



PANHANDLE EASTERN PIPE LINE
An ENERGY TRANSFER Company

February 28, 2022
Ms. Kendal Stegmann
Air Quality Division
Oklahoma Department of Environmental Quality
P.O. Box 1677
Oklahoma City, OK 73101-1677

Submitted by E-mail

SUBJECT: Response to 4-Factor Analysis on Control Scenarios Request
Clean Air Act Regional Haze Program
Cashion Compressor Station
Permit No. 2013-1330-TV3 (M-1)
Panhandle Eastern Pipeline Company

Dear Ms. Stegmann:

Panhandle Eastern Pipeline Co. (PEPL) is submitting this response to the four-factor analysis additional clarification request from the Oklahoma Department of Environmental Quality (ODEQ) received on January 31, 2022 for the Cashion Compressor Station (Facility). This response is being provided per the deadline of February 28, 2022 as specified in the request.

ODEQ Information Request

The company should provide additional discussion of how the engine testing was conducted to determine the actual NO_x emissions from the four engines and, if available, provide the testing report or other documentation of the engine testing.

The Cooper engines U-2301 and U-2302 at Cashion Compressor Station are currently authorized in the ODEQ issued Permit No. 2013-1330-TV3 (M-3) at 4,500 Hp; however, these engines are limited to 3,940 Hp by FERC certificate. The historical emission inventories utilized the permitted horsepower rating and permit factors rather than the FERC limited horsepower and engine test data. The FERC horsepower limitation was not identified in our previously submitted 4-factor analysis. The Fairbanks Morse engines are limited in the permit to 9,100 hours combined annually.

The historical emissions inventories utilized a permitted NO_x emission factor for the Coopers of 9.0 g/hp-hr. In the initial response PEPL provided a summary of portable engine analyzer (PEA) tests performed on May 3, 2016, March 15, 2017, February 16, 2018, January 22 and 23, as required by the ODEQ issued permit compliance demonstration, to determine emissions from the engines. The PEA test results for the 2016, 2017, 2018 and 2019 were summarized and included in the initial submittal. Since that time PEPL has conducted additional inhouse PEA tests and on February 10, 2022 PEPL had a third-party vendor conduct a PEA test on the units to confirm and verify the lower emissions using the FERC limited horsepower rating. Table 1 shows a comparison of the most recent test results.

Table 1 – Comparison of PEA Tests

Unit	1/10,15/2020 in-house Test Result (lb/hr)	1/10,15/2020 in-house Test Result (g/hp-hr)	2/10/2022 Test 3rd party Result (lb/hr)	2/10/2022 Test 3rd party Result (g/hp-hr)
U-2301	37.423	4.31	31.55	3.95
U-2302	44.125	5.08	33.392	4.03

These results substantiate our analysis that Cashion CS has negligible contribution to visibility impairment at the Wichita Mountains Wilderness Area and that by utilizing our actual emission results, the site did not and does not trigger the Four Factor Analysis applicability criteria for this area. PEPL believes that had the FERC limited horsepower and the emission factor from the PEA test been utilized in the annual emissions inventory calculations, the Cashion Compressor Station would not have been selected for this Four-Factor Analysis based on the Q/d applicability criteria. Attached hereto are the referenced emission test reports.

If you have any questions or comments please do not hesitate to contact me at (214) 840-5693 or by email at David.Hennessy@energytransfer.com.

Sincerely,



David Hennessy
Director – Environmental
Energy Transfer Partners

Attachments



Engine Emissions Test Report

SCAQMD 1110.2

Emissions Test Date: 01/15/2020 Q1

Cashion Station
Panhandle Eastern Pipeline
Jason Hembree
Phone: 580-327-2029
26441 N. 2950 Rd.
Cashion, OK 73016
Mobile: 580-747-2413
Email: jason.hembree@energytransfer.com

CO: lb/hr

10.665

Pass

(22.82 lb/hr)

NOx: lb/hr

37.423

Pass

(89.3 lb/hr)

PHYSICAL LOCATION

Operational Area: Liberal

Facility Name: Cashion Station

EQUIPMENT INFORMATION

Equipment:	2301	Unit #:	2301	AF Controller Make:	
Model:	Cooper Quad 12Q155HC	Serial #:	48764	AF Controller Model:	
Service :	Natural Gas Compression	Ignition Timing:		Catalytic Converter Make:	
Stack Flow:		Fuel Type:	Gas: Natural	Catalytic Converter Model:	
Intake MP:	Left: Right:	Intake MT:	Left: Right:	Fuel Consumption:	26300
Stack Height:		FuelSG:		Horsepower:	3520
Equipment Hours:		Fuel Pressure:		RPM:	
Stepper Position:	Left: Right:	Exhaust Temp:	Left: Right:	MV Target Set Point:	
Catalyst dp:		Pre-Catalyst Temp:		MV Actual:	Left: Right:
				Post-Catalyst Temp:	

PERMIT INFORMATION

Permit #: 2013-1330-TVR3
Permit Equipment #: U2301

Permit Date: 08/06/2015
Permit Units: lb/hr @ 0 % O2

Permit CO Limit: 22.82
Permit NOx Limit: 89.3

ANALYZER INFORMATION

Model:
Last Linearity Test : 00/00/00

Serial #: 7364

Last Stability Test : 00/00/00

EMISSIONS TEST RESULTS

Parameter	Test 1		Cal Adjusted @ 0% O2	Permit Limit @ 0% O2
	Average Measured	Cal Adjusted		
O2%	13.55	13.49		
CO ppm	217.82	216.36	610.24	22.82
NO ppm	420.55	416.78		
NO2 ppm	51.82	50.79		
NOx ppm		467.57	1318.79	89.30

Drift correction applied: 78.144

Test 2				
Parameter	Average Measured	Cal Adjusted	Cal Adjusted @ 0% O2	Permit Limit @ 0% O2
O2%	13.73	13.66		
CO ppm	224.64	223.13	644.28	22.82
NO ppm	405.00	401.30		
NO2 ppm	48.73	47.76		
NOx ppm		449.06	1296.67	89.30

Test 3				
Parameter	Average Measured	Cal Adjusted	Cal Adjusted @ 0% O2	Permit Limit @ 0% O2
O2%	13.58	13.52		
CO ppm	220.82	219.34	620.91	22.82
NO ppm	445.09	441.22		
NO2 ppm	49.82	48.83		
NOx ppm		490.05	1387.28	89.30

Combined Tests	
Parameter	Overall Average
O2%	13.62
CO ppm	221.09
NO ppm	423.55
NO2 ppm	50.12
NOx ppm	473.67

Cell Temperature		
Start	End	Ambient Temp
76.5F	79.0F	81.5F

RampUp 1 - 01/15/20										
Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:06:46	14.30	202.00	3.70	465.00	54.00	519.00	0.00	0.00	69.30	71.60
11:07:46	14.20	207.00	3.80	456.00	54.00	510.00	0.00	0.00	70.20	73.00
11:08:46	14.10	208.00	3.80	451.00	54.00	505.00	0.00	0.00	71.10	73.90

Test 1 - 01/15/20										
Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:08:48	14.10	208.00	3.80	451.00	54.00	505.00	0.00	0.00	71.10	73.90
11:09:48	14.00	208.00	3.90	454.00	54.00	508.00	0.00	0.00	72.00	74.50
11:10:48	14.00	211.00	3.90	444.00	53.00	497.00	0.00	0.00	72.70	75.00
11:11:48	13.80	214.00	4.00	430.00	52.00	482.00	0.00	0.00	73.40	75.90
11:12:48	13.60	218.00	4.10	428.00	52.00	480.00	0.00	0.00	74.10	76.30
11:13:48	13.50	219.00	4.20	418.00	52.00	470.00	0.00	0.00	74.80	77.00
11:14:48	13.40	220.00	4.20	404.00	51.00	455.00	0.00	0.00	75.60	77.40
11:15:48	13.30	223.00	4.30	404.00	51.00	455.00	0.00	0.00	76.10	78.10
11:16:48	13.20	224.00	4.30	392.00	50.00	442.00	0.00	0.00	76.80	78.80
11:17:48	13.10	225.00	4.40	401.00	51.00	452.00	0.00	0.00	77.40	79.30
11:18:48	13.10	226.00	4.40	400.00	50.00	450.00	0.00	0.00	77.90	79.30

Average O2 =	13.55 %	Average NOx =	472.36 ppm	Average CO =	217.82 ppm
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Average NO = 420.55 ppm Average NO2 = 51.82 ppm

Purge 1 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:18:56	13.10	226.00	4.40	393.00	50.00	443.00	0.00	0.00	78.10	79.30
11:19:56	19.60	10.00	0.80	15.00	0.00	15.00	0.00	0.00	78.60	79.90
11:20:56	19.70	6.00	0.70	10.00	0.00	10.00	0.00	0.00	79.00	79.70
11:21:56	20.00	4.00	0.60	8.00	0.00	8.00	0.00	0.00	79.30	79.50

RampUp 2 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:21:59	20.00	4.00	0.60	8.00	0.00	8.00	0.00	0.00	79.30	79.50
11:22:59	13.40	219.00	4.20	415.00	50.00	465.00	0.00	0.00	79.50	79.90
11:23:59	13.40	223.00	4.20	404.00	51.00	455.00	0.00	0.00	79.70	79.90

Test 2 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:24:00	13.40	223.00	4.20	404.00	51.00	455.00	0.00	0.00	79.70	79.90
11:25:00	13.40	221.00	4.20	411.00	50.00	461.00	0.00	0.00	79.90	80.10
11:26:00	13.50	221.00	4.20	406.00	50.00	456.00	0.00	0.00	80.20	80.10
11:27:00	13.50	224.00	4.20	391.00	49.00	440.00	0.00	0.00	80.40	79.90
11:28:00	13.70	226.00	4.10	389.00	48.00	437.00	0.00	0.00	80.40	79.20
11:29:00	13.80	230.00	4.00	387.00	48.00	435.00	0.00	0.00	80.40	79.00
11:30:00	13.90	228.00	4.00	391.00	48.00	439.00	0.00	0.00	80.20	79.20
11:31:00	13.90	223.00	4.00	426.00	48.00	474.00	0.00	0.00	80.20	78.80
11:32:00	14.10	223.00	3.80	421.00	48.00	469.00	0.00	0.00	80.20	78.40
11:33:00	13.90	223.00	4.00	430.00	49.00	479.00	0.00	0.00	80.10	78.80
11:34:00	13.90	229.00	4.00	399.00	47.00	446.00	0.00	0.00	80.10	79.20

Average O2 = 13.73 % Average NOx = 453.73 ppm Average CO = 224.64 ppm
 Average NO = 405.00 ppm Average NO2 = 48.73 ppm

Purge 2 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:34:09	13.90	230.00	4.00	409.00	47.00	456.00	0.00	0.00	80.10	79.20
11:35:09	20.90	10.00	0.00	15.00	0.00	15.00	0.00	0.00	80.10	79.00
11:36:09	21.00	5.00	0.00	11.00	0.00	11.00	0.00	0.00	80.10	78.80
11:37:09	20.80	4.00	0.00	9.00	0.00	9.00	0.00	0.00	80.10	79.00

RampUp 3 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:37:12	20.80	4.00	0.00	9.00	0.00	9.00	0.00	0.00	80.10	79.00
11:38:12	13.70	219.00	4.10	415.00	48.00	463.00	0.00	0.00	80.10	79.30
11:39:12	13.60	223.00	4.10	417.00	49.00	466.00	0.00	0.00	80.20	79.70

Test 3 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:39:14	13.60	223.00	4.10	417.00	49.00	466.00	0.00	0.00	80.20	79.70
11:40:14	13.60	223.00	4.10	429.00	49.00	478.00	0.00	0.00	80.40	79.50
11:41:14	13.70	224.00	4.10	440.00	49.00	489.00	0.00	0.00	80.40	79.70
11:42:14	13.70	224.00	4.10	427.00	49.00	476.00	0.00	0.00	80.40	79.90
11:43:14	13.60	226.00	4.10	424.00	49.00	473.00	0.00	0.00	80.60	80.40
11:44:14	13.60	221.00	4.10	430.00	49.00	479.00	0.00	0.00	80.80	80.40
11:45:14	13.60	221.00	4.10	435.00	50.00	485.00	0.00	0.00	81.00	80.40
11:46:14	13.60	222.00	4.10	466.00	51.00	517.00	0.00	0.00	81.10	80.20
11:47:14	13.50	216.00	4.20	473.00	51.00	524.00	0.00	0.00	81.10	80.60
11:48:14	13.50	215.00	4.20	476.00	51.00	527.00	0.00	0.00	81.30	80.80
11:49:14	13.40	214.00	4.20	479.00	51.00	530.00	0.00	0.00	81.50	81.50

Average O2 =	13.58 %	Average NOx =	494.91 ppm	Average CO =	220.82 ppm
Average NO =	445.09 ppm	Average NO2 =	49.82 ppm		

Purge 3 - 01/15/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:49:22	13.40	214.00	4.20	480.00	51.00	531.00	0.00	0.00	81.50	81.50
11:50:22	20.10	10.00	0.50	19.00	0.00	19.00	0.00	0.00	81.70	81.10
11:51:22	20.10	6.00	0.50	14.00	0.00	14.00	0.00	0.00	81.90	81.10
11:52:22	20.00	4.00	0.60	12.00	0.00	12.00	0.00	0.00	82.00	81.30

ANALYZER AVERAGE INFORMATION

Total Average O2 =	13.62 %	Total Average NOx =	473.67 ppm	Total Average CO =	221.09 ppm
Total Average NO =	423.55 ppm	Total Average NO2 =	50.12 ppm		

NOTES:

TEST COMPLETED BY:

Jeff Simon
 Panhandle Eastern Pipeline
 42589 Grady Rd.
 Alva, OK 73717
 Phone: 580-327-2029
 Mobile:
 Email: jeff.simon@energytransfer.com
 Home Page:

Technician



Date

1-15-2020



Pre & Post Calibration Test Report

Calibration Test Date: 01/15/2020

Cashion Station
Panhandle Eastern Pipeline
Jason Hembree
Phone: 580-327-2029
26441 N. 2950 Rd.
Cashion, OK 73016
Mobile: 580-747-2413
Email: jason.hembree@energytransfer.com

Sensor	Span Gas Value	Expiration date	Zero Error % Limit	Cal Error % Limit	Zero Drift % Limit	Span Drift % Limit
O2 %	20.9	4/8/2014	0.5	0.5	0.5	0.5
CO ppm	296	12/5/2024	5	5	5	5
NO ppm	708	7/27/2026	5	5	5	5
NO2 ppm	396	2/2/2021	25	5	5	50

PHYSICAL LOCATION

Operational Area: Liberal

Facility Name: Cashion Station

EQUIPMENT INFORMATION

Equipment:	338	Unit #:	338	AF Controller Make:	
Model:	Fairbanks Morse 38DS8	Serial #:	38D879004S18RM	AF Controller Model:	
Service :	Natural Gas Compression	Ignition Timing:		Catalytic Converter Make:	
Stack Flow:		Fuel Type:	Gas: Natural	Catalytic Converter Model:	
Intake MP:	Left: Right:	Intake MT:	Left: Right:	Fuel Consumption:	9950
Stack Height:		FuelSG:		Horsepower:	1414
Equipment Hours:		Fuel Pressure:		RPM:	
Stepper Position:	Left: Right:	Exhaust Temp:	Left: Right:	MV Target Set Point:	
Catalyst dp:		Pre-Catalyst Temp:		MV Actual:	Left: Right:
				Post-Catalyst Temp:	

PERMIT INFORMATION

Permit #: 2013-1330-TVR3
Permit Equipment #: U338

Permit Date: 08/06/2015
Permit Units: lb/hr @ 0 % O2

Permit CO Limit: 6.87
Permit NOx Limit: 54.77

ANALYZER INFORMATION

Model:
Last Linearity Test : 00/00/00

Serial #: 7364

Last Stability Test : 00/00/00

Calibration Specs

	O2 %	CO ppm	NO ppm	NO2 ppm
Pre-Test Zero %	0.0	0.0	0.0	0.0
Post-Test Zero %	0.0	0.0	4	0.0
Mean Zero, Ccz	0.0	0.0	2.0	0.0
Zero Result	Pass	Pass	Pass	Pass
Pre-Test Span	21.0	297	714	406
Pre-Test Result	Pass	Pass	Pass	Pass
Post Test Span	21.0	299	712	402
Post Test Drift %	0.5	1.0	0.6	1.5
Post Test Results	Pass	Pass	Pass	Pass
Span Drift (%)	0.0	0.7	0.3	1.0
Mean Span, Ccm	21.0	298.0	713.0	404.0

Pre Test Calibration					
Time	O2	CO	NO	NO2	IFlow
10:19:16	0.0	0.0	0.0	0.0	0.00
10:20:15	0.0	★ ¹ 0.0	0.0	0.0	2.60
10:20:16	0.0	0.0	0.0	0.0	2.60
10:20:21	0.0	0.0	★ ¹ 0.0	0.0	2.60
10:20:26	0.0	0.0	0.0	★ ¹ 0.0	2.60
10:20:27	0.0	0.0	0.0	0.0	★ ¹ 2.60
10:20:48	21.0	★ ² 0.0	0.0	0.0	2.46
10:21:16	21.0	0.0	0.0	0.0	2.45
10:22:16	0.2	197	0.0	0.0	2.33
10:23:16	0.0	289	0.0	0.0	2.34
10:24:16	0.0	292	0.0	0.0	2.34
10:25:16	0.0	293	0.0	0.0	2.33
10:26:16	0.0	293	0.0	0.0	2.34
10:27:16	0.0	293	0.0	0.0	2.34
10:28:16	0.0	296	0.0	0.0	2.35
10:29:16	0.0	296	0.0	0.0	2.36
10:30:16	0.0	296	0.0	0.0	2.37
10:31:16	0.0	296	0.0	0.0	2.37
10:32:16	0.0	296	0.0	0.0	2.37
10:33:16	0.0	297	0.0	0.0	2.37
10:34:16	0.0	297	0.0	0.0	2.38
10:34:21	0.0	297	★ ² 0.0	0.0	2.39
10:35:16	20.8	25	0.0	0.0	2.49
10:36:16	8.2	6	205	111	2.35
10:37:16	0.0	5	692	34	2.36
10:38:16	0.0	3	705	21	2.35
10:39:16	0.0	3	711	17	2.37
10:40:16	0.0	3	710	15	2.37
10:41:16	0.0	2	713	14	2.37
10:41:58	0.0	2	714	★ ² 14	2.35
10:42:16	14.5	1	123	13	2.48
10:43:16	20.9	0.0	13	4	2.48
10:44:16	20.9	1	8	2	2.48

Pre Test Calibration					
10:45:16	20.9	1	5	1	2.50
10:46:16	0.0	2	76	125	2.37
10:47:16	0.0	2	74	176	2.38
10:48:16	0.0	1	67	220	2.35
10:49:16	0.0	2	61	258	2.35
10:50:16	0.0	1	56	289	2.31
10:51:16	0.0	1	52	315	2.33
10:52:16	0.0	1	49	339	2.35
10:53:16	0.0	1	46	358	2.36
10:54:16	0.0	1	43	374	2.31
10:55:16	0.0	1	42	387	2.29
10:56:21	0.0	1	40	400	2.31
10:56:49	0.0	1	39	406	★ ² 2.35

Post Test Drift Check					
Time	O2	CO	NO	NO2	IFlow
13:13:13	21.0	0.0	7	0.0	2.48
13:13:18	21.0	0.0	★ ¹ 6	0.0	2.48
13:13:21	21.0	0.0	6	0.0	★ ¹ 2.49
13:14:13	21.0	0.0	6	0.0	2.49
13:15:03	0.0	★ ¹ 248	7	0.0	2.42
13:15:13	0.0	278	7	0.0	2.43
13:16:13	0.0	296	6	0.0	2.42
13:17:13	0.0	298	5	0.0	2.43
13:17:27	0.0	299	★ ² 5	0.0	2.42
13:18:13	2.9	300	5	0.0	2.50
13:18:46	21.0	★ ² 22	5	0.0	2.50
13:19:13	21.0	8	5	0.0	2.49
13:20:13	21.0	1	4	1	2.47
13:21:13	0.0	1	65	220	2.42
13:22:13	0.0	0.0	59	281	2.43
13:23:13	0.0	0.0	53	322	2.41
13:24:13	0.0	0.0	49	352	2.39
13:25:13	0.0	0.0	46	375	2.38
13:26:13	0.0	0.0	44	393	2.38
13:26:44	0.0	0.0	43	402	★ ² 2.40
13:27:14	16.7	0.0	17	180	2.46
13:28:13	21.0	0.0	7	11	2.47
13:29:13	21.0	0.0	6	5	2.46
13:30:13	21.0	0.0	5	3	2.46
13:31:13	21.0	0.0	5	2	2.46
13:32:00	21.0	0.0	4	★ ¹ 1	2.45
13:32:13	21.0	0.0	4	1	2.45
13:33:13	0.0	0.0	667	100	2.40
13:34:13	0.0	0.0	699	49	2.40
13:35:13	0.0	0.0	708	38	2.41

Post Test Drift Check					
13:35:50	0.0	0.0	712	★ ² 34	2.43

★¹ : Captured Zero

★² : Captured Cal Response

NOTES:

TEST COMPLETED BY:

Jeff Simon
 Panhandle Eastern Pipeline
 42589 Grady Rd.
 Alva, OK 73717
 Phone: 580-327-2029
 Mobile:
 Email: jeff.simon@energytransfer.com
 Home Page:

Technician



Date

1-15-2020



Engine Emissions Test Report

SCAQMD 1110.2

Emissions Test Date: 01/10/2020 Q1

Cashion Station
Panhandle Eastern Pipeline
Jason Hembree
Phone: 580-327-2029
26441 N. 2950 Rd.
Cashion, OK 73016
Mobile: 580-747-2413
Email: jason.hembree@energytransfer.com

CO: lb/hr

6.278

Pass

(22.82 lb/hr)

NOx: lb/hr

44.125

Pass

(89.3 lb/hr)

PHYSICAL LOCATION

Operational Area: Liberal

Facility Name: Cashion Station

EQUIPMENT INFORMATION

Equipment:	2302	Unit #:	2302	AF Controller Make:	
Model:	Cooper Quad 12Q155HC	Serial #:	48765	AF Controller Model:	
Service :	Natural Gas Compression	Ignition Timing:		Catalytic Converter Make:	
Stack Flow:		Fuel Type:	Gas: Natural	Catalytic Converter Model:	
Intake MP:	Left: Right:	Intake MT:	Left: Right:	Fuel Consumption:	23961
Stack Height:		FuelSG:		Horsepower:	3292
Equipment Hours:		Fuel Pressure:		RPM:	
Stepper Position:	Left: Right:	Exhaust Temp:	Left: Right:	MV Target Set Point:	
Catalyst dp:		Pre-Catalyst Temp:		MV Actual:	Left: Right:
				Post-Catalyst Temp:	

PERMIT INFORMATION

Permit #: 2013-1330-TVR3
Permit Equipment #: U2302

Permit Date: 08/06/2015
Permit Units: lb/hr @ 0 % O2

Permit CO Limit: 22.82
Permit NOx Limit: 89.3

ANALYZER INFORMATION

Model:
Last Linearity Test : 00/00/00

Serial #: 7364

Last Stability Test : 00/00/00

EMISSIONS TEST RESULTS

Parameter	Test 1		Cal Adjusted @ 0% O2	Permit Limit @ 0% O2
	Average Measured	Cal Adjusted		
O2%	14.00	13.93		
CO ppm	129.09	129.09	387.27	22.82
NO ppm	571.82	568.41		
NO2 ppm	50.64	48.09		
NOx ppm		616.50	1849.49	89.30

Drift correction applied: 166.944

Test 2				
Parameter	Average Measured	Cal Adjusted	Cal Adjusted @ 0% O2	Permit Limit @ 0% O2
O2%	14.15	14.08		
CO ppm	128.45	128.45	393.54	22.82
NO ppm	545.36	542.07		
NO2 ppm	47.91	45.50		
NOx ppm		587.56	1800.09	89.30

Test 3				
Parameter	Average Measured	Cal Adjusted	Cal Adjusted @ 0% O2	Permit Limit @ 0% O2
O2%	14.35	14.28		
CO ppm	140.64	140.64	443.81	22.82
NO ppm	456.55	453.62		
NO2 ppm	43.18	41.01		
NOx ppm		494.63	1560.92	89.30

		Combined Tests	
Parameter		Overall Average	
O2%		14.16	
CO ppm		132.73	
NO ppm		524.58	
NO2 ppm		47.24	
NOx ppm		571.82	
Cell Temperature			
Start		End	Ambient Temp
78.8F		81.1F	78.3F

RampUp 1 - 01/10/20										
Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
10:30:07	18.10	0.00	1.60	158.00	18.00	176.00	0.00	0.00	76.60	75.90
10:31:07	14.00	124.00	3.90	594.00	54.00	648.00	0.00	0.00	76.80	75.90
10:32:07	14.00	127.00	3.90	592.00	53.00	645.00	0.00	0.00	77.00	75.90

Test 1 - 01/10/20										
Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
10:32:08	14.00	127.00	3.90	592.00	53.00	645.00	0.00	0.00	77.00	75.90
10:33:08	14.00	128.00	3.90	568.00	51.00	619.00	0.00	0.00	77.20	75.90
10:34:08	14.00	129.00	3.90	576.00	51.00	627.00	0.00	0.00	77.20	76.10
10:35:08	14.00	129.00	3.90	581.00	51.00	632.00	0.00	0.00	77.40	76.10
10:36:08	14.00	129.00	3.90	577.00	51.00	628.00	0.00	0.00	77.40	76.30
10:37:08	14.00	128.00	3.90	556.00	50.00	606.00	0.00	0.00	77.50	76.30
10:38:08	14.00	129.00	3.90	568.00	51.00	619.00	0.00	0.00	77.50	76.50
10:39:08	14.00	131.00	3.90	556.00	50.00	606.00	0.00	0.00	77.70	76.60
10:40:08	14.00	129.00	3.90	574.00	49.00	623.00	0.00	0.00	77.70	76.60
10:41:08	14.00	129.00	3.90	555.00	49.00	604.00	0.00	0.00	77.90	76.60
10:42:08	14.00	132.00	3.90	587.00	51.00	638.00	0.00	0.00	77.90	76.60

Average O2 =	14.00 %	Average NOx =	622.45 ppm	Average CO =	129.09 ppm
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Average NO = 571.82 ppm Average NO2 = 50.64 ppm

Purge 1 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
10:42:18	14.00	131.00	3.90	578.00	50.00	628.00	0.00	0.00	77.90	76.60
10:43:19	20.50	6.00	0.30	14.00	0.00	14.00	0.00	0.00	78.10	76.60
10:44:19	20.50	3.00	0.30	9.00	0.00	9.00	0.00	0.00	78.10	76.80
10:45:19	20.60	2.00	0.20	7.00	0.00	7.00	0.00	0.00	78.30	77.00

RampUp 2 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
10:45:21	20.60	2.00	0.20	7.00	0.00	7.00	0.00	0.00	78.30	77.00
10:46:21	14.10	125.00	3.80	531.00	49.00	580.00	0.00	0.00	78.30	76.80
10:47:21	14.10	124.00	3.80	555.00	50.00	605.00	0.00	0.00	78.40	77.00

Test 2 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
10:47:23	14.10	124.00	3.80	555.00	50.00	605.00	0.00	0.00	78.40	77.00
10:48:23	14.10	124.00	3.80	557.00	49.00	606.00	0.00	0.00	78.40	77.20
10:49:23	14.10	126.00	3.80	573.00	49.00	622.00	0.00	0.00	78.40	77.20
10:50:23	14.10	125.00	3.80	572.00	49.00	621.00	0.00	0.00	78.40	77.20
10:51:23	14.10	128.00	3.80	566.00	49.00	615.00	0.00	0.00	78.60	77.20
10:52:23	14.10	127.00	3.80	557.00	49.00	606.00	0.00	0.00	78.60	77.40
10:53:23	14.20	128.00	3.80	556.00	48.00	604.00	0.00	0.00	78.60	77.20
10:54:23	14.20	130.00	3.80	537.00	47.00	584.00	0.00	0.00	78.60	77.20
10:55:23	14.20	132.00	3.80	513.00	46.00	559.00	0.00	0.00	78.60	77.40
10:56:23	14.20	133.00	3.80	518.00	46.00	564.00	0.00	0.00	78.80	77.40
10:57:23	14.20	136.00	3.80	495.00	45.00	540.00	0.00	0.00	78.80	77.40

Average O2 = 14.15 % Average NOx = 593.27 ppm Average CO = 128.45 ppm
 Average NO = 545.36 ppm Average NO2 = 47.91 ppm

Purge 2 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
10:57:33	14.20	136.00	3.80	490.00	45.00	535.00	0.00	0.00	78.80	77.40
10:58:33	20.60	7.00	0.20	15.00	0.00	15.00	0.00	0.00	78.80	77.50
10:59:33	20.60	3.00	0.20	10.00	0.00	10.00	0.00	0.00	79.00	77.50
11:00:33	20.70	2.00	0.00	8.00	0.00	8.00	0.00	0.00	79.00	77.50

RampUp 3 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:00:37	20.70	2.00	0.00	8.00	0.00	8.00	0.00	0.00	79.00	77.50
11:01:37	14.40	143.00	3.70	404.00	41.00	445.00	0.00	0.00	79.00	77.50
11:02:37	14.40	145.00	3.70	406.00	42.00	448.00	0.00	0.00	79.20	77.50

Test 3 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:02:39	14.40	145.00	3.70	409.00	42.00	451.00	0.00	0.00	79.20	77.50
11:03:39	14.40	147.00	3.70	398.00	42.00	440.00	0.00	0.00	79.20	77.70
11:04:39	14.40	149.00	3.70	393.00	42.00	435.00	0.00	0.00	79.20	77.90
11:05:39	14.40	147.00	3.70	412.00	42.00	454.00	0.00	0.00	79.30	77.90
11:06:39	14.40	145.00	3.70	429.00	42.00	471.00	0.00	0.00	79.30	78.10
11:07:39	14.30	142.00	3.70	450.00	42.00	492.00	0.00	0.00	79.30	78.10
11:08:39	14.30	141.00	3.70	471.00	44.00	515.00	0.00	0.00	79.70	78.30
11:09:39	14.30	139.00	3.70	512.00	44.00	556.00	0.00	0.00	79.50	78.30
11:10:39	14.30	133.00	3.70	482.00	44.00	526.00	0.00	0.00	79.50	78.40
11:11:39	14.30	130.00	3.70	523.00	45.00	568.00	0.00	0.00	79.70	78.40
11:12:39	14.30	129.00	3.70	543.00	46.00	589.00	0.00	0.00	79.70	78.30

Average O2 =	14.35 %	Average NOx =	499.73 ppm	Average CO =	140.64 ppm
Average NO =	456.55 ppm	Average NO2 =	43.18 ppm		

Purge 3 - 01/10/20

Time	O2	CO	CO2	NO	NO2	NOx	SO2	CxHy	Tgas	Tamb
11:12:51	14.30	129.00	3.70	542.00	46.00	588.00	0.00	0.00	79.70	78.30
11:13:51	20.60	6.00	0.20	16.00	0.00	16.00	0.00	0.00	79.70	77.90
11:14:51	20.60	3.00	0.20	11.00	0.00	11.00	0.00	0.00	79.70	77.90
11:15:51	20.60	2.00	0.20	9.00	0.00	9.00	0.00	0.00	79.70	78.10

ANALYZER AVERAGE INFORMATION

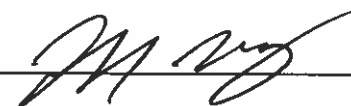
Total Average O2 =	14.16 %	Total Average NOx =	571.82 ppm	Total Average CO =	132.73 ppm
Total Average NO =	524.58 ppm	Total Average NO2 =	47.24 ppm		

NOTES:

TEST COMPLETED BY:

Jeff Simon
 Panhandle Eastern Pipeline
 42589 Grady Rd.
 Alva, OK 73717
 Phone: 580-327-2029
 Mobile:
 Email: jeff.simon@energytransfer.com
 Home Page:

Technician



Date 1-10-2020



Pre & Post Calibration Test Report

Calibration Test Date: 01/10/2020

Cashion Station

Panhandle Eastern Pipeline

Jason Hembree

Phone: 580-327-2029

26441 N. 2950 Rd.

Cashion, OK 73016

Mobile: 580-747-2413

Email: jason.hembree@energytransfer.com

Sensor	Span Gas Value	Expiration date	Zero Error % Limit	Cal Error % Limit	Zero Drift % Limit	Span Drift % Limit
O2 %	20.9	4/8/2014	0.5	0.5	0.5	0.5
CO ppm	296	12/5/2024	5	5	5	5
NO ppm	708	7/27/2026	5	5	5	5
NO2 ppm	396	2/2/2021	25	5	5	50

PHYSICAL LOCATION

Operational Area: Liberal

Facility Name: Cashion Station

EQUIPMENT INFORMATION

Equipment:	2302	Unit #:	2302	AF Controller Make:	
Model:	Cooper Quad 12Q155HC	Serial #:	48765	AF Controller Model:	
Service :	Natural Gas Compression	Ignition Timing:		Catalytic Converter Make:	
Stack Flow:		Fuel Type:	Gas: Natural	Catalytic Converter Model:	
Intake MP:	Left: Right:	Intake MT:	Left: Right:	Fuel Consumption:	23961
Stack Height:		FuelSG:		Horsepower:	3292
Equipment Hours:		Fuel Pressure:		RPM:	
Stepper Position:	Left: Right:	Exhaust Temp:	Left: Right:	MV Target Set Point:	
Catalyst dp:		Pre-Catalyst Temp:		MV Actual:	Left: Right:
				Post-Catalyst Temp:	

PERMIT INFORMATION

Permit #: 2013-1330-TVR3

Permit Date: 08/06/2015

Permit CO Limit: 22.82

Permit Equipment #: U2302

Permit Units: lb/hr @ 0 % O2

Permit NOx Limit: 89.3

ANALYZER INFORMATION

Model:

Serial #: 7364

Last Stability Test : 00/00/00

Last Linearity Test : 00/00/00

Calibration Specs

	O2 %	CO ppm	NO ppm	NO2 ppm
Pre-Test Zero %	0.0	0.0	0.0	0.0
Post-Test Zero %	0.0	0.0	2	0.0
Mean Zero, Ccz	0.0	0.0	1.0	0.0
Zero Result	Pass	Pass	Pass	Pass
Pre-Test Span	21.0	296	716	437
Pre-Test Result	Pass	Pass	Pass	Fail
Post Test Span	21.0	296	708	397
Post Test Drift %	0.5	0.0	0.0	0.3
Post Test Results	Pass	Pass	Pass	Pass
Span Drift (%)	0.0	0.0	1.1	9.2
Mean Span, Ccm	21.0	296.0	712.0	417.0

Pre Test Calibration

Time	O2	CO	NO	NO2	IFlow
09:11:58	21.0	0.0	0.0	0.0	2.46
09:12:02	21.0	0.0	★ ¹	0.0	2.46
09:12:04	21.0	0.0	0.0	★ ¹	2.46
09:12:05	21.0	0.0	0.0	0.0	★ ¹ 2.46
09:12:39	21.0	★ ²	0.0	0.0	2.46
09:12:43	21.0	★ ²	0.0	0.0	2.46
09:12:44	21.0	★ ²	0.0	0.0	2.46
09:12:44	21.0	★ ²	0.0	0.0	2.46
09:12:45	21.0	★ ²	0.0	0.0	2.46
09:12:45	21.0	★ ²	0.0	0.0	2.46
09:12:45	21.0	★ ²	0.0	0.0	2.46
09:12:46	21.0	★ ²	0.0	0.0	2.46
09:12:58	21.0	0.0	0.0	0.0	2.45
09:13:58	21.0	0.0	0.0	0.0	2.46
09:14:58	21.0	0.0	0.0	0.0	2.45
09:15:58	5.8	11	2	0.0	2.34
09:16:49	0.0	★ ¹ 275	0.0	0.0	2.34
09:16:58	0.0	276	0.0	0.0	2.35
09:17:58	0.0	279	0.0	0.0	2.36
09:18:58	0.0	281	0.0	0.0	2.36
09:19:58	0.0	281	0.0	0.0	2.36
09:20:58	0.0	281	0.0	0.0	2.37
09:21:58	0.0	282	0.0	0.0	2.37
09:22:58	0.0	282	0.0	0.0	2.37
09:23:58	0.0	282	0.0	0.0	2.37
09:24:58	0.0	282	0.0	0.0	2.37
09:25:58	0.0	282	0.0	0.0	2.36
09:26:58	0.0	296	0.0	0.0	2.37
09:27:58	0.0	296	0.0	0.0	2.37
09:28:58	0.0	296	0.0	0.0	2.37
09:29:58	0.0	296	0.0	0.0	2.37
09:30:58	0.0	296	0.0	0.0	2.36
09:31:58	0.0	296	0.0	0.0	2.37

Pre Test Calibration					
09:32:58	0.0	296	0.0	0.0	2.37
09:33:25	0.0	296	★ ²	0.0	2.37
09:33:58	19.4	206	0.0	0.0	2.47
09:34:58	21.0	7	0.0	0.0	2.47
09:35:58	21.0	4	0.0	0.0	2.47
09:36:58	0.0	5	662	52	2.38
09:37:58	0.0	3	681	25	2.38
09:38:58	0.0	4	686	19	2.37
09:39:58	0.0	4	691	16	2.38
09:40:58	0.0	3	694	15	2.38
09:41:58	0.0	3	696	14	2.38
09:42:58	0.0	2	709	13	2.37
09:43:58	0.0	2	711	12	2.37
09:44:58	0.0	1	713	12	2.37
09:45:58	0.0	1	714	11	2.38
09:46:58	0.0	1	715	10	2.38
09:47:58	0.0	0.0	716	10	2.38
09:48:16	0.0	0.0	716	★ ²	2.39
09:48:58	21.0	0.0	26	10	2.47
09:49:58	21.0	0.0	11	3	2.46
09:50:58	21.0	0.0	7	1	2.46
09:51:58	0.0	1	70	142	2.37
09:52:58	0.0	1	69	212	2.35
09:53:58	0.0	1	63	248	2.37
09:54:58	0.0	1	57	279	2.37
09:55:58	0.0	1	53	307	2.37
09:56:58	0.0	1	49	331	2.35
09:57:58	0.0	1	46	352	2.36
09:58:58	0.0	1	44	371	2.35
09:59:58	0.0	0.0	41	387	2.35
10:00:58	0.0	0.0	39	401	2.35
10:01:58	0.0	0.0	37	412	2.32
10:02:58	0.0	0.0	36	422	2.33
10:03:58	0.0	0.0	34	431	2.33
10:04:43	0.0	0.0	33	437	★ ² 2.32

Post Test Drift Check					
Time	O2	CO	NO	NO2	IFlow
14:00:20	21.0	0.0	5	0.0	2.47
14:00:23	21.0	0.0	★ ¹ 5	0.0	2.47
14:00:25	21.0	0.0	5	0.0	★ ¹ 2.46
14:01:20	21.0	0.0	5	0.0	2.46
14:02:20	21.0	0.0	4	0.0	2.46
14:03:20	21.0	0.0	4	0.0	2.47
14:04:20	21.0	0.0	4	0.0	2.47
14:05:20	21.0	0.0	4	0.0	2.47

Post Test Drift Check					
14:06:20	21.0	0.0	4	0.0	2.47
14:07:20	21.0	0.0	3	0.0	2.46
14:08:20	21.0	0.0	3	0.0	2.45
14:09:20	21.0	0.0	3	0.0	2.46
14:10:20	21.0	0.0	3	0.0	2.45
14:11:20	0.5	124	7	2	2.36
14:11:28	0.0	★ ¹ 220	5	1	2.36
14:12:20	0.0	291	3	0.0	2.36
14:13:20	0.0	295	3	0.0	2.39
14:14:06	0.0	296	★ ² 3	0.0	2.39
14:14:20	0.0	296	★ ² 3	0.0	2.39
14:14:20	0.0	296	3	0.0	2.39
14:15:20	21.0	15	2	0.0	2.46
14:15:24	21.0	★ ² 11	3	0.0	2.46
14:16:20	4.3	7	46	97	2.37
14:17:20	0.0	0.0	60	241	2.36
14:18:20	0.0	0.0	51	294	2.37
14:19:20	0.0	0.0	45	330	2.37
14:20:20	0.0	0.0	41	357	2.40
14:21:20	0.0	0.0	38	376	2.34
14:22:20	0.0	0.0	36	391	2.32
14:22:45	0.0	0.0	35	397	★ ² 2.32
14:23:20	20.9	0.0	8	87	2.42
14:24:20	21.0	0.0	4	9	2.44
14:25:20	21.0	0.0	3	4	2.44
14:26:20	21.0	0.0	3	2	2.43
14:27:20	21.0	0.0	3	1	2.43
14:28:20	21.0	0.0	3	1	2.42
14:29:20	21.0	0.0	2	1	2.42
14:30:21	21.0	0.0	2	0.0	2.44
14:31:20	21.0	0.0	2	0.0	2.44
14:32:20	21.0	0.0	2	0.0	2.43
14:33:20	21.0	0.0	2	0.0	2.43
14:34:20	21.0	0.0	2	0.0	2.43
14:35:20	21.0	0.0	2	0.0	2.43
14:36:20	21.0	0.0	2	0.0	2.44
14:37:20	21.0	0.0	2	0.0	2.43
14:37:55	21.0	0.0	2	★ ¹ 0.0	2.43
14:38:20	6.0	0.0	450	81	2.30
14:39:20	0.0	0.0	688	39	2.34
14:40:20	0.0	0.0	703	23	2.34
14:41:13	0.0	0.0	708	★ ² 18	2.35

★¹ : Captured Zero

★² : Captured Cal Response

NOTES:

TEST COMPLETED BY:

Jeff Simon

Panhandle Eastern Pipeline

42589 Grady Rd.

Alva, OK 73717

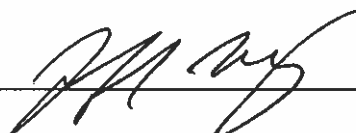
Phone: 580-327-2029

Mobile:

Email: jeff.simon@energytransfer.com

Home Page:

Technician



Date

1-10-2020

**ODEQ Quarterly Compliance
Performance Test Report**

Test Type: Quarterly
Test Date: 02-10-2022

Source:
Cooper Quad 12Q155HC
Lean Burn 4 Cycle Engine

Unit Number: U-2301
Serial Number: 48764
Engine Hours: 234682

Permit: #2018-0674-TV4

Location:
Cashion Compressor Station
Kingfisher County, Oklahoma

Prepared on Behalf of:
Panhandle Eastern Pipeline

	CO		NOx																
	State		State																
Results ppmvd	189.190		309.282																
Results lb/hr	11.750		31.552																
Permit lb/hr	22.820		89.300																
Results g/hp-hr	1.471		3.949																
Results TPY	51.465		138.199																
Permit TPY	99.960		391.150																
PASS ALL	Pass		Pass																

Test Started: 11:29 Test Completed: 12:35



4.0 Test Summary

Unit U-2301 with a serial number of 48764 which is a Cooper Quad 12Q155HC engine located at Cashion Compressor Station and operated by Panhandle Eastern Pipeline was tested for emissions of: (Oxides of Nitrogen) (Carbon Monoxide) . The test was conducted on 02-10-2022 by Jeremiah Giles with Great Plains Analytical Services, Inc. All quality assurance and quality control tests were within acceptable tolerances.

The engine is a natural gas fired Lean Burn (4 Cycle) engine rated at 3940 brake horse power (BHP) at 450 RPM. The engine was operating at 3624.00 BHP and 450 RPM which is 91.98% of maximum engine load during the test.

This test will satisfy the testing requirements for ODEQ Quarterly Compliance. Unit U-2301 is authorized to operate under permit #2018-0674-TV4.

Site Verification Photos

Feb 10, 2022 at 9:36:33 AM
Cashion OK 73016
United States

A COOPER-BESSEMER PRODUCT



RATED BHP	AIR INTAKE TEMP. °F	AIR MANIF. TEMP. °F	ALTITUDE FT.
4140	80	110	1090

RATED SPEED	OVERSPEED TRIP	MODEL
475 RPM	523 RPM	12Q155HC
BORE	STROKE	SERIAL NO.
15.5 IN.	14 IN.	48764

CUSTOMER ITEM NO.
2301

1R	2R	3R	4R	5R	6R	7R	8R	9R	10R
CYLINDER NUMBERS									
1L	2L	3L	4L	5L	6L	7L	8L	9L	10L

POWER TAKEOFF END
DIRECTION OF ROTATION
CW

FIRING ORDER
1L - 6R - 1R - 4L - 4R - 5L
5R - 2L - 2R - 3L - 3R - 6L

COOPER ENERGY SERVICES
2-07P-584-001

4.0 Test Summary

Engine/Compressor Specs					
Location	Cashion Compressor Station	Unit ID	U-2301	T e s t S u m m a r y	
Make	Cooper Quad	Site Elevation ft.	1220		
Model	12Q155HC	Atmospheric Pressure psi	14.05		
Serial number	48764				
mfg. rated hp	3940	Catalyst	No		
mfg. rated rpm	450	Date of Manufacture			
Engine/Compressor Operation		Run 1	Run 2	Run 3	3 Run Average
Test Horsepower		3624	3624	3624	3624
Test RPM		450	450	450	450
Percent Load %		91.98%	91.98%	91.98%	91.98%
Intake Manifold Pressure (hg)		17.00	17.00	17.00	17.00
Intake Manifold Temperature (F)		90.10	90.10	90.10	90.10
Ambient Conditions					
Ambient Temperature Dry (F)		55.00	55.00	55.00	55.00
Exhaust Flow Data					
Q Stack (dscfh)		854712.62	854712.62	854712.62	854712.62
Q Stack (dscm/hr)		24202.54	24202.54	24202.54	24202.54
Fuel Consumption (Btu/hp-hr)		7470.00	7470.00	7470.00	7470.00
Fuel Flow (dscfh)		108876.32	109044.67	109061.32	108994.10
Fuel (Btu/scf)		1022.00	1022.00	1022.00	1022.00
O2 F factor		8710.00	8710.00	8710.00	8710.00
Results					
Oxygen %		15.13%	15.14%	15.14%	15.14%

Permitted Standards				Results				
Test Start/Completed Times:				11:29	11:51	12:13	12:35	2/10/22
	State			Run 1	Run 2	Run 3	3 Run Average	Pass Permits
CO (g/hp-hr)				1.466	1.472	1.475	1.471	
CO (lbs/hr)	22.820			11.710	11.757	11.783	11.750	Pass
CO (TPY)	99.960			51.291	51.497	51.608	51.465	Pass
CO (ppmvd) @15% O2				192.941	194.016	194.463	193.807	
CO (ppbvd) @15% O2				192940.840	194016.264	194462.666	193806.590	
CO (ppmvd)				188.549	189.308	189.714	189.190	
			CO (mol wt)	28.01				
NOx (g/hp-hr)				3.951	3.976	3.921	3.949	
NOx (lbs/hr)	89.300			31.569	31.763	31.324	31.552	Pass
NOx (TPY)	391.150			138.274	139.122	137.201	138.199	Pass
NOx (ppmvd) @15% O2				316.657	319.092	314.734	316.828	
NOx (ppbvd) @15% O2				316656.648	319092.389	314733.500	316827.512	
NOx (ppmvd)				309.449	311.348	307.048	309.282	
			NOx (mol wt)	46.01				

5.0 Calibrations/System Bias & Drift Check

Span Gas

CO	1302.00
NO	790.10
NO2	100.50
O2	20.90%

Analyzer

Make:	Testo
Model:	350
Serial Number:	7855

Longest Response Time

0:01:40

Direct Calibrations

Start Time: 6:37					
Bottle Concentration		Calibration Response	Absolute Difference	<5% of Span	
Zero	CO	0.00	0.00	0.00	0.00%
	NO	0.00	0.00	0.00	0.00%
	NO2	0.00	1.37	1.37	1.36%
	O2	0.00%	0.00%	0.00	0.00%
CO	Mid Level	1302.00	1295.13	6.88	0.53%
NO	Mid Level	790.10	785.13	4.98	0.63%
NO2					
	High Level	100.50	101.30	0.80	0.80%
O2					
	High Level	20.90%	20.90%	0.00%	0.00%

Post

Start Time: 12:40							
Bottle Concentration		System Response	Absolute Difference	<5% of Span	<5% Drift		
Zero	CO	0.00	0.00	0.00	0.00%		
	NO	0.00	0.00	0.00	0.00%		
	NO2	0.00	2.07	2.07	2.06%		
	O2	0.00%	0.03%	0.00	0.14%		
CO	Upscale	1302.00	1289.38	12.63	0.97%	0.45%	
NO	Upscale	790.10	782.63	7.48	0.95%	0.32%	
NO2	Upscale	100.50	100.73	0.22	0.22%	0.57%	
O2	Upscale	20.90%	20.90%	0.00	0.00%	0.00%	

6.0 Engine Parameter Data Sheet



Company	Panhandle Eastern Pipeline
Facility	Cashion Compressor Station
Date	2/10/2022
Site Elevation (ft)	1,220
Unit ID	U-2301
Make	Cooper Quad
Model	12Q155HC
Serial Number	48764
Technician	Jeremiah Giles

	Run 1	Run 2	Run 3	Completed
Run Start Times	11:29	11:51	12:13	12:35
Engine Hours	234682	234682	234682	234682

[illegible]

 <-- Not available on this unit

11.0 Signature Page

R0

Job/File Name: Panhandle Eastern Pipeline; Cashion Compressor Station; U-2301; ODEQ
Quarterly Compliance;



We certify that based on review of test data, knowledge of those individuals directly responsible for conducting this test, we believe the submitted information to be accurate and complete.

Company:	G.A.S. Inc.	Date:	2/16/22
Print Name:	Jeremiah Giles		
Title:	Director of PEA Testing		
Signature:	<i>Jeremiah Giles</i>		
Phone Number:	580-515-2920		

Company:	G.A.S. Inc.	Date:	2/16/22
Print Name:	Jeremiah Giles		
Title:	Emissions Specialist		

Company:			
Print Name:		Date:	
Signature:			
Title:			
Phone Number:			

Appendices

(PEA) Special CO/NO High

**CERTIFICATE OF ANALYSIS****Grade of Product: EPA Protocol**

Part Number: E03NI99E15A7XK1 Reference Number: 54-401126470-1
 Cylinder Number: CC1007 Cylinder Volume: 144.4 Cubic Feet
 Laboratory: 124 - Chicago (SAP) - IL Cylinder Pressure: 2015 PSIG
 PGVP Number: B12018 Valve Outlet: 660
 Gas Code: CO,NO,NOX,BALN Certification Date: Mar 01, 2018

Expiration Date: Mar 01, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	3500 PPM	3533 PPM	G1	+/- 1% NIST Traceable	02/19/2018, 03/01/2018
NITRIC OXIDE	3500 PPM	3526 PPM	G1	+/- 1% NIST Traceable	02/19/2018, 03/01/2018
CARBON MONOXIDE	4500 PPM	4517 PPM	G1	+/- 1.0% NIST Traceable	02/22/2018
NITROGEN	Balance			-	

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124264848107	SG9148003BAL	5454 PPM NITRIC OXIDE/NITROGEN	+/- 0.7%	Aug 14, 2023
NTRM	14060160	CC437085	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 18, 2019
GMIS	1114201605	CC506716	4.995 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Nov 14, 2019
PRM	12367	APEX1099237	10.0 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
NTRM	13060213	CC401957	4950 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Feb 15, 2019

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO-2 SIEMENS ULTRAMAT 6E N1J5700	NDIR	Jan 21, 2018
Nicolet 6700 AHR0801332	FTIR	Feb 21, 2018
Nicolet 6700 AHR0801332	FTIR	Feb 21, 2018

Triad Data Available Upon Request



Signature on file
Approved for Release

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(PEA) Mid CO/NO



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI99E15AC2T0 Reference Number: 54-401845408-1
 Cylinder Number: CC285225 Cylinder Volume: 144.4 CF
 Laboratory: 124 - Chicago (SAP) - IL Cylinder Pressure: 2015 PSIG
 PGPV Number: B12020 Valve Outlet: 660
 Gas Code: CO,NO,NOX,BALN Certification Date: Jul 14, 2020

Expiration Date: Jul 14, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	800.0 PPM	790.1 PPM	G1	+/- 0.6% NIST Traceable	07/07/2020, 07/14/2020
NITRIC OXIDE	800.0 PPM	790.1 PPM	G1	+/- 0.6% NIST Traceable	07/07/2020, 07/14/2020
CARBON MONOXIDE	1300 PPM	1302 PPM	G1	+/- 0.6% NIST Traceable	07/07/2020
NITROGEN	Balance			-	

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	15060242	CC449815	997.2 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Nov 07, 2020
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	7302017104	CC506604	4.426 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Jul 03, 2022
NTRM	08012238	KAL004643	2466 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	May 24, 2024

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO-2 SIEMENS ULTRAMAT 6E N1J5700	NDIR	Jun 10, 2020
Nicolet 6700 AMP0900100	FTIR	Jun 15, 2020
Nicolet 6700 AMP0900100	FTIR	Jun 15, 2020

Triad Data Available Upon Request

PERMANENT NOTES:GREAT PLAINS ANALYTICAL



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(PEA) CO/NO Low



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI99E15AC2S8	Reference Number: 54-401721512-1
Cylinder Number: CC472329	Cylinder Volume: 144.4 CF
Laboratory: 124 - Chicago (SAP) - IL	Cylinder Pressure: 2015 PSIG
PGVP Number: B12020	Valve Outlet: 660
Gas Code: CO,NO,NOX,BALN	Certification Date: Feb 17, 2020

Expiration Date: Feb 17, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	150.0 PPM	148.9 PPM	G1	+/- 1.4% NIST Traceable	02/10/2020, 02/17/2020
NITRIC OXIDE	150.0 PPM	148.8 PPM	G1	+/- 1.4% NIST Traceable	02/10/2020, 02/17/2020
CARBON MONOXIDE	220.0 PPM	222.9 PPM	G1	+/- 1% NIST Traceable	02/10/2020
NITROGEN	Balance			-	

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	15060350	CC448769	241.0 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Mar 30, 2021
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
NTRM	18060128	KAL004272	249.9 PPM NITRIC OXIDE/NITROGEN	+/- 0.4	Nov 08, 2023
GMIS	7302017104	CC506604	4.426 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Jul 03, 2022
NTRM	13010131	ND48544	495.4 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jul 03, 2024

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AMP0900100	FTIR	Feb 03, 2020
Nicolet 6700 AMP0900100	FTIR	Feb 03, 2020
Nicolet 6700 AMP0900100	FTIR	Feb 03, 2020

Triad Data Available Upon Request

PERMANENT NOTES: GREAT PLAINS ANALYTICAL



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(PEA) NO2 High



Airgas Specialty Gases
 Airgas USA, LLC
 12722 S. Wentworth Ave.
 Chicago, IL 60628
 Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15W51V7	Reference Number:	54-402246614-1
Cylinder Number:	CC503115	Cylinder Volume:	144.0 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2016 PSIG
PGVP Number:	B12021	Valve Outlet:	660
Gas Code:	NO2,BALN	Certification Date:	Oct 20, 2021

Expiration Date: Oct 20, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NITROGEN DIOXIDE	100.0 PPM	100.5 PPM	G1	+/- 2% NIST Traceable	10/12/2021, 10/20/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	1534002020601	EB0130023	101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.4%	Apr 30, 2024
PRM	12397	D887665	74.2 PPM NITROGEN DIOXIDE/AIR	+/- 1.3%	Feb 02, 2022

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
MKS FTIR NO2 017707558	FTIR	Oct 14, 2021

Triad Data Available Upon Request

PERMANENT NOTES: OXYGEN ADDED TO MAINTAIN STABILITY



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7.0 Raw Data

CO/NO Pre						
Date / time	% O ₂	ppm CO	ppm NO	ppm NO ₂	ppm NOx	l/min Pump
6:37:46	20.9	0.0	0.0	1.7	1.7	0.82
6:37:56	20.9	0.0	0.0	1.5	1.5	0.98
6:38:06	20.9	0.0	0.0	0.9	0.9	0.98
6:38:16	15.8	333.0	451.0	0.5	451.5	0.98
6:38:26	4.4	1104.0	577.0	0.2	577.2	0.98
6:38:36	2.7	1188.0	687.0	0.0	687.0	0.98
6:38:46	1.5	1243.0	699.0	0.0	699.0	0.98
6:38:56	0.9	1267.0	723.0	0.0	723.0	0.98
6:39:06	0.2	1278.0	745.0	0.0	745.0	0.98
6:39:16	0.1	1282.0	772.0	0.0	772.0	0.98
6:39:26	0.0	1288.0	778.0	0.0	778.0	0.99
6:39:36	0.0	1290.0	780.0	0.0	780.0	0.98
6:39:46	0.0	1292.0	781.0	0.0	781.0	0.98
6:39:56	0.0	1293.0	782.0	0.0	782.0	0.98
6:40:06	0.0	1293.0	783.0	0.0	783.0	0.98
6:40:16	0.0	1293.0	783.0	0.0	783.0	0.98
6:40:26	0.0	1293.0	783.0	0.0	783.0	0.98
6:40:36	0.0	1294.0	784.0	0.0	784.0	0.98
6:40:46	0.0	1294.0	784.0	0.0	784.0	0.98
6:40:56	0.0	1294.0	784.0	0.0	784.0	0.98
6:41:06	0.0	1294.0	784.0	0.0	784.0	0.98
6:41:16	0.0	1295.0	785.0	0.0	785.0	0.98
6:41:26	0.0	1295.0	785.0	0.0	785.0	0.98
6:41:36	0.0	1295.0	785.0	0.0	785.0	0.98
6:41:46	0.0	1295.0	785.0	0.0	785.0	0.99
6:41:56	0.0	1295.0	785.0	0.0	785.0	0.98
6:42:06	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:16	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:26	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:36	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:46	0.0	1297.0	786.0	0.0	786.0	0.98
6:42:56	12.9	1119.0	787.0	0.0	787.0	0.99
6:43:06	18.9	667.0	443.0	0.0	443.0	0.99
6:43:16	20.2	421.0	211.0	0.0	211.0	0.98
6:43:26	20.9	213.0	96.0	0.0	96.0	0.98
6:43:36	21.0	67.0	53.0	0.0	53.0	0.98
6:43:46	21.1	15.0	21.0	0.0	21.0	0.98

NO2 Pre

Date / time	% O₂	ppm CO	ppm NO	ppm NO₂	ppm NOx	l/min Pump
7:00:51	20.9	0.0	0.0	1.6	1.6	1.43
7:01:01	20.9	0.0	0.0	1.2	1.2	0.98
7:01:11	20.9	0.0	0.0	1.0	1.0	0.98
7:01:21	10.9	0.0	0.0	66.7	66.7	0.98
7:01:31	3.4	0.0	0.0	93.2	93.2	0.98
7:01:41	2.8	0.0	0.0	98.6	98.6	0.98
7:01:51	1.0	0.0	0.0	100.2	100.2	0.98
7:02:01	0.7	0.0	0.0	100.9	100.9	0.98
7:02:11	0.1	0.0	0.0	101.0	101.0	0.98
7:02:21	0.1	0.0	0.0	101.1	101.1	0.98
7:02:31	0.1	0.0	0.0	101.3	101.3	0.98
7:02:41	0.1	0.0	0.0	101.7	101.7	0.98
7:02:51	0.1	0.0	0.0	101.2	101.2	0.98
7:03:01	0.1	0.0	0.0	101.2	101.2	0.98
7:03:11	0.1	0.0	0.0	101.2	101.2	0.98
7:03:21	0.1	0.0	0.0	101.2	101.2	0.98
7:03:31	0.1	0.0	0.0	101.2	101.2	0.99
7:03:41	0.1	0.0	0.0	101.2	101.2	0.98
7:03:51	0.1	0.0	0.0	101.3	101.3	0.98
7:04:01	0.1	0.0	0.0	101.3	101.3	0.98
7:04:11	0.1	0.0	0.0	101.3	101.3	0.98
7:04:21	0.1	0.0	0.0	101.3	101.3	0.98
7:04:31	0.1	0.0	0.0	101.3	101.3	0.98
7:04:41	0.1	0.0	0.0	101.3	101.3	0.98
7:04:51	0.1	0.0	0.0	101.3	101.3	0.98
7:05:01	0.1	0.0	0.0	101.3	101.3	0.98
7:05:11	0.1	0.0	0.0	101.3	101.3	0.98
7:05:21	0.1	0.0	0.0	101.3	101.3	0.98
7:05:31	0.1	0.0	0.0	101.4	101.4	0.98
7:05:41	0.1	0.0	0.0	101.4	101.4	0.98
7:05:51	0.1	0.0	0.0	101.4	101.4	0.98
7:06:01	19.9	0.0	0.0	28.8	28.8	0.98
7:06:11	20.5	0.0	0.0	6.7	6.7	0.98
7:06:21	20.7	0.0	0.0	1.9	1.9	0.98
7:06:31	20.7	0.0	0.0	0.6	0.6	0.98
7:06:41	20.8	0.0	0.0	0.2	0.2	0.98
7:06:51	20.9	0.0	0.0	0.0	0.0	0.98

Source Test

Date / time	% O ₂	ppm CO	ppm NO	ppm NO ₂	ppm NO _x	l/min Pump
11:28:55	20.9	0.0	0.0	1.1	1.1	1.36
11:29:05	20.9	2.0	0.0	3.7	3.7	0.98
11:29:15	20.9	2.0	2.0	3.0	5.0	0.98
11:29:25	19.1	2.0	22.0	6.1	28.1	0.98
11:29:35	16.0	49.0	73.0	11.7	84.7	0.98
11:29:45	15.4	146.0	177.0	21.7	198.7	0.98
11:29:55	15.3	178.0	213.0	25.7	238.7	0.98
11:30:05	15.2	183.0	236.0	27.7	263.7	0.98
11:30:15	15.2	183.0	248.0	29.0	277.0	0.98
11:30:25	15.2	184.0	255.0	29.7	284.7	0.98
11:30:35	15.2	185.0	256.0	30.2	286.2	0.98
11:30:45	15.2	185.0	256.0	30.7	286.7	0.98
11:30:55	15.1	186.0	258.0	31.3	289.3	0.98
11:31:05	15.1	187.0	258.0	31.8	289.8	0.98
11:31:15	15.1	186.0	263.0	32.9	295.9	0.98
11:31:25	15.1	186.0	272.0	34.0	306.0	0.98
11:31:35	15.1	185.0	268.0	34.0	302.0	0.98
11:31:45	15.1	184.0	267.0	34.5	301.5	0.99
11:31:55	15.1	186.0	273.0	35.2	308.2	0.98
11:32:05	15.2	186.0	264.0	34.8	298.8	0.98
11:32:15	15.1	188.0	264.0	35.3	299.3	0.98
11:32:25	15.1	190.0	266.0	35.6	301.6	0.98
11:32:35	15.1	189.0	268.0	36.0	304.0	0.98
11:32:45	15.2	189.0	265.0	36.0	301.0	0.98
11:32:55	15.2	189.0	262.0	36.0	298.0	0.98
11:33:05	15.1	188.0	261.0	36.3	297.3	0.98
11:33:15	15.1	189.0	265.0	36.6	301.6	0.98
11:33:25	15.1	189.0	265.0	36.7	301.7	0.98
11:33:35	15.4	190.0	264.0	36.7	300.7	0.98
11:33:45	15.1	189.0	264.0	36.7	300.7	0.98
11:33:55	15.2	189.0	265.0	37.0	302.0	0.98
11:34:05	15.1	189.0	266.0	37.1	303.1	0.98
11:34:15	15.1	191.0	265.0	37.2	302.2	0.98
11:34:25	15.1	191.0	263.0	37.1	300.1	0.98
11:34:35	15.1	190.0	264.0	37.4	301.4	0.98
11:34:45	15.1	189.0	265.0	37.5	302.5	0.98
11:34:55	15.1	188.0	270.0	37.8	307.8	0.98
11:35:05	15.1	187.0	272.0	38.0	310.0	0.98
11:35:15	15.1	187.0	267.0	37.7	304.7	0.98
11:35:25	15.1	188.0	268.0	37.8	305.8	0.98
11:35:35	15.1	189.0	270.0	38.0	308.0	0.98
11:35:45	15.1	189.0	262.0	37.5	299.5	0.98
11:35:55	15.2	189.0	263.0	37.5	300.5	0.98
11:36:05	15.1	191.0	263.0	37.8	300.8	0.98
11:36:15	15.2	191.0	265.0	38.0	303.0	0.98
11:36:25	15.1	191.0	264.0	38.2	302.2	0.98

11:36:35	15.1	189.0	269.0	38.5	307.5	0.98
11:36:45	15.1	190.0	271.0	38.5	309.5	0.98
11:36:55	15.1	188.0	270.0	38.5	308.5	0.98
11:37:05	15.1	188.0	269.0	38.3	307.3	0.98
11:37:15	15.1	189.0	271.0	38.6	309.6	0.98
11:37:25	15.1	188.0	272.0	38.6	310.6	0.98
11:37:35	15.1	188.0	277.0	39.1	316.1	0.98
11:37:45	15.1	189.0	277.0	39.0	316.0	0.98
11:37:55	15.2	189.0	272.0	38.6	310.6	0.98
11:38:05	15.1	189.0	269.0	38.4	307.4	0.98
11:38:15	15.2	189.0	270.0	38.4	308.4	0.98
11:38:25	15.1	190.0	269.0	38.2	307.2	0.99
11:38:35	15.1	189.0	268.0	38.3	306.3	0.98
11:38:45	15.1	188.0	269.0	38.4	307.4	0.98
11:38:55	15.1	189.0	273.0	38.7	311.7	0.98
11:39:05	15.1	191.0	271.0	38.4	309.4	0.98
11:39:15	15.1	189.0	270.0	38.3	308.3	0.98
11:39:25	15.1	189.0	272.0	38.4	310.4	0.98
11:39:35	15.1	188.0	274.0	38.7	312.7	0.98
11:39:45	15.1	189.0	278.0	39.1	317.1	0.98
11:39:55	15.1	188.0	277.0	38.8	315.8	0.98
11:40:05	15.1	187.0	273.0	38.4	311.4	0.98
11:40:15	15.1	189.0	272.0	38.4	310.4	0.98
11:40:25	15.2	188.0	273.0	38.4	311.4	0.98
11:40:35	15.2	188.0	272.0	38.3	310.3	0.98
11:40:45	15.1	188.0	269.0	38.1	307.1	0.98
11:40:55	15.2	188.0	267.0	38.0	305.0	0.98
11:41:05	15.1	188.0	267.0	37.9	304.9	0.98
11:41:15	15.1	187.0	269.0	38.3	307.3	0.98
11:41:25	15.2	188.0	273.0	38.4	311.4	0.98
11:41:35	15.1	187.0	274.0	38.7	312.7	0.98
11:41:45	15.1	188.0	277.0	38.7	315.7	0.98
11:41:55	15.1	187.0	276.0	38.5	314.5	0.98
11:42:05	15.1	187.0	273.0	38.5	311.5	0.98
11:42:15	15.1	189.0	272.0	38.3	310.3	0.98
11:42:25	15.1	187.0	270.0	38.2	308.2	0.98
11:42:35	15.1	190.0	268.0	37.9	305.9	0.98
11:42:45	15.2	189.0	267.0	38.0	305.0	0.98
11:42:55	15.1	188.0	271.0	38.2	309.2	0.98
11:43:05	15.1	187.0	269.0	38.2	307.2	0.98
11:43:15	15.1	186.0	269.0	38.3	307.3	0.98
11:43:25	15.1	188.0	273.0	38.5	311.5	0.98
11:43:35	15.1	189.0	276.0	38.8	314.8	0.98
11:43:45	15.2	189.0	274.0	38.3	312.3	0.98
11:43:55	15.2	188.0	270.0	38.2	308.2	0.98
11:44:05	15.2	188.0	273.0	38.5	311.5	0.98
11:44:15	15.1	188.0	273.0	38.4	311.4	0.98
11:44:25	15.2	188.0	278.0	38.8	316.8	0.98

11:44:35	15.1	187.0	280.0	38.9	318.9	0.98
11:44:45	15.1	185.0	280.0	39.0	319.0	0.98
11:44:55	15.1	188.0	278.0	38.9	316.9	0.98
11:45:05	15.1	189.0	280.0	39.0	319.0	0.98
11:45:15	15.1	188.0	278.0	38.9	316.9	0.98
11:45:25	15.1	188.0	275.0	38.8	313.8	0.98
11:45:35	15.2	189.0	274.0	38.6	312.6	0.98
11:45:45	15.1	190.0	272.0	38.6	310.6	0.98
11:45:55	15.1	189.0	277.0	38.7	315.7	0.98
11:46:05	15.2	190.0	276.0	38.8	314.8	0.98
11:46:15	15.1	190.0	279.0	39.2	318.2	0.98
11:46:25	15.1	189.0	279.0	39.2	318.2	0.98
11:46:35	15.1	187.0	279.0	39.3	318.3	0.98
11:46:45	15.1	187.0	275.0	38.8	313.8	0.98
11:46:55	15.2	187.0	270.0	38.8	308.8	0.98
11:47:05	15.2	189.0	271.0	38.8	309.8	0.98
11:47:15	15.2	191.0	273.0	38.8	311.8	0.98
11:47:25	15.2	189.0	274.0	39.0	313.0	0.98
11:47:35	15.1	188.0	277.0	39.2	316.2	0.98
11:47:45	15.1	187.0	277.0	39.1	316.1	0.98
11:47:55	15.2	188.0	274.0	38.9	312.9	0.98
11:48:05	19.1	189.0	158.0	12.9	170.9	0.98
11:48:15	20.4	101.0	61.0	4.3	65.3	0.98
11:48:25	20.7	32.0	29.0	1.9	30.9	0.98
11:48:35	20.9	10.0	17.0	1.0	18.0	0.98
11:48:45	20.9	4.0	12.0	0.7	12.7	0.98
11:48:55	20.9	2.0	8.0	0.5	8.5	0.98
11:49:05	20.9	1.0	6.0	0.5	6.5	0.98
11:49:15	20.9	1.0	5.0	0.4	5.4	0.98
11:49:25	20.9	0.0	4.0	0.3	4.3	0.98
11:49:35	20.9	1.0	3.0	0.3	3.3	0.98
11:49:45	21.0	0.0	3.0	0.2	3.2	0.98
11:49:55	21.0	0.0	2.0	0.2	2.2	0.98
11:50:05	21.0	0.0	2.0	0.2	2.2	0.98
11:50:15	20.8	0.0	1.0	0.2	1.2	0.98
11:50:25	20.9	0.0	1.0	0.2	1.2	0.98
11:50:35	20.9	0.0	1.0	0.1	1.1	0.98
11:50:45	21.0	0.0	1.0	0.2	1.2	0.98
11:50:55	21.1	0.0	1.0	0.1	1.1	0.99
11:51:05	16.6	0.0	100.0	43.1	143.1	0.98
11:51:15	15.4	95.0	174.0	55.5	229.5	0.98
11:51:25	15.2	164.0	200.0	48.2	248.2	0.98
11:51:35	15.2	180.0	220.0	40.5	260.5	0.98
11:51:45	15.2	186.0	244.0	37.6	281.6	0.98
11:51:55	15.2	191.0	260.0	38.3	298.3	0.98
11:52:05	15.1	190.0	264.0	38.2	302.2	0.98
11:52:15	15.5	189.0	272.0	38.8	310.8	0.98
11:52:25	15.2	189.0	272.0	38.7	310.7	0.98

11:52:35	15.2	190.0	272.0	38.7	310.7	0.98
11:52:45	15.2	191.0	269.0	38.4	307.4	0.98
11:52:55	15.2	190.0	267.0	38.2	305.2	0.98
11:53:05	15.2	190.0	264.0	38.2	302.2	0.98
11:53:15	15.2	191.0	267.0	38.3	305.3	0.98
11:53:25	15.2	192.0	270.0	38.6	308.6	0.98
11:53:35	15.2	190.0	273.0	38.6	311.6	0.98
11:53:45	15.4	188.0	276.0	38.8	314.8	0.98
11:53:55	15.1	188.0	272.0	38.5	310.5	0.98
11:54:05	15.1	188.0	268.0	38.3	306.3	0.98
11:54:15	15.2	188.0	270.0	38.5	308.5	0.98
11:54:25	15.1	189.0	270.0	38.4	308.4	0.98
11:54:35	15.1	187.0	274.0	38.7	312.7	0.98
11:54:45	15.1	188.0	275.0	38.8	313.8	0.98
11:54:55	15.1	187.0	275.0	38.8	313.8	0.98
11:55:05	15.1	187.0	275.0	39.0	314.0	0.98
11:55:15	15.1	189.0	275.0	39.1	314.1	0.98
11:55:25	15.1	189.0	277.0	39.2	316.2	0.98
11:55:35	15.3	187.0	278.0	39.2	317.2	0.98
11:55:45	15.1	186.0	275.0	38.9	313.9	0.98
11:55:55	15.1	187.0	273.0	38.9	311.9	0.98
11:56:05	15.2	188.0	271.0	38.7	309.7	0.98
11:56:15	15.2	188.0	269.0	38.7	307.7	0.98
11:56:25	15.2	188.0	271.0	39.1	310.1	0.98
11:56:35	15.1	188.0	275.0	39.3	314.3	0.98
11:56:45	15.1	188.0	272.0	39.0	311.0	0.99
11:56:55	15.2	187.0	277.0	39.5	316.5	0.98
11:57:05	15.1	188.0	279.0	39.5	318.5	0.98
11:57:15	15.1	188.0	279.0	39.5	318.5	0.98
11:57:25	15.1	189.0	280.0	39.6	319.6	0.98
11:57:35	15.1	189.0	276.0	39.3	315.3	0.98
11:57:45	15.1	189.0	277.0	39.3	316.3	0.98
11:57:55	15.1	190.0	273.0	38.9	311.9	0.98
11:58:05	15.1	189.0	272.0	38.9	310.9	0.98
11:58:15	15.1	189.0	270.0	38.7	308.7	0.98
11:58:25	15.1	186.0	273.0	39.2	312.2	0.98
11:58:35	15.1	186.0	276.0	39.3	315.3	0.98
11:58:45	15.1	187.0	273.0	39.0	312.0	0.98
11:58:55	15.1	187.0	277.0	39.3	316.3	0.98
11:59:05	15.3	189.0	276.0	39.1	315.1	0.98
11:59:15	15.2	189.0	272.0	38.8	310.8	0.98
11:59:25	15.2	189.0	273.0	38.8	311.8	0.98
11:59:35	15.1	189.0	270.0	38.7	308.7	0.98
11:59:45	14.9	190.0	268.0	38.5	306.5	0.98
11:59:55	15.1	191.0	268.0	38.6	306.6	0.98
12:00:05	15.1	189.0	271.0	38.8	309.8	0.98
12:00:15	15.3	190.0	274.0	38.8	312.8	0.98
12:00:25	15.1	190.0	275.0	38.9	313.9	0.98

12:00:35	15.3	188.0	279.0	39.3	318.3	0.98
12:00:45	15.1	189.0	278.0	39.2	317.2	0.98
12:00:55	15.1	189.0	274.0	38.9	312.9	0.98
12:01:05	15.2	190.0	269.0	38.7	307.7	0.98
12:01:15	15.2	191.0	266.0	38.2	304.2	0.98
12:01:25	15.2	191.0	262.0	38.0	300.0	0.98
12:01:35	15.2	190.0	262.0	38.1	300.1	0.98
12:01:45	15.1	189.0	263.0	38.4	301.4	0.98
12:01:55	15.2	193.0	264.0	38.2	302.2	0.98
12:02:05	15.2	193.0	264.0	38.3	302.3	0.98
12:02:15	15.1	191.0	265.0	38.3	303.3	0.98
12:02:25	15.1	191.0	269.0	38.6	307.6	0.98
12:02:35	15.2	191.0	272.0	38.7	310.7	0.98
12:02:45	15.1	190.0	274.0	38.9	312.9	0.98
12:02:55	15.1	188.0	275.0	38.9	313.9	0.98
12:03:05	15.1	188.0	273.0	38.8	311.8	0.98
12:03:15	15.1	189.0	279.0	39.3	318.3	0.98
12:03:25	15.2	188.0	281.0	39.4	320.4	0.98
12:03:35	15.1	189.0	276.0	39.1	315.1	0.98
12:03:45	15.1	188.0	277.0	38.9	315.9	0.98
12:03:55	15.1	189.0	275.0	38.9	313.9	0.98
12:04:05	15.1	189.0	276.0	39.0	315.0	0.98
12:04:15	15.2	190.0	274.0	38.9	312.9	0.98
12:04:25	15.2	189.0	271.0	38.8	309.8	0.98
12:04:35	15.2	188.0	274.0	38.9	312.9	0.98
12:04:45	15.0	190.0	274.0	38.8	312.8	0.98
12:04:55	15.2	190.0	275.0	39.0	314.0	0.98
12:05:05	15.2	191.0	275.0	39.1	314.1	0.98
12:05:15	15.1	192.0	274.0	38.9	312.9	0.98
12:05:25	15.2	191.0	276.0	39.1	315.1	0.98
12:05:35	15.1	191.0	275.0	39.0	314.0	0.98
12:05:45	15.1	192.0	272.0	38.8	310.8	0.98
12:05:55	15.2	191.0	270.0	38.6	308.6	0.98
12:06:05	15.2	189.0	268.0	38.5	306.5	0.98
12:06:15	15.2	191.0	269.0	38.6	307.6	0.98
12:06:25	15.2	191.0	266.0	38.3	304.3	0.98
12:06:35	15.2	190.0	266.0	38.2	304.2	0.98
12:06:45	15.1	189.0	269.0	38.6	307.6	0.98
12:06:55	15.1	190.0	270.0	38.7	308.7	0.98
12:07:05	15.2	192.0	269.0	38.6	307.6	0.98
12:07:15	15.1	190.0	268.0	38.5	306.5	0.98
12:07:25	15.2	190.0	275.0	39.0	314.0	0.98
12:07:35	15.1	190.0	275.0	38.8	313.8	0.98
12:07:45	15.1	188.0	272.0	38.8	310.8	0.98
12:07:55	15.1	188.0	273.0	38.6	311.6	0.98
12:08:05	15.2	189.0	272.0	38.6	310.6	0.98
12:08:15	15.2	190.0	270.0	38.5	308.5	0.98
12:08:25	15.2	192.0	270.0	38.7	308.7	0.98

12:08:35	15.2	192.0	267.0	38.4	305.4	0.98
12:08:45	15.2	189.0	265.0	38.1	303.1	0.98
12:08:55	15.2	188.0	267.0	38.3	305.3	0.98
12:09:05	15.2	188.0	276.0	38.9	314.9	0.98
12:09:15	15.1	190.0	278.0	39.1	317.1	0.98
12:09:25	15.2	190.0	274.0	38.6	312.6	0.98
12:09:35	15.1	189.0	272.0	38.7	310.7	0.98
12:09:45	15.1	191.0	274.0	38.8	312.8	0.98
12:09:55	15.2	190.0	276.0	38.9	314.9	0.98
12:10:05	19.5	188.0	143.0	11.5	154.5	0.98
12:10:15	20.7	90.0	50.0	3.1	53.1	0.98
12:10:25	20.8	24.0	25.0	1.2	26.2	0.98
12:10:35	20.9	7.0	16.0	0.6	16.6	0.98
12:10:45	20.9	3.0	11.0	0.4	11.4	0.98
12:10:55	21.0	2.0	9.0	0.3	9.3	0.98
12:11:05	20.9	1.0	7.0	0.2	7.2	0.98
12:11:15	20.9	1.0	5.0	0.1	5.1	0.98
12:11:25	21.0	1.0	4.0	0.1	4.1	0.98
12:11:35	20.9	1.0	4.0	0.1	4.1	0.98
12:11:45	21.0	0.0	3.0	0.1	3.1	0.98
12:11:55	21.0	0.0	3.0	0.1	3.1	0.98
12:12:05	20.9	0.0	2.0	0.0	2.0	0.98
12:12:15	21.0	0.0	2.0	0.1	2.1	0.98
12:12:25	20.9	0.0	2.0	0.0	2.0	0.98
12:12:35	21.0	0.0	1.0	0.0	1.0	0.98
12:12:45	21.0	0.0	1.0	0.0	1.0	0.98
12:12:55	21.0	0.0	1.0	0.0	1.0	0.98
12:13:05	16.3	3.0	109.0	42.2	151.2	0.98
12:13:15	15.4	98.0	177.0	53.1	230.1	0.98
12:13:25	15.3	166.0	204.0	47.6	251.6	0.98
12:13:35	15.2	181.0	221.0	38.6	259.6	0.98
12:13:45	15.2	186.0	242.0	37.2	279.2	0.98
12:13:55	15.2	188.0	255.0	37.6	292.6	0.98
12:14:05	15.2	188.0	254.0	37.5	291.5	0.98
12:14:15	15.2	189.0	259.0	37.8	296.8	0.98
12:14:25	15.2	190.0	260.0	37.8	297.8	0.98
12:14:35	15.2	189.0	265.0	38.2	303.2	0.98
12:14:45	16.2	188.0	266.0	38.3	304.3	0.98
12:14:55	15.2	189.0	267.0	38.4	305.4	0.98
12:15:05	15.2	191.0	266.0	38.2	304.2	0.98
12:15:15	15.2	191.0	264.0	38.2	302.2	0.98
12:15:25	15.2	190.0	265.0	38.2	303.2	0.98
12:15:35	15.2	188.0	271.0	38.7	309.7	0.98
12:15:45	15.1	188.0	277.0	38.9	315.9	0.98
12:15:55	15.3	187.0	271.0	38.5	309.5	0.98
12:16:05	15.1	188.0	271.0	38.4	309.4	0.98
12:16:15	15.2	188.0	270.0	38.5	308.5	0.98
12:16:25	15.1	189.0	272.0	38.4	310.4	0.98

12:16:35	15.2	190.0	271.0	38.3	309.3	0.98
12:16:45	15.2	190.0	270.0	38.3	308.3	0.98
12:16:55	15.2	190.0	272.0	38.5	310.5	0.98
12:17:05	15.1	189.0	274.0	38.8	312.8	0.98
12:17:15	15.1	187.0	278.0	39.0	317.0	0.98
12:17:25	15.1	186.0	276.0	38.8	314.8	0.98
12:17:35	15.2	186.0	272.0	38.7	310.7	0.98
12:17:45	15.2	188.0	270.0	38.5	308.5	0.98
12:17:55	15.2	189.0	270.0	38.4	308.4	0.98
12:18:05	15.2	188.0	269.0	38.3	307.3	0.98
12:18:15	15.2	190.0	268.0	38.4	306.4	0.98
12:18:25	15.2	191.0	267.0	38.3	305.3	0.98
12:18:35	15.2	190.0	266.0	38.2	304.2	0.98
12:18:45	15.2	189.0	264.0	38.2	302.2	0.98
12:18:55	15.1	189.0	269.0	38.4	307.4	0.98
12:19:05	15.2	191.0	271.0	38.7	309.7	0.98
12:19:15	15.1	192.0	271.0	38.5	309.5	0.98
12:19:25	15.2	192.0	268.0	38.4	306.4	0.98
12:19:35	15.2	190.0	267.0	38.3	305.3	0.98
12:19:45	15.2	190.0	267.0	38.2	305.2	0.98
12:19:55	15.2	190.0	265.0	38.0	303.0	0.98

CO/NO Post

Date / time	% O₂	ppm CO	ppm NO	ppm NO₂	ppm NOx	l/min Pump
12:40:30	20.9	0.0	0.0	2.1	2.1	0.00
12:40:40	20.9	0.0	0.0	2.1	2.1	0.98
12:40:50	20.9	0.0	0.0	2.0	2.0	0.98
12:41:00	7.2	11.0	0.0	517.6	517.6	0.97
12:41:10	0.8	661.0	428.0	167.3	595.3	0.98
12:41:20	0.3	1123.0	651.0	47.7	698.7	0.98
12:41:30	0.2	1236.0	715.0	21.6	736.6	0.98
12:41:40	0.2	1264.0	746.0	14.4	760.4	0.98
12:41:50	0.1	1273.0	758.0	11.6	769.6	0.98
12:42:00	0.1	1278.0	765.0	10.2	775.2	0.98
12:42:10	0.1	1280.0	769.0	9.2	778.2	0.98
12:42:20	0.1	1282.0	772.0	8.6	780.6	0.98
12:42:30	0.1	1283.0	773.0	8.1	781.1	0.98
12:42:40	0.1	1284.0	775.0	7.6	782.6	0.98
12:42:50	0.0	1285.0	776.0	7.2	783.2	0.98
12:43:00	0.1	1286.0	777.0	7.0	784.0	0.98
12:43:10	0.0	1286.0	778.0	6.7	784.7	0.98
12:43:20	0.0	1287.0	779.0	6.5	785.5	0.98
12:43:30	0.0	1287.0	780.0	6.2	786.2	0.98
12:43:40	0.0	1288.0	780.0	6.1	786.1	0.98
12:43:50	0.0	1288.0	781.0	6.0	787.0	0.98
12:44:00	0.0	1288.0	781.0	5.8	786.8	0.98
12:44:10	0.0	1289.0	782.0	5.7	787.7	0.98
12:44:20	0.0	1289.0	782.0	5.5	787.5	0.98
12:44:30	0.0	1289.0	783.0	5.5	788.5	0.98
12:44:40	0.0	1290.0	783.0	5.3	788.3	0.98
12:44:50	0.0	1290.0	784.0	5.3	789.3	0.98
12:45:00	0.0	1292.0	785.0	5.2	790.2	0.98
12:45:10	0.0	1291.0	784.0	5.2	789.2	0.98
12:45:20	0.0	1290.0	784.0	5.1	789.1	0.98
12:45:30	0.0	1290.0	784.0	5.0	789.0	0.98
12:45:40	15.3	1276.0	384.0	3.0	387.0	0.98
12:45:50	19.2	673.0	133.0	2.0	135.0	0.98
12:46:00	20.3	165.0	60.0	1.3	61.3	0.98
12:46:10	20.6	55.0	34.0	0.8	34.8	0.98
12:46:20	20.8	28.0	23.0	0.6	23.6	0.98
12:46:30	20.8	18.0	16.0	0.4	16.4	0.98

NO2 Post

Date / time	% O ₂	ppm CO	ppm NO	ppm NO ₂	ppm NOx	l/min Pump
12:58:07	20.9	0.0	0.0	0.6	0.6	0.00
12:58:17	20.9	0.0	0.0	1.3	1.3	0.98
12:58:27	20.9	0.0	0.0	1.1	1.1	0.98
12:58:37	6.8	4.0	22.0	79.2	101.2	0.98
12:58:47	0.8	62.0	0.0	93.1	93.1	0.99
12:58:57	0.4	21.0	0.0	97.8	97.8	0.98
12:59:07	0.1	3.0	0.0	99.3	99.3	0.98
12:59:17	0.1	0.0	0.0	99.8	99.8	0.98
12:59:27	0.1	0.0	0.0	100.0	100.0	0.98
12:59:37	0.1	0.0	0.0	100.1	100.1	0.98
12:59:47	0.1	0.0	0.0	100.3	100.3	0.98
12:59:57	0.1	0.0	0.0	100.3	100.3	0.98
13:00:07	0.1	0.0	0.0	100.4	100.4	0.98
13:00:17	0.1	0.0	0.0	100.5	100.5	0.98
13:00:27	0.1	0.0	0.0	100.4	100.4	0.98
13:00:37	0.1	0.0	0.0	100.5	100.5	0.98
13:00:47	0.1	0.0	0.0	100.5	100.5	0.98
13:00:57	0.1	0.0	0.0	100.6	100.6	0.98
13:01:07	0.1	0.0	0.0	100.6	100.6	0.98
13:01:17	0.1	0.0	0.0	100.6	100.6	0.98
13:01:27	0.1	0.0	0.0	100.6	100.6	0.98
13:01:37	0.1	0.0	0.0	100.7	100.7	0.98
13:01:47	0.1	0.0	0.0	100.7	100.7	0.99
13:01:57	0.1	0.0	0.0	100.7	100.7	0.98
13:02:07	0.1	0.0	0.0	100.8	100.8	0.98
13:02:17	0.1	0.0	0.0	100.7	100.7	0.98
13:02:27	0.1	0.0	0.0	100.8	100.8	0.98
13:02:37	0.1	0.0	0.0	100.8	100.8	0.98
13:02:47	0.1	0.0	0.0	100.8	100.8	0.98
13:02:57	0.1	0.0	0.0	100.8	100.8	0.98
13:03:07	0.1	0.0	0.0	100.8	100.8	0.98
13:03:17	15.1	0.0	2.0	27.9	29.9	0.98
13:03:27	19.1	0.0	2.0	9.6	11.6	0.98
13:03:37	20.3	0.0	1.0	3.2	4.2	0.98
13:03:47	20.7	0.0	0.0	1.7	1.7	0.98
13:03:57	20.8	0.0	0.0	1.1	1.1	0.98
13:04:07	20.8	0.0	0.0	0.8	0.8	0.98

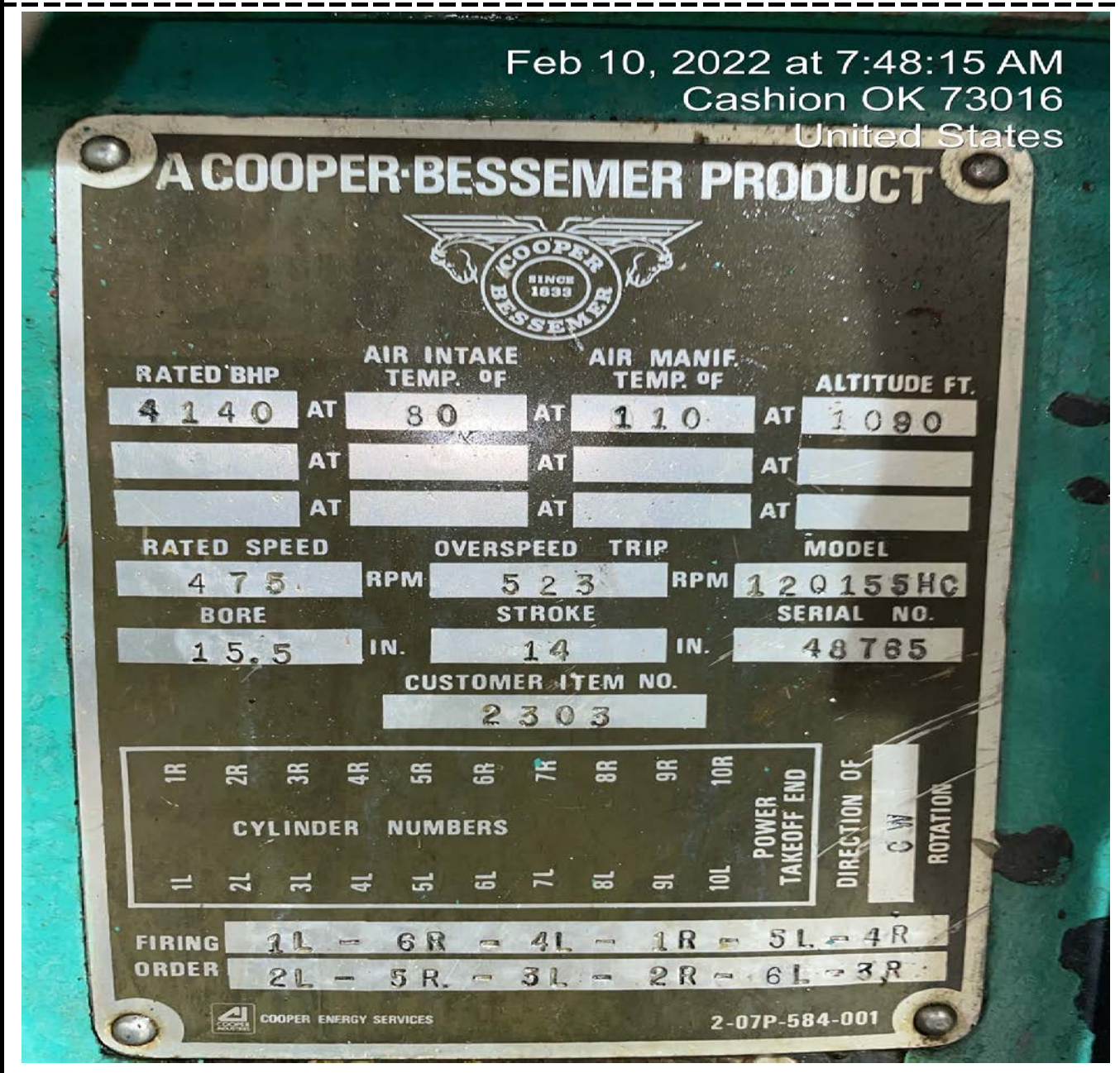
4.0 Test Summary

Unit U-2302 with a serial number of 48765 which is a Cooper Quad 12Q155HC engine located at Cashion Compressor Station and operated by Panhandle Eastern Pipeline was tested for emissions of: (Oxides of Nitrogen) (Carbon Monoxide) . The test was conducted on 02-10-2022 by Jeremiah Giles with Great Plains Analytical Services, Inc. All quality assurance and quality control tests were within acceptable tolerances.

The engine is a natural gas fired Lean Burn (4 Cycle) engine rated at 3940 brake horse power (BHP) at 450 RPM. The engine was operating at 3757.00 BHP and 450 RPM which is 95.36% of maximum engine load during the test.

This test will satisfy the testing requirements for ODEQ Quarterly Compliance. Unit U-2302 is authorized to operate under permit #2018-0674-TVR4.

Site Verification Photos



5.0 Calibrations/System Bias & Drift Check

Span Gas

CO	1302.00
NO	790.10
NO2	100.50
O2	20.90%

Analyzer

Make:	Testo
Model:	350
Serial Number:	7855

Longest Response Time

0:01:40

Direct Calibrations

Start Time: 6:37					
Bottle Concentration			Calibration Response	Absolute Difference	<5% of Span
Zero	CO	0.00	0.00	0.00	0.00%
	NO	0.00	0.00	0.00	0.00%
	NO2	0.00	1.37	1.37	1.36%
	O2	0.00%	0.00%	0.00	0.00%
CO	Mid Level	1302.00	1295.13	6.88	0.53%
NO	Mid Level	790.10	785.13	4.98	0.63%
NO2	High Level	100.50	101.30	0.80	0.80%
O2	High Level	20.90%	20.90%	0.00%	0.00%

Post

Start Time: 12:40							
Bottle Concentration			System Response	Absolute Difference	<5% of Span	<5% Drift	
Zero	CO	0.00	0.00	0.00	0.00%		
	NO	0.00	0.00	0.00	0.00%		
	NO2	0.00	2.07	2.07	2.06%		
	O2	0.00%	0.03%	0.00	0.14%		
CO	Upscale	1302.00	1289.38	12.63	0.97%	0.45%	
NO	Upscale	790.10	782.63	7.48	0.95%	0.32%	
NO2	Upscale	100.50	100.73	0.22	0.22%	0.57%	
O2	Upscale	20.90%	20.90%	0.00	0.00%	0.00%	

6.0 Engine Parameter Data Sheet



Company	Panhandle Eastern Pipeline
Facility	Cashion Compressor Station
Date	2/10/2022
Site Elevation (ft)	1,220
Unit ID	U-2302
Make	Cooper Quad
Model	12Q155HC
Serial Number	48765
Technician	Jeremiah Giles

	Run 1	Run 2	Run 3	Completed
Run Start Times	7:55	8:17	8:39	9:01
Engine Hours	231969	231969	231969	231969

[illegible]

 <-- Not available on this unit

11.0 Signature Page

R0

Job/File Name: Panhandle Eastern Pipeline; Cashion Compressor Station; U-2302; ODEQ
Quarterly Compliance;



We certify that based on review of test data, knowledge of those individuals directly responsible for conducting this test, we believe the submitted information to be accurate and complete.

Company:	G.A.S. Inc.	Date:	2/16/22
Print Name:	Jeremiah Giles		
Title:	Director of PEA Testing		
Signature:	<i>Jeremiah Giles</i>		
Phone Number:	580-515-2920		

Company:	G.A.S. Inc.	Date:	2/16/22
Print Name:	Jeremiah Giles		
Title:	Emissions Specialist		

Company:			
Print Name:		Date:	
Signature:			
Title:			
Phone Number:			

Appendices

(PEA) Special CO/NO High

**CERTIFICATE OF ANALYSIS****Grade of Product: EPA Protocol**

Part Number:	E03NI99E15A7XK1	Reference Number:	54-401126470-1
Cylinder Number:	CC1007	Cylinder Volume:	144.4 Cubic Feet
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12018	Valve Outlet:	660
Gas Code:	CO,NO,NOX,BALN	Certification Date:	Mar 01, 2018

Expiration Date: Mar 01, 2026

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	3500 PPM	3533 PPM	G1	+/- 1% NIST Traceable	02/19/2018, 03/01/2018
NITRIC OXIDE	3500 PPM	3526 PPM	G1	+/- 1% NIST Traceable	02/19/2018, 03/01/2018
CARBON MONOXIDE	4500 PPM	4517 PPM	G1	+/- 1.0% NIST Traceable	02/22/2018
NITROGEN	Balance			-	

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124264848107	SG9148003BAL	5454 PPM NITRIC OXIDE/NITROGEN	+/- 0.7%	Aug 14, 2023
NTRM	14060160	CC437085	990.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Nov 18, 2019
GMIS	1114201605	CC506716	4.995 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.0%	Nov 14, 2019
PRM	12367	APEX1099237	10.0 PPM NITROGEN DIOXIDE/AIR	+/- 1.5%	Jun 02, 2017
NTRM	13060213	CC401957	4950 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Feb 15, 2019

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO-2 SIEMENS ULTRAMAT 6E N1J5700	NDIR	Jan 21, 2018
Nicolet 6700 AHR0801332	FTIR	Feb 21, 2018
Nicolet 6700 AHR0801332	FTIR	Feb 21, 2018

Triad Data Available Upon Request



Signature on file
Approved for Release

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(PEA) Mid CO/NO



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI99E15AC2T0 Reference Number: 54-401845408-1
 Cylinder Number: CC285225 Cylinder Volume: 144.4 CF
 Laboratory: 124 - Chicago (SAP) - IL Cylinder Pressure: 2015 PSIG
 PGPV Number: B12020 Valve Outlet: 660
 Gas Code: CO,NO,NOX,BALN Certification Date: Jul 14, 2020

Expiration Date: Jul 14, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	800.0 PPM	790.1 PPM	G1	+/- 0.6% NIST Traceable	07/07/2020, 07/14/2020
NITRIC OXIDE	800.0 PPM	790.1 PPM	G1	+/- 0.6% NIST Traceable	07/07/2020, 07/14/2020
CARBON MONOXIDE	1300 PPM	1302 PPM	G1	+/- 0.6% NIST Traceable	07/07/2020
NITROGEN	Balance			-	

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	15060242	CC449815	997.2 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Nov 07, 2020
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	7302017104	CC506604	4.426 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Jul 03, 2022
NTRM	08012238	KAL004643	2466 PPM CARBON MONOXIDE/NITROGEN	+/- 0.5%	May 24, 2024

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO-2 SIEMENS ULTRAMAT 6E N1J5700	NDIR	Jun 10, 2020
Nicolet 6700 AMP0900100	FTIR	Jun 15, 2020
Nicolet 6700 AMP0900100	FTIR	Jun 15, 2020

Triad Data Available Upon Request

PERMANENT NOTES:GREAT PLAINS ANALYTICAL



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(PEA) CO/NO Low



CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E03NI99E15AC2S8	Reference Number: 54-401721512-1
Cylinder Number: CC472329	Cylinder Volume: 144.4 CF
Laboratory: 124 - Chicago (SAP) - IL	Cylinder Pressure: 2015 PSIG
PGVP Number: B12020	Valve Outlet: 660
Gas Code: CO,NO,NOX,BALN	Certification Date: Feb 17, 2020

Expiration Date: Feb 17, 2028

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	150.0 PPM	148.9 PPM	G1	+/- 1.4% NIST Traceable	02/10/2020, 02/17/2020
NITRIC OXIDE	150.0 PPM	148.8 PPM	G1	+/- 1.4% NIST Traceable	02/10/2020, 02/17/2020
CARBON MONOXIDE	220.0 PPM	222.9 PPM	G1	+/- 1% NIST Traceable	02/10/2020
NITROGEN	Balance			-	

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	15060350	CC448769	241.0 PPM NITRIC OXIDE/NITROGEN	+/- 0.5%	Mar 30, 2021
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
NTRM	18060128	KAL004272	249.9 PPM NITRIC OXIDE/NITROGEN	+/- 0.4	Nov 08, 2023
GMIS	7302017104	CC506604	4.426 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%	Jul 03, 2022
NTRM	13010131	ND48544	495.4 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Jul 03, 2024

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

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AMP0900100	FTIR	Feb 03, 2020
Nicolet 6700 AMP0900100	FTIR	Feb 03, 2020
Nicolet 6700 AMP0900100	FTIR	Feb 03, 2020

Triad Data Available Upon Request

PERMANENT NOTES: GREAT PLAINS ANALYTICAL



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(PEA) NO2 High



Airgas Specialty Gases
 Airgas USA, LLC
 12722 S. Wentworth Ave.
 Chicago, IL 60628
 Airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15W51V7	Reference Number:	54-402246614-1
Cylinder Number:	CC503115	Cylinder Volume:	144.0 CF
Laboratory:	124 - Chicago (SAP) - IL	Cylinder Pressure:	2016 PSIG
PGVP Number:	B12021	Valve Outlet:	660
Gas Code:	NO2,BALN	Certification Date:	Oct 20, 2021

Expiration Date: Oct 20, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NITROGEN DIOXIDE	100.0 PPM	100.5 PPM	G1	+/- 2% NIST Traceable	10/12/2021, 10/20/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	1534002020601	EB0130023	101 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.4%	Apr 30, 2024
PRM	12397	D887665	74.2 PPM NITROGEN DIOXIDE/AIR	+/- 1.3%	Feb 02, 2022

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
MKS FTIR NO2 017707558	FTIR	Oct 14, 2021

Triad Data Available Upon Request

PERMANENT NOTES: OXYGEN ADDED TO MAINTAIN STABILITY



 Signature on file
 Approved for Release

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7.0 Raw Data

CO/NO Pre						
Date / time	% O ₂	ppm CO	ppm NO	ppm NO ₂	ppm NOx	l/min Pump
6:37:46	20.9	0.0	0.0	1.7	1.7	0.82
6:37:56	20.9	0.0	0.0	1.5	1.5	0.98
6:38:06	20.9	0.0	0.0	0.9	0.9	0.98
6:38:16	15.8	333.0	451.0	0.5	451.5	0.98
6:38:26	4.4	1104.0	577.0	0.2	577.2	0.98
6:38:36	2.7	1188.0	687.0	0.0	687.0	0.98
6:38:46	1.5	1243.0	699.0	0.0	699.0	0.98
6:38:56	0.9	1267.0	723.0	0.0	723.0	0.98
6:39:06	0.2	1278.0	745.0	0.0	745.0	0.98
6:39:16	0.1	1282.0	772.0	0.0	772.0	0.98
6:39:26	0.0	1288.0	778.0	0.0	778.0	0.99
6:39:36	0.0	1290.0	780.0	0.0	780.0	0.98
6:39:46	0.0	1292.0	781.0	0.0	781.0	0.98
6:39:56	0.0	1293.0	782.0	0.0	782.0	0.98
6:40:06	0.0	1293.0	783.0	0.0	783.0	0.98
6:40:16	0.0	1293.0	783.0	0.0	783.0	0.98
6:40:26	0.0	1293.0	783.0	0.0	783.0	0.98
6:40:36	0.0	1294.0	784.0	0.0	784.0	0.98
6:40:46	0.0	1294.0	784.0	0.0	784.0	0.98
6:40:56	0.0	1294.0	784.0	0.0	784.0	0.98
6:41:06	0.0	1294.0	784.0	0.0	784.0	0.98
6:41:16	0.0	1295.0	785.0	0.0	785.0	0.98
6:41:26	0.0	1295.0	785.0	0.0	785.0	0.98
6:41:36	0.0	1295.0	785.0	0.0	785.0	0.98
6:41:46	0.0	1295.0	785.0	0.0	785.0	0.99
6:41:56	0.0	1295.0	785.0	0.0	785.0	0.98
6:42:06	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:16	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:26	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:36	0.0	1296.0	786.0	0.0	786.0	0.98
6:42:46	0.0	1297.0	786.0	0.0	786.0	0.98
6:42:56	12.9	1119.0	787.0	0.0	787.0	0.99
6:43:06	18.9	667.0	443.0	0.0	443.0	0.99
6:43:16	20.2	421.0	211.0	0.0	211.0	0.98
6:43:26	20.9	213.0	96.0	0.0	96.0	0.98
6:43:36	21.0	67.0	53.0	0.0	53.0	0.98
6:43:46	21.1	15.0	21.0	0.0	21.0	0.98

NO2 Pre

Date / time	% O₂	ppm CO	ppm NO	ppm NO₂	ppm NOx	l/min Pump
7:00:51	20.9	0.0	0.0	1.6	1.6	1.43
7:01:01	20.9	0.0	0.0	1.2	1.2	0.98
7:01:11	20.9	0.0	0.0	1.0	1.0	0.98
7:01:21	10.9	0.0	0.0	66.7	66.7	0.98
7:01:31	3.4	0.0	0.0	93.2	93.2	0.98
7:01:41	2.8	0.0	0.0	98.6	98.6	0.98
7:01:51	1.0	0.0	0.0	100.2	100.2	0.98
7:02:01	0.7	0.0	0.0	100.9	100.9	0.98
7:02:11	0.1	0.0	0.0	101.0	101.0	0.98
7:02:21	0.1	0.0	0.0	101.1	101.1	0.98
7:02:31	0.1	0.0	0.0	101.3	101.3	0.98
7:02:41	0.1	0.0	0.0	101.7	101.7	0.98
7:02:51	0.1	0.0	0.0	101.2	101.2	0.98
7:03:01	0.1	0.0	0.0	101.2	101.2	0.98
7:03:11	0.1	0.0	0.0	101.2	101.2	0.98
7:03:21	0.1	0.0	0.0	101.2	101.2	0.98
7:03:31	0.1	0.0	0.0	101.2	101.2	0.99
7:03:41	0.1	0.0	0.0	101.2	101.2	0.98
7:03:51	0.1	0.0	0.0	101.3	101.3	0.98
7:04:01	0.1	0.0	0.0	101.3	101.3	0.98
7:04:11	0.1	0.0	0.0	101.3	101.3	0.98
7:04:21	0.1	0.0	0.0	101.3	101.3	0.98
7:04:31	0.1	0.0	0.0	101.3	101.3	0.98
7:04:41	0.1	0.0	0.0	101.3	101.3	0.98
7:04:51	0.1	0.0	0.0	101.3	101.3	0.98
7:05:01	0.1	0.0	0.0	101.3	101.3	0.98
7:05:11	0.1	0.0	0.0	101.3	101.3	0.98
7:05:21	0.1	0.0	0.0	101.3	101.3	0.98
7:05:31	0.1	0.0	0.0	101.4	101.4	0.98
7:05:41	0.1	0.0	0.0	101.4	101.4	0.98
7:05:51	0.1	0.0	0.0	101.4	101.4	0.98
7:06:01	19.9	0.0	0.0	28.8	28.8	0.98
7:06:11	20.5	0.0	0.0	6.7	6.7	0.98
7:06:21	20.7	0.0	0.0	1.9	1.9	0.98
7:06:31	20.7	0.0	0.0	0.6	0.6	0.98
7:06:41	20.8	0.0	0.0	0.2	0.2	0.98
7:06:51	20.9	0.0	0.0	0.0	0.0	0.98

Source Test

Date / time	% O ₂	ppm CO	ppm NO	ppm NO ₂	ppm NO _x	I/min Pump
7:55:19	20.9	0.0	2.0	0.1	2.1	0.06
7:55:29	20.9	0.0	2.0	0.0	2.0	0.98
7:55:39	20.9	0.0	1.0	0.0	1.0	0.97
7:55:49	16.7	44.0	168.0	50.2	218.2	0.96
7:55:59	16.3	143.0	205.0	48.8	253.8	0.97
7:56:09	16.1	167.0	226.0	42.2	268.2	0.97
7:56:19	16.0	182.0	236.0	30.2	266.2	0.97
7:56:29	16.0	189.0	261.0	19.8	280.8	0.97
7:56:39	16.0	186.0	276.0	17.5	293.5	0.97
7:56:49	16.1	184.0	274.0	16.9	290.9	0.97
7:56:59	16.1	183.0	279.0	17.3	296.3	0.97
7:57:09	16.1	184.0	285.0	17.5	302.5	0.97
7:57:19	16.0	184.0	287.0	17.6	304.6	0.97
7:57:29	16.0	184.0	287.0	17.8	304.8	0.97
7:57:39	16.0	185.0	290.0	18.1	308.1	0.97
7:57:49	16.0	184.0	290.0	18.2	308.2	0.97
7:57:59	16.0	185.0	286.0	18.0	304.0	0.97
7:58:09	16.0	186.0	282.0	17.9	299.9	0.97
7:58:19	16.0	185.0	287.0	18.6	305.6	0.97
7:58:29	16.0	185.0	287.0	18.8	305.8	0.97
7:58:39	16.0	186.0	292.0	19.5	311.5	0.97
7:58:49	15.9	188.0	290.0	19.4	309.4	0.97
7:58:59	16.0	189.0	283.0	19.1	302.1	0.97
7:59:09	15.9	188.0	284.0	19.6	303.6	0.97
7:59:19	15.9	189.0	289.0	20.2	309.2	0.97
7:59:29	15.9	191.0	292.0	20.7	312.7	0.97
7:59:39	15.9	190.0	291.0	21.1	312.1	0.96
7:59:49	15.9	192.0	293.0	21.2	314.2	0.97
7:59:59	15.8	193.0	287.0	21.1	308.1	0.97
8:00:09	15.9	194.0	279.0	20.7	299.7	0.97
8:00:19	15.8	195.0	276.0	20.8	296.8	0.98
8:00:29	15.9	196.0	274.0	21.1	295.1	0.98
8:00:39	15.9	197.0	270.0	21.0	291.0	0.98
8:00:49	15.8	197.0	263.0	21.1	284.1	0.98
8:00:59	15.8	198.0	263.0	21.1	284.1	0.98
8:01:09	15.9	200.0	255.0	20.9	275.9	0.98
8:01:19	15.9	203.0	252.0	21.3	273.3	0.98
8:01:29	15.8	206.0	251.0	21.3	272.3	0.98
8:01:39	15.9	206.0	251.0	22.0	273.0	0.98
8:01:49	15.8	210.0	253.0	22.1	275.1	0.98
8:01:59	15.8	209.0	253.0	22.1	275.1	0.98
8:02:09	15.8	206.0	250.0	22.1	272.1	0.98
8:02:19	15.8	205.0	252.0	22.2	274.2	0.98
8:02:29	15.8	209.0	245.0	22.2	267.2	0.98
8:02:39	15.8	211.0	244.0	22.4	266.4	0.98
8:02:49	15.8	211.0	247.0	22.8	269.8	0.98

8:02:59	15.7	210.0	248.0	22.9	270.9	0.98
8:03:09	15.8	208.0	244.0	22.7	266.7	0.98
8:03:19	15.8	210.0	243.0	22.9	265.9	0.98
8:03:29	15.7	212.0	245.0	23.1	268.1	0.98
8:03:39	15.7	213.0	239.0	22.9	261.9	0.98
8:03:49	15.7	215.0	236.0	22.7	258.7	0.98
8:03:59	15.7	214.0	241.0	23.2	264.2	0.98
8:04:09	15.7	214.0	241.0	23.6	264.6	0.98
8:04:19	15.7	213.0	252.0	24.3	276.3	0.98
8:04:29	15.7	209.0	252.0	24.3	276.3	0.98
8:04:39	15.7	212.0	251.0	24.2	275.2	0.98
8:04:49	15.7	213.0	247.0	24.3	271.3	0.98
8:04:59	15.7	213.0	253.0	24.8	277.8	0.98
8:05:09	15.7	213.0	253.0	24.8	277.8	0.98
8:05:19	15.7	215.0	250.0	24.7	274.7	0.98
8:05:29	15.6	219.0	245.0	24.5	269.5	0.98
8:05:39	15.8	218.0	242.0	24.4	266.4	0.98
8:05:49	15.7	217.0	242.0	24.4	266.4	0.98
8:05:59	15.7	214.0	252.0	25.2	277.2	0.98
8:06:09	15.6	211.0	262.0	26.2	288.2	0.98
8:06:19	15.6	213.0	260.0	25.8	285.8	0.98
8:06:29	15.6	214.0	260.0	26.1	286.1	0.98
8:06:39	15.6	214.0	265.0	26.2	291.2	0.98
8:06:49	15.6	214.0	259.0	26.0	285.0	0.98
8:06:59	15.6	217.0	266.0	26.7	292.7	0.98
8:07:09	15.6	218.0	262.0	26.4	288.4	0.98
8:07:19	15.6	217.0	257.0	26.2	283.2	0.98
8:07:29	15.5	219.0	259.0	26.3	285.3	0.98
8:07:39	15.6	219.0	255.0	26.0	281.0	0.98
8:07:49	15.5	215.0	250.0	25.8	275.8	0.98
8:07:59	15.6	218.0	252.0	26.2	278.2	0.98
8:08:09	15.6	222.0	256.0	26.7	282.7	0.98
8:08:19	15.6	223.0	265.0	27.4	292.4	0.98
8:08:29	15.5	220.0	267.0	27.4	294.4	0.98
8:08:39	15.6	218.0	268.0	27.4	295.4	0.98
8:08:49	15.5	216.0	275.0	28.0	303.0	0.98
8:08:59	15.5	216.0	280.0	28.3	308.3	0.98
8:09:09	15.5	216.0	280.0	28.2	308.2	0.98
8:09:19	15.5	216.0	278.0	28.4	306.4	0.98
8:09:29	15.5	214.0	277.0	28.1	305.1	0.98
8:09:39	15.5	215.0	270.0	27.8	297.8	0.98
8:09:49	15.6	217.0	269.0	27.8	296.8	0.98
8:09:59	15.5	214.0	271.0	27.9	298.9	0.98
8:10:09	15.5	213.0	273.0	28.2	301.2	0.98
8:10:19	15.5	216.0	279.0	28.9	307.9	0.98
8:10:29	15.5	217.0	286.0	29.4	315.4	0.98
8:10:39	15.5	215.0	292.0	30.1	322.1	0.98
8:10:49	15.5	213.0	292.0	29.5	321.5	0.98

8:10:59	15.5	214.0	285.0	29.1	314.1	0.98
8:11:09	15.5	213.0	283.0	29.3	312.3	0.98
8:11:19	15.5	216.0	282.0	29.2	311.2	0.98
8:11:29	15.5	219.0	290.0	30.0	320.0	0.98
8:11:39	15.5	217.0	291.0	29.9	320.9	0.98
8:11:49	15.5	214.0	292.0	30.5	322.5	0.98
8:11:59	15.5	214.0	300.0	31.0	331.0	0.98
8:12:09	15.4	213.0	303.0	31.2	334.2	0.98
8:12:19	15.5	213.0	298.0	30.6	328.6	0.98
8:12:29	15.5	213.0	293.0	30.3	323.3	0.98
8:12:39	15.5	213.0	288.0	29.8	317.8	0.98
8:12:49	15.5	212.0	281.0	29.7	310.7	0.98
8:12:59	15.5	214.0	288.0	30.8	318.8	0.98
8:13:09	15.5	216.0	297.0	31.1	328.1	0.98
8:13:19	15.4	212.0	300.0	31.5	331.5	0.98
8:13:29	15.4	213.0	302.0	31.6	333.6	0.98
8:13:39	15.4	213.0	303.0	31.4	334.4	0.98
8:13:49	15.4	212.0	294.0	30.8	324.8	0.98
8:13:59	15.4	214.0	290.0	30.7	320.7	0.98
8:14:09	15.5	216.0	291.0	31.0	322.0	0.98
8:14:19	15.5	217.0	294.0	31.4	325.4	0.98
8:14:29	19.6	212.0	157.0	8.7	165.7	0.98
8:14:39	20.8	100.0	57.0	2.2	59.2	0.98
8:14:49	21.0	27.0	31.0	0.7	31.7	0.98
8:14:59	21.0	10.0	21.0	0.2	21.2	0.98
8:15:09	21.0	5.0	16.0	0.1	16.1	0.98
8:15:19	20.9	3.0	13.0	0.0	13.0	0.98
8:15:29	21.0	3.0	11.0	0.0	11.0	0.98
8:15:39	21.0	2.0	10.0	0.0	10.0	0.98
8:15:49	21.0	2.0	9.0	0.0	9.0	0.98
8:15:59	21.0	1.0	8.0	0.0	8.0	0.98
8:16:09	21.0	1.0	8.0	0.0	8.0	0.98
8:16:19	21.0	1.0	7.0	0.0	7.0	0.98
8:16:29	21.0	1.0	7.0	0.0	7.0	0.98
8:16:39	21.0	1.0	6.0	0.0	6.0	0.99
8:16:49	21.0	1.0	6.0	0.0	6.0	0.98
8:16:59	21.0	1.0	6.0	0.0	6.0	0.98
8:17:09	21.0	1.0	6.0	0.0	6.0	0.98
8:17:19	21.0	1.0	5.0	0.0	5.0	0.98
8:17:29	16.8	3.0	114.0	59.4	173.4	0.97
8:17:39	15.7	112.0	185.0	78.4	263.4	0.98
8:17:49	15.6	183.0	211.0	60.3	271.3	0.98
8:17:59	15.5	201.0	230.0	48.9	278.9	0.98
8:18:09	15.4	210.0	274.0	37.0	311.0	0.98
8:18:19	15.5	214.0	295.0	35.5	330.5	0.98
8:18:29	15.5	209.0	300.0	35.2	335.2	0.98
8:18:39	15.5	208.0	300.0	35.1	335.1	0.98
8:18:49	15.5	207.0	309.0	36.1	345.1	0.98

8:18:59	15.5	206.0	318.0	36.9	354.9	0.98
8:19:09	15.5	206.0	316.0	36.5	352.5	0.98
8:19:19	15.5	205.0	318.0	36.5	354.5	0.98
8:19:29	15.4	205.0	321.0	36.4	357.4	0.98
8:19:39	15.5	204.0	318.0	36.0	354.0	0.98
8:19:49	15.4	204.0	312.0	35.1	347.1	0.98
8:19:59	15.6	204.0	310.0	35.2	345.2	0.98
8:20:09	15.5	205.0	306.0	34.7	340.7	0.98
8:20:19	15.5	207.0	311.0	35.0	346.0	0.98
8:20:29	15.5	205.0	315.0	35.6	350.6	0.98
8:20:39	15.5	206.0	316.0	35.3	351.3	0.98
8:20:49	15.5	208.0	305.0	34.4	339.4	0.98
8:20:59	15.5	209.0	298.0	33.5	331.5	0.98
8:21:09	15.5	210.0	295.0	33.4	328.4	0.98
8:21:19	15.5	208.0	298.0	33.7	331.7	0.98
8:21:29	15.4	207.0	311.0	35.1	346.1	0.98
8:21:39	15.4	207.0	309.0	34.5	343.5	0.98
8:21:49	15.5	206.0	296.0	33.0	329.0	0.98
8:21:59	15.6	209.0	286.0	32.6	318.6	0.98
8:22:09	15.5	209.0	287.0	32.8	319.8	0.98
8:22:19	15.5	211.0	288.0	32.9	320.9	0.98
8:22:29	15.5	214.0	290.0	33.1	323.1	0.98
8:22:39	15.6	214.0	284.0	32.4	316.4	0.98
8:22:49	15.6	216.0	276.0	31.8	307.8	0.98
8:22:59	15.5	215.0	279.0	32.1	311.1	0.98
8:23:09	15.5	213.0	279.0	32.1	311.1	0.98
8:23:19	15.5	213.0	279.0	32.1	311.1	0.98
8:23:29	15.5	213.0	280.0	32.1	312.1	0.98
8:23:39	15.5	214.0	279.0	32.2	311.2	0.98
8:23:49	15.5	215.0	281.0	32.3	313.3	0.98
8:23:59	15.4	218.0	278.0	32.0	310.0	0.98
8:24:09	15.5	218.0	275.0	31.7	306.7	0.98
8:24:19	15.5	220.0	263.0	30.7	293.7	0.98
8:24:29	15.5	223.0	260.0	30.6	290.6	0.98
8:24:39	15.5	223.0	262.0	31.0	293.0	0.98
8:24:49	15.5	221.0	268.0	31.6	299.6	0.98
8:24:59	15.4	219.0	265.0	31.2	296.2	0.98
8:25:09	15.5	218.0	272.0	31.6	303.6	0.98
8:25:19	15.4	218.0	267.0	31.2	298.2	0.98
8:25:29	15.5	219.0	265.0	30.9	295.9	0.98
8:25:39	15.4	222.0	263.0	30.8	293.8	0.98
8:25:49	15.4	224.0	267.0	31.2	298.2	0.98
8:25:59	15.4	224.0	275.0	31.6	306.6	0.98
8:26:09	15.4	222.0	278.0	31.7	309.7	0.98
8:26:19	15.4	218.0	282.0	32.1	314.1	0.98
8:26:29	15.5	218.0	281.0	32.2	313.2	0.98
8:26:39	15.4	220.0	282.0	32.2	314.2	0.98
8:26:49	15.4	223.0	275.0	31.6	306.6	0.98

8:26:59	15.5	223.0	269.0	31.2	300.2	0.98
8:27:09	15.4	223.0	278.0	32.2	310.2	0.98
8:27:19	15.4	222.0	281.0	32.3	313.3	0.98
8:27:29	15.4	221.0	288.0	32.7	320.7	0.98
8:27:39	15.4	220.0	287.0	32.7	319.7	0.98
8:27:49	15.4	221.0	284.0	32.3	316.3	0.98
8:27:59	15.4	221.0	282.0	32.5	314.5	0.98
8:28:09	15.3	224.0	281.0	32.6	313.6	0.98
8:28:19	15.4	223.0	276.0	32.1	308.1	0.98
8:28:29	15.4	222.0	274.0	32.0	306.0	0.98
8:28:39	15.4	222.0	269.0	31.8	300.8	0.98
8:28:49	15.4	223.0	274.0	32.2	306.2	0.98
8:28:59	15.4	227.0	270.0	31.7	301.7	0.98
8:29:09	15.4	226.0	267.0	31.4	298.4	0.98
8:29:19	15.4	224.0	270.0	31.9	301.9	0.98
8:29:29	15.4	224.0	275.0	32.1	307.1	0.98
8:29:39	15.4	225.0	278.0	32.2	310.2	0.98
8:29:49	15.4	224.0	284.0	32.9	316.9	0.98
8:29:59	15.3	221.0	294.0	33.6	327.6	0.98
8:30:09	15.3	218.0	287.0	32.7	319.7	0.98
8:30:19	15.3	222.0	278.0	32.3	310.3	0.98
8:30:29	15.4	222.0	276.0	32.1	308.1	0.98
8:30:39	15.4	222.0	279.0	32.3	311.3	0.98
8:30:49	15.3	222.0	287.0	33.0	320.0	0.98
8:30:59	15.3	222.0	288.0	32.6	320.6	0.98
8:31:09	15.3	219.0	288.0	32.9	320.9	0.98
8:31:19	15.4	221.0	288.0	32.7	320.7	0.98
8:31:29	15.4	223.0	280.0	32.5	312.5	0.98
8:31:39	15.4	224.0	279.0	32.2	311.2	0.98
8:31:49	15.4	223.0	284.0	32.7	316.7	0.98
8:31:59	15.4	222.0	292.0	33.4	325.4	0.98
8:32:09	15.4	222.0	295.0	33.8	328.8	0.98
8:32:19	15.3	220.0	305.0	34.5	339.5	0.98
8:32:29	15.3	219.0	311.0	34.7	345.7	0.98
8:32:39	15.3	215.0	303.0	34.0	337.0	0.98
8:32:49	15.3	215.0	301.0	34.1	335.1	0.98
8:32:59	15.3	218.0	310.0	34.8	344.8	0.98
8:33:09	15.3	218.0	308.0	34.4	342.4	0.98
8:33:19	15.3	216.0	313.0	35.0	348.0	0.98
8:33:29	15.4	214.0	311.0	34.5	345.5	0.98
8:33:39	15.4	218.0	304.0	34.1	338.1	0.98
8:33:49	15.4	217.0	304.0	34.0	338.0	0.98
8:33:59	15.3	214.0	302.0	33.9	335.9	0.98
8:34:09	15.4	213.0	307.0	34.4	341.4	0.98
8:34:19	15.3	215.0	307.0	34.2	341.2	0.98
8:34:29	15.4	215.0	307.0	34.5	341.5	0.98
8:34:39	15.4	215.0	307.0	34.3	341.3	0.98
8:34:49	15.4	213.0	313.0	35.3	348.3	0.98

8:34:59	15.4	214.0	307.0	34.5	341.5	0.98
8:35:09	15.4	217.0	298.0	33.7	331.7	0.98
8:35:19	15.4	218.0	289.0	33.1	322.1	0.98
8:35:29	15.4	218.0	295.0	33.6	328.6	0.98
8:35:39	15.4	218.0	297.0	33.9	330.9	0.98
8:35:49	15.4	217.0	302.0	34.0	336.0	0.98
8:35:59	15.4	216.0	305.0	34.3	339.3	0.98
8:36:09	15.3	216.0	314.0	35.0	349.0	0.98
8:36:19	15.3	216.0	313.0	34.8	347.8	0.98
8:36:29	19.4	212.0	161.0	11.2	172.2	0.98
8:36:39	20.8	107.0	68.0	3.1	71.1	0.98
8:36:49	20.9	32.0	38.0	1.2	39.2	0.98
8:36:59	21.0	12.0	25.0	0.6	25.6	0.98
8:37:09	21.0	6.0	19.0	0.1	19.1	0.98
8:37:19	21.0	4.0	15.0	0.0	15.0	0.98
8:37:29	21.0	3.0	13.0	0.0	13.0	0.98
8:37:39	21.0	2.0	11.0	0.0	11.0	0.98
8:37:49	21.0	2.0	10.0	0.0	10.0	0.98
8:37:59	21.0	1.0	9.0	0.0	9.0	0.98
8:38:09	21.0	1.0	9.0	0.0	9.0	0.98
8:38:19	21.0	1.0	8.0	0.0	8.0	0.98
8:38:29	21.0	1.0	7.0	0.0	7.0	0.98
8:38:39	21.0	1.0	7.0	0.0	7.0	0.98
8:38:49	21.0	1.0	7.0	0.0	7.0	0.98
8:38:59	21.0	1.0	6.0	0.0	6.0	0.98
8:39:09	21.0	0.0	6.0	0.0	6.0	0.98
8:39:19	21.0	0.0	6.0	0.0	6.0	0.98
8:39:29	17.0	3.0	110.0	61.0	171.0	0.97
8:39:39	15.6	113.0	189.0	75.0	264.0	0.98
8:39:49	15.5	186.0	216.0	56.8	272.8	0.98
8:39:59	15.4	202.0	234.0	47.5	281.5	0.98
8:40:09	15.5	209.0	265.0	36.8	301.8	0.98
8:40:19	15.5	216.0	299.0	37.9	336.9	0.98
8:40:29	15.5	212.0	306.0	38.1	344.1	0.98
8:40:39	15.4	210.0	312.0	38.7	350.7	0.98
8:40:49	15.4	208.0	315.0	39.0	354.0	0.98
8:40:59	15.5	209.0	319.0	39.1	358.1	0.98
8:41:09	15.5	206.0	322.0	39.4	361.4	0.98
8:41:19	15.5	207.0	310.0	37.6	347.6	0.98
8:41:29	15.5	212.0	288.0	35.9	323.9	0.98
8:41:39	15.5	215.0	289.0	36.2	325.2	0.98
8:41:49	15.5	214.0	300.0	37.0	337.0	0.98
8:41:59	15.5	212.0	305.0	37.3	342.3	0.98
8:42:09	15.5	213.0	306.0	37.0	343.0	0.98
8:42:19	15.5	214.0	298.0	35.8	333.8	0.98
8:42:29	15.5	215.0	288.0	35.0	323.0	0.98
8:42:39	15.4	213.0	293.0	35.2	328.2	0.98
8:42:49	15.5	214.0	296.0	35.3	331.3	0.98

8:42:59	15.5	215.0	290.0	34.7	324.7	0.98
8:43:09	15.5	215.0	286.0	34.2	320.2	0.98
8:43:19	15.5	216.0	291.0	34.6	325.6	0.98
8:43:29	15.5	217.0	296.0	35.0	331.0	0.98
8:43:39	15.5	216.0	289.0	34.2	323.2	0.98
8:43:49	15.5	214.0	284.0	33.8	317.8	0.98
8:43:59	15.5	216.0	280.0	33.3	313.3	0.98
8:44:09	15.5	218.0	281.0	33.6	314.6	0.98
8:44:19	15.4	218.0	289.0	34.1	323.1	0.98
8:44:29	15.5	215.0	298.0	34.7	332.7	0.98
8:44:39	15.5	211.0	289.0	33.7	322.7	0.98
8:44:49	15.5	212.0	277.0	32.9	309.9	0.98
8:44:59	15.5	214.0	269.0	32.2	301.2	0.98
8:45:09	15.5	216.0	272.0	32.6	304.6	0.98
8:45:19	15.4	217.0	282.0	33.8	315.8	0.98
8:45:29	15.4	216.0	287.0	33.6	320.6	0.98
8:45:39	15.5	217.0	282.0	33.0	315.0	0.98
8:45:49	15.5	216.0	264.0	31.8	295.8	0.98
8:45:59	15.5	221.0	254.0	31.3	285.3	0.98
8:46:09	15.6	222.0	256.0	31.3	287.3	0.98
8:46:19	15.5	224.0	261.0	32.1	293.1	0.98

CO/NO Post

Date / time	% O₂	ppm CO	ppm NO	ppm NO₂	ppm NOx	l/min Pump
12:40:30	20.9	0.0	0.0	2.1	2.1	0.00
12:40:40	20.9	0.0	0.0	2.1	2.1	0.98
12:40:50	20.9	0.0	0.0	2.0	2.0	0.98
12:41:00	7.2	11.0	0.0	517.6	517.6	0.97
12:41:10	0.8	661.0	428.0	167.3	595.3	0.98
12:41:20	0.3	1123.0	651.0	47.7	698.7	0.98
12:41:30	0.2	1236.0	715.0	21.6	736.6	0.98
12:41:40	0.2	1264.0	746.0	14.4	760.4	0.98
12:41:50	0.1	1273.0	758.0	11.6	769.6	0.98
12:42:00	0.1	1278.0	765.0	10.2	775.2	0.98
12:42:10	0.1	1280.0	769.0	9.2	778.2	0.98
12:42:20	0.1	1282.0	772.0	8.6	780.6	0.98
12:42:30	0.1	1283.0	773.0	8.1	781.1	0.98
12:42:40	0.1	1284.0	775.0	7.6	782.6	0.98
12:42:50	0.0	1285.0	776.0	7.2	783.2	0.98
12:43:00	0.1	1286.0	777.0	7.0	784.0	0.98
12:43:10	0.0	1286.0	778.0	6.7	784.7	0.98
12:43:20	0.0	1287.0	779.0	6.5	785.5	0.98
12:43:30	0.0	1287.0	780.0	6.2	786.2	0.98
12:43:40	0.0	1288.0	780.0	6.1	786.1	0.98
12:43:50	0.0	1288.0	781.0	6.0	787.0	0.98
12:44:00	0.0	1288.0	781.0	5.8	786.8	0.98
12:44:10	0.0	1289.0	782.0	5.7	787.7	0.98
12:44:20	0.0	1289.0	782.0	5.5	787.5	0.98
12:44:30	0.0	1289.0	783.0	5.5	788.5	0.98
12:44:40	0.0	1290.0	783.0	5.3	788.3	0.98
12:44:50	0.0	1290.0	784.0	5.3	789.3	0.98
12:45:00	0.0	1292.0	785.0	5.2	790.2	0.98
12:45:10	0.0	1291.0	784.0	5.2	789.2	0.98
12:45:20	0.0	1290.0	784.0	5.1	789.1	0.98
12:45:30	0.0	1290.0	784.0	5.0	789.0	0.98
12:45:40	15.3	1276.0	384.0	3.0	387.0	0.98
12:45:50	19.2	673.0	133.0	2.0	135.0	0.98
12:46:00	20.3	165.0	60.0	1.3	61.3	0.98
12:46:10	20.6	55.0	34.0	0.8	34.8	0.98
12:46:20	20.8	28.0	23.0	0.6	23.6	0.98
12:46:30	20.8	18.0	16.0	0.4	16.4	0.98

NO2 Post

Date / time	% O ₂	ppm CO	ppm NO	ppm NO ₂	ppm NOx	l/min Pump
12:58:07	20.9	0.0	0.0	0.6	0.6	0.00
12:58:17	20.9	0.0	0.0	1.3	1.3	0.98
12:58:27	20.9	0.0	0.0	1.1	1.1	0.98
12:58:37	6.8	4.0	22.0	79.2	101.2	0.98
12:58:47	0.8	62.0	0.0	93.1	93.1	0.99
12:58:57	0.4	21.0	0.0	97.8	97.8	0.98
12:59:07	0.1	3.0	0.0	99.3	99.3	0.98
12:59:17	0.1	0.0	0.0	99.8	99.8	0.98
12:59:27	0.1	0.0	0.0	100.0	100.0	0.98
12:59:37	0.1	0.0	0.0	100.1	100.1	0.98
12:59:47	0.1	0.0	0.0	100.3	100.3	0.98
12:59:57	0.1	0.0	0.0	100.3	100.3	0.98
13:00:07	0.1	0.0	0.0	100.4	100.4	0.98
13:00:17	0.1	0.0	0.0	100.5	100.5	0.98
13:00:27	0.1	0.0	0.0	100.4	100.4	0.98
13:00:37	0.1	0.0	0.0	100.5	100.5	0.98
13:00:47	0.1	0.0	0.0	100.5	100.5	0.98
13:00:57	0.1	0.0	0.0	100.6	100.6	0.98
13:01:07	0.1	0.0	0.0	100.6	100.6	0.98
13:01:17	0.1	0.0	0.0	100.6	100.6	0.98
13:01:27	0.1	0.0	0.0	100.6	100.6	0.98
13:01:37	0.1	0.0	0.0	100.7	100.7	0.98
13:01:47	0.1	0.0	0.0	100.7	100.7	0.99
13:01:57	0.1	0.0	0.0	100.7	100.7	0.98
13:02:07	0.1	0.0	0.0	100.8	100.8	0.98
13:02:17	0.1	0.0	0.0	100.7	100.7	0.98
13:02:27	0.1	0.0	0.0	100.8	100.8	0.98
13:02:37	0.1	0.0	0.0	100.8	100.8	0.98
13:02:47	0.1	0.0	0.0	100.8	100.8	0.98
13:02:57	0.1	0.0	0.0	100.8	100.8	0.98
13:03:07	0.1	0.0	0.0	100.8	100.8	0.98
13:03:17	15.1	0.0	2.0	27.9	29.9	0.98
13:03:27	19.1	0.0	2.0	9.6	11.6	0.98
13:03:37	20.3	0.0	1.0	3.2	4.2	0.98
13:03:47	20.7	0.0	0.0	1.7	1.7	0.98
13:03:57	20.8	0.0	0.0	1.1	1.1	0.98
13:04:07	20.8	0.0	0.0	0.8	0.8	0.98