Section 114 Information Collection Request Emissions Test Report

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GCC Rio Grande Inc.
Pueblo Plant
EPA Registry ID: 110037262636
3372 Lime Road
Pueblo, CO 81004
Report No. M234207A

mostardi platt

Section 114 Information Collection Request
Emissions Test Report

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Pueblo Plant
EPA Registry ID: 110037262636
3372 Lime Road
Pueblo, CO 81004

Report Submittal Date:
December 19, 2023

Report No. M234207A

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 GCC Rio Grande Inc. at the Pueblo Plant located in Pueblo, Colorado. 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
Facility Representative	GCC Rio Grande, Inc. 3372 Lime Road Pueblo, CO 81004	Amy Veek (719) 647-6861 aveek@gcc.com
Testing Company Representative	Mostardi Platt 7715 Commercial Way Suite 155 Henderson, NV 89011	Rich Sollars P: (630) 993-2100 (phone) E: 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
		≤ 0.14 ppmvd @7% O_2	
		≤ 0.05 lb/hr	
		≤ 0.0005 lb/ton clinker	
	HF[1]	≤ 0.14 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.17 ppmvd @7% O_2	
		≤ 0.06 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Chlorine (Cl_2)[1]	≤ 0.04 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.05 ppmvd @7% O_2	
		≤ 0.07 lb/hr	
		≤ 0.0006 lb/ton clinker	
	Hydrogen Cyanide (HCN)	8.40 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		11.77 ppmvd @7% O_2	
		6.02 lb/hr	
		0.0521 lb/ton clinker	
	Oxygen (O_2)	9.4 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO_2)	20.0 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H_2O)	13.4 %	USEPA Method 320, 40CFR63, Appendix A
	Cyclonic Flow Determination	PASS	USEPA Method 1, 40CFR60, Appendix A, Section 11.4
	Three-point O_2 Stratification Determination	< 5 %	USEPA Method 3A, 40CFR60, Appendix A and Method 7E, Section 8.1.2

[1] HF and 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
		≤ 0.10 ppmvd @7% O_2	
		≤ 0.04 lb/hr	
		≤ 0.0003 lb/ton clinker	
	HF[2]	≤ 0.19 ppmvd	Method 26A, 40CFR60, Appendix A
		≤ 0.16 ppmvd @7% O_2	
		≤ 0.06 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Chlorine (Cl_2)[2]	≤ 0.05 ppmvd	USEPA Method 26A, 40CFR60, Appendix A
		≤ 0.04 ppmvd @7% O_2	
		≤ 0.06 lb/hr	
		≤ 0.0005 lb/ton clinker	
	Hydrogen Cyanide (HCN)	13.02 ppmvw	USEPA Method 320, 40CFR63, Appendix A
		12.64 ppmvd @7% O_2	
		6.39 lb/hr	
		0.0534 lb/ton clinker	
	Oxygen (O_2)	4.6 % (dry)	USEPA Method 3A, 40CFR60, Appendix A
	Carbon Dioxide (CO_2)	28.9 % (dry)	USEPA Method 320, 40CFR63, Appendix A
	Moisture (H_2O)	12.4 %	USEPA Method 320, 40CFR63, Appendix A
	Cyclonic Flow Determination	PASS	USEPA Method 1, 40CFR60, Appendix A, Section 11.4
	Three-point O_2 Stratification Determination	< 5 %	USEPA Method 3A, 40CFR60, Appendix A and Method 7E, Section 8.1.2

[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

Table 3-1 QA/QC Specifications

Parameter	Method	QA/QC Specification	Acceptance Criteria	Actual Result
HCN	320	Method Detection Limit	0.5 ppm	0.4 ppmvw
		SNR	>2500 at 64 scans	4826 (Run 1 Average)
		S Beam	>0.9	1.320 (Run 1 Average)
		Direct HCN Analysis	±5% of tag value	-2.5%
		Dynamic Spike Analysis	≤10% of total sample volume	4.5%
			Spike gas ~twice native concentration or 3-4 ppm addition to native concentration	~twice native concentration
			≤±20% of expected value or ≤±0.5 ppm, whichever is less restrictive	+1.0 %
		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.	0.01 ppmvd

4.0 TEST PROCEDURES

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

4.1 Method 1 Sample and Velocity Traverse Determination

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

Sample Point Selection

Test Location	Stack Diameter	Port Length	Upstream Diameters	Downstream Diameters	Test Parameter	Number of Sampling Points
Main Kiln	10.25 Feet	9.5 Inches	4.9 Diameters	24.4 Diameters	HF/Cl_2 (26A)	12
					O_2 (3A)	3 (stratification)
					$HCN/HF/CO_2$ (320/3A)	1

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

4.2 Method 2 Volumetric Flow Rate Determination

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

All sampling system components were heated to 375ºF +/- 25ºF, 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: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill On	Mill On	Mill On	
Date	10/18/23	10/18/23	10/18/23	
Start Time	8:40	9:40	12:25	
End Time	9:46	12:02	13:31	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Velocity, ft/sec	52.564	51.821	51.923	52.103
Gas Volumetric Flow Rate, acfm	260,243	256,563	257,069	257,958
Gas Volumetric Flow Rate, dscfm	146,674	151,130	144,575	147,460
Gas Volumetric Flow Rate, scfm	170,216	169,789	168,268	169,424
Average %CO_2 by volume, dry basis	19.4	19.9	20.6	20.0
Average %O_2 by volume, dry basis	9.7	9.5	9.1	9.4
Clinker Production, ton/hr	112.6	114.3	119.7	115.5
Chloride (Cl2) Emissions				
ppm	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04
ppm@7%O2	≤ 0.05	≤ 0.05	≤ 0.05	≤ 0.05
lb/hr	≤ 0.06	≤ 0.07	≤ 0.06	≤ 0.07
lb/ton	≤ 0.0006	≤ 0.0006	≤ 0.0005	≤ 0.0006
Hydrogen Fluoride (HF) Emissions				
ppm	≤ 0.14	≤ 0.14	≤ 0.14	≤ 0.14
ppm@7%O2	≤ 0.17	≤ 0.17	≤ 0.16	≤ 0.17
lb/hr	≤ 0.06	≤ 0.07	≤ 0.06	≤ 0.06
lb/ton	≤ 0.0006	≤ 0.0006	≤ 0.0005	≤ 0.0006

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill On	Mill On	Mill On	
Date	10/18/23	10/18/23	10/18/23	
Start Time	8:40	9:40	12:25	
End Time	9:46	12:02	13:31	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	215.3	206.8	214.3	212.1
Flue Gas Moisture, percent by volume	14.1%	12.9%	14.1%	13.7%
Average Flue Pressure, in. Hg	24.94	24.94	24.94	24.94
Gas Sample Volume, dscf	46.481	47.302	45.248	46.344
Average Gas Velocity, ft/sec	53.009	53.197	53.178	53.128
Gas Volumetric Flow Rate, acfm	262,445	263,375	263,281	263,034
Gas Volumetric Flow Rate, dscfm	146,915	151,414	147,497	148,609
Gas Volumetric Flow Rate, scfm	171,002	173,818	171,802	172,207
Average %CO_2 by volume, dry basis	19.4	19.9	20.6	20.0
Average %O_2 by volume, dry basis	9.7	9.5	9.1	9.4
Isokinetic Variance	101.1	99.8	98.0	99.6
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.14	≤ 0.14	≤ 0.14	≤ 0.14

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill On	Mill On	Mill On	
Date	10/18/23	10/18/23	10/18/23	
Start Time	8:40	10:10	12:25	
End Time	9:46	12:02	13:31	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	210.2	203.0	210.1	207.8
Flue Gas Moisture, percent by volume	13.6%	9.0%	14.0%	12.2%
Average Flue Pressure, in. Hg	24.94	24.94	24.94	24.94
Gas Sample Volume, dscf	47.238	46.403	46.482	46.708
Average Gas Velocity, ft/sec	52.119	50.445	50.668	51.077
Gas Volumetric Flow Rate, acfm	258,040	249,751	250,857	252,883
Gas Volumetric Flow Rate, dscfm	146,433	150,846	141,652	146,310
Gas Volumetric Flow Rate, scfm	169,429	165,759	164,733	166,640
Average %CO_2 by volume, dry basis	19.4	19.9	20.6	20.0
Average %O_2 by volume, dry basis	9.7	9.5	9.1	9.4
Isokinetic Variance	102.3	97.6	104.1	101.3
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.14	≤ 0.14	≤ 0.14	≤ 0.14

GCC Rio Grande, Inc.
Pueblo Plant
Main Kiln
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	10/18/2023	8:40	9:39	9.7	13.6%	8.14	11.69	0.10	0.14
2	10/18/2023	10:10	11:09	9.5	13.0%	8.59	12.06	0.10	0.14
3	10/18/2023	12:25	13:24	9.1	13.7%	8.46	11.57	0.10	0.14
Average				**9.4**	**13.4%**	**8.40**	**11.77**	**0.10**	**0.14**

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	10/18/2023	8:40	9:39	146,674	112.6	5.81	0.0516	0.05	0.0005
2	10/18/2023	10:10	11:09	151,130	114.3	6.28	0.0549	0.05	0.0005
3	10/18/2023	12:25	13:24	144,575	119.7	5.97	0.0498	0.05	0.0004
Average				**147,460**	**115.5**	**6.02**	**0.0521**	**0.05**	**0.0005**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill Off	Mill Off	Mill Off	
Date	10/17/23	10/17/23	10/17/23	
Start Time	8:00	13:40	15:05	
End Time	9:09	14:46	16:14	
	Run 1	Run 2	Run 3	Average
Stack Conditions				
Average Gas Velocity, ft/sec	43.299	45.276	44.940	44.505
Gas Volumetric Flow Rate, acfm	214,367	224,159	222,495	220,340
Gas Volumetric Flow Rate, dscfm	101,191	103,004	102,211	102,135
Gas Volumetric Flow Rate, scfm	114,976	119,177	116,973	117,042
Average %CO_2 by volume, dry basis	29.1	27.9	29.8	28.9
Average %O_2 by volume, dry basis	4.2	5.2	4.2	4.5
Clinker Production, ton/hr	119.5	119.6	119.7	119.6
Chloride (Cl2) Emissions				
ppm	≤ 0.05	≤ 0.05	≤ 0.05	≤ 0.05
ppm@7%O2	≤ 0.04	≤ 0.04	≤ 0.04	≤ 0.04
lb/hr	≤ 0.06	≤ 0.06	≤ 0.06	≤ 0.06
lb/ton	≤ 0.0005	≤ 0.0005	≤ 0.0005	≤ 0.0005
Hydrogen Fluoride (HF) Emissions				
ppm	≤ 0.19	≤ 0.19	≤ 0.19	≤ 0.19
ppm@7%O2	≤ 0.16	≤ 0.17	≤ 0.16	≤ 0.16
lb/hr	≤ 0.06	≤ 0.06	≤ 0.06	≤ 0.06
lb/ton	≤ 0.0005	≤ 0.0005	≤ 0.0005	≤ 0.0005

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill Off	Mill Off	Mill Off	
Date	10/17/23	10/17/23	10/17/23	
Start Time	8:00	13:40	15:05	
End Time	9:09	14:46	16:14	
	Run 1A	Run 2A	Run 3A	Average
Stack Conditions				
Average Gas Temperature, °F	356.4	364.0	369.8	363.4
Flue Gas Moisture, percent by volume	12.4%	12.8%	12.7%	12.6%
Average Flue Pressure, in. Hg	24.76	24.76	24.76	24.76
Gas Sample Volume, dscf	34.855	32.877	33.567	33.766
Average Gas Velocity, ft/sec	44.684	45.051	44.674	44.803
Gas Volumetric Flow Rate, acfm	221,226	223,044	221,180	221,817
Gas Volumetric Flow Rate, dscfm	103,676	103,155	101,677	102,836
Gas Volumetric Flow Rate, scfm	118,414	118,288	116,487	117,730
Average $\%CO_2$ by volume, dry basis	29.1	27.9	29.8	28.9
Average $\%O_2$ by volume, dry basis	4.2	5.2	4.2	4.5
Isokinetic Variance	107.4	101.8	105.5	104.9
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.05	≤ 0.06	≤ 0.05	≤ 0.05
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.18	≤ 0.19	≤ 0.19	≤ 0.19

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Test Method: 26A

Source Condition	Mill Off	Mill Off	Mill Off	
Date	10/17/23	10/17/23	10/17/23	
Start Time	8:00	13:40	15:05	
End Time	9:09	14:46	16:14	
	Run 1B	Run 2B	Run 3B	Average
Stack Conditions				
Average Gas Temperature, °F	353.0	359.9	372.7	361.9
Flue Gas Moisture, percent by volume	11.5%	14.3%	12.5%	12.8%
Average Flue Pressure, in. Hg	24.76	24.76	24.76	24.76
Gas Sample Volume, dscf	33.079	34.929	34.830	34.279
Average Gas Velocity, ft/sec	41.913	45.501	45.205	44.206
Gas Volumetric Flow Rate, acfm	207,507	225,273	223,809	218,863
Gas Volumetric Flow Rate, dscfm	98,706	102,853	102,745	101,435
Gas Volumetric Flow Rate, scfm	111,538	120,065	117,459	116,354
Average $\%CO_2$ by volume, dry basis	29.1	27.9	29.8	28.9
Average $\%O_2$ by volume, dry basis	4.2	5.2	4.2	4.5
Isokinetic Variance	106.3	107.7	107.6	107.2
Chloride (Cl2) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.05	≤ 0.05	≤ 0.05	≤ 0.05
Hydrogen Fluoride (HF) Emissions				
ug of sample collected	≤ 150.00	≤ 150.00	≤ 150.00	≤ 150.00
ppm	≤ 0.19	≤ 0.18	≤ 0.18	≤ 0.19

GCC Rio Grande, Inc.
Pueblo Plant
Main Kiln
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	10/17/2023	8:00	8:59	4.2	12.4%	13.04	12.41	0.10	0.10
2	10/17/2023	13:40	14:39	5.2	12.5%	11.78	11.95	0.10	0.10
3	10/17/2023	15:05	16:04	4.2	12.4%	14.24	13.56	0.10	0.10
Average				**4.6**	**12.4%**	**13.02**	**12.64**	**0.10**	**0.10**

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	10/17/2023	8:00	8:59	101,191	119.5	6.34	0.0530	0.04	0.0003
2	10/17/2023	13:40	14:39	103,004	119.6	5.83	0.0488	0.04	0.0003
3	10/17/2023	15:05	16:04	102,211	119.7	6.99	0.0584	0.04	0.0003
Average				**102,135**	**119.6**	**6.39**	**0.0534**	**0.04**	**0.0003**

6.0 CERTIFICATION

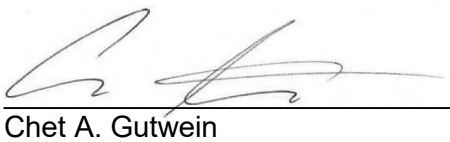
Mostardi Platt is pleased to have been of service to GCC Rio Grande Inc. If you have any questions regarding this test report, please do not hesitate to contact us at 630-993-2100.

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 (sT/hr) (TNHR) Expression Value
10/17/2023 08:00	119.4
10/17/2023 08:01	119.4
10/17/2023 08:02	119.4
10/17/2023 08:03	119.4
10/17/2023 08:04	119.4
10/17/2023 08:05	119.4
10/17/2023 08:06	119.4
10/17/2023 08:07	119.4
10/17/2023 08:08	119.3
10/17/2023 08:09	119.5
10/17/2023 08:10	119.4
10/17/2023 08:11	119.4
10/17/2023 08:12	119.4
10/17/2023 08:13	119.5
10/17/2023 08:14	119.4
10/17/2023 08:15	119.4
10/17/2023 08:16	119.4
10/17/2023 08:17	119.5
10/17/2023 08:18	119.4
10/17/2023 08:19	119.3
10/17/2023 08:20	119.4
10/17/2023 08:21	119.4
10/17/2023 08:22	119.4
10/17/2023 08:23	119.4
10/17/2023 08:24	119.4
10/17/2023 08:25	119.4
10/17/2023 08:26	119.4
10/17/2023 08:27	119.5
10/17/2023 08:28	119.4
10/17/2023 08:29	119.4
10/17/2023 08:30	119.4
10/17/2023 08:31	119.3
10/17/2023 08:32	119.4
10/17/2023 08:33	119.4
10/17/2023 08:34	119.4
10/17/2023 08:35	119.4
10/17/2023 08:36	119.5
10/17/2023 08:37	119.4
10/17/2023 08:38	119.4
10/17/2023 08:39	119.4
10/17/2023 08:40	119.4
10/17/2023 08:41	119.4
10/17/2023 08:42	119.4
10/17/2023 08:43	119.4
10/17/2023 08:44	119.4
10/17/2023 08:45	119.3
10/17/2023 08:46	119.4
10/17/2023 08:47	119.4
10/17/2023 08:48	119.4
10/17/2023 08:49	119.4
10/17/2023 08:50	119.4
10/17/2023 08:51	119.4
10/17/2023 08:52	119.4
10/17/2023 08:53	121.3
10/17/2023 08:54	120.3
10/17/2023 08:55	119.7
10/17/2023 08:56	119.6
10/17/2023 08:57	119.6
10/17/2023 08:58	119.6
10/17/2023 08:59	119.6

119.5 Run 1 Mill Off HCN

Date/Time	KILN_CLINKER_PROD (sT/hr) (TNHR) Expression Value
10/17/2023 13:40	119.7
10/17/2023 13:41	119.7
10/17/2023 13:42	119.6
10/17/2023 13:43	119.7
10/17/2023 13:44	119.6
10/17/2023 13:45	119.6
10/17/2023 13:46	119.6
10/17/2023 13:47	119.7
10/17/2023 13:48	119.6
10/17/2023 13:49	119.7
10/17/2023 13:50	119.6
10/17/2023 13:51	119.6
10/17/2023 13:52	119.6
10/17/2023 13:53	119.6
10/17/2023 13:54	119.6
10/17/2023 13:55	119.7
10/17/2023 13:56	119.7
10/17/2023 13:57	119.6
10/17/2023 13:58	119.7
10/17/2023 13:59	119.7
10/17/2023 14:00	119.7
10/17/2023 14:01	119.7
10/17/2023 14:02	119.6
10/17/2023 14:03	119.6
10/17/2023 14:04	119.6
10/17/2023 14:05	119.6
10/17/2023 14:06	119.7
10/17/2023 14:07	119.7
10/17/2023 14:08	119.7
10/17/2023 14:09	119.6
10/17/2023 14:10	119.7
10/17/2023 14:11	119.6
10/17/2023 14:12	119.6
10/17/2023 14:13	119.7
10/17/2023 14:14	119.7
10/17/2023 14:15	119.6
10/17/2023 14:16	119.6
10/17/2023 14:17	119.7
10/17/2023 14:18	119.7
10/17/2023 14:19	119.6
10/17/2023 14:20	119.7
10/17/2023 14:21	119.7
10/17/2023 14:22	119.6
10/17/2023 14:23	119.6
10/17/2023 14:24	119.7
10/17/2023 14:25	119.7
10/17/2023 14:26	119.7
10/17/2023 14:27	119.7
10/17/2023 14:28	119.6
10/17/2023 14:29	119.6
10/17/2023 14:30	119.6
10/17/2023 14:31	119.7
10/17/2023 14:32	119.6
10/17/2023 14:33	119.7
10/17/2023 14:34	119.6
10/17/2023 14:35	119.7
10/17/2023 14:36	119.7
10/17/2023 14:37	119.6
10/17/2023 14:38	119.6
10/17/2023 14:39	119.6

119.6 Run 2 Mill Off HCN

Date/Time	KILN_CLINKER_PROD (sT/hr) (TNHR) Expression Value
10/17/2023 15:05	119.6
10/17/2023 15:06	119.7
10/17/2023 15:07	119.6
10/17/2023 15:08	119.6
10/17/2023 15:09	119.7
10/17/2023 15:10	119.7
10/17/2023 15:11	119.7
10/17/2023 15:12	119.7
10/17/2023 15:13	119.7
10/17/2023 15:14	119.7
10/17/2023 15:15	119.7
10/17/2023 15:16	119.7
10/17/2023 15:17	119.6
10/17/2023 15:18	119.6
10/17/2023 15:19	119.6
10/17/2023 15:20	119.7
10/17/2023 15:21	119.7
10/17/2023 15:22	119.6
10/17/2023 15:23	119.7
10/17/2023 15:24	119.7
10/17/2023 15:25	119.7
10/17/2023 15:26	119.7
10/17/2023 15:27	119.7
10/17/2023 15:28	119.6
10/17/2023 15:29	119.7
10/17/2023 15:30	119.7
10/17/2023 15:31	119.6
10/17/2023 15:32	119.6
10/17/2023 15:33	119.6
10/17/2023 15:34	119.6
10/17/2023 15:35	119.7
10/17/2023 15:36	119.6
10/17/2023 15:37	119.7
10/17/2023 15:38	119.6
10/17/2023 15:39	119.7
10/17/2023 15:40	119.7
10/17/2023 15:41	119.7
10/17/2023 15:42	119.7
10/17/2023 15:43	119.7
10/17/2023 15:44	119.6
10/17/2023 15:45	119.7
10/17/2023 15:46	119.7
10/17/2023 15:47	119.7
10/17/2023 15:48	119.6
10/17/2023 15:49	119.6
10/17/2023 15:50	119.7
10/17/2023 15:51	119.7
10/17/2023 15:52	119.6
10/17/2023 15:53	119.7
10/17/2023 15:54	119.6
10/17/2023 15:55	119.6
10/17/2023 15:56	119.6
10/17/2023 15:57	119.6
10/17/2023 15:58	119.6
10/17/2023 15:59	119.6
10/17/2023 16:00	119.6
10/17/2023 16:01	119.7
10/17/2023 16:02	119.6
10/17/2023 16:03	119.7
10/17/2023 16:04	119.7

119.7 Run 3 Mill Off HCN

Date/Time	(sT/hr) (TNHR) Expression Value
10/18/2023 08:40	112.5
10/18/2023 08:41	112.5
10/18/2023 08:42	112.7
10/18/2023 08:43	112.5
10/18/2023 08:44	112.5
10/18/2023 08:45	112.5
10/18/2023 08:46	112.5
10/18/2023 08:47	112.5
10/18/2023 08:48	112.5
10/18/2023 08:49	112.7
10/18/2023 08:50	112.5
10/18/2023 08:51	112.5
10/18/2023 08:52	112.7
10/18/2023 08:53	112.7
10/18/2023 08:54	112.5
10/18/2023 08:55	112.7
10/18/2023 08:56	112.5
10/18/2023 08:57	112.7
10/18/2023 08:58	112.7
10/18/2023 08:59	112.7
10/18/2023 09:00	112.5
10/18/2023 09:01	112.7
10/18/2023 09:02	112.7
10/18/2023 09:03	112.5
10/18/2023 09:04	112.7
10/18/2023 09:05	112.7
10/18/2023 09:06	112.5
10/18/2023 09:07	112.7
10/18/2023 09:08	112.7
10/18/2023 09:09	112.7
10/18/2023 09:10	112.5
10/18/2023 09:11	112.5
10/18/2023 09:12	112.5
10/18/2023 09:13	112.7
10/18/2023 09:14	112.7
10/18/2023 09:15	112.5
10/18/2023 09:16	112.7
10/18/2023 09:17	112.5
10/18/2023 09:18	112.7
10/18/2023 09:19	112.5
10/18/2023 09:20	112.7
10/18/2023 09:21	112.5
10/18/2023 09:22	112.7
10/18/2023 09:23	112.5
10/18/2023 09:24	112.5
10/18/2023 09:25	112.7
10/18/2023 09:26	112.7
10/18/2023 09:27	112.7
10/18/2023 09:28	112.5
10/18/2023 09:29	112.7
10/18/2023 09:30	112.5
10/18/2023 09:31	112.7
10/18/2023 09:32	112.5
10/18/2023 09:33	112.5
10/18/2023 09:34	112.7
10/18/2023 09:35	112.5
10/18/2023 09:36	112.5
10/18/2023 09:37	112.7
10/18/2023 09:38	112.7
10/18/2023 09:39	112.7

112.6 Run 1 Mill On HCN

Date/Time	KILN_CLINKER_PROD (sT/hr) (TNHR) Expression Value
10/18/2023 10:10	112.7
10/18/2023 10:11	112.5
10/18/2023 10:12	112.7
10/18/2023 10:13	112.7
10/18/2023 10:14	112.5
10/18/2023 10:15	112.5
10/18/2023 10:16	112.7
10/18/2023 10:17	112.7
10/18/2023 10:18	112.7
10/18/2023 10:19	112.7
10/18/2023 10:20	112.7
10/18/2023 10:21	112.5
10/18/2023 10:22	112.7
10/18/2023 10:23	112.5
10/18/2023 10:24	112.7
10/18/2023 10:25	112.7
10/18/2023 10:26	112.5
10/18/2023 10:27	112.7
10/18/2023 10:28	112.5
10/18/2023 10:29	112.7
10/18/2023 10:30	112.7
10/18/2023 10:31	112.7
10/18/2023 10:32	112.7
10/18/2023 10:33	112.7
10/18/2023 10:34	112.5
10/18/2023 10:35	112.7
10/18/2023 10:36	112.9
10/18/2023 10:37	114.3
10/18/2023 10:38	114.4
10/18/2023 10:39	114.4
10/18/2023 10:40	114.4
10/18/2023 10:41	114.3
10/18/2023 10:42	114.4
10/18/2023 10:43	114.3
10/18/2023 10:44	114.4
10/18/2023 10:45	114.3
10/18/2023 10:46	114.3
10/18/2023 10:47	114.4
10/18/2023 10:48	116.1
10/18/2023 10:49	116.2
10/18/2023 10:50	116.1
10/18/2023 10:51	116.1
10/18/2023 10:52	116.2
10/18/2023 10:53	116.1
10/18/2023 10:54	116.2
10/18/2023 10:55	116.2
10/18/2023 10:56	116.2
10/18/2023 10:57	116.2
10/18/2023 10:58	116.2
10/18/2023 10:59	116.1
10/18/2023 11:00	116.2
10/18/2023 11:01	116.2
10/18/2023 11:02	116.2
10/18/2023 11:03	116.2
10/18/2023 11:04	116.2
10/18/2023 11:05	116.1
10/18/2023 11:06	116.2
10/18/2023 11:07	116.7
10/18/2023 11:08	117.8
10/18/2023 11:09	117.9

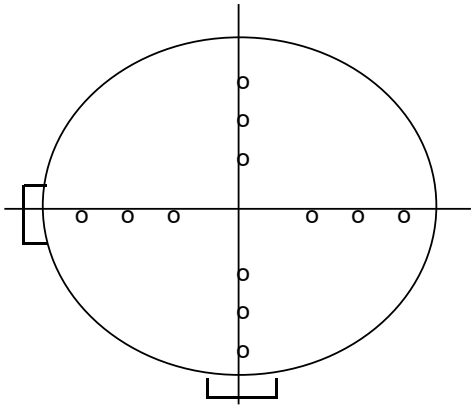
114.3 Run 2 Mill On HCN

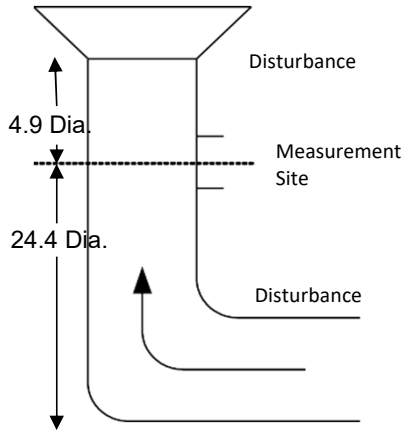
Date/Time	KILN_CLINKER_PROD (sT/hr) (TNHR) Expression Value
10/18/2023 12:25	119.7
10/18/2023 12:26	119.6
10/18/2023 12:27	119.6
10/18/2023 12:28	119.6
10/18/2023 12:29	119.7
10/18/2023 12:30	119.6
10/18/2023 12:31	119.7
10/18/2023 12:32	119.7
10/18/2023 12:33	119.7
10/18/2023 12:34	119.6
10/18/2023 12:35	119.7
10/18/2023 12:36	119.7
10/18/2023 12:37	119.6
10/18/2023 12:38	119.6
10/18/2023 12:39	119.7
10/18/2023 12:40	119.7
10/18/2023 12:41	119.8
10/18/2023 12:42	119.7
10/18/2023 12:43	119.6
10/18/2023 12:44	119.6
10/18/2023 12:45	119.7
10/18/2023 12:46	119.6
10/18/2023 12:47	119.7
10/18/2023 12:48	119.6
10/18/2023 12:49	119.6
10/18/2023 12:50	119.7
10/18/2023 12:51	119.7
10/18/2023 12:52	119.7
10/18/2023 12:53	119.7
10/18/2023 12:54	119.6
10/18/2023 12:55	119.7
10/18/2023 12:56	119.6
10/18/2023 12:57	119.6
10/18/2023 12:58	119.6
10/18/2023 12:59	119.6
10/18/2023 13:00	119.7
10/18/2023 13:01	119.7
10/18/2023 13:02	119.7
10/18/2023 13:03	119.7
10/18/2023 13:04	119.7
10/18/2023 13:05	119.7
10/18/2023 13:06	119.7
10/18/2023 13:07	119.6
10/18/2023 13:08	119.6
10/18/2023 13:09	119.6
10/18/2023 13:10	119.6
10/18/2023 13:11	119.6
10/18/2023 13:12	119.6
10/18/2023 13:13	119.6
10/18/2023 13:14	119.7
10/18/2023 13:15	119.7
10/18/2023 13:16	119.6
10/18/2023 13:17	119.7
10/18/2023 13:18	119.6
10/18/2023 13:19	119.7
10/18/2023 13:20	119.6
10/18/2023 13:21	119.7
10/18/2023 13:22	119.6
10/18/2023 13:23	119.6
10/18/2023 13:24	119.6

119.7 Run 3 Mill On HCN

Appendix B – Test Section Diagrams

EQUAL AREA TRAVERSE FOR ROUND DUCTS





Client: GCC Rio Grande, Inc.

Facility: Pueblo Plant

Test Location: Main Kiln Stack

Date: 10/17/23 & 10/18/23

Diameter (Feet): 10.250

Port Length (In): 9.50

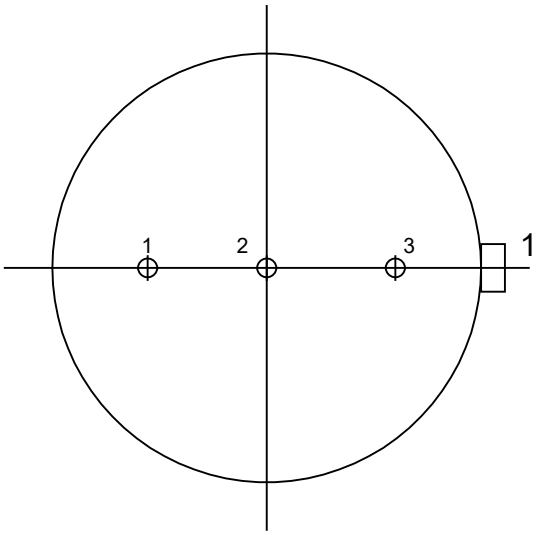
Ports Sampled: 4

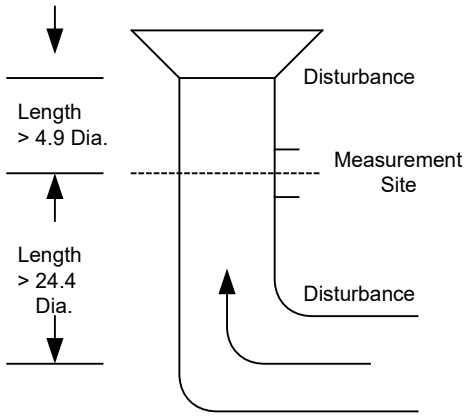
Points/Port: 3

Point Markings

	From inside wall (in.)	% of Diameter
1	5.41	4.40
2	17.96	14.60
3	36.41	29.60

STRATIFICATION TEST FOR ROUND DUCTS





Job: GCC Rio Grande Inc.
Pueblo Plant
Pueblo, Colorado

Test Location: Main Kiln

Stack Diameter: 10.25 Feet

Stack Area: 82.516 Square Feet

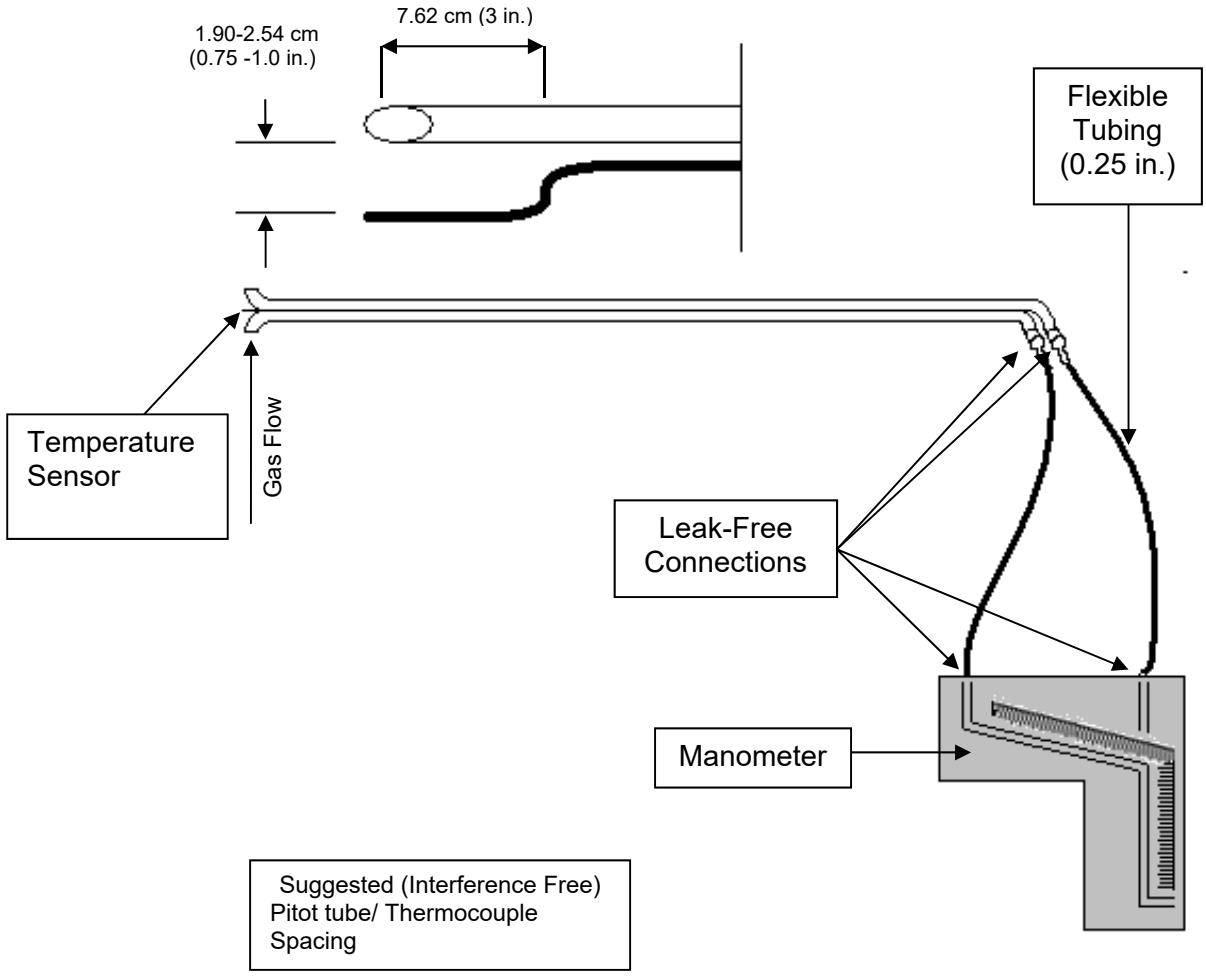
No. Sample Points: 3

Distance from Inside Wall
To Traverse Point:

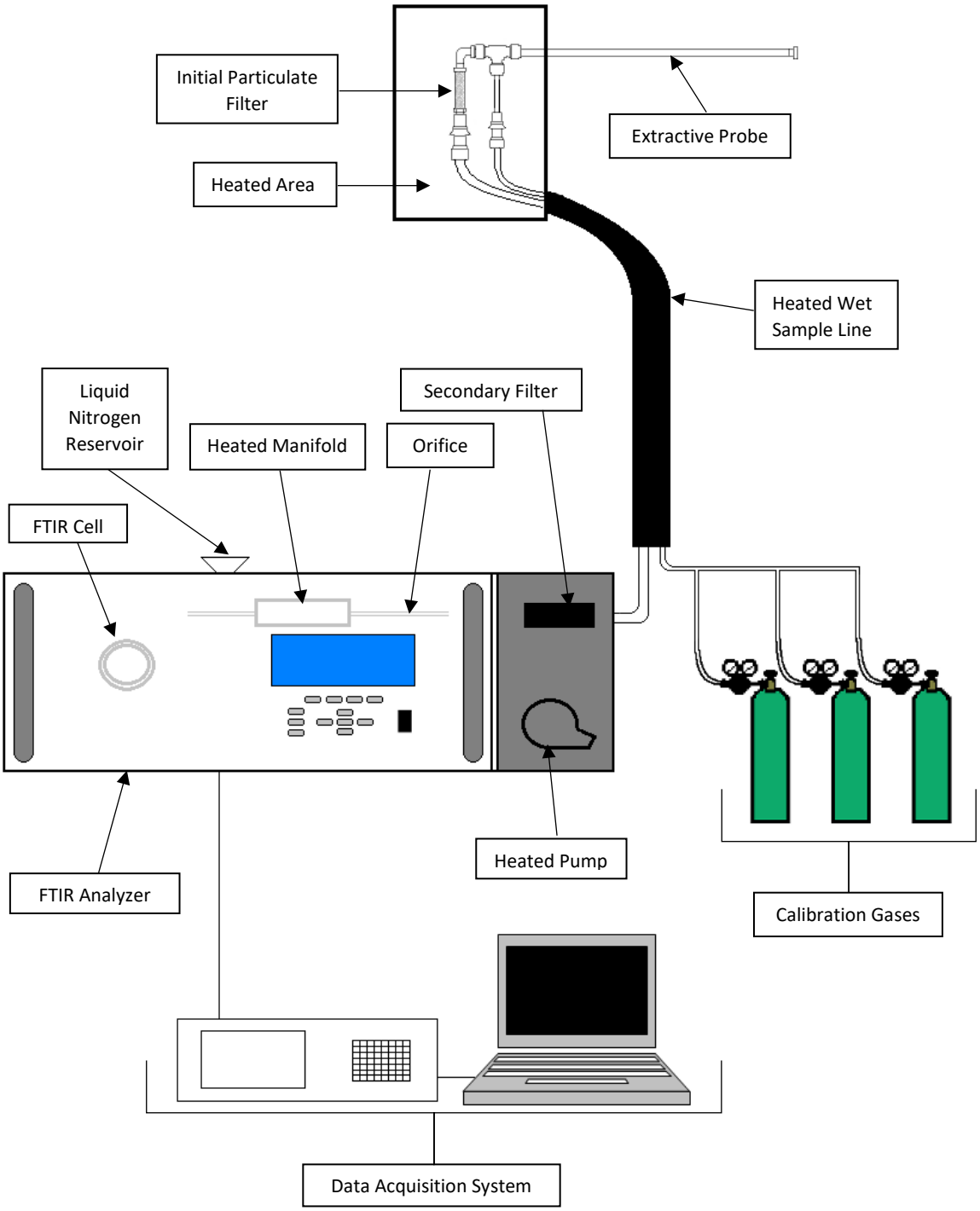
1. 83.3 % of diameter
2. 50.0 % of diameter
3. 16.7 % of diameter

Appendix C – Sample Train Diagrams

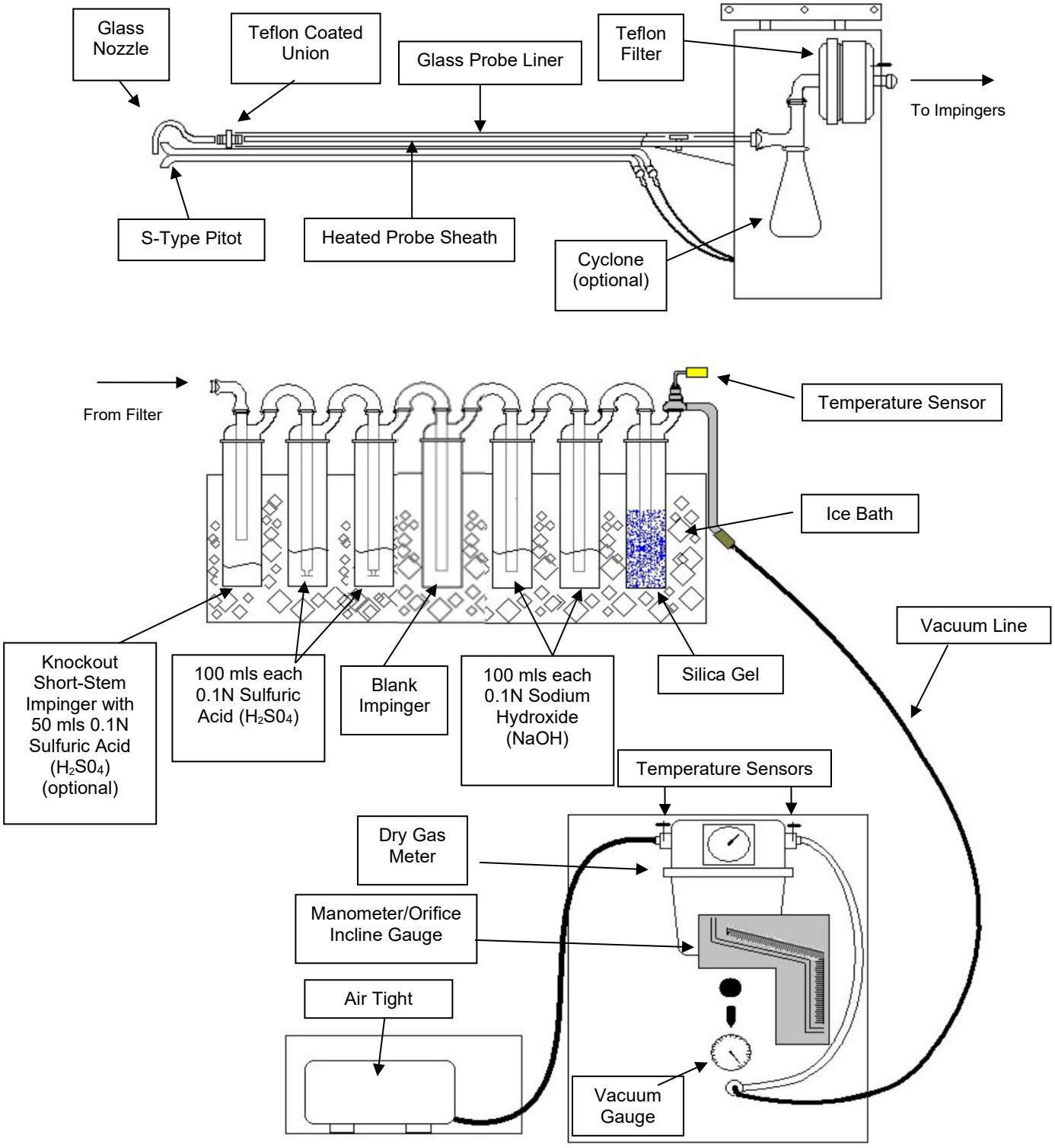
USEPA Method 2 – Type S Pitot Tube Manometer Assembly



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:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Run:	**1**
Date:	**10/18/2023**
Method:	**26A**
Source Condition:	**Mill On**

Dry Molecular Weight

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

$\%CO_2$ =	19.4	$\%O_2$ =	9.7	$\%N_2$ =	70.9

Md = 31.492

Wet Molecular Weight

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

Md =	31.492	Bws =	0.141

Ms = 29.592

Meter Volume at Standard Conditions

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

Y =	0.994	Vm =	55.293	Pbar =	24.9
DH =	2.3	Tm =	62.8		

Vm(std) = 46.481

Volume of Water Vapor Condensed

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

Net H_2O = 161.8

Vw(std) = 7.621

Moisture Content

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

Vw(std) =	7.621	Vm(std) =	46.481

Bws = 0.141

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Run:	**1**
Date:	**10/18/2023**
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) =**	**215.3**	**Sqrt DP (avg):**	**0.790**
Ps =	**24.94**	**Ms =**	**29.592**		

Vs = 53.009

Volumetric Flow Rate (Actual Basis)

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

Vs =	**53.009**	**A =**	**82.516**

Q = 262,445

Volumetric Flow Rate (Standard Basis)

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

Q =	**262,445**	**Ps =**	**24.94**	**Ts (avg) =**	**215.3**

Qstd = 171,002

Volumetric Flow Rate (Standard Dry Basis)

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

Qstd =	**171,002**	**Bws =**	**0.141**

Qstd(dry) = 146,915

Isokinetic Variation:

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

Ts =	**215.3**	**Vm(std) =**	**46.481**	**Vs =**	**53.009**
An =	**0.0004307**	**θ =**	**60**	**Ps =**	**24.94**
Bws =	**0.141**				

%ISO = 101.1

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln Stack
Run: 1
Date: 10/18/2023
Method: 26A
Source Condition: Mill On

Chloride (Cl2) Concentration:

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

mg= 0.15 Vm(std) = 46.481

mg/m^3= 0.11

Chloride (Cl2) Emission Rate:

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

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

lb of Chloride (Cl2) = 3.31E-10 dscfm = 146,915

Emission Rate lb/hr = 0.0627

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

lb/hr of Chloride (Cl2) = 0.0627 clinker ton/hr = 112.6

Emission Rate lb/ton = 0.0006

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/23

Sample Calculations

$$(9.66\ \% - 0.04\ \%) \times \frac{\text{O2 \% (dry)}\ 11.07\ \%}{11.02\ \% - 0.04\ \%} = 9.70\ \%$$

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

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: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/23

FTIR Sample Calculations

Direct Recovery % of Calibration Transfer Standard

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

Cma= 100.7 D_{cts} = 100.8

DR_{cts} = 100.1%

Recovery % with Calibration Transfer Standard System Purge

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

Sys_{cts} = 100.5 D_{cts} = 100.8

R_{cts} = 100%

Direct Recovery % of Analyte Spike Gas

SF6

$$DR_{sf6} = \frac{D_{sf6}}{Cma} \times 100$$

Cma= 10.0 D_{sf6} = 10.0

DR_{sf6} = 100%

HCN

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

Cma= 199.2 D_{asg} = 194.2

DR_{asg} = 97.5%

Dilution Factor for Analyte Spiking

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

Spk_{sf6} = 0.594 D_{sf6} = 10.000

DF = 0.059

Recovery % for Analyte Spike With HCN

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

Spk_x = 21.2 N_x = 10.5

DF = 0.059 D_{asg} = 194.2

R_x = 98.8 %

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

Moisture Calculations

$$V_{wc(std)} = \frac{(V_f - V_i)\rho_w RT_{std}}{P_{std}M_w} = 0.04707(V_f - V_i)$$

$$V_{wsg(std)} = \frac{(W_f - W_i)\rho_w RT_{std}}{P_{std}M_w} = 0.04715(W_f - W_i)$$

$$V_{m(std)} = 17.64\, V_m Y \frac{P_{bar} + \frac{\Delta H}{13.6}}{T_m}$$

$$B_{ws} = \frac{V_{wc(std)} + V_{wsg(std)}}{V_{wc(std)} + V_{wsg(std)} + V_{m(std)}}$$

Where:

B_{ws} = Water vapor in gas stream, proportion by volume
M_w = Molecular weight of water, 18.015 lb/lb-mole
P_{bar} = Barometric pressure at the testing site, in. Hg
P_{std} = Standard absolute pressure, 29.92 in. Hg
R = Ideal gas constant, 0.048137 (in. Hg)(ft^3)/(g-mole)(°R) = [21.8348(in. Hg)(ft^3)/(lb-mole)(°R)]/453.592 g-mole/lb-mole
T_m = Absolute average dry gas meter temperature, °R
T_{std} = Standard absolute temperature, 528 °R
V_f = Final volume of condenser water, ml
V_i = Initial volume of condenser water, ml
V_m = Dry gas volume measured by dry gas meter, dcf
$V_{m(std)}$ = Dry gas volume measured by dry gas meter, corrected to standard conditions, scf
$V_{wc(std)}$ = Volume of condensed water vapor, corrected to standard conditions, scf
$V_{wsg(std)}$ = Volume of water vapor collected in silica gel, corrected to standard conditions, scf
W_f = Final weight of silica gel, g
W_i = Initial weight of silica gel, g
Y = Dry gas meter calibration factor
ΔH = Average pressure exerted on dry gas meter outlet by gas sample bag, in. H_2O
ρ_w = Density of water, 0.9982 g/ml
13.6 = Specific gravity of mercury (Hg)
17.64 = T_{std}/P_{std}
0.04707 = ft^3/ml 0.04715 = ft^3/g

MOSTARDI PLATT

Volumetric Flow Nomenclature

A =	Cross-sectional area of stack or duct, ft2
Bws =	Water vapor in gas stream, proportion by volume
Cp =	Pitot tube coefficient, dimensionless
Md =	Dry molecular weight of gas, lb/lb-mole
Ms =	Molecular weight of gas, wet basis, lb/lb-mole
Mw =	Molecular weight of water, 18.0 lb/lb-mole
Pbar =	Barometric pressure at testing site, in. Hg
Pg =	Static pressure of gas, in. Hg (in. H2O/13.6)
DH=	Static pressure of gas, in.H2O
Ps =	Absolute pressure of gas, in. Hg = Pbar + Pg
Pstd =	Standard absolute pressure, 29.92 in. Hg
Acfm =	Actual volumetric gas flow rate
Scfm=	Volumetric gas flow rate, corrected to standard conditions
Dscfm =	Standard volumetric flow rate, corrected to dry conditions
R =	Ideal gas constant, 21.85 in. Hg-ft3/°R-lb-mole
Ts =	Average stack gas temperature, °F
Tm =	Average dry gas meter temperature, 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

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Chain-of-Custody Form

Project Number: M234207	Date Results Required:
Client: GCC Rio Grande Inc.	TAT Required:
Plant/Test Location: Pueblo Kiln Stack (Mill Off)	Project Supervisor: R. Sollars

Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
001	10/17/23	#1A KILN M26A H2SO4	1		HF	432.9
002	10/17/23	#1A KILN M26A NaOH	1		Cl_2	314.4
003	10/17/23	#1B KILN M26A H2SO4	1		HF	436.4
004	10/17/23	#1B KILN M26A NaOH	1		Cl_2	340.0
005	10/17/23	#2A KILN M26A H2SO4	1		HF	411.3
006	10/17/23	#2A KILN M26A NaOH	1		Cl_2	320.0
007	10/17/23	#2B KILN M26A H2SO4	1		HF	421.7
008	10/17/23	#2B KILN M26A NaOH	1		Cl_2	284.0
009	10/17/23	#3A KILN M26A H2SO4	1		HF	378.0
010	10/17/23	#3A KILN M26A NaOH	1		Cl_2	319.0
011	10/17/23	#3B KILN M26A H2SO4	1		HF	441.3
012	10/17/23	#3B KILN M26A NaOH	1		Cl_2	302.2
013	10/17/23	A Train Blank H2SO4	1		HF	284.4
014	10/17/23	A Train Blank NaOH	1		Cl_2	216.5
015	10/17/23	DI Reagent Blank	1		HF/Cl_2	207.8

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

Laboratory Notes:

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Chain-of-Custody Form

Project Number: M234207	Date Results Required:
Client: GCC Rio Grande Inc.	TAT Required:
Plant/Test Location: Pueblo Kiln Stack (Mill On)	Project Supervisor: R. Sollars

Sample Number	Sample Date	Sample Point Identification	# of Conts	Sub Lab	Analysis Required	Volume, mls
001	10/18/23	#1A KILN M26A H2SO4	1		HF	535.5
002	10/18/23	#1A KILN M26A NaOH	1		Cl_2	315.5
003	10/18/23	#1B KILN M26A H2SO4	1		HF	467.5
004	10/18/23	#1B KILN M26A NaOH	1		Cl_2	289.6
005	10/18/23	#2A KILN M26A H2SO4	1		HF	462.9
006	10/18/23	#2A KILN M26A NaOH	1		Cl_2	327.3
007	10/18/23	#2B KILN M26A H2SO4	1		HF	404.5
008	10/18/23	#2B KILN M26A NaOH	1		Cl_2	327.2
009	10/18/23	#3A KILN M26A H2SO4	1		HF	499.1
010	10/18/23	#3A KILN M26A NaOH	1		Cl_2	303.3
011	10/18/23	#3B KILN M26A H2SO4	1		HF	434.9
012	10/18/23	#3B KILN M26A NaOH	1		Cl_2	278.7

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

Laboratory Notes:

Main Kiln Mill On

Client:	GCC	Analysis Date:	11/15/2023
Facility:	Pueblo	Analysis Location:	Elmhurst
Test Location:	Main Kiln Mill On	Analyst:	JMG
Project Number:	M234207		
Method:	26A		
Date Samples Received:	11/3/2023		

Train A

Sampling Date		10/18/2023	10/18/2023	10/18/2023	10/18/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	215	254	499	499		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		10/18/2023	10/18/2023	10/18/2023			
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**	**M26A- H2SO4 Field Blank**		**RDL**	**MDL**
Sulfuric Acid Volume	ml	472	505	231			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		10/18/2023	10/18/2023	10/18/2023	10/18/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	215	254	475	475		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		10/18/2023	10/18/2023				
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**			**RDL**	**MDL**
Sulfuric Acid Volume	ml	407	452				
Hydrofluoric Acid	ug	<150	<150			150	15

Client:	GCC	**Analysis Date:**	11/15/2023								
Facility:	Pueblo	**Analysis Location:**	Elmhurst								
Test Location:	Main Kiln Mill On	**Analyst:**	JMG								
Project Number:	M234207										
Method:	26A										
Date Samples Received:	11/3/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2190	0.2190	**0.95**	**0.2296**							
2	0.4460	0.2230	**1.94**								
5	1.1517	0.2303	**5.02**	**Response Factor Ave**							
8	1.8720	0.2340	**8.15**	**0.2295**							
10	2.4109	0.2411	**10.50**								
Lot Number	Ricca 8209004										
	R^2	**0.9994**									
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**
001	10/18/2023	Test 1A H2SO4 Imp	0.0096	0.0418	0.0418	1	499	0.0209	0.0220		
001	10/18/2023	Test 1A H2SO4 Imp	0.0121	0.0527	0.0527	1	499	0.0263	0.0277	**0.0248**	**24.83378709**
001	10/18/2023	Test 1A H2SO4 Imp	0.0112	0.0488	0.0488	1	499	0.0243	0.0256		
001	10/18/2023	Test 1A H2SO4 Imp	0.0159	0.0692	0.0692	1	499	0.0346	0.0364	**0.0310**	**31.01362351**
005	10/18/2023	Test 2A H2SO4 Imp	0.0231	0.1006	0.1006	1	472	0.0475	0.0500		
005	10/18/2023	Test 2A H2SO4 Imp	0.0180	0.0784	0.0784	1	472	0.0370	0.0390	**0.0445**	**44.49041886**
009	10/18/2023	Test 3A H2SO4 Imp	0.0151	0.0658	0.0658	1	505	0.0332	0.0350		
009	10/18/2023	Test 3A H2SO4 Imp	0.0202	0.0880	0.0880	1	505	0.0444	0.0468	**0.0409**	**40.88356488**
015	10/18/2023	Train Blank A	0.0316	0.1376	0.1376	1	231	0.0318	0.0327		
015	10/18/2023	Train Blank A	0.0276	0.1202	0.1202	1	231	0.0278	0.0285	**0.0306**	**30.61670491**
					Expected Value	**% Difference**					
		Run 1 H2SO4 Spike W/ 2ppm	0.2399	1.0447	0.9948						
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2400	1.0452	0.9948	5.05%					
CCV ppm F	**Area**	**PPM F**									
1 ppm ICV	0.2453	1.0682									
5 ppm CCV	1.1285	4.9145									
5 ppm CCV	1.1247	4.8979									
Standard ppm F	**Area**	**Difference**									
1	0.2059	3.18%									
2	0.4244	2.54%									
5	1.1246	1.20%									
8	1.8850	0.34%									
10	2.3985	0.26%									

Client:	GCC	**Analysis Date:**	11/15/2023								
Facility:	Pueblo	**Analysis Location:**	Elmhurst								
Test Location:	Main Kiln Mill On	**Analyst:**	JMG								
Project Number:	M234207										
Method:	26A										
Date Samples Received:	11/3/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2190	0.2190	**0.95**	**0.2296**							
2	0.4460	0.2230	**1.94**								
5	1.1517	0.2303	**5.02**	**Response Factor Ave**							
8	1.8720	0.2340	**8.15**	**0.2295**							
10	2.4109	0.2411	**10.50**								
Lot Number	Ricca 8209004										
	R^2	**0.9994**									
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**
003	10/18/2023	Test 1B H2SO4 Imp	0.0112	0.0488	0.0488	1	475	0.0232	0.0244		
003	10/18/2023	Test 1B H2SO4 Imp	0.0179	0.0780	0.0780	1	475	0.0370	0.0390	**0.0317**	**31.70073069**
003	10/18/2023	Test 1B H2SO4 Imp	0.0185	0.0806	0.0806	1	475	0.0383	0.0403		
003	10/18/2023	Test 1B H2SO4 Imp	0.0186	0.0810	0.0810	1	475	0.0385	0.0405	**0.0404**	**40.41570819**
007	10/18/2023	Test 2B H2SO4 Imp	0.0342	0.1489	0.1489	1	407	0.0606	0.0638		
007	10/18/2023	Test 2B H2SO4 Imp	0.0375	0.1633	0.1633	1	407	0.0665	0.0700	**0.0669**	**66.92621109**
011	10/18/2023	Test 3B H2SO4 Imp	0.0079	0.0344	0.0344	1	452	0.0156	0.0164		
011	10/18/2023	Test 3B H2SO4 Imp	0.0075	0.0327	0.0327	1	452	0.0148	0.0155	**0.0160**	**15.96400406**
Standard ppm F	**Area**	**Difference**									
1	0.2059	3.18%									
2	0.4244	2.54%									
5	1.1246	1.20%									
8	1.8850	0.34%									
10	2.3985	0.26%									

Main Kiln Mill On

Client:	GCC	Analysis Date:	11/15/2023
Facility:	Pueblo	Analysis Location:	Elmhurst
Test Location:	Main Kiln Mill On	Analyst:	JMG
Project Number:	M234207		
Method:	26A		
Date Samples Received:	11/3/2023		

Train A

Sampling Date		10/18/2023	10/18/2023	10/18/2023	10/18/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	215	254	312	312		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		10/18/2023	10/18/2023	10/18/2023			
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**	**Train A Blank**		**RDL**	**MDL**
Sodium Hydroxide Volume	ml	323	299	215			
Chlorine	ug	<150	<150	<150		150	15

Train B

Sampling Date		10/18/2023	10/18/2023	10/18/2023	10/18/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	215	254	300	300		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		10/18/2023	10/18/2023				
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**			**RDL**	**MDL**
Sodium Hydroxide Volume	ml	329	288				
Chlorine	ug	<150	<150			150	15

Client:	GCC	**Analysis Date:**	11/15/2023							
Facility:	Pueblo	**Analysis Location:**	Elmhurst Lab							
Test Location:	Main Kiln Mill On	**Analyst:**	JMG							
Project Number:	M234207									
Method:	26A									
Date Samples Received:	11/3/2023									
Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**						
1	0.1523	0.1523	**1.01**	**0.1513**						
2	0.2939	0.1470	**1.94**							
5	0.7660	0.1532	**5.06**	**Response Factor Ave**						
8	1.2141	0.1518	**8.03**	**0.1512**						
10	1.5201	0.1520	**10.05**							
Lot Number	Ricca 8209004									
	R^2	**0.9999**								
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**
	10/18/2023	DI Reagent Blank	0.0027	0.0179	0.0179	1	215	0.0038		
	10/18/2023	DI Reagent Blank	0.0017	0.0112	0.0112	1	215	0.0024	**0.0031**	**3.127100777**
	10/18/2023	NaOH Reagent Blank	0.0470	0.3107	0.3107	1	254	0.0789		
	10/18/2023	NaOH Reagent Blank	0.0335	0.2215	0.2215	1	254	0.0563	**0.0676**	**67.58967187**
002	10/18/2023	Test 1A NaOH Imp	0.0166	0.1097	0.1097	1	312	0.0342		
002	10/18/2023	Test 1A NaOH Imp	0.0175	0.1157	0.1157	1	312	0.0361	**0.0352**	**35.16897525**
002	10/18/2023	Test 1A NaOH Imp	0.0111	0.0734	0.0734	1	312	0.0229		
002	10/18/2023	Test 1A NaOH Imp	0.0116	0.0767	0.0767	1	312	0.0239	**0.0234**	**23.41160523**
006	10/18/2023	Test 2A NaOH Imp	0.0014	0.0093	0.0093	1	323	0.0030		
006	10/18/2023	Test 2A NaOH Imp	0.0031	0.0205	0.0205	1	323	0.0066	**0.0048**	**4.804694481**
010	10/18/2023	Test 3A NaOH Imp	0.0122	0.0807	0.0807	1	299	0.0241		
010	10/18/2023	Test 3A NaOH Imp	0.0096	0.0635	0.0635	1	299	0.0190	**0.0215**	**21.54658381**
	10/18/2023	Train Blank	0.0140	0.0926	0.0926	1	215	0.0199		
	10/18/2023	Train Blank	0.0152	0.1005	0.1005	1	215	0.0216	**0.0208**	**20.75257788**
					Expected Value	**% Difference**				
		Run 1 H2SO4 Spike W/ 2ppm	0.1858	1.2284	1.0279					
		Run 1 H2SO4 Spike W/ 2ppm	0.1683	1.1127	1.0279	13.88%				
CCV ppm Cl	**Area**	**PPM Cl**								
5 ppm ICV	0.7339	4.8520								
5 ppm CCV	0.761	5.0311								
5 ppm CCV		0.0000								
5 ppm CCV		0.0000								
Standard ppm Cl	**Area**	**Difference**								
1	0.1575	1.65%								
2	0.2902	0.64%								
5	0.7781	0.78%								
8	1.2309	0.68%								
10	1.5781	1.84%								

Client:	GCC	**Analysis Date:**	11/15/2023						
Facility:	Pueblo	**Analysis Location:**	Elmhurst Lab						
Test Location:	Main Kiln Mill On	**Analyst:**	JMG						
Project Number:	M234207								
Method:	26A								
Date Samples Received:	11/3/2023								

Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**
1	0.1523	0.1523	**1.01**	**0.1513**
2	0.2939	0.1470	**1.94**	
5	0.7660	0.1532	**5.06**	**Response Factor Ave**
8	1.2141	0.1518	**8.03**	**0.1512**
10	1.5201	0.1520	**10.05**	
Lot Number	Ricca 8209004			
	R^2	**0.9999**		

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**
	10/18/2023	DI Reagent Blank	0.0027	0.0179	0.0179	1	215	0.0038		
	10/18/2023	DI Reagent Blank	0.0017	0.0112	0.0112	1	215	0.0024	**0.0031**	**3.127100777**
	10/18/2023	NaOH Reagent Blank	0.0470	0.3107	0.3107	1	254	0.0789		
	10/18/2023	NaOH Reagent Blank	0.0335	0.2215	0.2215	1	254	0.0563	**0.0676**	**67.58967187**
004	10/18/2023	Test 1B NaOH Imp	0.0037	0.0245	0.0245	1	300	0.0073		
004	10/18/2023	Test 1B NaOH Imp	0.0024	0.0159	0.0159	1	300	0.0048	**0.0060**	**6.049254146**
004	10/18/2023	Test 1B NaOH Imp	0.0028	0.0185	0.0185	1	300	0.0056		
004	10/18/2023	Test 1B NaOH Imp	0.0051	0.0337	0.0337	1	300	0.0101	**0.0078**	**7.834279959**
008	10/18/2023	Test 2B NaOH Imp	0.0028	0.0185	0.0185	1	329	0.0061		
008	10/18/2023	Test 2B NaOH Imp	0.0012	0.0079	0.0079	1	329	0.0026	**0.0044**	**4.35017402**
012	10/18/2023	Test 3B NaOH Imp	0.0022	0.0145	0.0145	1	288	0.0042		
012	10/18/2023	Test 3B NaOH Imp	0.0016	0.0106	0.0106	1	288	0.0030	**0.0036**	**3.617652315**

CCV ppm Cl	**Area**	**PPM Cl**
5 ppm ICV	0.7339	4.8520
5 ppm CCV	0.761	5.0311
5 ppm CCV	0.7786	5.1475
5 ppm CCV	0.7748	5.1224

Standard ppm Cl	**Area**	**Difference**
1	0.1575	1.65%
2	0.2902	0.64%
5	0.7781	0.78%
8	1.2309	0.68%
10	1.5781	1.84%

Main Kiln Mill Off

Client:	GCC	Analysis Date:	11/15/2023
Facility:	Pueblo	Analysis Location:	Elmhurst
Test Location:	Main Kiln Mill Off	Analyst:	JMG
Project Number:	M234207		
Method:	26A		
Date Samples Received:	11/3/2023		

Train A

Sampling Date		10/18/2023	10/18/2023	10/17/2023	10/17/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	215	254	440	440		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		10/17/2023	10/17/2023	10/18/2023			
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**	**M26A- H2SO4 Train Blank**		**RDL**	**MDL**
Sulfuric Acid Volume	ml	425	382	231			
Hydrofluoric Acid	ug	<150	<150	<150		150	15

Train B

Sampling Date		10/18/2023	10/18/2023	10/18/2023	10/17/2023		
	UNITS	**M26A DI Blank**	**M26A H2SO4 Blank**	**M26A H2SO4-R1**	**M26A H2SO4-R1 Dup**	**RDL**	**MDL**
Sulfuric Acid Volume	ml	215	254	449	449		
Hydrofluoric Acid	ug	<150	<150	<150	<150	150	15

Sampling Date		10/17/2023	10/17/2023				
	UNITS	**M26A- H2SO4 R2**	**M26A- H2SO4 R3**			**RDL**	**MDL**
Sulfuric Acid Volume	ml	430	453				
Hydrofluoric Acid	ug	<150	<150			150	15

Client:	GCC	**Analysis Date:**	11/15/2023								
Facility:	Pueblo	**Analysis Location:**	Elmhurst								
Test Location:	Main Kiln Mill Off	**Analyst:**	JMG								
Project Number:	M234207										
Method:	26A										
Date Samples Received:	11/3/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2190	0.2190	**0.95**	**0.2296**							
2	0.4460	0.2230	**1.94**								
5	1.1517	0.2303	**5.02**	**Response Factor Ave**							
8	1.8720	0.2340	**8.15**	**0.2295**							
10	2.4109	0.2411	**10.50**								
Lot Number	Ricca 8209004										
	R^2	**0.9994**									
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**
015	10/18/2023	DI Reagent Blank	0.0065	0.0283	0.0283	1	215	0.0061	0.0064		
015	10/18/2023	DI Reagent Blank	0.0057	0.0248	0.0248	1	215	0.0053	0.0056	**0.0060**	**6.015627896**
	10/18/2023	H2SO4 Reagent Blank	0.0392	0.1707	0.1707	1	254	0.0434	0.0457		
	10/18/2023	H2SO4 Reagent Blank	0.0388	0.1690	0.1690	1	254	0.0429	0.0452	**0.0454**	**45.43714063**
001	10/17/2023	Test 1A H2SO4 Imp	0.0112	0.0488	0.0488	1	440	0.0215	0.0226		
001	10/17/2023	Test 1A H2SO4 Imp	0.0151	0.0658	0.0658	1	440	0.0289	0.0305	**0.0265**	**26.53939993**
001	10/17/2023	Test 1A H2SO4 Imp	0.0178	0.0775	0.0775	1	440	0.0341	0.0359		
001	10/17/2023	Test 1A H2SO4 Imp	0.0149	0.0649	0.0649	1	440	0.0286	0.0301	**0.0330**	**32.99765694**
005	10/17/2023	Test 2A H2SO4 Imp	0.0173	0.0753	0.0753	1	425	0.0320	0.0337		
005	10/17/2023	Test 2A H2SO4 Imp	0.0191	0.0832	0.0832	1	425	0.0354	0.0372	**0.0355**	**35.47913212**
009	10/17/2023	Test 3A H2SO4 Imp	0.0188	0.0819	0.0819	1	382	0.0313	0.0329		
009	10/17/2023	Test 3A H2SO4 Imp	0.0231	0.1006	0.1006	1	382	0.0384	0.0405	**0.0367**	**36.70794395**
013	10/18/2023	Train Blank A	0.0316	0.1376	0.1376	1	231	0.0318	0.0327		
013	10/18/2023	Train Blank A	0.0276	0.1202	0.1202	1	231	0.0278	0.0285	**0.0306**	**30.61670491**
					Expected Value	**% Difference**					
		Run 1 H2SO4 Spike W/ 2ppm	0.2419	1.0534	0.9998						
Lot Number: Thermo 21-191JKS		Run 1 H2SO4 Spike W/ 2ppm	0.2299	1.0012	0.9998	2.76%					
CCV ppm F	**Area**	**PPM F**									
1 ppm ICV	0.2453	1.0682									
5 ppm CCV	1.1285	4.9145									
5 ppm CCV	1.1247	4.8979									
5 ppm CCV	1.1317	4.9284									
5 ppm CCV		0.0000									
Standard ppm F	**Area**	**Difference**									
1	0.2059	3.18%									
2	0.4244	2.54%									
5	1.1246	1.20%									
8	1.8850	0.34%									
10	2.3985	0.26%									

Client:	GCC	**Analysis Date:**	11/15/2023								
Facility:	Pueblo	**Analysis Location:**	Elmhurst								
Test Location:	Main Kiln Mill Off	**Analyst:**	JMG								
Project Number:	M234207										
Method:	26A										
Date Samples Received:	11/3/2023										
Standard ppm HF	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**							
1	0.2190	0.2190	**0.95**	**0.2296**							
2	0.4460	0.2230	**1.94**								
5	1.1517	0.2303	**5.02**	**Response Factor Ave**							
8	1.8720	0.2340	**8.15**	**0.2295**							
10	2.4109	0.2411	**10.50**								
Lot Number	Ricca 8209004										
	R^2	**0.9994**									
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**
015	10/18/2023	DI Reagent Blank	0.0065	0.0283	0.0283	1	215	0.0061	0.0064		
015	10/18/2023	DI Reagent Blank	0.0057	0.0248	0.0248	1	215	0.0053	0.0056	**0.0060**	**6.015627896**
	10/18/2023	H2SO4 Reagent Blank	0.0392	0.1707	0.1707	1	254	0.0434	0.0457		
	10/18/2023	H2SO4 Reagent Blank	0.0388	0.1690	0.1690	1	254	0.0429	0.0452	**0.0454**	**45.43714063**
003	10/17/2023	Test 1B H2SO4 Imp	0.0120	0.0523	0.0523	1	449	0.0235	0.0247		
003	10/17/2023	Test 1B H2SO4 Imp	0.0118	0.0514	0.0514	1	449	0.0231	0.0243	**0.0245**	**24.5078928**
003	10/17/2023	Test 1B H2SO4 Imp	0.0138	0.0601	0.0601	1	449	0.0270	0.0284		
003	10/17/2023	Test 1B H2SO4 Imp	0.0122	0.0531	0.0531	1	449	0.0239	0.0251	**0.0268**	**26.77332827**
007	10/17/2023	Test 2B H2SO4 Imp	0.0221	0.0962	0.0962	1	430	0.0414	0.0436		
007	10/17/2023	Test 2B H2SO4 Imp	0.0227	0.0989	0.0989	1	430	0.0425	0.0448	**0.0442**	**44.18034914**
011	10/17/2023	Test 3B H2SO4 Imp	0.0179	0.0780	0.0780	1	453	0.0353	0.0372		
011	10/17/2023	Test 3B H2SO4 Imp	0.0145	0.0631	0.0631	1	453	0.0286	0.0301	**0.0337**	**33.6609126**
	10/17/2023	Train Blank B	0.0169	0.0736	0.0736	1	222	0.0163	0.0172		
	10/17/2023	Train Blank B	0.0181	0.0788	0.0788	1	222	0.0175	0.0184	**0.0178**	**17.81983559**
Standard ppm F	**Area**	**Difference**									
1	0.2059	3.18%									
2	0.4244	2.54%									
5	1.1246	1.20%									
8	1.8850	0.34%									
10	2.3985	0.26%									

Main Kiln Mill Off

Client:	GCC	Analysis Date:	11/15/2023
Facility:	Pueblo	Analysis Location:	Elmhurst
Test Location:	Main Kiln Mill Off	Analyst:	JMG
Project Number:	M234207		
Method:	26A		
Date Samples Received:	11/3/2023		

Train A

Sampling Date		10/18/2023	10/18/2023	10/17/2023	10/17/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	215	254	315	315		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		10/17/2023	10/17/2023	10/18/2023			
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**	**Train A Blank**		**RDL**	**MDL**
Sodium Hydroxide Volume	ml	318	299	215			
Chlorine	ug	<150	<150	<150		150	15

Train B

Sampling Date		10/17/2023	10/18/2023	10/17/2023	10/17/2023		
	UNITS	**M26A DI Blank**	**M26A NaOH Blank**	**M26A NaOH-R1**	**M26A NaOH-R1 Dup**	**RDL**	**MDL**
Sodium Hydroxide Volume	ml	215	254	330	330		
Chlorine	ug	<150	<150	<150	<150	150	15

Sampling Date		10/17/2023	10/17/2023				
	UNITS	**M26A- NaOH R2**	**M26A- NaOH R3**			**RDL**	**MDL**
Sodium Hydroxide Volume	ml	292	328				
Chlorine	ug	<150	<150			150	15

Client:	GCC	**Analysis Date:**	11/15/2023							
Facility:	Pueblo	**Analysis Location:**	Elmhurst Lab							
Test Location:	Main Kiln Mill Off	**Analyst:**	JMG							
Project Number:	M234207									
Method:	26A									
Date Samples Received:	11/3/2023									
Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**						
1	0.1523	0.1523	**1.01**	**0.1513**						
2	0.2939	0.1470	**1.94**							
5	0.7660	0.1532	**5.06**	**Response Factor Ave**						
8	1.2141	0.1518	**8.03**	**0.1512**						
10	1.5201	0.1520	**10.05**							
Lot Number	Ricca 8209004									
	R^2	**0.9999**								
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**
015	10/18/2023	DI Reagent Blank	0.0027	0.0179	0.0179	1	215	0.0038		
015	10/18/2023	DI Reagent Blank	0.0017	0.0112	0.0112	1	215	0.0024	**0.0031**	**3.127100777**
	10/18/2023	NaOH Reagent Blank	0.0470	0.3107	0.3107	1	254	0.0789		
	10/18/2023	NaOH Reagent Blank	0.0335	0.2215	0.2215	1	254	0.0563	**0.0676**	**67.58967187**
002	10/17/2023	Test 1A NaOH Imp	0.0152	0.1005	0.1005	1	315	0.0317		
002	10/17/2023	Test 1A NaOH Imp	0.0137	0.0906	0.0906	1	315	0.0285	**0.0301**	**30.09256017**
002	10/17/2023	Test 1A NaOH Imp	0.0144	0.0952	0.0952	1	315	0.0300		
002	10/17/2023	Test 1A NaOH Imp	0.0135	0.0893	0.0893	1	315	0.0281	**0.0291**	**29.05129511**
006	10/17/2023	Test 2A NaOH Imp	0.0081	0.0536	0.0536	1	318	0.0170		
006	10/17/2023	Test 2A NaOH Imp	0.0076	0.0502	0.0502	1	318	0.0160	**0.0165**	**16.50355533**
010	10/17/2023	Test 3A NaOH Imp	0.0168	0.1111	0.1111	1	299	0.0332		
010	10/17/2023	Test 3A NaOH Imp	0.0144	0.0952	0.0952	1	299	0.0285	**0.0308**	**30.83731261**
014	10/18/2023	Train Blank	0.0140	0.0926	0.0926	1	215	0.0199		
014	10/18/2023	Train Blank	0.0152	0.1005	0.1005	1	215	0.0216	**0.0208**	**20.75257788**
					Expected Value	**% Difference**				
		Run 1 H2SO4 Spike W/ 2ppm	0.1548	1.0234	1.0193					
		Run 1 H2SO4 Spike W/ 2ppm	0.1553	1.0267	1.0193	0.57%				
CCV ppm Cl	**Area**	**PPM Cl**								
5 ppm ICV	0.7339	4.8520								
5 ppm CCV	0.761	5.0311								
5 ppm CCV	0.7936	5.2467								
Standard ppm Cl	**Area**	**Difference**								
1	0.1575	1.65%								
2	0.2902	0.64%								
5	0.7781	0.78%								
8	1.2309	0.68%								
10	1.5781	1.84%								

Client:	GCC	**Analysis Date:**	11/15/2023						
Facility:	Pueblo	**Analysis Location:**	Elmhurst Lab						
Test Location:	Main Kiln Mill Off	**Analyst:**	JMG						
Project Number:	M234207								
Method:	26A								
Date Samples Received:	11/3/2023								

Standard ppm Cl	**Area**	**Response Factor**	**Calculated Value**	**Slope of Regression Curve**
1	0.1523	0.1523	**1.01**	**0.1513**
2	0.2939	0.1470	**1.94**	
5	0.7660	0.1532	**5.06**	**Response Factor Ave**
8	1.2141	0.1518	**8.03**	**0.1512**
10	1.5201	0.1520	**10.05**	
Lot Number	Ricca 8209004			
	R^2	**0.9999**		

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**
015	10/18/2023	DI Reagent Blank	0.0027	0.0179	0.0179	1	215	0.0038		
015	10/18/2023	DI Reagent Blank	0.0017	0.0112	0.0112	1	215	0.0024	**0.0031**	**3.127100777**
	10/18/2023	NaOH Reagent Blank	0.0470	0.3107	0.3107	1	254	0.0789		
	10/18/2023	NaOH Reagent Blank	0.0335	0.2215	0.2215	1	254	0.0563	**0.0676**	**67.58967187**
004	10/17/2023	Test 1B NaOH Imp	0.0159	0.1051	0.1051	1	330	0.0347		
004	10/17/2023	Test 1B NaOH Imp	0.0091	0.0602	0.0602	1	330	0.0199	**0.0273**	**27.27122771**
004	10/17/2023	Test 1B NaOH Imp	0.0138	0.0912	0.0912	1	330	0.0301		
004	10/17/2023	Test 1B NaOH Imp	0.0093	0.0615	0.0615	1	330	0.0203	**0.0252**	**25.1986144**
008	10/17/2023	Test 2B NaOH Imp	0.0164	0.1084	0.1084	1	292	0.0317		
008	10/17/2023	Test 2B NaOH Imp	0.0166	0.1097	0.1097	1	292	0.0320	**0.0319**	**31.85279396**
012	10/17/2023	Test 3B NaOH Imp	0.0162	0.1071	0.1071	1	328	0.0351		
012	10/17/2023	Test 3B NaOH Imp	0.0177	0.1170	0.1170	1	328	0.0384	**0.0368**	**36.75566486**

CCV ppm Cl	**Area**	**PPM Cl**
5 ppm ICV	0.7339	4.8520
5 ppm CCV	0.761	5.0311
5 ppm CCV	0.7786	5.1475
5 ppm CCV	0.7748	5.1224

Standard ppm Cl	**Area**	**Difference**
1	0.1575	1.65%
2	0.2902	0.64%
5	0.7781	0.78%
8	1.2309	0.68%
10	1.5781	1.84%

Appendix F - Reference Method Test Data

Client:	GCC Rio Grande, Inc.		
Facility:	Pueblo Plant		
Test Location:	Main Kiln Stack		
Project #:	M234207		
Test Method:	26A		
Test Engineer:	DCS		
Test Technician:	SWK		
	Run 1A	**Run 2A**	**Run 3A**
Temp ID:	CM53	CM53	CM53
Meter ID:	CM53	CM53	CM53
Pitot ID:	S8-031A	S8-031A	S8-031A
Nozzle Diameter (Inches):	0.281	0.281	0.281
Meter Calibration Date:	9/6/2023	9/6/2023	9/6/2023
Meter Calibration Factor (Y):	0.994	0.994	0.994
Meter Orifice Setting (Delta H):	1.775	1.775	1.775
Nozzle Kit ID Number and Material:	#32 Glass	#32 Glass	#32 Glass
Pitot Tube Coefficient:		0.820	
Probe Length (Feet):		6.0	
Probe Liner Material:		Glass	
Sample Plane:		Horizontal	
Port Length (Inches):		9.50	
Port Size (Diameter, Inches):		6.00	
Port Type:		Flange	
Duct Shape:		Circular	
Diameter (Feet):		10.25	
Duct Area (Square Feet):		82.516	
Upstream Diameters:		4.9	
Downstream Diameters:		24.4	
Number of Ports Sampled:		4	
Number of Points per Port:		3	
Minutes per Point:		5.0	
Minutes per Reading:		5.0	
Total Number of Traverse Points:		12	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill On	
Diluent Model/Serial Number:		CAI700	
Moisture Balance ID:		LV3	
# of Runs		3	

Run 1A - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/18/23**
Facility: Pueblo Plant | **Start Time: 8:40**
Test Location: Main Kiln Stack | **End Time: 9:46**
Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.34	in. H_2O	Static Pressure	0.75	in. H_2O
Meter Temperature, Tm:	62.8	°F	Flue Pressure (Ps):	24.94	in. Hg. abs.
Sqrt ΔP:	0.790	in. H_2O	Carbon Dioxide:	19.40	%
Stack Temperature, Ts:	215.3	°F	Oxygen:	9.70	%
Meter Volume, Vm:	55.293	ft^3	Nitrogen:	70.90	%
Meter Volume, Vmstd:	46.481	dscf	Gas Weight dry, Md:	31.492	lb/lb mole
Meter Volume, Vwstd:	7.621	wscf	Gas Weight wet, Ms:	29.592	lb/lb mole
Isokinetic Variance:	101.1	%I	Excess Air:	---	%
			Gas Velocity, Vs:	53.009	fps
Test Length:	60.00	in mins.	Volumetric Flow:	262,445	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	146,915	dscfm
Barometric Pressure:	24.88	in Hg	Volumetric Flow:	171,002	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3547.1	ml	Silica Initial Wt.	832.7	grams
Final Impinger Content:	3662.5	ml	Silica Final Wt.	879.1	grams
Impinger Difference:	115.4	ml	Silica Difference:	46.4	grams

Total Water Gain: 161.8 Moisture, Bws: 0.141

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F	
1-1	8:40:00	0.71	2.80	290.780	239	71	57	263	273	53	
1-2	8:45:00	0.67	2.40	295.620	233	70	57	269	270	53	
1-3	8:50:00	0.49	1.80	300.260	230	69	58	270	268	53	
	8:55:00			304.515							
2-1	8:57:00	0.69	2.50	304.515	221	67	58	270	270	53	
2-2	9:02:00	0.64	2.40	309.350	217	67	58	267	268	53	
2-3	9:07:00	0.55	2.00	314.050	215	67	58	265	265	53	
	9:12:00			318.524							
3-1	9:14:00	0.70	2.60	318.524	210	66	58	265	265	53	
3-2	9:19:00	0.63	2.40	323.060	208	65	59	264	266	53	
3-3	9:24:00	0.56	2.10	328.030	206	65	61	264	268	53	
	9:29:00			332.682							
4-1	9:31:00	0.69	2.60	332.682	203	65	60	266	261	53	
4-2	9:36:00	0.63	2.40	337.110	201	64	60	265	260	53	
4-3	9:41:00	0.56	2.10	341.620	201	65	61	267	264	53	
	9:46:00			346.073							
Total	1:00:00			55.293		66.8	58.8				
Average			2.34		215.3	62.8					
Min			1.80		201.0	57.0					
Max			2.80		239.0	71.0					

Impinger Weight Sheet - Run 1A

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/18/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/18/2023**

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	823.5	740.8	82.7
0.1N H2SO4	691.2	682.8	8.4
Empty	652.0	642.4	9.6
0.1N NaOH	746.7	782.3	-35.6
0.1N NaOH	749.1	698.8	50.3
Silica Gel	879.1	832.7	46.4

Liquid Final	Liquid Initial	Liquid Gain
3,662.5	3,547.1	115.4

Silica Final	Silica Initial	Silica Gain
879.1	832.7	46.4

Run 2A - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/18/23**

Facility: Pueblo Plant | **Start Time: 9:40**

Test Location: Main Kiln Stack | **End Time: 12:02**

Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.47	In. H_2O	Static Pressure	0.75	in. H_2O
Meter Temperature, Tm:	64.9	°F	Flue Pressure (Ps):	24.94	in. Hg. abs.
Sqrt ΔP:	0.801	In. H_2O	Carbon Dioxide:	19.90	%
Stack Temperature, Ts:	206.8	°F	Oxygen:	9.50	%
Meter Volume, Vm:	56.477	ft^3	Nitrogen:	70.6	%
Meter Volume, Vmstd:	47.302	dscf	Gas Weight dry, Md:	31.564	lb/lb mole
Meter Volume, Vwstd:	6.999	wscf	Gas Weight wet, Ms:	29.816	lb/lb mole
Isokinetic Variance:	99.8	%I	Excess Air:	---	%
			Gas Velocity, Vs:	53.197	fps
Test Length:	60.00	in mins.	Volumetric Flow:	263,375	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	151,414	dscfm
Barometric Pressure:	24.88	in Hg	Volumetric Flow:	173,818	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3551.1	ml	Silica Initial Wt.	833.0	grams
Final Impinger Content:	3688.2	ml	Silica Final Wt.	844.5	grams
Impinger Difference:	137.1	ml	Silica Difference:	11.5	grams
Total Water Gain:	148.6		Moisture, Bws:	0.129	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:10:00	0.70	2.70	346.419	197	64	61	263	265	54
1-2	10:15:00	0.67	2.60	351.450	196	65	62	263	263	54
1-3	10:20:00	0.50	2.40	356.210	196	66	61	266	264	54
	10:25:00			361.051						
2-1	10:27:00	0.71	2.70	361.051	195	67	62	265	267	54
2-2	10:32:00	0.66	2.50	366.090	195	67	63	265	270	54
2-3	10:37:00	0.59	2.20	370.780	195	67	62	264	269	54
	10:42:00			375.679						
3-1	10:44:00	0.70	2.70	375.679	194	67	62	270	267	54
3-2	10:49:00	0.68	2.60	380.310	194	67	63	268	269	54
3-3	11:40:00	0.60	2.30	384.645	232	67	66	269	269	54
	11:45:00			389.134						
4-1	11:47:00	0.74	2.70	389.134	232	66	66	265	265	54
4-2	11:52:00	0.65	2.30	393.560	229	66	66	265	267	54
4-3	11:57:00	0.53	1.90	398.620	226	67	67	265	264	54
	12:02:00			402.896						
Total	1:46:00			56.477		66.3	63.4			
Average			2.47		206.8	64.9				
Min			1.90		194.0	61.0				
Max			2.70		232.0	67.0				

Impinger Weight Sheet - Run 2A

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/18/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/18/2023**

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	834.3	741.5	92.8
0.1N H2SO4	718.3	684.4	33.9
Empty	649.3	642.7	6.6
0.1N NaOH	782.6	781.0	1.6
0.1N NaOH	703.7	701.5	2.2
Silica Gel	844.5	833.0	11.5

Liquid Final	Liquid Initial	Liquid Gain
3,688.2	3,551.1	137.1

Silica Final	Silica Initial	Silica Gain
844.5	833.0	11.5

Run 3A - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/18/23**

Facility: Pueblo Plant | **Start Time: 12:25**

Test Location: Main Kiln Stack | **End Time: 13:31**

Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.33	In. H_2O	Static Pressure	0.75	in. H_2O
Meter Temperature, Tm:	70.3	°F	Flue Pressure (Ps):	24.94	in. Hg. abs.
Sqrt ΔP:	0.795	In. H_2O	Carbon Dioxide:	20.60	%
Stack Temperature, Ts:	214.3	°F	Oxygen:	9.10	%
Meter Volume, Vm:	54.609	ft^3	Nitrogen:	70.3	%
Meter Volume, Vmstd:	45.248	dscf	Gas Weight dry, Md:	31.660	lb/lb mole
Meter Volume, Vwstd:	7.456	wscf	Gas Weight wet, Ms:	29.728	lb/lb mole
Isokinetic Variance:	98.0	%I	Excess Air:	96.203	%
			Gas Velocity, Vs:	53.178	fps
Test Length:	60.00	in mins.	Volumetric Flow:	263,281	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	147,497	dscfm
Barometric Pressure:	24.88	in Hg	Volumetric Flow:	171,802	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3662.8	ml	Silica Initial Wt.	863.6	grams
Final Impinger Content:	3804.3	ml	Silica Final Wt.	880.4	grams
Impinger Difference:	141.5	ml	Silica Difference:	16.8	grams
Total Water Gain:	158.3		Moisture, Bws:	0.141	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	12:25:00	0.72	2.60	402.932	217	69	67	260	267	55
1-2	12:30:00	0.67	2.40	407.550	217	69	69	266	269	55
1-3	12:35:00	0.51	1.90	411.640	216	69	69	268	269	55
	12:40:00			416.145						
2-1	12:42:00	0.71	2.60	416.145	215	70	68	265	266	55
2-2	12:47:00	0.67	2.50	420.740	215	70	68	265	265	56
2-3	12:52:00	0.54	2.00	425.830	214	71	70	265	268	56
	12:57:00			430.049						
3-1	12:59:00	0.70	2.60	430.049	214	72	68	264	267	56
3-2	13:04:00	0.66	2.40	434.810	213	72	71	265	267	56
3-3	13:09:00	0.55	2.00	439.420	213	73	72	266	267	57
	13:14:00			443.821						
4-1	13:16:00	0.71	2.60	443.821	213	73	70	265	267	57
4-2	13:21:00	0.66	2.40	448.680	213	73	71	265	267	58
4-3	13:26:00	0.52	1.90	453.210	212	74	70	265	269	58
	13:31:00			457.541						
Total	1:00:00			54.609		71.3	69.4			
Average			2.33		214.3	70.3				
Min			1.90		212.0	67.0				
Max			2.60		217.0	74.0				

Impinger Weight Sheet - Run 3A

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/18/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/18/2023**

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	864.6	758.1	106.5
0.1N H2SO4	820.0	794.5	25.5
Empty	640.6	633.6	7.0
0.1N NaOH	734.9	733.1	1.8
0.1N NaOH	744.2	743.5	0.7
Silica Gel	880.4	863.6	16.8

3,804.3	3,662.8	141.5
Liquid Final	**Liquid Initial**	**Liquid Gain**
880.4	863.6	16.8
Silica Final	**Silica Initial**	**Silica Gain**

Client:	GCC Rio Grande, Inc.		
Facility:	Pueblo Plant		
Test Location:	Main Kiln Stack		
Project #:	M234207		
Test Method:	26A		
Test Engineer:	SWK		
Test Technician:	DCS		
	Run 1	**Run 2**	**Run 3**
Meter ID:	CM4	CM4	CM4
Pitot ID:	S8-032A	S8-032A	S8-032A
Nozzle Diameter (Inches):	0.282	0.282	0.282
Meter Calibration Date:	10/5/2023	10/5/2023	10/5/2023
Meter Calibration Factor (Y):	0.990	0.990	0.990
Meter Orifice Setting (Delta H):	1.889	1.889	1.889
Nozzle Kit ID Number and Material:	21 Glass	21 Glass	21 Glass
Pitot Tube Coefficient:		0.822	
Probe Length (Feet):		4.0	
Probe Liner Material:		Glass	
Sample Plane:		Horizontal	
Port Length (Inches):		9.50	
Port Size (Diameter, Inches):		6.00	
Port Type:		Flange	
Duct Shape:		Circular	
Diameter (Feet):		10.25	
Duct Area (Square Feet):		82.516	
Upstream Diameters:		4.9	
Downstream Diameters:		24.4	
Number of Ports Sampled:		4	
Number of Points per Port:		3	
Minutes per Point:		5.0	
Minutes per Reading:		5.0	
Total Number of Traverse Points:		12	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill On	
Diluent Model/Serial Number:		CAI700	
Moisture Balance ID:		LV3	
# of Runs		3	

Run 1 - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/18/23**
Facility: Pueblo Plant | **Start Time: 8:40**
Test Location: Main Kiln Stack | **End Time: 9:46**
Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.48	in. H_2O	Static Pressure	0.75	in. H_2O
Meter Temperature, Tm:	66.4	°F	Flue Pressure (Ps):	24.94	in. Hg. abs.
Sqrt ΔP:	0.779	in. H_2O	Carbon Dioxide:	19.40	%
Stack Temperature, Ts:	210.2	°F	Oxygen:	9.70	%
Meter Volume, Vm:	56.794	ft^3	Nitrogen:	70.90	%
Meter Volume, Vmstd:	47.238	dscf	Gas Weight dry, Md:	31.492	lb/lb mole
Meter Volume, Vwstd:	7.418	wscf	Gas Weight wet, Ms:	29.661	lb/lb mole
Isokinetic Variance:	102.3	%I	Excess Air:	---	%
			Gas Velocity, Vs:	52.119	fps
Test Length:	60.00	in mins.	Volumetric Flow:	258,040	acfm
Nozzle Diameter:	0.282	in inches	Volumetric Flow:	146,433	dscfm
Barometric Pressure:	24.88	in Hg	Volumetric Flow:	169,429	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3418.5	ml	Silica Initial Wt.	813.3	grams
Final Impinger Content:	3563.2	ml	Silica Final Wt.	826.1	grams
Impinger Difference:	144.7	ml	Silica Difference:	12.8	grams
Total Water Gain:	157.5		Moisture, Bws:	0.136	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F	
1-1	8:40:00	0.72	2.80	0.571	234	72	71	255	266	52	
1-2	8:45:00	0.65	2.60	5.670	227	71	70	257	267	53	
1-3	8:50:00	0.55	2.20	10.530	224	71	68	257	268	53	
	8:55:00			15.053							
2-1	8:57:00	0.65	2.60	15.053	216	68	66	260	267	54	
2-2	9:02:00	0.63	2.60	19.970	212	68	65	261	264	54	
2-3	9:07:00	0.56	2.30	24.720	209	68	64	261	267	55	
	9:12:00			29.290							
3-1	9:14:00	0.62	2.50	29.290	206	65	63	262	268	55	
3-2	9:19:00	0.62	2.50	33.990	203	67	63	261	266	55	
3-3	9:24:00	0.53	2.20	38.830	201	67	62	261	266	56	
	9:29:00			43.304							
4-1	9:31:00	0.63	2.60	43.304	198	65	62	266	265	57	
4-2	9:36:00	0.62	2.60	48.120	196	67	62	262	266	57	
4-3	9:41:00	0.52	2.20	52.940	196	67	62	263	265	57	
	9:46:00			57.365							
Total	1:00:00			56.794		68.0	64.8				
Average			2.48		210.2	66.4					
Min			2.20		196.0	62.0					
Max			2.80		234.0	72.0					

Impinger Weight Sheet - Run 1

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/18/2023**
Test Method:	**26A**
Weighed/Measured By:	
Balance ID:	**LV3**

Scale Calibration Check Date: **10/18/2023**

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	818.0	744.3	73.7
0.1N H2SO4	734.8	685.6	49.2
Empty	654.3	643.1	11.2
0.1N NaOH	745.2	738.2	7.0
0.1N NaOH	610.9	607.3	3.6
Silica Gel	826.1	813.3	12.8

Liquid Final	Liquid Initial	Liquid Gain
3,563.2	3,418.5	144.7

Silica Final	Silica Initial	Silica Gain
826.1	813.3	12.8

Run 2 - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/18/23**

Facility: Pueblo Plant | **Start Time: 10:10**

Test Location: Main Kiln Stack | **End Time: 12:02**

Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.40	In. H_2O	Static Pressure	0.75	in. H_2O
Meter Temperature, Tm:	65.8	°F	Flue Pressure (Ps):	24.94	in. Hg. abs.
Sqrt ΔP:	0.767	In. H_2O	Carbon Dioxide:	19.90	%
Stack Temperature, Ts:	203.0	°F	Oxygen:	9.50	%
Meter Volume, Vm:	55.736	ft^3	Nitrogen:	70.6	%
Meter Volume, Vmstd:	46.403	dscf	Gas Weight dry, Md:	31.564	lb/lb mole
Meter Volume, Vwstd:	4.588	wscf	Gas Weight wet, Ms:	30.344	lb/lb mole
Isokinetic Variance:	97.6	%I	Excess Air:	---	%
			Gas Velocity, Vs:	50.445	fps
Test Length:	60.00	in mins.	Volumetric Flow:	249,751	acfm
Nozzle Diameter:	0.282	in inches	Volumetric Flow:	150,846	dscfm
Barometric Pressure:	24.88	in Hg	Volumetric Flow:	165,759	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3495.9	ml	Silica Initial Wt.	891.6	grams
Final Impinger Content:	3584.4	ml	Silica Final Wt.	900.5	grams
Impinger Difference:	88.5	ml	Silica Difference:	8.9	grams
Total Water Gain:	97.4		Moisture, Bws:	0.090	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	10:10:00	0.63	2.60	57.785	192	61	60	250	265	53
1-2	10:15:00	0.61	2.50	62.610	192	66	61	254	267	54
1-3	10:20:00	0.51	2.10	67.340	191	68	61	255	266	55
	10:25:00			71.709						
2-1	10:27:00	0.61	2.50	71.709	191	66	62	255	265	55
2-2	10:32:00	0.60	2.50	76.460	190	71	63	254	265	56
2-3	10:37:00	0.54	2.30	81.240	190	72	63	258	265	56
	10:42:00			85.759						
3-1	10:44:00	0.64	2.70	85.759	189	68	64	260	266	56
3-2	10:49:00	0.64	2.70	90.670	189	71	64	260	268	57
	10:54:00			95.582						
3-3	11:40:00	0.60	2.30	95.582	237	67	65	262	267	61
	11:45:00			100.148						
4-1	11:47:00	0.62	2.40	100.148	229	67	65	260	265	62
4-2	11:52:00	0.59	2.30	104.800	224	70	66	260	264	63
4-3	11:57:00	0.48	1.90	109.350	222	72	66	263	266	63
	12:02:00			113.521						
Total	1:00:00			55.736		68.3	63.3			
Average			2.40		203.0	65.8				
Min			1.90		189.0	60.0				
Max			2.70		237.0	72.0				

Impinger Weight Sheet - Run 2

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/18/2023**
Test Method:	**26A**
Weighed/Measured By:	**0**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/18/2023**

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	814.5	747.8	66.7
0.1N H2SO4	687.3	674.6	12.7
Empty	599.3	597.9	1.4
0.1N NaOH	697.8	692.0	5.8
0.1N NaOH	785.5	783.6	1.9
Silica Gel	900.5	891.6	8.9

Liquid Final	Liquid Initial	Liquid Gain
3,584.4	3,495.9	88.5

Silica Final	Silica Initial	Silica Gain
900.5	891.6	8.9

Run 3 - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/18/23**

Facility: Pueblo Plant | **Start Time: 12:25**

Test Location: Main Kiln Stack | **End Time: 13:31**

Source Condition: Mill On

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	2.45	In. H_2O	Static Pressure	0.75	in. H_2O
Meter Temperature, Tm:	71.2	°F	Flue Pressure (Ps):	24.94	in. Hg. abs.
Sqrt ΔP:	0.759	In. H_2O	Carbon Dioxide:	20.60	%
Stack Temperature, Ts:	210.1	°F	Oxygen:	9.10	%
Meter Volume, Vm:	56.397	ft^3	Nitrogen:	70.3	%
Meter Volume, Vmstd:	46.482	dscf	Gas Weight dry, Md:	31.660	lb/lb mole
Meter Volume, Vwstd:	7.574	wscf	Gas Weight wet, Ms:	29.746	lb/lb mole
Isokinetic Variance:	104.1	%I	Excess Air:	96.203	%
			Gas Velocity, Vs:	50.668	fps
Test Length:	60.00	in mins.	Volumetric Flow:	250,857	acfm
Nozzle Diameter:	0.282	in inches	Volumetric Flow:	141,652	dscfm
Barometric Pressure:	24.88	in Hg	Volumetric Flow:	164,733	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3427.3	ml	Silica Initial Wt.	825.6	grams
Final Impinger Content:	3574.7	ml	Silica Final Wt.	839.0	grams
Impinger Difference:	147.4	ml	Silica Difference:	13.4	grams
Total Water Gain:	160.8		Moisture, Bws:	0.140	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	12:25:00	0.63	2.70	114.590	213	67	66	250	253	51
1-2	12:30:00	0.60	2.50	119.490	212	71	67	263	264	51
1-3	12:35:00	0.55	2.30	124.310	212	73	67	257	263	51
	12:40:00			128.930						
2-1	12:42:00	0.63	2.70	128.930	211	71	68	253	265	51
2-2	12:47:00	0.59	2.50	133.860	210	75	68	250	264	52
2-3	12:52:00	0.52	2.20	138.690	210	76	69	253	265	52
	12:57:00			143.196						
3-1	12:59:00	0.62	2.70	143.196	209	73	69	258	264	53
3-2	13:04:00	0.59	2.50	148.100	209	76	70	259	265	53
3-3	13:09:00	0.48	2.10	152.920	209	76	70	257	265	54
	13:14:00			157.293						
4-1	13:16:00	0.63	2.70	157.293	209	73	70	262	263	56
4-2	13:21:00	0.59	2.50	162.270	209	76	71	257	265	56
4-3	13:26:00	0.49	2.00	166.990	208	76	71	253	264	56
	13:31:00			170.987						
Total	1:00:00			56.397		73.6	68.8			
Average			2.45		210.1	71.2				
Min			2.00		208.0	66.0				
Max			2.70		213.0	76.0				

Impinger Weight Sheet - Run 3

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/18/2023**
Test Method:	**26A**
Weighed/Measured By:	**0**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/18/2023**

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	851.0	745.1	105.9
0.1N H2SO4	722.0	689.5	32.5
Empty	650.3	643.2	7.1
0.1N NaOH	742.5	740.8	1.7
0.1N NaOH	608.9	608.7	0.2
Silica Gel	839.0	825.6	13.4
	3,574.7	3,427.3	147.4
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	839.0	825.6	13.4
	Silica Final	**Silica Initial**	**Silica Gain**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/23

Run 1

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN1_0360.LAB	8:40	14.42	15.49	7.74	0.10	190.74	0.85	10.72
RUN1_0361.LAB	8:41	14.40	15.38	7.75	0.10	190.70	0.85	10.80
RUN1_0362.LAB	8:42	13.78	15.99	7.78	0.10	190.71	0.85	10.31
RUN1_0363.LAB	8:43	12.89	16.50	7.62	0.10	190.74	0.85	9.92
RUN1_0364.LAB	8:44	12.71	16.60	7.94	0.10	190.69	0.85	9.98
RUN1_0365.LAB	8:45	12.50	16.33	8.53	0.10	190.55	0.85	10.31
RUN1_0366.LAB	8:46	13.19	16.47	8.62	0.10	190.67	0.85	10.14
RUN1_0367.LAB	8:47	13.40	16.72	8.07	0.10	190.64	0.85	9.64
RUN1_0368.LAB	8:48	13.54	17.13	7.97	0.10	190.58	0.85	9.42
RUN1_0369.LAB	8:49	13.87	17.43	8.07	0.10	190.48	0.85	9.02
RUN1_0370.LAB	8:50	13.76	17.21	7.72	0.10	190.54	0.85	9.21
RUN1_0371.LAB	8:51	13.55	17.01	7.92	0.10	190.63	0.85	9.24
RUN1_0372.LAB	8:52	13.65	16.69	7.77	0.10	190.65	0.85	9.53
RUN1_0373.LAB	8:53	13.33	16.33	7.87	0.10	190.74	0.85	10.02
RUN1_0374.LAB	8:54	13.36	16.54	8.07	0.10	190.68	0.85	10.02
RUN1_0375.LAB	8:55	13.32	16.68	8.02	0.10	190.59	0.85	9.89
RUN1_0376.LAB	8:56	13.56	17.09	7.98	0.10	190.72	0.85	9.65
RUN1_0377.LAB	8:57	13.78	17.24	8.12	0.10	190.79	0.85	9.19
RUN1_0378.LAB	8:58	13.66	16.70	7.96	0.10	190.76	0.85	9.38
RUN1_0379.LAB	8:59	13.54	16.81	7.95	0.10	190.74	0.85	9.59
RUN1_0380.LAB	9:00	13.71	16.92	7.83	0.10	190.73	0.85	9.59
RUN1_0381.LAB	9:01	13.68	17.03	7.87	0.10	190.50	0.85	9.53
RUN1_0382.LAB	9:02	13.94	17.22	8.04	0.10	190.48	0.85	9.32
RUN1_0383.LAB	9:03	13.84	16.79	8.08	0.10	190.57	0.85	9.07
RUN1_0384.LAB	9:04	13.81	16.77	8.22	0.10	190.60	0.85	9.81
RUN1_0385.LAB	9:05	14.07	17.21	8.53	0.10	190.58	0.85	9.24
RUN1_0386.LAB	9:06	13.57	16.65	8.40	0.10	190.68	0.85	9.31
RUN1_0387.LAB	9:07	13.68	17.07	8.66	0.10	190.72	0.85	9.93
RUN1_0388.LAB	9:08	13.73	16.60	8.28	0.10	190.63	0.85	9.44
RUN1_0389.LAB	9:09	13.80	17.01	8.31	0.10	190.80	0.85	9.74
RUN1_0390.LAB	9:10	13.98	17.03	8.24	0.10	190.76	0.85	9.44
RUN1_0391.LAB	9:11	13.92	17.07	8.17	0.10	190.82	0.85	9.29
RUN1_0392.LAB	9:12	14.05	17.54	8.33	0.10	190.68	0.85	9.34
RUN1_0393.LAB	9:13	14.08	17.23	8.23	0.10	190.49	0.85	8.90
RUN1_0394.LAB	9:14	13.84	16.72	8.01	0.10	190.82	0.85	8.98
RUN1_0395.LAB	9:15	13.89	16.70	8.00	0.10	191.04	0.85	9.39
RUN1_0396.LAB	9:16	13.62	16.81	7.97	0.10	190.89	0.85	9.58
RUN1_0397.LAB	9:17	13.67	16.56	7.70	0.10	190.62	0.85	9.72
RUN1_0398.LAB	9:18	13.58	16.50	8.02	0.10	190.64	0.85	9.65
RUN1_0399.LAB	9:19	13.85	16.73	7.88	0.10	190.65	0.85	9.99
RUN1_0400.LAB	9:20	13.35	16.14	8.20	0.10	190.41	0.85	9.56
RUN1_0401.LAB	9:21	13.57	16.92	8.53	0.10	190.33	0.85	9.97
RUN1_0402.LAB	9:22	13.57	16.94	8.21	0.10	190.40	0.85	9.98
RUN1_0403.LAB	9:23	13.75	17.08	8.08	0.10	190.54	0.85	9.56
RUN1_0404.LAB	9:24	13.95	17.10	8.07	0.10	190.63	0.85	9.63
RUN1_0405.LAB	9:25	13.55	16.03	7.76	0.10	190.71	0.85	9.23
RUN1_0406.LAB	9:26	13.55	16.14	8.26	0.10	190.64	0.85	9.41
RUN1_0407.LAB	9:27	13.61	16.66	8.44	0.10	190.63	0.85	10.30
RUN1_0408.LAB	9:28	13.52	16.72	8.42	0.10	190.67	0.85	10.08
RUN1_0409.LAB	9:29	13.41	16.66	8.40	0.10	190.55	0.85	9.78
RUN1_0410.LAB	9:30	13.68	16.74	8.32	0.10	190.59	0.84	9.78
RUN1_0411.LAB	9:31	13.60	16.66	8.34	0.10	190.59	0.84	9.87
RUN1_0412.LAB	9:32	13.66	16.74	8.69	0.10	190.61	0.85	9.72
RUN1_0413.LAB	9:33	13.41	16.93	8.65	0.10	190.64	0.84	9.59
RUN1_0414.LAB	9:34	13.45	16.85	8.46	0.10	190.56	0.85	9.71
RUN1_0415.LAB	9:35	13.43	16.83	8.28	0.10	190.66	0.85	9.62
RUN1_0416.LAB	9:36	13.47	16.91	8.21	0.10	190.51	0.84	9.67
RUN1_0417.LAB	9:37	13.40	16.89	8.20	0.10	190.48	0.84	9.73
RUN1_0418.LAB	9:38	13.78	17.08	8.26	0.10	190.59	0.85	9.58
RUN1_0419.LAB	9:39	13.60	17.02	8.09	0.10	190.60	0.84	9.64
Average		**13.63**	**16.76**	**8.14**	**0.10**	**190.64**	**0.85**	**9.66**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/23

Run 2

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN2_0490.LAB	10:10	12.97	16.9	8.08	0.10	190.5	0.84	9.45
RUN2_0491.LAB	10:11	13.43	17.0	8.10	0.10	190.5	0.84	9.56
RUN2_0492.LAB	10:12	13.14	16.8	8.12	0.10	190.5	0.84	9.60
RUN2_0493.LAB	10:13	13.30	17.1	8.17	0.10	190.6	0.84	9.42
RUN2_0494.LAB	10:14	13.47	16.9	7.89	0.10	190.5	0.84	9.40
RUN2_0495.LAB	10:15	13.43	17.0	8.09	0.10	190.5	0.84	9.39
RUN2_0496.LAB	10:16	13.20	17.1	8.05	0.10	190.3	0.84	9.24
RUN2_0497.LAB	10:17	13.46	16.8	7.98	0.10	190.4	0.84	9.55
RUN2_0498.LAB	10:18	13.18	16.8	8.08	0.10	190.4	0.84	9.77
RUN2_0499.LAB	10:19	13.40	16.9	8.03	0.10	190.4	0.85	9.49
RUN2_0500.LAB	10:20	13.60	17.0	7.88	0.10	190.5	0.85	9.36
RUN2_0501.LAB	10:21	13.23	17.1	8.18	0.10	190.4	0.84	9.36
RUN2_0502.LAB	10:22	13.71	16.9	8.15	0.10	190.5	0.84	9.48
RUN2_0503.LAB	10:23	13.50	17.1	8.20	0.10	190.5	0.85	9.35
RUN2_0504.LAB	10:24	13.40	16.6	8.07	0.10	190.5	0.85	9.83
RUN2_0505.LAB	10:25	13.41	16.8	8.41	0.10	190.5	0.84	9.73
RUN2_0506.LAB	10:26	13.03	16.9	8.27	0.10	190.5	0.85	9.63
RUN2_0507.LAB	10:27	13.56	17.3	8.25	0.10	190.5	0.85	9.23
RUN2_0508.LAB	10:28	13.72	17.2	8.13	0.10	190.5	0.84	9.18
RUN2_0509.LAB	10:29	13.80	17.4	8.47	0.10	190.6	0.85	9.00
RUN2_0510.LAB	10:30	13.53	17.1	8.19	0.10	190.4	0.85	9.14
RUN2_0511.LAB	10:31	13.86	17.0	8.14	0.10	190.5	0.84	9.29
RUN2_0512.LAB	10:32	13.34	16.8	8.05	0.10	190.6	0.85	9.56
RUN2_0513.LAB	10:33	13.61	16.8	7.72	0.10	190.6	0.85	9.55
RUN2_0514.LAB	10:34	13.58	16.8	7.85	0.10	190.6	0.85	9.68
RUN2_0515.LAB	10:35	13.03	16.8	7.94	0.10	190.7	0.85	9.72
RUN2_0516.LAB	10:36	13.33	16.8	7.92	0.10	190.5	0.85	9.58
RUN2_0517.LAB	10:37	13.06	16.9	7.98	0.10	190.4	0.84	9.77
RUN2_0518.LAB	10:38	13.24	16.6	7.68	0.10	190.3	0.85	9.70
RUN2_0519.LAB	10:39	13.17	16.6	7.69	0.10	190.3	0.85	9.75
RUN2_0520.LAB	10:40	12.70	16.8	8.27	0.10	190.4	0.84	9.92
RUN2_0521.LAB	10:41	13.08	16.6	8.16	0.10	190.6	0.84	9.84
RUN2_0522.LAB	10:42	13.03	16.5	8.19	0.10	190.6	0.84	9.95
RUN2_0523.LAB	10:43	12.71	16.9	8.64	0.10	190.5	0.84	10.02
RUN2_0524.LAB	10:44	12.99	17.0	8.49	0.10	190.5	0.85	9.80
RUN2_0525.LAB	10:45	13.15	16.7	8.31	0.10	190.5	0.84	9.63
RUN2_0526.LAB	10:46	12.70	16.6	8.43	0.10	190.3	0.84	9.83
RUN2_0527.LAB	10:47	12.75	16.9	8.51	0.10	190.4	0.84	10.02
RUN2_0528.LAB	10:48	13.13	16.9	7.97	0.10	190.5	0.84	9.85
RUN2_0529.LAB	10:49	12.91	16.7	7.94	0.10	190.5	0.84	9.61
RUN2_0530.LAB	10:50	12.72	16.9	7.99	0.10	190.4	0.84	9.90
RUN2_0531.LAB	10:51	11.84	16.9	7.87	0.10	190.5	0.85	9.77
RUN2_0532.LAB	10:52	10.36	19.3	9.39	0.10	190.6	0.84	9.70
RUN2_0576.LAB	11:40	12.40	17.8	9.43	0.10	190.5	0.84	9.40
RUN2_0577.LAB	11:41	12.21	17.7	9.84	0.10	190.4	0.84	9.53
RUN2_0578.LAB	11:42	12.26	18.0	10.11	0.10	190.3	0.84	9.26
RUN2_0579.LAB	11:43	12.39	18.0	9.79	0.10	190.3	0.84	9.17
RUN2_0580.LAB	11:44	12.30	18.2	9.76	0.10	190.4	0.84	8.88
RUN2_0581.LAB	11:45	12.52	18.5	9.74	0.10	190.5	0.84	8.64
RUN2_0582.LAB	11:46	12.68	18.3	9.66	0.10	190.4	0.84	8.53
RUN2_0583.LAB	11:47	12.70	18.6	9.94	0.10	190.3	0.84	8.55
RUN2_0584.LAB	11:48	12.48	18.3	9.91	0.10	190.2	0.84	8.88
RUN2_0585.LAB	11:49	12.33	17.9	9.81	0.10	190.2	0.84	9.36
RUN2_0586.LAB	11:50	12.69	17.9	10.07	0.10	190.3	0.84	9.08
RUN2_0587.LAB	11:51	13.39	18.1	9.75	0.10	190.3	0.84	8.71
RUN2_0588.LAB	11:52	13.11	18.3	9.62	0.10	190.3	0.84	8.73
RUN2_0589.LAB	11:53	13.10	18.5	9.63	0.10	190.4	0.84	8.53
RUN2_0590.LAB	11:54	12.96	18.2	9.46	0.10	190.6	0.84	8.67
RUN2_0591.LAB	11:55	12.86	18.1	9.38	0.10	190.5	0.84	8.97
RUN2_0592.LAB	11:56	13.26	18.2	9.43	0.10	190.4	0.84	8.69
Average		**13.02**	**17.29**	**8.59**	**0.10**	**190.46**	**0.84**	**9.40**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/23

Run 3

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN3_0659.LAB	12:25	13.50	17.6	8.79	0.10	190.5	0.84	9.00
RUN3_0660.LAB	12:26	13.43	17.9	8.91	0.10	190.5	0.84	8.93
RUN3_0661.LAB	12:27	13.58	17.9	8.75	0.10	190.4	0.84	9.00
RUN3_0662.LAB	12:28	13.50	17.8	8.77	0.10	190.4	0.84	8.87
RUN3_0663.LAB	12:29	13.62	17.9	8.81	0.10	190.5	0.84	8.93
RUN3_0664.LAB	12:30	13.34	17.9	8.71	0.10	190.3	0.84	9.32
RUN3_0665.LAB	12:31	13.51	17.6	8.78	0.10	190.1	0.84	8.86
RUN3_0666.LAB	12:32	13.58	18.1	8.80	0.10	190.2	0.84	8.42
RUN3_0667.LAB	12:33	13.87	18.2	8.99	0.10	190.3	0.84	8.95
RUN3_0668.LAB	12:34	13.34	17.9	8.66	0.10	190.2	0.84	9.01
RUN3_0669.LAB	12:35	13.50	17.7	8.75	0.10	190.2	0.84	9.27
RUN3_0670.LAB	12:36	13.41	17.5	8.87	0.10	190.1	0.84	9.47
RUN3_0671.LAB	12:37	13.32	17.7	8.88	0.10	190.2	0.84	9.13
RUN3_0672.LAB	12:38	13.63	17.7	8.70	0.10	190.2	0.84	9.09
RUN3_0673.LAB	12:39	13.61	17.9	8.60	0.10	190.3	0.84	8.78
RUN3_0674.LAB	12:40	13.94	18.2	8.79	0.10	190.4	0.84	8.56
RUN3_0675.LAB	12:41	13.91	18.1	8.59	0.10	190.2	0.84	8.61
RUN3_0676.LAB	12:42	13.89	18.0	8.64	0.10	190.4	0.84	8.67
RUN3_0677.LAB	12:43	13.69	17.7	8.56	0.10	190.4	0.84	8.98
RUN3_0678.LAB	12:44	13.59	17.8	8.81	0.10	190.2	0.84	9.02
RUN3_0679.LAB	12:45	13.78	18.0	8.61	0.10	190.2	0.84	8.67
RUN3_0680.LAB	12:46	13.84	17.8	8.40	0.10	190.0	0.84	8.82
RUN3_0681.LAB	12:47	13.72	17.5	8.47	0.10	190.2	0.84	9.08
RUN3_0682.LAB	12:48	13.61	17.8	8.77	0.10	190.3	0.84	9.04
RUN3_0683.LAB	12:49	13.67	17.5	8.66	0.10	190.2	0.84	9.30
RUN3_0684.LAB	12:50	13.38	17.7	8.78	0.10	190.4	0.84	9.15
RUN3_0685.LAB	12:51	13.65	17.7	8.80	0.10	190.3	0.84	9.14
RUN3_0686.LAB	12:52	13.55	17.8	8.72	0.10	190.1	0.84	9.06
RUN3_0687.LAB	12:53	13.56	18.0	8.79	0.10	190.3	0.84	8.81
RUN3_0688.LAB	12:54	13.79	18.0	8.60	0.10	190.2	0.84	8.94
RUN3_0689.LAB	12:55	13.59	17.8	8.57	0.10	190.3	0.84	8.74
RUN3_0690.LAB	12:56	13.74	17.4	8.54	0.10	190.6	0.84	9.04
RUN3_0691.LAB	12:57	13.42	17.5	8.88	0.10	190.3	0.84	9.29
RUN3_0692.LAB	12:58	13.64	17.6	8.89	0.10	190.4	0.84	9.35
RUN3_0693.LAB	12:59	13.69	17.7	8.89	0.10	190.3	0.84	9.18
RUN3_0694.LAB	13:00	13.60	17.7	8.96	0.10	190.3	0.84	9.12
RUN3_0695.LAB	13:01	13.57	17.8	8.84	0.10	190.3	0.84	9.02
RUN3_0696.LAB	13:02	13.63	17.7	8.61	0.10	190.2	0.84	9.06
RUN3_0697.LAB	13:03	13.52	17.9	8.62	0.10	190.2	0.84	9.20
RUN3_0698.LAB	13:04	13.71	18.0	8.73	0.10	190.3	0.84	8.97
RUN3_0699.LAB	13:05	13.62	17.9	8.46	0.10	190.3	0.84	8.88
RUN3_0700.LAB	13:06	13.73	17.6	8.15	0.10	190.2	0.84	8.90
RUN3_0701.LAB	13:07	13.50	17.6	8.20	0.10	190.2	0.84	9.12
RUN3_0702.LAB	13:08	13.73	17.7	7.96	0.10	190.3	0.84	9.13
RUN3_0703.LAB	13:09	13.79	17.8	7.94	0.10	190.2	0.84	8.97
RUN3_0704.LAB	13:10	13.61	17.6	7.86	0.10	190.2	0.84	8.87
RUN3_0705.LAB	13:11	13.87	17.7	8.08	0.10	190.2	0.84	9.08
RUN3_0706.LAB	13:12	13.56	17.8	8.43	0.10	190.2	0.84	8.96
RUN3_0707.LAB	13:13	13.68	17.7	8.39	0.10	190.2	0.84	8.81
RUN3_0708.LAB	13:14	13.67	17.9	8.16	0.10	190.3	0.84	9.11
RUN3_0709.LAB	13:15	14.01	18.1	7.90	0.10	190.2	0.84	8.98
RUN3_0710.LAB	13:16	13.75	17.6	7.56	0.10	190.4	0.84	8.59
RUN3_0711.LAB	13:17	13.61	17.4	7.40	0.10	190.5	0.84	8.78
RUN3_0712.LAB	13:18	13.94	17.4	7.60	0.10	190.4	0.84	9.19
RUN3_0713.LAB	13:19	13.91	17.4	8.23	0.10	190.4	0.84	9.02
RUN3_0714.LAB	13:20	14.00	17.4	8.16	0.10	190.3	0.84	9.42
RUN3_0715.LAB	13:21	14.08	17.8	7.93	0.10	190.3	0.84	9.36
RUN3_0716.LAB	13:22	14.03	17.5	7.59	0.10	190.0	0.84	9.12
RUN3_0717.LAB	13:23	14.07	17.4	7.32	0.10	190.0	0.84	8.82
RUN3_0718.LAB	13:24	14.00	17.2	7.31	0.10	190.2	0.84	9.07
Average		**13.68**	**17.75**	**8.46**	**0.10**	**190.27**	**0.84**	**9.00**

Client:	GCC Rio Grande, Inc.		
Facility:	Pueblo Plant		
Test Location:	Main Kiln Stack		
Project #:	M234207		
Test Method:	26A		
Test Engineer:	DCS		
Test Technician:	SWK		
	Run 1A	**Run 2A**	**Run 3A**
Temp ID:	CM53	CM53	CM53
Meter ID:	CM53	CM53	CM53
Pitot ID:	S8-031A	S8-031A	S8-031A
Nozzle Diameter (Inches):	0.281	0.281	0.281
Meter Calibration Date:	9/6/2023	9/6/2023	9/6/2023
Meter Calibration Factor (Y):	0.994	0.994	0.994
Meter Orifice Setting (Delta H):	1.775	1.775	1.775
Nozzle Kit ID Number and Material:	#32 Glass	#32 Glass	#32 Glass
Pitot Tube Coefficient:		0.820	
Probe Length (Feet):		6.0	
Probe Liner Material:		Glass	
Sample Plane:		Horizontal	
Port Length (Inches):		9.50	
Port Size (Diameter, Inches):		6.00	
Port Type:		Flange	
Duct Shape:		Circular	
Diameter (Feet):		10.25	
Duct Area (Square Feet):		82.516	
Upstream Diameters:		4.9	
Downstream Diameters:		24.4	
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:		CAI700	
Moisture Balance ID:		LV3	
# of Runs		3	

Run 1A - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/17/23**
Facility: Pueblo Plant | **Start Time: 8:00**
Test Location: Main Kiln Stack | **End Time: 9:09**
Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.22	in. H_2O	Static Pressure	-0.50	in. H_2O
Meter Temperature, Tm:	65.6	°F	Flue Pressure (Ps):	24.76	in. Hg. abs.
Sqrt ΔP:	0.618	in. H_2O	Carbon Dioxide:	29.10	%
Stack Temperature, Ts:	356.4	°F	Oxygen:	4.20	%
Meter Volume, Vm:	41.960	ft^3	Nitrogen:	66.70	%
Meter Volume, Vmstd:	34.855	dscf	Gas Weight dry, Md:	32.824	lb/lb mole
Meter Volume, Vwstd:	4.955	wscf	Gas Weight wet, Ms:	30.979	lb/lb mole
Isokinetic Variance:	107.4	%I	Excess Air:	31.323	%
			Gas Velocity, Vs:	44.684	fps
Test Length:	60.00	in mins.	Volumetric Flow:	221,226	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	103,676	dscfm
Barometric Pressure:	24.80	in Hg	Volumetric Flow:	118,414	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3557.8	ml	Silica Initial Wt.	780.4	grams
Final Impinger Content:	3657.6	ml	Silica Final Wt.	785.8	grams
Impinger Difference:	99.8	ml	Silica Difference:	5.4	grams
Total Water Gain:	105.2		Moisture, Bws:	0.124	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F	
1-1	8:00:00	0.45	1.50	132.931	344	64	63	252	259	50	
1-2	8:05:00	0.38	1.20	136.655	347	61	64	261	267	50	
1-3	8:10:00	0.35	1.10	140.067	347	59	64	272	269	50	
	8:15:00			144.322							
2-1	8:18:00	0.42	1.30	144.322	354	59	65	273	269	51	
2-2	8:23:00	0.42	1.30	147.867	356	59	67	271	268	51	
2-3	8:28:00	0.29	0.90	151.400	356	59	65	273	267	51	
	8:33:00			154.361							
3-1	8:36:00	0.45	1.40	154.361	356	66	69	272	267	51	
3-2	8:41:00	0.40	1.30	158.086	364	64	69	270	269	51	
3-3	8:46:00	0.32	1.00	161.577	363	72	70	266	270	51	
	8:51:00			164.727							
4-1	8:54:00	0.40	1.30	164.727	354	67	70	273	269	53	
4-2	8:59:00	0.38	1.20	168.250	368	68	70	270	270	53	
4-3	9:04:00	0.34	1.10	171.660	368	69	71	267	270	55	
	9:09:00			174.891							
Total	1:00:00			41.960		63.9	67.3				
Average			1.22		356.4	65.6					
Min			0.90		344.0	59.0					
Max			1.50		368.0	72.0					

Impinger Weight Sheet - Run 1A

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/17/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/17/2023**

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	776.5	743.8	32.7
0.1N H2SO4	725.1	688.0	37.1
Empty	659.5	643.5	16.0
0.1N NaOH	789.4	780.8	8.6
0.1N NaOH	707.1	701.7	5.4
Silica Gel	785.8	780.4	5.4

3,657.6	3,557.8	99.8
Liquid Final	**Liquid Initial**	**Liquid Gain**
785.8	780.4	5.4
Silica Final	**Silica Initial**	**Silica Gain**

Run 2A - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/17/23**

Facility: Pueblo Plant | **Start Time: 13:40**

Test Location: Main Kiln Stack | **End Time: 14:46**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.29	In. H_2O	Static Pressure	-0.50	in. H_2O
Meter Temperature, Tm:	86.1	°F	Flue Pressure (Ps):	24.76	in. Hg. abs.
Sqrt ΔP:	0.618	In. H_2O	Carbon Dioxide:	27.90	%
Stack Temperature, Ts:	364.0	°F	Oxygen:	5.20	%
Meter Volume, Vm:	41.116	ft^3	Nitrogen:	66.9	%
Meter Volume, Vmstd:	32.877	dscf	Gas Weight dry, Md:	32.672	lb/lb mole
Meter Volume, Vwstd:	4.823	wscf	Gas Weight wet, Ms:	30.795	lb/lb mole
Isokinetic Variance:	101.8	%I	Excess Air:	41.728	%
			Gas Velocity, Vs:	45.051	fps
Test Length:	60.00	in mins.	Volumetric Flow:	223,044	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	103,155	dscfm
Barometric Pressure:	24.80	in Hg	Volumetric Flow:	118,288	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3480.1	ml	Silica Initial Wt.	857.5	grams
Final Impinger Content:	3572.7	ml	Silica Final Wt.	867.3	grams
Impinger Difference:	92.6	ml	Silica Difference:	9.8	grams
Total Water Gain:	102.4		Moisture, Bws:	0.128	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	13:40:00	0.43	1.40	181.959	375	87	83	259	268	61
1-2	13:45:00	0.40	1.30	185.860	375	87	83	264	268	60
1-3	13:50:00	0.30	1.00	189.430	374	87	83	266	267	63
	13:55:00			192.815						
2-1	13:57:00	0.46	1.50	192.815	353	90	85	260	267	65
2-2	14:02:00	0.42	1.40	196.060	352	85	84	263	266	64
2-3	14:07:00	0.29	1.00	199.230	351	85	86	266	266	62
	14:12:00			202.435						
3-1	14:14:00	0.46	1.50	202.435	352	83	88	271	264	67
3-2	14:19:00	0.41	1.40	205.940	353	83	88	270	265	63
3-3	14:24:00	0.29	1.00	209.530	353	87	89	270	267	64
	14:29:00			212.709						
4-1	14:31:00	0.45	1.50	212.709	375	82	91	265	261	66
4-2	14:36:00	0.39	1.30	216.110	378	83	92	261	267	65
4-3	14:41:00	0.32	1.20	219.570	377	84	92	263	267	66
	14:46:00			223.075						
Total	1:00:00			41.116		85.3	87.0			
Average			1.29		364.0	86.1				
Min			1.00		351.0	82.0				
Max			1.50		378.0	92.0				

Impinger Weight Sheet - Run 2A

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/17/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/17/2023**

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	810.6	746.6	64.0
0.1N H2SO4	690.0	673.6	16.4
Empty	597.8	593.4	4.4
0.1N NaOH	691.3	685.2	6.1
0.1N NaOH	783.0	781.3	1.7
Silica Gel	867.3	857.5	9.8

3,572.7	3,480.1	92.6
Liquid Final	**Liquid Initial**	**Liquid Gain**
867.3	857.5	9.8
Silica Final	**Silica Initial**	**Silica Gain**

Run 3A - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/17/23**

Facility: Pueblo Plant | **Start Time: 15:05**

Test Location: Main Kiln Stack | **End Time: 16:14**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.24	In. H_2O	Static Pressure	-0.50	in. H_2O
Meter Temperature, Tm:	92.2	°F	Flue Pressure (Ps):	24.76	in. Hg. abs.
Sqrt ΔP:	0.613	In. H_2O	Carbon Dioxide:	29.80	%
Stack Temperature, Ts:	369.8	°F	Oxygen:	4.20	%
Meter Volume, Vm:	42.450	ft^3	Nitrogen:	66	%
Meter Volume, Vmstd:	33.567	dscf	Gas Weight dry, Md:	32.936	lb/lb mole
Meter Volume, Vwstd:	4.889	wscf	Gas Weight wet, Ms:	31.037	lb/lb mole
Isokinetic Variance:	105.5	%I	Excess Air:	31.760	%
			Gas Velocity, Vs:	44.674	fps
Test Length:	60.00	in mins.	Volumetric Flow:	221,180	acfm
Nozzle Diameter:	0.281	in inches	Volumetric Flow:	101,677	dscfm
Barometric Pressure:	24.80	in Hg	Volumetric Flow:	116,487	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3553.5	ml	Silica Initial Wt.	830.0	grams
Final Impinger Content:	3647.3	ml	Silica Final Wt.	840.0	grams
Impinger Difference:	93.8	ml	Silica Difference:	10.0	grams
Total Water Gain:	103.8		Moisture, Bws:	0.127	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	15:05:00	0.43	1.40	223.435	381	84	96	268	269	64
1-2	15:10:00	0.38	1.20	227.530	382	83	97	264	270	64
1-3	15:15:00	0.29	1.10	231.040	281	85	98	270	267	64
	15:20:00			234.291						
2-1	15:22:00	0.44	1.40	234.291	381	88	100	270	265	65
2-2	15:27:00	0.38	1.20	238.230	383	90	101	268	265	65
2-3	15:32:00	0.27	0.90	241.570	381	84	102	265	264	65
	15:37:00			244.615						
3-1	15:39:00	0.43	1.40	244.615	383	81	103	265	266	65
3-2	15:44:00	0.38	1.20	248.320	384	81	104	268	265	65
3-3	15:49:00	0.29	0.90	251.880	384	79	103	265	263	65
	15:54:00			254.819						
4-1	15:59:00	0.48	1.60	254.819	380	82	102	270	268	66
4-2	16:04:00	0.44	1.50	258.510	360	82	102	271	266	66
4-3	16:09:00	0.34	1.10	262.430	357	83	102	272	269	66
	16:14:00			265.885						
Total	1:00:00			42.450		83.5	100.8			
Average			1.24		369.8	92.2				
Min			0.90		281.0	79.0				
Max			1.60		384.0	104.0				

Impinger Weight Sheet - Run 3A

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/17/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/17/2023**

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	811.1	743.2	67.9
0.1N H2SO4	709.0	687.8	21.2
Empty	646.4	643.8	2.6
0.1N NaOH	781.8	781.8	0.0
0.1N NaOH	699.0	696.9	2.1
Silica Gel	840.0	830.0	10.0

Liquid Final	Liquid Initial	Liquid Gain
3,647.3	3,553.5	93.8

Silica Final	Silica Initial	Silica Gain
840.0	830.0	10.0

Client:	GCC Rio Grande, Inc.		
Facility:	Pueblo Plant		
Test Location:	Main Kiln Stack		
Project #:	M234207		
Test Method:	26A		
Test Engineer:	SWK		
Test Technician:	DCS		
	Run 1B	**Run 2B**	**Run 3B**
Temp ID:	CM4	CM4	CM4
Meter ID:	CM4	CM4	CM4
Pitot ID:	S8-032A	S8-032A	S8-032A
Nozzle Diameter (Inches):	0.282	0.282	0.282
Meter Calibration Date:	10/5/2023	10/5/2023	10/5/2023
Meter Calibration Factor (Y):	0.990	0.990	0.990
Meter Orifice Setting (Delta H):	1.889	1.889	1.889
Nozzle Kit ID Number and Material:	21 Glass	21 Glass	21 Glass
Pitot Tube Coefficient:		0.822	
Probe Length (Feet):		4.0	
Probe Liner Material:		Glass	
Sample Plane:		Horizontal	
Port Length (Inches):		9.50	
Port Size (Diameter, Inches):		6.00	
Port Type:		Flange	
Duct Shape:		Circular	
Diameter (Feet):		10.25	
Duct Area (Square Feet):		82.516	
Upstream Diameters:		4.9	
Downstream Diameters:		24.4	
Number of Ports Sampled:		4	
Number of Points per Port:		3	
Minutes per Point:		5.0	
Minutes per Reading:		5.0	
Total Number of Traverse Points:		12	
Test Length (Minutes):		60	
Train Type:		Anderson Box	
Source Condition:		Mill Off	
Diluent Model/Serial Number:		CAI 700	
Moisture Balance ID:		LV3	
# of Runs		3	

Run 1B - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/17/23**

Facility: Pueblo Plant | **Start Time: 8:00**

Test Location: Main Kiln Stack | **End Time: 9:09**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.17	in. H_2O	Static Pressure	-0.50	in. H_2O
Meter Temperature, Tm:	73.8	°F	Flue Pressure (Ps):	24.76	in. Hg. abs.
Sqrt ΔP:	0.581	in. H_2O	Carbon Dioxide:	29.10	%
Stack Temperature, Ts:	353.0	°F	Oxygen:	4.20	%
Meter Volume, Vm:	40.617	ft^3	Nitrogen:	66.70	%
Meter Volume, Vmstd:	33.079	dscf	Gas Weight dry, Md:	32.824	lb/lb mole
Meter Volume, Vwstd:	4.300	wscf	Gas Weight wet, Ms:	31.119	lb/lb mole
Isokinetic Variance:	106.3	%I	Excess Air:	31.323	%
			Gas Velocity, Vs:	41.913	fps
Test Length:	60.00	in mins.	Volumetric Flow:	207,507	acfm
Nozzle Diameter:	0.282	in inches	Volumetric Flow:	98,706	dscfm
Barometric Pressure:	24.80	in Hg	Volumetric Flow:	111,538	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3450.4	ml	Silica Initial Wt.	799.0	grams
Final Impinger Content:	3530.3	ml	Silica Final Wt.	810.4	grams
Impinger Difference:	79.9	ml	Silica Difference:	11.4	grams
Total Water Gain:	91.3		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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	8:00:00	0.30	1.00	37.342	337	71	65	250	250	55
1-2	8:05:00	0.35	1.20	40.520	343	73	66	255	250	55
1-3	8:10:00	0.30	1.10	43.980	342	74	66	252	259	55
	8:15:00			47.167						
2-1	8:18:00	0.38	1.30	47.167	350	77	68	258	255	56
2-2	8:23:00	0.37	1.30	50.760	352	79	69	262	269	57
2-3	8:28:00	0.32	1.10	54.300	351	81	71	259	264	57
	8:33:00			57.619						
3-1	8:36:00	0.37	1.30	57.619	356	80	72	252	264	57
3-2	8:41:00	0.32	1.10	61.180	359	81	73	255	263	58
3-3	8:46:00	0.28	0.98	64.470	358	81	74	256	264	59
	8:51:00			67.571						
4-1	8:54:00	0.40	1.40	67.571	362	79	73	260	264	62
4-2	8:59:00	0.38	1.10	71.240	364	70	74	259	264	61
4-3	9:04:00	0.29	1.10	74.810	362	81	74	262	264	62
	9:09:00			77.959						
Total	1:00:00			40.617		77.3	70.4			
Average			1.17		353.0	73.8				
Min			0.98		337.0	65.0				
Max			1.40		364.0	81.0				

Impinger Weight Sheet - Run 1B

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/17/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/17/2023**

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	773.3	746.0	27.3
0.1N H2SO4	727.3	689.1	38.2
Empty	664.2	664.1	0.1
0.1N NaOH	750.5	741.2	9.3
0.1N NaOH	615.0	610.0	5.0
Silica Gel	810.4	799.0	11.4
	3,530.3	3,450.4	79.9
	Liquid Final	**Liquid Initial**	**Liquid Gain**
	810.4	799.0	11.4
	Silica Final	**Silica Initial**	**Silica Gain**

Run 2B - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/17/23**

Facility: Pueblo Plant | **Start Time: 13:40**

Test Location: Main Kiln Stack | **End Time: 14:46**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.44	In. H_2O	Static Pressure	-0.50	in. H_2O
Meter Temperature, Tm:	86.6	°F	Flue Pressure (Ps):	24.76	in. Hg. abs.
Sqrt ΔP:	0.622	In. H_2O	Carbon Dioxide:	27.90	%
Stack Temperature, Ts:	359.9	°F	Oxygen:	5.20	%
Meter Volume, Vm:	43.876	ft^3	Nitrogen:	66.9	%
Meter Volume, Vmstd:	34.929	dscf	Gas Weight dry, Md:	32.672	lb/lb mole
Meter Volume, Vwstd:	5.845	wscf	Gas Weight wet, Ms:	30.569	lb/lb mole
Isokinetic Variance:	107.7	%I	Excess Air:	41.728	%
			Gas Velocity, Vs:	45.501	fps
Test Length:	60.00	in mins.	Volumetric Flow:	225,273	acfm
Nozzle Diameter:	0.282	in inches	Volumetric Flow:	102,853	dscfm
Barometric Pressure:	24.80	in Hg	Volumetric Flow:	120,065	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3663.9	ml	Silica Initial Wt.	844.1	grams
Final Impinger Content:	3774.6	ml	Silica Final Wt.	857.5	grams
Impinger Difference:	110.7	ml	Silica Difference:	13.4	grams
Total Water Gain:	124.1		Moisture, Bws:	0.143	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	13:40:00	0.42	1.50	84.286	370	77	74	255	250	52
1-2	13:45:00	0.40	1.30	88.050	371	79	75	253	259	54
1-3	13:50:00	0.34	1.20	91.100	368	80	75	256	267	56
	13:55:00			94.560						
2-1	13:57:00	0.44	1.70	94.560	349	86	85	257	263	53
2-2	14:02:00	0.41	1.60	98.550	349	90	85	256	261	53
2-3	14:07:00	0.34	1.30	102.350	346	91	86	256	263	54
	14:12:00			105.872						
3-1	14:14:00	0.44	1.70	105.872	349	90	87	258	255	54
3-2	14:19:00	0.40	1.50	109.880	349	94	88	257	264	55
3-3	14:24:00	0.35	1.30	113.650	347	95	88	265	264	56
	14:29:00			117.250						
4-1	14:31:00	0.43	1.60	117.250	370	93	89	252	263	56
4-2	14:36:00	0.39	1.50	121.180	375	96	89	256	262	57
4-3	14:41:00	0.30	1.10	124.890	376	96	90	270	264	58
	14:46:00			128.162						
Total	1:00:00			43.876		88.9	84.3			
Average			1.44		359.9	86.6				
Min			1.10		346.0	74.0				
Max			1.70		376.0	96.0				

Impinger Weight Sheet - Run 2B

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/17/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/17/2023**

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	830.9	754.6	76.3
0.1N H2SO4	814.6	796.1	18.5
Empty	636.9	634.2	2.7
0.1N NaOH	743.2	735.0	8.2
0.1N NaOH	749.0	744.0	5.0
Silica Gel	857.5	844.1	13.4

3,774.6	3,663.9	110.7
Liquid Final	**Liquid Initial**	**Liquid Gain**
857.5	844.1	13.4
Silica Final	**Silica Initial**	**Silica Gain**

Run 3B - Method 26A

Client: GCC Rio Grande, Inc. | **Date: 10/17/23**

Facility: Pueblo Plant | **Start Time: 15:05**

Test Location: Main Kiln Stack | **End Time: 16:14**

Source Condition: Mill Off

DRY GAS METER CONDITIONS			STACK CONDITIONS		
ΔH:	1.43	In. H_2O	Static Pressure	-0.50	in. H_2O
Meter Temperature, Tm:	97.9	°F	Flue Pressure (Ps):	24.76	in. Hg. abs.
Sqrt ΔP:	0.618	In. H_2O	Carbon Dioxide:	29.80	%
Stack Temperature, Ts:	372.7	°F	Oxygen:	4.20	%
Meter Volume, Vm:	44.657	ft^3	Nitrogen:	66	%
Meter Volume, Vmstd:	34.830	dscf	Gas Weight dry, Md:	32.936	lb/lb mole
Meter Volume, Vwstd:	4.988	wscf	Gas Weight wet, Ms:	31.065	lb/lb mole
Isokinetic Variance:	107.6	%I	Excess Air:	31.760	%
			Gas Velocity, Vs:	45.205	fps
Test Length:	60.00	in mins.	Volumetric Flow:	223,809	acfm
Nozzle Diameter:	0.282	in inches	Volumetric Flow:	102,745	dscfm
Barometric Pressure:	24.80	in Hg	Volumetric Flow:	117,459	scfm

MOISTURE DETERMINATION

Initial Impinger Content:	3426.8	ml	Silica Initial Wt.	797.3	grams
Final Impinger Content:	3523.5	ml	Silica Final Wt.	806.5	grams
Impinger Difference:	96.7	ml	Silica Difference:	9.2	grams
Total Water Gain:	105.9		Moisture, Bws:	0.125	

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	Probe Temp °F	Filter Exit Temp °F	Impinger Exit Temp °F
1-1	15:05:00	0.42	1.60	129.827	379	93	92	252	250	52
1-2	15:10:00	0.40	1.50	133.670	380	97	93	255	254	52
1-3	15:15:00	0.33	1.20	137.480	377	99	95	257	264	52
	15:20:00			140.902						
2-1	15:22:00	0.40	1.50	140.902	378	99	96	257	264	53
2-2	15:27:00	0.41	1.50	144.690	380	104	99	255	264	53
2-3	15:32:00	0.33	1.20	148.540	377	106	99	257	263	54
	15:37:00			152.039						
3-1	15:39:00	0.42	1.60	152.039	379	101	98	259	265	55
3-2	15:44:00	0.40	1.50	155.940	381	101	98	262	265	55
3-3	15:49:00	0.32	1.20	159.710	377	100	98	261	266	56
	15:54:00			163.120						
4-1	15:59:00	0.43	1.60	163.120	360	97	96	250	266	57
4-2	16:04:00	0.40	1.50	167.090	353	98	96	253	265	57
4-3	16:09:00	0.34	1.30	170.900	351	98	96	259	264	58
	16:14:00			174.484						
Total	1:00:00			44.657		99.4	96.3			
Average			1.43		372.7	97.9				
Min			1.20		351.0	92.0				
Max			1.60		381.0	106.0				

Impinger Weight Sheet - Run 3B

Client:	**GCC Rio Grande, Inc.**
Facility:	**Pueblo Plant**
Test Location:	**Main Kiln Stack**
Project #:	**M234207**
Date:	**10/17/2023**
Test Method:	**26A**
Weighed/Measured By:	**WAP**
Balance ID:	**LV3**

Scale Calibration Check Date: **10/17/2023**

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	816.9	743.8	73.1
0.1N H2SO4	705.1	685.9	19.2
Empty	646.1	642.7	3.4
0.1N NaOH	743.3	742.7	0.6
0.1N NaOH	612.1	611.7	0.4
Silica Gel	806.5	797.3	9.2

3,523.5	3,426.8	96.7
Liquid Final	**Liquid Initial**	**Liquid Gain**
806.5	797.3	9.2
Silica Final	**Silica Initial**	**Silica Gain**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/17/23

Run 1

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
Run1_0377.LAB	8:00	12.25	25.52	12.40	0.10	190.43	0.85	4.24
Run1_0378.LAB	8:01	12.24	25.62	12.59	0.10	190.47	0.85	4.35
Run1_0379.LAB	8:02	12.51	25.46	12.34	0.10	190.55	0.85	4.40
Run1_0380.LAB	8:03	12.20	25.11	12.40	0.10	190.67	0.85	4.81
Run1_0381.LAB	8:04	12.26	25.38	12.33	0.10	190.47	0.85	4.34
Run1_0382.LAB	8:05	12.68	25.31	12.18	0.10	190.57	0.85	4.30
Run1_0383.LAB	8:06	12.16	25.59	12.36	0.10	190.67	0.85	4.19
Run1_0384.LAB	8:07	12.35	25.52	12.43	0.10	190.49	0.85	4.31
Run1_0385.LAB	8:08	12.50	25.72	12.59	0.10	190.55	0.85	4.09
Run1_0386.LAB	8:09	12.13	25.22	12.66	0.10	190.54	0.85	4.54
Run1_0387.LAB	8:10	12.28	25.65	12.63	0.10	190.59	0.85	4.30
Run1_0388.LAB	8:11	12.87	25.60	12.69	0.10	190.70	0.85	3.60
Run1_0389.LAB	8:12	12.17	25.29	12.78	0.10	190.70	0.85	4.76
Run1_0390.LAB	8:13	12.44	25.02	12.66	0.10	190.61	0.85	4.47
Run1_0391.LAB	8:14	12.18	25.46	12.70	0.10	190.51	0.85	4.55
Run1_0392.LAB	8:15	12.40	25.56	13.00	0.10	190.54	0.85	4.08
Run1_0393.LAB	8:16	12.23	25.67	13.21	0.10	190.52	0.85	4.18
Run1_0394.LAB	8:17	12.08	25.22	13.22	0.10	190.53	0.85	4.31
Run1_0395.LAB	8:18	12.13	25.72	13.12	0.10	190.45	0.85	4.51
Run1_0396.LAB	8:19	12.14	25.56	13.19	0.10	190.40	0.85	4.17
Run1_0397.LAB	8:20	12.37	26.05	12.80	0.10	190.36	0.85	4.34
Run1_0398.LAB	8:21	12.38	26.00	13.17	0.10	190.30	0.85	3.62
Run1_0399.LAB	8:22	12.64	25.40	13.17	0.10	190.19	0.85	3.75
Run1_0400.LAB	8:23	12.15	25.57	13.21	0.10	190.22	0.85	4.24
Run1_0401.LAB	8:24	12.60	25.64	13.14	0.10	190.36	0.85	3.98
Run1_0402.LAB	8:25	12.40	25.74	12.98	0.10	190.53	0.85	3.75
Run1_0403.LAB	8:26	12.68	26.13	12.86	0.10	190.57	0.85	3.86
Run1_0404.LAB	8:27	12.26	25.83	13.39	0.10	190.64	0.85	3.57
Run1_0405.LAB	8:28	12.11	25.28	13.22	0.10	190.68	0.85	4.03
Run1_0406.LAB	8:29	12.17	25.59	13.48	0.10	190.59	0.85	4.53
Run1_0407.LAB	8:30	12.34	26.17	13.18	0.10	190.59	0.85	4.20
Run1_0408.LAB	8:31	12.73	25.82	12.96	0.10	190.61	0.85	3.83
Run1_0409.LAB	8:32	12.27	25.32	13.21	0.10	190.54	0.85	3.66
Run1_0410.LAB	8:33	12.33	25.47	13.48	0.10	190.40	0.85	4.14
Run1_0411.LAB	8:34	12.24	25.55	13.57	0.10	190.51	0.85	4.28
Run1_0412.LAB	8:35	12.08	25.03	13.31	0.10	190.49	0.85	4.30
Run1_0413.LAB	8:36	12.10	25.04	13.04	0.10	190.42	0.85	4.46
Run1_0414.LAB	8:37	12.26	25.49	12.87	0.10	190.28	0.85	5.05
Run1_0415.LAB	8:38	12.37	25.45	12.84	0.10	190.36	0.85	4.34
Run1_0416.LAB	8:39	12.75	25.77	13.16	0.10	190.38	0.85	4.21
Run1_0417.LAB	8:40	12.50	25.74	13.37	0.10	190.38	0.85	3.97
Run1_0418.LAB	8:41	12.22	25.28	13.27	0.10	190.43	0.85	3.79
Run1_0419.LAB	8:42	12.32	25.79	13.13	0.10	190.34	0.85	4.02
Run1_0420.LAB	8:43	12.60	25.41	13.08	0.10	190.38	0.85	4.38
Run1_0421.LAB	8:44	12.64	25.37	13.02	0.10	190.42	0.85	3.81
Run1_0422.LAB	8:45	12.72	25.52	13.03	0.10	190.45	0.85	4.09
Run1_0423.LAB	8:46	12.15	25.26	13.24	0.10	190.39	0.85	4.07
Run1_0424.LAB	8:47	12.52	25.33	13.21	0.10	190.34	0.85	3.90
Run1_0425.LAB	8:48	12.66	25.28	13.00	0.10	190.33	0.85	4.54
Run1_0426.LAB	8:49	12.19	25.37	13.47	0.10	190.33	0.85	4.30
Run1_0427.LAB	8:50	12.76	25.52	13.05	0.10	190.41	0.85	4.25
Run1_0428.LAB	8:51	12.23	25.32	13.27	0.10	190.45	0.85	4.34
Run1_0429.LAB	8:52	12.77	25.44	13.21	0.10	190.52	0.85	4.03
Run1_0430.LAB	8:53	12.05	24.77	13.62	0.10	190.49	0.85	4.42
Run1_0431.LAB	8:54	12.30	25.44	13.83	0.10	190.55	0.85	4.19
Run1_0432.LAB	8:55	12.56	25.49	13.43	0.10	190.45	0.85	4.94
Run1_0433.LAB	8:56	12.04	25.15	13.25	0.10	190.47	0.85	4.57
Run1_0434.LAB	8:57	12.15	24.64	13.22	0.10	190.41	0.85	4.32
Run1_0435.LAB	8:58	12.58	25.37	13.42	0.10	190.48	0.85	4.35
Run1_0436.LAB	8:59	12.21	25.21	13.75	0.10	190.45	0.85	5.16
Average		**12.36**	**25.47**	**13.04**	**0.10**	**190.47**	**0.85**	**4.23**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/17/23

Run 2

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN2_0743.LAB	13:40	12.72	23.9	11.37	0.10	189.8	0.84	5.35
RUN2_0744.LAB	13:41	12.95	24.2	11.14	0.10	189.9	0.84	5.16
RUN2_0745.LAB	13:42	12.71	23.7	10.93	0.10	190.1	0.84	5.61
RUN2_0746.LAB	13:43	12.67	23.7	10.67	0.10	190.0	0.84	5.58
RUN2_0747.LAB	13:44	12.53	23.4	10.68	0.10	189.9	0.84	6.06
RUN2_0748.LAB	13:45	12.58	23.6	10.94	0.10	189.7	0.84	5.68
RUN2_0749.LAB	13:46	12.36	24.0	11.21	0.10	190.0	0.84	5.40
RUN2_0750.LAB	13:47	12.49	23.8	11.47	0.10	190.0	0.84	5.71
RUN2_0751.LAB	13:48	12.44	23.8	11.30	0.10	189.7	0.84	5.69
RUN2_0752.LAB	13:49	12.57	24.2	11.01	0.10	189.3	0.84	5.34
RUN2_0753.LAB	13:50	12.41	23.6	10.90	0.10	189.6	0.84	5.64
RUN2_0754.LAB	13:51	12.36	23.6	10.99	0.10	189.7	0.84	5.86
RUN2_0755.LAB	13:52	12.42	23.7	11.39	0.10	189.7	0.84	5.87
RUN2_0756.LAB	13:53	12.65	24.4	11.58	0.10	189.7	0.84	5.33
RUN2_0757.LAB	13:54	12.52	23.8	10.90	0.10	189.8	0.84	5.33
RUN2_0758.LAB	13:55	12.32	23.5	10.95	0.10	189.8	0.84	5.88
RUN2_0759.LAB	13:56	12.42	23.9	11.33	0.10	189.6	0.84	5.73
RUN2_0760.LAB	13:57	12.35	23.8	11.29	0.10	189.7	0.84	5.67
RUN2_0761.LAB	13:58	12.60	24.2	11.37	0.10	190.0	0.84	5.61
RUN2_0762.LAB	13:59	12.33	23.5	10.94	0.10	189.9	0.84	5.58
RUN2_0763.LAB	14:00	12.46	23.8	11.03	0.10	189.8	0.84	5.93
RUN2_0764.LAB	14:01	12.56	24.0	11.22	0.10	189.8	0.84	5.62
RUN2_0765.LAB	14:02	12.49	23.9	11.25	0.10	189.7	0.84	5.47
RUN2_0766.LAB	14:03	12.52	24.0	11.14	0.10	189.9	0.84	5.62
RUN2_0767.LAB	14:04	12.60	24.1	11.15	0.10	189.9	0.84	5.35
RUN2_0768.LAB	14:05	12.52	23.9	10.98	0.10	189.7	0.84	5.24
RUN2_0769.LAB	14:06	12.64	24.3	11.21	0.10	189.7	0.84	5.52
RUN2_0770.LAB	14:07	12.54	24.0	11.48	0.10	189.8	0.84	5.13
RUN2_0771.LAB	14:08	12.34	23.8	11.65	0.10	189.8	0.84	5.36
RUN2_0772.LAB	14:09	12.11	24.3	12.03	0.10	189.8	0.84	5.81
RUN2_0773.LAB	14:10	12.67	24.4	11.68	0.10	189.7	0.84	5.60
RUN2_0774.LAB	14:11	12.60	23.9	11.40	0.10	189.8	0.84	5.00
RUN2_0775.LAB	14:12	12.37	24.7	11.93	0.10	189.6	0.84	5.38
RUN2_0776.LAB	14:13	12.60	24.6	11.59	0.10	189.6	0.84	4.92
RUN2_0777.LAB	14:14	12.80	24.8	11.64	0.10	189.6	0.84	4.83
RUN2_0778.LAB	14:15	12.05	23.6	11.76	0.10	189.6	0.84	4.53
RUN2_0779.LAB	14:16	12.27	24.1	12.31	0.10	189.7	0.84	5.60
RUN2_0780.LAB	14:17	12.41	25.0	12.41	0.10	189.7	0.84	6.07
RUN2_0781.LAB	14:18	12.37	24.1	12.04	0.10	189.7	0.84	5.00
RUN2_0782.LAB	14:19	12.26	24.6	12.35	0.10	189.6	0.84	5.02
RUN2_0783.LAB	14:20	12.50	24.8	12.25	0.10	189.7	0.84	5.58
RUN2_0784.LAB	14:21	12.44	24.3	11.91	0.10	190.0	0.84	5.03
RUN2_0785.LAB	14:22	12.55	24.5	12.03	0.10	189.8	0.84	5.00
RUN2_0786.LAB	14:23	12.58	24.5	11.92	0.10	189.8	0.84	5.20
RUN2_0787.LAB	14:24	12.66	24.8	11.63	0.10	189.7	0.84	4.96
RUN2_0788.LAB	14:25	12.77	24.7	10.72	0.10	189.6	0.84	4.95
RUN2_0789.LAB	14:26	12.36	25.0	12.99	0.10	189.9	0.84	4.49
RUN2_0790.LAB	14:27	12.11	25.8	13.26	0.10	189.7	0.84	4.51
RUN2_0791.LAB	14:28	12.60	26.4	13.20	0.10	189.7	0.84	4.88
RUN2_0792.LAB	14:29	12.61	26.1	13.06	0.10	189.6	0.84	4.34
RUN2_0793.LAB	14:30	12.42	25.0	12.76	0.10	189.9	0.84	3.62
RUN2_0794.LAB	14:31	12.46	25.3	12.77	0.10	190.1	0.84	3.70
RUN2_0795.LAB	14:32	12.40	25.3	12.64	0.10	190.0	0.84	4.64
RUN2_0796.LAB	14:33	12.44	25.0	12.60	0.10	189.9	0.84	4.56
RUN2_0797.LAB	14:34	12.63	26.0	12.44	0.10	189.7	0.84	4.48
RUN2_0798.LAB	14:35	12.75	26.3	12.53	0.10	189.6	0.84	4.84
RUN2_0799.LAB	14:36	12.49	25.6	13.21	0.10	189.6	0.84	4.31
RUN2_0800.LAB	14:37	12.54	25.7	13.23	0.10	189.7	0.84	3.28
RUN2_0801.LAB	14:38	12.45	25.8	13.51	0.10	189.7	0.84	4.58
RUN2_0802.LAB	14:39	12.47	25.8	13.43	0.10	189.7	0.84	4.21
Average		**12.50**	**24.45**	**11.78**	**0.10**	**189.76**	**0.84**	**5.17**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/17/23

Run 3

		FTIR Data						Analyzer Data
Spectrum	Time	H2O %	CO2 % (wet)	HCN ppmvw	HF ppmvw	Cell Temp	Pressure	O2 % (dry)
RUN3_0869.LAB	15:05	12.60	26.7	13.73	0.10	189.9	0.83	3.59
RUN3_0870.LAB	15:06	12.74	26.5	14.09	0.10	189.8	0.83	4.18
RUN3_0871.LAB	15:07	12.52	26.0	14.14	0.10	189.9	0.83	3.81
RUN3_0872.LAB	15:08	12.66	26.3	13.60	0.10	189.7	0.83	4.39
RUN3_0873.LAB	15:09	12.40	25.7	13.51	0.10	189.5	0.83	4.30
RUN3_0874.LAB	15:10	12.45	25.6	13.47	0.10	189.4	0.83	4.46
RUN3_0875.LAB	15:11	12.49	26.0	13.37	0.10	189.4	0.83	3.86
RUN3_0876.LAB	15:12	12.64	26.3	13.55	0.10	189.6	0.83	3.58
RUN3_0877.LAB	15:13	12.57	26.2	13.45	0.10	189.6	0.83	4.46
RUN3_0878.LAB	15:14	12.33	25.1	13.18	0.10	189.5	0.83	4.82
RUN3_0879.LAB	15:15	12.40	25.4	13.55	0.10	189.3	0.83	4.42
RUN3_0880.LAB	15:16	12.45	25.9	14.07	0.10	189.4	0.83	4.72
RUN3_0881.LAB	15:17	12.23	25.9	14.16	0.10	189.6	0.83	4.45
RUN3_0882.LAB	15:18	11.89	26.2	14.29	0.10	189.4	0.83	4.40
RUN3_0883.LAB	15:19	12.52	26.5	14.19	0.10	189.4	0.83	4.12
RUN3_0884.LAB	15:20	12.33	26.8	13.61	0.10	189.2	0.83	3.44
RUN3_0885.LAB	15:21	12.69	26.7	13.70	0.10	189.4	0.83	3.50
RUN3_0886.LAB	15:22	12.72	26.4	14.29	0.10	189.6	0.84	3.67
RUN3_0887.LAB	15:23	12.50	25.9	14.49	0.10	189.6	0.83	4.39
RUN3_0888.LAB	15:24	11.96	25.7	14.27	0.10	189.4	0.84	4.81
RUN3_0889.LAB	15:25	12.33	26.0	14.30	0.10	189.4	0.84	4.45
RUN3_0890.LAB	15:26	11.84	26.0	14.61	0.10	189.3	0.84	4.73
RUN3_0891.LAB	15:27	11.96	25.9	14.60	0.10	189.6	0.84	4.60
RUN3_0892.LAB	15:28	12.72	26.4	14.01	0.10	189.8	0.84	3.87
RUN3_0893.LAB	15:29	12.73	26.6	14.08	0.10	190.0	0.84	3.56
RUN3_0894.LAB	15:30	12.58	26.7	14.28	0.10	190.1	0.84	3.69
RUN3_0895.LAB	15:31	12.49	26.6	14.29	0.10	189.8	0.84	3.60
RUN3_0896.LAB	15:32	12.49	26.3	14.59	0.10	189.9	0.84	4.14
RUN3_0897.LAB	15:33	12.60	26.3	14.59	0.10	189.8	0.84	3.97
RUN3_0898.LAB	15:34	12.65	26.1	14.69	0.10	189.6	0.84	3.83
RUN3_0899.LAB	15:35	12.33	26.9	14.25	0.10	189.6	0.84	4.08
RUN3_0900.LAB	15:36	12.80	26.8	14.60	0.10	189.6	0.84	3.55
RUN3_0901.LAB	15:37	12.69	26.5	14.74	0.10	189.6	0.84	3.72
RUN3_0902.LAB	15:38	12.31	26.4	15.07	0.10	189.5	0.84	4.10
RUN3_0903.LAB	15:39	12.42	26.6	14.88	0.10	189.6	0.84	3.98
RUN3_0904.LAB	15:40	12.40	26.8	14.81	0.10	189.6	0.84	3.96
RUN3_0905.LAB	15:41	12.32	27.2	14.39	0.10	189.6	0.84	3.83
RUN3_0906.LAB	15:42	12.71	26.6	14.69	0.10	189.7	0.84	3.59
RUN3_0907.LAB	15:43	12.78	26.6	14.84	0.10	189.9	0.84	3.77
RUN3_0908.LAB	15:44	12.37	26.8	14.84	0.10	189.7	0.84	3.76
RUN3_0909.LAB	15:45	12.63	26.8	14.70	0.10	189.6	0.84	3.86
RUN3_0910.LAB	15:46	12.26	26.8	14.99	0.10	189.7	0.84	3.74
RUN3_0911.LAB	15:47	11.25	26.8	15.66	0.10	189.9	0.84	3.72
RUN3_0912.LAB	15:48	12.29	27.0	15.30	0.10	189.6	0.84	3.99
RUN3_0913.LAB	15:49	12.66	26.6	14.87	0.10	189.5	0.84	3.91
RUN3_0914.LAB	15:50	12.28	26.4	14.78	0.10	189.6	0.84	3.93
RUN3_0915.LAB	15:51	12.57	26.3	14.82	0.10	189.7	0.84	4.15
RUN3_0916.LAB	15:52	12.64	26.1	14.63	0.10	189.7	0.84	4.00
RUN3_0917.LAB	15:53	12.15	25.0	14.05	0.10	189.7	0.84	4.13
RUN3_0918.LAB	15:54	12.09	24.9	13.89	0.10	189.8	0.84	4.54
RUN3_0919.LAB	15:55	12.16	25.3	13.74	0.10	189.9	0.84	4.84
RUN3_0920.LAB	15:56	12.31	25.5	13.79	0.10	189.8	0.84	4.91
RUN3_0921.LAB	15:57	12.21	25.6	14.22	0.10	189.7	0.84	4.67
RUN3_0922.LAB	15:58	12.09	25.0	14.13	0.10	189.6	0.84	4.45
RUN3_0923.LAB	15:59	11.92	24.7	13.69	0.10	189.6	0.84	4.74
RUN3_0924.LAB	16:00	11.98	24.9	13.92	0.10	189.7	0.84	4.92
RUN3_0925.LAB	16:01	12.47	26.1	13.27	0.10	189.7	0.84	5.11
RUN3_0926.LAB	16:02	12.64	25.8	13.93	0.10	189.6	0.84	5.03
RUN3_0927.LAB	16:03	12.63	25.5	14.24	0.10	189.6	0.84	4.23
RUN3_0928.LAB	16:04	12.60	25.0	14.02	0.10	189.6	0.84	4.36
Average		**12.41**	**26.13**	**14.24**	**0.10**	**189.63**	**0.84**	**4.16**

Method 1 and 2 Cyclonic Flow Check Data

Project Number	M234207	**Source Condition:**	Mill On
Client:	GCC Rio Grande, Inc.	**Run No.:**	1
Facility:	Pueblo Plant	**Date:**	10/18/2023
Location:	Main Kiln Stack	**Start Time:**	7:30
Pitot ID:	S8-031A	**End Time:**	8:00
Pitot Coefficient:	0.820	**RM Testers:**	
Probe Length:	6	**Port Length:**	9.50

Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (^oF)	Yaw (o)		Velocity (V)	Port	Point	DP (in. H_2O)	Sqrt. DP	Temp (^oF)	Yaw (o)		Velocity (V)
A	1	0.51	0.7141	287.0	2.0	2.0	47.83	C	1	0.63	0.7937	289.0	2.0	2.0	53.23
A	2	0.55	0.7416	291.0	6.0	6.0	49.80	C	2	0.55	0.7416	291.0	7.0	7.0	49.80
A	3	0.43	0.6557	294.0	4.0	4.0	44.12	C	3	0.50	0.7071	291.0	4.0	4.0	47.48
B	1	0.63	0.7937	292.0	3.0	3.0	53.33	D	1	0.57	0.7550	293.0	3.0	3.0	50.76
B	2	0.58	0.7616	292.0	7.0	7.0	51.17	D	2	0.55	0.7416	295.0	5.0	5.0	49.93
B	3	0.47	0.6856	291.0	5.0	5.0	46.04	D	3	0.49	0.7000	295.0	4.0	4.0	47.13

Average Yaw Angle 4.3 °

Stratification Test Results Summary
GCC Rio Grande, Inc.
Pueblo Plant
Main Kiln
October 18, 2023

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

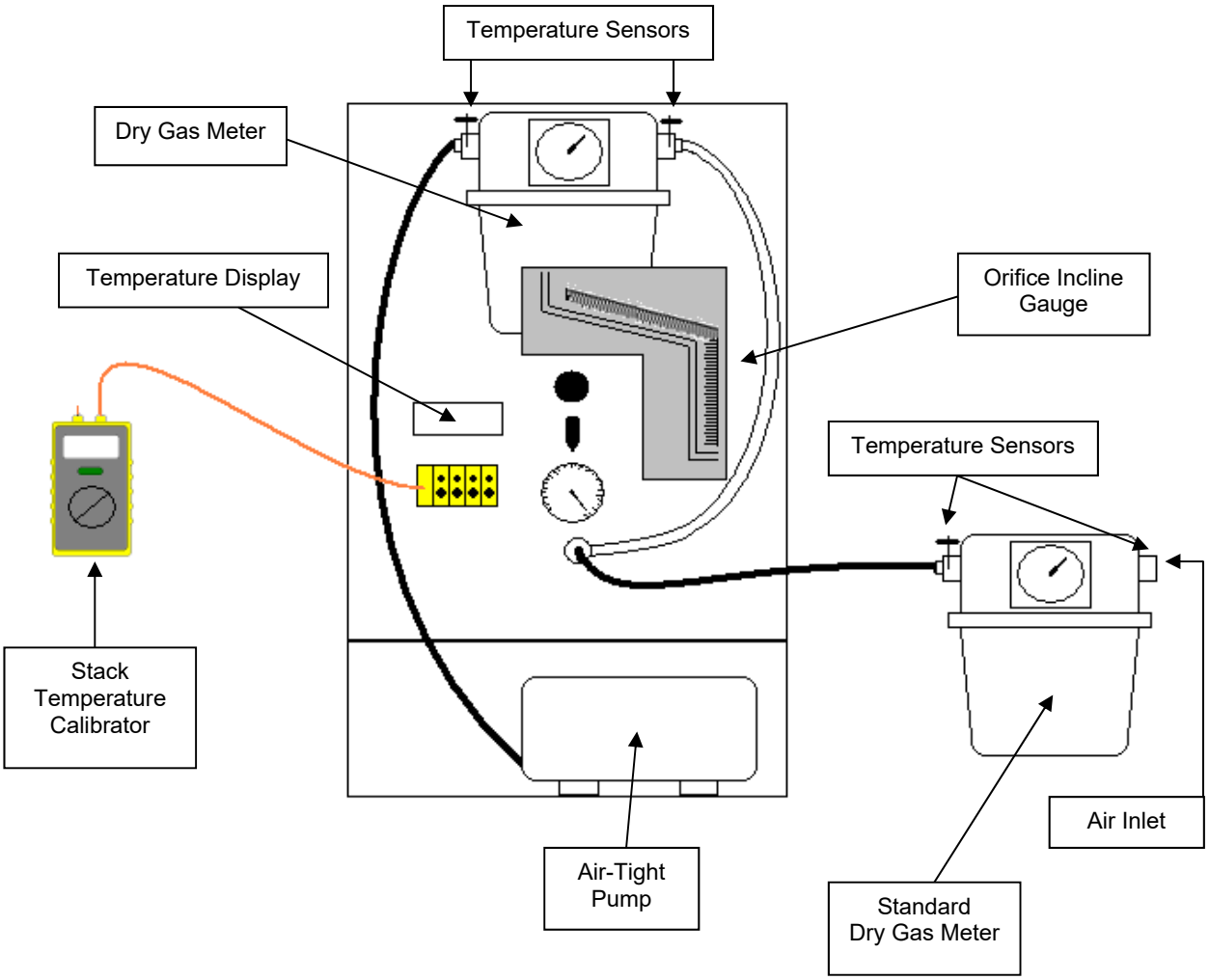
Port No.	Point No.	Time	O_2%	Actual % Difference O_2%	Mean Difference O_2%
1	1	8:30	10.07	0.47	0.05
	2	8:34	9.94	0.83	0.08
	3	8:38	10.06	0.37	0.04
Average			**10.02**		

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.	*CM4*	*Date:*	*October 5, 2023*
Standard Meter No.	*18654513*	*Calibrated By:*	*PJC1*
Standard Meter (Y)	*1.00630*	*Barometric Pressure:*	*25.08*

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			*754.625*	*515.870*	*67*	*72*	*72*					
Initial			*750.054*	*511.167*	*66*	*71*	*71*					
Difference	*1*	*0.20*	*4.571*	*4.703*	*67*	*72*	*72*	*72*	*18*	*0*	*0.987*	*2.029*
Final			*759.516*	*520.890*	*67*	*73*	*72*					
Initial			*754.625*	*515.870*	*67*	*72*	*72*					
Difference	*2*	*0.50*	*4.891*	*5.020*	*67*	*73*	*72*	*72*	*12*	*0*	*0.989*	*1.970*
Final			*764.457*	*525.963*	*68*	*74*	*73*					
Initial			*759.516*	*520.890*	*67*	*73*	*72*					
Difference	*3*	*0.70*	*4.941*	*5.073*	*68*	*74*	*73*	*73*	*10*	*0*	*0.988*	*1.877*
Final			*769.565*	*531.209*	*68*	*75*	*73*					
Initial			*764.457*	*525.963*	*68*	*74*	*73*					
Difference	*4*	*0.90*	*5.108*	*5.246*	*68*	*75*	*73*	*74*	*9*	*0*	*0.988*	*1.830*
Final			*774.817*	*536.590*	*68*	*76*	*74*					
Initial			*769.565*	*531.209*	*68*	*75*	*73*					
Difference	*5*	*1.20*	*5.252*	*5.381*	*68*	*76*	*74*	*75*	*8*	*0*	*0.991*	*1.821*
Final			*745.815*	*506.810*	*66*	*73*	*71*					
Initial			*740.711*	*501.625*	*66*	*71*	*70*					
Difference	*6*	*2.00*	*5.104*	*5.185*	*66*	*72*	*71*	*71*	*6*	*0*	*0.995*	*1.805*

Average	***0.990***	***1.889***

Stack Temperature Sensor Calibration			
Temperature ID :	CM4	Name :	PJC1
Ambient Temperature, °F :	68.8	Date :	October 5, 2023

Temperature Calibrator			
Model # :	CL23A	Certification Date:	November 8, 2022
Serial # :	T-314718	Expiration Date:	November 8, 2023

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	-2	0.4
250	247	0.4
600	596	0.4
1200	1197	0.2

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

Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM4*	*Date:*	*December 18, 2023*
Standard Meter No.	*15788714*	*Calibrated By:*	*PJC1*
Standard Meter (Y)	*0.98570*	*Barometric Pressure:*	*24.93*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F° tr	Dry Gas Meter Inlet Temp. F° tdi	Dry Gas Meter Outlet Temp. F° tdo	Dry Gas Meter Avg. Temp. F° td	Time Min	Time Sec	Y	Chg (H)
Final			*332.019*	*903.402*	*60*	*64*	*64*					
Initial			*327.011*	*898.401*	*60*	*63*	*62*					
Difference	*1*	*0.20*	*5.008*	*5.001*	*60*	*64*	*63*	*63*	*18*	*0*	*0.993*	*1.756*
Final			*337.024*	*908.451*	*60*	*65*	*64*					
Initial			*332.019*	*903.402*	*60*	*64*	*64*					
Difference	*2*	*0.50*	*5.005*	*5.049*	*60*	*65*	*64*	*64*	*12*	*0*	*0.984*	*1.950*
Final			*342.280*	*913.608*	*60*	*66*	*65*					
Initial			*337.024*	*908.451*	*60*	*65*	*64*					
Difference	*3*	*0.70*	*5.256*	*5.157*	*60*	*66*	*65*	*65*	*10*	*0*	*1.012*	*1.716*
Final			*347.665*	*918.963*	*60*	*67*	*65*					
Initial			*342.280*	*913.601*	*60*	*66*	*65*					
Difference	*4*	*0.90*	*5.385*	*5.362*	*60*	*67*	*65*	*66*	*9*	*0*	*0.998*	*1.700*
Final			*353.012*	*924.278*	*61*	*68*	*66*					
Initial			*347.665*	*918.963*	*60*	*67*	*65*					
Difference	*5*	*1.20*	*5.347*	*5.315*	*61*	*68*	*66*	*67*	*8*	*0*	*1.000*	*1.818*
Final			*311.894*	*883.397*	*59*	*57*	*57*					
Initial			*306.651*	*878.334*	*59*	*60*	*60*					
Difference	*6*	*2.00*	*5.243*	*5.063*	*59*	*59*	*59*	*59*	*6*	*0*	*1.014*	*1.789*
									Average		***1.000***	***1.788***

Stack Temperature Sensor Calibration			
Temperature ID :	CM4	Name :	PJC1
Ambient Temperature, °F :	66.4	Date :	##########

Temperature Calibrator			
Model # :	CL23A	Certification Date:	October 19, 2023
Serial # :	T-314718	Expiration Date:	October 18, 2024

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

Reference Source Temperature (°F)	Test Thermometer Temperature (°F)	Temperature Difference %
0	-2	0.4
250	247	0.4
600	595	0.5
1200	1197	0.2

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

Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM53*	*Date:*	*September 6, 2023*
Standard Meter No.	*18654530*	*Calibrated By:*	*DV*
Standard Meter (Y)	*0.99730*	*Barometric Pressure:*	*28.12*

Run Number		Orifice Setting in H_2O Chg (H)	Standard Meter Gas Volume vr	Dry Gas Meter Gas Volume vd	Standard Meter Temp. F° tr	Dry Gas Meter Inlet Temp. F° tdi	Dry Gas Meter Outlet Temp. F° tdo	Dry Gas Meter Avg. Temp. F° td	Time Min	Time Sec	Y	Chg (H)
Final			*108.455*	*58.760*	*81*	*82*	*82*					
Initial			*103.434*	*53.667*	*80*	*81*	*81*					
Difference	*1*	*0.20*	*5.021*	*5.093*	*81*	*82*	*82*	*82*	*18*	*35*	*0.985*	*1.683*
Final			*103.434*	*53.667*	*80*	*81*	*81*					
Initial			*98.353*	*48.581*	*80*	*80*	*80*					
Difference	*2*	*0.50*	*5.081*	*5.086*	*80*	*81*	*81*	*81*	*12*	*12*	*0.996*	*1.771*
Final			*98.353*	*48.581*	*80*	*80*	*80*					
Initial			*93.335*	*43.543*	*79*	*79*	*79*					
Difference	*3*	*0.70*	*5.018*	*5.038*	*80*	*80*	*80*	*80*	*10*	*15*	*0.992*	*1.795*
Final			*93.335*	*43.543*	*79*	*79*	*79*					
Initial			*88.268*	*38.486*	*79*	*78*	*78*					
Difference	*4*	*0.90*	*5.067*	*5.057*	*79*	*79*	*79*	*79*	*9*	*10*	*0.996*	*1.810*
Final			*88.268*	*38.486*	*79*	*78*	*78*					
Initial			*83.006*	*33.210*	*79*	*77*	*77*					
Difference	*5*	*1.20*	*5.262*	*5.276*	*79*	*78*	*78*	*78*	*8*	*12*	*0.989*	*1.794*
Final			*83.006*	*33.210*	*79*	*77*	*77*					
Initial			*76.885*	*27.189*	*78*	*77*	*77*					
Difference	*6*	*2.00*	*6.121*	*6.021*	*79*	*77*	*77*	*77*	*7*	*24*	*1.006*	*1.798*
								Average			***0.994***	***1.775***

Stack Temperature Sensor Calibration

Meter Box # : CM53 *Name :* DV

Ambient Temperature : 80.1 °F *Date :* September 6, 2023

Calibrator Model # : CL940A

Serial # : 526

Date Of Certification : December 28, 2022

Primary Standards Directly Traceable Nationa 108.5 58.76

103.4 53.667

Reference Source Temperature (°F)	*Test Thermometer Temperature (°F)*	*Temperature Difference %*
0	*1*	0.2
250	*252*	0.3
600	*601*	0.1
1200	*1205*	0.3

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

Dry Gas Meter Calibration Data

Dry Gas Meter No.	*CM53*	*Date:*	*October 26, 2023*
Standard Meter No.	*18654530*	*Calibrated By:*	*ER*
Standard Meter (Y)	*0.99730*	*Barometric Pressure:*	*28.05*

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			*10.800*	*37.210*	*71*	*71*	*71*					
Initial			*5.798*	*32.147*	*71*	*71*	*71*					
Difference	*1*	*0.20*	*5.002*	*5.063*	*71*	*71*	*71*	*71*	*18*	*35*	*0.985*	*1.674*
Final			*15.810*	*42.298*	*73*	*73*	*73*					
Initial			*10.800*	*37.210*	*71*	*71*	*71*					
Difference	*2*	*0.50*	*5.010*	*5.088*	*72*	*72*	*72*	*72*	*12*	*10*	*0.981*	*1.791*
Final			*20.871*	*47.430*	*72*	*73*	*73*					
Initial			*15.810*	*42.298*	*73*	*73*	*72*					
Difference	*3*	*0.70*	*5.061*	*5.132*	*73*	*73*	*73*	*73*	*10*	*19*	*0.982*	*1.768*
Final			*25.915*	*52.558*	*72*	*73*	*73*					
Initial			*20.871*	*47.430*	*72*	*73*	*73*					
Difference	*4*	*0.90*	*5.044*	*5.128*	*72*	*73*	*73*	*73*	*9*	*0*	*0.980*	*1.737*
Final			*30.935*	*57.662*	*72*	*74*	*74*					
Initial			*25.915*	*52.558*	*72*	*73*	*73*					
Difference	*5*	*1.20*	*5.020*	*5.104*	*72*	*74*	*74*	*74*	*8*	*15*	*0.981*	*1.963*
Final			*5.798*	*32.147*	*71*	*71*	*71*					
Initial			*0.792*	*27.133*	*71*	*71*	*71*					
Difference	*6*	*2.00*	*5.006*	*5.014*	*71*	*71*	*71*	*71*	*6*	*20*	*0.991*	*1.941*
											0.983	***1.812***

Average

Stack Temperature Sensor Calibration			
Temperature ID :	100769	Name :	ER
Ambient Temperature, ^{o}F :	72.2	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 (^{o}F)	Test Thermometer Temperature (^{o}F)	Temperature Difference %
0	0	0.0
250	251	0.1
600	601	0.1
1200	1205	0.3

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

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

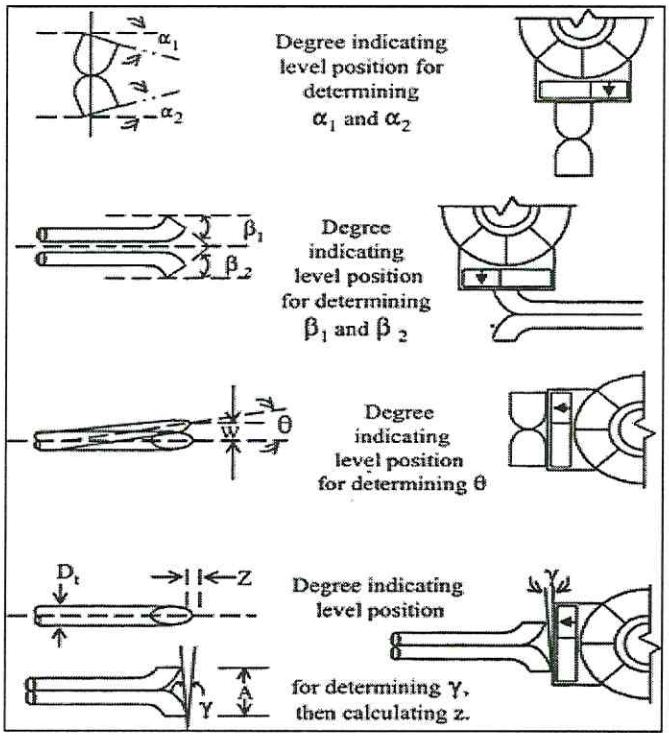
$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \textbf{-0.45\%}$$ Pass

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°.

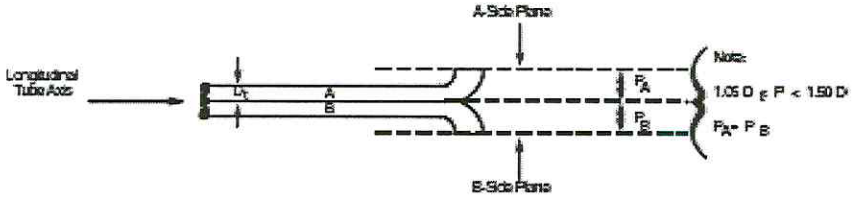
C_p = 0.818

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

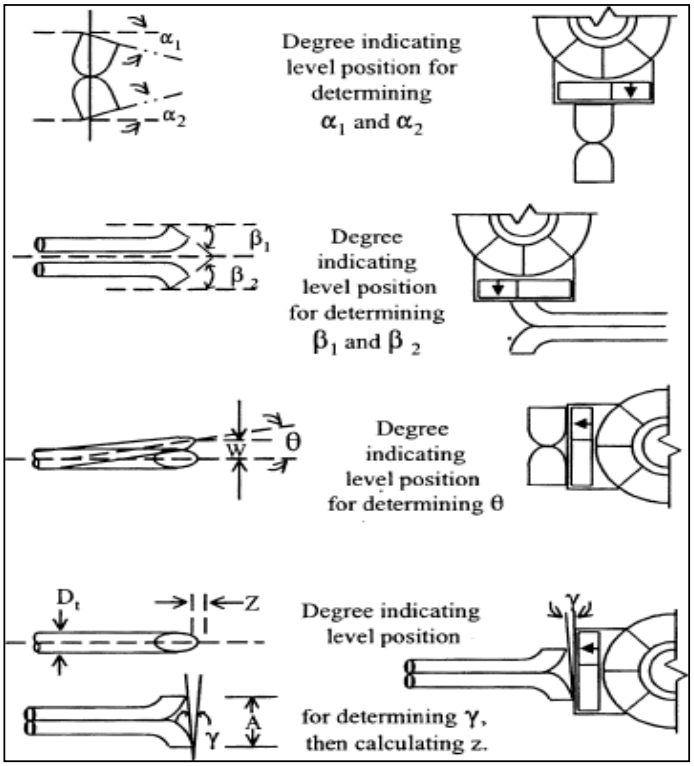
$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \textbf{-0.43\%}$$ **Pass**

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.

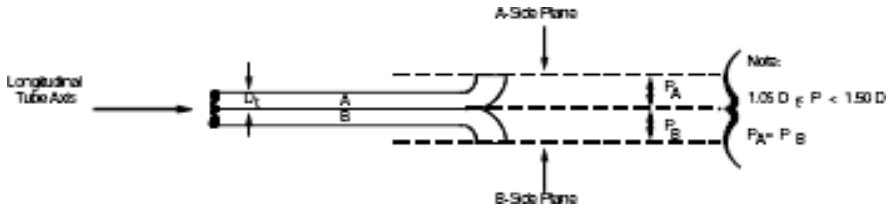
C_p = 0.821

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

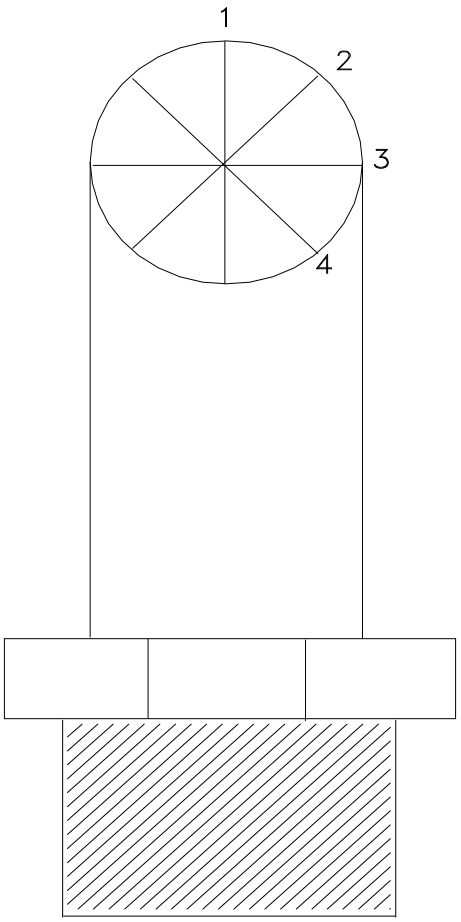
Nozzle Calibration

Date: 4/25/2023

Nozzle ID No.: 909

Analyst: WAP

Material/Type: Glass



0.282	1
0.282	2
0.281	3
0.281	4

Valid Data

Average
0.282

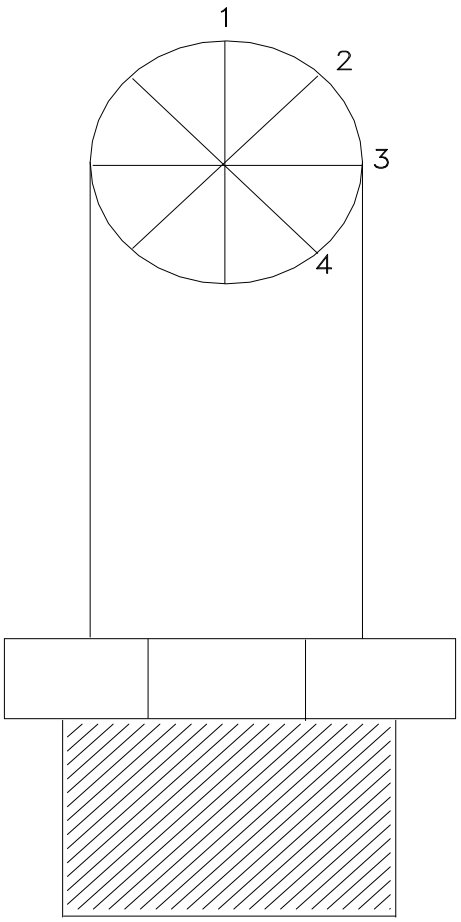
Nozzle Calibration

Date: 10/13/2023

Nozzle ID No.: 981

Analyst: WAP

Material/Type: Glass



0.281	1
0.281	2
0.281	3
0.281	4

Average
0.281

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/2023
Operator: R. Sollars
Operating Condition Mill On

Sample System:	FTIR				
Probe Length:	8.0	**ft**			
Probe Type:	FTIR				
Sample Plane:	Vertical				
Port Length:	9.5	**in.**			
Port Size (diameter):	6	**in.**			
Port Type:	Flange				
Duct Shape:	Circular				
Diameter:	10.25	**ft**			
Duct Area:	82.52	**Sq. Ft.**			
Upstream Diameters:	4.90		Minimum Upstream Distance	5.1	Feet
Downstream Diameters:	24.40		Minimum Downstream Distance	20.5	Feet
Number of Ports Sampled:	1		Ideal Upstream Distance	20.5	Feet
Number of Points per Port:	1		Ideal Downstream Distance	82.0	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	0.02	-0.09%	N/A		1500
	Mid	CC175274	11.07	11.08	-0.04%	5/11/2031	49.40%	1500
	High	CC420519	22.41	22.43	-0.09%	7/15/2029		1000

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	Nitrogen	Zero Nitrogen	0.0	N/A	1700
Calibration Transfer Standard	Ethylene	CC401933	100.7	7/10/2026	1800
Analyte Spike Gas	HCN	CC768255	199.20	3/12/2024	1900
	SF6		10.000		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAI 700	221018	25	22.41
HF ppmvw	MKS 2030	E10004	10	N/A
HCN ppmvw	MKS 2030	E10004	100	N/A

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Diluent: O2 %

Test Location: Main Kiln
Date: 10/18/23
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	11.07	11.10	10.94	0.05	0.03	0.04	11.02	9.66	9.7	0.62	-0.71	-0.04	-0.09
2	11.07	10.94	10.92	0.03	0.02	0.03	10.93	9.40	9.5	0.71	-0.09	0.00	-0.04
3	11.07	10.92	10.92	0.02	0.02	0.02	10.92	9.00	9.1	0.71	0.00	0.00	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	10/18/23	8:40	9:39	13.63%	9.70	16.76	19.40	8.14	11.69	0.10	0.14
2	10/18/23	10:10	11:09	13.02%	9.52	17.29	19.87	8.59	12.06	0.10	0.14
3	10/18/23	12:25	13:24	13.68%	9.12	17.75	20.56	8.46	11.57	0.10	0.14

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln
Date: 10/18/23
Project #: M234207

Linearity Cal/Pre 1 Cal

Time	O2 % (dry)	
6:08	0.03	
6:09	0.02	iz
6:10	9.92	
6:11	22.36	
6:12	22.43	ih
6:13	16.48	
6:14	0.05	
6:15	0.02	
6:16	0.09	
6:17	14.61	
6:18	11.07	
6:19	11.08	im
6:20	18.88	
6:21	20.89	
6:22	20.88	
6:23	11.43	
6:24	0.07	
6:25	0.05	z
6:26	11.18	
6:27	11.08	
6:28	11.10	m

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/18/23

Post 1/Pre 2			Post 2/Pre 3		
Time	**O2 % (dry)**		**Time**	**O2 % (dry)**	
9:55	2.52		12:09	1.45	
9:56	0.03		12:10	0.02	
9:57	0.03	**z**	12:11	0.02	**z**
9:58	0.02		12:12	0.02	
9:59	9.14		12:13	5.70	
10:00	10.93		12:14	10.91	
10:01	10.94	**m**	12:15	10.92	**m**

Post 3		
Time	**O2 % (dry)**	
13:40	2.78	
13:41	0.03	
13:42	0.02	**z**
13:43	0.02	
13:44	3.79	
13:45	10.90	
13:46	10.92	**m**
	10.93	

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/17/2023
Operator: R. Sollars
Operating Condition Mill Off

Sample System:	FTIR				
Probe Length:	8.0	**ft**			
Probe Type:	FTIR				
Sample Plane:	Vertical				
Port Length:	9.5	**in.**			
Port Size (diameter):	6	**in.**			
Port Type:	Flange				
Duct Shape:	Circular				
Diameter:	10.25	**ft**			
Duct Area:	82.52	**Sq. Ft.**			
Upstream Diameters:	4.90		Minimum Upstream Distance	5.1	Feet
Downstream Diameters:	24.40		Minimum Downstream Distance	20.5	Feet
Number of Ports Sampled:	1		Ideal Upstream Distance	20.5	Feet
Number of Points per Port:	1		Ideal Downstream Distance	82.0	Feet
Total Number of Traverse Points:	1				

Calibration Gases

Type	Setting	Cylinder ID	Cylinder Value	Analyzer Response	Difference, % of Span	Expiration Date	Mid cylinder % of high cylinder		Final Bottle Pressure, PSI
O2 % (dry)	Zero	Zero Nitrogen	0.0	0.03	-0.13%	N/A			1500
	Mid	CC175274	11.07	11.09	-0.09%	5/11/2031	49.40%		1500
	High	CC420519	22.41	22.46	-0.22%	7/15/2029			1000

Type	Compound	Cylinder ID	Cylinder Value	Expiration Date	Final Bottle Pressure, PSI
Zero Gas	Nitrogen	Zero Nitrogen	0.0	N/A	1700
Calibration Transfer Standard	Ethylene	CC401933	100.7	7/10/2026	1800
Analyte Spike Gas	HCN	CC768255	199.20	3/12/2024	1900
	SF6		10.000		

Response Time Data

Type	RM Analyzer Make/Model	RM Analyzer s/n	Analyzer Span	RM Gas Span
O2 % (dry)	CAI 700	221018	25	22.41
HF ppmvw	MKS 2030	E10004	10	N/A
HCN ppmvw	MKS 2030	E10004	100	N/A

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Diluent: O2 %

Test Location: Main Kiln
Date: 10/17/23
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	11.07	11.09	10.93	0.06	0.02	0.04	11.01	4.23	4.2	0.71	-0.71	0.04	-0.18
2	11.07	10.93	10.87	0.02	0.01	0.02	10.90	5.17	5.2	0.98	-0.27	0.09	-0.04
3	11.07	10.87	10.87	0.01	0.00	0.01	10.87	4.16	4.2	0.98	0.00	0.13	-0.04

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	10/17/23	8:00	8:59	12.36%	4.23	25.47	29.06	13.04	12.41	0.10	0.10
2	10/17/23	13:40	14:39	12.50%	5.24	24.45	27.94	11.78	11.95	0.10	0.10
3	10/17/23	15:05	16:04	12.41%	4.23	26.13	29.83	14.24	13.56	0.10	0.10

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Test Location: Main Kiln
Date: 10/17/23
Project #: M234207

Linearity Cal/Pre 1 Cal

Time	O2 % (dry)	
6:14	0.03	
6:15	0.03	iz
6:16	8.84	
6:17	20.85	
6:18	22.71	
6:19	22.69	
6:20	22.46	ih
6:21	19.76	
6:22	11.10	
6:23	11.09	im
6:24	11.35	
6:25	20.52	
6:26	20.92	
6:27	20.91	
6:28	11.89	
6:29	0.08	
6:30	0.06	z
6:31	10.45	
6:32	11.08	
6:33	11.09	m

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Test Location: Main Kiln
Date: 10/17/23

Post 1/Pre 2			Post 2/Pre 3		
Time	**O2 % (dry)**		**Time**	**O2 % (dry)**	
9:15	1.25		14:53	1.05	
9:16	0.02		14:54	0.02	
9:17	0.91		14:55	0.01	
9:18	0.37		14:56	0.01	**z**
9:19	0.02		14:57	0.33	
9:20	0.02	**z**	14:58	9.42	
9:21	0.53		14:59	10.86	
9:22	8.86		15:00	10.87	**m**
9:23	10.91				
9:24	10.92				
9:25	10.93	**m**			

Post 3		
Time	**O2 % (dry)**	
16:20	1.96	
16:21	0.01	
16:22	2.31	
16:23	0.01	
16:24	0.00	**z**
16:25	0.96	
16:26	9.82	
16:27	10.85	
16:28	10.87	**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**
E10004	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	100.7	Airgas	CC401933	Primary +/- 1%
HCN/SF_6	199.2/10.00	Airgas	CC768255	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.

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill On

Test Location: Main Kiln
Date: 10/18/2023
Operator: R. Sollars
FTIR s/n: E10004

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_0001BKG.LAB	10/18/23	6:02:49	0.0	0.0	0.0	191.2	0.83	0.0	0.0	0.000
N2_DIR_0002.LAB	10/18/23	6:03:04	0.0	0.0	0.0	190.8	0.83	0.0	0.0	0.001
N2_DIR_0003.LAB	10/18/23	6:03:12	0.0	0.0	0.1	190.8	0.83	0.0	0.0	0.003
N2_DIR_0004.LAB	10/18/23	6:03:20	0.0	0.0	0.0	190.8	0.83	-0.1	-0.2	-0.007
N2_DIR_0005.LAB	10/18/23	6:03:28	0.0	0.0	0.0	190.8	0.83	0.0	0.1	0.004
N2_DIR_0006.LAB	10/18/23	6:03:36	0.0	0.0	0.0	190.8	0.83	0.0	-0.1	0.003
N2_DIR_0007.LAB	10/18/23	6:03:44	0.0	0.0	0.0	190.7	0.83	0.0	-0.1	0.003
N2_DIR_0008.LAB	10/18/23	6:03:51	0.0	0.0	0.0	190.7	0.83	-0.2	0.1	-0.004
N2_DIR_0009.LAB	10/18/23	6:03:59	0.0	0.0	0.0	190.7	0.83	-0.1	0.3	-0.001

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_0017.LAB	10/18/23	6:05:55	0.0	0.0	0.0	190.5	0.83	100.7	0.1	-0.023	**100.0%**
CTS_DIR_0018.LAB	10/18/23	6:06:02	0.0	0.0	0.0	190.6	0.83	100.9	0.0	-0.035	**100.2%**
CTS_DIR_0019.LAB	10/18/23	6:06:10	0.0	0.0	0.0	190.6	0.83	100.9	0.1	-0.025	**100.2%**
CTS_DIR_0020.LAB	10/18/23	6:06:19	0.0	0.0	0.0	190.7	0.83	100.7	0.1	-0.025	**100.0%**
CTS_DIR_0021.LAB	10/18/23	6:06:26	0.0	0.0	0.0	190.7	0.83	100.8	0.0	-0.031	**100.1%**
CTS_DIR_0022.LAB	10/18/23	6:06:34	0.0	0.0	-0.1	190.7	0.83	100.8	-0.1	-0.032	**100.1%**
CTS_DIR_0023.LAB	10/18/23	6:06:42	0.0	0.0	0.0	190.7	0.83	101.0	0.1	-0.030	**100.3%**
	Average							**100.8**			**100.1%**

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
199.2HCN_DIR_0035.LAB	10/18/23	6:09:24	0.0	0.0	-0.1	190.7	0.83	0.6	193.7	10.007	**97.2%**
199.2HCN_DIR_0036.LAB	10/18/23	6:09:31	0.0	0.0	0.0	190.6	0.83	0.5	194.2	10.001	**97.5%**
199.2HCN_DIR_0037.LAB	10/18/23	6:09:39	0.0	0.0	0.0	190.6	0.83	0.5	194.1	9.993	**97.4%**
199.2HCN_DIR_0038.LAB	10/18/23	6:09:47	0.0	0.0	0.0	190.6	0.83	0.7	194.3	10.011	**97.6%**
199.2HCN_DIR_0039.LAB	10/18/23	6:09:55	0.0	0.0	0.0	190.7	0.83	0.6	194.5	10.012	**97.7%**
199.2HCN_DIR_0040.LAB	10/18/23	6:10:03	0.0	0.0	0.0	190.7	0.83	0.7	194.3	9.990	**97.5%**
199.2HCN_DIR_0041.LAB	10/18/23	6:10:11	0.0	0.0	-0.1	190.7	0.83	0.7	194.2	9.993	**97.5%**
199.2HCN_DIR_0042.LAB	10/18/23	6:10:18	0.0	0.0	0.0	190.8	0.83	0.5	194.1	9.996	**97.4%**
	Average								**194.2**	**10.000**	**97.5%**

CTS, System Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
CTS_RT_0079.LAB	10/18/23	6:24:38	0.0	0.0	0.0	190.9	0.84	101.2	0.2	-0.022	**100.5%**
CTS_RT_0080.LAB	10/18/23	6:24:45	0.0	0.0	0.0	190.8	0.84	101.2	0.3	-0.012	**100.5%**
CTS_RT_0081.LAB	10/18/23	6:24:54	0.0	0.0	0.0	190.9	0.84	100.5	0.1	-0.012	**99.7%**
CTS_RT_0082.LAB	10/18/23	6:25:01	0.0	0.0	0.0	190.9	0.84	100.8	0.2	-0.025	**100.0%**
CTS_RT_0083.LAB	10/18/23	6:25:09	0.0	0.0	0.0	190.9	0.84	100.6	0.1	-0.024	**99.8%**
CTS_RT_0084.LAB	10/18/23	6:25:17	0.0	0.0	0.0	190.9	0.84	100.7	0.3	-0.019	**99.8%**
CTS_RT_0085.LAB	10/18/23	6:25:25	0.0	0.0	0.0	190.9	0.84	100.4	0.1	-0.044	**99.6%**
CTS_RT_0086.LAB	10/18/23	6:25:33	0.0	0.0	0.0	191.0	0.84	100.9	0.2	-0.012	**100.1%**

Response Time Test

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Response Time (sec)
CTS_RT_0071.LAB	10/18/23	6:23:35	0.7	0.0	0.0	190.9	0.84	0.1	-0.2	0.008	-
CTS_RT_0072.LAB	10/18/23	6:23:43	0.4	1.6	0.0	190.9	0.84	44.2	0.6	-0.011	**15.653**
CTS_RT_0073.LAB	10/18/23	6:23:50	0.1	0.0	0.1	190.9	0.84	100.5	0.2	-0.023	**23.653**
CTS_RT_0074.LAB	10/18/23	6:23:58	0.0	0.0	0.0	190.9	0.84	100.5	0.2	-0.011	
CTS_RT_0075.LAB	10/18/23	6:24:06	0.0	0.0	0.0	190.9	0.84	100.2	0.3	-0.023	
CTS_RT_0076.LAB	10/18/23	6:24:14	0.0	0.0	-0.1	190.9	0.84	100.9	0.3	-0.027	
CTS_RT_0077.LAB	10/18/23	6:24:22	0.0	0.0	0.0	190.9	0.84	101.3	0.1	-0.034	
CTS_RT_0078.LAB	10/18/23	6:24:30	0.0	0.0	0.0	190.8	0.84	100.9	0.1	-0.021	
CTS_RT_0079.LAB	10/18/23	6:24:38	0.0	0.0	0.0	190.9	0.84	101.2	0.2	-0.022	

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill On

Test Location: Main Kiln
Date: 10/18/2023
Operator: R. Sollars
FTIR s/n: E10004

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_0204.LAB	10/18/23	6:44:51	12.5	22.1	-0.1	190.9	0.84	3.1	10.7	-0.019
AMBIENT_STACK_0205.LAB	10/18/23	6:44:59	12.6	22.1	-0.1	190.9	0.83	2.8	10.3	-0.032
AMBIENT_STACK_0206.LAB	10/18/23	6:45:06	12.6	22.1	-0.1	190.9	0.84	2.9	10.6	-0.032
									10.5	**-0.028**

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_0219.LAB	10/18/23	6:48:42	11.9	19.9	-0.1	190.8	0.84	2.3	21.2	0.594	**0.059**	**98.8%**
PRE1_SPK_0220.LAB	10/18/23	6:48:50	11.9	20.0	-0.1	190.8	0.84	2.7	21.4	0.582	**0.058**	**101.0%**
PRE1_SPK_0221.LAB	10/18/23	6:48:58	11.9	19.9	0.0	190.8	0.84	2.9	21.2	0.597	**0.060**	**98.7%**
PRE1_SPK_0222.LAB	10/18/23	6:49:06	11.9	19.9	-0.1	190.8	0.84	2.6	21.4	0.583	**0.058**	**101.0%**
PRE1_SPK_0223.LAB	10/18/23	6:49:14	11.8	19.9	-0.1	190.8	0.84	2.4	21.3	0.587	**0.059**	**100.4%**
PRE1_SPK_0224.LAB	10/18/23	6:49:22	11.9	20.0	-0.1	190.7	0.84	2.6	21.3	0.584	**0.058**	**100.5%**
PRE1_SPK_0225.LAB	10/18/23	6:49:29	11.9	20.0	-0.1	190.7	0.84	2.6	21.2	0.585	**0.059**	**99.8%**
PRE1_SPK_0226.LAB	10/18/23	6:49:37	11.9	20.0	-0.1	190.8	0.84	2.6	21.4	0.589	**0.059**	**100.5%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN1_0421.LAB	10/18/23	9:44:38	13.1	16.9	-0.1	190.5	0.85	2.9	7.9	-0.016
RUN1_0422.LAB	10/18/23	9:45:41	12.8	16.9	-0.1	190.6	0.84	2.9	8.2	-0.013
RUN1_0423.LAB	10/18/23	9:46:44	13.0	17.2	-0.1	190.7	0.84	2.9	8.5	-0.016
									8.2	**-0.015**

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_0436.LAB	10/18/23	9:51:15	12.8	16.4	-0.1	191.1	0.84	2.5	16.3	0.417	**0.042**	**101.9%**
POST1_SPK_0437.LAB	10/18/23	9:51:23	12.7	16.3	-0.1	191.0	0.84	2.5	15.9	0.434	**0.043**	**97.6%**
POST1_SPK_0438.LAB	10/18/23	9:51:31	12.9	16.2	0.0	191.0	0.84	2.8	16.0	0.441	**0.044**	**97.7%**
POST1_SPK_0439.LAB	10/18/23	9:51:39	13.3	16.1	-0.1	191.0	0.84	2.7	15.9	0.424	**0.042**	**98.6%**
POST1_SPK_0440.LAB	10/18/23	9:51:47	13.3	16.0	-0.1	191.0	0.84	2.6	15.7	0.422	**0.042**	**97.7%**
POST1_SPK_0441.LAB	10/18/23	9:51:55	13.0	15.9	-0.1	191.0	0.84	2.5	15.7	0.431	**0.043**	**96.8%**
POST1_SPK_0442.LAB	10/18/23	9:52:03	12.7	15.9	-0.1	191.0	0.84	2.8	15.8	0.426	**0.043**	**98.1%**
POST1_SPK_0443.LAB	10/18/23	9:52:11	12.6	15.8	-0.1	190.9	0.84	2.4	15.8	0.437	**0.044**	**96.6%**

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
POST1_CTS_0450.LAB	10/18/23	9:54:06	0.0	0.0	0.0	190.7	0.84	100.4	0.7	-0.022	**99.5%**
POST1_CTS_0451.LAB	10/18/23	9:54:14	0.0	0.0	0.1	190.7	0.84	99.6	0.5	-0.031	**98.8%**
POST1_CTS_0452.LAB	10/18/23	9:54:22	0.1	0.0	0.0	190.7	0.84	100.9	0.6	-0.015	**100.0%**
POST1_CTS_0453.LAB	10/18/23	9:54:30	0.0	0.0	0.0	190.7	0.84	100.6	0.6	-0.022	**99.8%**
POST1_CTS_0454.LAB	10/18/23	9:54:38	0.0	0.0	0.0	190.7	0.84	100.5	0.5	-0.029	**99.7%**
POST1_CTS_0455.LAB	10/18/23	9:54:46	0.0	0.0	0.0	190.7	0.84	100.6	0.5	-0.026	**99.8%**
POST1_CTS_0456.LAB	10/18/23	9:54:53	0.0	0.0	0.0	190.7	0.84	100.5	0.5	-0.016	**99.7%**
POST1_CTS_0457.LAB	10/18/23	9:55:01	0.0	0.0	0.0	190.7	0.84	100.3	0.4	-0.024	**99.5%**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill On

Test Location: Main Kiln
Date: 10/18/2023
Operator: R. Sollars
FTIR s/n: E10004

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_0571.LAB	10/18/23	11:35:11	12.2	16.6	-0.1	190.5	0.84	2.6	7.8	-0.017
RUN2_0572.LAB	10/18/23	11:36:14	12.1	17.1	-0.1	190.4	0.84	2.5	8.3	-0.014
RUN2_0573.LAB	10/18/23	11:37:17	12.4	17.2	-0.1	190.4	0.84	2.6	8.5	-0.017
									8.2	**-0.016**

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_0607.LAB	10/18/23	12:04:56	12.2	17.7	-0.1	190.3	0.84	2.4	15.7	0.331	**0.033**	**109.2%**
POST2_SPK_0608.LAB	10/18/23	12:05:04	12.3	17.7	-0.1	190.3	0.84	2.5	15.6	0.338	**0.034**	**107.8%**
POST2_SPK_0609.LAB	10/18/23	12:05:12	12.3	17.8	0.0	190.2	0.84	2.7	15.9	0.327	**0.033**	**111.0%**
POST2_SPK_0610.LAB	10/18/23	12:05:20	12.2	17.7	-0.1	190.3	0.84	2.6	15.7	0.331	**0.033**	**109.4%**
POST2_SPK_0611.LAB	10/18/23	12:05:27	12.2	17.6	-0.1	190.2	0.84	2.5	15.7	0.339	**0.034**	**108.4%**
POST2_SPK_0612.LAB	10/18/23	12:05:35	12.2	17.6	-0.1	190.1	0.84	2.3	15.6	0.333	**0.033**	**108.4%**
POST2_SPK_0613.LAB	10/18/23	12:05:43	12.2	17.5	-0.1	190.2	0.84	2.5	15.6	0.345	**0.034**	**106.6%**
POST2_SPK_0614.LAB	10/18/23	12:05:51	12.1	17.4	-0.1	190.2	0.84	2.6	15.5	0.327	**0.033**	**108.2%**

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
POST2_CTS_0622.LAB	10/18/23	12:08:08	0.1	0.0	-0.1	190.5	0.84	101.1	0.5	-0.019	**100.2%**
POST2_CTS_0623.LAB	10/18/23	12:08:16	0.1	0.0	-0.1	190.6	0.84	100.8	0.5	-0.029	**100.0%**
POST2_CTS_0624.LAB	10/18/23	12:08:24	0.1	0.0	0.1	190.6	0.84	100.9	0.4	-0.026	**100.1%**
POST2_CTS_0625.LAB	10/18/23	12:08:32	0.1	0.0	0.0	190.6	0.84	100.3	0.5	-0.010	**99.5%**
POST2_CTS_0626.LAB	10/18/23	12:08:40	0.1	0.0	0.0	190.5	0.84	100.6	0.3	-0.016	**99.7%**
POST2_CTS_0627.LAB	10/18/23	12:08:47	0.1	0.0	0.0	190.6	0.84	101.1	0.5	-0.023	**100.2%**
POST2_CTS_0628.LAB	10/18/23	12:08:55	0.1	0.0	0.0	190.5	0.84	100.4	0.1	-0.035	**99.6%**
POST2_CTS_0629.LAB	10/18/23	12:09:03	0.1	0.0	0.0	190.5	0.84	100.6	0.2	-0.020	**99.8%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
RUN3_0720.LAB	10/18/23	13:29:00	14.2	17.6	0.0	190.2	0.84	2.6	7.9	-0.023
RUN3_0721.LAB	10/18/23	13:30:03	14.3	17.9	0.0	190.1	0.84	2.8	8.0	-0.018
RUN3_0722.LAB	10/18/23	13:31:05	14.1	17.6	0.0	190.1	0.84	2.8	8.0	-0.015
									8.0	**-0.019**

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_0737.LAB	10/18/23	13:35:44	13.2	16.8	0.0	190.1	0.84	2.6	15.8	0.411	**0.041**	**101.2%**
POST3_SPK_0738.LAB	10/18/23	13:35:52	13.0	16.7	0.0	190.1	0.84	2.6	15.5	0.416	**0.042**	**98.8%**
POST3_SPK_0739.LAB	10/18/23	13:36:01	13.5	16.6	0.0	190.1	0.84	2.7	15.4	0.411	**0.041**	**98.9%**
POST3_SPK_0740.LAB	10/18/23	13:36:08	13.6	16.6	-0.1	190.1	0.84	2.3	15.6	0.426	**0.043**	**98.2%**
POST3_SPK_0741.LAB	10/18/23	13:36:16	13.1	16.6	0.0	190.1	0.84	2.7	15.7	0.421	**0.042**	**99.5%**
POST3_SPK_0742.LAB	10/18/23	13:36:24	12.9	16.5	-0.1	190.2	0.84	2.6	15.4	0.407	**0.041**	**99.4%**
POST3_SPK_0743.LAB	10/18/23	13:36:32	13.5	16.6	0.0	190.1	0.84	2.7	15.8	0.424	**0.042**	**99.5%**
POST3_SPK_0744.LAB	10/18/23	13:36:39	13.4	16.7	0.0	190.1	0.84	2.6	15.5	0.418	**0.042**	**98.6%**

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_0756.LAB	10/18/23	13:39:15	0.0	0.0	-0.1	190.1	0.84	101.1	0.5	-0.024	**100.2%**
POST3_CTS_0757.LAB	10/18/23	13:39:22	0.0	0.0	0.0	190.1	0.84	100.8	0.6	-0.030	**100.0%**
POST3_CTS_0758.LAB	10/18/23	13:39:30	0.0	0.0	0.0	190.0	0.84	100.3	0.3	-0.025	**99.5%**
POST3_CTS_0759.LAB	10/18/23	13:39:38	0.0	0.0	0.0	190.0	0.84	100.6	0.6	-0.026	**99.8%**
POST3_CTS_0760.LAB	10/18/23	13:39:46	0.0	0.0	0.0	190.0	0.84	100.4	0.5	-0.016	**99.6%**
POST3_CTS_0761.LAB	10/18/23	13:39:54	0.0	0.0	0.0	190.0	0.84	101.3	0.3	-0.022	**100.4%**
POST3_CTS_0762.LAB	10/18/23	13:40:01	0.0	0.0	0.1	190.1	0.84	100.9	0.2	-0.016	**100.1%**
POST3_CTS_0763.LAB	10/18/23	13:40:10	0.0	0.0	0.0	190.1	0.84	100.7	0.5	-0.031	**99.8%**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill On

Test Location: Main Kiln
Date: 10/18/2023
Operator: R. Sollars
FTIR s/n: E10004

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_0854.LAB	10/18/23	14:57:57	0.0	0.0	-0.1	190.5	0.83	100.7	0.4	-0.021	**99.8%**
CTS_DIR_0855.LAB	10/18/23	14:58:05	0.0	0.0	0.0	190.5	0.83	100.6	0.2	-0.031	**99.8%**
CTS_DIR_0856.LAB	10/18/23	14:58:13	0.0	0.0	0.0	190.5	0.83	100.8	0.2	-0.035	**100.0%**
CTS_DIR_0857.LAB	10/18/23	14:58:21	0.0	0.0	0.0	190.5	0.83	100.9	0.4	-0.017	**100.1%**
CTS_DIR_0858.LAB	10/18/23	14:58:29	0.0	0.0	0.0	190.5	0.83	100.6	0.5	-0.022	**99.8%**
CTS_DIR_0859.LAB	10/18/23	14:58:37	0.0	0.0	0.0	190.5	0.83	100.9	0.4	-0.029	**100.1%**
CTS_DIR_0860.LAB	10/18/23	14:58:44	0.0	0.0	0.0	190.4	0.83	100.8	0.3	-0.025	**100.0%**
CTS_DIR_0861.LAB	10/18/23	14:58:52	0.0	0.0	0.0	190.4	0.83	100.8	0.4	-0.024	**100.0%**
	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_0863.LAB	10/18/23	15:02:01	0.0	0.0	0.0	190.3	0.83	0.0	-0.1	0.001
N2_DIR_0864.LAB	10/18/23	15:04:07	0.0	0.0	0.0	190.3	0.83	0.0	-0.1	0.001
N2_DIR_0865.LAB	10/18/23	15:06:13	0.0	0.0	0.0	190.3	0.83	0.0	0.0	0.001

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill Off

Test Location: Main Kiln
Date: 10/17/2023
Operator: R. Sollars
FTIR s/n: E10004

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_0012.LAB	10/17/23	6:07:44	0.0	0.0	0.0	191.2	0.83	0.1	0.0	0.006
N2_DIR_0013BKG.LAB	10/17/23	6:10:01	0.0	0.0	0.0	191.1	0.83	0.0	0.0	0.000
N2_DIR_0014.LAB	10/17/23	6:10:15	0.0	0.0	0.0	191.0	0.83	-0.1	0.3	0.003
N2_DIR_0015.LAB	10/17/23	6:10:23	0.0	0.0	0.0	190.9	0.83	0.0	-0.2	-0.005
N2_DIR_0016.LAB	10/17/23	6:10:30	0.0	0.0	0.0	190.9	0.83	-0.2	-0.1	0.001
N2_DIR_0017.LAB	10/17/23	6:10:38	0.0	0.0	0.0	190.8	0.83	-0.1	0.1	-0.002
N2_DIR_0018.LAB	10/17/23	6:10:46	0.0	0.0	0.0	190.8	0.83	0.0	-0.1	0.002
N2_DIR_0019.LAB	10/17/23	6:10:54	0.0	0.0	0.0	190.8	0.83	0.1	-0.1	-0.001
N2_DIR_0020.LAB	10/17/23	6:11:02	0.0	0.0	0.0	190.8	0.83	0.0	0.0	-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_0035.LAB	10/17/23	6:14:34	0.0	0.0	0.1	190.6	0.83	100.6	0.0	-0.033	**99.9%**
CTS_DIR_0036.LAB	10/17/23	6:14:42	0.0	0.0	0.0	190.6	0.83	100.4	-0.2	-0.022	**99.7%**
CTS_DIR_0037.LAB	10/17/23	6:14:50	0.0	0.0	0.0	190.6	0.83	100.5	0.0	-0.036	**99.8%**
CTS_DIR_0038.LAB	10/17/23	6:14:58	0.0	0.0	0.0	190.6	0.83	100.5	0.1	-0.031	**99.8%**
CTS_DIR_0039.LAB	10/17/23	6:15:06	0.0	0.0	0.0	190.6	0.83	100.4	0.1	-0.036	**99.7%**
CTS_DIR_0040.LAB	10/17/23	6:15:13	0.0	0.0	0.0	190.6	0.83	100.3	0.2	-0.038	**99.6%**
CTS_DIR_0041.LAB	10/17/23	6:15:22	0.0	0.0	0.0	190.6	0.83	100.3	0.0	-0.039	**99.6%**
	Average							**100.4**			**99.7%**

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
199.2HCN_DIR_0250.LAB	10/17/23	7:06:38	0.0	0.0	0.0	190.5	0.83	1.0	198.2	10.143	**99.5%**
199.2HCN_DIR_0251.LAB	10/17/23	7:06:46	0.0	0.0	0.0	190.5	0.83	1.2	198.4	10.145	**99.6%**
199.2HCN_DIR_0252.LAB	10/17/23	7:06:53	0.0	0.0	0.0	190.6	0.83	0.9	198.4	10.137	**99.6%**
199.2HCN_DIR_0253.LAB	10/17/23	7:07:01	0.0	0.0	0.0	190.5	0.83	0.8	198.3	10.140	**99.5%**
199.2HCN_DIR_0254.LAB	10/17/23	7:07:10	0.0	0.0	0.0	190.5	0.83	1.1	198.2	10.137	**99.5%**
199.2HCN_DIR_0255.LAB	10/17/23	7:07:17	0.0	0.0	0.0	190.5	0.83	1.1	198.2	10.137	**99.5%**
199.2HCN_DIR_0256.LAB	10/17/23	7:07:25	0.0	0.0	0.0	190.5	0.83	0.9	198.6	10.143	**99.7%**
199.2HCN_DIR_0257.LAB	10/17/23	7:07:33	0.0	0.0	0.0	190.4	0.83	0.9	198.6	10.145	**99.7%**
	Average								**198.4**	**10.141**	**99.6%**

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_0095.LAB	10/17/23	6:35:59	0.1	0.0	0.0	190.8	0.83	101.0	0.0	-0.021	**100.3%**
CTS_RT_0096.LAB	10/17/23	6:36:07	0.0	0.0	0.0	190.7	0.84	100.5	0.1	-0.027	**99.8%**
CTS_RT_0097.LAB	10/17/23	6:36:15	0.0	0.0	0.0	190.7	0.84	100.9	0.1	-0.029	**100.5%**
CTS_RT_0098.LAB	10/17/23	6:36:23	0.0	0.0	0.0	190.7	0.84	101.5	-0.1	-0.022	**101.1%**
CTS_RT_0099.LAB	10/17/23	6:36:31	0.0	0.0	0.0	190.7	0.84	101.0	0.2	-0.030	**100.6%**
CTS_RT_0100.LAB	10/17/23	6:36:39	0.0	0.0	0.1	190.8	0.84	101.1	0.0	-0.026	**100.7%**
CTS_RT_0101.LAB	10/17/23	6:36:47	0.0	0.0	0.1	190.8	0.83	101.5	-0.1	-0.022	**101.0%**
CTS_RT_0102.LAB	10/17/23	6:36:55	0.0	0.0	0.0	190.8	0.84	100.8	0.0	-0.027	**100.3%**

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_0090.LAB	10/17/23	6:35:20	0.6	0.0	0.1	190.8	0.84	0.0	-0.2	0.000	-
CTS_RT_0091.LAB	10/17/23	6:35:28	0.5	0.8	0.1	190.8	0.84	43.6	-0.3	-0.025	**15.657**
CTS_RT_0092.LAB	10/17/23	6:35:36	0.1	0.0	0.0	190.8	0.84	100.8	0.0	-0.032	**23.657**
CTS_RT_0093.LAB	10/17/23	6:35:44	0.1	0.0	0.1	190.8	0.84	100.3	0.0	-0.032	
CTS_RT_0094.LAB	10/17/23	6:35:52	0.1	0.0	0.0	190.7	0.84	100.5	0.1	-0.029	
CTS_RT_0095.LAB	10/17/23	6:35:59	0.1	0.0	0.0	190.8	0.83	101.0	0.0	-0.021	
CTS_RT_0096.LAB	10/17/23	6:36:07	0.0	0.0	0.0	190.7	0.84	100.5	0.1	-0.027	
CTS_RT_0097.LAB	10/17/23	6:36:15	0.0	0.0	0.0	190.7	0.84	100.9	0.1	-0.029	
CTS_RT_0098.LAB	10/17/23	6:36:23	0.0	0.0	0.0	190.7	0.84	101.5	-0.1	-0.022	

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill Off

Test Location: Main Kiln
Date: 10/17/2023
Operator: R. Sollars
FTIR s/n: E10004

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
PRE1_NATIVE_0293.LAB	10/17/23	7:13:40	13.1	23.8	-0.1	190.7	0.83	3.3	11.3	-0.034
PRE1_NATIVE_0294.LAB	10/17/23	7:13:48	12.6	23.8	-0.1	190.7	0.84	3.7	11.1	-0.039
PRE1_NATIVE_0295.LAB	10/17/23	7:13:56	11.6	23.8	-0.1	190.7	0.84	3.6	11.3	-0.036
									11.3	**-0.036**

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_0305.LAB	10/17/23	7:16:56	11.6	21.5	-0.1	190.5	0.83	2.8	21.9	0.609	**0.060**	**97.6%**
PRE1_SPK_0306.LAB	10/17/23	7:17:04	11.4	21.3	-0.1	190.5	0.83	2.7	22.0	0.617	**0.061**	**97.1%**
PRE1_SPK_0307.LAB	10/17/23	7:17:11	10.7	21.2	-0.1	190.5	0.84	3.0	22.0	0.610	**0.060**	**97.6%**
PRE1_SPK_0308.LAB	10/17/23	7:17:19	10.4	21.3	0.1	190.4	0.84	3.0	22.1	0.622	**0.061**	**97.2%**
PRE1_SPK_0309.LAB	10/17/23	7:17:27	10.7	21.5	0.0	190.4	0.83	2.6	22.3	0.620	**0.061**	**98.1%**
PRE1_SPK_0310.LAB	10/17/23	7:17:35	11.0	21.6	0.0	190.4	0.84	2.8	22.1	0.608	**0.060**	**98.3%**
PRE1_SPK_0311.LAB	10/17/23	7:17:43	11.3	21.7	0.0	190.4	0.83	2.9	22.2	0.620	**0.061**	**98.0%**
PRE1_SPK_0312.LAB	10/17/23	7:17:51	11.4	21.8	-0.1	190.4	0.84	3.4	22.0	0.616	**0.061**	**97.4%**

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_0440.LAB	10/17/23	9:06:51	12.7	25.3	-0.1	190.5	0.85	3.4	13.3	-0.040
Run1_0441.LAB	10/17/23	9:07:54	12.0	24.5	-0.1	190.4	0.85	2.9	13.5	-0.040
Run1_0442.LAB	10/17/23	9:08:57	12.3	24.7	-0.1	190.5	0.85	2.8	13.4	-0.042
									13.4	**-0.041**

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_0452.LAB	10/17/23	9:13:26	11.6	23.0	-0.1	190.1	0.84	2.8	23.5	0.556	**0.055**	**99.8%**
POST1_SPK_0453.LAB	10/17/23	9:13:34	11.0	23.5	0.0	190.1	0.84	2.5	23.9	0.549	**0.054**	**102.1%**
POST1_SPK_0454.LAB	10/17/23	9:13:42	10.7	24.0	0.0	190.1	0.84	3.1	23.8	0.547	**0.054**	**101.9%**
POST1_SPK_0455.LAB	10/17/23	9:13:50	11.0	24.2	-0.1	190.1	0.84	2.9	23.5	0.547	**0.054**	**100.4%**
POST1_SPK_0456.LAB	10/17/23	9:13:58	11.5	24.4	0.0	190.2	0.84	2.7	23.7	0.545	**0.054**	**101.7%**
POST1_SPK_0457.LAB	10/17/23	9:14:05	11.7	24.4	-0.1	190.2	0.84	3.1	23.5	0.561	**0.055**	**99.5%**
POST1_SPK_0458.LAB	10/17/23	9:14:13	11.7	24.3	0.0	190.2	0.84	2.9	23.5	0.557	**0.055**	**99.8%**
POST1_SPK_0459.LAB	10/17/23	9:14:21	11.7	23.9	-0.1	190.2	0.84	3.0	23.7	0.546	**0.054**	**101.7%**

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
POST1_CTS_0470.LAB	10/17/23	9:16:42	0.1	0.0	0.1	190.5	0.84	100.7	0.4	-0.024	**100.3%**
POST1_CTS_0471.LAB	10/17/23	9:16:50	0.1	0.1	0.0	190.5	0.84	100.2	0.5	-0.024	**99.8%**
POST1_CTS_0472.LAB	10/17/23	9:16:58	0.0	0.0	0.0	190.5	0.84	100.9	0.3	-0.032	**100.5%**
POST1_CTS_0473.LAB	10/17/23	9:17:06	0.0	0.0	0.0	190.6	0.84	100.8	0.4	-0.012	**100.4%**
POST1_CTS_0474.LAB	10/17/23	9:17:14	0.1	0.0	0.0	190.6	0.84	100.4	0.5	-0.027	**100.0%**
POST1_CTS_0475.LAB	10/17/23	9:17:21	0.0	0.0	0.1	190.6	0.84	100.2	0.4	-0.030	**99.7%**
POST1_CTS_0476.LAB	10/17/23	9:17:29	0.0	0.0	0.1	190.5	0.84	100.8	0.6	-0.026	**100.4%**
POST1_CTS_0477.LAB	10/17/23	9:17:37	0.0	0.1	0.1	190.5	0.84	100.4	0.2	-0.028	**100.0%**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill Off

Test Location: Main Kiln
Date: 10/17/2023
Operator: R. Sollars
FTIR s/n: E10004

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_0803.LAB	10/17/23	14:43:41	12.6	25.8	-0.1	189.7	0.84	3.0	13.7	-0.035
RUN2_0804.LAB	10/17/23	14:44:44	12.4	25.6	-0.1	189.6	0.84	2.8	13.6	-0.033
RUN2_0805.LAB	10/17/23	14:45:47	12.6	25.8	-0.1	189.7	0.84	3.0	13.5	-0.035
									13.6	**-0.034**

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_0822.LAB	10/17/23	14:49:49	11.8	24.1	-0.2	189.6	0.84	3.3	25.7	0.658	**0.065**	**100.4%**
POST2_SPK_0823.LAB	10/17/23	14:49:57	11.8	24.3	-0.1	189.6	0.83	3.1	25.8	0.668	**0.066**	**100.1%**
POST2_SPK_0824.LAB	10/17/23	14:50:05	11.8	24.3	-0.1	189.5	0.83	2.9	25.7	0.668	**0.066**	**99.8%**
POST2_SPK_0825.LAB	10/17/23	14:50:13	11.8	24.4	-0.1	189.6	0.84	3.0	25.3	0.668	**0.066**	**98.3%**
POST2_SPK_0826.LAB	10/17/23	14:50:21	11.8	24.2	-0.1	189.5	0.84	3.0	25.8	0.673	**0.066**	**99.9%**
POST2_SPK_0827.LAB	10/17/23	14:50:28	11.7	24.0	-0.1	189.6	0.83	3.1	26.1	0.679	**0.067**	**100.5%**
POST2_SPK_0828.LAB	10/17/23	14:50:36	11.6	23.6	-0.1	189.6	0.84	3.1	26.1	0.672	**0.066**	**101.0%**
POST2_SPK_0829.LAB	10/17/23	14:50:44	11.5	23.3	-0.1	189.6	0.83	2.9	25.7	0.659	**0.065**	**100.6%**

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
POST2_CTS_0832.LAB	10/17/23	14:52:19	0.1	0.1	0.0	189.6	0.83	100.7	0.9	-0.026	**100.2%**
POST2_CTS_0833.LAB	10/17/23	14:52:27	0.1	0.1	0.1	189.7	0.83	100.5	0.4	-0.014	**100.1%**
POST2_CTS_0834.LAB	10/17/23	14:52:35	0.1	0.1	0.1	189.7	0.83	101.6	0.8	-0.042	**101.2%**
POST2_CTS_0835.LAB	10/17/23	14:52:43	0.1	0.0	0.0	189.7	0.83	100.9	0.6	-0.018	**100.5%**
POST2_CTS_0836.LAB	10/17/23	14:52:51	0.1	0.1	0.0	189.8	0.83	100.2	0.6	-0.028	**99.8%**
POST2_CTS_0837.LAB	10/17/23	14:52:59	0.1	0.1	0.0	189.8	0.83	100.7	0.5	-0.009	**100.3%**
POST2_CTS_0838.LAB	10/17/23	14:53:07	0.1	0.0	0.0	189.7	0.84	101.1	0.5	-0.019	**100.7%**
POST2_CTS_0839.LAB	10/17/23	14:53:14	0.1	0.0	0.0	189.7	0.83	101.2	0.5	-0.017	**100.8%**

Native Effluent Prior to Analyte Spike

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet	Recovery % Ethylene
POST3_CTS_0965.LAB	10/17/23	16:21:08	0.1	0.1	0.0	189.7	0.83	100.2	0.8	-0.001	**99.7%**
POST3_CTS_0966.LAB	10/17/23	16:21:16	0.1	0.1	0.0	189.7	0.83	100.8	0.9	-0.007	**100.4%**
POST3_CTS_0967.LAB	10/17/23	16:21:24	0.1	0.1	0.0	189.7	0.83	100.7	1.1	-0.015	**100.3%**
POST3_CTS_0968.LAB	10/17/23	16:21:31	0.1	0.1	0.0	189.7	0.83	100.7	0.8	-0.013	**100.3%**
POST3_CTS_0969.LAB	10/17/23	16:21:40	0.1	0.1	0.0	189.7	0.83	100.6	0.7	-0.024	**100.2%**
POST3_CTS_0970.LAB	10/17/23	16:21:47	0.1	0.0	0.0	189.6	0.83	101.0	0.6	-0.024	**100.6%**
POST3_CTS_0971.LAB	10/17/23	16:21:55	0.1	0.0	0.0	189.6	0.83	101.0	0.7	-0.016	**100.6%**
POST3_CTS_0972.LAB	10/17/23	16:22:03	0.1	0.0	0.0	189.6	0.83	101.0	0.8	-0.008	**100.6%**

Client: GCC Rio Grande, Inc.
Facility: Pueblo Plant
Project #: M234207
Operating Condition: Mill Off

Test Location: Main Kiln
Date: 10/17/2023
Operator: R. Sollars
FTIR s/n: E10004

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_1045.LAB	10/17/23	17:20:16	0.0	0.0	0.0	189.5	0.82	100.6	0.2	-0.020	**100.2%**
CTS_DIR_1046.LAB	10/17/23	17:20:32	0.0	0.0	0.1	189.5	0.82	100.5	0.2	-0.030	**100.1%**
CTS_DIR_1047.LAB	10/17/23	17:20:47	0.0	0.0	0.0	189.5	0.82	100.6	0.2	-0.022	**100.2%**
CTS_DIR_1048.LAB	10/17/23	17:21:03	0.0	0.0	0.0	189.4	0.82	100.6	0.3	-0.025	**100.1%**
CTS_DIR_1049.LAB	10/17/23	17:21:19	0.0	0.0	0.0	189.5	0.82	100.9	0.2	-0.017	**100.5%**
CTS_DIR_1050.LAB	10/17/23	17:21:34	0.0	0.0	0.0	189.5	0.82	100.5	0.1	-0.023	**100.1%**
CTS_DIR_1051.LAB	10/17/23	17:21:50	0.0	0.0	0.0	189.5	0.82	100.5	0.3	-0.023	**100.1%**
CTS_DIR_1052.LAB	10/17/23	17:22:06	0.0	0.0	0.0	189.5	0.82	100.2	0.0	-0.023	**99.8%**
	Average							**100.6**			

Post Test N2, Direct Purge

Spectrum	Date	Time	H2O% %v	CO2 %v wet	HF ppmv wet	FTIR Gas Cell Temperature deg C	FTIR Gas Cell Pressure atm	Ethylene ppmv wet	HCN ppmv wet	SF6 ppmv wet
N2_DIR_1054.LAB	10/17/23	17:25:26	0.0	0.0	0.0	189.5	0.82	-0.1	0.1	0.002
N2_DIR_1055.LAB	10/17/23	17:27:32	0.0	0.0	0.0	189.5	0.82	-0.1	0.1	0.001
N2_DIR_1056.LAB	10/17/23	17:29:38	0.0	0.0	0.0	189.5	0.82	-0.1	0.2	0.001

Time	DL summary - zero gas		Time	DL summary - in stack	
	HF ppm (10) 191C	HCN (100) 191C		HF ppm (10) 191C	HCN (100) 191C
6:03:36 AM	0.02	0.14	6:53:47 AM	-0.04	-0.23
6:03:44 AM	-0.02	0.02	6:53:55 AM	0.02	-0.12
6:03:51 AM	-0.03	0.14	6:54:03 AM	0.00	-0.50
6:03:59 AM	0.03	-0.01	6:54:10 AM	-0.04	-0.33
6:04:07 AM	-0.06	-0.33	6:54:18 AM	-0.02	-0.09
6:04:15 AM	-0.03	-0.18	6:54:26 AM	-0.05	-0.14
6:04:23 AM	-0.05	-0.23	6:54:34 AM	-0.04	-0.21
Standard Deviation	**0.03**	**0.17**	**Standard Deviation**	**0.02**	**0.13**
3x = DL	**0.10**	**0.51**	**3x = DL**	**0.07**	**0.40**

Appendix I - Gas Cylinder Certifications

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	0.4	—	—
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.

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:	48-402737254-1
Cylinder Number:	CC175274	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:	May 11, 2023

Expiration Date: May 11, 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 %	11.18 %	G1	+/- 0.6% NIST Traceable	05/11/2023
OXYGEN	11.00 %	11.07 %	G1	+/- 0.9% NIST Traceable	05/11/2023
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	Apr 26, 2023
SIEMENS OXYMAT 6	PARAMAGNETIC	Apr 21, 2023

Triad Data Available Upon Request

Signature on file
Approved for Release

Airgas Specialty Gases
Airgas USA LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: CERTIFIED STANDARD-SPEC

Part Number:	X02NI99C15A1268	Reference Number:	153-402780689-1
Cylinder Number:	CC401933	Cylinder Volume:	144.0 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
Analysis Date:	Jul 10, 2023	Valve Outlet:	350
Lot Number:	153-402780689-1		

Expiration Date: Jul 10, 2026

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	100.7 PPM	+/- 2%
NITROGEN	Balance		

Signature on file
Approved for Release

Airgas Specialty Gases
Airgas USA LLC
525 North Industrial Loop Road
Tooele, UT 84074
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E03NI59E15A3452	Reference Number:	153-402157382-1
Cylinder Number:	CC420519	Cylinder Volume:	159.0 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72021	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Jul 15, 2021

Expiration Date: Jul 15, 2029

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	19.00 %	18.99 %	G1	+/- 0.6% NIST Traceable	07/15/2021
OXYGEN	22.00 %	22.41 %	G1	+/- 0.3% NIST Traceable	07/15/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060802	CC415397	24.04 % CARBON DIOXIDE/NITROGEN	0.6%	Dec 11, 2025
NTRM	12062008	CC367433	22.883 % OXYGEN/NITROGEN	0.2%	May 14, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Jun 17, 2021
Horiba MPA-510 W603MM58 O2	O2 Paramagnetic (Mason)	Jul 12, 2021

Triad Data Available Upon Request

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Airgas
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

Part Number:	X03NI99C15AC0Y6	Reference Number:	160-402841636-1
Cylinder Number:	CC768255	Cylinder Volume:	144.4 CF
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
Analysis Date:	Sep 12, 2023	Valve Outlet:	350SS
Lot Number:	160-402841636-1		

Expiration Date: Mar 12, 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	10.00 PPM	10.00 PPM	+/- 5%
HYDROGEN CYANIDE	200.0 PPM	199.2 PPM	+/- 5%
NITROGEN	Balance		

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END OF THE REPORT