Source Test Report

Eastern Research Group
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Uinta Wax Operating, LLC.
Deep Creek, Kendall, Lamb, Merritt, Womack, Gravitte,
Szyndrowski, & Gardner State

Sources Tested: Fifteen (15) Pumpjack Engines
Test Dates: July 25, 26, and August 2, 2022

Project No. AST-2022-2097-002

Prepared By
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Source Information

Make / Model	*Serial #*	*Facility Name*	*Target Parameters*
Arrow / L-795	L-601135	Lamb 3-15-4-2E	NOx, NMHC
Arrow / L-795	AIL 795038	Deep Creek 9-15-4-2E	NOx, NMHC
Arrow / A-90	BCA905002	Kendall 15-7-3-1E	NOx, NMHC
Arrow / L-795	FDE795008	Kendall 2-18-3-1E-H4	NOx, NMHC
Arrow / L-795	--	Merritt 1-18-3-1E-H1	NOx, NMHC
Arrow / L-795	L-600978	Womack 3-8-3-1E	NOx, NMHC
Arrow / L-795	DDL795003	Szyndrowski 35-34-3-1E-H1	NOx, CO, NMHC
Arrow / A-90	BFA905004	Gavitte 15-23-3-1E	NOx, CO, NMHC
Ajax / E-565	86523	Gavitte 10-23-3-1E	NOx, CO, NMHC
Arrow / L-795	L-601092	Gavitte 13-23-3-1E	NOx, CO, NMHC
Arrow / L-795	L-601200	Gavitte 4-26-3-1E	NOx, CO, NMHC
Ajax / E-565	86488	Kendall 4-17-3-1E	NOx, CO, NMHC
Arrow / A-90	AKA905002	Kendall 1-18-3-1E	NOx, CO, NMHC
Arrow / L-795	--	Kendall 5-17-3-1E	NOx, CO, NMHC
Arrow / L795	SP114P1	Gardner State 1-26-3-2E	NOx, CO, NMHC

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Deep Creek, Kendall, Lamb, Merritt, Womack, Gravitte,
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Alliance Technical Group, LLC (Alliance) has completed the source testing as described in this report. Results apply only to the sources tested and operating conditions for the specific test dates and times identified within this report. All results are intended to be considered in their entirety, and Alliance is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections in the test report.

This report is only considered valid once an authorized representative of Alliance has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.

Andrew Bellard, QSTI
Alliance Technical Group, LLC

9/8/2022
Date

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Introduction

1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by Eastern Research Group (ERG) to conduct compliance testing at Uinta Wax Operating, LLC Deep Creek, Kendall, Lamb, Merritt, Womack, Gravitte, Szyndrowski, and Gardner State facilities. Testing was conducted to determine the emission rates of nitrogen oxides (NOx), carbon monoxide (CO) and non-methane hydrocarbons (NMHC) from thirteen (13) Arrow engines and two (2) Ajax engines. Due to the analyzer issues encountered in the field, six (6) Arrow engines were unable to be tested for CO.

Due to the small diameter of the stacks of these engines, emission rates were calculated using the Wyoming Analyzer Protocol, Page 25, Section 10.1.2. The maximum Engine Brake Work (MAXEBW) horsepower (hp) is the nameplate hp in the field, the Engine Brake Work (EBW) hp is the site-rated hp adjusted to 5,000' elevation.

Where manufacturer-specified Brake Specific Fuel Consumption (BSFC) in BTU/HP-hr and nameplate horsepower in HP were available, those were used in calculations for emission mass rates. Where they were not available, the Wyoming Analyzer Protocol default value of 9,400 BTU/hp-hr was used. Where manufacture year or horsepower were not available on the engine nameplate, or there was no nameplate, the year and horsepower reported were provided by the EPA relying on emission inventory data.

1.1 Project Team

Personnel involved in this project are identified in the following table.

Table 1-1: Project Team

EPA Personnel	Youn Joo Kim
ERG Personnel	Jason Huckaby
Alliance Personnel	Andrew Bellard

1.2 Test Program Notes

Due to the analyzer issues encountered in the field, six (6) Arrow engines were unable to be tested for CO. These engines were: Deep Creek 9-15-4-2E, Kendall 2-18-3-1E-H4, Kendall 15-7-3-1E, Lamb 3-15-4-2E, Merritt 1-18-3-1E-H1, and Womack 3-8-3-1E.

Summary of Results

2.0 Summary of Results

Alliance conducted compliance testing at the Uinta Wax Operating, LLC Deep Creek, Kendall, Lamb, Merritt, Womack, Gravitte, Szyndrowski, and Gardner State facilities on July 25, 26, and August 2, 2022. Testing consisted of determining the emission rates of NOx, CO and NMHC from the exhaust of fifteen (15) engines. Due to the small diameter of the stacks of these engines, emission rates were calculated using the Wyoming Analyzer Protocol, Page 25, Section 10.1.2.

Tables 2-1 through 2-4 provide summaries of the emission testing results. Any difference between the summary results listed in the following tables and the detailed results contained in appendices is due to rounding for presentation.

Table 2-1: Summary of Results

Engine ID/Serial #	Lamb 3-15-4-2E / L-601135	Deep Creek 9-15-4-2E / AIL 795038	Kendall 15-7-3-1E/ BCA905002	Kendall 2-18-3-1E-H4 / FDE795008
Date	**07/25/22**	**07/25/22**	**07/25/22**	**07/25/22**
Carbon Monoxide Data				
Concentration, ppmvd	--	--	--	--
Concentration, ppmvd @ 15% O_2	--	--	--	--
Emission Rate, lb/hr	--	--	--	--
Emission Rate, ton/yr	--	--	--	--
Emission Factor, g/hp-hr	--	--	--	--
Nitrogen Oxides Data				
Concentration, ppmvd	41.8	244.4	1,270.0	190.7
Concentration, ppmvd @ 15% O_2	37.1	170.2	485.7	126.1
Emission Rate, lb/hr	0.091	0.42	1.4	0.31
Emission Rate, ton/yr	0.40	1.8	6.0	1.4
Emission Factor, g/hp-hr	0.75	3.4	6.7	2.5
Methane Data				
Concentration, ppmvd	0.49	4.9	4.4	31.2
Concentration, ppmvd @ 15% O_2	0.44	3.4	1.7	20.6
Emission Rate, lb/hr	0.00038	0.0029	0.0016	0.018
Emission Rate, ton/yr	0.0016	0.013	0.0072	0.077
Emission Factor, g/hp-hr	0.0031	0.024	0.0080	0.15
Non-Methane Hydrocarbons Data				
Concentration, ppmvd	1,203.4	2,210.5	2,265.3	1,725.5
Concentration, ppmvd @ 15% O_2	1,069.3	1,539.2	866.3	1,141.1
Emission Rate, lb/hr	2.5	3.6	2.3	2.7
Emission Rate, ton/yr	11.0	15.9	10.2	11.8
Emission Factor, g/hp-hr	20.7	29.8	11.4	22.1

Table 2-2: Summary of Results

Engine ID/Serial #	Merritt 1-18-3-1E-H1	Womack 3-8-3-1E / L-600978	Szyndrowski 35-34-3-1E-H1 / DDL795003	Gavitte 15-23-3-1E / BFA905004
Date	**07/25/22**	**07/25/22**	**07/26/22**	**07/26/22**
Carbon Monoxide Data				
Concentration, ppmvd	--	--	330.4	8221.5
Concentration, ppmvd @ 15% O_2	--	--	176.1	2473.8
Emission Rate, lb/hr	--	--	0.26	4.2
Emission Rate, ton/yr	--	--	1.2	18.5
Emission Factor, g/hp-hr	--	--	2.2	20.7
Nitrogen Oxides Data				
Concentration, ppmvd	790.6	4.9	47.2	1,947.0
Concentration, ppmvd @ 15% O_2	371.0	7.7	25.2	585.8
Emission Rate, lb/hr	1.1	0.019	0.062	1.6
Emission Rate, ton/yr	4.8	0.083	0.27	7.2
Emission Factor, g/hp-hr	7.5	0.16	0.51	8.0
Methane Data				
Concentration, ppmvd	29.7	23.5	46.3	11.0
Concentration, ppmvd @ 15% O_2	13.9	37.2	24.7	3.3
Emission Rate, lb/hr	0.014	0.032	0.021	0.0032
Emission Rate, ton/yr	0.063	0.14	0.093	0.014
Emission Factor, g/hp-hr	0.098	0.26	0.17	0.016
Non-Methane Hydrocarbons Data				
Concentration, ppmvd	3,105.2	1,590.8	1,529.3	284.1
Concentration, ppmvd @ 15% O_2	1,457.2	2,520.6	814.9	85.5
Emission Rate, lb/hr	4.1	5.9	1.9	0.23
Emission Rate, ton/yr	18.1	26.0	8.4	1.0
Emission Factor, g/hp-hr	28.2	48.8	15.8	1.1

Table 2-3: Summary of Results

Engine ID/Serial #	Gavitte 10-23-3-1E / 86523	Gavitte 13-23-3-1E / L-601092	Gavitte 4-26-3-1E / L-601200	Kendall 4-17-3-1E / 86488
Date	**07/26/22**	**07/26/22**	**07/26/22**	**07/26/22**
Carbon Monoxide Data				
Concentration, ppmvd	173.4	9.4	21.1	45.7
Concentration, ppmvd @ 15% O_2	231.1	31.2	73.0	269.9
Emission Rate, lb/hr	0.23	0.047	0.11	0.27
Emission Rate, ton/yr	1.0	0.20	0.48	1.2
Emission Factor, g/hp-hr	3.1	0.38	0.90	3.7
Nitrogen Oxides Data				
Concentration, ppmvd	92.0	2.7	103.6	0.00
Concentration, ppmvd @ 15% O_2	122.6	9.0	358.5	0.00
Emission Rate, lb/hr	0.20	0.022	0.88	0.00
Emission Rate, ton/yr	0.89	0.098	3.9	0.00
Emission Factor, g/hp-hr	2.7	0.18	7.2	0.00
Methane Data				
Concentration, ppmvd	75.3	44.8	29.0	25.8
Concentration, ppmvd @ 15% O_2	100.3	148.6	100.4	152.4
Emission Rate, lb/hr	0.058	0.13	0.086	0.089
Emission Rate, ton/yr	0.26	0.56	0.38	0.39
Emission Factor, g/hp-hr	0.78	1.0	0.71	1.2
Non-Methane Hydrocarbons Data				
Concentration, ppmvd	1,863.9	889.1	692.5	868.8
Concentration, ppmvd @ 15% O_2	2,483.8	2,949.8	2,395.4	5,134.2
Emission Rate, lb/hr	4.0	7.0	5.7	8.2
Emission Rate, ton/yr	17.4	30.5	24.7	35.9
Emission Factor, g/hp-hr	53.0	57.1	46.4	109.5

Underlined values returned negative results and were set to zero.

Table 2-4: Summary of Results

Engine ID/Serial #	Kendall 1-18-3-1E / AKA905002	Kendall 5-17-3-1E	Gardner State 1-26-3-2E / SP114P1
Date	**07/26/22**	**07/26/22**	**08/02/22**
Carbon Monoxide Data			
Concentration, ppmvd	10,035.2	5,631.6	166.3
Concentration, ppmvd @ 15% O_2	3,209.1	8,058.6	142.9
Emission Rate, lb/hr	5.5	14.5	0.21
Emission Rate, ton/yr	24.0	63.7	0.94
Emission Factor, g/hp-hr	26.8	99.1	1.8
Nitrogen Oxides Data			
Concentration, ppmvd	696.7	51.1	502.6
Concentration, ppmvd @ 15% O_2	222.8	73.2	432.1
Emission Rate, lb/hr	0.62	0.22	1.1
Emission Rate, ton/yr	2.7	0.95	4.7
Emission Factor, g/hp-hr	3.1	1.5	8.7
Methane Data			
Concentration, ppmvd	32.5	73.6	42.3
Concentration, ppmvd @ 15% O_2	10.4	105.4	36.4
Emission Rate, lb/hr	0.010	0.11	0.031
Emission Rate, ton/yr	0.044	0.48	0.14
Emission Factor, g/hp-hr	0.050	0.74	0.26
Non-Methane Hydrocarbons Data			
Concentration, ppmvd	1,204.7	2,691.0	764.4
Concentration, ppmvd @ 15% O_2	385.2	3,850.7	657.1
Emission Rate, lb/hr	1.0	10.9	1.5
Emission Rate, ton/yr	4.5	47.9	6.8
Emission Factor, g/hp-hr	5.1	74.6	12.7

Testing Methodology

3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix C.

Table 3-1: Source Testing Methodology

Parameter	U.S. EPA Reference Test Methods	Notes/Remarks
Oxygen / Carbon Dioxide	3A	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Carbon Monoxide	10	Instrumental Analysis
Volumetric Flow Rate	19	Fuel Factors / Heat Inputs
Non-Methane Hydrocarbons	25A	Instrumental Analysis
Gas Dilution System Certification	205	--

3.1 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide

The oxygen (O_2) and carbon dioxide (CO_2) testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line, gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.7.

3.2 U.S. EPA Reference Test Method 7E – Nitrogen Oxides

The nitrogen oxides (NOx) testing was conducted in accordance with U.S. EPA Reference Test Method 7E. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line, gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.7.

3.3 U.S. EPA Reference Test Method 10 – Carbon Monoxide

The carbon monoxide (CO) testing was conducted in accordance with U.S. EPA Reference Test Method 10. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, Teflon sample line, gas conditioning system, and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.7.

3.4 U.S. EPA Reference Test Method 19 – Volumetric Flow Rate

The gas volumetric flow rate was determined in accordance with U.S. EPA Reference Test Method 19 using the measured oxygen concentration, the published fuel factor, the Brake Specific Fuel Consumption (BTU/HP-hr) and the Engine Brake Work (HP).

3.5 U.S. EPA Reference Test Method 25A – Non-Methane Hydrocarbons

The non-methane hydrocarbon (NMHC) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. The Thermo Scientific Model 55i Methane and Non-methane Analyzer is a back-flush gas chromatography (GC) system designed for automated measurement of methane and non-methane hydrocarbons. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line and the identified gas analyzer. The quality control measures are described in Section 3.8.

3.6 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

3.7 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A, 7E and 10

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low-Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas. For the Calibration Error Test, Low, Mid, and High Level calibration gases were sequentially introduced directly to the analyzer. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppmv/% (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppmv/% (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppmv/% or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv/% absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 3 percent of the Calibration Span or 0.5 ppmv/% absolute difference. If the drift exceeded 3 percent or 0.5 ppmv/%, the Calibration Error Test and System Bias were repeated.

An NO_2 – NO converter check was performed on the analyzer at the completion of testing. An approximately 50 ppm nitrogen dioxide cylinder gas was introduced directly to the NOx analyzer and the instrument response was recorded in an electronic data sheet. The instrument response was within +/- 10 percent of the cylinder concentration.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

3.8 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, Zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a *.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.

Appendix A

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097
Run No. /Method Run 1 / Method 7E

NOx - Outlet Concentration (C_{NOx}), ppmvd

$$C_{NOx} = (C_{obs} - C_0) \times \left(\frac{C_{MA}}{(C_M - C_0)} \right)$$

where,

C_{obs}	44.7	= average analyzer value during test, ppmvd
C_o	3.5	= average of pretest & posttest zero responses, ppmvd
C_{MA}	750.0	= actual concentration of calibration gas, ppmvd
C_M	742.3	= average of pretest & posttest calibration responses, ppmvd
C_{NOx}	41.8	= NOx Concentration, ppmvd

NOx - Outlet Concentration (C_{NOxc15}), ppmvd @ 15% O_2

$$C_{NOxc15} = C_{NOx} \times \left(\frac{20.9 - 15}{20.9 - O_2} \right)$$

where,

C_{NOx}	41.8	= NOx - Outlet Concentration, ppmvd
C_{O_2}	14.3	= oxygen concentration, %
C_{NOxc15}	37.1	= ppmvd @15% O_2

NOx - Outlet Emission Rate (ER_{NOx}), lb/hr

$$ER_{NOx} = \frac{C_{NOx} \times MW \times Qs \times 60 \ \frac{min}{hr} \times 28.32 \ \frac{L}{ft^3}}{24.04 \ \frac{L}{g-mole} \times 1.0E06 \times 453.592 \ \frac{g}{lb}}$$

where,

C_{NOx}	41.8	= NOx - Outlet Concentration, ppmvd
MW	46.0055	= NOx molecular weight, g/g-mole
Qs	305	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{NOx}	0.091	= lb/hr

NOx - Outlet Emission Rate (ER_{NOxTPY}), ton/yr

$$ER_{NOxTPY} = \frac{ER_{NOx} \times 8{,}760 \ \frac{hr}{yr}}{2{,}000 \ \frac{lb}{ton}}$$

where,

ER_{NOx}	0.091	= NOx - Outlet Emission Rate, lb/hr
ER_{NOxTPY}	0.40	= ton/yr

NOx - Outlet Emission Factor (EF_{NOx}), g/hp-hr

$$EF_{NOx} = \frac{ER_{NOx} \times 453.592 \ \frac{g}{lb}}{EBW}$$

where,

ER_{NOx}	0.091	= NOx - Outlet Emission Rate, lb/hr
EBW	55	= engine brake work, HP
EF_{NOx}	0.75	= g/hp-hr

Location: Uinta Wax - Roosevelt, UT
Source: Szyndrowski 35-34-3-1E-H1
Project No.: 2022-2097
Run No. /Method Run 1 / Method 10

Stack Gas Volumetric Flow Rate (Qs), dscfm

$$Qs = \frac{EBW \times BSFC \times Fd \times \left(\frac{20.9}{20.9 - C_{O2}}\right)}{1.0E+06 \times 60}$$

where,

EBW	55	= engine brake work, HP
BSFC	12,081	= brake specific fuel consumption, Btu/HP-hr
F_{Factor}	8,710	= fuel factor, dscf/MMBtu
C_{O2}	9.8	= oxygen concentration, %
Qs	183	= dscfm

CO - Outlet Concentration (C_{CO}), ppmvd

$$C_{CO} = (C_{obs} - C_0) \times \left(\frac{C_{MA}}{(C_M - C_0)}\right)$$

where,

C_{obs}	334.1	= average analyzer value during test, ppmvd
C_o	-1.2	= average of pretest & posttest zero responses, ppmvd
C_{MA}	5000.0	= actual concentration of calibration gas, ppmvd
C_M	5072.9	= average of pretest & posttest calibration responses, ppmvd
C_{CO}	330.4	= CO Concentration, ppmvd

CO - Outlet Concentration (C_{COc15}), ppmvd @ 15% O_2

$$C_{COc15} = C_{CO} \times \left(\frac{20.9 - 15}{20.9 - O_2}\right)$$

where,

C_{CO}	330.4	= CO - Outlet Concentration, ppmvd
C_{O_2}	9.8	= oxygen concentration, %
C_{COc15}	176.1	= ppmvd @15% O_2

CO - Outlet Emission Rate (ER_{CO}), lb/hr

$$ER_{CO} = \frac{C_{CO} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 453.592 \frac{g}{lb}}$$

where,

C_{CO}	330.4	= CO - Outlet Concentration, ppmvd
MW	28.01	= CO molecular weight, g/g-mole
Qs	183	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{CO}	0.26	= lb/hr

CO - Outlet Emission Rate (ER_{COTPY}), ton/yr

$$ER_{COTPY} = \frac{ER_{CO} \times 8,760 \frac{hr}{yr}}{2,000 \frac{lb}{ton}}$$

where,

ER_{CO}	0.26	= CO - Outlet Emission Rate, lb/hr
ER_{COTPY}	1.2	= ton/yr

CO - Outlet Emission Factor (EF_{CO}), g/hp-hr

$$EF_{CO} = \frac{ER_{CO} \times 453.592}{EBW} \quad \frac{g}{lb}$$

where,

ER_{CO}	0.26	= CO - Outlet Emission Rate, lb/hr
EBW	55	= engine brake work, HP
EF_{CO}	2.2	= g/hp-hr

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097
Run No. /Method Run 1 / Method 25A

Methane - Outlet Concentration (as C3H8) (C_{CH4}), ppmvd

$$C_{CH4} = \frac{C_{CH4w}}{1 - BWS}$$

where,

C_{CH4w}	0.46	= Methane - Outlet Concentration (as C3H8), ppmvw
BWS	0.074	= moisture fraction, unitless
C_{CH4}	0.49	= ppmvd

Methane - Outlet Concentration (as C3H8) (C_{CH4w}), ppmvw

$$C_{CH4w} = C_{CH4} \times (1 - BWS)$$

where,

C_{CH4}	0.49	= Methane - Outlet Concentration (as C3H8), ppmvd
BWS	0.074	= moisture fraction, unitless
C_{CH4w}	0.46	= ppmvw

Methane - Outlet Concentration (as C3H8) ($C_{Methanec15}$), ppmvd @ 15% O_2

$$C_{Methanec15} = C_{CH4} \times \left(\frac{20.9 - 15}{20.9 - O_2}\right)$$

where,

C_{CH4}	0.49	= Methane - Outlet Concentration (as C3H8), ppmvd
C_{O_2}	14.3	= oxygen concentration, %
$C_{Methanec15}$	0.44	= ppmvd @15% O_2

Methane - Outlet Emission Rate (as C3H8) (ER_{CH4}), lb/hr

$$ER_{CH4} = \frac{C_{CH4} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 454 \frac{g}{lb}}$$

where,

C_{CH4}	0.49	= Methane - Outlet Concentration (as C3H8), ppmvd
MW	16.04	= Methane molecular weight, g/g-mole
Qs	305	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{CH4}	0.00038	= lb/hr

Methane - Outlet Emission Rate (as C3H8) (ER_{CH4TPY}), ton/yr

$$ER_{CH4TPY} = \frac{ER_{CH4} \times 8{,}760 \frac{hr}{yr}}{2{,}000 \frac{lb}{ton}}$$

where,

ER_{CH4}	0.00038	= Methane - Outlet Emission Rate (as C3H8), lb/hr
ER_{CH4TPY}	0.0016	= ton/yr

Methane - Outlet Emission Factor (as C3H8) (EF_{CH4}), g/hp-hr

$$EF_{CH4} = \frac{ER_{CH4} \times 454 \ \frac{g}{lb}}{EBW}$$

where,

ER_{CH4}	0.00038	= Methane - Outlet Emission Rate (as C3H8), lb/hr
EBW	55	= engine brake work, HP
EF_{CH4}	0.0031	= g/hp-hr

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097
Run No. /Method Run 1 / Method 25A

NMHC - Outlet Concentration (as C3H8) (C_{NMHC}), ppmvd

$$C_{NMHC} = \frac{C_{NMHCw}}{1 - BWS}$$

where,

C_{NMHCw}	1114.6	= NMHC - Outlet Concentration (as C3H8), ppmvw
BWS	0.074	= moisture fraction, unitless
C_{NMHC}	1203.4	= ppmvd

NMHC - Outlet Concentration (as C3H8) (C_{NMHCw}), ppmvw

$$C_{NMHCw} = C_{NMHC} \times (1 - BWS)$$

where,

C_{NMHC}	1203.4	= NMHC - Outlet Concentration (as C3H8), ppmvd
BWS	0.074	= moisture fraction, unitless
C_{NMHCw}	1114.6	= ppmvw

NMHC - Outlet Concentration (as C3H8) ($C_{NMHCc15}$), ppmvd @ 15% O_2

$$C_{NMHCc15} = C_{THC} \times \left(\frac{20.9 - 15}{20.9 - O_2}\right)$$

where,

C_{NMHC}	1203.4	= NMHC - Outlet Concentration (as C3H8), ppmvd
C_{O_2}	14.3	= oxygen concentration, %
$C_{NMHCc15}$	1069.3	= ppmvd @15% O_2

NMHC - Outlet Emission Rate (as C3H8) (ER_{NMHC}), lb/hr

$$ER_{NMHC} = \frac{C_{THC} \times MW \times Qs \times 60 \frac{min}{hr} \times 28.32 \frac{L}{ft^3}}{24.04 \frac{L}{g-mole} \times 1.0E06 \times 454 \frac{g}{lb}}$$

where,

C_{NMHC}	1203.4	= NMHC - Outlet Concentration (as C3H8), ppmvd
MW	44.1	= NMHC molecular weight, g/g-mole
Qs	305	= stack gas volumetric flow rate at standard conditions, dscfm
ER_{NMHC}	2.5	= lb/hr

NMHC - Outlet Emission Rate (as C3H8) ($ER_{NMHCTPY}$), ton/yr

$$ER_{NMHCTPY} = \frac{ER_{NMHC} \times 8{,}760 \frac{hr}{yr}}{2{,}000 \frac{lb}{ton}}$$

where,

ER_{NMHC}	2.5	= NMHC - Outlet Emission Rate (as C3H8), lb/hr
$ER_{NMHCTPY}$	11.0	= ton/yr

NMHC - Outlet Emission Factor (as C3H8) (EF_{NMHC}), g/hp-hr

$$EF_{NMHC} = \frac{ER_{NMHC} \text{ x } 454 \ \frac{g}{lb}}{EBW}$$

where,

ER_{NMHC}	2.5	= NMHC - Outlet Emission Rate (as C3H8), lb/hr
EBW	55	= engine brake work, HP
EF_{NMHC}	20.7	= g/hp-hr

Appendix B

Location Uinta Wax - Roosevelt, UT
Source Lamb 3-15-4-2E
Project No. 2022-2097

Run Number		Run 1
Date		7/25/22
Start Time		10:00
Stop Time		10:21
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	77
Relative Humidity, %	RH	46
Barometric Pressure, in. Hg	Pb	25.56
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.074
Volumetric Flow Rate (M19), dscfm	Qs	305
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	14.26
CO_2 Concentration, % dry	C_{CO_2}	3.88
NOx Concentration, ppmvd	C_{NOx}	41.8
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	37.1
NOx Emission Rate, lb/hr	ER_{NOx}	0.091
NOx Emission Rate, ton/yr	ER_{NOxTPY}	0.40
NOx Emission Factor, g/HP-hr	EF_{NOx}	0.75
Methane Concentration, ppmvd	C_{CH4}	0.49
Methane Concentration, ppmvw	C_{CH4w}	0.46
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	0.44
Methane Emission Rate, lb/hr	ER_{CH4}	0.00038
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.0016
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.0031
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	1,203.4
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	1,114.6
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	1,069.3
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	2.5
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	11.0
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	20.7

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097
Date: 7/25/22

Time	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid
10:00	16.88	1.97	33.62	0.45	1,133.40
10:01	14.02	3.96	53.93	0.37	813.86
10:02	13.89	4.03	29.47	0.43	1,266.20
10:03	13.85	4.15	23.84	0.45	1,114.43
10:04	13.87	4.16	38.09	0.44	1,057.00
10:05	13.92	4.11	55.56	0.45	1,161.11
10:06	13.95	4.04	36.81	0.44	1,270.36
10:07	13.87	4.13	61.15	0.47	1,165.41
10:08	13.99	4.11	71.80	0.45	1,111.11
10:09	14.02	4.06	57.77	0.39	1,239.83
10:10	13.99	4.09	47.56	0.44	1,240.39
10:11	13.99	4.05	47.96	0.45	1,191.51
10:12	14.00	4.07	45.82	0.50	1,263.65
10:13	14.17	4.07	29.42	0.45	1,017.86
10:14	14.06	3.98	26.93	0.46	1,100.90
10:15	14.06	4.04	29.79	0.43	1,007.56
10:16	13.91	4.06	41.69	0.47	1,199.60
10:17	13.89	4.03	37.41	0.49	1,132.42
10:18	13.75	4.14	56.77	0.52	865.51
10:19	14.06	4.24	63.57	0.58	1,100.17
10:20	13.95	4.06	49.72	0.46	955.07

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	14.1	4.0	44.7	0.5	1,114.6
Cal Gas Concentration (C_{MA})	11.0	11.0	750.0	NA	3,000.0
Pretest System Zero Response	0.22	0.08	2.26	0.34	-0.27
Posttest System Zero Response	0.21	0.15	4.82	0.39	-0.26
Average Zero Response (Co)	0.2	0.1	3.5	0.4	-0.3
Pretest System Cal Response	10.92	11.05	741.30	0.47	2,930.11
Posttest System Cal Response	10.93	11.08	743.35	0.49	3,068.76
Average Cal Response (C_M)	10.9	11.1	742.3	0.5	2,999.4
Corrected Run Average (Corr)	14.3	3.9	41.8	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	14.3
Relative Humidity, %RH	46.0
Barometric, in.Hg	25.56
Ambient Temp, °F	77.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.074**

Location Uinta Wax - Roosevelt, UT
Source Deep Creek 9-15-4-2E
Project No. 2022-2097

Run Number		Run 1
Date		7/25/22
Start Time		11:03
Stop Time		11:24
Engine Data		
Engine Manufacturer		Arow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	79
Relative Humidity, %	RH	47
Barometric Pressure, in. Hg	Pb	25.55
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.091
Volumetric Flow Rate (M19), dscfm	Qs	239
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	12.43
CO_2 Concentration, % dry	C_{CO_2}	4.85
NOx Concentration, ppmvd	C_{NOx}	244.4
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	170.2
NOx Emission Rate, lb/hr	ER_{NOx}	0.42
NOx Emission Rate, ton/yr	ER_{NOxTPY}	1.8
NOx Emission Factor, g/HP-hr	EF_{NOx}	3.4
Methane Concentration, ppmvd	C_{CH4}	4.9
Methane Concentration, ppmvw	C_{CH4w}	4.4
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	3.4
Methane Emission Rate, lb/hr	ER_{CH4}	0.0029
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.013
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.024
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	2,210.5
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	2,009.4
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	1,539.2
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	3.6
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	15.9
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	29.8

Location: Uinta Wax - Roosevelt, UT
Source: Deep Creek 9-15-4-2E
Project No.: 2022-2097
Date: 7/25/22

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	NOx - Outlet ppmvd Valid	Methane - Outlet ppmvw Valid	NMHC - Outlet ppmvw Valid
11:03	12.82	4.75	265.73	0.42	520.42
11:04	12.54	4.76	232.43	0.40	959.13
11:05	12.41	4.89	196.70	0.37	2,166.60
11:06	12.20	4.90	294.85	0.46	2,185.65
11:07	12.41	5.05	210.79	0.41	2,048.48
11:08	12.40	4.87	282.05	0.34	1,639.26
11:09	12.17	4.95	165.16	0.41	1,855.69
11:10	12.52	4.99	235.32	0.44	2,477.44
11:11	11.94	4.92	208.92	0.40	1,387.27
11:12	12.13	5.11	236.77	0.40	1,825.58
11:13	12.38	5.02	272.74	0.38	2,728.16
11:14	11.98	5.00	260.35	0.39	1,786.33
11:15	12.33	5.14	279.94	0.36	1,428.27
11:16	12.38	4.97	258.74	0.37	2,798.05
11:17	12.50	4.92	254.09	0.34	2,374.36
11:18	12.24	4.88	252.45	0.43	1,634.64
11:19	12.15	5.07	284.03	0.47	2,300.82
11:20	12.29	4.92	242.82	0.45	1,772.46
11:21	12.48	4.91	255.46	0.40	1,853.98
11:22	12.43	4.84	230.61	54.84	3,157.79
11:23	12.25	4.92	253.92	30.35	3,296.85

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	12.3	4.9	246.4	4.4	2,009.4
Cal Gas Concentration (C_{MA})	11.0	11.0	750.0	NA	3,000.0
Pretest System Zero Response	0.21	0.15	4.82	0.38	-0.26
Posttest System Zero Response	0.31	0.06	8.45	0.40	-0.24
Average Zero Response (Co)	0.3	0.1	6.6	0.4	-0.3
Pretest System Cal Response	10.93	11.08	743.35	0.52	3,068.76
Posttest System Cal Response	10.96	11.08	741.54	0.48	3,014.70
Average Cal Response (C_M)	10.9	11.1	742.4	0.5	3,041.7
Corrected Run Average (Corr)	12.4	4.8	244.4	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Deep Creek 9-15-4-2E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	12.4
Relative Humidity, %RH	47.0
Barometric, in.Hg	25.55
Ambient Temp, °F	79.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.091**

Location Uinta Wax - Roosevelt, UT
Source Kendall 15-7-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/25/22
Start Time		12:45
Stop Time		13:06
Engine Data		
Engine Manufacturer		Arrow
Engine Model		A-90
Engine Type		Spark Ignition - 4SRB
Engine Brake Work, HP	EBW	93
Maximum Engine Brake Work, HP	MaxEBW	109
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	88
Relative Humidity, %	RH	31
Barometric Pressure, in. Hg	Pb	25.51
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	8,200
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.148
Volumetric Flow Rate (M19), dscfm	Qs	149
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	5.47
CO_2 Concentration, % dry	C_{CO_2}	9.25
NOx Concentration, ppmvd	C_{NOx}	1,270.0
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	485.7
NOx Emission Rate, lb/hr	ER_{NOx}	1.4
NOx Emission Rate, ton/yr	ER_{NOxTPY}	6.0
NOx Emission Factor, g/HP-hr	EF_{NOx}	6.7
Methane Concentration, ppmvd	C_{CH4}	4.4
Methane Concentration, ppmvw	C_{CH4w}	3.7
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	1.7
Methane Emission Rate, lb/hr	ER_{CH4}	0.0016
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.0072
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.0080
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	2,265.3
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	1,929.1
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	866.3
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	2.3
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	10.2
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	11.4

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 15-7-3-1E
Project No.: 2022-2097
Date: 7/25/22

Time	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid
12:45	5.56	9.22	1,126.22	6.18	803.87
12:46	5.53	9.25	1,498.13	3.48	447.95
12:47	5.52	9.26	952.28	4.33	470.40
12:48	5.54	9.28	1,158.57	4.24	520.13
12:49	5.50	9.35	1,502.24	3.59	468.14
12:50	5.48	9.33	982.69	2.03	463.99
12:51	5.49	9.33	1,169.03	2.93	611.24
12:52	5.43	9.34	1,590.79	2.89	985.18
12:53	5.46	9.38	996.65	2.89	1,911.20
12:54	5.49	9.33	1,165.87	2.94	2,299.30
12:55	5.48	9.35	1,603.26	3.03	2,693.02
12:56	5.49	9.32	1,003.77	4.32	2,999.65
12:57	5.52	9.30	1,172.63	4.24	3,055.42
12:58	5.47	9.33	1,562.16	4.31	2,836.32
12:59	5.53	9.36	966.30	3.02	2,826.38
13:00	5.60	9.32	1,154.06	4.20	2,944.71
13:01	5.52	9.27	1,536.51	4.25	3,015.72
13:02	5.50	9.36	957.17	3.18	2,885.30
13:03	5.50	9.32	1,166.72	4.02	2,819.02
13:04	5.47	9.37	1,558.46	4.22	2,755.20
13:05	5.49	9.32	983.11	4.25	2,698.62

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	5.5	9.3	1,228.9	3.7	1,929.1
Cal Gas Concentration (C_{MA})	11.0	11.0	750.0	NA	3,000.0
Pretest System Zero Response	0.31	0.06	8.45	0.46	-0.24
Posttest System Zero Response	-0.07	0.04	2.03	0.36	-0.26
Average Zero Response (Co)	0.1	0.1	5.2	0.4	-0.3
Pretest System Cal Response	10.96	11.08	741.54	3.88	3,014.70
Posttest System Cal Response	10.92	11.07	714.24	3.82	2,926.83
Average Cal Response (C_M)	10.9	11.1	727.9	3.9	2,970.8
Corrected Run Average (Corr)	5.5	9.2	1,270.0	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 15-7-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	5.5
Relative Humidity, %RH	31.0
Barometric, in.Hg	25.51
Ambient Temp, °F	88.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.148**

Location Uinta Wax - Roosevelt, UT
Source Kendall 2-18-3-1E-H4
Project No. 2022-2097

Run Number		Run 1
Date		7/25/22
Start Time		14:21
Stop Time		14:42
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	92
Relative Humidity, %	RH	26
Barometric Pressure, in. Hg	Pb	25.46
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.092
Volumetric Flow Rate (M19), dscfm	Qs	227
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	11.98
CO_2 Concentration, % dry	C_{CO_2}	5.15
NOx Concentration, ppmvd	C_{NOx}	190.7
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	126.1
NOx Emission Rate, lb/hr	ER_{NOx}	0.31
NOx Emission Rate, ton/yr	ER_{NOxTPY}	1.4
NOx Emission Factor, g/HP-hr	EF_{NOx}	2.5
Methane Concentration, ppmvd	C_{CH4}	31.2
Methane Concentration, ppmvw	C_{CH4w}	28.3
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	20.6
Methane Emission Rate, lb/hr	ER_{CH4}	0.018
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.077
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.15
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	1,725.5
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	1,566.9
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	1,141.1
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	2.7
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	11.8
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	22.1

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 2-18-3-1E-H4
Project No.: 2022-2097
Date: 7/25/22

Time	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid
14:21	13.45	4.24	170.04	8.73	493.88
14:22	13.39	4.31	154.56	15.99	877.66
14:23	13.36	4.31	161.65	19.84	1,064.63
14:24	13.58	4.28	166.05	23.67	1,200.73
14:25	12.67	4.29	165.35	23.82	1,204.26
14:26	11.33	5.23	175.78	22.50	1,077.45
14:27	10.61	5.73	176.40	16.71	784.43
14:28	10.59	5.90	178.47	10.60	582.43
14:29	10.91	5.91	163.55	22.13	1,322.11
14:30	11.48	5.73	171.92	27.01	1,597.19
14:31	11.73	5.35	184.34	35.32	1,929.52
14:32	11.55	5.41	186.83	39.72	2,147.23
14:33	11.72	5.38	185.99	40.44	2,213.94
14:34	11.51	5.37	178.96	34.61	1,963.79
14:35	11.41	5.48	201.34	36.27	2,124.43
14:36	11.39	5.48	213.80	45.05	2,586.14
14:37	11.50	5.48	218.40	44.57	2,434.75
14:38	11.53	5.43	212.79	32.75	1,782.52
14:39	11.49	5.46	222.92	26.85	1,639.25
14:40	11.68	5.43	216.70	31.55	1,881.65
14:41	11.69	5.34	208.01	36.37	1,997.35

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	11.8	5.2	186.4	28.3	1,566.9
Cal Gas Concentration (C_{MA})	11.0	11.0	750.0	NA	3,000.0
Pretest System Zero Response	-0.07	0.04	2.03	0.48	-0.26
Posttest System Zero Response	0.07	0.12	1.84	0.48	-0.18
Average Zero Response (Co)	0.0	0.1	1.9	0.5	-0.2
Pretest System Cal Response	10.92	11.07	714.24	0.54	2,926.83
Posttest System Cal Response	10.82	11.05	740.12	0.51	2,984.29
Average Cal Response (C_M)	10.9	11.1	727.2	0.5	2,955.6
Corrected Run Average (Corr)	12.0	5.1	190.7	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 2-18-3-1E-H4
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	12.0
Relative Humidity, %RH	26.0
Barometric, in.Hg	25.46
Ambient Temp, °F	92.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.092**

Location Uinta Wax - Roosevelt, UT
Source Merritt 1-18-3-1E-H1
Project No. 2022-2097

Run Number		Run 1
Date		7/25/22
Start Time		15:21
Stop Time		15:42
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	67
Maximum Engine Brake Work, HP	MaxEBW	78
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	94
Relative Humidity, %	RH	16
Barometric Pressure, in. Hg	Pb	25.44
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.118
Volumetric Flow Rate (M19), dscfm	Qs	194
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	8.33
CO_2 Concentration, % dry	C_{CO_2}	7.42
NOx Concentration, ppmvd	C_{NOx}	790.6
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	371.0
NOx Emission Rate, lb/hr	ER_{NOx}	1.1
NOx Emission Rate, ton/yr	ER_{NOxTPY}	4.8
NOx Emission Factor, g/HP-hr	EF_{NOx}	7.5
Methane Concentration, ppmvd	C_{CH4}	29.7
Methane Concentration, ppmvw	C_{CH4w}	26.2
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	13.9
Methane Emission Rate, lb/hr	ER_{CH4}	0.014
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.063
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.098
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	3,105.2
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	2,739.3
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	1,457.2
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	4.1
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	18.1
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	28.2

Location: Uinta Wax - Roosevelt, UT
Source: Merritt 1-18-3-1E-H1
Project No.: 2022-2097
Date: 7/25/22

Time Unit Status	O_2 - Outlet % dry Valid	CO_2 - Outlet % dry Valid	NOx - Outlet ppmvd Valid	Methane - Outlet ppmvw Valid	NMHC - Outlet ppmvw Valid
15:21	8.25	7.37	747.95	48.94	3,120.62
15:22	8.25	7.41	746.85	46.32	2,961.16
15:23	8.26	7.44	776.18	45.71	2,912.24
15:24	8.24	7.47	777.36	43.70	2,789.02
15:25	8.28	7.47	768.86	43.66	2,774.42
15:26	8.30	7.42	769.24	47.77	2,922.87
15:27	8.26	7.44	779.39	50.11	3,037.56
15:28	8.28	7.44	760.67	44.75	2,909.93
15:29	8.30	7.48	761.10	32.06	2,908.81
15:30	8.33	7.44	773.71	11.70	2,805.94
15:31	8.23	7.45	773.21	45.59	3,013.23
15:32	8.16	7.47	766.10	46.10	3,039.06
15:33	8.21	7.52	765.44	40.27	3,004.61
15:34	8.22	7.46	773.67	0.43	2,114.71
15:35	8.23	7.48	774.16	0.50	2,495.37
15:36	8.21	7.47	772.61	0.48	2,611.35
15:37	8.19	7.51	791.61	0.46	2,553.05
15:38	8.16	7.51	767.89	0.39	2,574.41
15:39	8.23	7.56	756.07	0.44	2,334.06
15:40	8.21	7.53	719.61	0.44	2,365.36
15:41	8.24	7.48	748.85	0.47	2,277.17

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	8.2	7.5	765.3	26.2	2,739.3
Cal Gas Concentration (C_{MA})	11.0	11.0	750.0	NA	3,000.0
Pretest System Zero Response	0.07	0.12	1.84	0.44	-0.18
Posttest System Zero Response	0.08	0.17	3.42	0.46	-0.21
Average Zero Response (Co)	0.1	0.1	2.6	0.5	-0.2
Pretest System Cal Response	10.82	11.05	740.12	0.54	2,984.29
Posttest System Cal Response	10.90	10.96	712.01	0.49	2,996.54
Average Cal Response (C_M)	10.9	11.0	726.1	0.5	2,990.4
Corrected Run Average (Corr)	8.3	7.4	790.6	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Merritt 1-18-3-1E-H1
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	8.3
Relative Humidity, %RH	16.0
Barometric, in.Hg	25.44
Ambient Temp, °F	94.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.118**

Location Uinta Wax - Roosevelt, UT
Source Womack 3-8-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/25/22
Start Time		16:20
Stop Time		16:41
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	93
Relative Humidity, %	RH	23
Barometric Pressure, in. Hg	Pb	25.42
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.046
Volumetric Flow Rate (M19), dscfm	Qs	544
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	17.18
CO_2 Concentration, % dry	C_{CO_2}	1.88
NOx Concentration, ppmvd	C_{NOx}	4.9
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	7.7
NOx Emission Rate, lb/hr	ER_{NOx}	0.019
NOx Emission Rate, ton/yr	ER_{NOxTPY}	0.083
NOx Emission Factor, g/HP-hr	EF_{NOx}	0.16
Methane Concentration, ppmvd	C_{CH4}	23.5
Methane Concentration, ppmvw	C_{CH4w}	22.4
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	37.2
Methane Emission Rate, lb/hr	ER_{CH4}	0.032
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.14
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.26
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	1,590.8
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	1,517.6
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	2,520.6
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	5.9
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	26.0
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	48.8

Location: Uinta Wax - Roosevelt, UT
Source: Womack 3-8-3-1E
Project No.: 2022-2097
Date: 7/25/22

Time	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid
16:20	16.57	2.23	7.69	12.80	955.27
16:21	16.71	2.21	7.91	25.05	1,790.05
16:22	16.84	2.16	7.45	26.90	1,877.38
16:23	16.76	2.11	7.01	20.97	1,517.19
16:24	17.11	2.11	7.29	16.87	1,232.30
16:25	17.10	1.96	6.55	22.77	1,641.64
16:26	17.06	2.01	7.04	21.56	1,495.57
16:27	16.93	1.97	6.46	22.79	1,519.31
16:28	16.75	2.12	6.71	21.73	1,510.89
16:29	16.84	2.18	7.04	18.07	1,222.54
16:30	17.07	2.10	6.71	23.96	1,912.04
16:31	16.77	1.98	6.39	20.94	1,489.49
16:32	17.14	2.05	6.76	25.99	1,698.43
16:33	17.02	1.91	6.74	22.69	1,617.39
16:34	17.06	1.97	7.18	14.20	1,008.61
16:35	16.76	1.91	6.62	23.57	1,725.28
16:36	16.98	2.07	6.80	18.62	1,415.97
16:37	16.89	1.93	7.05	45.60	1,847.32
16:38	16.99	2.03	6.92	29.40	1,872.52
16:39	16.87	2.02	6.43	13.36	891.35
16:40	17.22	2.01	6.27	22.59	1,628.22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	16.9	2.0	6.9	22.4	1,517.6
Cal Gas Concentration (C_{MA})	11.0	11.0	750.0	NA	3,000.0
Pretest System Zero Response	0.08	0.17	3.42	0.49	-0.21
Posttest System Zero Response	0.09	0.22	1.21	0.51	-0.20
Average Zero Response (Co)	0.1	0.2	2.3	0.5	-0.2
Pretest System Cal Response	10.90	10.96	712.01	0.53	2,996.54
Posttest System Cal Response	10.84	11.08	711.29	0.53	2,975.49
Average Cal Response (C_M)	10.9	11.0	711.7	0.5	2,986.0
Corrected Run Average (Corr)	17.2	1.9	4.9	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Womack 3-8-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	17.2
Relative Humidity, %RH	23.0
Barometric, in.Hg	25.42
Ambient Temp, °F	93.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.046**

Location Uinta Wax - Roosevelt, UT
Source Szyndrowski 35-34-3-1E-H1
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		9:09
Stop Time		9:30
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	77
Relative Humidity, %	RH	37
Barometric Pressure, in. Hg	Pb	25.51
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.108
Volumetric Flow Rate (M19), dscfm	Qs	183
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	9.83
CO_2 Concentration, % dry	C_{CO_2}	6.46
CO Concentration, ppmvd	C_{CO}	330.4
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	176.1
CO Emission Rate, lb/hr	ER_{CO}	0.26
CO Emission Rate, ton/yr	ER_{COTPY}	1.2
CO Emission Factor, g/HP-hr	EF_{CO}	2.2
NOx Concentration, ppmvd	C_{NOx}	47.2
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	25.2
NOx Emission Rate, lb/hr	ER_{NOx}	0.062
NOx Emission Rate, ton/yr	ER_{NOxTPY}	0.27
NOx Emission Factor, g/HP-hr	EF_{NOx}	0.51
Methane Concentration, ppmvd	C_{CH4}	46.3
Methane Concentration, ppmvw	C_{CH4w}	41.3
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	24.7
Methane Emission Rate, lb/hr	ER_{CH4}	0.021
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.093
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.17
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	1,529.3
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	1,363.5
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	814.9
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	1.9
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	8.4
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	15.8

Location: Uinta Wax - Roosevelt, UT
Source: Szyndrowski 35-34-3-1E-H1
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
9:09	9.91	6.60	301.87	48.75	37.66	1,233.94
9:10	9.83	6.65	459.60	45.36	54.15	1,724.51
9:11	9.83	6.63	466.65	39.21	34.66	1,093.20
9:12	10.36	6.57	308.38	54.08	47.97	1,497.29
9:13	9.81	6.37	437.45	59.34	35.27	1,105.25
9:14	9.54	6.68	326.02	56.70	46.77	1,511.40
9:15	9.64	6.84	314.73	45.50	48.15	1,545.75
9:16	10.03	6.69	350.51	46.18	48.29	1,621.54
9:17	9.72	6.59	385.21	46.34	44.78	1,427.96
9:18	9.82	6.63	292.36	45.70	46.58	1,581.05
9:19	9.94	6.67	294.52	47.96	44.82	1,475.91
9:20	9.91	6.61	297.75	64.98	43.35	1,378.53
9:21	10.05	6.61	294.31	48.71	36.25	1,238.42
9:22	10.16	6.49	321.34	62.00	37.63	1,238.28
9:23	10.00	6.56	304.57	41.44	35.58	1,210.40
9:24	10.08	6.58	298.29	42.55	38.20	1,303.06
9:25	10.24	6.44	284.15	40.23	33.25	1,110.24
9:26	9.92	6.49	292.21	44.02	34.84	1,169.92
9:27	9.78	6.61	308.78	52.05	37.01	1,276.23
9:28	10.37	6.66	315.46	43.61	38.63	1,360.41
9:29	10.04	6.35	361.44	47.37	43.65	1,529.26

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	10.0	6.6	334.1	48.7	41.3	1,363.5
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	750.0	NA	3,000.0
Pretest System Zero Response	0.34	0.05	-0.05	1.68	0.40	-0.24
Posttest System Zero Response	0.38	0.07	-2.41	5.99	0.48	-0.14
Average Zero Response (Co)	0.4	0.1	-1.2	3.8	0.4	-0.2
Pretest System Cal Response	11.03	11.09	5,090.29	709.61	0.51	2,925.93
Posttest System Cal Response	11.16	11.25	5,055.53	722.09	0.52	3,009.85
Average Cal Response (C_M)	11.1	11.2	5,072.9	715.9	0.5	2,967.9
Corrected Run Average (Corr)	9.8	6.5	330.4	47.2	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Szyndrowski 35-34-3-1E-H1
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	9.8
Relative Humidity, %RH	37.0
Barometric, in.Hg	25.51
Ambient Temp, °F	77.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.108**

Location Uinta Wax - Roosevelt, UT
Source Gavitte 15-23-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		10:28
Stop Time		10:49
Engine Data		
Engine Manufacturer		Arrow
Engine Model		A-90
Engine Type		Spark Ignition - 4SRB
Engine Brake Work, HP	EBW	93
Maximum Engine Brake Work, HP	MaxEBW	109
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	82
Relative Humidity, %	RH	37
Barometric Pressure, in. Hg	Pb	25.52
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	8,200
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.184
Volumetric Flow Rate (M19), dscfm	Qs	118
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	1.29
CO_2 Concentration, % dry	C_{CO_2}	11.01
CO Concentration, ppmvd	C_{CO}	8221.5
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	2473.8
CO Emission Rate, lb/hr	ER_{CO}	4.2
CO Emission Rate, ton/yr	ER_{COTPY}	18.5
CO Emission Factor, g/HP-hr	EF_{CO}	20.7
NOx Concentration, ppmvd	C_{NOx}	1,947.0
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	585.8
NOx Emission Rate, lb/hr	ER_{NOx}	1.6
NOx Emission Rate, ton/yr	ER_{NOxTPY}	7.2
NOx Emission Factor, g/HP-hr	EF_{NOx}	8.0
Methane Concentration, ppmvd	C_{CH4}	11.0
Methane Concentration, ppmvw	C_{CH4w}	9.0
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	3.3
Methane Emission Rate, lb/hr	ER_{CH4}	0.0032
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.014
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.016
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	284.1
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	231.8
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	85.5
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	0.23
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	1.0
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	1.1

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 15-23-3-1E
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
10:28	1.55	11.26	7,847.67	2,258.64	10.11	216.69
10:29	1.76	11.22	8,498.26	2,105.08	17.09	384.10
10:30	1.54	11.26	7,736.78	1,623.02	11.99	269.29
10:31	1.59	11.25	8,410.44	2,045.19	9.64	181.66
10:32	1.65	11.23	8,207.78	2,043.06	7.87	141.02
10:33	1.59	11.26	8,576.76	1,332.34	5.19	101.23
10:34	1.66	11.22	8,468.37	2,074.31	6.75	137.14
10:35	1.64	11.24	8,459.01	1,969.48	6.43	147.81
10:36	1.79	11.25	8,169.58	1,640.87	7.77	244.70
10:37	1.64	11.23	7,499.09	2,205.36	6.53	196.44
10:38	1.77	11.26	8,190.33	2,033.00	9.77	284.55
10:39	1.61	11.25	7,860.82	1,685.18	10.87	289.35
10:40	1.72	11.22	8,564.29	2,126.11	9.60	182.81
10:41	1.65	11.25	8,012.71	1,985.51	9.57	355.26
10:42	1.62	11.27	8,388.16	1,359.43	9.61	331.20
10:43	1.66	11.23	8,204.79	2,133.99	11.06	320.84
10:44	1.67	11.29	8,257.69	1,840.12	9.66	300.43
10:45	1.71	11.26	8,510.55	1,601.14	7.30	237.46
10:46	1.66	11.22	8,373.65	2,172.97	5.98	111.44
10:47	1.79	11.27	8,567.56	1,957.36	8.00	218.84
10:48	1.66	11.18	8,535.74	1,741.12	7.38	215.92

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	1.7	11.2	8,254.3	1,901.6	9.0	231.8
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	1,200.0	NA	3,000.0
Pretest System Zero Response	0.38	0.07	-2.41	28.68	0.53	-0.14
Posttest System Zero Response	0.42	0.17	3.81	9.61	0.51	-0.09
Average Zero Response (Co)	0.4	0.1	0.7	19.1	0.5	-0.1
Pretest System Cal Response	11.16	11.25	5,055.53	1,175.47	2.07	3,009.85
Posttest System Cal Response	11.16	11.22	4,984.94	1,183.29	2.23	3,049.67
Average Cal Response (C_M)	11.2	11.2	5,020.2	1,179.4	2.2	3,029.8
Corrected Run Average (Corr)	1.3	11.0	8,221.5	1,947.0	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 15-23-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	1.3
Relative Humidity, %RH	37.0
Barometric, in.Hg	25.52
Ambient Temp, °F	82.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.184**

Location Uinta Wax - Roosevelt, UT
Source Gavitte 10-23-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		11:08
Stop Time		11:29
Engine Data		
Engine Manufacturer		Ajax
Engine Model		E-565
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	34
Maximum Engine Brake Work, HP	MaxEBW	40
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	82
Relative Humidity, %	RH	37
Barometric Pressure, in. Hg	Pb	25.52
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	13,300
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.054
Volumetric Flow Rate (M19), dscfm	Qs	310
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	16.47
CO_2 Concentration, % dry	C_{CO_2}	2.58
CO Concentration, ppmvd	C_{CO}	173.4
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	231.1
CO Emission Rate, lb/hr	ER_{CO}	0.23
CO Emission Rate, ton/yr	ER_{COTPY}	1.0
CO Emission Factor, g/HP-hr	EF_{CO}	3.1
NOx Concentration, ppmvd	C_{NOx}	92.0
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	122.6
NOx Emission Rate, lb/hr	ER_{NOx}	0.20
NOx Emission Rate, ton/yr	ER_{NOxTPY}	0.89
NOx Emission Factor, g/HP-hr	EF_{NOx}	2.7
Methane Concentration, ppmvd	C_{CH4}	75.3
Methane Concentration, ppmvw	C_{CH4w}	71.2
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	100.3
Methane Emission Rate, lb/hr	ER_{CH4}	0.058
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.26
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.78
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	1,863.9
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	1,763.4
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	2,483.8
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	4.0
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	17.4
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	53.0

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 10-23-3-1E
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
11:08	17.34	2.35	132.46	50.87	47.53	1,194.21
11:09	16.92	2.31	134.22	64.92	57.61	1,460.89
11:10	16.40	2.59	194.77	186.50	61.33	1,550.76
11:11	16.37	2.87	210.39	77.79	75.65	1,888.83
11:12	16.41	2.78	150.18	49.54	75.89	1,856.28
11:13	16.81	2.82	144.41	78.13	81.98	2,115.54
11:14	17.28	2.47	186.14	146.65	70.66	1,732.12
11:15	16.87	2.37	140.62	45.26	71.74	1,779.39
11:16	16.15	2.74	231.01	144.69	63.02	1,563.77
11:17	16.14	2.95	236.23	83.10	80.05	1,969.65
11:18	16.34	3.01	145.71	47.19	77.64	1,894.79
11:19	16.05	2.85	156.15	120.64	73.74	1,834.83
11:20	16.11	3.04	233.10	154.47	72.08	1,758.61
11:21	15.92	3.01	159.28	69.84	75.78	1,858.77
11:22	16.36	3.07	209.92	155.90	84.22	2,025.01
11:23	16.32	2.82	165.97	62.22	77.29	1,871.14
11:24	16.32	2.91	144.20	68.81	73.87	1,817.11
11:25	17.15	2.78	172.56	158.59	76.05	1,871.09
11:26	17.00	2.36	154.20	67.53	68.23	1,693.95
11:27	16.75	2.55	146.80	96.30	64.62	1,616.07
11:28	16.55	2.63	201.62	138.90	67.13	1,679.04

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	16.6	2.7	173.8	98.5	71.2	1,763.4
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	1,200.0	NA	3,000.0
Pretest System Zero Response	0.42	0.17	3.81	9.61	0.50	-0.09
Posttest System Zero Response	0.41	0.10	-0.09	6.64	0.60	-0.26
Average Zero Response (Co)	0.4	0.1	1.9	8.1	0.6	-0.2
Pretest System Cal Response	11.16	11.22	4,984.94	1,183.29	2.23	3,049.67
Posttest System Cal Response	11.22	11.12	4,933.00	1,190.32	2.68	3,095.61
Average Cal Response (C_M)	11.2	11.2	4,959.0	1,186.8	2.5	3,072.6
Corrected Run Average (Corr)	16.5	2.6	173.4	92.0	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 10-23-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	16.5
Relative Humidity, %RH	37.0
Barometric, in.Hg	25.52
Ambient Temp, °F	82.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.054**

Location Uinta Wax - Roosevelt, UT
Source Gavitte 13-23-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		12:51
Stop Time		13:12
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	87
Relative Humidity, %	RH	31
Barometric Pressure, in. Hg	Pb	25.51
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.031
Volumetric Flow Rate (M19), dscfm	Qs	1,139
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	19.12
CO_2 Concentration, % dry	C_{CO_2}	1.02
CO Concentration, ppmvd	C_{CO}	9.4
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	31.2
CO Emission Rate, lb/hr	ER_{CO}	0.047
CO Emission Rate, ton/yr	ER_{COTPY}	0.20
CO Emission Factor, g/HP-hr	EF_{CO}	0.38
NOx Concentration, ppmvd	C_{NOx}	2.7
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	9.0
NOx Emission Rate, lb/hr	ER_{NOx}	0.022
NOx Emission Rate, ton/yr	ER_{NOxTPY}	0.098
NOx Emission Factor, g/HP-hr	EF_{NOx}	0.18
Methane Concentration, ppmvd	C_{CH4}	44.8
Methane Concentration, ppmvw	C_{CH4w}	43.4
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	148.6
Methane Emission Rate, lb/hr	ER_{CH4}	0.13
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.56
Methane Emission Factor, g/HP-hr	EF_{CH4}	1.0
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	889.1
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	861.5
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	2,949.8
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	7.0
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	30.5
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	57.1

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 13-23-3-1E
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
12:51	19.01	1.10	17.23	5.44	39.65	778.19
12:52	18.82	1.23	17.13	7.10	29.90	607.25
12:53	19.05	1.16	17.15	6.25	55.31	1,119.32
12:54	18.96	1.15	17.15	5.73	52.96	1,023.66
12:55	18.95	1.12	17.16	7.03	32.01	632.21
12:56	18.96	1.19	17.24	6.37	52.40	1,071.23
12:57	18.92	1.15	17.12	8.47	49.89	964.82
12:58	18.84	1.15	17.11	6.86	40.98	833.77
12:59	18.83	1.20	17.17	8.67	63.96	1,271.10
13:00	18.93	1.24	17.24	7.20	55.77	1,024.56
13:01	18.89	1.19	17.18	6.29	38.05	743.60
13:02	18.96	1.15	17.11	5.70	46.78	929.75
13:03	18.87	1.19	18.71	8.44	38.36	742.58
13:04	19.09	1.15	17.20	6.19	38.23	787.88
13:05	19.03	1.11	17.28	7.26	55.88	1,106.03
13:06	19.13	1.11	17.19	6.10	36.88	739.21
13:07	19.29	1.02	17.18	5.83	32.94	703.61
13:08	19.13	0.97	17.14	5.75	47.47	950.71
13:09	19.14	1.08	17.16	5.13	37.33	717.27
13:10	19.23	1.08	17.19	6.21	26.68	522.83
13:11	19.06	1.03	17.17	5.26	39.87	822.90

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	19.0	1.1	17.2	6.5	43.4	861.5
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	1,200.0	NA	3,000.0
Pretest System Zero Response	0.41	0.10	-0.09	6.64	0.56	-0.26
Posttest System Zero Response	0.12	0.11	15.87	1.04	0.57	-0.17
Average Zero Response (Co)	0.3	0.1	7.9	3.8	0.6	-0.2
Pretest System Cal Response	11.22	11.12	4,933.00	1,190.32	1.57	3,095.61
Posttest System Cal Response	10.87	11.14	5,038.32	1,191.16	1.80	3,002.97
Average Cal Response (C_M)	11.0	11.1	4,985.7	1,190.7	1.7	3,049.3
Corrected Run Average (Corr)	19.1	1.0	9.4	2.7	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 13-23-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	19.1
Relative Humidity, %RH	31.0
Barometric, in.Hg	25.51
Ambient Temp, °F	87.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.031**

Location Uinta Wax - Roosevelt, UT
Source Gavitte 4-26-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		13:43
Stop Time		14:04
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	89
Relative Humidity, %	RH	26
Barometric Pressure, in. Hg	Pb	25.49
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.029
Volumetric Flow Rate (M19), dscfm	Qs	1,187
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	19.19
CO_2 Concentration, % dry	C_{CO_2}	1.19
CO Concentration, ppmvd	C_{CO}	21.1
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	73.0
CO Emission Rate, lb/hr	ER_{CO}	0.11
CO Emission Rate, ton/yr	ER_{COTPY}	0.48
CO Emission Factor, g/HP-hr	EF_{CO}	0.90
NOx Concentration, ppmvd	C_{NOx}	103.6
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	358.5
NOx Emission Rate, lb/hr	ER_{NOx}	0.88
NOx Emission Rate, ton/yr	ER_{NOxTPY}	3.9
NOx Emission Factor, g/HP-hr	EF_{NOx}	7.2
Methane Concentration, ppmvd	C_{CH4}	29.0
Methane Concentration, ppmvw	C_{CH4w}	28.2
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	100.4
Methane Emission Rate, lb/hr	ER_{CH4}	0.086
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.38
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.71
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	692.5
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	672.7
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	2,395.4
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	5.7
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	24.7
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	46.4

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 4-26-3-1E
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
13:43	18.57	1.42	16.68	106.43	16.21	352.78
13:44	18.63	1.30	25.66	99.39	24.99	552.18
13:45	18.78	1.29	16.16	99.26	25.84	633.97
13:46	18.78	1.21	39.76	111.38	24.52	641.03
13:47	18.67	1.26	23.79	109.42	23.56	600.53
13:48	18.87	1.25	16.67	96.71	30.12	714.86
13:49	19.01	1.11	7.84	84.73	31.39	725.84
13:50	19.14	1.13	6.83	90.71	27.35	676.57
13:51	18.93	1.09	7.03	91.53	30.73	771.60
13:52	18.69	1.15	18.24	99.59	29.59	703.84
13:53	18.59	1.34	32.77	109.88	33.90	784.55
13:54	18.80	1.32	21.64	115.07	41.75	925.32
13:55	18.55	1.34	15.00	100.55	36.78	770.43
13:56	18.81	1.33	14.92	93.23	13.10	355.53
13:57	18.75	1.29	10.52	115.01	18.05	510.32
13:58	18.89	1.22	14.21	128.73	23.84	587.53
13:59	18.66	1.25	14.81	100.66	24.32	611.93
14:00	18.79	1.23	14.93	104.63	39.18	874.30
14:01	18.75	1.28	14.92	107.93	31.47	776.84
14:02	18.75	1.31	13.03	106.83	32.83	792.42
14:03	18.70	1.29	4.87	134.89	32.76	763.99

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	18.8	1.3	16.7	105.1	28.2	672.7
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	1,200.0	NA	3,000.0
Pretest System Zero Response	0.12	0.11	15.87	1.04	0.57	-0.17
Posttest System Zero Response	0.16	0.01	-24.63	4.68	0.97	-0.14
Average Zero Response (Co)	0.1	0.1	-4.4	2.9	0.8	-0.2
Pretest System Cal Response	10.87	11.14	5,038.32	1,191.16	1.84	3,002.97
Posttest System Cal Response	10.76	11.20	4,925.10	1,181.56	1.77	3,004.77
Average Cal Response (C_M)	10.8	11.2	4,981.7	1,186.4	1.8	3,003.9
Corrected Run Average (Corr)	19.2	1.2	21.1	103.6	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 4-26-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	19.2
Relative Humidity, %RH	26.0
Barometric, in.Hg	25.49
Ambient Temp, °F	89.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.029**

Location Uinta Wax - Roosevelt, UT
Source Kendall 4-17-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		14:52
Stop Time		15:13
Engine Data		
Engine Manufacturer		Ajax
Engine Model		E-565
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	34
Maximum Engine Brake Work, HP	MaxEBW	40
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	91
Relative Humidity, %	RH	24
Barometric Pressure, in. Hg	Pb	25.47
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	13,300
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.022
Volumetric Flow Rate (M19), dscfm	Qs	1,374
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	19.90
CO_2 Concentration, % dry	C_{CO_2}	0.80
CO Concentration, ppmvd	C_{CO}	45.7
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	269.9
CO Emission Rate, lb/hr	ER_{CO}	0.27
CO Emission Rate, ton/yr	ER_{COTPY}	1.2
CO Emission Factor, g/HP-hr	EF_{CO}	3.7
NOx Concentration, ppmvd	C_{NOx}	0.00
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	0.00
NOx Emission Rate, lb/hr	ER_{NOx}	0.00
NOx Emission Rate, ton/yr	ER_{NOxTPY}	0.00
NOx Emission Factor, g/HP-hr	EF_{NOx}	0.00
Methane Concentration, ppmvd	C_{CH4}	25.8
Methane Concentration, ppmvw	C_{CH4w}	25.2
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	152.4
Methane Emission Rate, lb/hr	ER_{CH4}	0.089
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.39
Methane Emission Factor, g/HP-hr	EF_{CH4}	1.2
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	868.8
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	849.4
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	5,134.2
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	8.2
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	35.9
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	109.5

Underlined values returned negative results and were set to zero.

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 4-17-3-1E
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
14:52	19.32	1.01	23.22	1.83	27.58	920.18
14:53	19.36	0.97	23.18	1.08	27.05	918.16
14:54	19.39	0.98	23.32	1.66	24.80	870.99
14:55	19.45	0.91	23.26	1.19	23.98	848.80
14:56	19.46	0.93	23.35	1.03	25.22	864.77
14:57	19.48	0.89	23.16	1.05	26.18	873.04
14:58	19.40	0.91	23.33	1.03	25.22	842.74
14:59	19.38	0.91	42.59	1.02	27.59	942.74
15:00	19.42	0.92	41.77	1.02	28.83	925.35
15:01	19.38	0.92	33.10	0.98	28.83	991.62
15:02	19.48	0.93	33.01	1.05	30.21	970.64
15:03	19.52	0.82	33.02	1.03	26.63	888.28
15:04	19.46	0.91	23.80	1.04	27.45	931.30
15:05	19.45	0.92	23.33	1.04	25.34	851.35
15:06	19.64	0.86	16.18	1.02	25.02	814.35
15:07	19.56	0.82	14.69	1.05	21.90	750.14
15:08	19.56	0.87	19.30	1.03	22.08	748.36
15:09	19.56	0.82	13.94	1.06	21.42	701.91
15:10	19.58	0.79	13.91	1.07	21.11	729.01
15:11	19.58	0.84	13.98	1.04	21.15	723.15
15:12	19.57	0.90	13.89	1.16	21.94	730.40

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	19.5	0.9	23.8	1.1	25.2	849.4
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	1,200.0	NA	3,000.0
Pretest System Zero Response	0.16	0.01	-24.63	4.68	0.97	-0.14
Posttest System Zero Response	0.31	0.19	-18.16	1.25	0.99	-0.09
Average Zero Response (Co)	0.2	0.1	-21.4	3.0	1.0	-0.1
Pretest System Cal Response	10.76	11.20	4,925.10	1,181.56	2.25	3,004.77
Posttest System Cal Response	10.98	10.97	4,923.43	1,194.80	2.33	3,012.26
Average Cal Response (C_M)	10.9	11.1	4,924.3	1,188.2	2.3	3,008.5
Corrected Run Average (Corr)	19.9	0.8	45.7	**0.0**	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 4-17-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	19.9
Relative Humidity, %RH	24.0
Barometric, in.Hg	25.47
Ambient Temp, °F	91.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.022**

Location Uinta Wax - Roosevelt, UT
Source Kendall 1-18-3-1E
Project No. 2022-2097

Run Number		Run 1
Date		7/26/22
Start Time		15:38
Stop Time		15:59
Engine Data		
Engine Manufacturer		Arrow
Engine Model		A-90
Engine Type		Spark Ignition - 4SRB
Engine Brake Work, HP	EBW	93
Maximum Engine Brake Work, HP	MaxEBW	109
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	92
Relative Humidity, %	RH	25
Barometric Pressure, in. Hg	Pb	25.45
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	8,200
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.173
Volumetric Flow Rate (M19), dscfm	Qs	125
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	2.45
CO_2 Concentration, % dry	C_{CO_2}	8.83
CO Concentration, ppmvd	C_{CO}	10,035.2
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	3,209.1
CO Emission Rate, lb/hr	ER_{CO}	5.5
CO Emission Rate, ton/yr	ER_{COTPY}	24.0
CO Emission Factor, g/HP-hr	EF_{CO}	26.8
NOx Concentration, ppmvd	C_{NOx}	696.7
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	222.8
NOx Emission Rate, lb/hr	ER_{NOx}	0.62
NOx Emission Rate, ton/yr	ER_{NOxTPY}	2.7
NOx Emission Factor, g/HP-hr	EF_{NOx}	3.1
Methane Concentration, ppmvd	C_{CH4}	32.5
Methane Concentration, ppmvw	C_{CH4w}	26.9
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	10.4
Methane Emission Rate, lb/hr	ER_{CH4}	0.010
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.044
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.050
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	1,204.7
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	996.3
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	385.2
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	1.0
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	4.5
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	5.1

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 1-18-3-1E
Project No.: 2022-2097
Date: 7/26/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
15:38	2.51	8.88	9,976.05	684.92	54.12	1,967.76
15:39	2.61	8.85	9,975.88	649.42	46.51	1,842.37
15:40	2.68	8.86	9,975.65	675.80	16.19	600.30
15:41	2.55	8.83	9,975.55	673.62	17.66	721.71
15:42	2.58	8.90	9,975.32	668.96	15.46	643.57
15:43	2.60	8.83	9,975.27	720.97	17.76	567.69
15:44	2.54	8.81	9,975.32	710.77	29.20	956.88
15:45	2.51	8.91	9,975.33	705.76	19.87	741.34
15:46	2.62	8.89	9,975.11	696.24	32.34	1,147.66
15:47	2.67	8.87	9,975.17	704.73	38.84	1,464.82
15:48	2.62	8.78	9,975.03	704.87	20.47	786.47
15:49	2.60	8.87	9,975.08	698.70	15.67	590.06
15:50	2.53	8.86	9,974.99	681.70	18.54	752.97
15:51	2.66	8.96	9,974.99	706.95	17.35	668.31
15:52	2.73	8.86	9,974.88	691.53	21.68	777.24
15:53	2.61	8.82	9,974.85	672.05	21.13	820.98
15:54	2.63	8.82	9,974.81	685.02	26.58	919.42
15:55	2.59	8.83	9,974.78	697.56	44.05	1,438.96
15:56	2.56	8.87	9,974.71	696.70	34.36	1,261.54
15:57	2.62	8.93	9,974.69	712.46	21.67	858.81
15:58	2.67	8.88	9,974.69	725.80	35.28	1,394.16

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	2.6	8.9	9,975.2	693.5	26.9	996.3
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	1,200.0	NA	3,000.0
Pretest System Zero Response	0.31	0.19	-18.16	1.25	0.99	-0.09
Posttest System Zero Response	0.15	0.14	11.26	4.54	0.63	-0.09
Average Zero Response (Co)	0.2	0.2	-3.5	2.9	0.8	-0.1
Pretest System Cal Response	10.98	10.97	4,923.43	1,194.80	1.76	3,012.26
Posttest System Cal Response	10.80	11.03	5,013.26	1,190.30	1.78	3,027.13
Average Cal Response (C_M)	10.9	11.0	4,968.3	1,192.6	1.8	3,019.7
Corrected Run Average (Corr)	2.5	8.8	10,035.2	696.7	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 1-18-3-1E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	2.5
Relative Humidity, %RH	25.0
Barometric, in.Hg	25.45
Ambient Temp, °F	92.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.173**

Location Uinta Wax - Roosevelt, UT
Source Gardner State 1-26-3-2E
Project No. 2022-2097

Run Number		Run 1
Date		8/2/22
Start Time		13:46
Stop Time		14:07
Engine Data		
Engine Manufacturer		Arrow
Engine Model		L-795
Engine Type		Spark Ignition - 2SLB
Engine Brake Work, HP	EBW	55
Maximum Engine Brake Work, HP	MaxEBW	65
Fuel Heating Value, Btu/scf	F_{HV}	1,040
Fuel Factor (O2 dry), dscf/MMBtu	Fd	8,710
Ambient Temperature	T_{Amb}	81
Relative Humidity, %	RH	49
Barometric Pressure, in. Hg	Pb	25.56
Brake Specific Fuel Consumption, Btu/HP-hr	BSFC	12,081
Input Data - Outlet		
Moisture Fraction, dimensionless	BWS	0.079
Volumetric Flow Rate (M19), dscfm	Qs	295
Calculated Data - Outlet		
O_2 Concentration, % dry	C_{O_2}	14.04
CO_2 Concentration, % dry	C_{CO_2}	4.06
CO Concentration, ppmvd	C_{CO}	166.3
CO Concentration, ppmvd @ 15 % O_2	C_{COc15}	142.9
CO Emission Rate, lb/hr	ER_{CO}	0.21
CO Emission Rate, ton/yr	ER_{COTPY}	0.94
CO Emission Factor, g/HP-hr	EF_{CO}	1.8
NOx Concentration, ppmvd	C_{NOx}	502.6
NOx Concentration, ppmvd @ 15 % O_2	C_{NOxc15}	432.1
NOx Emission Rate, lb/hr	ER_{NOx}	1.1
NOx Emission Rate, ton/yr	ER_{NOxTPY}	4.7
NOx Emission Factor, g/HP-hr	EF_{NOx}	8.7
Methane Concentration, ppmvd	C_{CH4}	42.3
Methane Concentration, ppmvw	C_{CH4w}	38.9
Methane Concentration, ppmvd @ 15 % O_2	C_{CH4c15}	36.4
Methane Emission Rate, lb/hr	ER_{CH4}	0.031
Methane Emission Rate, ton/yr	ER_{CH4TPY}	0.14
Methane Emission Factor, g/HP-hr	EF_{CH4}	0.26
NMHC (as C3H8) Concentration, ppmvd	C_{THC}	764.4
NMHC (as C3H8) Concentration, ppmvw	C_{THCw}	703.8
NMHC (as C3H8) Concentration, ppmvd @ 15 % O_2	$C_{NMHCc15}$	657.1
NMHC (as C3H8) Emission Rate, lb/hr	ER_{THC}	1.5
NMHC (as C3H8) Emission Rate, ton/yr	ER_{THCTPY}	6.8
NMHC (as C3H8) Emission Factor, g/HP-hr	EF_{THC}	12.7

Location: Uinta Wax - Roosevelt, UT
Source: Gardner State 1-26-3-2E
Project No.: 2022-2097
Date: 8/2/22

Time	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Unit	% dry	% dry	ppmvd	ppmvd	ppmvw	ppmvw
Status	Valid	Valid	Valid	Valid	Valid	Valid
13:46	14.01	4.02	138.52	453.98	27.14	457.41
13:47	14.09	4.04	160.58	503.51	35.04	687.61
13:48	14.04	4.01	176.75	550.10	28.91	594.81
13:49	14.21	4.05	153.21	497.10	30.24	591.29
13:50	13.89	3.99	142.43	441.09	32.71	631.33
13:51	14.16	4.13	161.42	488.70	38.03	696.85
13:52	13.86	4.03	156.07	525.35	51.46	908.42
13:53	14.13	4.13	179.24	531.18	54.32	950.47
13:54	14.06	4.05	136.58	500.07	46.56	806.87
13:55	14.05	4.02	136.54	446.22	58.33	1,032.43
13:56	14.02	4.09	161.77	475.19	43.29	775.94
13:57	13.91	4.10	162.94	537.04	37.89	685.05
13:58	14.02	4.12	187.10	525.91	41.80	772.84
13:59	14.08	4.08	187.17	489.12	38.98	729.33
14:00	13.95	4.00	151.90	497.56	25.29	485.83
14:01	13.97	4.14	144.96	562.15	26.79	493.89
14:02	13.96	4.08	161.91	542.23	30.92	565.48
14:03	13.82	4.11	148.30	512.97	39.56	704.18
14:04	14.00	4.20	185.81	477.28	49.66	823.74
14:05	14.01	4.10	146.19	526.58	39.24	678.18
14:06	13.96	4.07	135.30	535.22	41.70	708.08

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	Methane - Outlet	NMHC - Outlet
Uncorrected Run Average (C_{obs})	14.0	4.1	157.8	505.6	38.9	703.8
Cal Gas Concentration (C_{MA})	11.0	11.0	5,000.0	750.0	NA	3,000.0
Pretest System Zero Response	0.30	0.15	-4.94	1.75	3.00	-0.28
Posttest System Zero Response	0.31	0.17	-5.83	4.37	2.86	-0.12
Average Zero Response (Co)	0.3	0.2	-5.4	3.1	2.9	-0.2
Pretest System Cal Response	11.01	10.77	4,924.45	737.30	17.31	2,993.81
Posttest System Cal Response	11.08	10.77	4,882.67	768.65	9.00	2,972.12
Average Cal Response (C_M)	11.0	10.8	4,903.6	753.0	13.2	2,983.0
Corrected Run Average (Corr)	14.0	4.1	166.3	502.6	NA	NA

Location: Uinta Wax - Roosevelt, UT
Source: Gardner State 1-26-3-2E
Project No.: 2022-2097

	Run 1
O2 Value, %Dry	14.0
Relative Humidity, %RH	49.0
Barometric, in.Hg	25.56
Ambient Temp, °F	81.0
F_d	8,710
F_w	10,610
% Free water in fuel	0
Moisture Fraction	**0.079**

Appendix C

Location Uinta Wax - Roosevelt, UT
Source Lamb 3-15-4-2E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo
Model	4900	4900	42L	55i
S/N	0410403-2409	0410403-2409	1321958971	1202108608
Operating Range	0-100	0-100	0-2000	0-5000
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC403317	EB0085311
High	EB0104764	EB0104764	CC403317	EB0085311
Cylinder Certifed Values				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4990
Mid	24.0	23.9	2358	4990
High	24.0	23.9	2358	4990
Cylinder Expiration Date				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	4/1/27	4/19/29
High	4/27/29	4/27/29	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097
Date: 7/25/22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	750.00	3,000.00
Span Between				
Low	12.00	12.00	750.00	4,500.00
High	60.00	60.00	3,750.00	15,000.00
Desired Span	24.00	23.90	1,500.00	**6,000.00**
Low Range Gas				
Low	NA	NA	NA	1,500.00
High	NA	NA	NA	2,100.00
Mid Range Gas				
Low	9.60	9.56	600.00	2,700.00
High	14.40	14.34	900.00	3,300.00
High Range Gas				
Low	NA	NA	NA	4,800.00
High	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	2,000
Mid	11.0	11.0	750	3,000
High	24.0	23.9	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	120.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.05	0.00	0.07	-0.27
Low	NA	NA	NA	1,986.74
Mid	11.01	11.19	760.01	2,930.11
High	23.95	23.94	1,501.55	4,989.09
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.21	0.00	0.00	0.00
Low	NA	NA	NA	0.64
Mid	0.04	0.79	0.67	2.36
High	0.21	0.17	0.10	0.00
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Lamb 3-15-4-2E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/25/22				
Span Value	24.0	23.9	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Final Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Pretest System Zero Response	0.2	0.1	2.3	-0.3
Posttest System Zero Response	0.2	0.2	4.8	-0.3
Pretest System Upscale Response	10.9	11.1	741.3	2,930.1
Posttest System Upscale Response	10.9	11.1	743.4	3,068.8
Bias (%)				
Pretest Zero	0.7	0.3	0.1	NA
Posttest Zero	0.7	0.6	0.3	NA
Pretest Span	-0.4	-0.6	-1.2	NA
Posttest Span	-0.3	-0.5	-1.1	NA
Drift (%)				
Zero	0.0	0.3	0.2	0.0
Mid	0.0	0.1	0.1	2.3

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Deep Creek 9-15-4-2E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo
Model	4900	4900	42L	55i
S/N	0410403-2409	0410403-2409	1321958971	1202108608
Operating Range	0-100	0-100	0-2000	0-5000
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC403317	EB0085311
High	EB0104764	EB0104764	CC403317	EB0085311
Cylinder Certifed Values				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4990
Mid	24.0	23.9	2358	4990
High	24.0	23.9	2358	4990
Cylinder Expiration Date				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	4/1/27	4/19/29
High	4/27/29	4/27/29	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Deep Creek 9-15-4-2E
Project No.: 2022-2097
Date: 7/25/22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	750.00	3,000.00
Span Between				
Low	12.00	12.00	750.00	4,500.00
High	60.00	60.00	3,750.00	15,000.00
Desired Span	24.00	23.90	1,500.00	**6,000.00**
Low Range Gas				
Low	NA	NA	NA	1,500.00
High	NA	NA	NA	2,100.00
Mid Range Gas				
Low	9.60	9.56	600.00	2,700.00
High	14.40	14.34	900.00	3,300.00
High Range Gas				
Low	NA	NA	NA	4,800.00
High	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	2,000
Mid	11.0	11.0	750	3,000
High	24.0	23.9	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	120.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.05	0.00	0.07	-0.27
Low	NA	NA	NA	1,986.74
Mid	11.01	11.19	760.01	2,930.11
High	23.95	23.94	1,501.55	4,989.09
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.21	0.00	0.00	0.00
Low	NA	NA	NA	0.64
Mid	0.04	0.79	0.67	2.36
High	0.21	0.17	0.10	0.00
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Deep Creek 9-15-4-2E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/25/22				
Span Value	24.0	23.9	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Final Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Pretest System Zero Response	0.2	0.2	4.8	-0.3
Posttest System Zero Response	0.3	0.1	8.5	-0.2
Pretest System Upscale Response	10.9	11.1	743.4	3,068.8
Posttest System Upscale Response	11.0	11.1	741.5	3,014.7
Bias (%)				
Pretest Zero	0.7	0.6	0.3	NA
Posttest Zero	1.1	0.3	0.6	NA
Pretest Span	-0.3	-0.5	-1.1	NA
Posttest Span	-0.2	-0.5	-1.2	NA
Drift (%)				
Zero	0.4	-0.4	0.2	0.0
Mid	0.1	0.0	-0.1	-0.9

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Kendall 15-7-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo
Model	4900	4900	42L	55i
S/N	0410403-2409	0410403-2409	1321958971	1202108608
Operating Range	0-100	0-100	0-2000	0-5000
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC403317	EB0085311
High	EB0104764	EB0104764	CC403317	EB0085311
Cylinder Certifed Values				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4990
Mid	24.0	23.9	2358	4990
High	24.0	23.9	2358	4990
Cylinder Expiration Date				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	4/1/27	4/19/29
High	4/27/29	4/27/29	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 15-7-3-1E
Project No.: 2022-2097
Date: 7/25/22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	750.00	3,000.00
Span Between				
Low	12.00	12.00	750.00	4,500.00
High	60.00	60.00	3,750.00	15,000.00
Desired Span	24.00	23.90	1,500.00	**6,000.00**
Low Range Gas				
Low	NA	NA	NA	1,500.00
High	NA	NA	NA	2,100.00
Mid Range Gas				
Low	9.60	9.56	600.00	2,700.00
High	14.40	14.34	900.00	3,300.00
High Range Gas				
Low	NA	NA	NA	4,800.00
High	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	2,000
Mid	11.0	11.0	750	3,000
High	24.0	23.9	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	120.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.05	0.00	0.07	-0.27
Low	NA	NA	NA	1,986.74
Mid	11.01	11.19	760.01	2,930.11
High	23.95	23.94	1,501.55	4,989.09
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.21	0.00	0.00	0.00
Low	NA	NA	NA	0.64
Mid	0.04	0.79	0.67	2.36
High	0.21	0.17	0.10	0.00
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 15-7-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/25/22				
Span Value	24.0	23.9	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Final Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Pretest System Zero Response	0.3	0.1	8.5	-0.2
Posttest System Zero Response	-0.1	0.0	2.0	-0.3
Pretest System Upscale Response	11.0	11.1	741.5	3,014.7
Posttest System Upscale Response	10.9	11.1	714.2	2,926.8
Bias (%)				
Pretest Zero	1.1	0.3	0.6	NA
Posttest Zero	-0.5	0.2	0.1	NA
Pretest Span	-0.2	-0.5	-1.2	NA
Posttest Span	-0.4	-0.5	-3.1	NA
Drift (%)				
Zero	-1.6	-0.1	-0.4	0.0
Mid	-0.2	0.0	-1.8	-1.5

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Kendall 2-18-3-1E-H4
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo
Model	4900	4900	42L	55i
S/N	0410403-2409	0410403-2409	1321958971	1202108608
Operating Range	0-100	0-100	0-2000	0-5000
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC403317	EB0085311
High	EB0104764	EB0104764	CC403317	EB0085311
Cylinder Certifed Values				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4990
Mid	24.0	23.9	2358	4990
High	24.0	23.9	2358	4990
Cylinder Expiration Date				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	4/1/27	4/19/29
High	4/27/29	4/27/29	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 2-18-3-1E-H4
Project No.: 2022-2097
Date: 7/25/22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	750.00	3,000.00
Span Between				
Low	12.00	12.00	750.00	4,500.00
High	60.00	60.00	3,750.00	15,000.00
Desired Span	24.00	23.90	1,500.00	**6,000.00**
Low Range Gas				
Low	NA	NA	NA	1,500.00
High	NA	NA	NA	2,100.00
Mid Range Gas				
Low	9.60	9.56	600.00	2,700.00
High	14.40	14.34	900.00	3,300.00
High Range Gas				
Low	NA	NA	NA	4,800.00
High	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	2,000
Mid	11.0	11.0	750	3,000
High	24.0	23.9	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	120.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.05	0.00	0.07	-0.27
Low	NA	NA	NA	1,986.74
Mid	11.01	11.19	760.01	2,930.11
High	23.95	23.94	1,501.55	4,989.09
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.21	0.00	0.00	0.00
Low	NA	NA	NA	0.64
Mid	0.04	0.79	0.67	2.36
High	0.21	0.17	0.10	0.00
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Alliance SOURCE TESTING

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 2-18-3-1E-H4
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/25/22				
Span Value	24.0	23.9	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Final Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Pretest System Zero Response	-0.1	0.0	2.0	-0.3
Posttest System Zero Response	0.1	0.1	1.8	-0.2
Pretest System Upscale Response	10.9	11.1	714.2	2,926.8
Posttest System Upscale Response	10.8	11.1	740.1	2,984.3
Bias (%)				
Pretest Zero	-0.5	0.2	0.1	NA
Posttest Zero	0.1	0.5	0.1	NA
Pretest Span	-0.4	-0.5	-3.1	NA
Posttest Span	-0.8	-0.6	-1.3	NA
Drift (%)				
Zero	0.6	0.3	0.0	0.0
Mid	-0.4	-0.1	1.7	1.0

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Merritt 1-18-3-1E-H1
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo
Model	4900	4900	42L	55i
S/N	0410403-2409	0410403-2409	1321958971	1202108608
Operating Range	0-100	0-100	0-2000	0-5000
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC403317	EB0085311
High	EB0104764	EB0104764	CC403317	EB0085311
Cylinder Certifed Values				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4990
Mid	24.0	23.9	2358	4990
High	24.0	23.9	2358	4990
Cylinder Expiration Date				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	4/1/27	4/19/29
High	4/27/29	4/27/29	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Merritt 1-18-3-1E-H1
Project No.: 2022-2097
Date: 7/25/22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	750.00	3,000.00
Span Between				
Low	12.00	12.00	750.00	4,500.00
High	60.00	60.00	3,750.00	15,000.00
Desired Span	24.00	23.90	1,500.00	**6,000.00**
Low Range Gas				
Low	NA	NA	NA	1,500.00
High	NA	NA	NA	2,100.00
Mid Range Gas				
Low	9.60	9.56	600.00	2,700.00
High	14.40	14.34	900.00	3,300.00
High Range Gas				
Low	NA	NA	NA	4,800.00
High	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	2,000
Mid	11.0	11.0	750	3,000
High	24.0	23.9	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	120.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.05	0.00	0.07	-0.27
Low	NA	NA	NA	1,986.74
Mid	11.01	11.19	760.01	2,930.11
High	23.95	23.94	1,501.55	4,989.09
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.21	0.00	0.00	0.00
Low	NA	NA	NA	0.64
Mid	0.04	0.79	0.67	2.36
High	0.21	0.17	0.10	0.00
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Merritt 1-18-3-1E-H1
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/25/22				
Span Value	24.0	23.9	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Final Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Pretest System Zero Response	0.1	0.1	1.8	-0.2
Posttest System Zero Response	0.1	0.2	3.4	-0.2
Pretest System Upscale Response	10.8	11.1	740.1	2,984.3
Posttest System Upscale Response	10.9	11.0	712.0	2,996.5
Bias (%)				
Pretest Zero	0.1	0.5	0.1	NA
Posttest Zero	0.1	0.7	0.2	NA
Pretest Span	-0.8	-0.6	-1.3	NA
Posttest Span	-0.5	-1.0	-3.2	NA
Drift (%)				
Zero	0.0	0.2	0.1	0.0
Mid	0.3	-0.4	-1.9	0.2

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Womack 3-8-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo
Model	4900	4900	42L	55i
S/N	0410403-2409	0410403-2409	1321958971	1202108608
Operating Range	0-100	0-100	0-2000	0-5000
Cylinder ID				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC403317	EB0085311
High	EB0104764	EB0104764	CC403317	EB0085311
Cylinder Certifed Values				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4990
Mid	24.0	23.9	2358	4990
High	24.0	23.9	2358	4990
Cylinder Expiration Date				
Zero	NA	NA	NA	NA
Low	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	4/1/27	4/19/29
High	4/27/29	4/27/29	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Womack 3-8-3-1E
Project No.: 2022-2097
Date: 7/25/22

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	750.00	3,000.00
Span Between				
Low	12.00	12.00	750.00	4,500.00
High	60.00	60.00	3,750.00	15,000.00
Desired Span	24.00	23.90	1,500.00	**6,000.00**
Low Range Gas				
Low	NA	NA	NA	1,500.00
High	NA	NA	NA	2,100.00
Mid Range Gas				
Low	9.60	9.56	600.00	2,700.00
High	14.40	14.34	900.00	3,300.00
High Range Gas				
Low	NA	NA	NA	4,800.00
High	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)				
Zero	0.00	0.00	0.00	0.00
Low	NA	NA	NA	2,000
Mid	11.0	11.0	750	3,000
High	24.0	23.9	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	120.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)				
Zero	0.05	0.00	0.07	-0.27
Low	NA	NA	NA	1,986.74
Mid	11.01	11.19	760.01	2,930.11
High	23.95	23.94	1,501.55	4,989.09
Performance (% of Span or Cal. Gas Conc.)				
Zero	0.21	0.00	0.00	0.00
Low	NA	NA	NA	0.64
Mid	0.04	0.79	0.67	2.36
High	0.21	0.17	0.10	0.00
Status				
Zero	PASS	PASS	PASS	PASS
Low	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Womack 3-8-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/25/22				
Span Value	24.0	23.9	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Final Instrument Zero Cal Response	0.1	0.0	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.2	760.0	2,930.1
Pretest System Zero Response	0.1	0.2	3.4	-0.2
Posttest System Zero Response	0.1	0.2	1.2	-0.2
Pretest System Upscale Response	10.9	11.0	712.0	2,996.5
Posttest System Upscale Response	10.8	11.1	711.3	2,975.5
Bias (%)				
Pretest Zero	0.1	0.7	0.2	NA
Posttest Zero	0.2	0.9	0.1	NA
Pretest Span	-0.5	-1.0	-3.2	NA
Posttest Span	-0.7	-0.5	-3.2	NA
Drift (%)				
Zero	0.0	0.2	-0.1	0.0
Mid	-0.3	0.5	0.0	-0.4

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Szyndrowski 35-34-3-1E-H1
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Szyndrowski 35-34-3-1E-H1
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	750.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	750.00	4,500.00
High	60.00	60.00	24,000.00	3,750.00	15,000.00
Desired Span	24.00	23.90	9,600.00	1,500.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	600.00	2,700.00
High	14.40	14.34	5,760.00	900.00	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	750	3,000
High	24.0	23.9	9,600	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	0.08	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	749.43	2,925.93
High	23.99	24.03	9,660.64	1,500.54	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.01	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.04	2.51
High	0.04	0.54	0.63	0.04	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Szyndrowski 35-34-3-1E-H1
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	0.1	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	749.4	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	0.1	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	749.4	2,925.9
Pretest System Zero Response	0.3	0.1	-0.1	1.7	-0.2
Posttest System Zero Response	0.4	0.1	-2.4	6.0	-0.1
Pretest System Upscale Response	11.0	11.1	5,090.3	709.6	2,925.9
Posttest System Upscale Response	11.2	11.3	5,055.5	722.1	3,009.9
Bias (%)					
Pretest Zero	1.4	0.1	0.0	0.1	NA
Posttest Zero	1.5	0.2	0.0	0.4	NA
Pretest Span	0.1	0.4	-0.7	-2.7	NA
Posttest Span	0.6	1.0	-1.1	-1.8	NA
Drift (%)					
Zero	0.2	0.1	0.0	0.3	0.0
Mid	0.5	0.7	-0.4	0.8	1.4

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Gavitte 15-23-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 15-23-3-1E
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	750.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	750.00	4,500.00
High	60.00	60.00	24,000.00	3,750.00	15,000.00
Desired Span	24.00	23.90	9,600.00	2,358.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	943.20	2,700.00
High	14.40	14.34	5,760.00	1,414.80	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	1,200	3,000
High	24.0	23.9	9,600	2,358	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	1.18	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	1,219.98	2,925.93
High	23.99	24.03	9,600.64	2,340.33	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.05	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.85	2.51
High	0.04	0.54	0.01	0.75	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 15-23-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	2,358.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Pretest System Zero Response	0.4	0.1	-2.4	28.7	-0.1
Posttest System Zero Response	0.4	0.2	3.8	9.6	-0.1
Pretest System Upscale Response	11.2	11.3	5,055.5	1,175.5	3,009.9
Posttest System Upscale Response	11.2	11.2	4,984.9	1,183.3	3,049.7
Bias (%)					
Pretest Zero	1.5	0.2	0.0	1.2	NA
Posttest Zero	1.7	0.6	0.0	0.4	NA
Pretest Span	0.6	1.0	-1.1	-1.9	NA
Posttest Span	0.6	0.9	-1.8	-1.6	NA
Drift (%)					
Zero	0.2	0.4	0.1	-0.8	0.0
Mid	0.0	-0.1	-0.7	0.3	0.7

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Gavitte 10-23-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 10-23-3-1E
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	750.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	750.00	4,500.00
High	60.00	60.00	24,000.00	3,750.00	15,000.00
Desired Span	24.00	23.90	9,600.00	2,358.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	943.20	2,700.00
High	14.40	14.34	5,760.00	1,414.80	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	1,200	3,000
High	24.0	23.9	9,600	2,358	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	1.18	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	1,219.98	2,925.93
High	23.99	24.03	9,600.64	2,340.33	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.05	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.85	2.51
High	0.04	0.54	0.01	0.75	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 10-23-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	2,358.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Pretest System Zero Response	0.4	0.2	3.8	9.6	-0.1
Posttest System Zero Response	0.4	0.1	-0.1	6.6	-0.3
Pretest System Upscale Response	11.2	11.2	4,984.9	1,183.3	3,049.7
Posttest System Upscale Response	11.2	11.1	4,933.0	1,190.3	3,095.6
Bias (%)					
Pretest Zero	1.7	0.6	0.0	0.4	NA
Posttest Zero	1.7	0.3	0.0	0.2	NA
Pretest Span	0.6	0.9	-1.8	-1.6	NA
Posttest Span	0.9	0.5	-2.3	-1.3	NA
Drift (%)					
Zero	0.0	-0.3	0.0	-0.1	0.0
Mid	0.3	-0.4	-0.5	0.3	0.8

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Gavitte 13-23-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 13-23-3-1E
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	1,200.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	1,200.00	4,500.00
High	60.00	60.00	24,000.00	6,000.00	15,000.00
Desired Span	24.00	23.90	9,600.00	2,358.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	943.20	2,700.00
High	14.40	14.34	5,760.00	1,414.80	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	1,200	3,000
High	24.0	23.9	9,600	2,358	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	1.18	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	1,219.98	2,925.93
High	23.99	24.03	9,600.64	2,340.33	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.05	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.85	2.51
High	0.04	0.54	0.01	0.75	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 13-23-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	2,358.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Pretest System Zero Response	0.4	0.1	-0.1	6.6	-0.3
Posttest System Zero Response	0.1	0.1	15.9	1.0	-0.2
Pretest System Upscale Response	11.2	11.1	4,933.0	1,190.3	3,095.6
Posttest System Upscale Response	10.9	11.1	5,038.3	1,191.2	3,003.0
Bias (%)					
Pretest Zero	1.7	0.3	0.0	0.2	NA
Posttest Zero	0.5	0.4	0.2	0.0	NA
Pretest Span	0.9	0.5	-2.3	-1.3	NA
Posttest Span	-0.6	0.6	-1.2	-1.2	NA
Drift (%)					
Zero	-1.2	0.0	0.2	-0.2	0.0
Mid	-1.5	0.1	1.1	0.0	-1.5

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Gavitte 4-26-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 4-26-3-1E
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,500.00	1,200.00	3,000.00
Span Between					
Low	12.00	12.00	4,500.00	1,200.00	4,500.00
High	60.00	60.00	22,500.00	6,000.00	15,000.00
Desired Span	24.00	23.90	9,600.00	2,358.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	943.20	2,700.00
High	14.40	14.34	5,760.00	1,414.80	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	1,200	3,000
High	24.0	23.9	9,600	2,358	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	1.18	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	1,219.98	2,925.93
High	23.99	24.03	9,600.64	2,340.33	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.05	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.85	2.51
High	0.04	0.54	0.01	0.75	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Gavitte 4-26-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	2,358.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Pretest System Zero Response	0.1	0.1	15.9	1.0	-0.2
Posttest System Zero Response	0.2	0.0	-24.6	4.7	-0.1
Pretest System Upscale Response	10.9	11.1	5,038.3	1,191.2	3,003.0
Posttest System Upscale Response	10.8	11.2	4,925.1	1,181.6	3,004.8
Bias (%)					
Pretest Zero	0.5	0.4	0.2	0.0	NA
Posttest Zero	0.6	0.0	-0.3	0.1	NA
Pretest Span	-0.6	0.6	-1.2	-1.2	NA
Posttest Span	-1.0	0.8	-2.4	-1.6	NA
Drift (%)					
Zero	0.2	-0.4	-0.4	0.2	0.0
Mid	-0.5	0.3	-1.2	-0.4	0.0

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Kendall 4-17-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 4-17-3-1E
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	1,200.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	1,200.00	4,500.00
High	60.00	60.00	24,000.00	6,000.00	15,000.00
Desired Span	24.00	23.90	9,600.00	2,358.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	943.20	2,700.00
High	14.40	14.34	5,760.00	1,414.80	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	1,200	3,000
High	24.0	23.9	9,600	2,358	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	1.18	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	1,219.98	2,925.93
High	23.99	24.03	9,600.64	2,340.33	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.05	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.85	2.51
High	0.04	0.54	0.01	0.75	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 4-17-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	2,358.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Pretest System Zero Response	0.2	0.0	-24.6	4.7	-0.1
Posttest System Zero Response	0.3	0.2	-18.2	1.3	-0.1
Pretest System Upscale Response	10.8	11.2	4,925.1	1,181.6	3,004.8
Posttest System Upscale Response	11.0	11.0	4,923.4	1,194.8	3,012.3
Bias (%)					
Pretest Zero	0.6	0.0	-0.3	0.1	NA
Posttest Zero	1.3	0.7	-0.2	0.0	NA
Pretest Span	-1.0	0.8	-2.4	-1.6	NA
Posttest Span	-0.1	-0.1	-2.4	-1.1	NA
Drift (%)					
Zero	0.6	0.8	0.1	-0.1	0.0
Mid	0.9	-1.0	0.0	0.6	0.1

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Kendall 1-18-3-1E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	EB0104764	EB0104764	CC174185	CC403317	EB0085311
High	EB0104764	EB0104764	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.0	23.9	9600	2358	4990
High	24.0	23.9	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29
High	4/27/29	4/27/29	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 1-18-3-1E
Project No.: 2022-2097
Date: 7/26/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	1,200.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	1,200.00	4,500.00
High	60.00	60.00	24,000.00	6,000.00	15,000.00
Desired Span	24.00	23.90	9,600.00	2,358.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.60	9.56	3,840.00	943.20	2,700.00
High	14.40	14.34	5,760.00	1,414.80	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.0	11.0	5,000	1,200	3,000
High	24.0	23.9	9,600	2,358	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.01	0.02	1.10	1.18	-0.24
Low	NA	NA	NA	NA	1,938.32
Mid	11.01	11.00	5,157.41	1,219.98	2,925.93
High	23.99	24.03	9,600.64	2,340.33	4,989.03
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.04	0.08	0.01	0.05	0.00
Low	NA	NA	NA	NA	3.15
Mid	0.04	0.00	1.64	0.85	2.51
High	0.04	0.54	0.01	0.75	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Kendall 1-18-3-1E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 7/26/22					
Span Value	24.0	23.9	9,600.0	2,358.0	6,000.0
Initial Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Initial Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Final Instrument Zero Cal Response	0.0	0.0	1.1	1.2	-0.2
Final Instrument Upscale Cal Response	11.0	11.0	5,157.4	1,220.0	2,925.9
Pretest System Zero Response	0.3	0.2	-18.2	1.3	-0.1
Posttest System Zero Response	0.2	0.1	11.3	4.5	-0.1
Pretest System Upscale Response	11.0	11.0	4,923.4	1,194.8	3,012.3
Posttest System Upscale Response	10.8	11.0	5,013.3	1,190.3	3,027.1
Bias (%)					
Pretest Zero	1.3	0.7	-0.2	0.0	NA
Posttest Zero	0.6	0.5	0.1	0.1	NA
Pretest Span	-0.1	-0.1	-2.4	-1.1	NA
Posttest Span	-0.9	0.1	-1.5	-1.3	NA
Drift (%)					
Zero	-0.7	-0.2	0.3	0.1	0.0
Mid	-0.7	0.3	0.9	-0.2	0.2

Alliance SOURCE TESTING

QA Data

Location Uinta Wax - Roosevelt, UT
Source Gardner State 1-26-3-2E
Project No. 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Make	Servomex	Servomex	Thermo	Thermo	Thermo
Model	4900	4900	48H	42L	55i
S/N	0410403-2409	0410403-2409	48 48000 279	1321958971	1202108608
Operating Range	0-100	0-100	0-10000	0-2000	0-5000
Cylinder ID					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	EB0085311
Mid	SX55038	SX55038	CC174185	CC403317	EB0085311
High	SX55038	SX55038	CC174185	CC403317	EB0085311
Cylinder Certifed Values					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4990
Mid	24.05	23.55	9600	2358	4990
High	24.05	23.55	9600	2358	4990
Cylinder Expiration Date					
Zero	NA	NA	NA	NA	NA
Low	NA	NA	NA	NA	4/19/29
Mid	7/6/28	7/6/28	11/25/27	4/1/27	4/19/29
High	7/6/28	7/6/28	11/25/27	4/1/27	4/19/29

Alliance SOURCE TESTING

Calibration Data

Location: Uinta Wax - Roosevelt, UT
Source: Gardner State 1-26-3-2E
Project No.: 2022-2097
Date: 8/2/22

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Expected Average Concentration	12.00	12.00	4,800.00	750.00	3,000.00
Span Between					
Low	12.00	12.00	4,800.00	750.00	4,500.00
High	60.00	60.00	24,000.00	3,750.00	15,000.00
Desired Span	24.05	23.55	9,600.00	1,500.00	**6,000.00**
Low Range Gas					
Low	NA	NA	NA	NA	1,500.00
High	NA	NA	NA	NA	2,100.00
Mid Range Gas					
Low	9.62	9.42	3,840.00	600.00	2,700.00
High	14.43	14.13	5,760.00	900.00	3,300.00
High Range Gas					
Low	NA	NA	NA	NA	4,800.00
High	NA	NA	NA	NA	5,400.00
Actual Concentration (% or ppm)					
Zero	0.00	0.00	0.00	0.00	0.00
Low	NA	NA	NA	NA	2,000
Mid	11.00	11.00	5,000	750	3,000
High	24.05	23.55	9,600	1,500	4,990
Response Time (seconds)	60.00	60.00	60.00	60.00	60.00
Upscale Calibration Gas (C_{MA})	Mid	Mid	Mid	Mid	Mid
Instrument Response (% or ppm)					
Zero	0.04	-0.07	-0.61	0.12	-0.27
Low	NA	NA	NA	NA	1,999.57
Mid	11.03	10.98	5,082.57	755.02	3,018.63
High	24.07	23.55	9,549.16	1,503.16	4,988.57
Performance (% of Span or Cal. Gas Conc.)					
Zero	0.17	0.30	0.01	0.01	0.00
Low	NA	NA	NA	NA	0.02
Mid	0.12	0.08	0.86	0.33	0.65
High	0.08	0.00	0.53	0.21	0.00
Status					
Zero	PASS	PASS	PASS	PASS	PASS
Low	NA	NA	NA	NA	PASS
Mid	PASS	PASS	PASS	PASS	PASS
High	PASS	PASS	PASS	PASS	PASS

Bias/Drift Determinations

Location: Uinta Wax - Roosevelt, UT
Source: Gardner State 1-26-3-2E
Project No.: 2022-2097

Parameter	O_2 - Outlet	CO_2 - Outlet	CO - Outlet	NOx - Outlet	NMHC - Outlet
Run 1 Date 8/2/22					
Span Value	24.1	23.6	9,600.0	1,500.0	6,000.0
Initial Instrument Zero Cal Response	0.0	-0.1	-0.6	0.1	-0.3
Initial Instrument Upscale Cal Response	11.0	11.0	5,082.6	755.0	3,018.6
Final Instrument Zero Cal Response	0.0	-0.1	-0.6	0.1	-0.3
Final Instrument Upscale Cal Response	11.0	11.0	5,082.6	755.0	3,018.6
Pretest System Zero Response	0.3	0.2	-4.9	1.8	-0.3
Posttest System Zero Response	0.3	0.2	-5.8	4.4	-0.1
Pretest System Upscale Response	11.0	10.8	4,924.5	737.3	2,993.8
Posttest System Upscale Response	11.1	10.8	4,882.7	768.7	2,972.1
Bias (%)					
Pretest Zero	1.1	0.9	0.0	0.1	NA
Posttest Zero	1.1	1.0	-0.1	0.3	NA
Pretest Span	-0.1	-0.9	-1.6	-1.2	NA
Posttest Span	0.2	-0.9	-2.1	0.9	NA
Drift (%)					
Zero	0.0	0.1	0.0	0.2	0.0
Mid	0.3	0.0	-0.4	2.1	-0.4

Red Ball Technical Gas Service
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150
PGVP Vendor ID # G12021

PJLA Calibration and Testing
Accreditation #62754

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	EB0104764	Certification Date:	04/29/2021
Product ID Number:	127907	Expiration Date:	04/27/2029
Cylinder Pressure:	1900 PSIG	MFG Facility:	- Shreveport - LA
COA #	EB0104764.20210414-0	Lot Number:	EB0104764.20210414
Customer PO. NO.:		Tracking Number:	097022950
Customer:		Previous Certification Dates:	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G2.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Carbon Dioxide	23.9 %	±0.16 %	NDIR	04/29/2021
Oxygen	24.0 %	±0.13 %	MPA	04/27/2021
Nitrogen	Balance			

Analytical Measurement Data Available Online.

Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
CC729793	CC729793.20201022	04/06/2029	GMIS	N2	O2	20.01 %	0.115	SRM 2659a
~~EB0007615~~	~~EB0007615.20190610~~	~~11/24/2027~~	~~GMIS~~	~~N2~~	~~CO2~~	~~24.71 %~~	~~0.274~~	~~C1579010.02~~
EB0041474	EB0041474.20180504	07/21/2026	GMIS	N2	O2	24 %	0.497	071001
EB0097757	EB0097757.20190610	11/24/2027	GMIS	N2	CO2	19.58 %	0.306	C1579010.02

Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
O2	MPA	Thermo	410i	1162980025	04/20/2021
CO2	NDIR	Thermo	410i	1162980025	04/09/2021

SMART-CERT

This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

Anthony Cyr
Assistant Operations Manager
Assay Laboratory: Red Ball TGS
Version 02-J, Revised on 2018-09-17

PRAXAIR
Making our planet more productive

DocNumber: 294222

Praxair Distribution, Inc.
6055 Brent Drive
Toledo OH 43611
Tel: +1 (419) 729-7732
Fax: +1 (419) 729-2411
PGVP ID: F12019

CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

Customer & Order Information

PRAXAIR PKG HILLSIDE IL HS
12000 ROOSEVELT RD
HILLSIDE IL 60162-2004

Certificate Issuance Date: 11/25/2019
Praxair Order Number: 71163881
Part Number: NI CO9500E-AS
Customer PO Number: 79150774

Fill Date: 11/14/2019
Lot Number: 700019318GF
Cylinder Style & Outlet: AS CGA 350
Cylinder Pressure and Volume: 2000 psig 140 ft3

Certified Concentration

ProSpec EZ Cert

Expiration Date:	**11/25/2027**	NIST Traceable
Cylinder Number:	**CC174185**	Expanded Uncertainty
9600 ppm	**Carbon monoxide**	**± 1.1 %**
Balance	**Nitrogen**	

Certification Information:

Certification Date: 11/25/2019 *Term:* 96 Months *Expiration Date:* 11/25/2027

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1.
Do Not Use this Standard if Pressure is less than 100 PSIG.

Analytical Data:

(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)

1. ***Component:*** **Carbon monoxide**

Requested Concentration: 9500 ppm
Certified Concentration: 9600 ppm
Instrument Used: Horbia VIA-510
Analytical Method: NDIR
Last Multipoint Calibration: 09/19/2019

Reference Standard: Type / Cylinder #: GMIS / EB0029842
Concentration / Uncertainty: 1.02 % ±1%
Expiration Date: 05/09/2020
Traceable to: SRM # / Sample # / Cylinder #: 2639a / 54-D-26 / CAL014084
SRM Concentration / Uncertainty: 0.9792% / ±0.0038%
SRM Expiration Date: 09/23/2018

First Analysis Data:						**Date**	11/25/2019
Z:	0	**R:**	1.02	**C:**	0.96	**Conc:**	1
R:	1.02	**Z:**	0	**C:**	0.95	**Conc:**	1
Z:	0	**C:**	0.96	**R:**	1.02	**Conc:**	1
UOM:	%			**Mean Test Assay:**		1	ppm

Second Analysis Data:						**Date**	
Z:	0	**R:**	0	**C:**	0	**Conc:**	0
R:	0	**Z:**	0	**C:**	0	**Conc:**	0
Z:	0	**C:**	0	**R:**	0	**Conc:**	0
UOM:	%			**Mean Test Assay:**			ppm

Analyzed By Lloyd Knapp

Certified By Edward E Zucal

Airgas
an Air Liquide company

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A1631	Reference Number:	153-401457051-1
Cylinder Number:	CC403317	Cylinder Volume:	144.4 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72019	Valve Outlet:	660
Gas Code:	NO,NOX,BALN	Certification Date:	Apr 01, 2019

Expiration Date: Apr 01, 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
NOX	2400 PPM	2358 PPM	G1	+/- 0.7% NIST Traceable	03/25/2019, 04/01/2019
NITRIC OXIDE	2400 PPM	2354 PPM	G1	+/- 0.7% NIST Traceable	03/25/2019, 04/01/2019
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	14061015	CC437008	2990 PPM NITRIC OXIDE/NITROGEN	0.5%	Jul 28, 2019
PRM	12376	D562879	10.01 PPM NITROGEN DIOXIDE/NITROGEN	2.0%	Aug 17, 2018
GMIS	7301017103	CC506597	4.451 PPM NITROGEN DIOXIDE/NITROGEN	2.0%	Dec 18, 2020

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
Nicolet 6700 AMP0900119 NO H2NO	FTIR	Mar 13, 2019
Nicolet 6700 AMP0900119 NO2 impurity	FTIR NO2 impurity	Mar 14, 2019

Triad Data Available Upon Request

Approved for Release

Red Ball Technical Gas Service
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150
PGVP Vendor ID # G12021

PJLA Calibration and Testing
Accreditation #62754

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	EB0085311	**Certification Date**:	04/21/2021
Product ID Number:	124111	**Expiration Date:**	04/19/2029
Cylinder Pressure:	1900 PSIG	**MFG Facility:**	- Shreveport - LA
COA #	EB0085311.20210406-0	**Lot Number:**	EB0085311.20210406
Customer PO. NO.:		**Tracking Number:**	083082362
Customer:		**Previous Certification Dates:**	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G2.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Propane	**4990 PPM**	±40 PPM	FTIR	04/21/2021
Nitrogen	Balance			

Analytical Measurement Data Available Online.

Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
EB0070649	EB0070649.20160114g	05/17/2024	GMIS	N2	C3H8	1494 PPM	0.603	2647a

Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
C3H8	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	04/20/2021

SMART-CERT

This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

Anthony Cyr
Assistant Operations Manager
Assay Laboratory: Red Ball TGS
Version 02-J, Revised on 2018-09-17

NOx Converter Efficiency Check

Location: Eastern Research Group - Roosevelt, UT
Project No.: 2022-2097

NO_2 Converter Check					
Analyzer Make	Thermo	**Pre-Test Date**	--	**Time**	--
Analyzer Model	42L	**Pre-Test Concentration, ppm**			--
Serial Number	1321958971	**Pre-Test Efficiency, %**			-
Cylinder ID Number	EB0058339	**Post-Test Date**	8/4/22	**Time**	16:00
Cylinder Exp. Date	11/18/24	**Post-Test Concentration, ppm**			48.12
Cylinder Concentration, ppm	48.8	**Post-Test Efficiency, %**			99

**Required Efficiency is ≥ 90 %.*

RED BALL TECHNICAL GAS SERVICES

PJLA Calibration and Testing
Accreditation #62754

Red Ball Technical Gas Service
555 Craig Kennedy Way
Shreveport, LA 71107
800-551-8150
PGVP Vendor ID # G12021

EPA PROTOCOL GAS CERTIFICATE OF ANALYSIS

Cylinder Number:	EB0058339	**Certification Date**:	11/19/2021
Product ID Number:	130113	**Expiration Date:**	11/18/2024
Cylinder Pressure:	1550 PSIG	**MFG Facility:**	- Shreveport - LA
COA #	EB0058339.20210922-0	**Lot Number:**	EB0058339.20210922
Customer PO. NO.:		**Tracking Number:**	074330814
Customer:		**Previous Certification Dates:**	

This calibration standard has been certified per the May 2012 EPA Traceability Protocol, Document EPA-600/R-12/531, using procedure G2.

Do Not Use This Cylinder Below 100 psig (0.7 Megapascal).

Certified Concentration(s)

Component	Concentration	Uncertainty	Analytical Principle	Assayed On
Nitrogen Dioxide	**48.8 PPM**	±0.5 PPM	FTIR	10/15/2021, 11/05/2021, 11/19/2021
Oxygen	**5.02 %**	±0.04 %	MPA	10/04/2021

Nitrogen Balance

Analytical Measurement Data Available Online.

Reference Standard(s)

Serial Number	Lot	Expiration	Type	Balance	Component	Concentration	Uncertainty(%)	NIST Reference
EB0069863	EB0069863.20191017	01/07/2028	GMIS	N2	O2	6.01 %	0.219	SRM 2659a
EB0078072	EB0078072.20180504	07/21/2026	GMIS	N2	O2	24 %	0.497	071001
EB0083217	EB0083217.20161201	09/24/2023	GMIS	AIR	NO2	28.3 PPM	1.088	C1847810.02
EB0085260	EB0085260.20190102	02/26/2024	GMIS	AIR	NO2	87.3 PPM	1.063	C1847810.02
EB0100438	EB0100438.20190102	09/24/2023	GMIS	AIR	NO2	60.9 PPM	1.043	C1847810.02

Analytical Instrumentation

Component	Principle	Make	Model	Serial	MPC Date
O2	MPA	Thermo	410i	1162980025	10/01/2021
NO2	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	09/17/2021
NO2	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	10/22/2021
NO2	FTIR	MKS	MKS 2031DJG2EKVS13T	017146467	11/19/2021

SMART-CERT

This is to certify the gases referenced have been calibrated/tested, and verified to meet the defined specifications. This calibration/test was performed using Gases or Scales that are traceable through National Institute of Standards and Technology (NIST) to the International System of Units (SI). The basis of compliance stated is a comparison of the measurement parameters to the specified or required calibration/testing process. The expanded uncertainties use a coverage factor of k=2 to approximate the 95% confidence level of the measurement, unless otherwise noted. This calibration certificate applies only to the item described and shall not be reproduced other than in full, without written approval from Red Ball Technical Gas Services. If not included, the uncertainty of calibrations are available upon request and were taken into account when determining pass or fail.

Brandon Theus
Laboratory Supervisor
Assay Laboratory: Red Ball TGS
Version 02-J, Revised on 2018-09-17

EPA Method 205
Field Calibration of Dilution System

Location: Eastern Research Group - Roosevelt, UT
Project No.: 2022-2097

Analyzer Make:	Servomex
Analyzer Model:	4900
Analyzer SN:	0410403-2409
Environics ID:	8027
Component/Balance Gas:	O2/N2
Cylinder Gas ID (Dilution):	EB0104764
Cylinder Gas Concentration (Dilution), %:	24
Cylinder Gas ID (Mid-Level):	EB0081895
Cylinder Gas Concentration (Mid-Level), %:	11.18

Target Mass Flow Contollers	Target Dilution (%)	Target Flow Rate lpm	Target Concentration (%)	Actual Concentration (%)	Injection 1 Analyzer Concentration (%)	Injection 2 Analyzer Concentration (%)	Injection 3 Analyzer Concentration (%)	Average Analyzer Concentration (%)	Difference (%)	Average Error (± 2 %)
10L/5L	80.0	5.0	19.2	19.2	19.1	19.0	19.1	19.08	-0.12	-0.6%
10L/5L	50.0	5.0	12.0	12.0	11.9	11.9	11.9	11.91	-0.09	-0.8%
10L/1L	20.0	4.0	4.8	4.8	4.8	4.8	4.8	4.81	0.01	0.1%
10L/1L	10.0	4.0	2.4	2.4	2.4	2.4	2.4	2.41	0.01	0.6%

*Not all AST Environics Units have 2-10L Mass Flow Controllers. For these units the 90% @ 7lpm and 80% @ 7lpm injections will not be conducted.

Average Analyzer Concentration (%)	Injection 1 Error (± 2 %)	Injection 2 Error (± 2 %)	Injection 3 Error (± 2 %)
19.08	0.2%	-0.4%	0.1%
11.91	0.1%	0.1%	-0.2%
4.81	-0.3%	0.7%	-0.3%
2.41	0.3%	-1.0%	0.7%

Mid-Level Supply Gas Calibration Direct to Analyzer

Calibration Gas Concentration (%)	Injection 1 Analyzer Concentration (%)	Injection 2 Analyzer Concentration (%)	Injection 3 Analyzer Concentration (%)	Average Analyzer Concentration (%)	Difference (%)	Average Error (± 2 %)
11.18	11.1	11.1	11.1	11.09	-0.09	-0.8%

Alliance
SOURCE TESTING

Mass Flow Controller Calibration

Dilution System Make:	Environics
Dilution System Model:	4040
Dilution System S/N:	8027
Calibration Equipment Make:	Alicat Scientific
Calibration Equipment Model:	M-10SLPD/5MM-D/5M, M-1SLPM-D/5I
Calibration Equipment S/N:	197206 / 197208
Flow Cell S/N:	127208
Flow Cell S/N:	127206
Calibration Gas:	Nitrogen
Barometric Pressure, mmHg:	25.19
Ambient Temperature, °F:	69

Mass Flow Controller ID	#1			# 2			# 3		
Size, ccm:	10,000			10,000			1,000		
Make:	Environics			Environics			Environics		
Model:	EFC 202			EFC 202			EFC 202		
S/N:	455242007			455242008			455238004		
	Set Flow cc/min	**True Flow cc/min**	**Difference**	**Set Flow cc/min**	**True Flow cc/min**	**Difference**	**Set Flow cc/min**	**True Flow cc/min**	**Difference**
5%	500	509	1.8%	500	511	2.2%	50	51	1.8%
10%	1,000	1,020	2.0%	1,000	1,022	2.2%	100	102	1.8%
20%	2,000	2,041	2.1%	2,000	2,041	2.1%	200	204	1.9%
30%	3,000	3,064	2.1%	3,000	3,063	2.1%	300	306	2.1%
40%	4,000	4,083	2.1%	4,000	4,084	2.1%	400	408	2.1%
50%	5,000	5,106	2.1%	5,000	5,103	2.1%	500	510	1.9%
60%	6,000	6,123	2.1%	6,000	6,119	2.0%	600	612	1.9%
70%	7,000	7,142	2.0%	7,000	7,141	2.0%	700	714	2.0%
80%	8,000	8,162	2.0%	8,000	8,160	2.0%	800	817	2.1%
90%	9,000	9,182	2.0%	9,000	9,184	2.0%	900	918	2.0%
100%	10,000	10,211	2.1%	10,000	10,206	2.1%	1,000	1,020	2.0%

Note: The mass flow controller's calibration values are used by the dilution system's operating software to improve accuracy. These calibrations are not necessarily indicative of the systems overall performance. Performance is verified by conducting a Method 205 prior to each field use.

Calibration Performed By TCH

Date 3/28/22

Airgas
an Air Liquide company

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

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E03NI78E15A0225	Reference Number:	153-124603219-1
Cylinder Number:	EB0081895	Cylinder Volume:	151.7 CF
Laboratory:	124 - Tooele (SAP) - UT	Cylinder Pressure:	2015 PSIG
PGVP Number:	B72017	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Feb 14, 2017

Expiration Date: Feb 14, 2025

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 DIOXIDE	11.00 %	10.80 %	G1	+/- 0.7% NIST Traceable	02/14/2017
OXYGEN	11.00 %	11.18 %	G1	+/- 0.7% NIST Traceable	02/14/2017
NITROGEN	Balance			-	

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	1	CC413742	16.939 % CARBON DIOXIDE/NITROGEN	0.60	May 08, 2019
NTRM	98051014	SG9162888BAL	12.05 % OXYGEN/NITROGEN	0.7%	Dec 02, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Horiba VIA-510 SV4MEUTJ CO2	CO2 NDIR (Dixon)	Feb 13, 2017
Horiba MPA-510 X9A4UGL8 O2	O2 Paramagnetic (Dixon)	Jan 19, 2017

Triad Data Available Upon Request

Signature on file
Approved for Release

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