SUNOCO PARTNERS
MARKETING & TERMINALS
An ENERGY TRANSFER Partnership

**Certified Mail: 7016 0340 0000 1757 4902**

January 9, 2019

Mr. James Rebarchak
Southeast Region Air Program Manager
Pennsylvania Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

**RE: Sunoco Partners Marketing & Terminals L.P. – Marcus Hook Industrial Complex**
**Title V Operating Permit 23-00119**
**Emissions Test Report – Source ID 113**

Dear Mr. Rebarchak:

As required by Title V Operating Permit 23-00119, Sunoco Partners Marketing & Terminals L.P. – Marcus Hook Industrial Complex (SPMT) hereby submits the attached Source Emissions Test Report for Source ID 113.

Should you have any questions, please do not hesitate to call me at (610) 859-1279.

Sincerely,

Kevin W. Smith
Specialist – Environmental Compliance

Enclosure

Cc: PSIMS Administrator
Central Office
Pennsylvania Department of Environmental Protection
400 Market Street
Harrisburg, PA 17101

Office of Air Enforcement and Compliance Assistance (3AP20)
United States Environmental Protection Agency
Region 3
1650 Arch Street
Philadelphia, PA 19103-2029

SUNOCO PARTNERS
MARKETING & TERMINALS
An ENERGY TRANSFER Partnership

**Certified Mail: 7016 0340 0000 1757 4896**

January 9, 2019

PSIMS Administrator
Central Office
Pennsylvania Department of Environmental Protection
400 Market Street
Harrisburg, PA 17101

**RE: Sunoco Partners Marketing & Terminals L.P. – Marcus Hook Industrial Complex**
**Title V Operating Permit 23-00119**
**Emissions Test Report – Source ID 113**

To Whom It May Concern:

As required by Title V Operating Permit 23-00119, Sunoco Partners Marketing & Terminals L.P. – Marcus Hook Industrial Complex (SPMT) hereby submits the attached Source Emissions Test Report for Source ID 113.

Should you have any questions, please do not hesitate to call me at (610) 859-1279.

Sincerely,

Kevin W. Smith
Specialist – Environmental Compliance

Enclosure

Cc: Mr. James Rebarchak
Southeast Region Air Program Manager
Pennsylvania Department of Environmental Protection
2 East Main Street
Norristown, PA 19401

Office of Air Enforcement and Compliance Assistance (3AP20)
United States Environmental Protection Agency
Region 3
1650 Arch Street
Philadelphia, PA 19103-2029



ED_006296_00003464-00002

SOURCE EMISSION TEST REPORT

# Source Emissions Testing of Three Reciprocating Internal Combustion Engines

**Sunoco Partners Marketing and Terminals LP**
**Marcus Hook, Pennsylvania**

January 8, 2019

OBG
Part of Ramboll

JANUARY 8, 2019| 20727|68756

# Source Emissions Testing of Three Reciprocating Internal Combustion Engines

Prepared for:

**Sunoco Partners Marketing and Terminals LP**
**Marcus Hook, Pennsylvania**

The state and federal regulations applicable to this source have been reviewed and to the best of our knowledge, all testing requirements for this source have been included as part of this test program.

BRIAN GOODHILE, SENIOR PROJECT SCIENTIST
O'Brien & Gere Engineers, Inc.

DAVID OSTASZEWSKI, P.E., SENIOR MANAGING ENGINEER
O'Brien & Gere Engineers, Inc.

KEVIN SMITH, SPECIALIST-ENVIRONMENTAL COMPLIANCE
Sunoco Partners Marketing and Terminals LP

## P-05-02B ENGINE TEST RESULTS

The table below summarizes the P-05-02B engine exhaust (Source ID 113) emissions test results conducted on November 16, 2018. Emissions were compared to the applicable emission standards set forth in the facility's Title V Operating Permit No. 23-00119, Section D I #004.

| Parameter | Reporting Units | Emission Standard | Emissions Test Result |
|---|---|---|---|
| CO | ppm, dry | NA | 7.17 |
| | ppm, dry @15% $O_2$ | ≤23 | 4.31 |

## P-05-04A ENGINE TEST RESULTS

The table below summarizes the P-05-04A engine exhaust (Source ID 113) emissions test results conducted on December 20, 2018. Emissions were compared to the applicable emission standards set forth in the facility's Title V Operating Permit No. 23-00119, Section D I #004.

| Parameter | Reporting Units | Emission Standard | Emissions Test Result |
|---|---|---|---|
| CO | ppm, dry | NA | 6.11 |
| | ppm, dry @15% $O_2$ | ≤23 | 3.43 |

## P-05-06B ENGINE TEST RESULTS

The table below summarizes the P-05-06B engine exhaust (Source ID 113) emissions test results conducted on November 16, 2018. Emissions were compared to the applicable emission standards set forth in the facility's Title V Operating Permit No. 23-00119, Section D I #004.

| Parameter | Reporting Units | Emission Standard | Emissions Test Result |
|---|---|---|---|
| CO | ppm, dry | NA | 3.20 |
| | ppm, dry @15% $O_2$ | ≤23 | 1.97 |

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A Test Protocol and USEPA/PADEP Correspondences
B Schematic of the Test Location
C Operations Data
D Field Data
E Test Results and Calculations
F Equipment Calibration Data

## 1. INTRODUCTION AND BACKGROUND

O'Brien & Gere (OBG) was retained by Sunoco Partners Marketing and Terminals, LP (Sunoco) to conduct source emissions testing on Sunoco's six diesel engines (Source ID 113) serving the Marcus Hook Industrial Complex located in Marcus Hook, Pennsylvania. The test program is designed to satisfy source emission testing requirements outlined in 40 CFR Part 63, Subpart ZZZZ (RICE MACT) and Sunoco's Operating Permit (23-00119). The objective of this test program was to evaluate carbon monoxide (CO) concentrations from the engine exhausts with respect to emission limits.

Mr. Brian Goodhile of OBG conducted the test program for the P-05-02 B and P-05-06 B engines on November 16, 2018 and the test program for the P-05-04 A engine was conducted on December 20, 2018. Mr. Kevin Smith of Sunoco was present to monitor process conditions and collect facility operations data.

This report presents a description of the sources tested, a summary of the scope of work conducted, sampling methods used, QA/QC procedures, and emission test results. A copy of the approved test protocol and all United States Environmental Protection Agency (USEPA) and Pennsylvania Department of Environmental Protection (PADEP) correspondences are presented in Appendix A. The following are the testing program's participants and their contact information.

### 1.1 EMISSIONS TESTING PROGRAM PARTICIPANTS

**Facility**

| | |
|---|---|
| Name: | Sunoco Partners Marketing and Terminals LP |
| Address: | 100 Green Street<br>Marcus Hook, PA 19061 |
| Contact: | Kevin Smith |
| Email: | kevin.smith2@energytransfer.com |
| Telephone number: | (610) 859-1279 |

**Source Testing Firm**
***PADEP Environmental Laboratory Registration No. 46-03650***

| | |
|---|---|
| Name: | O'Brien & Gere Engineers, Inc. |
| Address: | 301 E. Germantown Pike,<br>Bentwood Campus<br>3rd Floor<br>E. Norriton, PA 19401 |
| Contact: | Brian Goodhile |
| Email: | Brian.Goodhile@obg.com |
| Telephone number: | (215) 628-9100 |

## 2. SOURCE DESCRIPTION

This section provides a description of the process tested, as well as operating requirements and parameters maintained during testing.

### 2.1 PROCESS DESCRIPTION

Sunoco owns and operates a refined petroleum product and crude oil storage and transfer terminal at its Marcus Hook Industrial Complex located in Marcus Hook, Pennsylvania. The Marcus Hook Industrial Complex employs six diesel engines (three pair of engines) (Source ID 113) to power six water pumps utilized to remove surface water from the Marcus Hook facility roadways to allow access to pipe racks and cable trays during a significant rainfall event. As the amount of water subsides the pumps are shut-down as the engines are no longer required to drain the area. It should be noted that maximum load for the engines are only achieved during these events and it is not feasible to recirculate the surface water through the discharge pump as when the surface water heats it may overheat the discharge pump resulting in damage.

#### 2.1.1 P-05A-02 A & B

The P-05-02 A & B engines are identical Caterpillar Model 3512 sixteen cylinder, compression ignition engines. The units are fired with No. 2 fuel oil and have a maximum rated horsepower of 1745 HP at 1800 RPM. Each engine is directly coupled to a facility water pump with a maximum rated pump capacity of 23,500 gallons per minute (gpm). Each engine is equipped with an oxidation catalyst for CO control.

#### 2.1.2 P-05A-04 A & B

The P-05-04 A & B engines are identical Caterpillar Model 3516 sixteen cylinder, compression ignition engines. The units are fired with No. 2 fuel oil and have a maximum rated horsepower of 2294 HP at 1800 RPM. Each engine is directly coupled to a facility water pump with a maximum rated pump capacity of 32,000 gpm. Each engine is equipped with an oxidation catalyst for CO control.

#### 2.1.3 P-05A-06 A & B

The P-05-06 A & B engines are identical Caterpillar Model 3508 sixteen cylinder, compression ignition engines. The units are fired with No. 2 fuel oil and have a maximum rated horsepower of 1184 HP at 1800 RPM. Each engine is directly coupled to a facility water pump with a maximum rated pump capacity of 42,650 gpm. Each engine is equipped with an oxidation catalyst for CO control.

### 2.2 UNIT OPERATING PARAMETERS

Please note, each engine operates at a reduced load level and testing within 90 percent of the maximum rated capacity was not feasible. Testing was conducted while the engines were operated within 10 percent of the maximum normal operating condition and approximately 55 percent of the maximum rated capacity as maintained by facility personnel. The typical maximum normal operating condition is approximately 60 percent of the rated capacity.

Operating data including catalyst pressure drop (in $H_2O$), catalyst inlet temperature (Deg F.) and pump governor position (%) was monitored and recorded by facility personnel during the test periods. These data are presented in Appendix B.

## 3. SUMMARY OF TEST PROGRAM

This section provides a summary of the source emissions testing program performed on each engine exhaust.

### 3.1 TEST PROGRAM VARIANCE

Due to the complex nature of predicting the variability of storm events and predicting the actual run time of each engine, the USEPA, in a letter dated February 20, 2018, granted a proposed alternative test plan to Sunoco relaxing the required three 1-hour test runs to three 15-minute test runs and additionally allowing Sunoco to test one engine per each pair of identical engines. In the initial 40 CFR Part 63 Subpart ZZZZ compliance test conducted in September 2015, engines P-05-02A, P-05-04B, and P-05-06A were tested. As recommended by the USEPA, Sunoco conducted testing on engines P-05-02B, P-05-04A, and P-05-06B to demonstrate subsequent compliance. A copy of the USEPA approval and subsequent correspondence are presented in Appendix A of this test report.

### 3.2 TESTING PROGRAM SUMMARY

In accordance with Sunoco Partners Marketing and Terminals, LP's Operating Permit No. 23-00119, Section D II and 40 CFR Part 63 Subpart ZZZZ, source emission testing was conducted to evaluate emissions of CO while each unit fires No.2 fuel oil. Emissions compliance testing consisted of three test runs per engine. All test runs were a minimum of 15 minutes in duration. Results for CO are reported in units of parts per million on a dry basis (ppm, dry) and ppm, dry normalized to 15% oxygen (ppm, dry @ 15% $O_2$). Please note no fuel sampling or analysis was conducted as part of this test program.

A summary of the sources tested and target parameters is outlined below.

**Table 3.2 Compliance Test Program Parameters.**

| | Parameter | Reference Method | No. of Test Runs Per Location | Test Run Duration |
|---|---|---|---|---|
| P-05-02B, P-05-04A, & P-05-06B | CO | USEPA RM 10 | 3 | 15 min. |
| | $O_2$ | USEPA RM 3A | 3 | concurrent |

CO emissions were evaluated to demonstrate compliance with the applicable short term emission limits set forth in the facility's Title V Operating Permit No. 23-00119, Section D I #004:

- CO emission limit – ≤23 ppm, dry @ 15% $O_2$

# 4. SAMPLING AND ANALYTICAL PROCEDURES

This section provides a description of the test methods that were utilized during the source emissions test program.

## 4.1 TEST METHODS

The test procedures will be conducted in accordance with the most recent updates to the United States Environmental Protection Agency (USEPA) Reference Methods (RM) described in 40 CFR 60; Appendix A.

| | |
|---|---|
| Method 1: | Sample and velocity traverses for stationary sources |
| Method 3A: | Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources – Instrumental Analyzer Procedure |
| Method 10: | Determination of carbon monoxide emissions from stationary sources (Instrumental Analyzer Procedure) |

## 4.2 SAMPLE LOCATION DESCRIPTION

Each engine exhausts to atmosphere through a circular stack approximately 14 inches in diameter. A single test port is located 28 inches (approximately 2.0 duct diameters) downstream of the nearest flow disturbance, and 7 inches (approximately 0.5 duct diameters) upstream of the stack exhaust point.

A schematic of the test locations is presented in Appendix C.

## 4.3 SAMPLING PROCEDURE

A 3-point gas stratification check was conducted in conjunction with the first test run of each engine. The results of the stratification check demonstrated that the gas stream within the stack was not stratified (<5% or ±0.5 ppm of the overall average at each traverse point) and sampling was conducted at a single point near the center of the duct for the remaining test runs.

## 4.4 OXYGEN CONCENTRATION

The percent $O_2$ levels in the exhaust stream were evaluated in accordance USEPA RM 3A procedures. $O_2$ concentrations were evaluated using a California Analytical Instruments Model 600 paramagnetic analyzer. A continuous gas sample was extracted from the exhaust stack through, a stainless steel probe, heated Teflon® line and through a conditioning system used to remove moisture from the gas stream. All material that came in contact with the sample was constructed of either stainless steel, glass, or Teflon®.

Analyzer outputs were monitored using a laptop computer and recorded every two seconds by a data acquisition system (DAS). The DAS reported emissions data as 1-minute averages for each test run. $O_2$ concentration data reported by the DAS were corrected for system zero and span bias.

## 4.5 CARBON MONOXIDE EMISSIONS

Emissions of CO were evaluated in accordance with USEPA RM 10 using a Thermo Model 48i non-dispersive infrared analyzer. The sample collection and data recording were conducted in the same manner as described in Section 4.4. CO concentration data reported by the DAS was corrected for system zero and span bias.

The analyzers were calibrated using USEPA Protocol 1 gas standards. Table 4.1 outlines the analyzer span and calibration gases that were used during the testing.

**Table 4.1 Analyzer Operating Range and Calibration Gases.**

| Analyzer ID | Source ID | Calibration Span | Calibration Gases[a] |
|---|---|---|---|
| $O_2$ (CAI 600) | P-05-02B & P-05-06B | 0 – 21.0% | 12.26 % $O_2$ in $CO_2/N_2$<br>21.0 % $O_2$ in $CO_2/N_2$ |
| | P-05-04A | 0 – 20.83% | 11.45 % $O_2$ in $N_2$<br>20.83 % $O_2$ in $CO_2/N_2$ |
| CO (THERMO 48I) | P-05-02B & P-05-06B | 0 – 46.5 ppm | 22.7 ppm CO in $N_2$<br>46.5 ppm CO in $N_2$ |
| | P-05-04A | 0 – 45.4 ppm | 22.7 ppm CO in $N_2$<br>45.4 ppm CO in $N_2$ |

[a] Analyzers were zeroed with ultra high purity (UHP) grade nitrogen

## 5. EMISSIONS TEST RESULTS

The emissions testing program for the P-05-02B and P-05-6B engines were performed on November 16, 2018. The emissions testing program for P-05-04A was conducted on December 20, 2018. A summary of the emissions test results is presented in Tables 1 through 3 of the appendices. Field data are presented in Appendix D of this test report. Detailed test results and example calculations are presented in Appendix E.

### 5.1 P-05-02B ENGINE TEST RESULTS

Table 1 of the appendices presents the complete emission test results for the P-05-02B engine exhaust (Source ID 113). Table 5.1 below summarizes the P-05-02B engine exhaust emissions test results.

**Table 5.1 Summary of P-05-02B Engine Exhaust Test Results.**

| Parameter | Reporting Units | Emission Standard | Emissions Test Result |
|---|---|---|---|
| CO | ppm, dry | NA | 7.17 |
| | ppm, dry @15% $O_2$ | ≤23 | 4.31 |

As shown in Table 5.1, the CO concentrations for the P-05-02B engine averaged 7.17 parts per million, dry (ppm, dry) and concentrations normalized to 15% oxygen averaged 4.31 ppm, dry @15% $O_2$ or approximately 19 percent of the 23 ppm, dry @15% $O_2$ emission standard.

### 5.2 P-05-04A ENGINE TEST RESULTS

Table 2 of the appendices presents the complete emission test results for the P-05-04A engine exhaust (Source ID 113). Table 5.2 below summarizes the P-05-04A engine exhaust emissions test results.

**Table 5.2 Summary of P-05-04A Engine Exhaust Test Results.**

| Parameter | Reporting Units | Emission Standard | Emissions Test Result |
|---|---|---|---|
| CO | ppm, dry | NA | 6.11 |
| | ppm, dry @15% $O_2$ | ≤23 | 3.43 |

As shown in Table 5.2, the CO concentrations for the P-05-04A engine averaged 6.11 ppm, dry and concentrations normalized to 15% oxygen averaged 3.43 ppm, dry @15% $O_2$ or approximately 15 percent of the 23 ppm, dry @15% $O_2$ emission standard.

### 5.3 P-05-06B ENGINE TEST RESULTS

Table 3 of the appendices presents the complete emission test results for the P-05-06B engine exhaust (Source ID 113). Table 5.3 below summarizes the P-05-06B engine exhaust emissions test results.

Table 5.3 Summary of P-05-06B Engine Exhaust Test Results.

| Parameter | Reporting Units | Emission Standard | Emissions Test Result |
|---|---|---|---|
| CO | ppm, dry | NA | 3.20 |
| | ppm, dry @15% $O_2$ | ≤23 | 1.97 |

As shown in Table 5.3, the CO concentrations for the P-05-06B engine averaged 3.20 ppm, dry and concentrations normalized to 15% oxygen averaged 1.97 ppm, dry @15% $O_2$ or approximately 9 percent of the 23 ppm, dry @15% $O_2$ emission standard.

## 5.4 DISCUSSIONS AND CONCLUSION

There were no operational or testing problems that impacted the test results and all test data is believed to be representative of the emissions encountered during the test program.

# 6. QUALITY ASSURANCE/QUALITY CONTROL

The following summarizes the QA/QC procedures that were used for the testing.

## 6.1 EQUIPMENT CALIBRATION

Analyzers were calibrated in accordance with the procedures outlined in the corresponding USEPA test methods and/or the USEPA document entitled Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III - Stationary Source Specific Methods (EPA 600/R-94/038c).

At the beginning of and following every test run each analyzer and the entire instrument measurement system was challenged with USEPA Protocol No. 1 gas standards (zero and mid gas) in accordance with procedures specified in each respective test method. The calibration gases were introduced to the sampling system near the end of the sample probe to expose the calibration standards to as much of the system as possible. CO and $O_2$ concentrations were bias corrected in accordance with USEPA RM 7E procedures.

Protocol calibration standards were prepared in accordance with USEPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards. The accuracy of these gases were +/-2% or better. Copies of the calibration certificates are included in Appendix E of this final source test report.

## 6.2 TEST DATA AND REPORT REVIEW

Test data input and emission calculations were double-checked for accuracy. The test results were reviewed by senior personnel for completeness and accuracy. The final report was peer reviewed by senior personnel and certified by the project manager.

# Table 1
## Summary of Emissions Test Results
## Sunoco Partners Marketing and Terminals, L.P.
## P-05A-02B
## Engine Exhaust
## Marcus Hook, Pennsylvania

| Run Identification | | Run 1 | Run 2 | Run 3 | Average | Emission Standard | Percent of Emission Standard |
|---|---|---|---|---|---|---|---|
| Run Date | | 16Nov18 | 16Nov18 | 16Nov18 | | | |
| Start/Stop Time | | 1628-1643 | 1657-1713 | 1720-1735 | | | |
| Exhaust Gas Conditions | | | | | | | |
| | Oxygen (dry volume %) | 11.51 | 10.91 | 10.89 | 11.10 | | |
| Carbon Monoxide | | | | | | | |
| | ppm, dry | 6.58 | 7.86 | 7.07 | 7.17 | | |
| | ppmv, dry (adj. to 15% O2) | 4.13 | 4.64 | 4.17 | 4.31 | 23 | 19 |

# Table 2
## Summary of Emissions Test Results
## Sunoco Partners Marketing and Terminals, L.P.
## P-05A-04A
## Engine Exhaust
## Marcus Hook, Pennsylvania

| Run Identification | | Run 1 | Run 2 | Run 3 | Average | Emission Standard | Percent of Emission Standard |
|---|---|---|---|---|---|---|---|
| Run Date | | 20Dec18 | 20Dec18 | 20Dec18 | | | |
| Start/Stop Time | | 1722-1737 | 1750-1805 | 1822-1837 | | | |
| Exhaust Gas Conditions | | | | | | | |
| | Oxygen (dry volume %) | 10.35 | 10.30 | 10.55 | 10.40 | | |
| Carbon Monoxide | | | | | | | |
| | ppm, dry | 7.09 | 6.46 | 4.77 | 6.11 | | |
| | ppmv, dry (adj. to 15% O2) | 3.97 | 3.60 | 2.72 | 3.43 | 23 | 15 |

# Table 3
## Summary of Emissions Test Results
## Sunoco Partners Marketing and Terminals, L.P.
## P-05A-06B
## Engine Exhaust
## Marcus Hook, Pennsylvania

| Run Identification | | Run 1 | Run 2 | Run 3 | Average | Emission Standard | Percent of Emission Standard |
|---|---|---|---|---|---|---|---|
| Run Date | | 16Nov18 | 16Nov18 | 16Nov18 | | | |
| Start/Stop Time | | 1350-1405 | 1413-1428 | 1434-1449 | | | |
| Exhaust Gas Conditions | | | | | | | |
| | Oxygen (dry volume %) | 10.54 | 11.85 | 11.14 | 11.18 | | |
| Carbon Monoxide | | | | | | | |
| | ppm, dry | 2.12 | 3.89 | 3.58 | 3.20 | | |
| | ppmv, dry (adj. to 15% O2) | 1.21 | 2.54 | 2.16 | 1.97 | 23 | 9 |

# Test Protocol and USEPA/PADEP Correspondences

## Brian Goodhile

**From:** Smith, Kevin W <kevin.smith2@energytransfer.com>
**Sent:** Friday, December 21, 2018 8:06 AM
**To:** Henry, Heather
**Cc:** Willard, Erin; Eckert, George; Brian Goodhile; Pappa Jr, John J; Bryan, Nick
**Subject:** RE: Sunoco Partners Marketing & Terminals L.P. - Engine Testing

Testing on Engine 4A was completed last night.

---

**From:** Smith, Kevin W
**Sent:** Wednesday, December 19, 2018 1:33 PM
**To:** 'Henry, Heather' <hehenry@pa.gov>
**Cc:** 'Willard, Erin' <Willard.ErinM@epa.gov>; 'Eckert, George' <geckert@pa.gov>; 'Brian Goodhile' <Brian.Goodhile@obg.com>; Pappa Jr, John J <JOHN.PAPPA@energytransfer.com>
**Subject:** RE: Sunoco Partners Marketing & Terminals L.P. - Engine Testing

Heather,

Engine 4A has been fixed. As stated in my voicemail, Sunoco Partners Marketing & Terminals L.P. is expecting rainfall tomorrow afternoon and into Friday. Due to the sporadic and unpredictable nature of the operation of the wastewater diesel engines (Source ID: 113) based on rainfall, the EPA has allowed notification for the performance testing to take place by telephone and email as soon as SPMT is aware of the possibility of completing a test, rather than the 60-day written notification. If there is sufficient rainfall, SPMT will conduct the testing on December 20th or 21st, 2018. If the testing cannot be completed on either of these dates, SPMT will notify you by telephone and email.

If you have any questions, comments, or concerns, please do not hesitate to contact me.

Thanks,
Kevin

---

**From:** Smith, Kevin W
**Sent:** Monday, November 19, 2018 8:03 AM
**To:** 'Henry, Heather' <hehenry@pa.gov>
**Cc:** 'Willard, Erin' <Willard.ErinM@epa.gov>; 'Eckert, George' <geckert@pa.gov>; 'Brian Goodhile' <Brian.Goodhile@obg.com>; Pappa Jr, John J <JOHN.PAPPA@energytransfer.com>
**Subject:** RE: Sunoco Partners Marketing & Terminals L.P. - Engine Testing

Heather,

We completed testing on Engines 2B and 6B last Friday. Engine 4A would not start because it had a low coolant alarm and over crank alarm. Our Maintenance Department was unable to fix it on Friday, so we will have to complete Engine 4A another day once it is fix.

Kevin

---

**From:** Smith, Kevin W
**Sent:** Thursday, November 15, 2018 9:26 AM
**To:** 'Henry, Heather' <hehenry@pa.gov>

**Cc:** 'Willard, Erin' <Willard.ErinM@epa.gov>; 'Eckert, George' <geckert@pa.gov>; 'Brian Goodhile' <Brian.Goodhile@obg.com>; Pappa Jr, John J <JOHN.PAPPA@energytransfer.com>
**Subject:** Sunoco Partners Marketing & Terminals L.P. - Engine Testing

Hi Heather,

As discussed in our telephone conversation, Sunoco Partners Marketing & Terminals L.P. is expecting snow then rainfall this evening and into Friday. Due to the sporadic and unpredictable nature of the operation of the wastewater diesel engines (Source ID: 113) based on rainfall, the EPA has allowed notification for the performance testing to take place by telephone and email as soon as SPMT is aware of the possibility of completing a test, rather than the 60-day written notification. If there is sufficient rainfall, SPMT will conduct the testing on November 16, 2018. If the testing cannot be completed on this date, SPMT will notify you by telephone and email.

If you have any questions, comments, or concerns, please do not hesitate to contact me.

Thanks,
Kevin

ENERGY TRANSFER

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**Kevin W. Smith**
Specialist – Environmental Compliance
Marcus Hook Industrial Complex
Sunoco Partners Marketing & Terminals L.P.

**O:** 610.859.1279
**C:** 215.817.3361
Kevin.smith2@energytransfer.com

Private and confidential as detailed here. If you cannot access hyperlink, please e-mail sender.

## Brian Goodhile

**From:** Smith, Kevin W <kevin.smith2@energytransfer.com>
**Sent:** Monday, September 10, 2018 10:23 AM
**To:** Henry, Heather
**Cc:** Eckert, George; Bryan, Nick; Willard, Erin; Brian Goodhile
**Subject:** FW: Subpart ZZZZ Engine Testing
**Attachments:** Sampling Locations.pdf

Heather,

Per my voicemail, we were unable to test the engines (2B, 4A, and 6B) today because the engines never had sampling ports installed on them. Diesel Engines 2A, 4B, and 6A had extended exhausts and sampling ports installed back in 2014 and these engines we tested in 2015. I was not aware that the extended exhausts and sampling ports were not installed in the other engines. Our Maintenance Department will have these fabricated and installed by the end of the month. We will plan on testing in October.

Thanks,
Kevin

---

**From:** Smith, Kevin W
**Sent:** Friday, September 07, 2018 10:10 AM
**To:** Henry, Heather <hehenry@pa.gov>
**Cc:** 'Eckert, George' <geckert@pa.gov>; Bryan, Nick <Nick.Bryan@energytransfer.com>; 'Willard, Erin' <Willard.ErinM@epa.gov>; Brian Goodhile <Brian.Goodhile@obg.com>; Pappa Jr, John J <JOHN.PAPPA@energytransfer.com>
**Subject:** Subpart ZZZZ Engine Testing

Hi Heather,

As discussed in our telephone conversation, Sunoco Partners Marketing & Terminals L.P. is expecting heavy rainfall this weekend and into Monday. Due to the sporadic and unpredictable nature of the operation of the wastewater diesel engines (Source ID: 113) based on rainfall, the EPA has allowed notification for the performance testing to take place by telephone and email as soon as SPMT is aware of the possibility of completing a test, rather than the 60-day written notification per the attached letter. If there is sufficient rainfall, SPMT will conduct the testing on September 10, 2018. If the testing cannot be completed on this date, SPMT will notify you by telephone and email.

If you have any questions, comments, or concerns, please do not hesitate to contact me.

Thanks,
Kevin

ENERGY TRANSFER

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**Kevin W. Smith**
Specialist – Environmental Compliance
Marcus Hook Industrial Complex
Energy Transfer Partners

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Private and confidential as detailed here. If you cannot access hyperlink, please e-mail sender.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

FEB 20 2018

In Reply Refer To: 3AP20

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. Kevin Smith
Environmental Compliance Specialist
Sunoco Partners
Marketing & Terminals, L.P.
100 Green Street
Marcus Hook, PA 19061

Dear Mr. Smith:

The United States Environmental Protection Agency, (EPA) Region 3 issued an approval for an alternative testing scenario to Sunoco Partners Marketing & Terminals, L.P. (Sunoco) on August 1, 2013 for six reciprocating internal combustion (RICE) compression ignition (CI) engines located at the Marcus Hook Refinery, located in Marcus Hook, PA (facility or site). The engines are used to power flood pumps that move large quantities of water at the facility during large rain events, preventing flooding of the facility and allowing access to pipe racks and cable trays at the site.

Each of the six engines is subject to 40 C.F.R. Part 63 Subpart ZZZZ: National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (Subpart 4Z or RICE Rule), because each is a stationary RICE located at a major source of hazardous air pollutants (HAPs). Furthermore, even though the six engines operate only during heavy rains, they do not meet the definition of an "emergency stationary RICE" in accordance with an October 12, 2011 letter issued by EPA Region 1, Air Programs Branch, to the Massachusetts Water Resources Authority. In order to comply with the emissions standards in Subpart 4Z, Sunoco installed pollution reduction catalyst on each unit prior to the May 3, 2013 compliance date found at § 63.6595(a) for existing CI RICE.

The six engines were manufactured by Caterpillar, installed in 1994, and are arranged as three sets of two identical units, summarized below:

| Designation | Horsepower (hp)/each engine | Pumping Capacity Gallons per Minute (GPM) |
|---|---|---|
| MP05-02 A & B | 1745 | 23,500 |
| MP05-04 A & B | 2294 | 32,000 |
| MP05-06 A & B | 1184 | 42,650 |

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Due to the sporadic and unpredictable nature of the operation of the engines based on rainfall, EPA's August 1, 2013 approval allowed Sunoco to implement the following testing protocol alternatives:

1. EPA will allow notification for the performance test to take place by phone and email as soon as Sunoco is aware of the possibility of completing a test, rather than the 60-day written notification of intent to test required at § 63.6645(g) and by the requirements of the General Provisions at § 63.7.

2. EPA will allow testing on one engine from each pair only, so long as Sunoco provides documentation to EPA demonstrating that each engine from each pair is identical to the other one from the pair. For the next required performance test, Sunoco should make the effort to test the other engine from the pair, in order to compile a full complement of performance tests for all six engines.

3. EPA will allow an extension of an additional 180 days to complete the performance testing in order to ensure rain event(s) heavy enough to allow testing on the engine sets. If after one year of the compliance date (May 3, 2014) there have not been enough rain events to complete testing on each engine, Sunoco shall contact EPA, Region 3 to discuss continuing the compliance period.

4. EPA will allow a shortened run of 15 minutes each, rather than the three (1) hour runs required in the rule. Sunoco should perform three test runs at 90% (or greater) of the design load for each engine being tested.

Following the testing alternatives 1-4 above, Sunoco completed its performance test on Engines -02A, -04B and -06A during a rain event on September 30, 2015; this test demonstrated compliance with the required emission limit of 23 ppm carbon monoxide (CO) at 15% oxygen ($O_2$). Subpart 4Z at § 63.6615 and Table 3 requires Sunoco to complete testing on the engines every three years (or 8760 hours of operation). In accordance with the 2013 Approval and by letter dated January 22, 2018[1], Sunoco requested approval of the same alternative testing protocol for the three untested engines, -02B, -04A and -06B by September 30, 2018. Sunoco provided updated operational info in February 2018 demonstrating that the cumulative annual operating hours (2014 to 2017) for all six engines varied between 185 and 655 hours, so testing every 3 years is the appropriate compliance schedule.

EPA Region 3 approves Sunoco's request as outlined above in Items 1-4 for engine units -02B, -04A and -06B. Please be aware that while the rule specifies a 3-year testing schedule, Sunoco may complete its test at any time within that 3-year window, meaning it can complete its test upon receipt of this approval.

The performance test protocol and final test reports will be submitted to EPA and Pennsylvania Department of Environmental Protection (PADEP) as required by Subpart 4Z, the General Provisions of 40 CFR Part 63, PADEP's rules and Sunoco's Title V Permit. Nothing in this approval alters the rules and requirements of Subpart 4Z as they apply to the Marcus Hook

[1] The letter also included a request for a waiver of EPA Test Methods. R3 referred Sunoco to the appropriate staff at EPA's Office of Air Quality Planning and Standards (OAQPS) for approval of the Test Method request. Mr. Smith indicated in a February 2, 2018 email that Sunoco would follow the Test Methods required by Subpart 4Z.

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Marcus Hook facility or any other Sunoco Logistics site, for the subject fire pump engines and all other engines at this or other sites.

If you have questions or comments regarding this letter, please contact Erin Willard of the Office of Air Enforcement and Compliance Assistance at (215) 814-2152 or by email at Willard.ErinM@epa.gov.

Sincerely,

Cristina Fernandez, Director
Air Protection Division

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*Customer Service Hotline: 1-800-438-2474*

SUNOCO PARTNERS
MARKETING & TERMINALS
An ENERGY TRANSFER Partnership

**CERTIFIED MAIL: 7016 0340 0000 1757 6845**

Erin Willard
Environmental Scientist
US EPA Region III
Office of Air Enforcement and Compliance Assistance (3AP20)
1650 Arch Street
Philadelphia, PA 19103

**Re: Sunoco Partners Marketing & Terminals L.P. – Marcus Hook Industrial Complex**
**Title V Operating Permit 23-00119**
**Request for an Alternate Testing Plan for 40 CFR Part 63, Subpart ZZZZ**

Dear Ms. Willard,

Sunoco Partners Marketing & Terminals L.P. (SPMT) has six (6) diesel engines located at its Marcus Hook Industrial Complex and subject to 40 CFR Part 63, Subpart ZZZZ. Those six diesel engines power six water pumps that are used only when a significant rain event occurs in the facility. The pumps were installed in 1994. As they were subject to Subpart ZZZZ as existing engines located at a major facility and were greater than 500 HP, controls were installed under Pennsylvania Plan Approval 23-0001AD and later incorporated into Tile V Operating Permit 23-00119. The Subpart ZZZZ regulation has specific requirements for notification and testing at full load that are not reasonably achievable due to uncertainty of rainwater. In order to achieve the load conditions required of the regulation, a significant rainfall must occur. Also, the equipment cannot normally run fully loaded for the length of time to do full testing (three, 1-hour runs typically require 4 hours per source). As the amount of water subsides in the facility, the pumps are shutdown as they cannot operate without water.

Below is a summary of the diesel engine pump sets:

| Description | Horsepower of Diesel | Standard Capacity |
|---|---|---|
| MP05-02 A & B | 1745 | 23,500 GPM |
| MP05-04 A&B | 2294 | 32,000 GPM |
| MP05-06 A & B | 1184 | 42,650 GPM |

SPMT previously requested an alternate testing plan in a letter to the EPA dated July 8, 2013. The EPA approved of the alternate testing plan in a letter to SPMT dated August 1, 2013. SPMT completed the testing of engines 2A, 4B, and 6A on September 30, 2015. Per 40 CFR 63.6615, subsequent performance testing in accordance with 40 CFR 63, Subpart ZZZZ, Table 4 (Item 3), shall be performed on each engine every 8,760 operating hours or three (3) years. Therefore, SPMT proposes to test engines 2B, 4A, and 6B by September 30, 2018.

SPMT kindly requests an alternative testing plan to demonstrate compliance with the 23 ppm of CO at 15% O2 (40 CFR 63 ZZZZ Table 2C). SPMT intends to monitor the forecast for significant rain, mobilize our testing contractors, and stage testing equipment near the pumps in preparation for the test.

- Testing of CO in 15 minute runs verses the three 1-hour runs (1-hour run requirement is found in Table 4 item #5 of the standard. Per 40 CFR 63.6630, 15-minute requirement allowed for other equipment).
- 60-day notification of intent to test requirement waived (63.6645(g)).
- Testing of one engine per pair. SPMT previously tested engines 2A, 4B, and 6A and proposes to test engines 2B, 4A, and 6B for this test.
- Waiver of stratification requirement Method 1 (this was granted for internal combustion engine test for Reference Method 7E). See attached.
- Compliance standard of 23 ppm CO at 15% excess O2 is the applicable standard.

Submittal of testing protocols and final test reports to the appropriate agencies will be compliant with the State and Federal rules.

Please feel free to contact me by email at kevin.smith2@energytransfer.com or by telephone at 610-859-1279.

Sincerely,

Kevin Smith
Specialist – Environmental Compliance

Cc: Heather Henry, PADEP Bureau of Air Quality

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NC 27711

JUL 27 2011

OFFICE OF
AIR QUALITY PLANNING
AND STANDARDS

Mr. Ryan O'Dea
Alliance Source Testing
8020 Counts Massie Road
N. Little Rock, Arkansas 72113

Dear Mr. O'Dea:

In your July 21, 2011 correspondence, you asked for a waiver of the stratification test required in Method 7E (40 CFR 60, Appendix A) when testing reciprocating internal combustion engines. You noted the difficulty in evaluating emission profiles where gas concentrations are constantly varying and exhausts are too small to effectively traverse. These conditions render a stratification test ineffective and inappropriate. Under Federal New Source Performance Standards (40 CFR 60 Subparts IIII and JJJJ), Methods 1 or 1A and Method 7E are required for selecting sampling points and measuring nitrogen oxides ($NO_x$). Method 7E requires a stratification check before each test.

We agree that a stratification test does not enhance representative sampling and is not appropriate under the noted conditions. We are currently revising Subparts IIII and JJJJ to delete the Method 1 or 1A requirement for sampling point selection. In its place we will specify single-point sampling at the centroid of the exhaust. This new requirement will preclude the need for a stratification test with Method 7E.

We grant your request for a waiver of the stratification test whenever Method 7E is used to determine $NO_x$ emissions from Federally-regulated engines. Single-point sampling at the centroid of the exhaust is adequate. This waiver also applies to carbon monoxide testing. We will be posting this approval on our website at http://www.epa.gov/ttn/emc/approalt.html for use by other interested parties with similar situations.

If you have questions or would like to discuss the matter further, please call Foston Curtis at (919) 541-1063 or you may email him at curtis.foston@epa.gov.

Sincerely,

Connie Oldham

Conniesue B. Oldham, Ph.D., Group Leader
Measurements Technology Group

cc: Melanie King, OAQPS/SPPD/ESD (D243-01)



ED_006296_00003464-00031

SOURCE EMISSION TEST PROTOCOL

# Source Emissions Testing of Three Reciprocating Internal Combustion Engines

**Sunoco Partners Marketing and Terminals, L.P.**
**Marcus Hook, Pennsylvania**

January 31, 2018

OBG

JANUARY 31, 2018| 20727| 68756

# Source Emissions Testing of Three Reciprocating Internal Combustion Engines

Prepared for:

**Sunoco Partners Marketing and Terminals, L.P.**
**Marcus Hook, Pennsylvania**

The state and federal regulations applicable to this source have been reviewed and to the best of our knowledge, all testing requirements for this source have been included as part of this test program.

BRIAN GOODHILE, SENIOR PROJECT SCIENTIST
O'Brien & Gere Engineers, Inc.

DAVID OSTASZEWSKI, P.E., SENIOR MANAGING ENGINEER
O'Brien & Gere Engineers, Inc.

KEVIN SMITH, SPECIALIST-ENVIRONMENTAL COMPLIANCE
Sunoco Partners Marketing and Terminals, LP

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# 1. INTRODUCTION AND BACKGROUND

O'Brien & Gere (OBG) has been retained by Sunoco Partners Marketing and Terminals, LP (Sunoco) to conduct source emissions testing on Sunoco's six diesel engines serving the Marcus Hook Industrial Complex located in Marcus Hook, Pennsylvania. The test program is designed to satisfy source emission testing requirements outlined in 40 CFR Part 63, Subpart ZZZZ (RICE MACT) and Sunoco's Operating Permit (23-00119). The objective of this test program is to evaluate carbon monoxide (CO) concentrations from the engine exhausts with respect to emission limits. The following source emissions test protocol is submitted for your review and approval.

The test program will be carried out in accordance with the procedures outlined in 40 CFR 60, Appendix A and the PADEP Source Testing Manual (Revision No. 3.3, November 2000).

The protocol presents a description of the sources to be tested, a summary of the scope of work to be conducted, sampling methods to be used, QA/QC procedures, and final reporting content. The following are the testing program's participants and their contact information.

## 1.1 EMISSIONS TESTING PROGRAM PARTICIPANTS

**Facility**

| | |
|---|---|
| Name: | Sunoco Partners Marketing and Terminals, LP |
| Address: | 100 Green Street<br>Marcus Hook, PA 19061 |
| Contact: | Kevin Smith |
| Email: | kevin.smith2@energytransfer.com |
| Telephone number: | (610) 859-1279 |

**Source Testing Firm**
***PADEP Environmental Laboratory Registration No. 46-03650***

| | |
|---|---|
| Name: | O'Brien & Gere Engineers, Inc. |
| Address: | 301 E. Germantown Pike,<br>Bentwood Campus<br>3rd Floor<br>E. Norriton, PA 19401 |
| Contact: | Brian Goodhile |
| Email: | Brian.Goodhile@obg.com |
| Telephone number: | (215) 628-9100 |

## 2. SOURCE DESCRIPTION

This section provides a description of the processes to be tested, as well as operating requirements and parameters to be maintained during testing.

### 2.1 PROCESS DESCRIPTION

Sunoco owns and operates a refined petroleum product and crude oil storage and transfer terminal at its Marcus Hook Industrial Complex located in Marcus Hook, Pennsylvania. The Marcus Hook Industrial Complex employs six diesel engines (three pair of engines) to power six water pumps utilized to remove surface water from the Marcus Hook facility roadways to allow access to pipe racks and cable trays during a significant rainfall event. As the amount of water subsides the pumps are shut-down as the engines are no longer required to drain the area. It should be noted that maximum load for the engines are only achieved during these events and it is not feasible to recirculate the surface water through the discharge pump as when the surface water heats it may overheat the discharge pump resulting in damage.

#### 2.1.1 P-05A-02 A & B

The P-05-02 A & B engines are identical Caterpillar Model 3512 sixteen cylinder, compression ignition engines. The units are fired with No. 2 fuel oil and have a maximum rated horsepower of 1745 HP at 1800 RPM. Each engine is directly coupled to a facility water pump with a maximum rated pump capacity of 23,500 gallons per minute (gpm). Each engine is equipped with an oxidation catalyst for CO control.

#### 2.1.2 P-05A-04 A & B

The P-05-04 A & B engines are identical Caterpillar Model 3516 sixteen cylinder, compression ignition engines. The units are fired with No. 2 fuel oil and have a maximum rated horsepower of 2294 HP at 1800 RPM. Each engine is directly coupled to a facility water pump with a maximum rated pump capacity of 32,000 gpm. Each engine is equipped with an oxidation catalyst for CO control.

#### 2.1.3 P-05A-06 A & B

The P-05-06 A & B engines are identical Caterpillar Model 3508 sixteen cylinder, compression ignition engines. The units are fired with No. 2 fuel oil and have a maximum rated horsepower of 1184 HP at 1800 RPM. Each engine is directly coupled to a facility water pump with a maximum rated pump capacity of 42,650 gpm. Each engine is equipped with an oxidation catalyst for CO control.

### 2.2 UNIT OPERATING PARAMETERS

Please note, each engine operates at a reduced load level and testing within 90 percent of the maximum rated capacity is not feasible. Testing will be conducted within 90 percent of the engine maximum normal operating condition as maintained by facility personnel. The typical maximum normal operating condition is approximately 60 percent of the rated capacity.

Operating data including engine revolutions per minute (rpm), catalyst pressure drop (in $H_2O$), catalyst inlet temperature (Deg F.) and pump governor position (%) will be monitored and recorded by facility personnel during the test periods. This data will be provided to OBG and included in the final test report.

## 3. SUMMARY OF TEST PROGRAM

This section provides a summary of the source emissions testing program to be performed on each engine exhaust.

### 3.1 TEST PROGRAM VARIANCE

Due to the complex nature of predicting the variability of storm events and predicting the actual run time of each engine, the USEPA, in a letter dated August 1, 2013, granted a proposed alternative test plan to Sunoco relaxing the required three 1-hour test runs to three 15-minute test runs and additionally allowing Sunoco to test one engine per each pair of identical engines. In the initial 40 CFR Part 63 Subpart ZZZZ compliance test conducted in September 2015, engines P-05-02A, P-05-04B, and P-05-06A were tested. As recommended by the USEPA, Sunoco intends to conduct testing on engines P-05-02B, P-05-04A, and P-05-06B to demonstrate subsequent compliance. A copy of the USEPA approval and subsequent correspondence are presented in Appendix A of this test protocol.

### 3.2 TESTING PROGRAM SUMMARY

In accordance with Sunoco Partners Marketing and Terminals, LP's Operating Permit No. 23-00119, Section D II and 40 CFR Part 63 Subpart ZZZZ, source emission testing will be conducted to evaluate emissions of CO while each unit fires No.2 fuel oil. Emissions compliance testing will consist of three test runs per engine. All test runs will be a minimum of 15 minutes in duration. Results for CO will be reported in units of parts per million on a dry basis (ppm, dry) and ppm, dry normalized to 15% oxygen (ppm, dry @ 15% $O_2$). Please note no fuel sampling or analysis will be conducted as part of this test program.

A summary of the sources to be tested and target parameters is outlined below.

**Table 3.2 Compliance Test Program Parameters.**

| | Parameter | Reference Method | No. of Test Runs Per Location | Test Run Duration |
|---|---|---|---|---|
| P-05-02B, P-05-04A, & P-05-06B | CO | USEPA RM 10 | 3 | 15 min. |
| | $O_2$ | USEPA RM 3A | 3 | concurrent |

CO emissions will be observed to evaluate the applicable short term emission limits set forth in the facility's Title V Operating Permit No. 23-00119, Section D I #004:

- CO emission limit – ≤23 ppm, dry @ 15% $O_2$

### 3.3 PROPOSED TEST SCHEDULE

OBG will coordinate the test schedule with Pennsylvania Department of Environmental Protection (PADEP) and Sunoco once the PADEP protocol approval has been received. Please note that due to difficulty of predicting these storm events, we ask for the 15-day test notification requirement required by the PADEP Source Testing Manual (Revision No. 3.3, November 2000) to be relaxed. OBG and Sunoco request that the 15-day notification be relaxed to a 5-day notification in order to determine if a significant rain event will occur the following week. Notification will be delivered via email once a potential storm event has been identified.

# 4. SAMPLING AND ANALYTICAL PROCEDURES

This section provides a description of the test methods that will be utilized during the test program.

## 4.1 PROPOSED TEST METHODS

The test procedures will be conducted in accordance with the most recent updates to the United States Environmental Protection Agency (USEPA) Reference Methods (RM) described in 40 CFR 60; Appendix A.

| | |
|---|---|
| Method 1: | Sample and velocity traverses for stationary sources |
| Method 3A: | Determination of oxygen and carbon dioxide concentrations in emissions from stationary sources – Instrumental Analyzer Procedure |
| Method 10: | Determination of carbon monoxide emissions from stationary sources (Instrumental Analyzer Procedure) |

## 4.2 SAMPLE LOCATION DESCRIPTION

Each engine exhausts to atmosphere through a circular stack approximately 14 inches in diameter. A single test port is located 28 inches (approximately 2.0 duct diameters) downstream of the nearest flow disturbance, and 7 inches (approximately 0.5 duct diameters) upstream of the stack exhaust point.

A schematic of the test locations is presented in Appendix B.

## 4.3 SAMPLING PROCEDURE

A gas stratification check will be conducted prior to the start of the emissions test program. If stratification is not present in the gas stream, sampling will be performed at a single point near the center of the duct. If gas stratification is present, sampling will be conducted either at 3 traverse points in accordance with USEPA RM 7E or at 12 traverse points in accordance with USEPA RM 1 depending on the degree of stratification.

## 4.4 OXYGEN CONCENTRATION

The percent $O_2$ levels in the exhaust stream will be evaluated in accordance USEPA RM 3A procedures. $O_2$ concentrations will be evaluated using a California Analytical Instruments Model 600 or equivalent paramagnetic analyzer. A continuous gas sample will be extracted from the exhaust stack through, a stainless steel probe, heated Teflon® line and through a conditioning system used to remove moisture from the gas stream. All material that will come in contact with the sample will be constructed of either stainless steel, glass, or Teflon®.

Analyzer outputs will be monitored using a laptop computer and PCMCIA card and recorded every two seconds by a data acquisition system (DAS). The DAS will report emissions data as 1-minute averages for each test run. $O_2$ concentration data reported by the DAS were corrected for system zero and span bias.

## 4.5 CARBON MONOXIDE EMISSIONS

Emissions of CO will be evaluated in accordance with USEPA RM 10 using a Thermo Model 48i or equivalent non-dispersive infrared analyzer. The sample collection and data recording will be conducted in the same manner as described in Section 4.4. CO concentration data reported by the DAS will be corrected for system zero and span bias.

The analyzers will be calibrated using USEPA Protocol 1 gas standards. Table 4.1 outlines the anticipated analyzer span and calibration gases that will be used during the testing. OBG will be prepared to use alternate operating ranges should pollutant concentrations dictate.

**Table 4.1 Analyzer Operating Range and Calibration Gases.**

| Analyzer ID | Source ID | Calibration Span | Calibration Gases[a] |
|---|---|---|---|
| $O_2$ (CAI 600) | P-05-02B, P-05-04A, & P-05-06B | 0 – 21% | ~12.2 % $O_2$ in $CO_2/N_2$<br>~21.0 % $O_2$ in $CO_2/N_2$ |
| CO (THERMO 48I) | P-05-02B, P-05-04A, & P-05-06B | 0 – 50 ppm | ~25 ppm CO in $N_2$<br>~50 ppm CO in $N_2$ |

[a] Analyzers will be zeroed with ultra high purity (UHP) grade nitrogen

Example field data sheets for the above referenced methods are included in Appendix C.

## 5. REPORTING

A source emissions testing report will be submitted to PADEP within 60 days following completion of field activities. The test report is anticipated to be structured as follows:

- Test result summary page
- Introduction and purpose
- Source descriptions
- Process operating data
- Sampling and analytical procedures
- Results, discussion and conclusions from testing

Appendices will include process operating data, raw field data sheets, equipment calibration data, sampling parameters, and supporting calculations.

# 6. QUALITY ASSURANCE/QUALITY CONTROL

The following summarizes the QA/QC procedures that will be used for the testing.

## 6.1 EQUIPMENT CALIBRATION

Analyzers will be calibrated in accordance with the procedures outlined in the corresponding USEPA test methods and/or the USEPA document entitled Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III - Stationary Source Specific Methods (EPA 600/R-94/038c).

At the beginning of and following every test run each analyzer and the entire instrument measurement system will be challenged with USEPA Protocol No. 1 gas standards (zero and mid gas) in accordance with procedures specified in each respective test method. The calibration gases will be introduced to the sampling system near the end of the sample probe to expose the calibration standards to as much of the system as possible. CO and $O_2$ concentrations will be bias corrected in accordance with USEPA RM 7E procedures.

Protocol calibration standards will be prepared in accordance with USEPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards. The accuracy of these gases will be +/- 2% or better. Copies of the calibration certificates will be included in the final source test report.

## 6.2 TEST DATA AND REPORT REVIEW

Test data input and emission calculations will be double-checked for accuracy. The test results will be reviewed by senior personnel for completeness and accuracy. The final report is peer reviewed by senior personnel and certified by the project manager.

# USEPA Correspondence

Sunoco Logistics

Sunoco Logistics Partners
Marketing & Terminals, L.P.
100 Green Street
Marcus Hook, PA 19061

**CERTIFIED MAIL: 7012 2210 0002 4332 3785**

July 8, 2013

Kristen Hall
Acting Associate Director
US EPA Region III
Office of Air Enforcement and Compliance Assistance
1650 Arch Street
Philadelphia, PA 19103

**RE: Request for an Alternative Testing Plan for 6 RICE MACT (40 CFR 63.6580) applicable diesels located at Sunoco Marcus Hook Industrial Complex**

Dear Ms Willard;

Sunoco has six diesel engines subject to 40 CFR 63.6580 (RICE MACT). Those six diesel engines power six water pumps that are used only when a significant rain event occurs in the facility. The pumps were installed in 1994. As they were subject to the RICE MACT as existing engines at a major facility and were greater than 500 HP, controls were installed under Pennsylvania Plan Approval 23-00001 AD. The RICE MACT regulation has specific requirements for notification and testing at full load that are not reasonably achievable due to the uncertainty of rainwater. In order to achieve the load conditions required of the regulation a significant rainfall must occur. Also, the equipment cannot normally run fully loaded for the length of time to do full testing (Three, one-hour runs generally take about four hours per source). As the amount of water subsides in the facility the pumps are shutdown as they cannot run without water.

Below is a summary of the diesel engine pump sets:

| Description | Horsepower of diesel | Standard Capacity |
|---|---|---|
| MP05-02 A & B | 1745 | 23,500 GPM |
| MP05-04 A & B | 2294 | 32,000 GPM |
| MP05-06 A & B | 1184 | 42,650 GPM |

Sunoco requests an alternative testing plan to prove compliance with the 23 ppm of CO at 15% $O_2$ (40 CFR 63 ZZZZ table 2c). It is our intention to plan as best we can when we see significant rain in the forecast, mobilize our testing vendor and stage testing equipment near the pumps in preparation for the test.

- Testing of CO in 15 minutes runs versus three one-hour runs (one-hour run requirement is found in table 4 item #5 of the standard - 15 minute requirement allowed for other equipment as per 63.6630)

Sunoco Logistics

Sunoco Logistics Partners
Marketing & Terminals, L.P.
100 Green Street
Marcus Hook, PA 19061

- 60 day notification of intent to test requirements waived (63.6645 (g)).
- In the case of identical diesels with identical controls, compliance will be proven based on testing only one of the two identical diesel pump sets. Sunoco will certify that the diesels are identical with identical controls.
- Waiver of stratification requirements method 1 (this was granted for internal combustion engine test for Reference test method 7E) see attached.
- Allowance for additional time over the 240 days as per 63.6611 if there are not enough rain events to get all 3 sets of diesels tested. Sunoco will make every effort to get the testing done by November 1st 2013.
- Compliance standard of 23 ppm CO at 15% excess $O_2$ is the applicable standard.

Submittal of testing protocols and final test reports to the appropriate agencies will be compliant with the state and federal rules.

Please feel free to call me at (610)859-1279 if you have any questions.

Sincerely,

Dorothy Rurak
Environmental Specialist

Cc Erin Willard
Environmental Scientist
US EPA Region III
Office of Air Enforcement and Compliance Assistance
1650 Arch Street
Philadelphia, PA 19103

George Eckert (PA DEP)
Southeast Regional Office
2 East Main Street
Norristown, PA 19401-4915

Heather Henry (PA DEP)
Air Quality Program
Southeast Regional Office
2 East Main Street
Norristown, PA 19401-4915

**File: AIR-6: 2013 July_Marcus Hook Industrial Complex_Request For Alternative Testing Plan For 6 RICE MACT Applicable Diesels_DR**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

In Reply Refer To: 3AP20

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

AUG 01 2013

Ms. Dorothy Rurak
Environmental Specialist
Sunoco Logistics Partners
Marketing & Terminals, L.P.
100 Green Street
Marcus Hook, Pennsylvania 19061

Dear Ms. Rurak:

The United States Environmental Protection Agency (EPA) Region III received a voicemail from Sunoco Logistics Partners ("Sunoco") on April 18, 2013 regarding required performance testing on six reciprocating internal combustion engines (RICE) located at the Marcus Hook Refinery located in Marcus Hook, PA ("facility" or "site")[1]. Sunoco also submitted a formal letter on July 8, 2013 regarding the same subject matter. The engines are installed in three pairs, each pair containing two of the same-size engine. All engines are compression ignition ("CI") units manufactured by Caterpillar in the mid-1990s. Below is a summary of the diesel pump sets:

| Designation | Horsepower (hp)/each engine | Pumping Capacity Gallons per Minute (GPM) |
|---|---|---|
| MP05-02 A & B | 1745 | 23,500 |
| MP05-04 A & B | 2294 | 32,000 |
| MP05-06 A & B | 1184 | 42,650 |

Each engine is attached to a very large water pump with up to an 18 inch diameter discharge pipe. The engines only operate during large rain events, and are responsible for pumping excess water from the surface of facility roadways to allow access to pipe racks and cable trays. Without the engines and associated pumps, portions of the site would flood during heavy rain. Sunoco provided hourly usage records for each engine for the years 2008-2011, averages over the four year period demonstrate that each engine may operate as few as 72 hours/year or as many as 745 hours/year.

Each of the six engines referenced above is subject to 40 C.F.R. Part 63 Subpart ZZZZ National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines ("Subpart 4Z" or "RICE Rule") because each is a stationary RICE located

[1] The refinery is currently shutdown, but still holds a valid Title V permit.

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at a major source of hazardous air pollutants (HAPs). Furthermore, even though the six engines operate only during heavy rains, they do not meet the definition of an "emergency stationary RICE" in accordance with an October 12, 2011 letter issued by EPA Region 1 Air Programs Branch to the Massachusetts Water Resources Authority. In order to comply with the emissions standards in Subpart 4Z, Sunoco installed pollution reduction catalyst on each unit prior to the May 3, 2013 compliance date found at § 63.6595(a) for existing CI RICE.

Subpart 4Z at § 63.6620 and the General Provisions at § 63.7(a)(2) requires subject facilities complete a performance test to demonstrate compliance with the emissions requirements found in the rule, no later than 180 days after the compliance date. Subject facilities are required to notify the Administrator at least 60 day prior to a planned test, to perform three (1) hour test runs, and to ensure the load on each subject engine is 90% (or greater) of the maximum rated load.

Because the function of the engines is to pump water during heavy rain events, Sunoco will have difficulty scheduling a performance test because of the uncertainty of predicting storms. EPA had inquired if Sunoco could operate the engines without the pumps, or artificially load the pumps with recycled water. If the engines operate without the pumps connected, they aren't doing any mechanical work and will only be able to reach 10-15% of their maximum load. Because the pumps connected to the engines are so large, water recycling through the pumps several times will result in the water becoming hot and potentially damaging the pumps.

In order to allow Sunoco operational leeway to be able to schedule its performance tests when possible during heavy rains, EPA will allow the following alternatives to the Subpart 4Z performance test requirements:

1. EPA will allow notification for the performance test to take place by phone and email as soon as Sunoco is aware of the possibility of completing a test.

2. To allow a better chance of completing a test for each engine model, EPA will allow testing on one engine from each pair only, so long as Sunoco provides documentation to EPA demonstrating that each engine from each pair is identical to the other one from the pair. For the next required performance test, Sunoco should make the effort to test the other engine from the pair, in order to compile a full complement of performance tests for all six engines.

3. EPA will allow an extension of an additional 180 days to complete the performance testing in order to ensure rain event(s) heavy enough to allow testing on the engine sets. If after one year of the compliance date (May 3, 2014) there have not been enough rain events to complete testing on each engine, Sunoco shall contact EPA Region 3 to discuss continuing the compliance period.

4. EPA will allow a shortened run of 15 minutes each, rather than the three (1) hour runs required in the rule. Sunoco should perform three test runs at 90% (or greater) of the design load for each engine being tested.

EPA Region III will review the test protocol for the performance tests for these engines as soon as Sunoco can submit it. Additionally, if Sunoco chooses to only test one engine from each pair, it must submit documentation demonstrating the size, model, age, maintenance activities performed on each engine since purchase, and specifications on the newly installed CO

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reduction catalyst. Finally, nothing in this approval alters the rules and requirements of Subpart 4Z as they apply to the Marcus Hook facility or any other Sunoco Logistics site, for the subject fire pump engines and all other engines at this or other sites.

If you have questions or comments regarding this letter, please contact Ms. Erin Willard of the Office of Air Enforcement and Compliance Assistance, at (215) 814-2152 or by email at Willard.ErinM@epa.gov.

Sincerely,

Diana Esher, Director
Air Protection Division

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Ms. Dorothy Rurak
Environmental Specialist
Sunoco Logistics Partners, L.P.
100 Green Street
Marcus Hook, PA 19061

September 17, 2014

RE: 6 RICE MACT Applicable Diesels Located at Sunoco Logistics Marcus Hook Industrial Complex

Dear Ms. Rurak,

After examining each engine in the field, I hereby certify that each engine from each pair is identical to the other one pair that is summarized in the table below:

| Description | Horsepower of diesel | Standard Capacity |
|---|---|---|
| MP05-02 A & B | 1745 | 23,500 GPM |
| MP05-04 A & B | 2294 | 32,000 GPM |
| MP05-06 A & B | 1184 | 42,650 GPM |

Should you have any questions, please contact me at 484-753-5031

Sincerely,

Louis T. Phillips, Jr. P.E.
Project Manager

# Schematic of the Test Locations

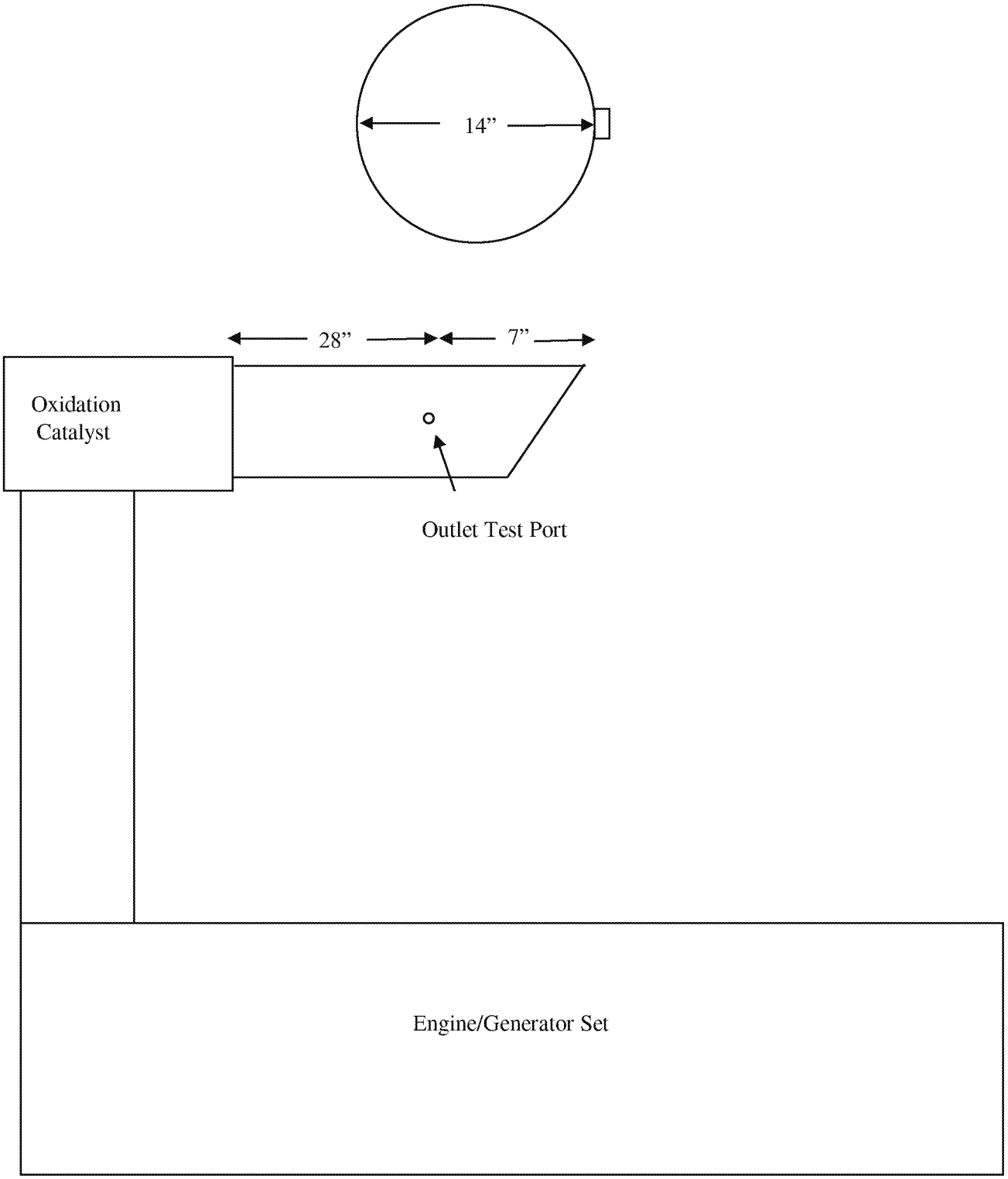


**Figure 1**
Marcus Hook Industrial Complex Engine/Generator Sets (typical)
Sunoco Partners and Terminals, LP
Marcus Hook, Pennsylvania

# Example Field Data Forms

# Daily Analyzer Calibration

Plant I.D. _____ Project No. _____

Source I.D _____ Personnel _____

Pollutant _____ Analyzer I.D. _____

Analyzer Serial No. _____ Span Value _____

Date _____ Time _____ Test Method _____

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | | | | | |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | | | | | |
| | Cylinder ID | | | | |
| High Level Gas | | | | | |
| | Cylinder ID | | | | |

Calibration Error = $\frac{\text{(Analyzer Response - Cylinder Value)}}{\text{Span Value}} \times 100$

System Bias = $\frac{\text{(System Response - Analyzer Response)}}{\text{Span Value}} \times 100$

# System Calibration Bias and Drift Data

Plant I.D. _____ Project No. _____

Source I.D. _____ Personnel _____

Pollutant _____ Analyzer I.D. _____

Analyzer Serial No. _____ Span Value _____

Date _____ Time _____ Test Method _____

Run No. _____

| | Analyzer Calibration Response (ppm or %) | Initial System Response (ppm or %) | System Calibration Bias (% of Span) +/- 5% | Final System Response (ppm or %) | System Drift (% of Span) +/-3% |
|---|---|---|---|---|---|
| Zero Gas | | | | | |
| Span Gas | | | | | |

Date _____ Time _____

Run No. _____

| | Analyzer Calibration Response (ppm or %) | Initial System Response (ppm or %) | System Calibration Bias (% of Span) +/- 5% | Final System Response (ppm or %) | System Drift (% of Span) +/-3% |
|---|---|---|---|---|---|
| Zero Gas | | | | | |
| Span Gas | | | | | |

Date _____ Time _____

Run No. _____

| | Analyzer Calibration Response (ppm or %) | Initial System Response (ppm or %) | System Calibration Bias (% of Span) +/- 5% | Final System Response (ppm or %) | System Drift (% of Span) +/-3% |
|---|---|---|---|---|---|
| Zero Gas | | | | | |
| Span Gas | | | | | |

$$\text{System Calibration Bias} = \frac{(\text{System Cal. Response} - \text{Analyzer Cal. Response}) \times 100}{\text{Analyzer Span}}$$

$$\text{Calibration Drift} = \frac{(\text{Final System Cal. Response} - \text{Initial System Cal. Response}) \times 100}{\text{Analyzer Span}}$$

# CEMS Measurement Data

Plant I.D. _____ Project No. _____

Source I.D. _____ Personnel _____

Date _____

| Clock Time | O2 (%) | CO2 (%) | NOx (ppm) | CO (ppm) | SO2 (ppm) | THC-1 (ppm) | THC-2 (ppm) |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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# Analyzer Response Time

Pollutant _____ Analyzer I.D. _____

Analyzer Serial No. _____ High Span Gas _____

Date _____ Time _____

| Upscale Response | | |
|---|---|---|
| Run 1 | _____ | seconds |
| Run 2 | _____ | seconds |
| Run 3 | _____ | seconds |
| Average | _____ | seconds |

| Downscale Response | | |
|---|---|---|
| Run 1 | _____ | seconds |
| Run 2 | _____ | seconds |
| Run 3 | _____ | seconds |
| Average | _____ | seconds |

Pollutant _____ Analyzer I.D. _____

Analyzer Serial No. _____ High Span Gas _____

Date _____ Time _____

| Upscale Response | | |
|---|---|---|
| Run 1 | _____ | seconds |
| Run 2 | _____ | seconds |
| Run 3 | _____ | seconds |
| Average | _____ | seconds |

| Downscale Response | | |
|---|---|---|
| Run 1 | _____ | seconds |
| Run 2 | _____ | seconds |
| Run 3 | _____ | seconds |
| Average | _____ | seconds |

# Example Emission Calculations

# Example Calculations

***Sunoco Partners Marketing & Terminals L.P.***
***Diesel Engines***
***Marcus Hook, Pennsylvania***

## *CO Emission Rates*

**1. *CO ppmvd @ 15% $O_2$ = CO concentration normalized to 15% $O_2$***

$$CO\ ppmvd \times \left[\frac{(20.9\ - 15.0)}{20.9\ - \%O_2}\right]$$

## *CEM Calibration Calculations*

**2. *Calibration Error = Difference between the manufacture certified standard and measured concentration introduced directly to the analyzer***

$$\frac{|Analyzer\ Response - Cylinder\ Gas\ Standard\ Value|}{Span\ Value} \times 100$$

**3. *System Bias = Difference between the measured concentration introduced directly to the analyzer and the measured concentration introduced through the entire CEM sampling system***

$$\frac{System\ Response - Analyzer\ Response}{Span\ Value} \times 100$$

**4. *System Drift = Difference between the initial run System Bias concentration and the post run System Bias***

$$\frac{System\ Post\ Response - System\ Initial\ Response}{Span\ Value} \times 100$$

OBG

THERE'S A WAY

# Schematic of the Test Location

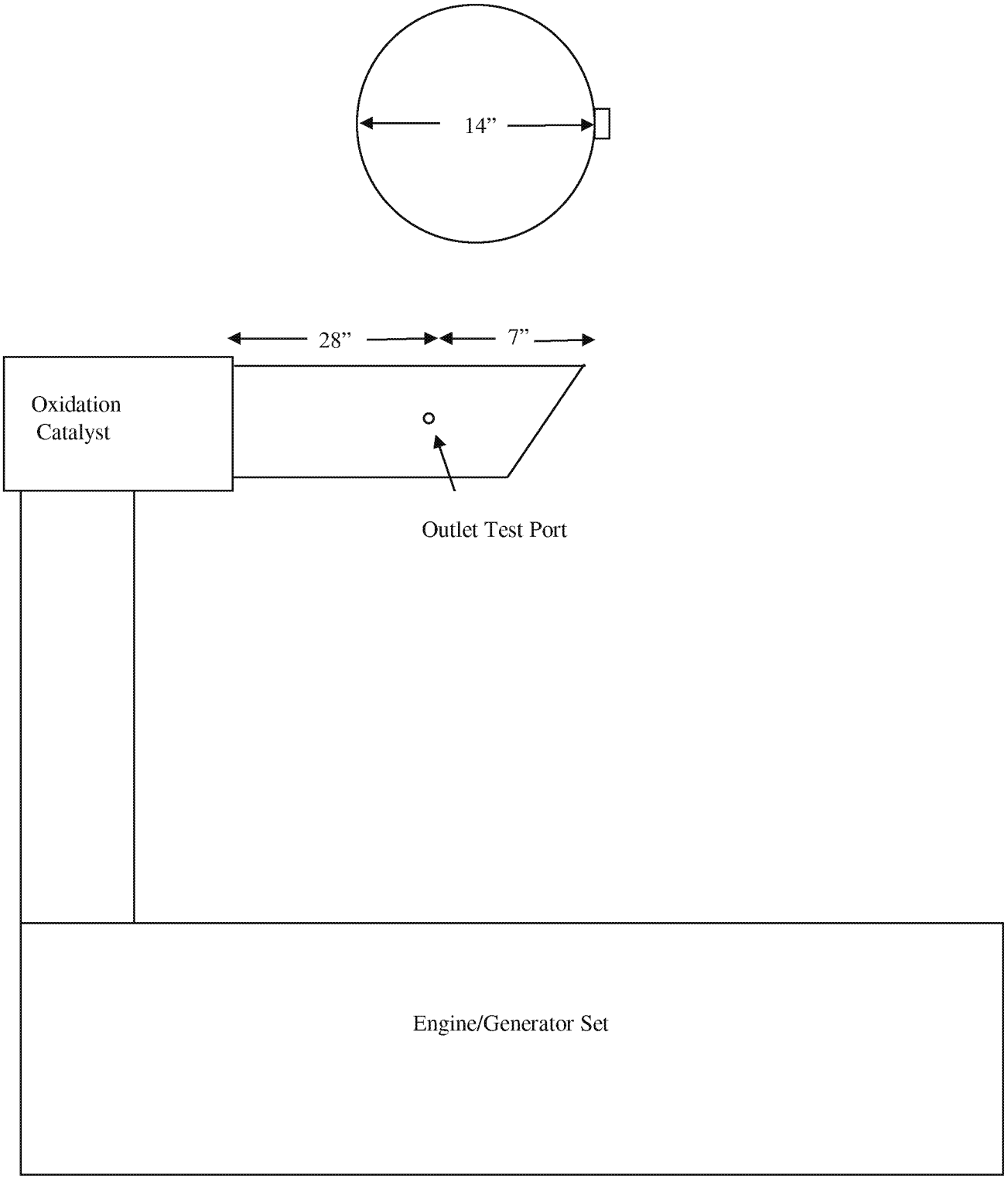


**Figure 1**
Marcus Hook Industrial Complex Engine/Generator Sets (typical)
Sunoco Partners and Terminals, LP
Marcus Hook, Pennsylvania

# Operations Data

# P-05A-02B Engine

**Diesel Engine 2B**

| Date - Time | Gov Position | Inlet Temp | Catalyst DP |
|---|---|---|---|
| 11/16/18 16:28 | 55 | 772.85 | 1.99 |
| 11/16/18 16:29 | 55 | 777.21 | 2.38 |
| 11/16/18 16:30 | 55 | 777.57 | 2.43 |
| 11/16/18 16:31 | 55 | 787.36 | 2.52 |
| 11/16/18 16:32 | 55 | 792.53 | 2.57 |
| 11/16/18 16:33 | 55 | 797.06 | 2.40 |
| 11/16/18 16:34 | 55 | 802.41 | 2.42 |
| 11/16/18 16:35 | 55 | 802.96 | 2.38 |
| 11/16/18 16:36 | 55 | 806.22 | 2.51 |
| 11/16/18 16:37 | 55 | 806.58 | 2.56 |
| 11/16/18 16:38 | 55 | 809.85 | 2.30 |
| 11/16/18 16:39 | 55 | 810.21 | 2.14 |
| 11/16/18 16:40 | 55 | 813.47 | 2.44 |
| 11/16/18 16:41 | 55 | 813.84 | 2.43 |
| 11/16/18 16:42 | 55 | 813.84 | 2.38 |
| 11/16/18 16:43 | 55 | 813.84 | 2.28 |
| 11/16/18 16:44 | 55 | 813.84 | 2.46 |
| 11/16/18 16:45 | 55 | 813.84 | 2.23 |
| 11/16/18 16:46 | 55 | 816.28 | 2.22 |
| 11/16/18 16:47 | 55 | 817.37 | 2.27 |
| 11/16/18 16:48 | 55 | 817.46 | 2.23 |
| 11/16/18 16:49 | 55 | 817.46 | 2.25 |
| 11/16/18 16:50 | 55 | 817.46 | 2.41 |
| 11/16/18 16:51 | 55 | 817.46 | 2.41 |
| 11/16/18 16:52 | 55 | 815.01 | 2.24 |
| 11/16/18 16:53 | 55 | 813.93 | 2.50 |
| 11/16/18 16:54 | 55 | 813.84 | 2.31 |
| 11/16/18 16:55 | 55 | 813.84 | 2.37 |
| 11/16/18 16:56 | 55 | 813.84 | 2.24 |
| 11/16/18 16:57 | 55 | 817.10 | 2.13 |
| 11/16/18 16:58 | 55 | 817.46 | 2.03 |
| 11/16/18 16:59 | 55 | 817.46 | 2.39 |
| 11/16/18 17:00 | 55 | 816.65 | 2.24 |
| 11/16/18 17:01 | 55 | 817.37 | 2.18 |
| 11/16/18 17:02 | 55 | 817.46 | 2.08 |
| 11/16/18 17:03 | 55 | 816.65 | 2.44 |
| 11/16/18 17:04 | 55 | 817.37 | 2.29 |
| 11/16/18 17:05 | 55 | 817.46 | 2.41 |
| 11/16/18 17:06 | 55 | 817.46 | 2.21 |
| 11/16/18 17:07 | 55 | 816.65 | 2.39 |
| 11/16/18 17:08 | 55 | 817.37 | 2.42 |
| 11/16/18 17:09 | 55 | 817.46 | 2.47 |
| 11/16/18 17:10 | 55 | 816.65 | 2.07 |

| | | | |
|---|---|---|---|
| 11/16/18 17:11 | 55 | 817.37 | 2.07 |
| 11/16/18 17:12 | 55 | 817.46 | 2.53 |
| 11/16/18 17:13 | 55 | 816.65 | 2.35 |
| 11/16/18 17:14 | 55 | 814.11 | 2.45 |
| 11/16/18 17:15 | 55 | 815.47 | 2.29 |
| 11/16/18 17:16 | 55 | 815.65 | 2.32 |
| 11/16/18 17:17 | 55 | 817.28 | 2.35 |
| 11/16/18 17:18 | 55 | 816.65 | 2.10 |
| 11/16/18 17:19 | 55 | 817.37 | 2.35 |
| 11/16/18 17:20 | 55 | 817.46 | 2.07 |
| 11/16/18 17:21 | 55 | 817.46 | 2.39 |
| 11/16/18 17:22 | 55 | 816.65 | 2.40 |
| 11/16/18 17:23 | 55 | 814.11 | 2.28 |
| 11/16/18 17:24 | 55 | 817.10 | 2.28 |
| 11/16/18 17:25 | 55 | 815.01 | 2.32 |
| 11/16/18 17:26 | 55 | 817.19 | 2.30 |
| 11/16/18 17:27 | 55 | 817.46 | 2.32 |
| 11/16/18 17:28 | 55 | 817.46 | 2.33 |
| 11/16/18 17:29 | 55 | 817.46 | 2.23 |
| 11/16/18 17:30 | 55 | 817.46 | 2.36 |
| 11/16/18 17:31 | 55 | 817.46 | 2.10 |
| 11/16/18 17:32 | 55 | 817.46 | 2.35 |
| 11/16/18 17:33 | 55 | 817.46 | 2.23 |
| 11/16/18 17:34 | 55 | 816.65 | 2.13 |
| 11/16/18 17:35 | 55 | 817.37 | 2.19 |

# P-05A-04A Engine

**Diesel Engine 4A**

| Date - Time | Gov Position | Inlet Temp | Catalyst DP |
|---|---|---|---|
| 12/20/18 17:22 | 55 | 551.39 | 2.10 |
| 12/20/18 17:23 | 55 | 551.39 | 2.10 |
| 12/20/18 17:24 | 55 | 551.39 | 2.10 |
| 12/20/18 17:25 | 55 | 551.39 | 2.10 |
| 12/20/18 17:26 | 55 | 551.39 | 2.10 |
| 12/20/18 17:27 | 55 | 551.39 | 2.10 |
| 12/20/18 17:28 | 55 | 551.39 | 2.10 |
| 12/20/18 17:29 | 55 | 551.39 | 2.10 |
| 12/20/18 17:30 | 55 | 551.39 | 2.10 |
| 12/20/18 17:31 | 55 | 551.39 | 2.10 |
| 12/20/18 17:32 | 55 | 551.39 | 2.10 |
| 12/20/18 17:33 | 55 | 551.39 | 2.10 |
| 12/20/18 17:34 | 55 | 813.61 | 2.51 |
| 12/20/18 17:35 | 55 | 837.45 | 2.55 |
| 12/20/18 17:36 | 55 | 837.45 | 2.55 |
| 12/20/18 17:37 | 55 | 844.09 | 3.03 |
| 12/20/18 17:38 | 55 | 846.35 | 2.57 |
| 12/20/18 17:39 | 55 | 846.50 | 2.52 |
| 12/20/18 17:40 | 55 | 846.50 | 2.52 |
| 12/20/18 17:41 | 55 | 781.78 | 1.53 |
| 12/20/18 17:42 | 55 | 775.89 | 1.44 |
| 12/20/18 17:43 | 55 | 775.89 | 1.44 |
| 12/20/18 17:44 | 55 | 775.89 | 1.44 |
| 12/20/18 17:45 | 55 | 630.28 | 0.84 |
| 12/20/18 17:46 | 55 | 617.05 | 0.78 |
| 12/20/18 17:47 | 55 | 617.05 | 0.78 |
| 12/20/18 17:48 | 55 | 567.32 | 1.01 |
| 12/20/18 17:49 | 55 | 562.80 | 1.03 |
| 12/20/18 17:50 | 55 | 562.80 | 1.03 |
| 12/20/18 17:51 | 55 | 562.80 | 1.03 |
| 12/20/18 17:52 | 55 | 771.41 | 1.98 |
| 12/20/18 17:53 | 55 | 790.38 | 2.07 |
| 12/20/18 17:54 | 55 | 790.38 | 2.07 |
| 12/20/18 17:55 | 55 | 790.38 | 2.07 |
| 12/20/18 17:56 | 55 | 790.38 | 2.07 |
| 12/20/18 17:57 | 55 | 790.38 | 2.07 |
| 12/20/18 17:58 | 55 | 831.87 | 2.02 |
| 12/20/18 17:59 | 55 | 840.62 | 2.94 |
| 12/20/18 18:00 | 55 | 841.07 | 3.02 |
| 12/20/18 18:01 | 55 | 841.07 | 3.02 |
| 12/20/18 18:02 | 55 | 841.07 | 3.02 |
| 12/20/18 18:03 | 55 | 841.07 | 3.02 |
| 12/20/18 18:04 | 55 | 841.07 | 3.02 |

| | | | |
|---|---|---|---|
| 12/20/18 18:05 | 55 | 847.71 | 1.97 |
| 12/20/18 18:06 | 55 | 848.31 | 2.32 |
| 12/20/18 18:07 | 55 | 850.80 | 2.60 |
| 12/20/18 18:08 | 55 | 851.03 | 2.62 |
| 12/20/18 18:09 | 55 | 735.99 | 1.23 |
| 12/20/18 18:10 | 55 | 685.76 | 1.31 |
| 12/20/18 18:11 | 55 | 642.36 | 0.95 |
| 12/20/18 18:12 | 55 | 638.75 | 0.92 |
| 12/20/18 18:13 | 55 | 595.65 | 0.65 |
| 12/20/18 18:14 | 55 | 571.84 | 0.61 |
| 12/20/18 18:15 | 55 | 570.04 | 0.61 |
| 12/20/18 18:16 | 55 | 570.04 | 0.61 |
| 12/20/18 18:17 | 55 | 570.04 | 0.61 |
| 12/20/18 18:18 | 55 | 570.04 | 0.61 |
| 12/20/18 18:19 | 55 | 536.89 | 0.74 |
| 12/20/18 18:20 | 55 | 533.87 | 0.76 |
| 12/20/18 18:21 | 55 | 533.87 | 0.76 |
| 12/20/18 18:22 | 55 | 533.87 | 0.76 |
| 12/20/18 18:23 | 55 | 533.87 | 0.76 |
| 12/20/18 18:24 | 55 | 533.87 | 0.76 |
| 12/20/18 18:25 | 55 | 777.30 | 1.82 |
| 12/20/18 18:26 | 55 | 801.09 | 1.64 |
| 12/20/18 18:27 | 55 | 801.24 | 1.62 |
| 12/20/18 18:28 | 55 | 801.24 | 1.62 |
| 12/20/18 18:29 | 55 | 801.24 | 1.62 |
| 12/20/18 18:30 | 55 | 801.24 | 1.62 |
| 12/20/18 18:31 | 55 | 801.24 | 1.62 |
| 12/20/18 18:32 | 55 | 801.24 | 1.62 |
| 12/20/18 18:33 | 55 | 824.05 | 1.98 |
| 12/20/18 18:34 | 55 | 826.59 | 2.02 |
| 12/20/18 18:35 | 55 | 826.59 | 2.02 |
| 12/20/18 18:36 | 55 | 826.59 | 2.02 |
| 12/20/18 18:37 | 55 | 826.59 | 2.02 |

# P-05A-06B Engine

**Diesel Engine 6B**

| Date - Time | Gov Position | Inlet Temp | Catalyst DP |
|---|---|---|---|
| 11/16/18 13:50 | 51.75 | 540.81 | 1.23 |
| 11/16/18 13:51 | 55 | 610.63 | 1.10 |
| 11/16/18 13:52 | 55 | 637.84 | 1.18 |
| 11/16/18 13:53 | 55 | 657.02 | 1.57 |
| 11/16/18 13:54 | 55 | 671.87 | 1.30 |
| 11/16/18 13:55 | 55 | 685.47 | 1.29 |
| 11/16/18 13:56 | 55 | 696.54 | 1.25 |
| 11/16/18 13:57 | 55 | 705.64 | 1.34 |
| 11/16/18 13:58 | 55 | 715.44 | 1.44 |
| 11/16/18 13:59 | 55 | 722.92 | 1.77 |
| 11/16/18 14:00 | 55 | 730.94 | 1.31 |
| 11/16/18 14:01 | 55 | 736.69 | 1.86 |
| 11/16/18 14:02 | 55 | 741.21 | 1.34 |
| 11/16/18 14:03 | 55 | 744.16 | 1.29 |
| 11/16/18 14:04 | 55 | 747.68 | 1.22 |
| 11/16/18 14:05 | 55 | 752.02 | 1.70 |
| 11/16/18 14:06 | 55 | 753.35 | 1.42 |
| 11/16/18 14:07 | 55 | 755.06 | 1.62 |
| 11/16/18 14:08 | 55 | 757.60 | 1.32 |
| 11/16/18 14:09 | 55 | 759.49 | 1.25 |
| 11/16/18 14:10 | 55 | 759.67 | 1.25 |
| 11/16/18 14:11 | 55 | 762.10 | 1.07 |
| 11/16/18 14:12 | 55 | 763.18 | 1.40 |
| 11/16/18 14:13 | 55 | 763.34 | 1.31 |
| 11/16/18 14:14 | 55 | 765.61 | 1.36 |
| 11/16/18 14:15 | 55 | 766.78 | 1.21 |
| 11/16/18 14:16 | 55 | 766.12 | 1.52 |
| 11/16/18 14:17 | 55 | 766.05 | 1.38 |
| 11/16/18 14:18 | 55 | 766.05 | 1.37 |
| 11/16/18 14:19 | 55 | 770.10 | 1.10 |
| 11/16/18 14:20 | 55 | 772.12 | 1.83 |
| 11/16/18 14:21 | 55 | 773.93 | 1.44 |
| 11/16/18 14:22 | 55 | 776.62 | 1.67 |
| 11/16/18 14:23 | 55 | 779.33 | 1.75 |
| 11/16/18 14:24 | 55 | 779.49 | 1.83 |
| 11/16/18 14:25 | 55 | 779.48 | 1.84 |
| 11/16/18 14:26 | 55 | 780.36 | 1.30 |
| 11/16/18 14:27 | 55 | 780.45 | 1.29 |
| 11/16/18 14:28 | 55 | 778.83 | 1.16 |
| 11/16/18 14:29 | 55 | 777.78 | 1.16 |
| 11/16/18 14:30 | 55 | 777.68 | 1.31 |
| 11/16/18 14:31 | 55 | 776.94 | 1.88 |
| 11/16/18 14:32 | 55 | 776.04 | 1.26 |

| | | | |
|---|---|---|---|
| 11/16/18 14:33 | 55 | 776.76 | 1.03 |
| 11/16/18 14:34 | 55 | 777.60 | 1.06 |
| 11/16/18 14:35 | 55 | 776.92 | 1.02 |
| 11/16/18 14:36 | 55 | 776.85 | 1.60 |
| 11/16/18 14:37 | 55 | 779.08 | 1.31 |
| 11/16/18 14:38 | 55 | 773.76 | 1.37 |
| 11/16/18 14:39 | 55 | 773.25 | 1.24 |
| 11/16/18 14:40 | 55 | 773.25 | 1.68 |
| 11/16/18 14:41 | 55 | 776.22 | 1.51 |
| 11/16/18 14:42 | 55 | 773.53 | 1.45 |
| 11/16/18 14:43 | 55 | 774.76 | 1.34 |
| 11/16/18 14:44 | 55 | 776.38 | 1.42 |
| 11/16/18 14:45 | 55 | 773.58 | 1.32 |
| 11/16/18 14:46 | 55 | 776.22 | 1.17 |
| 11/16/18 14:47 | 55 | 774.32 | 0.98 |
| 11/16/18 14:48 | 55 | 775.70 | 1.32 |
| 11/16/18 14:49 | 55 | 775.88 | 1.44 |

# Field Data

# P-05A-02B Engine

# AVERAGED CEM DATA

**Job Number:** *Engine2B* **Start Time:** *16:28:00*
**Run ID:** *2BR1* **Start Date:** *11/16/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 11/16/2018 | 16:29:00 | 11.26 | 6.33 |
| 11/16/2018 | 16:30:00 | 11.27 | 6.45 |
| 11/16/2018 | 16:31:00 | 11.29 | 6.93 |
| 11/16/2018 | 16:32:00 | 11.29 | 6.7 |
| 11/16/2018 | 16:33:00 | 11.3 | 6.5 |
| 11/16/2018 | 16:34:00 | 11.31 | 6.83 |
| 11/16/2018 | 16:35:00 | 11.32 | 6.97 |
| 11/16/2018 | 16:36:00 | 11.33 | 7.17 |
| 11/16/2018 | 16:37:00 | 11.33 | 7.22 |
| 11/16/2018 | 16:38:00 | 11.33 | 7.36 |
| 11/16/2018 | 16:39:00 | 11.34 | 7.21 |
| 11/16/2018 | 16:40:00 | 11.33 | 7.24 |
| 11/16/2018 | 16:41:00 | 11.32 | 7.27 |
| 11/16/2018 | 16:42:00 | 11.33 | 7.26 |
| 11/16/2018 | 16:43:00 | 11.34 | 7.33 |
| **Average Value:** | | **11.31** | **6.99** |
| **Corrected Average:** | | **11.51** | **6.58** |

# AVERAGED CEM DATA

**Job Number:** *Engine2B* **Start Time:** *16:57:00*
**Run ID:** *2BR2* **Start Date:** *11/16/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 11/16/2018 | 16:58:00 | 10.52 | 8.46 |
| 11/16/2018 | 16:59:00 | 10.62 | 8.44 |
| 11/16/2018 | 17:00:00 | 10.62 | 8.47 |
| 11/16/2018 | 17:01:00 | 10.63 | 8.43 |
| 11/16/2018 | 17:02:00 | 10.63 | 8.28 |
| 11/16/2018 | 17:03:00 | 10.63 | 8.36 |
| 11/16/2018 | 17:04:00 | 10.63 | 8.2 |
| 11/16/2018 | 17:05:00 | 10.63 | 8.14 |
| 11/16/2018 | 17:06:00 | 10.63 | 8.14 |
| 11/16/2018 | 17:07:00 | 10.63 | 8.04 |
| 11/16/2018 | 17:08:00 | 10.63 | 8. |
| 11/16/2018 | 17:09:00 | 10.64 | 8. |
| 11/16/2018 | 17:10:00 | 10.64 | 7.8 |
| 11/16/2018 | 17:11:00 | 10.65 | 7.7 |
| 11/16/2018 | 17:12:00 | 10.65 | 7.75 |
| **Average Value:** | | **10.63** | **8.15** |
| **Corrected Average:** | | **10.91** | **7.86** |

# AVERAGED CEM DATA

**Job Number:** *Engine2B* **Start Time:** *17:20:00*
**Run ID:** *2BR3* **Start Date:** *11/16/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 11/16/2018 | 17:21:00 | 10.7 | 7.05 |
| 11/16/2018 | 17:22:00 | 10.67 | 6.97 |
| 11/16/2018 | 17:23:00 | 10.67 | 7.02 |
| 11/16/2018 | 17:24:00 | 10.67 | 6.99 |
| 11/16/2018 | 17:25:00 | 10.67 | 6.87 |
| 11/16/2018 | 17:26:00 | 10.67 | 6.83 |
| 11/16/2018 | 17:27:00 | 10.66 | 6.89 |
| 11/16/2018 | 17:28:00 | 10.66 | 6.83 |
| 11/16/2018 | 17:29:00 | 10.67 | 6.88 |
| 11/16/2018 | 17:30:00 | 10.67 | 6.81 |
| 11/16/2018 | 17:31:00 | 10.67 | 6.75 |
| 11/16/2018 | 17:32:00 | 10.67 | 6.68 |
| 11/16/2018 | 17:33:00 | 10.67 | 6.6 |
| 11/16/2018 | 17:34:00 | 10.67 | 6.66 |
| 11/16/2018 | 17:35:00 | 10.67 | 6.53 |
| **Average Value:** | | **10.67** | **6.82** |
| **Corrected Average:** | | **10.89** | **7.07** |

## P-05A-02B Stratification Check

| DATE | TIME | O2 | CO |
|---|---|---|---|
| **Point 1** | | | |
| 11/16/2018 | 16:28:30 | 11.25 | 6.38 |
| 11/16/2018 | 16:29:00 | 11.26 | 6.28 |
| 11/16/2018 | 16:29:30 | 11.27 | 6.33 |
| 11/16/2018 | 16:30:00 | 11.28 | 6.58 |
| 11/16/2018 | 16:30:30 | 11.28 | 6.85 |
| 11/16/2018 | 16:31:00 | 11.29 | 7.01 |
| 11/16/2018 | 16:31:30 | 11.29 | 7.09 |
| 11/16/2018 | 16:32:00 | 11.29 | 6.32 |
| 11/16/2018 | 16:32:30 | 11.29 | 6.42 |
| 11/16/2018 | 16:33:00 | 11.30 | 6.58 |
| | **Average:** | **11.28** | **6.58** |
| **Point 2** | | | |
| 11/16/2018 | 16:33:30 | 11.31 | 6.71 |
| 11/16/2018 | 16:34:00 | 11.32 | 6.95 |
| 11/16/2018 | 16:34:30 | 11.32 | 6.91 |
| 11/16/2018 | 16:35:00 | 11.32 | 7.04 |
| 11/16/2018 | 16:35:30 | 11.33 | 7.08 |
| 11/16/2018 | 16:36:00 | 11.34 | 7.25 |
| 11/16/2018 | 16:36:30 | 11.33 | 7.15 |
| 11/16/2018 | 16:37:00 | 11.33 | 7.29 |
| 11/16/2018 | 16:37:30 | 11.33 | 7.36 |
| 11/16/2018 | 16:38:00 | 11.34 | 7.36 |
| | **Average:** | **11.33** | **7.11** |
| **Point 3** | | | |
| 11/16/2018 | 16:38:30 | 11.34 | 7.21 |
| 11/16/2018 | 16:39:00 | 11.34 | 7.21 |
| 11/16/2018 | 16:39:30 | 11.33 | 7.28 |
| 11/16/2018 | 16:40:00 | 11.32 | 7.21 |
| 11/16/2018 | 16:40:30 | 11.32 | 7.27 |
| 11/16/2018 | 16:41:00 | 11.32 | 7.27 |
| 11/16/2018 | 16:41:30 | 11.33 | 7.27 |
| 11/16/2018 | 16:42:00 | 11.33 | 7.24 |
| 11/16/2018 | 16:42:30 | 11.34 | 7.31 |
| 11/16/2018 | 16:43:00 | 11.35 | 7.36 |
| | **Average:** | **11.33** | **7.26** |
| | **Overall Average:** | **11.31** | **6.99** |

# P-05A-04A Engine

# AVERAGED CEM DATA

**Job Number:** *Engine4A* **Start Time:** *17:22:00*
**Run ID:** *4AR1* **Start Date:** *12/20/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 12/20/2018 | 17:23:00 | 9.92 | 6.52 |
| 12/20/2018 | 17:24:00 | 10.11 | 6.27 |
| 12/20/2018 | 17:25:00 | 10.22 | 6.87 |
| 12/20/2018 | 17:26:00 | 10.3 | 7.01 |
| 12/20/2018 | 17:27:00 | 10.34 | 6.62 |
| 12/20/2018 | 17:28:00 | 10.36 | 6.2 |
| 12/20/2018 | 17:29:00 | 10.38 | 7.16 |
| 12/20/2018 | 17:30:00 | 10.39 | 7.37 |
| 12/20/2018 | 17:31:00 | 10.42 | 7.31 |
| 12/20/2018 | 17:32:00 | 10.45 | 7.06 |
| 12/20/2018 | 17:33:00 | 10.46 | 7.04 |
| 12/20/2018 | 17:34:00 | 10.45 | 7.11 |
| 12/20/2018 | 17:35:00 | 10.45 | 7.1 |
| 12/20/2018 | 17:36:00 | 10.46 | 7.05 |
| 12/20/2018 | 17:37:00 | 10.47 | 6.98 |
| **Average Value:** | | **10.35** | **6.91** |
| **Corrected Average:** | | **10.35** | **7.09** |

# AVERAGED CEM DATA

**Job Number:** *Engine4A* **Start Time:** *17:50:00*
**Run ID:** *4AR2* **Start Date:** *12/20/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 12/20/2018 | 17:51:00 | 9.73 | 5.09 |
| 12/20/2018 | 17:52:00 | 9.71 | 4.8 |
| 12/20/2018 | 17:53:00 | 9.9 | 5.01 |
| 12/20/2018 | 17:54:00 | 10.12 | 5.81 |
| 12/20/2018 | 17:55:00 | 10.22 | 6.59 |
| 12/20/2018 | 17:56:00 | 10.28 | 6.51 |
| 12/20/2018 | 17:57:00 | 10.31 | 6.52 |
| 12/20/2018 | 17:58:00 | 10.33 | 6.55 |
| 12/20/2018 | 17:59:00 | 10.38 | 6.36 |
| 12/20/2018 | 18:00:00 | 10.45 | 6.25 |
| 12/20/2018 | 18:01:00 | 10.48 | 6.08 |
| 12/20/2018 | 18:02:00 | 10.51 | 6.15 |
| 12/20/2018 | 18:03:00 | 10.51 | 6.23 |
| 12/20/2018 | 18:04:00 | 10.49 | 6.24 |
| 12/20/2018 | 18:05:00 | 10.5 | 6.17 |
| **Average Value:** | | **10.26** | **6.02** |
| **Corrected Average:** | | **10.3** | **6.46** |

# AVERAGED CEM DATA

**Job Number:** *Engine4A* **Start Time:** *18:22:00*
**Run ID:** *4AR3* **Start Date:** *12/20/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 12/20/2018 | 18:23:00 | 9.98 | 3.82 |
| 12/20/2018 | 18:24:00 | 10.28 | 3.73 |
| 12/20/2018 | 18:25:00 | 10.4 | 3.85 |
| 12/20/2018 | 18:26:00 | 10.48 | 3.82 |
| 12/20/2018 | 18:27:00 | 10.62 | 3.59 |
| 12/20/2018 | 18:28:00 | 10.61 | 3.73 |
| 12/20/2018 | 18:29:00 | 10.61 | 3.82 |
| 12/20/2018 | 18:30:00 | 10.6 | 3.97 |
| 12/20/2018 | 18:31:00 | 10.62 | 4.03 |
| 12/20/2018 | 18:32:00 | 10.63 | 4.02 |
| 12/20/2018 | 18:33:00 | 10.63 | 4.15 |
| 12/20/2018 | 18:34:00 | 10.59 | 4.95 |
| 12/20/2018 | 18:35:00 | 10.57 | 5.19 |
| 12/20/2018 | 18:36:00 | 10.58 | 5.15 |
| 12/20/2018 | 18:37:00 | 10.58 | 5.16 |
| **Average Value:** | | **10.52** | **4.2** |
| **Corrected Average:** | | **10.55** | **4.77** |

**P-05-04A Engine Stratification Check**

| DATE | TIME | O2 | CO |
|---|---|---|---|
| **Point 1** | | | |
| 12/20/2018 | 17:22:30 | 9.88 | 6.27 |
| 12/20/2018 | 17:23:00 | 9.97 | 6.77 |
| 12/20/2018 | 17:23:30 | 10.08 | 6.36 |
| 12/20/2018 | 17:24:00 | 10.15 | 6.19 |
| 12/20/2018 | 17:24:30 | 10.20 | 6.86 |
| 12/20/2018 | 17:25:00 | 10.25 | 6.89 |
| 12/20/2018 | 17:25:30 | 10.28 | 6.99 |
| 12/20/2018 | 17:26:00 | 10.31 | 7.03 |
| 12/20/2018 | 17:26:30 | 10.33 | 7.07 |
| 12/20/2018 | 17:27:00 | 10.35 | 6.16 |
| | **Average:** | **10.18** | **6.66** |
| **Point 2** | | | |
| 12/20/2018 | 17:27:30 | 10.36 | 6.16 |
| 12/20/2018 | 17:28:00 | 10.36 | 6.24 |
| 12/20/2018 | 17:28:30 | 10.38 | 6.86 |
| 12/20/2018 | 17:29:00 | 10.38 | 7.45 |
| 12/20/2018 | 17:29:30 | 10.38 | 7.46 |
| 12/20/2018 | 17:30:00 | 10.40 | 7.28 |
| 12/20/2018 | 17:30:30 | 10.41 | 7.34 |
| 12/20/2018 | 17:31:00 | 10.43 | 7.28 |
| 12/20/2018 | 17:31:30 | 10.45 | 7.04 |
| 12/20/2018 | 17:32:00 | 10.46 | 7.09 |
| | **Average:** | **10.40** | **7.02** |
| **Point 3** | | | |
| 12/20/2018 | 17:32:30 | 10.46 | 7.05 |
| 12/20/2018 | 17:33:00 | 10.46 | 7.03 |
| 12/20/2018 | 17:33:30 | 10.45 | 7.08 |
| 12/20/2018 | 17:34:00 | 10.45 | 7.14 |
| 12/20/2018 | 17:34:30 | 10.45 | 7.10 |
| 12/20/2018 | 17:35:00 | 10.46 | 7.11 |
| 12/20/2018 | 17:35:30 | 10.46 | 7.08 |
| 12/20/2018 | 17:36:00 | 10.46 | 7.01 |
| 12/20/2018 | 17:36:30 | 10.46 | 6.96 |
| 12/20/2018 | 17:37:00 | 10.48 | 6.99 |
| | **Average:** | **10.46** | **7.05** |
| | **Overall Average:** | **10.35** | **6.91** |

# P-05A-06B Engine

# AVERAGED CEM DATA

**Job Number:** *Engine6B* **Start Time:** *13:50:00*
**Run ID:** *6BR1* **Start Date:** *11/16/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 11/16/2018 | 13:51:00 | 10.38 | 1.87 |
| 11/16/2018 | 13:52:00 | 10.57 | 2.14 |
| 11/16/2018 | 13:53:00 | 10.67 | 2.11 |
| 11/16/2018 | 13:54:00 | 10.68 | 2.27 |
| 11/16/2018 | 13:55:00 | 10.68 | 2.24 |
| 11/16/2018 | 13:56:00 | 10.69 | 2.24 |
| 11/16/2018 | 13:57:00 | 10.72 | 2.15 |
| 11/16/2018 | 13:58:00 | 10.73 | 2.24 |
| 11/16/2018 | 13:59:00 | 10.69 | 2.38 |
| 11/16/2018 | 14:00:00 | 10.64 | 2.58 |
| 11/16/2018 | 14:01:00 | 10.56 | 2.58 |
| 11/16/2018 | 14:02:00 | 10.57 | 2.19 |
| 11/16/2018 | 14:03:00 | 10.58 | 1.78 |
| 11/16/2018 | 14:04:00 | 10.58 | 1.93 |
| 11/16/2018 | 14:05:00 | 10.55 | 2.14 |
| **Average Value:** | | **10.62** | **2.19** |
| **Corrected Average:** | | **10.54** | **2.12** |

# AVERAGED CEM DATA

**Job Number:** *Engine6B* **Start Time:** *14:13:00*
**Run ID:** *6BR2* **Start Date:** *11/16/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 11/16/2018 | 14:14:00 | 10.18 | 3.91 |
| 11/16/2018 | 14:15:00 | 12.24 | 3.85 |
| 11/16/2018 | 14:16:00 | 12.31 | 3.76 |
| 11/16/2018 | 14:17:00 | 12.3 | 3.84 |
| 11/16/2018 | 14:18:00 | 12.3 | 3.97 |
| 11/16/2018 | 14:19:00 | 12.29 | 3.79 |
| 11/16/2018 | 14:20:00 | 12.31 | 3.84 |
| 11/16/2018 | 14:21:00 | 12.29 | 4.04 |
| 11/16/2018 | 14:22:00 | 12.14 | 4.05 |
| 11/16/2018 | 14:23:00 | 12.1 | 4.2 |
| 11/16/2018 | 14:24:00 | 12.07 | 4.11 |
| 11/16/2018 | 14:25:00 | 12.09 | 4.15 |
| 11/16/2018 | 14:26:00 | 12.11 | 4.33 |
| 11/16/2018 | 14:27:00 | 12.1 | 4.19 |
| 11/16/2018 | 14:28:00 | 12.14 | 4.19 |
| **Average Value:** | | **12.06** | **4.01** |
| **Corrected Average:** | | **11.85** | **3.89** |

# AVERAGED CEM DATA

**Job Number:** *Engine6B* **Start Time:** *14:34:00*
**Run ID:** *6BR3* **Start Date:** *11/16/18*

| Date | Time | O2 | CO |
|---|---|---|---|
| 11/16/2018 | 14:35:00 | 11.13 | 3.87 |
| 11/16/2018 | 14:36:00 | 11.4 | 3.81 |
| 11/16/2018 | 14:37:00 | 11.42 | 3.81 |
| 11/16/2018 | 14:38:00 | 11.42 | 3.81 |
| 11/16/2018 | 14:39:00 | 11.43 | 3.73 |
| 11/16/2018 | 14:40:00 | 11.47 | 3.75 |
| 11/16/2018 | 14:41:00 | 11.46 | 3.67 |
| 11/16/2018 | 14:42:00 | 11.43 | 3.7 |
| 11/16/2018 | 14:43:00 | 11.44 | 3.51 |
| 11/16/2018 | 14:44:00 | 11.45 | 3.63 |
| 11/16/2018 | 14:45:00 | 11.43 | 3.56 |
| 11/16/2018 | 14:46:00 | 11.43 | 3.74 |
| 11/16/2018 | 14:47:00 | 11.41 | 3.66 |
| 11/16/2018 | 14:48:00 | 11.41 | 3.77 |
| 11/16/2018 | 14:49:00 | 11.42 | 3.64 |
| **Average Value:** | | **11.41** | **3.71** |
| **Corrected Average:** | | **11.14** | **3.58** |

**P-05A-06B Engine Stratification Check**

| DATE | TIME | O2 | CO |
|---|---|---|---|
| **Point 1** | | | |
| 11/16/2018 | 13:50:30 | 10.34 | 2.34 |
| 11/16/2018 | 13:51:00 | 10.43 | 1.40 |
| 11/16/2018 | 13:51:30 | 10.53 | 1.99 |
| 11/16/2018 | 13:52:00 | 10.60 | 2.29 |
| 11/16/2018 | 13:52:30 | 10.65 | 2.11 |
| 11/16/2018 | 13:53:00 | 10.69 | 2.10 |
| 11/16/2018 | 13:53:30 | 10.68 | 2.25 |
| 11/16/2018 | 13:54:00 | 10.68 | 2.28 |
| 11/16/2018 | 13:54:30 | 10.68 | 2.14 |
| 11/16/2018 | 13:55:00 | 10.68 | 2.34 |
| | **Average:** | **10.60** | **2.12** |
| **Point 2** | | | |
| 11/16/2018 | 13:55:30 | 10.68 | 2.32 |
| 11/16/2018 | 13:56:00 | 10.70 | 2.16 |
| 11/16/2018 | 13:56:30 | 10.72 | 2.15 |
| 11/16/2018 | 13:57:00 | 10.72 | 2.15 |
| 11/16/2018 | 13:57:30 | 10.74 | 2.10 |
| 11/16/2018 | 13:58:00 | 10.72 | 2.38 |
| 11/16/2018 | 13:58:30 | 10.69 | 2.30 |
| 11/16/2018 | 13:59:00 | 10.68 | 2.45 |
| 11/16/2018 | 13:59:30 | 10.68 | 2.61 |
| 11/16/2018 | 14:00:00 | 10.61 | 2.56 |
| | **Average:** | **10.69** | **2.32** |
| **Point 3** | | | |
| 11/16/2018 | 14:00:30 | 10.56 | 2.63 |
| 11/16/2018 | 14:01:00 | 10.56 | 2.52 |
| 11/16/2018 | 14:01:30 | 10.57 | 2.58 |
| 11/16/2018 | 14:02:00 | 10.56 | 1.80 |
| 11/16/2018 | 14:02:30 | 10.58 | 1.80 |
| 11/16/2018 | 14:03:00 | 10.59 | 1.76 |
| 11/16/2018 | 14:03:30 | 10.58 | 1.81 |
| 11/16/2018 | 14:04:00 | 10.59 | 2.06 |
| 11/16/2018 | 14:04:30 | 10.57 | 2.03 |
| 11/16/2018 | 14:05:00 | 10.53 | 2.26 |
| | **Average:** | **10.57** | **2.12** |
| | **Overall Average:** | **10.62** | **2.19** |

# Test Results and Calculations

# P-05A-02B Engine

Sunoco Partners Marketing and Terminals, L.P.
P-05A-02B
Engine Exhaust
Marcus Hook, Pennsylvania
Carbon Monoxides Emissions Data

| Run I.D. | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Date | 16Nov18 | 16Nov18 | 16Nov18 |
| Time | 1628-1643 | 1657-1713 | 1720-1735 |
| Stack Gas Oxygen Concentrations | | | |
| % O2 | 11.51 | 10.91 | 10.89 |
| Emission Concentration | | | |
| ppmv, dry (actual) | 6.58 | 7.86 | 7.07 |
| ppmv, dry (adj. to 15% O2) | 4.13 | 4.64 | 4.17 |

Summary of Calculations

Concentration

ppmv, dry (adj. to 15% O2) = measured pollutant conc., ppmv, dry x [ ( 20.9 -15.0 ) / (20.9 - meas'd. O2 conc., %, dry)]

# P-05A-04A Engine

Sunoco Partners Marketing and Terminals, L.P.
P-05A-04A
Engine Exhaust
Marcus Hook, Pennsylvania
Carbon Monoxides Emissions Data

| Run I.D. | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Date | 20Dec18 | 20Dec18 | 20Dec18 |
| Time | 1722-1737 | 1750-1805 | 1822-1837 |
| Stack Gas Oxygen Concentrations | | | |
| % O2 | 10.35 | 10.30 | 10.55 |
| Emission Concentration | | | |
| ppmv, dry (actual) | 7.09 | 6.46 | 4.77 |
| ppmv, dry (adj. to 15% O2) | 3.97 | 3.60 | 2.72 |

Summary of Calculations

Concentration

ppmv, dry (adj. to 15% O2) = measured pollutant conc., ppmv, dry x [ ( 20.9 -15.0 ) / (20.9 - meas'd. O2 conc., %, dry)]

# P-05A-06B Engine

Sunoco Partners Marketing and Terminals, L.P.
P-05A-06B
Engine Exhaust
Marcus Hook, Pennsylvania
Carbon Monoxides Emissions Data

| Run I.D. | Run 1 | Run 2 | Run 3 |
|---|---|---|---|
| Date | 16Nov18 | 16Nov18 | 16Nov18 |
| Time | 1350-1405 | 1413-1428 | 1434-1449 |
| Stack Gas Oxygen Concentrations | | | |
| % O2 | 10.54 | 11.85 | 11.14 |
| Emission Concentration | | | |
| ppmv, dry (actual) | 2.12 | 3.89 | 3.58 |
| ppmv, dry (adj. to 15% O2) | 1.21 | 2.54 | 2.16 |

Summary of Calculations

Concentration

ppmv, dry (adj. to 15% O2) = measured pollutant conc., ppmv, dry x [ ( 20.9 -15.0 ) / (20.9 - meas'd. O2 conc., %, dry)]

# Equipment Calibration Data

# CEMs Calibrations

# P-05A-02B Engine

# Daily Analyzer Calibration

| | | | |
|---|---|---|---|
| Plant I.D. | Sunoco Partners Marketing and Terminals, L.P. | Project No. | 68756 |
| Source I.D | P-05A-02B Engine | Personnel | BAG |
| Pollutant | O2 | Analyzer I.D. | CAI 600 |
| Analyzer Serial No. | T03020 | Span Value | 21.00 |
| Date 11/16/2018 | Time 1607 | Test Method | 3A |

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | 0.0 | 0.01 | 0.0 | 0.02 | 0.0 |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | 12.26 | 12.29 | 0.1 | 12.23 | -0.3 |
| | Cylinder ID CC247310 | | | | |
| High Level Gas | 21.00 | 20.87 | -0.6 | NA | NA |
| | Cylinder ID CC342170 | | | | |

$$\text{Calibration Error} = \frac{(\text{Analyzer Response} - \text{Cylinder Value})}{\text{Span Value}} \times 100$$

$$\text{System Bias} = \frac{(\text{System Response} - \text{Analyzer Response})}{\text{Span Value}} \times 100$$

# Daily Analyzer Calibration

| | | | |
|---|---|---|---|
| Plant I.D. | Sunoco Partners Marketing and Terminals, L.P. | Project No. | 68756 |
| Source I.D | P-05A-02B Engine | Personnel | BAG |
| Pollutant | CO | Analyzer I.D. | TECO 48i |
| Analyzer Serial No. | JC1505601496 | Span Value | 46.50 |
| Date | 11/16/2018 Time 1607 | Test Method | 10 |

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | 0.0 | 0.10 | 0.2 | -0.03 | -0.3 |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | 22.70 | 22.75 | 0.1 | 22.78 | 0.1 |
| | Cylinder ID CC239412 | | | | |
| High Level Gas | 46.50 | 46.24 | -0.6 | NA | NA |
| | Cylinder ID SA8359 | | | | |

$$\text{Calibration Error} = \frac{(\text{Analyzer Response} - \text{Cylinder Value})}{\text{Span Value}} \times 100$$

$$\text{System Bias} = \frac{(\text{System Response} - \text{Analyzer Response})}{\text{Span Value}} \times 100$$

# DAILY CALIBRATION REPORT

**Start Time:** *16:07:16* **Methods: 3A, 6C, 7E and 10**

**Date:** *11/16/2018* **End Time:** *16:15:54* **Job Number: Sunoco**

| Param | Span Value | Mid-Gas Standard | Analyzer Zero Response | Analyzer Mid Response | Zero Cal Error | Mid Cal Error | System Zero Response | System Mid Response | System Zero Bias | System Mid Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 21 | 12.26 | 0.01 | 12.29 | 0.1% | 0.2% | 0.02 | 12.23 | 0.0% | -0.3% |
| CO | 46 | 22.70 | 0.1 | 22.75 | 0.2% | 0.1% | -0.03 | 22.78 | -0.3% | 0.1% |

**Calibration Error =** **100% x (Analyzer Response - Cylinder Gas Standard Value) / (Span Value)**

**System Bias =** **100% x (System Response - Analyzer Response) / (Span Value)**

For THC Measurements:

**Calibration Error =** **100% x (System Response - Cylinder Gas Standard Value) / (Cylinder Gas Standard Value)**

**System Bias =** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *16:12:45* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *2BR1* **Date:** *11/16/2018* **End Time:** *16:54:29* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 12.29 | 0.02 | 12.23 | 0.0% | -0.3% | 0.17 | 11.86 | 0.7% | -2.1% | 0.7% | -1.8% | 0.09 | 12.04 |
| CO | 0.1 | 22.75 | -0.03 | 22.78 | -0.3% | 0.1% | 1.09 | 22.82 | 2.1% | 0.1% | 2.4% | 0.1% | 0.53 | 22.8 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *16:45:39* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *2BR2* **Date:** *11/16/2018* **End Time:** *17:18:24* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 12.29 | 0.17 | 11.86 | 0.7% | -2.1% | 0.03 | 12. | 0.1% | -1.4% | -0.7% | 0.7% | 0.1 | 11.93 |
| CO | 0.1 | 22.75 | 1.09 | 22.82 | 2.1% | 0.1% | -0.31 | 22.77 | -0.9% | 0.0% | -3.0% | -0.1% | 0.39 | 22.79 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *17:16:05* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *2BR3* **Date:** *11/16/2018* **End Time:** *17:39:39* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 12.29 | 0.03 | 12. | 0.1% | -1.4% | 0.19 | 12. | 0.8% | -1.4% | 0.8% | 0.0% | 0.11 | 12. |
| CO | 0.1 | 22.75 | -0.31 | 22.77 | -0.9% | 0.0% | -0.49 | 22.8 | -1.3% | 0.1% | -0.4% | 0.1% | -0.4 | 22.79 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# P-05A-04A Engine

# Daily Analyzer Calibration

| | | | |
|---|---|---|---|
| Plant I.D. | Sunoco Partners Marketing and Terminals, L.P. | Project No. | 68756 |
| Source I.D | P-O5A-04A Engine | Personnel | BAG |
| Pollutant | O2 | Analyzer I.D. | CAI 600 |
| Analyzer Serial No. | T03020 | Span Value | 20.83 |
| Date 12/20/2018 | Time 1454 | Test Method | 3A |

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | 0.0 | 0.01 | 0.0 | 0.03 | 0.1 |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | 11.45 | 11.46 | 0.0 | 11.49 | 0.1 |
| | Cylinder ID CC2624 | | | | |
| High Level Gas | 20.83 | 20.69 | -0.7 | NA | NA |
| | Cylinder ID CC109527 | | | | |

$$\text{Calibration Error} = \frac{(\text{Analyzer Response} - \text{Cylinder Value})}{\text{Span Value}} \times 100$$

$$\text{System Bias} = \frac{(\text{System Response} - \text{Analyzer Response})}{\text{Span Value}} \times 100$$

# Daily Analyzer Calibration

| | | | |
|---|---|---|---|
| Plant I.D. | Sunoco Partners Marketing and Terminals, L.P. | Project No. | 68756 |
| Source I.D | P-O5A-04A Engine | Personnel | BAG |
| Pollutant | CO | Analyzer I.D. | TECO 48i |
| Analyzer Serial No. | JC1505601496 | Span Value | 45.40 |
| Date 12/20/2018 | Time 1454 | Test Method | 10 |

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | 0.0 | 0.16 | 0.4 | -0.10 | -0.6 |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | 22.70 | 22.79 | 0.2 | 22.73 | -0.1 |
| | Cylinder ID CC239412 | | | | |
| High Level Gas | 45.40 | 44.93 | -1.0 | NA | NA |
| | Cylinder ID CC132250 | | | | |

$$\text{Calibration Error} = \frac{(\text{Analyzer Response} - \text{Cylinder Value})}{\text{Span Value}} \times 100$$

$$\text{System Bias} = \frac{(\text{System Response} - \text{Analyzer Response})}{\text{Span Value}} \times 100$$

# DAILY CALIBRATION REPORT

**Start Time:** *14:54:01* **Methods: 3A, 6C, 7E and 10**

**Date:** *12/20/2018* **End Time:** *15:13:50* **Job Number: Sunoco**

| Param | Span Value | Mid-Gas Standard | Analyzer Zero Response | Analyzer Mid Response | Zero Cal Error | Mid Cal Error | System Zero Response | System Mid Response | System Zero Bias | System Mid Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 21 | 11.45 | 0.01 | 11.46 | 0.1% | 0.1% | 0.03 | 11.49 | 0.1% | 0.1% |
| CO | 45 | 22.70 | 0.16 | 22.79 | 0.4% | 0.2% | -0.01 | 22.73 | -0.4% | -0.2% |

**Calibration Error =** **100% x (Analyzer Response - Cylinder Gas Standard Value) / (Span Value)**

**System Bias =** **100% x (System Response - Analyzer Response) / (Span Value)**

For THC Measurements:

**Calibration Error =** **100% x (System Response - Cylinder Gas Standard Value) / (Cylinder Gas Standard Value)**

**System Bias =** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *15:10:23* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *4AR1* **Date:** *12/20/2018* **End Time:** *17:44:14* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 11.46 | 0.03 | 11.49 | 0.1% | 0.1% | 0.05 | 11.4 | 0.2% | -0.3% | 0.1% | -0.5% | 0.04 | 11.45 |
| CO | 0.16 | 22.79 | -0.01 | 22.73 | -0.4% | -0.2% | -0.18 | 21.93 | -0.7% | -1.9% | -0.4% | -1.8% | -0.09 | 22.33 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *17:40:50* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *4AR2* **Date:** *12/20/2018* **End Time:** *18:12:48* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 11.46 | 0.05 | 11.4 | 0.2% | -0.3% | 0.02 | 11.42 | 0.1% | -0.2% | -0.1% | 0.1% | 0.04 | 11.41 |
| CO | 0.16 | 22.79 | -0.18 | 21.93 | -0.7% | -1.9% | -0.46 | 22.03 | -1.4% | -1.7% | -0.6% | 0.2% | -0.32 | 21.98 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *18:09:09* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *4AR3* **Date:** *12/20/2018* **End Time:** *18:44:25* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 11.46 | 0.02 | 11.42 | 0.1% | -0.2% | 0. | 11.41 | -0.1% | -0.3% | -0.1% | 0.0% | 0.01 | 11.42 |
| CO | 0.16 | 22.79 | -0.46 | 22.03 | -1.4% | -1.7% | -0.56 | 21.75 | -1.6% | -2.3% | -0.2% | -0.6% | -0.51 | 21.89 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# P-05A-06B Engine

# Daily Analyzer Calibration

| | | | |
|---|---|---|---|
| Plant I.D. | Sunoco Partners Marketing and Terminals, L.P. | Project No. | 68756 |
| Source I.D | P-05A-06B Engine | Personnel | BAG |
| Pollutant | O2 | Analyzer I.D. | CAI 600 |
| Analyzer Serial No. | T03020 | Span Value | 21.00 |
| Date 11/16/2018 | Time 1317 | Test Method | 3A |

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | 0.0 | 0.01 | 0.0 | 0.02 | 0.0 |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | 12.26 | 12.33 | 0.3 | 12.29 | -0.2 |
| | Cylinder ID CC247310 | | | | |
| High Level Gas | 21.00 | 21.02 | 0.1 | NA | NA |
| | Cylinder ID CC342170 | | | | |

$$\text{Calibration Error} = \frac{(\text{Analyzer Response} - \text{Cylinder Value})}{\text{Span Value}} \times 100$$

$$\text{System Bias} = \frac{(\text{System Response} - \text{Analyzer Response})}{\text{Span Value}} \times 100$$

# Daily Analyzer Calibration

| | | | |
|---|---|---|---|
| Plant I.D. | Sunoco Partners Marketing and Terminals, L.P. | Project No. | 68756 |
| Source I.D | P-05A-06B Engine | Personnel | BAG |
| Pollutant | CO | Analyzer I.D. | TECO 48i |
| Analyzer Serial No. | JC1505601496 | Span Value | 46.50 |
| Date 11/16/2018 | Time 1317 | Test Method | 10 |

| | Cylinder Value (ppm or %) | Analyzer Response (ppm or %) | Calibration Error (% of Span) +/- 2% | System Response (ppm or %) | System Bias (% of Span) +/-5% |
|---|---|---|---|---|---|
| Zero Gas | 0.0 | 0.17 | 0.4 | 0.11 | -0.1 |
| | Cylinder ID | | | | |
| Low Level Gas | | | | | |
| | Cylinder ID | | | | |
| Mid Level Gas | 22.70 | 22.88 | 0.4 | 22.47 | -0.9 |
| | Cylinder ID | CC239412 | | | |
| High Level Gas | 46.50 | 46.44 | -0.1 | NA | NA |
| | Cylinder ID | SA8359 | | | |

$$\text{Calibration Error} = \frac{(\text{Analyzer Response} - \text{Cylinder Value})}{\text{Span Value}} \times 100$$

$$\text{System Bias} = \frac{(\text{System Response} - \text{Analyzer Response})}{\text{Span Value}} \times 100$$

# DAILY CALIBRATION REPORT

**Start Time:** *13:17:48* **Methods: 3A, 6C, 7E and 10**

**Date:** *11/16/2018* **End Time:** *13:28:29* **Job Number: Sunoco**

| Param | Span Value | Mid-Gas Standard | Analyzer Zero Response | Analyzer Mid Response | Zero Cal Error | Mid Cal Error | System Zero Response | System Mid Response | System Zero Bias | System Mid Bias |
|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 21 | 12.26 | 0.01 | 12.33 | 0.1% | 0.4% | 0.02 | 12.29 | 0.0% | -0.2% |
| CO | 46 | 22.70 | 0.17 | 22.88 | 0.4% | 0.4% | 0.11 | 22.47 | -0.1% | -0.9% |

**Calibration Error =** **100% x (Analyzer Response - Cylinder Gas Standard Value) / (Span Value)**

**System Bias =** **100% x (System Response - Analyzer Response) / (Span Value)**

For THC Measurements:

**Calibration Error =** **100% x (System Response - Cylinder Gas Standard Value) / (Cylinder Gas Standard Value)**

**System Bias =** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *13:25:14* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *6BR1* **Date:** *11/16/2018* **End Time:** *14:12:05* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 12.33 | 0.02 | 12.29 | 0.0% | -0.2% | 0.02 | 12.4 | 0.0% | 0.3% | 0.0% | 0.5% | 0.02 | 12.35 |
| CO | 0.17 | 22.88 | 0.11 | 22.47 | -0.1% | -0.9% | 0.06 | 22.81 | -0.2% | -0.2% | -0.1% | 0.7% | 0.08 | 22.64 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *14:08:48* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *6BR2* **Date:** *11/16/2018* **End Time:** *14:33:22* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 12.33 | 0.02 | 12.4 | 0.0% | 0.3% | 0.04 | 12.55 | 0.1% | 1.0% | 0.1% | 0.7% | 0.03 | 12.48 |
| CO | 0.17 | 22.88 | 0.06 | 22.81 | -0.2% | -0.2% | 0.21 | 22.68 | 0.1% | -0.4% | 0.3% | -0.3% | 0.14 | 22.75 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# CALIBRATION CHECK REPORT

**Start Time:** *14:30:02* **EPA Methods: 3A, 6C, 7E and 10**

**Run ID:** *6BR3* **Date:** *11/16/2018* **End Time:** *14:53:26* **Job Number:** Sunoco

| Param | Analyzer Zero Response | Analyzer Mid Response | System Pre-Zero Response | System Pre-Mid Response | System Pre-Zero Bias | System Pre-Mid Bias | System Post-Zero Response | System Post-Mid Response | System Post-Zero Bias | System Post-Mid Bias | Zero Drift | Mid Drift | System Avg-Zero Response | Syste Avg-M Respor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O2 | 0.01 | 12.33 | 0.04 | 12.55 | 0.1% | 1.0% | 0.09 | 12.56 | 0.3% | 1.0% | 0.2% | 0.0% | 0.06 | 12.55 |
| CO | 0.17 | 22.88 | 0.21 | 22.68 | 0.1% | -0.4% | 0.12 | 22.59 | -0.1% | -0.6% | -0.2% | -0.2% | 0.17 | 22.64 |

**System Bias=** **100% x (System Response - Analyzer Response) / (Span Value)**

**System Drift=** **100% x (System Post Response - System Pre Response) / (Span Value)**

For THC Measurements:

**System Bias=** **100% x (System Response - Cylinder Gas Standard Value) / (Span Value)**

# Cylinder Certifications

PRAXAIR
*Making our planet more productive*

DocNumber: 000025739

Praxair Distribution, Inc.
One Steel Road East
Morrisville PA 19067
Tel: 1-800-638-6360
Fax: 1-215-736-5237
PGVP ID: F32018

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

**Customer & Order Information**

OBRIEN & GERE ENGINEERS
2588 INDUSTRY LANE
EAST NORRITON PA 19403

Praxair Order Number:
Part Number: NI CD9O9E-AS

Fill Date: 07/06/2018
Lot Number: 301746187903
Cylinder Style & Outlet: AS CGA 590
Cylinder Pressure and Volume: 2000 psig 140 cu. ft.

## Certified Concentration

| Expiration Date: | 07/10/2026 | NIST Traceable |
|---|---|---|
| Cylinder Number: | CC247310 | Expanded Uncertainty |
| 9.12 % | CARBON DIOXIDE | ± 0.4 % |
| 12.26 % | OXYGEN | ± 0.2 % |
| Balance | NITROGEN | |

## Certification Information:

Certification Date: 07/10/2018 Term: 96 Months Expiration Date: 07/10/2026

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1..

Do Not Use this Standard If Pressure is less than 100 PSIG.

## Analytical Data:

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

1. **Component:** CARBON DIOXIDE

Requested Concentration: 9 %
Certified Concentration: 9.12 %
Instrument Used: SIEMENS ULTRAMAT 5E SN: D2-412
Analytical Method: NON-DISPERSIVE INFRARED
Last Multipoint Calibration: 06/15/2018

Reference Standard: Type / Cylinder #: GMIS / CC43746
Concentration: 9.99 %

Traceable to: SRM # / Sample # / Cylinder #: 2745 / 9-C-34 / CAL016129

| First Analysis Data: | | | | Date | 07/10/2018 |
|---|---|---|---|---|---|
| Z: 0 | R: 9.99 | C: 9.13 | Conc: 9.13 | | |
| R: 10 | Z: 0 | C: 9.13 | Conc: 9.13 | | |
| Z: 0 | C: 9.12 | R: 9.99 | Conc: 9.12 | | |
| UOM: % | | Mean Test Assay: | 9.12 % | | |

| Second Analysis Data: | | | | Date | |
|---|---|---|---|---|---|
| Z: 0 | R: 0 | C: 0 | Conc: 0 | | |
| R: 0 | Z: 0 | C: 0 | Conc: 0 | | |
| Z: 0 | C: 0 | R: 0 | Conc: 0 | | |
| UOM: % | | Mean Test Assay: | 0 % | | |

2. **Component:** OXYGEN

Requested Concentration: 12 %
Certified Concentration: 12.26 %
Instrument Used: SIEMENS OXYMAT 5F
Analytical Method: PARAMAGNETIC
Last Multipoint Calibration: 06/15/2018

Reference Standard: Type / Cylinder #: GMIS / CC52969
Concentration: 11.98%

Traceable to: SRM # / Sample # / Cylinder #: 2659a / 71-E-24 / FF18300

| First Analysis Data: | | | | Date | 07/10/2018 |
|---|---|---|---|---|---|
| Z: 0 | R: 11.98 | C: 12.26 | Conc: 12.26 | | |
| R: 11.98 | Z: 0 | C: 12.26 | Conc: 12.26 | | |
| Z: 0 | C: 12.26 | R: 11.98 | Conc: 12.26 | | |
| UOM: % | | Mean Test Assay: | 12.26 % | | |

| Second Analysis Data: | | | | Date | |
|---|---|---|---|---|---|
| Z: 0 | R: 0 | C: 0 | Conc: 0 | | |
| R: 0 | Z: 0 | C: 0 | Conc: 0 | | |
| Z: 0 | C: 0 | R: 0 | Conc: 0 | | |
| UOM: % | | Mean Test Assay: | 0 % | | |

Analyzed By Megha Patel — Megha Patel

Certified By Remzy Jemal — Remzy Jemal

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Tel: (800) 638-6360 Fax:(215) 736 5240
PGVP ID: F32018

DocNumber: 000024498

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

***Customer & Order Information:***

PRAXAIR PKG ALLENTOWN PA H
5275 TILGHMAN ST
ALLENTOWN PA 18104

*Praxair Order Number:* 70553629
*Customer P. O. Number:*
*Customer Reference Number:*

*Fill Date:* 3/30/2018
*Part Number:* NI CD17.5O4E-AS
*Lot Number:* 304322089806
*Cylinder Style & Outlet:* AS CGA 590
*Cylinder Pressure & Volume:* 2000 psig 140 cu. ft.

***Certified Concentration:***

| | | | |
|---|---|---|---|
| Expiration Date: | | **4/4/2026** | NIST Traceable |
| Cylinder Number: | | **CC342170** | Analytical Uncertainty: |
| **17.22** | **%** | **CARBON DIOXIDE** | ± 0.3 % |
| **21.00** | **%** | **OXYGEN** | ± 0.2 % |
| | **Balance** | **NITROGEN** | |

***Certifcation Information:*** *Certification Date:* 4/4/2018 *Term:* 96 Months *Expiration Date:* 4/4/2026

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

***Analytical Data:*** *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

**1. Component: CARBON DIOXIDE**

Requested Concentration: 17.5 %
Certified Concentration: 17.22 %
Instrument Used: SIEMENS ULTRAMAT 5E SN: D2-412
Analytical Method: NON-DISPERSIVE INFRARED
Last Multipoint Calibration: 3/11/2018

Reference Standard Type: SRM
Ref. Std. Cylinder # : SA4406
Ref. Std. Conc: 17.59%
Ref. Std. Traceable to SRM # : 2745
SRM Sample # : 9-C-34
SRM Cylinder # : CAL016129

| First Analysis Data: | | | | Date: | 4/4/2018 |
|---|---|---|---|---|---|
| Z: 0 | R: 17.59 | C: 17.22 | Conc: | 17.22 | |
| R: 17.6 | Z: 0 | C: 17.24 | Conc: | 17.24 | |
| Z: 0 | C: 17.22 | R: 17.59 | Conc: | 17.22 | |
| UOM: % | | Mean Test Assay: | | 17.22 % | |

| Second Analysis Data: | | | | Date: | |
|---|---|---|---|---|---|
| Z: 0 | R: 0 | C: 0 | Conc: | 0 | |
| R: 0 | Z: 0 | C: 0 | Conc: | 0 | |
| Z: 0 | C: 0 | R: 0 | Conc: | 0 | |
| UOM: % | | Mean Test Assay: | | 0 % | |

**2. Component: OXYGEN**

Requested Concentration: 21 %
Certified Concentration: 21.00 %
Instrument Used: SIEMENS OXYMAT 5F
Analytical Method: PARAMAGNETIC
Last Multipoint Calibration: 3/11/2018

Reference Standard Type: GMIS
Ref. Std. Cylinder # : ND22706
Ref. Std. Conc: 20.60 %
Ref. Std. Traceable to SRM # : 2659A
SRM Sample # : 71-E-24
SRM Cylinder # : FF18300

| First Analysis Data: | | | | Date: | 4/4/2018 |
|---|---|---|---|---|---|
| Z: 0 | R: 20.6 | C: 21 | Conc: | 21 | |
| R: 20.6 | Z: 0 | C: 21 | Conc: | 21 | |
| Z: 0 | C: 21 | R: 20.6 | Conc: | 21 | |
| UOM: % | | Mean Test Assay: | | 21 % | |

| Second Analysis Data: | | | | Date: | |
|---|---|---|---|---|---|
| Z: 0 | R: 0 | C: 0 | Conc: | 0 | |
| R: 0 | Z: 0 | C: 0 | Conc: | 0 | |
| Z: 0 | C: 0 | R: 0 | Conc: | 0 | |
| UOM: % | | Mean Test Assay: | | 0 % | |

Analyzed by: Megha Patel

Certified by: Jessica Goodman

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DocNumber: 000025472

PGVP ID: F32018

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

***Customer & Order Information:***

OBRIEN & GERE ENGINEERS
PO BOX 4873
SYRACUSE NY 13221-

*Praxair Order Number:* 59172629
*Customer P. O. Number:* 10064713
*Customer Reference Number:*

*Fill Date:* 5/30/2018
*Part Number:* NI OX11E-AS
*Lot Number:* 301603
*Cylinder Style & Outlet:* AS CGA
*Cylinder Pressure & Volume:* 2000 psig 140 cu. ft.

## *Certified Concentration:*

| | | | |
|---|---|---|---|
| Expiration Date: | | **6/6/2026** | NIST Traceable |
| Cylinder Number: | | **CC2624** | Analytical Uncertainty: |
| **11.45** | **%** | **OXYGEN** | ± 0.3 % |
| | **Balance** | **NITROGEN** | |

***Certifcation Information:*** *Certification Date:* 6/6/2018 *Term:* 96 Months *Expiration Date:* 6/6/2026

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

***Analytical Data:*** *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

**1. Component: OXYGEN**

Requested Concentration: 11 %
Certified Concentration: 11.45 %
Instrument Used: SIEMENS OXYMAT 5F
Analytical Method: PARAMAGNETIC
Last Multipoint Calibration: 5/14/2018

Reference Standard Type: GMIS
Ref. Std. Cylinder #: CC102021
Ref. Std. Conc: 11.89%
Ref. Std. Traceable to SRM #: 2659a
SRM Sample #: 71-E-24
SRM Cylinder #: FF18300

| **First Analysis Data:** | | | | | | | | **Date:** | 5/30/2018 |
|---|---|---|---|---|---|---|---|---|---|
| **Z:** | 0 | **R:** | 11.9 | **C:** | 11.46 | **Conc:** | 11.45 | | |
| **R:** | 11.9 | **Z:** | 0 | **C:** | 11.46 | **Conc:** | 11.45 | | |
| **Z:** | 0 | **C:** | 11.46 | **R:** | 11.9 | **Conc:** | 11.45 | | |
| **UOM:** | % | | | **Mean Test Assay:** | | | 11.45 % | | |

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

Analyzed by: Megha Patel

Certified by: Jeff Gosner

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DocNumber: 000019878

PGVP ID: F32017

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

***Customer & Order Information:***

PRAXAIR PKG LIVERPOOL NY HP
4560 MORGAN PLACE
LIVERPOOL NY 13090

*Praxair Order Number:* 70196317
*Customer P. O. Number:*
*Customer Reference Number:*

*Fill Date:* 1/31/2017
*Part Number:* EV NICDOXE111AS
*Lot Number:* 301633031701
*Cylinder Style & Outlet:* AS CGA 590
*Cylinder Pressure & Volume:* 2000 psig 140 cu. ft.

***Certified Concentration:***

| | | | |
|---|---|---|---|
| Expiration Date: | | **2/3/2025** | NIST Traceable |
| Cylinder Number: | | **CC109527** | Analytical Uncertainty: |
| **17.4** | **%** | **CARBON DIOXIDE** | ± 0.3 % |
| **20.83** | **%** | **OXYGEN** | ± 0.2 % |
| | **Balance** | **NITROGEN** | |

***Certifcation Information:*** *Certification Date:* 2/3/2017 *Term:* 96 Months *Expiration Date:* 2/3/2025

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

***Analytical Data:*** *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

**1. Component: CARBON DIOXIDE**

Requested Concentration: 17 %
Certified Concentration: 17.4 %
Instrument Used: SIEMENS ULTRAMAT 5E SN: D2-412
Analytical Method: NON-DISPERSIVE INFRARED
Last Multipoint Calibration: 1/5/2017

Reference Standard Type: SRM
Ref. Std. Cylinder # : SA12314
Ref. Std. Conc: 17.50%
Ref. Std. Traceable to SRM # : 2745
SRM Sample # : 9-C-34
SRM Cylinder # : CAL016129

| **First Analysis Data:** | | | | | | | **Date:** | 2/3/2017 |
|---|---|---|---|---|---|---|---|---|
| **Z:** | 0 | **R:** | 17.5 | **C:** | 17.4 | **Conc:** | 17.4 | |
| **R:** | 17.5 | **Z:** | 0 | **C:** | 17.4 | **Conc:** | 17.4 | |
| **Z:** | 0 | **C:** | 17.4 | **R:** | 17.5 | **Conc:** | 17.4 | |
| **UOM:** | % | | | **Mean Test Assay:** | | | 17.4 % | |

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

**2. Component: OXYGEN**

Requested Concentration: 21 %
Certified Concentration: 20.83 %
Instrument Used: SIEMENS OXYMAT 5F
Analytical Method: PARAMAGNETIC
Last Multipoint Calibration: 1/5/2017

Reference Standard Type: GMIS
Ref. Std. Cylinder # : ND20825
Ref. Std. Conc: 23.18%
Ref. Std. Traceable to SRM # : 2659A
SRM Sample # : 71-E-24
SRM Cylinder # : FF18300

| **First Analysis Data:** | | | | | | | **Date:** | 2/3/2017 |
|---|---|---|---|---|---|---|---|---|
| **Z:** | 0 | **R:** | 23.18 | **C:** | 20.82 | **Conc:** | 20.82 | |
| **R:** | 23.24 | **Z:** | 0 | **C:** | 20.84 | **Conc:** | 20.84 | |
| **Z:** | 0 | **C:** | 20.84 | **R:** | 23.24 | **Conc:** | 20.84 | |
| **UOM:** | % | | | **Mean Test Assay:** | | | 20.83 % | |

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

Analyzed by: Jessica Goodman

Certified by: Jeff Gosner

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**Fax: 1-215-736-5237**
**PGVP ID: F32017**

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

***Customer & Order Information***

OBRIEN & GERE ENGINEERS
PO BOX 4873
SYRACUSE NY 13221-4873

*Praxair Order Number:* 91505521
*Part Number:* NI CO25ME-AS
*Customer PO Number:* 10064701

*Fill Date:* 05/15/2017
*Lot Number:* 304613135702
*Cylinder Style & Outlet:* AS CGA 350
*Cylinder Pressure and Volume:* 2000 psig 140 cu. ft.

## *Certified Concentration*

| | | |
|---|---|---|
| Expiration Date: | **05/19/2025** | NIST Traceable |
| Cylinder Number: | **CC239412** | Expanded Uncertainty |
| **22.7 ppm** | **CARBON MONOXIDE** | **± 0.7 %** |
| **Balance** | **NITROGEN** | |

## *Certification Information:*

*Certification Date:* 05/19/2017 *Term:* 96 Months *Expiration Date:* 05/19/2025

This cylinder was certified according to the 2012 EPA Traceability Protocol, Document #EPA-600/R-12/531, using Procedure G1..

Do Not Use this Standard if Pressure is less than 100 PSIG.

## *Analytical Data:*

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

1. ***Component:*** **CARBON MONOXIDE**

Requested Concentration: 25 ppm
Certified Concentration: 22.7 ppm
Instrument Used: HORIBA VIA-510,S/N:577172041
Analytical Method: NON-DISPERSIVE INFRARED
Last Multipoint Calibration: 05/12/2017

**Reference Standard:** Type / Cylinder #: GMIS / SA4638
Concentration: 25.3 PPM

**Traceable to:** SRM # / Sample # / Cylinder #: 1678 PPM / 4-K-05 / CAL016806

| **First Analysis Data:** | | | | | | | | **Date** | 05/19/2017 |
|---|---|---|---|---|---|---|---|---|---|
| **Z:** | 0 | **R:** | 25.3 | **C:** | 22.7 | **Conc:** | 22.7 | | |
| **R:** | 25.3 | **Z:** | 0 | **C:** | 22.7 | **Conc:** | 22.7 | | |
| **Z:** | 0 | **C:** | 22.7 | **R:** | 25.3 | **Conc:** | 22.7 | | |
| **UOM:** | PPM | | | | | **Mean Test Assay:** | 22.7 | PPM | |

| **Second Analysis Data:** | | | | | | | | **Date** | |
|---|---|---|---|---|---|---|---|---|---|
| **Z:** | 0 | **R:** | 0 | **C:** | 0 | **Conc:** | 0 | | |
| **R:** | 0 | **Z:** | 0 | **C:** | 0 | **Conc:** | 0 | | |
| **Z:** | 0 | **C:** | 0 | **R:** | 0 | **Conc:** | 0 | | |
| **UOM:** | PPM | | | | | **Mean Test Assay:** | 0 | PPM | |

Jessica Goodman

Analyzed By **Jessica Goodman**

Megha Patel

Certified By **Megha Patel**

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DocNumber: 000006364

PGVP ID: F32013

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

***Customer & Order Information:***

PDMA SYRACUSE
4560 MORGAN PL
LIVERPOOL NY 130900

*Praxair Order Number:* 04575412
*Customer P. O. Number:* 00598853
*Customer Reference Number:*

*Fill Date:* 10/18/2013
*Part Number:* NI CO45ME-AS
*Lot Number:* 304530291303
*Cylinder Style & Outlet:* AS CGA 350
*Cylinder Pressure & Volume:* 2000 psig 140 cu. ft.

***Certified Concentration:***

| | | | |
|---|---|---|---|
| Expiration Date: | **10/29/2021** | | NIST Traceable |
| Cylinder Number: | **SA8359** | | Analytical Uncertainty: |
| **46.5** | **ppm** | **CARBON MONOXIDE** | ± 1 % |
| | **Balance** | **NITROGEN** | |

***Certification Information:*** *Certification Date:* 10/29/2013 *Term:* 96 Months *Expiration Date:* 10/29/2021

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

***Analytical Data:*** *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

**1. Component: CARBON MONOXIDE**

Requested Concentration: 45 ppm
Certified Concentration: 46.5 ppm
Instrument Used: HORIBA VIA-3000 S/N Y9EY78L6
Analytical Method: NDIR
Last Multipoint Calibration: 10/24/2013

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC27828
Ref. Std. Conc: 50.6 PPM
Ref. Std. Traceable to SRM # : 1679c
SRM Sample # : 3-J-47
SRM Cylinder # : CAL018062

| **First Analysis Data:** | | | | | | **Date:** | 10/29/2013 |
|---|---|---|---|---|---|---|---|
| Z: | 0 | R: | 50.1 | C: | 46.2 | Conc: | 46.75 |
| R: | 49.9 | Z: | 0 | C: | 45.8 | Conc: | 46.35 |
| Z: | 0 | C: | 45.9 | R: | 50 | Conc: | 46.45 |
| UOM: | PPM | | | Mean Test Assay: | | | 46.52 PPM |

| **Second Analysis Data:** | | | | | | **Date:** | |
|---|---|---|---|---|---|---|---|
| Z: | 0 | R: | 0 | C: | 0 | Conc: | 0 |
| R: | 0 | Z: | 0 | C: | 0 | Conc: | 0 |
| Z: | 0 | C: | 0 | R: | 0 | Conc: | 0 |
| UOM: | PPM | | | Mean Test Assay: | | | 0 PPM |

Analyzed by: Jeff Gosner

Certified by: Judith Imperial

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PGVP ID: F32016

DocNumber: 000018424

# CERTIFICATE OF ANALYSIS / EPA PROTOCOL GAS

***Customer & Order Information:***

PRAXAIR PKG LIVERPOOL NY HP
4560 MORGAN PLACE
LIVERPOOL NY 13090

*Praxair Order Number:* 70114165
*Customer P. O. Number:*
*Customer Reference Number:*

*Fill Date:* 9/16/2016
*Part Number:* NI CO45ME-AS
*Lot Number:* 304613260603
*Cylinder Style & Outlet:* AS CGA 350
*Cylinder Pressure & Volume:* 2000 psig 140 cu. ft.

## *Certified Concentration:*

| | | | |
|---|---|---|---|
| Expiration Date: | 9/20/2024 | | NIST Traceable |
| Cylinder Number: | CC132250 | | Analytical Uncertainty: |
| 45.4 | ppm | CARBON MONOXIDE | ± 0.8 % |
| | Balance | NITROGEN | |

***Certifcation Information:*** *Certification Date:* 9/20/2016 *Term:* 96 Months *Expiration Date:* 9/20/2024

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

***Analytical Data:*** *(R=Reference Standard, Z=Zero Gas, C=Gas Candidate)*

**1. Component: CARBON MONOXIDE**

Requested Concentration: 45 ppm
Certified Concentration: 45.4 ppm
Instrument Used: HORIBA VIA-3000 S/N Y9EY78L6
Analytical Method: NDIR
Last Multipoint Calibration: 9/15/2016

Reference Standard Type: GMIS
Ref. Std. Cylinder # : CC207689
Ref. Std. Conc: 150.7 PPM
Ref. Std. Traceable to SRM # : 1679 c
SRM Sample # : 3-J-47
SRM Cylinder # : CAL018062

| First Analysis Data: | | | | | | | Date: | 9/20/2016 |
|---|---|---|---|---|---|---|---|---|
| Z: | 0 | R: | 149.9 | C: | 44.9 | Conc: | 45.2 | |
| R: | 149.7 | Z: | 0 | C: | 45.3 | Conc: | 45.6 | |
| Z: | 0 | C: | 45.1 | R: | 149.8 | Conc: | 45.4 | |
| UOM: | PPM | | | Mean Test Assay: | | | 45.4 PPM | |

| Second Analysis Data: | | | | | | | Date: | |
|---|---|---|---|---|---|---|---|---|
| Z: | 0 | R: | 0 | C: | 0 | Conc: | 0 | |
| R: | 0 | Z: | 0 | C: | 0 | Conc: | 0 | |
| Z: | 0 | C: | 0 | R: | 0 | Conc: | 0 | |
| UOM: | PPM | | | Mean Test Assay: | | | 0 PPM | |

Analyzed by: Jeff Gosner

Certified by: Jessica Goodman

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