AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF AIR POLLUTANT EMISSIONS
FROM A
LANDFILL GAS FUELED FLARE

Prepared for:

Ottawa County Farms Landfill
SRN N3294

Test Date: June 16, 2022

ICT Project No.: 2200137
July 18, 2022

IMPACT
COMPLIANCE & TESTING

Report Certification

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Ottawa County Farms Landfill
Coopersville, MI

Report Certification

The material and data in this document were prepared under the supervision and direction of the undersigned.

Impact Compliance & Testing, Inc.

Andrew Eisenberg
Environmental Consultant

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1.0 Introduction

Ottawa County Farms Landfill (OCFL) operates a landfill gas (LFG) fueled enclosed flare (enclosed flare) at its facility in Coopersville, Ottawa County, Michigan.

The State of Michigan Department of Environment, Great Lakes, and Energy – Air Quality Division (EGLE-AQD) has issued to OCFL Renewable Operating Permit (ROP) No. MI-ROP-N3294-2019 and Permit to Install (PTI) No. 116-20, which consists of:

- One (1) enclosed flare identified as emission unit EUENCLOSEDFLARE.

Air emission compliance testing was performed pursuant to conditions of MI-ROP-N3294-2019, PTI No. 116-20, the federal Standards of Performance for Municipal Solid Waste Landfills (40 CFR 60, Subpart XXX, and 40 CFR 63, Subpart AAAA). While PTI No. 116-20 references 40 CFR 63, Subpart WWW, it is no longer applicable in Michigan as it has be superseded by 40 CFR 63, Subpart AAAA.

The compliance testing presented in this report was performed by Impact Compliance & Testing, Inc. (ICT), a Michigan-based environmental consulting and testing company. ICT representatives Blake Beddow and Andrew Eisenberg performed the field sampling and measurements June 16, 2022.

The enclosed flare performance tests consisted of triplicate, one-hour sampling periods for carbon monoxide (CO). Exhaust gas velocity, moisture, oxygen (O_2) content, and carbon dioxide (CO_2) content were determined for each test period to calculate pollutant mass emission rates.

The exhaust gas sampling and analysis was performed using procedures specified in the Stack Test Protocol submitted May 9, 2022, that was reviewed and approved by EGLE-AQD. Mr. Trevor Drost of EGLE-AQD observed portions of the compliance testing.

Questions regarding this air emission test report should be directed to:

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2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Conditions of MI-ROP-N3294-2019, PTI No. 116-20, the federal Standards of Performance for Municipal Solid Waste Landfills (40 CFR 60, Subpart XXX, and 40 CFR 63, Subpart AAAA) require OCFL to test an enclosed flare (EUENCLOSEDFLARE) for air pollutant emissions. EUENCLOSEDFLARE was tested during this compliance test event.

2.2 Operating Conditions During the Compliance Tests

The flare testing was performed while the enclosed flare was operated at normal routine operating conditions. For the enclosed flare, OCFL representatives monitored and recorded the combustion zone temperature (°F), fuel use (scfm), and fuel methane content (%) at 15-minute intervals for each test period.

Appendix 2 provides operating records provided by OCFL representatives for the test periods.

Average process operating data for the emission unit is presented in Tables 2.1 and 6.1.

2.3 Summary of Air Pollutant Sampling Results

The gases exhausted from the sampled LFG fueled enclosed fare were each sampled for three (3) one-hour test periods during the compliance testing performed June 16, 2022.

Table 2.2 presents the average measured required air pollutant data for the enclosed flare (average of the three test periods).

Test results for each one-hour sampling period and comparison to the permitted emission rates are presented in Section 6.0 of this report.

Table 2.1 Average enclosed flare operating conditions during the test periods

Emission Unit	Combustion Temperature (°F)	LFG Fuel Use (scfm)	LFG CH_4 Content (%)
EUENCLOSEDFLARE	1,546	2,199	51.0

Table 2.2 Average measured air pollutant data for the enclosed flare (three-test average)

Emission Unit	CO (lb/MMBtu)
EUENCLOSEDFLARE	0.004
Permit Limit	***0.20***

3.0 Source and Sampling Location Description

3.1 General Process Description

OCFL is permitted to operate one (1) enclosed flare at its facility. The unit is fired exclusively with LFG that is recovered from the OCFL facility and treated prior to use.

3.2 Rated Capacities and Air Emission Controls

The enclosed flare has a rated LFG use rate of 3,700 scfm.

The enclosed flare serves as the control device for LFG generated at the OCFL. The enclosed flare is not equipped with add-on emission control equipment.

3.3 Sampling Locations

The EUENCLOSEDFLARE exhaust gas is released to the atmosphere through a dedicated vertical exhaust stack. The vertical exhaust stack has an inner diameter of 132 inches. The vertical exhaust stack is equipped with four (4) sample ports, each opposed by 90°, that provide a sampling location 96.0 inches (0.73 duct diameters) upstream and 444 inches (3.4 duct diameters) downstream from any flow disturbance and satisfies the USEPA Method 1 criteria for a representative sample location.

All sample port locations satisfy the USEPA Method 1 criteria for a representative sample location. Individual traverse points were determined in accordance with USEPA Method 1.

Appendix 1 provides a diagram of the emission test sampling locations with actual stack dimension measurements.

4.0 Sampling and Analytical Procedures

A Stack Test Protocol for the air emission testing was reviewed and approved by EGLE-AQD. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

4.1 Summary of Sampling Methods

USEPA Method 1	Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1.
USEPA Method 2	Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube.
USEPA Method 3A	Exhaust gas O_2 and CO_2 content was determined using paramagnetic and infrared instrumental analyzers, respectively.
USEPA Method 4	Exhaust gas moisture was determined based on the water weight gain in chilled impingers.
USEPA Method 10	Exhaust gas CO concentration was measured using an infrared instrumental analyzer.

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

Exhaust stack gas velocities and volumetric flow rates were determined using USEPA Method 2 once during each test period. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure at each traverse point across the stack cross section. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube. The Pitot tube and connective tubing were leak-checked periodically throughout the test periods to verify the integrity of the measurement system.

The absence of significant cyclonic flow at each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

Appendix 3 provides exhaust gas flowrate calculations and field data sheets.

4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

CO_2 and O_2 content in the enclosed flare exhaust gas stream were measured continuously throughout each test period in accordance with USEPA Method 3A. The CO_2 content of the exhaust was monitored using a Servomex 1440D infrared gas analyzer. The O_2 content of the exhaust was monitored using a Servomex 1440D gas analyzer that uses a paramagnetic sensor.

During each sampling period, a continuous sample of the exhaust gas stream was extracted from the stack using an Inconel probe connected to a Teflon® heated sample line. The sampled gas was conditioned by removing moisture prior to being introduced to the analyzers; therefore, measurement of O_2 and CO_2 concentrations correspond to standard dry gas conditions. Instrument response data were recorded using an ESC Model 8816 data acquisition system that monitored the analog output of the instrumental analyzers continuously and logged data as one-minute averages.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document). Sampling times were recorded on field data sheets.

Appendix 4 provides O_2 and CO_2 calculation sheets. Raw instrument response data are provided in Appendix 5.

4.4 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the enclosed flare exhaust gas stream was determined in accordance with USEPA Method 4 using a chilled impinger sampling train. Exhaust gas moisture content measurements were performed concurrently with the instrumental analyzer sampling periods. At the conclusion of each sampling period the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

4.5 CO Concentration Measurements (USEPA Method 10)

CO pollutant concentration in the enclosed flare exhaust gas stream was determined using a Thermo Environmental Instruments, Inc. (TEI) Model 48i infrared CO analyzer.

Throughout each test period, a continuous sample of the engine exhaust gas was extracted from the stack using the Teflon® heated sample line and gas conditioning system and delivered to the instrumental analyzers. Instrument response for each analyzer was recorded on an ESC Model 8816 data acquisition system that logged data as one-minute averages. Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias.

Appendix 4 provides CO calculation sheets. Raw instrument response data are provided in Appendix 5.

5.0 QA/QC Activities

5.1 Flow Measurement Equipment

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (pyrometer, Pitot tube, and scale) were calibrated to specifications in the sampling methods.

5.2 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

5.3 Instrumental Analyzer Interference Check

The instrumental analyzers used to measure CO, O_2, and CO_2 have had an interference response test preformed prior to their use in the field, pursuant to the interference response test procedures specified in USEPA Method 7E. The appropriate interference test gases (i.e., gases that would be encountered in the exhaust gas stream) were introduced into each analyzer, separately and as a mixture with the analyte that each analyzer is designed to measure. All of analyzers exhibited a composite deviation of less than 2.5% of the span for all measured interferent gases. No major analytical components of the analyzers have been replaced since performing the original interference tests.

5.4 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the CO, CO2, and O_2 analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the Inconel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of CO_2, O_2, and CO in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

5.5 Determination of Exhaust Gas Stratification

A stratification test was performed for each port on the exhaust stack. The stainless-steel sample probe was positioned at multiple sample points across each plane of the stack diameter. Pollutant concentration data were recorded at each sample point for a minimum of twice the maximum system response time.

The recorded concentration data for the exhaust stack indicated that the measured CO concentrations did vary by more than 10% of the mean across the stack diameter. Therefore, the exhaust stack was considered to be stratified and the compliance test sampling was performed at twelve (12) sampling locations within the exhaust stack.

5.6 System Response Time

The response time of the sampling system was determined prior to the compliance test program by introducing upscale gas and zero gas, in series, into the sampling system using a tee connection at the base of the sample probe. The elapsed time for the analyzer to display a reading of 95% of the expected concentration was determined using a stopwatch.

Sampling periods did not commence until the sampling probe had been in place for at least twice the greatest system response time.

5.7 Meter Box Calibrations

The dry gas meter sampling console used for moisture testing was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

6.0 Results

6.1 Test Results and Allowable Limits

Enclosed flare operating data and air pollutant concentration and emission measurement results for each one-hour test period are presented in Table 6.1.

The measured CO air pollutant emission rates for the enclosed flare are less than the allowable limit specified in MI-ROP-N3294-2019, PTI No. 116-20, the federal Standards of Performance for Municipal Solid Waste Landfills (40 CFR 60, Subpart XXX, and 40 CFR 63, Subpart AAAA). The allowable limit for CO emissions is listed in the following table.

	CO
EUENCLOSEDFLARE	**(lb/MMBtu)**
Permit Limit	***0.02***

6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the approved Stack Test Protocol. The enclosed flare was operated at normal routine operating conditions. No variations from normal operating conditions occurred during the test periods.

The exhaust gas velocity measurement for the fourth (4^{th}) port during the third (3^{rd}) test run was deemed inaccurate so the manometer was re-zeroed and leak checked and another exhaust gas velocity measurement was taken.

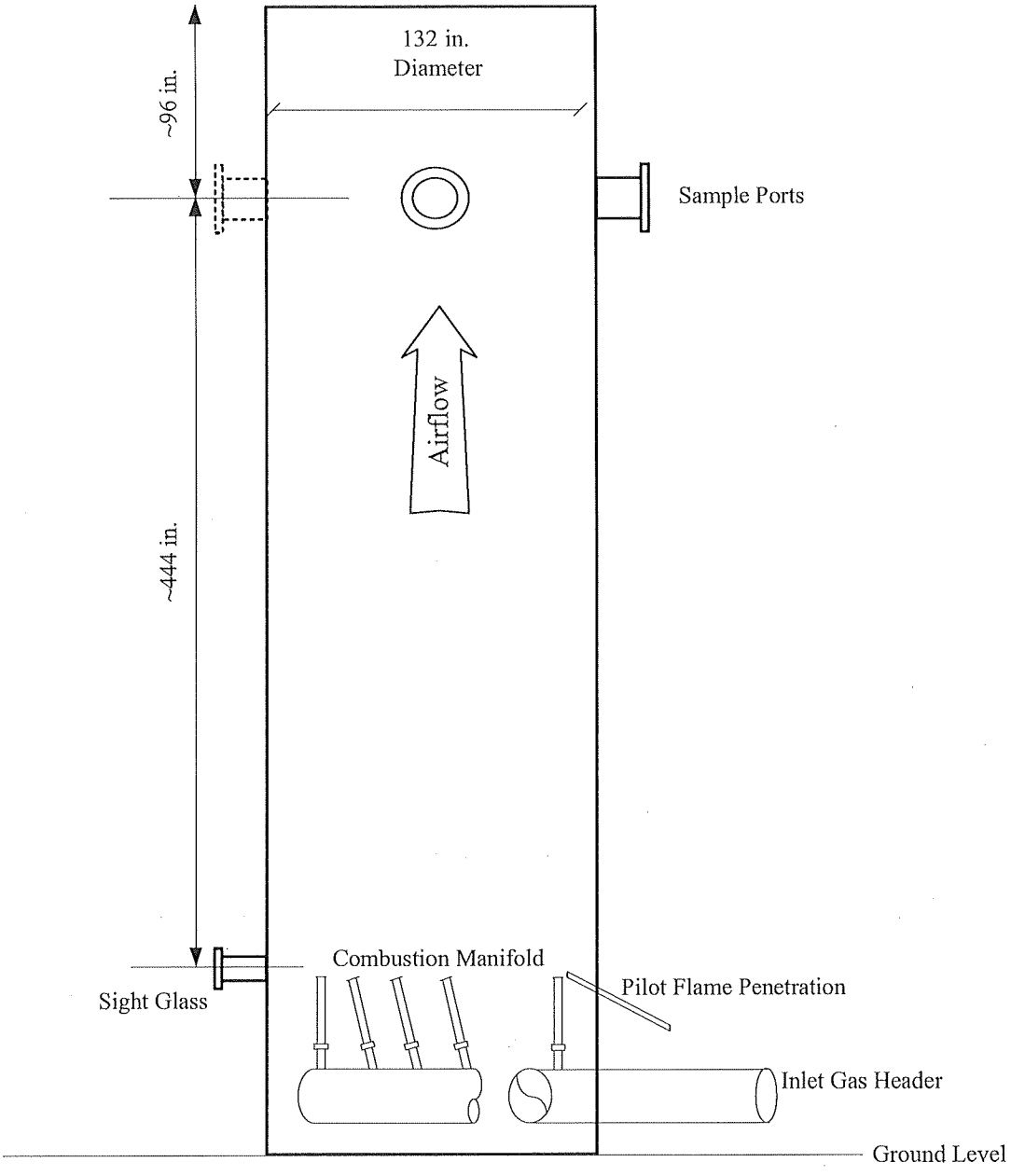
Table 6.1 Measured exhaust gas conditions and air pollutant emission rates for EUENCLOSEDFLARE

Test No. Test date Test period (24-hr clock)	1 6/16/2022 0835-1012	2 6/16/2022 1045-1215	3 6/16/2022 1335-1509	Three Test Average
Combustion temperature (°F)	1,568	1,569	1,500	1,546
Fuel flowrate (scfm)	2,248	2,217	2,132	2,199
LFG methane content (%)	51.8	51.3	49.7	51.0
Exhaust Gas Composition				
CO_2 content (% vol)	6.04	6.26	5.84	6.05
O_2 content (% vol)	14.4	14.0	14.6	14.4
Moisture (% vol)	10.4	9.2	8.6	9.4
Exhaust gas temperature (°F)	1,575	1,463	1,595	1,544
Exhaust gas flowrate (dscfm)	30,853	26,646	27,881	28,460
Exhaust gas flowrate (scfm)	34,439	29,353	30,516	31,436
Carbon Monoxide				
CO conc. (ppmvd)	2.10	0.21	3.93	2.08
CO emissions (lb/hr)	0.28	0.02	0.48	0.26
CO emissions (lb/MMBtu)	0.0045	0.0004	0.0083	0.0044
CO permit limit (lb/MMBtu)	-	-	-	*0.20*

APPENDIX 1

- Sample Port Diagram

EUENCLOSEDFLARE



Enclosed Flare Sampling and Measurement Locations

5/5/2022	**Ottawa County Farms Landfill** **EUENCLOSEDFLARE Exhaust Sample Location**		
	Scale None	Sheet 1 of 1	IMPACT COMPLIANCE & TESTING

Appendix 2

- Facility Operating Records

Landfill Gas Fueled Enclosed Flare
Process Operating Data

Facility: OCFL
Location: Coopersville, MI
Date: 6/16/2022
Unit ID: EUENCLOSEDFLARE

Date	EUENCLOSEDFLARE	Test #	Combustion Temp. (°F)	Fuel Flow (scfm)	Fuel CH_4 (%)
6/16/2022	8:35	1	1,575	2,250	51.7
	8:59	1	1,570	2,249	51.9
	9:20	1	1,560	2,255	51.7
	9:56	1	1,560	2,250	51.8
	10:12	1	1,575	2,235	51.8

6/16/2022	EUENCLOSEDFLARE	Test #	Combustion Temp. (°F)	Fuel Flow (scfm)	Fuel CH_4 (%)
	10:45	2	1,565	2,235	51.9
	11:04	2	1,568	2,222	51.7
	11:25	2	1,568	2,215	51.3
	12:00	2	1,571	2,210	51.0
	12:15	2	1,574	2,204	50.8

6/16/2022	EUENCLOSEDFLARE	Test #	Combustion Temp. (°F)	Fuel Flow (scfm)	Fuel CH_4 (%)
	13:35	3	1,535	2,135	50.1
	14:00	3	1,533	2,132	49.9
	14:20	3	1,475	2,138	49.6
	14:54	3	1,470	2,129	49.6
	15:09	3	1,488	2,128	49.5

PROCESS OPERATING DATA

Facility Name: Republic - OCFL
Location: Coopersville, MI
Test Date: 6/16/2022
Source ID
~~Engine No.~~: EUEnclosedFlare
Serial No.:
Engine Hours:

TEST NO. 1
Start Time: 8:35

	Combustion Temp. (°F)	Fuel Use (scfm)	CH4 Content (%)		
0 min	1575	2250	~~1755~~ 51.7		
15 min	1576	2249	51.9		
30 min	1560	2255	51.7		
45 min	1560	2250	51.8		
60 min	1575	2235	51.8		

Stop Time: 10:12

TEST NO. 2
Start Time: 10:44

	~~Generator Output~~ Combustion Temp (kW)	Engine Fuel Use scfm or ~~lb/hr~~	CH4 Content (%)		
0 min	1565	2235	51.9		
15 min	1568	2222	51.7		
30 min	1568	2215	51.3		
45 min	1571	2210	51.0		
60 min	1574	2207	50.8		

Stop Time: 12:15

TEST NO. 3
Start Time: ~~13:19~~ 13:35

	~~Generator Output~~ Combustion Temp (kW)	Engine Fuel Use scfm or ~~lb/hr~~	CH4 Content (%)		
0 min	~~1580~~ 1535	~~2180~~ 2139	50.1		
15 min	1533	2132	49.9		
30 min	1475	2138	~~49.6~~		
45 min	1470	2129	49.6		
60 min	1488	2128	49.5		

Stop Time: 15:09

Operator Initials: B.M.

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APPENDIX 3

- Flowrate Field Data Sheets
- Flowrate Calculation Sheets

EXHAUST GAS VELOCITY, MOISTURE, AND FLOWRATE CALCULATION SHEET

Company	OCFL		
Source Designation	EUENCLOSEDFLARE	**Pitot Tube Number**	8F-I
Test Date	6/16/2022	**Pitot Tube Corr. Factor**	0.84
Test Number	1	**% CO_2**	6.04
Time	8:40	**% O_2**	14.45
Barometric Pressure	29.21	**% CO**	0.000
Stack Static Pressure	-0.13	**% N_2**	79.51
Stack Diameter (in.)	132.00	**Md**	29.54
Traverse points	16	**Ms**	28.34
Operator	AE/BB	**Moisture Content (%)**	10.4

Traverse Point Number	Stack Temp. (°F)	Velocity Pres. ("H2O)	Traverse Point Number	Stack Temp. (°F)	Velocity Pres. ("H2O)
Side A			Side B		
1	1,496	0.04	1	1,681	0.05
2	1,498	0.05	2	1,648	0.05
3	1,500	0.05	3	1,678	0.05
4	1,500	0.04	4	1,710	0.04
5	1,527	0.04	5	1,561	0.05
6	1,536	0.05	6	1,570	0.04
7	1,551	0.04	7	1,598	0.04
8	1,542	0.04	8	1,598	0.04
Average	1,519	0.04		1,631	0.05

Average Velocity Pressure ("H_2O)	0.044
Average Velocity Pressure Sqrt ("H_2O)	0.212
Stack Pressure ("Hg)	29.20
Stack Gas Specific Gravity (Gs)	0.98
Average Stack Temperature (°F)	1574.6
Average Stack Velocity (fps)	23.85
Average Stack Velocity (fpm)	1430.9
Area of Stack (ft^2)	95.033
Flowrate (Actual-CFM)	135,987
Flowrate (Standard Wet-SCFM)	34,439
Flowrate (Standard Dry-DSCFM)	30,853

Moisture Calculation	
Bws=	0.104
Cond. Vol.=	3.09
Samp. Vol. std=	26.57
Vwc=	55.8
Wsg=	9.8
Vmf=	871.266
Vmi=	843.839
Ym=	1.0216
Delta H=	1.898
Tm=	83

EXHAUST GAS VELOCITY, MOISTURE, AND FLOWRATE CALCULATION SHEET

Company	OCFL		
Source Designation	EUENCLOSEDFLARE	**Pitot Tube Number**	8F-I
Test Date	6/16/2022	**Pitot Tube Corr. Factor**	0.84
Test Number	2	**% CO_2**	6.26
Time	10:46	**% O_2**	14.02
Barometric Pressure	29.24	**% CO**	0.000
Stack Static Pressure	-0.13	**% N_2**	79.72
Stack Diameter (in.)	132.00	**Md**	29.56
Traverse points	16	**Ms**	28.50
Operator	AE/BB	**Moisture Content (%)**	9.2

Traverse Point Number	Stack Temp. (°F)	Velocity Pres. ("H2O)	Traverse Point Number	Stack Temp. (°F)	Velocity Pres. ("H2O)
Side A			Side B		
1	1,450	0.03	1	1,320	0.02
2	1,450	0.02	2	1,360	0.02
3	1,520	0.02	3	1,400	0.02
4	1,680	0.01	4	1,498	0.01
5	1,359	0.04	5	1,390	0.08
6	1,354	0.04	6	1,400	0.07
7	1,472	0.04	7	1,590	0.06
8	1,570	0.02	8	1,590	0.04
Average	1,482	0.03		1,444	0.04

Average Velocity Pressure ("H_2O)	0.034
Average Velocity Pressure Sqrt ("H_2O)	0.176
Stack Pressure ("Hg)	29.23
Stack Gas Specific Gravity (Gs)	0.98
Average Stack Temperature (°F)	1462.7
Average Stack Velocity (fps)	19.19
Average Stack Velocity (fpm)	1151.4
Area of Stack (ft^2)	95.033
Flowrate (Actual-CFM)	109,424
Flowrate (Standard Wet-SCFM)	29,353
Flowrate (Standard Dry-DSCFM)	26,646

Moisture Calculation	
Bws=	0.092
Cond. Vol.=	2.66
Samp. Vol. std=	26.14
Vwc=	51.2
Wsg=	5.2
Vmf=	898.563
Vmi=	871.456
Ym=	1.0216
Delta H=	1.898
Tm=	86

EXHAUST GAS VELOCITY, MOISTURE, AND FLOWRATE CALCULATION SHEET

Company	OCFL		
Source Designation	EUENCLOSEDFLARE	**Pitot Tube Number**	8F-I
Test Date	6/16/2022	**Pitot Tube Corr. Factor**	0.84
Test Number	3	**% CO_2**	5.84
Time	13:30	**% O_2**	14.59
Barometric Pressure	29.21	**% CO**	0.000
Stack Static Pressure	-0.13	**% N_2**	79.57
Stack Diameter (in.)	132.00	**Md**	29.52
Traverse points	16	**Ms**	28.52
Operator	AE/BB	**Moisture Content (%)**	8.6

Traverse Point Number	Stack Temp. (°F)	Velocity Pres. ("H2O)	Traverse Point Number	Stack Temp. (°F)	Velocity Pres. ("H2O)
Side A			Side B		
1	1,625	0.03	1	1,590	0.04
2	1,625	0.04	2	1,590	0.04
3	1,622	0.02	3	1,566	0.04
4	1,622	0.04	4	1,564	0.05
5	1,550	0.05	5	1,590	0.04
6	1,560	0.04	6	1,590	0.05
7	1,649	0.02	7	1,560	0.04
8	1,649	0.01	8	1,560	0.04
Average	1,613	0.03		1,576	0.04

Average Velocity Pressure ("H_2O)	0.037
Average Velocity Pressure Sqrt ("H_2O)	0.189
Stack Pressure ("Hg)	29.20
Stack Gas Specific Gravity (Gs)	0.98
Average Stack Temperature (°F)	1594.5
Average Stack Velocity (fps)	21.34
Average Stack Velocity (fpm)	1280.2
Area of Stack (ft^2)	95.033
Flowrate (Actual-CFM)	121,657
Flowrate (Standard Wet-SCFM)	30,516
Flowrate (Standard Dry-DSCFM)	27,881

Moisture Calculation	
Bws=	0.086
Cond. Vol.=	2.60
Samp. Vol. std=	27.55
Vwc=	46.1
Wsg=	9.2
Vmf=	927.740
Vmi=	898.891
Ym=	1.0216
Delta H=	1.898
Tm=	91

USEPA Method 2
Gas Velocity Measurement Data Sheet

Company: Republic - CCFL
Source ID: Enclosed Flare

No. Points: 16
Operator: BB/AE

Pitot Type: (Type S) or Standard
Pitot ID: SF-I

Date:	6/16/2022		Date:	6/16/2022		Date:	6/16/2022		Date:		
Test No.:	1		Test No.:	2		Test No.:	3		Test No.:		
Time:	8:40	(24-hr)	Time:	1046	(24-hr)	Time:	1330	(24-hr)	Time:		(24-hr)
Bar. Press.:	29.208	in. Hg	Bar. Press.:	29.236	in. Hg	Bar. Press.:	29.212	in. Hg	Bar. Press.:		in. Hg
Static Press.:	-0.13	in. H_2O	Static Press.:	-0.13	in. H_2O	Static Press.:	-0.13	in. H_2O	Static Press.:		in. H_2O
O_2 Content:	14.9	%	O_2 Content:	14.6	%	O_2 Content:	14.7	%	O_2 Content:		%
CO_2 Content:	5.46	%	CO_2 Content:	5.55	%	CO_2 Content:	5.40	%	CO_2 Content:		%
Wet Bulb Temp.:	—	°F	Wet Bulb Temp.:	—	°F	Wet Bulb Temp.:	—	°F	Wet Bulb Temp.:		°F

Point No.	Stack Temp. (°F)	Velocity Head (in. H_2O)	Stack Temp. (°F)	Velocity Head (in. H_2O)	Stack Temp. (°F)	Velocity Head (in. H_2O)	Stack Temp. (°F)	Velocity Head (in. H_2O)
1	1496	0.04	1450	0.03	1625	0.03		
2	1498	0.05	1450	0.02	1625	0.04		
3	1500	0.05	1500	0.02	1622	0.02		
4	1500	0.04	1600	0.01	1622	0.04		
1	1527	0.04	1359	0.04	1550	0.05		
2	1536	0.05	1354	0.04	1560	0.04		
3	1551	0.04	1472	0.04	1649	0.02		
4	1542	0.04	1570	0.02	1649	0.01		
1	1651	0.05	1320	0.02	1590	0.04		
2	1648	0.05	1380	0.02	1590	0.04		
3	1678	0.05	1400	0.02	1566	0.04		
4	1710	0.04	1498	0.01	1564	0.05		
1	1561	0.05	1390	0.08	1580	0.08		
2	1570	0.04	1400	0.07	1570	0.08		
3	1598	0.04	1590	0.06	1570	0.08		
4	1598	0.04	1590	0.04	1575	0.08		
					1590	0.04		
					1590	0.05		
					1560	0.04		
					1560	0.04		

USEPA Method 4 Field Sampling Data Sheet

Company: Republic - OCFL
Source Designation: Enclosed Flare

Test Date: 6/16/22
Test Number: 1
Operator: BB/AE
Bar. Press (Pb): 29.208

Meter Number: N-1
Kiso: 1749.954
Delta H@: 1.898
Meter Yd: 1.0216
Assumed H2O: 7%

Leak Rate Initial: 0.0 @ 10 "
Leak Rate Final: 0.0 @ 5 "

Moisture Data			
Impinger	Initial (g / mL)	Final (g / mL)	Net Gain (g / mL)
1 - Modified	647.0	740.8	43.8
2 - Standard	697.1	706.1	9
3 - Modified	590.0	602.0	3
4			
5			
Silica Gel 1017.5	1017.5	1027.3	9.8
Cond.Vol. (Vlc-1)		515.8	(g / mL)
SG Gain (Vlc-2)		9.6	(g / mL)

Sampling Time (Min) ø	Time (24 hour)	Train Vacuum ("Hg)	Orifice Differential ("H2O) ΔH	Sample Volume (ft3) Vm	DGM Temp. Inlet (°F) Tm	DGM Temp. Outlet (°F) Tm	Last Imp. Temp. (°F)
0	835	4.0	2.0	843.839	79	78	61
5		4.0	2.0	847.79	80	79	62
10		4.0	2.0	851.73	84	79	62
15		4.0	2.0	855.63	85	79	62
20		4.0	2.0	859.54	89	80	64
25		4.0	2.0	863.43	92	81	59
30		4.0	2.0	867.35	96	82	59
35	910			871.266			

2250 475 51.9

USEPA Method 4 Field Sampling Data Sheet

Company: Republic - OCFL
Source Designation: Enclosed Flare

Test Date: 6/16/22
Test Number: 2
Operator: BB/AE
Bar. Press (Pb): 29.236

Meter Number: N-1
Kiso: 1749.954
Delta H@: 1.898
Meter Yd: 1.0216
Assumed H2O: 7%

Leak Rate Initial: 0 @ 5 "
Leak Rate Final: 0 @ 7 "

Moisture Data			
Impinger	Initial (g / mL)	Final (g / mL)	Net Gain (g / mL)
1 - Modified	740.8	784.7	43.9
2 - Standard	706.1	712.5	6.4
3 - Modified	602.0	602.9	0.9
4			
5			
Silica Gel	1027.3	1032.5	5.2
Cond.Vol. (Vlc-1)		51.2	(g / mL)
SG Gain (Vlc-2)		5.2	(g / mL)

Sampling Time (Min) ø	Time (24 hour)	Train Vacuum ("Hg)	Orifice Differential ("H2O) DH	Sample Volume (ft3) Vm	DGM Temp. Inlet (°F) Tm	DGM Temp. Outlet (°F) Tm	Last Imp. Temp. (°F)
0	1045	4.0	2.0	871.456	82	81	62
5		4.0	2.0	675.30	82	81	60
10		4.0	2.0	879.30	93	82	59
15		4.0	2.0	883.08	91	83	57
20		4.0	2.0	886.95	91	83	58
25		4.0	2.0	890.72	99	86	63
30		4.0	2.0	894.92	98	85	59
35	1120	-	-	898.563	-	-	-

USEPA Method 4 Field Sampling Data Sheet

Company: Republic - CCFL
Source Designation: Enclosed Flare

Test Date: 6/16/22
Test Number: 3
Operator: BB/AE
Bar. Press (Pb): 29.29

Meter Number: N-1
Kiso: 1749.954
Delta H@: 1.898
Meter Yd: 1.0216
Assumed H2O: 7%

Leak Rate Initial: 00 @ 7 "
Leak Rate Final: 00 @ 9 "

Moisture Data			
Impinger	Initial (g / mL)	Final (g / mL)	Net Gain (g / mL)
1 - Modified	784.7	826.8	42.1
2 - Standard	712.5	715.5	3
3 - Modified	602.9	603.9	1
4			-
5			
Silica Gel	1032.5	1041.7	9.2
Cond.Vol. (Vlc-1)		46.1	(g / mL)
SG Gain (Vlc-2)		9.2	(g / mL)

(Min) ø	Sampling Time Time (24 hour)	Train Vacuum ("Hg)	Orifice Differential ("H2O) DH	Sample Volume (ft3) Vm	DGM Temp. Inlet (°F) Tm	DGM Temp. Outlet (°F) Tm	Last Imp. Temp. (°F)
0	1250	4.0	2.0	898.891	90	65	67
5	1355	4.0	2.0	902.80	89	88	67
10		4.0	2.0	906.80	90	88	62
15		4.0	2.0	910.83	93	89	60
20		4.0	2.0	914.75	94	89	60
25		4.0	2.0	918.72	96	90	59
30		4.0	2.0	922.70	99	91	60
35	~~1325~~	-	-	927.74	-	-	-

Paused #4 bridge

APPENDIX 4

- Air Pollutant Calculation Sheets

EPA Method 10 CO Calculation Summary

Company: OCFL
Location: Coopersville, MI
Source: EUENCLOSEDFLARE
Date: 6/16/2022

		Test 1	Test 2	Test 3	
Average CO concentration	=	2.59	0.68	4.46	ppmvd
Average pre-test and post-test instrument zero	=	0.44	0.47	0.44	ppmvd
Average pre-test and post-test instrument calibration	=	151	152	151	ppmvd
Midrange calibration gas concentration	=	147	147	147	ppmvd
Volumetric flow rate	=	30,853	26,646	27,881	dscfm

CO CONCENTRATION CORRECTED FOR CALIBRATION AND ZERO DRIFT

C_d = (CO conc.-Avg. zero)x(Cal. gas conc.)/(Avg. cal.-Avg. zero) =	2.10	0.21	3.93	ppmvd

CO EMISSION RATE

$E_{CO} = (C_d)\ (Q_dstd)\ (60\ min/hr)\ (MW_{CO}) / (V_M)$ =	0.28	0.02	0.48	lb/hr

where:
C_d = observed CO concentration, dry basis (ft^3 CO / 10^6 ft^3 stack gas)
Q_dstd = stack gas flowrate (dscfm)
MW_{CO} = molecular weight CO (28.0 lb/lb-mol)
V_M = molar volume of ideal gas at std conditions (385 ft^3/lb-mol)

HE = (CH4) (909 Btu/scf) (GF) / (1,000,000 Btu) (60 min/hr) =	63.5	62.1	57.8	MMBtu

where:
CH4 = Methane content of gas to flare (%)
GF = Gas flow to flare (scfm)

(ECO) / HE =	0.0045	0.0004	0.0083	lb/MMBtu

where:
ECO = CO emission rate (lb/hr)
HE = Heat energy of gas to flare

EPA Method 3A O_2 Calculation Summary

Company: OCFL
Location: Coopersville, MI
Source: EUENCLOSEDFLARE
Date: 6/16/2022

		Test 1	Test 2	Test 3	
Average O_2 concentration	=	14.5	14.1	14.5	%
Average pre-test and post-test instrument zero	=	0.34	0.22	0.21	%
Average pre-test and post-test instrument calibration	=	10.6	10.6	10.5	%
Midrange calibration gas concentration	=	10.5	10.5	10.5	%
Volumetric flow rate	=	30,853	26,646	27,881	dscfm

O_2 CONCENTATION CORRECTED FOR CALIBRATION AND ZERO DRIFT

(O_2 conc.-Avg. zero)x(Cal. gas conc.)/(Avg. cal.-Avg. zero)	=	14.4	14.0	14.6	%

EPA Method 3A CO_2 Calculation Summary

Company: OCFL
Location: Coopersville, MI
Source: EUENCLOSEDFLARE
Date: 6/16/2022

		Test 1	Test 2	Test 3	
Average CO_2 concentration	=	5.81	5.97	5.56	%
Average pre-test and post-test instrument zero	=	0.03	0.03	0.02	%
Average pre-test and post-test instrument calibration	=	11.3	11.2	11.2	%
Midrange calibration gas concentration	=	11.8	11.8	11.8	%
Volumetric flow rate	=	30,853	26,646	27,881	dscfm

CO_2 CONCENTATION CORRECTED FOR CALIBRATION AND ZERO DRIFT

(CO_2 conc.-Avg. zero)x(Cal. gas conc.)/(Avg. cal.-Avg. zero) =		6.04	6.26	5.84	%

APPENDIX 5

- Instrumental Analyzer Raw Data

Date	Hour	CO	CO2	O2
06/15/22	12:50	715.7	4.97	5.13
06/15/22	12:51	41.38	0	0.09
06/15/22	12:52	633.72	17.76	15.29
06/15/22	12:53	1712.85	23.55	21.22
06/15/22	12:54	1737.76	23.57	21.23
06/15/22	12:55	1741.27	23.65	21.31

M205 Divider Certification - Oxygen

06/15/22	12:56	1733.84	24.01	21.33
06/15/22	12:57	1522.69	16.56	15.14
06/15/22	12:58	1105.94	14.16	12.61
06/15/22	12:59	1092.47	13.2	11.91
06/15/22	13:00	845.57	9.51	8.32
06/15/22	13:01	941.97	17.47	14.94
06/15/22	13:02	1668.85	23.99	21.31
06/15/22	13:03	1720.14	24.01	21.31
06/15/22	13:04	1701.92	21.26	19.28
06/15/22	13:05	1202.79	14.18	12.6
06/15/22	13:06	1085.79	14.16	12.59
06/15/22	13:07	907.45	9.62	8.6
06/15/22	13:08	770.48	9.51	8.31
06/15/22	13:09	768.14	9.5	8.3
06/15/22	13:10	767.23	9.5	8.3
06/15/22	13:11	767.75	9.49	8.3
06/15/22	13:12	1008.84	18.94	16.23
06/15/22	13:13	1668.4	24	21.31
06/15/22	13:14	1614.85	19.1	17.37
06/15/22	13:15	1121.33	14.16	12.6
06/15/22	13:16	1019.58	11.51	10.35
06/15/22	13:17	772.47	9.51	8.31
06/15/22	13:18	762.73	9.5	8.3
06/15/22	13:19	762.81	9.5	8.3
06/15/22	13:20	592.16	4.42	14.79
06/15/22	13:21	70.01	0.12	15.94
06/15/22	13:22	13.75	0.08	12.73
06/15/22	13:23	1.36	0.05	12.63
06/15/22	13:24	1.43	0.05	9.59
06/15/22	13:25	1.54	0.05	4.98
06/15/22	13:26	1.19	0.03	12.61
06/15/22	13:27	0.84	0.03	12.61
06/15/22	13:28	0.84	0.03	12.61
06/15/22	13:29	0.91	0.03	7.5
06/15/22	13:30	0.47	0.02	0.01
06/15/22	13:31	0.31	0.02	0.01
06/15/22	13:32	0.32	0.02	0.01
06/15/22	13:33	1.69	0.03	11.63
06/15/22	13:34	0.82	0.02	12.59

06/15/22	13:35	0.81	0.02	12.58
06/15/22	13:36	50.94	2.15	8.58
06/15/22	13:37	378.76	4.71	4.07
06/15/22	13:38	398.57	4.73	4.07
06/15/22	13:39	309.48	4.73	4.07
06/15/22	13:40	291.52	4.74	4.07

Test ID	Time	CO	CO2	O2
EF T1	0835-1012	2.59	5.81	14.47
EF T2	1045-1215	0.68	5.97	14.09
EF T3	1335-1509	4.46	5.56	14.51

Date	Hour	CO	CO2	O2
06/16/22	06:55	11.59	0.1	0
06/16/22	06:56	-0.02	0.07	0.01
06/16/22	06:57	181.46	12.62	10.66
06/16/22	06:58	892.44	23.74	21.27
06/16/22	06:59	940.64	23.95	21.33
06/16/22	07:00	942.25	22.7	20.57
06/16/22	07:01	646.9	11.72	10.47
06/16/22	07:02	500.61	10.19	9.28
06/16/22	07:03	281.16	4.76	4.14
06/16/22	07:04	261.52	4.74	4.13
06/16/22	07:05	294.41	4.74	4.12
06/16/22	07:06	295.13	4.74	4.12
06/16/22	07:07	292.86	4.47	3.94
06/16/22	07:08	187.35	2.49	2.05
06/16/22	07:09	150.68	2.48	2.04
06/16/22	07:10	150.51	2.48	2.04
06/16/22	07:11	109.81	0.81	0.77
06/16/22	07:12	1.44	0.02	0
06/16/22	07:13	0.51	0.02	0
06/16/22	07:14	1.1	0.07	15.8
06/16/22	07:15	2	0.08	21.2
06/16/22	07:16	2.26	0.08	21.2
06/16/22	07:17	2.01	0.08	21.2
06/16/22	07:18	2.75	0.07	21.21
06/16/22	07:19	3.04	0.07	21.21
06/16/22	07:20	3.05	0.07	21.22
06/16/22	07:21	2.62	0.08	21.22
06/16/22	07:22	2.7	0.08	21.22
06/16/22	07:23	2.5	0.08	21.22
06/16/22	07:24	3.37	0.07	21.22
06/16/22	07:25	3.48	0.07	21.23
06/16/22	07:26	44.37	2.21	18.98
06/16/22	07:27	492.56	11.23	10.64
06/16/22	07:28	646.83	11.38	10.53
06/16/22	07:29	622.51	8.48	7.88
06/16/22	07:30	215.02	2.5	2.4
06/16/22	07:31	148.26	2.45	2.37
06/16/22	07:32	137.03	1.6	1.68
06/16/22	07:33	13.73	0.07	0.39
06/16/22	07:34	0.97	0.05	0.39

06/16/22	07:35	0.73	0.04	0.39
06/16/22	07:36	0.44	0.03	0.39
06/16/22	07:37	0.45	0.04	5.55
06/16/22	07:38	1.01	0.08	20.04
06/16/22	07:39	1.15	0.08	20.13
06/16/22	07:40	0.96	0.08	20.16
06/16/22	07:41	0.95	0.08	20.2
06/16/22	07:42	0.96	0.08	20.66
06/16/22	07:43	1.27	0.08	21.19
06/16/22	07:44	1.92	0.08	21.21
06/16/22	07:45	0.97	0.08	21.22
06/16/22	07:46	1.21	0.08	21.23
06/16/22	07:47	0.97	0.08	21.23
06/16/22	07:48	0.97	0.08	21.24
06/16/22	07:49	0.98	0.08	21.24
06/16/22	07:50	0.98	0.08	21.24
06/16/22	07:51	0.96	0.08	21.25
06/16/22	07:52	0.98	0.08	21.25
06/16/22	07:53	1.46	0.08	21.25
06/16/22	07:54	1.16	0.08	21.25
06/16/22	07:55	0.97	0.08	21.25
06/16/22	07:56	0.96	0.07	21.25
06/16/22	07:57	1.05	0.08	21.25
06/16/22	07:58	0.97	0.07	21.25
06/16/22	07:59	1.3	0.08	21.25
06/16/22	08:00	1.29	0.08	21.25
06/16/22	08:01	1.65	0.08	21.25
06/16/22	08:02	5.89	0.09	21.24
06/16/22	08:03	4.35	0.08	21.25
06/16/22	08:04	2.22	0.08	21.25
06/16/22	08:05	3.9	0.08	21.25
06/16/22	08:06	3.49	0.08	21.25
06/16/22	08:07	4.57	0.08	21.25
06/16/22	08:08	4.33	0.08	21.25
06/16/22	08:09	3.08	0.07	21.25
06/16/22	08:10	2.03	0.07	21.25
06/16/22	08:11	0.97	0.07	21.25
06/16/22	08:12	0.96	0.07	21.25
06/16/22	08:13	0.95	0.07	21.25
06/16/22	08:14	1.34	2.78	18.07
06/16/22	08:15	1.87	5.91	14.28
06/16/22	08:16	1.61	5.69	14.57
06/16/22	08:17	2.3	5.53	14.77
06/16/22	08:18	5.53	5.33	15.03
06/16/22	08:19	3.93	5.57	14.73
06/16/22	08:20	1.46	5.53	14.78
06/16/22	08:21	1.99	1.89	19.11
06/16/22	08:22	1.23	0.12	21.21

06/16/22	08:23	0.96	0.1	21.23
06/16/22	08:24	0.96	0.09	21.23
06/16/22	08:25	0.97	0.08	21.23
06/16/22	08:26	0.97	0.08	21.23
06/16/22	08:27	0.96	3.38	17.34
06/16/22	08:28	2.31	5.72	14.5
06/16/22	08:29	3.64	5.58	14.7
06/16/22	08:30	2.54	5.53	14.78
06/16/22	08:31	1.4	5.59	14.7
06/16/22	08:32	0.95	5.57	14.72
06/16/22	08:33	1.03	5.5	14.82
06/16/22	08:34	1.38	5.49	14.82

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06/16/22	08:35	2.55	5.47	14.85
06/16/22	08:36	1.29	5.47	14.86
06/16/22	08:37	1.14	5.5	14.82
06/16/22	08:38	2.71	5.43	14.91
06/16/22	08:39	2.26	5.48	14.85
06/16/22	08:40	0.97	5.46	14.85
06/16/22	08:41	0.98	5.54	14.77
06/16/22	08:42	1.44	5.47	14.85
06/16/22	08:43	2.09	5.53	14.78
06/16/22	08:44	2.02	5.6	14.69
06/16/22	08:45	1.78	5.6	14.69
06/16/22	08:46	2.12	5.63	14.65
06/16/22	08:47	2.55	5.75	14.5
06/16/22	08:48	3.01	5.68	14.59
06/16/22	08:49	1.28	5.55	14.75
06/16/22	08:50	0.96	4.55	16.01

Paused for Port Change

06/16/22	08:51	0.97	4.34	16.19
06/16/22	08:52	0.97	0.16	21.16
06/16/22	08:53	0.98	0.11	21.21
06/16/22	08:54	0.97	0.09	21.22
06/16/22	08:55	0.96	0.08	21.23
06/16/22	08:56	1.47	0.08	21.23
06/16/22	08:57	1.24	0.08	21.23
06/16/22	08:58	1.14	1.71	19.34

Resumed

06/16/22	08:59	1.46	6.05	14.11
06/16/22	09:00	2.01	5.81	14.4
06/16/22	09:01	2.49	5.76	14.48
06/16/22	09:02	2.53	5.7	14.56
06/16/22	09:03	2.68	5.66	14.61
06/16/22	09:04	3.04	5.7	14.57
06/16/22	09:05	3.05	5.72	14.54
06/16/22	09:06	3.04	5.75	14.51

06/16/22	09:07	2.96	5.85	14.38
06/16/22	09:08	3.02	5.95	14.27
06/16/22	09:09	2.56	6.33	13.86
06/16/22	09:10	2.01	6.43	13.76
06/16/22	09:11	2.02	6.78	13.38
06/16/22	09:12	1.75	6.97	13.18
06/16/22	09:13	1.46	6.93	13.21
06/16/22	09:14	1.46	7.03	13.12
	Paused for Port Change			
06/16/22	09:15	1.46	7.14	12.97
06/16/22	09:16	1.47	1.24	19.9
06/16/22	09:17	1.45	0.13	21.2
06/16/22	09:18	1.46	0.58	20.72
06/16/22	09:19	1.47	6.48	13.68
	Resumed			
06/16/22	09:20	1.97	6.3	13.88
06/16/22	09:21	2.01	6.15	14.05
06/16/22	09:22	2.02	6.09	14.12
06/16/22	09:23	2.01	6	14.21
06/16/22	09:24	2	6	14.21
06/16/22	09:25	2.01	6.04	14.17
06/16/22	09:26	2.42	6.01	14.19
06/16/22	09:27	2.23	6.13	14.07
06/16/22	09:28	2.33	6.07	14.13
06/16/22	09:29	2.49	6.38	13.81
06/16/22	09:30	2.4	6.37	13.82
06/16/22	09:31	2.43	6.27	13.93
06/16/22	09:32	2	6.28	13.92
06/16/22	09:33	2	6.72	13.46
06/16/22	09:34	2.01	6.97	13.18
06/16/22	09:35	2	7.03	13.11
	Paused for Port Change			
06/16/22	09:36	1.84	6.82	13.35
06/16/22	09:37	1.47	1.47	19.63
06/16/22	09:38	1.46	0.14	21.19
06/16/22	09:39	1.46	0.11	21.21
06/16/22	09:40	1.07	0.1	21.22
06/16/22	09:41	0.96	0.1	21.22
06/16/22	09:42	0.96	0.09	21.23
06/16/22	09:43	0.97	0.09	21.23
06/16/22	09:44	1.37	0.09	21.23
06/16/22	09:45	1.05	0.09	21.23
06/16/22	09:46	1.86	0.09	21.24
06/16/22	09:47	1.71	0.09	21.23
06/16/22	09:48	6.41	0.08	21.24
06/16/22	09:49	2.05	0.08	21.24
06/16/22	09:50	0.96	0.08	21.24

06/16/22	09:51	0.95	0.08	21.24
06/16/22	09:52	1.1	0.08	21.24
06/16/22	09:53	1.46	0.08	21.24
06/16/22	09:54	1.22	0.08	21.24
06/16/22	09:55	0.95	3.39	17.36
		Resumed		
06/16/22	09:56	3.14	5.6	14.7
06/16/22	09:57	1.64	5.36	15.01
06/16/22	09:58	8.47	5.26	15.15
06/16/22	09:59	6.73	5.25	15.15
06/16/22	10:00	5.71	5.29	15.1
06/16/22	10:01	4.54	5.22	15.19
06/16/22	10:02	3.55	5.32	15.07
06/16/22	10:03	5.58	5.28	15.12
06/16/22	10:04	3.55	5.22	15.19
06/16/22	10:05	4.67	5.23	15.17
06/16/22	10:06	5.57	5.22	15.19
06/16/22	10:07	4.43	5.36	15.01
06/16/22	10:08	2.06	5.35	15.04
06/16/22	10:09	3.41	5.3	15.09
06/16/22	10:10	1.79	5.34	15.05
06/16/22	10:11	1.52	5.37	15.01
06/16/22	10:12	1.21	5.43	14.94
06/16/22	10:13	31.67	6.84	13.93
06/16/22	10:14	588.88	11.25	10.67
06/16/22	10:15	669.23	11.29	10.65
06/16/22	10:16	567.55	6.95	6.68
06/16/22	10:17	233.1	2.76	2.84
06/16/22	10:18	153.52	2.44	2.53
06/16/22	10:19	152.96	2.42	2.49
06/16/22	10:20	143.87	1.62	1.82
06/16/22	10:21	14.91	0.07	0.5
06/16/22	10:22	0.95	0.05	0.37
06/16/22	10:23	0.94	0.04	0.32
06/16/22	10:24	0.72	0.03	0.28
06/16/22	10:25	0.43	0.03	0.27
06/16/22	10:26	0.43	0.03	0.25
06/16/22	10:27	0.43	0.03	0.51
06/16/22	10:28	0.75	0.07	17.69
06/16/22	10:29	0.95	0.07	19.98
06/16/22	10:30	2.51	0.07	20.03
06/16/22	10:31	3.5	0.07	20.05
06/16/22	10:32	0.95	0.07	20.07
06/16/22	10:33	0.65	0.07	20.89
06/16/22	10:34	0.94	0.07	21
06/16/22	10:35	0.95	0.07	21.01
06/16/22	10:36	0.96	0.07	21.02

06/16/22	10:37	0.54	0.07	21.02
06/16/22	10:38	0.7	0.07	21.03
06/16/22	10:39	0.87	0.07	21.03
06/16/22	10:40	0.96	0.07	21.03
06/16/22	10:41	0.96	0.07	21.03
06/16/22	10:42	0.88	0.07	21.03
06/16/22	10:43	0.52	0.07	21.03
06/16/22	10:44	0.63	4.21	16.16

EUENCLOSEDFLARE, Test No. 2

06/16/22	10:45	2.35	5.72	14.32
06/16/22	10:46	3.29	5.59	14.51
06/16/22	10:47	1.43	5.56	14.55
06/16/22	10:48	1.74	5.55	14.56
06/16/22	10:49	0.73	5.5	14.63
06/16/22	10:50	0.79	5.51	14.61
06/16/22	10:51	2.8	5.54	14.59
06/16/22	10:52	0.72	5.64	14.45
06/16/22	10:53	1.12	5.7	14.37
06/16/22	10:54	1.47	5.67	14.41
06/16/22	10:55	1.04	5.71	14.37
06/16/22	10:56	0.44	5.73	14.34
06/16/22	10:57	0.45	5.79	14.26
06/16/22	10:58	0.77	5.83	14.21
06/16/22	10:59	0.46	5.46	14.69
06/16/22	11:00	0.45	5.56	14.56

Paused for Port Change

06/16/22	11:01	0.45	4.53	15.77
06/16/22	11:02	0.46	1.32	19.65
06/16/22	11:03	0.39	6.46	13.51

Resumed

06/16/22	11:04	0.45	6.29	13.71
06/16/22	11:05	0.45	6.28	13.72
06/16/22	11:06	0.44	6.25	13.76
06/16/22	11:07	0.44	6.29	13.71
06/16/22	11:08	0.44	6.31	13.7
06/16/22	11:09	0.44	6.49	13.51
06/16/22	11:10	0.45	6.68	13.3
06/16/22	11:11	0.44	6.68	13.31
06/16/22	11:12	0.45	6.61	13.38
06/16/22	11:13	0.42	6.93	13.03
06/16/22	11:14	0.28	7.09	12.85
06/16/22	11:15	0.32	7.1	12.85
06/16/22	11:16	0.43	6.9	13.07
06/16/22	11:17	0.43	7.28	12.64
06/16/22	11:18	0.43	7.01	12.94
06/16/22	11:19	0.43	7.12	12.83

Paused for Port Change

06/16/22	11:20	0.42	5.27	14.97
06/16/22	11:21	0.51	0.18	20.95
06/16/22	11:22	0.75	0.12	20.99
06/16/22	11:23	0.53	0.11	21.01
06/16/22	11:24	0.43	2.89	17.75
		Resumed		
06/16/22	11:25	0.44	6.16	13.81
06/16/22	11:26	0.43	5.92	14.09
06/16/22	11:27	0.45	5.9	14.12
06/16/22	11:28	0.44	5.92	14.1
06/16/22	11:29	0.45	5.97	14.05
06/16/22	11:30	0.44	5.87	14.16
06/16/22	11:31	0.44	5.87	14.16
06/16/22	11:32	0.45	5.83	14.21
06/16/22	11:33	0.45	6.02	13.99
06/16/22	11:34	0.5	6.05	13.96
06/16/22	11:35	0.96	6.25	13.75
06/16/22	11:36	0.45	6.31	13.69
06/16/22	11:37	0.84	6.32	13.68
06/16/22	11:38	0.46	6.66	13.31
06/16/22	11:39	0.5	6.65	13.33
06/16/22	11:40	0.93	6.84	13.12
		Paused for Port Change		
06/16/22	11:41	0.62	6.79	13.19
06/16/22	11:42	0.8	0.37	20.72
06/16/22	11:43	1.05	0.13	20.97
06/16/22	11:44	1.03	0.11	20.99
06/16/22	11:45	1.02	0.1	21
06/16/22	11:46	0.7	0.09	21
06/16/22	11:47	0.81	0.09	21.01
06/16/22	11:48	1.02	0.09	21.01
06/16/22	11:49	1.47	0.08	21.01
06/16/22	11:50	1.09	0.08	21.01
06/16/22	11:51	5.6	0.08	21.01
06/16/22	11:52	2.89	0.08	21.02
06/16/22	11:53	1.19	0.08	21.02
06/16/22	11:54	1.02	0.08	21.02
06/16/22	11:55	1	0.08	21.02
06/16/22	11:56	1.02	0.08	21.02
06/16/22	11:57	1.01	0.08	21.02
06/16/22	11:58	0.96	5.27	14.89
06/16/22	11:59	0.48	5.59	14.49
		Resumed		
06/16/22	12:00	0.5	5.43	14.7
06/16/22	12:01	0.49	5.45	14.67
06/16/22	12:02	0.5	5.37	14.79
06/16/22	12:03	0.44	5.38	14.78

06/16/22	12:04	0.5	5.42	14.72
06/16/22	12:05	0.49	5.33	14.83
06/16/22	12:06	0.5	5.31	14.85
06/16/22	12:07	0.53	5.35	14.81
06/16/22	12:08	0.51	5.35	14.81
06/16/22	12:09	0.51	5.34	14.82
06/16/22	12:10	0.51	5.34	14.82
06/16/22	12:11	0.51	5.43	14.7
06/16/22	12:12	0.52	5.29	14.89
06/16/22	12:13	0.53	5.37	14.79
06/16/22	12:14	0.52	5.44	14.69
06/16/22	12:15	0.44	5.53	14.58
06/16/22	12:16	0.44	4.33	16
06/16/22	12:17	8.77	2.15	18.84
06/16/22	12:18	512.12	11.11	10.56
06/16/22	12:19	655.38	11.21	10.52
06/16/22	12:20	627.44	8.22	7.73
06/16/22	12:21	218.47	2.47	2.45
06/16/22	12:22	150.2	2.42	2.38
06/16/22	12:23	149.88	2.4	2.35
06/16/22	12:24	143.14	1.69	1.74
06/16/22	12:25	19.4	0.06	0.38
06/16/22	12:26	1.02	0.04	0.37
06/16/22	12:27	0.53	0.03	0.29
06/16/22	12:28	0.51	0.02	0.27
06/16/22	12:29	0.5	0.02	0.21
06/16/22	12:30	0.51	0.02	0.15
06/16/22	12:31	0.5	0.02	0.14
06/16/22	12:32	0.49	0.02	0.13
06/16/22	12:33	0.41	0.04	7.88
06/16/22	12:34	0.47	0.07	19.89
06/16/22	12:35	0.83	0.07	19.97
06/16/22	12:36	1.23	0.07	19.99
06/16/22	12:37	0.95	0.07	20.01
06/16/22	12:38	0.75	0.07	20.5
06/16/22	12:39	1.11	0.07	20.95
06/16/22	12:40	0.4	0.07	20.97
06/16/22	12:41	0.39	0.07	20.98
06/16/22	12:42	0.39	0.07	20.99
06/16/22	12:43	0.4	0.07	20.99
06/16/22	12:44	0.4	0.07	21
06/16/22	12:45	0.41	0.07	21
06/16/22	12:46	0.41	0.07	21
06/16/22	12:47	0.4	0.07	21
06/16/22	12:48	0.4	4.23	16.13
06/16/22	12:49	0.41	6.03	13.94
06/16/22	12:50	0.26	5.88	14.13

06/16/22	12:51	-0.11	5.76	14.28
06/16/22	12:52	-0.11	5.67	14.39
06/16/22	12:53	-0.09	5.64	14.43
06/16/22	12:54	-0.08	5.63	14.45
06/16/22	12:55	-0.1	5.67	14.39
06/16/22	12:56	-0.01	5.69	14.37
06/16/22	12:57	0.11	5.53	14.58
06/16/22	12:58	0.28	5.72	14.33
06/16/22	12:59	0.38	5.67	14.4
06/16/22	13:00	0.15	5.72	14.33
06/16/22	13:01	0.41	5.7	14.36
06/16/22	13:02	-0.05	5.69	14.37
06/16/22	13:03	-0.08	5.66	14.41
06/16/22	13:04	-0.1	5.73	14.31
06/16/22	13:05	130.68	4.63	-3.55
06/16/22	13:06	-23.07	2.49	3.38
06/16/22	13:07	0.76	5.7	14.35
06/16/22	13:08	-0.08	5.61	14.47
06/16/22	13:09	0.06	5.55	14.55
06/16/22	13:10	1.13	2.26	1.68
06/16/22	13:11	-35.75	-0.24	2.12
06/16/22	13:12	38.38	-0.56	-1.01
06/16/22	13:13	-11.06	-3.44	-0.34
06/16/22	13:14	50.82	3.52	-1.68
06/16/22	13:15	-114.14	5.36	7.67
06/16/22	13:16	-33.37	3.58	12.95
06/16/22	13:17	46.76	5.73	14.32
06/16/22	13:18	0.31	5.78	14.25
06/16/22	13:19	0.39	5.7	14.35
06/16/22	13:20	0.39	5.8	14.23
06/16/22	13:21	0.4	5.78	14.26
06/16/22	13:22	0.4	5.59	14.5
06/16/22	13:23	0.42	5.38	14.76
06/16/22	13:24	0.4	5.46	14.65
06/16/22	13:25	0.35	5.62	14.46
06/16/22	13:26	0.14	5.61	14.47
06/16/22	13:27	-0.11	5.65	14.42
06/16/22	13:28	-0.1	5.61	14.47
06/16/22	13:29	-0.08	5.48	14.63
06/16/22	13:30	-0.09	5.51	14.59
06/16/22	13:31	0.37	5.53	14.57
06/16/22	13:32	0.4	5.77	14.26
06/16/22	13:33	0.14	5.74	14.3
06/16/22	13:34	1.79	5.52	14.58
EUENCLOSEDFLARE, Test No. 3				
06/16/22	13:35	2.57	5.57	14.51
06/16/22	13:36	1.04	5.62	14.44

06/16/22	13:37	0.46	5.62	14.44
06/16/22	13:38	0.98	5.55	14.53
06/16/22	13:39	6.05	5.4	14.73
06/16/22	13:40	1.2	5.3	14.84
06/16/22	13:41	0.94	5.35	14.78
06/16/22	13:42	1.66	5.41	14.7
06/16/22	13:43	0.79	5.53	14.55
06/16/22	13:44	0.41	5.59	14.47
06/16/22	13:45	-0.12	5.65	14.39
06/16/22	13:46	0.28	5.58	14.49
06/16/22	13:47	0.42	5.55	14.53
06/16/22	13:48	0.48	5.58	14.48
06/16/22	13:49	0.48	5.7	14.34
06/16/22	13:50	0.38	5.76	14.26
	Paused for Port Change			
06/16/22	13:51	0.48	5.4	14.68
06/16/22	13:52	0.46	0.23	20.83
06/16/22	13:53	0.47	0.11	20.94
06/16/22	13:54	0.49	0.09	20.96
06/16/22	13:55	0.47	0.08	20.96
06/16/22	13:56	0.47	0.07	20.97
06/16/22	13:57	0.47	0.07	20.97
06/16/22	13:58	0.48	0.07	20.97
06/16/22	13:59	0.24	5.2	14.94
	Resumed			
06/16/22	14:00	0.47	5.82	14.15
06/16/22	14:01	0.49	5.68	14.34
06/16/22	14:02	0.35	5.69	14.33
06/16/22	14:03	0.39	5.67	14.35
06/16/22	14:04	0.35	5.74	14.26
06/16/22	14:05	0.14	5.64	14.4
06/16/22	14:06	0.06	5.71	14.3
06/16/22	14:07	1.66	5.56	14.5
06/16/22	14:08	0.94	5.49	14.58
06/16/22	14:09	1.06	5.47	14.61
06/16/22	14:10	0.86	5.67	14.36
06/16/22	14:11	0.73	5.76	14.24
06/16/22	14:12	0.72	5.9	14.09
06/16/22	14:13	0.83	6.12	13.85
06/16/22	14:14	0.67	6.14	13.82
06/16/22	14:15	0.63	6.04	13.93
	Paused for Port Change			
06/16/22	14:16	0.52	3.99	16.36
06/16/22	14:17	0.49	0.15	20.9
06/16/22	14:18	2.63	2.93	17.64
06/16/22	14:19	13.81	5.8	14.18
	Resumed			

06/16/22	14:20	10.05	5.71	14.3
06/16/22	14:21	6.76	5.6	14.44
06/16/22	14:22	19.95	5.68	14.35
06/16/22	14:23	8.24	5.76	14.23
06/16/22	14:24	4.25	5.79	14.2
06/16/22	14:25	5.67	5.7	14.31
06/16/22	14:26	6.48	5.7	14.32
06/16/22	14:27	5.54	5.86	14.12
06/16/22	14:28	3.2	5.9	14.06
06/16/22	14:29	3.22	5.8	14.18
06/16/22	14:30	2.15	5.83	14.15
06/16/22	14:31	3.25	6.01	13.97
06/16/22	14:32	4.57	5.82	14.18
06/16/22	14:33	1.25	6.11	13.85
06/16/22	14:34	0.97	6.43	13.51
06/16/22	14:35	0.27	6.41	13.52
	Paused for Port Change			
06/16/22	14:36	2.86	6.2	13.75
06/16/22	14:37	1.69	4.06	16.28
06/16/22	14:38	0.51	0.15	20.9
06/16/22	14:39	0.49	0.1	20.94
06/16/22	14:40	0.43	0.09	20.95
06/16/22	14:41	0.47	0.08	20.95
06/16/22	14:42	0.47	0.08	20.95
06/16/22	14:43	0.49	0.08	20.96
06/16/22	14:44	0.48	0.07	20.96
06/16/22	14:45	0.49	0.07	20.96
06/16/22	14:46	0.48	0.07	20.96
06/16/22	14:47	0.64	0.07	20.96
06/16/22	14:48	1.68	0.07	20.96
06/16/22	14:49	0.64	0.07	20.96
06/16/22	14:50	0.5	0.07	20.96
06/16/22	14:51	0.45	0.07	20.96
06/16/22	14:52	0.41	0.09	20.93
06/16/22	14:53	26.61	5.07	15.1
	Resumed			
06/16/22	14:54	26.24	5.09	15.06
06/16/22	14:55	14.85	5.05	15.12
06/16/22	14:56	7.22	4.97	15.21
06/16/22	14:57	21.22	4.95	15.24
06/16/22	14:58	11.49	4.94	15.24
06/16/22	14:59	29.14	4.85	15.36
06/16/22	15:00	19.74	4.94	15.26
06/16/22	15:01	13.75	5.05	15.13
06/16/22	15:02	1.63	5.05	15.13
06/16/22	15:03	1.15	5.15	15
06/16/22	15:04	2.13	5.05	15.13

06/16/22	15:05	3.93	5.06	15.11
06/16/22	15:06	6.62	5.1	15.06
06/16/22	15:07	4.67	5.08	15.09
06/16/22	15:08	3.79	5.08	15.08
06/16/22	15:09	3.81	5.14	15.01
06/16/22	15:10	3.44	5.01	15.16
06/16/22	15:11	2.12	5.12	15.04
06/16/22	15:12	14.3	3.41	17.05
06/16/22	15:13	77.04	4.59	16
06/16/22	15:14	598.43	11.11	10.52
06/16/22	15:15	657	11.21	10.46
06/16/22	15:16	648.67	9.11	8.49
06/16/22	15:17	256.41	2.49	2.41
06/16/22	15:18	151.05	2.42	2.34
06/16/22	15:19	151.08	2.4	2.32
06/16/22	15:20	154.86	2.39	2.3
06/16/22	15:21	154.3	2.38	2.28
06/16/22	15:22	121.23	1.05	1.14
06/16/22	15:23	4.13	0.04	0.29
06/16/22	15:24	0.39	0.02	0.27
06/16/22	15:25	0.38	0.02	0.26
06/16/22	15:26	0.38	0.01	0.24
06/16/22	15:27	0.38	0.01	1.37
06/16/22	15:28	0.05	0.05	20.63
06/16/22	15:29	-0.12	0.05	20.93
06/16/22	15:30	-0.13	0.05	20.94

APPENDIX 6

- Test Equipment QA/QC Records

CALIBRATION SUMMARY

Company: Republic - OCFL
Location: Compressville, MI
Source Designation: Enclosed Flare
Date: 6/15/22
Operator(s): BB

Pre 1: Run High, Mid, Low, Zero, for CH_4, NMOC, THC
Run High, Mid, Low (Zero) Instrument Cal, and Mid, Zero Dynamic Cal for NOX, O2, CO, CO2, SO2

Cylinder ID	Analyte	Concentration	Unit
	CO/CO2/O2	1987/23.61/20.98	
	O2	12.49	

Test 1
Start Time: 0835
Stop Time: 1012
P1 | 835-850 | 1.82
P2 | 859-914 | 2.35
P3 | 920-935 | 2.15
P4 | 956-1012 | 3.98
2.58

Test 2
Start Time: 1045
Stop Time: 1215
P1 | 1045-1100 | 1.25
P2 | 1104-1119 | 0.42
P3 | 1125-1140 | 0.54
P4 | 1200-1215 | 0.50
0.68

Test 3
Start Time: ~~1252~~ 1335 AE
Stop Time: 1509
P1 | ~~1335-1350~~ ~~1250-1305~~ ~~1314-1334~~ | 9.03
P2 | 1400-1415 | 0.65
P3 | 1420-1435 | 5.36
P4 | 1454-1509 | 10.7

Time	Procedure	Response (ppm)	Exp. Value (ppm)	Notes
1256	O2 Inst	21.33	20.98	M20S
1258		12.61	12.59	
1300		8.32	8.39	
1303		21.31	20.98	
1305		12.60	12.59	
1310		8.30	8.39	
1313		21.31	20.98	
1315		12.60	12.59	
1318		8.30	8.39	
1323	O2 Inst	12.63	12.49	Direct Inject
1328		12.61	12.49	
1334		12.59	12.49	
	6/16/2022			
659	O2 Inst	21.33	20.98	
701		10.47	10.48	
712		0.00	Ø	
659	CO2 Inst	23.95	23.61	
701		11.72	11.81	
712		0.02	Ø	
706	CO Inst	295.13	293.4	
709		150.68	146.7	
713		0.51	Ø	
728	O2 Sys	10.53	10.47	Response Time (RT): 37s
736		0.39	Ø	
726	CO2 Sys	11.38	11.72	RT: 37s
736		0.03	Ø	
731	CO Sys	198.26	150.68	RT: 55s
736		0.44	Ø	
1014	O2 Sys	10.67	10.47	
1024		0.28	Ø	
1014	CO2 Sys	11.25	11.72	
1024		0.03	Ø	
1018	CO Sys	153.52	150.68	
1025		0.43	Ø	
1219	O2 Sys	10.52	10.47	
1230		0.15	Ø	
1219	CO2 Sys	11.21	11.72	
1231		0.02	Ø	
1222	CO Sys	150.20	150.68	
1231		0.50	Ø	
1515	O2 Sys	10.46	10.47	
1524		0.27	Ø	
1515	CO2 Sys	11.21	11.72	
1524		0.02	Ø	

Calibration Error = $(C_{dir} - C_v)/CS \times 100$ (must be ≤ 2%)
Bias (SB) = $(C_s - C_{dir})/CS * 100$ (must be ≤ 5%)
Calibration Drift = $(SB_f - SB_i)$ (must be ≤ 3%)

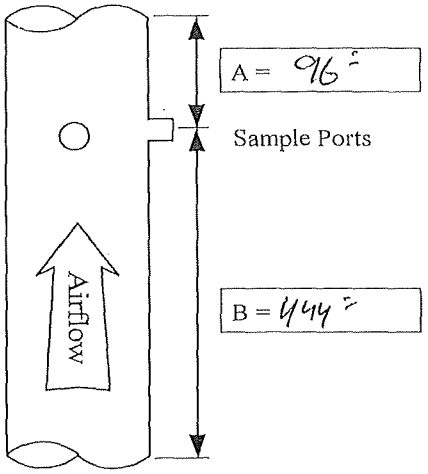
CO Sys	1518	151.05	150.68	
	1525	0.38	Ø	

USEPA Method 2
Gas Velocity Measurement Data Sheet

Company	Republic - OCFL	No. of Points	16
Source Designation	~~Capacitance~~ Enclosed Flare	Operator(s)	BB/AE
Test Date	6/16/22	Pitot Type	(Type S) or Standard
Test Number	Prelim	Pitot Identification	8F-I
Time (24-hr clock)	1500 - 1535	O_2 Content (%)	15%
Barometric Press. (in. Hg)	29.194	CO_2 Content (%)	5%
Static Pressure (in. H_2O)	-0.13	Wet Bulb Temp.	N/A

Inches from Stack Wall	Traverse Point Number	Stack Temperature (°F)	Velocity Head (in. H_2O)	Null Angel (zero angle)
4.22	1	~~1340~~ 1480	0.05	0
13.86	2	~~1340~~ 1462	0.05	0
25.61	3	~~1340~~ 1460	0.06	0
42.50	4	~~1340~~ 1465	0.06	0
~~89.36~~	1	1492	0.06	0
	2	"	0.06	0
	3	"	0.05	0
	4	"	0.05	0
	1	1526	0.08	0
	2	1525	0.07	0
	3	1525	0.07	0
	4	1525	0.07	0
	1	1525	0.07	0
	2	1525	0.05	0
	3	1525	0.05	0
	4	1525	0.05	0

Stack / Duct Measurements



Round Duct Dia. (D) 132"

Square Duct (LxW) ~~—~~ x

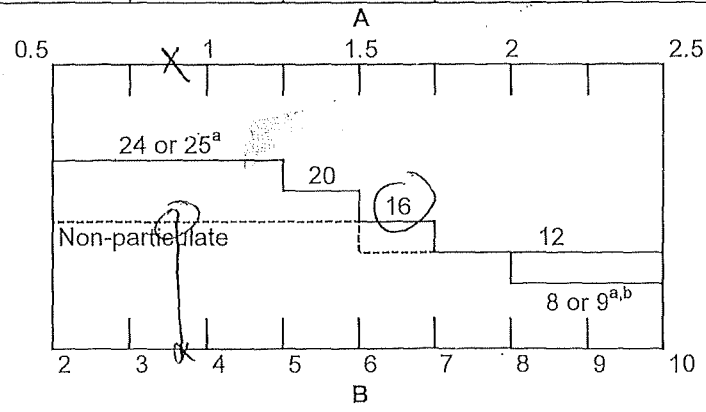
Square Duct Dia. (De): ~~—~~

De = 2LW / (L+W)

Straight Length: (diameters)

A / D ~~96~~ 0.73

B / D ~~444~~ = 3.36



a- Higher No. for rectanguar stacks

b- For stacks between 12 and 24 in.

Traverse Point	No. of Traverse Points Per Dia. 6	8	10	12
1	4.4	3.2	2.6	2.1
2	14.6	10.5	8.2	6.7
3	29.6	19.4	14.6	11.8
4	70.4	32.2	22.6	17.7
5	85.4	67.7	34.2	25.0
6	95.6	80.6	65.8	35.6
7		89.5	77.4	64.4
8		96.8	85.4	75.0
9			91.8	82.3
10			97.4	88.2
11				93.3
12				97.9

1575°F 1830 scfm

520% CH_4

Method 7E Stratification Testing Field Data Sheet

Facility: Republic - CCFL Date: _____

Source: _____ Operator: _____

	Point No. 1	Point No. 2	Point No. 3	Point 4 ~~Average~~	Average
Time	835-837	838-840	841-843	844-846	
Pollutant					
CO	1.66	1.98	1.50	1.97	1.78
CO_2	5.48	5.46	5.51	5.61	
O_2	14.8	14.9	14.8	14.7	

PITOT TUBE INSPECTION CRITERIA CHECKLIST

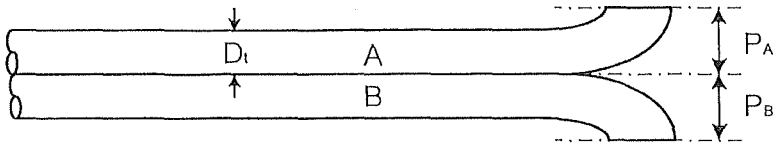
Tube #: 8F-I

Date: 6/15/2022

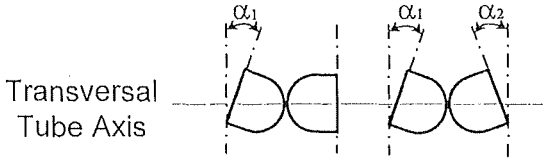
$3/16" \leq D_t \leq 3/8"$ — Yes / No

$P_A = P_B$ — Yes / No

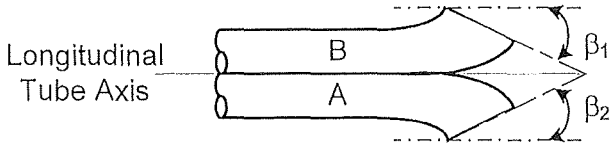
$1.05D_t \leq P_{A,B} \leq 1.5D_t$ — Yes / No



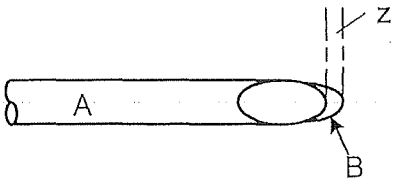
α_1 and $\alpha_2 < 10^o$ — Yes / No



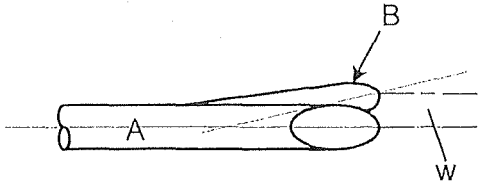
β_1 and $\beta_2 < 5^o$ — Yes / No



$z < 0.32$ cm — Yes / No



$w < 0.08$ cm — Yes / No



Pitot Tube Correction Factor: 0.84

Impact Compliance & Testing

Scale Calibration Sheet

Facility: OCFL

Scale ID: T-2

Source: Flare

Operator: AE

Expected (grams)	Date: 6/16/2022			Date:	
	Actual (g)	% Difference		Actual (g)	% Difference
2.0					
5.0	5.0				
10.0	9.9				
20.0	19.7				
50.0	49.7				
100.0	100.0				
200.0	199.7				
500.0	499.8				
1000.0	999.2				

METHOD 205 - DILUTION MODULE VERIFICATION

Date: 6/15/2022
Client: OCFL

Evaluate dilution module at two (2) dilutions within the range of the module. Repeat twice (total of 3 trials). Calculate average instrument response for each triplicate injection.

Gas used: 20.98 %, oxygen calibration gas

Divider Setting	Expected Concentration	Injection			Average	%Error	Individual Response Errors as Compared to Average		
		No. 1	No. 2	No. 3					
100%	20.98	21.33	21.31	21.31	21.32	1.60%	0.1%	0.0%	0.0%
60%	12.59	12.61	12.60	12.60	12.60	0.12%	0.1%	0.0%	0.0%
40%	8.39	8.32	8.30	8.30	8.31	-1.02%	0.2%	-0.1%	-0.1%

Introduce mid-level protocol gas (instrument). Repeat twice (total of 3 injections).

Mid-Range Gas	Expected Concentration	Injection			Average	%Error	Individual Response Errors as Compared to Average		
		No. 1	No. 2	No. 3					
O_2	12.49	12.63	12.61	12.59	12.61	0.96%	0.2%	0.0%	-0.2%

Criteria:

1. Each injection shall differ no more than 2% from the triplicate average.
2. No average shall be greater than 2% of the predicted value.

METHOD 7E - STACK STRATIFICATION DETERMINATION

Date: 6/16/2022
Client: OCFL

Measure three points located at 16.7%, 50.0% and 83.3% of stack diameter for twice the system response time. Determine the pecent difference of the response at each point compared the the three point average.

EUENCLOSEDFLARE	Recorded	Concentration		
Point	Time	CO_2 (%)	O_2 (%)	CO (ppm)
1	8:37	5.48	14.8	1.66
2	8:40	5.46	14.9	1.98
3	8:43	5.51	14.8	1.50
4	8:46	5.61	14.7	1.97
Average	**-**	**5.52**	**14.8**	**1.78**

Response as Compared to Average		
CO_2	O_2	CO
-0.6%	0.0%	-6.6%
-1.0%	0.7%	11.4%
-0.1%	0.0%	-15.6%
1.7%	-0.7%	10.8%
-	-	-

Criteria:

1. If the response differs no more than 5% from the three point average, measure at one point.
2. If the response differs more than 5% but no more than 10% from the three point average, measure at three points.
3. If the response differs more than 10% from the three point average, measure at twelve points.

Summary of Calibration Data

Client:	OCFL	
Source:	EUENCLOSEDFLARE	
Date:	6/16/2022	
CO	1,467	ppm
O_2	20.98	%
CO_2	23.61	%

Instrument: Servomex Model 1400D - O_2

Span: 20.98 %

ACE Expected Values (ppm)	20.98	10.49	0	Analyzer Calibration Error (%)		
Test ID	*Hi*	*Mid*	*Low*	*Hi*	*Mid*	*Low*
Initial Calibration Response	21.33	10.47	0.00	1.67	-0.10	0.00
System Bias (ppm)						
Test ID	*Upscale*	*Bias (%)*	*Drift (%)*	*Zero*	*Bias (%)*	*Drift (%)*
EF, Pre Test 1	10.53	0.29	-	0.39	1.86	-
EF, Post Test 1/Pre Test 2	10.67	0.95	0.67	0.28	1.33	0.52
EF, Post Test 2/Pre Test 3	10.52	0.24	0.71	0.15	0.71	0.62
EF, Post Test 3	10.46	-0.05	0.29	0.27	1.29	0.57

Instrument: Servomex Model 1400D - CO_2

Span: 23.61 %

ACE Expected Values (ppm)	23.61	11.81	0	Analyzer Calibration Error (%)		
Test ID	*Hi*	*Mid*	*Low*	*Hi*	*Mid*	*Low*
Initial Calibration Response	23.95	11.72	0.02	1.44	-0.36	0.08
System Bias (ppm)						
Test ID	*Upscale*	*Bias (%)*	*Drift (%)*	*Zero*	*Bias (%)*	*Drift (%)*
EF, Pre Test 1	11.38	-1.44	-	0.03	0.04	-
EF, Post Test 1/Pre Test 2	11.25	-1.99	0.55	0.03	0.04	0.00
EF, Post Test 2/Pre Test 3	11.21	-2.16	0.17	0.02	0.00	0.04
EF, Post Test 3	11.21	-2.16	0.00	0.02	0.00	0.00

Instrument: Thermo Environmental Instruments, Inc., Model 48i - CO

Span: 293.4 ppm

ACE Expected Values (ppm)	293.4	146.7	0	Analyzer Calibration Error (%)		
Test ID	*Hi*	*Mid*	*Low*	*Hi*	*Mid*	*Low*
Initial Calibration Response	295.1	150.7	0.51	0.59	1.36	0.17
System Bias (ppm)						
Test ID	*Upscale*	*Bias (%)*	*Drift (%)*	*Zero*	*Bias (%)*	*Drift (%)*
EF, Pre Test 1	148.3	-0.82	-	0.44	-0.02	-
EF, Post Test 1/Pre Test 2	153.5	0.97	1.79	0.43	-0.03	0.00
EF, Post Test 2/Pre Test 3	150.2	-0.16	1.13	0.50	0.00	0.02
EF, Post Test 3	151.1	0.13	0.29	0.38	-0.04	0.04

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

IMPACT COMPLIANCE & TESTING, INC.

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 6/08/2022 | METER SERIAL #: N1 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.08, FINAL 29.08, AVG (P_{bar}) 29.08

METER PART #: N1 | CRITICAL ORIFICE SET SERIAL #: 1316

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)
#29	1	0.7968	18.00	782.518	787.53	5.012	73	74	76	71	71	73.0	5.00	3.60	4.8704	5.0197	1.0307	
Brass	2	0.7968	18.00	787.53	792.54	5.010	73	76	78	71	72	74.3	5.00	3.60	4.8571	5.0197	1.0335	
	3	0.7968	18.00	792.54	797.568	5.028	73	78	79	72	73	75.5	5.00	3.60	4.8631	5.0197	1.0322	
																AVG =	1.0321	1.03
#24	1	0.6534	19.75	797.568	806.00	8.432	73	79	80	73	74	76.5	10.00	2.40	8.1158	8.2326	1.0144	
Brass	2	0.6534	19.75	806.00	814.43	8.430	73	80	81	74	75	77.5	10.00	2.40	8.0988	8.2326	1.0165	
	3	0.6534	19.75	814.43	822.894	8.464	74	81	82	75	76	78.5	10.00	2.40	8.1163	8.2249	1.0134	
																AVG =	1.0148	-0.67
#20	1	0.5333	21.00	822.894	829.80	6.906	74	82	82	76	77	79.3	10.00	1.50	6.5982	6.7131	1.0174	
Brass	2	0.5333	21.00	829.80	836.69	6.890	75	82	82	77	77	79.5	10.00	1.50	6.5798	6.7068	1.0193	
	3	0.5333	21.00	836.69	843.597	6.907	75	82	82	77	78	79.8	10.00	1.50	6.5930	6.7068	1.0173	
																AVG =	1.0180	-0.36

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:

The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **1.0216**

Y-5%= 0.971 | 1.073 =Y+5%

6/08/2022 | Delta H@ 1.898 | Kiso 1749.954

(1) $V_m(std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}(std) = K' \sqrt{\frac{P_{bar}\,\theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr}(std)}{V_m(std)}$ = DGM calibration factor

PYROMETER CALIBRATION						
Meter	32	100	252	500	1000	1500
Omega	32	100	250	500	1000	1500
% Difference	0.0	0.0	0.8	0.0	0.0	0.0

METHOD 5 DRY GAS METER CALIBRATION USING CRITICAL ORIFICES

IMPACT COMPLIANCE & TESTING, INC.

1) Select three critical orifices to calibrate the dry gas meter which bracket the expected operating range.
2) Record barometric pressure before and after calibration procedure.
3) Run at maximum attainable vacuum (open coarse valve, close fine valve), for period of 5 minutes minimum for large orifice up to 10 minutes for smallest orifice.
4) Record readings in outlined boxes below, other columns are automatically calculated.

DATE: 7/08/2022 | METER SERIAL #: N1 | BAROMETRIC PRESSURE (in Hg): INITIAL 29.21, FINAL 29.21, AVG (P_{bar}) 29.207

METER PART #: N1 | CRITICAL ORIFICE SET SERIAL #: 1316

IF Y VARIATION EXCEEDS 2.00%, ORIFICE SHOULD BE RECALIBRATED

ORIFICE #	RUN #	K' FACTOR (AVG)	TESTED VACUUM (in Hg)	DGM READINGS (FT^3) INITIAL	DGM READINGS (FT^3) FINAL	DGM READINGS (FT^3) NET (V_m)	TEMPERATURES °F AMBIENT	DGM INLET INITIAL	DGM INLET FINAL	DGM OUTLET INITIAL	DGM OUTLET FINAL	DGM AVG	ELAPSED TIME (MIN) θ	DGM ΔH (in H_2O)	(1) V_m (STD)	(2) V_{cr} (STD)	(3) Y	Y VARIATION (%)
#29	1	0.7968	18.00	982.444	987.50	5.056	80	83	84	82	82	82.8	5.00	3.60	4.8457	5.0088	1.0337	
Brass	2	0.7968	18.00	987.50	992.56	5.060	80	84	85	82	82	83.3	5.00	3.60	4.8451	5.0088	1.0338	
	3	0.7968	18.00	992.56	997.615	5.055	80	85	86	82	82	83.8	5.00	3.60	4.8359	5.0088	1.0358	
																AVG =	1.0344	1.25
#24	1	0.6534	19.75	997.615	1006.18	8.565	81	86	88	82	83	84.8	10.00	2.40	8.1542	8.2071	1.0065	
Brass	2	0.6534	19.75	1006.18	1014.75	8.570	81	88	90	83	84	86.3	10.00	2.40	8.1365	8.2071	1.0087	
	3	0.6534	19.75	1014.75	1023.300	8.550	81	90	91	84	85	87.5	10.00	2.40	8.0990	8.2071	1.0134	
																AVG =	1.0095	-1.19
#20	1	0.5333	21.00	1023.300	1030.23	6.930	82	91	91	85	86	88.3	10.00	1.50	6.5407	6.6924	1.0232	
Brass	2	0.5333	21.00	1030.23	1037.18	6.950	82	91	91	86	86	88.5	10.00	1.50	6.5566	6.6924	1.0207	
	3	0.5333	21.00	1037.18	1044.142	6.962	82	91	91	86	87	88.8	10.00	1.50	6.5649	6.6924	1.0194	
																AVG =	1.0211	-0.05

USING THE CRITICAL ORIFICES AS CALIBRATION STANDARDS:
The following equations are used to calculate the standard volumes of air passed through the DGM, V_m (std), and the critical orifice, V_{cr} (std), and the DGM calibration factor, Y. These equations are automatically calculated in the spreadsheet above.

AVERAGE DRY GAS METER CALIBRATION FACTOR, Y = **1.0217**

Y-5%= 0.971 | 1.073 =Y+5%

7/08/2022 | Delta H@ 1.885 | Kiso 1775.037

(1) $V_m(std) = K_1 V_m \frac{P_{bar} + (\Delta H/13.6)}{T_m}$ = Net volume of gas sample passed through DGM, corrected to standard conditions

K_1 = 17.64 °R/in. Hg (English), 0.3858 °K/mm Hg (Metric)

T_m = Absolute DGM avg. temperature (°R - English, °K - Metric)

(2) $V_{cr}(std) = K' \sqrt{\frac{P_{bar}\,\theta}{T_{amb}}}$ = Volume of gas sample passed through the critical orifice, corrected to standard conditions

T_{amb} = Absolute ambient temperature (°R - English, °K - Metric)

K' = Average K' factor from Critical Orifice Calibration

(3) $Y = \frac{V_{cr}(std)}{V_m(std)}$ = DGM calibration factor

PYROMETER CALIBRATION

Meter	32	100	252	500	1000	1500
Omega	32	100	250	500	1000	1500
% Difference	0.0	0.0	0.8	0.0	0.0	0.0

Method 7E Interference Response Verification

Date: 7/26/2006
Analyzer: Thermo Model 42c

Tested Calibration Span: 44.0 ppm

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
CO_2/NO_x	1.72% / 26.4	26.20	0.20
CO_2	4.29%	-0.10	0.10
O_2/NO_x	8.36% / 26.4	26.27	0.13
O_2	20.9%	0.00	0.00
CO/NO_x	23.88 / 26.4	26.40	0.00
CO	59.70	-0.11	0.11
CH_4/NO_x	33.6 / 26.4	26.10	0.30
CH_4	84.0	-0.11	0.11
SO_2/NO_x	8.16 / 26.4	26.20	0.20
SO_2	20.4	-0.10	0.10
C_3H_8/NO_x	33.32 / 26.4	26.34	0.06
C_3H_8	83.3	-0.11	0.11
		Total Deviation (ppm)[2]	**1.05**
		% of Calibration Span[3]	**2.38**

1 - Measured concentrations were corrected for system bias.
2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
3 - Total Interference must be less than 2.50% of the calibration span.

Calibrator: Andy Rusnak

7/26/2006
Date

Method 7E Interference Response Verification

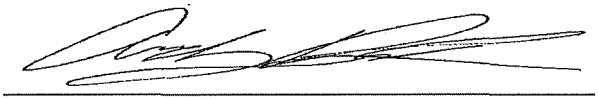
Date: 1/27/2021
Analyzer: Thermo Model 42i

Tested Calibration Span: 100.7 ppm

Test Gas Type	*Concentration (ppm)*	*Analyzer Response*	*Deviation from Expected Response (ppm)*
CO_2/NO_x	18.51% / 100.68	100.73	0.05
CO_2	23.14%	0.08	0.08
O_2/NO_x	16.81% / 100.68	100.73	0.05
O_2	21.01%	0.08	0.08
CO/NO_x	1188 / 100.68	100.73	0.05
CO	1485	0.08	0.08
Acetaldehyde/NO_x	168.6 / 100.68	100.86	0.18
Acetaldehyde	210.7	0.17	0.17
SO_2/NO_x	165.0 / 100.68	100.86	0.18
SO_2	206.3	0.17	0.17
C_3H_8/NO_x	67.4 / 100.68	100.71	0.03
C_3H_8	84.25	0.17	0.17
		Total Deviation (ppm)[1]	**0.77**
		% of Calibration Span[2]	**0.76**

1 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.

2 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

1/27/2021
Date

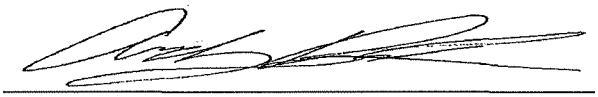
Method 7E Interference Response Verification

Date: 6/21/2011
Analyzer: Thermo Model 48c

Tested Calibration Span: 100.0 ppm

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
CO_2/CO	5.40% / 60.0	60.1	0.07
CO_2	13.50%	0.00	0.00
O_2/CO	5.02% / 60.0	60.2	0.15
O_2	12.55%	0.00	0.00
NO_x/CO	39.7 / 60.0	59.9	0.09
NO_x	99.3	0.01	0.01
CH_4/CO	35.2 / 60.0	60.6	0.64
CH_4	88.1	-0.05	0.05
SO_2/CO	12.2 / 60.0	60.17	0.17
SO_2	30.4	-0.04	0.04
C_3H_8/CO	40.8 / 60.0	60.90	0.90
C_3H_8	102	0.41	0.41
		Total Deviation (ppm)[2]	**2.02**
		% of Calibration Span[3]	**2.02**

1 - Measured concentrations were corrected for system bias.
2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
3 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

6/21/2011
Date

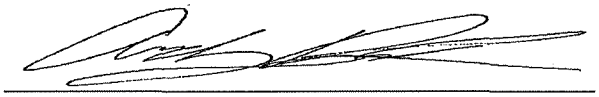
Method 7E Interference Response Verification

Date: 4/19/2016
Analyzer: Thermo Model 48i

Tested Calibration Span: 1484.0 ppm

Test Gas Type	*Concentration (ppm)*	*Analyzer Response*	*Deviation from Expected Response (ppm)*
CO_2/CO	11.22% / 742.0	746.3	4.31
CO_2	22.44%	-0.50	0.50
O_2/CO	10.45% / 742.0	736.6	5.37
O_2	21.11%	0.10	0.10
NO/CO	148.8 / 742.0	741.9	0.10
NO	119.0	0.09	0.09
NO_2/CO	25.1 / 742.0	741.4	0.61
NO_2	50.24	0.07	0.07
C_3H_8/CO	42.9 / 742.0	736.63	5.37
C_3H_8	85.8	1.08	1.08
		Total Deviation (ppm)[1]	**15.76**
		% of Calibration Span[2]	**1.06**

1 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
2 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

4/21/2016
Date

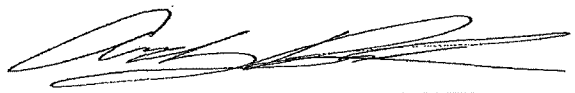
Method 7E Interference Response Verification

Date: 7/26/2006
Analyzer: Fuji ZRF CO Cell

Tested Calibration Span: 298.8 ppm

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
CO_2/CO	1.72% / 179.3	179.1	0.20
CO_2	1.72%	0.06	0.06
O_2/CO	8.36% / 179.3	180.6	1.37
O_2	20.9%	-0.09	0.09
NO_x/CO	26.4 / 179.3	179.3	0.02
NO_x	44.0	-0.10	0.10
CH_4/CO	33.6 / 179.3	180.6	1.28
CH_4	84.0	-0.01	0.01
SO_2/CO	8.16 / 179.3	179.08	0.20
SO_2	20.4	1.29	1.29
C_3H_8/CO	33.32 / 179.3	179.42	0.14
C_3H_8	83.3	0.02	0.02
		Total Deviation (ppm)[2]	**4.38**
		% of Calibration Span[3]	**1.46**

1 - Measured concentrations were corrected for system bias.
2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
3 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

7/26/2006
Date

Method 7E Interference Response Verification

Date: 7/26/2006

Analyzer: Fuji ZRF CO_2 Cell

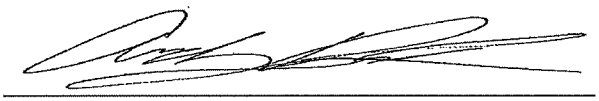
Tested Calibration Span: 4.29 %

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
NO_x/CO_2	26.4 / 1.72%	1.72	0.01
NO_x	44.0	0.00	0.00
O_2/CO_2	8.36% / 1.72%	1.73	0.02
O_2	20.9%	0.00	0.00
CO/CO_2	23.88 / 2.57%	2.57	0.00
CO	59.70	0.00	0.00
CH_4/CO_2	33.6 / 2.57%	2.57	0.00
CH_4	84.0	0.00	0.00
C_3H_8/CO_2	33.32 / 2.57	2.57	0.00
C_3H_8	83.3	0.00	0.00
	Total Deviation (ppm) [2]		**0.03**
	% of Calibration Span [3]		**0.59**

1 - Measured concentrations were corrected for system bias.

2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.

3 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

7/26/2006

Date

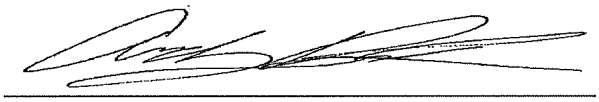
Method 7E Interference Response Verification

Date: 7/26/2006
Analyzer: Fuji ZFK3 O_2 Cell

Tested Calibration Span: 20.9 %

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
CO_2/O_2	1.72% / 12.54%	12.62	0.08
CO_2	4.29%	0.00	0.00
NO_x/O_2	26.4 / 8.36%	8.41	0.05
NO_x	44.0	0.00	0.00
CO/O_2	23.88 / 12.54	12.56	0.02
CO	59.70	0.00	0.00
SO_2/O_2	8.16 / 12.54	12.62	0.08
SO_2	20.4	0.29	0.29
C_3H_8/O_2	33.32 / 12.54	12.58	0.04
C_3H_8	83.3	0.00	0.00
		Total Deviation (ppm)[2]	**0.48**
		% of Calibration Span[3]	**2.30**

1 - Measured concentrations were corrected for system bias.
2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
3 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

7/26/2006
Date

Method 7E Interference Response Verification

Date: 7/3/2007
Analyzer: API Model 100 AH

Tested Calibration Span: 20.9 ppmv

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
SO_2/CO_2	20.9 / 4.33%	20.85	0.05
CO_2	4.29%	-0.12	0.12
SO_2/NO_x	16.72 / 5.04	16.71	0.01
NO_x	5.04	-0.10	0.10
SO_2/CO	16.72 / 11.94	16.80	0.08
CO	59.70	-0.06	0.06
SO_2/O_2	16.72 / 1.75%	16.78	0.06
O_2	8.75%	0.07	0.07
SO_2/C_3H_8	16.72 / 34.84	16.75	0.03
C_3H_8	174.2	0.03	0.03
		Total Deviation (ppm)[2]	**0.40**
		% of Calibration Span[3]	**1.91**

1 - Measured concentrations were corrected for system bias.
2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
3 - Total Interference must be less than 2.50% of the calibration span.

Calibrator: Andy Rusnak

7/3/2007
Date

Method 7E Interference Response Verification

Date: 4/3/2012

Analyzer: Servomex CO_2 Cell

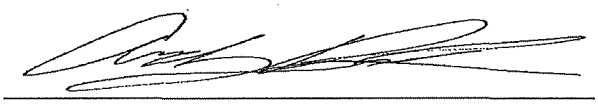
Tested Calibration Span: 13.32 %

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
NO_x/CO_2	109 / 5.33%	5.29	0.03
NO_x	109.0	0.00	0.00
O_2/CO_2	12.5% / 5.33%	5.33	0.01
O_2	12.5%	0.00	0.00
CO/CO_2	60.0 / 5.33%	5.31	0.01
CO	60.0	0.00	0.00
CH_4/CO_2	61.2 / 5.33%	5.28	0.04
CH_4	61.2	0.00	0.00
SO_2/CO_2	30.4 / 5.33%	5.34	0.02
SO_2	30.4	0.00	0.00
C_3H_8/CO_2	50.9 / 5.33%	5.26	0.06
C_3H_8	50.9	0.00	0.00
		Total Deviation (ppm)[2]	**0.16**
		% of Calibration Span[3]	**1.20**

1 - Measured concentrations were corrected for system bias.

2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.

3 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

4/3/2012

Date

Method 7E Interference Response Verification

Date: 4/3/2012

Analyzer: Servomex O_2 Cell

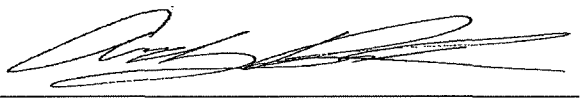
Tested Calibration Span: 20.8 %

Test Gas Type	*Concentration (ppm)*	*Analyzer Response* [1]	*Deviation from Expected Response (ppm)*
CO_2/O_2	5.33% / 12.5%	12.55	0.05
CO_2	7.99%	0.04	0.04
NO_x/O_2	109 / 8.33%	8.33	0.01
NO_x	109	0.00	0.00
CO/O_2	60.0 / 8.33%	8.28	0.06
CO	60.0	0.00	0.00
SO_2/O_2	30.4 / 8.33%	8.30	0.04
SO_2	30.4	0.03	0.03
CH_4/O_2	61.2 / 12.5%	12.44	0.06
C_3H_8/O_2	50.9 / 12.5%	12.50	0.00
		Total Deviation (ppm)[2]	**0.14**
		% of Calibration Span[3]	**0.68**

1 - Measured concentrations were corrected for system bias.

2 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.

3 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

4/3/2012

Date

Method 7E Interference Response Verification

Date: 6/12/2014

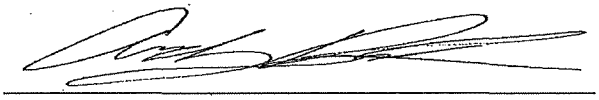
Analyzer: Servomex 1440D CO_2 Cell

Tested Calibration Span: 22.63 %

Test Gas Type	*Concentration (ppm)*	*Analyzer Response*	*Deviation from Expected Response (ppm)*
CO_2/O_2	11.32 / 10.47%	11.35	0.03
O_2	13.58%	0.03	0.03
NOx/CO_2	248 / 11.32%	11.35	0.03
NOx	497	0.05	0.05
CO/CO_2	746 / 11.32%	11.49	0.17
CO	1491	0.03	0.03
SO_2/CO_2	100.7 / 11.32%	11.37	0.05
SO_2	201.3	0.07	0.07
CH_4/CO_2	867 / 11.32%	11.39	0.07
CH_4	867	0.04	0.04
C_3H_8/CO_2	42.23 / 11.32%	11.38	0.06
C_3H_8	42.23	0.03	0.03
		Total Deviation (ppm)[1]	**0.45**
		% of Calibration Span[2]	**1.99**

1 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.

2 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

6/12/2014

Date

Method 7E Interference Response Verification

Date: 6/12/2014

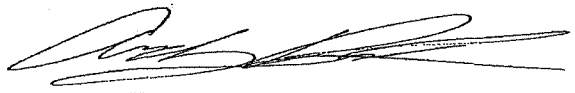
Analyzer: Servomex 1440D O_2 Cell

Tested Calibration Span: 20.9 %

Test Gas Type	*Concentration (ppm)*	*Analyzer Response*	*Deviation from Expected Response (ppm)*
CO_2/O_2	11.32 / 10.47	10.52	0.05
CO_2	13.58%	0.06	0.06
NOx/O_2	248 / 10.47%	10.35	0.12
NOx	497	0.00	0.00
CO/O_2	746 / 10.47%	10.50	0.03
CO	1491	-0.01	0.01
SO_2/O_2	100.7 / 10.47%	10.47	0.00
SO_2	201.3	-0.15	0.15
CH_4/O_2	867 / 10.47%	10.40	0.07
C_3H_8/O_2	42.23 / 10.47%	10.40	0.07
		Total Deviation (%)[2]	**0.50**
		% of Calibration Span[3]	**2.39**

1 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.

2 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

6/12/2014

Date

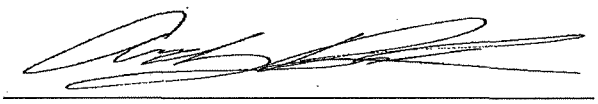
Method 7E Interference Response Verification

Date: 11/12/2015
Analyzer: TEI 43i HL SO2 Analyzer

Tested Calibration Span: 80.52 ppm

Test Gas Type	*Concentration (ppm)*	*Analyzer Response*	*Deviation from Expected Response (ppm)*
CO_2/SO_2	13.58% / 80.52	80.76	0.24
CO_2	22.63%	0.44	0.23
NOx	50.5	0.65	0.44
CO/SO_2	892 / 80.52	80.41	0.11
CO	1487.0	0.35	0.14
O_2/SO_2	12.76% / 80.52	80.31	0.21
O_2	21.27%	0.17	0.04
C_3H_8/SO_2	50.6 / 80.52	80.93	0.41
C_3H_8	84.41	0.21	0.00
		Total Deviation (ppm)[2]	**1.43**
		% of Calibration Span[3]	**1.78**

1 - In summing the total deviation use the larger of the absolute values obtained for the interferent tested with and without the pollutant present.
2 - Total Interference must be less than 2.50% of the calibration span.



Calibrator: Andy Rusnak

11/12/2015
Date

Airflow Sciences Corporation

Probe Calibration for Method 2

Data Collection and Analysis

Date:	8/19/2021
Temperature (°F):	79.8
Pressure ("Hg):	29.37
Personnel:	mcn
Probe:	8F-IN-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	1.17	0.823	0.823	0.000	0.001	Pass
0.81	0.81	1.17	0.824		0.001		
0.81	0.81	1.17	0.822		-0.001		
1.81	1.82	2.64	0.821	0.821	0.000	0.000	Pass
1.81	1.82	2.64	0.821		0.000		
1.81	1.82	2.64	0.821		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: 8F-IN-A
Probe Calibration Date: 08/19/21
Test Point Location: center
Ambient Temperature (°F): 79.8
Barometric Pressure ("Hg): 29.37

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	79.8	1.17	0	0.82
2	60	0.81	79.8	1.17	0	0.82
3	60	0.81	79.8	1.17	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	79.8	2.64	0	0.82
2	90	1.82	79.8	2.64	0	0.82
3	90	1.82	79.8	2.64	0	0.82
					Average ($C_{p(avg-high)}$)	0.82

$$\% \text{ Difference} = \frac{C_{p(avg-low)} - C_{p(avg-high)}}{C_{p(avg-low)}} \times 100\% = \mathbf{0.26\%}$$ 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 = 0.822

HORIBA
Automotive

ANAB ACCREDITED ISO/IEC 17025 CALIBRATION AND TESTING LABORATORY

HORIBA Instruments Incorporated
5900 Hines Drive
Ann Arbor, MI 48108

Certificate of Calibration

Certificate Number: **K4CG7DTB-102721**

The calibration was performed using reference standards which have traceability to the International System of Units (SI) through the United States National Institute of Standards and Technology (NIST). This calibration is accredited under the laboratory's ISO/IEC 17025 accreditation issued by the ANSI-ASQ National Accreditation Board. Refer to certificate and scope of accreditation ACT-1312. The calibration was performed using the procedure number stated below.

Customer: Impact Compliance & Testing
Customer Address: 4180 Keller Road, Suite B
Holt, MI 48842

Manufacturer: STEC
Description: Gas Divider
Condition Received: Passed
Cal Procedure: WI-QM-B-010

Date Calibrated: 10/27/21
Calibration Gas: Zero N_2

Part Number: SGD-710C
HGS Number: K4CG7DTB
Condition Returned: Passed
Uncertainty: +/- 0.048 L/min
Recommended
Re-calibration Due: 10/27/22
Lot Number: 32-402237693-1

Standards Traceability

Mfr./Model Number	Serial #	Test Number	Cal. Date	Due Date
Fluke / 3E4-VCR-V-Q	1016+	PHC4504.0005	06/21/21	06/21/22
Fluke / 3E4-VCR-V-Q	1015+	PHC4504.0005	06/21/21	06/21/22
Fluke / Molbox 1+	448+	PHC4504.0006	06/21/21	06/21/22

Calibrated by: _____ **Date:** **10/27/21**

Approved by: _____ **Date:** **10/27/21**

This certificate may not be reproduced, except in full, without the written approval of HORIBA. The calibrated system is operating within the specification. The recommended calibration cycle implies system usage in normal, non-extreme, environmental conditions.

The uncertainty is calculated at a 95% confidence interval with a coverage factor of k=2. Pass/Fail determination is based on the simple acceptance rule. The unit is considered passing if calibration data is within the specification limits.

This certificate is issued under the authority of: HORIBA Instruments Incorporated, 2890 John R Road, Troy, MI 48083.

GDC-03, SGD-A10, SGD-710 GAS DIVIDERS VERIFICATION CHECK SHEET

As Found Data

CUSTOMER: Impact Compliance DATE: 10/27/21

MODEL:SGD-710C HGS NUMBER: K4CG7DTB

CUT PT.	COMP A MIXTURE GAS	COMP B DILUTANT GAS	TOTAL FLOW POINT	MIXTURE FLOW %	%POINT ERROR >2.0%	STATUS
0	0.0000	3.9742	3.9742	0.000	0.000	Pass
10	0.3994	3.5986	3.9980	9.990	0.100	Pass
20	0.8017	3.2182	4.0199	19.943	0.284	Pass
30	1.2018	2.8360	4.0378	29.764	0.794	Pass
40	1.6101	2.4353	4.0454	39.801	0.501	Pass
50	2.0141	2.0392	4.0533	49.690	0.623	Pass
60	2.4329	1.6232	4.0561	59.981	0.031	Pass
70	2.8345	1.2262	4.0607	69.803	0.282	Pass
80	3.2467	0.8202	4.0669	79.832	0.210	Pass
90	3.6674	0.4089	4.0763	89.969	0.035	Pass
100	4.0705	0.0000	4.0705	100.000	0.000	Pass

STD. DEV. 0.0321 LPM

MIXTURE GAS INLET PRESSURE TO DIVIDER: 21.0 PSIG
(At 100% CUTPOINT)

DILUTION GAS INLET PRESSURE TO DIVIDER: 17.0 PSIG
(AT 0.0% CUTPOINT)

OUTLET FLOW FROM GAS DIVIDER: 4.00 LPM

Airgas
an Air Liquide company

Airgas Great Lakes region
Airgas USA, LLC
1290 Combermere Dr.
Troy, MI 48083
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	DERENZO & ASSOCIATES		
Part Number:	E03NI56E15A0002	Reference Number:	32-401412499-1
Cylinder Number:	SG9152485BAL	Cylinder Volume:	162.0 CF
Laboratory:	112 - Troy-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62019	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Feb 05, 2019

Expiration Date: Feb 05, 2027

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 volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	21.00 %	21.41 %	G1	+/- 0.5% NIST Traceable	02/05/2019
CARBON DIOXIDE	22.50 %	22.26 %	G1	+/- 0.6% NIST Traceable	02/05/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010924	K021247	20.89 % OXYGEN/NITROGEN	+/-0.5%	Jun 27, 2022
NTRM	12061526	CC354795	19.87 % CARBON DIOXIDE/NITROGEN	+/-0.6%	Jan 11, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared (NDIR)	Jan 29, 2019
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	Jan 08, 2019

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
1290 Combermere Dr.
Troy, MI 48083
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	IMPACT COMPLIANCE & TESTING		
Part Number:	E04NI56E15A0001	Reference Number:	32-402117338-1
Cylinder Number:	ALM-047867	Cylinder Volume:	162.0 CF
Laboratory:	112 - Troy-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62021	Valve Outlet:	590
Gas Code:	CO,CO2,O2,BALN	Certification Date:	Jun 07, 2021

Expiration Date: Jun 07, 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.

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 MONOXIDE	1500 PPM	1467 PPM	G1	+/- 0.5% NIST Traceable	06/03/2021
OXYGEN	21.00 %	20.98 %	G1	+/- 0.5% NIST Traceable	06/03/2021
CARBON DIOXIDE	22.50 %	23.61 %	G2	+/- 0.8% NIST Traceable	06/07/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	080122	KAL004663	2466 PPM CARBON MONOXIDE/NITROGEN	+/-0.5%	May 09, 2024
NTRM	100109	K-022371	20.89 % OXYGEN/NITROGEN	+/-0.5%	Jun 27, 2022
NTRM	12061511	CC354702	19.87 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	Jan 11, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54 NICOLET IS50 CO2 13/20%	FTIR	May 25, 2021
CO SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared (NDIR)	May 06, 2021
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	May 12, 2021

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas Great Lakes region
Airgas USA, LLC
1290 Combermere Dr.
Troy, MI 48083
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	DERENZO AND ASSOCIATES		
Part Number:	E02NI87E15A0480	Reference Number:	32-401414049-1
Cylinder Number:	CC15940	Cylinder Volume:	145.5 CF
Laboratory:	112 - Troy-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62019	Valve Outlet:	590
Gas Code:	O2,BALN	Certification Date:	Feb 05, 2019

Expiration Date: Feb 05, 2027

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 volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	12.50 %	12.49 %	G1	+/- 0.4% NIST Traceable	02/05/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	100106	K015462	9.967 % OXYGEN/NITROGEN	+/-0.3%	Apr 19, 2022

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	Jan 08, 2019

Triad Data Available Upon Request

Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
1290 Combermere Dr.
Troy, MI 48083
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	IMPACT COMPLIANCE & TESTING		
Part Number:	E02NI99E15A0077	Reference Number:	32-401572021-1
Cylinder Number:	XC004936B	Cylinder Volume:	144.3 CF
Laboratory:	112 - Troy-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62019	Valve Outlet:	350
Gas Code:	CO,BALN	Certification Date:	Aug 19, 2019

Expiration Date: Aug 19, 2027

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 volume/volume basis unless otherwise noted.

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 MONOXIDE	100.0 PPM	100.2 PPM	G1	+/- 0.6% NIST Traceable	08/19/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010249	KAL004915	98.48 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	Oct 16, 2024

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54 Nicolet 6700 CO	FTIR	Jul 23, 2019

Triad Data Available Upon Request

Approved for Release