1.0 EXECUTIVE SUMMARY

Mostardi Platt conducted a continuous emissions monitoring system (CEMS) relative accuracy test audit (RATA) program for Holcim (US) Inc. Lafarge Alpena at the Alpena Cement Plant in Alpena, Michigan, on the below listed test locations. 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 Locations	**Test Dates**	**Test Parameters**
Kilns 19, 20, and 21	August 31, 2022 and September 1 and 15, 2022	Mercury (Hg), Oxygen (O_2), Carbon Dioxide (CO_2), Nitrogen Oxides (NO_x), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Total Hydrocarbons (THC), and Volumetric Flow Rate
Kilns 22 and 23	August 30, 2022 and September 13, 2022	O_2, CO_2, NO_x, CO, and Volumetric Flow Rate
Raw Mills 14 and 15	August 23 and 24, 2022	THC

The purpose of the test program was to demonstrate the relative accuracies of the above 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).

TEST RESULTS			
Kiln 19			
Parameter	**Units**	**Required Performance**	**Actual Performance**
O_2	% (Dry)	≤ 20.0% of the mean reference method value	11.35%
CO_2	% (Wet)	≤ 20.0% of the mean reference method value	5.59%
NO_x	ppmvd	≤ 20.0% of the mean reference method value	3.28%
	lb/hr	≤ 20.0% of the mean reference method value	7.90%
	lb/ton	≤ 20.0% of the mean reference method value	6.60%
SO_2	ppmvd	≤ 20.0% of the mean reference method value	18.76%
	lb/hr	≤ 10.0% of the applicable source standard of 136 lb/hr	5.47%
	lb/ton	≤ 10.0% of the applicable source standard of 4.07 lb/ton	3.79%
CO	ppmvd	≤ 10% of the mean reference method value	5.11%
	lb/hr	≤ 10.0% of the mean reference method value	7.93%
THC	ppmvd @ 7% O_2	≤ 10.0% of the applicable standard of 24 ppmvd @ 7 % O_2	6.15
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	4.44%
Hg	ug/wscm	≤ 20.0% of the mean reference method value	11.80%

Kiln 20			
Parameter	**Units**	**Required Performance**	**Actual Performance**
O_2	% (Dry)	≤ 20.0% of the mean reference method value	15.91%
CO_2	% (Wet)	≤ 20.0% of the mean reference method value	12.90%
NO_x	ppmvd	≤ 20.0% of the mean reference method value	15.98%
	lb/hr	≤ 20.0% of the mean reference method value	11.86%
	lb/ton	≤ 20.0% of the mean reference method value	12.31%
SO_2	ppmvd	≤ 20.0% of the mean reference method value	8.35%
	lb/hr	≤ 20.0% of the mean reference method value	5.00%
	lb/ton	≤ 20.0% of the mean reference method value	5.13%
CO	ppmvd	≤ 10.0% of the mean reference method value	3.07%
	lb/hr	≤ 10.0% of the mean reference method value	4.16%
THC	ppmvd @ 7% O_2	≤ 10.0% of the applicable standard of 24 ppmvd @ 7 % O_2	4.51%
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	3.31%
Hg	ug/wscm	≤ 20.0% of the mean reference method value	6.53%

Kiln 21			
Parameter	**Units**	**Required Performance**	**Actual Performance**
O_2	% (Dry)	≤ 20.0% of the mean reference method value	10.81%
CO_2	% (Wet)	≤ 20.0% of the mean reference method value	5.47%
NO_x	ppmvd	≤ 20.0% of the mean reference method value	7.76%
	lb/hr	≤ 10.0% of the applicable standard of 200 lb/hr	7.31%
	lb/ton	≤ 10.0% of the applicable standard of 4.48 lb/ton	7.89%
SO_2	ppmvd	≤ 20.0% of the mean reference method value	1.75%
	lb/hr	≤ 20.0% of the mean reference method value	3.42%
	lb/ton	≤ 10.0% of the applicable standard of 4.09 lb/ton	2.74%
CO	ppmvd	≤ 10.0% of the mean reference method value	4.19%
	lb/hr	≤ 10.0% of the mean reference method value	2.73%
THC	ppmvd @ 7% O_2	≤ 10.0% of the applicable standard of 24 ppmvd @ 7 % O_2	0.59%
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	1.99%
Hg	ug/wscm	≤ 20.0% of the mean reference method value	6.06%

Kiln 22			
Parameter	**Units**	**Required Performance**	**Actual Performance**
O_2	% (Dry)	≤ 20.0% of the mean reference method value	3.18%
CO_2	% (Dry)	≤ 20.0% of the mean reference method value	3.61%
NO_x	ppmvd	≤ 20.0% of the mean reference method value	14.62%
	lb/hr	≤ 20.0% of the mean reference method value	13.91%
	lb/ton	≤ 20.0% of the mean reference method value	14.12%
CO	ppmvd	≤ +/- 5ppm mean difference plus confidence coefficient	4.61 ppm + cc difference
	lb/hr	≤ 5.0% of the applicable source standard of 122.6 lb/hr	2.03%
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	6.07%

Kiln 23			
Parameter	**Units**	**Required Performance**	**Actual Performance**
O_2	% (Dry)	≤ 20.0% of the mean reference method value	2.29%
CO_2	% (Dry)	≤ 20.0% of the mean reference method value	2.37%
NO_x	ppmvd	≤ 20.0% of the mean reference method value	3.64%
	lb/hr	≤ 20.0% of the mean reference method value	7.99%
	lb/ton	≤ 20.0% of the mean reference method value	7.81%
CO	ppmvd	≤ 10.0% of the mean reference method value	6.74%
	lb/hr	≤ 20.0% of the mean reference method value	9.19%
Volumetric Flow	scfh	≤ 20.0% of the mean reference method value	9.61%

WGS			
Parameter	**Units**	**Required Performance**	**Actual Performance**
O_2	% (Dry)	≤ 20.0% of the mean reference method value	0.60%
SO_2	ppmvd	≤ 20.0% of the mean reference method value	4.96%
	lb/hr	≤ 20.0% of the mean reference method value	6.41%
	lb/ton	≤ 20.0% of the mean reference method value	9.15%
THC	ppmvd @ 7% O_2	≤ 20.0% of the mean reference method value	10.79%
Volumetric Flow	scfh	≤ 10.0% of the mean reference method value	1.51%
Hg	ug/wscm	≤ 20.0% of the mean reference method value	19.06%

Raw Mill 14			
Parameter	**Units**	**Required Performance**	**Actual Performance**
THC	ppmvd	≤ 20.0% of the mean reference method value	2.13%

Raw Mill 15			
Parameter	**Units**	**Required Performance**	**Actual Performance**
THC	ppmvd	≤ 20.0% of the mean reference method value	2.70%

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	Stuart Sands Senior Project Manager 630-993-2663 (phone) ssands@mp-mail.com
Testing Company Personnel		Joshua Kukla Project Supervisor
		Jared Priesz Test Engineer
		Mitchell Neessen Test Engineer
		Joseph Devereux Test Technician
		Aaron Benninghoff Test Technician
		Willie Drake Test Technician

2.0 TEST METHODOLOGY

Emission testing was conducted following the United States Environmental Protection Agency (USEPA) methods specified in 40CFR60, Appendix A in addition 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. CEM 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 19 Breaching Duct	8 x 9.91667	79.33	3	0.730	0.790	Volumetric Flow Rate	42
						O_2, CO_2, NO_x, SO_2,	3

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**
						CO, THC, and Hg	
Kiln 20 Breaching Duct	8 x 8.75	70.00	3	0.47	1.11	Volumetric Flow Rate	42
						O_2, CO_2, NO_x, SO_2, CO, THC, and Hg	3
Kiln 21 Breaching Duct	8 x 8.67	69.36	3	<0.5	>2.0	Volumetric Flow Rate	42
						O_2, CO_2, NO_x, SO_2, CO, THC, and Hg	3
Kiln 22 and 23 Baghouse Outlets (Identical)	10 diameter	78.54	2	0.19	1.46	Volumetric Flow Rate	16
						O_2, CO_2, NO_x, and CO	3
WGS Stack	12	113.10	4	6.0	4.5	Volumetric Flow Rate	42
						O_2, SO_2, THC, and Hg	3
Raw Mill 14 and 15 Exhausts (Identical)	5.45833 diameter	23.40	1	>2.0	~4.0	THC	3

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 2F Volumetric Flow Rate Determination

Gas velocity for the WGS was measured following USEPA Method 2F, 40CFR60, Appendix A, for purposes of calculating stack gas volumetric flow rate.

At each traverse point, the probe is yaw-nulled. Then, the yaw angle, differential pressures and temperatures were measured and recorded at each traverse point. The axial velocity at each traverse point is then calculated and used to calculate the stack gas volumetric flow rate using the appropriate calibration curves.

All of the equipment used is calibrated in accordance with the specifications of the method.

Method 3A Oxygen (O_2) Determination

Flue gas O_2 concentrations and emission rates were determined in accordance with USEPA Method 3A for volumetric flow molecular weight and the O_2 RATAs. A Thermo IQ 410 analyzer was used to determine the O_2 concentrations in the manner specified in the Method. The instrument has a paramagnetic detector and the O_2 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 % O_2 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.

Method 4 Moisture Determination

Kilns 22 and 23 stack gas moisture content was determined using a Method 4 sampling train. In this technique, stack gas is drawn through a heated probe and filter assembly after which moisture is condensed through a series of four impingers. The first two impingers were charged with approximately 100 mls of deionized, distilled water. Impinger three was left empty and impinger four was charged with clean, dried silica gel. The water volumes of the impinger train were measured and the silica gel was weighed before and after each test run to determine the mass of moisture condensed.

During testing, the sample train was operated in the manner specified in USEPA Method 4. All of the data specified in Method 4 (gas volume, delta H, impinger outlet well temperature, etc.) was recorded on field data sheets included in Appendix F.

Method 25A Total Hydrocarbons (THC) Determination

The Method 25A sampling and measurement system meets the requirements for sampling of THC set forth by the United States Environmental Protection Agency (USEPA). In particular, it meets the requirements of USEPA Reference Method 25A, “Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer,” 40CFR60, Appendix A. This method applies to the measurement of total gaseous organic concentration of hydrocarbons. With this method, the gas sample was extracted from the sample location through a heated Teflon sample line to the analyzer.

The flame ionization detectors (FID) used during this program, were Thermo 51i High-Temperature Hydrocarbon Analyzers. They are highly sensitive FIDs that provide a direct reading of organic vapor concentrations with linear ranges of 0-10, 100, 1000, and 10,000 ppm by volume. The instrument was calibrated using ultra-zero air and propane in air EPA Protocol standards for the total hydrocarbon (THC) determination. The calibrations were performed before and after sampling with calibration checks performed between each test run. Sample times and locations were logged simultaneously on data loggers.

The calibration data are found in Appendix G and copies of the calibration gas cylinder certifications are found in Appendix H.

Method 30B Mercury Determination

Per Method 30B sampling, each sample was collected on the paired in-situ sorbent traps. A tube of silica was used to capture remaining moisture prior to the sample reaching the gas metering system.

The sample train used for this test program was designed by APEX, Inc. and meets all requirements for Method 30B sampling. Samples were analyzed onsite utilizing an Ohio Lumex, Inc. analyzer for total gaseous mercury.

Mercury QA/QC data are presented in Appendix I.

Multi Gas Fourier Transform Infrared (FTIR) Detector for Moisture, CO, CO_2, NO_X, and SO_2 Determination

Extractive Fourier transform infrared (FTIR) spectrometry following USEPA Methods 3A, 6C, 7E, 10, and 320 was performed for determination of moisture, CO, CO_2, NO_X, and SO_2 at the Kilns 19, 20, and 21.

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: N_2, O_2, H_2, He, Ne, and Ar. Vibrations, stretches, bends, and rotations within the bonds of a molecule determine the infrared absorption distinctiveness. The absorption creates a “fingerprint" which is unique 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.

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**

FTIR QA/QC Procedures						
QA/QC Specification	**Purpose**	**Calibration Gas Analyte**	**Delivery**	**Frequency**	**Acceptance Criteria**	**Result**
M320: Analyte Spike	Verify system ability to deliver and quantify analyte of interest in the presence of other effluent gases	Acetaldehyde	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 acetaldehyde and methanol 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 acetaldehyde and methanol concentrations to be used in the spike recovery calculations. The analyte spiking gases contained a low concentration of sulfur hexafluoride (SF_6). The determined SF_6 concentration in the spiked sample was used to calculate the dilution factor of the spike and thus used to calculate the concentration of the spiked HCl. The spike target dilution ratio was 1:10 or less.
The following equation illustrates the percent recovery calculation.

$$DF = \frac{SF6(spk)}{SF6(direct)}$$ (Sec. 9.2.3 (3) USEPA Method 320)

$$CS = DF * Spike(dir) + Unspike(1 - DF)$$ (Sec. 9.2.3 (4) USEPA Method 320)

DF = Dilution factor of the spike gas
$SF_{6(dir)}$ = SF_6 concentration measured directly in undiluted spike gas
$SF_{6(spk)}$ = Diluted SF_6 concentration measured in a spiked sample
$Spike_{dir}$ = Concentration of the analyte in the spike standard measure by the FTIR directly
CS = Expected concentration of the spiked samples
Unspike = Native concentration of analytes in unspiked samples

QA/QC data are found in Appendix H. Copies of gas cylinder certifications are found in Appendix I. 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

3.1 Kiln 19 RATA Tables

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 3A

O_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	09/15/22	11:12	11:41	9.6	8.4	1.2	1.44
1	2	09/15/22	11:42	12:11	9.5	8.4	1.1	1.21
0	3	09/15/22	12:12	12:41	9.6	8.4	1.2	1.44
1	4	09/15/22	13:25	13:54	9.4	8.4	1.0	1.00
1	5	09/15/22	13:55	14:24	9.4	8.4	1.0	1.00
1	6	09/15/22	14:25	14:54	9.4	8.4	1.0	1.00
1	7	09/15/22	15:35	16:04	9.5	8.4	1.1	1.21
1	8	09/15/22	16:05	16:34	9.6	8.6	1.0	1.00
1	9	09/15/22	16:35	17:04	9.2	8.3	0.9	0.81
0	10	09/15/22	17:25	17:54	9.6	8.4	1.2	1.44
1	11	09/15/22	17:55	18:24	9.6	8.5	1.1	1.21
1	12	09/15/22	18:25	18:54	9.5	8.5	1.0	1.00
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**9.456**		**RM avg**	
				Mean CEM Value	**8.433**		**CEM avg**	
				Sum of Differences	**9.200**		**di**	
				Mean Difference	**1.022**		**d**	
				Sum of Differences Squared	**9.440**		**di^2**	
				Standard Deviation	**0.067**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.051**		**cc**	
				Relative Accuracy	**11.35**		**RA**	

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Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 3A

CO_2 % (wet) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (wet)	CEM CO_2 % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/15/22	11:12	11:41	16.3	17.2	-0.9	0.81
1	2	09/15/22	11:42	12:11	16.3	17.2	-0.9	0.81
0	3	09/15/22	12:12	12:41	16.1	17.1	-1.0	1.00
1	4	09/15/22	13:25	13:54	16.3	17.2	-0.9	0.81
1	5	09/15/22	13:55	14:24	16.5	17.3	-0.8	0.64
1	6	09/15/22	14:25	14:54	16.2	17.1	-0.9	0.81
1	7	09/15/22	15:35	16:04	16.4	17.3	-0.9	0.81
1	8	09/15/22	16:05	16:34	16.0	16.9	-0.9	0.81
1	9	09/15/22	16:35	17:04	16.6	17.5	-0.9	0.81
1	10	09/15/22	17:25	17:54	16.6	17.5	-0.9	0.81
0	11	09/15/22	17:55	18:24	16.1	17.1	-1.0	1.00
0	12	09/15/22	18:25	18:54	16.0	17.0	-1.0	1.00
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**16.356**		**RM avg**	
				Mean CEM Value	**17.244**		**CEM avg**	
				Sum of Differences	**-8.000**		**di**	
				Mean Difference	**-0.889**		**d**	
				Sum of Differences Squared	**7.120**		**di^2**	
				Standard Deviation	**0.033**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.026**		**cc**	
				Relative Accuracy	**5.59**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 7E

NO_x ppmvd RATA

1=accept 0=reject	Test Run	Mw	Test Date	Start Time	End Time	RM NO_x ppmvd	CEM NO_x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	56.5	09/15/22	11:12	11:41	199.1	215.6	-16.5	272.25
1	2	56.6	09/15/22	11:42	12:11	98.8	106.2	-7.4	54.76
1	3	56.3	09/15/22	12:12	12:41	88.8	80.5	8.3	68.89
1	4	56.3	09/15/22	13:25	13:54	241.3	238.5	2.8	7.84
1	5	56.5	09/15/22	13:55	14:24	244.3	242.1	2.2	4.84
0	6	56.4	09/15/22	14:25	14:54	207.0	223.7	-16.7	278.89
1	7	56.6	09/15/22	15:35	16:04	211.3	214.1	-2.8	7.84
1	8	56.5	09/15/22	16:05	16:34	228.2	238.0	-9.8	96.04
1	9	56.4	09/15/22	16:35	17:04	210.4	205.3	5.1	26.01
0	10	56.4	09/15/22	17:25	17:54	225.7	234.0	-8.3	68.89
1	11	56.4	09/15/22	17:55	18:24	235.5	241.0	-5.5	30.25
1	12	56.6	09/15/22	18:25	18:54	230.4	237.7	-7.3	53.29

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**198.778**	**RM avg**
Mean CEM Value	**200.378**	**CEM avg**
Sum of Differences	**-14.400**	**di**
Mean Difference	**-1.600**	**d**
Sum of Differences Squared	**349.760**	**di^2**
Standard Deviation	**6.391**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**4.912**	**cc**
Relative Accuracy	**3.28**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/hr RATA

1=accept 0=reject	Test Run	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	09/15/22	11:12	11:41	145.33	158.47	-13.14	172.6596
1	2	09/15/22	11:42	12:11	69.68	77.95	-8.27	68.3929
1	3	09/15/22	12:12	12:41	59.51	58.87	0.64	0.4096
0	4	09/15/22	13:25	13:54	173.36	174.49	-1.13	1.2769
0	5	09/15/22	13:55	14:24	178.98	178.86	0.12	0.0144
1	6	09/15/22	14:25	14:54	152.06	165.08	-13.02	169.5204
1	7	09/15/22	15:35	16:04	152.25	157.80	-5.55	30.8025
1	8	09/15/22	16:05	16:34	168.33	173.70	-5.37	28.8369
0	9	09/15/22	16:35	17:04	152.72	149.74	2.98	8.8804
1	10	09/15/22	17:25	17:54	161.45	172.93	-11.48	131.7904
1	11	09/15/22	17:55	18:24	171.09	178.65	-7.56	57.1536
1	12	09/15/22	18:25	18:54	172.24	174.57	-2.33	5.4289

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**139.104**	**RM avg**
Mean CEM Value	**146.447**	**CEM avg**
Sum of Differences	**-66.080**	**di**
Mean Difference	**-7.342**	**d**
Sum of Differences Squared	**664.995**	**di^2**
Standard Deviation	**4.741**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**3.644**	**cc**
Relative Accuracy	**7.90**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/ton RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/ton	CEM NO_x lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/15/22	11:12	11:41	2.6	2.8	-0.2	0.04
1	2	09/15/22	11:42	12:11	1.2	1.4	-0.2	0.03
0	3	09/15/22	12:12	12:41	1.1	1.0	0.1	0.00
1	4	09/15/22	13:25	13:54	3.1	3.1	0.0	0.00
1	5	09/15/22	13:55	14:24	3.2	3.2	0.0	0.00
1	6	09/15/22	14:25	14:54	2.7	2.9	-0.2	0.05
1	7	09/15/22	15:35	16:04	2.7	2.8	-0.1	0.01
1	8	09/15/22	16:05	16:34	3.0	3.1	-0.1	0.01
0	9	09/15/22	16:35	17:04	2.7	2.7	0.0	0.00
1	10	09/15/22	17:25	17:54	2.9	3.1	-0.2	0.03
1	11	09/15/22	17:55	18:24	3.0	3.2	-0.2	0.03
1	12	09/15/22	18:25	18:54	3.0	3.1	-0.1	0.01
				n	**10**			
				t(0.975)	**2.262**			
				Mean Reference Method Value	**2.740**		**RM avg**	
				Mean CEM Value	**2.857**		**CEM avg**	
				Sum of Differences	**-1.173**		**di**	
				Mean Difference	**-0.117**		**d**	
				Sum of Differences Squared	**0.209**		**di^2**	
				Standard Deviation	**0.089**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.064**		**cc**	
				Relative Accuracy	**6.60**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 6C

SO_2 ppmvd RATA

1=accept 0=reject	Test Run	Mw	Test Date	Start Time	End Time	RM SO_2 ppmvd	CEM SO_2 ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	56.5	09/15/22	11:12	11:41	25.7	31.6	-5.9	34.81
1	2	56.6	09/15/22	11:42	12:11	46.2	49.1	-2.9	8.41
1	3	56.3	09/15/22	12:12	12:41	26.2	31.3	-5.1	26.01
1	4	56.3	09/15/22	13:25	13:54	23.4	27.3	-3.9	15.21
0	5	56.5	09/15/22	13:55	14:24	60.0	52.7	7.3	53.29
1	6	56.4	09/15/22	14:25	14:54	70.6	79.1	-8.5	72.25
1	7	56.6	09/15/22	15:35	16:04	45.9	51.2	-5.3	28.09
1	8	56.5	09/15/22	16:05	16:34	14.2	17.5	-3.3	10.89
0	9	56.4	09/15/22	16:35	17:04	79.3	88.8	-9.5	90.25
1	10	56.4	09/15/22	17:25	17:54	21.8	27.4	-5.6	31.36
1	11	56.4	09/15/22	17:55	18:24	22.9	26.1	-3.2	10.24
					n	**9**			
					t(0.975)	**2.306**			
					Mean Reference Method Value	**32.989**		**RM avg**	
					Mean CEM Value	**37.844**		**CEM avg**	
					Sum of Differences	**-43.700**		**di**	
					Mean Difference	**-4.856**		**d**	
					Sum of Differences Squared	**237.270**		**di^2**	
					Standard Deviation	**1.771**		**sd**	
					Confidence Coefficient 2.5% Error (1-tail)	**1.361**		**cc**	
					Relative Accuracy	**18.84**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 6C, 2
Applicable Standard: 136

SO2 lb/hr RATA

1=accept 0=reject	Test Run	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	09/15/22	11:12	11:41	27.43	34.28	-6.85	46.9225
1	2	09/15/22	11:42	12:11	47.77	52.89	-5.12	26.2144
0	3	09/15/22	12:12	12:41	25.71	33.82	-8.11	65.7721
1	4	09/15/22	13:25	13:54	24.59	29.36	-4.77	22.7529
0	5	09/15/22	13:55	14:24	64.31	57.17	7.14	50.9796
1	6	09/15/22	14:25	14:54	75.93	85.99	-10.06	101.2036
1	7	09/15/22	15:35	16:04	48.31	55.56	-7.25	52.5625
1	8	09/15/22	16:05	16:34	15.27	18.70	-3.43	11.7649
0	9	09/15/22	16:35	17:04	84.13	95.20	-11.07	122.5449
1	10	09/15/22	17:25	17:54	22.74	29.58	-6.84	46.7856
1	11	09/15/22	17:55	18:24	24.28	28.40	-4.12	16.9744
1	12	09/15/22	18:25	18:54	37.96	41.76	-3.80	14.4400
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**36.031**		**RM avg**	
				Mean CEM Value	**41.836**		**CEM avg**	
				Sum of Differences	**-52.240**		**di**	
				Mean Difference	**-5.804**		**d**	
				Sum of Differences Squared	**339.621**		**di^2**	
				Standard Deviation	**2.133**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**1.640**		**cc**	
				Relative Accuracy - APS	**5.47**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 6C, 2
Applicable Standard: 4.07

SO2 lb/ton RATA

1=accept 0=reject	Test Run	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)
0	1	09/15/22	11:12	11:41	0.5	0.6	-0.1	0.01
1	2	09/15/22	11:42	12:11	0.8	0.9	-0.1	0.01
1	3	09/15/22	12:12	12:41	0.5	0.6	-0.1	0.01
1	4	09/15/22	13:25	13:54	0.4	0.5	-0.1	0.01
0	5	09/15/22	13:55	14:24	1.1	1.0	0.1	0.01
1	6	09/15/22	14:25	14:54	1.3	1.5	-0.2	0.04
1	7	09/15/22	15:35	16:04	0.9	1.0	-0.1	0.01
1	8	09/15/22	16:05	16:34	0.3	0.3	0.0	0.00
1	9	09/15/22	16:35	17:04	1.5	1.7	-0.2	0.04
0	10	09/15/22	17:25	17:54	0.4	0.5	-0.1	0.01
1	11	09/15/22	17:55	18:24	0.4	0.5	-0.1	0.01
1	12	09/15/22	18:25	18:54	0.7	0.7	0.0	0.00
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**0.756**		**RM avg**	
				Mean CEM Value	**0.856**		**CEM avg**	
				Sum of Differences	**-0.900**		**di**	
				Mean Difference	**-0.100**		**d**	
				Sum of Differences Squared	**0.130**		**di^2**	
				Standard Deviation	**0.071**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.054**		**cc**	
				Relative Accuracy - APS	**3.79**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 10

CO ppmvd RATA

1=accept 0=reject	Test Run	Mw	Test Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	56.5	09/15/22	11:12	11:41	85.2	90.5	-5.3	28.09
1	2	56.6	09/15/22	11:42	12:11	113.8	117.3	-3.5	12.25
0	3	56.3	09/15/22	12:12	12:41	114.3	123.1	-8.8	77.44
1	4	56.3	09/15/22	13:25	13:54	83.2	88.4	-5.2	27.04
1	5	56.5	09/15/22	13:55	14:24	80.4	85.3	-4.9	24.01
1	6	56.4	09/15/22	14:25	14:54	78.2	80.5	-2.3	5.29
0	7	56.6	09/15/22	15:35	16:04	77.9	83.5	-5.6	31.36
1	8	56.5	09/15/22	16:05	16:34	75.9	77.4	-1.5	2.25
0	9	56.4	09/15/22	16:35	17:04	88.1	96.9	-8.8	77.44
1	10	56.4	09/15/22	17:25	17:54	81.4	81.0	0.4	0.16
1	11	56.4	09/15/22	17:55	18:24	79.2	77.5	1.7	2.89
1	12	56.6	09/15/22	18:25	18:54	78.8	78.2	0.6	0.36

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**84.011**	**RM avg**
Mean CEM Value	**86.233**	**CEM avg**
Sum of Differences	**-20.000**	**di**
Mean Difference	**-2.222**	**d**
Sum of Differences Squared	**102.340**	**di^2**
Standard Deviation	**2.690**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2.068**	**cc**
Relative Accuracy	**5.11**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 10, 2

CO lb/hr RATA

1=accept 0=reject	Test Run	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	09/15/22	11:12	11:41	37.82	40.49	-2.67	7.1289
1	2	09/15/22	11:42	12:11	48.85	52.21	-3.36	11.2896
0	3	09/15/22	12:12	12:41	46.58	54.85	-8.27	68.3929
1	4	09/15/22	13:25	13:54	36.37	39.35	-2.98	8.8804
1	5	09/15/22	13:55	14:24	35.83	38.32	-2.49	6.2001
1	6	09/15/22	14:25	14:54	34.96	36.13	-1.17	1.3689
1	7	09/15/22	15:35	16:04	34.15	37.46	-3.31	10.9561
1	8	09/15/22	16:05	16:34	34.06	34.22	-0.16	0.0256
0	9	09/15/22	16:35	17:04	38.90	43.02	-4.12	16.9744
1	10	09/15/22	17:25	17:54	35.44	36.35	-0.91	0.8281
1	11	09/15/22	17:55	18:24	35.04	34.92	0.12	0.0144
0	12	09/15/22	18:25	18:54	35.84	34.94	0.90	0.8100

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**36.947**	**RM avg**
Mean CEM Value	**38.828**	**CEM avg**
Sum of Differences	**-16.930**	**di**
Mean Difference	**-1.881**	**d**
Sum of Differences Squared	**46.692**	**di^2**
Standard Deviation	**1.362**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**1.047**	**cc**
Relative Accuracy	**7.93**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Facility: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** 25A, 3A
Applicable Standard: 24

THC ppmvd @ 7% O2 RATA

1=accept 0=reject	Test Run	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	09/15/22	11:12	11:41	1.7	0.0	1.7	2.89
0	2	09/15/22	11:42	12:11	2.3	0.0	2.3	5.29
0	3	09/15/22	12:12	12:41	2.3	0.0	2.3	5.29
1	4	09/15/22	13:25	13:54	1.4	0.0	1.4	1.96
1	5	09/15/22	13:55	14:24	1.4	0.0	1.4	1.96
1	6	09/15/22	14:25	14:54	1.3	0.0	1.3	1.69
1	7	09/15/22	15:35	16:04	1.3	0.0	1.3	1.69
1	8	09/15/22	16:05	16:34	1.3	0.0	1.3	1.69
1	9	09/15/22	16:35	17:04	1.4	0.0	1.4	1.96
1	10	09/15/22	17:25	17:54	1.2	0.0	1.2	1.44
1	11	09/15/22	17:55	18:24	1.0	0.0	1.0	1.00
0	12	09/15/22	18:25	18:54	1.0	0.0	1.0	1.00

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**1.333**	**RM avg**
Mean CEM Value	**0.000**	**CEM avg**
Sum of Differences	**12.000**	**di**
Mean Difference	**1.333**	**d**
Sum of Differences Squared	**16.280**	**di^2**
Standard Deviation	**0.187**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.144**	**cc**
Relative Accuracy - APS	**6.15**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Test Location:** Kiln 19
Facility: Alpena Cement Plant **Test Date:** 9/15/2022
Project #: M223406 **Test Method:** 2

Volumetric Flow RATA - Normal Load

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	09/15/22	11:12	11:41	6,440,199	6,520,401	-80,202	6,432,357,555
0	2	09/15/22	11:42	12:11	6,231,312	6,501,227	-269,915	72,854,289,936
0	3	09/15/22	12:12	12:41	5,910,806	6,497,145	-586,339	343,793,387,920
1	4	09/15/22	13:25	13:54	6,332,674	6,479,067	-146,393	21,430,987,683
1	5	09/15/22	13:55	14:24	6,451,346	6,534,997	-83,651	6,997,445,120
1	6	09/15/22	14:25	14:54	6,476,480	6,530,793	-54,313	2,949,881,378
1	7	09/15/22	15:35	16:04	6,344,645	6,523,520	-178,875	31,996,237,251
1	8	09/15/22	16:05	16:34	6,496,446	6,438,952	57,494	3,305,560,059
1	9	09/15/22	16:35	17:04	6,384,569	6,455,901	-71,332	5,088,222,251
0	10	09/15/22	17:25	17:54	6,293,911	6,524,488	-230,577	53,165,763,749
1	11	09/15/22	17:55	18:24	6,399,035	6,551,508	-152,473	23,248,140,633
1	12	09/15/22	18:25	18:54	6,584,520	6,503,726	80,793	6,527,574,032
				n	**9**			
				t(0.025)	**2.306**			
				Mean Reference Method Value	**6434434.812**		**RM avg**	
				Mean CEM Value	**6504318.311**		**CEM avg**	
				Sum of Differences	**-628951.489**		**di**	
				Mean Difference	**-69883.499**		**d**	
				Sum of Differences Squared	**107976405961.291**		**di^2**	
				Standard Deviation	**89458.842**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**68764.030**		**cc**	
				Relative Accuracy	**2.15**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 19
Plant: Alpena Cement Plant **Date:** 9/15/22
Project #: M223406 **Test Method:** Sorbent Hg (30B)

Hg ug/wscm RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM ug/wscm	CMMS ug/wscm	(RM-CMMS) Difference (di)	(RM-CMMS) Difference^2 (di^2)
1	1	09/15/22	09:10	09:40	2.9	3.2	-0.3	0.09
1	2	09/15/22	09:45	10:15	2.8	3.1	-0.3	0.09
1	3	09/15/22	10:25	10:55	2.9	3.1	-0.2	0.04
1	4	09/15/22	11:12	11:42	2.9	3.3	-0.4	0.16
1	5	09/15/22	11:49	12:19	2.9	3.3	-0.4	0.16
1	6	09/15/22	12:24	12:54	3.0	3.2	-0.2	0.04
1	7	09/15/22	13:25	13:55	3.0	3.2	-0.2	0.04
1	8	09/15/22	14:05	14:35	3.0	3.1	-0.1	0.01
1	9	09/15/22	14:42	15:12	2.8	3.1	-0.3	0.09
0	10	09/15/22	15:35	16:05	2.8	3.2	-0.4	0.16

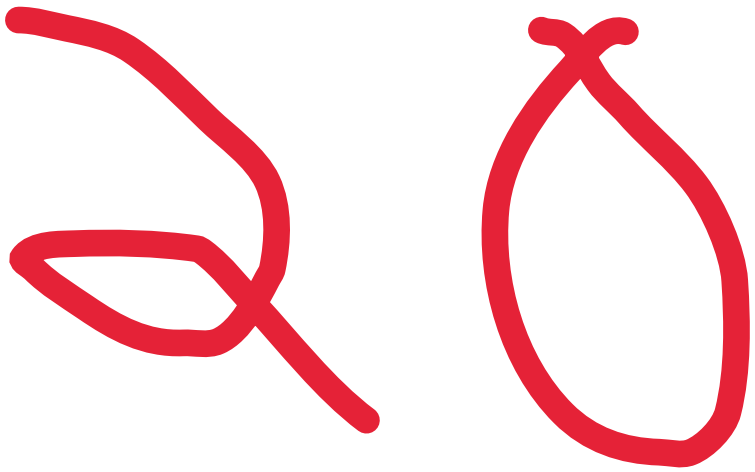
n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**2.911**	**RM avg**
Mean CMM Value	**3.178**	**CMM avg**
Sum of Differences	**-2.400**	**di**
Mean Difference	**-0.267**	**d**
Sum of Differences Squared	**0.720**	**di^2**
Standard Deviation	**0.100**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.077**	**cc**
Relative Accuracy	**11.80**	**RA**

3.2 Kiln 20 RATA Tables

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 3A

O_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/31/22	09:30	09:59	8.7	7.4	1.3	1.69
1	2	08/31/22	10:00	10:29	8.7	7.3	1.4	1.96
1	3	08/31/22	10:30	10:59	8.6	7.3	1.3	1.69
1	4	08/31/22	11:40	12:09	8.6	7.3	1.3	1.69
1	5	08/31/22	12:10	12:39	8.6	7.3	1.3	1.69
0	6	08/31/22	12:40	13:09	8.6	7.2	1.4	1.96
1	7	08/31/22	13:50	14:19	8.5	7.2	1.3	1.69
1	8	08/31/22	14:20	14:49	8.6	7.2	1.4	1.96
1	9	08/31/22	14:50	15:19	8.6	7.3	1.3	1.69
0	10	08/31/22	15:55	16:24	8.8	7.3	1.5	2.25
0	11	08/31/22	16:25	16:54	8.7	7.2	1.5	2.25
1	12	08/31/22	16:55	17:24	8.7	7.3	1.4	1.96
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**8.622**		**RM avg**	
				Mean CEM Value	**7.289**		**CEM avg**	
				Sum of Differences	**12.000**		**di**	
				Mean Difference	**1.333**		**d**	
				Sum of Differences Squared	**16.020**		**di^2**	
				Standard Deviation	**0.050**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.038**		**cc**	
				Relative Accuracy	**15.91**		**RA**	



Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 3A

CO_2 % (wet) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (wet)	CEM CO_2 % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/31/22	09:30	09:59	17.3	19.5	-2.2	4.84
1	2	08/31/22	10:00	10:29	17.6	19.7	-2.1	4.41
1	3	08/31/22	10:30	10:59	17.7	19.9	-2.2	4.84
0	4	08/31/22	11:40	12:09	17.3	19.6	-2.3	5.29
1	5	08/31/22	12:10	12:39	17.3	19.6	-2.3	5.29
0	6	08/31/22	12:40	13:09	17.4	19.7	-2.3	5.29
1	7	08/31/22	13:50	14:19	17.6	19.8	-2.2	4.84
1	8	08/31/22	14:20	14:49	17.5	19.7	-2.2	4.84
1	9	08/31/22	14:50	15:19	17.4	19.6	-2.2	4.84
1	10	08/31/22	15:55	16:24	17.4	19.6	-2.2	4.84
0	11	08/31/22	16:25	16:54	17.7	20.1	-2.4	5.76
1	12	08/31/22	16:55	17:24	17.7	20.0	-2.3	5.29

n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**17.500**	**RM avg**
Mean CEM Value	**19.711**	**CEM avg**
Sum of Differences	**-19.900**	**di**
Mean Difference	**-2.211**	**d**
Sum of Differences Squared	**44.030**	**di^2**
Standard Deviation	**0.060**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.046**	**cc**
Relative Accuracy	**12.90**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 7E

NO_x ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x ppmvd	CEM NO_x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/31/22	09:30	09:59	240.9	281.7	-40.8	1664.64
1	2	08/31/22	10:00	10:29	252.5	279.2	-26.7	712.89
1	3	08/31/22	10:30	10:59	259.2	286.3	-27.1	734.41
1	4	08/31/22	11:40	12:09	254.0	286.1	-32.1	1030.41
1	5	08/31/22	12:10	12:39	252.4	287.2	-34.8	1211.04
0	6	08/31/22	12:40	13:09	242.6	289.3	-46.7	2180.89
0	7	08/31/22	13:50	14:19	244.4	302.3	-57.9	3352.41
1	8	08/31/22	14:20	14:49	254.6	298.7	-44.1	1944.81
0	9	08/31/22	14:50	15:19	249.6	295.4	-45.8	2097.64
1	10	08/31/22	15:55	16:24	246.6	243.7	2.9	8.41
1	11	08/31/22	16:25	16:54	250.4	290.3	-39.9	1592.01
1	12	08/31/22	16:55	17:24	255.7	277.1	-21.4	457.96

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**251.811**	**RM avg**
Mean CEM Value	**281.144**	**CEM avg**
Sum of Differences	**-264.000**	**di**
Mean Difference	**-29.333**	**d**
Sum of Differences Squared	**9356.580**	**di^2**
Standard Deviation	**14.198**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**10.913**	**cc**
Relative Accuracy	**15.98**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/hr RATA

1=accept 0=reject	Test Run	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	08/31/22	09:30	09:59	133.15	146.16	-13.01	169.2601
1	2	08/31/22	10:00	10:29	131.90	145.26	-13.36	178.4896
1	3	08/31/22	10:30	10:59	136.43	150.01	-13.58	184.4164
1	4	08/31/22	11:40	12:09	136.41	149.78	-13.37	178.7569
1	5	08/31/22	12:10	12:39	135.70	148.41	-12.71	161.5441
1	6	08/31/22	12:40	13:09	131.84	151.61	-19.77	390.8529
0	7	08/31/22	13:50	14:19	132.65	154.47	-21.82	476.1124
1	8	08/31/22	14:20	14:49	140.11	156.40	-16.29	265.3641
1	9	08/31/22	14:50	15:19	138.35	152.21	-13.86	192.0996
0	10	08/31/22	15:55	16:24	133.09	125.33	7.76	60.2176
0	11	08/31/22	16:25	16:54	135.33	155.28	-19.95	398.0025
1	12	08/31/22	16:55	17:24	137.89	147.12	-9.23	85.1929
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**135.753**		**RM avg**	
				Mean CEM Value	**149.662**		**CEM avg**	
				Sum of Differences	**-125.180**		**di**	
				Mean Difference	**-13.909**		**d**	
				Sum of Differences Squared	**1805.977**		**di^2**	
				Standard Deviation	**2.847**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**2.189**		**cc**	
				Relative Accuracy	**11.86**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/ton RATA

CEM Analyzer Information

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/ton	CEM NO_x lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/31/22	09:30	09:59	2.4	2.6	-0.2	0.04
1	2	08/31/22	10:00	10:29	2.3	2.6	-0.3	0.09
1	3	08/31/22	10:30	10:59	2.4	2.6	-0.2	0.04
1	4	08/31/22	11:40	12:09	2.4	2.6	-0.2	0.04
1	5	08/31/22	12:10	12:39	2.4	2.6	-0.2	0.04
0	6	08/31/22	12:40	13:09	2.3	2.6	-0.3	0.09
0	7	08/31/22	13:50	14:19	2.3	2.7	-0.4	0.16
1	8	08/31/22	14:20	14:49	2.5	2.8	-0.3	0.09
1	9	08/31/22	14:50	15:19	2.4	2.7	-0.3	0.09
1	10	08/31/22	15:55	16:24	2.3	2.2	0.1	0.01
0	11	08/31/22	16:25	16:54	2.3	2.7	-0.4	0.16
1	12	08/31/22	16:55	17:24	2.4	2.6	-0.2	0.04
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**2.389**		**RM avg**	
				Mean CEM Value	**2.589**		**CEM avg**	
				Sum of Differences	**-1.800**		**di**	
				Mean Difference	**-0.200**		**d**	
				Sum of Differences Squared	**0.480**		**di^2**	
				Standard Deviation	**0.122**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.094**		**cc**	
				Relative Accuracy	**12.31**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 6C

SO_2 ppmvd RATA

1=accept 0=reject	Test Run	Mw	Test Date	Start Time	End Time	RM SO_2 ppmvd	CEM SO_2 ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	55.96	08/31/22	09:30	09:59	244.4	259.4	-15.0	225.00
1	2	56.62	08/31/22	10:00	10:29	283.2	312.9	-29.7	882.09
1	3	56.99	08/31/22	10:30	10:59	245.9	265.2	-19.3	372.49
0	4	57.7	08/31/22	11:40	12:09	259.1	292.2	-33.1	1095.61
1	5	57.7	08/31/22	12:10	12:39	285.9	297.2	-11.3	127.69
1	6	57.7	08/31/22	12:40	13:09	275.5	284.3	-8.8	77.44
1	7	57.2	08/31/22	13:50	14:19	298.7	319.6	-20.9	436.81
1	8	56.6	08/31/22	14:20	14:49	260.7	271.9	-11.2	125.44
1	9	57	08/31/22	14:50	15:19	237.9	239.8	-1.9	3.61
0	10	57.52	08/31/22	15:55	16:24	250.0	281.1	-31.1	967.21
1	11	57.65	08/31/22	16:25	16:54	261.3	284.6	-23.3	542.89
0	12	57.69	08/31/22	16:55	17:24	228.2	259.8	-31.6	998.56
					n	**9**			
					t(0.975)	**2.306**			
					Mean Reference Method Value	**265.944**		**RM avg**	
					Mean CEM Value	**281.656**		**CEM avg**	
					Sum of Differences	**-141.400**		**di**	
					Mean Difference	**-15.711**		**d**	
					Sum of Differences Squared	**2793.460**		**di^2**	
					Standard Deviation	**8.455**		**sd**	
					Confidence Coefficient 2.5% Error (1-tail)	**6.499**		**cc**	
					Relative Accuracy	**8.35**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 6C, 2

SO2 lb/hr RATA

1=accept 0=reject	Test Run	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	08/31/22	09:30	09:59	187.81	186.70	1.11	1.2321
0	2	08/31/22	10:00	10:29	205.68	226.62	-20.94	438.4836
1	3	08/31/22	10:30	10:59	179.93	192.60	-12.67	160.5289
0	4	08/31/22	11:40	12:09	193.48	212.11	-18.63	347.0769
1	5	08/31/22	12:10	12:39	213.68	213.73	-0.05	0.0025
1	6	08/31/22	12:40	13:09	208.12	207.40	0.72	0.5184
1	7	08/31/22	13:50	14:19	225.40	226.69	-1.29	1.6641
1	8	08/31/22	14:20	14:49	199.50	197.75	1.75	3.0625
1	9	08/31/22	14:50	15:19	183.38	172.07	11.31	127.9161
1	10	08/31/22	15:55	16:24	187.54	201.04	-13.50	182.2500
1	11	08/31/22	16:25	16:54	196.37	211.67	-15.30	234.0900
0	12	08/31/22	16:55	17:24	171.09	191.77	-20.68	427.6624

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**197.970**	**RM avg**
Mean CEM Value	**201.072**	**CEM avg**
Sum of Differences	**-27.920**	**di**
Mean Difference	**-3.102**	**d**
Sum of Differences Squared	**711.265**	**di^2**
Standard Deviation	**8.836**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**6.792**	**cc**
Relative Accuracy	**5.00**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 6C, 2

SO2 lb/ton RATA

1=accept 0=reject	Test Run	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	08/31/22	09:30	09:59	3.4	3.3	0.1	0.01
0	2	08/31/22	10:00	10:29	3.6	4.0	-0.4	0.16
1	3	08/31/22	10:30	10:59	3.2	3.4	-0.2	0.04
0	4	08/31/22	11:40	12:09	3.4	3.7	-0.3	0.09
1	5	08/31/22	12:10	12:39	3.7	3.7	0.0	0.00
1	6	08/31/22	12:40	13:09	3.6	3.6	0.0	0.00
1	7	08/31/22	13:50	14:19	3.9	4.0	-0.1	0.01
1	8	08/31/22	14:20	14:49	3.5	3.5	0.0	0.00
1	9	08/31/22	14:50	15:19	3.2	3.0	0.2	0.04
1	10	08/31/22	15:55	16:24	3.3	3.5	-0.2	0.04
1	11	08/31/22	16:25	16:54	3.4	3.7	-0.3	0.09
0	12	08/31/22	16:55	17:24	3.0	3.3	-0.3	0.09
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**3.467**		**RM avg**	
				Mean CEM Value	**3.522**		**CEM avg**	
				Sum of Differences	**-0.500**		**di**	
				Mean Difference	**-0.056**		**d**	
				Sum of Differences Squared	**0.230**		**di^2**	
				Standard Deviation	**0.159**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.122**		**cc**	
				Relative Accuracy	**5.13**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 10

CO ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/31/22	09:30	09:59	92.8	90.4	2.4	5.76
1	2	08/31/22	10:00	10:29	94.8	95.0	-0.2	0.04
1	3	08/31/22	10:30	10:59	96.0	95.0	1.0	1.00
1	4	08/31/22	11:40	12:09	96.2	95.8	0.4	0.16
1	5	08/31/22	12:10	12:39	103.5	99.8	3.7	13.69
0	6	08/31/22	12:40	13:09	94.9	89.0	5.9	34.81
0	7	08/31/22	13:50	14:19	99.3	91.9	7.4	54.76
1	8	08/31/22	14:20	14:49	95.3	90.5	4.8	23.04
0	9	08/31/22	14:50	15:19	90.9	86.1	4.8	23.04
1	10	08/31/22	15:55	16:24	84.5	88.3	-3.8	14.44
1	11	08/31/22	16:25	16:54	83.4	83.0	0.4	0.16
1	12	08/31/22	16:55	17:24	76.2	77.8	-1.6	2.56

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**91.411**	**RM avg**
Mean CEM Value	**90.622**	**CEM avg**
Sum of Differences	**7.100**	**di**
Mean Difference	**0.789**	**d**
Sum of Differences Squared	**60.850**	**di^2**
Standard Deviation	**2.628**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2.020**	**cc**
Relative Accuracy	**3.07**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 10, 2

CO lb/hr RATA

1=accept 0=reject	Test Run	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	08/31/22	09:30	09:59	31.23	30.62	0.61	0.3721
0	2	08/31/22	10:00	10:29	30.12	32.35	-2.23	4.9729
1	3	08/31/22	10:30	10:59	30.76	32.53	-1.77	3.1329
1	4	08/31/22	11:40	12:09	31.45	32.76	-1.31	1.7161
1	5	08/31/22	12:10	12:39	33.85	33.77	0.08	0.0064
1	6	08/31/22	12:40	13:09	31.36	30.52	0.84	0.7056
0	7	08/31/22	13:50	14:19	32.78	30.62	2.16	4.6656
1	8	08/31/22	14:20	14:49	31.91	30.87	1.04	1.0816
1	9	08/31/22	14:50	15:19	30.66	28.94	1.72	2.9584
0	10	08/31/22	15:55	16:24	27.74	29.61	-1.87	3.4969
1	11	08/31/22	16:25	16:54	27.42	28.82	-1.40	1.9600
1	12	08/31/22	16:55	17:24	25.00	26.80	-1.80	3.2400

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**30.404**	**RM avg**
Mean CEM Value	**30.626**	**CEM avg**
Sum of Differences	**-1.990**	**di**
Mean Difference	**-0.221**	**d**
Sum of Differences Squared	**15.173**	**di^2**
Standard Deviation	**1.357**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**1.043**	**cc**
Relative Accuracy	**4.16**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20
Facility: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** 25A, 3A
Applicable Standard: 24

THC ppmvd @ 7% O2 RATA

1=accept 0=reject	Test Run	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	08/31/22	9:30	9:59	2.3	1.5	0.8	0.71
0	2	08/31/22	10:00	10:29	3.3	1.4	1.9	3.76
1	3	08/31/22	10:30	10:59	2.4	1.4	1.0	0.94
1	4	08/31/22	11:40	12:09	2.5	1.5	1.0	1.00
1	5	08/31/22	12:10	12:39	2.4	1.7	0.7	0.55
1	6	08/31/22	12:40	13:09	1.9	1.3	0.6	0.32
1	7	08/31/22	13:50	14:19	1.4	1.4	0.0	0.00
1	8	08/31/22	14:20	14:49	1.6	1.4	0.3	0.06
1	9	08/31/22	14:50	15:19	1.9	1.3	0.6	0.36
1	10	08/31/22	15:55	16:24	2.9	1.3	1.6	2.53
0	11	08/31/22	16:25	16:54	2.8	1.2	1.6	2.53
0	12	08/31/22	16:55	17:24	2.8	1.1	1.7	2.86

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**2.144**	**RM avg**
Mean CEM Value	**1.416**	**CEM avg**
Sum of Differences	**6.560**	**di**
Mean Difference	**0.729**	**d**
Sum of Differences Squared	**6.470**	**di^2**
Standard Deviation	**0.459**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.353**	**cc**
Relative Accuracy - APS	**4.51**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Test Location:** Kiln 20 Breaching Duct
Facility: Alpena Cement Plant **Test Date:** 8/31/2022
Project #: M223406 **Test Method:** 2

Volumetric Flow RATA - Normal Load

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)
0	1	08/31/22	9:30	9:59	4,951,634	4,666,300	285,334	81,415,608,207
1	2	08/31/22	10:00	10:31	4,674,697	4,684,638	-9,941	98,816,724
1	3	08/31/22	10:30	10:59	4,710,143	4,713,382	-3,239	10,489,907
1	4	08/31/22	11:40	12:09	4,805,287	4,710,729	94,557	8,941,097,730
1	5	08/31/22	12:10	12:39	4,809,898	4,653,992	155,906	24,306,551,609
1	6	08/31/22	12:40	13:09	4,856,768	4,719,943	136,825	18,721,158,567
0	7	08/31/22	13:50	14:19	4,845,670	4,587,613	258,057	66,593,601,917
1	8	08/31/22	14:20	14:49	4,908,941	4,697,700	211,240	44,622,511,308
0	9	08/31/22	14:50	15:19	4,944,759	4,623,822	320,937	103,000,553,547
1	10	08/31/22	15:55	16:24	4,803,135	4,612,995	190,140	36,153,152,686
1	11	08/31/22	16:25	16:54	4,805,438	4,780,539	24,898	619,930,409
1	12	08/31/22	16:55	17:24	4,790,378	4,739,358	51,021	2,603,099,327

n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**4796076.153**	**RM avg**
Mean CEM Value	**4701475.266**	**CEM avg**
Sum of Differences	**851407.990**	**di**
Mean Difference	**94600.888**	**d**
Sum of Differences Squared	**136076808268.494**	**di^2**
Standard Deviation	**83316.307**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**64042.468**	**cc**
Relative Accuracy	**3.31**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 20 Stack
Plant: Alpena Cement Plant **Date:** 8/31/22
Project #: M223406 **Test Method:** Sorbent Hg (30B)

Hg ug/wscm RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM ug/wscm	CMMS ug/wscm	(RM-CMMS) Difference (di)	(RM-CMMS) Difference^2 (di^2)
0	1	08/31/22	09:30	10:00	3.1	2.7	0.400	0.160
1	2	08/31/22	10:10	10:40	2.6	2.6	0.000	0.000
1	3	08/31/22	10:45	11:15	2.6	2.7	-0.100	0.010
1	4	08/31/22	11:40	12:10	2.7	2.7	0.000	0.000
1	5	08/31/22	12:15	12:45	2.6	2.8	-0.200	0.040
1	6	08/31/22	12:50	13:20	2.7	2.9	-0.200	0.040
1	7	08/31/22	13:50	14:20	2.8	3.0	-0.200	0.040
1	8	08/31/22	14:25	14:55	3.3	3.1	0.200	0.040
1	9	08/31/22	15:00	15:30	3.0	3.2	-0.200	0.040
1	10	08/31/22	15:55	16:25	3.2	3.2	0.000	0.000

n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**2.833**	**RM avg**
Mean CMM Value	**2.911**	**CMM avg**
Sum of Differences	**-0.700**	**di**
Mean Difference	**-0.078**	**d**
Sum of Differences Squared	**0.210**	**di^2**
Standard Deviation	**0.139**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.107**	**cc**
Relative Accuracy	**6.53**	**RA**

3.3 Kiln 21 RATA Tables

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 3A

O_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/01/22	08:45	09:14	9.1	8.2	0.9	0.81
1	2	09/01/22	09:15	09:44	8.9	8.0	0.9	0.81
1	3	09/01/22	09:45	10:14	8.9	8.0	0.9	0.81
1	4	09/01/22	10:50	11:19	8.9	8.0	0.9	0.81
0	5	09/01/22	11:20	11:49	8.9	7.9	1.0	1.00
1	6	09/01/22	11:50	12:19	9.0	8.0	1.0	1.00
1	7	09/01/22	13:00	13:29	8.6	7.7	0.9	0.81
1	8	09/01/22	13:30	13:59	8.8	7.8	1.0	1.00
1	9	09/01/22	14:00	14:29	8.7	7.8	0.9	0.81
0	10	09/01/22	15:10	15:39	8.6	7.6	1.0	1.00
0	11	09/01/22	15:40	16:09	8.6	7.6	1.0	1.00
1	12	09/01/22	16:10	16:39	8.7	7.8	0.9	0.81
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**8.844**		**RM avg**	
				Mean CEM Value	**7.922**		**CEM avg**	
				Sum of Differences	**8.300**		**di**	
				Mean Difference	**0.922**		**d**	
				Sum of Differences Squared	**7.670**		**di^2**	
				Standard Deviation	**0.044**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.034**		**cc**	
				Relative Accuracy	**10.81**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 3A

CO_2 % (wet) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (wet)	CEM CO_2 % (wet)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	09/01/22	08:45	09:14	15.5	16.4	-0.9	0.81
1	2	09/01/22	09:15	09:44	16.3	17.1	-0.8	0.64
1	3	09/01/22	09:45	10:14	16.5	17.3	-0.8	0.64
1	4	09/01/22	10:50	11:19	16.2	17.1	-0.9	0.81
1	5	09/01/22	11:20	11:49	16.4	17.2	-0.8	0.64
0	6	09/01/22	11:50	12:19	16.1	17.0	-0.9	0.81
1	7	09/01/22	13:00	13:29	17.2	17.5	-0.3	0.09
0	8	09/01/22	13:30	13:59	16.1	17.3	-1.2	1.44
1	9	09/01/22	14:00	14:29	16.4	17.2	-0.8	0.64
1	10	09/01/22	15:10	15:39	16.4	17.3	-0.9	0.81
1	11	09/01/22	15:40	16:09	16.8	17.6	-0.8	0.64
1	12	09/01/22	16:10	16:39	16.7	17.5	-0.8	0.64
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**16.544**		**RM avg**	
				Mean CEM Value	**17.311**		**CEM avg**	
				Sum of Differences	**-6.900**		**di**	
				Mean Difference	**-0.767**		**d**	
				Sum of Differences Squared	**5.550**		**di^2**	
				Standard Deviation	**0.180**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.139**		**cc**	
				Relative Accuracy	**5.47**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 7E

NO_x ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x ppmvd	CEM NO_x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/01/22	08:45	09:14	118.3	136.4	-18.1	327.61
0	2	09/01/22	09:15	09:44	106.6	135.3	-28.7	823.69
1	3	09/01/22	09:45	10:14	139.3	151.9	-12.6	158.76
0	4	09/01/22	10:50	11:19	205.1	178.1	27.0	729.00
1	5	09/01/22	11:20	11:49	139.8	130.4	9.4	88.36
1	6	09/01/22	11:50	12:19	162.9	148.3	14.6	213.16
1	7	09/01/22	13:00	13:29	148.5	144.8	3.7	13.69
1	8	09/01/22	13:30	13:59	145.1	162.0	-16.9	285.61
1	9	09/01/22	14:00	14:29	140.1	147.5	-7.4	54.76
1	10	09/01/22	15:10	15:39	131.0	112.3	18.7	349.69
1	11	09/01/22	15:40	16:09	137.9	121.2	16.7	278.89
1	12	09/01/22	16:10	16:39	152.5	160.4	-7.9	62.41

n	**10**	
t(0.975)	**2.262**	
Mean Reference Method Value	**141.540**	**RM avg**
Mean CEM Value	**141.520**	**CEM avg**
Sum of Differences	**0.200**	**di**
Mean Difference	**0.020**	**d**
Sum of Differences Squared	**1832.940**	**di^2**
Standard Deviation	**14.271**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**10.208**	**cc**
Relative Accuracy	**7.23**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/hr RATA

1=accept 0=reject	Test Run	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	09/01/22	08:45	09:14	65.37	74.40	-9.03	81.5409
0	2	09/01/22	09:15	09:44	59.26	73.04	-13.78	189.8884
1	3	09/01/22	09:45	10:14	78.01	82.87	-4.86	23.6196
0	4	09/01/22	10:50	11:19	114.11	96.70	17.41	303.1081
1	5	09/01/22	11:20	11:49	76.89	72.90	3.99	15.9201
1	6	09/01/22	11:50	12:19	90.49	81.60	8.89	79.0321
1	7	09/01/22	13:00	13:29	83.39	79.80	3.59	12.8881
1	8	09/01/22	13:30	13:59	82.02	90.30	-8.28	68.5584
1	9	09/01/22	14:00	14:29	76.17	80.80	-4.63	21.4369
0	10	09/01/22	15:10	15:39	72.21	59.70	12.51	156.5001
1	11	09/01/22	15:40	16:09	73.94	62.90	11.04	121.8816
1	12	09/01/22	16:10	16:39	83.43	85.40	-1.97	3.8809

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**78.857**	**RM avg**
Mean CEM Value	**78.997**	**CEM avg**
Sum of Differences	**-1.260**	**di**
Mean Difference	**-0.140**	**d**
Sum of Differences Squared	**428.759**	**di^2**
Standard Deviation	**7.319**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**5.626**	**cc**
Relative Accuracy	**7.31**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 7E, 2

NOx lb/ton RATA

1=accept 0=reject	Test Run	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	09/01/22	08:45	09:14	1.5	1.7	-0.2	0.04
0	2	09/01/22	09:15	09:44	1.4	1.7	-0.3	0.09
1	3	09/01/22	09:45	10:14	1.8	2.0	-0.2	0.04
0	4	09/01/22	10:50	11:19	2.7	2.3	0.4	0.16
1	5	09/01/22	11:20	11:49	1.8	1.7	0.1	0.01
1	6	09/01/22	11:50	12:19	2.1	1.9	0.2	0.04
1	7	09/01/22	13:00	13:29	1.9	1.8	0.1	0.01
1	8	09/01/22	13:30	13:59	1.9	2.1	-0.2	0.04
1	9	09/01/22	14:00	14:29	1.7	1.8	-0.1	0.01
0	10	09/01/22	15:10	15:39	1.6	1.3	0.3	0.09
1	11	09/01/22	15:40	16:09	1.7	1.4	0.3	0.09
1	12	09/01/22	16:10	16:39	2.0	2.0	0.0	0.00
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**1.822**		**RM avg**	
				Mean CEM Value	**1.822**		**CEM avg**	
				Sum of Differences	**0.000**		**di**	
				Mean Difference	**0.000**		**d**	
				Sum of Differences Squared	**0.280**		**di^2**	
				Standard Deviation	**0.187**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.144**		**cc**	
				Relative Accuracy	**7.89**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 6C

SO_2 ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO_2 ppmvd	CEM SO_2 ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/01/22	08:45	09:14	199.9	200.2	-0.3	0.09
1	2	09/01/22	09:15	09:44	208.2	209.2	-1.0	1.00
0	3	09/01/22	09:45	10:14	32.1	46.9	-14.8	219.04
1	4	09/01/22	10:50	11:19	55.5	50.8	4.7	22.09
1	5	09/01/22	11:20	11:49	150.0	154.1	-4.1	16.81
1	6	09/01/22	11:50	12:19	164.0	159.4	4.6	21.16
0	7	09/01/22	13:00	13:29	147.5	155.1	-7.6	57.76
1	8	09/01/22	13:30	13:59	59.1	61.7	-2.6	6.76
1	9	09/01/22	14:00	14:29	64.2	62.3	1.9	3.61
1	10	09/01/22	15:10	15:39	134.2	135.2	-1.0	1.00
1	11	09/01/22	15:40	16:09	196.0	198.2	-2.2	4.84
0	12	09/01/22	16:10	16:39	112.7	136.5	-23.8	566.44
				n	**9**			
				t(0.025)	**2.306**			
				Mean Reference Method Value	**136.789**		**RM avg**	
				Mean CEM Value	**136.789**		**CEM avg**	
				Sum of Differences	**0.000**		**di**	
				Mean Difference	**0.000**		**d**	
				Sum of Differences Squared	**77.360**		**di^2**	
				Standard Deviation	**3.110**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**2.390**		**cc**	
				Relative Accuracy	**1.75**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 6C, 2

SO2 lb/hr RATA

1=accept 0=reject	Test Run	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	09/01/22	08:45	09:14	153.55	151.80	1.75	3.0625
1	2	09/01/22	09:15	09:44	160.89	157.22	3.67	13.4689
0	3	09/01/22	09:45	10:14	25.03	35.35	-10.32	106.5024
1	4	09/01/22	10:50	11:19	42.96	38.10	4.86	23.6196
1	5	09/01/22	11:20	11:49	114.70	118.60	-3.90	15.2100
0	6	09/01/22	11:50	12:19	126.60	121.50	5.10	26.0100
1	7	09/01/22	13:00	13:29	115.19	118.90	-3.71	13.7641
1	8	09/01/22	13:30	13:59	46.39	47.80	-1.41	1.9881
1	9	09/01/22	14:00	14:29	48.52	47.40	1.12	1.2544
1	10	09/01/22	15:10	15:39	102.86	98.90	3.96	15.6816
1	11	09/01/22	15:40	16:09	146.08	143.30	2.78	7.7284
0	12	09/01/22	16:10	16:39	85.69	101.10	-15.41	237.4681

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**103.460**	**RM avg**
Mean CEM Value	**102.447**	**CEM avg**
Sum of Differences	**9.120**	**di**
Mean Difference	**1.013**	**d**
Sum of Differences Squared	**95.778**	**di^2**
Standard Deviation	**3.289**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2.528**	**cc**
Relative Accuracy	**3.42**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 6C, 2

SO2 lb/ton RATA

1=accept 0=reject	Test Run	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	09/01/22	08:45	09:14	3.6	3.6	0.0	0.00
1	2	09/01/22	09:15	09:44	3.8	3.7	0.1	0.01
0	3	09/01/22	09:45	10:14	0.6	0.8	-0.2	0.04
0	4	09/01/22	10:50	11:19	1.0	0.9	0.1	0.01
1	5	09/01/22	11:20	11:49	2.7	2.8	-0.1	0.01
1	6	09/01/22	11:50	12:19	2.9	2.8	0.1	0.01
1	7	09/01/22	13:00	13:29	2.6	2.7	-0.1	0.01
1	8	09/01/22	13:30	13:59	1.1	1.1	0.0	0.00
1	9	09/01/22	14:00	14:29	1.1	1.1	0.0	0.00
1	10	09/01/22	15:10	15:39	2.3	2.2	0.1	0.01
1	11	09/01/22	15:40	16:09	3.3	3.3	0.0	0.00
0	12	09/01/22	16:10	16:39	2.0	2.4	-0.4	0.16
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**2.600**		**RM avg**	
				Mean CEM Value	**2.589**		**CEM avg**	
				Sum of Differences	**0.100**		**di**	
				Mean Difference	**0.011**		**d**	
				Sum of Differences Squared	**0.050**		**di^2**	
				Standard Deviation	**0.078**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.060**		**cc**	
				Relative Accuracy	**2.74**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 10

CO ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	09/01/22	08:45	09:14	52.4	55.4	-3.0	9.00
1	2	09/01/22	09:15	09:44	56.7	57.4	-0.7	0.49
1	3	09/01/22	09:45	10:14	50.1	52.8	-2.7	7.29
1	4	09/01/22	10:50	11:19	40.7	42.7	-2.0	4.00
1	5	09/01/22	11:20	11:49	53.7	55.3	-1.6	2.56
1	6	09/01/22	11:50	12:19	50.1	50.9	-0.8	0.64
1	7	09/01/22	13:00	13:29	55.3	57.3	-2.0	4.00
0	8	09/01/22	13:30	13:59	47.8	51.6	-3.8	14.44
1	9	09/01/22	14:00	14:29	53.7	55.0	-1.3	1.69
1	10	09/01/22	15:10	15:39	56.2	58.1	-1.9	3.61
1	11	09/01/22	15:40	16:09	54.6	56.8	-2.2	4.84
0	12	09/01/22	16:10	16:39	45.8	48.7	-2.9	8.41

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**52.344**	**RM avg**
Mean CEM Value	**54.033**	**CEM avg**
Sum of Differences	**-15.200**	**di**
Mean Difference	**-1.689**	**d**
Sum of Differences Squared	**29.120**	**di^2**
Standard Deviation	**0.657**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.505**	**cc**
Relative Accuracy	**4.19**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 10, 2

CO lb/hr RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO lb/hr	CEM CO lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	09/01/22	08:45	09:14	17.60	18.42	-0.82	0.6724
1	2	09/01/22	09:15	09:44	19.17	18.89	0.28	0.0784
1	3	09/01/22	09:45	10:14	17.08	17.55	-0.47	0.2209
1	4	09/01/22	10:50	11:19	13.77	14.20	-0.43	0.1849
0	5	09/01/22	11:20	11:49	17.96	18.70	-0.74	0.5476
1	6	09/01/22	11:50	12:19	16.94	17.00	-0.06	0.0036
1	7	09/01/22	13:00	13:29	18.90	19.30	-0.40	0.1600
0	8	09/01/22	13:30	13:59	16.43	17.50	-1.07	1.1449
1	9	09/01/22	14:00	14:29	17.78	18.30	-0.52	0.2704
1	10	09/01/22	15:10	15:39	18.84	18.60	0.24	0.0576
1	11	09/01/22	15:40	16:09	17.83	17.90	-0.07	0.0049
1	12	09/01/22	16:10	16:39	15.24	15.80	-0.56	0.3136
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**17.283**		**RM avg**	
				Mean CEM Value	**17.504**		**CEM avg**	
				Sum of Differences	**-1.990**		**di**	
				Mean Difference	**-0.221**		**d**	
				Sum of Differences Squared	**1.294**		**di^2**	
				Standard Deviation	**0.327**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.251**		**cc**	
				Relative Accuracy	**2.73**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21
Facility: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** 25A, 3A
Applicable Standard: 24

THC ppmvd @ 7% O2 RATA

1=accept 0=reject	Test Run	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)
0	1	09/01/22	8:45	9:14	1.4	0.8	0.6	0.41
0	2	09/01/22	9:15	9:44	1.5	0.7	0.8	0.59
0	3	09/01/22	9:45	10:14	1.6	0.9	0.7	0.52
1	4	09/01/22	10:50	11:19	0.7	0.7	0.0	0.00
1	5	09/01/22	11:20	11:49	0.9	0.8	0.1	0.01
1	6	09/01/22	11:50	12:19	0.9	0.7	0.2	0.04
1	7	09/01/22	13:00	13:29	0.7	0.8	-0.1	0.01
1	8	09/01/22	13:30	13:59	0.9	0.7	0.2	0.04
1	9	09/01/22	14:00	14:29	0.7	0.8	-0.1	0.01
1	10	09/01/22	15:10	15:39	0.9	1.0	-0.1	0.01
1	11	09/01/22	15:40	16:09	0.6	0.8	-0.2	0.04
1	12	09/01/22	16:10	16:39	0.5	0.7	-0.2	0.04

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**0.756**	**RM avg**
Mean CEM Value	**0.778**	**CEM avg**
Sum of Differences	**-0.200**	**di**
Mean Difference	**-0.022**	**d**
Sum of Differences Squared	**0.200**	**di^2**
Standard Deviation	**0.156**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.120**	**cc**
Relative Accuracy - APS	**0.59**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Test Location:** Kiln 21 Breaching Duct
Facility: Alpena Cement Plant **Test Date:** 9/1/2022
Project #: M223406 **Test Method:** 2

Volumetric Flow RATA - Normal Load

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	09/01/22	8:45	9:14	4,970,127	4,918,246	51,881	2,691,650,415
0	2	09/01/22	9:15	9:44	4,995,855	4,860,702	135,152	18,266,087,916
1	3	09/01/22	9:45	10:14	5,038,753	4,917,294	121,459	14,752,272,575
1	4	09/01/22	10:50	11:19	5,000,788	4,895,744	105,044	11,034,237,519
1	5	09/01/22	11:20	11:49	4,941,665	4,996,772	-55,108	3,036,849,500
1	6	09/01/22	11:50	12:19	4,990,830	4,940,595	50,235	2,523,585,699
1	7	09/01/22	13:00	13:29	5,029,971	4,970,824	59,147	3,498,402,496
1	8	09/01/22	13:30	13:59	5,072,755	5,027,675	45,080	2,032,188,970
1	9	09/01/22	14:00	14:29	4,900,245	4,942,785	-42,539	1,809,568,691
0	10	09/01/22	15:10	15:39	5,007,474	4,807,864	199,610	39,844,296,112
0	11	09/01/22	15:40	16:09	4,859,735	4,712,626	147,109	21,641,034,959
1	12	09/01/22	16:10	16:39	4,947,960	4,830,124	117,837	13,885,470,907

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**4988121.636**	**RM avg**
Mean CEM Value	**4937784.256**	**CEM avg**
Sum of Differences	**453036.421**	**di**
Mean Difference	**50337.380**	**d**
Sum of Differences Squared	**55264226772.911**	**di^2**
Standard Deviation	**63698.077**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**48962.589**	**cc**
Relative Accuracy	**1.99**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 21 Stack
Plant: Alpena Cement Plant **Date:** 9/1/22
Project #: M223406 **Test Method:** Sorbent Hg (30B)

Hg ug/wscm RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM ug/wscm	CMMS ug/wscm	(RM-CMMS) Difference (di)	(RM-CMMS) Difference^2 (di^2)
0	1	09/01/22	08:45	09:15	2.7	2.4	0.3	0.09
0	2	09/01/22	09:20	09:50	2.6	2.3	0.3	0.09
0	3	09/01/22	09:55	10:25	2.2	1.9	0.3	0.09
1	4	09/01/22	10:50	11:20	2.5	2.4	0.1	0.01
1	5	09/01/22	11:25	11:55	2.6	2.5	0.1	0.01
1	6	09/01/22	12:00	12:30	2.4	2.5	-0.1	0.01
1	7	09/01/22	13:00	13:30	2.6	2.6	0.0	0.00
1	8	09/01/22	13:35	14:05	2.7	2.6	0.1	0.01
1	9	09/01/22	14:10	14:40	2.7	2.6	0.1	0.01
1	10	09/01/22	15:10	15:40	2.9	2.7	0.2	0.04

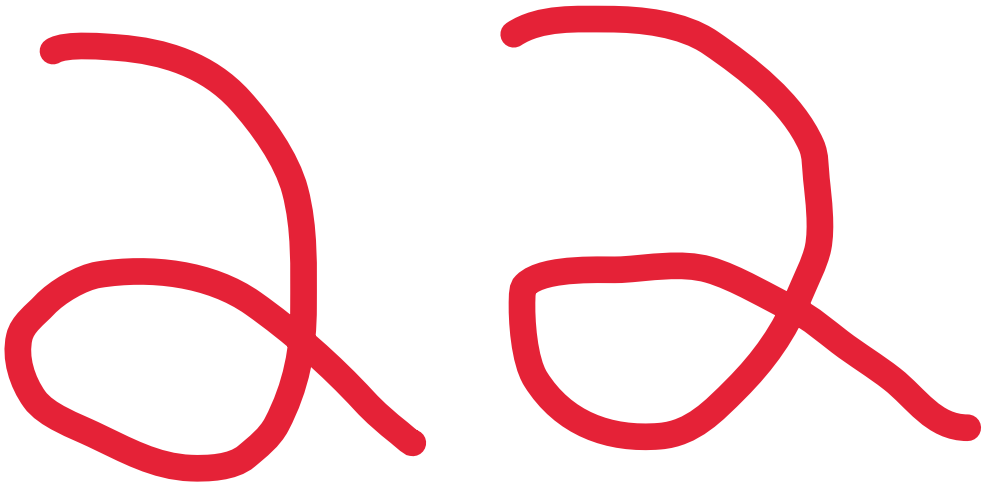
n	**7**	
t(0.025)	**2.447**	
Mean Reference Method Value	**2.629**	**RM avg**
Mean CMM Value	**2.557**	**CMM avg**
Sum of Differences	**0.500**	**di**
Mean Difference	**0.071**	**d**
Sum of Differences Squared	**0.090**	**di^2**
Standard Deviation	**0.095**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.088**	**cc**
Relative Accuracy	**6.06**	**RA**

3.4 Kiln 22 RATA Tables

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 8/30/22
Project #: M223406 **Test Method:** 3A

O_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/30/22	08:45	09:05	8.1	7.9	0.2	0.04
1	2	08/30/22	09:06	09:26	8.4	8.1	0.3	0.09
1	3	08/30/22	09:27	09:47	8.5	8.3	0.2	0.04
1	4	08/30/22	10:10	10:30	8.8	8.5	0.3	0.09
1	5	08/30/22	10:31	10:51	8.8	8.6	0.2	0.04
1	6	08/30/22	10:52	11:12	8.8	8.5	0.3	0.09
1	7	08/30/22	11:35	11:55	8.4	8.2	0.2	0.04
0	8	08/30/22	11:56	12:16	8.8	8.5	0.3	0.09
0	9	08/30/22	12:17	12:37	11.1	10.9	0.2	0.04
1	10	08/30/22	13:10	13:30	8.9	8.7	0.2	0.04
1	11	08/30/22	13:31	13:51	8.3	8.1	0.2	0.04
0	12	08/30/22	13:52	14:12	8.4	8.1	0.3	0.09
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**8.556**		**RM avg**	
				Mean CEM Value	**8.322**		**CEM avg**	
				Sum of Differences	**2.100**		**di**	
				Mean Difference	**0.233**		**d**	
				Sum of Differences Squared	**0.510**		**di^2**	
				Standard Deviation	**0.050**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.038**		**cc**	
				Relative Accuracy	**3.18**		**RA**	



Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 8/30/22
Project #: M223406 **Test Method:** 3A

CO_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (dry)	CEM CO_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/30/22	08:45	09:05	19.1	19.1	0.0	0.00
1	2	08/30/22	09:06	09:26	18.2	18.3	-0.1	0.01
1	3	08/30/22	09:27	09:47	18.1	18.0	0.1	0.01
1	4	08/30/22	10:10	10:30	17.4	18.0	-0.6	0.36
1	5	08/30/22	10:31	10:51	17.6	18.0	-0.4	0.16
1	6	08/30/22	10:52	11:12	17.7	18.3	-0.6	0.36
1	7	08/30/22	11:35	11:55	17.9	18.7	-0.8	0.64
0	8	08/30/22	11:56	12:16	17.2	18.1	-0.9	0.81
0	9	08/30/22	12:17	12:37	13.5	13.6	-0.1	0.01
1	10	08/30/22	13:10	13:30	14.3	14.9	-0.6	0.36
1	11	08/30/22	13:31	13:51	16.8	17.3	-0.5	0.25
0	12	08/30/22	13:52	14:12	17.5	18.4	-0.9	0.81
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**17.456**		**RM avg**	
				Mean CEM Value	**17.844**		**CEM avg**	
				Sum of Differences	**-3.500**		**di**	
				Mean Difference	**-0.389**		**d**	
				Sum of Differences Squared	**2.150**		**di^2**	
				Standard Deviation	**0.314**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.241**		**cc**	
				Relative Accuracy	**3.61**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 8/30/22
Project #: M223406 **Test Method:** 7E

NO_x ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x ppmvd	CEM NO_x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/30/22	08:45	09:05	326.3	371.5	-45.2	2043.04
1	2	08/30/22	09:06	09:26	403.3	450.5	-47.2	2227.84
1	3	08/30/22	09:27	09:47	424.3	489.0	-64.7	4186.09
1	4	08/30/22	10:10	10:30	471.5	536.8	-65.3	4264.09
1	5	08/30/22	10:31	10:51	422.2	488.8	-66.6	4435.56
1	6	08/30/22	10:52	11:12	307.5	355.7	-48.2	2323.24
1	7	08/30/22	11:35	11:55	223.1	247.9	-24.8	615.04
0	8	08/30/22	11:56	12:16	316.9	354.6	-37.7	1421.29
0	9	08/30/22	12:17	12:37	187.2	179.0	8.2	67.24
1	10	08/30/22	13:10	13:30	822.5	890.8	-68.3	4664.89
0	11	08/30/22	13:31	13:51	596.4	692.7	-96.3	9273.69
1	12	08/30/22	13:52	14:12	574.4	626.8	-52.4	2745.76
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**441.678**		**RM avg**	
				Mean CEM Value	**495.311**		**CEM avg**	
				Sum of Differences	**-482.700**		**di**	
				Mean Difference	**-53.633**		**d**	
				Sum of Differences Squared	**27505.550**		**di^2**	
				Standard Deviation	**14.216**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**10.927**		**cc**	
				Relative Accuracy	**14.62**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena | **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant | **Date:** 8/30/22
Project #: M223406 | **Test Method:** 7E, 2

NO_x lb/hr RATA

1=accept 0=reject	Test Run	Mw	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	62.9	08/30/22	08:45	09:05	262.16	306.20	-44.04	1939.5216
1	2	63.4	08/30/22	09:06	09:26	326.45	365.80	-39.35	1548.4225
1	3	62.9	08/30/22	09:27	09:47	349.21	398.00	-48.79	2380.4641
1	4	65.25	08/30/22	10:10	10:30	391.47	436.40	-44.93	2018.7049
0	5	65.16	08/30/22	10:31	10:51	348.84	401.22	-52.38	2743.6644
1	6	65.67	08/30/22	10:52	11:12	255.49	294.51	-39.02	1522.5604
1	7	66.24	08/30/22	11:35	11:55	178.70	207.92	-29.22	853.8084
0	8	28.98	08/30/22	11:56	12:16	261.06	293.98	-32.92	1083.7264
0	9	18.17	08/30/22	12:17	12:37	155.51	121.97	33.54	1124.9316
1	10	62.33	08/30/22	13:10	13:30	688.83	608.97	79.86	6377.6196
1	11	63	08/30/22	13:31	13:51	474.45	484.68	-10.23	104.6529
1	12	63.08	08/30/22	13:52	14:12	458.65	475.89	-17.24	297.2176

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**376.157**	**RM avg**
Mean CEM Value	**397.597**	**CEM avg**
Sum of Differences	**-192.960**	**di**
Mean Difference	**-21.440**	**d**
Sum of Differences Squared	**17042.972**	**di^2**
Standard Deviation	**40.165**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**30.874**	**cc**
Relative Accuracy	**13.91**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 8/30/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/ton RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/ton	CEM NO_x lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	08/30/22	08:45	09:05	4.20	4.90	-0.70	0.4900
1	2	08/30/22	09:06	09:26	5.10	5.80	-0.70	0.4900
1	3	08/30/22	09:27	09:47	5.60	6.30	-0.70	0.4900
1	4	08/30/22	10:10	10:30	6.00	6.70	-0.70	0.4900
1	5	08/30/22	10:31	10:51	5.40	6.20	-0.80	0.6400
1	6	08/30/22	10:52	11:12	3.90	4.50	-0.60	0.3600
1	7	08/30/22	11:35	11:55	2.70	3.20	-0.50	0.2500
0	8	08/30/22	11:56	12:16	9.00	32.80	-23.80	566.4400
0	9	08/30/22	12:17	12:37	8.60	18.50	-9.90	98.0100
1	10	08/30/22	13:10	13:30	11.10	9.80	1.30	1.6900
1	11	08/30/22	13:31	13:51	7.50	7.70	-0.20	0.0400
1	12	08/30/22	13:52	14:12	7.30	7.60	-0.30	0.0900
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**6.067**		**RM avg**	
				Mean CEM Value	**6.422**		**CEM avg**	
				Sum of Differences	**-3.200**		**di**	
				Mean Difference	**-0.356**		**d**	
				Sum of Differences Squared	**4.540**		**di^2**	
				Standard Deviation	**0.652**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.501**		**cc**	
				Relative Accuracy	**14.12**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 8/30/22
Project #: M223406 **Test Method:** 10

CO ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/30/22	08:45	09:05	56.2	61.3	-5.1	26.01
1	2	08/30/22	09:06	09:26	36.5	42.6	-6.1	37.21
1	3	08/30/22	09:27	09:47	30.1	35.1	-5.0	25.00
1	4	08/30/22	10:10	10:30	32.7	33.5	-0.8	0.64
1	5	08/30/22	10:31	10:51	33.9	34.0	-0.1	0.01
1	6	08/30/22	10:52	11:12	39.0	41.8	-2.8	7.84
1	7	08/30/22	11:35	11:55	51.9	56.0	-4.1	16.81
0	8	08/30/22	11:56	12:16	31.3	37.8	-6.5	42.25
0	9	08/30/22	12:17	12:37	50.8	44.9	5.9	34.81
1	10	08/30/22	13:10	13:30	33.4	33.0	0.4	0.16
1	11	08/30/22	13:31	13:51	70.4	68.4	2.0	4.00
0	12	08/30/22	13:52	14:12	51.7	57.9	-6.2	38.44

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**42.678**	**RM avg**
Mean CEM Value	**45.078**	**CEM avg**
Sum of Differences	**-21.600**	**di**
Mean Difference	**-2.400**	**d**
Sum of Differences Squared	**117.680**	**di^2**
Standard Deviation	**2.869**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2.205**	**cc**
Relative Accuracy - APS	**4.61**	**ppm + cc difference[A]**

[A] Relative accuracy based upon alternate performance standard of +/- 5 ppm CO plus the confidence coefficient.

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 8/30/22
Project #: M223406 **Test Method:** 10, 2
Applicable Standard: 122.6

CO lb/hr RATA

CEM Analyzer Information

1=accept 0=reject	Test Run	Mw	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	62.9	08/30/22	08:45	09:05	27.48	30.59	-3.11	9.6721
1	2	63.4	08/30/22	09:06	09:26	17.96	21.09	-3.13	9.7969
1	3	62.9	08/30/22	09:27	09:47	15.08	17.39	-2.31	5.3361
1	4	65.25	08/30/22	10:10	10:30	16.50	16.56	-0.06	0.0036
1	5	65.16	08/30/22	10:31	10:51	17.02	16.99	0.03	0.0009
1	6	65.67	08/30/22	10:52	11:12	19.71	21.12	-1.41	1.9881
0	7	66.24	08/30/22	11:35	11:55	25.29	28.61	-3.32	11.0224
0	8	28.98	08/30/22	11:56	12:16	15.69	19.26	-3.57	12.7449
0	9	18.17	08/30/22	12:17	12:37	25.65	18.78	6.87	47.1969
1	10	62.33	08/30/22	13:10	13:30	17.02	13.75	3.27	10.6929
1	11	63	08/30/22	13:31	13:51	34.07	29.17	4.90	24.0100
1	12	63.08	08/30/22	13:52	14:12	25.10	26.40	-1.30	1.6900

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**21.104**	**RM avg**
Mean CEM Value	**21.451**	**CEM avg**
Sum of Differences	**-3.120**	**di**
Mean Difference	**-0.347**	**d**
Sum of Differences Squared	**63.191**	**di^2**
Standard Deviation	**2.786**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2.142**	**cc**
Relative Accuracy - APS	**2.03**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Test Location:** Kiln 22 Baghouse Outlet
Facility: Alpena Cement Plant **Test Date:** 8/30/2022
Project #: M223406 **Test Method:** 2

Volumetric Flow RATA - Normal Load

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	08/30/22	8:45	9:05	7,127,364	7,237,389	-110,025	12,105,420,452
1	2	08/30/22	9:06	9:26	7,181,652	7,158,305	23,347	545,062,493
1	3	08/30/22	9:27	9:47	7,302,396	7,169,302	133,094	17,714,083,427
1	4	08/30/22	10:10	10:30	7,342,163	7,160,486	181,677	33,006,638,505
1	5	08/30/22	10:31	10:51	7,307,497	7,235,334	72,163	5,207,489,391
1	6	08/30/22	10:52	11:12	7,347,936	7,300,685	47,251	2,232,678,258
1	7	08/30/22	11:35	11:55	7,285,127	7,390,110	-104,983	11,021,408,639
0	8	08/30/22	11:56	12:16	7,250,002	7,320,023	-70,021	4,902,891,443
0	9	08/30/22	12:17	12:37	5,335,542	5,746,791	-411,249	169,125,562,828
0	10	08/30/22	13:10	13:30	7,474,748	6,019,413	1,455,335	2,117,999,199,693
1	11	08/30/22	13:31	13:51	7,099,624	6,161,372	938,252	880,316,064,466
1	12	08/30/22	13:52	14:12	7,127,081	6,652,487	474,594	225,239,861,926

n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**7235648.975**	**RM avg**
Mean CEM Value	**7051718.889**	**CEM avg**
Sum of Differences	**1655370.778**	**di**
Mean Difference	**183930.086**	**d**
Sum of Differences Squared	**1187388707557.520**	**di^2**
Standard Deviation	**332211.570**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**255359.960**	**cc**
Relative Accuracy	**6.07**	**RA**

3.5 Kiln 23 RATA Tables

Client: Holcim (US) Inc. Lafarge Alpena
Location: Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant
Date: 9/13/22
Project #: M223406
Test Method: 3A

O_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/13/22	08:15	08:35	6.7	6.8	-0.1	0.01
1	2	09/13/22	08:36	08:56	6.6	6.6	0.0	0.00
1	3	09/13/22	08:57	09:17	6.5	6.5	0.0	0.00
1	4	09/13/22	09:45	10:05	6.8	6.8	0.0	0.00
1	5	09/13/22	10:06	10:26	6.9	7.0	-0.1	0.01
0	6	09/13/22	10:27	10:47	6.9	7.1	-0.2	0.04
1	7	09/13/22	11:45	12:05	8.1	8.2	-0.1	0.01
1	8	09/13/22	12:06	12:26	8.0	8.2	-0.2	0.04
1	9	09/13/22	12:27	12:47	8.1	8.3	-0.2	0.04
0	10	09/13/22	13:10	13:30	8.0	8.3	-0.3	0.09
0	11	09/13/22	13:31	13:51	7.6	7.8	-0.2	0.04
1	12	09/13/22	13:52	14:12	7.9	8.1	-0.2	0.04
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**7.289**		**RM avg**	
				Mean CEM Value	**7.389**		**CEM avg**	
				Sum of Differences	**-0.900**		**di**	
				Mean Difference	**-0.100**		**d**	
				Sum of Differences Squared	**0.150**		**di^2**	
				Standard Deviation	**0.087**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.067**		**cc**	
				Relative Accuracy	**2.29**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 9/13/22
Project #: M223406 **Test Method:** 3A

CO_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO_2 % (dry)	CEM CO_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/13/22	08:15	08:35	21.0	21.4	-0.4	0.16
1	2	09/13/22	08:36	08:56	21.6	21.9	-0.3	0.09
1	3	09/13/22	08:57	09:17	21.6	21.9	-0.3	0.09
0	4	09/13/22	09:45	10:05	21.0	21.6	-0.6	0.36
1	5	09/13/22	10:06	10:26	20.7	21.1	-0.4	0.16
1	6	09/13/22	10:27	10:47	20.7	21.2	-0.5	0.25
1	7	09/13/22	11:45	12:05	19.5	20.0	-0.5	0.25
1	8	09/13/22	12:06	12:26	19.5	20.0	-0.5	0.25
0	9	09/13/22	12:27	12:47	19.0	19.5	-0.5	0.25
0	10	09/13/22	13:10	13:30	19.2	19.7	-0.5	0.25
1	11	09/13/22	13:31	13:51	20.1	20.6	-0.5	0.25
1	12	09/13/22	13:52	14:12	19.8	20.2	-0.4	0.16
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**20.500**		**RM avg**	
				Mean CEM Value	**20.922**		**CEM avg**	
				Sum of Differences	**-3.800**		**di**	
				Mean Difference	**-0.422**		**d**	
				Sum of Differences Squared	**1.660**		**di^2**	
				Standard Deviation	**0.083**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.064**		**cc**	
				Relative Accuracy	**2.37**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 9/13/22
Project #: M223406 **Test Method:** 7E

NO_x ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x ppmvd	CEM NO_x ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	09/13/22	08:15	08:35	673.4	687.1	-13.7	187.69
1	2	09/13/22	08:36	08:56	509.6	527.4	-17.8	316.84
1	3	09/13/22	08:57	09:17	521.5	529.1	-7.6	57.76
1	4	09/13/22	09:45	10:05	789.9	817.6	-27.7	767.29
0	5	09/13/22	10:06	10:26	697.0	737.4	-40.4	1632.16
0	6	09/13/22	10:27	10:47	679.6	710.9	-31.3	979.69
1	7	09/13/22	11:45	12:05	307.3	289.8	17.5	306.25
1	8	09/13/22	12:06	12:26	266.8	247.0	19.8	392.04
0	9	09/13/22	12:27	12:47	453.9	427.4	26.5	702.25
1	10	09/13/22	13:10	13:30	263.8	246.0	17.8	316.84
1	11	09/13/22	13:31	13:51	93.0	87.1	5.9	34.81
1	12	09/13/22	13:52	14:12	140.3	127.7	12.6	158.76
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**396.178**		**RM avg**	
				Mean CEM Value	**395.422**		**CEM avg**	
				Sum of Differences	**6.800**		**di**	
				Mean Difference	**0.756**		**d**	
				Sum of Differences Squared	**2538.280**		**di^2**	
				Standard Deviation	**17.794**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**13.678**		**cc**	
				Relative Accuracy	**3.64**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 9/13/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/hr RATA

1=accept 0=reject	Test Run	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)
0	1	09/13/22	08:15	08:35	520.96	476.74	44.22	1955.4084
1	2	09/13/22	08:36	08:56	375.14	362.45	12.69	161.0361
1	3	09/13/22	08:57	09:17	394.56	367.35	27.21	740.3841
1	4	09/13/22	09:45	10:05	610.76	586.08	24.68	609.1024
1	5	09/13/22	10:06	10:26	560.12	528.16	31.96	1021.4416
1	6	09/13/22	10:27	10:47	525.59	499.59	26.00	676.0000
1	7	09/13/22	11:45	12:05	236.90	224.65	12.25	150.0625
1	8	09/13/22	12:06	12:26	217.56	187.60	29.96	897.6016
0	9	09/13/22	12:27	12:47	379.49	327.27	52.22	2726.9284
0	10	09/13/22	13:10	13:30	216.50	184.73	31.77	1009.3329
1	11	09/13/22	13:31	13:51	76.40	63.44	12.96	167.9616
1	12	09/13/22	13:52	14:12	109.19	96.48	12.71	161.5441
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**345.136**		**RM avg**	
				Mean CEM Value	**323.978**		**CEM avg**	
				Sum of Differences	**190.420**		**di**	
				Mean Difference	**21.158**		**d**	
				Sum of Differences Squared	**4585.134**		**di^2**	
				Standard Deviation	**8.339**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**6.410**		**cc**	
				Relative Accuracy	**7.99**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 9/13/22
Project #: M223406 **Test Method:** 7E, 2

NO_x lb/ton RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM NO_x lb/ton	CEM NO_x lb/ton	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	09/13/22	08:15	08:35	7.9	7.2	0.7	0.49
1	2	09/13/22	08:36	08:56	5.7	5.5	0.2	0.04
1	3	09/13/22	08:57	09:17	6.0	5.6	0.4	0.16
1	4	09/13/22	09:45	10:05	9.2	8.9	0.3	0.09
1	5	09/13/22	10:06	10:26	7.9	7.4	0.5	0.25
1	6	09/13/22	10:27	10:47	7.9	7.5	0.4	0.16
1	7	09/13/22	11:45	12:05	3.6	3.4	0.2	0.04
1	8	09/13/22	12:06	12:26	3.2	2.8	0.4	0.16
0	9	09/13/22	12:27	12:47	5.7	5.0	0.7	0.49
0	10	09/13/22	13:10	13:30	3.2	2.7	0.5	0.25
1	11	09/13/22	13:31	13:51	1.1	0.9	0.2	0.04
1	12	09/13/22	13:52	14:12	1.6	1.4	0.2	0.04
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**5.133**		**RM avg**	
				Mean CEM Value	**4.822**		**CEM avg**	
				Sum of Differences	**2.800**		**di**	
				Mean Difference	**0.311**		**d**	
				Sum of Differences Squared	**0.980**		**di^2**	
				Standard Deviation	**0.117**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.090**		**cc**	
				Relative Accuracy	**7.81**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant **Date:** 9/13/22
Project #: M223406 **Test Method:** 10

CO ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM CO ppmvd	CEM CO ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	09/13/22	08:15	08:35	86.1	77.3	8.8	77.44
0	2	09/13/22	08:36	08:56	102.2	92.4	9.8	96.04
0	3	09/13/22	08:57	09:17	108.3	99.0	9.3	86.49
1	4	09/13/22	09:45	10:05	65.4	68.3	-2.9	8.41
1	5	09/13/22	10:06	10:26	56.2	58.8	-2.6	6.76
1	6	09/13/22	10:27	10:47	54.6	58.4	-3.8	14.44
1	7	09/13/22	11:45	12:05	49.6	54.8	-5.2	27.04
1	8	09/13/22	12:06	12:26	55.0	59.4	-4.4	19.36
1	9	09/13/22	12:27	12:47	40.6	44.4	-3.8	14.44
1	10	09/13/22	13:10	13:30	50.2	53.0	-2.8	7.84
1	11	09/13/22	13:31	13:51	127.9	128.8	-0.9	0.81
1	12	09/13/22	13:52	14:12	73.3	77.0	-3.7	13.69
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**63.644**		**RM avg**	
				Mean CEM Value	**66.989**		**CEM avg**	
				Sum of Differences	**-30.100**		**di**	
				Mean Difference	**-3.344**		**d**	
				Sum of Differences Squared	**112.790**		**di^2**	
				Standard Deviation	**1.231**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.946**		**cc**	
				Relative Accuracy	**6.74**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena
Facility: Alpena Cement Plant
Project #: M223406

Location: Kiln 23 Baghouse Outlet
Date: 9/13/22
Test Method: 10, 2

CO lb/hr RATA

1=accept 0=reject	Test Run	Mw	Test Date	Start Time	End Time	RM CO lb/hr	CEM CO lb/hr	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
0	1	65.8	09/13/22	08:15	08:35	40.54	32.64	7.90	62.4100
0	2	65.8	09/13/22	08:36	08:56	45.78	38.64	7.14	50.9796
0	3	65.9	09/13/22	08:57	09:17	49.88	41.83	8.05	64.8025
1	4	66.2	09/13/22	09:45	10:05	30.79	29.79	1.00	1.0000
1	5	70.9	09/13/22	10:06	10:26	27.50	25.63	1.87	3.4969
1	6	66.6	09/13/22	10:27	10:47	25.70	24.98	0.72	0.5184
1	7	66.6	09/13/22	11:45	12:05	23.27	25.85	-2.58	6.6564
1	8	67	09/13/22	12:06	12:26	27.29	27.45	-0.16	0.0256
1	9	66	09/13/22	12:27	12:47	20.67	20.69	-0.02	0.0004
1	10	67.8	09/13/22	13:10	13:30	25.06	24.22	0.84	0.7056
1	11	68.6	09/13/22	13:31	13:51	63.94	57.09	6.85	46.9225
1	12	68.1	09/13/22	13:52	14:12	34.73	35.40	-0.67	0.4489
					n	**9**			
					t(0.975)	**2.306**			
					Mean Reference Method Value	**30.994**		**RM avg**	
					Mean CEM Value	**30.122**		**CEM avg**	
					Sum of Differences	**7.850**		**di**	
					Mean Difference	**0.872**		**d**	
					Sum of Differences Squared	**59.775**		**di^2**	
					Standard Deviation	**2.572**		**sd**	
					Confidence Coefficient 2.5% Error (1-tail)	**1.977**		**cc**	
					Relative Accuracy	**9.19**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Test Location:** Kiln 23 Baghouse Outlet
Facility: Alpena Cement Plant **Test Date:** 9/13/2022
Project #: M223406 **Test Method:** 2

Volumetric Flow RATA - Normal Load

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)
0	1	09/13/22	8:15	8:35	6,907,716	6,116,883	790,833	625,417,464,450
1	2	09/13/22	8:36	8:56	6,572,934	6,058,669	514,265	264,468,454,229
1	3	09/13/22	8:57	9:17	6,755,111	6,120,895	634,216	402,230,070,616
1	4	09/13/22	9:45	10:05	6,903,825	6,319,542	584,283	341,387,095,730
0	5	09/13/22	10:06	10:26	7,175,496	6,314,381	861,115	741,519,365,815
1	6	09/13/22	10:27	10:57	6,905,207	6,195,538	709,669	503,629,409,034
1	7	09/13/22	11:45	12:05	6,912,887	6,834,217	78,671	6,189,108,958
1	8	09/13/22	12:06	12:26	7,313,334	6,695,962	617,372	381,147,766,521
1	9	09/13/22	12:27	12:47	7,496,831	6,750,617	746,214	556,835,305,932
1	10	09/13/22	13:10	13:30	6,874,696	6,620,161	254,535	64,787,909,949
0	11	09/13/22	13:31	13:51	7,313,712	6,421,510	892,202	796,023,710,554
1	12	09/13/22	13:52	14:12	6,925,475	6,660,988	264,487	69,953,252,541

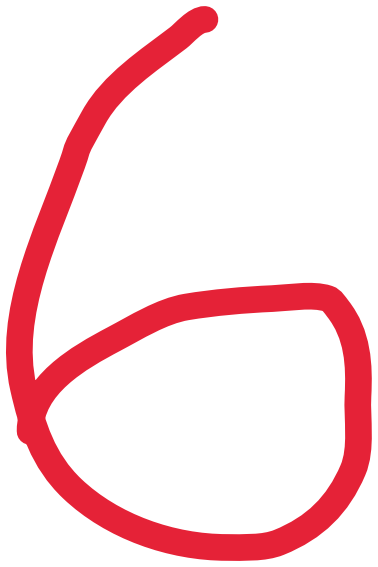
n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**6962255.684**	**RM avg**
Mean CEM Value	**6472954.463**	**CEM avg**
Sum of Differences	**4403710.993**	**di**
Mean Difference	**489301.221**	**d**
Sum of Differences Squared	**2590628373509.790**	**di^2**
Standard Deviation	**233422.151**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**179423.827**	**cc**
Relative Accuracy	**9.61**	**RA**

3.6 Wet Gas Scrubber RATA Tables

Client: Holcim (US) Inc. **Location:** Wet Gas Scrubber
Facility: Alpena Cement Plant **Date:** 8/29/22
Project #: M223406 **Test Method:** 3A

O_2 % (dry) RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM O_2 % (dry)	CEM O_2 % (dry)	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/29/22	09:04	09:33	11.8	11.7	0.1	0.01
0	2	08/29/22	09:34	10:03	11.7	11.6	0.1	0.01
0	3	08/29/22	10:04	10:33	11.5	11.4	0.1	0.01
1	4	08/29/22	14:40	15:09	11.3	11.3	0.0	0.00
1	5	08/29/22	15:10	15:39	11.5	11.5	0.0	0.00
1	6	08/29/22	15:40	16:09	11.6	11.6	0.0	0.00
1	7	08/29/22	16:43	17:12	11.8	11.8	0.0	0.00
1	8	08/29/22	17:13	17:42	12.0	12.0	0.0	0.00
1	9	08/29/22	17:43	18:12	12.0	12.0	0.0	0.00
1	10	08/29/22	18:50	19:19	12.7	12.6	0.1	0.01
1	11	08/29/22	19:20	19:49	13.0	12.9	0.1	0.01
0	12	08/29/22	19:50	20:19	13.1	12.9	0.2	0.04
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**11.967**		**RM avg**	
				Mean CEM Value	**11.933**		**CEM avg**	
				Sum of Differences	**0.300**		**di**	
				Mean Difference	**0.033**		**d**	
				Sum of Differences Squared	**0.030**		**di^2**	
				Standard Deviation	**0.050**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.038**		**cc**	
				Relative Accuracy	**0.60**		**RA**	



Client: Holcim (US) Inc. **Location:** Wet Gas Scrubber
Facility: Alpena Cement Plant **Date:** 8/29/22
Project #: M223406 **Test Method:** 6C

SO2 ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM SO2 ppmvd	CEM SO2 ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/29/22	09:04	09:33	38.4	37.4	1.0	0.91
0	2	08/29/22	09:34	10:03	64.0	56.4	7.6	57.67
1	3	08/29/22	10:04	10:33	50.9	48.6	2.3	5.46
0	4	08/29/22	14:40	15:09	88.3	81.1	7.2	51.30
1	5	08/29/22	15:10	15:39	104.3	99.3	5.0	24.97
1	6	08/29/22	15:40	16:09	73.8	74.0	-0.2	0.04
1	7	08/29/22	16:43	17:12	35.6	38.4	-2.8	7.66
1	8	08/29/22	17:13	17:42	37.0	37.2	-0.2	0.02
1	9	08/29/22	17:43	18:12	55.2	51.0	4.2	17.94
1	10	08/29/22	18:50	19:19	15.0	18.2	-3.2	10.24
1	11	08/29/22	19:20	19:49	19.0	21.4	-2.4	5.76
1	12	08/29/22	19:50	20:19	27.7	29.8	-2.1	4.41

n	**10**	
t(0.025)	**2.262**	
Mean Reference Method Value	**45.701**	**RM avg**
Mean CEM Value	**45.530**	**CEM avg**
Sum of Differences	**1.707**	**di**
Mean Difference	**0.171**	**d**
Sum of Differences Squared	**77.409**	**di^2**
Standard Deviation	**2.927**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**2.094**	**cc**
Relative Accuracy	**4.96**	**RA**

Client: Holcim (US) Inc. **Location:** Wet Gas Scrubber
Facility: Alpena Cement Plant **Date:** 8/29/22
Project #: M223406 **Test Method:** 6C, 2

SO2 lb/hr RATA

1=accept 0=reject	Test Run	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	08/29/22	09:04	09:33	146.72	141.00	5.72	32.7184
0	2	08/29/22	09:34	10:03	241.36	212.60	28.76	827.1376
1	3	08/29/22	10:04	10:33	194.52	182.30	12.22	149.3284
0	4	08/29/22	14:40	15:09	336.50	302.20	34.30	1176.4900
0	5	08/29/22	15:10	15:39	395.35	370.20	25.15	632.5225
1	6	08/29/22	15:40	16:09	280.27	274.90	5.37	28.8369
1	7	08/29/22	16:43	17:12	134.61	142.70	-8.09	65.4481
1	8	08/29/22	17:13	17:42	141.21	138.60	2.61	6.8121
1	9	08/29/22	17:43	18:12	210.38	190.10	20.28	411.2784
1	10	08/29/22	18:50	19:19	57.79	67.90	-10.11	102.2121
1	11	08/29/22	19:20	19:49	72.2	80.50	-8.28	68.5584
1	12	08/29/22	19:50	20:19	105.2	111.80	-6.59	43.4281
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**149.214**		**RM avg**	
				Mean CEM Value	**147.756**		**CEM avg**	
				Sum of Differences	**13.130**		**di**	
				Mean Difference	**1.459**		**d**	
				Sum of Differences Squared	**908.621**		**di^2**	
				Standard Deviation	**10.544**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**8.105**		**cc**	
				Relative Accuracy	**6.41**		**RA**	

Client: Holcim (US) Inc. **Location:** Wet Gas Scrubber
Facility: Alpena Cement Plant **Date:** 8/29/22
Project #: M223406 **Test Method:** 6C, 2

SO2 lb/ton RATA

1=accept 0=reject	Test Run	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	08/29/22	09:04	09:33	1.2	1.1	0.1	0.01
0	2	08/29/22	09:34	10:03	1.9	1.7	0.2	0.04
1	3	08/29/22	10:04	10:33	1.6	1.5	0.1	0.01
1	4	08/29/22	14:40	15:09	2.6	2.4	0.2	0.04
1	5	08/29/22	15:10	15:39	3.1	2.9	0.2	0.04
1	6	08/29/22	15:40	16:09	2.2	2.1	0.1	0.01
1	7	08/29/22	16:43	17:12	1.1	1.1	0.0	0.00
1	8	08/29/22	17:13	17:42	1.1	1.5	-0.4	0.16
0	9	08/29/22	17:43	18:12	1.7	1.1	0.6	0.36
1	10	08/29/22	18:50	19:19	0.5	0.6	-0.1	0.01
1	11	08/29/22	19:20	19:49	0.7	0.7	0.0	0.00
1	12	08/29/22	19:50	20:19	1.0	1.1	-0.1	0.01

n	**10**	
t(0.975)	**2.262**	
Mean Reference Method Value	**1.510**	**RM avg**
Mean CEM Value	**1.500**	**CEM avg**
Sum of Differences	**0.100**	**di**
Mean Difference	**0.010**	**d**
Sum of Differences Squared	**0.290**	**di^2**
Standard Deviation	**0.179**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.128**	**cc**
Relative Accuracy	**9.15**	**RA**

Client: Holcim (US) Inc. **Location:** Wet Gas Scrubber
Facility: Alpena Cement Plant **Date:** 8/29/22
Project #: M223406 **Test Method:** 25A, 3A

THC ppmvd @ 7% O2 RATA

1=accept 0=reject	Test Run	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)
0	1	08/29/22	9:04	9:33	0.5	1.0	-0.5	0.25
0	2	08/29/22	9:34	10:03	0.5	1.1	-0.6	0.36
1	3	08/29/22	10:04	10:33	1.0	1.2	-0.2	0.04
1	4	08/29/22	14:40	15:09	1.4	1.3	0.1	0.01
1	5	08/29/22	15:10	15:39	1.7	1.7	0.0	0.00
1	6	08/29/22	15:40	16:09	1.6	1.4	0.2	0.04
1	7	08/29/22	16:43	17:12	1.3	1.2	0.1	0.01
1	8	08/29/22	17:13	17:42	1.8	1.7	0.1	0.01
0	9	08/29/22	17:43	18:12	2.7	2.2	0.5	0.25
1	10	08/29/22	18:50	19:19	1.2	1.2	0.0	0.00
1	11	08/29/22	19:20	19:49	1.4	1.2	0.2	0.04
1	12	08/29/22	19:50	20:19	1.0	1.2	-0.2	0.04

n	**9**	
t(0.975)	**2.306**	
Mean Reference Method Value	**1.378**	**RM avg**
Mean CEM Value	**1.344**	**CEM avg**
Sum of Differences	**0.300**	**di**
Mean Difference	**0.033**	**d**
Sum of Differences Squared	**0.190**	**di^2**
Standard Deviation	**0.150**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.115**	**cc**
Relative Accuracy	**10.79**	**RA**

Client: Holcim (US) Inc. Lafarge Alpena **Test Location:** Wet Scrubber Stack
Facility: Alpena Cement Plant **Test Date:** 8/29/2022
Project #: M223406 **Test Method:** 2F

Volumetric Flow RATA - Normal Load

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	08/29/22	9:04	9:33	26,216,634	26,367,091	-150,457	14,742,743,548
0	2	08/29/22	9:34	10:03	25,877,978	26,374,039	-496,061	85,044,557,376
1	3	08/29/22	10:04	10:33	26,141,972	26,353,486	-211,514	27,441,446,501
1	4	08/29/22	14:40	15:09	26,009,901	26,345,185	-335,284	22,637,429,215
0	5	08/29/22	15:10	15:39	25,860,700	26,330,209	-469,509	246,076,317,297
1	6	08/29/22	15:40	16:09	25,876,650	26,318,047	-441,397	44,737,960,682
0	7	08/29/22	16:43	17:12	25,831,737	26,306,003	-474,266	112,415,494,770
1	8	08/29/22	17:13	17:42	26,066,734	26,308,909	-242,175	220,438,513,277
1	9	08/29/22	17:43	18:12	26,102,718	26,311,195	-208,477	194,831,046,771
1	10	08/29/22	18:50	19:19	26,377,439	26,256,020	121,420	224,927,764,490
1	11	08/29/22	19:20	19:49	25,989,582	26,281,206	-291,624	58,648,633,755
1	12	08/29/22	19:50	20:19	26,041,276	26,206,931	-165,655	43,462,617,834
				n	**9**			
				t(0.975)	**2.306**			
				Mean Reference Method Value	**26091434.144**		**RM avg**	
				Mean CEM Value	**26305341.078**		**CEM avg**	
				Sum of Differences	**-1925162.400**		**di**	
				Mean Difference	**-213906.933**		**d**	
				Sum of Differences Squared	**851868156073.489**		**di^2**	
				Standard Deviation	**234537.463**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**180281.130**		**cc**	
				Relative Accuracy	**1.51**		**RA**	

Client: Holcim (US) Inc. Lafarge Alpena **Location:** Wet Gas Scrubber Stack
Plant: Alpena Cement Plant **Date:** 8/29/22
Project #: M223406 **Test Method:** Sorbent Hg (30B)

Hg ug/wscm RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM ug/wscm	CMMS ug/wscm	(RM-CMMS) Difference (di)	(RM-CMMS) Difference^2 (di^2)
1	1	08/29/22	08:50	09:20	0.42	0.34	0.08	0.0064
1	2	08/29/22	09:40	10:10	0.45	0.39	0.06	0.0036
1	3	08/29/22	10:24	10:54	0.50	0.40	0.10	0.0100
1	4	08/29/22	13:25	13:55	0.53	0.45	0.08	0.0064
1	5	08/29/22	14:14	14:44	0.47	0.40	0.07	0.0049
1	6	08/29/22	15:06	15:36	0.48	0.40	0.08	0.0064
1	7	08/29/22	15:50	16:20	0.44	0.40	0.04	0.0016
1	8	08/29/22	16:34	17:04	0.53	0.43	0.10	0.0100
1	9	08/29/22	17:16	17:46	0.48	0.40	0.08	0.0064
0	10	08/29/22	17:56	18:26	0.43	0.04	0.39	0.1521

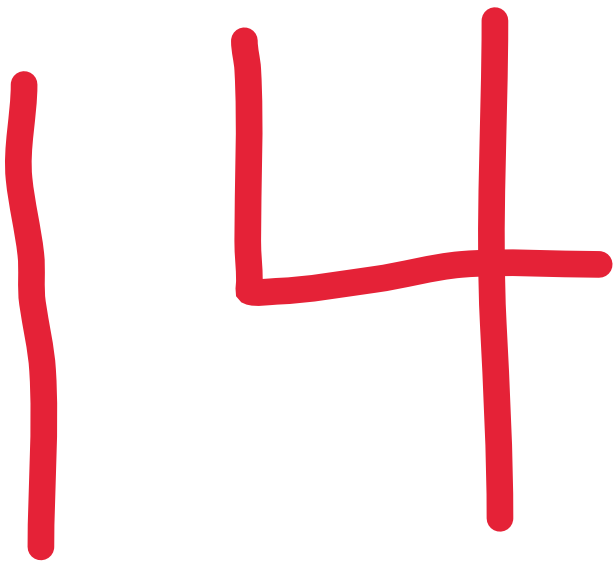
n	**9**	
t(0.025)	**2.306**	
Mean Reference Method Value	**0.478**	**RM avg**
Mean CMM Value	**0.401**	**CMM avg**
Sum of Differences	**0.690**	**di**
Mean Difference	**0.077**	**d**
Sum of Differences Squared	**0.056**	**di^2**
Standard Deviation	**0.019**	**sd**
Confidence Coefficient 2.5% Error (1-tail)	**0.014**	**cc**
Relative Accuracy	**19.06**	**RA**

3.7 Raw Mill RATA Tables

Client: Holcim (US) Inc.Lafarge Alpena **Location:** Raw Mill 14 Exhaust
Facility: Alpena Cement Plant **Date:** 8/24/22
Project #: M223406 **Test Method:** 25A, 320

THC ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM THC ppmvd	CEM THC ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/24/22	08:10	08:30	6.5	6.7	-0.2	0.04
1	2	08/24/22	08:31	08:51	6.0	6.0	0.0	0.00
1	3	08/24/22	08:52	09:12	5.3	5.5	-0.2	0.04
1	4	08/24/22	09:55	10:15	6.5	6.2	0.3	0.09
0	5	08/24/22	10:16	10:36	7.8	7.0	0.8	0.64
0	6	08/24/22	10:37	10:57	7.8	6.8	1.0	1.00
1	7	08/24/22	13:20	13:40	6.6	6.8	-0.2	0.04
1	8	08/24/22	13:41	14:01	6.0	6.2	-0.2	0.04
1	9	08/24/22	14:02	14:22	6.2	6.0	0.2	0.04
1	10	08/24/22	14:48	15:08	6.0	5.9	0.1	0.01
1	11	08/24/22	15:09	15:29	8.5	8.3	0.2	0.04
1	12	08/24/22	15:30	15:50	7.6	7.6	0.0	0.00
					10			
				t(0.975)	**2.262**			
				Mean Reference Method Value	**6.520**		**RM avg**	
				Mean CEM Value	**6.520**		**CEM avg**	
				Sum of Differences	**0.000**		**di**	
				Mean Difference	**0.000**		**d**	
				Sum of Differences Squared	**0.340**		**di^2**	
				Standard Deviation	**0.194**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.139**		**cc**	
				Relative Accuracy	**2.13**		**RA**	



Client: Holcim (US) Inc. Lafarge Alpena
Facility: Alpena Cement Plant
Project #: M223406

Location: Raw Mill 15 Exhaust
Date: 8/23/22
Test Method: 25A, 320

THC ppmvd RATA

1=accept 0=reject	Test Run	Test Date	Start Time	End Time	RM THC ppmvd	CEM THC ppmvd	(RM-CEM) Difference (di)	(RM-CEM) Difference^2 (di^2)
1	1	08/23/22	10:25	10:45	6.8	7.1	-0.3	0.09
1	2	08/23/22	10:46	11:06	7.0	6.7	0.3	0.09
1	3	08/23/22	11:07	11:27	7.1	6.8	0.3	0.09
0	4	08/23/22	11:56	12:16	7.0	6.6	0.4	0.16
1	5	08/23/22	12:17	12:37	6.6	6.7	-0.1	0.01
1	6	08/23/22	12:38	12:58	6.3	6.7	-0.4	0.16
1	7	08/23/22	13:34	13:54	6.2	6.4	-0.2	0.04
1	8	08/23/22	13:55	14:15	6.4	6.4	0.0	0.00
1	9	08/23/22	14:16	14:36	6.6	6.5	0.1	0.01
0	10	08/23/22	15:08	15:28	6.6	6.0	0.6	0.36
1	11	08/23/22	15:29	15:49	7.1	7.0	0.1	0.01
1	12	08/23/22	15:50	16:10	6.7	6.6	0.1	0.01
				n	**10**			
				t(0.975)	**2.262**			
				Mean Reference Method Value	**6.680**		**RM avg**	
				Mean CEM Value	**6.690**		**CEM avg**	
				Sum of Differences	**-0.100**		**di**	
				Mean Difference	**-0.010**		**d**	
				Sum of Differences Squared	**0.510**		**di^2**	
				Standard Deviation	**0.238**		**sd**	
				Confidence Coefficient 2.5% Error (1-tail)	**0.170**		**cc**	
				Relative Accuracy	**2.70**		**RA**	

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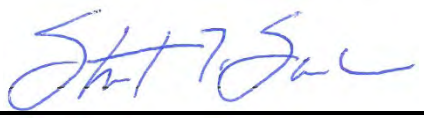
4.0 CERTIFICATION

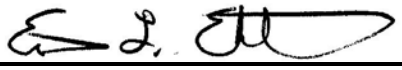
Mostardi Platt is pleased to have been of service to Holcim (US) Inc. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

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



Stuart T. Sands — Project Manager

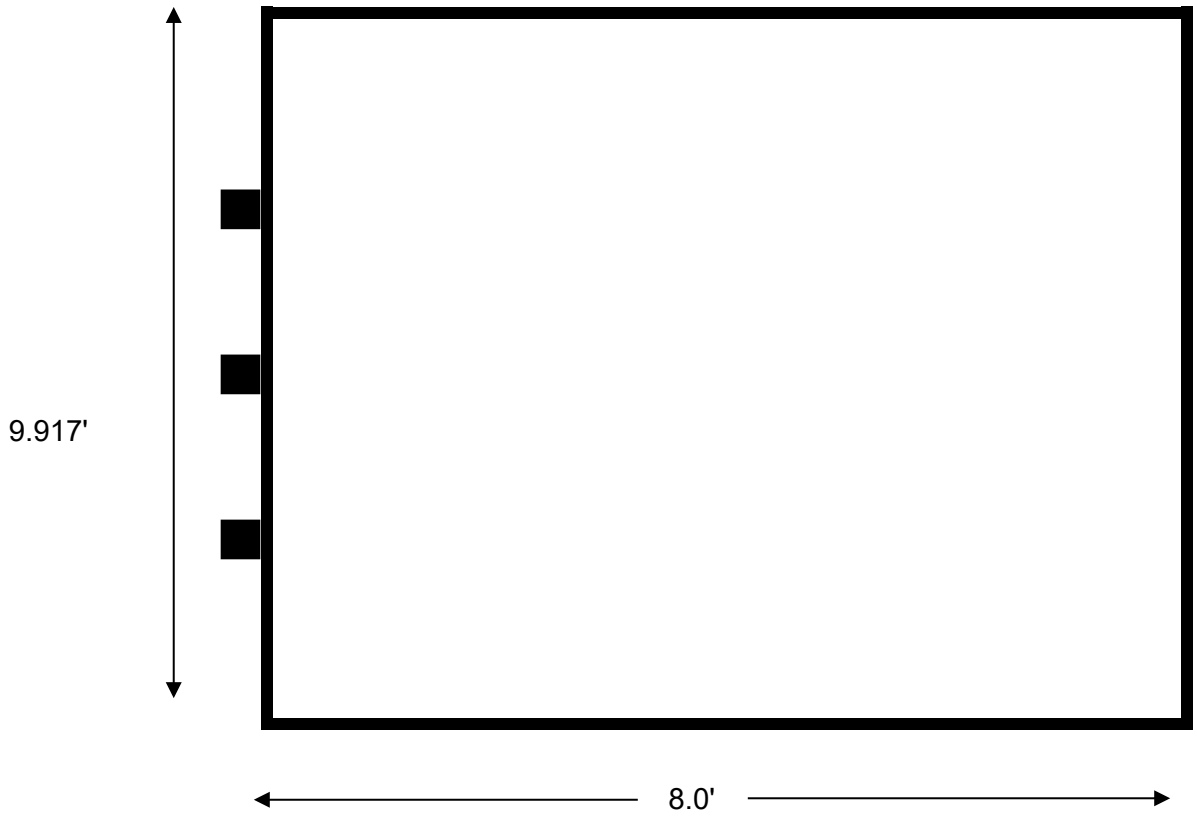


Eric Ehlers — Quality Assurance

APPENDICES

Appendix A - Test Section Diagrams

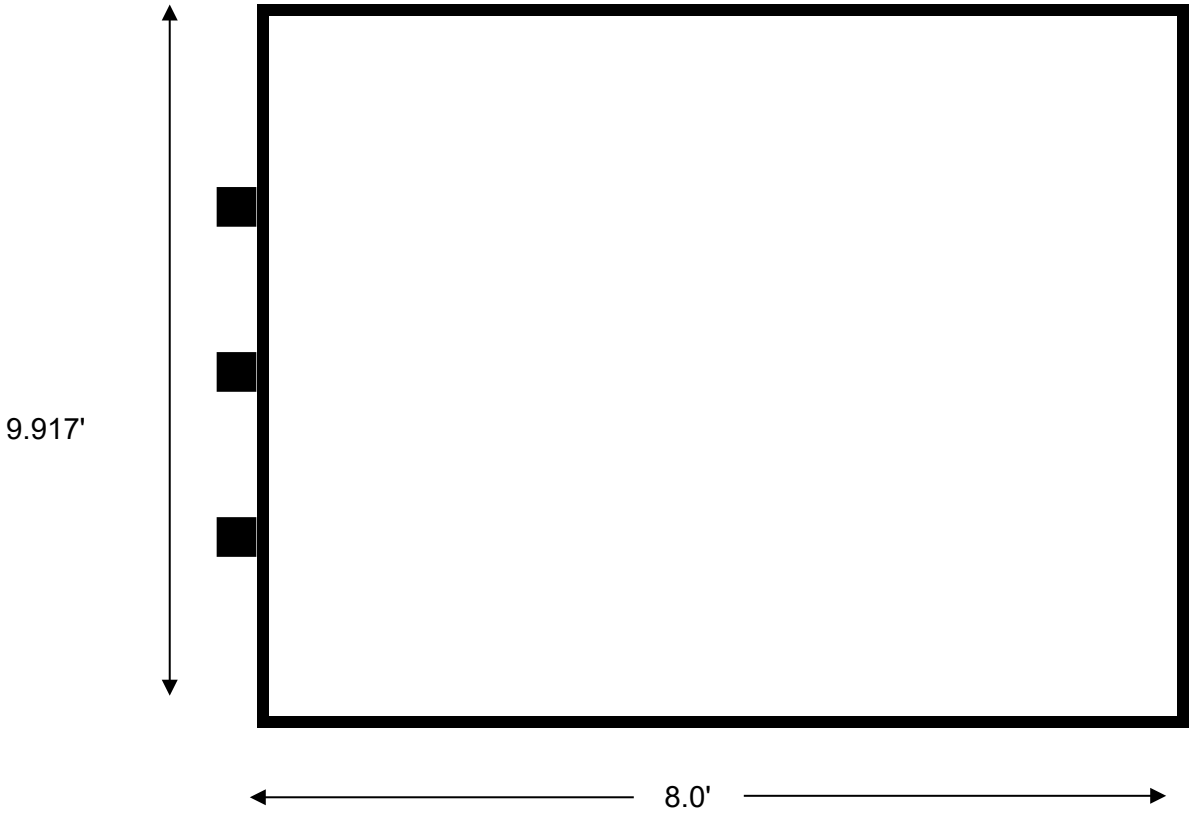
EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS
(Gaseous)



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

Test Date:	September 15, 2022	Area:	79.33 square feet
Test Location:	Kiln 19 Breaching Duct	No. Test Ports:	1
Length:	8.0 Feet	Test Points per Port:	3
Width:	9.917 Feet		
Upstream:	0.73 Diameters		
Downstream:	0.79 Diameters		
Equivalent Diameter:	8.856 Feet		
Port Length:	12.0 Inches		

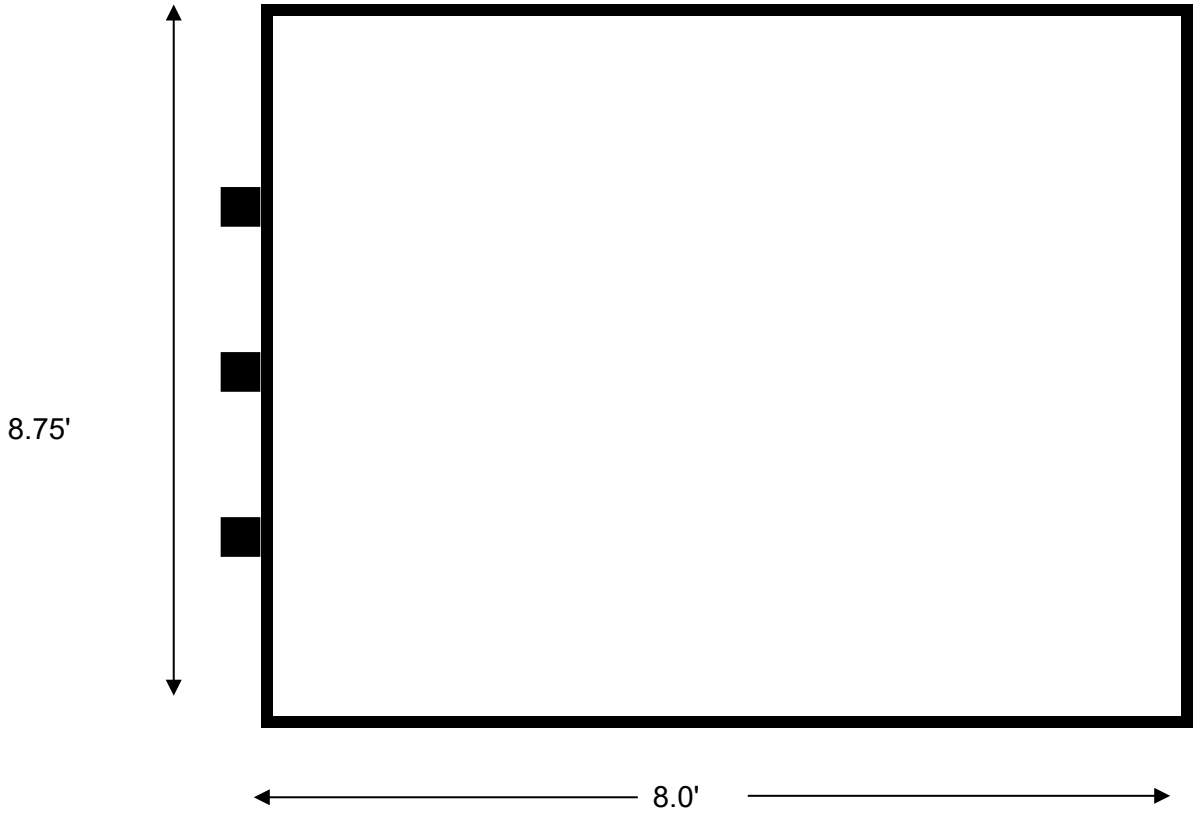
EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS
(Volumetric Flow Rate)



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

Test Dates:	September 15, 2022	Area:	79.33 square feet
Test Location:	Kiln 19 Breaching Duct	No. Test Ports:	3
Length:	8.0 Feet	Test Points per Port:	14
Width:	9.917 Feet		
Upstream:	0.730 Diameters		
Downstream:	0.790 Diameters		
Equivalent Diameter:	8.856 Feet		
Port Length:	3.25 Inches		

EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS
(Gaseous)



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

Test Dates: August 31, 2022

Test Location: Kiln 20 Breaching Duct

Length: 8.0 Feet

Width: 8.75 Feet

Upstream: 0.47 Diameters

Downstream: 1.11 Diameters

Equivalent Diameter: 8.358 Feet

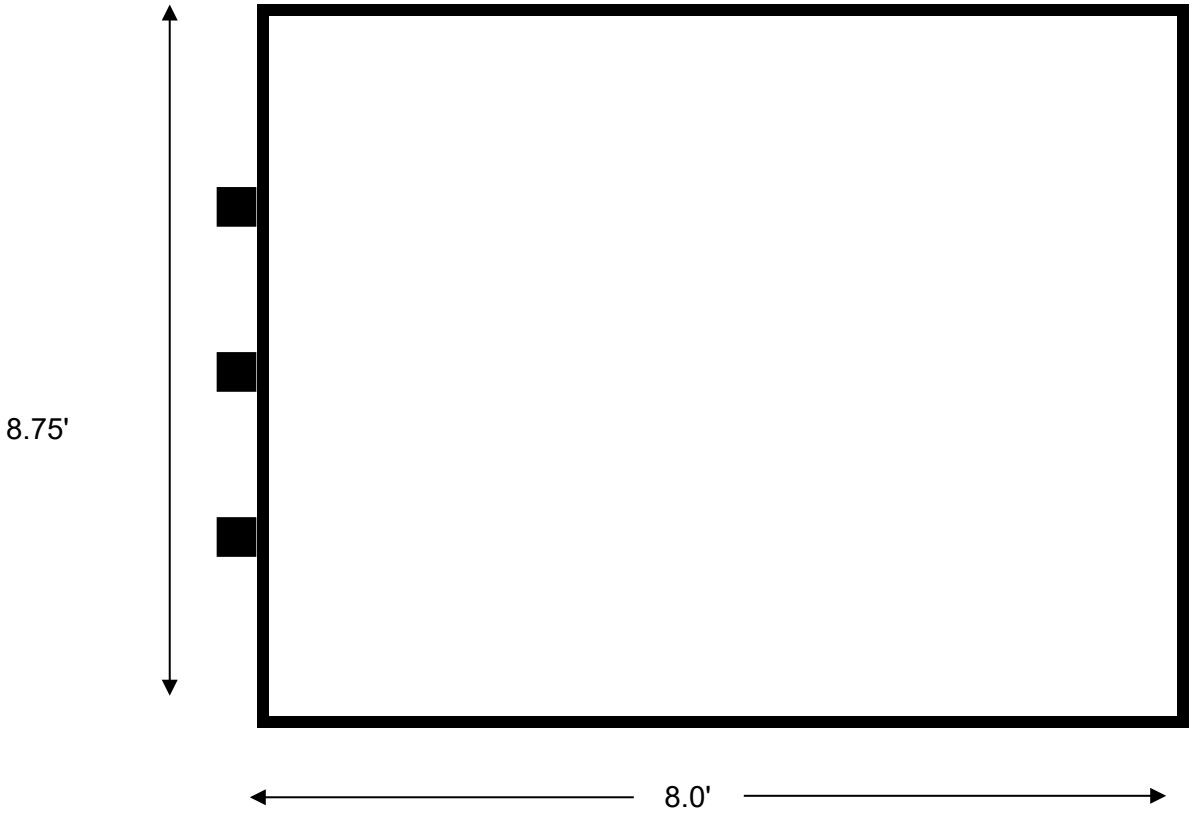
Port Length 3.25 Inches

Area: 70.00 square feet

No. Test Ports: 1

Test Points per Port: 3

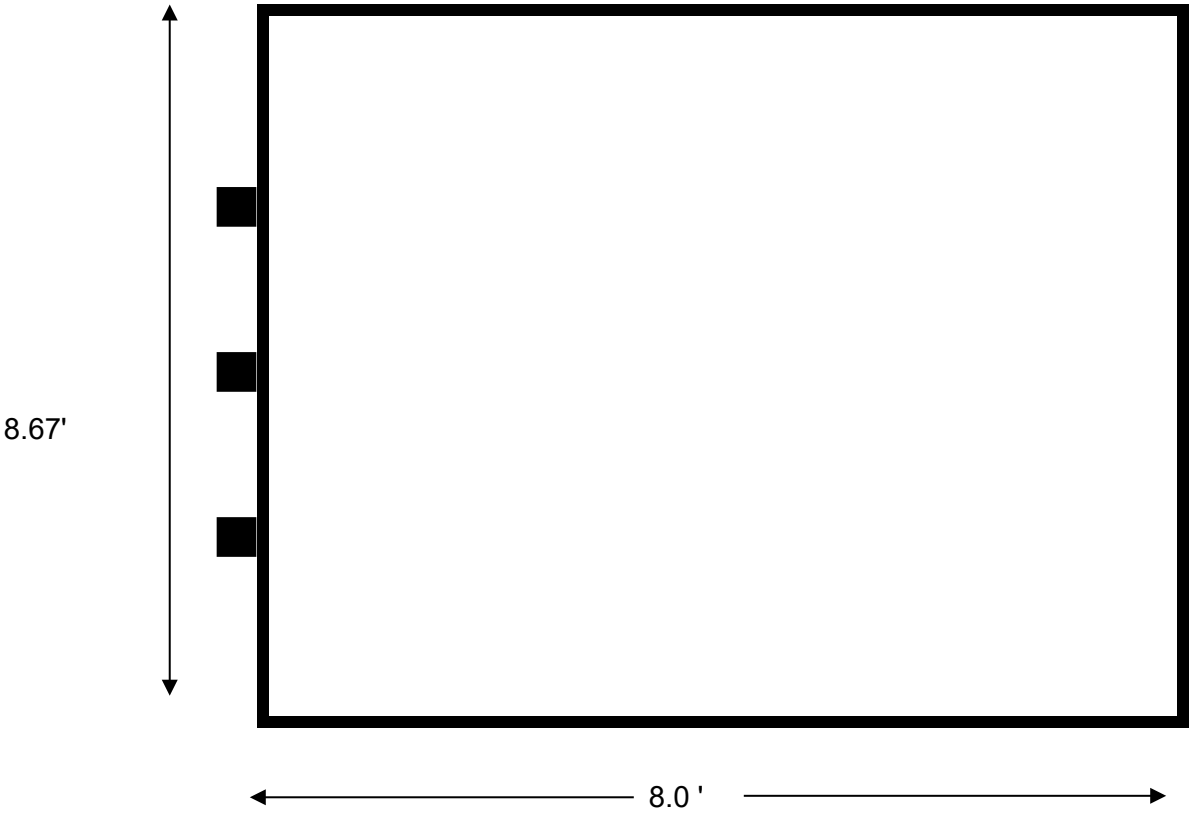
EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS
(Volumetric Flow Rate)



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

Test Dates:	August 31, 2022	Area:	70.00 square feet
Test Location:	Kiln 20 Breaching Duct	No. Test Ports:	3
Length:	8.0 Feet	Test Points per Port:	14
Width:	8.75 Feet		
Upstream:	0.47 Diameters		
Downstream:	1.11 Diameters		
Equivalent Diameter:	8.358 Feet		
Port Length:	3.25 Inches		

EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS
(Gaseous)



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

Test Dates: September 1, 2022

Test Location: Kiln 21 Breaching Ducts

Length: 8.0 Feet

Width: 8.67 Feet

Upstream: 0.470 Diameters

Downstream: 1.110 Diameters

Equivalent Diameter: 8.322 Feet

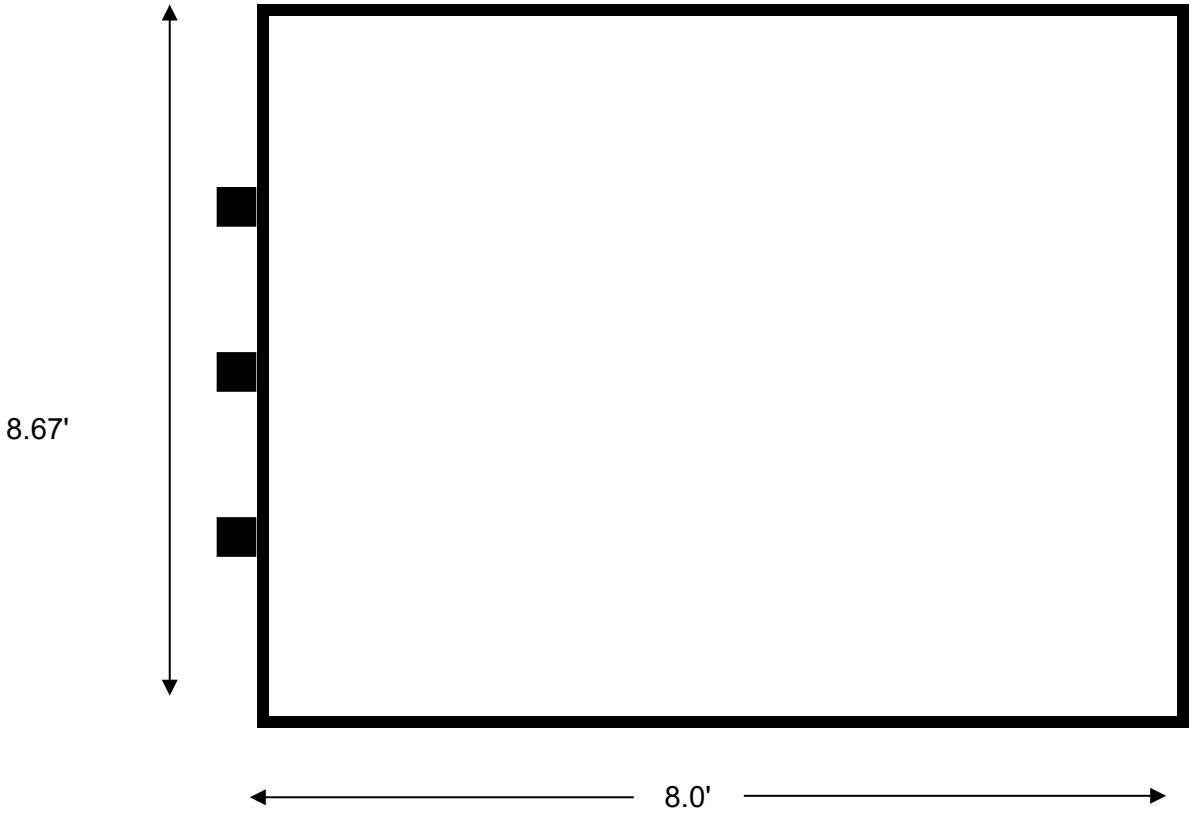
Port Length 9.0 Inches

Area: 69.36 square feet

No. Test Ports: 1

Test Points per Port: 3

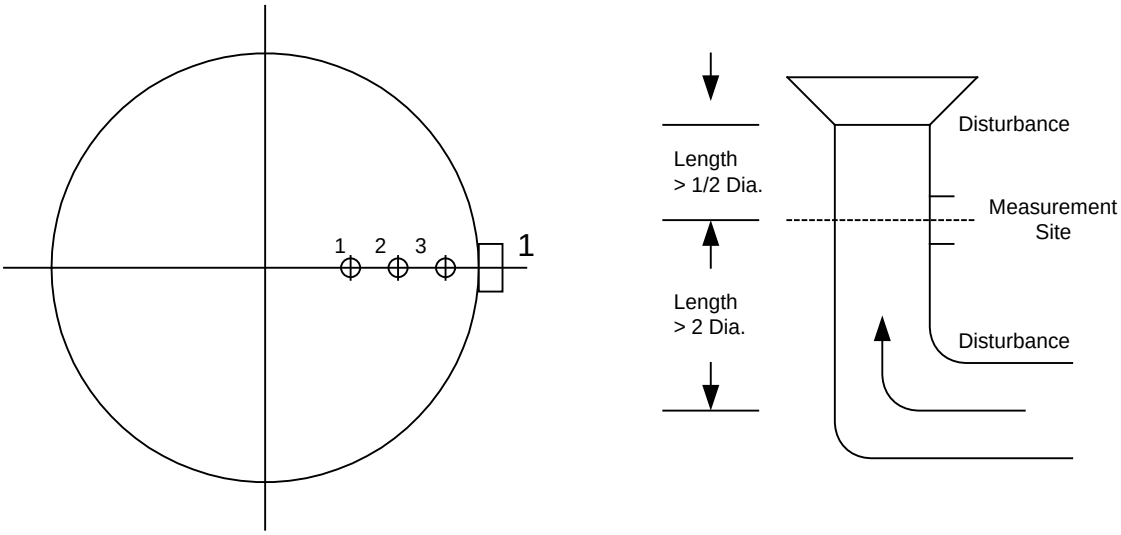
EQUAL AREA TRAVERSE
FOR RECTANGULAR DUCTS
(Volumetric Flow Rate)



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

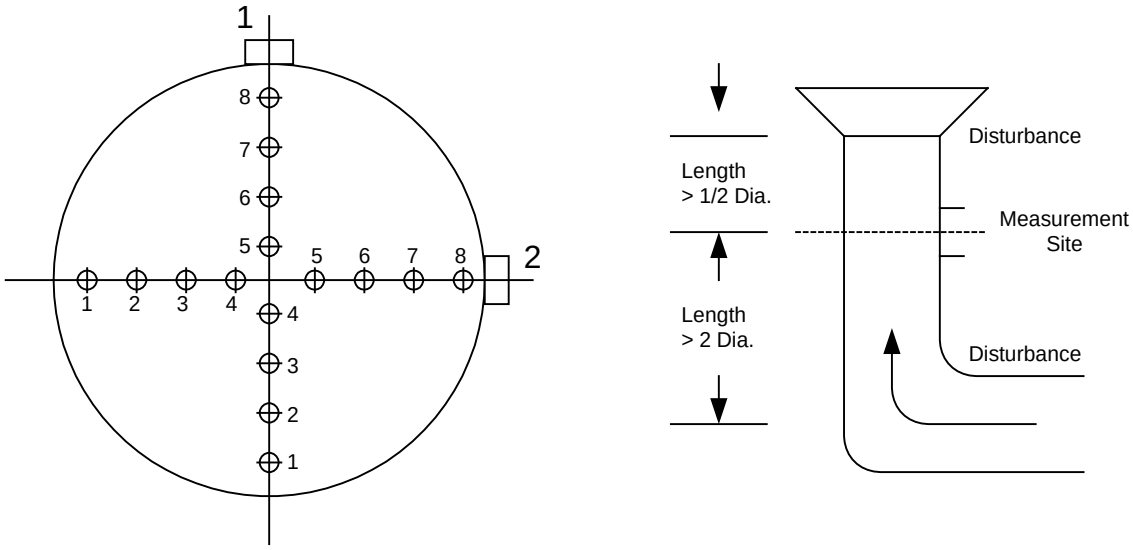
Test Dates:	September 1, 2022	Area:	69.36 square feet
Test Location:	Kiln 21 Breaching Ducts	No. Test Ports:	3
Length:	8 Feet	Test Points per Port:	14
Width:	8.67 Feet		
Upstream:	0.470 Diameters		
Downstream:	1.110 Diameters		
Equivalent Diameter:	8.322 Feet		
Port Length:	9.0 Inches		

GASEOUS TRAVERSE FOR ROUND DUCTS



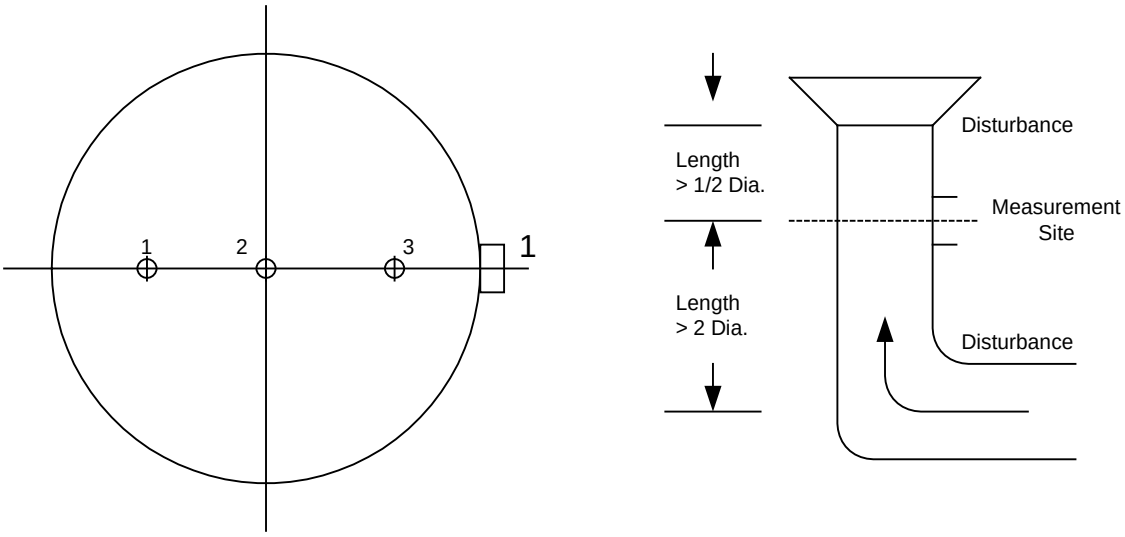
Job:	Holcim (US) Inc. Alpena Cement Plant Alpena, Michigan
Test Dates:	August 30 and September 13, 2022
Test Location:	Kiln 22 and 23 Baghouse Outlets
Duct Diameter:	10 Feet
Duct Area:	78.54 Square Feet
Upstream Disturbance:	0.19 diameters
Downstream Disturbance:	1.46 diameters
No. Sample Points:	3
Port Length:	8.0 Inches

VOLUMETRIC FLOW RATE TRAVERSE FOR ROUND DUCTS



Job:	Holcim (US) Inc. Alpena Cement Plant Alpena, Michigan
Test Date:	August 30 and September 13, 2022
Test Location:	Kiln 22 and 23 Baghouse Outlets
Duct Diameter:	10 Feet
Duct Area:	78.54 Square Feet
Upstream Disturbance:	0.19 diameters
Downstream Disturbance:	1.46 diameters
No. Sample Points:	16
Port Length:	8.0 Inches

GASEOUS TRAVERSE FOR ROUND DUCTS



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

Test Date: August 23 and 24, 2022

Test Location: Raw Mill 14 and 15 Stacks

Stack Diameter: 5.46 Feet

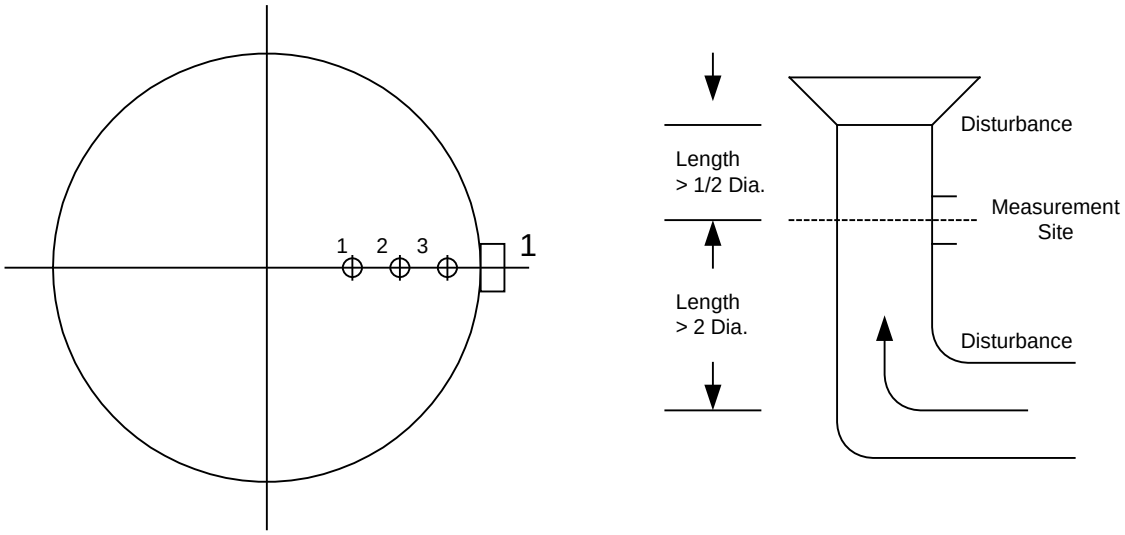
Stack Area: 23.40 Square Feet

Upstream Disturbance: >2.0 diameters

Downstream Disturbance: ~4.0 diameters

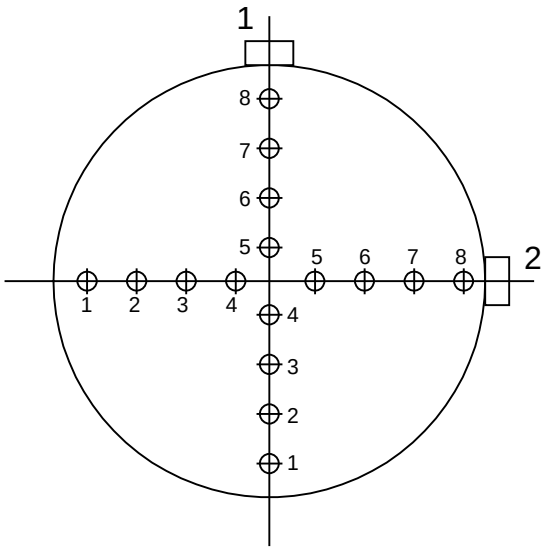
No. Sample Points: 3

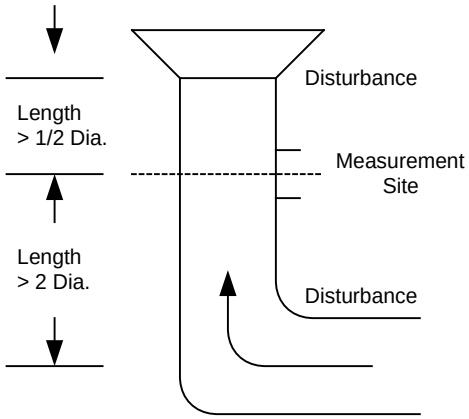
GASEOUS TRAVERSE FOR ROUND DUCTS



Job:	Holcim (US) Inc. Alpena Plant Alpena, Michigan
Date:	August 29, 2022
Test Location:	Wet Gas Scrubber Stack
Stack Diameter:	12 Feet
Stack Area:	113.097 Square Feet
Upstream Disturbance:	6.0 diameters
Downstream Disturbance:	4.5 diameters
No. Sample Points:	3

VOLUMETRIC FLOW RATE TRAVERSE FOR ROUND DUCTS

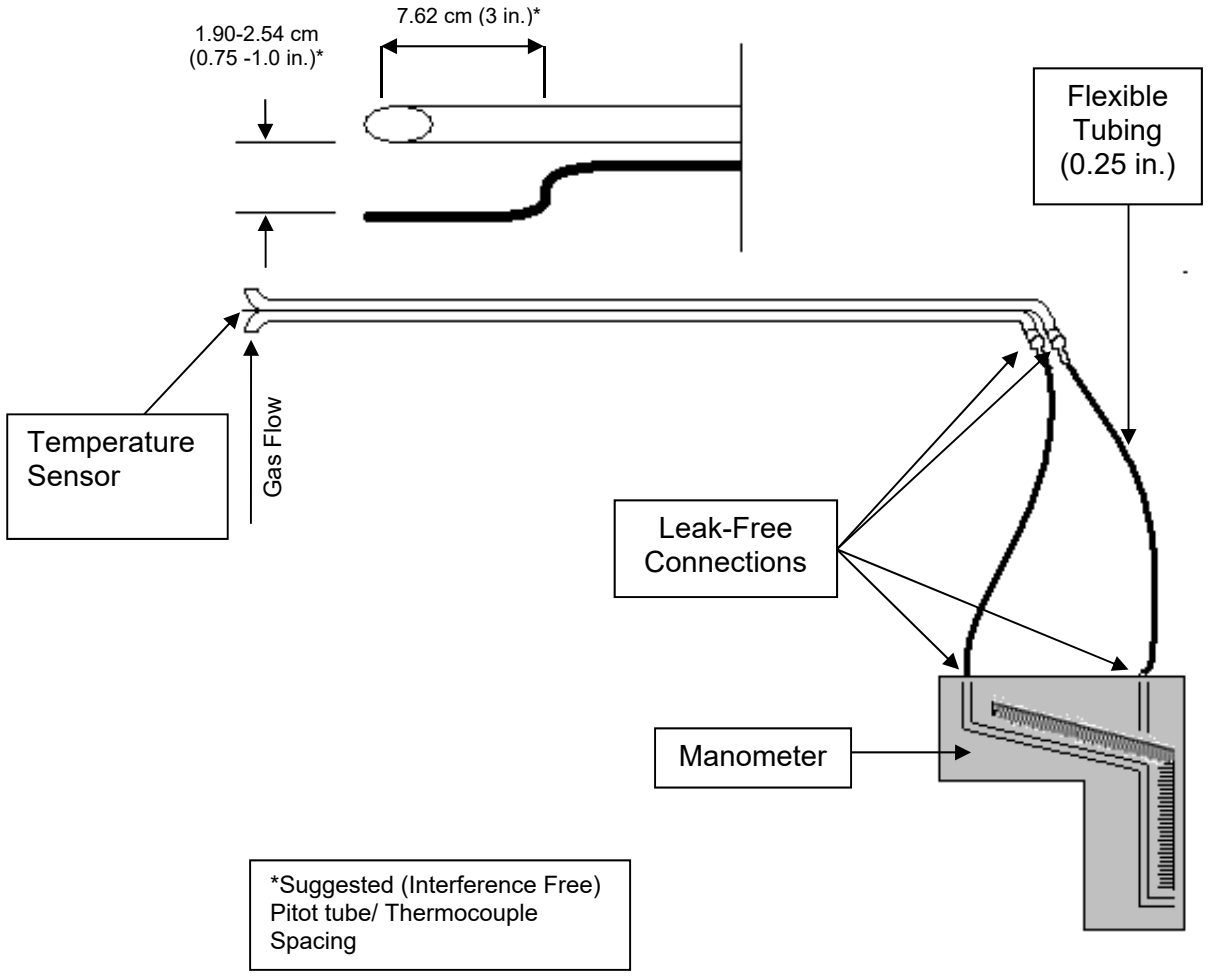




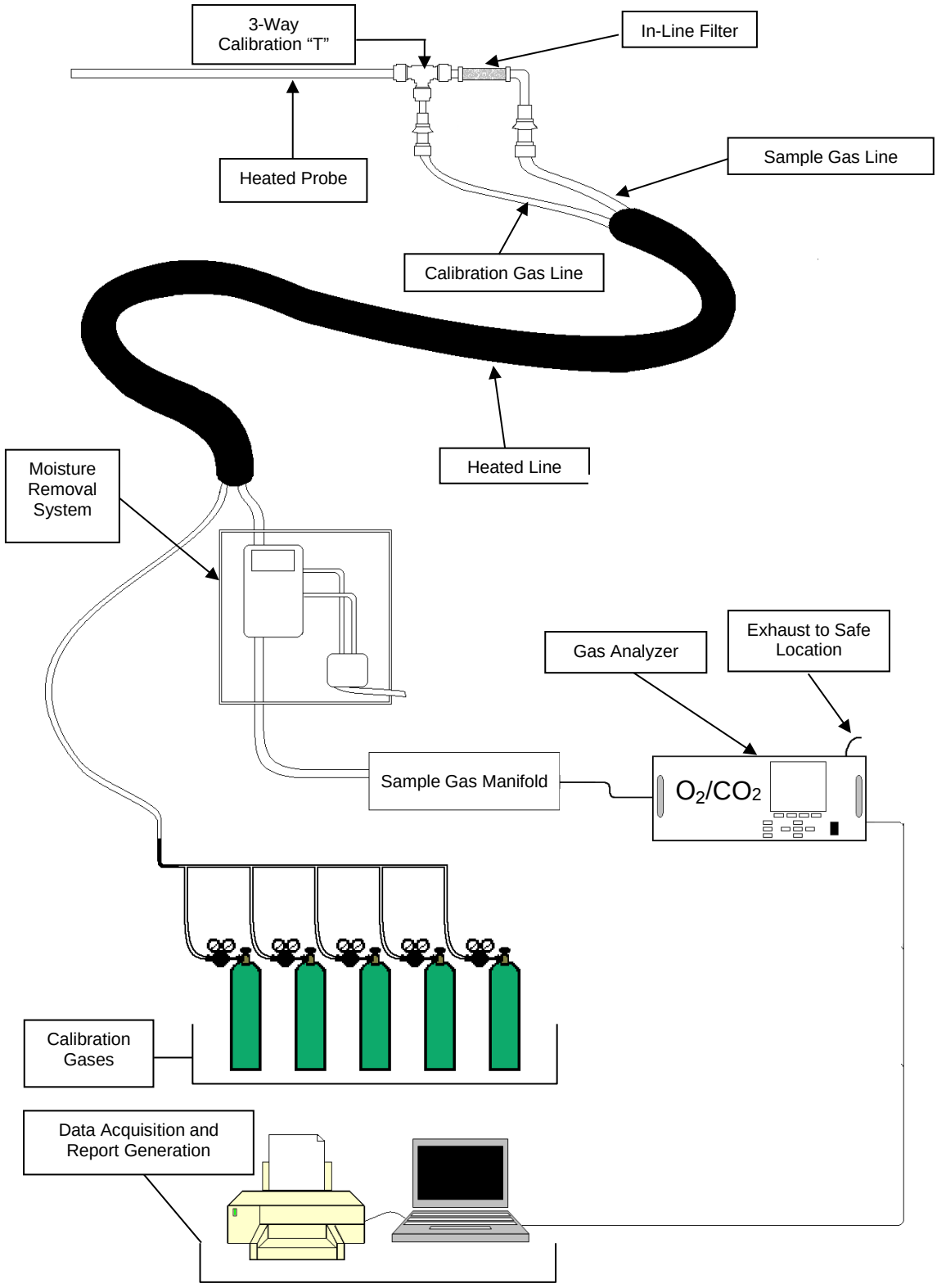
Job:	Holcim (US) Inc. Alpena Cement Plant Alpena, Michigan
Date:	August 29, 2022
Test Location:	West Gas Scrubber Stack
Stack Diameter (Feet):	12
Stack Area (Square Feet):	113.097
No. Sample Points Across Diameter:	8
No. of Ports:	2
Port Length (Inches):	5

Appendix B - Sample Train Diagrams

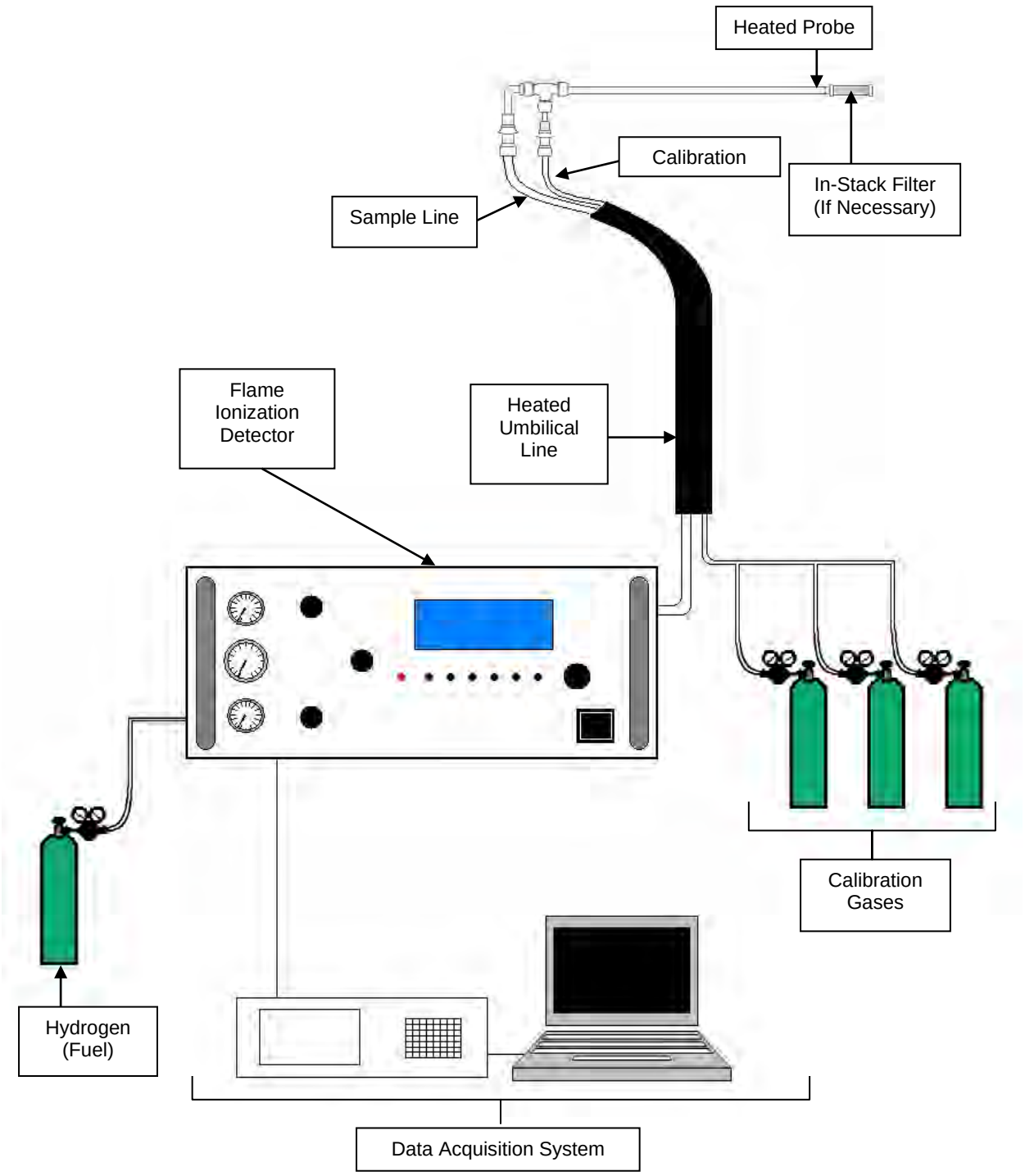
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



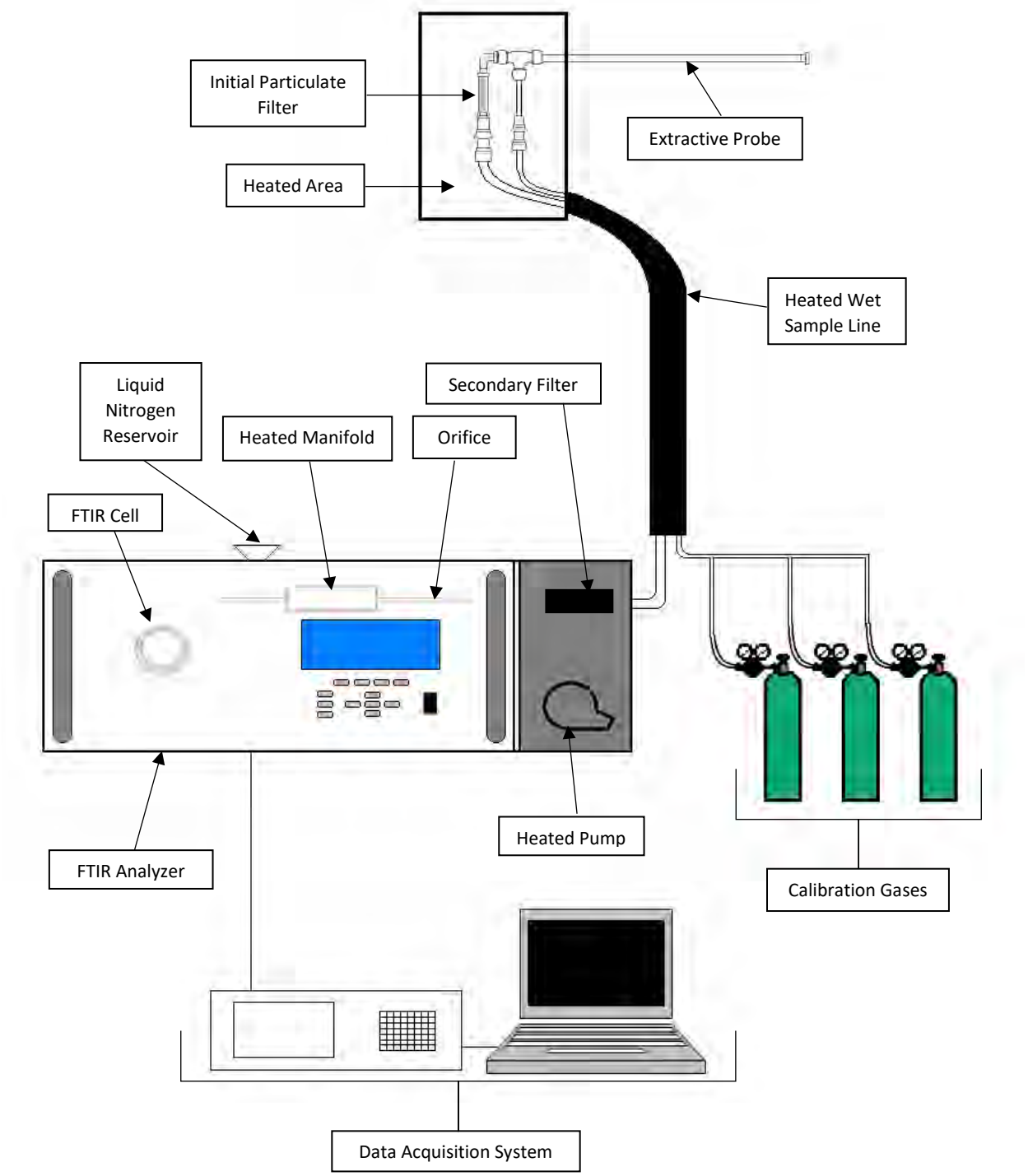
USEPA Method 3A Extractive Gaseous Sampling Diagram



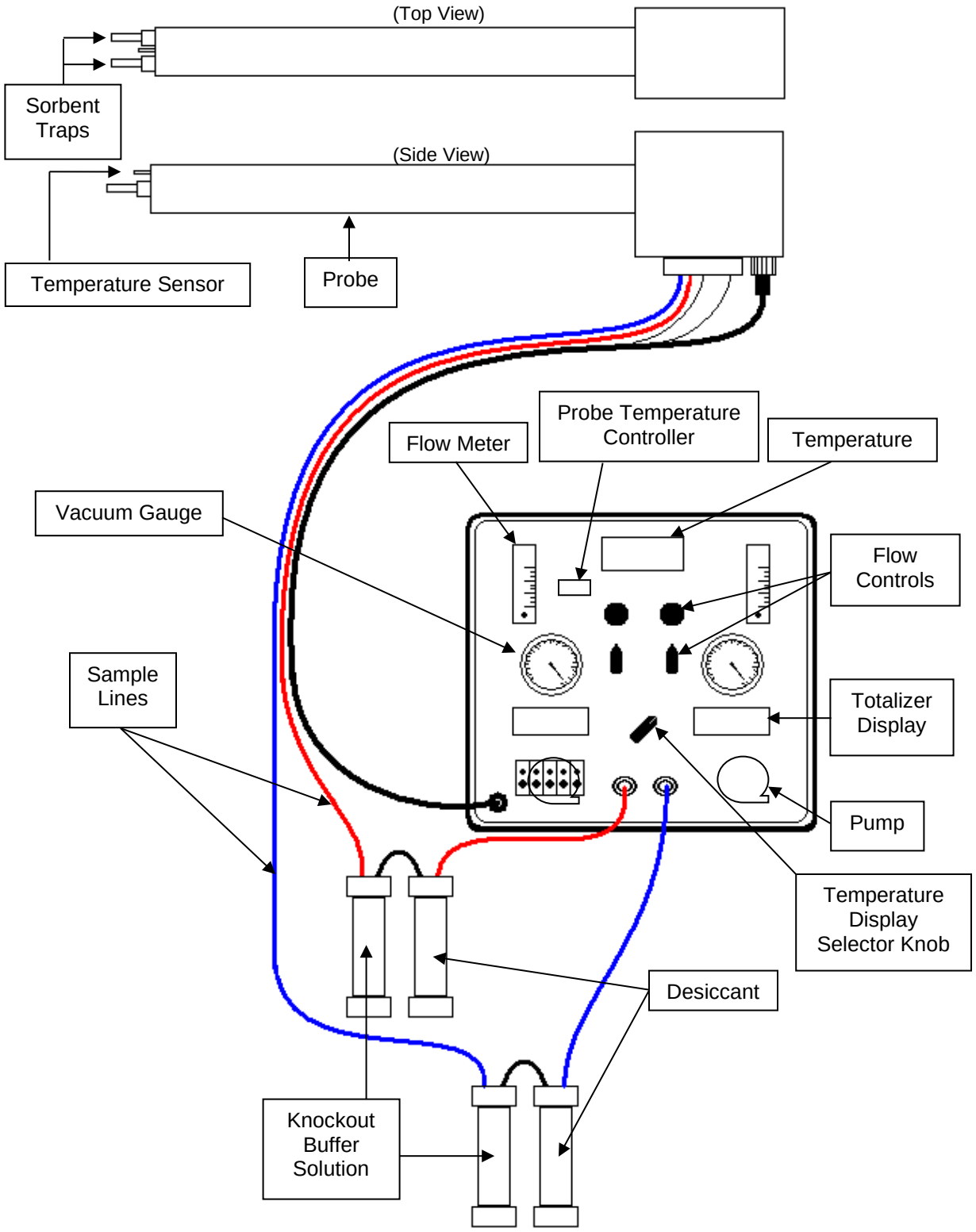
USEPA Method 25A – Total Gaseous Organic Compound Sample Train



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



USEPA Method 30B- Mercury Sorbent Trap Sampling Train



USEPA Method 4- Moisture Content Sample Train Diagram