



**Continuous Emissions Monitoring System
Relative Accuracy Test Audit Report**

**Holcim (US) Inc. Lafarge Alpena
Alpena Cement Plant
Kiln 21
Alpena, Michigan
May 4, 2023**

**Report Submittal Date
May 25, 2023**

© Copyright 2023
All rights reserved in
Mostardi Platt

Report No. M231018B



MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
AIR QUALITY DIVISION

**RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION**

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environment, Great Lakes, and Energy, Air Quality Division upon request.

Source Name Holcim (US) d/b/a Lafarge Alpena County Alpena

Source Address 1435 Ford Avenue City Alpena

AQD Source ID (SRN) B1477 ROP No. MI-ROP-B1477-2020b ROP Section No. _____

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

Reporting period (provide inclusive dates): From _____ To _____

- 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.
- 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From _____ To _____

- 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.
- 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

Other Report Certification

Reporting period (provide inclusive dates): From May 4, 2023 To _____

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Continuous Emissions Monitoring System Relative Accuracy Test Audit Report

Kiln 21, for CEMS recertification after installation of new spectrometer

Project No. M231018B

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Jeffrey Scott
Name of Responsible Official (print or type)

Plant Manager
Title

(989) 354-4171
Phone Number

[Signature]
Signature of Responsible Official

5/24/2023
Date

* Photocopy this form as needed.

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY	1
2.0 TEST METHODOLOGY	2
Method 1 Sample and Velocity Traverse Determination	2
Method 2 Volumetric Flow Rate Determination	3
Method 3A Oxygen (O ₂) Determination	3
Multi Gas Fourier Transform Infrared (FTIR) Detector for Moisture, CO, CO ₂ , NO _x , and SO ₂ Determination	3
3.0 TEST RESULT SUMMARIES	5
4.0 CERTIFICATION.....	17
APPENDICES	
Appendix A - Test Section Diagrams	19
Appendix B - Sample Train Diagrams	22
Appendix C - Calculation Nomenclature and Formulas	25
Appendix D - Reference Method Test Data	33
Appendix E - CEMS Data	59
Appendix F – Calibration, Response, and QA/QC Data.....	69
Appendix G – Calibration Gas Cylinder Data	81
Appendix H – FTIR QA/QC DATA.....	93

1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a continuous emissions monitoring system (CEMS) relative accuracy test audit (RATA) and certification program for Holcim (US) Inc. Lafarge Alpena at the Alpena Cement Plant in Alpena, Michigan, on Kiln 21. This report summarizes the results of the test program and test methods.

The test locations, test dates, and test parameters are summarized below.

TEST INFORMATION		
Test Location	Test Date	Test Parameters
Kiln 21	May 4, 2023	Oxygen (O ₂), Carbon Dioxide (CO ₂), Nitrogen Oxides (NO _x), Sulfur Dioxide (SO ₂), Carbon Monoxide (CO), Total Hydrocarbons (THC), Volumetric Flow Rate

The purpose of the test program was to demonstrate the relative accuracies of the CEMS during the specified operating condition. The test results from this test program indicate that each CEMS meets the United States Environmental Protection Agency (USEPA) annual performance specification for relative accuracy and certification as published in 40 Code of Federal Regulations Part 60 (40CFR60).

RATA TEST RESULTS			
Parameter	Units	Required Performance	Actual Performance
O ₂	% (Dry)	≤ 20.0% of the mean reference method value	5.21%
CO ₂	% (Wet)	≤ 20.0% of the mean reference method value	4.20%
NO _x	ppmvw	≤ 20.0% of the mean reference method value	12.93%
	lb/hr	≤ 20.0% of the mean reference method value	11.26%
	lb/ton	≤ 20.0% of the mean reference method value	11.34%
SO ₂	ppmvw	≤ 20.0% of the mean reference method value	9.77%
	lb/hr	≤ 20.0% of the mean reference method value	7.54%
	lb/ton	≤ 20.0% of the mean reference method value	9.66%
CO	ppmvw	≤ 10.0% of the mean reference method value	6.20%
	lb/hr	≤ 10.0% of the mean reference method value	3.85%
THC	ppmvd @ 7% O ₂	≤ 10.0% of the applicable standard of 24 ppmvd @ 7 % O ₂	8.88%
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	2.85%

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	Address	Contact
Test Facility	Holcim (US) Inc. 1435 Ford Avenue Alpena, Michigan 49707	Mallory Miller Area Environmental Engineer (224) 517-6896 mallory.miller@holcim.com
Testing Company Supervisor	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Josh Kukla Project Manager 630-993-2100 (phone) jkukla@mp-mail.com
Testing Company Personnel		Josh Kolodziejczyk Test Engineer
		Chris Buglio Test Engineer

2.0 TEST METHODOLOGY

Emission testing was conducted following the United States Environmental Protection Agency (USEPA) methods specified in 40CFR60, Appendix A in addition to the Mostardi Platt Quality Manual. Schematics of the test section diagrams and sampling trains used are included in Appendix A and B respectively. Calculation nomenclature are included in Appendix C. Copies of analyzer print-outs for each test run are included in Appendix D. CEMS data and process data as provided by Holcim (US) Inc. are also included in Appendix E.

The following methodologies were used during the test program:

Method 1 Sample and Velocity Traverse Determination

Test measurement points were selected in accordance with USEPA Method 1, 40CFR60, Appendix A. The characteristics of the measurement locations are summarized below.

SAMPLE LOCATION INFORMATION							
Test Location	Duct Dimensions (Feet)	Duct Area (Square Feet)	No. of Ports	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Kiln 21 Breaching Duct	8 x 8.75	70.0	1	<0.5	>2.0	O ₂ , CO ₂ , NO _x , SO ₂ , CO, and THC	3
			4			Volumetric Flow Rate	40

Method 2 Volumetric Flow Rate Determination

Gas velocity was measured following USEPA Method 2, 40CFR60, Appendix A, for purposes of calculating stack gas volumetric flow rate. S-type pitot tubes, 0-10-inch differential pressure gauge, and K-type thermocouple and temperature readout were used to determine gas velocity at each sample point. All of the equipment used was calibrated in accordance with the specifications of the Method. Copies of field data sheets are included in Appendix F. Calibration data are presented in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 3A Oxygen (O₂) Determination

Flue gas O₂ concentrations and emission rates were determined in accordance with USEPA Method 3A for volumetric flow molecular weight and the O₂ RATAs. A Thermo IQ 410 analyzer was used to determine the O₂ concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the O₂ operates in the nominal range of 0% to 25% with the specific range determined by the high-level calibration gas. High-range calibrations were performed using USEPA Protocol gas. Zero nitrogen (a low ppm pollutant in balance nitrogen calibration gases) was introduced during other instrument calibrations to check instrument zero. High- and a mid-range % O₂ levels in balance nitrogen were also introduced. Zero and mid-range calibrations were performed using USEPA Protocol gas after each series of test runs. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method.

Multi Gas Fourier Transform Infrared (FTIR) Detector for Moisture, CO, CO₂, NO_x, and SO₂ Determination

Extractive Fourier transform infrared (FTIR) spectrometry following USEPA Methods 3A, 6C, 7E, 10, and 320 was performed for determination of moisture, CO, CO₂, NO_x, and SO₂.

FTIR technology works on the principle that most gases absorb infrared light. This is true for all compounds with the exception of 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 to 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. Analyte spiking was performed to assure the ability of the FTIR to quantify analytes in the presence of effluent gas. All analyte spikes were introduced using an instrument grade stainless steel rotometer. All QA/QC procedures were within the acceptance criteria allowance of Method 320.

RECEIVED

JUN 01 2023

AIR QUALITY DIVISION

FTIR QA/QC Procedures						
QA/QC Specification	Purpose	Calibration Gas Analyte	Delivery	Frequency	Acceptance Criteria	Result
M320: Zero	Verify that the FTIR is free of contaminants & zero the FTIR	Nitrogen (zero)	Direct to FTIR	pre/post test	< MDL or Noise	Pass
M320: Calibration Transfer Standard (CTS) Direct	Verify FTIR stability, confirm optical path length	Ethylene	Direct to FTIR	pretest	+/- 5% cert. value	Pass
M320: CTS Response	Verify system stability, recovery, response time	Ethylene	Sampling System	Daily, pre/post test	+/- 5% of Direct Measurement	Pass
M320: Zero Response	Verify system is free of contaminants, system bias	Nitrogen (zero)	Sampling System	pretest	Bias correct data	Pass
M320: Analyte Spike	Verify system ability to deliver and quantify analyte of interest in the presence of other effluent gases	Sulfur Dioxide	Dynamic Addition to Sampling System, ~1:10 effluent	pre test	+/- 30% theoretical recovery	Pass

Note: The determined concentrations from direct analyses were used in all system/spike recovery calculations.

Analyte Spiking

Spiking was performed prior to testing to verify the ability of the sampling system to quantitatively deliver a sample containing sulfur dioxide from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR sampling system to recover acid gases in the presence of effluent gas.

As part of the spiking procedure, samples were measured to determine native sulfur dioxide concentrations to be used in the spike recovery calculations. Dilution factor was determined using either CO₂ or H₂O% concentration in the native stack gas and when sulfur dioxide was introduced into the system to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked HCl.

QA/QC data are found in Appendix G. Copies of gas cylinder certifications are found in Appendix H. All concentration data were recorded on a wet, volume basis. The sample and data collection followed the procedures outlined in Method 320.

3.0 TEST RESULT SUMMARIES

Client: Holcim (US) Inc				Location: Kiln 21 Breaching Duct					
Facility: Alpena Cement Plant				Date: 5/4/23					
Project #: M231018				Test Method: 3A					
O₂ % (wet) RATA									
1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM O₂ % (wet)	CEM O₂ % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference² (di²)
1	1	44.1	05/04/23	10:30	10:59	7.6	7.9	-0.3	0.09
1	2	43.8	05/04/23	11:03	11:32	7.7	7.9	-0.2	0.04
1	3	43.6	05/04/23	11:37	12:06	7.6	7.9	-0.3	0.09
1	4	43.7	05/04/23	13:05	13:34	8.0	8.3	-0.3	0.09
1	5	43.5	05/04/23	13:38	14:07	7.9	8.3	-0.4	0.16
0	6	43.3	05/04/23	14:12	14:41	8.2	8.7	-0.5	0.25
1	7	44.0	05/04/23	15:38	16:07	7.8	8.2	-0.4	0.16
0	8	43.0	05/04/23	16:10	16:39	8.0	8.6	-0.6	0.36
1	9	42.9	05/04/23	16:41	17:10	8.3	8.8	-0.5	0.25
0	10	43.0	05/04/23	17:55	18:24	8.1	8.7	-0.6	0.36
1	11	43.3	05/04/23	18:30	18:59	7.9	8.3	-0.4	0.16
1	12	38.9	05/04/23	19:05	19:34	8.1	8.3	-0.2	0.04
n						9			
t(0.975)						2.306			
Mean Reference Method Value						7.878		RM avg	
Mean CEM Value						8.211		CEM avg	
Sum of Differences						-3.000		di	
Mean Difference						-0.333		d	
Sum of Differences Squared						1.080		di²	
Standard Deviation						0.100		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.077		cc	
Relative Accuracy						5.21		RA	

Client: Holcim (US) Inc Facility: Alpena Cement Plant Project #: M231018	Location: Kiln 21 Breaching Duct Test Method: 3A
---	---

CO2 % (wet) RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM CO2 % (wet)	CEM CO2 % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	17.4	17.5	-0.1	0.01
1	2	43.8	05/04/23	11:03	11:32	17.9	17.3	0.6	0.36
1	3	43.6	05/04/23	11:37	12:06	17.6	17.1	0.5	0.25
1	4	43.7	05/04/23	13:05	13:34	17.0	16.7	0.3	0.09
1	5	43.5	05/04/23	13:38	14:07	17.9	17.1	0.8	0.64
1	6	43.3	05/04/23	14:12	14:41	16.1	15.7	0.4	0.16
0	7	44.0	05/04/23	15:38	16:07	13.3	17.5	-4.2	17.64
0	8	43.0	05/04/23	16:10	16:39	12.8	16.9	-4.1	16.81
0	9	42.9	05/04/23	16:41	17:10	11.8	15.8	-4.0	16.00
1	10	43.0	05/04/23	17:55	18:24	15.1	16.1	-1.0	1.00
1	11	43.3	05/04/23	18:30	18:59	16.6	17.5	-0.9	0.81
1	12	38.9	05/04/23	19:05	19:34	16.4	17.8	-1.4	1.96
n						9			
t(0.975)						2.306			
Mean Reference Method Value						16.889		RM avg	
Mean CEM Value						16.978		CEM avg	
Sum of Differences						-0.800		di	
Mean Difference						-0.089		d	
Sum of Differences Squared						5.280		di²	
Standard Deviation						0.807		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.620		cc	
Relative Accuracy						4.20		RA	

Client: Holcim (US) Inc Facility: Alpena Cement Plant Project #: M231018	Location: Kiln 21 Breaching Duct Date: 5/4/23 Test Method: 7E
---	--

NOx ppmvw RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM NOx ppmvw	CEM NOx ppmvw	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	230.9	189.3	41.6	1730.80
1	2	43.8	05/04/23	11:03	11:32	262.2	266.9	-4.7	21.85
1	3	43.6	05/04/23	11:37	12:06	263.4	267.9	-4.5	20.49
1	4	43.7	05/04/23	13:05	13:34	308.2	342.1	-33.9	1148.97
0	5	43.5	05/04/23	13:38	14:07	276.0	329.3	-53.3	2843.91
0	6	43.3	05/04/23	14:12	14:41	313.3	390.8	-77.5	6000.58
1	7	44.0	05/04/23	15:38	16:07	89.8	103.7	-13.9	193.77
1	8	43.0	05/04/23	16:10	16:39	215.0	249.5	-34.5	1191.62
0	9	42.9	05/04/23	16:41	17:10	314.7	405.8	-91.1	8306.35
1	10	43.0	05/04/23	17:55	18:24	192.2	212.8	-20.6	426.39
1	11	43.3	05/04/23	18:30	18:59	129.1	133.9	-4.8	23.43
1	12	38.9	05/04/23	19:05	19:34	98.1	96.1	2.0	3.81
n						9			
t(0.975)						2.306			
Mean Reference Method Value						198.750		RM avg	
Mean CEM Value						206.913		CEM avg	
Sum of Differences						-73.471		di	
Mean Difference						-8.163		d	
Sum of Differences Squared						4761.134		di²	
Standard Deviation						22.807		sd	
Confidence Coefficient 2.5% Error (1-tail)						17.531		cc	
Relative Accuracy						12.93		RA	

Client: Holcim (US) Inc	Location: Kiln 21 Breaching Duct
Facility: Alpena Cement Plant	Test Method: 7E, 2
Project #: M231018	

NO_x lb/hr RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM NO _x lb/hr	CEM NO _x lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	151.17	129.82	21.35	455.8796
1	2	43.8	05/04/23	11:03	11:32	173.84	183.06	-9.22	85.0084
1	3	43.6	05/04/23	11:37	12:06	175.94	181.57	-5.63	31.6969
1	4	43.7	05/04/23	13:05	13:34	220.51	239.29	-18.78	352.6884
0	5	43.5	05/04/23	13:38	14:07	191.89	229.81	-37.92	1437.9264
0	6	43.3	05/04/23	14:12	14:41	226.55	268.13	-41.58	1728.8964
1	7	44.0	05/04/23	15:38	16:07	64.97	71.43	-6.46	41.7316
1	8	43.0	05/04/23	16:10	16:39	155.13	173.69	-18.56	344.4736
0	9	42.9	05/04/23	16:41	17:10	226.28	276.99	-50.71	2571.5041
1	10	43.0	05/04/23	17:55	18:24	138.89	144.94	-6.05	36.6025
1	11	43.3	05/04/23	18:30	18:59	85.55	91.90	-6.35	40.3225
1	12	38.9	05/04/23	19:05	19:34	65.99	74.46	-8.47	71.7409
n						9			
t(0.975)						2.306			
Mean Reference Method Value						136.888		RM avg	
Mean CEM Value						143.351		CEM avg	
Sum of Differences						-58.169		di	
Mean Difference						-6.463		d	
Sum of Differences Squared						1460.144		di²	
Standard Deviation						11.641		sd	
Confidence Coefficient 2.5% Error (1-tail)						8.948		cc	
Relative Accuracy						11.26		RA	

Client: Holcim (US) Inc **Location:** Kiln 21 Breaching Duct
Facility: Alpena Cement Plant **Test Method:** 7E, 2
Project #: M231018

NOx lb/ton RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM NOx lb/ton	CEM NOx lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	3.43	2.95	0.48	0.2304
1	2	43.8	05/04/23	11:03	11:32	3.97	4.21	-0.24	0.0576
1	3	43.6	05/04/23	11:37	12:06	4.04	4.16	-0.12	0.0144
1	4	43.7	05/04/23	13:05	13:34	5.05	5.47	-0.42	0.1764
0	5	43.5	05/04/23	13:38	14:07	4.41	5.29	-0.88	0.7744
0	6	43.3	05/04/23	14:12	14:41	5.23	6.20	-0.97	0.9409
1	7	44.0	05/04/23	15:38	16:07	1.48	1.60	-0.12	0.0144
1	8	43.0	05/04/23	16:10	16:39	3.61	4.00	-0.39	0.1521
0	9	42.9	05/04/23	16:41	17:10	5.27	6.50	-1.23	1.5129
1	10	43.0	05/04/23	17:55	18:24	3.23	3.40	-0.17	0.0289
1	11	43.3	05/04/23	18:30	18:59	1.98	2.10	-0.12	0.0144
1	12	38.9	05/04/23	19:05	19:34	1.70	2.00	-0.30	0.0900
n						9			
t(0.975)						2.306			
Mean Reference Method Value						3.166		RM avg	
Mean CEM Value						3.321		CEM avg	
Sum of Differences						-1.400		di	
Mean Difference						-0.156		d	
Sum of Differences Squared						0.779		di²	
Standard Deviation						0.265		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.204		cc	
Relative Accuracy						11.34		RA	

Client: Holcim (US) Inc	Location: Kiln 21 Breaching Duct
Facility: Alpena Cement Plant	Date: 5/4/23
Project #: M231018	Test Method: 6C

SO2 ppmvw RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM SO2 ppmvw	CEM SO2 ppmvw	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	389.6	431.2	-41.6	1728.32
0	2	43.8	05/04/23	11:03	11:32	501.6	458.2	43.4	1886.66
1	3	43.6	05/04/23	11:37	12:06	629.5	586.3	43.2	1863.31
1	4	43.7	05/04/23	13:05	13:34	11.8	14.9	-3.1	9.50
1	5	43.5	05/04/23	13:38	14:07	112.4	135.8	-23.4	549.73
1	6	43.3	05/04/23	14:12	14:41	7.7	10.9	-3.2	10.30
1	7	44.0	05/04/23	15:38	16:07	308.1	344.0	-35.9	1286.54
1	8	43.0	05/04/23	16:10	16:39	32.9	31.7	1.3	1.56
1	9	42.9	05/04/23	16:41	17:10	9.2	6.4	2.8	7.95
1	10	43.0	05/04/23	17:55	18:24	96.4	84.7	11.7	136.79
0	11	43.3	05/04/23	18:30	18:59	415.6	536.3	-120.7	14565.47
1	12	38.9	05/04/23	19:05	19:34	1169.7	1097.8	71.9	5166.98
n						10			
t(0.975)						2.262			
Mean Reference Method Value						276.722		RM avg	
Mean CEM Value						274.359		CEM avg	
Sum of Differences						23.634		di	
Mean Difference						2.363		d	
Sum of Differences Squared						10760.968		di²	
Standard Deviation						34.489		sd	
Confidence Coefficient 2.5% Error (1-tail)						24.670		cc	
Relative Accuracy						9.77		RA	

Client: Holcim (US) Inc **Location:** Kiln 21 Breaching Duct
Facility: Alpena Cement Plant **Test Method:** 6C, 2
Project #: M231018

SO2 lb/hr RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM SO ₂ lb/hr	CEM SO ₂ lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	354.64	409.46	-54.82	3005.2324
1	2	43.8	05/04/23	11:03	11:32	462.34	437.73	24.61	605.6521
1	3	43.6	05/04/23	11:37	12:06	584.61	555.66	28.95	838.1025
1	4	43.7	05/04/23	13:05	13:34	11.76	14.51	-2.75	7.5625
1	5	43.5	05/04/23	13:38	14:07	108.61	132.15	-23.54	554.1316
1	6	43.3	05/04/23	14:12	14:41	7.73	9.97	-2.24	5.0176
1	7	44.0	05/04/23	15:38	16:07	310.00	330.57	-20.57	423.1249
1	8	43.0	05/04/23	16:10	16:39	33.02	30.54	2.48	6.1504
1	9	42.9	05/04/23	16:41	17:10	9.19	6.12	3.07	9.4249
1	10	43.0	05/04/23	17:55	18:24	96.83	80.95	15.88	252.1744
0	11	43.3	05/04/23	18:30	18:59	383.03	512.78	-129.75	16835.0625
1	12	38.9	05/04/23	19:05	19:34	1094.20	1044.43	49.77	2477.0529
n						11			
t(0.975)						2.228			
Mean Reference Method Value						279.357		RM avg	
Mean CEM Value						277.463		CEM avg	
Sum of Differences						20.840		di	
Mean Difference						1.895		d	
Sum of Differences Squared						8183.626		di²	
Standard Deviation						28.538		sd	
Confidence Coefficient 2.5% Error (1-tail)						19.171		cc	
Relative Accuracy						7.54		RA	

Client: Holcim (US) Inc Facility: Alpena Cement Plant Project #: M231018	Location: Kiln 21 Breaching Duct Test Method: 6C, 2
---	--

SO2 lb/ton RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM SO ₂ lb/ton	CEM SO ₂ lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	8.04	9.30	-1.26	1.5830
1	2	43.8	05/04/23	11:03	11:32	10.56	9.94	0.62	0.3844
1	3	43.6	05/04/23	11:37	12:06	13.41	12.77	0.64	0.4096
1	4	43.7	05/04/23	13:05	13:34	0.27	0.33	-0.06	0.0036
1	5	43.5	05/04/23	13:38	14:07	2.50	3.04	-0.54	0.2916
1	6	43.3	05/04/23	14:12	14:41	0.18	0.23	-0.05	0.0025
1	7	44.0	05/04/23	15:38	16:07	7.05	7.50	-0.45	0.2025
1	8	43.0	05/04/23	16:10	16:39	0.77	0.70	0.07	0.0049
1	9	42.9	05/04/23	16:41	17:10	0.21	0.10	0.11	0.0121
1	10	43.0	05/04/23	17:55	18:24	2.25	1.90	0.35	0.1225
0	11	43.3	05/04/23	18:30	18:59	8.85	11.90	-3.05	9.3025
1	12	38.9	05/04/23	19:05	19:34	28.13	26.30	1.83	3.3489
n						11			
t(0.975)						2.228			
Mean Reference Method Value						6.670		RM avg	
Mean CEM Value						6.555		CEM avg	
Sum of Differences						1.262		di	
Mean Difference						0.115		d	
Sum of Differences Squared						6.366		di²	
Standard Deviation						0.789		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.530		cc	
Relative Accuracy						9.66		RA	

Client: Holcim (US) Inc
 Facility: Alpena Cement Plant
 Project #: M231018

Location: Kiln 21 Breaching Duct
 Date: 5/4/23
 Test Method: 10

CO ppmvw RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM CO ppmvw	CEM CO ppmvw	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	204.9	204.1	0.8	0.64
0	2	43.8	05/04/23	11:03	11:32	266.7	236.2	30.5	930.25
0	3	43.6	05/04/23	11:37	12:06	219.1	189.0	30.1	906.01
1	4	43.7	05/04/23	13:05	13:34	63.3	62.2	1.1	1.21
1	5	43.5	05/04/23	13:38	14:07	77.1	75.5	1.6	2.56
1	6	43.3	05/04/23	14:12	14:41	39.4	38.7	0.7	0.49
1	7	44.0	05/04/23	15:38	16:07	141.5	151.0	-9.5	90.25
1	8	43.0	05/04/23	16:10	16:39	62.6	62.0	0.6	0.36
1	9	42.9	05/04/23	16:41	17:10	47.5	42.6	4.9	24.01
1	10	43.0	05/04/23	17:55	18:24	73.4	73.1	0.3	0.09
1	11	43.3	05/04/23	18:30	18:59	211.4	197.1	14.3	204.49
0	12	38.9	05/04/23	19:05	19:34	391.6	378.2	13.4	179.56
n						9			
t(0.975)						2.306			
Mean Reference Method Value						102.344		RM avg	
Mean CEM Value						100.700		CEM avg	
Sum of Differences						14.800		di	
Mean Difference						1.644		d	
Sum of Differences Squared						324.100		di²	
Standard Deviation						6.121		sd	
Confidence Coefficient 2.5% Error (1-tail)						4.705		cc	
Relative Accuracy						6.20		RA	

RECEIVED

JUN 01 2023

AIR QUALITY DIVISION

Client: Holcim (US) Inc						Location: Kiln 21 Breaching Duct			
Facility: Alpena Cement Plant						Test Method: 10, 2			
Project #: M231018									
CO lb/hr RATA									
1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM CO lb/hr	CEM CO lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	81.62	84.86	-3.24	10.4976
0	2	43.8	05/04/23	11:03	11:32	107.60	98.72	8.88	78.8544
0	3	43.6	05/04/23	11:37	12:06	89.08	78.44	10.64	113.2096
1	4	43.7	05/04/23	13:05	13:34	27.57	26.51	1.06	1.1236
1	5	43.5	05/04/23	13:38	14:07	32.64	32.03	0.61	0.3721
1	6	43.3	05/04/23	14:12	14:41	17.34	16.14	1.20	1.4400
1	7	44.0	05/04/23	15:38	16:07	62.32	63.44	-1.12	1.2544
1	8	43.0	05/04/23	16:10	16:39	27.50	26.23	1.27	1.6129
0	9	42.9	05/04/23	16:41	17:10	20.81	17.72	3.09	9.5481
1	10	43.0	05/04/23	17:55	18:24	32.28	30.37	1.91	3.6481
1	11	43.3	05/04/23	18:30	18:59	85.29	82.66	2.63	6.9169
1	12	38.9	05/04/23	19:05	19:34	160.34	157.54	2.80	7.8400
n						9			
t(0.975)						2.306			
Mean Reference Method Value						58.544		RM avg	
Mean CEM Value						57.753		CEM avg	
Sum of Differences						7.120		di	
Mean Difference						0.791		d	
Sum of Differences Squared						34.706		di²	
Standard Deviation						1.906		sd	
Confidence Coefficient 2.5% Error (1-tail)						1.465		cc	
Relative Accuracy						3.85		RA	

Client: Holcim (US) Inc			Location: Kiln 21 Breaching Duct						
Facility: Alpena Cement Plant			Test Method: 25A, 3A						
Project #: M231018			Applicable Standard: 24						
THC ppmvd @ 7% O2 RATA									
1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM THC ppmvd @ 7% O2	CEM THC ppmvd @ 7% O2	(RM-CEM) Difference (di)	(RM-CEM) Difference² (di²)
1	1	44.1	05/04/23	10:30	10:59	3.6	1.1	2.5	6.43
1	2	43.8	05/04/23	11:03	11:32	3.0	0.7	2.3	5.41
1	3	43.6	05/04/23	11:37	12:06	3.0	0.7	2.3	5.51
1	4	43.7	05/04/23	13:05	13:34	1.4	0.0	1.4	1.99
1	5	43.5	05/04/23	13:38	14:07	1.6	0.0	1.6	2.62
1	6	43.3	05/04/23	14:12	14:41	1.2	0.0	1.2	1.43
0	7	44.0	05/04/23	15:38	16:07	4.4	1.7	2.7	7.30
1	8	43.0	05/04/23	16:10	16:39	1.3	0.0	1.3	1.65
1	9	42.9	05/04/23	16:41	17:10	1.3	0.0	1.3	1.60
1	10	43.0	05/04/23	17:55	18:24	1.6	0.0	1.6	2.41
0	11	43.3	05/04/23	18:30	18:59	3.9	1.3	2.7	7.10
0	12	38.9	05/04/23	19:05	19:34	4.2	1.3	2.9	8.18
n						9			
t(0.975)						2.306			
Mean Reference Method Value						1.994			
Mean CEM Value						0.268			
Sum of Differences						15.535			
Mean Difference						1.726			
Sum of Differences Squared						29.050			
Standard Deviation						0.528			
Confidence Coefficient 2.5% Error (1-tail)						0.406			
Relative Accuracy - APS						8.88			
						RM avg			
						CEM avg			
						di			
						d			
						di²			
						sd			
						cc			
						RA			

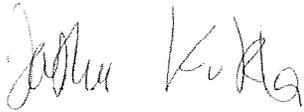
Client: Holcim (US) Inc					Test Location: Kiln 21 Breaching Duct			
Facility: Alpena Cement Plant					Test Date: 5/4/2023			
Project #: M231805					Test Method: 2			
Volumetric Flow RATA								
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	Reference Method Flow SCFH	CEM Flow SCFH	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	05/04/23	10:30	10:59	5,483,221	5,736,972	-253,751	64,389,505,888
1	2	05/04/23	11:03	11:32	5,552,183	5,750,060	-197,877	39,155,182,736
1	3	05/04/23	11:37	12:06	5,594,830	5,690,812	-95,982	9,212,496,243
1	4	05/04/23	13:05	13:34	5,992,197	5,858,949	133,249	17,755,207,171
1	5	05/04/23	13:38	14:07	5,823,556	5,841,354	-17,798	316,763,714
0	6	05/04/23	14:12	14:41	6,055,466	5,756,781	298,685	89,212,740,877
1	7	05/04/23	15:38	16:07	6,060,669	5,773,240	287,428	82,614,973,292
1	8	05/04/23	16:10	16:39	6,043,757	5,830,810	212,947	45,346,389,155
0	9	05/04/23	16:41	17:10	6,022,942	5,718,775	304,167	92,517,422,537
0	10	05/04/23	17:55	18:23	6,053,769	5,706,430	347,340	120,644,770,031
1	11	05/04/23	18:30	18:59	5,551,851	5,757,656	-205,805	42,355,543,915
1	12	05/04/23	19:05	19:34	5,635,372	5,633,841	1,531	2,344,486
n					9			
t(0.975)					2.306			
Mean Reference Method Value					5748626.252		RM avg	
Mean CEM Value					5763743.678		CEM avg	
Sum of Differences					-136056.832		di	
Mean Difference					-15117.426		d	
Sum of Differences Squared					301148406598.720		di²	
Standard Deviation					193355.753		sd	
Confidence Coefficient 2.5% Error (1-tail)					148626.122		cc	
Relative Accuracy					2.85		RA	

4.0 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 the program 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. The test program was performed in accordance with the test methods and the Mostardi Platt Quality Manual, as applicable.

MOSTARDI PLATT



Josh Kukla

Project Manager



Eric Ehlers

Quality Assurance

APPENDICES



**Continuous Emissions Monitoring System
Relative Accuracy Test Audit Report**

**Holcim (US) Inc. Lafarge Alpena
Alpena Cement Plant
Kiln 21
Alpena, Michigan
May 4, 2023**

**Report Submittal Date
May 25, 2023**

© Copyright 2023
All rights reserved in
Mostardi Platt

Report No. M231018B



MICHIGAN DEPARTMENT OF ENVIRONMENT, GREAT LAKES, AND ENERGY
AIR QUALITY DIVISION

**RENEWABLE OPERATING PERMIT
REPORT CERTIFICATION**

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environment, Great Lakes, and Energy, Air Quality Division upon request.

Source Name Holcim (US) d/b/a Lafarge Alpena County Alpena
Source Address 1435 Ford Avenue City Alpena
AQD Source ID (SRN) B1477 ROP No. MI-ROP-B1477-2020b ROP Section No. _____

Please check the appropriate box(es):

Annual Compliance Certification (Pursuant to Rule 213(4)(c))

Reporting period (provide inclusive dates): From _____ To _____

- 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.
- 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))

Reporting period (provide inclusive dates): From _____ To _____

- 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.
- 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

Other Report Certification

Reporting period (provide inclusive dates): From May 4, 2023 To _____

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Continuous Emissions Monitoring System Relative Accuracy Test Audit Report

Kiln 21, for CEMS recertification after installation of new spectrometer

Project No. M231018B

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

Jeffrey Scott Plant Manager (989) 354-4171
Name of Responsible Official (print or type) Title Phone Number

 Date 5/24/2023
Signature of Responsible Official

* Photocopy this form as needed.

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY	1
2.0 TEST METHODOLOGY	2
Method 1 Sample and Velocity Traverse Determination	2
Method 2 Volumetric Flow Rate Determination	3
Method 3A Oxygen (O ₂) Determination	3
Multi Gas Fourier Transform Infrared (FTIR) Detector for Moisture, CO, CO ₂ , NO _x , and SO ₂ Determination	3
3.0 TEST RESULT SUMMARIES	5
4.0 CERTIFICATION.....	17
APPENDICES	
Appendix A - Test Section Diagrams	19
Appendix B - Sample Train Diagrams	22
Appendix C - Calculation Nomenclature and Formulas	25
Appendix D - Reference Method Test Data	33
Appendix E - CEMS Data	59
Appendix F – Calibration, Response, and QA/QC Data.....	69
Appendix G – Calibration Gas Cylinder Data	81
Appendix H – FTIR QA/QC DATA.....	93

1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a continuous emissions monitoring system (CEMS) relative accuracy test audit (RATA) and certification program for Holcim (US) Inc. Lafarge Alpena at the Alpena Cement Plant in Alpena, Michigan, on Kiln 21. This report summarizes the results of the test program and test methods.

The test locations, test dates, and test parameters are summarized below.

TEST INFORMATION		
Test Location	Test Date	Test Parameters
Kiln 21	May 4, 2023	Oxygen (O ₂), Carbon Dioxide (CO ₂), Nitrogen Oxides (NO _x), Sulfur Dioxide (SO ₂), Carbon Monoxide (CO), Total Hydrocarbons (THC), Volumetric Flow Rate

The purpose of the test program was to demonstrate the relative accuracies of the CEMS during the specified operating condition. The test results from this test program indicate that each CEMS meets the United States Environmental Protection Agency (USEPA) annual performance specification for relative accuracy and certification as published in 40 Code of Federal Regulations Part 60 (40CFR60).

RATA TEST RESULTS			
Parameter	Units	Required Performance	Actual Performance
O ₂	% (Dry)	≤ 20.0% of the mean reference method value	5.21%
CO ₂	% (Wet)	≤ 20.0% of the mean reference method value	4.20%
NO _x	ppmvw	≤ 20.0% of the mean reference method value	12.93%
	lb/hr	≤ 20.0% of the mean reference method value	11.26%
	lb/ton	≤ 20.0% of the mean reference method value	11.34%
SO ₂	ppmvw	≤ 20.0% of the mean reference method value	9.77%
	lb/hr	≤ 20.0% of the mean reference method value	7.54%
	lb/ton	≤ 20.0% of the mean reference method value	9.66%
CO	ppmvw	≤ 10.0% of the mean reference method value	6.20%
	lb/hr	≤ 10.0% of the mean reference method value	3.85%
THC	ppmvd @ 7% O ₂	≤ 10.0% of the applicable standard of 24 ppmvd @ 7 % O ₂	8.88%
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	2.85%

The identifications of the individuals associated with the test program are summarized below.

TEST PERSONNEL INFORMATION		
Location	Address	Contact
Test Facility	Holcim (US) Inc. 1435 Ford Avenue Alpena, Michigan 49707	Mallory Miller Area Environmental Engineer (224) 517-6896 mallory.miller@holcim.com
Testing Company Supervisor	Mostardi Platt 888 Industrial Drive Elmhurst, Illinois 60126	Josh Kukla Project Manager 630-993-2100 (phone) jkukla@mp-mail.com
Testing Company Personnel		Josh Kolodziejczyk Test Engineer
		Chris Buglio Test Engineer

2.0 TEST METHODOLOGY

Emission testing was conducted following the United States Environmental Protection Agency (USEPA) methods specified in 40CFR60, Appendix A in addition to the Mostardi Platt Quality Manual. Schematics of the test section diagrams and sampling trains used are included in Appendix A and B respectively. Calculation nomenclature are included in Appendix C. Copies of analyzer print-outs for each test run are included in Appendix D. CEMS data and process data as provided by Holcim (US) Inc. are also included in Appendix E.

The following methodologies were used during the test program:

Method 1 Sample and Velocity Traverse Determination

Test measurement points were selected in accordance with USEPA Method 1, 40CFR60, Appendix A. The characteristics of the measurement locations are summarized below.

SAMPLE LOCATION INFORMATION							
Test Location	Duct Dimensions (Feet)	Duct Area (Square Feet)	No. of Ports	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Kiln 21 Breaching Duct	8 x 8.75	70.0	1	<0.5	>2.0	O ₂ , CO ₂ , NO _x , SO ₂ , CO, and THC	3
			4			Volumetric Flow Rate	40

Method 2 Volumetric Flow Rate Determination

Gas velocity was measured following USEPA Method 2, 40CFR60, Appendix A, for purposes of calculating stack gas volumetric flow rate. S-type pitot tubes, 0-10-inch differential pressure gauge, and K-type thermocouple and temperature readout were used to determine gas velocity at each sample point. All of the equipment used was calibrated in accordance with the specifications of the Method. Copies of field data sheets are included in Appendix F. Calibration data are presented in Appendix G. This testing met the performance specifications as outlined in the Method.

Method 3A Oxygen (O₂) Determination

Flue gas O₂ concentrations and emission rates were determined in accordance with USEPA Method 3A for volumetric flow molecular weight and the O₂ RATAs. A Thermo IQ 410 analyzer was used to determine the O₂ concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the O₂ operates in the nominal range of 0% to 25% with the specific range determined by the high-level calibration gas. High-range calibrations were performed using USEPA Protocol gas. Zero nitrogen (a low ppm pollutant in balance nitrogen calibration gases) was introduced during other instrument calibrations to check instrument zero. High- and a mid-range % O₂ levels in balance nitrogen were also introduced. Zero and mid-range calibrations were performed using USEPA Protocol gas after each series of test runs. Copies of the gas cylinder certifications are found in Appendix H. This testing met the performance specifications as outlined in the Method.

Multi Gas Fourier Transform Infrared (FTIR) Detector for Moisture, CO, CO₂, NO_x, and SO₂ Determination

Extractive Fourier transform infrared (FTIR) spectrometry following USEPA Methods 3A, 6C, 7E, 10, and 320 was performed for determination of moisture, CO, CO₂, NO_x, and SO₂.

FTIR technology works on the principle that most gases absorb infrared light. This is true for all compounds with the exception of 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 to 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. Analyte spiking was performed to assure the ability of the FTIR to quantify analytes in the presence of effluent gas. All analyte spikes were introduced using an instrument grade stainless steel rotometer. All QA/QC procedures were within the acceptance criteria allowance of Method 320.

RECEIVED

JUN 01 2023

AIR QUALITY DIVISION

FTIR QA/QC Procedures						
QA/QC Specification	Purpose	Calibration Gas Analyte	Delivery	Frequency	Acceptance Criteria	Result
M320: Zero	Verify that the FTIR is free of contaminants & zero the FTIR	Nitrogen (zero)	Direct to FTIR	pre/post test	< MDL or Noise	Pass
M320: Calibration Transfer Standard (CTS) Direct	Verify FTIR stability, confirm optical path length	Ethylene	Direct to FTIR	pretest	+/- 5% cert. value	Pass
M320: CTS Response	Verify system stability, recovery, response time	Ethylene	Sampling System	Daily, pre/post test	+/- 5% of Direct Measurement	Pass
M320: Zero Response	Verify system is free of contaminants, system bias	Nitrogen (zero)	Sampling System	pretest	Bias correct data	Pass
M320: Analyte Spike	Verify system ability to deliver and quantify analyte of interest in the presence of other effluent gases	Sulfur Dioxide	Dynamic Addition to Sampling System, ~1:10 effluent	pre test	+/- 30% theoretical recovery	Pass

Note: The determined concentrations from direct analyses were used in all system/spike recovery calculations.

Analyte Spiking

Spiking was performed prior to testing to verify the ability of the sampling system to quantitatively deliver a sample containing sulfur dioxide from the base of the probe to the FTIR. Analyte spiking assures the ability of the FTIR sampling system to recover acid gases in the presence of effluent gas.

As part of the spiking procedure, samples were measured to determine native sulfur dioxide concentrations to be used in the spike recovery calculations. Dilution factor was determined using either CO₂ or H₂O% concentration in the native stack gas and when sulfur dioxide was introduced into the system to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked HCl.

QA/QC data are found in Appendix G. Copies of gas cylinder certifications are found in Appendix H. All concentration data were recorded on a wet, volume basis. The sample and data collection followed the procedures outlined in Method 320.

3.0 TEST RESULT SUMMARIES

Client: Holcim (US) Inc				Location: Kiln 21 Breaching Duct					
Facility: Alpena Cement Plant				Date: 5/4/23					
Project #: M231018				Test Method: 3A					
O₂ % (wet) RATA									
1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM O₂ % (wet)	CEM O₂ % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference² (di²)
1	1	44.1	05/04/23	10:30	10:59	7.6	7.9	-0.3	0.09
1	2	43.8	05/04/23	11:03	11:32	7.7	7.9	-0.2	0.04
1	3	43.6	05/04/23	11:37	12:06	7.6	7.9	-0.3	0.09
1	4	43.7	05/04/23	13:05	13:34	8.0	8.3	-0.3	0.09
1	5	43.5	05/04/23	13:38	14:07	7.9	8.3	-0.4	0.16
0	6	43.3	05/04/23	14:12	14:41	8.2	8.7	-0.5	0.25
1	7	44.0	05/04/23	15:38	16:07	7.8	8.2	-0.4	0.16
0	8	43.0	05/04/23	16:10	16:39	8.0	8.6	-0.6	0.36
1	9	42.9	05/04/23	16:41	17:10	8.3	8.8	-0.5	0.25
0	10	43.0	05/04/23	17:55	18:24	8.1	8.7	-0.6	0.36
1	11	43.3	05/04/23	18:30	18:59	7.9	8.3	-0.4	0.16
1	12	38.9	05/04/23	19:05	19:34	8.1	8.3	-0.2	0.04
n						9			
t(0.975)						2.306			
Mean Reference Method Value						7.878		RM avg	
Mean CEM Value						8.211		CEM avg	
Sum of Differences						-3.000		di	
Mean Difference						-0.333		d	
Sum of Differences Squared						1.080		di²	
Standard Deviation						0.100		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.077		cc	
Relative Accuracy						5.21		RA	

Client: Holcim (US) Inc
 Facility: Alpena Cement Plant
 Project #: M231018

Location: Kiln 21 Breaching Duct
 Test Method: 3A

CO2 % (wet) RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM CO2 % (wet)	CEM CO2 % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	17.4	17.5	-0.1	0.01
1	2	43.8	05/04/23	11:03	11:32	17.9	17.3	0.6	0.36
1	3	43.6	05/04/23	11:37	12:06	17.6	17.1	0.5	0.25
1	4	43.7	05/04/23	13:05	13:34	17.0	16.7	0.3	0.09
1	5	43.5	05/04/23	13:38	14:07	17.9	17.1	0.8	0.64
1	6	43.3	05/04/23	14:12	14:41	16.1	15.7	0.4	0.16
0	7	44.0	05/04/23	15:38	16:07	13.3	17.5	-4.2	17.64
0	8	43.0	05/04/23	16:10	16:39	12.8	16.9	-4.1	16.81
0	9	42.9	05/04/23	16:41	17:10	11.8	15.8	-4.0	16.00
1	10	43.0	05/04/23	17:55	18:24	15.1	16.1	-1.0	1.00
1	11	43.3	05/04/23	18:30	18:59	16.6	17.5	-0.9	0.81
1	12	38.9	05/04/23	19:05	19:34	16.4	17.8	-1.4	1.96
n						9			
t(0.975)						2.306			
Mean Reference Method Value						16.889		RM avg	
Mean CEM Value						16.978		CEM avg	
Sum of Differences						-0.800		di	
Mean Difference						-0.089		d	
Sum of Differences Squared						5.280		di²	
Standard Deviation						0.807		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.620		cc	
Relative Accuracy						4.20		RA	

Client: Holcim (US) Inc	Location: Kiln 21 Breaching Duct
Facility: Alpena Cement Plant	Date: 5/4/23
Project #: M231018	Test Method: 7E

NOx ppmvw RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM NOx ppmvw	CEM NOx ppmvw	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	230.9	189.3	41.6	1730.80
1	2	43.8	05/04/23	11:03	11:32	262.2	266.9	-4.7	21.85
1	3	43.6	05/04/23	11:37	12:06	263.4	267.9	-4.5	20.49
1	4	43.7	05/04/23	13:05	13:34	308.2	342.1	-33.9	1148.97
0	5	43.5	05/04/23	13:38	14:07	276.0	329.3	-53.3	2843.91
0	6	43.3	05/04/23	14:12	14:41	313.3	390.8	-77.5	6000.58
1	7	44.0	05/04/23	15:38	16:07	89.8	103.7	-13.9	193.77
1	8	43.0	05/04/23	16:10	16:39	215.0	249.5	-34.5	1191.62
0	9	42.9	05/04/23	16:41	17:10	314.7	405.8	-91.1	8306.35
1	10	43.0	05/04/23	17:55	18:24	192.2	212.8	-20.6	426.39
1	11	43.3	05/04/23	18:30	18:59	129.1	133.9	-4.8	23.43
1	12	38.9	05/04/23	19:05	19:34	98.1	96.1	2.0	3.81
n						9			
t(0.975)						2.306			
Mean Reference Method Value						198.750		RM avg	
Mean CEM Value						206.913		CEM avg	
Sum of Differences						-73.471		di	
Mean Difference						-8.163		d	
Sum of Differences Squared						4761.134		di²	
Standard Deviation						22.807		sd	
Confidence Coefficient 2.5% Error (1-tail)						17.531		cc	
Relative Accuracy						12.93		RA	

Client: Holcim (US) Inc	Location: Kiln 21 Breaching Duct
Facility: Alpena Cement Plant	Test Method: 7E, 2
Project #: M231018	

NOx lb/ton RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM NOx lb/ton	CEM NOx lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	3.43	2.95	0.48	0.2304
1	2	43.8	05/04/23	11:03	11:32	3.97	4.21	-0.24	0.0576
1	3	43.6	05/04/23	11:37	12:06	4.04	4.16	-0.12	0.0144
1	4	43.7	05/04/23	13:05	13:34	5.05	5.47	-0.42	0.1764
0	5	43.5	05/04/23	13:38	14:07	4.41	5.29	-0.88	0.7744
0	6	43.3	05/04/23	14:12	14:41	5.23	6.20	-0.97	0.9409
1	7	44.0	05/04/23	15:38	16:07	1.48	1.60	-0.12	0.0144
1	8	43.0	05/04/23	16:10	16:39	3.61	4.00	-0.39	0.1521
0	9	42.9	05/04/23	16:41	17:10	5.27	6.50	-1.23	1.5129
1	10	43.0	05/04/23	17:55	18:24	3.23	3.40	-0.17	0.0289
1	11	43.3	05/04/23	18:30	18:59	1.98	2.10	-0.12	0.0144
1	12	38.9	05/04/23	19:05	19:34	1.70	2.00	-0.30	0.0900
n						9			
t(0.975)						2.306			
Mean Reference Method Value						3.166		RM avg	
Mean CEM Value						3.321		CEM avg	
Sum of Differences						-1.400		di	
Mean Difference						-0.156		d	
Sum of Differences Squared						0.779		di²	
Standard Deviation						0.265		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.204		cc	
Relative Accuracy						11.34		RA	

Client: Holcim (US) Inc	Location: Kiln 21 Breaching Duct
Facility: Alpena Cement Plant	Date: 5/4/23
Project #: M231018	Test Method: 6C

SO2 ppmvw RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM SO2 ppmvw	CEM SO2 ppmvw	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	389.6	431.2	-41.6	1728.32
0	2	43.8	05/04/23	11:03	11:32	501.6	458.2	43.4	1886.66
1	3	43.6	05/04/23	11:37	12:06	629.5	586.3	43.2	1863.31
1	4	43.7	05/04/23	13:05	13:34	11.8	14.9	-3.1	9.50
1	5	43.5	05/04/23	13:38	14:07	112.4	135.8	-23.4	549.73
1	6	43.3	05/04/23	14:12	14:41	7.7	10.9	-3.2	10.30
1	7	44.0	05/04/23	15:38	16:07	308.1	344.0	-35.9	1286.54
1	8	43.0	05/04/23	16:10	16:39	32.9	31.7	1.3	1.56
1	9	42.9	05/04/23	16:41	17:10	9.2	6.4	2.8	7.95
1	10	43.0	05/04/23	17:55	18:24	96.4	84.7	11.7	136.79
0	11	43.3	05/04/23	18:30	18:59	415.6	536.3	-120.7	14565.47
1	12	38.9	05/04/23	19:05	19:34	1169.7	1097.8	71.9	5166.98
n						10			
t(0.975)						2.262			
Mean Reference Method Value						276.722		RM avg	
Mean CEM Value						274.359		CEM avg	
Sum of Differences						23.634		di	
Mean Difference						2.363		d	
Sum of Differences Squared						10760.968		di²	
Standard Deviation						34.489		sd	
Confidence Coefficient 2.5% Error (1-tail)						24.670		cc	
Relative Accuracy						9.77		RA	

Client: Holcim (US) Inc	Location: Kiln 21 Breaching Duct
Facility: Alpena Cement Plant	Test Method: 6C, 2
Project #: M231018	

SO2 lb/hr RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM SO ₂ lb/hr	CEM SO ₂ lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	354.64	409.46	-54.82	3005.2324
1	2	43.8	05/04/23	11:03	11:32	462.34	437.73	24.61	605.6521
1	3	43.6	05/04/23	11:37	12:06	584.61	555.66	28.95	838.1025
1	4	43.7	05/04/23	13:05	13:34	11.76	14.51	-2.75	7.5625
1	5	43.5	05/04/23	13:38	14:07	108.61	132.15	-23.54	554.1316
1	6	43.3	05/04/23	14:12	14:41	7.73	9.97	-2.24	5.0176
1	7	44.0	05/04/23	15:38	16:07	310.00	330.57	-20.57	423.1249
1	8	43.0	05/04/23	16:10	16:39	33.02	30.54	2.48	6.1504
1	9	42.9	05/04/23	16:41	17:10	9.19	6.12	3.07	9.4249
1	10	43.0	05/04/23	17:55	18:24	96.83	80.95	15.88	252.1744
0	11	43.3	05/04/23	18:30	18:59	383.03	512.78	-129.75	16835.0625
1	12	38.9	05/04/23	19:05	19:34	1094.20	1044.43	49.77	2477.0529
n						11			
t(0.975)						2.228			
Mean Reference Method Value						279.357		RM avg	
Mean CEM Value						277.463		CEM avg	
Sum of Differences						20.840		di	
Mean Difference						1.895		d	
Sum of Differences Squared						8183.626		di²	
Standard Deviation						28.538		sd	
Confidence Coefficient 2.5% Error (1-tail)						19.171		cc	
Relative Accuracy						7.54		RA	

Client: Holcim (US) Inc **Location:** Kiln 21 Breaching Duct
Facility: Alpena Cement Plant **Test Method:** 6C, 2
Project #: M231018

SO2 lb/ton RATA

1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM SO ₂ lb/ton	CEM SO ₂ lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	8.04	9.30	-1.26	1.5830
1	2	43.8	05/04/23	11:03	11:32	10.56	9.94	0.62	0.3844
1	3	43.6	05/04/23	11:37	12:06	13.41	12.77	0.64	0.4096
1	4	43.7	05/04/23	13:05	13:34	0.27	0.33	-0.06	0.0036
1	5	43.5	05/04/23	13:38	14:07	2.50	3.04	-0.54	0.2916
1	6	43.3	05/04/23	14:12	14:41	0.18	0.23	-0.05	0.0025
1	7	44.0	05/04/23	15:38	16:07	7.05	7.50	-0.45	0.2025
1	8	43.0	05/04/23	16:10	16:39	0.77	0.70	0.07	0.0049
1	9	42.9	05/04/23	16:41	17:10	0.21	0.10	0.11	0.0121
1	10	43.0	05/04/23	17:55	18:24	2.25	1.90	0.35	0.1225
0	11	43.3	05/04/23	18:30	18:59	8.85	11.90	-3.05	9.3025
1	12	38.9	05/04/23	19:05	19:34	28.13	26.30	1.83	3.3489
n						11			
t(0.975)						2.228			
Mean Reference Method Value						6.670		RM avg	
Mean CEM Value						6.555		CEM avg	
Sum of Differences						1.262		di	
Mean Difference						0.115		d	
Sum of Differences Squared						6.366		di²	
Standard Deviation						0.789		sd	
Confidence Coefficient 2.5% Error (1-tail)						0.530		cc	
Relative Accuracy						9.66		RA	

Client: Holcim (US) Inc				Location: Kiln 21 Breaching Duct					
Facility: Alpena Cement Plant				Test Method: 10, 2					
Project #: M231018									
CO lb/hr RATA									
1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM CO lb/hr	CEM CO lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	81.62	84.86	-3.24	10.4976
0	2	43.8	05/04/23	11:03	11:32	107.60	98.72	8.88	78.8544
0	3	43.6	05/04/23	11:37	12:06	89.08	78.44	10.64	113.2096
1	4	43.7	05/04/23	13:05	13:34	27.57	26.51	1.06	1.1236
1	5	43.5	05/04/23	13:38	14:07	32.64	32.03	0.61	0.3721
1	6	43.3	05/04/23	14:12	14:41	17.34	16.14	1.20	1.4400
1	7	44.0	05/04/23	15:38	16:07	62.32	63.44	-1.12	1.2544
1	8	43.0	05/04/23	16:10	16:39	27.50	26.23	1.27	1.6129
0	9	42.9	05/04/23	16:41	17:10	20.81	17.72	3.09	9.5481
1	10	43.0	05/04/23	17:55	18:24	32.28	30.37	1.91	3.6481
1	11	43.3	05/04/23	18:30	18:59	85.29	82.66	2.63	6.9169
1	12	38.9	05/04/23	19:05	19:34	160.34	157.54	2.80	7.8400
n						9			
t(0.975)						2.306			
Mean Reference Method Value						58.544		RM avg	
Mean CEM Value						57.753		CEM avg	
Sum of Differences						7.120		di	
Mean Difference						0.791		d	
Sum of Differences Squared						34.706		di²	
Standard Deviation						1.906		sd	
Confidence Coefficient 2.5% Error (1-tail)						1.465		cc	
Relative Accuracy						3.85		RA	

Client: Holcim (US) Inc						Location: Kiln 21 Breaching Duct			
Facility: Alpena Cement Plant						Test Method: 25A, 3A			
Project #: M231018									
Applicable Standard: 24									
THC ppmvd @ 7% O2 RATA									
1=accept 0=reject	Test Run	Clinker ton/hr	Test Date	Start Time	End Time	RM THC ppmvd @ 7% O2	CEM THC ppmvd @ 7% O2	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	44.1	05/04/23	10:30	10:59	3.6	1.1	2.5	6.43
1	2	43.8	05/04/23	11:03	11:32	3.0	0.7	2.3	5.41
1	3	43.6	05/04/23	11:37	12:06	3.0	0.7	2.3	5.51
1	4	43.7	05/04/23	13:05	13:34	1.4	0.0	1.4	1.99
1	5	43.5	05/04/23	13:38	14:07	1.6	0.0	1.6	2.62
1	6	43.3	05/04/23	14:12	14:41	1.2	0.0	1.2	1.43
0	7	44.0	05/04/23	15:38	16:07	4.4	1.7	2.7	7.30
1	8	43.0	05/04/23	16:10	16:39	1.3	0.0	1.3	1.65
1	9	42.9	05/04/23	16:41	17:10	1.3	0.0	1.3	1.60
1	10	43.0	05/04/23	17:55	18:24	1.6	0.0	1.6	2.41
0	11	43.3	05/04/23	18:30	18:59	3.9	1.3	2.7	7.10
0	12	38.9	05/04/23	19:05	19:34	4.2	1.3	2.9	8.18
n						9			
t(0.975)						2.306			
Mean Reference Method Value						1.994			
Mean CEM Value						0.268			
Sum of Differences						15.535			
Mean Difference						1.726			
Sum of Differences Squared						29.050			
Standard Deviation						0.528			
Confidence Coefficient 2.5% Error (1-tail)						0.406			
Relative Accuracy - APS						8.88			
						RM avg			
						CEM avg			
						di			
						d			
						di²			
						sd			
						cc			
						RA			

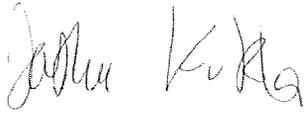
Client: Holcim (US) Inc Facility: Alpena Cement Plant Project #: M231805					Test Location: Kiln 21 Breaching Duct Test Date: 5/4/2023 Test Method: 2 Volumetric Flow RATA			
1=accept 0=reject	Test Run	Test Date	Start Time	End Time	Reference Method Flow SCFH	CEM Flow SCFH	(RM-CEM) Difference (di)	(RM-CEM) Difference ² (di ²)
1	1	05/04/23	10:30	10:59	5,483,221	5,736,972	-253,751	64,389,505,888
1	2	05/04/23	11:03	11:32	5,552,183	5,750,060	-197,877	39,155,182,736
1	3	05/04/23	11:37	12:06	5,594,830	5,690,812	-95,982	9,212,496,243
1	4	05/04/23	13:05	13:34	5,992,197	5,858,949	133,249	17,755,207,171
1	5	05/04/23	13:38	14:07	5,823,556	5,841,354	-17,798	316,763,714
0	6	05/04/23	14:12	14:41	6,055,466	5,756,781	298,685	89,212,740,877
1	7	05/04/23	15:38	16:07	6,060,669	5,773,240	287,428	82,614,973,292
1	8	05/04/23	16:10	16:39	6,043,757	5,830,810	212,947	45,346,389,155
0	9	05/04/23	16:41	17:10	6,022,942	5,718,775	304,167	92,517,422,537
0	10	05/04/23	17:55	18:23	6,053,769	5,706,430	347,340	120,644,770,031
1	11	05/04/23	18:30	18:59	5,551,851	5,757,656	-205,805	42,355,543,915
1	12	05/04/23	19:05	19:34	5,635,372	5,633,841	1,531	2,344,486
n					9			
t(0.975)					2.306			
Mean Reference Method Value					5748626.252		RM avg	
Mean CEM Value					5763743.678		CEM avg	
Sum of Differences					-136056.832		di	
Mean Difference					-15117.426		d	
Sum of Differences Squared					301148406598.720		di²	
Standard Deviation					193355.753		sd	
Confidence Coefficient 2.5% Error (1-tail)					148626.122		cc	
Relative Accuracy					2.85		RA	

4.0 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 the program 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. The test program was performed in accordance with the test methods and the Mostardi Platt Quality Manual, as applicable.

MOSTARDI PLATT



Josh Kukla

Project Manager



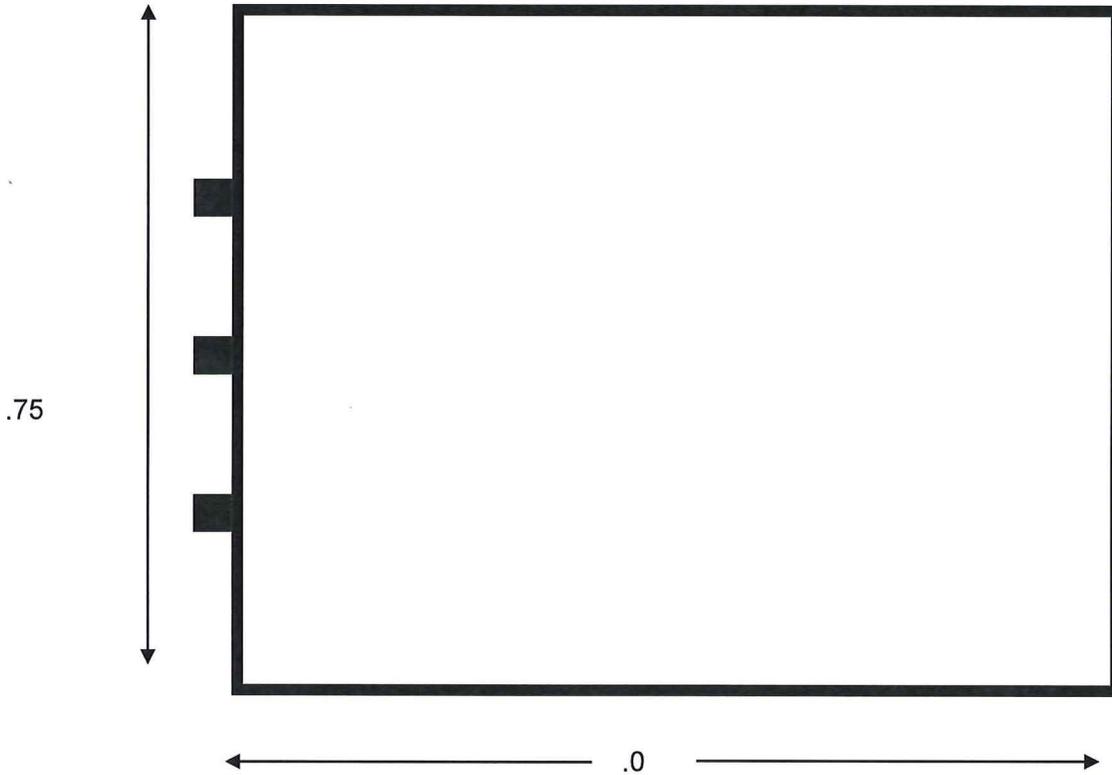
Eric Ehlers

Quality Assurance

APPENDICES

Appendix A - Test Section Diagrams

EQUAL AREA TRAVERSE FOR RECTANGULAR DUCTS (Gaseous)



Job: Holcim (US) Inc.
Alpena Cement Plant
Alpena, Michigan

Test Date : May 4, 2023

Area: 70.0 square feet

Test Location: Kiln 21 Breaching Duct

No. Test Ports: 1 Test

Length: .0 feet

Points per Port: 3

Width: .75 feet

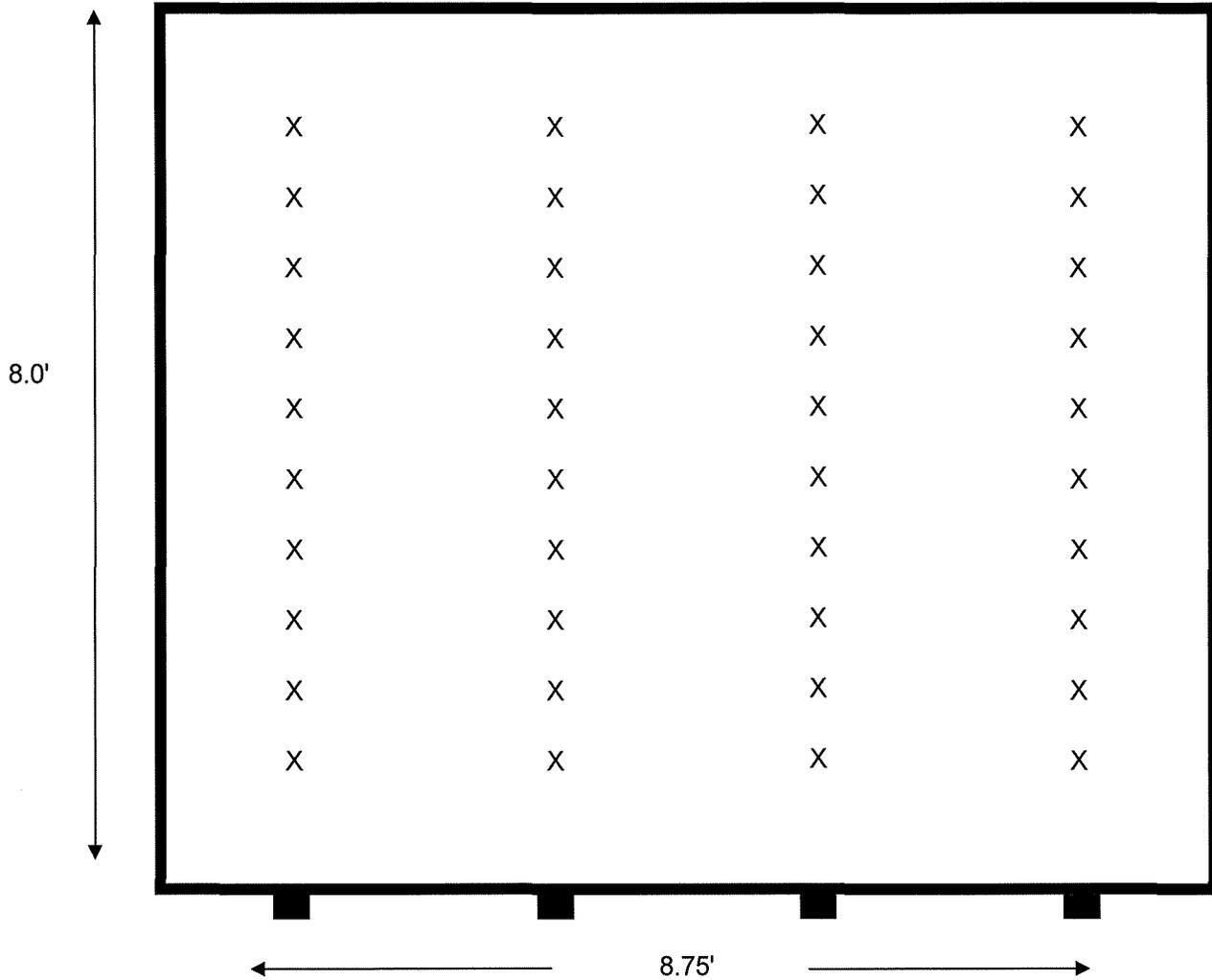
Upstream: 0.470 meter

Downstream: 1.110 meter

Equivalent Diameter: .322 feet

Port Length 9.0 Inches

EQUAL AREA TRAVERSE FOR RECTANGULAR DUCTS



Job: Holcim (US) Inc.
Alpena Plant

Date: May 4, 2023

Area: 70.00 square feet

Test Location: Kiln 21 Breaching Duct

No. Test Ports: 4

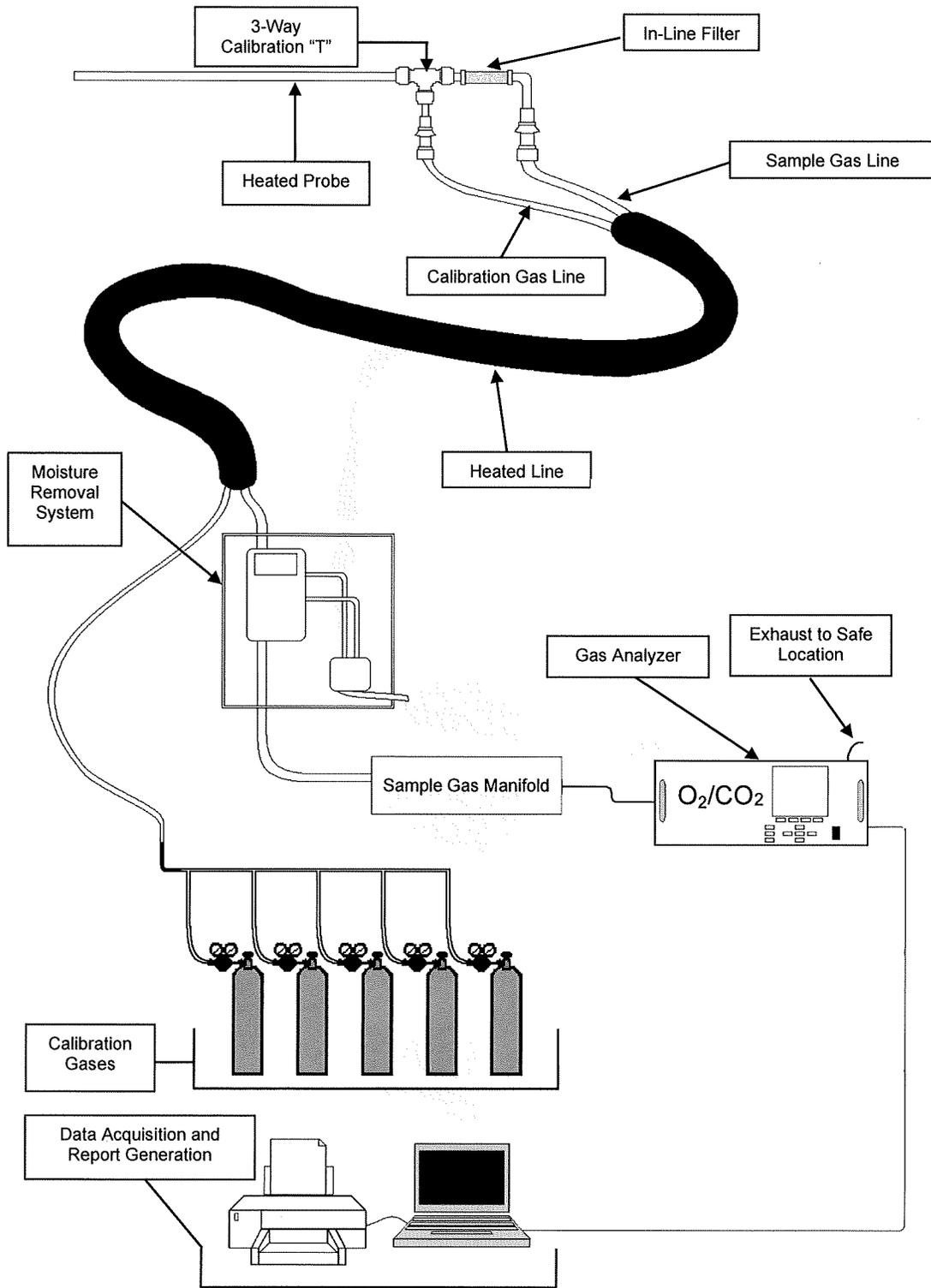
Length: 8.00 feet

Tests Points per Port: 12

Width: 8.75 feet

Appendix B - Sample Train Diagrams

USEPA Method 3A Extractive Gaseous Sampling Diagram



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

