

COMPLIANCE TEST REPORT

for

CARBON MONOXIDE EMISSIONS (CO)

UNITS 12-1 to 12-5

SRN: B2803

**Placid Substation
Clarkston, Michigan**

July 9-13, 2018

Prepared By
Environmental Management & Resources
Environmental Field Services Group
DTE Corporate Services, LLC
7940 Livernois H-136
Detroit, MI 48210

DTE Energy





EXECUTIVE SUMMARY

DTE Energy's Environmental Management and Resources (EM&R) Field Services Group, performed emissions testing on four (4) 3,600 Brake-HP diesel engines located at the Placid Substation in Clarkston, Michigan. The fieldwork, performed on July 9-13, 2018 was conducted to satisfy requirements of 40CFR Part 63 Subpart ZZZZ. Emission tests were performed on Units 12-1 to 12-5 for carbon monoxide (CO) destruction efficiency.

The results of the emissions testing are highlighted below:

CO Emissions Test Results Placid Substation July 9-13, 2018

Date	Unit	Average CO Destruction Efficiency (%)
7-9-18	12-1	81.3
7-10-18	12-2	81.1
7-13-18	12-3	79.4
7-12-18	12-4	83.3
7-11-18	12-5	80.3

Subpart ZZZZ Limit: Limit the concentration of CO in the stationary RICE exhaust to 23 ppmvd or less at 15% O₂; or Reduce CO emissions by 70% or more



3.0 SAMPLING AND ANALYTICAL PROCEDURES

DTE Energy obtained emissions measurements in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below:

Sampling Method	Parameter	Analysis
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method

3.1 OXYGEN AND CARBON MONOXIDE (USEPA METHODS 3A AND 10)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The O_2 analyzer utilizes a paramagnetic sensor.

Carbon monoxide (CO) emissions were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes a NDIR detector.

3.1.2 O_2 and CO Sampling Train

The EPA Methods 3A and 10 sampling systems at the inlet and outlet (Figure 2) consisted of the following components:

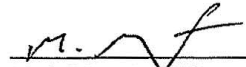
- (1) Single-point stainless steel sampling probe with a cindered filter.
- (2) Heated PTFE™ sampling line.
- (3) Universal® and MAK® gas conditioners with a particulate filter.
- (4) Flexible unheated PTFE sampling line.
- (5) Servomex 1400 O_2/CO_2 gas analyzer and TECO 48i NDIR CO gas analyzer.
- (6) USEPA Protocol 1 calibration gases.
- (7) Data Acquisition System.

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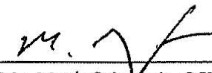


6.0 CERTIFICATION STATEMENT

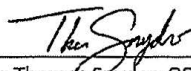
"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."



Mark Grigereit, QSTI

This report prepared by: 

Mr. Mark Grigereit, QSTI
Principal Engineer, Field Services Group
Environmental Management and Resources
DTE Energy Corporate Services, LLC

This report reviewed by: 

Mr. Thomas Snyder, QSTI
Environmental Specialist, Field Services Group
Environmental Management and Resources
DTE Energy Corporate Services, LLC



RESULTS TABLES



TABLE NO. 2
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 12-2 Placid Substation
July 10, 2018

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop H ₂ O	Oxygen ⁽¹⁾		CO Emissions @ 15% O ₂ ⁽¹⁾		Destruction Efficiency (%)
					Inlet (%)	Outlet (%)	Inlet (ppm)	Outlet (ppm)	
Run - 1	8:52-9:52	2.6	651	0.004	11.3	11.3	202.0	38.1	81.1
Run - 2	10:07-11:07	2.6	678	0.003	11.3	11.3	200.9	38.3	80.9
Run - 3	11:21-12:21	<u>2.6</u>	<u>708</u>	<u>0.004</u>	<u>11.2</u>	<u>11.3</u>	<u>207.7</u>	<u>39.1</u>	<u>81.2</u>
	Avg:	2.6	679	0.004	11.3	11.3	203.5	38.5	81.1

⁽¹⁾ Corrected for analyzer drift per USEPA method 7E
40CFR Part 63 Subpart ZZZZ Limit: 70% DE



TABLE NO. 4
CARBON MONOXIDE (CO) EMISSION TESTING RESULTS
Unit 12-4 Placid Substation
July 12, 2018

Test	Time	Load (MW)	Catalyst Inlet Temperature (°F)	Catalyst Pressure Drop (H ₂ O)	CO (ppm)		CO Emission Rate (lb/hr)		Deactivation Efficiency (%)
					Inlet	Outlet	Inlet	Outlet	
Run - 1	8:37-9:37	2.6	703	0.004	11.3	11.3	208.2	35.3	83.0
Run - 2	9:53-10:53	2.6	734	0.005	11.3	11.3	217.5	36.5	83.2
Run - 3	11:08-12:08	<u>2.6</u>	<u>740</u>	<u>0.005</u>	<u>11.3</u>	<u>11.3</u>	<u>214.6</u>	<u>35.2</u>	<u>83.6</u>
	Avg:	2.6	726	0.005	11.3	11.3	213.4	35.7	83.3

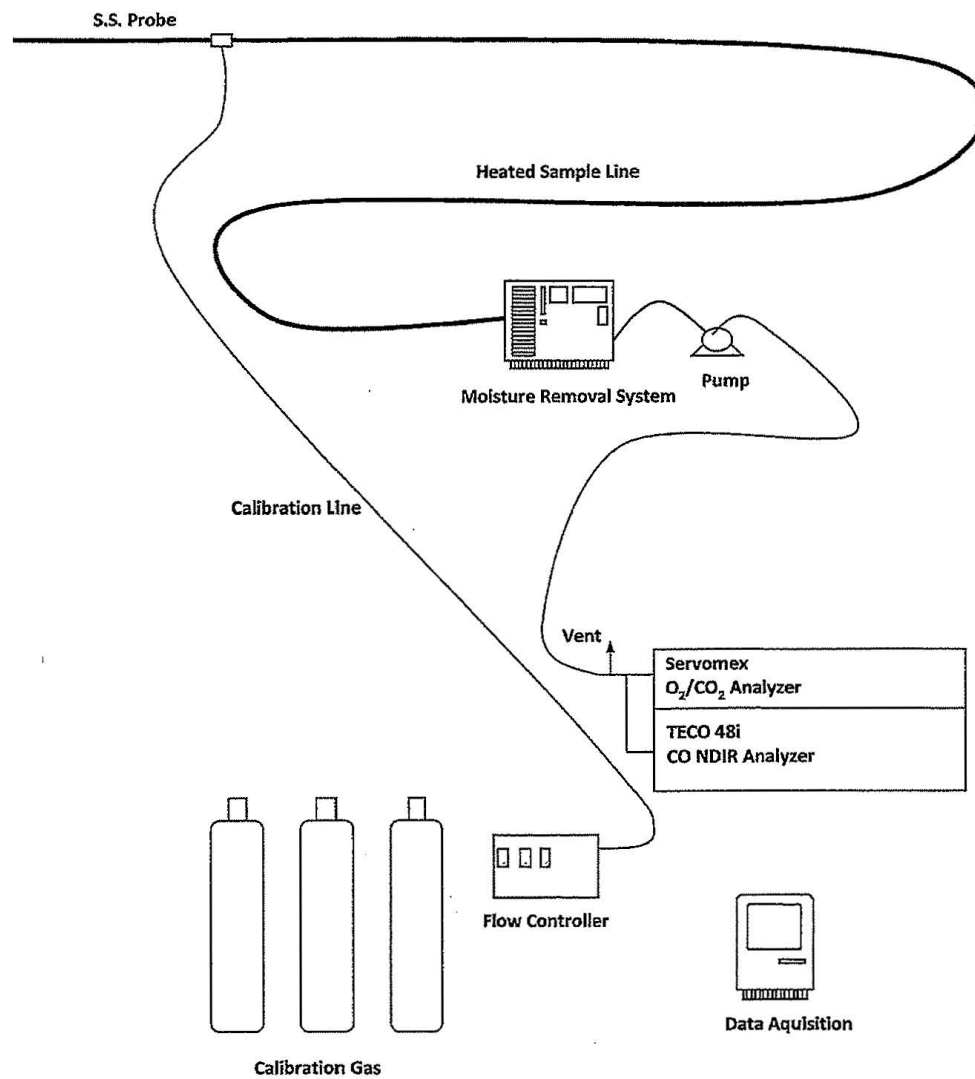
⁽¹⁾ Corrected for analyzer drift per USEPA method 7E
40CFR Part 63 Subpart ZZZZ Limit: 70% DE



FIGURES



Figure 2 – EPA Methods 3A/10
Placid Substation Diesel Generator
July 9-13, 2018





RICK SNYDER
GOVERNOR

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING



C. HEIDI GRETHER
DIRECTOR

May 1, 2018

Ms. Stefanie Zanke
DTE Energy Corporate Services
EMR
655 General Offices
2000 2nd Avenue
Detroit, Michigan 48226

Dear Ms. Zanke:

SUBJECT: Diesel Engine Generator, Carbon Monoxide Catalyst Destruction Efficiency
Testing, SRN: B2795, B2796, B2802, B2803, B2804, B2807

The Department of Environmental Quality (DEQ), Air Quality Division has reviewed the protocol for destruction efficiency testing of carbon monoxide (CO) catalysts installed on diesel engine generators at six DTE Energy locations. Testing will be performed to show compliance with the requirements of 40CFR Part 63 Subpart ZZZZ.

Testing will be performed at the following facilities:

SRN	Site	City	Test date	engines
B2803	Placid	Clarkston	July 9-13, 2018	DG11-1 through 11-5
B2802	Oliver	Pigeon	July 16-20, 2018	DG11-1 through 11-5
B2807	Putnam	Mayville	August 13-17 2018	DG11-1 through 11-5
B2795	Colfax	Fowlerville	Oct 1-5, 2018	DG11-1 through 11-5
B2796	St. Clair	East China Twp	Nov 13-14, 2018	DG12-1 & DG12-2
B2804	Wilmot	Kingston Twp	Nov 26-30, 2018	DG11-1 through DG11-5

The inlet and outlet of the catalysts will be tested in accordance with 40 CFR Part 60 Appendix A, Methods 3A and 10. Sample points will be selected in accordance with Subpart ZZZZ Table 4. Destruction efficiency will be calculated on the basis of CO ppm corrected to 15% oxygen

The following process data will be recorded during testing and included in the report:

- Engine load in megawatts
- Catalyst inlet temperature
- Pressure drop across the catalyst
- Crank case vacuum
- Fuel use

The test report will include:

- the analyzer calibration error, system bias, zero and calibration drift data, 1-minute and run averages, all in a tabular format
- The process data listed above.

All aborted or failed runs must be included in the report.

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April 24, 2018

Ms. Karen Kajiya-Mills
Toxics & Compliance Support Section
Michigan Department of Environmental Quality
Air Quality Division
Constitution Hall, 525 W. Allegan St.
Lansing, MI 48933

Subject: Test Plan for 40 CFR Part 63 NESHAP Subpart ZZZZ RICE MACT compliance emissions testing of six peaker sites in Michigan.

Dear Ms. Kajiya-Mills:

The Environmental Management & Resources (EMR) Field Services Group of DTE Energy Corporate Services, LLC (DECS), is pleased to provide the following Test Plan for compliance emissions testing of six DTE Electric peaking sites as required by 40 CFR Part 63 Subpart ZZZZ MACT standards and site specific ROP's. The six locations to be tested are Oliver, Placid, Putnam, Colfax, Wilmot, and St. Clair. Each site employs five 3600 Horse Power diesel engines with the exception of St. Clair (two engines). EMR will test for carbon monoxide (CO) destruction efficiency on all 27 sources. The purpose of this document is to provide the required testing information and to notify the Michigan Department of Environmental Quality (MDEQ) of the upcoming testing.

DTE Energy Corporate Services, LLC's Environmental Management & Resources (EMR) Field Services Group will be performing the emissions testing. Mr. Thomas Snyder, Environmental Specialist, with the Field Services Group of EMR prepared this Test Plan.

The following lists our tentative testing dates, pending MDEQ approval of the Test Plan:

Oliver - 346 S. Gagetown Rd., Pigeon, MI	July 16-20, 2018
Placid - 4912 Edgar, Clarkston, MI	July 9-13, 2018
Putnam - 5660 Mertz, Mayville, MI	August 13-17, 2018
Colfax - 4025 Gregory, Fowlerville, MI	Oct. 1-5, 2018
Wilmot - 5977 E. Bevens Rd., Kingston Twp., MI	Nov. 26-30, 2018
St. Clair - 4901 Pointe Dr. East China Twp., MI	Nov. 13-14, 2018



Test Plan – Diesel Peaking Facilities

- 1a. *Names, titles, and telephone numbers for the personnel directly involved with this study are listed in the following table:*

Name and Title	Company	Telephone
Ms. Stefanie Zanke Associate Environmental Specialist - EMR	DECS -EMR 655 General Offices 2000 2nd Avenue Detroit, MI 48226	(734) 326-4852
Mr. Thomas Snyder Environmental Specialist – EMR Field Services	DECS-EMR 6100 West Warren Avenue Room H136 Detroit, MI 48210	(313) 897-0899

- 1b. *Type of industrial process or combustion facility:*

Oliver - 346 S. Gagetown Rd., Pigeon, MI
Placid - 4912 Edgar, Clarkston, MI
Putnam - 5660 Mertz, Mayville, MI
Colfax - 4025 Gregory, Fowlerville, MI
Wilmot - 5977 E. Bevens Rd., Kingston Twp., MI

Each Peaker site employs five GM Electro-Motive Division MP45, 20 cylinder, diesel fueled, 3600 horsepower compression ignition (CI) engines designated DG 11-1, 11-2, 11-3, 11-4, and 11-5. The sites are used as electrical substations, which generate supplemental electrical power during peak electrical demand periods or when required for load stability. On site diesel generators, produce the electrical power supply which is sent to the electric grid. Each unit is capable of producing approximately 2.5MW_{gross}.

St. Clair – 4901 Pointe Dr. East China Twp., MI

This Peaker site employs two engines of the same specifications, designated DG 12-1 and 12-2.

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2c. Rated capacity and efficiency of the control device:

The Engines are rated at 3,600 Hp. The catalyst is capable of at least 70% reduction of CO.

3. Applicable permit number and emission limits for the process to be tested:

Each engines' emissions are limited by a MDEQ Renewable Operating Permit (ROP), and 40 CFR Part 63 NESHAP Subpart ZZZZ MACT standards. The emission requirements are; limit concentration of CO in the stationary RICE exhaust to 23ppmvd at 15% O₂ or; reduce CO Emissions by 70% or more.

Permit Numbers:

Oliver – MI-ROP-B2802-2013

Placid – MI-ROP-2803-2013

Putnam – MI-ROP-B2807-2013

Colfax – MI-ROP-B2795-2016

Wilmot – MI-ROP-B2804-2013

4. Identify all pollutants to be measured:

The exhaust gas emission concentrations of CO will be measured while the compressor engines are operating at maximum operating conditions (+/- 10% of 100% load).

5. Description of the sampling train(s) to be used, including schematic diagrams if appropriate:

Emissions testing will be performed at +/- 10% of 100% load via triplicate 60-minute test runs on each engine. CO testing will be performed utilizing USEPA Method 10. O₂ testing will be performed utilizing USEPA Method 3A. Emission rates will be calculated utilizing USEPA Method 19 stoichiometric calculations.

6. Detailed sampling and analysis procedures, including the applicable standard methods referenced:

Sampling and analysis methods will include the following:

Parameter	Method	Analytical Method
Molecular weight	USEPA Method 3A	Paramagnetic Analyzer
CO	USEPA Method 10	NDIR Analyzer

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14. *Field quality assurance/quality control procedures (e.g. – field blanks, sample storage and transport methods):*

The sampling team will prepare and calibrate field-sampling equipment and perform quality assurance/quality control (QA/QC) consistent with the employed USEPA methodology. CO testing will be performed utilizing appropriate analyzer calibration ranges that satisfy criteria stated in USEPA Method 10.

15. *Laboratory quality assurance/quality control procedures utilized as part of the testing:*

Calibrations for USEPA Method 10 will follow protocol stated in USEPA Methods and will utilize appropriate calibration gases.

16. *Names and titles of personnel who will be performing the testing:*

The testing will be performed by EMR's Field Services Group.

Mr. Mark Grigereit, Principal Engineer, QSTI, EM&R Field Services

Mr. Thomas Snyder, Environmental Specialist, QSTI, EM&R Field Services

Mr. Mark Westerberg, Environmental Specialist, QSTI, EM&R Field Services

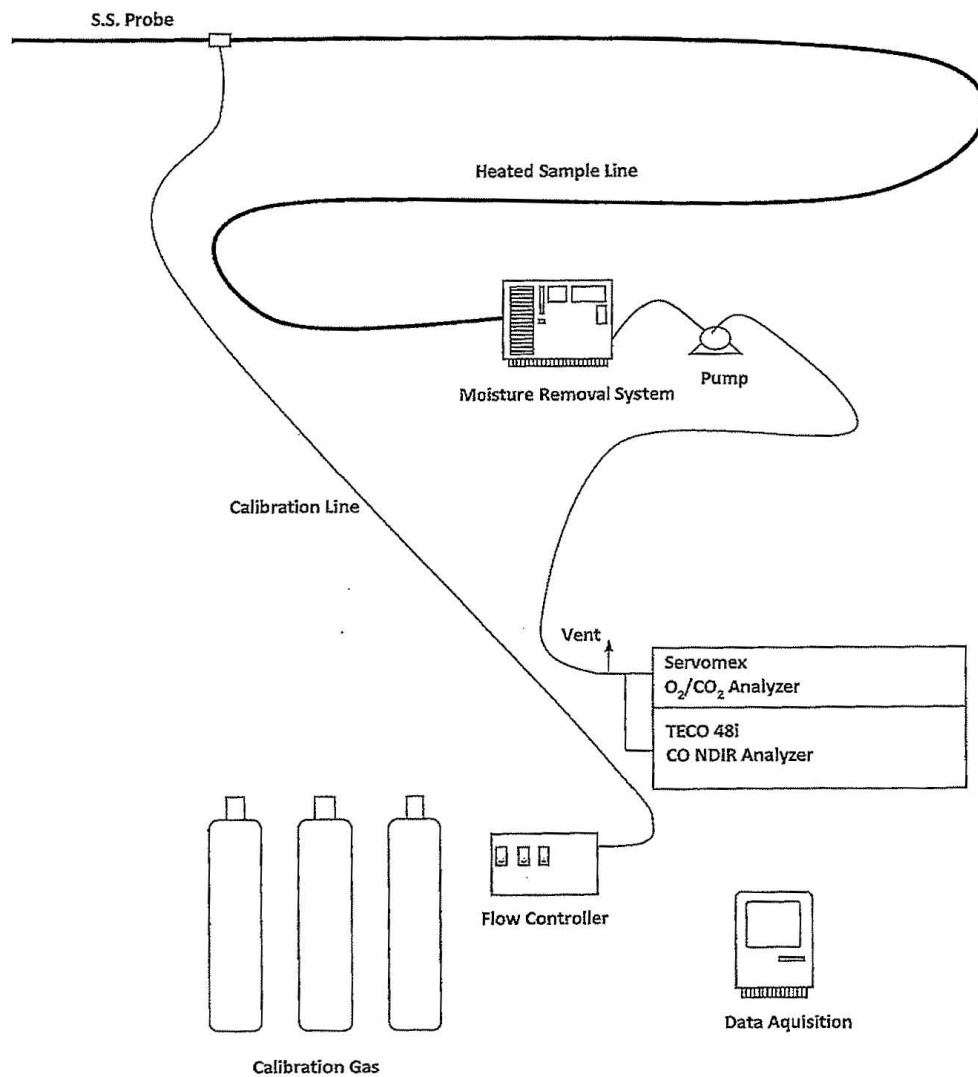
Mr. Fred Meinecke, Senior Technician, EM&R Field Services

Mr. Ken St.Amant, Senior Technician, QSTI, EM&R Field Services

The emission test report will include the items found on pages 3 and 4 of the MDEQ/Air Quality Division's Format for Submittal of Source Emission Test Plans and Reports. Included in the report will be a site description with the reason for testing, source descriptions, a summary of results, our sampling and analytical procedures, and test results and discussion.



Figure 2 – EPA Methods 3A/10
RICE Peaker Sites
2018



Carbon Monoxide (CO) Emissions Testing Results
 Diesel Peaker 12-1
 DTE Energy, Placid Substation
 Clarkston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	07/09/18	07/09/18	07/09/18	
Sampling Start Time	8:55-9:15, 9:33-10:13	10:27-11:27	11:40-12:40	
Average Inlet O ₂ Content (% dry)	12.1	11.9	11.8	11.9
Average Inlet O ₂ Content (% dry, corrected) ¹	12.1	12.0	11.9	12.0
Average Inlet CO Concentration (ppmv, dry)	178.7	193.1	201.2	191.0
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	178.9	193.2	200.7	190.9
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	120.4	127.6	132.0	
Average Outlet O ₂ Content (% dry)	12.0	11.9	11.9	11.9
Average Outlet O ₂ Content (% dry, corrected) ¹	12.1	12.0	11.9	12.0
Average Outlet CO Concentration (ppmv, dry)	35.6	36.5	37.1	36.4
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	35.1	35.9	36.6	35.8
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	23.4	23.7	24.0	
CO Destruction Efficiency	80.5%	81.4%	81.8%	81.3%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

ppmv : parts per million on a volume-to-volume basis

lb/hr : pounds per hour

Carbon Monoxide (CO) Emissions Testing Results
 Diesel Peaker 12-3
 DTE Energy, Placid Substation
 Clarkston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	07/13/18	07/13/18	07/13/18	
Sampling Start Time	8:39-9:39	9:50-10:50	11:06-12:06	
Average Inlet O ₂ Content (% dry)	11.3	11.3	11.2	11.3
Average Inlet O ₂ Content (% dry, corrected) ¹	11.3	11.3	11.2	11.3
Average Inlet CO Concentration (ppmv, dry)	320.3	325.8	357.3	334.4
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	320.7	325.0	357.1	334.3
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	197.3	200.1	217.9	
Average Outlet O ₂ Content (% dry)	11.2	11.2	11.1	11.2
Average Outlet O ₂ Content (% dry, corrected) ¹	11.3	11.3	11.2	11.3
Average Outlet CO Concentration (ppmv, dry)	67.8	66.1	70.4	68.1
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	68.2	66.8	71.2	68.7
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	42.0	41.1	43.5	
CO Destruction Efficiency	78.7%	79.5%	80.1%	79.4%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

ppmv : parts per million on a volume-to-volume basis

lb/hr : pounds per hour

Carbon Monoxide (CO) Emissions Testing Results
Diesel Peaker 12-S
DTE Energy, Placid Substation
Clarkston, Michigan

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	07/11/18	07/11/18	07/11/18	
Sampling Start Time	8:40-9:40	9:51-10:51	11:05-12:05	
Average Inlet O ₂ Content (% dry)	10.9	10.8	10.7	10.8
Average Inlet O ₂ Content (% dry, corrected) ¹	11.0	10.9	10.8	10.9
Average Inlet CO Concentration (ppmv, dry)	407.1	449.2	479.2	445.2
Average Inlet CO Concentration (ppmv, dry, corrected) ¹	408.0	448.0	477.8	444.6
Average Inlet CO Concentration (ppmv @ 15% O ₂) ²	242.3	263.2	278.9	
Average Outlet O ₂ Content (% dry)	10.9	10.7	10.7	10.8
Average Outlet O ₂ Content (% dry, corrected) ¹	11.0	10.9	10.8	10.9
Average Outlet CO Concentration (ppmv, dry)	80.8	85.4	93.0	86.4
Average Outlet CO Concentration (ppmv, dry, corrected) ¹	81.4	86.7	94.6	87.6
Average Outlet CO Concentration (ppmv @ 15% O ₂) ²	48.3	50.9	55.2	
CO Destruction Efficiency	80.1%	80.7%	80.2%	80.3%

¹corrected for analyzer drift as per USEPA Method 7E

MW : megawatts

O₂ : oxygen

CO : carbon monoxide

ppmv : parts per million on a volume-to-volume basis

lb/hr : pounds per hour

DTE Energy Placid Station, Unit 12-1
July 9, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
8:53	12.10	37.8	12.00	176.5
8:54	12.08	36.6	12.01	175.2
8:55	12.07	36.0	11.99	176.7
8:56	12.07	35.6	12.00	175.0
8:57	12.05	35.4	11.98	174.1
8:58	12.06	35.8	11.98	178.2
8:59	12.06	35.4	11.99	177.3
9:00	12.06	35.1	11.99	175.5
9:01	12.06	35.1	11.98	175.2
9:02	12.05	34.9	11.99	174.4
9:03	12.04	34.6	11.99	171.5
9:04	12.04	34.9	11.99	173.4
9:05	12.04	35.0	11.98	175.7
9:06	12.04	34.4	11.99	172.9
9:07	12.04	34.2	11.99	169.8
9:08	12.05	34.3	11.99	171.1
9:09	12.06	34.4	11.99	172.0
9:10	12.05	34.5	11.99	172.2
9:11	12.04	34.9	12.09	174.5
9:12	12.04	35.3	16.12	133.3
9:13	12.04	35.0	16.60	84.7
9:14	12.04	35.0	16.62	83.0
9:15	12.02	35.1	16.63	82.9
9:16	12.03	35.3	16.66	83.7
9:17	12.02	34.9	16.67	81.7
9:18	12.03	34.9	16.66	81.5
9:19	12.03	35.1	16.67	82.1
9:20	12.01	35.2	16.64	82.6
9:21	12.02	35.6	16.65	83.3
9:22	12.03	35.6	12.81	121.6
9:23	12.00	35.5	12.01	183.7
9:24	12.00	35.5	11.98	181.8
9:25	12.01	35.7	12.85	183.6
9:26	12.02	35.2	16.79	107.4
9:27	12.00	35.1	18.63	69.8
9:28	12.00	35.8	20.70	7.5
9:29	12.00	36.1	20.72	1.5
9:30	12.00	36.0	20.73	1.4
9:31	12.01	36.1	18.45	3.4
9:32	12.01	35.5	12.10	137.4
9:33	12.01	35.4	12.02	179.2
9:34	12.00	34.9	12.00	178.5
9:35	11.99	35.2	11.98	177.8
9:36	11.99	35.4	11.98	179.7
9:37	12.00	35.6	11.98	181.2
9:38	11.99	35.7	11.99	180.1
9:39	11.99	36.1	11.97	183.6

DTE Energy Placid Station, Unit 12-1
July 9, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
10:27	11.98	35.1	11.91	183.7
10:28	11.97	34.9	11.93	184.2
10:29	11.96	35.2	11.93	184.7
10:30	11.96	35.6	11.92	188.0
10:31	11.96	35.9	11.91	191.5
10:32	11.96	35.8	11.91	191.7
10:33	11.95	35.9	11.91	190.8
10:34	11.94	36.1	11.91	191.2
10:35	11.93	36.0	11.90	191.3
10:36	11.95	35.9	11.89	191.6
10:37	11.95	36.0	11.90	191.0
10:38	11.95	36.2	11.90	193.3
10:39	11.96	36.0	11.90	194.5
10:40	11.97	35.3	11.90	189.6
10:41	11.96	35.4	11.89	189.1
10:42	11.95	35.3	11.89	188.6
10:43	11.96	36.1	11.89	193.6
10:44	11.95	35.9	11.92	194.2
10:45	11.96	36.0	11.93	192.6
10:46	11.96	36.6	11.93	191.6
10:47	11.95	36.3	11.93	189.7
10:48	11.97	36.0	11.93	189.7
10:49	11.96	35.6	11.94	184.5
10:50	11.95	36.1	11.93	186.8
10:51	11.92	36.7	11.90	190.4
10:52	11.94	37.4	11.90	195.6
10:53	11.93	37.3	11.91	195.5
10:54	11.92	36.9	11.91	193.1
10:55	11.90	36.9	11.90	192.8
10:56	11.90	37.1	11.89	192.5
10:57	11.90	37.0	11.89	192.7
10:58	11.89	37.1	11.88	192.0
10:59	11.90	37.8	11.88	196.6
11:00	11.91	37.7	11.89	197.9
11:01	11.93	37.1	11.90	195.3
11:02	11.91	36.6	11.91	192.4
11:03	11.91	36.3	11.90	193.2
11:04	11.91	36.3	11.90	192.4
11:05	11.91	35.9	11.90	190.2
11:06	11.92	36.2	11.89	191.6
11:07	11.92	36.7	11.91	194.2
11:08	11.91	36.8	11.90	196.3
11:09	11.89	37.1	11.88	196.8
11:10	11.89	37.2	11.87	198.7
11:11	11.90	37.3	11.87	201.4
11:12	11.92	36.7	11.88	196.6
11:13	11.92	36.7	11.89	193.4

DTE Energy Placid Station, Unit 12-1
July 9, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
12:01	11.89	36.8	11.85	200.9
12:02	11.88	37.0	11.84	200.8
12:03	11.88	37.0	11.86	203.7
12:04	11.88	37.0	11.86	200.9
12:05	11.88	37.1	11.86	201.4
12:06	11.88	36.5	11.87	199.6
12:07	11.87	36.8	11.86	197.3
12:08	11.86	37.4	11.85	202.2
12:09	11.89	37.6	11.85	205.3
12:10	11.87	37.2	11.87	202.1
12:11	11.88	37.2	11.85	202.0
12:12	11.89	36.8	11.86	201.0
12:13	11.87	36.5	11.87	195.9
12:14	11.85	37.0	11.85	198.3
12:15	11.85	37.4	11.84	203.6
12:16	11.84	37.1	11.84	200.3
12:17	11.83	37.6	11.84	200.0
12:18	11.85	37.9	11.83	205.8
12:19	11.85	37.7	11.83	202.9
12:20	11.87	37.8	11.83	204.9
12:21	11.85	37.8	11.84	204.3
12:22	11.83	38.1	11.83	205.9
12:23	11.86	38.7	11.80	210.2
12:24	11.86	38.1	11.85	209.8
12:25	11.83	37.0	11.84	202.3
12:26	11.84	37.3	11.82	204.5
12:27	11.83	36.9	11.82	202.9
12:28	11.83	36.7	11.82	200.6
12:29	11.84	37.3	11.82	205.2
12:30	11.85	37.0	11.83	203.4
12:31	11.84	37.4	11.83	204.1
12:32	11.84	37.7	11.82	208.4
12:33	11.85	37.1	11.83	205.1
12:34	11.85	37.4	11.82	205.1
12:35	11.85	37.2	11.83	204.7
12:36	11.84	37.4	11.82	205.2
12:37	11.82	37.5	11.82	206.0
12:38	11.82	37.5	11.80	207.9
12:39	11.84	37.4	11.79	207.3
12:40	11.86	37.1	11.82	206.7
12:41	10.13	31.3	11.50	195.4
12:42	10.01	5.9	9.98	38.4
12:43	10.02	0.6	9.95	1.3
12:44	2.29	2.5	9.97	1.0
12:45	0.06	19.5	3.01	86.6
12:46	0.05	26.8	0.13	280.7
12:47	0.05	26.8	0.11	284.1

DTE Energy Placid Station, Unit 12-2
July 10, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
7:54	14.40	0.9	20.61	1.0
7:55	0.06	1.3	10.33	0.8
7:56	0.04	0.3	0.04	0.4
7:57	0.00	0.2	0.04	0.4
7:58	3.60	0.3	3.25	0.4
7:59	12.92	0.3	17.81	0.7
8:00	17.93	0.3	17.84	0.9
8:01	12.74	0.0	11.70	0.4
8:02	10.11	0.0	10.19	0.1
8:03	0.07	11.6	2.55	220.4
8:04	0.00	44.5	0.05	486.4
8:05	-0.01	47.7	0.05	486.6
8:06	-0.02	47.4	0.05	488.7
8:07	0.54	47.0	6.71	461.8
8:08	-0.01	34.1	7.71	113.5
8:09	-0.03	26.8	0.05	282.4
8:10	-0.03	26.6	0.05	284.6
8:11	10.20	27.5	16.21	180.2
8:12	0.04	43.7	11.41	35.3
8:13	0.02	28.0	0.22	269.9
8:14	0.01	27.1	0.15	284.2
8:15	6.79	24.0	0.14	284.5
8:16	9.91	5.9	8.93	138.9
8:17	9.92	0.7	9.93	1.8
8:18	9.92	0.6	9.94	0.9
8:19	10.74	4.9	9.94	0.7
8:20	11.20	42.6	10.66	63.5
8:21	11.24	50.0	11.25	314.6
8:22	11.21	50.0	11.28	311.4
8:23	11.21	50.0	11.25	318.2
8:24	11.24	50.0	11.25	323.7
8:25	11.24	50.0	11.28	308.3
8:26	11.24	50.0	11.27	311.1
8:27	11.27	50.0	11.27	313.9
8:28	11.23	70.0	11.30	307.4
8:30	11.25	67.0	11.27	321.7
8:31	11.26	37.7	11.25	317.2
8:32	11.26	14.4	11.24	325.5
8:33	11.30	16.0	11.24	325.2
8:34	11.28	46.8	11.27	316.8
8:35	11.27	89.7	11.24	316.3
8:36	11.28	98.4	11.24	326.2
8:37	11.25	99.2	11.25	321.5
8:38	11.27	79.0	11.24	327.3
8:39	11.31	30.9	11.26	323.6
8:40	11.31	26.7	11.28	311.1
8:41	11.30	34.8	11.27	314.5

DTE Energy Placid Station, Unit 12-2
July 10, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
9:29	11.16	60.4	11.20	327.9
9:30	11.17	60.5	11.20	332.4
9:31	11.16	60.0	11.21	327.5
9:32	11.16	60.0	11.21	326.3
9:33	11.17	60.3	11.20	328.3
9:34	11.17	60.9	11.20	331.0
9:35	11.17	60.3	11.21	329.1
9:36	11.15	60.9	11.19	328.1
9:37	11.20	60.9	11.20	336.9
9:38	11.20	58.5	11.25	317.1
9:39	11.15	59.5	11.22	316.4
9:40	11.15	61.0	11.19	332.3
9:41	11.13	61.1	11.19	333.9
9:42	11.12	61.6	11.17	336.1
9:43	11.13	61.9	11.16	341.7
9:44	11.14	61.4	11.18	340.6
9:45	11.14	61.4	11.17	336.7
9:46	11.16	61.3	11.18	339.2
9:47	11.19	59.7	11.22	330.2
9:48	11.14	59.1	11.22	316.3
9:49	11.12	61.0	11.18	333.9
9:50	11.11	61.6	11.16	337.4
9:51	11.09	62.6	11.15	345.7
9:52	11.10	62.9	11.15	348.7
9:53	11.10	62.4	11.15	344.8
9:54	11.10	62.7	11.15	346.3
9:55	11.10	62.3	11.15	346.3
9:56	11.10	62.2	11.15	345.1
9:57	4.06	61.5	11.21	343.7
9:58	0.02	53.7	10.11	138.6
9:59	0.01	48.1	9.95	1.9
10:00	4.83	46.7	9.95	1.2
10:01	9.91	18.3	4.95	33.9
10:02	9.92	1.2	0.16	267.0
10:03	9.93	0.7	0.13	283.8
10:04	10.07	0.7	0.12	284.2
10:05	11.17	14.9	2.62	284.6
10:06	11.13	59.6	11.09	307.8
10:07	11.16	65.8	11.15	332.5
10:08	11.17	65.1	11.19	328.1
10:09	11.16	65.2	11.18	324.5
10:10	11.21	65.8	11.20	336.9
10:11	11.21	63.9	11.23	321.2
10:12	11.19	64.0	11.22	319.1
10:13	11.19	64.6	11.21	324.8
10:14	11.18	64.1	11.22	319.5
10:15	11.19	65.1	11.21	324.4

DTE Energy Placid Station, Unit 12-2
July 10, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
11:03	11.19	59.3	11.24	320.8
11:04	11.12	60.4	11.21	320.0
11:05	11.14	63.1	11.16	344.9
11:06	11.17	61.9	11.19	341.8
11:07	11.20	60.3	11.22	328.9
11:08	11.17	59.3	11.24	318.2
11:09	10.29	53.7	9.47	322.1
11:10	9.94	11.8	0.27	294.6
11:11	9.94	0.7	0.13	285.5
11:12	9.95	0.6	0.11	285.6
11:13	3.52	2.8	0.11	284.1
11:14	0.02	31.8	7.72	203.7
11:15	0.01	47.3	9.91	5.1
11:16	3.65	47.9	9.92	1.3
11:17	11.17	53.7	10.23	2.7
11:18	11.15	60.5	11.21	231.2
11:19	11.17	62.3	11.18	315.9
11:20	11.16	62.4	11.20	321.4
11:21	11.16	63.4	11.18	324.3
11:22	11.16	62.9	11.19	325.9
11:23	11.11	63.1	11.18	321.8
11:24	11.15	65.0	11.14	337.8
11:25	11.19	62.8	11.19	329.7
11:26	11.17	61.6	11.21	314.2
11:27	11.10	63.4	11.18	321.5
11:28	11.13	65.3	11.13	338.6
11:29	11.17	63.9	11.18	337.0
11:30	11.12	63.1	11.18	320.9
11:31	11.09	65.4	11.14	338.4
11:32	11.10	67.0	11.11	349.9
11:33	11.09	67.5	11.12	354.8
11:34	11.14	67.1	11.12	356.4
11:35	11.18	64.4	11.18	343.0
11:36	11.17	63.4	11.19	327.4
11:37	11.18	62.6	11.21	328.4
11:38	11.15	62.9	11.20	321.1
11:39	11.16	63.8	11.18	332.4
11:40	11.15	63.4	11.18	327.7
11:41	11.14	64.5	11.17	334.2
11:42	11.15	65.0	11.15	339.3
11:43	11.16	64.4	11.18	339.2
11:44	11.15	64.6	11.16	333.4
11:45	11.17	64.4	11.18	341.2
11:46	11.16	61.2	11.19	324.1
11:47	11.18	59.7	11.21	322.4
11:48	11.19	58.9	11.22	314.0
11:49	11.18	59.1	11.22	315.9

DTE Energy Placid Station, Unit 12-2
July 10, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
12:37	20.76	1.0	13.37	220.8
12:38	20.76	1.0	20.58	12.2

Average Results				
	O2 out %	CO out ppm	O2 in %	CO in ppm
Run 1	11.17	62.3	11.21	328.8
Run 2	11.17	62.3	11.21	327.7
Run 3	11.11	63.8	11.15	341.7

DTE Energy Placid Station, Unit 12-3
July 13, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
8:57	11.22	65.4	11.29	315.7
8:58	11.21	64.5	11.28	311.1
8:59	11.19	64.7	11.28	313.6
9:00	11.18	66.9	11.27	320.4
9:01	11.17	69.3	11.27	322.3
9:02	11.18	69.8	11.27	323.8
9:03	11.21	69.3	11.30	319.0
9:04	11.19	68.3	11.28	316.9
9:05	11.20	69.2	11.27	323.2
9:06	11.21	69.1	11.30	320.0
9:07	11.21	68.8	11.29	319.6
9:08	11.22	69.3	11.30	322.9
9:09	11.22	68.3	11.31	315.5
9:10	11.21	68.1	11.30	318.3
9:11	11.22	68.1	11.30	316.1
9:12	11.22	67.2	11.31	308.3
9:13	11.23	66.8	11.32	308.5
9:14	11.21	66.6	11.31	309.5
9:15	11.22	66.8	11.31	311.5
9:16	11.21	67.6	11.30	313.2
9:17	11.20	68.3	11.30	319.2
9:18	11.19	69.2	11.28	323.4
9:19	11.20	69.7	11.29	325.2
9:20	11.22	68.7	11.31	319.7
9:21	11.19	67.7	11.29	315.1
9:22	11.18	69.4	11.26	327.6
9:23	11.15	69.4	11.25	326.5
9:24	11.14	70.7	11.24	335.9
9:25	11.18	70.6	11.26	334.0
9:26	11.23	68.7	11.30	320.7
9:27	11.22	67.0	11.31	313.2
9:28	11.21	67.1	11.31	315.5
9:29	11.23	67.7	11.31	318.7
9:30	11.22	67.6	11.31	316.8
9:31	11.21	67.3	11.31	315.4
9:32	11.20	67.7	11.29	319.1
9:33	11.21	68.4	11.30	322.6
9:34	11.17	68.7	11.28	324.3
9:35	11.15	70.3	11.25	334.4
9:36	11.15	71.3	11.25	339.6
9:37	11.18	70.6	11.27	334.9
9:38	11.20	69.5	11.29	328.7
9:39	11.21	68.7	11.31	323.7
9:40	8.20	68.5	11.31	325.9
9:41	0.04	60.2	5.87	330.5
9:42	0.02	47.8	2.56	297.6
9:43	0.02	47.2	0.11	286.4
9:44	3.19	46.5	0.09	285.0
9:45	9.91	20.8	9.44	135.6
9:46	9.93	1.4	9.97	1.7

DTE Energy Placid Station, Unit 12-3
July 13, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
10:37	11.19	68.0	11.29	322.9
10:38	11.19	68.5	11.29	324.0
10:39	11.19	69.2	11.29	327.7
10:40	11.20	68.8	11.30	325.7
10:41	11.19	68.3	11.29	325.7
10:42	11.20	68.2	11.30	323.5
10:43	11.18	68.4	11.30	323.7
10:44	11.17	69.7	11.28	331.4
10:45	11.17	70.4	11.28	336.2
10:46	11.17	70.1	11.28	332.8
10:47	11.16	69.9	11.28	333.9
10:48	11.17	71.0	11.27	338.2
10:49	11.17	70.1	11.27	333.7
10:50	11.17	69.8	11.28	334.1
10:51	11.15	70.6	11.27	338.5
10:52	11.03	72.0	11.24	349.0
10:53	9.95	43.1	10.30	191.1
10:54	9.94	3.0	10.00	1.3
10:55	9.94	0.6	10.00	0.8
10:56	3.48	3.7	7.25	14.2
10:57	0.02	34.2	0.13	228.0
10:58	0.02	47.2	0.10	284.7
10:59	11.03	51.0	6.98	293.6
11:00	11.14	60.7	11.24	335.0
11:01	11.14	61.6	11.24	335.4
11:02	11.16	62.2	11.26	337.6
11:03	11.15	61.2	11.27	330.4
11:04	11.15	61.4	11.26	335.4
11:05	11.13	62.4	11.25	340.6
11:06	11.10	64.0	11.20	354.1
11:07	11.11	64.9	11.21	356.6
11:08	11.14	64.2	11.23	353.2
11:09	11.15	62.9	11.25	344.0
11:10	11.15	62.7	11.25	346.3
11:11	11.17	63.0	11.27	345.6
11:12	11.17	62.7	11.27	341.8
11:13	11.16	62.8	11.26	340.1
11:14	11.17	63.3	11.26	343.6
11:15	11.16	63.2	11.25	343.9
11:16	11.16	63.7	11.25	347.3
11:17	11.18	62.8	11.26	342.1
11:18	11.17	62.3	11.27	336.6
11:19	11.17	62.9	11.26	342.0
11:20	11.16	62.9	11.26	341.6
11:21	11.17	62.8	11.27	339.8
11:22	11.16	62.5	11.26	339.1
11:23	11.14	62.1	11.25	339.0
11:24	11.16	63.7	11.26	339.8
11:25	11.15	69.0	11.26	339.3
11:26	11.13	70.0	11.24	338.8

DTE Energy Placid Station, Unit 12-3
July 13, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
12:17	9.93	0.6	9.98	0.8

	Average Results			
	O2 out %	CO out ppm	O2 in %	CO in ppm
Run 1	11.20	67.8	11.28	320.3
Run 2	11.20	66.1	11.30	325.8
Run 3	11.12	70.4	11.21	357.3

DTE Energy Placid Station, Unit 12-4
July 12, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
8:50	11.17	61.3	11.24	355.9
8:51	11.16	61.7	11.24	357.6
8:52	11.20	61.9	11.26	359.7
8:53	11.25	59.4	11.32	333.2
8:54	11.24	57.4	11.32	328.8
8:55	11.27	57.8	11.34	330.4
8:56	11.29	56.2	11.39	318.7
8:57	11.25	56.1	11.34	322.1
8:58	11.19	57.6	11.28	327.8
8:59	11.26	57.7	11.33	339.1
9:00	11.17	54.5	11.29	326.9
9:01	11.13	57.2	11.23	353.2
9:02	11.12	58.7	11.21	365.9
9:03	11.12	59.9	11.20	373.8
9:04	11.21	58.6	11.27	354.9
9:05	11.24	55.1	11.33	331.4
9:06	11.16	55.2	11.26	341.4
9:07	11.21	57.0	11.29	359.0
9:08	11.26	54.8	11.33	333.4
9:09	11.23	52.4	11.33	313.1
9:10	11.22	54.6	11.30	337.4
9:11	11.24	54.5	11.33	329.5
9:12	11.18	53.8	11.28	328.1
9:13	11.30	55.7	11.35	341.3
9:14	11.33	50.8	11.42	291.6
9:15	11.28	50.3	11.39	300.7
9:16	11.25	52.1	11.34	318.2
9:17	11.24	53.2	11.32	324.5
9:18	11.30	53.5	11.37	323.6
9:19	11.24	51.2	11.33	301.8
9:20	11.15	54.2	11.25	343.0
9:21	11.08	58.3	11.18	370.0
9:22	11.09	60.2	11.19	380.6
9:23	11.10	59.8	11.18	379.9
9:24	11.10	60.2	11.19	377.2
9:25	11.16	59.3	11.22	376.3
9:26	11.17	56.5	11.27	346.8
9:27	11.16	56.6	11.24	360.3
9:28	11.28	55.6	11.36	337.5
9:29	11.25	52.0	11.34	316.4
9:30	11.33	52.3	11.40	316.5
9:31	11.37	50.2	11.45	298.8
9:32	11.37	49.0	11.46	289.5
9:33	11.28	48.8	11.41	290.7
9:34	11.19	53.1	11.30	335.4
9:35	11.12	56.6	11.23	357.6
9:36	11.09	60.1	11.18	385.8
9:37	11.09	60.9	11.19	386.4
9:38	11.08	61.2	11.17	391.3
9:39	11.04	61.8	11.13	396.2

DTE Energy Placid Station, Unit 12-4
July 12, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
10:30	11.08	58.1	11.17	365.7
10:31	11.19	59.6	11.27	375.1
10:32	11.25	55.5	11.31	341.3
10:33	11.31	52.8	11.39	316.3
10:34	11.28	50.9	11.39	304.6
10:35	11.18	52.8	11.29	327.4
10:36	11.23	56.3	11.30	352.2
10:37	11.18	55.0	11.29	336.7
10:38	11.10	57.1	11.21	362.4
10:39	11.09	59.6	11.20	379.9
10:40	11.05	60.5	11.15	389.4
10:41	11.02	62.4	11.10	406.0
10:42	11.08	62.3	11.18	394.3
10:43	11.24	58.8	11.29	368.2
10:44	11.27	52.9	11.36	315.9
10:45	11.31	51.2	11.39	311.0
10:46	11.32	50.4	11.41	301.2
10:47	11.28	50.2	11.38	303.4
10:48	11.12	53.5	11.24	338.6
10:49	11.08	59.0	11.17	378.3
10:50	11.16	60.0	11.24	377.0
10:51	11.13	57.6	11.24	357.7
10:52	11.10	59.2	11.19	377.5
10:53	11.05	60.6	11.16	382.6
10:54	11.11	62.4	11.18	402.3
10:55	10.29	52.3	10.72	307.8
10:56	9.96	10.5	10.01	11.2
10:57	9.97	0.6	10.00	0.9
10:58	3.03	2.3	7.24	7.5
10:59	0.02	19.3	0.10	238.1
11:00	0.01	26.6	0.07	285.1
11:01	0.02	26.7	0.07	285.4
11:02	0.00	32.8	0.06	285.6
11:03	0.00	46.0	0.06	285.7
11:04	0.00	47.0	0.06	285.8
11:05	9.29	49.6	5.12	296.5
11:06	11.07	62.5	11.11	397.8
11:07	11.21	63.5	11.24	376.5
11:08	11.17	58.2	11.28	332.3
11:09	11.01	62.2	11.11	388.0
11:10	11.02	68.4	11.08	426.1
11:11	11.01	67.9	11.10	410.3
11:12	11.12	68.1	11.15	415.9
11:13	11.26	62.3	11.32	357.5
11:14	11.29	56.6	11.35	323.7
11:15	11.26	55.6	11.34	321.6
11:16	11.27	56.8	11.34	329.2
11:17	11.31	56.7	11.37	325.7
11:18	11.27	55.5	11.36	319.2
11:19	11.33	56.5	11.37	327.5

DTE Energy Placid Station, Unit 12-4
July 12, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
12:10	8.24	57.4	10.88	371.1
12:11	0.03	55.4	0.40	321.8
12:12	0.01	47.7	0.25	284.3
12:13	0.00	47.0	0.07	281.7
12:14	1.60	47.0	0.06	284.8
12:15	9.93	29.9	7.94	201.2
12:16	9.95	2.8	9.97	6.1
12:17	9.95	0.5	9.98	0.9
12:18	9.95	0.5	9.99	0.9
12:19	14.08	0.5	9.99	0.8
12:20	20.78	0.7	14.53	0.7
12:21	20.80	0.9	20.80	1.1
12:22	20.80	1.1	20.83	1.1
12:23	20.80	1.1	20.83	1.2

Average Results				
	O2 out %	CO out ppm	O2 in %	CO in ppm
Run 1	11.21	56.8	11.30	338.7
Run 2	11.17	58.8	11.26	355.8
Run 3	11.21	56.4	11.28	349.8

DTE Energy Placid Station, Unit 12-5

July 11, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
8:56	10.88	74.8	10.89	419.2
8:57	10.86	74.4	10.89	410.1
8:58	10.88	74.8	10.90	410.4
8:59	10.90	73.2	10.93	399.7
9:00	10.86	73.0	10.91	399.0
9:01	10.84	75.6	10.88	422.3
9:02	10.84	75.9	10.89	419.2
9:03	10.85	75.2	10.88	418.5
9:04	10.88	81.6	10.90	409.5
9:05	10.89	84.9	10.91	402.6
9:06	10.87	84.3	10.91	399.3
9:07	10.88	85.5	10.90	409.7
9:08	10.89	84.5	10.91	399.9
9:09	10.89	83.2	10.93	394.5
9:10	10.87	83.0	10.92	395.0
9:11	10.87	83.3	10.92	395.8
9:12	10.87	83.3	10.93	396.0
9:13	10.88	83.2	10.92	396.5
9:14	10.87	82.8	10.92	392.9
9:15	10.86	84.0	10.91	403.0
9:16	10.85	85.6	10.90	411.9
9:17	10.87	85.8	10.92	412.2
9:18	10.88	85.2	10.93	408.2
9:19	10.88	83.7	10.94	398.6
9:20	10.86	83.6	10.93	399.5
9:21	10.80	85.7	10.87	416.9
9:22	10.81	88.6	10.86	428.8
9:23	10.83	87.8	10.89	417.3
9:24	10.82	86.5	10.88	413.4
9:25	10.84	87.8	10.88	421.8
9:26	10.84	86.6	10.90	410.4
9:27	10.82	87.1	10.88	418.5
9:28	10.84	87.1	10.90	413.7
9:29	10.85	85.4	10.91	407.1
9:30	10.84	85.2	10.90	406.2
9:31	10.84	85.5	10.90	406.8
9:32	10.85	85.6	10.90	409.1
9:33	10.86	84.6	10.92	399.8
9:34	10.85	84.5	10.91	402.5
9:35	10.86	84.8	10.91	402.4
9:36	10.86	85.0	10.91	405.7
9:37	10.86	85.0	10.91	404.6
9:38	10.84	85.3	10.90	407.5
9:39	10.85	86.8	10.90	416.1
9:40	10.84	87.0	10.90	416.3
9:41	10.78	86.1	10.91	409.3
9:42	9.95	50.5	10.25	208.8

DTE Energy Placid Station, Unit 12-5
July 11, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
10:30	10.78	89.6	10.83	438.6
10:31	10.73	88.2	10.81	437.1
10:32	10.69	93.2	10.75	468.1
10:33	10.70	98.0	10.76	472.9
10:34	10.71	97.5	10.77	467.1
10:35	10.69	97.2	10.75	468.3
10:36	10.69	97.3	10.76	469.0
10:37	10.68	98.1	10.74	478.7
10:38	10.69	98.5	10.75	476.6
10:39	10.70	96.9	10.75	466.6
10:40	10.72	95.8	10.78	458.7
10:41	10.72	95.0	10.78	456.2
10:42	10.68	94.8	10.76	456.4
10:43	10.67	96.8	10.74	471.4
10:44	10.67	98.0	10.74	476.9
10:45	10.67	97.9	10.74	475.5
10:46	10.66	98.7	10.72	480.9
10:47	10.68	98.5	10.74	475.7
10:48	10.66	98.0	10.74	475.5
10:49	10.67	99.5	10.72	488.0
10:50	10.68	99.5	10.74	482.1
10:51	10.04	98.8	10.74	481.6
10:52	0.07	83.4	1.64	383.2
10:53	0.01	50.5	0.06	286.2
10:54	0.00	47.1	0.05	286.3
10:55	9.21	37.3	3.93	300.3
10:56	9.91	5.6	10.13	161.4
10:57	9.92	0.6	10.14	115.3
10:58	9.93	0.6	10.12	117.5
10:59	9.92	0.5	9.95	31.4
11:00	9.93	0.6	9.95	0.8
11:01	10.30	3.1	9.95	0.7
11:02	10.66	54.7	10.46	137.5
11:03	10.67	90.8	10.73	477.5
11:04	10.74	89.5	10.78	464.7
11:05	10.69	87.3	10.77	448.2
11:06	10.66	90.0	10.73	475.0
11:07	10.65	92.1	10.72	489.1
11:08	10.70	92.0	10.75	486.4
11:09	10.71	90.0	10.78	466.9
11:10	10.67	91.4	10.73	479.2
11:11	10.65	93.1	10.72	486.6
11:12	10.64	94.5	10.69	501.9
11:13	10.65	95.2	10.70	506.6
11:15	10.67	93.6	10.72	494.1
11:16	10.68	92.9	10.73	493.2
11:17	10.70	92.8	10.73	491.5

DTE Energy Placid Station, Unit 12-5
July 11, 2018

Time	O2 out %	CO out ppm	O2 in %	CO in ppm
12:05	10.64	100.0	10.69	502.5
12:06	10.67	100.0	10.72	487.5
12:07	10.66	92.0	10.71	480.9
12:08	10.67	79.7	10.74	469.3
12:09	10.67	78.5	10.73	473.7
12:10	10.70	78.8	10.76	471.6
12:11	10.70	76.0	10.76	463.0
12:12	10.67	75.9	10.74	465.8
12:13	10.69	77.4	10.75	476.2
12:14	10.64	80.3	10.70	493.7
12:15	10.67	80.4	10.72	497.8
12:16	10.66	78.1	10.73	483.2
12:17	10.68	77.9	10.74	483.8
12:18	10.71	78.2	10.77	469.3
12:19	10.70	76.8	10.77	462.9
12:20	10.70	75.4	10.76	459.8
12:21	10.71	74.9	10.78	458.4
12:22	10.67	75.3	10.75	462.9
12:23	10.69	77.3	10.74	478.6
12:24	10.28	68.9	10.60	418.5
12:25	9.94	15.3	9.96	25.8
12:26	9.94	0.7	9.96	1.0
12:27	9.93	0.5	9.96	0.9
12:28	9.94	0.5	9.96	0.7
12:29	8.97	0.5	9.96	0.6
12:30	0.06	11.4	5.32	41.6
12:31	0.02	43.2	0.07	273.7
12:32	0.02	47.0	0.05	284.1
12:33	15.09	45.3	3.82	284.2

Average Results				
	O2 out %	CO out ppm	O2 in %	CO in ppm
Run 1	10.86	80.8	10.90	407.1
Run 2	10.74	85.4	10.80	449.2
Run 3	10.68	93.0	10.74	479.2

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	RSC/DTE	Reference Number:	32-401052924-1
Part Number:	E03NI80E15AC1W2	Cylinder Volume:	150.9 CF
Cylinder Number:	CC465772	Cylinder Pressure:	2015 PSIG
Laboratory:	112 - Troy-32 (SAP) - MI	Valve Outlet:	590
PGVP Number:	B62017	Certification Date:	Dec 06, 2017
Gas Code:	CO2,O2,BALN		

Expiration Date: Dec 06, 2025

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

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	10.06 %	G1	+/- 1% NIST Traceable	12/06/2017
OXYGEN	10.00 %	10.00 %	G1	+/- 1% NIST Traceable	12/06/2017
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060607	CC413544	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 09, 2019
NTRM	09060226	CC263080	9.961 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared (NDIR)	Nov 27, 2017
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	Nov 17, 2017

Triad Data Available Upon Request



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

Customer:	RSC/DTE ENERGY	Reference Number:	32-400807127-1
Part Number:	E03N164E15AC041	Cylinder Volume:	157.6 CF
Cylinder Number:	CC210738	Cylinder Pressure:	2015 PSIG
Laboratory:	112 - Royal Oak-32 (SAP) - MI	Valve Outlet:	590
PGVP Number:	B62016	Certification Date:	Nov 16, 2016
Gas Code:	CO2,O2,BALN		

Expiration Date: Nov 16, 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 volume/volume basis unless otherwise noted.

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	18.00 %	17.84 %	G1	+/- 1.1% NIST Traceable	11/16/2016
OXYGEN	18.00 %	17.93 %	G1	+/- 1.0% NIST Traceable	11/16/2016
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060812	CC416634	24.04 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 16, 2019
NTRM	160605-10	XC021734B	23.204 % OXYGEN/NITROGEN	+/-0.2	Dec 24, 2021

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared (NDIR)	Nov 09, 2016
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	Oct 17, 2016

Triad Data Available Upon Request



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Approved for Release

Airgas USA, LLC

2009 Bellaire Ave.
Royal Oak, MI 48067-8020
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	RSC/DTE ENERGY	Reference Number:	32-400200861-1
Part Number:	E02NI99E15A3193	Cylinder Volume:	144.3 CF
Cylinder Number:	XC025119B	Cylinder Pressure:	2015 PSIG
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Valve Outlet:	350
PGVP Number:	B62013	Certification Date:	May 21, 2013
Gas Code:	CO,BALN		

Expiration Date: May 21, 2021

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

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	26.00 PPM	26.37 PPM	G1	+/- 1.0% NIST Traceable	05/21/2013
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09061810	CC273571	24.35 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	Oct 02, 2013

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54, 100ppmFS CO, Nicolet 6700	FTIR	May 16, 2013

Triad Data Available Upon Request

Notes:

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	DTE	Reference Number:	32-112348215-4
Part Number:	E02NI99E15AC2F5	Cylinder Volume:	144 Cu.Ft.
Cylinder Number:	CC313053	Cylinder Pressure:	2015 PSIG
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Valve Outlet:	350
PGVP Number:	B62011	Analysis Date:	Sep 06, 2011
Gas Code:	APPVD		

Expiration Date: Sep 06, 2014

Certification performed in accordance with "EPA Traceability Protocol (Sept. 1997)" using the assay procedures listed. Analytical Methodology does not require correction for analytical interferences. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.
Do Not Use This Cylinder below 150 psig, i.e. 1 Mega Pascal

ANALYTICAL RESULTS				
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty
CARBON MONOXIDE	95.00 PPM	93.67 PPM	G1	+/- 1% NIST Traceable
NITROGEN	Balance			

CALIBRATION STANDARDS				
Type	Lot ID	Cylinder No	Concentration	Expiration Date
NTRM	09060503	CC280417	98.88PPM CARBON MONOXIDE/NITROGEN	Feb 01, 2013

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54, 100ppmFS CO, Nicolet 6700	Fourier Transform Infrared (FTIR)	Aug 20, 2011

Triad Data Available Upon Request

Notes: Order # 413480

Approved for Release

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Customer:	RSC/DTE ENERGY	Reference Number:	32-400572732-1
Part Number:	E02NI99E15A03L6	Cylinder Volume:	144.3 CF
Cylinder Number:	XC008284B	Cylinder Pressure:	2015 PSIG
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Valve Outlet:	350
PGVP Number:	B62015	Certification Date:	Jul 24, 2015
Gas Code:	CO,BALN		

Expiration Date: Jul 24, 2023

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

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

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON MONOXIDE	490.0 PPM	488.6 PPM	G1	+/- 0.8% NIST Traceable	07/24/2015
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12062408	CC189564	487.1 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Jun 22, 2018

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54 Nicolet 6700 CO	FTIR	Jul 13, 2015

Triad Data Available Upon Request




Approved for Release

CO and O₂ Calibration Sheet
Outlet

Plant: Placid
Location: Unit 12-1
Date: 7/9/2018
Test #: Runs 1-3

CO Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct injection	System injection**											
		Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.00	0.00	0.04	0.60	0.60	0.60		1.2	0.0	0.0	0.1	1.3	1.3	1.3
47.57	47.60					-0.1							
26.37	26.30	26.90	26.90	27.00	26.80	-0.1	0.0	0.2	-0.4	1.3	1.3	1.5	1.1

Operator: TS/MG/FM
Monitor: TECO 48i
Servomex 1440

O ₂ Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct injection	System injection**											
		Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
		ppm											
0.0	0.1	0.1	0.1	0.1	0.0		0.0	0.1	-0.3	-0.2	-0.2	-0.1	-0.4
17.9	18.0					0.2							
10.0	10.1	10.0	10.0	10.0	10.0	0.1	0.2	-0.2	0.1	-0.3	-0.1	-0.3	-0.2

Span value, CO = 47.57
O₂ = 17.93

Response Time = 30

** Run zero and either mid or high calibration gas, whichever one is closer to actual stack concentration.
Analyzer cal. error, % of span = (dir. inj. cal. response, ppm - cal. gas conc., ppm)X100%/(span value, ppm): Limit = 2%.
Drift, % of span = (sys. inj. final cal. response, ppm - sys. inj. initial cal. response, ppm)X100%/(span value, ppm): Limit = 3%.
System bias, % of span = (relevant sys. inj. cal. resp., ppm - dir. inj. cal. resp., ppm)X100%/(span value, ppm): Limit = 5%.
System response time (95% of response from zero to high cal. gas), sec. = 30

CO and O₂ Calibration Sheet
Inlet

Plant: Placid

Location: Unit 12-2

Date: 7/10/2018

Test #: Runs 1-3

Operator: MG/FM

Monitor: TECO 48i
Servomex 1440

CO	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct	System injection**											
	injection	Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.0	0.1	1.1	1.4	1.5	0.9		0.1	0.0	-0.1	0.2	0.3	0.3	0.2
488.6	487.9					-0.1							
284.1	284.5	284.0	284.0	285.7	285.1	0.1	0.0	0.3	-0.1	-0.1	-0.1	0.2	0.1

O ₂	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct	System injection**											
	injection	Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.0	0.1	0.2	0.1	0.1	0.1		-0.2	-0.1	0.0	0.6	0.4	0.3	0.3
17.9	17.8					-0.1							
10.0	10.2	9.9	10.0	9.9	10.0	1.1	0.1	-0.2	0.2	-1.4	-1.3	-1.5	-1.3

Span value, CO = 488.6
O₂ = 17.85

Response Time = 30

** Run zero and either mid or high calibration gas, whichever one is closer to actual stack concentration.
 Analyzer cal. error, % of span = (dir. inj. cal. response, ppm - cal. gas conc., ppm)X100%/(span value, ppm): Limit = 2%.
 Drift, % of span = (sys. inj. final cal. response, ppm - sys. inj. initial cal. response, ppm)X100%/(span value, ppm): Limit = 3%.
 System bias, % of span = (relevant sys. inj. cal. resp., ppm - dir. inj. cal. resp., ppm)X100%/(span value, ppm): Limit = 5%.
 System response time (95% of response from zero to high cal. gas), sec. = 30

Placid
7-10-18
unit 2
HG/FM

<u>O₂ out</u>		<u>CO₂ out</u>		
0.0-0.01-0.01		0.0-0.0-0.6		
17.93-17.92		47.57-47.5-47.8		
10.04-9.99-9.92		26.37-26.6-27.1		
		93.67-94.0		
<u>O₂ in</u>		<u>CO₂ in</u>		
0.0-0.05-0.16		0.0-0.1-1.1		
17.85-17.83		284.1-284.5-284.0		
10.00-10.19-9.94		488.6-487.9		
Run 1	<u>O₂ in</u>	<u>CO₂ in</u>	<u>O₂ out</u>	<u>CO₂ out</u>
0852-0952	0.12	1.4	0.01	0.6
	9.95	284.0	9.93	480
Run 2	<u>O₂ in</u>	<u>CO₂ in</u>	<u>O₂ out</u>	<u>CO₂ out</u>
1007-1107	0.11	1.5	0.02	0.6
	9.92	285.7	9.94	47.4
Run 3	<u>O₂ in</u>	<u>CO₂ in</u>	<u>O₂ out</u>	<u>CO₂ out</u>
1121-1221	0.11	0.9	0.00	0.6
	9.95	285.1	9.89	47.8

CO and O₂ Calibration Sheet
Outlet

Plant: Placid
Location: Unit 12-3
Date: 7/13/2018
Test #: Runs 1-3

CO Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct Injection	System injection**											
		Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.00	0.00	0.70	0.70	0.60	0.60		0.0	-0.1	0.0	0.7	0.7	0.6	0.6
93.67	92.90					-0.8							
47.57	46.80	47.70	47.30	47.20	47.20	-0.8	-0.4	-0.1	0.0	1.0	0.5	0.4	0.4

Operator: TS/MG/FM
Monitor: TECO 48i
Servomex 1440

O ₂ Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct injection	System injection**											
		Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	0.1	0.3	0.3	0.2	0.3
17.9	18.0					0.3							
10.0	10.0	9.9	9.9	9.9	9.9	-0.2	-0.1	0.1	0.0	-0.4	-0.4	-0.4	-0.4

Span value, CO = 93.67
O₂ = 17.93

Response Time = 30

** Run zero and either mid or high calibration gas, whichever one is closer to actual stack concentration.

Analyzer cal. error, % of span = (dir. inj. cal. response, ppm - cal. gas conc., ppm)X100%/(span value, ppm): Limit = 2%.

Drift, % of span = (sys. inj. final cal. response, ppm - sys. inj. initial cal. response, ppm)X100%/(span value, ppm): Limit = 3%.

System bias, % of span = (relevant sys. inj. cal. resp., ppm - dir. inj. cal. resp., ppm)X100%/(span value, ppm): Limit = 5%.

System response time (95% of response from zero to high cal. gas), sec. = 30

CO and O₂ Calibration Sheet
Inlet

Plant: Placid
Location: Unit 12-4
Date: 7/12/2018
Test #: Runs 1-3

CO Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct	System injection**											
	Injection	Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.0	0.4	0.6	0.8	0.9	0.9		0.0	0.0	0.0	0.0	0.1	0.1	0.1
488.6	486.2					-0.5							
284.1	283.2	282.8	285.5	285.2	284.1	-0.2	0.6	-0.1	-0.2	-0.1	0.5	0.4	0.2

Operator: MG/FM
Monitor: TECO 48i
Servomex 1440

O ₂ Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct	System Injection**											
	Injection	Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
	0.0	0.0	0.1	0.1	0.1		0.1	-0.2	0.1	-0.1	0.3	0.2	0.2
17.9	17.9					0.0							
10.0	10.0	10.0	10.0	10.0	10.0	0.2	-0.3	0.1	-0.1	0.0	-0.3	-0.2	-0.2

CO = 488.6
Span value, O₂ = 17.85

Response Time = 30

** Run zero and either mid or high calibration gas, whichever one is closer to actual stack concentration.
Analyzer cal. error, % of span = (dir. inj. cal. response, ppm - cal. gas conc., ppm)X100%/(span value, ppm): Limit = 2%.
Drift, % of span = (sys. inj. final cal. response, ppm - sys. inj. initial cal. response, ppm)X100%/(span value, ppm): Limit = 3%.
System bias, % of span = (relevant sys. inj. cal. resp., ppm - dir. inj. cal. resp., ppm)X100%/(span value, ppm): Limit = 5%.
System response time (95% of response from zero to high cal. gas), sec. = 30

Placid (Clarkston)

Unit 4

7/12/18

TS/FM

<u>O₂ Out</u>	<u>CO out</u>
0.0 - (0.01) - 0.00	0.0 - 0.4 - 0.6
17.93 - 18.01	47.57 - 46.7 - 47.2
10.04 - 10.01 - 9.95	26.37 - 26.4 - 26.5
	93.67 - 93.1

<u>O₂ In</u>	<u>CO In</u>
0.0 - 0.03 - 0.09	0.0 - 0.4 - 0.6
17.85 - 17.85	284.1 - 283.2 - 282.8
10.00 - 10.03 - 10.03	488.6 - 486.2 - 475.4

Run 1	<u>O₂ In</u>	<u>CO In</u>	<u>O₂ Out</u>	<u>CO out</u>
837-937	0.06	0.8	0.00	0.5
	9.98	285.5	9.96	47.1

Run 2	<u>O₂ In</u>	<u>CO In</u>	<u>O₂ Out</u>	<u>CO out</u>
953-1053	0.07	0.9	0.00	0.5
	10.00	285.2	9.96	46.9

Run 3	<u>O₂ In</u>	<u>CO In</u>	<u>O₂ Out</u>	<u>CO out</u>
11:08-12:08	0.06	0.9	0.0	0.5
	9.99	284.1	9.96	47.0

CO and O₂ Calibration Sheet
Outlet

Plant: Placid
Location: Unit 12-5
Date: 7/11/2018
Test #: Runs 1-3

CO Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct Injection	System injection**											
		Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.00	0.10	0.70	0.60	0.60	0.50		-0.1	0.0	-0.1	0.6	0.5	0.5	0.4
93.67	93.50					-0.2							
47.57	47.00	47.00	47.20	47.10	47.00	-0.6	0.2	-0.1	-0.1	0.0	0.2	0.1	0.0

Operator: TS/MG/FM
Monitor: TECO 48i
Servomex 1440

O ₂ Calibration gas conc., ppm	Calibration response, ppm					Analyzer cal. error, % of span	Drift, % of span			System bias, % of span			
	Direct Injection	System injection**											
		Pretest	PostT 1	PostT 2	PostT 3		Test 1	Test 2	Test 3	Pretest	PostT 1	PostT 2	PostT 3
0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1	
17.9	18.0					0.3							
10.0	10.0	10.0	9.9	9.9	9.9	-0.1	-0.1	-0.1	0.1	-0.4	-0.4	-0.5	-0.4

CO = 93.67
Span value, O₂ = 17.93

Response Time = 30

** Run zero and either mid or high calibration gas, whichever one is closer to actual stack concentration.
Analyzer cal. error, % of span = (dir. inj. cal. response, ppm - cal. gas conc., ppm)X100%/(span value, ppm): Limit = 2%.
Drift, % of span = (sys. inj. final cal. response, ppm - sys. inj. initial cal. response, ppm)X100%/(span value, ppm): Limit = 3%.
System bias, % of span = (relevant sys. inj. cal. resp., ppm - dir. inj. cal. resp., ppm)X100%/(span value, ppm): Limit = 5%.
System response time (95% of response from zero to high cal. gas), sec. = 30



APPENDIX D

EXAMPLE CALCULATIONS



APPENDIX E

OPERATIONAL DATA

CDL Placid Unit 12-2
10-Jul-18

Date	Catalyst Inlet Temp (F)	Crank Case Vacuum (in. H2O)	Pressure Drop Across Catalyst (in. H2O) * (0.01)
7/10/2018 11:27	728.7	0.19	0.0002
7/10/2018 11:12	728.7	0.67	0.0029
7/10/2018 10:57	728.7	0.6	0.0035
7/10/2018 10:42	728.7	0.63	0.0042
7/10/2018 10:27	700.8	0.51	0.0042
7/10/2018 10:12	700.8	0.56	0.0026
7/10/2018 9:57	700.8	0.6	0.0043
7/10/2018 9:42	700.8	0.63	0.0016
7/10/2018 9:27	672.2	0.53	0.0047
7/10/2018 9:12	672.2	0.61	0.0045
7/10/2018 8:57	672.2	0.57	0.0039
7/10/2018 8:42	672.2	0.53	0.0025
7/10/2018 8:27	650.4	0.52	0.0027
7/10/2018 8:12	650.4	0.58	0.0034
7/10/2018 7:57	650.4	0.58	0.004
7/10/2018 7:42	650.4	0.5	0.0033
7/10/2018 7:27	653.2	0.55	0.0043
7/10/2018 7:12	653.2	0.44	0.0035
7/10/2018 6:57	653.2	0.7	0.0025

DAS 01:15 behind (i.e. 6:57 DAS Time = 8:12 EST)

CDL Placid Unit 12-4
12-Jul-18

Date	Catalyst Inlet Temp (F)	Crank Case Vacuum (in. H2O)	Pressure Drop Across Catalyst (in. H2O) * (0.01)
7/12/2018 13:24	760.4	2.16	0.0043
7/12/2018 13:09	760.4	2.14	0.0051
7/12/2018 12:54	754.3	2.17	0.0039
7/12/2018 12:39	754.3	2.18	0.0044
7/12/2018 12:24	754.3	2.23	0.0047
7/12/2018 12:09	754.3	2.18	0.0055
7/12/2018 11:54	735.1	2.19	0.0046
7/12/2018 11:39	735.1	2.24	0.0052
7/12/2018 11:24	735.1	2.11	0.0054
7/12/2018 11:09	735.1	2.12	0.0046
7/12/2018 10:54	734.2	2.15	0.0061
7/12/2018 10:39	734.2	2.22	0.0054
7/12/2018 10:24	734.2	2.23	0.0046
7/12/2018 10:09	734.2	2.24	0.0044
7/12/2018 9:54	702.7	2.08	0.0046
7/12/2018 9:39	702.7	2.11	0.004
7/12/2018 9:24	702.7	2.12	0.0038
7/12/2018 9:09	702.7	2.43	0.0036

DAS 00:20 ahead (i.e. 9:09 DAS Time = 8:49 EST)

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Current Location: Elev: 976 ft. Lat: 42.6650° N Lon: -83.4181° W
Station: PONTIAC OAKLAND CO INTERNATIONAL AIRPORT, MI US 94817

Local Climatological Data
Hourly Precipitation
July 2018
Generated on 08/15/2018

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Date	For Hour (LST) Ending at																							Date																																				
	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	NOON	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM		MID																																			
01																0.07									01																																			
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30																T	T								30																																			
31																T	T	0.06	0.09	0.30	0.01	T	0.01	0.06	0.30	31																																		
Maximum Short Duration Precipitation																																																												
Time Period (Minutes)	5					10					15					20					30					45					60					80					100					120					150					180				
Precipitation (Inches)	0.22					0.41					0.52					0.59					0.63					0.63					0.63					0.63					0.63					0.63					0.63					0.63				
Ending Date Time (yyyy-mm-dd hh:mm)	2018-07-16 15:24					2018-07-16 15:29					2018-07-16 15:31					2018-07-16 15:33					2018-07-16 15:35					2018-07-16 15:35					2018-07-16 15:35					2018-07-16 15:35					2018-07-16 15:35					2018-07-16 15:35					2018-07-16 15:35									

Hourly, daily, and monthly totals on the Daily Summary page and the Hourly Precipitation Table are shown as reported by the instrumentation at the site. However, NWS does not edit hourly values for its ASOS sites, but may edit the daily and monthly totals for selected sites which will be reflected on the Daily Summary page.

T = Trace
s = Suspect
* = Erroneous
blank = No precipitation observed
M = Missing

Current Location: Elev: 976 ft. Lat: 42.8650° N Lon: -83.4181° W
Station: PONTIAC OAKLAND CO INTERNATIONAL AIRPORT, MI US 94817

Generated on 08/15/2018

Generated on 08/15/2018

Asheville, North Carolina 28801

Date	Temperature (F)							Degree Days (base 66F)			Sun (LST)		Weather	Precipitation (in)			Pressure (inHg)		Wind Avg Speed	Maximum Wind Speed = MPH Direction = Degrees							
	Max	Min	Avg	Dep	ARH	ADP	AWB	Heat	Cool	Rise	Set	Weather Type		TLC	Snow Fall	Snow Depth	Avg Stn	Avg SL		Peak Speed	Peak Dir	Sust. Speed	Sust. Dir				
1	2	3	4	5	6	7	8	9	10	11	12		13	14	15	16	17	18	19	20	21	22	23				
01	03	71	82	10.4				0	17	0459	2015	TS RA	0.07				28.91		6.3	30	180	22	200				
02	88	69	78	6.3				0	13	0500	2015		0.00				28.94		7.2	20	290	15	290				
03	90	65	77	5.1				0	12	0500	2015	FG	0.00				28.13		5.8	18	100	14	080				
04	92	71	82	10.0				0	17	0501	2015	HZ	0.00				29.18		5.1	19s	180s	14	180				
05	94*	75	84	11.9				0	19	0502	2015	BR HZ	0.00				29.12		9.1	28	270	21	270				
06	78	60	69	-3.1				0	4	0502	2014		0.00				29.24		11.3	26	350	21	020				
07	79	52*	65	-7.2				0	0	0503	2014		0.00				29.30		5.3	19	110	14	140				
08	87	53	70	-2.3				0	5	0504	2013		0.00				29.23		4.0	16	130	13	140				
09	90	60	75	2.7				0	10	0504	2013	FG	0.00				29.11		7.2	20	240	17	270				
10	88	65	75	2.6				0	10	0505	2013		0.00				29.02		7.5	23	020	18	330				
11	84	58	71	-1.4				0	6	0506	2012		0.00				29.08		5.8	21	020	16	030				
12	84	56	70	-2.4				0	5	0507	2012		0.00				29.15		3.9	20	160	16	150				
13	91	65	78	5.6				0	13	0507	2011	RA	0.02				29.08		5.1	19	210	14	210				
14	84	69	77	4.6				0	12	0508	2010	RA	0.02				29.00		4.3	16	270	13	270				
15	92	70	81	8.6				0	18	0509	2010		T				28.95		3.8	16	140	13	150				
16	93	70	82	9.6				0	17	0510	2009	TS RA FG BR	0.74				28.85		5.4	37	290	28	300				
17	90	62	71	-1.4				0	6	0511	2008		0.00				28.92		9.1	24	320	20	320				
18	80	58	69	-3.4				0	4	0512	2008		0.00				29.03		4.1	14	270	10	070				
19	83	57	70	-2.4				0	5	0512	2007		0.00				28.99		6.5	19	200	14	120				
20	82	62	72	-0.4				0	7	0513	2006	RA	0.02				28.82		10.0	27s	140s	21	140				
21	72	67	69	-3.3				0	4	0514	2005	RA DZ BR	0.29				28.72		8.1	24	160	17	170				
22	71	82	67	-5.3				0	2	0515	2004	RA	0.07				28.79		7.4	26	360	18	050				
23	79	62	71	-1.3				0	6	0516	2004	TS	0.00				28.84		2.2	12	140	9	130				
24	81	69	75	2.8				0	10	0517	2003	BR	0.00				28.88		4.4	18	290	14	300				
25	86	66	76	3.8				0	11	0518	2002	BR	0.00				28.89		4.5	18	290	14	310				
26	83	65	74	1.8				0	9	0519	2001	TS	T				28.81		10.0	29	280	23	280				
27	79	60	70	-2.1				0	5	0520	2000	RA	T				28.90		8.9	23	300	20	300				
28	79	59	69	-3.1				0	4	0521	1959		0.00				29.02		8.9	20	260	16	280				
29	83	60	72	0.0				0	7	0522	1958		0.00				29.04		3.5	15	290	12	280				
30	80	60	70	-2.0				0	5	0523	1957	FG	T				29.03		4.1	25	180	13	140				
31	80	61	71	-0.9				0	6	0524	1955	RA DZ FG BR	0.83				28.97		5.9	20	070	14	070				
	83.9	63.2	73.6									Monthly Averages Totals			2.06s			29.00	30.04	6.3							
	1.7	1.0	1.4					Departure from Normal (1981-2010)								-0.77s											
Degrees Days												Number of days with...															
Monthly				Season-to-date				Temperature				Precipitation				Snow		Weather									
Total		Departure		Total		Departure		Max		<=32°		Min		<=0°		>=0.1"		>=0.1"		>=1"		T-Storms		Heavy Fog			
Heating		0		-6		0		>=80°		0		<=32°		0		>=0.1"		8		3							
Cooling		285		36		511		8		0		<=32°		0		>=0.1"		8		3							
Date of 5-sec to 3-sec wind equipment change												Sea Level Pressure				Greatest...											
N/A												Maximum		30.41		Date		Time		24-Hr...		Snowfall		Snow Depth			
												Minimum		29.73		07		0904		Precip							
																20		1634		0.83							
												31-31				Date											
Station Augmentation																											
Name: N/A Lat: N/A Lon: N/A Elevation: N/A Distance: N/A Elements: N/A Equipment: N/A																											

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service
Current Location: Elev: 978 ft. Lat: 42.6650° N Lon: -83.4181° W
Station: PONTIAC OAKLAND CO INTERNATIONAL AIRPORT, MI US 94817

Local Climatological Data
Hourly Observations
July 2018
Generated on 08/16/2018

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Date	Time (LST)	Station Type	Sky Conditions	Visi- bility	Weather Type (see documentation)	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend.	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Alti-meter Setting (inHg)
					AU AW MW	(F)	(C)	(F)	(C)	(F)	(C)											
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
10	0053	7	CLR:00	10.00		71	21.7	63	17.3	58	14.4	63	3	250		29.02	8	+0.02	30.04	FM-15	0.00	30.07
10	0153	7	SCT:04 95	10.00		71	21.7	63	17.0	57	13.9	61	6	240		29.01			30.03	FM-15	0.00	30.06
10	0253	7	CLR:00	10.00		71	21.7	63	17.3	58	14.4	63	6	240		29.00			30.02	FM-15	0.00	30.05
10	0353	7	BKN:07 55	10.00		72	22.2	65	18.1	60	15.6	66	3	300		29.00	5	+0.01	30.03	FM-15	0.00	30.05
10	0453	7	FEW:02 55 FEW:02 100	10.00		71	21.7	64	17.9	60	15.6	68	5	290		29.00			30.03	FM-15	0.00	30.05
10	0553	7	FEW:02 50 FEW:02 100 SCT:04 250	10.00		72	22.2	65	18.4	61	16.1	68	6	300		29.01			30.03	FM-15	0.00	30.06
10	0653	7	FEW:02 55 SCT:04 90 SCT:04 250	10.00		74	23.3	66	18.8	61	16.1	64	8	340		29.02	3	-0.02	30.04	FM-15	0.00	30.07
10	0753	7	BKN:07 65 BKN:07 95 BKN:07 250	10.00		74	23.3	66	18.8	61	16.1	64	8	050		29.03			30.05	FM-15	0.00	30.08
10	0853	7	SCT:04 70 SCT:04 95 BKN:07 250	10.00		77	25.0	64	17.9	56	13.3	48	7	070		29.02			30.05	FM-15	0.00	30.07
10	0953	7	FEW:02 60 FEW:02 100 SCT:04 140	10.00		81	27.2	63	17.1	50	10.0	34	8	040		29.02	8	+0.00	30.05	FM-15	0.00	30.07
10	1053	7	FEW:02 38 FEW:02 60 SCT:04 250	10.00		83	28.3	63	17.5	50	10.0	32	10	020		29.02			30.05	FM-15	0.00	30.07
10	1153	7	BKN:07 47 BKN:07 65	10.00		84	28.9	64	17.7	50	10.0	31	5	020		29.03			30.06	FM-15	0.00	30.08
10	1253	7	FEW:02 47 BKN:07 250	10.00		85	29.4	65	18.1	51	10.6	31	14	330		29.03	0	-0.01	30.06	FM-15	0.00	30.08
10	1353	7	FEW:02 50 FEW:02 90 BKN:07 250	10.00		86	30.0	66	18.8	53	11.7	32	9	VRB	21	29.01			30.03	FM-15	0.00	30.06
10	1453	7	FEW:02 50 FEW:02 90 SCT:04 250	10.00		86	30.0	65	18.3	51	10.6	30	15	350	22	29.00			30.02	FM-15	0.00	30.05
10	1553	7	SCT:04 250	10.00		86	30.0	64	17.8	49	9.4	28	11	350	22	29.00	6	+0.03	30.02	FM-15	0.00	30.05
10	1653	7	FEW:02 140 SCT:04 250	10.00		83	28.3	63	17.5	50	10.0	32	13	360	21	29.00			30.03	FM-15	0.00	30.05
10	1753	7	FEW:02 140 SCT:04 250	10.00		82	27.8	63	17.3	50	10.0	33	10	360		29.01			30.03	FM-15	0.00	30.06
10	1853	7	FEW:02 140 BKN:07 250	10.00		80	26.7	63	17.2	51	10.6	37	10	360		29.00	0	-0.01	30.03	FM-15	0.00	30.05
10	1953	7	FEW:02 140 BKN:07 250	10.00		76	24.4	62	16.6	52	11.1	43	7	060		29.01			30.04	FM-15	0.00	30.06
10	2053	7	SCT:04 140 OVC:08 250	10.00		72	22.2	60	15.5	51	10.6	48	6	080		29.02			30.05	FM-15	0.00	30.07
10	2153	7	SCT:04 140 OVC:08 250	10.00		70	21.1	59	15.1	51	10.6	51	3	050		29.04	3	-0.04	30.07	FM-15	0.00	30.09
10	2253	7	SCT:04 140 BKN:07 250	10.00		68	20.0	58	14.7	51	10.6	55	3	050		29.04			30.07	FM-15	0.00	30.09
10	2353	7	CLR:00	10.00		65	18.3	57	14.0	51	10.6	61	3	040		29.04			30.07	FM-15	0.00	30.09

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Environmental Satellite, Data, and Information Service

Current Location: Elev: 976 ft. Lat: 42.6650° N Lon: -83.4181° W
Station: PONTIAC OAKLAND CO INTERNATIONAL AIRPORT, MI US 94817

Local Climatological Data
Hourly Observations
July 2018
Generated on 08/15/2018

National Centers for Environmental Information
151 Patton Avenue
Asheville, North Carolina 28801

Date	Time (LST)	Station Type	Sky Conditions	Visi- bility	Weather Type (see documentation) AU AW MW	Dry Bulb Temp		Wet Bulb Temp		Dew Point Temp		Rel Hum %	Wind Speed (MPH)	Wind Dir (Deg)	Wind Gusts (MPH)	Station Press (inHg)	Press. Tend	Net 3-Hr Change (inHg)	Sea Level Press. (inHg)	Report Type	Precip Total (in)	Alti- meter Setting (inHg)
						(F)	(C)	(F)	(C)	(F)	(C)											
12	0053	7	CLR:00	10.00	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
12	0153	7	CLR:00	10.00		80	16.6	55	12.8	51	10.6	72	0	000		29.15	0	-0.02	30.18	FM-15	0.00	30.20
12	0253	7	CLR:00	10.00		59	15.0	55	12.9	52	11.1	78	0	000		29.14			30.18	FM-15	0.00	30.19
12	0353	7	CLR:00	10.00		59	15.0	56	13.4	54	12.2	83	0	000		29.15			30.18	FM-15	0.00	30.20
12	0453	7	FEW:02 250	10.00		57	13.9	54	12.4	52	11.1	83	0	000		29.15	5	+0.00	30.18	FM-15	0.00	30.20
12	0553	7	BKN:07 250	10.00		57	13.9	55	12.7	53	11.7	87	0	000		29.14			30.18	FM-15	0.00	30.19
12	0653	7	BKN:07 250	10.00		80	15.6	57	13.7	54	12.2	80	0	000		29.15			30.19	FM-15	0.00	30.20
12	0753	7	SCT:04 250	10.00		88	18.8	60	15.6	58	13.3	70	0	000		29.16	3	-0.02	30.20	FM-15	0.00	30.22
12	0853	7	SCT:04 250	10.00		89	20.6	62	16.6	57	13.9	66	8	120		29.18			30.21	FM-15	0.00	30.23
12	0953	7	SCT:04 250	10.00		73	22.8	63	17.4	57	13.9	57	0	000		29.18			30.22	FM-15	0.00	30.23
12	1053	7	FEW:02 60 BKN:07 250	10.00		77	25.0	64	17.9	56	13.3	48	5	210		29.18	1	-0.01	30.22	FM-15	0.00	30.23
12	1153	7	FEW:02 60 BKN:07 250	10.00		80	26.7	64	17.7	53	11.7	38	8	210		29.21			30.24	FM-15	0.00	30.26
12	1253	7	FEW:02 60 BKN:07 250	10.00		80	26.7	63	17.4	52	11.1	38	3	VRB		29.18			30.22	FM-15	0.00	30.23
12	1353	7	FEW:02 150 BKN:07 250	10.00		82	27.8	65	18.3	54	12.2	38	5	VRB		29.15	8	+0.02	30.20	FM-15	0.00	30.21
12	1453	7	FEW:02 150 OVC:08 250	10.00		81	27.2	65	18.1	54	12.2	39	9	140		29.15			30.19	FM-15	0.00	30.20
12	1553	7	OVC:08 250	10.00		84	28.9	66	18.7	54	12.2	38	8	VRB		29.15			30.18	FM-15	0.00	30.20
12	1653	7	FEW:02 130 OVC:08 220	10.00		82	27.8	65	18.6	55	12.8	40	5	VRB		29.14	6	+0.02	30.18	FM-15	0.00	30.19
12	1753	7	SCT:04 130 OVC:08 220	10.00		80	26.7	65	18.5	56	13.3	44	9	140		29.12			30.16	FM-15	0.00	30.17
12	1853	7	BKN:07 130 OVC:08 200	10.00		79	26.1	63	17.2	52	11.1	39	6	160		29.13	5	+0.01	30.16	FM-15	0.00	30.18
12	1953	7	BKN:07 120	10.00		78	25.6	61	16.3	49	9.4	36	8	140		29.12			30.15	FM-15	0.00	30.17
12	2053	7	OVC:08 110	10.00		77	25.0	61	16.3	50	10.0	39	9	130		29.12			30.14	FM-15	0.00	30.17
12	2153	7	OVC:08 100	10.00		76	23.9	61	16.2	51	10.6	43	5	150		29.12	5	+0.01	30.15	FM-15	0.00	30.17
12	2253	7	BKN:07 100 OVC:08 200	10.00		73	22.8	61	16.0	52	11.1	48	5	160		29.13			30.16	FM-15	0.00	30.18
12	2353	7	CLR:00	10.00		71	21.7	61	15.9	53	11.7	53	6	170		29.13			30.16	FM-15	0.00	30.18