erthwrks

AIR EMISSIONS TESTING FOR INDUSTRY

Relative Accuracy Test Audit

for

Marathon Petroleum Company LP

at the

Detroit Refinery in Detroit, Michigan

on the

Crude Flare

subject to

Permit No. MI-ROP-A9831-2012c

&

40 CFR Part 60, Appendix F

MARATHON® Marathon Petroleum Company LP

Test Date: October 6, 2022

Erthwrks Project No. 9049.1.D1

A9831_test_20221006

STAC STACK TESTING ACCREDITATION COUNCIL

ACCREDITED TO ASTM D7036 ONLY CERT #6147.01

Louisiana Environmental Lab Accreditation Program LELAP

CARB

Endorsement Page

This report was developed in accordance with the requirements designated in the applicable regulatory permit(s) and or regulatory rules. To the best of my knowledge the techniques, instrumentation, and calculations presented in this report will serve to accurately and efficiently detail the results of the test campaign requirements.

Erthwrks, Inc.

Name: Jason Dunn

Title: QC Specialist

Signature: 

This report has been reviewed for accuracy and completeness. The actions presented in this report are, to the best of my knowledge, an accurate representation of the results and findings of the test campaign. Erthwrks, Inc. operates in conformance with the requirements on ASTM D7036-04 Standard Practice for Competence of Air Emission Testing Bodies and is accredited as such by the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA).

Erthwrks, Inc.

Name: Trey Chapman

Title: CEO

Signature: 

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1.0 INTRODUCTION

1.1 Identification, location and dates of tests

Erthwrks, Inc. was contracted to conduct a relative accuracy test audit (RATA) on the hydrogen sulfide (H_2S) continuous emissions monitoring system (CEMS) associated with the Crude Flare in operation at the Detroit Refinery, located in Detroit, Michigan. The RATA test was conducted on October 6, 2022.

1.2 Purpose of Testing

This RATA was conducted to demonstrate the accuracy and reliability of the CEMS monitor installed for the Crude Flare used to demonstrate the continuous emission compliance of the unit. All testing and audit procedures were conducted in accordance with the requirements set forth in 40 CFR, Part 60, Appendix B and F, which defines the CEMS performance specifications and testing procedures.

1.3 Contact Information

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Facility Location:
1300 South Fort Street
Detroit, MI 48217

2.0 SUMMARY OF RESULTS

Table 2.1: GBR Crude Flare RATA Results

Pollutant Measured	Performance Specification	Relative Accuracy	Applicable Limit	Pass/Fail
H_2S	Performance Spec. 7	9.16% RA_{AS}	<10%	Pass

3.0 SOURCE DESCRIPTION

3.1 Description of the process

The flare (or torch) systems are open-flame control devices used for control of waste gas streams during both routine process and emergency or upset conditions. Flare vent gas is released to the flare as a result of relief valve leakage, process upsets, process sweep gas, equipment preparation for maintenance, and supplemental gas streams.

The flare system is equipped with an H_2S monitoring system as required by the refinery Title V Permit and associated State and Federal regulations.

Table 3.1 GBR Crude Flare CEMS Description

Pollutant Measured	Analyzer Manufacturer	Analyzer Model	Detection Principle	Serial Number
H_2S	Siemens	Maxum II	Gas Chromatography	3002674165-001060

3.2 Applicable permit and source designation

The Detroit Refinery operates the Crude Flare monitoring system under the Permit No. MI-ROP-A9831-2012c, 40 CFR Part 60 Subpart Ja, and the CEMS quality assurance procedures delineated in the 40 CFR Part 60, Appendix F. Under these regulations, the Detroit Refinery is required to conduct an annual RATA to demonstrate the relative accuracy of the CEMS associated with this unit.

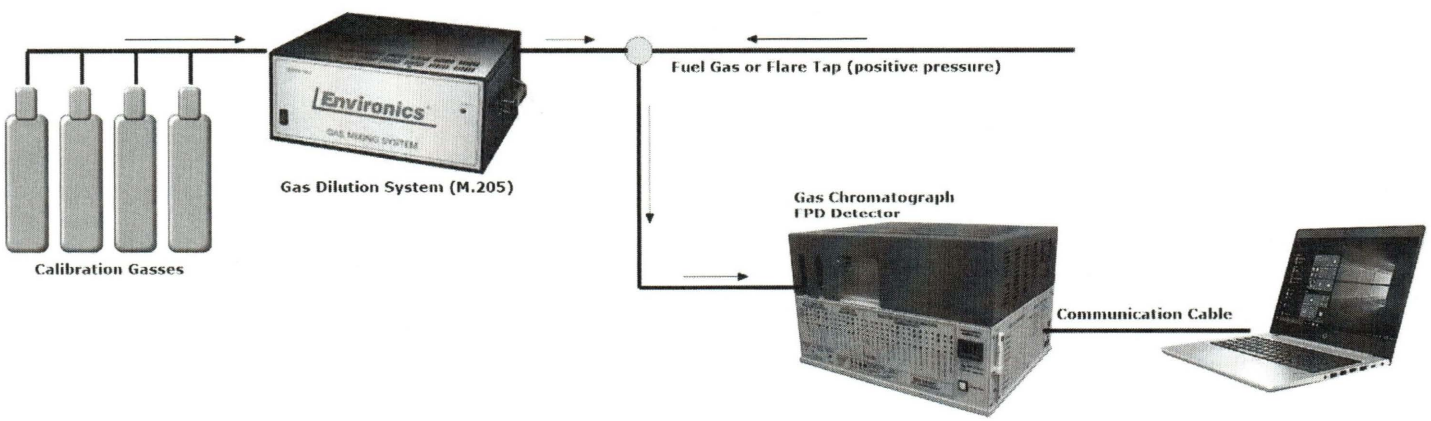
4.0 SAMPLING AND ANALYTICAL PROCEDURES

Erthwrks completed this CEMS audit project utilizing all applicable test methods specified in the USEPA Title 40 CFR Part 60, Appendix A and B. Specifically, this emission testing program entailed the execution of the 40 CFR Part 60, Appendix B, Performance Specifications 7. These documents define the specifications and test procedures for H_2S CEMS. The RATA required by these regulations was conducted utilizing a mobile emission testing laboratory.

4.1 Gaseous Sampling – H_2S

The analysis of the sample stream was conducted following all procedures as specified in USEPA Method 15. For this, Erthwrks utilized an SRI Model 8610 Gas Chromatograph (GC) equipped with an FPD detector. This instrumentation is able to separate and analyze separately each individual component. Three calibration gas concentrations, using a calibration gas dilution system, were sent to the GC and analyzed in triplicate. These triplicate values where recorded and averaged. A graphical plot of concentration versus the calibration area values was created and used to calculate the concentration of the sample. All data from this analysis and all raw gas chromatograph shots are found in Attachment B. Post-test analysis of the mid-calibration standard was performed and found to be within 5% of the original curve, therefore no additional quality assurance measurements were necessary. EPA Method 205 was utilized to dilute the H_2S calibration gas.

The figure below summarizes the Erthwrks GC Sampling System:



4.2 RATA Procedures

The RATA test is a direct comparison of the CEMS monitoring data with that data collected from an independently operated EPA reference method tests for each pollutant, following all the quality assurance and quality control procedures as required in the particular method. As required by the RATA test procedures, a minimum of nine (9) EPA reference method tests were conducted for each pollutant monitored by the CEMS system. Each of

these test runs were conducted for minimum duration of thirty (30) minutes. The results of these reference method tests were compared to CEMS measurement data from the facility data acquisition and handling system (DAHS) from the same time periods to determine the relative accuracy of the CEMS. The results of the RATA test are considered acceptable if the calculated relative accuracy when compared directly to the reference method does not exceed 20.0%. Alternatively, for affected units where the average of the reference method measurements is less than 50 percent of the emission standard, as in this case, the relative accuracy should not exceed 10% with respect to the applicable standard.

4.3 Discussion of sampling procedure or operational variances

Erthwrks, Inc. conducted the emission testing with no sampling or procedural variances. The Crude Flare operated with no operational variances.

Attachment A
Detailed Results of Emission Test

Erthwrks Relative Accuracy Test Audit--H_2S RATA
Performance Specification 7

Crude Flare							H_2S RATA--Perfo
Test Run	**Run 1**	**Run 2**	**Run 3**	**Run 4**	**Run 5**	**Run 6**	**Run 7**
Date	10/6/2022	10/6/2022	10/6/2022	10/6/2022	10/6/2022	10/6/2022	10/6/2022
Start Time	8:45	9:15	9:45	10:15	10:45	11:15	11:45
End Time	9:15	9:45	10:15	10:45	11:15	11:45	12:15
RM H_2S (ppmvw)	**0.56**	**5.40**	**0.49**	**0.65**	**1.27**	**2.65**	**3.31**
CEMS H_2S (ppmvw)	**7.57**	**6.87**	**9.38**	**11.78**	**14.35**	**17.56**	**14.88**
Abs. Diff.	-7.01	-1.47	-8.89	-11.13	-13.08	-14.91	-11.57
Accept or Reject	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*	*Accept*

Applicable Standard (ppmv)	162
Mean of the Difference (d_{avg})	-11.12
Standard Deviation (S_d)	4.83
Confidence Coefficient (CC)	3.71
Relative Accuracy via AS, RA_{AS}	**9.16%** ← *Pass*

*RA_{RM} *(Reference Method) must be less than 20%, or*

†RA_{AS} *(Applicable Standard) must be less then 10%*

Attachment B
Calibration, QAQC, and Raw Data

Erthwrks GC Calibration and Analysis Data

Date: 10/6/2022
Client: Marathon Petroleum
Facility: Detroit Refinery
Location: Complex 2
Unit ID: Crude Flare
Erthwrks Tech: JH, TC, AS

Initial Calibration

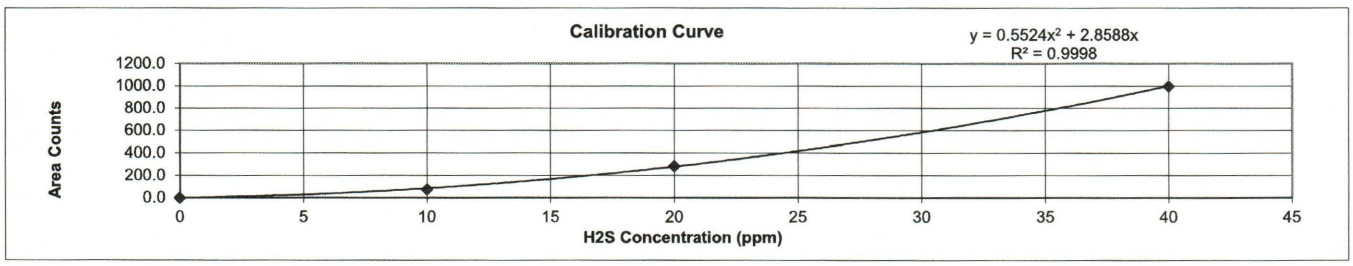
H2S Concentration	0			
GC Results	0.3	0.1	0.2	0.1
Average Response	**0.16**			
Standard Deviation	**0.07**			
MDL (3 times standard deviation)	**0.21**			

H2S Concentration	40		
GC Results	986.2	996.0	1009.2
% Diff	*1.10%*	*0.11%*	*-1.21%*
Average Response	**997.13**		

H2S Concentration	20		
GC Results	282.0	285.4	286.0
% Diff	*0.87%*	*-0.33%*	*-0.54%*
Average Response	**284.47**		

H2S Concentration	10		
GC Results	75.6	74.6	76.0
% Diff	*-0.28%*	*1.08%*	*-0.80%*
Average Response	**75.39**		

Sample Line Loss	20		
GC Results	287.1	286.6	282.8
% Diff	*-0.57%*	*-0.37%*	*0.94%*
Average Response	**285.50**		
<20% of Direct	-0.36%		



Data from Calibration Curve

a:	0.5524	**0.21 MDL**
b:	2.8588	
R^2:	0.9998	
c:	0	

Test Runs

	START	*END*		
Run 1 Time	8:45	9:15		
Run 1 GC Response	2.8	1.6	0.9	
Average Response	1.8			
Run Result	**0.6 ppm**		**0.6 ppm**	

	START	*END*		
Run 2 Time	9:15	9:45		
Run 2 GC Response	1.1	62.1	0.9	
Average Response	31.6			
Run Result	**5.4 ppm**		**5.4 ppm**	

	START	*END*		
Run 3 Time	9:45	10:15		
Run 3 GC Response	1.0	0.9	2.6	
Average Response	1.5			
Run Result	**0.5 ppm**		**0.5 ppm**	

Erthwrks GC Calibration and Analysis Data

Date: 10/6/2022
Client: Marathon Petroleum
Facility: Detroit Refinery
Location: Complex 2
Unit ID: Crude Flare
Erthwrks Tech: JH, TC, AS

	START	*END*	
Run 4 Time	10:15	10:45	
Run 4 GC Response	1.5	2.4	2.5
Average Response	2.1		
Run Result	**0.7 ppm**		**0.7 ppm**

	START	*END*	
Run 5 Time	10:45	11:15	
Run 5 GC Response	3.5	4.1	5.9
Average Response	4.5		
Run Result	**1.3 ppm**		**1.3 ppm**

	START	*END*	
Run 6 Time	11:15	11:45	
Run 6 GC Response	7.5	11.5	15.4
Average Response	11.5		
Run Result	**2.7 ppm**		**2.7 ppm**

	START	*END*	
Run 7 Time	11:45	12:15	
Run 7 GC Response	14.2	14.9	17.5
Average Response	15.5		
Run Result	**3.3 ppm**		**3.3 ppm**

	START	*END*	
Run 8 Time	12:15	12:45	
Run 8 GC Response	19.4	22.9	27.9
Average Response	23.4		
Run Result	**4.4 ppm**		**4.4 ppm**

	START	*END*	
Run 9 Time	12:45	13:15	
Run 9 GC Response	29.2	34.4	38.8
Average Response	34.1		
Run Result	**5.7 ppm**		**5.7 ppm**

	START	*END*	
Run 10 Time	13:15	13:45	
Run 10 GC Response	40.9	46.8	45.6
Average Response	44.4		
Run Result	**6.7 ppm**		**6.8 ppm**

Post Cal GC Response	279.5	278.6	283.7
Average Response	280.6		
% Difference	**1.36%**	**PASS Post Test Calibration Check**	

Erthwrks Gaseous Sample Collection and Quality Assurance Worksheet

Date: 10/5/2022
Client: Marathon Petroleum
Facility: Detroit Refinery
Location: Complex 2
Unit ID: Crude Flare
Erthwrks Tech: JH, TC, AS

Method 205 Field Evaluation for H2S Calibration Gas

Dilution Calibrator Verification					Direct Cal.
Pred. Conc.	**95.0**	**%Diff from Avg.**	**45.0**	**%Diff from Avg.**	**50.36**
Instrument Res 1	96.18	0.18%	45.35	-0.41%	50.17
Instrument Res 2	96.02	0.35%	45.01	0.35%	50.02
Instrument Res 3	96.87	-0.54%	45.14	0.06%	50.38
Average Response	96.36	n/a	45.17	n/a	50.19
%Diff from Pred.	1.41%	n/a	0.37%	n/a	-0.34%

Dilutor & Method 205 Gases	
Dilutor S/N:	9144
Root Gas Conc:	965.6
Root Gas Cyl. #:	CC418906
Direct Gas Conc:	50.36
Direct Gas Cyl. #:	CC429848

TimeStamp	Project Number	Client	Facility	Unit	Test Period	CO
10/5/2022 7:48	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		90.751
10/5/2022 7:49	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Dilution 1	96.183
10/5/2022 7:50	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		86.167
10/5/2022 7:51	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		47.775
10/5/2022 7:52	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Dilution 2	45.354
10/5/2022 7:53	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		46.435
10/5/2022 7:54	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		49.301
10/5/2022 7:55	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Direct Cal	50.171
10/5/2022 7:56	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		37.942
10/5/2022 7:57	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		77.923
10/5/2022 7:58	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		94.353
10/5/2022 7:59	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Dilution 1	96.018
10/5/2022 8:00	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		96.282
10/5/2022 8:01	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		56.533
10/5/2022 8:02	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		44.924
10/5/2022 8:03	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Dilution 2	45.012
10/5/2022 8:04	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		32.267
10/5/2022 8:05	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		11.798
10/5/2022 8:06	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		15.77
10/5/2022 8:07	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		45.621
10/5/2022 8:08	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Direct Cal	50.02
10/5/2022 8:09	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		32.574
10/5/2022 8:10	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		84.465
10/5/2022 8:11	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		96.608
10/5/2022 8:12	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Dilution 1	96.874
10/5/2022 8:13	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		68.878
10/5/2022 8:14	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		45.139
10/5/2022 8:15	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare	Dilution 2	45.14
10/5/2022 8:16	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		42.847
10/5/2022 8:17	9049.1.D1	Marathon Petroleum	Detroit Refinery	Crude Flare		47.936

Erthwrks Raw Datalogs

Chromatogram #	Date	Time	Test Period	Pollutant	Retention	Area Count
EP FG47.chr	10/5/2022	12:35:42		H2S	0.886	272.3
EP FG48.chr	10/5/2022	12:37:19		H2S	0.876	309.4
EP FG49.chr	10/5/2022	12:38:24		H2S	0.89	305.7
EP FG50.chr	10/5/2022	12:39:31		H2S	0.883	272.1
EP FG51.chr	10/5/2022	12:43:04		H2S	0.886	257.4
EP FG52.chr	10/5/2022	12:44:24		H2S	0.883	275.5
EP FG53.chr	10/5/2022	12:45:29	20 ppm Cal	H2S	0.883	282.0
EP FG54.chr	10/5/2022	12:46:40	20 ppm Cal	H2S	0.873	285.4
EP FG55.chr	10/5/2022	12:47:50	20 ppm Cal	H2S	0.88	286.0
EP FG56.chr	10/5/2022	12:50:04		H2S	0.873	268.8
EP FG57.chr	10/5/2022	12:51:10		H2S	0.873	982.3
EP FG58.chr	10/5/2022	12:52:17	40 ppm Cal	H2S	0.87	986.2
EP FG59.chr	10/5/2022	12:53:23	40 ppm Cal	H2S	0.87	996.0
EP FG60.chr	10/5/2022	12:54:29	40 ppm Cal	H2S	0.883	1009.2
EP FG61.chr	10/5/2022	12:55:35		H2S	0.883	105.3
EP FG62.chr	10/5/2022	12:56:41		H2S	0.873	77.3
EP FG63.chr	10/5/2022	12:57:47	10 ppm Cal	H2S	0.876	75.6
EP FG64.chr	10/5/2022	12:58:53	10 ppm Cal	H2S	0.88	74.6
EP FG65.chr	10/5/2022	12:59:59	10 ppm Cal	H2S	0.873	76.0
EP FG66.chr	10/5/2022	13:01:05		H2S	0.87	381.4
EP FG67.chr	10/5/2022	13:02:11	Zero Cal MDL	H2S	0.913	0.3
EP FG68.chr	10/5/2022	13:03:18	Zero Cal MDL	H2S	0.87	0.1
EP FG69.chr	10/5/2022	13:04:24	Zero Cal MDL	H2S	0.926	0.2
EP FG70.chr	10/5/2022	13:05:30	Zero Cal MDL	H2S	0.88	0.1
EP FG71.chr	10/5/2022	13:06:57		H2S	0.886	269.3
EP FG72.chr	10/5/2022	13:08:03		H2S	0.88	292.4
EP FG73.chr	10/5/2022	13:09:09	Sample Line Loss	H2S	0.88	291.7
EP FG74.chr	10/5/2022	13:10:15	Sample Line Loss	H2S	0.873	295.9
EP FG75.chr	10/5/2022	13:11:21	Sample Line Loss	H2S	0.873	294.2
CrudeFlare26.chr	10/6/2022	8:33:01		H2S	0.843	285.9
CrudeFlare27.chr	10/6/2022	8:34:07	Sample Line Loss	H2S	0.843	287.1
CrudeFlare28.chr	10/6/2022	8:35:13	Sample Line Loss	H2S	0.856	286.6
CrudeFlare29.chr	10/6/2022	8:36:19	Sample Line Loss	H2S	0.853	282.8
CrudeFlare30.chr	10/6/2022	8:40:05		H2S	0.85	2.1
CrudeFlare31.chr	10/6/2022	8:41:11		H2S	0.793	1.0
CrudeFlare32.chr	10/6/2022	8:42:17		H2S	0.843	2.6
CrudeFlare35.chr	10/6/2022	8:45:32	Run 1	H2S	0.843	2.8
CrudeFlare36.chr	10/6/2022	8:55:32	Run 1	H2S	0.906	1.6
CrudeFlare37.chr	10/6/2022	9:05:32	Run 1	H2S	0.876	0.9
CrudeFlare38.chr	10/6/2022	9:15:32	Run 2	H2S	0.8	1.1
CrudeFlare39.chr	10/6/2022	9:25:32	Run 2	H2S	0.863	62.1
CrudeFlare40.chr	10/6/2022	9:35:32	Run 2	H2S	0.886	0.9
CrudeFlare41.chr	10/6/2022	9:45:33	Run 3	H2S	0.92	1.0
CrudeFlare42.chr	10/6/2022	9:55:35	Run 3	H2S	0.92	0.9
CrudeFlare43.chr	10/6/2022	10:05:35	Run 3	H2S	0.843	2.6
CrudeFlare44.chr	10/6/2022	10:15:36	Run 4	H2S	0.853	1.5
CrudeFlare45.chr	10/6/2022	10:25:36	Run 4	H2S	0.843	2.4
CrudeFlare46.chr	10/6/2022	10:35:36	Run 4	H2S	0.843	2.5
CrudeFlare47.chr	10/6/2022	10:45:36	Run 5	H2S	0.84	3.5
CrudeFlare48.chr	10/6/2022	10:55:36	Run 5	H2S	0.84	4.1
CrudeFlare49.chr	10/6/2022	11:05:36	Run 5	H2S	0.85	5.9
CrudeFlare50.chr	10/6/2022	11:15:36	Run 6	H2S	0.84	7.5

Erthwrks Raw Datalogs

Chromatogram #	Date	Time	Test Period	Pollutant	Retention	Area Count
CrudeFlare51.chr	10/6/2022	11:25:36	Run 6	H2S	0.84	11.5
CrudeFlare52.chr	10/6/2022	11:35:36	Run 6	H2S	0.85	15.4
CrudeFlare53.chr	10/6/2022	11:45:37	Run 7	H2S	0.85	14.2
CrudeFlare54.chr	10/6/2022	11:55:37	Run 7	H2S	0.836	14.9
CrudeFlare55.chr	10/6/2022	12:05:37	Run 7	H2S	0.84	17.5
CrudeFlare56.chr	10/6/2022	12:15:37	Run 8	H2S	0.85	19.4
CrudeFlare57.chr	10/6/2022	12:25:37	Run 8	H2S	0.836	22.9
CrudeFlare58.chr	10/6/2022	12:35:37	Run 8	H2S	0.84	27.9
CrudeFlare59.chr	10/6/2022	12:45:37	Run 9	H2S	0.836	29.2
CrudeFlare60.chr	10/6/2022	12:55:37	Run 9	H2S	0.85	34.4
CrudeFlare61.chr	10/6/2022	13:05:37	Run 9	H2S	0.85	38.8
CrudeFlare62.chr	10/6/2022	13:15:38	Run 10	H2S	0.85	40.9
CrudeFlare63.chr	10/6/2022	13:25:38	Run 10	H2S	0.84	46.8
CrudeFlare64.chr	10/6/2022	13:35:38	Run 10	H2S	0.84	45.6
CrudeFlare65.chr	10/6/2022	13:45:52	Run 10	H2S	0.856	73.4
CrudeFlare66.chr	10/6/2022	13:46:58		H2S	0.856	178.5
CrudeFlare67.chr	10/6/2022	13:48:04	Post Cal	H2S	0.856	279.5
CrudeFlare68.chr	10/6/2022	13:49:10	Post Cal	H2S	0.85	278.6
CrudeFlare69.chr	10/6/2022	13:50:16	Post Cal	H2S	0.846	283.7

Attachment C
Certificates

STACK TESTING ACCREDITATION COUNCIL

American Association for Labo

Accredited Air Emission Testing

A2LA has accredited

ERTHWRKS, INC.

In recognition of the successful completion of the joint A2LA and Stack Testing Accreditation Co evaluation process, this laboratory is accredited to perform testing activities in compliance ASTM D7036:2004 - Standard Practice for Competence of Air Emission Testing Bodies.

Presented this 29th day of March 2021.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 6147.01
Valid to March 31, 2023

This accreditation program is not included under the A2LA ILAC Mutual Recognition Arrangemer

Environics
69 Industrial Park Rd E, Tolland CT 06084
https://www.environics.com/service-request
(860) 872-1111 info@environics.com

ENVIRONICS FLOW CONTROLLER CALIBRATION REPORT

Unit Summary		Std Conditions		MFC Summary	
Model #:	S4040	Temp:	32°F	MFC #:	1
Unit SN :	9144	Pressure:	29.92 in. Hg	MFC FS Flow:	10000
		Gas:	NITROGEN	MFC S/N:	0995030001

Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	500	535.942
10%	1000	1068.271
20%	2000	2140.081
30%	3000	3190.149
40%	4000	4216.403
50%	5000	5248.716
60%	6000	6260.214
70%	7000	7247.619
80%	8000	8247.958
90%	9000	9235.485
100%	10000	10230.140

All values in SCCM

Flow Verification Data

	Set Flow	True Flow	% dev
99%	9900	9929.928	0.30%
85%	8500	8520.603	0.24%
55%	5500	5500.753	0.01%
25%	2500	2507.681	0.31%
10%	1000	1001.440	0.14%

All values in SCCM

This calibration complies with ISO 17025-2005 [non-accredited] and is traceable to the National Institute of Standards and Technology (NIST). Calibration and verification are accomplished exclusively by qualified personnel following controlled procedures under ISO 9001:2015. For questions or concerns, contact Customer Service via our website, email or by phone, weekdays from 8AM - 4PM.

Verified by: Ashfaq Ahmad Date: 8-16-22

Environics®

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https://www.environics.com/service-request
(860) 872-1111 info@environics.com

ENVIRONICS FLOW CONTROLLER CALIBRATION REPORT

Unit Summary		Std Conditions		MFC Summary	
Model #:	S4040	Temp:	32°F	MFC #:	2
Unit SN :	9144	Pressure:	29.92 in. Hg	MFC FS Flow:	4000
		Gas:	NITROGEN	MFC S/N:	0995032001

Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	200	209.074
10%	400	420.913
20%	800	842.487
30%	1200	1265.189
40%	1600	1678.978
50%	2000	2082.343
60%	2400	2475.043
70%	2800	2884.917
80%	3200	3260.854
90%	3600	3651.022
100%	4000	4051.684

All values in SCCM

Flow Verification Data

	Set Flow	True Flow	% dev
99%	3960	3976.419	0.41%
85%	3400	3413.736	0.40%
55%	2200	2210.047	0.46%
25%	1000	1000.119	0.01%
10%	400	399.975	-0.01%

All values in SCCM

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Verified by: Ashton Attwood Date: 8-16-22

Environics®

69 Industrial Park Rd E, Tolland CT 06084
https://www.environics.com/service-request
(860) 872-1111 info@environics.com

ENVIRONICS FLOW CONTROLLER CALIBRATION REPORT

Unit Summary		Std Conditions		MFC Summary	
Model #:	S4040	Temp:	32°F	MFC #:	4
Unit SN :	9144	Pressure:	29.92 in. Hg	MFC FS Flow:	40
		Gas:	NITROGEN	MFC S/N:	0995036001

Flow Calibration Data is not performance data. This data is used by the system operating mode to improve the flow accuracy. The Flow Verification Data is performance data.

Flow Calibration Data

	Set Flow	True Flow
5%	2	1.817
10%	4	3.905
20%	8	8.055
30%	12	12.163
40%	16	16.314
50%	20	20.438
60%	24	24.557
70%	28	28.677
80%	32	32.799
90%	36	36.927
100%	40	40.977

All values in SCCM

Flow Verification Data

	Set Flow	True Flow	% dev
99%	39.6	39.669	0.17%
85%	34	33.973	-0.08%
55%	22	21.989	-0.05%
25%	10	10.003	0.03%
10%	4	3.992	-0.20%

All values in SCCM

This calibration complies with ISO 17025-2005 [non-accredited] and is traceable to the National Institute of Standards and Technology (NIST). Calibration and verification are accomplished exclusively by qualified personnel following controlled procedures under ISO 9001:2015. For questions or concerns, contact Customer Service via our website, email or by phone, weekdays from 8AM - 4PM.

Verified by: _____ Date: 8-16-22

Airgas
an Air Liquide company

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA PROTOCOL STANDARD

Part Number:	E02NI99E15A2110	Reference Number:	160-402112379-1
Cylinder Number:	CC62329	Cylinder Volume:	144.4 Cubic Feet
Laboratory:	124 - Plumsteadville - PA	Cylinder Pressure:	2015 PSIG
PGVP Number:	A12021	Valve Outlet:	330
Gas Code:	H2S,BALN	Certification Date:	May 25, 2021

Expiration Date: May 25, 2024

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
HYDROGEN SULFIDE	1000 PPM	1007 PPM	G2	+/- 2%	05/18/2021, 05/25/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124156356102	CC273734	953.7 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.50	Mar 25, 2024
PRM	C1940510.06	D887260	999 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.50	Jan 20, 2024

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
AMETEK 9000 ZZ-9000-10464-1	NDUV	May 21, 2021

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	ERTHWRKS		
Part Number:	E04NI99E15A7125	Reference Number:	163-402095745-1
Cylinder Number:	CC429848	Cylinder Volume:	144.4 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,PPN,BALN	Certification Date:	May 04, 2021

Expiration Date: May 04, 2024

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
NOX	50.00 PPM	49.91 PPM	G1	+/- 1.2% NIST Traceable	04/27/2021, 05/04/2021
CARBON MONOXIDE	50.00 PPM	50.36 PPM	G1	+/- 0.8% NIST Traceable	04/27/2021
NITRIC OXIDE	50.00 PPM	49.84 PPM	G1	+/- 1.2% NIST Traceable	04/27/2021, 05/04/2021
PROPANE	50.00 PPM	50.68 PPM	G1	+/- 0.7% NIST Traceable	04/27/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	10010515	AAL073265	25.54 PPM CARBON MONOXIDE/NITROGEN	+/-0.7%	Apr 13, 2022
PRM	12377	D562881	30.00 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 04, 2018
NTRM	200611-29	CC733348	49.82 PPM NITRIC OXIDE/NITROGEN	+/-1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/-2.0%	Feb 20, 2020
GMIS	7292017105	CC506724	30.4 PPM NITROGEN DIOXIDE/AIR	+/-2.0%	Sep 03, 2021
GMIS	401648677102	CC506986	15.21 PPM NITROGEN DIOXIDE/NITROGEN	+/-2.1%	Feb 10, 2023
NTRM	17061006	ND61234	49.13 PPM PROPANE/AIR	+/-0.4%	Jul 24, 2023

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO-XL-NICOLET iS50 AUP2010248	FTIR	Apr 15, 2021
NO-XL-NICOLET iS50 AUP2010248	FTIR	Apr 28, 2021
NO2-NICOLET iS50 AUP2010248	FTIR	Apr 28, 2021
C3H8-XXL-NICOLET iS50 AUP2010248	FTIR	Apr 22, 2021

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas
an Air Liquide company

Airgas USA, LLC
9810 BAY AREA BLVD
Pasadena, TX 77507
Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	ERTHWRKS		
Part Number:	E04NI99E15A7149	Reference Number:	163-401505767-1
Cylinder Number:	CC418906	Cylinder Volume:	144.4 CF
Laboratory:	124 - Pasadena (SG06) - TX	Cylinder Pressure:	2015 PSIG
PGVP Number:	A32019	Valve Outlet:	660
Gas Code:	CO,NO,NOX,PPN,BALN	Certification Date:	Jun 04, 2019

Expiration Date: Jun 04, 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 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
NOX	950.0 PPM	952.4 PPM	G1	+/- 0.8% NIST Traceable	05/28/2019, 06/04/2019
CARBON MONOXIDE	950.0 PPM	965.6 PPM	G1	+/- 0.5% NIST Traceable	05/28/2019
NITRIC OXIDE	950.0 PPM	952.4 PPM	G1	+/- 0.8% NIST Traceable	05/28/2019, 06/04/2019
PROPANE	950.0 PPM	960.9 PPM	G1	+/- 0.6% NIST Traceable	05/28/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09010306	KAL004473	970.0 PPM CARBON MONOXIDE/NITROGEN	+/-0.4%	May 14, 2021
PRM	12377	D562881	30.00 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Sep 04, 2018
NTRM	08011740	KAL004072	970.9 PPM NITRIC OXIDE/NITROGEN	+/-0.6%	Apr 16, 2024
GMIS	7292017105	CC506724	30.4 PPM NITROGEN DIOXIDE/AIR	+/-2.0%	Sep 03, 2021
NTRM	15060808	CC462511	992.3 PPM PROPANE/NITROGEN	+/-0.6%	Jul 22, 2021

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO-M - NICOLET 6700 AHR0600411	FTIR	May 16, 2019
NO-M - NICOLET 6700 AHR0600411	FTIR	May 30, 2019
NO2 - NICOLET 6700 AHR0600411	FTIR	May 30, 2019
C3H8-L-NICOLET 6700 AHR0600411	FTIR	May 22, 2019

Triad Data Available Upon Request

Signature on file

Approved for Release

Attachment D
Example Calculations

Erthwrks RATA Example Calculations

Example Calculations for H_2S RATA

Arithmetic Mean--Mean of the Difference between reference method and client CEMS, d_{avg}

$$d_{avg} = \frac{1}{n}\sum_{i=1}^{n} d_i \qquad \textit{Eq. 2-3}$$

where: d = absolute difference between reference method and client CEMS

i = run number

d_1 =	-7.01	d_4 =	-11.13	d_7 =	-11.57	d_{10} =	0
d_2 =	-1.47	d_5 =	-13.08	d_8 =	-14.44	d_{11} =	0
d_3 =	-8.89	d_6 =	-14.91	d_9 =	-17.62	d_{12} =	0

n = number of runs = **9**

d_{avg} = -11.12

Standard Deviation, S_d

$$S_d = \sqrt{\frac{\sum_{i=1}^{n} d_i^{\,2} - \frac{\left[\sum_{i=1}^{n} di\right]^2}{n}}{n-1}} \qquad \textit{Eq. 2-4}$$

$$S_d = \left(\frac{\textbf{1.30E+03} \quad - \quad \frac{\textbf{1.00E+04}}{\textbf{9}}}{\textbf{8}} \right)^{\textbf{1/2}}$$

S_d = 4.83

Confidence Coefficient, CC

$$CC = t_{0.975} \frac{S_d}{n^{1/2}} \qquad \textit{Eq. 2-5}$$

where: $t_{0.975}$ = 2.306

$$CC = 2.306 * \frac{4.83E+00}{3}$$

CC = 3.71

Relative Accuracy, RA_{AS}

$$RA_{AS} = \frac{|d_{avg}| + |CC|}{AS} \times 100 \qquad \textit{Eq. 2-6}$$

where: AS = the unit's permit limit or applicable standard

AS = *162*

$$RA_{AS} = \frac{11.1244 + 3.71E+0}{162} * 100$$

RA_{AS} = 9.16%

Erthwrks Example Calculations

Example Calcs : Fuel gas

Example Calcs for Pollutant : H_2S

C_V	= 40.0	=	Low Level Target concentration of calibration gas, ppmv.
C_{Dir}	= 20.0	=	Mid Level Target concentration of calibration gas, ppmv.
CS	= 10.0	=	High Level Target concentration of calibration gas, ppmv.
C_S	= 997.1	=	Low Level Average GC Response
SB_i	= 284.5	=	Mid Level Average GC Response
SB_f	= 75.4	=	High Level Average GC Response

GC Calibration Curve (Polynomial Excel Generated)

$$y = ax^2 + bx + c$$

where: a = 0.5524
b = 2.8588
c = 0

Run 1 Example Calculation

y = 1.771 (average response Run 1)

solution = $$x = \frac{-b + [b^2 - 4(a)(c-y)]^{1/2}}{2(a)}$$

where: a = 0.5524
b = 2.8588
c = 0.000 (c - y)

$$x = \frac{-2.8588 \quad [\ 2.86\text{^}2 - \quad 4\ (\ 0.5524\ ) \quad -(\ 1.77\ )\ ]\text{^}1/2}{2\ (\ 0.5524\ )}$$

x = 0.56 ppmv

Attachment E
CEMS Data

CEMS Data

Run #	Date/Time	04AI2055H	S/VG 1H Avg 04FFI2051A	Vent Gas Mass Flow (PPH) 04FI2051A	NHV of VG(Btu/SCF) 04AI2053B_B
	10/6/2022 8:45	5.53	2.00	352.49	1104.98
	10/6/2022 8:46	8.74	2.00	352.79	1096.26
	10/6/2022 8:47	8.78	2.00	353.10	1095.05
	10/6/2022 8:48	8.78	2.00	353.40	1093.83
	10/6/2022 8:49	8.78	2.00	353.71	1092.62
	10/6/2022 8:50	8.78	1.99	354.02	1091.40
	10/6/2022 8:51	8.78	1.99	354.32	1090.18
	10/6/2022 8:52	8.78	1.99	354.62	1088.97
	10/6/2022 8:53	8.48	1.99	352.11	1069.72
	10/6/2022 8:54	8.04	2.00	346.64	1060.91
	10/6/2022 8:55	8.04	2.00	345.90	1060.34
	10/6/2022 8:56	8.04	2.00	347.38	1059.77
	10/6/2022 8:57	8.04	2.01	348.87	1059.20
	10/6/2022 8:58	8.04	2.01	350.36	1058.63
	10/6/2022 8:59	8.04	2.01	351.84	1058.06
	10/6/2022 9:00	7.96	2.01	353.33	1054.19
1	10/6/2022 9:01	7.19	2.02	354.44	1045.88
	10/6/2022 9:02	7.17	2.02	354.47	1044.72
	10/6/2022 9:03	7.17	2.02	354.42	1043.55
	10/6/2022 9:04	7.17	2.02	354.38	1042.38
	10/6/2022 9:05	7.17	2.01	354.34	1041.21
	10/6/2022 9:06	7.17	2.01	354.30	1040.05
	10/6/2022 9:07	7.17	2.01	354.26	1038.88
	10/6/2022 9:08	6.73	2.00	354.22	1036.89
	10/6/2022 9:09	6.44	2.00	354.18	1036.11
	10/6/2022 9:10	6.44	2.00	354.14	1035.74
	10/6/2022 9:11	6.44	2.00	353.91	1035.38
	10/6/2022 9:12	6.44	1.99	352.82	1035.02
	10/6/2022 9:13	6.44	2.00	351.63	1034.66
	10/6/2022 9:14	6.44	2.00	350.43	1034.29
	10/6/2022 9:15				
	Run average	**7.57**	**2.00**	**352.56**	**1059.29**

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 9:15	6.44	2.00	349.24	1033.93
	10/6/2022 9:16	6.48	2.00	348.05	1033.57
	10/6/2022 9:17	6.48	2.00	346.86	1033.20
	10/6/2022 9:18	6.48	2.00	345.36	1032.93
	10/6/2022 9:19	6.48	2.01	348.51	1032.84
	10/6/2022 9:20	6.48	2.01	353.02	1032.75
	10/6/2022 9:21	6.48	2.01	353.97	1032.66
	10/6/2022 9:22	6.48	2.01	354.13	1032.57
	10/6/2022 9:23	6.46	2.02	354.29	1032.49
	10/6/2022 9:24	6.46	2.03	354.45	1032.40
	10/6/2022 9:25	6.46	2.04	354.61	1032.31
	10/6/2022 9:26	6.46	2.05	354.76	1032.22
	10/6/2022 9:27	6.46	2.06	354.92	1032.13
	10/6/2022 9:28	6.46	2.08	355.08	1032.07
	10/6/2022 9:29	6.46	2.09	355.24	1032.14
	10/6/2022 9:30	6.61	2.10	354.20	1032.23
	10/6/2022 9:31	7.06	2.11	339.36	1032.32
2	10/6/2022 9:32	7.06	2.10	335.64	1032.40
	10/6/2022 9:33	7.06	2.08	337.30	1032.49
	10/6/2022 9:34	7.06	2.07	338.97	1032.58
	10/6/2022 9:35	7.06	2.05	340.64	1032.67
	10/6/2022 9:36	7.06	2.03	342.30	1032.76
	10/6/2022 9:37	7.06	2.03	343.22	1032.84
	10/6/2022 9:38	7.50	2.08	337.11	1032.91
	10/6/2022 9:39	7.57	2.10	334.77	1032.74
	10/6/2022 9:40	7.57	2.09	334.33	1032.51
	10/6/2022 9:41	7.57	2.08	333.88	1032.29
	10/6/2022 9:42	7.57	2.06	333.44	1032.06
	10/6/2022 9:43	7.57	2.05	332.99	1031.83
	10/6/2022 9:44	7.57	2.04	332.55	1031.61
	10/6/2022 9:45				
	Run average	**6.87**	**2.05**	**345.11**	**1032.55**

CEMS Data

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 9:45	7.88	2.02	332.10	1031.38
	10/6/2022 9:46	8.18	2.04	331.66	1031.16
	10/6/2022 9:47	8.18	2.08	331.21	1030.93
	10/6/2022 9:48	8.18	2.08	333.32	1030.75
	10/6/2022 9:49	8.18	2.02	348.77	1030.80
	10/6/2022 9:50	8.18	2.03	353.01	1030.90
	10/6/2022 9:51	8.18	2.04	351.31	1031.00
	10/6/2022 9:52	8.21	2.06	349.61	1031.09
	10/6/2022 9:53	8.90	2.07	347.91	1031.19
	10/6/2022 9:54	8.92	2.08	346.21	1031.28
	10/6/2022 9:55	8.92	2.10	344.20	1031.38
	10/6/2022 9:56	8.92	2.11	334.26	1031.48
	10/6/2022 9:57	8.92	2.10	336.11	1031.57
	10/6/2022 9:58	8.92	2.08	342.63	1031.67
	10/6/2022 9:59	8.92	2.07	345.14	1031.79
	10/6/2022 10:00	9.29	2.05	347.06	1031.92
3	10/6/2022 10:01	9.59	2.04	348.99	1032.05
	10/6/2022 10:02	9.59	2.02	350.92	1032.18
	10/6/2022 10:03	9.59	2.01	352.73	1032.31
	10/6/2022 10:04	9.59	2.02	353.27	1032.44
	10/6/2022 10:05	9.59	2.02	353.52	1032.57
	10/6/2022 10:06	9.59	2.02	353.76	1032.70
	10/6/2022 10:07	9.72	2.02	354.01	1032.83
	10/6/2022 10:08	11.03	2.02	354.26	1032.96
	10/6/2022 10:09	11.06	2.03	354.51	1033.09
	10/6/2022 10:10	11.06	2.03	354.75	1033.26
	10/6/2022 10:11	11.06	2.03	355.00	1033.42
	10/6/2022 10:12	11.06	2.03	355.25	1033.59
	10/6/2022 10:13	11.06	2.04	355.44	1033.75
	10/6/2022 10:14	11.06	2.04	355.44	1033.91
	10/6/2022 10:15				
	Run average	**9.38**	**2.05**	**347.55**	**1032.04**

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 10:15	11.22	2.04	355.42	1034.08
	10/6/2022 10:16	11.25	2.05	355.40	1034.24
	10/6/2022 10:17	11.25	2.05	355.38	1034.41
	10/6/2022 10:18	11.25	2.05	355.36	1034.56
	10/6/2022 10:19	11.25	2.06	355.35	1034.71
	10/6/2022 10:20	11.25	2.06	355.33	1034.91
	10/6/2022 10:21	11.25	2.06	355.31	1035.11
	10/6/2022 10:22	11.39	2.07	355.29	1035.30
	10/6/2022 10:23	11.65	2.06	355.39	1035.50
	10/6/2022 10:24	11.65	2.05	356.58	1035.70
	10/6/2022 10:25	11.65	2.04	358.03	1035.89
	10/6/2022 10:26	11.65	2.03	359.49	1036.09
	10/6/2022 10:27	11.65	2.02	360.94	1036.29
	10/6/2022 10:28	11.65	2.01	362.40	1036.48
	10/6/2022 10:29	11.65	2.00	363.85	1036.90
	10/6/2022 10:30	11.86	1.98	366.91	1037.63
4	10/6/2022 10:31	11.93	1.98	373.80	1038.37
	10/6/2022 10:32	11.93	2.05	365.74	1039.10
	10/6/2022 10:33	11.93	2.07	361.87	1039.84
	10/6/2022 10:34	11.93	2.06	358.24	1040.57
	10/6/2022 10:35	11.93	2.06	356.48	1041.31
	10/6/2022 10:36	11.93	2.06	356.40	1042.04
	10/6/2022 10:37	12.06	2.06	356.31	1042.78
	10/6/2022 10:38	12.32	2.06	356.23	1043.51
	10/6/2022 10:39	12.32	2.06	356.15	1044.05
	10/6/2022 10:40	12.32	2.06	356.07	1044.46
	10/6/2022 10:41	12.32	2.06	355.98	1044.87
	10/6/2022 10:42	12.32	2.06	355.90	1045.28
	10/6/2022 10:43	12.32	2.07	355.82	1045.69
	10/6/2022 10:44	12.33	2.06	355.74	1046.10
	10/6/2022 10:45				
	Run average	**11.78**	**2.05**	**358.24**	**1038.86**

CEMS Data

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
5	10/6/2022 10:45	12.63	2.06	355.77	1046.51
	10/6/2022 10:46	12.64	2.06	355.83	1046.92
	10/6/2022 10:47	12.64	2.05	355.89	1047.33
	10/6/2022 10:48	12.64	2.05	355.95	1047.74
	10/6/2022 10:49	12.64	2.05	356.01	1048.09
	10/6/2022 10:50	12.64	2.04	356.07	1048.38
	10/6/2022 10:51	12.64	2.04	356.13	1048.67
	10/6/2022 10:52	13.46	2.04	356.19	1048.97
	10/6/2022 10:53	13.88	2.04	356.25	1049.26
	10/6/2022 10:54	13.88	2.04	356.31	1049.56
	10/6/2022 10:55	13.88	2.05	356.67	1049.85
	10/6/2022 10:56	13.89	2.05	357.45	1050.15
	10/6/2022 10:57	13.88	2.06	358.23	1050.44
	10/6/2022 10:58	13.88	2.06	359.01	1050.74
	10/6/2022 10:59	14.21	2.07	359.80	1051.20
	10/6/2022 11:00	14.72	2.07	360.58	1052.35
	10/6/2022 11:01	14.73	2.08	361.36	1053.55
	10/6/2022 11:02	14.73	2.08	362.14	1054.75
	10/6/2022 11:03	14.73	2.03	363.98	1055.95
	10/6/2022 11:04	14.73	1.99	370.79	1057.15
	10/6/2022 11:05	14.73	2.01	375.89	1058.35
	10/6/2022 11:06	14.86	2.03	374.49	1059.73
	10/6/2022 11:07	15.90	2.04	371.62	1061.42
	10/6/2022 11:08	15.91	2.06	368.41	1062.16
	10/6/2022 11:09	15.91	2.08	365.99	1062.89
	10/6/2022 11:10	15.91	2.08	364.71	1063.63
	10/6/2022 11:11	15.91	2.08	363.43	1064.37
	10/6/2022 11:12	15.91	2.07	362.14	1065.10
	10/6/2022 11:13	15.91	2.07	360.86	1065.84
	10/6/2022 11:14	16.61	2.06	359.57	1066.58
	10/6/2022 11:15				
	Run average	**14.35**	**2.05**	**361.25**	**1054.59**

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
6	10/6/2022 11:15	16.78	2.06	358.29	1067.31
	10/6/2022 11:16	16.78	2.05	357.16	1068.04
	10/6/2022 11:17	16.78	2.05	356.97	1069.35
	10/6/2022 11:18	16.78	2.04	356.95	1071.49
	10/6/2022 11:19	16.78	2.04	356.92	1073.63
	10/6/2022 11:20	16.78	2.04	356.89	1075.77
	10/6/2022 11:21	17.12	2.04	356.86	1077.92
	10/6/2022 11:22	17.72	2.04	356.84	1079.26
	10/6/2022 11:23	17.72	2.04	356.81	1080.22
	10/6/2022 11:24	17.72	2.04	356.78	1081.17
	10/6/2022 11:25	17.72	2.04	356.75	1082.12
	10/6/2022 11:26	17.72	2.04	356.74	1083.08
	10/6/2022 11:27	17.72	2.04	356.78	1084.03
	10/6/2022 11:28	17.77	2.04	356.84	1084.98
	10/6/2022 11:29	18.22	2.04	356.90	1085.94
	10/6/2022 11:30	18.23	2.03	356.96	1086.89
	10/6/2022 11:31	18.23	2.04	357.02	1087.77
	10/6/2022 11:32	18.23	2.04	357.07	1088.40
	10/6/2022 11:33	18.23	2.04	357.13	1089.05
	10/6/2022 11:34	18.23	2.04	357.19	1089.69
	10/6/2022 11:35	18.23	2.04	357.25	1090.34
	10/6/2022 11:36	17.91	2.04	357.28	1090.99
	10/6/2022 11:37	17.65	2.04	357.27	1091.64
	10/6/2022 11:38	17.65	2.04	357.26	1092.28
	10/6/2022 11:39	17.65	2.04	357.26	1092.93
	10/6/2022 11:40	17.65	2.04	357.26	1093.58
	10/6/2022 11:41	17.65	2.04	357.26	1094.21
	10/6/2022 11:42	17.65	2.03	357.25	1094.77
	10/6/2022 11:43	17.44	2.03	357.25	1095.34
	10/6/2022 11:44	16.03	2.03	357.25	1095.92
	10/6/2022 11:45				
	Run average	**17.56**	**2.04**	**357.08**	**1084.60**

CEMS Data

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 11:45	16.02	2.03	357.24	1096.49
	10/6/2022 11:46	16.02	2.02	357.48	1097.07
	10/6/2022 11:47	16.02	2.02	360.47	1097.64
	10/6/2022 11:48	16.02	2.02	364.24	1098.21
	10/6/2022 11:49	16.02	2.01	364.71	1098.79
	10/6/2022 11:50	16.02	2.02	358.41	1099.36
	10/6/2022 11:51	15.18	2.02	358.53	1099.92
	10/6/2022 11:52	14.71	2.01	359.66	1100.20
	10/6/2022 11:53	14.71	2.01	360.79	1100.39
	10/6/2022 11:54	14.71	2.01	361.92	1100.58
	10/6/2022 11:55	14.71	2.01	363.06	1100.78
	10/6/2022 11:56	14.71	2.00	364.19	1100.97
	10/6/2022 11:57	14.71	2.00	365.69	1101.17
	10/6/2022 11:58	14.55	2.00	360.42	1101.36
	10/6/2022 11:59	13.93	2.00	361.79	1101.56
	10/6/2022 12:00	13.92	2.00	370.05	1101.75
	10/6/2022 12:01	13.93	2.02	377.03	1101.95
7	10/6/2022 12:02	13.92	2.05	373.68	1103.36
	10/6/2022 12:03	13.92	2.08	365.01	1105.75
	10/6/2022 12:04	13.92	2.07	361.30	1108.15
	10/6/2022 12:05	13.93	2.03	370.01	1110.58
	10/6/2022 12:06	14.61	2.00	376.85	1115.36
	10/6/2022 12:07	14.74	2.03	374.95	1116.27
	10/6/2022 12:08	14.74	2.06	367.57	1117.06
	10/6/2022 12:09	14.74	2.09	361.14	1117.85
	10/6/2022 12:10	14.74	2.10	358.52	1118.64
	10/6/2022 12:11	14.74	2.09	358.34	1119.43
	10/6/2022 12:12	14.74	2.09	358.15	1120.22
	10/6/2022 12:13	15.29	2.09	357.97	1123.33
	10/6/2022 12:14	16.52	2.09	357.79	1126.38
	10/6/2022 12:15				
	Run average	**14.88**	**2.04**	**363.57**	**1106.69**

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 12:15	16.52	2.09	357.61	1127.32
	10/6/2022 12:16	16.52	2.09	357.43	1128.25
	10/6/2022 12:17	16.52	2.08	357.25	1129.19
	10/6/2022 12:18	16.52	2.08	357.06	1130.13
	10/6/2022 12:19	16.52	2.08	356.89	1131.06
	10/6/2022 12:20	16.52	2.08	356.89	1132.00
	10/6/2022 12:21	17.61	2.08	356.91	1132.93
	10/6/2022 12:22	17.77	2.07	356.93	1133.87
	10/6/2022 12:23	17.76	2.07	356.95	1134.67
	10/6/2022 12:24	17.76	2.06	356.96	1134.75
	10/6/2022 12:25	17.77	2.06	356.98	1134.74
	10/6/2022 12:26	17.76	2.05	357.00	1134.73
	10/6/2022 12:27	17.76	2.05	357.02	1134.71
	10/6/2022 12:28	18.98	2.04	357.04	1146.23
	10/6/2022 12:29	20.10	2.04	357.05	1150.25
	10/6/2022 12:30	20.10	2.07	354.99	1149.92
	10/6/2022 12:31	20.10	2.10	351.22	1149.59
8	10/6/2022 12:32	20.10	2.13	347.52	1149.25
	10/6/2022 12:33	20.10	2.08	350.61	1148.92
	10/6/2022 12:34	20.10	2.04	354.48	1148.59
	10/6/2022 12:35	20.09	2.03	354.58	1148.25
	10/6/2022 12:36	19.62	2.03	352.70	1147.92
	10/6/2022 12:37	19.58	2.02	350.83	1147.59
	10/6/2022 12:38	19.58	2.01	348.96	1147.52
	10/6/2022 12:39	19.58	2.01	347.09	1148.62
	10/6/2022 12:40	19.58	2.00	345.35	1149.85
	10/6/2022 12:41	19.58	1.99	347.64	1151.08
	10/6/2022 12:42	19.58	1.99	350.25	1152.32
	10/6/2022 12:43	22.00	1.98	352.89	1162.58
	10/6/2022 12:44	23.85	2.00	351.22	1165.20
	10/6/2022 12:45				
	Run average	**18.86**	**2.05**	**353.88**	**1142.73**

CEMS Data

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 12:45	23.85	2.06	342.43	1165.65
	10/6/2022 12:46	23.85	2.07	335.13	1166.10
	10/6/2022 12:47	23.85	2.06	339.78	1166.55
	10/6/2022 12:48	23.85	2.04	349.82	1166.99
	10/6/2022 12:49	23.85	2.03	339.54	1167.44
	10/6/2022 12:50	23.85	2.02	332.58	1172.05
	10/6/2022 12:51	26.63	2.01	334.98	1190.83
	10/6/2022 12:52	26.77	1.99	337.55	1191.44
	10/6/2022 12:53	26.78	1.98	342.89	1192.06
	10/6/2022 12:54	26.77	1.97	352.48	1192.67
	10/6/2022 12:55	26.77	1.98	353.02	1193.29
	10/6/2022 12:56	26.78	1.98	353.50	1193.90
	10/6/2022 12:57	26.78	1.98	353.98	1194.51
	10/6/2022 12:58	24.04	1.99	354.46	1164.90
	10/6/2022 12:59	22.25	1.99	354.93	1158.03
	10/6/2022 13:00	22.25	1.99	355.41	1158.16
9	10/6/2022 13:01	22.25	2.00	355.89	1158.29
	10/6/2022 13:02	22.25	2.00	356.37	1158.42
	10/6/2022 13:03	22.25	2.00	356.84	1158.55
	10/6/2022 13:04	22.25	2.01	356.68	1158.68
	10/6/2022 13:05	22.04	2.02	355.55	1158.81
	10/6/2022 13:06	21.31	2.03	354.41	1158.94
	10/6/2022 13:07	21.30	2.04	353.27	1159.07
	10/6/2022 13:08	21.30	2.05	352.12	1159.13
	10/6/2022 13:09	21.30	2.06	350.98	1158.85
	10/6/2022 13:10	21.30	2.07	349.84	1158.52
	10/6/2022 13:11	21.30	2.08	348.70	1158.19
	10/6/2022 13:12	21.30	2.09	347.51	1157.86
	10/6/2022 13:13	20.32	2.10	338.43	1157.53
	10/6/2022 13:14	19.87	2.06	345.17	1157.20
	10/6/2022 13:15				
	Run average	**23.31**	**2.02**	**348.47**	**1168.42**

Run #	Date/Time	H2S (ppm)	S/VG	Vent Gas Mass Flow (PPH)	NHV of VG(Btu/SCF)
	10/6/2022 13:15	19.87	2.02	354.40	1156.87
	10/6/2022 13:16	19.87	2.03	352.78	1156.54
	10/6/2022 13:17	19.88	2.06	349.99	1156.21
	10/6/2022 13:18	19.87	2.08	345.12	1156.00
	10/6/2022 13:19	19.87	2.06	340.00	1156.74
	10/6/2022 13:20	20.52	2.01	350.69	1157.69
	10/6/2022 13:21	22.30	2.02	355.27	1158.65
	10/6/2022 13:22	22.31	2.03	354.50	1159.60
	10/6/2022 13:23	22.31	2.04	353.66	1160.55
	10/6/2022 13:24	22.31	2.05	352.81	1161.50
	10/6/2022 13:25	22.31	2.06	351.97	1162.46
	10/6/2022 13:26	22.31	2.07	351.12	1163.41
	10/6/2022 13:27	22.31	2.08	350.28	1164.36
	10/6/2022 13:28	22.52	2.09	349.43	1165.24
	10/6/2022 13:29	22.56	2.10	343.63	1165.40
10	10/6/2022 13:30	22.56	2.11	336.68	1165.39
	10/6/2022 13:31	22.56	2.09	338.91	1165.39
	10/6/2022 13:32	22.56	2.07	341.15	1165.38
	10/6/2022 13:33	22.56	2.05	343.39	1165.38
	10/6/2022 13:34	22.56	2.03	347.64	1165.38
	10/6/2022 13:35	26.70	2.02	352.67	1227.77
	10/6/2022 13:36	37.01	2.02	356.52	1291.46
	10/6/2022 13:37	37.03	2.02	356.89	1292.40
	10/6/2022 13:38	37.03	2.03	356.88	1293.35
	10/6/2022 13:39	37.03	2.03	356.87	1294.29
	10/6/2022 13:40	37.03	2.03	356.85	1295.23
	10/6/2022 13:41	37.03	2.03	356.84	1296.18
	10/6/2022 13:42	37.03	2.03	356.82	1295.16
	10/6/2022 13:43	33.95	2.04	356.81	1252.02
	10/6/2022 13:44	33.07	2.04	356.80	1250.38
	10/6/2022 13:45				
	Run average	**26.23**	**2.05**	**350.91**	**1200.55**