1. INTRODUCTION

This report presents the results of the source emissions testing conducted by Environmental Quality Management, Inc. (EQM) for TC Energy's ANR Pipeline (ANR) Woolfolk Compressor, near Big Rapids, MI, which is located in Mecosta County. The primary purpose of this testing program was to conduct emissions testing to determine compliance with with flexible groups FG-RICE-818-WLENGINES and RICE MACT in the permit and are subject to 40 CFR Part 63, Subpart ZZZZ requirement specified in Permit MI-ROP-B7220-2017a for the Units EUWL001(Unit 1), EUWL002 (Unit 2), EUWL003 (Unit 3), EUWL004 (Unit 4), EUWL005 (Unit 5), EUWL007(Unit 7), EUWL008 (Unit 8), and EUWL009 (Unit 9) Engines at ANR 's gas compressor facility.

To ensure that compliance with the emission limits is maintained, the Air Compliance Team of TC Energy's ANR contracted Environmental Quality Management, Inc. (EQM) to perform source emissions testing on the eight units. The primary purpose of this testing program was to conduct emissions testing to determine compliance with the permit at ANR's gas compressor facility.

EQM's responsibility was to conduct and oversee the compliance testing for the NO_x and Formaldehyde (H_2CO) emission rates and perform data reduction for conformance evaluation. ANR's responsibility was to maintain process operating parameters and to assist in providing process operating data per compliance test requirements. EQM contracted the services of Prism Analytical Technologies out of Mount Pleasant, MI for the Method 320.

The following report provides information pertaining to TC Energy's process operations, and Compliance testing. The Compliance testing conducted on Unit 1 and Unit 2 was performed on July 20, 2021 from 10:40 A.M.-5:17 P.M. The Compliance testing conducted on Unit 3 and Unit 4 was performed on July 21, 2021 from 9:02 A.M.-5:16 P.M. The Compliance testing conducted on Unit 5 and Unit 7 was performed on July 22, 2021 from 10:42 A.M.-5:57 P.M. The Compliance testing conducted on Unit 8 and Unit 9 was performed on July 23, 2021 from 8:27 A.M.-4:08 P.M.

The following requirements were specific for the testing program:

1. Equipment calibrations performed and calibration data provided.

2. Three (3) sixty (60) –minute NO_x, H_2CO and O_2, test runs performed at the eight Units pursuant to EPA, Title 40, Code of Federal Regulations, Part 60 (40 CFR 60), Appendix A.

3. Process operations conditions maintained within 10% rated load during the emissions testing periods.

4. All testing and analyses performed in accordance with current EPA test methodologies and analytical procedures for H_2CO and O_2 emissions

determinations via Extractive Fourier transform infarared (FTIR) spectrometry.

5. All testing and analyses performed in accordance with current EPA test methodologies and analytical procedures for O_2 to quantify the concentration levels from each source to correct formaldehyde concentrations for oxygen content.
6. All testing and analyses performed in accordance with current EPA test methodologies and analytical procedures for NOx, and O_2 test runs performed at the eight engines pursuant to EPA Reference methods as described in 40 CFR, Part 60, Appendix A

6. Stratification was found to be less than 3% in the turbine exhaust.

The testing program was approved by and/or coordinated with Tyrah Lydia, TC Energy's ANR Pipeline. The emission testing was performed by Karl Mast, Project Manager, EQM and Cody Shifflett, Prism Analytical Technologies. The emission testing was observed by Lindsey Wells, Michigan EGLE.

2. TEST RESULTS SUMMARY

The compliance testing was performed on Units 1, 2, 3, 4, 5, 7, 8, and 9 systems in accordance with the requirements of the Code of Federal Regulations, Title 40, Part 60, Appendix A, and the Permit MI-ROP-B7220-2017a requirements. A summary of the test results is given below:

Table 1. H_2CO % Destruction Effeciency

Unit	Run 1	Run 2	Run 3	Average	Limit
EUWL001	89.98	87.60	86.74	88.11	76%
EUWL002	86.49	86.59	87.10	86.73	76%
EUWL003	89.58	89.29	89.84	89.57	76%
EUWL004	91.08	90.63	90.63	90.78	76%
EUWL005	93.58	93.19	92.71	93.16	76%
EUWL007	91.08	90.22	90.88	90.73	76%
EUWL008	92.72	91.73	91.43	91.96	76%
EUWL009	91.27	91.46	91.29	91.34	76%

Table 2. NO_x Emission Results Lb/Hr					
Unit	**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
EUWL001	9.05	9.70	9.50	9.41	45.19
EUWL002	18.44	20.88	18.87	19.40	45.19
EUWL003	15.86	18.17	17.75	17.26	45.19
EUWL004	34.58	35.26	33.67	34.51	45.19
EUWL005	18.01	18.77	20.15	18.98	45.19
EUWL007	13.09	13.55	12.02	12.89	59.66
EUWL008	10.73	11.78	12.07	11.53	59.66
EUWL009	32.11	34.54	33.59	33.42	59.66

Table 3. NO_x Emission Results gr/bhp/hr					
Unit	**Run 1**	**Run 2**	**Run 3**	**Average**	**Limit**
EUWL001	4.23	4.53	4.52	4.42	20.5
EUWL002	9.11	9.69	8.91	9.23	20.5
EUWL003	7.52	8.55	8.46	8.18	20.5
EUWL004	16.06	16.82	16.11	16.33	20.5
EUWL005	9.02	9.12	9.80	9.32	20.5
EUWL007	4.67	4.95	4.29	4.63	20.5
EUWL008	3.87	4.21	4.29	4.12	20.5
EUWL009	11.93	12.76	12.21	12.32	20.5

Based on the information provided above, all eight units met the acceptance criteria during the course of the testing. A complete list of performance parameters for each test run that was performed at the stack sampling locations can be found in Tables 4-19.

Table 4 . Engine Operating and Ambient Conditions -Unit EUWL001

Run	1	2	3	
Date	07/20/21	07/20/21	07/20/21	
Time	9:40	11:08	12:21	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	971.0	972.0	954.0	965.7
Unit Speed (rpm)	331.0	329.0	328.0	329.3
Compressor Suction Pressure (PSIG)	503.0	508.0	518.0	509.7
Compressor Suction Temperature (°F)	66.2	67.1	68.3	67.2
Compressor Discharge Pressure (PSIG)	781.0	785.0	787.0	784.3
Compressor Flow (MMSCF/D)	42.2	42.7	43.5	42.8
% Load	97.1	97.2	95.4	96.6
% Torque	96.8	97.5	96.0	96.8
Heat Rate (BTU/HP-hr)	8,323.5	8,305.0	8,411.2	8,346.6
Ambient Conditions				
Ambient Temperature (°F)	72.00	75.00	79.00	75.33
Barometric Pressure (psi)	14.23	14.22	14.22	14.22
Ambient Relative Humidity (%)	76.00	68.00	63.00	69.00
Absolute Humidity (grains/LB)	192.44	190.42	201.90	194.92

Table 5. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL001

Run	1	2	3	
Date	07/20/21	07/20/21	07/20/21	
Time	9:40	11:08	12:21	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	667.92	717.15	703.98	696.35
NO_X g/BHP-HR	4.23	4.53	4.52	4.42
NO_X LB/HR	9.05	9.70	9.50	9.41
NO_X (ppm @ 15% O_2)	274.89	295.05	290.69	286.88
NOx LB/MMBTU	1.01	1.09	1.07	1.06
NO_X Tons/Year	39.62	42.48	41.60	41.23
H_2CO Inlet ppmw	12.41	12.05	12.34	12.27
H_2CO Inlet (ppmw @ 15% 0_2	4.67	4.53	4.65	4.62
H_2CO Outlet ppmw	1.1700	1.41	1.47	1.35
H_2CO Outlet (ppmw @ 15% 0_2	0.47	0.56	0.62	0.55
H_2CO % Removal Limit is 76%	89.98	87.60	86.73	88.10
H_2O ppm (% FTIR)	13.36	14.42	14.31	14.03
% O_2 Inlet (raw measured wet)	5.23	5.20	5.23	5.22
% O_2 Outlet (raw measured wet)	6.16	6.09	6.83	6.36
% O_2 (BIAS Corrected Dry)	6.56	6.56	6.61	6.58
Calculated Flows				
Fuel Flow - (SCFM)	139.67	139.50	138.67	139.28
Fuel Flow - (SCFH)	8,380	8,370	8,320	8,357
Exhaust Flow (LB/HR)	7,981.2	7,956.4	7,932.5	7,957
Exhaust Flow (WSCFM)	2,073.0	2,063.3	2,130.7	2,089
Air Flow (WSCFM)	1,829	1,826	1,822	1,825
Exhaust Flow Method 19 (scfm)	1,887	1,884	1,879	1,883
Exhaust Flow Method 19 (lbm/min)	88	88	88	88
Exhaust Flow Carbon Balance (lbm/min)	152.34	152.11	151.72	152
Air flow Beshouri (scfm)	1,982.08	1,979.09	1,973.89	1,978
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	8.38	8.37	8.32	8.36
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O2) - A/F IS TOTAL MASS RATIO				

Table 6 . Engine Operating and Ambient Conditions -Unit EUWL002

Run	1	2	3	
Date	07/20/21	07/20/21	07/20/21	
Time	14:26	15:44	16:57	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	918.0	978.0	961.0	952.3
Unit Speed (rpm)	329.0	331.0	333.0	331.0
Compressor Suction Pressure (PSIG)	540.0	513.0	522.0	525.0
Compressor Suction Temperature (°F)	70.1	68.7	68.5	69.1
Compressor Discharge Pressure (PSIG)	788.0	788.0	787.0	787.7
Compressor Flow (MMSCF/D)	45.4	43.1	44.3	44.3
% Load	91.8	97.8	96.1	95.2
% Torque	92.1	97.5	95.2	94.9
Heat Rate (BTU/HP-hr)	8,615.0	8,441.5	8,450.3	8,502.2
Ambient Conditions				
Ambient Temperature (°F)	81.00	79.00	77.00	79.00
Barometric Pressure (psi)	14.21	14.21	14.22	14.21
Ambient Relative Humidity (%)	59.00	59.00	62.00	60.00
Absolute Humidity (grains/LB)	201.97	188.68	185.43	192.03

Table 7. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL002

Run	1	2	3	
Date	07/20/21	07/20/21	07/20/21	
Time	14:26	15:44	16:57	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	1460.12	1589.85	1456.72	1502.23
NO_X g/BHP-HR	9.11	9.69	8.91	9.23
NO_X LB/HR	18.44	20.88	18.87	19.40
NO_X (ppm @ 15% O_2)	572.55	621.21	570.60	588.12
NOx LB/MMBTU	2.11	2.29	2.10	2.17
NO_X Tons/Year	80.76	91.47	82.64	84.96
H_2CO Inlet ppmw	11.83	12.00	11.70	11.84
H_2CO Inlet (ppmw @ 15% 0_2	4.20	4.28	4.18	4.22
H_2CO Outlet ppmw	1.48	1.58	1.43	1.50
H_2CO Outlet (ppmw @ 15% 0_2	0.57	0.57	0.54	0.56
H_2CO % Removal Limit is 76%	86.49	86.59	87.10	86.73
H_2O ppm (% FTIR)	15.56	16.28	15.59	15.81
% O_2 Inlet (raw measured wet)	4.30	4.36	4.40	4.35
% O_2 Outlet (raw measured wet)	5.53	4.66	5.27	5.15
% O_2 (BIAS Corrected Dry)	5.85	5.80	5.84	5.83
Calculated Flows				
Fuel Flow - (SCFM)	136.67	142.67	140.33	139.89
Fuel Flow - (SCFH)	8,200	8,560	8,420	8,393
Exhaust Flow (LB/HR)	7,471.1	7,769.2	7,670.7	7,637
Exhaust Flow (WSCFM)	1,957.2	1,962.6	1,985.1	1,968
Air Flow (WSCFM)	1,705	1,774	1,749	1,743
Exhaust Flow Method 19 (scfm)	1,759	1,830	1,804	1,798
Exhaust Flow Method 19 (lbm/min)	82	85	84	84
Exhaust Flow Carbon Balance (lbm/min)	142.57	148.34	146.25	146
Air flow Beshouri (scfm)	1,854.85	1,929.97	1,902.74	1,896
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	8.20	8.56	8.42	8.39
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O2) - A/F IS TOTAL MASS RATIO				

Table 8 . Engine Operating and Ambient Conditions -Unit EUWL003

Run	1	2	3	
Date	07/21/21	07/21/21	07/21/21	
Time	9:02	10:18	11:30	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	957.0	964.0	952.0	957.7
Unit Speed (rpm)	333.0	334.0	329.0	332.0
Compressor Suction Pressure (PSIG)	531.0	527.0	525.0	527.7
Compressor Suction Temperature (°F)	56.1	56.1	56.1	56.1
Compressor Discharge Pressure (PSIG)	793.0	788.0	790.0	790.3
Compressor Flow (MMSCF/D)	46.6	46.4	45.7	46.2
% Load	95.7	96.4	95.2	95.8
% Torque	94.8	95.2	95.5	95.2
Heat Rate (BTU/HP-hr)	8,738.6	8,775.4	8,794.7	8,769.6
Ambient Conditions				
Ambient Temperature (°F)	64.00	67.00	68.00	66.33
Barometric Pressure (psi)	14.29	14.30	14.30	14.30
Ambient Relative Humidity (%)	76.00	59.00	56.00	63.67
Absolute Humidity (grains/LB)	144.00	123.42	121.19	129.54

Table 9. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL003

Run	1	2	3	
Date	07/21/21	07/21/21	07/21/21	
Time	9:02	10:18	11:30	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	1151.74	1306.51	1290.00	1249.42
NO_X g/BHP-HR	7.52	8.55	8.46	8.18
NO_X LB/HR	15.86	18.17	17.75	17.26
NO_X (ppm @ 15% O_2)	465.91	527.55	520.79	504.75
NOx LB/MMBTU	1.72	1.94	1.92	1.86
NO_X Tons/Year	69.49	79.59	77.76	75.61
H_2CO Inlet ppmw	10.02	9.87	9.90	9.93
H_2CO Inlet (ppmw @ 15% 0_2	3.60	3.59	3.61	3.60
H_2CO Outlet ppmw	0.9520	1.00	0.96	0.97
H_2CO Outlet (ppmw @ 15% 0_2	0.38	0.38	0.37	0.38
H_2CO % Removal Limit is 76%	89.58	89.29	89.84	89.57
H_2O ppm (% FTIR)	14.40	14.90	14.25	14.52
% O_2 Inlet (raw measured wet)	4.50	4.66	4.70	4.62
% O_2 Outlet (raw measured wet)	5.94	5.54	5.50	5.66
% O_2 (BIAS Corrected Dry)	6.32	6.29	6.29	6.30
Calculated Flows				
Fuel Flow - (SCFM)	144.33	146.00	144.50	144.94
Fuel Flow - (SCFH)	8,660	8,760	8,670	8,697
Exhaust Flow (LB/HR)	8,159.6	8,215.2	8,125.0	8,167
Exhaust Flow (WSCFM)	2,117.8	2,101.2	2,075.7	2,098
Air Flow (WSCFM)	1,860	1,878	1,859	1,866
Exhaust Flow Method 19 (scfm)	1,919	1,937	1,917	1,925
Exhaust Flow Method 19 (lbm/min)	89	90	89	89
Exhaust Flow Carbon Balance (lbm/min)	155.13	156.66	155.02	156
Air flow Beshouri (scfm)	2,018.32	2,038.18	2,016.90	2,024
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	8.66	8.76	8.67	8.70
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O2) - A/F IS TOTAL MASS RATIO				

Table 10 . Engine Operating and Ambient Conditions -Unit EUWL004

Run	1	2	3	
Date	07/21/21	07/21/21	07/21/21	
Time	14:20	15:33	16:56	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	977.0	951.0	948.0	958.7
Unit Speed (rpm)	330.0	330.0	328.0	329.3
Compressor Suction Pressure (PSIG)	518.0	532.0	536.0	528.7
Compressor Suction Temperature (°F)	58.2	59.3	59.5	59.0
Compressor Discharge Pressure (PSIG)	791.0	794.0	797.0	794.0
Compressor Flow (MMSCF/D)	44.8	46.0	46.2	45.7
% Load	97.7	95.1	94.8	95.9
% Torque	97.7	95.1	95.4	96.1
Heat Rate (BTU/HP-hr)	9,192.3	9,321.8	9,330.9	9,281.7
Ambient Conditions				
Ambient Temperature (°F)	72.00	73.00	73.00	72.67
Barometric Pressure (psi)	14.29	14.29	14.29	14.29
Ambient Relative Humidity (%)	42.00	41.00	40.00	41.00
Absolute Humidity (grains/LB)	103.80	104.86	102.27	103.65

Table 11. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL004

Run	1	2	3	
Date	07/21/21	07/21/21	07/21/21	
Time	14:20	15:33	16:56	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	2722.07	2818.50	2692.03	2744.20
NO_X g/BHP-HR	16.06	16.82	16.11	16.33
NO_X LB/HR	34.58	35.26	33.67	34.51
NO_X (ppm @ 15% O_2)	945.70	976.86	934.95	952.51
NOx LB/MMBTU	3.48	3.60	3.44	3.51
NO_X Tons/Year	151.47	154.44	147.49	151.13
H_2CO Inlet ppmw	10.62	10.08	10.41	10.37
H_2CO Inlet (ppmw @ 15% 0_2	3.29	3.10	3.23	3.21
H_2CO Outlet ppmw	0.85	0.89	0.89	0.88
H_2CO Outlet (ppmw @ 15% 0_2	0.29	0.29	0.30	0.30
H_2CO % Removal Limit is 76%	91.08	90.63	90.63	90.78
H_2O ppm (% FTIR)	16.41	17.17	16.41	16.66
% O_2 Inlet (raw measured wet)	1.86	1.75	1.87	1.83
% O_2 Outlet (raw measured wet)	3.77	2.76	3.63	3.39
% O_2 (BIAS Corrected Dry)	3.92	3.88	3.91	3.90
Calculated Flows				
Fuel Flow - (SCFM)	155.00	153.00	152.67	153.56
Fuel Flow - (SCFH)	9,300	9,180	9,160	9,213
Exhaust Flow (LB/HR)	7,665.5	7,542.4	7,544.6	7,584
Exhaust Flow (WSCFM)	2,027.6	1,920.9	1,985.4	1,978
Air Flow (WSCFM)	1,717	1,691	1,691	1,700
Exhaust Flow Method 19 (scfm)	1,770	1,743	1,743	1,752
Exhaust Flow Method 19 (lbm/min)	82	81	81	81
Exhaust Flow Carbon Balance (lbm/min)	144.88	142.70	142.65	143
Air flow Beshouri (scfm)	1,884.95	1,856.57	1,856.01	1,866
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	9.30	9.18	9.16	9.21
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + 02) - A/F IS TOTAL MASS RATIO				

Table 12 . Engine Operating and Ambient Conditions Flows -Unit EUWL005

Run	1	2	3	
Date	07/22/21	07/22/21	07/22/21	
Time	10:42	11:55	13:07	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	905.0	933.0	933.0	923.7
Unit Speed (rpm)	318.0	323.0	323.0	321.3
Compressor Suction Pressure (PSIG)	498.0	471.0	471.0	480.0
Compressor Suction Temperature (°F)	57.9	58.6	58.6	58.4
Compressor Discharge Pressure (PSIG)	767.0	749.0	749.0	755.0
Compressor Flow (MMSCF/D)	40.9	39.3	39.3	39.8
% Load	90.5	93.3	93.3	92.4
% Torque	93.9	95.3	95.3	94.9
Heat Rate (BTU/HP-hr)	8,677.4	8,623.3	8,623.3	8,641.3
Ambient Conditions				
Ambient Temperature (°F)	68.00	73.00	73.00	71.33
Barometric Pressure (psi)	14.32	14.31	14.31	14.32
Ambient Relative Humidity (%)	57.00	51.00	51.00	53.00
Absolute Humidity (grains/LB)	123.22	130.99	130.99	128.40

Table 13. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL005

Run	1	2	3	
Date	07/22/21	07/22/21	07/22/21	
Time	10:42	11:55	13:07	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	1412.28	1435.51	1547.05	1464.95
NO_X g/BHP-HR	9.02	9.12	9.80	9.32
NO_X LB/HR	18.01	18.77	20.15	18.98
NO_X (ppm @ 15% O_2)	563.03	572.80	615.16	583.66
NOx LB/MMBTU	2.07	2.11	2.27	2.15
NO_X Tons/Year	78.86	82.20	88.28	83.11
H_2CO Inlet ppmw	11.20	11.11	11.10	11.14
H_2CO Inlet (ppmw @ 15% 0_2	4.05	4.02	4.02	4.03
H_2CO Outlet ppmw	0.67	0.69	0.78	0.71
H_2CO Outlet (ppmw @ 15% 0_2	0.26	0.27	0.29	0.28
H_2CO % Removal Limit is 76%	93.58	93.19	92.71	93.16
H_2O ppm (% FTIR)	14.56	14.38	15.23	14.72
% O_2 Inlet (raw measured wet)	4.60	4.60	4.60	4.60
% O_2 Outlet (raw measured wet)	5.75	5.95	5.15	5.62
% O_2 (BIAS Corrected Dry)	6.10	6.11	6.06	6.09
Calculated Flows				
Fuel Flow - (SCFM)	136.00	139.33	139.33	138.22
Fuel Flow - (SCFH)	8,160	8,360	8,360	8,293
Exhaust Flow (LB/HR)	7,548.7	7,730.7	7,697.0	7,659
Exhaust Flow (WSCFM)	1,967.7	2,035.8	1,959.1	1,988
Air Flow (WSCFM)	1,722	1,765	1,759	1,749
Exhaust Flow Method 19 (scfm)	1,776	1,821	1,815	1,804
Exhaust Flow Method 19 (lbm/min)	82	84	84	84
Exhaust Flow Carbon Balance (lbm/min)	143.76	147.41	146.94	146
Air flow Beshouri (scfm)	1,870.47	1,917.86	1,911.72	1,900
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	8.16	8.36	8.36	8.29
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O2)				
- A/F IS TOTAL MASS RATIO				

Table 14 . Engine Operating and Ambient Conditions -Unit EUWL007

Run	1	2	3	
Date	07/22/21	07/22/21	07/22/21	
Time	15:00	16:24	17:37	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	1,272.0	1,243.0	1,271.0	1,262.0
Unit Speed (rpm)	332.0	331.0	327.0	330.0
Compressor Suction Pressure (PSIG)	480.0	477.0	468.0	475.0
Compressor Suction Temperature (°F)	55.5	54.3	54.3	54.7
Compressor Discharge Pressure (PSIG)	738.0	736.0	733.0	735.7
Compressor Flow (MMSCF/D)	57.0	56.2	55.4	56.2
% Load	96.4	94.2	96.3	95.6
% Torque	95.8	93.9	97.2	95.6
Heat Rate (BTU/HP-hr)	8,761.3	8,911.5	8,881.8	8,851.6
Ambient Conditions				
Ambient Temperature (°F)	76.00	75.00	77.00	76.00
Barometric Pressure (psi)	14.30	14.30	14.30	14.30
Ambient Relative Humidity (%)	51.00	52.00	49.00	50.67
Absolute Humidity (grains/LB)	145.36	143.31	144.35	144.34

Table 15. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL007

Run	1	2	3	
Date	07/22/21	07/22/21	07/22/21	
Time	15:00	16:24	17:37	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	717.80	749.80	649.99	705.86
NO_X g/BHP-HR	4.67	4.95	4.29	4.63
NO_X LB/HR	13.09	13.55	12.02	12.89
NO_X (ppm @ 15% O_2)	288.55	300.46	261.39	283.47
NOx LB/MMBTU	1.06	1.11	0.96	1.04
NO_X Tons/Year	57.35	59.36	52.63	56.45
H_2CO Inlet ppmw	7.51	7.34	7.25	7.37
H_2CO Inlet (ppmw @ 15% 0_2	2.69	2.63	2.61	2.65
H_2CO Outlet ppmw	0.61	0.69	0.60	0.63
H_2CO Outlet (ppmw @ 15% 0_2	0.24	0.26	0.24	0.25
H_2CO % Removal Limit is 76%	91.08	90.22	90.88	90.73
H_2O ppm (% FTIR)	14.72	15.43	14.70	14.95
% O_2 Inlet (raw measured wet)	4.42	4.44	4.53	4.46
% O_2 Outlet (raw measured wet)	5.86	5.15	5.95	5.65
% O_2 (BIAS Corrected Dry)	6.22	6.18	6.23	6.21
Calculated Flows				
Fuel Flow - (SCFM)	193.00	191.83	195.50	193.44
Fuel Flow - (SCFH)	11,580	11,510	11,730	11,607
Exhaust Flow (LB/HR)	10,763.3	10,659.2	10,904.3	10,776
Exhaust Flow (WSCFM)	2,809.5	2,699.6	2,858.1	2,789
Air Flow (WSCFM)	2,463	2,441	2,496	2,467
Exhaust Flow Method 19 (scfm)	2,541	2,518	2,575	2,545
Exhaust Flow Method 19 (lbm/min)	118	117	120	118
Exhaust Flow Carbon Balance (lbm/min)	205.58	203.75	208.32	206
Air flow Beshouri (scfm)	2,674.79	2,650.88	2,710.41	2,679
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	11.58	11.51	11.73	11.61
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O2) - A/F IS TOTAL MASS RATIO				

Table 16 . Engine Operating and Ambient Conditions -Unit EUWL008

Run	1	2	3	
Date	07/23/21	07/23/21	07/23/21	
Time	8:27	9:40	10:53	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	1,259.0	1,268.0	1,276.0	1,267.7
Unit Speed (rpm)	328.0	332.0	328.0	329.3
Compressor Suction Pressure (PSIG)	530.0	531.0	532.0	531.0
Compressor Suction Temperature (°F)	54.1	54.3	54.6	54.3
Compressor Discharge Pressure (PSIG)	785.0	786.0	790.0	787.0
Compressor Flow (MMSCF/D)	63.2	63.9	63.9	63.7
% Load	95.4	96.1	96.7	96.0
% Torque	96.0	95.5	97.3	96.2
Heat Rate (BTU/HP-hr)	8,852.2	8,819.7	8,749.4	8,807.1
Ambient Conditions				
Ambient Temperature (°F)	65.00	65.00	67.00	65.67
Barometric Pressure (psi)	14.28	14.28	14.29	14.28
Ambient Relative Humidity (%)	98.00	98.00	98.00	98.00
Absolute Humidity (grains/LB)	194.56	194.55	209.14	199.42

Table 17. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL008

Run	1	2	3	
Date	07/23/21	07/23/21	07/23/21	
Time	8:27	9:40	10:53	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	590.95	647.90	663.20	634.02
NO_X g/BHP-HR	3.87	4.21	4.29	4.12
NO_X LB/HR	10.73	11.78	12.07	11.53
NO_X (ppm @ 15% O_2)	236.50	258.60	265.53	253.54
NOx LB/MMBTU	0.87	0.95	0.98	0.93
NO_X Tons/Year	47.00	51.57	52.87	50.48
H_2CO Inlet ppmw	14.20	11.27	10.84	12.10
H_2CO Inlet (ppmw @ 15% 0_2	5.24	4.19	4.03	4.49
H_2CO Outlet ppmw	0.98	0.92	0.88	0.93
H_2CO Outlet (ppmw @ 15% 0_2	0.38	0.35	0.34	0.36
H_2CO % Removal Limit is 76%	92.72	91.73	91.43	91.96
H_2O ppm (% FTIR)	15.04	15.84	15.12	15.34
% O_2 Inlet (raw measured wet)	4.92	5.02	5.02	4.99
% O_2 Outlet (raw measured wet)	5.80	5.20	5.91	5.64
% O_2 (BIAS Corrected Dry)	6.16	6.12	6.16	6.15
Calculated Flows				
Fuel Flow - (SCFM)	193.17	193.83	193.50	193.50
Fuel Flow - (SCFH)	11,590	11,630	11,610	11,610
Exhaust Flow (LB/HR)	10,792.9	10,794.8	10,811.3	10,800
Exhaust Flow (WSCFM)	2,800.7	2,730.5	2,820.4	2,784
Air Flow (WSCFM)	2,452	2,454	2,457	2,454
Exhaust Flow Method 19 (scfm)	2,530	2,532	2,535	2,532
Exhaust Flow Method 19 (lbm/min)	117	118	118	118
Exhaust Flow Carbon Balance (lbm/min)	204.72	204.93	205.17	205
Air flow Beshouri (scfm)	2,663.54	2,666.24	2,669.31	2,666
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	11.59	11.63	11.61	11.61
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + O2) - A/F IS TOTAL MASS RATIO				

Table 18 . Engine Operating and Ambient Conditions -Unit EUWL009

Run	1	2	3	
Date	07/23/21	07/23/21	07/23/21	
Time	13:23	14:35	15:48	
Engine Operating Conditions	HS-HT	HS-HT	HS-HT	Averages
Unit Horsepower from Control Panel	1,221.0	1,228.0	1,248.0	1,232.3
Unit Speed (rpm)	321.0	314.0	323.0	319.3
Compressor Suction Pressure (PSIG)	443.0	436.0	436.0	438.3
Compressor Suction Temperature (°F)	57.3	57.9	59.5	58.2
Compressor Discharge Pressure (PSIG)	714.0	714.0	718.0	715.3
Compressor Flow (MMSCF/D)	50.1	48.7	49.0	49.3
% Load	92.5	93.0	94.5	93.4
% Torque	95.1	97.8	96.6	96.5
Heat Rate (BTU/HP-hr)	8,348.1	8,394.4	8,360.1	8,367.5
Ambient Conditions				
Ambient Temperature (°F)	68.00	72.00	75.00	71.67
Barometric Pressure (psi)	14.29	14.27	14.26	14.27
Ambient Relative Humidity (%)	90.00	84.00	79.00	84.33
Absolute Humidity (grains/LB)	198.33	213.03	222.16	211.17

Table 19. Emissions Concentrations, Calculated Mass Emissions, Concentrations & Flows -Unit EUWL009

Run	1	2	3	
Date	07/23/21	07/23/21	07/23/21	
Time	13:23	14:35	15:48	
Emissions Concentrations & Calculated Mass Emissions				
NO_x ppm (BIAS Corrected)	2065.14	2202.81	2110.80	2126.25
NO_X g/BHP-HR	11.93	12.76	12.21	12.30
NO_X LB/HR	32.11	34.54	33.59	33.42
NO_X (ppm @ 15% O_2)	773.73	823.06	790.83	795.88
NOx LB/MMBTU	2.85	3.03	2.91	2.93
NO_X Tons/Year	140.64	151.31	147.14	146.37
H_2CO Inlet ppmw	41.64	41.45	40.12	41.07
H_2CO Inlet (ppmw @ 15% 0_2	13.89	13.89	13.34	13.71
H_2CO Outlet ppmw	3.29	3.38	3.15	3.27
H_2CO Outlet (ppmw @ 15% 0_2	1.21	1.19	1.16	1.19
H_2CO % Removal Limit is 76%	91.27	91.46	91.29	91.34
H_2O ppm (% FTIR)	16.18	16.89	16.23	16.43
% O_2 Inlet (raw measured wet)	3.22	3.30	3.15	3.22
% O_2 Outlet (raw measured wet)	4.90	4.10	4.90	4.63
% O_2 (BIAS Corrected Dry)	5.15	5.11	5.15	5.14
Calculated Flows				
Fuel Flow - (SCFM)	176.67	178.67	180.83	178.72
Fuel Flow - (SCFH)	10,600	10,720	10,850	10,723
Exhaust Flow (LB/HR)	9,322.1	9,381.3	9,515.4	9,406
Exhaust Flow (WSCFM)	2,438.3	2,379.3	2,495.8	2,438
Air Flow (WSCFM)	2,100	2,118	2,150	2,123
Exhaust Flow Method 19 (scfm)	2,166	2,185	2,217	2,189
Exhaust Flow Method 19 (lbm/min)	101	102	103	102
Exhaust Flow Carbon Balance (lbm/min)	176.22	177.77	180.38	178
Air flow Beshouri (scfm)	2,292.70	2,312.86	2,346.77	2,317
Fuel Flow Measurements				
Fuel Flow From Screen(MSCFH)	10.60	10.72	10.85	10.72
** BASED ON FUEL SPECIFIC DRY F-FACTOR CALCULATION	Run 1	Run 2	Run 3	
* BASED ON CARBON BALANCE (STOICH. + 02)				
- A/F IS TOTAL MASS RATIO				

3. FACILITY AND PROCESS DESCRIPTION

TC Energy's ANR Woolfolk Compressor Station is located in Big Rapids, MI. The facility operates five Ingersoll-Rand Compressor Engine labeled EUWL001, EUWL002, EUWL003 EUWL004, and EUWL005. The engines are a four stroke, rich burn, natural gas fired reciprocating compressor engine, Model KVG-103, 1000 horsepower, and used to compress natural gas for transport via natural gas pipeline. The units is subject to the RICE MACT and Rule 818 and are subject to 40 CFR Part 63, Subpart ZZZZ requirements.

Units EUWL007-EUWL009 are Ingersoll-Rand Compressor Engine Model KVG-123, 1320hp; used to compress natural gas for transport via natural gas pipeline. The units are a four stroke, rich burn, natural gas fired reciprocating compressor engines. The units is subject to the RICE MACT and Rule 818 and are subject to 40 CFR Part 63, Subpart ZZZZ requirements.

Process data is specified in Table 3. General engine information is located in Table 4.

Table 20. Process Data (Horsepower)

Unit	Run 1	Run 2	Run 3	Average	Rated
EUWL001	971.0	972.0	954.0	965.7	1,000
EUWL002	918.0	978.0	961.0	952.3	1,000
EUWL003	957.0	964.0	952.0	957.7	1,000
EUWL004	977.0	951.0	948.0	958.7	1,000
EUWL005	905.0	933.0	933.0	923.7	1,000
EUWL007	1,272.0	1,243.0	1,271.0	1,262.0	1,320
EUWL008	1,259.0	1,268.0	1,276.0	1,267.7	1,320
EUWL009	1,221.0	1,228.0	1,248.0	1,232.3	1,320

Table 21. Unit EUWL001 General Information

General Information

Date:	20-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	1
Engine Type:	IR KVG 103
Rated RPM:	330 RPM
Rated BHP:	1000 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	45.19	
CO:				
VOC:				
H2CO:	>76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.654
Carbon Dioxide	0.312
Methane	91.027
Ethane	7.680
Propane	0.288
I-Butane	0.016
N-Butane	0.019
I-Pentane	0.001
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

Table 22. Unit EUWL002 General Information

General Information

Date:	20-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	2
Engine Type:	IR KVG 103
Rated RPM:	330 RPM
Rated BHP:	1000 BHP

Permit Limits

	ppm@ 15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	45.19	
CO:				
VOC:				
H2CO:	>76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.654
Carbon Dioxide	0.312
Methane	91.027
Ethane	7.680
Propane	0.288
I-Butane	0.016
N-Butane	0.019
I-Pentane	0.001
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

Table 23. Unit EUWL003 General Information

General Information

Date:	21-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	3
Engine Type:	IR KVG 103
Rated RPM:	330 RPM
Rated BHP:	1000 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	45.19	
CO:				
VOC:				
H2CO:	>76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.638
Carbon Dioxide	0.298
Methane	90.880
Ethane	7.887
Propane	0.272
I-Butane	0.012
N-Butane	0.011
I-Pentane	0.000
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

Table 24. Unit EUWL004 General Information

General Information

Date:	21-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	4
Engine Type:	IR KVG 103
Rated RPM:	330 RPM
Rated BHP:	1000 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	45.19	
CO:				
VOC:				
H2CO:	>76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.638
Carbon Dioxide	0.298
Methane	90.880
Ethane	7.887
Propane	0.272
I-Butane	0.012
N-Butane	0.011
I-Pentane	0.000
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

Table 25. Unit EUWL005 General Information

General Information

Date:	22-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	5
Engine Type:	IR KVG 103
Rated RPM:	330 RPM
Rated BHP:	1000 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	45.19	
CO:				
VOC:				
H2CO:	->76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.689
Carbon Dioxide	0.338
Methane	91.108
Ethane	7.590
Propane	0.254
I-Butane	0.009
N-Butane	0.010
I-Pentane	0.000
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

Table 26. Unit EUWL007 General Information

General Information

Date:	22-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	7
Engine Type:	IR KVG 123
Rated RPM:	330 RPM
Rated BHP:	1320 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	59.86	
CO:				
VOC:				
H2CO:	>76 OE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.689
Carbon Dioxide	0.338
Methane	91.108
Ethane	7.590
Propane	0.254
I-Butane	0.009
N-Butane	0.010
I-Pentane	0.000
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below: 2

Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5

Pipe I.D.: 3.068

Orifice I.D.: 1.5

Table 27. Unit EUWL008 General Information

General Information

Date:	23-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	8
Engine Type:	IR KVG 123
Rated RPM:	330 RPM
Rated BHP:	1320 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	59.66	
CO:				
VOC:				
H2CO:	>76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.575
Carbon Dioxide	0.296
Methane	91.557
Ethane	7.319
Propane	0.228
I-Butane	0.011
N-Butane	0.012
I-Pentane	0.001
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

Table 28. Unit EUWL009 General Information

General Information

Date:	23-Jul-21
Company:	TC Energy
Station:	Woolfolk
Unit:	9
Engine Type:	IR KVG 123
Rated RPM:	330 RPM
Rated BHP:	1320 BHP

Permit Limits

	ppm@15%	g/Bhp-Hr	lb/hr	TPY
NOx:		20.5	59.66	
CO:				
VOC:				
H2CO:	>76 DE			

Limits are actuallly listed as average values

Fuel Gas Analysis

Constituent	Mole Percent
Nitrogen	0.575
Carbon Dioxide	0.296
Methane	91.557
Ethane	7.319
Propane	0.228
I-Butane	0.011
N-Butane	0.012
I-Pentane	0.001
N-Pentane	0.000
Hexane +	0.002
Total	100.000

Fuel Meter Type

Enter Type from List Below	2
Orifice Meter (upstream pressure tap):	1
Orifice Meter (downstream pressure tap):	2
Electronic Flow Meter (EFM):	3
Venturi (Nozzle) Meter:	4
Roots Meter w/ Accumulator:	5
Pipe I.D.:	3.068
Orifice I.D.:	1.5

4. TEST PROCEDURES

EQM and EQM's affiliates and subcontractors use current U.S. EPA accepted testing methodologies in their Air Quality Programs as listed in the U.S. Code of Federal Regulations, Title 40, Part 60, Appendix A. For this testing program, the following specific methodologies were utilized:

- U.S. EPA Method 3A – Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)
- U.S. EPA Method 7E– Determination of Nitrogen Oxides Emissions From Stationary Sources (Instrumental Analyzer Procedure)
- U.S. EPA Method 19– Determination of Volumetric Flow Rate From Stationary Sources
- U.S. EPA Method 320– Determination of Formaldehyde From Stationary Sources (Extractive Fourier Transform infareed (FTIR) Spectrometry)

USEPA Methods 3A, 7E, and 19 were performed at the Exhaust Stack sampling location by continuously extracting a gas sample from the stack through a single point stainless steel sample probe. The extracted sample was pulled through a series of filters to remove any particulate matter. Directly after the probe, the sample was conditioned by a series of refrigeration dryers to remove moisture from the gas stream. After the refrigeration dryers, the sample was transported through a Teflon® line to the analyzers. The flow of the stack gas sample was regulated at a constant rate to minimize drift.

At the start of the day, each monitor was checked for calibration error by introducing zero, mid-range and high-range EPA Protocol 1 gases to the measurement system at a point upstream of the analyzers. In this report, the calibration error test is referred to as instrument calibration. The gas was injected into the sampling valve located at the outlet of the sampling probe. The bias test was conducted before and after each consecutive test run by introducing zero and upscale calibration gases for each monitor. The upscale calibration gases used for each monitor were the high calibration gases.

Measurement System Performance Specifications were as follows:

- Analyzer Calibration Error - Less than +/- 2% of the span of the zero, mid-range and high-range calibration gases.
- Sampling System Bias - Less than +/-5% of the span for the zero, mid-range and high-range calibration gases.
- Zero Drift - Less than +/-3% of the span over the period of each test run.
- Calibration Drift - Less than +/-3% of the span over the period of each set of runs.

USEPA Method 320 was performed at the Exhaust Stack sampling locations by using MKS MultiGas 2030 FTIR spectrometers. The FTIRs were equipped with temperature-controlled, 5.11 meter multipass gas cells maintained at 191 °C. Gas flows and sampling system pressures were monitored using rotameters and pressure transducers. All data were collected at 0.5 cm-1 resolution. Each spectrum was derived from the coaddition of 64 scans, with a new data point generated approximately every one minute. Additional information may be found in Appendix A.

Calculations that were used in this testing event for the Unit 11 and Unit 12 are as follows:

Calibration Correction

$$C_{GAS} = (C_R - C_O)\frac{C_{MA}}{C_M - C_O}$$

Where:

C_{GAS}:	Corrected flue gas concentration (ppmvd)
C_R:	Flue gas concentration (ppmvd)
C_O:	Average of initial and final zero checks (ppmvd)
C_M:	Average of initial and final span checks (ppmvd)
C_{MA}:	Actual concentration of span gas (ppmvd)

EPA F-Factor

$$F_d = \frac{\left[(3.64 \cdot H_{Wt\%} \cdot 100) + (1.53 \cdot C_{Wt\%} \cdot 100)\right]}{\frac{GCV}{\rho_{FuelGas}}} \cdot 10^6 + \frac{\left[(0.14 \cdot N_{2Wt\%} \cdot 100) - (0.46 \cdot O_{2Wt\%} \cdot 100)\right]}{\frac{GCV}{\rho_{FuelGas}}} \cdot 10^6$$

Where:

F_d:	Fuel specific F-factor, dscf/MMBtu
$H_{Wt\%}$:	Hydrogen weight percent
$C_{Wt\%}$:	Carbon weight percent
$N_{2Wt\%}$:	Nitrogen weight percent
$O_{2Wt\%}$:	Oxygen weight percent
GCV:	Heating value of the fuel, BTU/dscf

$\rho_{Fuel\ Gas}$: Density of the fuel gas, lb/scf

Formaldehyde Removal Efficiency, RE (%)

$$RE = \left(\frac{\text{Inlet Formaldehyde} - \text{Outlet Formaldehyde}}{\text{Inlet Formaldehyde}}\right) \times 100$$

Where:
Inlet Formaldehyde = Inlet formaldehyde concentration at 15% O2

Outlet Formaldehyde = Inlet formaldehyde concentration at 15% O2

Inlet Analyzer Drift Correction

$$Cgas = (CAve - CO)\left(\frac{Cma}{Cm - Co}\right)$$

Where:

C_{GAS}: Average effluent gas concentration adjusted for bias
C_{Ave}: Average unadjusted gas concentration indicated by data recorder for the test run
C_O: Average of initial and final zero checks
C_M: Actual concentration of the upscale calibration gas
C_{MA}: Average of initial and final system calibration bias check responses for the upscale calibration gas

Outlet Analyzer Drift Correction

$$Cgas = (CAve - CO)\left(\frac{Cma}{Cm - Co}\right)$$

Where:

C_{GAS}: Average effluent gas concentration adjusted for bias
C_{Ave}: Average unadjusted gas concentration indicated by data recorder for the test run
C_O: Average of initial and final zero checks (ppmvd)
C_M: Actual concentration of the upscale calibration gas
C_{MA}: Average of initial and final system calibration bian check responses for the upscale calibration gas

Inlet Concentration, C_1 (corrected to 15%O_2)

$$Conc.i_{(Std.O_2)} = Conc.i_{(Measured O_2)}\left(\frac{20.9\% - Std.O_2\%}{20.9\% - Measured\ O_2\%}\right)$$

Where:

$Conc.i_{(Std.O2)}$=Concentration at standard O_2 level
$Conc.i_{(MeasuredO2)}$=Concentration measured at O_2 level
Std.O_2%=Oxygen concentration at standard level
Measured O_2%=Oxygen concentration at measured level

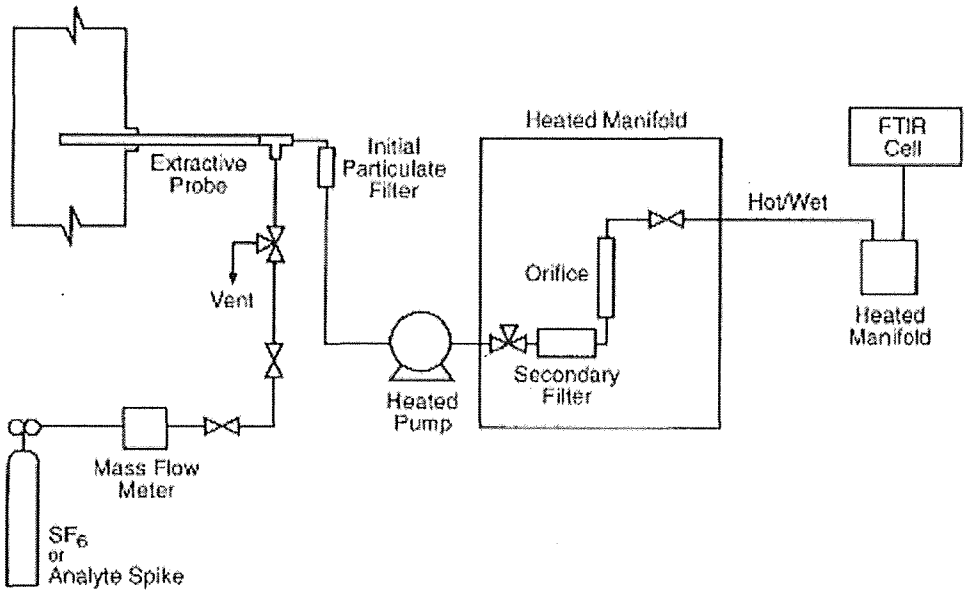

Figure 1. USEPA Method 320 Sampling Train

5. QUALITY ASSURANCE PROCEDURES

Each reference method presented in the U.S. Code of Federal Regulations details the instrument calibration requirements, sample recovery and analysis, data reduction and verification, types of equipment required, and the appropriate sampling and analytical procedures to ensure maximum performance and accuracy. EQM and EQM's affiliates and subcontractors adhere to the guidelines for quality control set forth by the United States Environmental Protection Agency. These procedures are outlined in the following documents:

- Code of Federal Regulations, Title 40, Part 51
- Code of Federal Regulations, Title 40, Part 60
- Quality Assurance Handbook, Volume 1, EPA 600/9-76-005
- Quality Assurance Handbook, Volume 2, EPA 600/4-77-027a
- Quality Assurance Handbook, Volume 3, EPA 600/4-77-027b

6. CONCLUSIONS

An Emissions Test was conducted on the internal combustion compressor engines labeled Unit EUWL001, Unit EUWL002, Unit EUWL003, Unit EUWL004, Unit EUWL005, Unit EUWL007, Unit EUWL008, and Unit EUWL009 at TC Energy's ANR Pipeline Company's Woolfolk Compressor Station located in Big Rapids, Michigan. The testing was conducted on July 20-23, 2021.

During the course of the testing, the eight engines conformed to the requirements of flexible groups FG-RICE-818-WLENGINES and RICE MACT in the permit and are subject to 40 CFR Part 63, Subpart ZZZZ requirement..

The usefulness and/or significance of the emissions values presented in this document as they relate to the compliance status of the emissions shall be determined by others.

For additional information pertaining to the testing program see Appendix D of this report

A. FIELD DATA