.40	15.5	3.50	≤ 0.10	191.25	0.83	11.27
RUN 3_030192.LAB	14:53	8.59	15.9	3.76	≤ 0.10	191.25	0.83	11.06
RUN 3_030193.LAB	14:54	8.49	15.7	3.55	≤ 0.10	191.26	0.83	10.67
RUN 3_030194.LAB	14:55	8.24	14.7	3.30	≤ 0.10	191.26	0.83	11.04
RUN 3_030195.LAB	14:56	8.32	15.0	3.55	≤ 0.10	191.24	0.83	11.66
RUN 3_030196.LAB	14:57	8.62	15.8	3.77	≤ 0.10	191.23	0.83	11.28
RUN 3_030197.LAB	14:58	8.59	15.9	3.83	≤ 0.10	191.26	0.83	10.84
RUN 3_030198.LAB	14:59	8.43	15.2	3.52	≤ 0.10	191.25	0.83	10.83
Average		8.45	15.52	3.50	≤ 0.10	191.16	0.83	11.05

Method 1 and 2 Cyclonic Flow Check Data

Project Number: M234611
Client: Holcim Cement (US) Inc.
Facility: Devil's Slide Cement Plant
Location: Main Kiln Stack
Pitot ID: S8-058-A
Pitot Coefficient: 0.834
Probe Length: 8

Source Condition: Mill Off
Run No.: 1

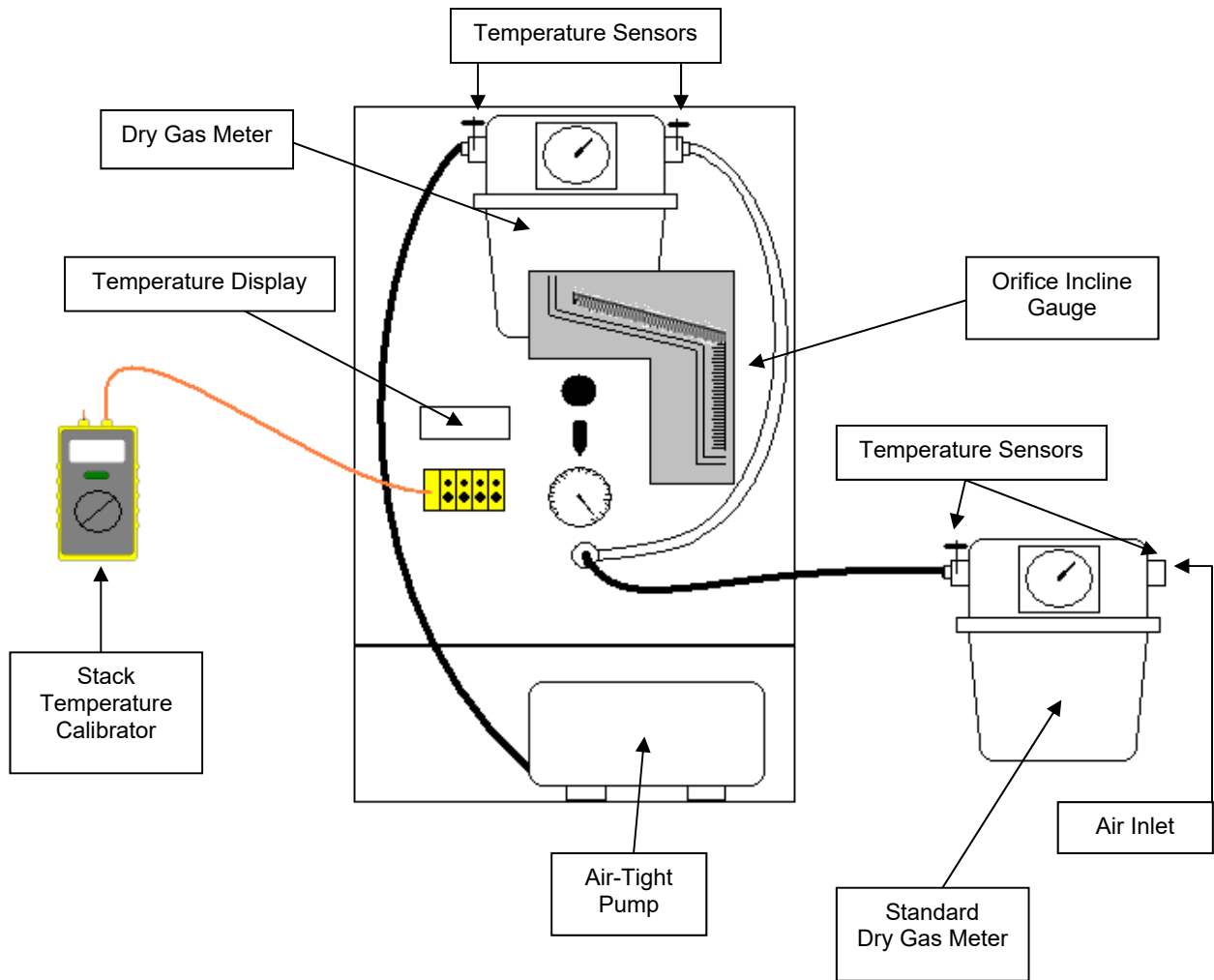
Port Length: 12.00

Port	Point	DP	Sqrt.	Temp	Yaw Angle	DP (in. H2O)	Velocity	Port	Point	DP	Sqrt.	Temp	Yaw Angle	DP (in. H2O)	Velocity
		(in. H ₂ O)	DP	(°F)	(°)	at Null Point Angle	(V)			(in. H ₂ O)	DP	(°F)	(°)	at Null Point Angle	(V)
A	1	0.63	0.7937	247.0	15.0	0.00	55.50	B	1	0.62	0.7874	250.0	15.0	0.00	55.18
A	2	0.60	0.7746	248.0	15.0	0.00	54.21	B	2	0.59	0.7681	250.0	10.0	0.00	53.83
A	3	0.57	0.7550	250.0	10.0	0.00	52.91	B	3	0.57	0.7550	249.0	15.0	0.00	52.87
A	4	0.56	0.7483	249.0	10.0	0.00	52.40	B	4	0.55	0.7416	249.0	15.0	0.00	51.93
A	5	0.54	0.7348	250.0	15.0	0.00	51.50	B	5	0.54	0.7348	250.0	15.0	0.00	51.50
A	6	0.52	0.7211	250.0	10.0	0.00	50.53	B	6	0.51	0.7141	250.0	15.0	0.00	50.05

Average Yaw Angle 13.3 °

Appendix G - Calibration Data

Dry Gas Meter/Control Module Calibration Diagram



Meter Box Calibration

Dry Gas Meter Calibration Data

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

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

Run Number	Orifice Setting in H ₂ O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F° tr	Dry Gas Meter Inlet Temp. F° tdi	Dry Gas Meter Outlet Temp. F° tdo	Dry Gas Meter Avg. Temp. F° td	Time Min	Time Sec	Y	Chg (H)
Final		80.713	50.815	70	73	73					
Initial		75.708	45.760	70	71	71					
Difference	1 0.20	5.005	5.055	70	72	72	72	18	25	0.991	1.635
Final		85.747	55.885	70	75	75					
Initial		80.713	50.815	70	73	73					
Difference	2 0.50	5.034	5.070	70	74	74	74	12	15	0.996	1.781
Final		90.789	60.960	70	75	75					
Initial		85.747	55.885	70	75	75					
Difference	3 0.70	5.042	5.075	70	75	75	75	10	25	0.998	1.794
Final		95.885	65.984	70	75	75					
Initial		90.789	60.960	70	75	75					
Difference	4 0.90	5.096	5.024	70	75	75	75	9	15	1.019	1.780
Final		100.892	71.025								
Initial		95.885	65.984	70	75	75					
Difference	5 1.20	5.007	5.041	70	75	75	75	8	15	0.997	1.956
Final		75.708	45.760	70	71	71					
Initial		70.675	40.735	70	71	71					
Difference	6 2.00	5.033	5.025	70	71	71	71	6	8	0.996	1.797

Average **0.999** **1.790**

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

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

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

Reference Source Temperature (° F)	Test Thermometer Temperature (° F)	Temperature Difference %
0	0	0.0
250	251	0.1
600	601	0.1
1200	1205	0.3

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

Meter Box Calibration

Dry Gas Meter Calibration Data

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

Date: February 28, 2024
 Calibrated By: FCT
 Barometric Pressure: 28.30

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		112.124	110.691	64	70	69					
Initial		107.060	105.582	64	69	68					
Difference	1 0.20	5.064	5.109	64	70	69	69	20	32	0.997	1.932
Final		101.978	100.236	64	68	67					
Initial		96.964	95.209	62	67	66					
Difference	2 0.50	5.014	5.027	63	68	67	67	12	20	1.001	1.777
Final		91.836	89.821	61	66	65					
Initial		86.680	84.711	62	66	64					
Difference	3 0.70	5.156	5.110	62	66	65	65	10	24	1.012	1.669
Final		86.680	84.711	62	66	64					
Initial		81.339	79.435	61	64	63					
Difference	4 0.90	5.341	5.276	62	65	64	64	9	25	1.013	1.642
Final		81.339	79.435	61	64	63					
Initial		76.119	74.293	61	63	62					
Difference	5 1.20	5.220	5.142	61	64	63	63	8	25	1.013	1.832
Final		76.119	74.293	61	63	62					
Initial		70.929	69.088	61	61	61					
Difference	6 2.00	5.190	5.205	61	62	62	62	6	33	0.991	1.876

Average **1.004** **1.788**

Stack Temperature Sensor Calibration			
Temperature ID :	100770	Name :	FCT
Ambient Temperature, °F :	62.8	Date :	2/28/2024

Temperature Calibrator			
Model # :	CL940A	Certification Date:	February 1, 2024
Serial # :	552	Expiration Date:	February 1, 2025

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	0	0.0
250	251	0.1
600	601	0.1
1200	1205	0.3

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

Meter Box Calibration

Dry Gas Meter Calibration Data

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

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

Run Number	Orifice Setting in H ₂ O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F° tr	Dry Gas Meter Inlet Temp. F° tdi	Dry Gas Meter Outlet Temp. F° tdo	Dry Gas Meter Avg. Temp. F° td	Time Min	Time Sec	Y	Chg (H)
Final		85.075	50.792	63	62	62					
Initial		80.075	45.760	62	61	61					
Difference	1 0.20	5.000	5.032	63	62	62	62	18	10	0.989	1.576
Final		90.083	55.842	63	64	64					
Initial		85.075	50.792	63	62	62					
Difference	2 0.50	5.008	5.050	63	63	63	63	12	5	0.988	1.736
Final		95.085	60.901	64	65	65					
Initial		90.083	55.842	63	64	64					
Difference	3 0.70	5.002	5.059	64	65	65	65	10	0	0.986	1.667
Final		100.343	66.210	64	66	66					
Initial		95.085	60.901	64	65	65					
Difference	4 0.90	5.258	5.309	64	66	66	66	9	15	0.988	1.659
Final		105.348	71.269	64	67	67					
Initial		100.343	66.210	64	66	66					
Difference	5 1.20	5.005	5.059	64	67	67	67	8	0	0.988	1.823
Final		80.075	45.760	62	61	61					
Initial		75.060	40.748	61	61	61					
Difference	6 2.00	5.015	5.012	62	61	61	61	6	0	0.992	1.704

Average 0.988 1.694

Stack Temperature Sensor Calibration

Meter Box # : CM54 Name : ER

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

Calibrator Model # : CL940

Serial # : 526

Date Of Certification : December 28, 2022

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

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

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

Ref. Temp., °F + 460

Meter Box Calibration

Dry Gas Meter Calibration Data

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

Date: February 27, 2024
 Calibrated By: FCT
 Barometric Pressure: 28.03

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		65.874	64.447	65	68	68					
Initial		60.861	59.335	65	67	67					
Difference	1 0.20	5.013	5.112	65	68	68	68	19	20	0.982	1.776
Final		60.861	59.335	65	67	67					
Initial		55.455	53.820	64	66	66					
Difference	2 0.50	5.406	5.515	65	67	67	67	12	10	0.980	1.512
Final		55.455	53.820	64	66	66					
Initial		50.331	48.611	65	65	65					
Difference	3 0.70	5.124	5.209	65	66	66	66	10	10	0.981	1.648
Final		50.331	48.611	65	65	65					
Initial		44.967	43.191	65	64	64					
Difference	4 0.90	5.364	5.420	65	65	65	65	9	50	0.984	1.816
Final		44.967	43.191	65	64	64					
Initial		39.774	37.951	64	64	64					
Difference	5 1.20	5.193	5.240	65	64	64	64	8	5	0.984	1.744
Final		70.929	69.572	67	68	68					
Initial		65.874	64.447	65	68	68					
Difference	6 2.00	5.055	5.125	66	68	68	68	6	5	0.982	1.734

Average **0.982** **1.705**

Stack Temperature Sensor Calibration			
Temperature ID :	100770	Name :	FCT
Ambient Temperature, °F :	64.4	Date :	2/27/2024

Temperature Calibrator			
Model # :	CL940A	Certification Date:	February 1, 2024
Serial # :	526	Expiration Date:	February 1, 2025

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	2	0.4
250	252	0.3
600	602	0.2
1200	1205	0.3

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



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 9/21/2023
 Temperature (°F): 72.6
 Pressure ("Hg): 29.48
 Personnel: wjg
 Probe: S8-058-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	1.15	0.831	0.832	0.000	0.000	Pass
0.81	0.81	1.15	0.832		0.000		
0.81	0.81	1.15	0.832		0.000		
1.81	1.82	2.55	0.837	0.837	0.000	0.001	Pass
1.81	1.82	2.55	0.837		0.000		
1.81	1.82	2.55	0.838		0.001		



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 9/21/2023
 Temperature (°F): 72.6
 Pressure ("Hg): 29.48
 Personnel: wjg
 Probe: S8-058-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	1.15	0.833	0.833	0.000	0.000	Pass
0.81	0.81	1.15	0.832		0.000		
0.81	0.81	1.15	0.833		0.000		
1.81	1.82	2.56	0.835	0.836	0.000	0.000	Pass
1.81	1.83	2.56	0.836		0.000		
1.81	1.83	2.56	0.836		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: S8-058-A
Probe Calibration Date: 09/21/23
Test Point Location: center
Ambient Temperature (°F): 72.6
Barometric Pressure ("Hg): 29.48

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	72.6	1.15	0	0.83
2	60	0.81	72.6	1.15	0	0.83
3	60	0.81	72.6	1.15	0	0.83
Average (C _{p(avg-low)})						0.83

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	72.6	2.55	0	0.84
2	90	1.82	72.6	2.55	0	0.84
3	90	1.82	72.6	2.55	0	0.84
Average (C _{p(avg-high)})						0.84

$$\text{\% Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.67\%}} \quad \text{Pass}$$

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 = 0.834



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: S8-058-B
Probe Calibration Date: 09/21/23
Test Point Location: center
Ambient Temperature (°F): 72.6
Barometric Pressure ("Hg): 29.48

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	72.6	1.15	0	0.83
2	60	0.81	72.6	1.15	0	0.83
3	60	0.81	72.6	1.15	0	0.83
Average (C _{p(avg-low)})						0.83

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	72.6	2.56	0	0.84
2	90	1.83	72.6	2.56	0	0.84
3	90	1.83	72.6	2.56	0	0.84
Average (C _{p(avg-high)})						0.84

$$\text{\% Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.37\%}} \quad \text{Pass}$$

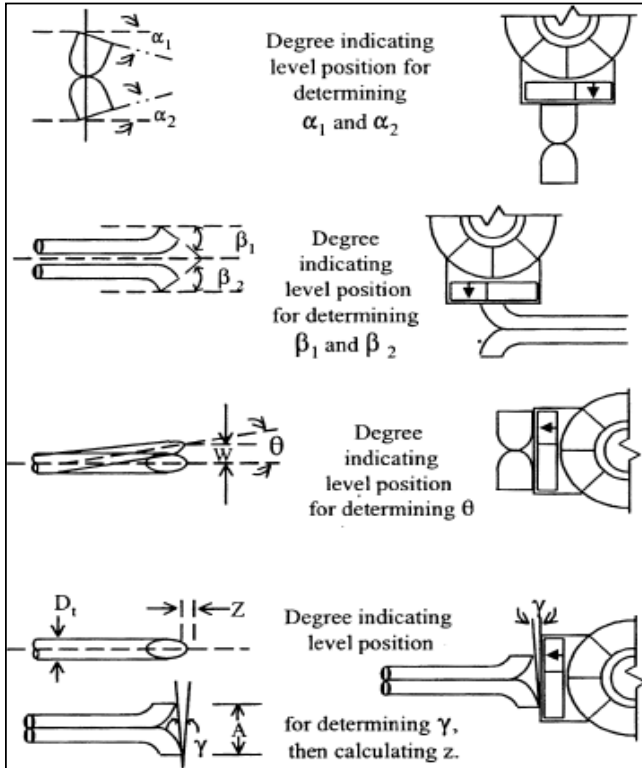
Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3%.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.834

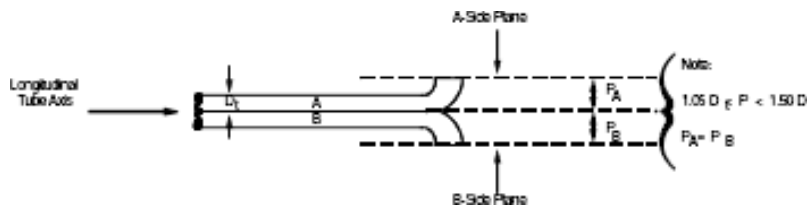


Airflow Sciences Corporation

Probe Inspection for Method 2G



α_1	0.4 (°)	Pass
α_2	0.5 (°)	Pass
β_1	0.3 (°)	Pass
β_2	0.3 (°)	Pass
D_t	0.375 (")	Pass
P_a	0.474 (")	Pass
P_b	0.474 (")	Pass
z	<0.02 (")	Pass
w	0.007 (")	Pass



Certification

I certify that Type S probe ID **S8-058** meets or exceeds all specifications, criteria, and applicable design features.

Certified by: W Jambeck

Date: 9/21/2023



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 9/21/2023
Temperature (°F): 72.8
Pressure ("Hg): 29.48
Personnel: wjg
Probe: S8-059-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	1.13	0.838	0.838	0.000	0.000	Pass
0.81	0.81	1.14	0.837		0.000		
0.81	0.81	1.14	0.838		0.000		
1.81	1.81	2.51	0.840	0.840	0.000	0.000	Pass
1.81	1.81	2.51	0.840		0.000		
1.81	1.81	2.51	0.840		0.000		



Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date: 9/21/2023
 Temperature (°F): 73.1
 Pressure ("Hg): 29.47
 Personnel: wjg
 Probe: S8-059-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	1.16	0.828	0.828	0.000	0.000	Pass
0.81	0.81	1.16	0.828		0.000		
0.81	0.81	1.16	0.828		0.000		
1.81	1.81	2.58	0.829	0.829	0.000	0.000	Pass
1.81	1.81	2.58	0.829		0.000		
1.81	1.81	2.58	0.829		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: S8-059-A
Probe Calibration Date: 09/21/23
Test Point Location: center
Ambient Temperature (°F): 72.8
Barometric Pressure ("Hg): 29.48

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	72.8	1.13	0	0.84
2	60	0.81	72.8	1.14	0	0.84
3	60	0.81	72.8	1.14	0	0.84
Average (C _{p(avg-low)})						0.84

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	72.8	2.51	0	0.84
2	90	1.81	72.8	2.51	0	0.84
3	90	1.81	72.8	2.51	0	0.84
Average (C _{p(avg-high)})						0.84

$$\text{\% Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.30\%}} \quad \text{Pass}$$

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 = 0.839



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: S8-059-B
Probe Calibration Date: 09/21/23
Test Point Location: center
Ambient Temperature (°F): 73.1
Barometric Pressure ("Hg): 29.47

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	73.1	1.16	0	0.83
2	60	0.81	73.1	1.16	0	0.83
3	60	0.81	73.1	1.16	0	0.83
Average (C _{p(avg-low)})						0.83

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	73.1	2.58	0	0.83
2	90	1.81	73.1	2.58	0	0.83
3	90	1.81	73.1	2.58	0	0.83
Average (C _{p(avg-high)})						0.83

$$\text{\% Difference} = \frac{C_{p(\text{avg-low})} - C_{p(\text{avg-high})}}{C_{p(\text{avg-low})}} \times 100\% = \underline{\underline{-0.17\%}} \quad \text{Pass}$$

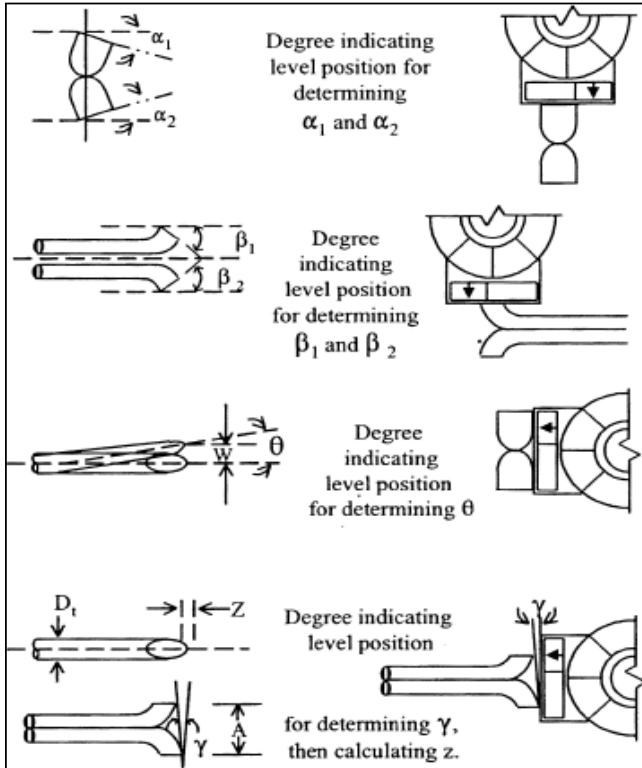
Note: (1) The percent difference between the low and high velocity setting C_p values shall be within +/- 3%.
 (2) If calibrating a 3-D probe for this method, the pitch angle setting must be 0°.

C_p = 0.829

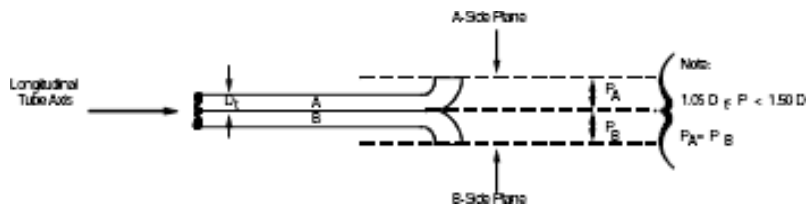


Airflow Sciences Corporation

Probe Inspection for Method 2G



α_1	0.9 (°)	Pass
α_2	0.5 (°)	Pass
β_1	0.7 (°)	Pass
β_2	0.9 (°)	Pass
D_t	0.375 (")	Pass
P_a	0.471 (")	Pass
P_b	0.471 (")	Pass
z	<0.02 (")	Pass
w	0.005 (")	Pass



Certification

I certify that Type S probe ID **S8-059** meets or exceeds all specifications, criteria, and applicable design features.

Certified by: W Jambeck

Date: 9/21/2023

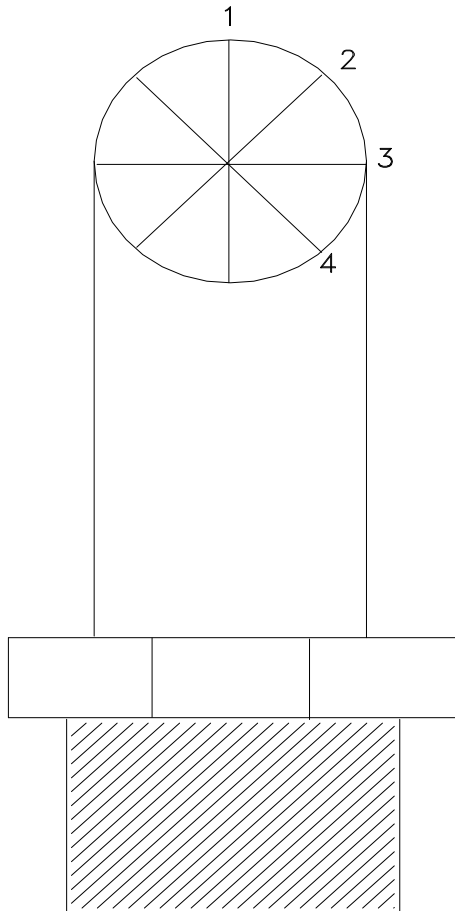
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 953

Analyst: RB

Material/Type: Glass



0.319	1
0.319	2
0.319	3
0.318	4

Average
<u>0.319</u>

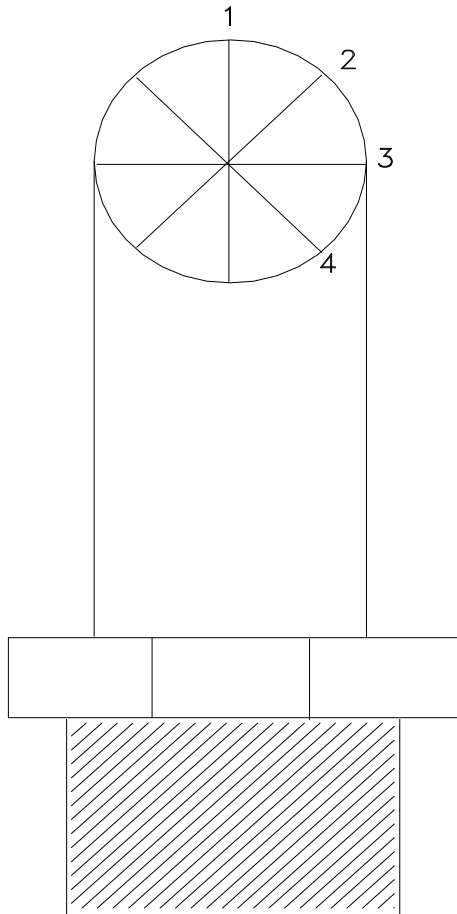
Nozzle Calibration

Date: 10/13/2023

Nozzle ID No.: 908

Analyst: EOS

Material/Type: Glass



0.312	1
0.311	2
0.310	3
0.311	4

Average
<u>0.311</u>

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/23/2024
 Operator: EE
 Operating Condition: Mill On > 90% Production

Sample System: FTIR
 Probe Length: 8.0 ft
 Probe Type: FTIR
 Sample Plane: Horizontal
 Port Type: Flange
 Duct Shape: Circular

Number of Ports Sampled: 1 Ideal Upstream Distance: 0.0 Feet
 Number of Points per Port: 1 Ideal Downstream Distance: 0.0 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	-0.03	0.14%	N/A		
	Mid	CC195925	12.04	12.07	-0.14%	4/24/2031	54.43%	
	High	CC308342	22.12	22.15	-0.14%	5/25/2031		

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

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAI/700LX	2211018	25	22.12
HF ppmvw	MKS 2030	00270	40	N/A
HCN ppmvw	MKS 2030	00270	200	N/A

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Project #: M234611
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 1/23/24
Operator: EE
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	12.18	12.02	0.09	0.17	0.13	12.10	11.77	11.7	0.23	-0.72	-0.90	0.36
2	12.04	12.02	11.98	0.17	0.01	0.09	12.00	11.86	11.9	0.41	-0.18	-0.18	-0.72
3	12.04	11.98	11.98	0.01	-0.04	-0.02	11.98	11.33	11.4	0.41	0.00	0.05	-0.23

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	1/23/24	9:10	10:09	10.39%	11.71	14.71	16.42	2.67	4.50	0.10	0.17
2	1/23/24	10:35	11:34	10.20%	11.89	14.82	16.50	2.80	4.82	0.10	0.17
3	1/23/24	12:15	13:14	10.55%	11.39	14.84	16.60	2.88	4.71	0.10	0.16

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Test Location: Main Kiln Stack
Date: 1/23/24
Project #: M234611

Linearity Cal/Pre 1 Cal

<u>Time</u>	<u>O2 % (dry)</u>	
7:27	-0.03	iz
7:28	14.25	
7:29	22.15	ih
7:30	22.19	
7:31	10.64	
7:32	0.06	
7:33	2.49	
7:34	11.56	
7:35	12.05	
7:36	12.07	im
7:37	5.93	
7:38	5.34	
7:39	8.04	
7:40	12.30	
7:41	13.62	
7:42	15.07	
7:43	19.62	
7:44	20.80	
7:45	20.88	
7:46	8.46	
7:47	0.28	
7:48	0.24	
7:49	3.85	
7:50	12.08	
7:51	12.18	m
7:52	10.20	
7:53	0.09	z

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Project #: M234611
Test Location: Main Kiln Stack
Date: 1/23/24

Post 1/Pre 2			Post 2/Pre 3		
<u>Time</u>	<u>O2 % (dry)</u>		<u>Time</u>	<u>O2 % (dry)</u>	
10:19	0.17	z	11:53	0.02	
10:20	10.84		11:54	0.01	z
10:21	12.02	m	11:55	10.78	
			11:56	11.97	
			11:57	11.98	m

Post 3		
<u>Time</u>	<u>O2 % (dry)</u>	
13:33	11.98	m
13:34	7.37	
13:35	0.02	
13:36	-0.01	
13:37	-0.01	
13:38	-0.04	z

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill On>90% Production

Test Location: Main Kiln Stack
 Date: 1/23/2024
 Operator: EE
 FTIR s/n: 00270

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_028434.LAB	1/23/24	7:16:03	0.0	0.0	0.0	190.6	0.83	0.5	-1.7	-0.018
N2 DIR_028435.LAB	1/23/24	7:16:11	0.0	0.0	-0.1	190.6	0.83	0.5	-2.0	-0.009
N2 DIR_028436.LAB	1/23/24	7:16:19	0.0	0.0	0.0	190.6	0.83	0.6	-1.5	-0.021
N2 DIR_028437.LAB	1/23/24	7:16:26	0.0	0.0	-0.1	190.5	0.83	0.4	-1.2	-0.011
N2 DIR_028438.LAB	1/23/24	7:16:34	0.0	0.0	0.0	190.5	0.83	0.2	-1.4	-0.011
N2 DIR_028439.LAB	1/23/24	7:16:42	0.0	0.0	0.1	190.6	0.83	0.4	-1.2	-0.011
N2 DIR_028440.LAB	1/23/24	7:16:50	0.0	0.0	0.1	190.6	0.83	0.3	-1.7	-0.011
N2 DIR_028441.LAB	1/23/24	7:16:58	0.0	0.0	0.0	190.5	0.83	0.8	-1.4	-0.010
N2 DIR_028442.LAB	1/23/24	7:17:06	0.0	0.0	0.0	190.5	0.83	0.5	-1.8	-0.006

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_028518.LAB	1/23/24	7:31:35	0.0	0.1	0.0	190.7	0.83	100.6	-0.1	-0.035	99.2%	
CTS DIR_028519.LAB	1/23/24	7:31:43	0.0	0.1	0.0	190.8	0.83	100.5	-0.2	-0.040	99.1%	
CTS DIR_028520.LAB	1/23/24	7:31:50	0.0	0.0	0.0	190.7	0.83	100.3	-0.3	-0.041	99.0%	
CTS DIR_028521.LAB	1/23/24	7:31:58	0.0	0.0	0.1	190.7	0.83	101.0	-0.4	-0.039	99.6%	
CTS DIR_028522.LAB	1/23/24	7:32:06	0.0	0.0	0.0	190.8	0.83	100.8	0.0	-0.032	99.4%	
CTS DIR_028523.LAB	1/23/24	7:32:14	0.0	0.0	0.0	190.7	0.83	100.8	0.1	-0.027	99.4%	
CTS DIR_028524.LAB	1/23/24	7:32:22	0.0	0.0	0.1	190.7	0.83	101.1	0.1	-0.035	99.7%	
Average								100.7				99.3%

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_028532.LAB	1/23/24	7:37:32	0.0	0.0	0.1	190.7	0.83	-0.2	51.5	4.903	103.9%
HCN DIR_028533.LAB	1/23/24	7:37:41	0.0	0.0	0.0	190.7	0.83	-0.1	51.8	4.913	104.6%
HCN DIR_028534.LAB	1/23/24	7:37:48	0.0	0.0	0.1	190.7	0.83	-0.1	51.9	4.918	104.7%
HCN DIR_028535.LAB	1/23/24	7:37:56	0.0	0.0	0.0	190.7	0.83	-0.1	51.7	4.927	104.4%
HCN DIR_028536.LAB	1/23/24	7:38:04	0.0	0.0	0.1	190.7	0.82	-0.1	51.7	4.922	104.3%
HCN DIR_028537.LAB	1/23/24	7:38:12	0.0	0.0	0.1	190.7	0.82	-0.1	51.9	4.869	104.7%
HCN DIR_028538.LAB	1/23/24	7:38:19	0.0	0.0	0.2	190.7	0.82	-0.3	51.8	4.873	104.4%
HCN DIR_028539.LAB	1/23/24	7:38:27	0.0	0.0	-0.1	190.7	0.82	-0.4	51.9	4.871	104.7%
Average								51.8	4.899		104.5%

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
CTS REMOTE_028599.LAB	1/23/24	7:47:15	0.0	0.0	0.0	191.3	0.90	100.6	0.2	-0.025	99.2%
CTS REMOTE_028600.LAB	1/23/24	7:47:23	0.0	0.0	0.0	191.3	0.90	100.4	0.1	-0.031	99.0%
CTS REMOTE_028601.LAB	1/23/24	7:47:31	0.0	0.0	0.1	191.3	0.90	100.4	0.0	-0.030	99.0%
CTS REMOTE_028602.LAB	1/23/24	7:47:39	0.0	0.0	0.0	191.3	0.90	100.4	-0.3	-0.041	99.0%
CTS REMOTE_028603.LAB	1/23/24	7:47:46	0.0	0.0	0.0	191.3	0.90	100.6	-0.1	-0.023	99.2%
CTS REMOTE_028604.LAB	1/23/24	7:47:54	0.0	0.0	0.0	191.3	0.90	100.2	0.1	-0.044	98.8%
CTS REMOTE_028605.LAB	1/23/24	7:48:02	0.0	0.0	0.0	191.3	0.90	100.0	0.3	-0.028	98.7%
CTS REMOTE_028606.LAB	1/23/24	7:48:10	0.0	0.0	0.0	191.3	0.90	100.0	-0.1	-0.038	98.6%

Response Time Test

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Response Time (sec)
CTS REMOTE_028593.LAB	1/23/24	7:46:28	0.1	0.0	0.0	191.3	0.90	100.1	0.2	-0.029	-
CTS REMOTE_028594.LAB	1/23/24	7:46:36	0.0	0.0	-0.1	191.4	0.90	99.9	0.1	-0.034	15.826
CTS REMOTE_028595.LAB	1/23/24	7:46:44	0.0	0.0	0.1	191.3	0.90	100.4	0.2	-0.029	23.826
CTS REMOTE_028596.LAB	1/23/24	7:46:51	0.0	0.0	0.0	191.3	0.90	100.8	0.1	-0.037	
CTS REMOTE_028597.LAB	1/23/24	7:46:59	0.0	0.0	0.1	191.3	0.90	99.9	-0.1	-0.036	
CTS REMOTE_028598.LAB	1/23/24	7:47:07	0.0	0.0	0.0	191.3	0.90	100.3	-0.3	-0.025	
CTS REMOTE_028599.LAB	1/23/24	7:47:15	0.0	0.0	0.0	191.3	0.90	100.6	0.2	-0.025	
CTS REMOTE_028600.LAB	1/23/24	7:47:23	0.0	0.0	0.0	191.3	0.90	100.4	0.1	-0.031	
CTS REMOTE_028601.LAB	1/23/24	7:47:31	0.0	0.0	0.1	191.3	0.90	100.4	0.0	-0.030	

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill On>90% Production

Test Location: Main Kiln Stack
 Date: 1/23/2024
 Operator: EE
 FTIR s/n: 00270

Pre 1 Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
NATIVE_028723.LAB	1/23/24	8:04:38	6.5	8.9	0.0	191.0	0.89	1.3	1.7	-0.041
NATIVE_028724.LAB	1/23/24	8:04:45	6.4	8.9	-0.1	191.0	0.89	1.2	1.7	-0.043
NATIVE_028725.LAB	1/23/24	8:04:53	6.4	8.9	-0.2	191.0	0.89	1.2	1.9	-0.039
									1.8	-0.041

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
PRE 1 SPIKE_028736.LAB	1/23/24	8:06:52	5.8	8.0	-0.1	191.1	0.89	1.4	5.5	0.338	0.069	105.2%
PRE 1 SPIKE_028737.LAB	1/23/24	8:07:00	5.8	8.0	-0.1	191.0	0.89	1.0	5.5	0.333	0.068	105.6%
PRE 1 SPIKE_028738.LAB	1/23/24	8:07:08	5.8	8.0	-0.1	191.1	0.89	1.1	5.6	0.338	0.069	106.5%
PRE 1 SPIKE_028739.LAB	1/23/24	8:07:16	5.8	8.0	0.0	191.1	0.89	1.1	5.4	0.345	0.070	102.3%
PRE 1 SPIKE_028740.LAB	1/23/24	8:07:24	5.8	7.9	-0.1	191.1	0.89	1.2	5.3	0.332	0.068	101.9%
PRE 1 SPIKE_028741.LAB	1/23/24	8:07:31	5.8	8.0	-0.1	191.0	0.89	1.1	5.6	0.338	0.069	107.6%
PRE 1 SPIKE_028742.LAB	1/23/24	8:07:40	6.1	8.3	0.0	191.0	0.89	1.1	5.4	0.337	0.069	103.2%
PRE 1 SPIKE_028743.LAB	1/23/24	8:07:47	5.8	7.9	0.0	191.1	0.89	1.0	5.4	0.337	0.069	104.1%

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
RUN 1_028866.LAB	1/23/24	10:11:55	6.6	9.0	-0.1	191.0	0.89	1.6	2.0	0.004
RUN 1_028867.LAB	1/23/24	10:12:56	6.4	8.7	-0.1	191.0	0.89	1.4	1.8	0.000
RUN 1_028868.LAB	1/23/24	10:13:57	6.3	8.7	-0.1	191.0	0.89	1.3	1.8	0.002
									1.9	0.002

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
RUN 1 POST SPIKE_028877.LAB	1/23/24	10:15:50	5.8	7.8	-0.2	190.9	0.89	1.3	5.2	0.331	0.068	98.6%
RUN 1 POST SPIKE_028878.LAB	1/23/24	10:15:58	5.8	7.7	-0.1	190.9	0.89	1.0	5.0	0.333	0.068	95.7%
RUN 1 POST SPIKE_028879.LAB	1/23/24	10:16:05	5.7	7.7	-0.2	190.9	0.89	1.2	5.0	0.337	0.069	94.1%
RUN 1 POST SPIKE_028880.LAB	1/23/24	10:16:13	5.8	7.8	-0.1	190.9	0.89	1.1	4.9	0.328	0.067	94.5%
RUN 1 POST SPIKE_028881.LAB	1/23/24	10:16:21	5.7	7.7	-0.1	190.9	0.89	1.2	4.9	0.337	0.069	92.8%
RUN 1 POST SPIKE_028882.LAB	1/23/24	10:16:28	5.7	7.6	-0.2	190.9	0.89	1.3	5.1	0.343	0.070	94.8%
RUN 1 POST SPIKE_028883.LAB	1/23/24	10:16:36	5.8	7.7	-0.1	190.9	0.89	1.3	4.9	0.335	0.068	93.3%
RUN 1 POST SPIKE_028884.LAB	1/23/24	10:16:44	5.8	7.6	-0.3	190.9	0.90	1.1	4.9	0.333	0.068	94.0%

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
RUN 1 POST CTS_028890.LAB	1/23/24	10:17:56	0.1	0.0	0.1	190.9	0.90	100.2	0.4	-0.037	98.8%
RUN 1 POST CTS_028891.LAB	1/23/24	10:18:04	0.0	0.0	0.1	190.9	0.90	100.6	-0.1	-0.025	99.2%
RUN 1 POST CTS_028892.LAB	1/23/24	10:18:12	0.0	0.0	0.0	190.9	0.90	100.2	0.2	-0.036	98.8%
RUN 1 POST CTS_028893.LAB	1/23/24	10:18:20	0.0	0.0	0.0	191.0	0.90	100.9	0.0	-0.032	99.5%
RUN 1 POST CTS_028894.LAB	1/23/24	10:18:27	0.0	0.0	0.0	190.9	0.90	100.4	0.5	-0.044	99.0%
RUN 1 POST CTS_028895.LAB	1/23/24	10:18:35	0.0	0.0	0.0	190.9	0.90	100.4	0.0	-0.036	99.0%
RUN 1 POST CTS_028896.LAB	1/23/24	10:18:43	0.0	0.0	0.0	190.9	0.90	100.3	-0.3	-0.042	98.9%
RUN 1 POST CTS_028897.LAB	1/23/24	10:18:51	0.0	0.0	0.2	191.0	0.90	100.3	0.1	-0.030	98.9%

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill On>90% Production

Test Location: Main Kiln Stack
 Date: 1/23/2024
 Operator: EE
 FTIR s/n: 00270

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN 2_028992.LAB	1/23/24	11:46:40	7.2	9.7	-0.1	191.0	0.93	1.5	4.8	0.236
RUN 2_028993.LAB	1/23/24	11:47:41	8.1	10.9	-0.1	190.9	0.93	1.7	2.1	-0.002
RUN 2_028994.LAB	1/23/24	11:48:42	8.0	10.8	-0.1	190.9	0.93	1.7	2.1	-0.002
									3.0	0.077

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
RUN 2 POST SPIKE_028997.LAB	1/23/24	11:49:54	7.3	9.7	-0.1	190.9	0.93	1.4	5.6	0.316	0.065	91.8%
RUN 2 POST SPIKE_028998.LAB	1/23/24	11:50:01	7.2	9.8	-0.1	190.9	0.93	1.0	5.2	0.317	0.065	84.9%
RUN 2 POST SPIKE_028999.LAB	1/23/24	11:50:09	7.1	9.7	-0.2	190.9	0.93	1.2	5.5	0.316	0.064	89.6%
RUN 2 POST SPIKE_029000.LAB	1/23/24	11:50:17	7.2	9.9	-0.1	190.9	0.93	1.4	5.4	0.312	0.064	88.1%
RUN 2 POST SPIKE_029001.LAB	1/23/24	11:50:25	7.1	9.8	-0.1	190.9	0.93	1.3	5.3	0.328	0.067	84.8%
RUN 2 POST SPIKE_029002.LAB	1/23/24	11:50:33	7.1	9.9	-0.1	190.9	0.93	1.6	5.1	0.323	0.066	82.5%
RUN 2 POST SPIKE_029003.LAB	1/23/24	11:50:40	6.9	9.6	-0.1	190.9	0.93	1.4	5.1	0.319	0.065	83.7%
RUN 2 POST SPIKE_029004.LAB	1/23/24	11:50:48	6.9	9.6	-0.1	190.9	0.93	1.4	5.3	0.326	0.067	85.2%

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
RUN 2 POST CTS_029014.LAB	1/23/24	11:52:30	0.1	0.0	0.1	190.9	0.93	100.7	0.3	-0.013	99.9%
RUN 2 POST CTS_029015.LAB	1/23/24	11:52:37	0.0	0.0	0.1	190.9	0.93	100.3	0.3	-0.022	99.6%
RUN 2 POST CTS_029016.LAB	1/23/24	11:52:45	0.0	0.0	0.1	191.0	0.93	101.1	0.1	-0.008	100.4%
RUN 2 POST CTS_029017.LAB	1/23/24	11:52:53	0.0	0.0	0.1	190.9	0.93	100.9	0.2	0.000	100.2%
RUN 2 POST CTS_029018.LAB	1/23/24	11:53:01	0.0	0.0	-0.1	190.9	0.92	100.8	0.2	-0.028	100.1%
RUN 2 POST CTS_029019.LAB	1/23/24	11:53:09	0.0	0.0	0.1	191.0	0.92	100.6	0.2	-0.055	99.9%
RUN 2 POST CTS_029020.LAB	1/23/24	11:53:17	0.0	0.0	0.1	191.0	0.92	101.1	0.2	-0.023	100.4%
RUN 2 POST CTS_029021.LAB	1/23/24	11:53:25	0.0	0.0	0.1	190.9	0.92	101.7	0.1	-0.051	100.9%

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
RUN 3_029183.LAB	1/23/24	13:25:05	10.5	15.1	-0.2	190.9	0.83	2.2	2.8	0.006
RUN 3_029184.LAB	1/23/24	13:26:06	10.7	14.9	-0.2	190.9	0.83	2.3	2.8	0.002
RUN 3_029185.LAB	1/23/24	13:27:07	10.4	14.3	-0.1	190.9	0.83	2.1	2.6	0.000
									2.8	0.003

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
RUN 3 POST SPIKE_029192.LAB	1/23/24	13:29:28	9.5	14.2	-0.2	190.9	0.83	2.5	6.8	0.394	0.080	101.7%
RUN 3 POST SPIKE_029193.LAB	1/23/24	13:29:36	9.5	14.2	-0.2	190.9	0.83	2.0	6.9	0.390	0.080	103.6%
RUN 3 POST SPIKE_029194.LAB	1/23/24	13:29:43	9.5	14.1	-0.1	190.9	0.83	2.0	6.6	0.379	0.077	101.3%
RUN 3 POST SPIKE_029195.LAB	1/23/24	13:29:51	9.4	14.0	-0.2	190.9	0.83	2.3	6.7	0.386	0.079	101.2%
RUN 3 POST SPIKE_029196.LAB	1/23/24	13:29:59	9.3	13.9	-0.1	190.9	0.83	2.1	6.8	0.383	0.078	103.3%
RUN 3 POST SPIKE_029197.LAB	1/23/24	13:30:07	9.3	13.8	-0.1	190.9	0.83	1.8	6.6	0.396	0.081	98.3%
RUN 3 POST SPIKE_029198.LAB	1/23/24	13:30:15	9.3	13.7	-0.1	190.9	0.83	2.2	6.7	0.394	0.080	99.8%
RUN 3 POST SPIKE_029199.LAB	1/23/24	13:30:23	9.4	13.6	-0.2	190.9	0.83	1.9	6.6	0.370	0.076	102.1%

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
RUN 3 POST CTS_029209.LAB	1/23/24	13:34:26	0.1	0.1	0.1	190.9	0.83	100.0	0.0	-0.041	99.3%
RUN 3 POST CTS_029210.LAB	1/23/24	13:34:34	0.0	0.0	0.1	190.9	0.83	100.5	0.2	-0.042	99.8%
RUN 3 POST CTS_029211.LAB	1/23/24	13:34:42	0.0	0.0	0.0	190.9	0.83	100.9	0.1	-0.047	100.1%
RUN 3 POST CTS_029212.LAB	1/23/24	13:34:50	0.0	0.0	0.0	190.9	0.83	100.6	0.3	-0.031	99.8%
RUN 3 POST CTS_029213.LAB	1/23/24	13:34:58	0.0	0.0	-0.1	190.9	0.83	100.8	-0.2	-0.039	100.1%
RUN 3 POST CTS_029214.LAB	1/23/24	13:35:05	0.0	0.0	0.1	190.9	0.83	101.4	-0.2	-0.027	100.7%
RUN 3 POST CTS_029215.LAB	1/23/24	13:35:13	0.0	0.0	0.1	190.9	0.83	101.3	-0.2	-0.038	100.6%
RUN 3 POST CTS_029216.LAB	1/23/24	13:35:21	0.0	0.0	0.1	190.9	0.83	101.2	-0.2	-0.019	100.5%

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill On>90% Production

Test Location: Main Kiln Stack
 Date: 1/23/2024
 Operator: EE
 FTIR s/n: 00270

Post Test CTS, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST CTS DIR_029234.LAB	1/23/24	13:38:28	1.3	0.0	0.1	190.9	0.82	99.7	0.3	-0.032	99.0%
POST CTS DIR_029235.LAB	1/23/24	13:38:36	1.2	0.0	0.2	190.9	0.82	100.1	-0.1	-0.040	99.4%
POST CTS DIR_029236.LAB	1/23/24	13:38:44	1.1	0.0	0.0	190.9	0.82	99.9	0.4	-0.035	99.2%
POST CTS DIR_029237.LAB	1/23/24	13:38:52	1.0	0.0	0.1	190.9	0.82	99.8	0.3	-0.041	99.1%
POST CTS DIR_029238.LAB	1/23/24	13:39:00	0.9	0.0	0.1	190.9	0.82	100.6	0.2	-0.031	99.9%
POST CTS DIR_029239.LAB	1/23/24	13:39:08	0.9	0.0	0.1	190.9	0.82	100.4	0.1	-0.040	99.7%
POST CTS DIR_029240.LAB	1/23/24	13:39:15	0.8	0.0	0.1	190.9	0.82	100.4	0.5	-0.038	99.7%
POST CTS DIR_029241.LAB	1/23/24	13:39:23	0.8	0.0	0.1	190.9	0.82	100.4	-0.1	-0.040	99.7%
Average								100.2			

Post Test N2, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
POST N2 DIR_029243.LAB	1/23/24	13:44:13	0.2	0.0	0.1	190.9	0.82	0.2	-0.1	0.002
POST N2 DIR_029244.LAB	1/23/24	13:46:19	0.1	0.0	0.1	190.9	0.82	0.2	0.1	-0.001
POST N2 DIR_029245.LAB	1/23/24	13:48:25	0.0	0.0	0.0	190.9	0.82	0.2	0.3	0.003

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Test Location: Main Kiln Stack
 Date: 1/24/2024
 Operator: EE
 Operating Condition: Mill Off > 90% Production

Sample System: FTIR
 Probe Length: 8.0 ft
 Probe Type: FTIR
 Sample Plane: Horizontal
 Port Type: Flange
 Duct Shape: Circular

Number of Ports Sampled: 1 Ideal Upstream Distance: 0.0 Feet
 Number of Points per Port: 1 Ideal Downstream Distance: 0.0 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,
O2 % (dry)	Zero	Zero Nitrogen	0.0	-0.04	0.18%	N/A		
	Mid	CC195925	12.04	11.97	0.32%	4/24/2031	54.43%	
	High	CC308342	22.12	22.06	0.27%	5/25/2031		

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

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAI/700LX	2211018	25	22.12
HF ppmvw	MKS 2030	00270	40	N/A
HCN ppmvw	MKS 2030	00270	200	N/A

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Project #: M234611
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 1/24/24
Operator: EE
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	11.98	11.98	0.08	0.01	0.05	11.98	11.14	11.2	-0.05	0.00	-0.23	-0.32
2	12.04	11.98	11.97	0.01	0.02	0.02	11.98	11.05	11.1	0.00	-0.05	-0.27	0.05
3	12.04	11.97	11.99	0.02	0.03	0.03	11.98	11.05	11.1	-0.09	0.09	-0.32	0.05

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

Calibration Corrected and Calculated Data

Run #	Run Date	Start Time	End Time	Moisture %	O2 % (dry)	CO2 % (wet)	CO2 % (dry)	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	1/24/24	11:00	11:59	8.62%	11.19	15.34	16.79	2.91	4.57	0.10	0.16
2	1/24/24	12:30	13:29	8.54%	11.11	15.50	16.95	3.39	5.26	0.10	0.16
3	1/24/24	14:00	14:59	8.45%	11.10	15.52	16.95	3.50	5.43	0.10	0.15

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Test Location: Main Kiln Stack
Date: 1/24/24
Project #: M234611

<u>Time</u>	<u>O2 % (dry)</u>	
7:11	-0.04	iz
7:12	2.32	
7:13	21.43	
7:14	21.97	
7:15	22.06	
7:16	22.06	ih
7:17	3.39	
7:18	0.45	
7:19	2.48	
7:20	0.07	
7:21	10.15	
7:22	11.96	
7:23	11.97	im
7:24	11.68	
7:25	11.92	
7:26	12.01	
7:27	5.67	
7:28	0.01	
9:38	0.08	z
9:39	1.57	
9:40	11.75	
9:41	11.97	
9:42	11.98	m

Client: Holcim (US) Inc.
Facility: Devils Slide Cement Plant
Project #: M234611
Test Location: Main Kiln Stack
Date: 1/24/24

Post 1/Pre 2			Post 2/Pre 3		
<u>Time</u>	<u>O2 % (dry)</u>		<u>Time</u>	<u>O2 % (dry)</u>	
12:19	0.09		13:48	0.02	z
12:20	0.01	z	13:49	1.42	
12:21	7.79		13:50	11.68	
12:22	11.96		13:51	11.97	m
12:23	11.98	m			

Post 3		
<u>Time</u>	<u>O2 % (dry)</u>	
15:22	0.04	
15:23	0.03	z
15:24	0.03	
15:25	0.04	
15:26	10.28	
15:27	11.98	
15:28	11.99	m

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill Off>90% Production

Test Location: Main Kiln Stack
 Date: 1/24/2024
 Operator: EE
 FTIR s/n: 00270

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_029527.LAB	1/24/24	7:08:34	0.0	0.0	0.0	190.5	0.83	0.2	0.0	-0.003
N2 DIR_029528.LAB	1/24/24	7:08:42	0.0	0.0	0.0	190.5	0.83	-0.1	-0.1	0.001
N2 DIR_029529.LAB	1/24/24	7:08:49	0.0	0.0	0.0	190.5	0.83	0.0	0.1	0.007
N2 DIR_029530.LAB	1/24/24	7:08:57	0.0	0.0	0.0	190.5	0.83	-0.1	0.1	-0.006
N2 DIR_029531.LAB	1/24/24	7:09:05	0.0	0.0	0.0	190.5	0.83	0.0	0.1	0.003
N2 DIR_029532.LAB	1/24/24	7:09:13	0.0	0.0	0.0	190.5	0.83	0.0	0.1	0.001
N2 DIR_029533.LAB	1/24/24	7:09:21	0.0	0.0	0.0	190.5	0.83	0.0	-0.2	0.009
N2 DIR_029534.LAB	1/24/24	7:09:29	0.0	0.0	0.0	190.4	0.83	-0.2	-0.2	0.002
N2 DIR_029535.LAB	1/24/24	7:09:36	0.0	0.0	0.0	190.4	0.83	-0.2	0.0	0.006

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_029551.LAB	1/24/24	7:17:05	0.0	0.1	0.0	191.2	0.83	101.1	0.0	-0.023	99.7%	
CTS DIR_029552.LAB	1/24/24	7:17:12	0.0	0.1	0.0	191.2	0.83	101.4	0.0	-0.024	100.0%	
CTS DIR_029553.LAB	1/24/24	7:17:21	0.0	0.0	0.0	191.2	0.83	101.1	-0.1	-0.019	99.7%	
CTS DIR_029554.LAB	1/24/24	7:17:28	0.0	0.0	0.0	191.2	0.83	101.6	-0.1	-0.026	100.2%	
CTS DIR_029555.LAB	1/24/24	7:17:36	0.0	0.0	0.0	191.2	0.83	101.5	0.1	-0.024	100.1%	
CTS DIR_029556.LAB	1/24/24	7:17:44	0.0	0.0	0.0	191.2	0.83	101.2	0.0	-0.022	99.8%	
CTS DIR_029557.LAB	1/24/24	7:17:52	0.0	0.0	0.0	191.2	0.83	101.5	-0.2	-0.020	100.1%	
Average								101.3		-0.2	-0.020	99.9%

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_029565.LAB	1/24/24	7:19:16	0.0	0.0	0.0	191.2	0.83	-0.3	51.2	4.925	103.2%
HCN DIR_029566.LAB	1/24/24	7:19:24	0.0	0.0	0.0	191.1	0.83	-0.2	51.4	4.931	103.7%
HCN DIR_029567.LAB	1/24/24	7:19:32	0.0	0.0	0.0	191.1	0.83	-0.4	51.5	4.924	103.9%
HCN DIR_029568.LAB	1/24/24	7:19:40	0.0	0.0	0.0	191.1	0.83	-0.4	51.6	4.930	104.2%
HCN DIR_029569.LAB	1/24/24	7:19:48	0.0	0.0	0.1	191.1	0.83	-0.5	51.9	4.919	104.7%
HCN DIR_029570.LAB	1/24/24	7:19:55	0.0	0.0	0.0	191.1	0.83	-0.5	52.0	4.922	104.9%
HCN DIR_029571.LAB	1/24/24	7:20:03	0.0	0.0	-0.1	191.1	0.83	-0.2	51.8	4.933	104.6%
HCN DIR_029572.LAB	1/24/24	7:20:11	0.0	0.0	0.0	191.1	0.83	-0.3	51.9	4.936	104.7%
Average								51.7	4.928		104.2%

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS REMOTE_029577.LAB	1/24/24	7:27:30	0.1	0.0	0.0	191.1	0.84	101.5	-0.2	-0.041	100.1%
CTS REMOTE_029578.LAB	1/24/24	7:27:38	0.0	0.0	0.0	191.1	0.84	102.0	0.1	-0.019	100.5%
CTS REMOTE_029579.LAB	1/24/24	7:27:46	0.0	0.0	0.0	191.1	0.84	101.9	0.0	-0.021	100.5%
CTS REMOTE_029580.LAB	1/24/24	7:27:54	0.0	0.0	0.0	191.1	0.84	101.9	-0.1	-0.003	100.5%
CTS REMOTE_029581.LAB	1/24/24	7:28:01	0.0	0.0	0.0	191.1	0.84	101.4	0.0	-0.022	100.0%
CTS REMOTE_029582.LAB	1/24/24	7:28:09	0.0	0.0	0.0	191.1	0.84	101.9	0.0	-0.017	100.5%
CTS REMOTE_029583.LAB	1/24/24	7:28:17	0.0	0.0	0.0	191.2	0.84	100.8	-0.1	-0.028	99.4%
CTS REMOTE_029584.LAB	1/24/24	7:28:25	0.0	0.0	0.0	191.1	0.84	101.5	-0.1	-0.013	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 REMOTE_029577.LAB	1/24/24	7:27:30	0.1	0.0	0.0	191.1	0.84	101.5	-0.2	-0.041	-
CTS REMOTE_029578.LAB	1/24/24	7:27:38	0.0	0.0	0.0	191.1	0.84	102.0	0.1	-0.019	15.821
CTS REMOTE_029579.LAB	1/24/24	7:27:46	0.0	0.0	0.0	191.1	0.84	101.9	0.0	-0.021	23.821
CTS REMOTE_029580.LAB	1/24/24	7:27:54	0.0	0.0	0.0	191.1	0.84	101.9	-0.1	-0.003	
CTS REMOTE_029581.LAB	1/24/24	7:28:01	0.0	0.0	0.0	191.1	0.84	101.4	0.0	-0.022	
CTS REMOTE_029582.LAB	1/24/24	7:28:09	0.0	0.0	0.0	191.1	0.84	101.9	0.0	-0.017	
CTS REMOTE_029583.LAB	1/24/24	7:28:17	0.0	0.0	0.0	191.2	0.84	100.8	-0.1	-0.028	
CTS REMOTE_029584.LAB	1/24/24	7:28:25	0.0	0.0	0.0	191.1	0.84	101.5	-0.1	-0.013	
CTS REMOTE_029585.LAB	1/24/24	7:28:33	0.0	0.0	0.0	191.1	0.84	101.5	-0.1	-0.013	

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill Off>90% Production

Test Location: Main Kiln Stack
 Date: 1/24/2024
 Operator: EE
 FTIR s/n: 00270

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
RUN 1 POST SPIKE_029782.LAB	1/24/24	9:35:48	9.8	13.4	-0.1	190.9	0.84	1.6	5.3	0.318
RUN 1 POST SPIKE_029783.LAB	1/24/24	9:35:56	9.9	13.5	-0.2	190.9	0.84	1.7	5.6	0.312
RUN 1 POST SPIKE_029784.LAB	1/24/24	9:36:04	9.9	13.6	-0.1	190.9	0.84	1.3	5.3	0.312
									5.4	0.314

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN 1_029959.LAB	1/24/24	12:12:25	8.7	15.5	-0.2	191.0	0.84	2.4	3.2	0.002
RUN 1_029960.LAB	1/24/24	12:13:26	8.6	15.2	-0.2	190.9	0.84	2.3	3.0	0.001
RUN 1_029961.LAB	1/24/24	12:14:26	8.5	15.2	-0.2	190.9	0.84	2.3	3.0	-0.004
									3.1	0.000

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
RUN 1 POST SPIKE_029968.LAB	1/24/24	12:16:47	7.9	14.2	-0.2	190.9	0.84	2.0	7.3	0.429	0.087	100.5%
RUN 1 POST SPIKE_029969.LAB	1/24/24	12:16:55	7.8	13.9	-0.2	190.9	0.84	2.2	7.1	0.435	0.088	95.8%
RUN 1 POST SPIKE_029970.LAB	1/24/24	12:17:02	7.7	13.7	-0.2	191.0	0.84	1.9	7.2	0.443	0.090	97.1%
RUN 1 POST SPIKE_029971.LAB	1/24/24	12:17:10	7.6	13.5	-0.2	190.9	0.84	2.3	6.9	0.435	0.088	94.1%
RUN 1 POST SPIKE_029972.LAB	1/24/24	12:17:18	7.6	13.5	-0.2	190.9	0.84	2.4	7.1	0.429	0.087	97.5%
RUN 1 POST SPIKE_029973.LAB	1/24/24	12:17:26	7.7	13.6	-0.2	190.9	0.84	2.3	7.0	0.434	0.088	95.2%
RUN 1 POST SPIKE_029974.LAB	1/24/24	12:17:34	7.7	13.7	-0.2	190.9	0.84	2.1	7.2	0.442	0.090	97.2%
RUN 1 POST SPIKE_029975.LAB	1/24/24	12:17:42	7.8	13.7	-0.1	190.9	0.84	2.0	6.9	0.435	0.088	93.1%

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
RUN 1 POST CTS_029981.LAB	1/24/24	12:18:47	0.1	0.1	0.0	190.9	0.84	101.3	0.2	-0.002	99.9%
RUN 1 POST CTS_029982.LAB	1/24/24	12:18:55	0.1	0.1	0.0	190.9	0.84	101.5	0.4	-0.019	100.1%
RUN 1 POST CTS_029983.LAB	1/24/24	12:19:03	0.1	0.0	0.0	190.9	0.84	101.9	0.4	-0.012	100.5%
RUN 1 POST CTS_029984.LAB	1/24/24	12:19:11	0.0	0.1	-0.1	190.9	0.84	101.6	0.3	-0.040	100.2%
RUN 1 POST CTS_029985.LAB	1/24/24	12:19:18	0.0	0.0	0.0	190.9	0.84	100.9	0.5	-0.010	99.5%
RUN 1 POST CTS_029986.LAB	1/24/24	12:19:27	0.0	0.0	0.0	190.9	0.84	101.6	0.2	-0.020	100.2%
RUN 1 POST CTS_029987.LAB	1/24/24	12:19:34	0.0	0.0	0.0	191.0	0.84	100.4	0.4	-0.031	99.0%
RUN 1 POST CTS_029988.LAB	1/24/24	12:19:42	0.0	0.0	0.0	191.0	0.84	102.3	0.1	-0.013	100.9%

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill Off/90% Production

Test Location: Main Kiln Stack
 Date: 1/24/2024
 Operator: EE
 FTIR s/n: 00270

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN 2_030084.LAB	1/24/24	13:40:54	8.4	15.4	-0.2	191.2	0.83	2.7	3.6	-0.002
RUN 2_030085.LAB	1/24/24	13:41:55	8.5	15.6	-0.2	191.2	0.83	3.7	4.0	0.002
RUN 2_030086.LAB	1/24/24	13:42:56	8.2	14.8	-0.1	191.1	0.83	2.6	3.4	-0.002
									3.7	-0.001

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
RUN 2 POST SPIKE_030091.LAB	1/24/24	13:45:20	7.5	14.0	-0.2	191.1	0.84	2.3	7.7	0.433	0.088	97.7%
RUN 2 POST SPIKE_030092.LAB	1/24/24	13:45:28	7.6	14.0	-0.2	191.1	0.84	2.3	7.4	0.447	0.091	92.0%
RUN 2 POST SPIKE_030091.LAB	1/24/24	13:45:20	7.5	14.0	-0.2	191.1	0.84	2.3	7.7	0.433	0.088	97.7%
RUN 2 POST SPIKE_030093.LAB	1/24/24	13:45:36	7.6	14.1	-0.2	191.1	0.83	2.7	8.0	0.425	0.086	102.5%
RUN 2 POST SPIKE_030091.LAB	1/24/24	13:45:20	7.5	14.0	-0.2	191.1	0.84	2.3	7.7	0.433	0.088	97.7%
RUN 2 POST SPIKE_030094.LAB	1/24/24	13:45:44	7.6	13.9	-0.2	191.1	0.83	2.1	7.6	0.446	0.090	95.4%
RUN 2 POST SPIKE_030091.LAB	1/24/24	13:45:20	7.5	14.0	-0.2	191.1	0.84	2.3	7.7	0.433	0.088	97.7%
RUN 2 POST SPIKE_030095.LAB	1/24/24	13:45:52	7.5	13.8	-0.2	191.1	0.83	1.8	7.7	0.462	0.094	94.3%

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
RUN 2 POST CTS_030103.LAB	1/24/24	13:47:13	0.3	0.1	-0.1	191.1	0.84	101.3	0.0	-0.007	100.0%
RUN 2 POST CTS_030104.LAB	1/24/24	13:47:21	0.1	0.1	0.0	191.1	0.84	101.4	0.3	-0.030	100.0%
RUN 2 POST CTS_030105.LAB	1/24/24	13:47:29	0.1	0.1	0.0	191.1	0.84	100.4	0.1	0.001	99.1%
RUN 2 POST CTS_030106.LAB	1/24/24	13:47:37	0.0	0.1	0.0	191.1	0.84	101.1	0.1	-0.020	99.8%
RUN 2 POST CTS_030107.LAB	1/24/24	13:47:45	0.1	0.0	-0.1	191.1	0.84	100.5	0.4	-0.037	99.2%
RUN 2 POST CTS_030108.LAB	1/24/24	13:47:52	0.0	0.0	0.0	191.1	0.84	101.3	0.1	-0.007	100.0%
RUN 2 POST CTS_030109.LAB	1/24/24	13:48:00	0.0	0.0	0.0	191.2	0.84	101.1	-0.1	-0.030	99.8%
RUN 2 POST CTS_030110.LAB	1/24/24	13:48:08	0.0	0.0	0.0	191.2	0.84	101.8	0.4	-0.010	100.5%

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN 3_030210.LAB	1/24/24	15:12:26	8.4	15.4	-0.2	191.3	0.83	2.2	3.5	-0.002
RUN 3_030211.LAB	1/24/24	15:13:27	8.4	15.7	-0.2	191.3	0.83	2.4	3.8	0.000
RUN 3_030212.LAB	1/24/24	15:14:28	8.4	15.3	-0.1	191.3	0.83	2.5	3.5	0.002
									3.6	0.000

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
RUN 3 POST SPIKE_030222.LAB	1/24/24	15:17:49	7.7	14.2	-0.2	190.9	0.83	1.9	7.6	0.439	0.089	96.7%
RUN 3 POST SPIKE_030223.LAB	1/24/24	15:17:57	7.8	14.3	-0.2	190.9	0.83	1.8	7.7	0.416	0.084	101.4%
RUN 3 POST SPIKE_030224.LAB	1/24/24	15:18:05	7.8	14.4	-0.2	190.9	0.83	2.0	7.8	0.427	0.087	100.2%
RUN 3 POST SPIKE_030225.LAB	1/24/24	15:18:13	7.8	14.4	-0.2	190.8	0.83	1.8	7.8	0.436	0.089	99.9%
RUN 3 POST SPIKE_030226.LAB	1/24/24	15:18:21	7.8	14.4	-0.2	190.8	0.83	1.9	8.0	0.448	0.091	100.1%
RUN 3 POST SPIKE_030227.LAB	1/24/24	15:18:29	7.7	14.1	-0.2	190.8	0.83	2.2	7.6	0.444	0.090	96.7%
RUN 3 POST SPIKE_030228.LAB	1/24/24	15:18:36	7.6	13.7	-0.2	190.7	0.83	2.0	7.5	0.450	0.091	94.7%
RUN 3 POST SPIKE_030229.LAB	1/24/24	15:18:44	7.6	13.8	-0.2	190.7	0.83	1.7	7.5	0.421	0.085	97.3%

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
RUN 3 POST CTS_030253.LAB	1/24/24	15:22:09	0.0	0.0	0.0	190.9	0.83	101.3	0.4	-0.016	100.0%
RUN 3 POST CTS_030254.LAB	1/24/24	15:22:17	0.0	0.0	0.0	190.9	0.83	101.4	0.4	-0.003	100.1%
RUN 3 POST CTS_030255.LAB	1/24/24	15:22:25	0.0	0.0	0.0	190.9	0.83	101.7	0.4	-0.018	100.4%
RUN 3 POST CTS_030256.LAB	1/24/24	15:22:33	0.0	0.0	-0.1	190.9	0.83	101.8	0.4	-0.040	100.5%
RUN 3 POST CTS_030257.LAB	1/24/24	15:22:41	0.0	0.0	0.0	190.9	0.83	101.5	0.5	-0.016	100.2%
RUN 3 POST CTS_030258.LAB	1/24/24	15:22:49	0.0	0.0	0.0	190.9	0.83	101.8	0.3	-0.034	100.5%
RUN 3 POST CTS_030259.LAB	1/24/24	15:22:56	0.0	0.0	0.0	190.9	0.83	101.9	0.3	-0.017	100.6%
RUN 3 POST CTS_030260.LAB	1/24/24	15:23:04	0.0	0.0	0.0	190.9	0.83	100.8	0.4	-0.030	99.4%

Client: Holcim (US) Inc.
 Facility: Devils Slide Cement Plant
 Project #: M234611
 Operating Condition: Mill Off>90% Production

Test Location: Main Kiln Stack
 Date: 1/24/2024
 Operator: EE
 FTIR s/n: 00270

Post Test CTS, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST CTS DIR_030297.LAB	1/24/24	15:30:19	1.4	0.0	0.0	190.9	0.83	100.2	0.3	-0.020	98.9%
POST CTS DIR_030298.LAB	1/24/24	15:30:27	1.2	0.0	-0.1	190.9	0.83	100.1	0.4	-0.028	98.8%
POST CTS DIR_030299.LAB	1/24/24	15:30:35	1.1	0.0	-0.1	191.0	0.83	100.4	0.4	-0.026	99.1%
POST CTS DIR_030300.LAB	1/24/24	15:30:42	1.0	0.0	0.0	191.0	0.83	100.3	0.4	-0.020	99.0%
POST CTS DIR_030301.LAB	1/24/24	15:30:50	0.9	0.0	0.0	190.9	0.83	100.5	0.3	-0.023	99.2%
POST CTS DIR_030302.LAB	1/24/24	15:30:58	0.9	0.0	-0.1	190.9	0.83	100.5	0.2	-0.029	99.2%
POST CTS DIR_030303.LAB	1/24/24	15:31:06	0.9	0.0	0.0	190.9	0.83	100.5	0.2	-0.031	99.2%
POST CTS DIR_030304.LAB	1/24/24	15:31:14	0.8	0.0	0.0	190.9	0.83	100.6	0.3	-0.024	99.3%
Average								100.4			

Post Test N2, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
POST N2 DIR_030309.LAB	1/24/24	15:38:14	0.2	0.0	0.0	191.2	0.83	0.1	0.1	0.001
POST N2 DIR_030310.LAB	1/24/24	15:40:20	0.1	0.0	0.0	191.3	0.83	0.1	0.2	0.002
POST N2 DIR_030311.LAB	1/24/24	15:42:26	0.0	0.0	0.0	191.4	0.83	0.1	0.3	0.003

Appendix H - Gas Cylinder Certifications

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

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

Expiration Date: Sep 05, 2031

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

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
ETHYLENE	100.0 PPM	101.4 PPM	+/- 2%
NITROGEN	Balance		



Signature on file

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

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

Expiration Date: Apr 24, 2031

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	12.00 %	12.04 %	G1	+/- 0.5% NIST Traceable	04/24/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

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

ANALYTICAL EQUIPMENT

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

Triad Data Available Upon Request



Signature on file

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

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

Expiration Date: May 25, 2031

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	22.00 %	22.58 %	G1	+/- 0.6% NIST Traceable	05/25/2023
OXYGEN	22.00 %	22.12 %	G1	+/- 1.1% NIST Traceable	05/25/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

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

ANALYTICAL EQUIPMENT

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

Triad Data Available Upon Request



Signature on file

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

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

Expiration Date: Mar 11, 2024

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

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
SULFUR HEXAFLUORIDE	5.000 PPM	5.001 PPM	+/- 1.3%
HYDROGEN CYANIDE	50.00 PPM	49.55 PPM	+/- 5%
NITROGEN	Balance		



Signature on file

END OF THE REPORT