Section 114 Information Collection Request Emissions Test Report

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CalPortland Company, Inc.
Redding Cement Plant
EPA Registry ID: 110070385909
15390 Wonderland Blvd.
Redding, CA 96003
Report No. M234605A

mostardi platt

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Emissions Test Report

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Report Submittal Date:
February 14, 2024

Report No. M234605A

Crown Point, IN | Mendota Heights, MN | Denver, CO | Henderson, NV

Corporate Headquarters
888 Industrial Drive
Elmhurst, Illinois 60126
630-993-2100

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1.0 INTRODUCTION

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

This test program was completed to satisfy the requirements of the United States Environmental Protection Agency (USEPA) Section 114 Information Collection Request for Portland Cement Manufacturing facilities.

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

Location	**Address**	**Contact**
Test Coordinator	CalPortland Company 15390 Wonderland Blvd. Redding, CA 96003	Meghan Way Environmental Manager (530) 806-1569 mway@calportland.com
Test Company Representative	Mostardi Platt 7715 Commercial Way, Suite 155 Henderson, NV 89011	Mr. Richard J. Sollars II Regional Manager (630) 993-2100 rsollars@mp-mail.com

2.0 TEST REQUIREMENTS

Testing was performed at the kiln stack. The following table presents a list of the parameters tested, the applicable methodologies utilized, and average test results:

Source	Parameter Tested	Test Results	Method/Regulation Citation
Kiln Stack Mill On	Hydrogen Fluoride (HF)	≤ 0.10 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.19 ppmvd @7% O_2	
		≤ 0.05 lb/hr	
		≤ 0.0006 lb/ton clinker	
	HF[1]	≤ 0.13 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.15 ppmvd @7% O_2	
		≤ 0.12 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Chlorine (Cl_2)[1]	≤ 0.04 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O_2	
		≤ 0.13 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Hydrogen Cyanide (HCN)	0.78 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		1.47 ppmvd @7% O_2	
		0.49 lb/hr	
		0.0064 lb/ton clinker	
	Oxygen (O_2)	12.5 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO_2)	13.7 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H_20)	11.6 %	USEPA Method 320, 40CFR63, Appendix A
	Cyclonic Flow Determination	PASS	USEPA Method 1, 40CFR60, Appendix A, Section 11.4
	Three-point O_2 Stratification Determination	< 5 %	USEPA Method 3A, 40CFR60, Appendix A and Method 7E, Section 8.1.2

[1] HF and Cl_2 Method 26A results are reported as the average from Train A and Train B.

Source	Parameter Tested	Test Results	Method/Regulation Citation
Kiln Stack Mill Off	Hydrogen Fluoride (HF)	≤ 0.10 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		≤ 0.16 ppmvd @7% O_2	
		≤ 0.04 lb/hr	
		≤ 0.0005 lb/ton clinker	
	HF[2]	≤ 0.10 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.14 ppmvd @7% O_2	
		≤ 0.04 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Chlorine (Cl_2)[1]	≤ 0.03 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.04 ppmvd @7% O_2	
		≤ 0.04 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Hydrogen Cyanide (HCN)	0.91 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		1.49 ppmvd @7% O_2	
		0.53 lb/hr	
		0.0067 lb/ton clinker	
	Oxygen (O_2)	11.2 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO_2)	16.2 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H_20)	12.2 %	USEPA Method 320, 40CFR63, Appendix A
	Cyclonic Flow Determination	PASS	USEPA Method 1, 40CFR60, Appendix A, Section 11.4
	Three-point O_2 Stratification Determination	< 5 %	USEPA Method 3A, 40CFR60, Appendix A and Method 7E, Section 8.1.2

[2] HF and Cl_2 Method 26A results are reported as the average from Train A and Train B.

3.0 QA SPECIFICATIONS AND PROCESS DIAGRAM

3-1 QA/QC Specifications

Parameter	Method	QA/QC Specification	Acceptance Criteria	Actual Result
HCN	320	Method Detection Limit	0.5 ppm	0.1 ppmvw
		SNR	>2500 at 64 scans	6951 (Run 1 Average)
		S Beam	>0.9	1.314 (Run 1 Average)
		Direct HCN Analysis	±5% of tag value	1.6%
		Dynamic Spike Analysis	≤10% of total sample volume	7.6%
			Spike gas ~twice native concentration or 3-4 ppm addition to native concentration	+3.5 ppm
			≤±20% of expected value or ≤±0.5 ppm, whichever is less restrictive	<20%
		Residuals	≤±0.3 ppm, or ≤±5% of measured value, whichever is less restrictive	0.2 ppmvw
Cl_2	26A	Detection Limit	300 µg	150 µg
		Paired Train Agreement	≤10% Relative Deviation or ≤0.2 ppm, whichever is less restrictive.	≤10% Relative Deviation

3-2 Process Description and Process Flow Diagram

The facility is located at 15390 Wonderland Blvd. in Redding, California. Limestone, shale, and other rawmaterials are sent from the quarry to be crushed into smaller pieces for processing. The raw material is milled then sent through the preheater tower in preparation of the rotary kiln. In the kiln, coal, coke, and other fuels are added for combustion; natural gas is used for startup heat. The milled blend is exposed to extreme temperatures in the kiln, transforming into a mineral compound called clinker. Clinker is sent to the contiguous satellite cooler tubes to quench before finish milling. With the addition of gypsum, finish mills grind clinker into Portland cement. Product is stored and then shipped from the facility.

PRIMARY CRUSHING

QUARRY

SECONDARY CRUSHING

RAW MATERIAL HANDLING

PREBLENDING AND STORAGE HALL

RAW MATERIAL BINS

RAW MILLING

BLENDING

STORAGE

RAW MEAL BLENDING

KILN

WHOLE TIRE FEED

COAL GRINDING

KILN

SAWDUST FEED

CLINKER HANDLING

FINISH GRINDING

A&B MILLS IN PARALLEL

FINISH MILL C

GRINDING AID SYSTEM

CKD SYSTEM

SHIPPING

PACKHOUSE

						DATE
					DRAWN,	K SMITH
3	.	. . .	. . .		CHK.	
2	..	..			APPVD.	
NO.	REVISION	DATE	BY		SCALE NONE	

CALPORTLAND
15390 WONDERLAND BLVD
REDDING CA 96001

REDDING
PLANT FLOW DIAGRAM
SHEET 1 OF 1

DWG NO. 100-F-101 R1

REV. 1

PLOT DATE 7-26-22

Project No. M234605A
Main Kiln Stack

4.0 TEST PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed as described in the Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40CFR60), Methods 1, 2, 3A, 4, 26A, and 40CFR63, Appendix A, Method 320; and the latest revisions thereof. Where applicable, the *Quality Assurance Handbook for Air Pollution Measurement Systems*, Volume III, Stationary Source Specific Methods, United States Environmental Protection Agency (USEPA) 600/R-94/038c, September 1994 was used to supplement procedures in addition to the appended "Draft General Test Plan".

4.1 Method 1 Sample and Velocity Traverse Determination

Sample points for testing are determined using USEPA Test Method 1, 40CFR60, Appendix A. The characteristics of the measurement location is summarized below.

Sample Point Selection

Test Location	Stack Diameter	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Main Kiln	7.0 Feet	16.0	11.0	HF/Cl_2 (26A)	12
				O_2 (3A)	3 (stratification)
				$HCN/HF/CO_2$ (320/3A)	1

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

4.2 Method 2 Volumetric Flow Rate Determination

The gas velocity and volumetric flowrate were determined using Method 2, 40CFR60, Appendix A, as an integrated part of the HF/Cl_2 sampling system.

Velocity pressures were determined by traversing the duct with wind tunnel calibrated S-type pitot tube. Temperatures were measured using K-type thermocouples with calibrated digital temperature indicators. The molecular weight and moisture content of the gases were also determined to permit the calculation of the volumetric flowrate.

4.3 Method 3A Oxygen (O_2) and Carbon Dioxide (CO_2) Determination

O_2 and CO_2 concentrations were determined in accordance with Method 3A, 40CFR60, Appendix A and Method 320, 40CRR63, Appendix A, respectively. A Servomex analyzer was used to determine O_2 concentrations while the MKS 2030 analyzer was used to determine CO_2 concentrations. The O_2 instrument has a paramagnetic detector and operates in a nominal range of 0-25%.

A list of calibration gases used and the results of all calibration and other required quality assurance checks are found in the appendix of this report. Copies of calibration gas certifications are also appended.

4.4 Method 26A Hydrogen Fluoride (HF) and Chlorine (Cl_2) Determination

HF and Cl_2 concentrations and emission rates were determined in accordance with Method 26A, 40CFR60, Appendix A. Paired sampling trains were used to collect the samples. A total of twelve (12) test points were sampled per run on the kiln stack. The sample was extracted isokinetically from the gas stream and passed through dilute sulfuric acid (0.1N H_2SO_4). HF was collected in the dilute acid. Cl_2 was collected in the dilute sodium hydroxide (0.1N NaOH) solution. The sample train consisted of a Teflon coated nozzle, a heated borosilicate glass probe liner, a Teflon® filter placed on the outlet of the glass probe liner, and six impingers. The first two impingers contained the 0.1N H_2SO_4, the third remained empty (and was recovered with the first two impingers), the fourth and fifth impingers contained the 0.1N NaOH, while the sixth impinger contained silica gel to absorb any remaining moisture. A de-ionized water rinse was performed on each set of impingers, and samples were stored in Nalgene sample containers for transport. The 0.1N H_2SO_4 impinger catch samples were analyzed for HF while the 0.1N NaOH impinger catch samples were analyzed for Cl_2. A method detection limit (MDL) of 150 µg was determined for both HF and Cl_2 using the “Definition and Procedure for the Determination of the Method Detection Limit, Revision 2”. All equipment used was calibrated in accordance with the specifications of the method. Calibration data is appended.

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

4.5 Method 320 Speciated Flue Gas Concentration Determinations

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

The average gas effluent concentrations were determined from the average gas concentration displayed by the MKS 2030 analyzer. The Method 320 sampling system vaporizes water droplets similar to Method 26A. The difference is that Method 320 is an extractive method that calculates concentration based on compounds continuously flowing through the FTIR gas cell where the Method 26A captures water vapor in an impinger train. Calculating Method 320 concentrations on a dry basis uses the water vapor contained in the FTIR gas cell. In order to calculate lb/hr, the dry FTIR concentration is used in combination with the dry stack gas volumetric flow rate.

All sampling system components were heated to 375^{o}F +/- 25^{o}F, including: stainless steel sample probe, stainless steel calibration tee, in line glass fiber particulate filter, Teflon® sample line, heated head sample pump, and FTIR detector cell. The sample pump distributes the gas sample to the instrument at a steady sample flow rate (+/- 10%). All components of the sampling system are constructed of stainless steel, glass, or Teflon®.

FTIR technology works on the principle that most gases absorb infrared light. This is true for all compounds except for homonuclear diatomic molecules and noble gases such as: 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 for each given compound. The quantity of infrared light absorbed is proportional to the gas concentration. Most compounds have absorbencies at different infrared frequencies, thus allowing the simultaneous analysis of multiple compounds at one time. The FTIR software compares each sample spectrum to a user-selected list of calibration references and concentration data is generated.

FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer. Data was generated at 0.5 cm^{-1}. Each Spectra was derived from the coaddition of 62-64 scans with a new data point generated approximately every minute. HCN analyte spiking assured the ability of the FTIR to quantify HCN in the presence of effluent gas. All analyte spikes were introduced using an instrument grade stainless steel rotameter. All QA/QC procedures were within the acceptance criteria allowance of the applicable methodology and the “General Test Plan.”

5.0 TEST RESULTS SUMMARIES

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Test Method:	**26A Combined**

Source Condition		**Mill On**		**Mill On**		**Mill On**		
Date		**11/14/23**		**11/14/23**		**11/14/23**		
Start Time		**8:00**		**9:25**		**10:50**		
End Time		**9:05**		**10:29**		**11:55**		
		Run 1		**Run 2**		**Run 3**		**Average**
Stack Conditions								
Average Gas Velocity, ft/sec		87.514		87.232		86.414		87.053
Gas Volumetric Flow Rate, acfm		202,076		201,424		199,535		201,011
Gas Volumetric Flow Rate, dscfm		133,876		133,465		132,493		133,278
Gas Volumetric Flow Rate, scfm		150,470		150,211		148,848		149,843
Average %CO_2 by volume, dry basis		13.4		13.7		13.8		13.6
Average %O_2 by volume, dry basis		12.7		12.5		12.5		12.6
Clinker production, ton/hr		77.2		77.2		78.3		77.6
Chloride (Cl2) Emissions								
ppm	≤	0.03	≤	0.03	≤	0.03	≤	0.03
ppm@7%O2	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/hr	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/ton of clinker	≤	0.0005	≤	0.0005	≤	0.0005	≤	0.0005
Hydrogen Fluoride (HF) Emissions								
ppm	≤	0.09	≤	0.09	≤	0.09	≤	0.09
ppm@7%O2	≤	0.15	≤	0.15	≤	0.15	≤	0.15
lb/hr	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/ton of clinker	≤	0.0005	≤	0.0005	≤	0.0005	≤	0.0005

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Kiln Stack
Test Method: 26A

Source Condition	Mill On	Mill On	Mill On	
Date	11/14/23	11/14/23	11/14/23	
Start Time	8:00	9:25	10:50	
End Time	9:05	10:29	11:55	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	231.4	230.2	229.7	230.4
Flue Gas Moisture, percent by volume	11.0%	11.4%	11.1%	11.2%
Average Flue Pressure, in. Hg	29.17	29.17	29.17	29.17
Gas Sample Volume, dscf	71.022	70.778	70.239	70.680
Average Gas Velocity, ft/sec	87.486	87.073	86.208	86.922
Gas Volumetric Flow Rate, acfm	202,011	201,058	199,061	200,710
Gas Volumetric Flow Rate, dscfm	133,928	132,811	132,060	132,933
Gas Volumetric Flow Rate, scfm	150,404	149,966	148,584	149,651
Average %CO_2 by volume, dry basis	13.4	13.7	13.8	13.6
Average %O_2 by volume, dry basis	12.7	12.5	12.5	12.6
Isokinetic Variance	102.3	102.8	102.6	102.6
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.09	≤ 0.09	≤ 0.09	≤ 0.09

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Kiln Stack
Test Method: 26A

Source Condition	Mill On	Mill On	Mill On	
Date	11/14/23	11/14/23	11/14/23	
Start Time	8:00	9:25	10:50	
End Time	9:05	10:29	11:55	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	231.3	230.4	230.5	230.7
Flue Gas Moisture, percent by volume	11.1%	10.9%	10.9%	11.0%
Average Flue Pressure, in. Hg	29.17	29.17	29.17	29.17
Gas Sample Volume, dscf	73.356	73.501	72.840	73.232
Average Gas Velocity, ft/sec	87.542	87.390	86.619	87.184
Gas Volumetric Flow Rate, acfm	202,140	201,789	200,009	201,313
Gas Volumetric Flow Rate, dscfm	133,824	134,118	132,926	133,623
Gas Volumetric Flow Rate, scfm	150,536	150,456	149,111	150,034
Average %CO_2 by volume, dry basis	13.4	13.7	13.8	13.6
Average %O_2 by volume, dry basis	12.7	12.5	12.5	12.6
Isokinetic Variance	102.4	102.4	102.3	102.4
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.02	≤ 0.02	≤ 0.03	≤ 0.02
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.09	≤ 0.09	≤ 0.09	≤ 0.09

CalPortland Company, Inc.
Redding Cement Plant
Main Kiln Stack
Reference Method Test Data
Mill On

Test No.	Date	Start Time	End Time	O2 % (dry)	Moisture %	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	11/14/2023	8:00	8:59	12.7	11.7%	0.76	1.45	≤ 0.10	≤ 0.19
2	11/14/2023	9:25	10:24	12.5	11.5%	0.78	1.46	≤ 0.10	≤ 0.19
3	11/14/2023	10:50	11:49	12.5	11.5%	0.80	1.49	≤ 0.10	≤ 0.19
Average				**12.5**	**11.6%**	**0.78**	**1.47**	**≤ 0.10**	**≤ 0.19**

Test No.	Date	Start Time	End Time	Volumetric Flow, DSCFM	Clinker Production, ton/hr	HCN lb/hr	HCN lb/ton	HF lb/hr	HF lb/ton
1	11/14/2023	8:00	8:59	133,876	77.2	0.49	0.0063	≤ 0.05	≤ 0.0006
2	11/14/2023	9:25	10:24	133,465	77.2	0.50	0.0064	≤ 0.05	≤ 0.0006
3	11/14/2023	10:50	11:49	132,493	78.3	0.50	0.0064	≤ 0.05	≤ 0.0006
Average				**133,278**	**77.6**	**0.49**	**0.0064**	**≤ 0.05**	**≤ 0.0006**

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Test Method:	**26A Combined**

Source Condition		**Mill Off**		**Mill Off**		**Mill Off**		
Date		**11/14/23**		**11/14/23**		**11/14/23**		
Start Time		**12:50**		**14:15**		**15:40**		
End Time		**13:55**		**15:19**		**16:44**		
		Run 1		**Run 2**		**Run 3**		**Average**
Stack Conditions								
Average Gas Velocity, ft/sec		85.762		86.028		84.657		85.482
Gas Volumetric Flow Rate, acfm		198,029		198,644		195,479		197,384
Gas Volumetric Flow Rate, dscfm		122,230		121,094		119,754		121,026
Gas Volumetric Flow Rate, scfm		137,807		136,316		134,967		136,363
Average %CO_2 by volume, dry basis		16.2		16.2		16.1		16.2
Average %O_2 by volume, dry basis		11.2		11.2		11.3		11.2
Clinker production, ton/hr		78.3		78.3		78.3		78.3
Chloride (Cl2) Emissions								
ppm	≤	0.03	≤	0.03	≤	0.03	≤	0.03
ppm@7%O2	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/hr	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/ton of clinker	≤	0.0005	≤	0.0005	≤	0.0005	≤	0.0005
Hydrogen Fluoride (HF) Emissions								
ppm	≤	0.10	≤	0.10	≤	0.10	≤	0.10
ppm@7%O2	≤	0.14	≤	0.14	≤	0.14	≤	0.14
lb/hr	≤	0.04	≤	0.04	≤	0.04	≤	0.04
lb/ton of clinker	≤	0.0005	≤	0.0005	≤	0.0005	≤	0.0005

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Kiln Stack
Test Method: 26A

Source Condition	Mill Off	Mill Off	Mill Off	
Date	11/14/23	11/14/23	11/14/23	
Start Time	12:50	14:15	15:40	
End Time	13:55	15:19	16:44	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	279.5	291.3	285.4	285.4
Flue Gas Moisture, percent by volume	11.4%	10.9%	11.0%	11.1%
Average Flue Pressure, in. Hg	29.17	29.17	29.17	29.17
Gas Sample Volume, dscf	65.240	64.262	63.758	64.420
Average Gas Velocity, ft/sec	85.662	85.633	84.289	85.195
Gas Volumetric Flow Rate, acfm	197,799	197,734	194,630	196,721
Gas Volumetric Flow Rate, dscfm	121,966	120,665	119,595	120,742
Gas Volumetric Flow Rate, scfm	137,693	135,479	134,411	135,861
Average %CO_2 by volume, dry basis	16.2	16.2	16.1	16.2
Average %O_2 by volume, dry basis	11.2	11.2	11.3	11.2
Isokinetic Variance	103.2	102.7	102.8	102.9
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.10	≤ 0.10	≤ 0.10	≤ 0.10

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Kiln Stack
Test Method: 26A

Source Condition	Mill Off	Mill Off	Mill Off	
Date	11/14/23	11/14/23	11/14/23	
Start Time	12:50	14:15	15:40	
End Time	13:55	15:19	16:44	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	280.0	289.0	285.8	284.9
Flue Gas Moisture, percent by volume	11.2%	11.4%	11.5%	11.4%
Average Flue Pressure, in. Hg	29.17	29.17	29.17	29.17
Gas Sample Volume, dscf	67.577	67.305	66.317	67.066
Average Gas Velocity, ft/sec	85.861	86.422	85.024	85.769
Gas Volumetric Flow Rate, acfm	198,259	199,554	196,327	198,047
Gas Volumetric Flow Rate, dscfm	122,493	121,522	119,912	121,309
Gas Volumetric Flow Rate, scfm	137,920	137,152	135,523	136,865
Average %CO_2 by volume, dry basis	16.2	16.2	16.1	16.2
Average %O_2 by volume, dry basis	11.2	11.2	11.3	11.2
Isokinetic Variance	103.0	103.4	103.3	103.2
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.03	≤ 0.03	≤ 0.03	≤ 0.03
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.09	≤ 0.10	≤ 0.10	≤ 0.10

CalPortland Company, Inc.
Redding Cement Plant
Main Kiln Stack
Reference Method Test Data
Mill Off

Test No.	Date	Start Time	End Time	O2 % (dry)	Moisture %	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	11/14/2023	12:50	13:49	11.2	12.2%	0.83	1.34	≤ 0.10	≤ 0.16
2	11/14/2023	14:15	15:14	11.2	12.4%	0.89	1.45	≤ 0.10	≤ 0.16
3	11/14/2023	15:40	16:39	11.3	12.0%	1.01	1.67	≤ 0.10	≤ 0.17
Average				**11.2**	**12.2%**	**0.91**	**1.49**	**≤ 0.10**	**≤ 0.16**

Test No.	Date	Start Time	End Time	Volumetric Flow, DSCFM	Clinker Production, ton/hr	HCN lb/hr	HCN lb/ton	HF lb/hr	HF lb/ton
1	11/14/2023	12:50	13:49	122,230	78.3	0.48	0.0062	≤ 0.04	≤ 0.0006
2	11/14/2023	14:15	15:14	121,094	78.3	0.52	0.0066	≤ 0.04	≤ 0.0006
3	11/14/2023	15:40	16:39	119,754	78.3	0.58	0.0074	≤ 0.04	≤ 0.0005
Average				**121,026**	**78.3**	**0.53**	**0.0067**	**≤ 0.04**	**≤ 0.0006**

6.0 CERTIFICATION

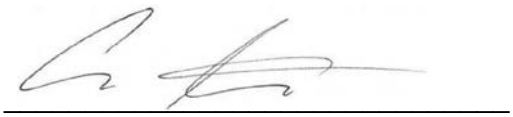
Mostardi Platt is pleased to have been of service to CalPortland Company, Inc. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

As project manager, I hereby certify that this test report represents a true and accurate summary of emissions test results and the methodologies employed to obtain those results, and the test program was performed in accordance with the methods specified in this test report.

MOSTARDI PLATT

Project Manager

Richard J. Sollars II



Quality Assurance

Chet A. Gutwein

APPENDICES

Appendix A – Plant Operating Data

Date/Time	KILN: CLINKER_PROD (TNHR) 1-Minute Block Average Expression Value
11/14/2023 08:00	77.20
11/14/2023 08:01	77.20
11/14/2023 08:02	77.20
11/14/2023 08:03	77.20
11/14/2023 08:04	77.20
11/14/2023 08:05	77.20
11/14/2023 08:06	77.20
11/14/2023 08:07	77.20
11/14/2023 08:08	77.20
11/14/2023 08:09	77.20
11/14/2023 08:10	77.20
11/14/2023 08:11	77.20
11/14/2023 08:12	77.20
11/14/2023 08:13	77.20
11/14/2023 08:14	77.20
11/14/2023 08:15	77.20
11/14/2023 08:16	77.14
11/14/2023 08:17	77.20
11/14/2023 08:18	77.20
11/14/2023 08:19	77.20
11/14/2023 08:20	77.20
11/14/2023 08:21	77.20
11/14/2023 08:22	77.20
11/14/2023 08:23	77.20
11/14/2023 08:24	77.20
11/14/2023 08:25	77.20
11/14/2023 08:26	77.20
11/14/2023 08:27	77.14
11/14/2023 08:28	77.20
11/14/2023 08:29	77.20
11/14/2023 08:30	77.20
11/14/2023 08:31	77.20
11/14/2023 08:32	77.20
11/14/2023 08:33	77.20
11/14/2023 08:34	77.20
11/14/2023 08:35	77.20
11/14/2023 08:36	77.20
11/14/2023 08:37	77.20
11/14/2023 08:38	77.20
11/14/2023 08:39	77.20
11/14/2023 08:40	77.20
11/14/2023 08:41	77.20
11/14/2023 08:42	77.20
11/14/2023 08:43	77.20
11/14/2023 08:44	77.20
11/14/2023 08:45	77.20
11/14/2023 08:46	77.20
11/14/2023 08:47	77.20
11/14/2023 08:48	77.20
11/14/2023 08:49	77.20
11/14/2023 08:50	77.20
11/14/2023 08:51	77.20
11/14/2023 08:52	77.20
11/14/2023 08:53	77.20
11/14/2023 08:54	77.20
11/14/2023 08:55	77.20
11/14/2023 08:56	77.20
11/14/2023 08:57	77.20
11/14/2023 08:58	77.20
11/14/2023 08:59	77.20
Average	77.20

Date/Time	KILN: CLINKER_PROD (TNHR) 1-Minute Block Average Expression Value
11/14/2023 09:25	77.20
11/14/2023 09:26	77.20
11/14/2023 09:27	77.20
11/14/2023 09:28	77.20
11/14/2023 09:29	77.14
11/14/2023 09:30	77.20
11/14/2023 09:31	77.20
11/14/2023 09:32	77.20
11/14/2023 09:33	77.20
11/14/2023 09:34	77.20
11/14/2023 09:35	77.20
11/14/2023 09:36	77.20
11/14/2023 09:37	77.20
11/14/2023 09:38	77.20
11/14/2023 09:39	77.20
11/14/2023 09:40	77.14
11/14/2023 09:41	77.20
11/14/2023 09:42	77.20
11/14/2023 09:43	77.20
11/14/2023 09:44	77.20
11/14/2023 09:45	77.20
11/14/2023 09:46	77.20
11/14/2023 09:47	77.20
11/14/2023 09:48	77.20
11/14/2023 09:49	77.20
11/14/2023 09:50	77.20
11/14/2023 09:51	77.20
11/14/2023 09:52	77.20
11/14/2023 09:53	77.20
11/14/2023 09:54	77.20
11/14/2023 09:55	77.20
11/14/2023 09:56	77.20
11/14/2023 09:57	77.20
11/14/2023 09:58	77.20
11/14/2023 09:59	77.20
11/14/2023 10:00	77.20
11/14/2023 10:01	77.20
11/14/2023 10:02	77.20
11/14/2023 10:03	77.20
11/14/2023 10:04	77.20
11/14/2023 10:05	77.20
11/14/2023 10:06	77.20
11/14/2023 10:07	77.20
11/14/2023 10:08	77.20
11/14/2023 10:09	77.20
11/14/2023 10:10	77.20
11/14/2023 10:11	77.20
11/14/2023 10:12	77.20
11/14/2023 10:13	77.20
11/14/2023 10:14	77.20
11/14/2023 10:15	77.20
11/14/2023 10:16	77.20
11/14/2023 10:17	77.20
11/14/2023 10:18	77.20
11/14/2023 10:19	77.20
11/14/2023 10:20	77.20
11/14/2023 10:21	77.20
11/14/2023 10:22	77.14
11/14/2023 10:23	77.20
11/14/2023 10:24	77.37
Average	77.20

Date/Time	KILN: CLINKER_PROD (TNHR) 1-Minute Block Average Expression Value
11/14/2023 10:50	78.32
11/14/2023 10:51	78.32
11/14/2023 10:52	78.32
11/14/2023 10:53	78.38
11/14/2023 10:54	78.32
11/14/2023 10:55	78.32
11/14/2023 10:56	78.32
11/14/2023 10:57	78.32
11/14/2023 10:58	78.32
11/14/2023 10:59	78.32
11/14/2023 11:00	78.32
11/14/2023 11:01	78.32
11/14/2023 11:02	78.32
11/14/2023 11:03	78.32
11/14/2023 11:04	78.32
11/14/2023 11:05	78.32
11/14/2023 11:06	78.32
11/14/2023 11:07	78.32
11/14/2023 11:08	78.32
11/14/2023 11:09	78.32
11/14/2023 11:10	78.32
11/14/2023 11:11	78.32
11/14/2023 11:12	78.38
11/14/2023 11:13	78.32
11/14/2023 11:14	78.32
11/14/2023 11:15	78.38
11/14/2023 11:16	78.32
11/14/2023 11:17	78.32
11/14/2023 11:18	78.32
11/14/2023 11:19	78.32
11/14/2023 11:20	78.32
11/14/2023 11:21	78.32
11/14/2023 11:22	78.32
11/14/2023 11:23	78.32
11/14/2023 11:24	78.32
11/14/2023 11:25	78.32
11/14/2023 11:26	78.32
11/14/2023 11:27	78.38
11/14/2023 11:28	78.32
11/14/2023 11:29	78.32
11/14/2023 11:30	78.32
11/14/2023 11:31	78.32
11/14/2023 11:32	78.32
11/14/2023 11:33	78.32
11/14/2023 11:34	78.32
11/14/2023 11:35	78.32
11/14/2023 11:36	78.38
11/14/2023 11:37	78.32
11/14/2023 11:38	78.32
11/14/2023 11:39	78.32
11/14/2023 11:40	78.32
11/14/2023 11:41	78.32
11/14/2023 11:42	78.32
11/14/2023 11:43	78.32
11/14/2023 11:44	78.32
11/14/2023 11:45	78.32
11/14/2023 11:46	78.32
11/14/2023 11:47	78.32
11/14/2023 11:48	78.32
11/14/2023 11:49	78.32
Average	78.33

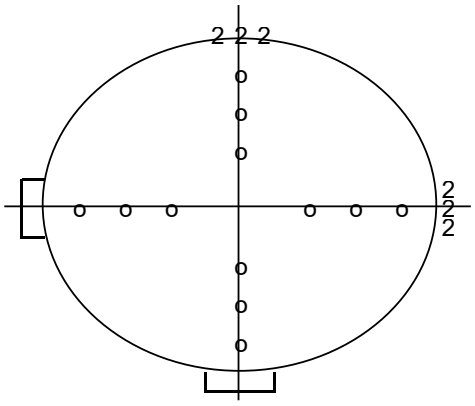
Date/Time	KILN: CLINKER_PROD (TNHR) 1-Minute Block Average Expression Value
11/14/2023 12:50	78.32
11/14/2023 12:51	78.32
11/14/2023 12:52	78.32
11/14/2023 12:53	78.32
11/14/2023 12:54	78.32
11/14/2023 12:55	78.32
11/14/2023 12:56	78.32
11/14/2023 12:57	78.32
11/14/2023 12:58	78.32
11/14/2023 12:59	78.32
11/14/2023 13:00	78.32
11/14/2023 13:01	78.32
11/14/2023 13:02	78.32
11/14/2023 13:03	78.32
11/14/2023 13:04	78.32
11/14/2023 13:05	78.32
11/14/2023 13:06	78.32
11/14/2023 13:07	78.32
11/14/2023 13:08	78.32
11/14/2023 13:09	78.32
11/14/2023 13:10	78.32
11/14/2023 13:11	78.32
11/14/2023 13:12	78.32
11/14/2023 13:13	78.32
11/14/2023 13:14	78.32
11/14/2023 13:15	78.32
11/14/2023 13:16	78.32
11/14/2023 13:17	78.32
11/14/2023 13:18	78.32
11/14/2023 13:19	78.32
11/14/2023 13:20	78.32
11/14/2023 13:21	78.32
11/14/2023 13:22	78.32
11/14/2023 13:23	78.32
11/14/2023 13:24	78.32
11/14/2023 13:25	78.38
11/14/2023 13:26	78.32
11/14/2023 13:27	78.32
11/14/2023 13:28	78.32
11/14/2023 13:29	78.32
11/14/2023 13:30	78.32
11/14/2023 13:31	78.32
11/14/2023 13:32	78.32
11/14/2023 13:33	78.32
11/14/2023 13:34	78.32
11/14/2023 13:35	78.32
11/14/2023 13:36	78.32
11/14/2023 13:37	78.32
11/14/2023 13:38	78.32
11/14/2023 13:39	78.32
11/14/2023 13:40	78.32
11/14/2023 13:41	78.32
11/14/2023 13:42	78.32
11/14/2023 13:43	78.32
11/14/2023 13:44	78.32
11/14/2023 13:45	78.32
11/14/2023 13:46	78.32
11/14/2023 13:47	78.32
11/14/2023 13:48	78.32
11/14/2023 13:49	78.32
Average	78.32

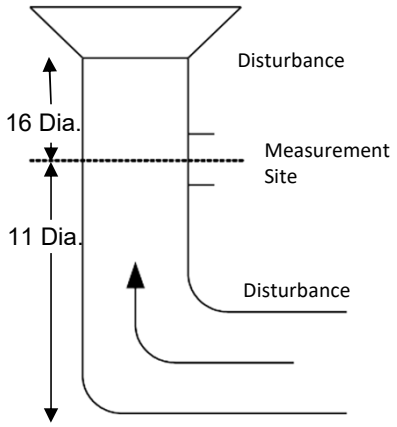
Date/Time	KILN: CLINKER_PROD (TNHR) 1-Minute Block Average Expression Value
11/14/2023 14:15	78.32
11/14/2023 14:16	78.32
11/14/2023 14:17	78.32
11/14/2023 14:18	78.32
11/14/2023 14:19	78.32
11/14/2023 14:20	78.32
11/14/2023 14:21	78.32
11/14/2023 14:22	78.32
11/14/2023 14:23	78.32
11/14/2023 14:24	78.32
11/14/2023 14:25	78.32
11/14/2023 14:26	78.38
11/14/2023 14:27	78.32
11/14/2023 14:28	78.32
11/14/2023 14:29	78.32
11/14/2023 14:30	78.32
11/14/2023 14:31	78.32
11/14/2023 14:32	78.32
11/14/2023 14:33	78.32
11/14/2023 14:34	78.32
11/14/2023 14:35	78.32
11/14/2023 14:36	78.32
11/14/2023 14:37	78.32
11/14/2023 14:38	78.32
11/14/2023 14:39	78.32
11/14/2023 14:40	78.32
11/14/2023 14:41	78.32
11/14/2023 14:42	78.32
11/14/2023 14:43	78.32
11/14/2023 14:44	78.32
11/14/2023 14:45	78.32
11/14/2023 14:46	78.32
11/14/2023 14:47	78.32
11/14/2023 14:48	78.32
11/14/2023 14:49	78.32
11/14/2023 14:50	78.32
11/14/2023 14:51	78.32
11/14/2023 14:52	78.32
11/14/2023 14:53	78.32
11/14/2023 14:54	78.32
11/14/2023 14:55	78.32
11/14/2023 14:56	78.32
11/14/2023 14:57	78.32
11/14/2023 14:58	78.32
11/14/2023 14:59	78.32
11/14/2023 15:00	78.32
11/14/2023 15:01	78.32
11/14/2023 15:02	78.32
11/14/2023 15:03	78.32
11/14/2023 15:04	78.32
11/14/2023 15:05	78.32
11/14/2023 15:06	78.32
11/14/2023 15:07	78.32
11/14/2023 15:08	78.32
11/14/2023 15:09	78.32
11/14/2023 15:10	78.32
11/14/2023 15:11	78.32
11/14/2023 15:12	78.32
11/14/2023 15:13	78.32
11/14/2023 15:14	78.32
Average	78.32

Date/Time	KILN: CLINKER_PROD (TNHR) 1-Minute Block Average Expression Value
11/14/2023 15:40	78.32
11/14/2023 15:41	78.32
11/14/2023 15:42	78.32
11/14/2023 15:43	78.32
11/14/2023 15:44	78.32
11/14/2023 15:45	78.32
11/14/2023 15:46	78.32
11/14/2023 15:47	78.32
11/14/2023 15:48	78.32
11/14/2023 15:49	78.38
11/14/2023 15:50	78.32
11/14/2023 15:51	78.32
11/14/2023 15:52	78.32
11/14/2023 15:53	78.32
11/14/2023 15:54	78.32
11/14/2023 15:55	78.32
11/14/2023 15:56	78.32
11/14/2023 15:57	78.32
11/14/2023 15:58	78.32
11/14/2023 15:59	78.32
11/14/2023 16:00	78.32
11/14/2023 16:01	78.32
11/14/2023 16:02	78.32
11/14/2023 16:03	78.32
11/14/2023 16:04	78.32
11/14/2023 16:05	78.32
11/14/2023 16:06	78.32
11/14/2023 16:07	78.32
11/14/2023 16:08	78.32
11/14/2023 16:09	78.32
11/14/2023 16:10	78.32
11/14/2023 16:11	78.32
11/14/2023 16:12	78.32
11/14/2023 16:13	78.32
11/14/2023 16:14	78.32
11/14/2023 16:15	78.32
11/14/2023 16:16	78.32
11/14/2023 16:17	78.32
11/14/2023 16:18	78.32
11/14/2023 16:19	78.32
11/14/2023 16:20	78.32
11/14/2023 16:21	78.32
11/14/2023 16:22	78.32
11/14/2023 16:23	78.32
11/14/2023 16:24	78.32
11/14/2023 16:25	78.32
11/14/2023 16:26	78.38
11/14/2023 16:27	78.32
11/14/2023 16:28	78.32
11/14/2023 16:29	78.32
11/14/2023 16:30	78.32
11/14/2023 16:31	78.32
11/14/2023 16:32	78.32
11/14/2023 16:33	78.32
11/14/2023 16:34	78.32
11/14/2023 16:35	78.32
11/14/2023 16:36	78.32
11/14/2023 16:37	78.32
11/14/2023 16:38	78.32
11/14/2023 16:39	78.32
Average	78.32

Appendix B – Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS





Client: CalPortland Company, Inc.

Facility: Redding Cement Plant

Test Location: Kiln Stack

Date: 11/14/23

Diameter (Feet): 7.000

Port Length (In): 12.00

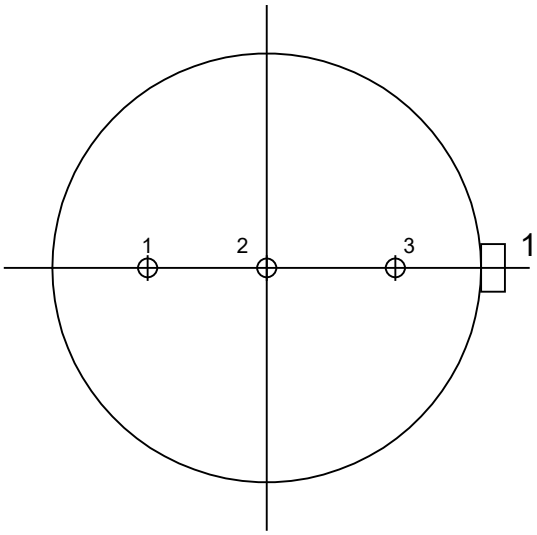
Ports Sampled: 2

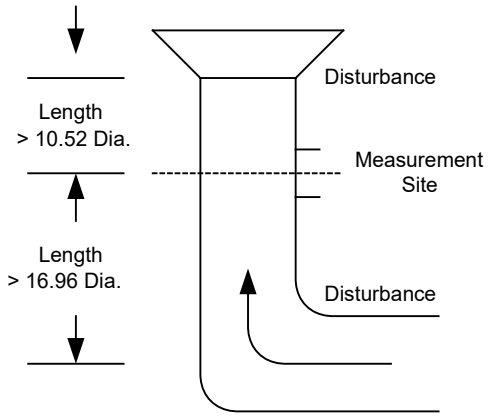
Points/Port: 6

Point Markings

	From inside wall (in.)	% of Diameter
1	3.70	4.40
2	12.26	14.60
3	24.86	29.60
4	59.14	70.40
5	71.74	85.40
6	80.30	95.60

GASEOUS TRAVERSE FOR ROUND DUCTS
(Stratification)





Job: CalPortland Redding

Test Location: Main Kiln Stack

Stack Diameter: 7.0 Feet

Stack Area: 38.485 Square Feet

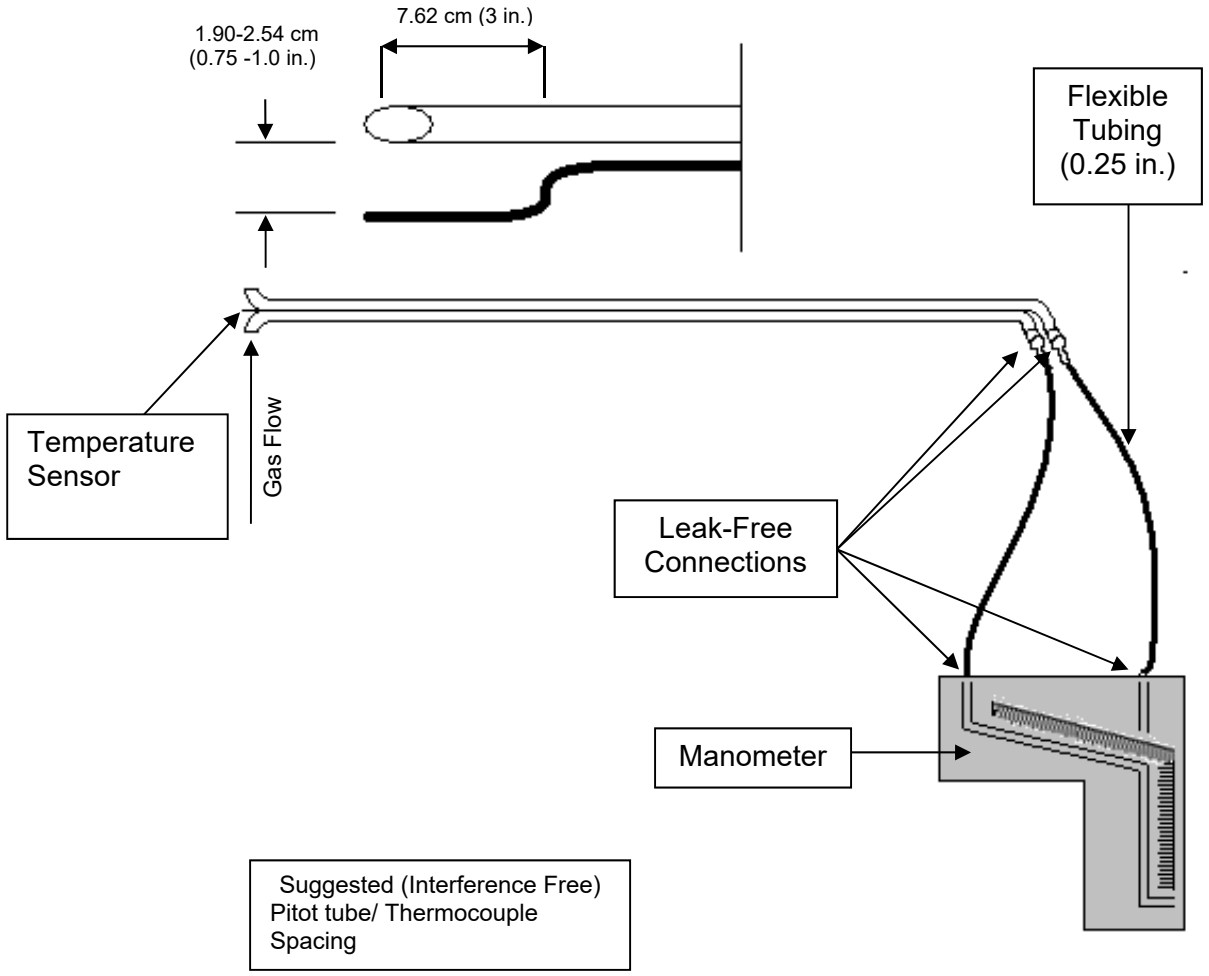
No. Sample Points: 3

Distance from Inside Wall
To Traverse Point:

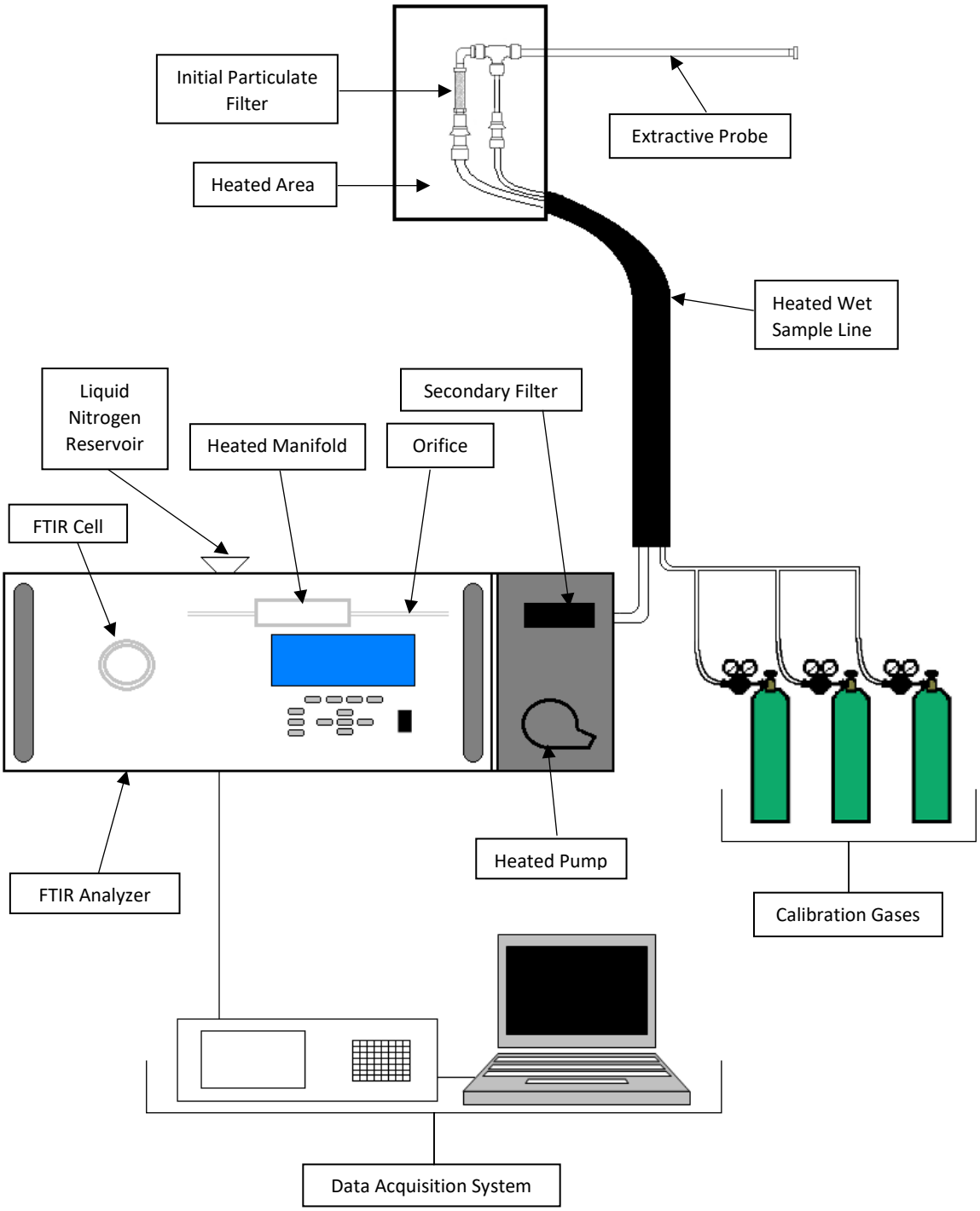
1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix C – Sample Train Diagrams

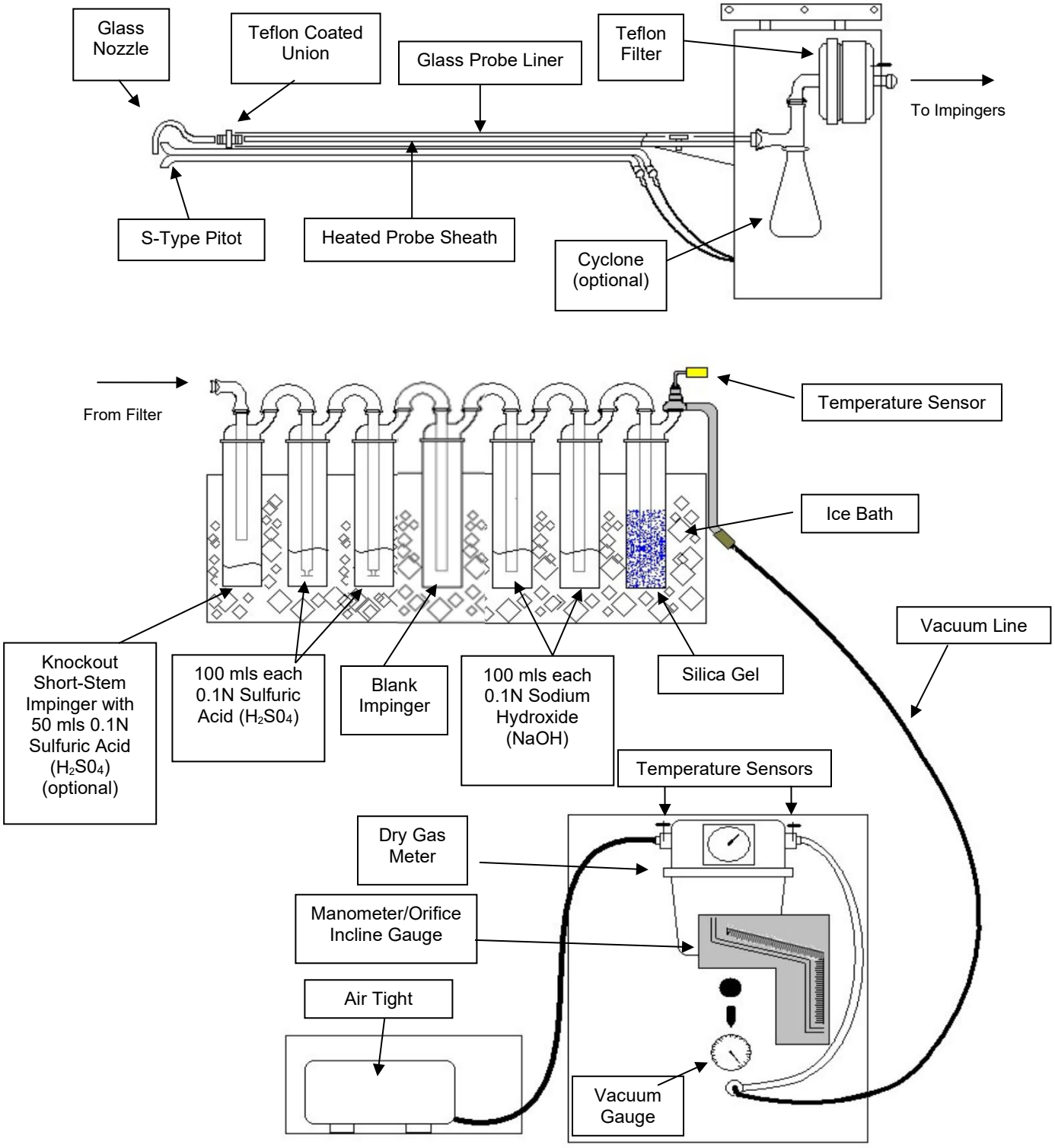
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



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



USEPA Method 26A – HF and Cl_2 Sample Train Diagram



Appendix D – Calculation Nomenclature and Formulas

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Sample Calculations

$$(12.59\ \% - 0.01\ \%) \times \frac{\text{O2 \% (dry)}\ 11.18\ \%}{11.12\ \% - 0.01\ \%} = 12.66\ \%$$

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

where:
C_{gas} = Effluent gas concentration, dry basis, ppm or %
C = Average gas concentration indicated by gas analyzer, dry basis, ppm or %
C_o = Average of initial and final system calibration bias check responses for the zero gas, ppm or %
C_m = Average of inititial and final system calibration bias check responses for the upscale calibration gas, ppm or %
C_{ma} = Actual concentration of the upscale calibration gas, ppm or %

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Run:	**1**
Date:	**11/14/2023**
Method:	**26A**
Source Condition:	**Mill On**

Dry Molecular Weight

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

$\%CO_2$ =	13.4	$\%O_2$ =	12.7	$\%N_2$ =	73.9

Md = 30.652

Wet Molecular Weight

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

Md =	30.652	Bws =	0.110

Ms = 29.266

Meter Volume at Standard Conditions

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

Y =	0.992	Vm =	70.975	Pbar =	29.2
DH =	4.2	Tm =	56.8		

Vm(std) = 71.022

Volume of Water Vapor Condensed

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

Net H_2O = 185.5

Vw(std) = 8.737

Moisture Content

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

Vw(std) =	8.737	Vm(std) =	71.022

Bws = 0.110

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Run:	**1**
Date:	**11/14/2023**
Method:	**26A**
Source Condition:	**Mill On**

Average Duct Velocity

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

Cp =	**0.820**	**Ts (avg) =**	**231.4**	**Sqrt DP (avg):**	**1.387**
Ps =	**29.17**	**Ms =**	**29.266**		

Vs = 87.486

Volumetric Flow Rate (Actual Basis)

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

Vs =	**87.486**	**A =**	**38.485**

Q = 202,011

Volumetric Flow Rate (Standard Basis)

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

Q =	**202,011**	**Ps =**	**29.17**	**Ts (avg) =**	**231.4**

Qstd = 150,404

Volumetric Flow Rate (Standard Dry Basis)

$$Qstd(dry) = Qstd \times (1-Bws)$$

Qstd =	**150,404**	**Bws =**	**0.110**

Qstd(dry) = 133,928

Isokinetic Variation:

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

Ts =	**231.4**	**Vm(std) =**	**71.022**	**Vs =**	**87.486**
An =	**0.0003327**	**θ =**	**60**	**Ps =**	**29.17**
Bws =	**0.110**				

%ISO = 102.3

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Kiln Stack
Run: 1
Date: 11/14/2023
Method: 26A
Source Condition: Mill On

Chloride (Cl2) Concentration:

$$mg/m^3 = \frac{\text{mg of Chloride (Cl2)}}{\text{Vm(std)} \times 0.02832\ m^3/ft^3}$$

mg= 0.15 Vm(std) = 71.022

mg/m^3= 0.07

Chloride (Cl2) Emission Rate:

$$\text{lb of Chloride (Cl2)} = \frac{\mu g \text{ of sample} \times 10^{-6}\ grams/\mu g}{453.6\ grams/lb}$$

$$\text{Emission Rate lb/hr} = \frac{\text{lb of Chloride (Cl2)}}{\text{Vm(std)}} \times \text{dscfm} \times 60\ min/hr$$

lb of Chloride (Cl2) = 3.31E-10 dscfm = 133,928

Emission Rate lb/hr = 0.0374

$$\text{Emission Rate lb/ton} = \frac{\text{lb/hr of Chloride (Cl2)}}{\text{clinker production ton/hr}}$$

lb/hr of Chloride (Cl2) = 0.0374 clinker ton/hr = 77.2

Emission Rate lb/ton = 0.0005

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

FTIR Sample Calculations

Direct Recovery % of Calibration Transfer Standard

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

Cma= 101.4 D_{cts} = 101.3

DR_{cts} = 99.9%

Recovery % with Calibration Transfer Standard System Purge

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

Sys_{cts} = 101.2 D_{cts} = 101.3

R_{cts} = 100%

Direct Recovery % of Analyte Spike Gas

SF6			HCN		
$DR_{sf6} = \frac{D_{sf6}}{Cma} \times 100$			$DR_{asg} = \frac{D_{asg}}{Cma} \times 100$		
Cma= 5.0	D_{sf6} = 5.0		Cma= 49.6	D_{asg} = 50.3	
DR_{sf6} = 99%			DR_{asg} = 101.6%		

Dilution Factor for Analyte Spiking

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

Spk_{sf6} = 0.317 D_{sf6} = 4.955

DF = 0.064

Recovery % for Analyte Spike With HCN

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

Spk_x = 3.9 N_x = 0.9

DF = 0.064 D_{asg} = 50.3

R_x = 95.6 %

where:

DR_{cts} = Recovery % of the calibration transfer standard directly to the analyzer
Cma = certified concentration of calibration gas, ppm
D_{cts} = Concentration of the calibration transfer standard gas directly to the analyzer, ppm
R_{cts} = Recovery % of the calibration transfer standard through the sampling system
Sys_{cts} = Concentration of the calibration transfer standard gas through the system, ppm
DF = Dilution Factor of analyte spike gas
Spk_{sf6} = SF6 concentration in effluent during spiking
Spk_x = Analyte concentration in effluent during spiking
D_{asg} = Concentration of the analyte spike gas directly to the analyzer, ppm
D_{sf6} = Concentration of the SF6 directly to the analyzer, ppm
R_x = Recovery % of the analyte spike gas
N_x = Native effluent (HCN) concentration prior to analyte spike

MOSTARDI PLATT

Volumetric Flow Nomenclature

A =	Cross-sectional area of stack or duct, ft2
Bws =	Water vapor in gas stream, proportion by volume
Cp =	Pitot tube coefficient, dimensionless
Md =	Dry molecular weight of gas, lb/lb-mole
Ms =	Molecular weight of gas, wet basis, lb/lb-mole
Mw =	Molecular weight of water, 18.0 lb/lb-mole
Pbar =	Barometric pressure at testing site, in. Hg
Pg =	Static pressure of gas, in. Hg (in. H2O/13.6)
DH=	Static pressure of gas, in.H2O
Ps =	Absolute pressure of gas, in. Hg = Pbar + Pg
Pstd =	Standard absolute pressure, 29.92 in. Hg
Acfm =	Actual volumetric gas flow rate
Scfm=	Volumetric gas flow rate, corrected to standard conditions
Dscfm =	Standard volumetric flow rate, corrected to dry conditions
R =	Ideal gas constant, 21.85 in. Hg-ft3/°R-lb-mole
Ts =	Average stack gas temperature, °F
Tm =	Average dry gas meter temperature, oF
Tstd =	Standard absolute temperature, 528°R
vs =	Gas velocity, ft/sec
Vm(std)=	Volume of gas sampled, corrected to standard conditions, scf
Vw(std) =	Volume of water vapor in gas sample, corrected to standard conditions, scf
Vlc=	Volume of liquid collected
Y =	Dry gas meter calibration factor
Δp =	Velocity head of gas, in. H2O
K1 =	17.647 °R/in. Hg
%EA =	Percent excess air
%CO2 =	Percent carbon dioxide by volume, dry basis
%O2 =	Percent oxygen by volume, dry basis
%N2 =	Percent nitrogen by volume, dry basis
0.264 =	Ratio of O2 to N2 in air, v/v
0.28 =	Molecular weight of N2 or CO, divided by 100
0.32 =	Molecular weight of O2 divided by 100
0.44 =	Molecular weight of CO2 divided by 100
13.6 =	Specific gravity of mercury (Hg)

MOSTARDI PLATT

Volumetric Air Flow Calculations

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

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

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

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

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

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

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

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

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

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

MOSTARDI PLATT

Isokinetic Calculation Formulas

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

MOSTARDI PLATT

Isokinetic Nomenclature

A = Cross-sectional area of stack or duct, square feet
A_n = Cross-sectional area of nozzle, square feet
B_{ws} = Water vapor in gas stream, by volume
C_a = Acetone blank residue concentration, g/g
C_{acf} = Concentration of particulate matter in gas stream at actual conditions, gr/acf
C_p = Pitot tube coefficient
C_s = Concentration of particulate matter in gas stream, dry basis, corrected to standard conditions, gr/dscf
IKV = Isokinetic sampling variance, must be 90.0 % ≤ IKV ≤ 110.0%
M_d = Dry molecular weight of gas, lb/lb-mole
M_s = Molecular weight of gas, wet basis, lb/lb-mole
M_w = Molecular weight of water, 18.0 lb/lb-mole
m_a = Mass of residue of acetone after evaporation, grams
P_{bar} = Barometric pressure at testing site, inches mercury
P_g = Static pressure of gas, inches mercury (inches water/13.6)
P_s = Absolute pressure of gas, inches mercury = P_{bar} + P_g
P_{std} = Standard absolute pressure, 29.92 inches mercury
Q_{acfm} = Actual volumetric gas flow rate, acfm
Q_{sd} = Dry volumetric gas flow rate corrected to standard conditions, dscfh
R = Ideal gas constant, 21.85 inches mercury cubic foot/°R-lb-mole
T_m = Dry gas meter temperature, °R
T_s = Gas temperature, °R
T_{std} = Absolute temperature, 528°R
V_a = Volume of acetone blank, ml
V_{aw} = Volume of acetone used in wash, ml
W_a = Weight of residue in acetone wash, grams
m_n = Total amount of particulate matter collected, grams
V_{1c} = Total volume of liquid collected in impingers and silica gel, ml
V_m = Volume of gas sample as measured by dry gas meter, dcf
$V_{m(std)}$ = Volume of gas sample measured by dry gas meter, corrected to standard conditions, dscf
v_s = Gas velocity, ft/sec
$V_{w(std)}$ = Volume of water vapor in gas sample, corrected to standard conditions, scf
Y = Dry gas meter calibration factor
ΔH = Average pressure differential across the orifice meter, inches water
Δp = Velocity head of gas, inches water
ρ_a = Density of acetone, 0.7855 g/ml (average)
ρ_w = Density of water, 0.002201 lb/ml
θ = Total sampling time, minutes
K_1 = 17.647 °R/in. Hg
K_2 = 0.04707 ft^3/ml
K_4 = 0.09450/100 = 0.000945
K_p = Pitot tube constant, $85.49 \frac{ft}{sec}\left[\frac{(lb/lb-mole)(in.\ Hg)}{(°R)(in.\ H_2O)}\right]^{1/2}$
%EA = Percent excess air
$\%CO_2$ = Percent carbon dioxide by volume, dry basis
$\%O_2$ = Percent oxygen by volume, dry basis
%CO = Percent carbon monoxide by volume, dry basis
$\%N_2$ = Percent nitrogen by volume, dry basis
0.264 = Ratio of O_2 to N_2 in air, v/v
28 = Molecular weight of N_2 or CO
32 = Molecular weight of O_2
44 = Molecular weight of CO_2
13.6 = Specific gravity of mercury (Hg)

MOSTARDI PLATT

Calculations for Hydrogen Fluoride By Method 26 or 26A

Concentration

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

where:

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

dscf = Volume of gas sampled

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

Parts Per Million

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

where:

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

106 = Conversion of ppm v/v

Emission Rate

lbs HF /dscf × dscfm × 60 min/hr = lbs/hr HF

MOSTARDI PLATT

Pollutant Concentration Correction 7% for Percent Oxygen

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

where:

C_{adj} = Pollutant concentration corrected to percent O_2

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

20.9 = Percent O_2 in air

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

C_d = Pollutant concentration measured, dry basis, ppm.

Appendix E- Laboratory Sample Analysis

mostardi platt

Chain-of-Custody Form						
Project Number: M234605				Date Results Required:		
Client: CalPortland – Redding				TAT Required:		
Plant/Test Location: Kiln Stack				Project Supervisor: Rich S		
Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
001	11/14/23	#1A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
002	11/14/23	#1A 26A Mill off 0.1N NaOH	1		M26A (Cl_2)	
003	11/14/23	#2A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
004	11/14/23	#2A 26A Mill off 0.1N NaOH	1		M26A (Cl_2)	
005	11/14/23	#3A 26A Mill off 0.1N H2SO4	1		M26A (HF)	
006	11/14/23	#3A 26A Mill off 0.1N NaOH	1		M26A (Cl_2)	
007	11/14/23	#1B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
008	11/14/23	#1B 26A Mill off 0.1N NaOH	1		M26A (Cl_2)	
009	11/14/23	#2B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
010	11/14/23	#2B 26A Mill off 0.1N NaOH	1		M26A (Cl_2)	
011	11/14/23	#3B 26A Mill off 0.1N H2SO4	1		M26A (HF)	
012	11/14/23	#3B 26A Mill off 0.1N NaOH	1		M26A (Cl_2)	
013	11/14/23	#1A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
014	11/14/23	#1A 26A Mill on 0.1N NaOH	1		M26A (Cl_2)	
015	11/14/23	#2A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
016	11/14/23	#2A 26A Mill on 0.1N NaOH	1		M26A (Cl_2)	
017	11/14/23	#3A 26A Mill on 0.1N H2SO4	1		M26A (HF)	
018	11/14/23	#3A 26A Mill on 0.1N NaOH	1		M26A (Cl_2)	
019	11/14/23	#1B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
020	11/14/23	#1B 26A Mill on 0.1N NaOH	1		M26A (Cl_2)	
021	11/14/23	#2B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
022	11/14/23	#2B 26A Mill on 0.1N NaOH	1		M26A (Cl_2)	
023	11/14/23	#3B 26A Mill on 0.1N H2SO4	1		M26A (HF)	
024	11/14/23	#3B 26A Mill on 0.1N NaOH	1		M26A (Cl_2)	

025	11/14/23	A Train Field Blank 0.1N H2SO4	1		M26A (HF)	
026	11/14/23	A Train Field Blank 0.1N NaOH	1		M26A (Cl_2)	
027	11/14/23	B Train Field Blank 0.1N H2SO4	1		M26A (HF)	
028	11/14/23	B Train Field Blank 0.1N NaOH	1		M26A (Cl_2)	
029	11/14/23	0.1N H2SO4 Reagent Blank	1		M26A (HF)	
030	11/14/23	0.1N NaOH Reagent Blank	1		M26A (Cl_2)	
031	11/14/23	DI Water Reagent Blank	1		M26A (HF and Cl_2)	

Delivered to Lab by: Date/Time:	Received by: Date/Time:	Processed by: Date/Time:

Laboratory Notes:

Kiln-Mill On

Client:	CalPortland	Analysis Date:	12/5/2023
Facility:	Redding	Analysis Location:	Elmhurst
Test Location:	Kiln-Mill On	Analyst:	JMG
Project Number:	M234605		
Method:	26A		
Date Samples Received:	11/21/2023		

Train A

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	200	200	406	406		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**	**Field Blank A**		**RDL**	**MDL**
Sulfuric Acid Volume	ml	379	424	294			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	200	200	415	415		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**	**Field Blank B**		**RDL**	**MDL**
Sulfuric Acid Volume	ml	447	423	294			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Client:	CalPortland	**Analysis Date:**	12/5/2023								
Facility:	Redding	**Analysis Location:**	Elmhurst								
Test Location:	Kiln-Mill On	**Analyst:**	JMG								
Project Number:	M234605										
Method:	26A										
Date Samples Received:	11/21/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2114	0.2114	**0.94**	**0.2252**							
2	0.4406	0.2203	**1.96**								
5	1.1289	0.2258	**5.01**	**Response Factor Ave**							
8	1.8566	0.2321	**8.24**	**0.2251**							
10	2.3617	0.2362	**10.49**								
Lot Number	Ricca 8209004										
	R²	**0.9997**									
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM F**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg F in soln**	**mg HF in soln**	**mg HF in soln avg**	**ug HF in soln**
031	11/14/2023	DI Reagent Blank	0.0086	0.0382	0.0382	1	200	0.0076	0.0080		
031	11/14/2023	DI Reagent Blank	0.0097	0.0431	0.0431	1	200	0.0086	0.0091	**0.0086**	**8.558142016**
029	11/14/2023	H2SO4 Reagent Blank	0.0325	0.1443	0.1443	1	200	0.0289	0.0304		
029	11/14/2023	H2SO4 Reagent Blank	0.0385	0.1709	0.1709	1	200	0.0342	0.0360	**0.0332**	**33.20372039**
013	11/14/2023	Test 1A H2SO4 Imp	0.0144	0.0639	0.0639	1	406	0.0260	0.0273		
013	11/14/2023	Test 1A H2SO4 Imp	0.0125	0.0555	0.0555	1	406	0.0225	0.0237	**0.0255**	**25.53740224**
013	11/14/2023	Test 1A H2SO4 Imp	0.0134	0.0595	0.0595	1	406	0.0242	0.0254		
013	11/14/2023	Test 1A H2SO4 Imp	0.0114	0.0506	0.0506	1	406	0.0206	0.0216	**0.0235**	**23.54377605**
015	11/14/2023	Test 2A H2SO4 Imp	0.0180	0.0799	0.0799	1	379	0.0303	0.0319		
015	11/14/2023	Test 2A H2SO4 Imp	0.0194	0.0861	0.0861	1	379	0.0326	0.0344	**0.0331**	**33.14432782**
017	11/14/2023	Test 3A H2SO4 Imp	0.0131	0.0582	0.0582	1	424	0.0247	0.0260		
017	11/14/2023	Test 3A H2SO4 Imp	0.0104	0.0462	0.0462	1	424	0.0196	0.0206	**0.0233**	**23.29872324**
025	11/14/2023	Train Blank A	0.0195	0.0866	0.0866	1	294	0.0255	0.0262		
025	11/14/2023	Train Blank A	0.0186	0.0826	0.0826	1	294	0.0243	0.0250	**0.0256**	**25.56894433**
					Expected Value	**% Difference**					
		Run 1 H2SO4 Spike W/ 2ppm	0.2100	0.9324	1.0080						
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2092	0.9289	1.0080	7.68%					
CCV ppm F	**Area**	**PPM F**									
1 ppm ICV	0.2385	1.0590									
5 ppm CCV	1.1184	4.9658									
5 ppm CCV	1.1191	4.9689									
5 ppm CCV	1.0923	4.8499									
Standard ppm F	**Area**	**Difference**									
1	0.2080	0.82%									
2	0.4223	2.17%									
5	1.1227	0.28%									
8	1.8638	0.19%									
10	2.3754	0.29%									

Client:	CalPortland	**Analysis Date:**	12/5/2023								
Facility:	Redding	**Analysis Location:**	Elmhurst								
Test Location:	Kiln-Mill On	**Analyst:**	JMG								
Project Number:	M234605										
Method:	26A										
Date Samples Received:	11/21/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2114	0.2114	**0.94**	**0.2252**							
2	0.4406	0.2203	**1.96**								
5	1.1289	0.2258	**5.01**	**Response Factor Ave**							
8	1.8566	0.2321	**8.24**	**0.2251**							
10	2.3617	0.2362	**10.49**								
Lot Number	Ricca 8209004										
	R^2	**0.9997**									
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM F**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg F in soln**	**mg HF in soln**	**mg HF in soln avg**	**ug HF in soln**
031	11/14/2023	DI Reagent Blank	0.0086	0.0382	0.0382	1	200	0.0076	0.0080		
031	11/14/2023	DI Reagent Blank	0.0097	0.0431	0.0431	1	200	0.0086	0.0091	**0.0086**	**8.558142016**
029	11/14/2023	H2SO4 Reagent Blank	0.0325	0.1443	0.1443	1	200	0.0289	0.0304		
029	11/14/2023	H2SO4 Reagent Blank	0.0385	0.1709	0.1709	1	200	0.0342	0.0360	**0.0332**	**33.20372039**
019	11/14/2023	Test 1B H2SO4 Imp	0.0127	0.0564	0.0564	1	415	0.0234	0.0246		
019	11/14/2023	Test 1B H2SO4 Imp	0.0115	0.0511	0.0511	1	415	0.0212	0.0223	**0.0235**	**23.48344816**
019	11/14/2023	Test 1B H2SO4 Imp	0.0117	0.0519	0.0519	1	415	0.0216	0.0227		
019	11/14/2023	Test 1B H2SO4 Imp	0.0118	0.0524	0.0524	1	415	0.0217	0.0229	**0.0228**	**22.80417487**
021	11/14/2023	Test 2B H2SO4 Imp	0.0135	0.0599	0.0599	1	447	0.0268	0.0282		
021	11/14/2023	Test 2B H2SO4 Imp	0.0134	0.0595	0.0595	1	447	0.0266	0.0280	**0.0281**	**28.11630247**
023	11/14/2023	Test 3B H2SO4 Imp	0.0196	0.0870	0.0870	1	423	0.0368	0.0388		
023	11/14/2023	Test 3B H2SO4 Imp	0.0162	0.0719	0.0719	1	423	0.0304	0.0320	**0.0354**	**35.40966334**
027	11/14/2023	Train Blank B	0.0195	0.0866	0.0866	1	294	0.0255	0.0268		
027	11/14/2023	Train Blank B	0.0186	0.0826	0.0826	1	294	0.0243	0.0256	**0.0262**	**26.19212349**
CCV ppm F	**Area**	**PPM CI**									
1 ppm ICV	0.2385	1.0590									
5 ppm CCV	1.1184	4.9658									
5 ppm CCV	1.1191	4.9689									
5 ppm CCV	1.0923	4.8499									
Standard ppm CI	**Area**	**Difference**									
1	0.2080	0.82%									
2	0.4223	2.17%									
5	1.1227	0.28%									
8	1.8638	0.19%									
10	2.3754	0.29%									

Kiln-Mill On

Client:	CalPortland	Analysis Date:	12/5/2023
Facility:	Redding	Analysis Location:	Elmhurst
Test Location:	Kiln-Mill On	Analyst:	JMG
Project Number:	M234605		
Method:	26A		
Date Samples Received:	11/21/2023		

Train A

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	200	200	264	264		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**	**Train A Blank**		**RDL**	**MDL**
Sodium Hydroxide Volume	ml	265	275	279			
Chlorine	ug	<150	<150	<150		150	15

Train B

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	200	200	269	269		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**	**Train B Blank**		**RDL**	**MDL**
Sodium Hydroxide Volume	ml	287	241	279			
Chlorine	ug	<150	<150	<150		150	15

Client:	CalPortland	**Analysis Date:**	12/6/2023							
Facility:	Redding	**Analysis Location:**	Elmhurst Lab							
Test Location:	Kiln-Mill On	**Analyst:**	JMG							
Project Number:	M234605									
Method:	26A									
Date Samples Received:	11/21/2023									
Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**						
1	0.1264	0.1264	**0.97**	**0.1308**						
2	0.2504	0.1252	**1.92**							
5	0.6542	0.1308	**5.00**	**Response Factor Ave**						
8	1.0781	0.1348	**8.25**	**0.1307**						
10	1.3636	0.1364	**10.43**							
Lot Number	Ricca 8209004									
	R^2	**0.9997**								
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM Cl**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg Cl in soln**	**ug Cl2 in soln**	**ug Cl2 in soln**
031	11/14/2023	DI Reagent Blank	0.0025	0.0191	0.0191	1	200	0.0038		
031	11/14/2023	DI Reagent Blank	0.0005	0.0038	0.0038	1	200	0.0008	**0.0023**	**2.294394956**
030	11/14/2023	NaOH Reagent Blank	0.0103	0.0788	0.0788	1	200	0.0158		
030	11/14/2023	NaOH Reagent Blank	0.0107	0.0818	0.0818	1	200	0.0164	**0.0161**	**16.06076469**
014	11/14/2023	Test 1A NaOH Imp	0.0024	0.0184	0.0184	1	264	0.0048		
014	11/14/2023	Test 1A NaOH Imp	0.0029	0.0222	0.0222	1	264	0.0059	**0.0054**	**5.350529038**
014	11/14/2023	Test 1A NaOH Imp	0.0035	0.0268	0.0268	1	264	0.0071		
014	11/14/2023	Test 1A NaOH Imp	0.0034	0.0260	0.0260	1	264	0.0069	**0.0070**	**6.965783087**
016	11/14/2023	Test 2A NaOH Imp	0.0015	0.0115	0.0115	1	265	0.0030		
016	11/14/2023	Test 2A NaOH Imp	0.0010	0.0076	0.0076	1	265	0.0020	**0.0025**	**2.533394431**
018	11/14/2023	Test 3A NaOH Imp	0.0049	0.0375	0.0375	1	275	0.0103		
018	11/14/2023	Test 3A NaOH Imp	0.0035	0.0268	0.0268	1	275	0.0074	**0.0088**	**8.833420582**
026	11/14/2023	Train Blank	0.0163	0.1247	0.1247	1	279	0.0348		
026	11/14/2023	Train Blank	0.0157	0.1201	0.1201	1	279	0.0335	**0.0341**	**34.14059695**
					Expected Value	**% Difference**				
		Run 1 H2SO4 Spike W/ 2ppm	0.1235	0.9445	0.9677					
		Run 1 H2SO4 Spike W/ 2ppm	0.1221	0.9338	0.9677	2.94%				
CCV ppm Cl	**Area**	**PPM Cl**								
5 ppm ICV	0.6732	5.1486								
5 ppm CCV	0.6685	5.1127								
5 ppm CCV	0.6758	5.1685								
Standard ppm Cl	**Area**	**Difference**								
1	0.1378	4.14%								
2	0.2611	2.05%								
5	0.6899	2.59%								
8	1.0936	0.71%								
10	1.3713	0.28%								

Client:	CalPortland	**Analysis Date:**	12/6/2023							
Facility:	Redding	**Analysis Location:**	Elmhurst Lab							
Test Location:	Kiln-Mill On	**Analyst:**	JMG							
Project Number:	M234605									
Method:	26A									
Date Samples Received:	11/21/2023									
Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**						
1	0.1264	0.1264	**0.97**	**0.1308**						
2	0.2504	0.1252	**1.92**							
5	0.6542	0.1308	**5.00**	**Response Factor Ave**						
8	1.0781	0.1348	**8.25**	**0.1307**						
10	1.3636	0.1364	**10.43**							
Lot Number	Ricca 8209004									
	R^2	**0.9997**								
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM Cl**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg Cl in soln**	**mg Cl2 in soln avg**	**ug Cl2 in soln**
031	11/14/2023	DI Reagent Blank	0.0025	0.0191	0.0191	1	200	0.0038		
031	11/14/2023	DI Reagent Blank	0.0005	0.0038	0.0038	1	200	0.0008	**0.0023**	**2.294394956**
030	11/14/2023	NaOH Reagent Blank	0.0103	0.0788	0.0788	1	200	0.0158		
030	11/14/2023	NaOH Reagent Blank	0.0107	0.0818	0.0818	1	200	0.0164	**0.0161**	**16.06076469**
020	11/14/2023	Test 1B NaOH Imp	0.0045	0.0344	0.0344	1	269	0.0093		
020	11/14/2023	Test 1B NaOH Imp	0.0050	0.0382	0.0382	1	269	0.0103	**0.0098**	**9.772210518**
020	11/14/2023	Test 1B NaOH Imp	0.0046	0.0352	0.0352	1	269	0.0095		
020	11/14/2023	Test 1B NaOH Imp	0.0038	0.0291	0.0291	1	269	0.0078	**0.0086**	**8.640691405**
022	11/14/2023	Test 2B NaOH Imp	0.0067	0.0512	0.0512	1	287	0.0147		
022	11/14/2023	Test 2B NaOH Imp	0.0058	0.0444	0.0444	1	287	0.0127	**0.0137**	**13.71856984**
024	11/14/2023	Test 3B NaOH Imp	0.0009	0.0069	0.0069	1	241	0.0017		
024	11/14/2023	Test 3B NaOH Imp	0.0009	0.0069	0.0069	1	241	0.0017	**0.0017**	**1.658847553**
028	11/14/2023	Train B Train Blank	0.0163	0.1247	0.1247	1	279	0.0348		
028	11/14/2023	Train B Train Blank	0.0157	0.1201	0.1201	1	279	0.0335	**0.0341**	**34.14059695**
CCV ppm Cl	**Area**	**PPM Cl**								
5 ppm ICV	0.6732	5.1486								
5 ppm CCV	0.6685	5.1127								
5 ppm CCV	0.6758	5.1685								
Standard ppm Cl	**Area**	**Difference**								
1	0.1378	4.14%								
2	0.2611	2.05%								
5	0.6899	2.59%								
8	1.0936	0.71%								
10	1.3713	0.28%								

Kiln-Mill Off

Client:	CalPortland	Analysis Date:	12/5/2023
Facility:	Redding	Analysis Location:	Elmhurst
Test Location:	Kiln-Mill Off	Analyst:	JMG
Project Number:	M234605		
Method:	26A		
Date Samples Received:	11/21/2023		

Train A

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	200	200	404	404		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**	**Field Blank A**		**RDL**	**MDL**
Sulfuric Acid Volume	ml	421	380	294			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	200	200	421	421		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**	**Field Blank B**		**RDL**	**MDL**
Sulfuric Acid Volume	ml	396	356	294			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Client:	CalPortland	**Analysis Date:**	12/5/2023								
Facility:	Redding	**Analysis Location:**	Elmhurst								
Test Location:	Kiln-Mill Off	**Analyst:**	JMG								
Project Number:	M234605										
Method:	26A										
Date Samples Received:	11/21/2023										

Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**
1	0.2114	0.2114	**0.94**	**0.2252**
2	0.4406	0.2203	**1.96**	
5	1.1289	0.2258	**5.01**	**Response Factor Ave**
8	1.8566	0.2321	**8.24**	**0.2251**
10	2.3617	0.2362	**10.49**	
Lot Number	Ricca 8209004			
	R^2	**0.9997**		

Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM F**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg F in soln**	**mg HF in soln**	**mg HF in soln avg**	**ug HF in soln**
031	11/14/2023	DI Reagent Blank	0.0086	0.0382	0.0382	1	200	0.0076	0.0080		
031	11/14/2023	DI Reagent Blank	0.0097	0.0431	0.0431	1	200	0.0086	0.0091	**0.0086**	**8.558142016**
029	11/14/2023	H2SO4 Reagent Blank	0.0325	0.1443	0.1443	1	200	0.0289	0.0304		
029	11/14/2023	H2SO4 Reagent Blank	0.0385	0.1709	0.1709	1	200	0.0342	0.0360	**0.0332**	**33.20372039**
001	11/14/2023	Test 1A H2SO4 Imp	0.0218	0.0968	0.0968	1	404	0.0391	0.0412		
001	11/14/2023	Test 1A H2SO4 Imp	0.0269	0.1194	0.1194	1	404	0.0483	0.0508	**0.0460**	**46.0053914**
001	11/14/2023	Test 1A H2SO4 Imp	0.0286	0.1270	0.1270	1	404	0.0513	0.0540		
001	11/14/2023	Test 1A H2SO4 Imp	0.0258	0.1146	0.1146	1	404	0.0463	0.0487	**0.0514**	**51.390006**
003	11/14/2023	Test 2A H2SO4 Imp	0.0226	0.1003	0.1003	1	421	0.0422	0.0445		
003	11/14/2023	Test 2A H2SO4 Imp	0.0252	0.1119	0.1119	1	421	0.0471	0.0496	**0.0471**	**47.05528369**
005	11/14/2023	Test 3A H2SO4 Imp	0.0336	0.1492	0.1492	1	380	0.0567	0.0597		
005	11/14/2023	Test 3A H2SO4 Imp	0.0369	0.1638	0.1638	1	380	0.0623	0.0656	**0.0626**	**62.64279361**
025	11/14/2023	Train Blank A	0.0195	0.0866	0.0866	1	294	0.0255	0.0262		
025	11/14/2023	Train Blank A	0.0186	0.0826	0.0826	1	294	0.0243	0.0250	**0.0256**	**25.56894433**
					Expected Value	**% Difference**					
		Run 1 H2SO4 Spike W/ 2ppm	0.2353	1.0447	1.0322						
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2295	1.0190	1.0322	0.03%					

CCV ppm F	**Area**	**PPM F**
1 ppm ICV	0.2385	1.0590
5 ppm CCV	1.1184	4.9658
5 ppm CCV	1.1191	4.9689
5 ppm CCV	1.0923	4.8499

Standard ppm F	**Area**	**Difference**
1	0.2080	0.82%
2	0.4223	2.17%
5	1.1227	0.28%
8	1.8638	0.19%
10	2.3754	0.29%

Client:	CalPortland	**Analysis Date:**	12/5/2023								
Facility:	Redding	**Analysis Location:**	Elmhurst								
Test Location:	Kiln-Mill Off	**Analyst:**	JMG								
Project Number:	M234605										
Method:	26A										
Date Samples Received:	11/21/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2114	0.2114	**0.94**	**0.2252**							
2	0.4406	0.2203	**1.96**								
5	1.1289	0.2258	**5.01**	**Response Factor Ave**							
8	1.8566	0.2321	**8.24**	**0.2251**							
10	2.3617	0.2362	**10.49**								
Lot Number	Ricca 8209004										
	R^2	**0.9997**									
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM F**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg F in soln**	**mg HF in soln**	**mg HF in soln avg**	**ug HF in soln**
031	11/14/2023	DI Reagent Blank	0.0086	0.0382	0.0382	1	200	0.0076	0.0080		
031	11/14/2023	DI Reagent Blank	0.0097	0.0431	0.0431	1	200	0.0086	0.0091	**0.0086**	**8.558142016**
029	11/14/2023	H2SO4 Reagent Blank	0.0325	0.1443	0.1443	1	200	0.0289	0.0304		
029	11/14/2023	H2SO4 Reagent Blank	0.0385	0.1709	0.1709	1	200	0.0342	0.0360	**0.0332**	**33.20372039**
007	11/14/2023	Test 1B H2SO4 Imp	0.0127	0.0564	0.0564	1	421	0.0237	0.0250		
007	11/14/2023	Test 1B H2SO4 Imp	0.0257	0.1141	0.1141	1	421	0.0480	0.0506	**0.0378**	**37.80173418**
007	11/14/2023	Test 1B H2SO4 Imp	0.0301	0.1336	0.1336	1	421	0.0563	0.0593		
007	11/14/2023	Test 1B H2SO4 Imp	0.0259	0.1150	0.1150	1	421	0.0484	0.0510	**0.0551**	**55.12752901**
009	11/14/2023	Test 2B H2SO4 Imp	0.0273	0.1212	0.1212	1	396	0.0480	0.0506		
009	11/14/2023	Test 2B H2SO4 Imp	0.0219	0.0972	0.0972	1	396	0.0385	0.0406	**0.0456**	**45.55737501**
011	11/14/2023	Test 3B H2SO4 Imp	0.0185	0.0821	0.0821	1	356	0.0292	0.0308		
011	11/14/2023	Test 3B H2SO4 Imp	0.0429	0.1905	0.1905	1	356	0.0678	0.0714	**0.0511**	**51.11128182**
027	11/14/2023	Train Blank B	0.0195	0.0866	0.0866	1	294	0.0255	0.0268		
027	11/14/2023	Train Blank B	0.0186	0.0826	0.0826	1	294	0.0243	0.0256	**0.0262**	**26.19212349**
CCV ppm F	**Area**	**PPM F**									
1 ppm ICV	0.2385	1.0590									
5 ppm CCV	1.1184	4.9658									
5 ppm CCV	1.1191	4.9689									
5 ppm CCV	1.0923	4.8499									
Standard ppm F	**Area**	**Difference**									
1	0.2080	0.82%									
2	0.4223	2.17%									
5	1.1227	0.28%									
8	1.8638	0.19%									
10	2.3754	0.29%									

Kiln-Mill Off

Client:	CalPortland	Analysis Date:	12/5/2023
Facility:	Redding	Analysis Location:	Elmhurst
Test Location:	Kiln-Mill Off	Analyst:	JMG
Project Number:	M234605		
Method:	26A		
Date Samples Received:	11/21/2023		

Train A

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	200	200	278	278		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**	**Train A Blank**		**RDL**	**MDL**
Sodium Hydroxide Volume	ml	255	276	279			
Chlorine	ug	<150	<150	<150		150	15

Train B

Sampling Date		11/14/2023	11/14/2023	11/14/2023	11/14/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	200	200	274	274		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		11/14/2023	11/14/2023	11/14/2023			
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**	**Train B Blank**		**RDL**	**MDL**
Sodium Hydroxide Volume	ml	255	277	279			
Chlorine	ug	<150	<150	<150		150	15

Client:	CalPortland	**Analysis Date:**	12/6/2023							
Facility:	Redding	**Analysis Location:**	Elmhurst Lab							
Test Location:	Kiln-Mill Off	**Analyst:**	JMG							
Project Number:	M234605									
Method:	26A									
Date Samples Received:	11/21/2023									
Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**						
1	0.1264	0.1264	**0.97**	**0.1308**						
2	0.2504	0.1252	**1.92**							
5	0.6542	0.1308	**5.00**	**Response Factor Ave**						
8	1.0781	0.1348	**8.25**	**0.1307**						
10	1.3636	0.1364	**10.43**							
Lot Number	Ricca 8209004									
	R^2	**0.9997**								
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM Cl**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg Cl in soln**	**ug Cl2 in soln**	**ug Cl2 in soln**
031	11/14/2023	DI Reagent Blank	0.0025	0.0191	0.0191	1	200	0.0038		
031	11/14/2023	DI Reagent Blank	0.0005	0.0038	0.0038	1	200	0.0008	**0.0023**	**2.294394956**
030	11/14/2023	NaOH Reagent Blank	0.0103	0.0788	0.0788	1	200	0.0158		
030	11/14/2023	NaOH Reagent Blank	0.0107	0.0818	0.0818	1	200	0.0164	**0.0161**	**16.06076469**
002	11/14/2023	Test 1A NaOH Imp	0.0029	0.0222	0.0222	1	278	0.0062		
002	11/14/2023	Test 1A NaOH Imp	0.0029	0.0222	0.0222	1	278	0.0062	**0.0062**	**6.165804046**
002	11/14/2023	Test 1A NaOH Imp	0.0033	0.0252	0.0252	1	278	0.0070		
002	11/14/2023	Test 1A NaOH Imp	0.0031	0.0237	0.0237	1	278	0.0066	**0.0068**	**6.803645844**
004	11/14/2023	Test 2A NaOH Imp	0.0069	0.0528	0.0528	1	255	0.0135		
004	11/14/2023	Test 2A NaOH Imp	0.0079	0.0604	0.0604	1	255	0.0154	**0.0144**	**14.43174427**
006	11/14/2023	Test 3A NaOH Imp	0.0064	0.0489	0.0489	1	276	0.0135		
006	11/14/2023	Test 3A NaOH Imp	0.0067	0.0512	0.0512	1	276	0.0141	**0.0138**	**13.82602401**
026	11/14/2023	Train Blank	0.0163	0.1247	0.1247	1	279	0.0348		
026	11/14/2023	Train Blank	0.0157	0.1201	0.1201	1	279	0.0335	**0.0341**	**34.14059695**
					Expected Value	**% Difference**				
		Run 1 H2SO4 Spike W/ 2ppm	0.1280	0.9789	0.9686					
		Run 1 H2SO4 Spike W/ 2ppm	0.1299	0.9935	0.9686	1.82%				
CCV ppm Cl	**Area**	**PPM Cl**								
5 ppm ICV	0.6732	5.1486								
5 ppm CCV	0.6685	5.1127								
5 ppm CCV	0.6758	5.1685								
5 ppm CCV	0.6739	5.1540								
Standard ppm Cl	**Area**	**Difference**								
1	0.1378	4.14%								
2	0.2611	2.05%								
5	0.6899	2.59%								
8	1.0936	0.71%								
10	1.3713	0.28%								

Client:	CalPortland	**Analysis Date:**	12/6/2023							
Facility:	Redding	**Analysis Location:**	Elmhurst Lab							
Test Location:	Kiln-Mill Off	**Analyst:**	JMG							
Project Number:	M234605									
Method:	26A									
Date Samples Received:	11/21/2023									
Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**						
1	0.1264	0.1264	**0.97**	**0.1308**						
2	0.2504	0.1252	**1.92**							
5	0.6542	0.1308	**5.00**	**Response Factor Ave**						
8	1.0781	0.1348	**8.25**	**0.1307**						
10	1.3636	0.1364	**10.43**							
Lot Number	Ricca 8209004									
	R^2	**0.9997**								
Sample Number	**Sample Date**	**Sample ID**	**Sample Area**	**PPM Cl**	**PPM X Dilution Factor**	**Dilution Factor**	**Total ml**	**mg Cl in soln**	**mg Cl2 in soln avg**	**ug Cl2 in soln**
031	11/14/2023	DI Reagent Blank	0.0025	0.0191	0.0191	1	200	0.0038		
031	11/14/2023	DI Reagent Blank	0.0005	0.0038	0.0038	1	200	0.0008	**0.0023**	**2.294394956**
030	11/14/2023	NaOH Reagent Blank	0.0103	0.0788	0.0788	1	200	0.0158		
030	11/14/2023	NaOH Reagent Blank	0.0107	0.0818	0.0818	1	200	0.0164	**0.0161**	**16.06076469**
008	11/14/2023	Test 1B NaOH Imp	0.0047	0.0359	0.0359	1	274	0.0098		
008	11/14/2023	Test 1B NaOH Imp	0.0055	0.0421	0.0421	1	274	0.0115	**0.0107**	**10.68729171**
008	11/14/2023	Test 1B NaOH Imp	0.0058	0.0444	0.0444	1	274	0.0122		
008	11/14/2023	Test 1B NaOH Imp	0.0069	0.0528	0.0528	1	274	0.0145	**0.0133**	**13.30672595**
010	11/14/2023	Test 2B NaOH Imp	0.0043	0.0329	0.0329	1	255	0.0084		
010	11/14/2023	Test 2B NaOH Imp	0.0050	0.0382	0.0382	1	255	0.0098	**0.0091**	**9.068596065**
012	11/14/2023	Test 3B NaOH Imp	0.0020	0.0153	0.0153	1	277	0.0042		
012	11/14/2023	Test 3B NaOH Imp	0.0037	0.0283	0.0283	1	277	0.0078	**0.0060**	**6.037700327**
028	11/14/2023	Train B Train Blank	0.0163	0.1247	0.1247	1	279	0.0348		
028	11/14/2023	Train B Train Blank	0.0157	0.1201	0.1201	1	279	0.0335	**0.0341**	**34.14059695**
CCV ppm Cl	**Area**	**PPM Cl**								
5 ppm ICV	0.6732	5.1486								
5 ppm CCV	0.6685	5.1127								
5 ppm CCV	0.6758	5.1685								
5 ppm CCV	0.6739	5.1540								
Standard ppm Cl	**Area**	**Difference**								
1	0.1378	4.14%								
2	0.2611	2.05%								
5	0.6899	2.59%								
8	1.0936	0.71%								
10	1.3713	0.28%								

Appendix F - Reference Method Test Data

Client:	CalPortland Company, Inc.														
Facility:	Redding Cement Plant														
Test Location:	Kiln Stack														
Project #:	M234605														
Test Method:	26A														
Test Engineer:	TRY														
Test Technician:	KLJ														
	Run 1A					**Run 2A**						**Run 3A**			
Temp ID:	CM45					CM45						CM45			
Meter ID:	CM45					CM45						CM45			
Pitot ID:	S8-031A					S8-031A						S8-031A			
Nozzle Diameter (Inches):	0.247					0.247						0.247			
Meter Calibration Date:	10/25/2023					10/25/2023						10/25/2023			
Meter Calibration Factor (Y):	0.992					0.992						0.992			
Meter Orifice Setting (Delta H):	1.729					1.729						1.729			
Nozzle Kit ID Number and Material:	Glass					Glass						Glass			
	Leak Checks														
Pre Pitot Leak Check	**0.0**	**@**	**3.5**	**"H_2O**		**0.0**	**@**	**4.0**	**"H_2O**			**0.0**	**@**	**4.5**	**"H_2O**
Post Pitot Leak Check	**0.0**	**@**	**4.2**	**"H_2O**		**0.0**	**@**	**5.2**	**"H_2O**			**0.0**	**@**	**5.0**	**"H_2O**
Pre Nozzle Leak Check	**0.0000**	**@**	**13**	**"Hg**		**0.0000**	**@**	**16**	**"Hg**			**0.0000**	**@**	**16**	**"Hg**
Post Nozzle Leak Check	**0.0000**	**@**	**10**	**"Hg**		**0.0000**	**@**	**12**	**"Hg**			**0.0000**	**@**	**10**	**"Hg**
Pitot Tube Coefficient:	0.820														
Probe Length (Feet):	8.0														
Probe Liner Material:	Glass														
Sample Plane:	Horizontal														
Port Length (Inches):	12.00														
Port Size (Diameter, Inches):	4.00														
Port Type:	Nipple														
Duct Shape:	Circular														
Diameter (Feet):	7														
Duct Area (Square Feet):	38.485														
Upstream Diameters:	16.0														
Downstream Diameters:	11.0														
Number of Ports Sampled:	2														
Number of Points per Port:	6														
Minutes per Point:	5.0														
Minutes per Reading:	5.0														
Total Number of Traverse Points:	12														
Test Length (Minutes):	60														
Train Type:	Anderson Box														
Source Condition:	Mill On														
Diluent Model/Serial Number:	CAI 700/221018														
Moisture Balance ID:	LV3														
# of Runs	3														

Run 1A - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 8:00**

Test Location: Kiln Stack | **End Time: 9:05**

Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	4.19	in. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	56.8	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.387	in. H_2O	Carbon Dioxide:	13.40	%
Stack Temperature, Ts:	231.4	°F	Oxygen:	12.70	%
Meter Volume, Vm:	70.975	ft^3	Nitrogen:	73.90	%
Meter Volume, Vmstd:	71.022	dscf	Gas Weight dry, Md:	30.652	lb/lb mole
Meter Volume, Vwstd:	8.737	wscf	Gas Weight wet, Ms:	29.266	lb/lb mole
Isokinetic Variance:	102.3	%I	Excess Air:	---	%
			Gas Velocity, Vs:	87.486	fps
Test Length:	60.00	in mins.	Volumetric Flow:	202,011	acfm
Nozzle Diameter:	0.247	in inches	Volumetric Flow:	133,928	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	150,404	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3555.7	ml	Silica Initial Wt.	885.6	grams
Final Impinger Content:	3724.4	ml	Silica Final Wt.	902.4	grams
Impinger Difference:	168.7	ml	Silica Difference:	16.8	grams

Total Water Gain: 185.5 Moisture, Bws: 0.110

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	8:00:00	2.20	4.80	106.232	232	55	54	6	256	254	54
1-2	8:05:00	1.90	4.10	112.530	232	56	55	6	252	254	48
1-3	8:10:00	2.00	4.30	118.390	233	55	55	5	253	252	50
1-4	8:15:00	1.90	4.10	124.390	233	56	55	6	254	254	56
1-5	8:20:00	1.80	3.90	130.250	232	56	55	5	256	253	58
1-6	8:25:00	1.80	3.90	135.960	231	56	56	6	254	256	59
	8:30:00			141.672							
2-1	8:35:00	1.90	4.20	141.672	232	59	57	6	254	255	54
2-2	8:40:00	2.00	4.40	147.560	232	58	57	5	256	256	56
2-3	8:45:00	1.80	3.90	153.600	231	59	57	5	253	255	57
2-4	8:50:00	1.80	3.90	159.340	230	59	58	7	257	255	59
2-5	8:55:00	2.10	4.60	165.090	230	60	57	7	255	252	58
2-6	9:00:00	1.90	4.20	171.290	229	59	58	7	253	254	56
	9:05:00			177.207							
Total	1:00:00			70.975		57.3	56.2				
Average			4.19		231.4	56.8		6			
Min			3.90		229.0	54.0		5			
Max			4.80		233.0	60.0		7			

Impinger Weight Sheet - Run 1A

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	794.1	746.5	47.6
0.1N H2SO4	819.2	744.5	74.7
Empty	684.8	655.5	29.3
0.1N NaOH	707.5	694.1	13.4
0.1N NaOH	718.8	715.1	3.7
Silica Gel	902.4	885.6	16.8

Liquid Final	Liquid Initial	Liquid Gain
3,724.4	3,555.7	168.7

Silica Final	Silica Initial	Silica Gain
902.4	885.6	16.8

Run 2A - Method 26A

Client: CalPortland Company, Inc. | **Date:** 11/14/23
Facility: Redding Cement Plant | **Start Time:** 9:25
Test Location: Kiln Stack | **End Time:** 10:29
Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	4.21	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	60.5	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.381	In. H_2O	Carbon Dioxide:	13.70	%
Stack Temperature, Ts:	230.2	°F	Oxygen:	12.50	%
Meter Volume, Vm:	71.242	ft^3	Nitrogen:	73.8	%
Meter Volume, Vmstd:	70.778	dscf	Gas Weight dry, Md:	30.692	lb/lb mole
Meter Volume, Vwstd:	9.142	wscf	Gas Weight wet, Ms:	29.240	lb/lb mole
Isokinetic Variance:	102.8	%I	Excess Air:	---	%
			Gas Velocity, Vs:	87.073	fps
Test Length:	60.00	in mins.	Volumetric Flow:	201,058	acfm
Nozzle Diameter:	0.247	in inches	Volumetric Flow:	132,811	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	149,966	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3566.1	ml	Silica Initial Wt.	893.9	grams
Final Impinger Content:	3736.8	ml	Silica Final Wt.	917.3	grams
Impinger Difference:	170.7	ml	Silica Difference:	23.4	grams

Total Water Gain: 194.1 Moisture, Bws: 0.114

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	9:25:00	2.10	4.60	77.581	229	59	57	6	256	256	54
1-2	9:30:00	1.90	4.20	83.790	230	60	59	6	254	254	53
1-3	9:35:00	2.00	4.40	89.700	230	61	59	5	256	255	54
1-4	9:40:00	1.80	3.90	95.780	232	61	58	6	255	256	52
1-5	9:45:00	1.80	4.00	101.530	231	60	60	6	253	256	53
1-6	9:50:00	1.90	4.20	107.290	230	60	60	6	254	256	55
	9:55:00			113.209							
2-1	9:59:00	1.80	4.00	113.209	230	62	60	7	253	254	57
2-2	10:04:00	1.80	4.00	118.980	229	61	61	7	254	255	58
2-3	10:09:00	1.90	4.20	124.760	230	62	60	5	256	255	61
2-4	10:14:00	2.10	4.60	130.700	230	62	62	5	257	257	58
2-5	10:19:00	2.00	4.40	136.950	231	63	62	5	251	253	56
2-6	10:24:00	1.80	4.00	143.050	230	62	61	6	254	254	53
	10:29:00			148.823							
Total	1:00:00			71.242		61.1	59.9				
Average			4.21		230.2	60.5		6			
Min			3.90		229.0	57.0		5			
Max			4.60		232.0	63.0		7			

Impinger Weight Sheet - Run 2A

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	795.5	765.5	30.0
0.1N H2SO4	735.6	663.8	71.8
Empty	683.6	648.2	35.4
0.1N NaOH	777.5	754.9	22.6
0.1N NaOH	744.6	733.7	10.9
Silica Gel	917.3	893.9	23.4

3,736.8	3,566.1	170.7
Liquid Final	**Liquid Initial**	**Liquid Gain**
917.3	893.9	23.4
Silica Final	**Silica Initial**	**Silica Gain**

Run 3A - Method 26A

Client: CalPortland Company, Inc. | **Date:** 11/14/23
Facility: Redding Cement Plant | **Start Time:** 10:50
Test Location: Kiln Stack | **End Time:** 11:55
Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	4.11	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	63.4	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.369	In. H_2O	Carbon Dioxide:	13.80	%
Stack Temperature, Ts:	229.7	°F	Oxygen:	12.50	%
Meter Volume, Vm:	71.113	ft^3	Nitrogen:	73.7	%
Meter Volume, Vmstd:	70.239	dscf	Gas Weight dry, Md:	30.708	lb/lb mole
Meter Volume, Vwstd:	8.789	wscf	Gas Weight wet, Ms:	29.295	lb/lb mole
Isokinetic Variance:	102.6	%I	Excess Air:	---	%
			Gas Velocity, Vs:	86.208	fps
Test Length:	60.00	in mins.	Volumetric Flow:	199,061	acfm
Nozzle Diameter:	0.247	in inches	Volumetric Flow:	132,060	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	148,584	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3569.7	ml	Silica Initial Wt.	881.1	grams
Final Impinger Content:	3737.4	ml	Silica Final Wt.	900.0	grams
Impinger Difference:	167.7	ml	Silica Difference:	18.9	grams

Total Water Gain: 186.6 Moisture, Bws: 0.111

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:50:00	1.90	4.20	49.325	230	64	62	6	253	255	53
1-2	10:55:00	2.10	4.10	55.290	229	63	62	5	255	254	51
1-3	11:00:00	1.80	4.00	61.550	230	63	62	6	252	257	52
1-4	11:05:00	2.00	4.40	67.350	230	63	63	6	254	256	52
1-5	11:10:00	1.80	4.00	73.460	229	64	62	6	256	252	54
1-6	11:15:00	1.90	4.20	79.270	229	64	63	6	254	251	57
	11:20:00			85.242							
2-1	11:25:00	1.80	4.00	85.242	229	65	62	6	255	256	59
2-2	11:30:00	1.80	4.00	91.050	230	66	62	5	253	254	61
2-3	11:35:00	1.90	4.20	96.860	230	65	63	6	254	255	60
2-4	11:40:00	1.90	4.20	102.840	231	65	63	6	256	257	58
2-5	11:45:00	1.80	4.00	108.810	230	64	63	7	255	256	54
2-6	11:50:00	1.80	4.00	114.620	229	65	64	6	257	253	56
	11:55:00			120.438							
Total	1:00:00			71.113		64.3	62.6				
Average			4.11		229.7	63.4		6			
Min			4.00		229.0	62.0		5			
Max			4.40		231.0	66.0		7			

Impinger Weight Sheet - Run 3A

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	822.3	740.0	82.3
0.1N H2SO4	815.4	754.2	61.2
Empty	669.5	654.2	15.3
0.1N NaOH	729.3	720.7	8.6
0.1N NaOH	700.9	700.6	0.3
Silica Gel	900.0	881.1	18.9

Liquid Final	Liquid Initial	Liquid Gain
3,737.4	3,569.7	167.7

Silica Final	Silica Initial	Silica Gain
900.0	881.1	18.9

Client:	CalPortland Company, Inc.														
Facility:	Redding Cement Plant														
Test Location:	Kiln Stack														
Project #:	M234605														
Test Method:	26A														
Test Engineer:	CLC														
Test Technician:	KLJ														
	Run 1B				**Run 2B**				**Run 3B**			
Temp ID:	CM18				CM18				CM18			
Meter ID:	CM18				CM18				CM18			
Pitot ID:	S8-032A				S8-032A				S8-032A			
Nozzle Diameter (Inches):	0.251				0.251				0.251			
Meter Calibration Date:	10/17/2023				10/17/2023				10/17/2023			
Meter Calibration Factor (Y):	0.987				0.987				0.987			
Meter Orifice Setting (Delta H):	1.533				1.533				1.533			
Nozzle Kit ID Number and Material:	Glass				Glass				Glass			
	Leak Checks											
Pre Pitot Leak Check	**0.0**	**@**	**3.2**	**"H_2O**	**0.0**	**@**	**4.3**	**"H_2O**	**0.0**	**@**	**4.3**	**"H_2O**
Post Pitot Leak Check	**0.0**	**@**	**3.5**	**"H_2O**	**0.0**	**@**	**4.2**	**"H_2O**	**0.0**	**@**	**3.8**	**"H_2O**
Pre Nozzle Leak Check	**0.0000**	**@**	**15**	**"Hg**	**0.0000**	**@**	**14**	**"Hg**	**0.0000**	**@**	**13**	**"Hg**
Post Nozzle Leak Check	**0.0000**	**@**	**16**	**"Hg**	**0.0000**	**@**	**8**	**"Hg**	**0.0000**	**@**	**16**	**"Hg**
Pitot Tube Coefficient:	0.822											
Probe Length (Feet):	8.0											
Probe Liner Material:	Glass											
Sample Plane:	Horizontal											
Port Length (Inches):	12.00											
Port Size (Diameter, Inches):	4.00											
Port Type:	Nipple											
Duct Shape:	Circular											
Diameter (Feet):	7											
Duct Area (Square Feet):	38.485											
Upstream Diameters:	16.0											
Downstream Diameters:	11.0											
Number of Ports Sampled:	2											
Number of Points per Port:	6											
Minutes per Point:	5.0											
Minutes per Reading:	5.0											
Total Number of Traverse Points:	12											
Test Length (Minutes):	60											
Train Type:	Anderson Box											
Source Condition:	Mill On											
Diluent Model/Serial Number:	CAI 700/221018											
Moisture Balance ID:	LV3											
# of Runs	3											

Run 1B - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 8:00**

Test Location: Kiln Stack | **End Time: 9:05**

Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	4.03	in. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	60.0	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.384	in. H_2O	Carbon Dioxide:	13.40	%
Stack Temperature, Ts:	231.3	°F	Oxygen:	12.70	%
Meter Volume, Vm:	74.178	ft^3	Nitrogen:	73.90	%
Meter Volume, Vmstd:	73.356	dscf	Gas Weight dry, Md:	30.652	lb/lb mole
Meter Volume, Vwstd:	9.161	wscf	Gas Weight wet, Ms:	29.247	lb/lb mole
Isokinetic Variance:	102.4	%I	Excess Air:	---	%
			Gas Velocity, Vs:	87.542	fps
Test Length:	60.00	in mins.	Volumetric Flow:	202,140	acfm
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	133,824	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	150,536	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3513.0	ml	Silica Initial Wt.	859.1	grams
Final Impinger Content:	3686.1	ml	Silica Final Wt.	880.5	grams
Impinger Difference:	173.1	ml	Silica Difference:	21.4	grams
Total Water Gain:	194.5		Moisture, Bws:	0.111	

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	8:00:00	2.10	4.40	44.126	232	58	57	5	253	251	55
1-2	8:05:00	2.00	4.20	50.570	232	58	57	5	252	250	41
1-3	8:10:00	1.80	3.80	56.860	232	60	58	5	252	251	48
1-4	8:15:00	2.00	4.20	62.840	232	62	58	7	252	251	55
1-5	8:20:00	1.90	4.00	69.160	231	63	58	7	252	251	56
1-6	8:25:00	1.80	3.80	75.330	230	63	58	7	251	252	58
	8:30:00			81.307							
2-1	8:35:00	1.80	3.80	81.307	232	62	58	7	251	252	58
2-2	8:40:00	1.90	4.00	87.560	232	62	58	7	251	250	59
2-3	8:45:00	1.90	4.00	93.450	231	63	58	7	251	250	59
2-4	8:50:00	1.80	3.80	99.600	231	63	60	6	255	253	58
2-5	8:55:00	2.00	4.20	105.450	230	63	59	5	253	254	57
2-6	9:00:00	2.00	4.20	111.900	230	64	61	6	254	251	60
	9:05:00			118.304							
Total	1:00:00			74.178		61.8	58.3				
Average			4.03		231.3	60.0		6			
Min			3.80		230.0	57.0		5			
Max			4.40		232.0	64.0		7			

Impinger Weight Sheet - Run 1B

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	775.0	709.0	66.0
0.1N H2SO4	811.5	740.5	71.0
Empty	642.8	627.9	14.9
0.1N NaOH	696.8	683.4	13.4
0.1N NaOH	760.0	752.2	7.8
Silica Gel	880.5	859.1	21.4
	3,686.1	3,513.0	173.1
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	880.5	859.1	21.4
	Silica Final	**Silica Initial**	**Silica Gain**

Run 2B - Method 26A

Client: CalPortland Company, Inc. | **Date:** 11/14/23
Facility: Redding Cement Plant | **Start Time:** 9:25
Test Location: Kiln Stack | **End Time:** 10:29
Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	4.08	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	65.0	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.384	In. H_2O	Carbon Dioxide:	13.70	%
Stack Temperature, Ts:	230.4	°F	Oxygen:	12.50	%
Meter Volume, Vm:	75.030	ft^3	Nitrogen:	73.8	%
Meter Volume, Vmstd:	73.501	dscf	Gas Weight dry, Md:	30.692	lb/lb mole
Meter Volume, Vwstd:	8.954	wscf	Gas Weight wet, Ms:	29.314	lb/lb mole
Isokinetic Variance:	102.4	%I	Excess Air:	---	%
			Gas Velocity, Vs:	87.390	fps
Test Length:	60.00	in mins.	Volumetric Flow:	201,789	acfm
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	134,118	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	150,456	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3629.4	ml	Silica Initial Wt.	869.4	grams
Final Impinger Content:	3800.5	ml	Silica Final Wt.	888.4	grams
Impinger Difference:	171.1	ml	Silica Difference:	19.0	grams

Total Water Gain: 190.1 Moisture, Bws: 0.109

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	9:25:00	2.10	4.45	18.870	230	62	60	5	251	250	55
1-2	9:30:00	1.80	3.80	25.350	230	64	61	5	250	250	56
1-3	9:35:00	2.00	4.20	31.350	230	66	61	5	252	250	56
1-4	9:40:00	1.90	4.00	37.700	230	68	62	5	251	251	57
1-5	9:45:00	1.80	3.80	43.950	231	68	62	5	251	250	58
1-6	9:50:00	2.00	4.30	50.500	231	68	62	5	250	250	60
	9:55:00			56.448							
2-1	9:59:00	1.90	4.00	56.448	230	68	62	5	251	250	60
2-2	10:04:00	1.80	3.90	62.620	230	69	63	5	251	250	61
2-3	10:09:00	1.80	3.90	68.750	231	69	63	5	250	250	61
2-4	10:14:00	2.00	4.30	74.820	231	70	64	5	251	250	62
2-5	10:19:00	2.00	4.30	81.200	230	70	64	5	251	251	62
2-6	10:24:00	1.90	4.00	87.620	231	71	64	5	250	250	63
	10:29:00			93.900							
Total	1:00:00			75.030		67.8	62.3				
Average			4.08		230.4	65.0		5			
Min			3.80		230.0	60.0		5			
Max			4.45		231.0	71.0		5			

Impinger Weight Sheet - Run 2B

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	805.5	754.3	51.2
0.1N H2SO4	802.4	754.2	48.2
Empty	681.5	645.4	36.1
0.1N NaOH	769.5	744.7	24.8
0.1N NaOH	741.6	730.8	10.8
Silica Gel	888.4	869.4	19.0
	3,800.5	3,629.4	171.1
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	888.4	869.4	19.0
	Silica Final	**Silica Initial**	**Silica Gain**

Run 3B - Method 26A

Client: CalPortland Company, Inc. | **Date:** 11/14/23
Facility: Redding Cement Plant | **Start Time:** 10:50
Test Location: Kiln Stack | **End Time:** 11:55
Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	4.02	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	65.0	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.372	In. H_2O	Carbon Dioxide:	13.80	%
Stack Temperature, Ts:	230.5	°F	Oxygen:	12.50	%
Meter Volume, Vm:	74.355	ft^3	Nitrogen:	73.7	%
Meter Volume, Vmstd:	72.840	dscf	Gas Weight dry, Md:	30.708	lb/lb mole
Meter Volume, Vwstd:	8.869	wscf	Gas Weight wet, Ms:	29.329	lb/lb mole
Isokinetic Variance:	102.3	%I	Excess Air:	---	%
			Gas Velocity, Vs:	86.619	fps
Test Length:	60.00	in mins.	Volumetric Flow:	200,009	acfm
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	132,926	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	149,111	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3510.3	ml	Silica Initial Wt.	880.0	grams
Final Impinger Content:	3682.7	ml	Silica Final Wt.	895.9	grams
Impinger Difference:	172.4	ml	Silica Difference:	15.9	grams

Total Water Gain: 188.3 Moisture, Bws: 0.109

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:50:00	1.80	3.80	94.365	230	62	62	5	250	251	41
1-2	10:55:00	2.00	4.30	100.350	230	64	62	5	250	250	44
1-3	11:00:00	1.90	4.00	106.756	230	66	63	6	251	250	46
1-4	11:05:00	1.90	4.00	112.980	231	67	63	7	251	251	48
1-5	11:10:00	2.00	4.30	119.200	231	67	63	7	252	251	49
1-6	11:15:00	1.80	3.90	125.580	231	68	64	7	251	251	50
	11:20:00			131.660							
2-1	11:25:00	1.90	4.00	131.660	230	66	63	5	250	250	51
2-2	11:30:00	1.80	3.85	137.880	230	66	63	6	251	250	52
2-3	11:35:00	1.80	3.85	143.940	231	67	64	7	251	251	54
2-4	11:40:00	2.00	4.30	150.000	231	68	64	7	250	250	55
2-5	11:45:00	1.80	3.80	156.400	230	69	64	7	251	250	56
2-6	11:50:00	1.90	4.10	162.450	231	69	65	7	251	251	58
	11:55:00			168.720							
Total	1:00:00			74.355		66.6	63.3	5.0			
Average			4.02		230.5	65.0		6			
Min			3.80		230.0	62.0		5			
Max			4.30		231.0	69.0		7			

Impinger Weight Sheet - Run 3B

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	797.3	706.3	91.0
0.1N H2SO4	802.8	751.6	51.2
Empty	638.0	629.2	8.8
0.1N NaOH	674.6	661.6	13.0
0.1N NaOH	770.0	761.6	8.4
Silica Gel	895.9	880.0	15.9
	3,682.7	3,510.3	172.4
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	895.9	880.0	15.9
	Silica Final	**Silica Initial**	**Silica Gain**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Run 1

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN1_000201.LAB	8:00	11.64	11.81	0.85	0.10	191.29	0.98	12.56
RUN1_000202.LAB	8:01	11.53	11.69	0.88	0.10	191.18	0.98	12.62
RUN1_000203.LAB	8:02	11.78	11.93	0.84	0.10	191.03	0.98	12.56
RUN1_000204.LAB	8:03	11.64	11.79	0.82	0.10	190.90	0.98	12.67
RUN1_000205.LAB	8:04	11.55	11.70	0.88	0.10	190.77	0.98	12.72
RUN1_000206.LAB	8:05	11.67	11.71	0.85	0.10	190.70	0.98	12.69
RUN1_000207.LAB	8:06	11.87	12.01	0.78	0.10	190.66	0.98	12.60
RUN1_000208.LAB	8:07	11.43	11.97	0.86	0.10	190.36	0.98	12.58
RUN1_000209.LAB	8:08	11.79	11.99	0.85	0.10	190.07	0.98	12.63
RUN1_000210.LAB	8:09	11.76	12.07	0.90	0.10	189.97	0.98	12.53
RUN1_000211.LAB	8:10	11.98	12.11	0.67	0.10	190.32	0.98	12.49
RUN1_000212.LAB	8:11	11.75	11.92	0.81	0.10	190.99	0.98	12.55
RUN1_000213.LAB	8:12	11.81	11.98	0.82	0.10	191.31	0.98	12.60
RUN1_000214.LAB	8:13	11.94	11.92	0.75	0.10	191.28	0.98	12.65
RUN1_000215.LAB	8:14	11.92	11.78	0.71	0.10	191.09	0.98	12.61
RUN1_000216.LAB	8:15	11.84	11.65	0.83	0.10	190.98	0.98	12.73
RUN1_000217.LAB	8:16	11.84	11.61	0.74	0.10	190.86	0.98	12.77
RUN1_000218.LAB	8:17	11.52	11.49	0.77	0.10	190.69	0.98	12.79
RUN1_000219.LAB	8:18	11.36	11.60	0.83	0.10	190.65	0.98	12.84
RUN1_000220.LAB	8:19	11.88	11.97	0.66	0.10	190.62	0.98	12.78
RUN1_000221.LAB	8:20	11.59	12.08	0.81	0.10	190.32	0.98	12.58
RUN1_000222.LAB	8:21	11.58	12.03	0.74	0.10	190.06	0.98	12.54
RUN1_000223.LAB	8:22	11.40	12.10	0.78	0.10	190.00	0.98	12.51
RUN1_000224.LAB	8:23	10.92	11.76	0.80	0.10	190.43	0.98	12.50
RUN1_000225.LAB	8:24	10.98	11.50	0.80	0.10	191.05	0.98	12.75
RUN1_000226.LAB	8:25	11.10	11.73	0.81	0.10	191.29	0.98	12.83
RUN1_000227.LAB	8:26	11.00	11.93	0.83	0.10	191.25	0.98	12.78
RUN1_000228.LAB	8:27	10.82	11.88	0.84	0.10	191.08	0.98	12.69
RUN1_000229.LAB	8:28	10.78	11.94	0.81	0.10	190.82	0.98	12.70
RUN1_000230.LAB	8:29	10.81	12.33	0.78	0.10	190.71	0.98	12.60
RUN1_000231.LAB	8:30	10.83	12.47	0.82	0.10	190.57	0.98	12.56
RUN1_000232.LAB	8:31	10.99	12.50	0.82	0.10	190.53	0.98	12.42
RUN1_000233.LAB	8:32	11.25	12.37	0.83	0.10	190.38	0.98	12.37
RUN1_000234.LAB	8:33	11.31	12.14	0.84	0.10	190.18	0.98	12.34
RUN1_000235.LAB	8:34	11.31	11.93	0.78	0.10	190.07	0.98	12.40
RUN1_000236.LAB	8:35	11.42	11.97	0.68	0.10	190.08	0.98	12.53
RUN1_000237.LAB	8:36	11.48	12.19	0.80	0.10	190.66	0.98	12.58
RUN1_000238.LAB	8:37	11.27	12.07	0.82	0.10	191.16	0.98	12.55
RUN1_000239.LAB	8:38	12.16	11.82	0.69	0.10	191.33	0.98	12.49
RUN1_000240.LAB	8:39	11.71	11.99	0.78	0.10	191.18	0.98	12.62
RUN1_000241.LAB	8:40	11.82	12.10	0.73	0.10	190.99	0.98	12.65
RUN1_000242.LAB	8:41	11.76	12.07	0.79	0.10	190.86	0.98	12.59
RUN1_000243.LAB	8:42	12.19	12.11	0.76	0.10	190.81	0.98	12.50
RUN1_000244.LAB	8:43	12.15	12.01	0.65	0.10	190.74	0.98	12.50
RUN1_000245.LAB	8:44	11.86	12.02	0.70	0.10	190.66	0.98	12.43
RUN1_000246.LAB	8:45	11.81	12.00	0.60	0.10	190.47	0.98	12.52
RUN1_000247.LAB	8:46	12.05	11.76	0.62	0.10	190.16	0.98	12.53
RUN1_000248.LAB	8:47	11.84	11.46	0.65	0.10	190.02	0.98	12.52
RUN1_000249.LAB	8:48	11.60	11.49	0.73	0.10	190.15	0.98	12.60
RUN1_000250.LAB	8:49	12.23	11.93	0.60	0.10	190.80	0.98	12.76
RUN1_000251.LAB	8:50	12.42	12.01	0.70	0.10	191.20	0.98	12.74
RUN1_000252.LAB	8:51	11.99	11.29	0.70	0.10	191.30	0.98	12.41
RUN1_000253.LAB	8:52	11.88	10.99	0.66	0.10	190.96	0.98	12.17
RUN1_000254.LAB	8:53	11.94	10.98	0.63	0.10	190.52	0.98	12.54
RUN1_000255.LAB	8:54	12.06	11.11	0.59	0.10	190.19	0.98	12.91
RUN1_000256.LAB	8:55	12.34	11.43	0.60	0.10	190.07	0.98	12.91
RUN1_000257.LAB	8:56	12.42	11.83	0.63	0.10	190.30	0.98	12.71
RUN1_000258.LAB	8:57	12.48	12.33	0.72	0.10	190.93	0.98	12.51
RUN1_000259.LAB	8:58	11.87	11.84	0.78	0.10	191.31	0.98	12.34
RUN1_000260.LAB	8:59	11.78	11.67	0.83	0.10	191.35	0.98	12.11
Average		**11.66**	**11.86**	**0.76**	**0.10**	**190.71**	**0.98**	**12.59**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Run 2

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN2_000334.LAB	9:25	11.95	12.5	0.65	0.10	190.4	0.98	12.29
RUN2_000335.LAB	9:26	12.25	12.2	0.65	0.10	190.1	0.98	12.33
RUN2_000336.LAB	9:27	12.21	12.0	0.60	0.10	190.0	0.98	12.40
RUN2_000337.LAB	9:28	11.79	12.1	0.73	0.10	190.4	0.98	12.44
RUN2_000338.LAB	9:29	11.86	11.9	0.63	0.10	191.0	0.98	12.42
RUN2_000339.LAB	9:30	11.59	12.0	0.83	0.10	191.2	0.98	12.48
RUN2_000340.LAB	9:31	11.62	11.9	0.78	0.10	191.2	0.98	12.54
RUN2_000341.LAB	9:32	11.36	11.9	0.88	0.10	191.1	0.98	12.57
RUN2_000342.LAB	9:33	11.36	11.9	0.84	0.10	190.9	0.98	12.53
RUN2_000343.LAB	9:34	11.31	11.8	0.76	0.10	190.8	0.98	12.58
RUN2_000344.LAB	9:35	11.24	11.9	0.77	0.10	190.7	0.98	12.58
RUN2_000345.LAB	9:36	11.08	12.1	0.77	0.10	190.6	0.98	12.54
RUN2_000346.LAB	9:37	11.30	12.2	0.80	0.10	190.6	0.98	12.51
RUN2_000347.LAB	9:38	10.88	12.3	0.82	0.10	190.5	0.98	12.46
RUN2_000348.LAB	9:39	10.96	12.3	0.80	0.10	190.3	0.98	12.40
RUN2_000349.LAB	9:40	11.44	12.3	0.79	0.10	190.1	0.98	12.33
RUN2_000350.LAB	9:41	11.50	12.3	0.75	0.10	190.0	0.98	12.34
RUN2_000351.LAB	9:42	11.18	12.4	0.81	0.10	190.2	0.98	12.37
RUN2_000352.LAB	9:43	11.66	12.0	0.86	0.10	190.9	0.98	12.36
RUN2_000353.LAB	9:44	11.57	11.7	0.77	0.10	191.3	0.98	12.47
RUN2_000354.LAB	9:45	11.07	11.6	0.86	0.10	191.3	0.98	12.59
RUN2_000355.LAB	9:46	11.21	11.7	0.83	0.10	191.2	0.98	12.74
RUN2_000356.LAB	9:47	11.85	12.0	0.70	0.10	191.0	0.98	12.66
RUN2_000357.LAB	9:48	11.61	12.2	0.80	0.10	190.9	0.98	12.42
RUN2_000358.LAB	9:49	11.63	12.1	0.82	0.10	190.8	0.98	12.28
RUN2_000359.LAB	9:50	11.81	12.2	0.76	0.10	190.7	0.98	12.34
RUN2_000360.LAB	9:51	11.39	12.5	0.77	0.10	190.5	0.98	12.31
RUN2_000361.LAB	9:52	11.48	12.6	0.80	0.10	190.3	0.98	12.22
RUN2_000362.LAB	9:53	11.72	12.4	0.69	0.10	190.1	0.98	12.25
RUN2_000363.LAB	9:54	12.03	12.3	0.62	0.10	190.1	0.98	12.18
RUN2_000364.LAB	9:55	11.50	12.5	0.84	0.10	190.4	0.98	12.30
RUN2_000365.LAB	9:56	11.27	12.4	0.86	0.10	190.9	0.98	12.34
RUN2_000366.LAB	9:57	11.71	12.1	0.81	0.10	191.2	0.98	12.27
RUN2_000367.LAB	9:58	11.35	12.1	0.84	0.10	191.2	0.98	12.31
RUN2_000368.LAB	9:59	11.22	12.0	0.83	0.10	191.1	0.98	12.42
RUN2_000369.LAB	10:00	11.45	11.9	0.77	0.10	190.9	0.98	12.44
RUN2_000370.LAB	10:01	11.03	12.0	0.85	0.10	190.8	0.98	12.47
RUN2_000371.LAB	10:02	10.84	12.1	0.84	0.10	190.7	0.98	12.57
RUN2_000372.LAB	10:03	11.22	12.1	0.81	0.10	190.5	0.98	12.57
RUN2_000373.LAB	10:04	11.58	12.1	0.68	0.10	190.2	0.98	12.53
RUN2_000374.LAB	10:05	11.17	12.2	0.73	0.10	190.1	0.98	12.48
RUN2_000375.LAB	10:06	11.28	12.2	0.79	0.10	190.2	0.98	12.42
RUN2_000376.LAB	10:07	11.52	12.4	0.86	0.10	190.8	0.98	12.38
RUN2_000377.LAB	10:08	11.68	12.5	0.77	0.10	191.2	0.98	12.39
RUN2_000378.LAB	10:09	11.57	12.2	0.85	0.10	191.3	0.98	12.36
RUN2_000379.LAB	10:10	11.55	12.2	0.82	0.10	191.2	0.98	12.23
RUN2_000380.LAB	10:11	11.25	12.3	0.87	0.10	191.1	0.98	12.28
RUN2_000381.LAB	10:12	11.62	12.1	0.81	0.10	191.0	0.98	12.37
RUN2_000382.LAB	10:13	11.04	12.2	0.83	0.10	190.8	0.98	12.31
RUN2_000383.LAB	10:14	11.63	12.1	0.80	0.10	190.5	0.98	12.41
RUN2_000384.LAB	10:15	11.72	12.2	0.77	0.10	190.2	0.98	12.44
RUN2_000385.LAB	10:16	11.72	12.3	0.77	0.10	190.2	0.98	12.34
RUN2_000386.LAB	10:17	11.54	12.2	0.83	0.10	190.8	0.98	12.32
RUN2_000387.LAB	10:18	12.03	12.2	0.78	0.10	191.2	0.98	12.30
RUN2_000388.LAB	10:19	12.31	12.2	0.75	0.10	191.3	0.98	12.21
RUN2_000389.LAB	10:20	12.35	12.2	0.73	0.10	191.2	0.98	12.29
RUN2_000390.LAB	10:21	11.82	12.5	0.81	0.10	191.0	0.98	12.26
RUN2_000391.LAB	10:22	12.38	12.4	0.71	0.10	190.9	0.98	12.22
RUN2_000392.LAB	10:23	11.95	12.4	0.71	0.10	190.8	0.98	12.20
RUN2_000393.LAB	10:24	11.75	12.3	0.82	0.10	190.7	0.98	12.13
Average		**11.55**	**12.16**	**0.78**	**0.10**	**190.73**	**0.98**	**12.39**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Run 3

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN3_000453.LAB	10:50	11.74	12.2	0.74	0.10	190.2	0.98	12.27
RUN3_000454.LAB	10:51	11.39	12.4	0.77	0.10	190.1	0.98	12.24
RUN3_000455.LAB	10:52	11.47	12.4	0.84	0.10	190.3	0.98	12.23
RUN3_000456.LAB	10:53	11.67	12.3	0.80	0.10	190.9	0.98	12.32
RUN3_000457.LAB	10:54	11.67	12.1	0.80	0.10	191.3	0.98	12.45
RUN3_000458.LAB	10:55	11.05	12.1	0.90	0.10	191.3	0.98	12.49
RUN3_000459.LAB	10:56	11.22	11.7	0.85	0.10	191.1	0.98	12.68
RUN3_000460.LAB	10:57	11.17	11.7	0.87	0.10	191.0	0.98	12.65
RUN3_000461.LAB	10:58	11.04	11.8	0.85	0.10	190.9	0.98	12.61
RUN3_000462.LAB	10:59	10.82	11.9	0.86	0.10	190.8	0.98	12.62
RUN3_000463.LAB	11:00	11.13	12.0	0.82	0.10	190.7	0.98	12.58
RUN3_000464.LAB	11:01	10.79	12.2	0.85	0.10	190.5	0.98	12.46
RUN3_000465.LAB	11:02	11.36	12.2	0.83	0.10	190.5	0.97	12.46
RUN3_000466.LAB	11:03	10.75	12.2	0.84	0.10	190.5	0.98	12.46
RUN3_000467.LAB	11:04	10.24	12.2	0.85	0.10	190.3	0.98	12.47
RUN3_000468.LAB	11:05	10.60	12.2	0.86	0.10	190.1	0.98	12.45
RUN3_000469.LAB	11:06	11.15	12.3	0.76	0.10	190.1	0.98	12.45
RUN3_000470.LAB	11:07	12.26	12.4	0.63	0.10	190.5	0.97	12.27
RUN3_000471.LAB	11:08	12.10	12.4	0.73	0.10	191.1	0.97	12.20
RUN3_000472.LAB	11:09	12.63	12.2	0.73	0.10	191.3	0.97	12.34
RUN3_000473.LAB	11:10	12.46	12.1	0.76	0.10	191.3	0.97	12.40
RUN3_000474.LAB	11:11	12.41	12.1	0.73	0.10	191.1	0.97	12.45
RUN3_000475.LAB	11:12	12.89	11.9	0.71	0.10	191.0	0.97	12.44
RUN3_000476.LAB	11:13	12.32	12.1	0.73	0.10	190.9	0.97	12.45
RUN3_000477.LAB	11:14	12.18	12.0	0.71	0.10	190.9	0.98	12.38
RUN3_000478.LAB	11:15	11.67	12.0	0.87	0.10	190.8	0.98	12.46
RUN3_000479.LAB	11:16	11.30	12.0	0.83	0.10	190.7	0.98	12.55
RUN3_000480.LAB	11:17	11.03	12.0	0.79	0.10	190.7	0.98	12.58
RUN3_000481.LAB	11:18	10.94	12.0	0.91	0.10	190.7	0.98	12.60
RUN3_000482.LAB	11:19	11.00	12.0	0.85	0.10	190.6	0.98	12.54
RUN3_000483.LAB	11:20	10.61	12.1	0.86	0.10	190.6	0.98	12.55
RUN3_000484.LAB	11:21	10.57	12.4	0.86	0.10	190.6	0.98	12.56
RUN3_000485.LAB	11:22	10.61	12.4	0.88	0.10	190.6	0.97	12.44
RUN3_000486.LAB	11:23	10.63	12.4	0.85	0.10	190.5	0.98	12.44
RUN3_000487.LAB	11:24	10.54	12.5	0.87	0.10	190.6	0.98	12.44
RUN3_000488.LAB	11:25	10.49	12.4	0.91	0.10	190.5	0.97	12.37
RUN3_000489.LAB	11:26	10.74	12.4	0.84	0.10	190.6	0.97	12.38
RUN3_000490.LAB	11:27	10.89	12.6	0.86	0.10	190.6	0.97	12.41
RUN3_000491.LAB	11:28	11.21	12.3	0.83	0.10	190.5	0.97	12.29
RUN3_000492.LAB	11:29	11.37	12.4	0.90	0.10	190.5	0.97	12.35
RUN3_000493.LAB	11:30	11.29	12.4	0.82	0.10	190.5	0.97	12.29
RUN3_000494.LAB	11:31	11.48	12.5	0.84	0.10	190.5	0.97	12.25
RUN3_000495.LAB	11:32	11.79	12.4	0.80	0.10	190.5	0.97	12.16
RUN3_000496.LAB	11:33	11.87	12.4	0.67	0.10	190.6	0.97	12.19
RUN3_000497.LAB	11:34	11.86	12.5	0.74	0.10	190.6	0.97	12.30
RUN3_000498.LAB	11:35	11.86	12.1	0.70	0.10	190.6	0.97	12.32
RUN3_000499.LAB	11:36	12.12	12.0	0.69	0.10	190.6	0.97	12.31
RUN3_000500.LAB	11:37	12.12	12.2	0.74	0.10	190.6	0.97	12.45
RUN3_000501.LAB	11:38	12.13	12.4	0.71	0.10	190.6	0.97	12.40
RUN3_000502.LAB	11:39	11.87	12.6	0.77	0.10	190.6	0.97	12.31
RUN3_000503.LAB	11:40	11.80	12.6	0.80	0.10	190.6	0.97	12.20
RUN3_000504.LAB	11:41	11.83	12.4	0.81	0.10	190.6	0.97	12.14
RUN3_000505.LAB	11:42	11.92	12.6	0.71	0.10	190.6	0.97	12.23
RUN3_000506.LAB	11:43	12.04	12.3	0.70	0.10	190.6	0.97	12.27
RUN3_000507.LAB	11:44	11.97	12.3	0.71	0.10	190.6	0.97	12.20
RUN3_000508.LAB	11:45	11.78	12.2	0.65	0.10	190.6	0.97	12.29
RUN3_000509.LAB	11:46	11.88	12.3	0.71	0.10	190.6	0.97	12.32
RUN3_000510.LAB	11:47	11.70	12.1	0.85	0.10	190.7	0.97	12.35
RUN3_000511.LAB	11:48	11.42	12.0	0.90	0.10	190.7	0.97	12.33
RUN3_000512.LAB	11:49	11.49	12.3	0.86	0.10	190.8	0.97	12.36
Average		**11.47**	**12.23**	**0.80**	**0.10**	**190.66**	**0.97**	**12.39**

Client:	CalPortland Company, Inc.		
Facility:	Redding Cement Plant		
Test Location:	Kiln Stack		
Project #:	M234605		
Test Method:	26A		
Test Engineer:	TRY		
Test Technician:	CLC		
	Run 1A	**Run 2A**	**Run 3A**
Temp ID:	CM45	CM45	CM45
Meter ID:	CM45	CM45	CM45
Pitot ID:	S8-031A	S8-031A	S8-031A
Nozzle Diameter (Inches):	0.247	0.247	0.247
Meter Calibration Date:	10/25/2023	10/25/2023	10/25/2023
Meter Calibration Factor (Y):	0.992	0.992	0.992
Meter Orifice Setting (Delta H):	1.729	1.729	1.729
Nozzle Kit ID Number and Material:	Glass	Glass 0	Glass

Leak Checks

Pre Pitot Leak Check	**0.0**	**@**	**3.8**	**"H_2O**	**0.0**	**@**	**4.6**	**"H_2O**	**0.0**	**@**	**4.8**	**"H_2O**
Post Pitot Leak Check	**0.0**	**@**	**4.6**	**"H_2O**	**0.0**	**@**	**5.2**	**"H_2O**	**0.0**	**@**	**5.6**	**"H_2O**
Pre Nozzle Leak Check	**0.0000**	**@**	**15**	**"Hg**	**0.0000**	**@**	**18**	**"Hg**	**0.0000**	**@**	**15**	**"Hg**
Post Nozzle Leak Check	**0.0000**	**@**	**11**	**"Hg**	**0.0000**	**@**	**12**	**"Hg**	**0.0000**	**@**	**10**	**"Hg**

Pitot Tube Coefficient:	0.820
Probe Length (Feet):	8.0
Probe Liner Material:	Glass
Sample Plane:	Horizontal
Port Length (Inches):	12.00
Port Size (Diameter, Inches):	4.00
Port Type:	Nipple
Duct Shape:	Circular
Diameter (Feet):	7
Duct Area (Square Feet):	38.485
Upstream Diameters:	16.0
Downstream Diameters:	11.0
Number of Ports Sampled:	4
Number of Points per Port:	3
Minutes per Point:	5.0
Minutes per Reading:	5.0
Total Number of Traverse Points:	12
Test Length (Minutes):	60
Train Type:	Anderson Box
Source Condition:	Mill Off
Diluent Model/Serial Number:	CAI 700/221018
Moisture Balance ID:	LV3
# of Runs	3

Run 1A - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 12:50**

Test Location: Kiln Stack | **End Time: 13:55**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	3.58	in. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	70.1	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.319	in. H_2O	Carbon Dioxide:	16.20	%
Stack Temperature, Ts:	279.5	°F	Oxygen:	11.20	%
Meter Volume, Vm:	66.982	ft^3	Nitrogen:	72.60	%
Meter Volume, Vmstd:	65.240	dscf	Gas Weight dry, Md:	31.040	lb/lb mole
Meter Volume, Vwstd:	8.412	wscf	Gas Weight wet, Ms:	29.551	lb/lb mole
Isokinetic Variance:	103.2	%I	Excess Air:	---	%
			Gas Velocity, Vs:	85.662	fps
Test Length:	60.00	in mins.	Volumetric Flow:	197,799	acfm
Nozzle Diameter:	0.247	in inches	Volumetric Flow:	121,966	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	137,693	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3572.1	ml	Silica Initial Wt.	896.2	grams
Final Impinger Content:	3729.9	ml	Silica Final Wt.	917.0	grams
Impinger Difference:	157.8	ml	Silica Difference:	20.8	grams

Total Water Gain: 178.6 Moisture, Bws: 0.114

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	12:50:00	1.70	3.10	21.270	278	67	65	6	253	255	60
1-2	12:55:00	1.70	3.50	26.750	279	67	65	6	255	257	58
1-3	13:00:00	1.80	3.30	32.230	277	66	66	7	256	254	57
1-4	13:05:00	1.60	3.30	37.870	278	67	66	6	254	256	54
1-5	13:10:00	1.80	3.80	43.190	277	68	66	7	255	251	56
1-6	13:15:00	1.90	4.00	48.840	277	68	65	5	253	253	58
	13:20:00			54.648							
2-1	13:25:00	1.80	3.80	54.648	281	74	72	6	253	254	61
2-2	13:30:00	1.60	3.30	60.350	282	73	73	5	252	253	58
2-3	13:35:00	1.70	3.60	65.720	282	75	73	5	255	254	59
2-4	13:40:00	1.70	3.60	71.270	281	75	73	5	254	255	59
2-5	13:45:00	1.80	3.80	76.820	280	74	74	6	257	255	60
2-6	13:50:00	1.80	3.80	82.530	282	76	74	6	256	254	58
	13:55:00			88.252							
Total	1:00:00			66.982		70.8	69.3				
Average			3.58		279.5	70.1		6			
Min			3.10		277.0	65.0		5			
Max			4.00		282.0	76.0		7			

Impinger Weight Sheet - Run 1A

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	807.3	769.0	38.3
0.1N H2SO4	725.0	660.0	65.0
Empty	676.9	648.0	28.9
0.1N NaOH	776.3	757.1	19.2
0.1N NaOH	744.4	738.0	6.4
Silica Gel	917.0	896.2	20.8

Liquid Final	Liquid Initial	Liquid Gain
3,729.9	3,572.1	157.8

Silica Final	Silica Initial	Silica Gain
917.0	896.2	20.8

Run 2A - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 14:15**

Test Location: Kiln Stack | **End Time: 15:19**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	3.61	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	76.5	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.310	In. H_2O	Carbon Dioxide:	16.20	%
Stack Temperature, Ts:	291.3	°F	Oxygen:	11.20	%
Meter Volume, Vm:	66.766	ft^3	Nitrogen:	72.6	%
Meter Volume, Vmstd:	64.262	dscf	Gas Weight dry, Md:	31.040	lb/lb mole
Meter Volume, Vwstd:	7.889	wscf	Gas Weight wet, Ms:	29.614	lb/lb mole
Isokinetic Variance:	102.7	%I	Excess Air:	---	%
			Gas Velocity, Vs:	85.633	fps
Test Length:	60.00	in mins.	Volumetric Flow:	197,734	acfm
Nozzle Diameter:	0.247	in inches	Volumetric Flow:	120,665	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	135,479	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3559.1	ml	Silica Initial Wt.	878.1	grams
Final Impinger Content:	3704.7	ml	Silica Final Wt.	900.0	grams
Impinger Difference:	145.6	ml	Silica Difference:	21.9	grams

Total Water Gain: 167.5 Moisture, Bws: 0.109

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	14:15:00	1.80	3.70	89.128	294	76	74	6	259	254	60
1-2	14:20:00	1.70	3.50	94.800	295	76	75	5	256	258	62
1-3	14:25:00	1.70	3.70	100.320	294	75	75	7	257	257	60
1-4	14:30:00	1.70	3.30	105.830	294	76	76	7	255	253	59
1-5	14:35:00	1.80	3.50	111.350	293	77	76	6	254	255	57
1-6	14:40:00	1.60	3.90	117.050	294	78	75	6	255	255	57
	14:45:00			122.404							
2-1	14:49:00	1.80	3.80	122.404	290	78	76	6	254	254	61
2-2	14:54:00	1.60	3.40	128.110	287	79	77	6	256	257	57
2-3	14:59:00	1.70	3.60	133.520	289	78	76	5	255	254	56
2-4	15:04:00	1.80	3.80	139.070	287	77	76	6	255	256	54
2-5	15:09:00	1.60	3.30	144.780	289	78	77	7	254	253	52
2-6	15:14:00	1.80	3.80	150.180	290	77	77	6	252	255	53
	15:19:00			155.894							
Total	1:00:00			66.766		77.1	75.8				
Average			3.61		291.3	76.5		6			
Min			3.30		287.0	74.0		5			
Max			3.90		295.0	79.0		7			

Impinger Weight Sheet - Run 2A

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	812.7	747.8	64.9
0.1N H2SO4	805.3	745.0	60.3
Empty	670.4	655.4	15.0
0.1N NaOH	712.4	707.2	5.2
0.1N NaOH	703.9	703.7	0.2
Silica Gel	900.0	878.1	21.9

Liquid Final	Liquid Initial	Liquid Gain
3,704.7	3,559.1	145.6

Silica Final	Silica Initial	Silica Gain
900.0	878.1	21.9

Run 3A - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 15:40**

Test Location: Kiln Stack | **End Time: 16:44**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	3.53	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	75.5	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.294	In. H_2O	Carbon Dioxide:	16.10	%
Stack Temperature, Ts:	285.4	°F	Oxygen:	11.30	%
Meter Volume, Vm:	66.138	ft^3	Nitrogen:	72.6	%
Meter Volume, Vmstd:	63.758	dscf	Gas Weight dry, Md:	31.028	lb/lb mole
Meter Volume, Vwstd:	7.899	wscf	Gas Weight wet, Ms:	29.592	lb/lb mole
Isokinetic Variance:	102.8	%I	Excess Air:	---	%
			Gas Velocity, Vs:	84.289	fps
Test Length:	60.00	in mins.	Volumetric Flow:	194,630	acfm
Nozzle Diameter:	0.247	in inches	Volumetric Flow:	119,595	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	134,411	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3576.0	ml	Silica Initial Wt.	917.0	grams
Final Impinger Content:	3725.0	ml	Silica Final Wt.	935.7	grams
Impinger Difference:	149.0	ml	Silica Difference:	18.7	grams
Total Water Gain:	167.7		Moisture, Bws:	0.110	

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	15:40:00	1.70	3.60	56.870	285	76	75	5	258	256	58
1-2	15:45:00	1.60	3.30	62.430	286	75	74	6	256	253	60
1-3	15:50:00	1.80	3.80	67.800	285	75	74	5	255	252	61
1-4	15:55:00	1.60	3.40	73.510	285	75	74	5	256	254	60
1-5	16:00:00	1.70	3.60	78.890	284	76	75	6	254	255	58
1-6	16:05:00	1.70	3.60	84.460	286	75	75	6	254	257	55
	16:10:00			90.011							
2-1	16:14:00	1.60	3.30	90.011	285	76	75	6	259	254	56
2-2	16:19:00	1.80	3.80	95.400	286	77	76	6	256	256	54
2-3	16:24:00	1.60	3.30	101.120	286	76	75	5	257	254	53
2-4	16:29:00	1.70	3.60	106.490	285	76	76	7	253	253	52
2-5	16:34:00	1.70	3.60	112.050	286	77	76	7	256	255	54
2-6	16:39:00	1.60	3.40	117.620	286	77	76	7	254	257	57
	16:44:00			123.008							
Total	1:00:00			66.138		75.9	75.1				
Average			3.53		285.4	75.5		6			
Min			3.30		284.0	74.0		5			
Max			3.80		286.0	77.0		7			

Impinger Weight Sheet - Run 3A

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	802.0	767.6	34.4
0.1N H2SO4	726.0	670.4	55.6
Empty	680.0	648.6	31.4
0.1N NaOH	754.5	735.1	19.4
0.1N NaOH	762.5	754.3	8.2
Silica Gel	935.7	917.0	18.7

Liquid Final	Liquid Initial	Liquid Gain
3,725.0	3,576.0	149.0

Silica Final	Silica Initial	Silica Gain
935.7	917.0	18.7

Client:	CalPortland Company, Inc.													
Facility:	Redding Cement Plant													
Test Location:	Kiln Stack													
Project #:	M234605													
Test Method:	26A													
Test Engineer:	CLC													
Test Technician:	KLJ													
	Run 1B				**Run 2B**				**Run 3B**					
Temp ID:	CM18				CM18				CM18					
Meter ID:	CM18				CM18				CM18					
Pitot ID:	S8-032A				S8-032A				S8-032A					
Nozzle Diameter (Inches):	0.251				0.251				0.251					
Meter Calibration Date:	10/17/2023				10/17/2023				10/17/2023					
Meter Calibration Factor (Y):	0.987				0.987				0.987					
Meter Orifice Setting (Delta H):	1.533				1.533				1.533					
Nozzle Kit ID Number and Material:	Glass				Glass				Glass					
	Leak Checks													
Pre Pitot Leak Check	**0.0**	**@**	**4.0**	**"H_2O**	**0.0**	**@**	**4.2**	**"H_2O**	**0.0**	**@**	**4.5**	**"H_2O**		
Post Pitot Leak Check	**0.0**	**@**	**3.8**	**"H_2O**	**0.0**	**@**	**4.0**	**"H_2O**	**0.0**	**@**	**4.0**	**"H_2O**		
Pre Nozzle Leak Check	**0.0000**	**@**	**14**	**"Hg**	**0.0000**	**@**	**14**	**"Hg**	**0.0000**	**@**	**15**	**"Hg**		
Post Nozzle Leak Check	**0.0000**	**@**	**10**	**"Hg**	**0.0000**	**@**	**10**	**"Hg**	**0.0000**	**@**	**12**	**"Hg**		
Pitot Tube Coefficient:	0.822													
Probe Length (Feet):	8.0													
Probe Liner Material:	Glass													
Sample Plane:	Horizontal													
Port Length (Inches):	12.00													
Port Size (Diameter, Inches):	4.00													
Port Type:	Nipple													
Duct Shape:	Circular													
Diameter (Feet):	7													
Duct Area (Square Feet):	38.485													
Upstream Diameters:	16.0													
Downstream Diameters:	11.0													
Number of Ports Sampled:	4													
Number of Points per Port:	3													
Minutes per Point:	5.0													
Minutes per Reading:	5.0													
Total Number of Traverse Points:	12													
Test Length (Minutes):	60													
Train Type:	Anderson Box													
Source Condition:	Mill Off													
Diluent Model/Serial Number:	CAI 700/221018													
Moisture Balance ID:	LV3													
# of Runs	3													

Run 1B - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 12:50**

Test Location: Kiln Stack | **End Time: 13:55**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	3.50	in. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	72.6	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.319	in. H_2O	Carbon Dioxide:	16.20	%
Stack Temperature, Ts:	280.0	°F	Oxygen:	11.20	%
Meter Volume, Vm:	70.080	ft^3	Nitrogen:	72.60	%
Meter Volume, Vmstd:	67.577	dscf	Gas Weight dry, Md:	31.040	lb/lb mole
Meter Volume, Vwstd:	8.511	wscf	Gas Weight wet, Ms:	29.581	lb/lb mole
Isokinetic Variance:	103.0	%I	Excess Air:	---	%
			Gas Velocity, Vs:	85.861	fps
Test Length:	60.00	in mins.	Volumetric Flow:	198,259	acfm
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	122,493	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	137,920	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3619.5	ml	Silica Initial Wt.	887.7	grams
Final Impinger Content:	3788.6	ml	Silica Final Wt.	899.3	grams
Impinger Difference:	169.1	ml	Silica Difference:	11.6	grams

Total Water Gain: 180.7 Moisture, Bws: 0.112

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	12:50:00	1.80	3.60	69.650	279	70	68	5	250	250	54
1-2	12:55:00	1.70	3.40	75.550	280	74	68	5	250	250	55
1-3	13:00:00	1.70	3.40	81.300	279	76	68	5	250	250	55
1-4	13:05:00	1.70	3.40	87.080	279	76	68	5	251	251	56
1-5	13:10:00	1.80	3.60	92.840	279	77	69	5	251	250	57
1-6	13:15:00	1.90	3.80	98.790	280	77	69	5	250	250	58
	13:20:00			104.900							
2-1	13:25:00	1.70	3.40	104.900	280	77	69	5	251	250	58
2-2	13:30:00	1.70	3.40	110.680	281	77	69	5	250	250	58
2-3	13:35:00	1.80	3.65	116.500	281	78	69	5	251	250	59
2-4	13:40:00	1.60	3.25	122.400	280	78	69	5	252	250	60
2-5	13:45:00	1.70	3.50	127.990	281	78	70	5	251	251	62
2-6	13:50:00	1.80	3.60	133.780	281	79	70	5	251	251	62
	13:55:00			139.730							
Total	1:00:00			70.080		76.4	68.8				
Average			3.50		280.0	72.6		5			
Min			3.25		279.0	68.0		5			
Max			3.80		281.0	79.0		5			

Impinger Weight Sheet - Run 1B

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	808.9	765.5	43.4
0.1N H2SO4	800.5	728.5	72.0
Empty	677.1	646.3	30.8
0.1N NaOH	763.1	743.9	19.2
0.1N NaOH	739.0	735.3	3.7
Silica Gel	899.3	887.7	11.6

Liquid Final	Liquid Initial	Liquid Gain
3,788.6	3,619.5	169.1

Silica Final	Silica Initial	Silica Gain
899.3	887.7	11.6

Run 2B - Method 26A

Client: CalPortland Company, Inc. | **Date:** 11/14/23
Facility: Redding Cement Plant | **Start Time:** 14:15
Test Location: Kiln Stack | **End Time:** 15:19
Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	3.44	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	75.0	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.319	In. H_2O	Carbon Dioxide:	16.20	%
Stack Temperature, Ts:	289.0	°F	Oxygen:	11.20	%
Meter Volume, Vm:	70.115	ft^3	Nitrogen:	72.6	%
Meter Volume, Vmstd:	67.305	dscf	Gas Weight dry, Md:	31.040	lb/lb mole
Meter Volume, Vwstd:	8.657	wscf	Gas Weight wet, Ms:	29.554	lb/lb mole
Isokinetic Variance:	103.4	%I	Excess Air:	---	%
			Gas Velocity, Vs:	86.422	fps
Test Length:	60.00	in mins.	Volumetric Flow:	199,554	acfm
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	121,522	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	137,152	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3521.5	ml	Silica Initial Wt.	890.9	grams
Final Impinger Content:	3686.2	ml	Silica Final Wt.	910.0	grams
Impinger Difference:	164.7	ml	Silica Difference:	19.1	grams

Total Water Gain: 183.8 Moisture, Bws: 0.114

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	14:15:00	1.90	3.80	40.835	284	74	73	7	250	250	47
1-2	14:20:00	1.80	3.65	46.880	290	74	73	7	250	250	48
1-3	14:25:00	1.70	3.50	52.870	291	75	73	7	251	250	50
1-4	14:30:00	1.70	3.50	58.660	290	76	74	7	251	250	51
1-5	14:35:00	1.80	3.65	64.450	287	76	74	7	251	251	52
1-6	14:40:00	1.70	3.50	70.400	288	78	74	7	252	251	54
	14:45:00			76.210							
2-1	14:49:00	1.70	3.40	76.210	290	75	73	7	251	250	51
2-2	14:54:00	1.80	3.60	81.960	288	76	74	7	251	251	53
2-3	14:59:00	1.70	3.40	87.880	289	76	74	7	250	250	54
2-4	15:04:00	1.70	3.40	93.650	290	77	74	7	251	250	56
2-5	15:09:00	1.80	3.60	99.410	291	78	74	7	250	251	58
2-6	15:14:00	1.60	2.25	105.350	290	79	75	7	250	250	60
	15:19:00			110.950							
Total	1:00:00			70.115		76.2	73.8				
Average			3.44		289.0	75.0		7			
Min			2.25		284.0	73.0		7			
Max			3.80		291.0	79.0		7			

Impinger Weight Sheet - Run 2B

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)
must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	799.6	714.1	85.5
0.1N H2SO4	791.4	735.1	56.3
Empty	639.4	630.0	9.4
0.1N NaOH	690.3	680.0	10.3
0.1N NaOH	765.5	762.3	3.2
Silica Gel	910.0	890.9	19.1

Liquid Final	Liquid Initial	Liquid Gain
3,686.2	3,521.5	164.7

Silica Final	Silica Initial	Silica Gain
910.0	890.9	19.1

Run 3B - Method 26A

Client: CalPortland Company, Inc. | **Date: 11/14/23**

Facility: Redding Cement Plant | **Start Time: 15:40**

Test Location: Kiln Stack | **End Time: 16:44**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	3.38	In. H_2O	Static Pressure	-0.80	in. H_2O
Meter Temperature, Tm:	74.4	°F	Flue Pressure (Ps):	29.17	in. Hg. abs.
Sqrt ΔP:	1.300	In. H_2O	Carbon Dioxide:	16.10	%
Stack Temperature, Ts:	285.8	°F	Oxygen:	11.30	%
Meter Volume, Vm:	69.025	ft^3	Nitrogen:	72.6	%
Meter Volume, Vmstd:	66.317	dscf	Gas Weight dry, Md:	31.028	lb/lb mole
Meter Volume, Vwstd:	8.633	wscf	Gas Weight wet, Ms:	29.527	lb/lb mole
Isokinetic Variance:	103.3	%I	Excess Air:	---	%
			Gas Velocity, Vs:	85.024	fps
Test Length:	60.00	in mins.	Volumetric Flow:	196,327	acfm
Nozzle Diameter:	0.251	in inches	Volumetric Flow:	119,912	dscfm
Barometric Pressure:	29.23	in Hg	Volumetric Flow:	135,523	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3627.4	ml	Silica Initial Wt.	899.3	grams
Final Impinger Content:	3801.6	ml	Silica Final Wt.	908.4	grams
Impinger Difference:	174.2	ml	Silica Difference:	9.1	grams

Total Water Gain: 183.3 Moisture, Bws: 0.115

Port-Point No.	Clock Time	Velocity Head Δp in. H2O	Orifice ΔH in. H2O	Actual Meter Vol. ft^3	Stack Temp °F	Meter Temp Inlet °F	Meter Temp Outlet °F	Pump Vacuum "Hg	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	15:40:00	1.80	3.60	11.485	285	74	72	5	250	250	54
1-2	15:45:00	1.60	3.20	17.400	286	74	72	5	251	250	54
1-3	15:50:00	1.70	3.40	22.980	285	75	72	5	251	251	56
1-4	15:55:00	1.70	3.40	28.750	286	76	73	5	250	250	56
1-5	16:00:00	1.80	3.60	34.500	285	76	73	5	251	251	57
1-6	16:05:00	1.60	3.20	40.450	287	77	73	5	251	250	58
	16:10:00			46.050							
2-1	16:14:00	1.70	3.40	46.050	285	75	72	5	250	250	57
2-2	16:19:00	1.60	3.20	51.810	285	76	72	5	251	250	58
2-3	16:24:00	1.70	3.40	57.400	286	77	73	5	251	250	59
2-4	16:29:00	1.80	3.60	63.200	286	77	73	5	250	250	59
2-5	16:34:00	1.60	3.20	69.100	287	78	73	5	251	251	60
2-6	16:39:00	1.70	3.40	74.720	286	79	74	5	252	251	60
	16:44:00			80.510							
Total	1:00:00			69.025		76.2	72.7				
Average			3.38		285.8	74.4		5			
Min			3.20		285.0	72.0		5			
Max			3.60		287.0	79.0		5			

Impinger Weight Sheet - Run 3B

Client:	**CalPortland Company, Inc.**
Facility:	**Redding Cement Plant**
Test Location:	**Kiln Stack**
Project #:	**M234605**
Date:	**11/14/2023**
Test Method:	**26A**
Weighed/Measured By:	**KLJ**
Balance ID:	**LV3**

Scale Calibration Check Date: **11/14/2023**

Scale Calibration Check (see QS-6.05C for procedure)

must be within ± 0.5g of certified mass

Certified Weight, grams	Result, grams
250	250.0
500	500.0
750	750.0

IMPINGER CONTENTS	FINAL MLS / GRAMS	INITIAL MLS / GRAMS	GAIN MLS / GRAMS
0.1N H2SO4	832.2	745.9	86.3
0.1N H2SO4	793.5	750.5	43.0
Empty	668.6	646.5	22.1
0.1N NaOH	760.0	744.5	15.5
0.1N NaOH	747.3	740.0	7.3
Silica Gel	908.4	899.3	9.1

3,801.6	3,627.4	174.2
Liquid Final	**Liquid Initial**	**Liquid Gain**
908.4	899.3	9.1
Silica Final	**Silica Initial**	**Silica Gain**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Run 1

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
MILLOFF_R1_000627.LAB	12:50	12.04	14.44	0.81	0.10	190.64	0.97	11.00
MILLOFF_R1_000628.LAB	12:51	11.91	14.18	0.81	0.10	190.64	0.97	11.03
MILLOFF_R1_000629.LAB	12:52	11.84	13.85	0.87	0.10	190.65	0.97	11.22
MILLOFF_R1_000630.LAB	12:53	11.96	13.93	0.80	0.10	190.64	0.97	11.24
MILLOFF_R1_000631.LAB	12:54	12.10	14.04	0.80	0.10	190.64	0.97	11.11
MILLOFF_R1_000632.LAB	12:55	12.15	14.07	0.76	0.10	190.64	0.97	11.05
MILLOFF_R1_000633.LAB	12:56	12.16	14.16	0.88	0.10	190.69	0.97	11.04
MILLOFF_R1_000634.LAB	12:57	12.08	14.18	0.83	0.10	190.77	0.97	11.11
MILLOFF_R1_000635.LAB	12:58	12.06	14.01	0.86	0.10	190.95	0.97	11.13
MILLOFF_R1_000636.LAB	12:59	12.14	13.96	0.77	0.10	191.02	0.97	11.19
MILLOFF_R1_000637.LAB	13:00	12.10	13.84	0.82	0.10	191.04	0.97	11.25
MILLOFF_R1_000638.LAB	13:01	12.10	13.92	0.88	0.10	190.94	0.97	11.17
MILLOFF_R1_000639.LAB	13:02	12.17	14.11	0.80	0.10	190.92	0.97	11.09
MILLOFF_R1_000640.LAB	13:03	12.06	13.97	0.78	0.10	190.86	0.97	11.12
MILLOFF_R1_000641.LAB	13:04	12.00	14.14	0.82	0.10	190.86	0.97	11.23
MILLOFF_R1_000642.LAB	13:05	12.07	14.30	0.80	0.10	190.80	0.97	11.23
MILLOFF_R1_000643.LAB	13:06	12.12	14.15	0.82	0.10	190.76	0.97	11.11
MILLOFF_R1_000644.LAB	13:07	12.15	14.21	0.79	0.10	190.76	0.97	11.12
MILLOFF_R1_000645.LAB	13:08	12.17	14.28	0.80	0.10	190.76	0.97	11.05
MILLOFF_R1_000646.LAB	13:09	12.12	14.25	0.84	0.10	190.75	0.97	11.00
MILLOFF_R1_000647.LAB	13:10	12.22	14.22	0.80	0.10	190.71	0.97	11.15
MILLOFF_R1_000648.LAB	13:11	12.23	13.89	0.80	0.10	190.64	0.97	11.15
MILLOFF_R1_000649.LAB	13:12	12.16	14.07	0.74	0.10	190.67	0.97	11.20
MILLOFF_R1_000650.LAB	13:13	12.17	14.16	0.79	0.10	190.73	0.97	11.15
MILLOFF_R1_000651.LAB	13:14	12.18	14.37	0.80	0.10	190.75	0.97	11.10
MILLOFF_R1_000652.LAB	13:15	12.17	14.40	0.78	0.10	190.94	0.97	11.05
MILLOFF_R1_000653.LAB	13:16	12.21	14.24	0.83	0.10	191.17	0.97	10.89
MILLOFF_R1_000654.LAB	13:17	12.18	14.26	0.81	0.10	191.20	0.97	11.07
MILLOFF_R1_000655.LAB	13:18	12.15	14.27	0.84	0.10	191.09	0.97	11.09
MILLOFF_R1_000656.LAB	13:19	12.20	14.29	0.78	0.10	190.91	0.97	10.99
MILLOFF_R1_000657.LAB	13:20	12.13	14.02	0.79	0.10	190.83	0.97	11.04
MILLOFF_R1_000658.LAB	13:21	12.18	14.08	0.80	0.10	190.73	0.97	11.07
MILLOFF_R1_000659.LAB	13:22	12.17	14.17	0.81	0.10	190.74	0.97	11.17
MILLOFF_R1_000660.LAB	13:23	12.17	14.30	0.86	0.10	190.71	0.97	11.10
MILLOFF_R1_000661.LAB	13:24	12.20	14.24	0.80	0.10	190.70	0.97	11.12
MILLOFF_R1_000662.LAB	13:25	12.15	13.99	0.84	0.10	190.65	0.97	11.04
MILLOFF_R1_000663.LAB	13:26	12.21	14.09	0.80	0.10	190.59	0.97	11.06
MILLOFF_R1_000664.LAB	13:27	12.10	13.99	0.78	0.10	190.58	0.97	11.20
MILLOFF_R1_000665.LAB	13:28	12.10	13.97	0.78	0.10	190.60	0.97	11.16
MILLOFF_R1_000666.LAB	13:29	12.22	14.06	0.82	0.10	190.73	0.97	11.24
MILLOFF_R1_000667.LAB	13:30	12.22	14.28	0.79	0.10	190.75	0.97	11.26
MILLOFF_R1_000668.LAB	13:31	12.11	14.11	0.82	0.10	190.71	0.97	11.15
MILLOFF_R1_000669.LAB	13:32	12.18	14.12	0.86	0.10	190.68	0.97	11.06
MILLOFF_R1_000670.LAB	13:33	12.34	14.27	0.85	0.10	190.72	0.97	11.17
MILLOFF_R1_000671.LAB	13:34	12.31	14.26	0.86	0.10	190.74	0.97	11.19
MILLOFF_R1_000672.LAB	13:35	12.36	14.41	0.87	0.10	190.70	0.97	11.09
MILLOFF_R1_000673.LAB	13:36	12.39	14.49	0.92	0.10	190.69	0.97	11.04
MILLOFF_R1_000674.LAB	13:37	12.30	14.55	0.80	0.10	190.66	0.97	10.91
MILLOFF_R1_000675.LAB	13:38	12.38	14.75	0.88	0.10	190.69	0.97	10.91
MILLOFF_R1_000676.LAB	13:39	12.48	14.54	0.86	0.10	190.71	0.97	10.94
MILLOFF_R1_000677.LAB	13:40	12.50	14.23	0.87	0.10	190.68	0.97	10.88
MILLOFF_R1_000678.LAB	13:41	12.40	14.13	0.85	0.10	190.62	0.97	10.86
MILLOFF_R1_000679.LAB	13:42	12.37	14.36	0.92	0.10	190.63	0.97	10.98
MILLOFF_R1_000680.LAB	13:43	12.44	14.52	0.90	0.10	190.53	0.97	10.96
MILLOFF_R1_000681.LAB	13:44	12.45	14.42	0.87	0.10	190.59	0.97	10.91
MILLOFF_R1_000682.LAB	13:45	12.32	14.36	0.88	0.10	190.72	0.97	10.84
MILLOFF_R1_000683.LAB	13:46	12.40	14.38	0.90	0.10	190.74	0.97	10.81
MILLOFF_R1_000684.LAB	13:47	12.47	14.24	0.83	0.10	190.79	0.97	10.81
MILLOFF_R1_000685.LAB	13:48	12.44	14.11	0.80	0.10	190.79	0.97	10.94
MILLOFF_R1_000686.LAB	13:49	12.39	13.95	0.85	0.10	190.76	0.97	10.98
Average		**12.20**	**14.19**	**0.83**	**0.10**	**190.76**	**0.97**	**11.07**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Run 2

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
MILLOFF_R2_000754.LAB	14:15	12.39	14.2	0.84	0.10	190.7	0.97	11.07
MILLOFF_R2_000755.LAB	14:16	12.35	14.4	0.84	0.10	190.7	0.97	11.17
MILLOFF_R2_000756.LAB	14:17	12.25	14.5	0.85	0.10	190.9	0.97	11.06
MILLOFF_R2_000757.LAB	14:18	12.17	14.5	0.89	0.10	191.0	0.97	11.28
MILLOFF_R2_000758.LAB	14:19	12.19	14.3	0.79	0.10	191.0	0.97	11.49
MILLOFF_R2_000759.LAB	14:20	12.20	14.1	0.89	0.10	190.9	0.97	11.33
MILLOFF_R2_000760.LAB	14:21	12.54	14.2	0.86	0.10	190.8	0.97	10.88
MILLOFF_R2_000761.LAB	14:22	12.74	14.3	0.84	0.10	190.8	0.97	10.87
MILLOFF_R2_000762.LAB	14:23	12.41	13.6	0.81	0.10	190.7	0.97	11.41
MILLOFF_R2_000763.LAB	14:24	12.08	13.1	0.85	0.10	190.7	0.97	11.60
MILLOFF_R2_000764.LAB	14:25	12.40	13.4	0.84	0.10	190.7	0.97	11.17
MILLOFF_R2_000765.LAB	14:26	12.81	14.1	0.91	0.10	190.8	0.97	10.65
MILLOFF_R2_000766.LAB	14:27	12.62	14.1	0.86	0.10	190.8	0.97	10.89
MILLOFF_R2_000767.LAB	14:28	12.36	13.8	0.83	0.10	190.8	0.97	11.28
MILLOFF_R2_000768.LAB	14:29	12.37	14.0	0.87	0.10	190.7	0.97	11.22
MILLOFF_R2_000769.LAB	14:30	12.35	14.3	0.90	0.10	190.6	0.97	11.22
MILLOFF_R2_000770.LAB	14:31	12.35	14.6	0.89	0.10	190.6	0.97	11.11
MILLOFF_R2_000771.LAB	14:32	12.50	14.6	0.89	0.10	190.7	0.97	11.06
MILLOFF_R2_000772.LAB	14:33	12.56	15.0	0.85	0.10	190.7	0.97	10.88
MILLOFF_R2_000773.LAB	14:34	12.57	15.0	0.86	0.10	190.8	0.97	10.84
MILLOFF_R2_000774.LAB	14:35	12.55	14.9	0.88	0.10	190.8	0.97	10.72
MILLOFF_R2_000775.LAB	14:36	12.63	14.6	0.83	0.10	190.7	0.97	10.92
MILLOFF_R2_000776.LAB	14:37	12.63	14.6	0.88	0.10	190.7	0.97	11.07
MILLOFF_R2_000777.LAB	14:38	12.64	14.7	0.90	0.10	190.6	0.97	10.90
MILLOFF_R2_000778.LAB	14:39	12.51	14.4	0.96	0.10	190.7	0.97	10.91
MILLOFF_R2_000779.LAB	14:40	12.43	14.3	0.86	0.10	190.7	0.97	11.09
MILLOFF_R2_000780.LAB	14:41	12.31	14.1	0.87	0.10	190.7	0.97	11.12
MILLOFF_R2_000781.LAB	14:42	12.24	14.3	0.89	0.10	190.6	0.97	11.19
MILLOFF_R2_000782.LAB	14:43	12.29	14.2	0.91	0.10	190.6	0.97	11.12
MILLOFF_R2_000783.LAB	14:44	12.33	14.3	0.92	0.10	190.6	0.97	11.02
MILLOFF_R2_000784.LAB	14:45	12.49	14.5	0.90	0.10	190.6	0.97	10.94
MILLOFF_R2_000785.LAB	14:46	12.31	13.9	0.90	0.10	190.6	0.97	10.95
MILLOFF_R2_000786.LAB	14:47	12.25	13.4	0.86	0.10	190.6	0.97	11.59
MILLOFF_R2_000787.LAB	14:48	12.23	13.4	0.90	0.10	190.7	0.97	11.80
MILLOFF_R2_000788.LAB	14:49	12.25	13.2	0.87	0.10	190.6	0.97	11.85
MILLOFF_R2_000789.LAB	14:50	12.34	13.9	0.84	0.10	190.7	0.97	11.78
MILLOFF_R2_000790.LAB	14:51	12.28	13.8	0.91	0.10	190.7	0.97	11.16
MILLOFF_R2_000791.LAB	14:52	12.21	14.0	0.86	0.10	190.7	0.97	11.25
MILLOFF_R2_000792.LAB	14:53	12.31	14.1	0.85	0.10	190.7	0.97	11.24
MILLOFF_R2_000793.LAB	14:54	12.24	14.2	0.83	0.10	190.7	0.97	11.11
MILLOFF_R2_000794.LAB	14:55	12.26	14.1	0.90	0.10	190.6	0.97	11.10
MILLOFF_R2_000795.LAB	14:56	12.47	14.2	0.93	0.10	190.6	0.97	11.06
MILLOFF_R2_000796.LAB	14:57	12.57	14.4	0.94	0.10	190.6	0.97	11.02
MILLOFF_R2_000797.LAB	14:58	12.53	14.3	0.93	0.10	190.6	0.97	10.99
MILLOFF_R2_000798.LAB	14:59	12.44	14.2	0.89	0.10	190.6	0.97	11.00
MILLOFF_R2_000799.LAB	15:00	12.50	14.2	0.97	0.10	190.7	0.97	10.92
MILLOFF_R2_000800.LAB	15:01	12.51	14.0	0.92	0.10	190.6	0.97	11.05
MILLOFF_R2_000801.LAB	15:02	12.49	14.3	0.90	0.10	190.6	0.97	11.18
MILLOFF_R2_000802.LAB	15:03	12.57	14.5	1.02	0.10	190.6	0.97	10.88
MILLOFF_R2_000803.LAB	15:04	12.46	14.3	0.95	0.10	190.6	0.97	10.97
MILLOFF_R2_000804.LAB	15:05	12.57	14.4	0.87	0.10	190.7	0.97	11.04
MILLOFF_R2_000805.LAB	15:06	12.59	14.5	0.99	0.10	190.8	0.97	11.01
MILLOFF_R2_000806.LAB	15:07	12.56	14.4	0.95	0.10	190.9	0.97	10.93
MILLOFF_R2_000807.LAB	15:08	12.57	14.5	0.96	0.10	190.9	0.97	10.94
MILLOFF_R2_000808.LAB	15:09	12.36	14.2	0.93	0.10	190.9	0.97	10.94
MILLOFF_R2_000809.LAB	15:10	12.35	14.1	0.86	0.10	190.8	0.97	10.94
MILLOFF_R2_000810.LAB	15:11	12.43	14.2	0.94	0.10	190.7	0.97	11.10
MILLOFF_R2_000811.LAB	15:12	12.35	14.2	0.88	0.10	190.7	0.97	11.15
MILLOFF_R2_000812.LAB	15:13	12.36	14.2	0.89	0.10	190.7	0.97	11.04
MILLOFF_R2_000813.LAB	15:14	12.34	14.3	0.95	0.10	190.8	0.97	11.10
Average		**12.42**	**14.21**	**0.89**	**0.10**	**190.72**	**0.97**	**11.11**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Run 3

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
MILLOFF_R3_000894.LAB	15:40	12.03	14.5	0.92	0.10	190.2	0.97	11.01
MILLOFF_R3_000895.LAB	15:41	12.05	14.9	1.00	0.10	190.5	0.97	10.82
MILLOFF_R3_000896.LAB	15:42	12.03	14.9	0.95	0.10	191.0	0.97	10.86
MILLOFF_R3_000897.LAB	15:43	12.08	14.6	1.00	0.10	191.1	0.97	11.00
MILLOFF_R3_000898.LAB	15:44	12.06	14.2	0.91	0.10	191.1	0.97	11.17
MILLOFF_R3_000899.LAB	15:45	12.07	14.1	0.93	0.10	191.1	0.97	11.21
MILLOFF_R3_000900.LAB	15:46	12.11	13.9	0.97	0.10	191.1	0.97	11.24
MILLOFF_R3_000901.LAB	15:47	12.10	13.9	0.90	0.10	191.1	0.97	11.33
MILLOFF_R3_000902.LAB	15:48	12.00	13.8	0.97	0.10	191.1	0.97	11.38
MILLOFF_R3_000903.LAB	15:49	12.07	14.0	0.96	0.10	191.1	0.97	11.32
MILLOFF_R3_000904.LAB	15:50	12.11	14.1	0.97	0.10	191.1	0.97	11.25
MILLOFF_R3_000905.LAB	15:51	12.02	14.1	0.95	0.10	191.1	0.97	11.31
MILLOFF_R3_000906.LAB	15:52	12.05	13.9	0.96	0.10	191.0	0.97	11.33
MILLOFF_R3_000907.LAB	15:53	12.10	14.0	0.91	0.10	190.9	0.97	11.45
MILLOFF_R3_000908.LAB	15:54	11.94	14.2	0.99	0.10	190.9	0.97	11.28
MILLOFF_R3_000909.LAB	15:55	11.92	14.1	0.94	0.10	190.9	0.97	11.18
MILLOFF_R3_000910.LAB	15:56	11.95	14.1	0.98	0.10	190.8	0.97	11.29
MILLOFF_R3_000911.LAB	15:57	12.10	14.2	0.91	0.10	190.8	0.97	11.26
MILLOFF_R3_000912.LAB	15:58	12.04	14.2	1.00	0.10	190.8	0.97	11.20
MILLOFF_R3_000913.LAB	15:59	12.02	14.0	0.98	0.10	190.8	0.97	11.22
MILLOFF_R3_000914.LAB	16:00	11.91	13.8	1.03	0.10	190.7	0.97	11.32
MILLOFF_R3_000915.LAB	16:01	11.70	13.7	1.06	0.10	190.6	0.97	11.49
MILLOFF_R3_000916.LAB	16:02	11.64	13.8	1.03	0.10	190.6	0.97	11.55
MILLOFF_R3_000917.LAB	16:03	11.72	13.8	1.04	0.10	190.6	0.97	11.55
MILLOFF_R3_000918.LAB	16:04	11.77	13.8	1.05	0.10	190.6	0.97	11.46
MILLOFF_R3_000919.LAB	16:05	11.84	13.9	1.08	0.10	190.6	0.97	11.46
MILLOFF_R3_000920.LAB	16:06	11.87	14.0	1.03	0.10	190.6	0.97	11.35
MILLOFF_R3_000921.LAB	16:07	11.89	14.3	0.96	0.10	190.7	0.97	11.35
MILLOFF_R3_000922.LAB	16:08	11.86	14.4	1.04	0.10	190.7	0.97	11.24
MILLOFF_R3_000923.LAB	16:09	11.83	14.3	1.10	0.10	190.7	0.97	11.23
MILLOFF_R3_000924.LAB	16:10	11.94	14.4	0.96	0.10	190.7	0.97	11.18
MILLOFF_R3_000925.LAB	16:11	11.87	14.1	1.03	0.10	190.7	0.97	11.27
MILLOFF_R3_000926.LAB	16:12	11.91	14.2	1.08	0.10	190.7	0.97	11.32
MILLOFF_R3_000927.LAB	16:13	11.93	14.3	0.99	0.10	190.6	0.97	11.18
MILLOFF_R3_000928.LAB	16:14	11.86	14.4	1.07	0.10	190.6	0.97	11.19
MILLOFF_R3_000929.LAB	16:15	12.44	14.5	0.97	0.10	190.6	0.97	11.19
MILLOFF_R3_000930.LAB	16:16	12.01	14.5	1.10	0.10	190.6	0.97	10.95
MILLOFF_R3_000931.LAB	16:17	12.12	14.2	1.03	0.10	190.6	0.97	11.01
MILLOFF_R3_000932.LAB	16:18	11.78	13.8	1.10	0.10	190.7	0.97	11.08
MILLOFF_R3_000933.LAB	16:19	11.54	13.4	1.04	0.10	190.7	0.97	11.22
MILLOFF_R3_000934.LAB	16:20	11.94	13.1	0.96	0.10	190.7	0.97	11.59
MILLOFF_R3_000935.LAB	16:21	11.88	13.8	0.98	0.10	190.6	0.97	11.81
MILLOFF_R3_000936.LAB	16:22	12.22	13.7	0.99	0.10	190.7	0.97	11.67
MILLOFF_R3_000937.LAB	16:23	11.63	12.9	1.05	0.10	190.7	0.97	10.95
MILLOFF_R3_000938.LAB	16:24	11.68	13.4	1.04	0.10	190.7	0.97	11.19
MILLOFF_R3_000939.LAB	16:25	11.93	13.5	1.01	0.10	190.7	0.97	11.84
MILLOFF_R3_000940.LAB	16:26	12.00	13.6	0.98	0.10	190.7	0.97	11.55
MILLOFF_R3_000941.LAB	16:27	12.25	13.8	1.02	0.10	190.7	0.97	11.42
MILLOFF_R3_000942.LAB	16:28	11.88	14.1	1.02	0.10	190.7	0.97	11.49
MILLOFF_R3_000943.LAB	16:29	11.78	14.3	1.06	0.10	190.7	0.97	11.53
MILLOFF_R3_000944.LAB	16:30	11.96	14.5	1.06	0.10	190.7	0.97	11.43
MILLOFF_R3_000945.LAB	16:31	12.38	14.9	1.06	0.10	190.7	0.97	11.22
MILLOFF_R3_000946.LAB	16:32	12.12	14.9	1.04	0.10	190.7	0.97	11.17
MILLOFF_R3_000947.LAB	16:33	11.99	15.0	1.03	0.10	190.7	0.97	10.97
MILLOFF_R3_000948.LAB	16:34	12.00	15.0	1.04	0.10	190.7	0.97	10.86
MILLOFF_R3_000949.LAB	16:35	12.09	15.0	1.04	0.10	190.8	0.97	10.92
MILLOFF_R3_000950.LAB	16:36	12.37	14.8	1.05	0.10	190.8	0.97	11.00
MILLOFF_R3_000951.LAB	16:37	12.34	14.7	1.10	0.10	190.8	0.97	10.97
MILLOFF_R3_000952.LAB	16:38	12.26	14.4	1.07	0.10	190.9	0.97	10.92
MILLOFF_R3_000953.LAB	16:39	11.99	14.3	1.08	0.10	191.0	0.97	11.01
Average		**11.98**	**14.15**	**1.01**	**0.10**	**190.78**	**0.97**	**11.25**

Method 1 and 2 Cyclonic Flow Check Data

Project Number	M234605	**Source Condition:**	Mill On
Client:	CalPortland Company, Inc.	**Run No.:**	1
Facility:	Redding Cement Plant	**Date:**	11/14/2023
Location:	Kiln Stack	**Start Time:**	7:20
Pitot ID:	S8-031A	**End Time:**	7:40
Pitot Coefficient:	0.820	**RM Testers:**	TRY/CLC
Probe Length:	8	**Port Length:**	12.00

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (^oF)	Yaw Angle (o)	DP (in. H2O) at Null Point Angle	Velocity (V)	Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (^oF)	Yaw Angle (o)	DP (in. H2O) at Null Point Angle	Velocity (V)
A	1	1.90	1.3784	229.0	3.0	0.00	86.81	B	1	2.20	1.4832	231.0	3.0	0.00	93.54
A	2	2.00	1.4142	230.0	2.0	0.00	89.13	B	2	1.90	1.3784	232.0	4.0	0.00	87.00
A	3	1.80	1.3416	230.0	3.0	0.00	84.55	B	3	2.00	1.4142	233.0	3.0	0.00	89.32
A	4	1.80	1.3416	232.0	4.0	0.00	84.68	B	4	1.90	1.3784	233.0	3.0	0.00	87.06
A	5	2.10	1.4491	232.0	3.0	0.00	91.46	B	5	1.80	1.3416	233.0	4.0	0.00	84.74
A	6	1.90	1.3784	232.0	4.0	0.00	87.00	B	6	1.80	1.3416	232.0	2.0	0.00	84.68

Average Yaw Angle 3.2 °

Stratification Test Results Summary
CalPortland Company, Inc.
Redding Cement Plant
Main Kiln Stack
November 14, 2023

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

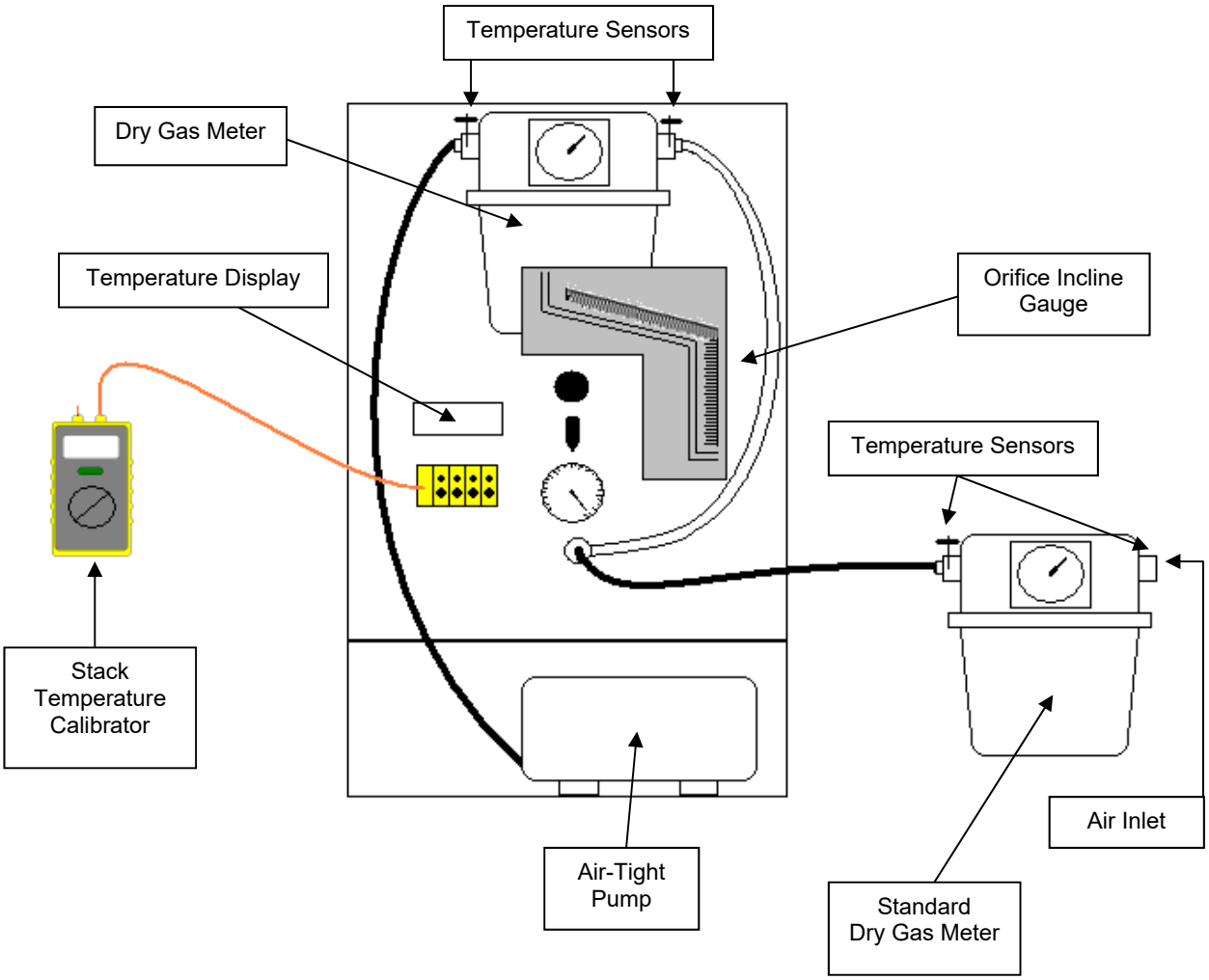
Port No.	Point No.	Time	O_2%	Actual % Difference O_2%	Mean Difference O_2%
1	1	7:41	12.42	1.19	0.15
	2	7:45	12.71	1.11	0.14
	3	7:49	12.58	0.08	0.01
Average			**12.57**		

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

One point traverse (<0.3% mean difference)
Three point traverse (0.4, 1.2, and 2.0 meters), < 0.5% mean difference for O_2
Twelve point traverse (Method 1 points) >0.5% mean difference for O_2

Appendix G - Calibration Data

Dry Gas Meter/Control Module Calibration Diagram



Dry Gas Meter Calibration Data

Dry Gas Meter No.	CM54	Date:	October 17, 2023
Standard Meter No.	18654530	Calibrated By:	IB
Standard Meter (Y)	0.99730	Barometric Pressure:	27.90

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			63.100	78.370	70	71	71					
Initial			57.720	72.920	70	70	70					
Difference	1	0.20	5.380	5.450	70	71	71	71	18	0	0.985	1.361
Final			68.591	83.944	71	72	72					
Initial			63.100	78.370	70	71	71					
Difference	2	0.50	5.491	5.574	71	72	72	72	12	3	0.983	1.464
Final			74.004	89.414	72	73	73					
Initial			68.591	83.944	71	72	72					
Difference	3	0.70	5.413	5.470	72	73	73	73	10	1	0.987	1.460
Final			79.380	94.860	72	74	74					
Initial			74.004	89.414	72	73	73					
Difference	4	0.90	5.376	5.446	72	74	74	74	9	0	0.985	1.536
Final			84.655	100.184	72	74	74					
Initial			79.380	94.860	72	74	74					
Difference	5	1.20	5.275	5.324	72	74	74	74	8	0	0.989	1.679
Final			57.720	72.920	70	70	70					
Initial			52.640	67.840	69	69	69					
Difference	6	2.00	5.080	5.080	70	70	70	70	6	0	0.992	1.696
								Average			**0.987**	**1.533**

Stack Temperature Sensor Calibration

Meter Box # : CM 18 *Name :* IB

Ambient Temperature : 73.4 ^{o}F *Date :* October 17, 2023

Calibrator Model # : CL940A

Serial # : 526

Date Of Certification : December 28, 2022

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

Reference Source Temperature (^{o}F)	***Test Thermometer Temperature (^{o}F)***	***Temperature Difference %***
0	*-1*	0.2
250	*248*	0.3
600	*597*	0.3
1200	*1199*	0.1

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

Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM18*	*Date:*	*December 7, 2023*
Standard Meter No.	*18654530*	*Calibrated By:*	*DV*
Standard Meter (Y)	*0.99730*	*Barometric Pressure:*	*28.16*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			*37.180*	*61.955*	*65*	*69*	*68*					
Initial			*32.123*	*56.846*	*65*	*68*	*66*					
Difference	*1*	*0.20*	*5.057*	*5.109*	*65*	*69*	*67*	*68*	*18*	*21*	*0.992*	*1.564*
Final			*32.123*	*56.846*	*65*	*68*	*66*					
Initial			*26.765*	*51.410*	*64*	*67*	*65*					
Difference	*2*	*0.50*	*5.358*	*5.436*	*65*	*68*	*66*	*67*	*12*	*12*	*0.985*	*1.541*
Final			*26.765*	*51.410*	*64*	*67*	*65*					
Initial			*21.369*	*46.097*	*63*	*65*	*64*					
Difference	*3*	*0.70*	*5.396*	*5.313*	*64*	*66*	*65*	*65*	*10*	*2*	*1.014*	*1.436*
Final			*21.369*	*46.097*	*63*	*65*	*64*					
Initial			*15.896*	*40.585*	*63*	*64*	*63*					
Difference	*4*	*0.90*	*5.473*	*5.512*	*63*	*65*	*64*	*64*	*9*	*0*	*0.990*	*1.445*
Final			*42.896*	*67.822*	*65*	*70*	*68*					
Initial			*37.449*	*62.323*	*65*	*69*	*68*					
Difference	*5*	*1.20*	*5.447*	*5.499*	*65*	*70*	*68*	*69*	*8*	*17*	*0.992*	*1.645*
Final			*10.794*	*35.460*	*63*	*63*	*63*					
Initial			*5.348*	*30.047*	*62*	*63*	*63*					
Difference	*6*	*2.00*	*5.446*	*5.413*	*63*	*63*	*63*	*63*	*6*	*4*	*0.999*	*1.473*

Average	***0.995***	***1.517***

Stack Temperature Sensor Calibration			
Temperature ID :	100770	Name :	DV
Ambient Temperature, °F :	67.8	Date :	12/7/2023

Temperature Calibrator			
Model # :	CL940A	Certification Date:	December 28, 2022
Serial # :	526	Expiration Date:	December 29, 2023

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	-1	0.2
250	248	0.3
600	597	0.3
1200	1199	0.1

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

Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM45*	*Date:*	*October 25, 2023*
Standard Meter No.	*18654530*	*Calibrated By:*	*ER*
Standard Meter (Y)	*0.99730*	*Barometric Pressure:*	*28.07*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			*55.157*	*83.483*	*71*	*70*	*70*					
Initial			*50.075*	*78.368*	*70*	*69*	*69*					
Difference	*1*	*0.20*	*5.082*	*5.115*	*71*	*70*	*70*	*70*	*18*	*10*	*0.988*	*1.550*
Final			*60.156*	*88.610*	*71*	*72*	*72*					
Initial			*55.107*	*83.583*	*71*	*70*	*70*					
Difference	*2*	*0.50*	*5.049*	*5.027*	*71*	*71*	*71*	*71*	*12*	*5*	*1.000*	*1.735*
Final			*65.214*	*93.743*	*72*	*73*	*73*					
Initial			*60.156*	*88.610*	*71*	*72*	*72*					
Difference	*3*	*0.70*	*5.058*	*5.133*	*72*	*73*	*73*	*73*	*10*	*12*	*0.983*	*1.723*
Final			*70.351*	*98.824*	*73*	*74*	*74*					
Initial			*65.214*	*93.743*	*72*	*73*	*73*					
Difference	*4*	*0.90*	*5.137*	*5.081*	*73*	*74*	*74*	*74*	*9*	*15*	*1.008*	*1.770*
Final			*50.175*	*78.368*	*70*	*69*	*69*					
Initial			*45.061*	*73.232*	*69*	*69*	*69*					
Difference	*5*	*1.20*	*5.114*	*5.136*	*70*	*69*	*69*	*69*	*8*	*3*	*0.989*	*1.798*
Final			*39.305*	*67.255*	*68*	*68*	*68*					
Initial			*34.281*	*62.201*	*68*	*67*	*67*					
Difference	*6*	*2.00*	*5.024*	*5.054*	*68*	*68*	*68*	*68*	*6*	*8*	*0.985*	*1.797*

Average	***0.992***	***1.729***

Stack Temperature Sensor Calibration			
Temperature ID :	100769	Name :	ER
Ambient Temperature, °F :	69	Date :	10/25/2023

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

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	1	0.2
250	252	0.3
600	601	0.1
1200	1204	0.2

$$\frac{(\text{Ref. Temp., °F} + 460) - (\text{Test Therm. Temp., °F} + 460)}{\text{Ref. Temp., °F} + 460} * 100 <= 1.5\ \%$$

Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM45*	*Date:*	*December 8, 2023*
Standard Meter No.	*18654530*	*Calibrated By:*	*ER*
Standard Meter (Y)	*0.99730*	*Barometric Pressure:*	*28.27*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F^o tr	Dry Gas Meter Inlet Temp. F^o tdi	Dry Gas Meter Outlet Temp. F^o tdo	Dry Gas Meter Avg. Temp. F^o td	Time Min	Time Sec	Y	Chg (H)
Final			*52.925*	*41.165*	*61*	*63*	*63*					
Initial			*47.906*	*36.110*	*61*	*62*	*62*					
Difference	*1*	*0.20*	*5.019*	*5.055*	*61*	*63*	*63*	*63*	*18*	*15*	*0.993*	*1.556*
Final			*57.944*	*46.214*	*61*	*63*	*63*					
Initial			*52.925*	*41.165*	*61*	*63*	*63*					
Difference	*2*	*0.50*	*5.019*	*5.049*	*61*	*63*	*63*	*63*	*12*	*5*	*0.994*	*1.704*
Final			*62.985*	*51.262*	*62*	*64*	*64*					
Initial			*57.944*	*46.214*	*61*	*63*	*63*					
Difference	*3*	*0.70*	*5.041*	*5.048*	*62*	*64*	*64*	*64*	*10*	*10*	*0.998*	*1.676*
Final			*68.012*	*56.366*	*62*	*64*	*64*					
Initial			*62.985*	*51.262*	*62*	*64*	*64*					
Difference	*4*	*0.90*	*5.027*	*5.104*	*62*	*64*	*64*	*64*	*9*	*5*	*0.984*	*1.731*
Final			*73.052*	*61.450*	*62*	*64*	*64*					
Initial			*68.012*	*56.366*	*62*	*64*	*64*					
Difference	*5*	*1.20*	*5.040*	*5.084*	*62*	*64*	*64*	*64*	*8*	*5*	*0.989*	*1.818*
Final			*47.906*	*36.110*	*61*	*62*	*62*					
Initial			*42.897*	*31.050*	*61*	*63*	*63*					
Difference	*6*	*2.00*	*5.009*	*5.060*	*61*	*63*	*63*	*63*	*6*	*5*	*0.985*	*1.736*
										Average	***0.990***	***1.704***

Stack Temperature Sensor Calibration

Meter Box # : CM45 *Name :* ER

Ambient Temperature : 62.3 ^{o}F *Date :* December 8, 2023

Calibrator Model # : CL940

Serial # : 526

Date Of Certification : December 28, 2022

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

Reference Source Temperature (^{o}F)	***Test Thermometer Temperature (^{o}F)***	***Temperature Difference %***
0	*1*	0.2
250	*251*	0.1
600	*600*	0.0
1200	*1204*	0.2

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

Airflow Sciences Corporation
Probe Calibration for Method 2

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

Repitition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (°)	
1	60	0.81	77.8	1.18	0	0.82
2	60	0.80	77.8	1.18	0	0.82
3	60	0.81	77.8	1.18	0	0.82
					Average ($C_{p(avg-low)}$)	0.82

Repitition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (deg)	
1	90	1.81	77.8	2.63	0	0.82
2	90	1.81	77.8	2.62	0	0.82
3	90	1.81	77.8	2.63	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

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

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

C_p = 0.820

Airflow Sciences Corporation

Probe Calibration for Method 2

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

Repitition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (°)	
1	60	0.81	77.5	1.19	0	0.82
2	60	0.81	77.5	1.19	0	0.82
3	60	0.81	77.5	1.19	0	0.82
					Average ($C_{p(avg-low)}$)	0.82

Repitition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (deg)	
1	90	1.81	77.5	2.65	0	0.82
2	90	1.81	77.5	2.64	0	0.82
3	90	1.81	77.5	2.64	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

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

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

C_p = 0.818

Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

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

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

Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

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

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

Airflow Sciences Corporation

Probe Calibration for Method 2

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

Repitition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (°)	
1	60	0.81	72.2	1.19	0	0.82
2	60	0.81	72.2	1.19	0	0.82
3	60	0.81	72.2	1.19	0	0.82
					Average ($C_{p(avg-low)}$)	0.82

Repitition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (deg)	
1	90	1.82	72.2	2.63	0	0.82
2	90	1.82	72.2	2.64	0	0.82
3	90	1.81	72.2	2.64	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

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

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

C_p = 0.820

Airflow Sciences Corporation
Probe Calibration for Method 2

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

Repitition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (°)	
1	60	0.81	72.0	1.19	0	0.82
2	60	0.81	72.0	1.19	0	0.82
3	60	0.81	72.0	1.19	0	0.82
					Average ($C_{p(avg-low)}$)	0.82

Repitition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (°F)	DP ("H_2O)	Yaw Angle (deg)	
1	90	1.82	72.0	2.65	0	0.82
2	90	1.82	72.0	2.65	0	0.82
3	90	1.82	72.0	2.64	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

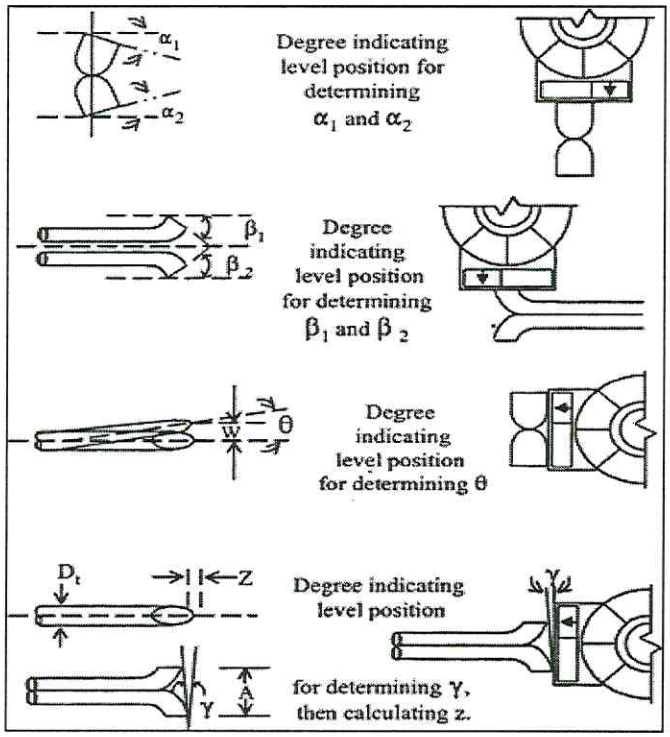
$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \textbf{-0.45\%}$$ Pass

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

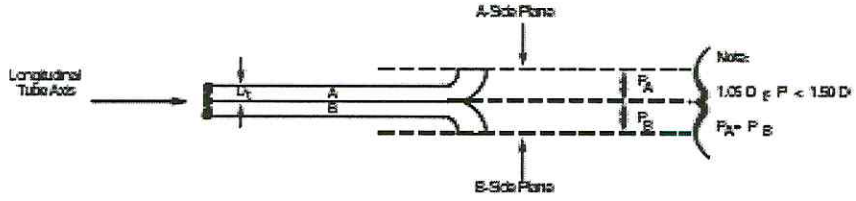
C_p = 0.818

Airflow Sciences Corporation

Probe Inspection for Method 2



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



Certification

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

Certified by: Craig Rood Date: 6/8/2017

Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

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

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

Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

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

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

Airflow Sciences Corporation

Probe Calibration for Method 2

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

Repitition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (^oF)	DP ("H_2O)	Yaw Angle (^{o})	
1	60	0.81	73.7	1.18	0	0.82
2	60	0.81	73.7	1.18	0	0.82
3	60	0.81	73.7	1.18	0	0.82
					Average ($C_{p(avg-low)}$)	0.82

Repitition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (^oF)	DP ("H_2O)	Yaw Angle (deg)	
1	90	1.82	73.7	2.62	0	0.82
2	90	1.82	73.7	2.63	0	0.82
3	90	1.82	73.7	2.63	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

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

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

C_p = 0.822

Airflow Sciences Corporation

Probe Calibration for Method 2

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

Repitition	Nominal Low Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (^oF)	DP ("H_2O)	Yaw Angle (^{o})	
1	60	0.81	74.5	1.19	0	0.82
2	60	0.81	74.5	1.19	0	0.82
3	60	0.81	74.5	1.19	0	0.82
					Average ($C_{p(avg-low)}$)	0.82

Repitition	Nominal High Velocity Setting (ft/s)	Calibration Pitot		Tested Probe		Calculated C_p
		DP_{std} ("H_2O)	Temperature (^oF)	DP ("H_2O)	Yaw Angle (deg)	
1	90	1.81	74.5	2.63	0	0.82
2	90	1.82	74.5	2.63	0	0.82
3	90	1.82	74.5	2.63	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

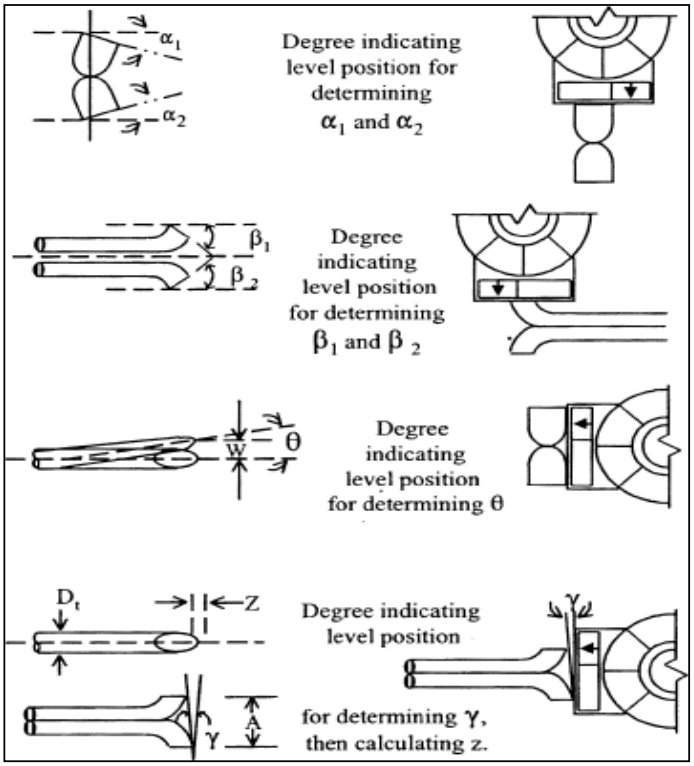
$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \textbf{-0.43\%}$$ **Pass**

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

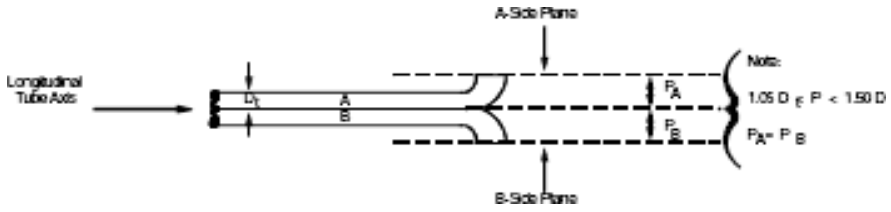
C_p = 0.821

Airflow Sciences Corporation

Probe Inspection for Method 2



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



Certification

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

Certified by: wgj Date: 8/31/2017

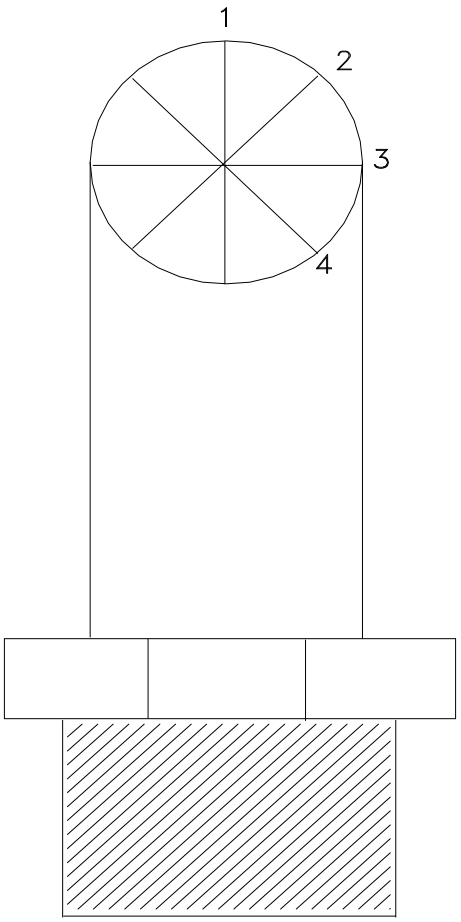
Nozzle Calibration

Date: 7/14/2023

Nozzle ID No.: 954

Analyst: RB

Material/Type: Glass



0.251	1
0.251	2
0.251	3
0.250	4

Valid Data

Average
0.251

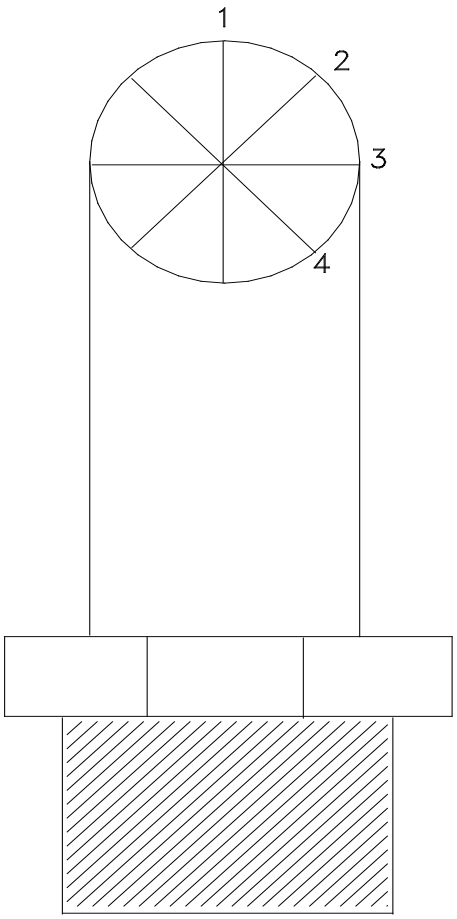
Nozzle Calibration

Date: 12/4/2020

Nozzle ID No.: 667

Analyst: EWB

Material/Type: Glass



0.247	1
0.247	2
0.248	3
0.246	4

Valid Data

Average
0.247

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
Operating Condition Mill On

Sample System:	FTIR				
Probe Length:	8.0	**ft**			
Probe Type:	FTIR				
Sample Plane:	Vertical				
Port Length:	12	**in.**			
Port Size (diameter):	4	**in.**			
Port Type:	Flange				
Duct Shape:	Circular				
Diameter:	7	**ft**			
Duct Area:	38.48	**Sq. Ft.**			
Upstream Diameters:	16.00		Minimum Upstream Distance	3.5	Feet
Downstream Diameters:	11.00		Minimum Downstream Distance	14.0	Feet
Number of Ports Sampled:	1		Ideal Upstream Distance	14.0	Feet
Number of Points per Port:	1		Ideal Downstream Distance	56.0	Feet
Total Number of Traverse Points:	1				

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder	Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	-0.07	0.32%	N/A		1300
	Mid	EB0075029	11.18	11.15	0.14%	9/7/2031	50.54%	1600
	High	CC308342	22.12	21.97	0.68%	5/25/2031		1800

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	Nitrogen	Zero Nitrogen	0.0	N/A	1300
Calibration Transfer Standard	Ethylene	AAL072815	101.4	9/5/2031	1700
Analyte Spike Gas	HCN	CC768241	49.55	3/11/2024	1800
	SF6		5.001		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAI 700	221018	25	22.12
HF ppmvw	MKS 2030	110161896	10	N/A
HCN ppmvw	MKS 2030	110161896	200	N/A

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 11/14/23
Operator: R. Sollars
O2 % Correction: 7

O2 % (dry) Correction Data

Run #	Cma	Precal	Postcal	Pre zero	Post zero	Co	Cm	C	Cgas	Span Bias	Span Drift	Zero Bias	Zero Drift
1	11.18	11.13	11.11	0.01	0.00	0.01	11.12	12.59	12.7	0.18	-0.09	-0.32	-0.05
2	11.18	11.11	11.11	0.00	0.00	0.00	11.11	12.39	12.5	0.18	0.00	-0.32	0.00
3	11.18	11.11	11.10	0.00	0.01	0.01	11.11	12.39	12.5	0.23	-0.05	-0.36	0.05

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

Calibration Corrected and Calculated Data

Run #	Run Date	Start Time	End Time	Moisture %	O2 % (dry)	CO2 % (wet)	CO2 % (dry)	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	11/14/23	8:00	8:59	11.66%	12.66	11.86	13.43	0.76	1.45	0.10	0.19
2	11/14/23	9:25	10:24	11.55%	12.47	12.16	13.75	0.78	1.46	0.10	0.19
3	11/14/23	10:50	11:49	11.47%	12.48	12.23	13.81	0.80	1.49	0.10	0.19

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Main Kiln Stack
Date: 11/14/23
Project #: M234605

Linearity Cal/Pre 1 Cal

Time	O2 % (dry)	
6:52	0.01	
6:53	-0.07	iz
6:54	-0.07	
6:55	2.72	
6:56	6.14	
6:57	5.68	
6:58	9.83	
6:59	4.55	
7:00	5.53	
7:01	20.83	
7:02	21.96	
7:03	21.97	ih
7:04	16.70	
7:05	11.11	
7:06	11.10	
7:07	11.15	im
7:08	18.80	
7:09	15.94	
7:10	0.05	
7:11	6.15	
7:12	20.73	
7:13	20.77	
7:14	20.78	
7:15	20.78	
7:16	15.71	
7:17	12.01	
7:18	12.42	
7:19	12.47	
7:20	12.41	
7:21	12.27	
7:22	10.82	
7:23	11.05	
7:24	11.19	
7:25	11.36	
7:26	10.71	
7:27	8.81	
7:28	0.04	
7:29	0.01	z
7:30	3.44	
7:31	10.83	
7:32	11.12	
7:33	11.13	
7:34	11.13	m

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Post 1/Pre 2			Post 2/Pre 3		
Time	**O2 % (dry)**		**Time**	**O2 % (dry)**	
9:10	10.26		10:37	8.31	
9:11	1.94		10:38	11.10	
9:12	0.01		10:39	11.11	**m**
9:13	0.00	**z**	10:40	10.55	
9:14	10.12		10:41	0.05	
9:15	11.10		10:42	0.00	**z**
9:16	11.11	**m**	10:43	2.15	
9:17	6.67		10:44	12.24	
			10:45	12.25	

Post 3		
Time	**O2 % (dry)**	
11:58	11.43	
11:59	11.21	
12:00	5.59	
12:01	0.04	
12:02	0.01	**z**
12:03	6.00	
12:04	11.08	
12:05	11.10	**m**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
Operating Condition Mill Off

Sample System:	FTIR				
Probe Length:	8.0	**ft**			
Probe Type:	FTIR				
Sample Plane:	Vertical				
Port Length:	12	**in.**			
Port Size (diameter):	4	**in.**			
Port Type:	Flange				
Duct Shape:	Circular				
Diameter:	7	**ft**			
Duct Area:	38.48	**Sq. Ft.**			
Upstream Diameters:	16.00		Minimum Upstream Distance	3.5	Feet
Downstream Diameters:	11.00		Minimum Downstream Distance	14.0	Feet
Number of Ports Sampled:	1		Ideal Upstream Distance	14.0	Feet
Number of Points per Port:	1		Ideal Downstream Distance	56.0	Feet
Total Number of Traverse Points:	1				

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder	Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	-0.07	0.32%	N/A		1300
	Mid	EB0075029	11.18	11.15	0.14%	9/7/2031	50.54%	1600
	High	CC308342	22.12	21.97	0.68%	5/25/2031		1800

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	Nitrogen	Zero Nitrogen	0.0	N/A	1300
Calibration Transfer Standard	Ethylene	AAL072815	101.4	9/5/2031	1700
Analyte Spike Gas	HCN	CC768241	49.55	3/11/2024	1800
	SF6		5.001		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAI 700	221018	25	22.12
HF ppmvw	MKS 2030	110161896	10	N/A
HCN ppmvw	MKS 2030	110161896	200	N/A

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Diluent: O2 %

Test Location: Main Kiln Stack
Date: 11/14/23
Operator: R. Sollars
O2 % Correction: 7

O2 % (dry) Correction Data

Run #	Cma	Precal	Postcal	Pre zero	Post zero	Co	Cm	C	Cgas	Span Bias	Span Drift	Zero Bias	Zero Drift
1	11.18	11.10	11.10	0.01	-0.01	0.00	11.10	11.07	11.2	0.23	0.00	-0.27	-0.09
2	11.18	11.10	11.10	-0.01	0.01	0.00	11.10	11.11	11.2	0.23	0.00	-0.36	0.09
3	11.18	11.10	11.10	0.01	0.01	0.01	11.10	11.25	11.3	0.23	0.00	-0.36	0.00

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

Calibration Corrected and Calculated Data

Run #	Run Date	Start Time	End Time	Moisture %	O2 % (dry)	CO2 % (wet)	CO2 % (dry)	HCN ppmvw	HCN ppmvd @ 7% O2	HF ppmvw	HF ppmvd @ 7% O2
1	11/14/23	12:50	13:49	12.20%	11.15	14.19	16.16	0.83	1.34	0.10	0.16
2	11/14/23	14:15	15:14	12.42%	11.19	14.21	16.22	0.89	1.45	0.10	0.16
3	11/14/23	15:40	16:39	11.98%	11.33	14.15	16.08	1.01	1.67	0.10	0.17

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Test Location: Main Kiln Stack
Date: 11/14/23
Project #: M234605

Linearity Cal/Pre 1 Cal

Time	O2 % (dry)	
6:52	0.01	
6:53	-0.07	iz
6:54	-0.07	
6:55	2.72	
6:56	6.14	
6:57	5.68	
6:58	9.83	
6:59	4.55	
7:00	5.53	
7:01	20.83	
7:02	21.96	
7:03	21.97	ih
7:04	16.70	
7:05	11.11	
7:06	11.10	
7:07	11.15	im
7:08	18.80	
7:09	15.94	
7:10	0.05	
7:11	6.15	
7:12	20.73	
7:13	20.77	
7:14	20.78	
7:15	20.78	
7:16	15.71	
7:17	12.01	
7:18	12.42	
7:19	12.47	
7:20	12.41	
7:21	12.27	
7:22	10.82	
7:23	11.05	
7:24	11.19	
7:25	11.36	
7:26	10.71	
7:27	8.81	
7:28	0.04	
7:29	0.01	
7:30	3.44	
7:31	10.83	
7:32	11.12	
7:33	11.13	
7:34	11.13	
11:58	11.43	
11:59	11.21	
12:00	5.59	

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Test Location: Main Kiln Stack
Date: 11/14/23

Post 1/Pre 2			Post 2/Pre 3		
Time	**O2 % (dry)**		**Time**	**O2 % (dry)**	
14:02	4.72		15:25	10.33	
14:03	11.08		15:26	6.63	
14:04	11.10	**m**	15:27	0.03	
14:05	10.65		15:28	0.01	**z**
14:06	0.11		15:29	7.45	
14:07	0.00		15:30	11.07	
14:08	-0.01	**z**	15:31	11.10	**m**

Post 3		
Time	**O2 % (dry)**	
16:47	10.54	
16:48	9.19	
16:49	2.11	
16:50	0.02	
16:51	0.01	**z**
16:52	8.45	
16:53	11.09	
16:54	11.10	**m**

Appendix H - FTIR QA/QC

Method 320 FTIR Detector Multi-Gas Determination QA/QC

FTIR data was collected using an MKS MultiGas 2030 FTIR spectrometer.

The FTIR was equipped with a temperature-controlled, 5.11 meter multi-pass gas cell maintained at 191°C. Gas flows and sampling system pressures were monitored using a rotameter and pressure transducer. All data was collected at 0.5 cm^{-1} resolution. Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. Analyzer data for each run is presented in the Reference Method Test Data appendix.

SAMPLING SYSTEM PARAMETERS				
MKS Serial #	**Sampling Line**	**Probe Assembly**	**Particulate Filter Media**	**Operating Temperatures**
110161896	100' 3/8" dia., heated Teflon	Heated 12', 3/8" dia. SS	0.01µ heated borosilicate glass fiber	191°C

QA/QC procedures followed US EPA Method 320 guidelines. See below for QA/QC procedure details and list of calibration gas standards. All calibration gases were introduced to the analyzer and the sampling system using an instrument grade stainless steel rotameter. All QA/QC procedures were within the acceptance criteria allowance of the applicable EPA methodology. Detailed FTIR QA/QC data follow the narrative portion of this appendix.

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: Analyte Direct	Verify FTIR calibration	HCN, SF_6	Direct to FTIR	Pretest	+/- 5% cert. value	**Pass**
M320: CTS Response	Verify system stability, recovery, response time	Ethylene	Sampling System	Daily, pre/post test	+/- 5% of Direct Measurement	**Pass**
M320: Zero Response	Verify system is free of contaminants, system bias	Nitrogen (zero)	Sampling System	pretest	Bias correct data	**Pass**
M320: Analyte Spike	Verify system ability to deliver and quantify analyte of interest in the presence of other effluent gases	HCN, SF_6	Dynamic Addition to Sampling System, 1:10 effluent	Throughout testing – daily	+/- 20% theoretical recovery	**Pass**

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

CALIBRATION GAS STANDARDS				
Components	**Concentration (ppm)**	**Vendor**	**Cylinder #**	**Standard Type**
Ethylene	101.4	Airgas	AAL072815	Primary +/- 1%
HCN/SF_6	49.55/5.001	Airgas	CC768241	Certified Standard-Spec +/- 5%
Nitrogen	Zero Gas	Airgas	Zero Nitrogen	UHP Grade

Analyte Spiking

HCN spiking was performed prior to testing to verify the ability of the sampling system to quantitatively deliver a sample containing HCN 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 HCN 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 HCN. 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

Post Collection Data Validation

As part of the data validation procedure, reference spectra are manually fit to that of the sample spectra and a concentration is determined. The reference spectra are scaled to match the peak amplitude of the sample, thus providing a scale factor. The scale factor multiplied by the reference spectra concentration is used to determine the concentration value for the sample spectra. Sample pressure and temperature corrections are then applied to compute the final sample concentration. The manually calculated results are then compared with the software-generated results. The data is then validated if the two concentrations are within ± 20% agreement. If there is a difference greater than ± 20% the spectra are reviewed for possible spectra interferences or any other possible causes leading to incorrectly quantified data.

Detection Limit

The detection limit of each analyte was calculated following Annex A2 of ASTM D6348-12 procedure using spectra that contained similar amounts of moisture.

FTIR DETECTION LIMITS			
Analyte	**Detection Limit (ppmv wet)**	**Detection Limit (%v)**	**Detection Limit (%v wet)**
Hydrogen Cyanide	0.2	—	—
Hydrogen Fluoride	0.1		
Water	—	**0.1**	**N/A**
Carbon Dioxide	—	**N/A**	**0.1**

Copies of gas cylinder certifications are appended. All concentration data were recorded on a wet, volume basis. HCN spiking was performed prior to testing to confirm the measurement system's ability to deliver and quantify HCN. The sample and data collection followed the procedures outlined in Methods 320.

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

System Leak Check: 0.0 mL/min

Nitrogen (Zero) Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
N2_DIR_000006.LAB	11/14/23	6:52:09	0.0	0.0	0.0	191.0	0.97	0.0	-0.1	-0.008
N2_DIR_000007BKG.LAB	11/14/23	6:54:23	0.0	0.0	0.0	190.6	0.97	0.0	0.0	0.000
N2_DIR_000008.LAB	11/14/23	6:54:37	0.0	0.0	0.0	190.4	0.97	0.0	-0.1	0.002
N2_DIR_000009.LAB	11/14/23	6:54:45	0.0	0.0	0.0	190.4	0.97	-0.1	-0.1	0.001
N2_DIR_000010.LAB	11/14/23	6:54:53	0.0	0.0	0.0	190.4	0.97	-0.1	0.0	-0.001
N2_DIR_000011.LAB	11/14/23	6:55:01	0.0	0.0	0.0	190.4	0.97	-0.2	0.0	0.003
N2_DIR_000012.LAB	11/14/23	6:55:09	0.0	0.0	0.0	190.4	0.97	-0.2	-0.1	0.002
N2_DIR_000013.LAB	11/14/23	6:55:17	0.0	0.0	0.0	190.3	0.97	-0.2	0.0	0.001
N2_DIR_000014.LAB	11/14/23	6:55:24	0.0	0.0	0.0	190.3	0.97	0.0	0.1	-0.003

Calibration Transfer Standard (CTS), Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS_DIR_000020.LAB	11/14/23	6:56:53	0.0	0.0	0.0	190.1	0.97	101.2	0.1	-0.022	**99.8%**
CTS_DIR_000021.LAB	11/14/23	6:57:01	0.0	0.0	0.0	190.1	0.97	101.2	-0.1	-0.021	**99.8%**
CTS_DIR_000022.LAB	11/14/23	6:57:08	0.0	0.0	0.0	190.1	0.97	101.5	0.0	-0.020	**100.1%**
CTS_DIR_000023.LAB	11/14/23	6:57:16	0.0	0.0	0.0	190.0	0.97	101.3	0.0	-0.028	**99.9%**
CTS_DIR_000024.LAB	11/14/23	6:57:24	0.0	0.0	0.0	190.0	0.97	101.4	0.0	-0.023	**100.0%**
CTS_DIR_000025.LAB	11/14/23	6:57:32	0.0	0.0	0.0	190.0	0.97	101.2	0.0	-0.023	**99.8%**
CTS_DIR_000026.LAB	11/14/23	6:57:40	0.0	0.0	0.0	189.9	0.97	101.3	0.2	-0.020	**99.9%**
	Average							**101.3**			**99.9%**

Analyte Spike Gas (HCN) Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % HCN
49.6HCN_DIR_000029.LAB	11/14/23	6:59:08	0.0	0.0	0.0	190.1	0.97	-0.2	50.3	4.957	**101.4%**
49.6HCN_DIR_000030.LAB	11/14/23	6:59:16	0.0	0.0	0.0	190.2	0.97	0.1	50.4	4.968	**101.8%**
49.6HCN_DIR_000031.LAB	11/14/23	6:59:24	0.0	0.0	0.0	190.3	0.97	-0.1	50.1	4.941	**101.1%**
49.6HCN_DIR_000032.LAB	11/14/23	6:59:32	0.0	0.0	0.0	190.4	0.97	0.0	50.5	4.961	**101.8%**
49.6HCN_DIR_000033.LAB	11/14/23	6:59:40	0.0	0.0	0.0	190.5	0.97	-0.4	50.3	4.959	**101.5%**
49.6HCN_DIR_000034.LAB	11/14/23	6:59:48	0.0	0.0	0.0	190.6	0.97	-0.1	50.4	4.949	**101.8%**
49.6HCN_DIR_000035.LAB	11/14/23	6:59:55	0.0	0.0	0.0	190.7	0.97	-0.2	50.3	4.951	**101.5%**
49.6HCN_DIR_000036.LAB	11/14/23	7:00:03	0.0	0.0	0.0	190.8	0.97	-0.2	50.4	4.957	**101.7%**
	Average								**50.3**	**4.955**	**101.6%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS_RT_000044.LAB	11/14/23	7:09:52	0.0	0.0	0.0	190.3	0.97	100.9	-0.1	-0.028	**99.5%**
CTS_RT_000045.LAB	11/14/23	7:10:00	0.0	0.0	0.0	190.2	0.97	101.1	0.0	-0.024	**99.7%**
CTS_RT_000046.LAB	11/14/23	7:10:08	0.0	0.0	0.0	190.3	0.97	101.2	0.0	-0.027	**99.9%**
CTS_RT_000047.LAB	11/14/23	7:10:16	0.0	0.0	0.0	190.2	0.97	101.3	-0.1	-0.026	**100.0%**
CTS_RT_000048.LAB	11/14/23	7:10:24	0.0	0.0	0.1	190.2	0.97	101.2	-0.3	-0.018	**99.9%**
CTS_RT_000049.LAB	11/14/23	7:10:32	0.0	0.0	0.0	190.2	0.97	101.4	0.0	-0.021	**100.1%**
CTS_RT_000050.LAB	11/14/23	7:10:39	0.0	0.0	0.1	190.1	0.97	101.3	-0.1	-0.020	**100.0%**
CTS_RT_000051.LAB	11/14/23	7:10:47	0.0	0.0	0.0	190.1	0.97	101.3	-0.1	-0.027	**100.0%**

Response Time Test

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Response Time (sec)
CTS_RT_000041.LAB	11/14/23	7:09:29	0.9	0.0	0.0	190.4	0.97	0.0	-0.2	-0.003	-
CTS_RT_000042.LAB	11/14/23	7:09:37	0.7	0.6	0.0	190.4	0.97	25.6	0.0	-0.024	**15.89**
CTS_RT_000043.LAB	11/14/23	7:09:44	0.1	0.0	0.0	190.3	0.97	99.9	0.0	-0.025	**23.89**
CTS_RT_000044.LAB	11/14/23	7:09:52	0.0	0.0	0.0	190.3	0.97	100.9	-0.1	-0.028	
CTS_RT_000045.LAB	11/14/23	7:10:00	0.0	0.0	0.0	190.2	0.97	101.1	0.0	-0.024	
CTS_RT_000046.LAB	11/14/23	7:10:08	0.0	0.0	0.0	190.3	0.97	101.2	0.0	-0.027	
CTS_RT_000047.LAB	11/14/23	7:10:16	0.0	0.0	0.0	190.2	0.97	101.3	-0.1	-0.026	
CTS_RT_000048.LAB	11/14/23	7:10:24	0.0	0.0	0.1	190.2	0.97	101.2	-0.3	-0.018	
CTS_RT_000049.LAB	11/14/23	7:10:32	0.0	0.0	0.0	190.2	0.97	101.4	0.0	-0.021	

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

Pre 1 Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
AMBIENT_STACK_000124.LAB	11/14/23	7:21:16	11.1	12.2	-0.2	190.8	0.97	0.7	0.7	-0.007
AMBIENT_STACK_000125.LAB	11/14/23	7:21:24	11.1	12.3	-0.2	190.7	0.97	0.7	0.9	0.001
AMBIENT_STACK_000126.LAB	11/14/23	7:21:31	11.1	12.4	-0.2	190.7	0.97	0.8	1.0	-0.007
									0.9	**-0.004**

Pre 1 Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
PRE1_SPK_000145.LAB	11/14/23	7:25:12	10.7	11.9	-0.2	190.1	0.97	0.7	3.9	0.317	**0.064**	**95.6%**
PRE1_SPK_000146.LAB	11/14/23	7:25:20	10.7	11.8	-0.2	190.0	0.97	0.8	3.9	0.316	**0.064**	**97.8%**
PRE1_SPK_000147.LAB	11/14/23	7:25:28	10.8	11.8	-0.2	190.0	0.97	0.7	3.7	0.312	**0.063**	**92.8%**
PRE1_SPK_000148.LAB	11/14/23	7:25:35	10.7	11.8	-0.2	189.9	0.97	0.6	3.7	0.324	**0.065**	**89.9%**
PRE1_SPK_000149.LAB	11/14/23	7:25:43	11.0	11.8	-0.2	189.9	0.97	0.6	3.6	0.313	**0.063**	**90.7%**
PRE1_SPK_000150.LAB	11/14/23	7:25:51	11.1	11.8	-0.2	189.9	0.97	0.8	3.7	0.316	**0.064**	**91.3%**
PRE1_SPK_000151.LAB	11/14/23	7:25:59	11.0	11.7	-0.2	189.9	0.97	0.7	3.7	0.303	**0.061**	**95.2%**
PRE1_SPK_000152.LAB	11/14/23	7:26:07	11.1	11.7	-0.2	190.0	0.97	0.6	3.7	0.309	**0.062**	**94.6%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN1_000261.LAB	11/14/23	9:03:30	11.5	11.8	-0.2	191.3	0.98	0.7	0.8	-0.001
RUN1_000262.LAB	11/14/23	9:04:33	11.8	11.8	-0.2	191.2	0.98	0.7	0.8	-0.002
RUN1_000263.LAB	11/14/23	9:05:36	12.1	11.9	-0.2	191.1	0.98	0.8	0.8	-0.003
									0.8	**-0.002**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST1_SPK_000282.LAB	11/14/23	9:09:16	10.6	11.6	-0.2	190.6	0.98	0.5	4.8	0.421	**0.085**	**95.6%**
POST1_SPK_000283.LAB	11/14/23	9:09:24	10.7	11.6	-0.2	190.6	0.98	0.8	4.8	0.417	**0.084**	**95.9%**
POST1_SPK_000284.LAB	11/14/23	9:09:32	10.6	11.7	-0.2	190.5	0.98	0.5	4.8	0.415	**0.084**	**96.9%**
POST1_SPK_000285.LAB	11/14/23	9:09:39	10.7	11.8	-0.2	190.5	0.98	0.7	4.9	0.418	**0.084**	**98.6%**
POST1_SPK_000286.LAB	11/14/23	9:09:47	10.7	11.8	-0.2	190.5	0.98	0.7	4.7	0.415	**0.084**	**95.0%**
POST1_SPK_000287.LAB	11/14/23	9:09:55	10.6	11.6	-0.2	190.5	0.98	0.7	5.0	0.411	**0.083**	**100.6%**
POST1_SPK_000288.LAB	11/14/23	9:10:03	10.6	11.4	-0.2	190.5	0.98	0.6	4.7	0.419	**0.085**	**93.4%**
POST1_SPK_000289.LAB	11/14/23	9:10:11	10.6	11.3	-0.2	190.5	0.98	0.8	4.7	0.418	**0.084**	**95.0%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST1_CTS_000299.LAB	11/14/23	9:12:20	0.4	0.0	0.0	190.3	0.98	100.1	0.1	-0.024	**98.9%**
POST1_CTS_000300.LAB	11/14/23	9:12:28	0.3	0.0	0.0	190.3	0.98	100.5	0.0	-0.028	**99.2%**
POST1_CTS_000301.LAB	11/14/23	9:12:36	0.3	0.0	0.0	190.2	0.98	100.6	0.1	-0.024	**99.3%**
POST1_CTS_000302.LAB	11/14/23	9:12:44	0.3	0.0	0.0	190.2	0.98	100.7	0.3	-0.019	**99.4%**
POST1_CTS_000303.LAB	11/14/23	9:12:51	0.2	0.0	0.0	190.2	0.98	100.8	0.1	-0.023	**99.5%**
POST1_CTS_000304.LAB	11/14/23	9:12:59	0.2	0.0	0.0	190.1	0.98	100.7	0.0	-0.030	**99.4%**
POST1_CTS_000305.LAB	11/14/23	9:13:07	0.2	0.0	0.0	190.1	0.98	100.6	-0.1	-0.024	**99.3%**
POST1_CTS_000306.LAB	11/14/23	9:13:15	0.2	0.0	0.0	190.1	0.98	100.3	-0.1	-0.026	**99.0%**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN2_000393.LAB	11/14/23	10:27:42	11.8	12.3	-0.2	190.7	0.98	0.8	0.8	0.001
RUN2_000394.LAB	11/14/23	10:28:45	12.0	12.1	-0.3	190.7	0.98	0.9	0.7	0.000
RUN2_000395.LAB	11/14/23	10:29:48	11.5	12.0	-0.2	190.6	0.98	0.8	0.8	-0.003
									0.8	**-0.001**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST1_SPK_000405.LAB	11/14/23	10:32:58	10.4	11.2	-0.2	190.5	0.98	0.8	4.5	0.393	**0.079**	**95.8%**
POST1_SPK_000406.LAB	11/14/23	10:33:06	10.7	11.1	-0.3	190.5	0.98	0.7	4.5	0.394	**0.079**	**96.3%**
POST1_SPK_000407.LAB	11/14/23	10:33:14	10.6	11.1	-0.2	190.5	0.98	0.7	4.6	0.395	**0.080**	**96.5%**
POST1_SPK_000408.LAB	11/14/23	10:33:22	10.5	11.1	-0.2	190.5	0.98	0.6	4.3	0.396	**0.080**	**91.6%**
POST1_SPK_000409.LAB	11/14/23	10:33:30	10.4	11.1	-0.2	190.4	0.98	0.7	4.5	0.386	**0.078**	**98.2%**
POST1_SPK_000410.LAB	11/14/23	10:33:38	10.4	11.2	-0.2	190.3	0.98	0.5	4.6	0.393	**0.079**	**97.1%**
POST1_SPK_000411.LAB	11/14/23	10:33:45	10.4	11.2	-0.2	190.3	0.98	0.6	4.4	0.397	**0.080**	**92.4%**
POST1_SPK_000412.LAB	11/14/23	10:33:54	10.4	11.4	-0.2	190.3	0.98	0.7	4.7	0.393	**0.079**	**99.0%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST1_CTS_000420.LAB	11/14/23	10:35:45	0.7	0.0	0.0	189.9	0.98	100.0	0.1	-0.018	**98.8%**
POST1_CTS_000421.LAB	11/14/23	10:35:53	0.6	0.0	0.0	189.9	0.98	100.1	0.2	-0.016	**98.8%**
POST1_CTS_000422.LAB	11/14/23	10:36:01	0.6	0.0	0.0	189.9	0.98	100.2	0.1	-0.023	**99.0%**
POST1_CTS_000423.LAB	11/14/23	10:36:09	0.5	0.0	0.0	190.0	0.98	100.5	0.0	-0.025	**99.2%**
POST1_CTS_000424.LAB	11/14/23	10:36:17	0.5	0.0	0.0	190.1	0.98	100.3	0.1	-0.018	**99.0%**
POST1_CTS_000425.LAB	11/14/23	10:36:24	0.4	0.0	0.0	190.1	0.98	100.2	-0.1	-0.019	**98.9%**
POST1_CTS_000426.LAB	11/14/23	10:36:32	0.4	0.0	0.0	190.3	0.98	100.3	0.2	-0.025	**99.1%**
POST1_CTS_000427.LAB	11/14/23	10:36:40	0.3	0.0	0.0	190.3	0.98	100.6	0.0	-0.016	**99.3%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN3_000513.LAB	11/14/23	11:53:08	11.4	12.1	-0.2	190.8	0.97	0.9	0.8	-0.002
RUN3_000514.LAB	11/14/23	11:54:10	11.4	12.3	-0.3	190.8	0.97	0.9	0.9	-0.001
RUN3_000515.LAB	11/14/23	11:55:13	11.4	12.2	-0.2	190.7	0.97	0.9	0.9	0.000
									0.9	**-0.001**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST3_SPK_000534.LAB	11/14/23	11:58:43	10.3	11.6	-0.2	190.6	0.97	0.9	4.5	0.409	**0.083**	**90.3%**
POST3_SPK_000535.LAB	11/14/23	11:58:51	10.4	11.6	-0.2	190.6	0.97	0.9	4.6	0.403	**0.081**	**94.5%**
POST3_SPK_000536.LAB	11/14/23	11:58:58	10.4	11.6	-0.3	190.6	0.97	0.8	4.6	0.400	**0.081**	**95.1%**
POST3_SPK_000537.LAB	11/14/23	11:59:06	10.4	11.5	-0.2	190.6	0.97	1.0	4.7	0.399	**0.080**	**97.4%**
POST3_SPK_000538.LAB	11/14/23	11:59:14	10.4	11.5	-0.2	190.6	0.97	0.9	4.7	0.399	**0.081**	**96.4%**
POST3_SPK_000539.LAB	11/14/23	11:59:22	10.4	11.5	-0.2	190.6	0.97	0.7	4.7	0.399	**0.081**	**97.2%**
POST3_SPK_000540.LAB	11/14/23	11:59:30	10.3	11.5	-0.2	190.6	0.97	0.7	4.8	0.395	**0.080**	**99.0%**
POST3_SPK_000541.LAB	11/14/23	11:59:38	10.4	11.4	-0.2	190.6	0.97	0.9	4.6	0.406	**0.082**	**93.6%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST3_CTS_000554.LAB	11/14/23	12:02:03	0.1	0.0	-0.1	190.6	0.97	100.6	0.0	-0.021	**99.3%**
POST3_CTS_000555.LAB	11/14/23	12:02:11	0.0	0.0	0.0	190.6	0.97	100.8	0.2	-0.027	**99.5%**
POST3_CTS_000556.LAB	11/14/23	12:02:19	0.1	0.0	0.0	190.6	0.97	100.8	0.0	-0.018	**99.5%**
POST3_CTS_000557.LAB	11/14/23	12:02:27	0.1	0.0	0.0	190.6	0.97	101.0	0.2	-0.020	**99.7%**
POST3_CTS_000558.LAB	11/14/23	12:02:34	0.0	0.0	0.1	190.6	0.97	100.8	0.1	-0.026	**99.5%**
POST3_CTS_000559.LAB	11/14/23	12:02:42	0.0	0.0	0.0	190.6	0.97	100.6	0.0	-0.028	**99.4%**
POST3_CTS_000560.LAB	11/14/23	12:02:50	0.0	0.0	0.0	190.6	0.97	100.9	0.2	-0.029	**99.6%**
POST3_CTS_000561.LAB	11/14/23	12:02:58	0.0	0.0	0.0	190.6	0.97	101.2	0.0	-0.019	**99.9%**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill On

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

Post Test CTS, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST3_CTS_000981.LAB	11/14/23	16:50:15	0.5	0.0	0.0	190.5	0.97	100.7	0.2	-0.018	**99.5%**
POST3_CTS_000982.LAB	11/14/23	16:50:23	0.5	0.0	0.0	190.5	0.97	100.6	0.1	-0.013	**99.3%**
POST3_CTS_000983.LAB	11/14/23	16:50:30	0.4	0.0	0.0	190.5	0.97	100.8	0.4	-0.015	**99.5%**
POST3_CTS_000984.LAB	11/14/23	16:50:38	0.3	0.0	0.0	190.5	0.97	100.6	0.1	-0.021	**99.4%**
POST3_CTS_000985.LAB	11/14/23	16:50:46	0.3	0.0	0.0	190.5	0.97	100.8	0.2	-0.025	**99.5%**
POST3_CTS_000986.LAB	11/14/23	16:50:54	0.3	0.0	0.0	190.5	0.97	100.8	0.2	-0.024	**99.5%**
POST3_CTS_000987.LAB	11/14/23	16:51:02	0.2	0.0	0.0	190.4	0.97	100.6	0.1	-0.015	**99.4%**
POST3_CTS_000988.LAB	11/14/23	16:51:10	0.2	0.0	0.0	190.5	0.97	101.2	0.1	-0.023	**99.9%**
	Average							**100.8**			

Post Test N2, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
CTS_DIR_001020.LAB	11/14/23	17:01:32	0.0	0.0	0.0	190.7	0.97	100.8	0.1	-0.023
CTS_DIR_001021.LAB	11/14/23	17:01:40	0.0	0.0	0.0	190.7	0.97	100.8	0.0	-0.019
CTS_DIR_001022.LAB	11/14/23	17:01:48	0.0	0.0	0.0	190.7	0.97	100.8	0.2	-0.024

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

System Leak Check: 0.0 mL/min

Nitrogen (Zero) Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
N2_DIR_000006.LAB	11/14/23	6:52:09	0.0	0.0	0.0	191.0	0.97	0.0	-0.1	-0.008
N2_DIR_000007BKG.LAB	11/14/23	6:54:23	0.0	0.0	0.0	190.6	0.97	0.0	0.0	0.000
N2_DIR_000008.LAB	11/14/23	6:54:37	0.0	0.0	0.0	190.4	0.97	0.0	-0.1	0.002
N2_DIR_000009.LAB	11/14/23	6:54:45	0.0	0.0	0.0	190.4	0.97	-0.1	-0.1	0.001
N2_DIR_000010.LAB	11/14/23	6:54:53	0.0	0.0	0.0	190.4	0.97	-0.1	0.0	-0.001
N2_DIR_000011.LAB	11/14/23	6:55:01	0.0	0.0	0.0	190.4	0.97	-0.2	0.0	0.003
N2_DIR_000012.LAB	11/14/23	6:55:09	0.0	0.0	0.0	190.4	0.97	-0.2	-0.1	0.002
N2_DIR_000013.LAB	11/14/23	6:55:17	0.0	0.0	0.0	190.3	0.97	-0.2	0.0	0.001
N2_DIR_000014.LAB	11/14/23	6:55:24	0.0	0.0	0.0	190.3	0.97	0.0	0.1	-0.003

Calibration Transfer Standard (CTS), Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS_DIR_000020.LAB	11/14/23	6:56:53	0.0	0.0	0.0	190.1	0.97	101.2	0.1	-0.022	**99.8%**
CTS_DIR_000021.LAB	11/14/23	6:57:01	0.0	0.0	0.0	190.1	0.97	101.2	-0.1	-0.021	**99.8%**
CTS_DIR_000022.LAB	11/14/23	6:57:08	0.0	0.0	0.0	190.1	0.97	101.5	0.0	-0.020	**100.1%**
CTS_DIR_000023.LAB	11/14/23	6:57:16	0.0	0.0	0.0	190.0	0.97	101.3	0.0	-0.028	**99.9%**
CTS_DIR_000024.LAB	11/14/23	6:57:24	0.0	0.0	0.0	190.0	0.97	101.4	0.0	-0.023	**100.0%**
CTS_DIR_000025.LAB	11/14/23	6:57:32	0.0	0.0	0.0	190.0	0.97	101.2	0.0	-0.023	**99.8%**
CTS_DIR_000026.LAB	11/14/23	6:57:40	0.0	0.0	0.0	189.9	0.97	101.3	0.2	-0.020	**99.9%**
	Average							**101.3**			**99.9%**

Analyte Spike Gas (HCN) Direct to FTIR

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % HCN
49.6HCN_DIR_000029.LAB	11/14/23	6:59:08	0.0	0.0	0.0	190.1	0.97	-0.2	50.3	4.957	**101.4%**
49.6HCN_DIR_000030.LAB	11/14/23	6:59:16	0.0	0.0	0.0	190.2	0.97	0.1	50.4	4.968	**101.8%**
49.6HCN_DIR_000031.LAB	11/14/23	6:59:24	0.0	0.0	0.0	190.3	0.97	-0.1	50.1	4.941	**101.1%**
49.6HCN_DIR_000032.LAB	11/14/23	6:59:32	0.0	0.0	0.0	190.4	0.97	0.0	50.5	4.961	**101.8%**
49.6HCN_DIR_000033.LAB	11/14/23	6:59:40	0.0	0.0	0.0	190.5	0.97	-0.4	50.3	4.959	**101.5%**
49.6HCN_DIR_000034.LAB	11/14/23	6:59:48	0.0	0.0	0.0	190.6	0.97	-0.1	50.4	4.949	**101.8%**
49.6HCN_DIR_000035.LAB	11/14/23	6:59:55	0.0	0.0	0.0	190.7	0.97	-0.2	50.3	4.951	**101.5%**
49.6HCN_DIR_000036.LAB	11/14/23	7:00:03	0.0	0.0	0.0	190.8	0.97	-0.2	50.4	4.957	**101.7%**
	Average								**50.3**	**4.955**	**101.6%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS_RT_000044.LAB	11/14/23	7:09:52	0.0	0.0	0.0	190.3	0.97	100.9	-0.1	-0.028	**99.5%**
CTS_RT_000045.LAB	11/14/23	7:10:00	0.0	0.0	0.0	190.2	0.97	101.1	0.0	-0.024	**99.7%**
CTS_RT_000046.LAB	11/14/23	7:10:08	0.0	0.0	0.0	190.3	0.97	101.2	0.0	-0.027	**99.9%**
CTS_RT_000047.LAB	11/14/23	7:10:16	0.0	0.0	0.0	190.2	0.97	101.3	-0.1	-0.026	**100.0%**
CTS_RT_000048.LAB	11/14/23	7:10:24	0.0	0.0	0.1	190.2	0.97	101.2	-0.3	-0.018	**99.9%**
CTS_RT_000049.LAB	11/14/23	7:10:32	0.0	0.0	0.0	190.2	0.97	101.4	0.0	-0.021	**100.1%**
CTS_RT_000050.LAB	11/14/23	7:10:39	0.0	0.0	0.1	190.1	0.97	101.3	-0.1	-0.020	**100.0%**
CTS_RT_000051.LAB	11/14/23	7:10:47	0.0	0.0	0.0	190.1	0.97	101.3	-0.1	-0.027	**100.0%**

Response Time Test

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Response Time (sec)
CTS_RT_000041.LAB	11/14/23	7:09:29	0.9	0.0	0.0	190.4	0.97	0.0	-0.2	-0.003	-
CTS_RT_000042.LAB	11/14/23	7:09:37	0.7	0.6	0.0	190.4	0.97	25.6	0.0	-0.024	**15.89**
CTS_RT_000043.LAB	11/14/23	7:09:44	0.1	0.0	0.0	190.3	0.97	99.9	0.0	-0.025	**23.89**
CTS_RT_000044.LAB	11/14/23	7:09:52	0.0	0.0	0.0	190.3	0.97	100.9	-0.1	-0.028	
CTS_RT_000045.LAB	11/14/23	7:10:00	0.0	0.0	0.0	190.2	0.97	101.1	0.0	-0.024	
CTS_RT_000046.LAB	11/14/23	7:10:08	0.0	0.0	0.0	190.3	0.97	101.2	0.0	-0.027	
CTS_RT_000047.LAB	11/14/23	7:10:16	0.0	0.0	0.0	190.2	0.97	101.3	-0.1	-0.026	
CTS_RT_000048.LAB	11/14/23	7:10:24	0.0	0.0	0.1	190.2	0.97	101.2	-0.3	-0.018	
CTS_RT_000049.LAB	11/14/23	7:10:32	0.0	0.0	0.0	190.2	0.97	101.4	0.0	-0.021	

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

Pre 1 Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN3_000513.LAB	11/14/23	11:53:08	11.4	12.1	-0.2	190.8	0.97	0.9	0.8	-0.002
RUN3_000514.LAB	11/14/23	11:54:10	11.4	12.3	-0.3	190.8	0.97	0.9	0.9	-0.001
RUN3_000515.LAB	11/14/23	11:55:13	11.4	12.2	-0.2	190.7	0.97	0.9	0.9	0.000
									0.9	**-0.001**

Pre 1 Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST3_SPK_000533.LAB	11/14/23	11:58:35	10.3	11.6	-0.2	190.6	0.97	0.7	4.5	0.396	**0.080**	**93.6%**
POST3_SPK_000534.LAB	11/14/23	11:58:43	10.3	11.6	-0.2	190.6	0.97	0.9	4.5	0.409	**0.083**	**90.3%**
POST3_SPK_000535.LAB	11/14/23	11:58:51	10.4	11.6	-0.2	190.6	0.97	0.9	4.6	0.403	**0.081**	**94.5%**
POST3_SPK_000536.LAB	11/14/23	11:58:58	10.4	11.6	-0.3	190.6	0.97	0.8	4.6	0.400	**0.081**	**95.1%**
POST3_SPK_000537.LAB	11/14/23	11:59:06	10.4	11.5	-0.2	190.6	0.97	1.0	4.7	0.399	**0.080**	**97.4%**
POST3_SPK_000538.LAB	11/14/23	11:59:14	10.4	11.5	-0.2	190.6	0.97	0.9	4.7	0.399	**0.081**	**96.4%**
POST3_SPK_000539.LAB	11/14/23	11:59:22	10.4	11.5	-0.2	190.6	0.97	0.7	4.7	0.399	**0.081**	**97.2%**
POST3_SPK_000540.LAB	11/14/23	11:59:30	10.3	11.5	-0.2	190.6	0.97	0.7	4.8	0.395	**0.080**	**99.0%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
MILLOFF_R1_000686.LAB	11/14/23	13:52:40	12.4	13.9	-0.2	190.8	0.97	1.1	0.8	0.004
MILLOFF_R1_000687.LAB	11/14/23	13:53:43	12.5	14.1	-0.2	190.7	0.97	1.1	0.8	0.003
MILLOFF_R1_000688.LAB	11/14/23	13:54:46	12.4	14.0	-0.2	190.7	0.97	1.1	0.9	0.004
									0.8	**0.004**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST1_SPK_000702.LAB	11/14/23	13:58:09	11.4	13.4	-0.2	190.5	0.97	1.0	4.5	0.384	**0.078**	**96.0%**
POST1_SPK_000703.LAB	11/14/23	13:58:17	11.4	13.5	-0.2	190.6	0.97	1.1	4.5	0.383	**0.077**	**96.1%**
POST1_SPK_000704.LAB	11/14/23	13:58:25	11.4	13.4	-0.2	190.5	0.97	0.9	4.5	0.382	**0.077**	**97.0%**
POST1_SPK_000705.LAB	11/14/23	13:58:33	11.4	13.3	-0.2	190.5	0.97	1.2	4.5	0.391	**0.079**	**94.5%**
POST1_SPK_000706.LAB	11/14/23	13:58:41	11.4	13.4	-0.2	190.6	0.97	1.1	4.5	0.408	**0.082**	**91.8%**
POST1_SPK_000707.LAB	11/14/23	13:58:49	11.5	13.5	-0.2	190.6	0.97	0.9	4.7	0.394	**0.080**	**98.7%**
POST1_SPK_000708.LAB	11/14/23	13:58:57	11.6	13.5	-0.2	190.6	0.97	0.9	4.6	0.397	**0.080**	**95.2%**
POST1_SPK_000709.LAB	11/14/23	13:59:04	11.7	13.5	-0.3	190.6	0.97	1.0	4.5	0.403	**0.081**	**93.2%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST1_CTS_000715.LAB	11/14/23	14:00:50	0.1	0.0	0.0	190.7	0.97	101.1	0.0	-0.016	**99.8%**
POST1_CTS_000716.LAB	11/14/23	14:00:58	0.1	0.0	0.1	190.7	0.97	101.0	-0.1	-0.022	**99.7%**
POST1_CTS_000717.LAB	11/14/23	14:01:06	0.1	0.0	0.0	190.7	0.97	101.0	0.2	-0.025	**99.7%**
POST1_CTS_000718.LAB	11/14/23	14:01:14	0.1	0.0	0.0	190.7	0.97	101.0	0.0	-0.019	**99.7%**
POST1_CTS_000719.LAB	11/14/23	14:01:22	0.1	0.0	0.0	190.7	0.97	100.8	0.3	-0.023	**99.6%**
POST1_CTS_000720.LAB	11/14/23	14:01:30	0.1	0.0	0.0	190.7	0.97	100.8	0.1	-0.025	**99.5%**
POST1_CTS_000721.LAB	11/14/23	14:01:38	0.1	0.0	0.0	190.7	0.97	101.2	0.1	-0.015	**99.9%**
POST1_CTS_000722.LAB	11/14/23	14:01:45	0.1	0.0	0.0	190.7	0.97	100.6	0.1	-0.018	**99.4%**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
MILLOFF_R2_000814.LAB	11/14/23	15:17:54	12.2	14.1	-0.2	191.1	0.97	1.2	1.0	0.004
MILLOFF_R2_000815.LAB	11/14/23	15:18:57	12.3	14.0	-0.2	191.2	0.97	1.2	0.9	0.001
MILLOFF_R2_000816.LAB	11/14/23	15:20:00	12.3	14.1	-0.2	191.2	0.97	1.2	1.0	0.006
									1.0	**0.004**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST2_SPK_000840.LAB	11/14/23	15:24:31	11.2	13.2	-0.3	190.7	0.97	1.1	4.4	0.351	**0.071**	**98.4%**
POST2_SPK_000841.LAB	11/14/23	15:24:39	11.2	13.2	-0.2	190.7	0.97	1.2	4.4	0.354	**0.071**	**97.3%**
POST2_SPK_000842.LAB	11/14/23	15:24:47	11.1	13.0	-0.2	190.7	0.97	1.1	4.2	0.352	**0.071**	**92.8%**
POST2_SPK_000843.LAB	11/14/23	15:24:55	11.1	12.8	-0.2	190.7	0.97	1.2	4.3	0.358	**0.072**	**94.1%**
POST2_SPK_000844.LAB	11/14/23	15:25:03	11.2	13.0	-0.2	190.7	0.97	1.0	4.5	0.352	**0.071**	**101.1%**
POST2_SPK_000845.LAB	11/14/23	15:25:10	11.4	13.1	-0.2	190.7	0.97	1.0	4.3	0.352	**0.071**	**95.6%**
POST2_SPK_000846.LAB	11/14/23	15:25:18	11.4	13.2	-0.2	190.7	0.97	1.0	4.4	0.359	**0.072**	**96.4%**
POST2_SPK_000847.LAB	11/14/23	15:25:26	11.4	13.1	-0.2	190.7	0.97	1.2	4.3	0.355	**0.072**	**95.9%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST2_CTS_000855.LAB	11/14/23	15:27:20	0.1	0.0	0.0	190.6	0.97	101.1	0.1	-0.027	**99.8%**
POST2_CTS_000856.LAB	11/14/23	15:27:29	0.1	0.0	0.0	190.6	0.97	101.3	0.0	-0.017	**100.0%**
POST2_CTS_000857.LAB	11/14/23	15:27:36	0.1	0.0	0.0	190.5	0.97	101.0	0.2	-0.023	**99.7%**
POST2_CTS_000858.LAB	11/14/23	15:27:44	0.1	0.0	0.0	190.5	0.97	101.0	0.1	-0.024	**99.7%**
POST2_CTS_000859.LAB	11/14/23	15:27:52	0.1	0.0	0.0	190.5	0.97	101.1	0.2	-0.025	**99.8%**
POST2_CTS_000860.LAB	11/14/23	15:28:00	0.1	0.0	0.0	190.5	0.97	101.1	0.1	-0.013	**99.8%**
POST2_CTS_000861.LAB	11/14/23	15:28:07	0.1	0.0	0.0	190.5	0.97	100.8	0.2	-0.026	**99.5%**
POST2_CTS_000862.LAB	11/14/23	15:28:15	0.1	0.0	0.1	190.5	0.97	101.2	0.1	-0.019	**99.9%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
MILLOFF_R3_000953.LAB	11/14/23	16:42:30	12.0	14.3	-0.2	191.0	0.97	1.4	1.1	-0.001
MILLOFF_R3_000954.LAB	11/14/23	16:43:33	11.9	14.0	-0.2	191.1	0.97	1.4	1.1	0.002
MILLOFF_R3_000955.LAB	11/14/23	16:44:35	11.7	13.8	-0.2	190.9	0.97	1.4	1.0	0.002
									1.1	**0.001**

Effluent Spike Using Analyte

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Dilution Factor	Recovery % HCN
POST3_SPK_000961.LAB	11/14/23	16:46:35	10.7	12.9	-0.3	190.7	0.97	1.5	4.1	0.315	**0.064**	**98.1%**
POST3_SPK_000962.LAB	11/14/23	16:46:43	10.6	12.8	-0.2	190.7	0.97	1.3	4.1	0.310	**0.063**	**97.8%**
POST3_SPK_000963.LAB	11/14/23	16:46:50	10.8	12.9	-0.2	190.7	0.97	1.3	4.3	0.325	**0.066**	**99.4%**
POST3_SPK_000964.LAB	11/14/23	16:46:58	10.7	13.0	-0.2	190.7	0.97	1.2	4.3	0.326	**0.066**	**100.1%**
POST3_SPK_000965.LAB	11/14/23	16:47:07	10.8	13.2	-0.2	190.6	0.97	1.4	4.2	0.327	**0.066**	**96.6%**
POST3_SPK_000966.LAB	11/14/23	16:47:14	10.9	13.1	-0.2	190.6	0.97	1.4	4.2	0.332	**0.067**	**95.4%**
POST3_SPK_000967.LAB	11/14/23	16:47:22	10.9	13.1	-0.2	190.6	0.97	1.3	4.4	0.325	**0.066**	**102.3%**
POST3_SPK_000968.LAB	11/14/23	16:47:30	10.9	13.2	-0.2	190.5	0.97	1.3	4.0	0.306	**0.062**	**97.7%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST3_CTS_000981.LAB	11/14/23	16:50:15	0.5	0.0	0.0	190.5	0.97	100.7	0.2	-0.018	**99.5%**
POST3_CTS_000982.LAB	11/14/23	16:50:23	0.5	0.0	0.0	190.5	0.97	100.6	0.1	-0.013	**99.3%**
POST3_CTS_000983.LAB	11/14/23	16:50:30	0.4	0.0	0.0	190.5	0.97	100.8	0.4	-0.015	**99.5%**
POST3_CTS_000984.LAB	11/14/23	16:50:38	0.3	0.0	0.0	190.5	0.97	100.6	0.1	-0.021	**99.4%**
POST3_CTS_000985.LAB	11/14/23	16:50:46	0.3	0.0	0.0	190.5	0.97	100.8	0.2	-0.025	**99.5%**
POST3_CTS_000986.LAB	11/14/23	16:50:54	0.3	0.0	0.0	190.5	0.97	100.8	0.2	-0.024	**99.5%**
POST3_CTS_000987.LAB	11/14/23	16:51:02	0.2	0.0	0.0	190.4	0.97	100.6	0.1	-0.015	**99.4%**
POST3_CTS_000988.LAB	11/14/23	16:51:10	0.2	0.0	0.0	190.5	0.97	101.2	0.1	-0.023	**99.9%**

Client: CalPortland Company, Inc.
Facility: Redding Cement Plant
Project #: M234605
Operating Condition: Mill Off

Test Location: Main Kiln Stack
Date: 11/14/2023
Operator: R. Sollars
FTIR s/n: 110161896

Post Test CTS, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS_DIR_001020.LAB	11/14/23	17:01:32	0.0	0.0	0.0	190.7	0.97	100.8	0.1	-0.023	**99.5%**
CTS_DIR_001021.LAB	11/14/23	17:01:40	0.0	0.0	0.0	190.7	0.97	100.8	0.0	-0.019	**99.5%**
CTS_DIR_001022.LAB	11/14/23	17:01:48	0.0	0.0	0.0	190.7	0.97	100.8	0.2	-0.024	**99.5%**
CTS_DIR_001023.LAB	11/14/23	17:01:56	0.0	0.0	0.0	190.7	0.97	101.0	0.1	-0.026	**99.7%**
CTS_DIR_001024.LAB	11/14/23	17:02:04	0.0	0.0	0.0	190.7	0.97	100.8	0.1	-0.026	**99.5%**
CTS_DIR_001025.LAB	11/14/23	17:02:11	0.0	0.0	0.0	190.7	0.97	100.5	0.1	-0.026	**99.3%**
CTS_DIR_001026.LAB	11/14/23	17:02:19	0.0	0.0	0.0	190.7	0.97	100.9	0.0	-0.029	**99.6%**
CTS_DIR_001027.LAB	11/14/23	17:02:27	0.0	0.0	0.0	190.7	0.97	100.9	0.1	-0.025	**99.7%**
	Average							**100.8**			

Post Test N2, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
N2_DIR_001031.LAB	11/14/23	17:05:55	0.0	0.0	0.0	190.6	0.97	0.1	0.0	0.000
N2_DIR_001032.LAB	11/14/23	17:08:01	0.0	0.0	0.0	190.5	0.97	0.1	0.0	-0.001
N2_DIR_001033.LAB	11/14/23	17:10:07	0.0	0.0	0.0	190.6	0.97	0.1	0.0	-0.002

Time	DL summary - zero gas		Time	DL summary - in stack	
	HF ppm (10) 191C	HCN (100) 191C		HF ppm (10) 191C	HCN (100) 191C
6:54:45 AM	0.02	-0.08	7:39:43 AM	-0.16	0.79
6:54:53 AM	0.02	-0.03	7:40:46 AM	-0.20	0.77
6:55:01 AM	0.04	-0.03	7:41:49 AM	-0.21	0.78
6:55:09 AM	-0.03	-0.06	7:42:52 AM	-0.18	0.76
6:55:17 AM	0.00	-0.01	7:43:55 AM	-0.20	0.79
6:55:24 AM	0.04	0.11	7:44:57 AM	-0.21	0.72
6:55:33 AM	0.03	-0.13	7:46:00 AM	-0.21	0.74
Standard Deviation	**0.02**	**0.07**	**Standard Deviation**	**0.02**	**0.02**
3x = DL	**0.07**	**0.21**	**3x = DL**	**0.05**	**0.07**

Appendix I - Gas Cylinder Certifications

Airgas Specialty Gases
Airgas USA LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

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

Expiration Date: May 25, 2031

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

ANALYTICAL RESULTS

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

CALIBRATION STANDARDS

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

ANALYTICAL EQUIPMENT

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

Triad Data Available Upon Request

Signature on file
Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E03NI78E15A0225	Reference Number:	48-402834276-1
Cylinder Number:	EB0075029	Cylinder Volume:	152.0 CF
Laboratory:	124 - Los Angeles (SAP) - CA	Cylinder Pressure:	2015 PSIG
PGVP Number:	B32023	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Sep 07, 2023

Expiration Date: Sep 07, 2031

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

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	11.00 %	11.15 %	G1	+/- 0.6% NIST Traceable	09/07/2023
OXYGEN	11.00 %	11.18 %	G1	+/- 1.4% NIST Traceable	09/07/2023
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	08010611	K005428	13.94 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 30, 2024
NTRM	98051002	SG9150866BAL	12.05 % OXYGEN/NITROGEN	+/- 0.7%	Dec 14, 2023

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
SIEMENS 6E CO2	NDIR	Aug 21, 2023
SIEMENS OXYMAT 6	PARAMAGNETIC	Aug 18, 2023

Triad Data Available Upon Request

Signature on file
Approved for Release

Airgas
an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
11711 S. Alameda Street
Los Angeles, CA 90059
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

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

Expiration Date: Sep 05, 2031

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

ANALYTICAL RESULTS

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

Signature on file
Approved for Release

![Airgas logo]

an Air Liquide company

Airgas Specialty Gases
Airgas USA LLC
6141 Easton Road
Plumsteadville, PA 18949
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

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

Expiration Date: Mar 11, 2024

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

ANALYTICAL RESULTS

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

Signature on file

Approved for Release

END OF THE REPORT