



**INITIAL PERFORMANCE TEST PROGRAM**

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SEP 16 2016

**AIR QUALITY DIV.**

*Performed At The*  
**Hillsdale Board of Public Utilities**  
**Unit 5 and Unit 6**  
**Hillsdale, Michigan**

*Test Date(s)*  
**August 16 and 17, 2016**

*Report No.*  
**TRC Environmental Corporation Report 254482A**

*Report Submittal Date*  
**September 14, 2016**

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INITIAL PERFORMANCE TEST PROGRAM

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed an initial performance test program on the Unit 5 and Unit 6 at the Hillsdale Board of Public Utilities in Hillsdale, Michigan on August 16 and 17, 2016. The tests were authorized by and performed for Hillsdale Board of Public Utilities.

The purpose of this test program was to determine the percent of carbon monoxide (CO) reduced by the diesel oxidation catalyst (DOC) system installed to control CO emissions during >90% of design capacity operating conditions. The test program was completed in accordance with the methods and specifications for the Reciprocating Internal Combustion Engine (RICE) Maximum Achievable Control Technology (MACT) regulations presented in Title 40, Code of Federal Regulations, Part 63, Subpart ZZZZ, "National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines". The test program was conducted according to the TRC Test Protocol 254482 dated May 24, 2016.

1.1 Project Contact Information

| Participants                      |  |   |
|-----------------------------------|--|---|
| Test Facility                     | Hillsdale Board of Public Utilities<br>201 Waterworks Ave<br>Hillsdale, Michigan 49242<br>State Registration Number: B7536 | Mr. Matt Burk<br>Director of Environmental Compliance<br>517-542-2346 Ext. 370 (phone)<br>517-542-2290 (fax)<br>burkm@mscpa.net |
| Air Emissions Testing Body (AETB) | TRC Environmental Corporation<br>7521 Brush Hill Road<br>Burr Ridge, Illinois 60527  | Mr. Anthony Sakellariou<br>Project Manager<br>312-533-2035 (phone)<br>312-533-2070 (fax)<br>asakellariou@trcsolutions.com       |

The tests were conducted by Cameron Dillion and Ben Cacao of TRC. Documentation of the on-site ASTM D7036-04 Qualified Individual (QI) can be located in the appendix to this report.

Mr. Brian Carley of the Michigan Department of Environmental Quality (MDEQ) observed the testing on August 16, 2016 and Mr. David Patterson of the MDEQ observed the testing on August 17, 2016 .



**1.2 Facility and Process Description**

Unit 5 and Unit 6 are subject to the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Stationary Reciprocating Internal Combustion Engines (RICE) requirements for existing non-emergency, non-black start compression ignition (CI) stationary RICE with a site rating of more than 500 brake horsepower (HP) located at a major source of HAP emissions. Unit 5 diesel engine generator uses No. 2 fuel oil and natural gas with an electrical generating capacity of 5613 KW. The fuel oil is from either of two outdoor storage tanks through two day tanks. Unit 6 diesel engine generator uses No. 2 fuel oil and natural gas with an electrical generating capacity of 6000 KW. The fuel oil is from either of two outdoor storage tanks through four dedicated day tanks. Both engines utilize lake water for cooling water.

Each diesel engine generator is equipped with a DCL International Diesel Oxidation Catalyst (DOC) System. The DOC is a single-stage device comprised of one or more substrates coated with catalytic material which promotes oxidation of carbon monoxide, hydrocarbons and particulate matter in the exhaust gas entering the DOC. The DOC was specifically designed to meet the NESHAP RICE requirements for stationary diesel engines.

**1.3 Source/Unit Information**

The following table identifies the design capacity, make, model number, serial number and date installed of each RICE.

| Unit   | Emission Unit ID | Engine Information |                 |                 |               |           |
|--------|------------------|--------------------|-----------------|-----------------|---------------|-----------|
|        |                  | Size (KW)          | Manufacturer    | Model No.       | Serial Number | Installed |
| Unit 5 | EU-ENG-5         | 5613               | Cooper Bessemer | LSV-16-GDT      | 7126          | 1/1/1972  |
| Unit 6 | EU-ENG-6         | 6000               | Cooper Bessemer | LSVB-20-GDT7167 | 7167          | 1/1/1976  |



## 2.0 SUMMARY OF RESULTS

The results of this test program are summarized in the table below. Detailed individual run results are presented in Section 6.0.

| Pollutant Tested |                    | Unit 5 |        |                      | Applicable Rule/Regulation                                |
|------------------|--------------------|--------|--------|----------------------|---|
|                  |                    | Inlet  | Outlet | Performance Criteria |   |
| CO               | ppmvd @ 15% Oxygen | 142.5  | 22.4   | 23 (Outlet) or       | USEPA 40CFR63 subpart ZZZZ - NESHAP for RICE Table 2c (5) |
|                  | Reduction (%)      | 84.3   |        | > 70% Reduction      |   |

| Pollutant Tested |                    | Unit 6 |        |                      | Applicable Rule/Regulation                                |
|------------------|--------------------|--------|--------|----------------------|---|
|                  |                    | Inlet  | Outlet | Performance Criteria |   |
| CO               | ppmvd @ 15% Oxygen | 259.5  | 45.8   | 23 (Outlet) or       | USEPA 40CFR63 subpart ZZZZ - NESHAP for RICE Table 2c (5) |
|                  | Reduction (%)      | 82.4   |        | > 70% Reduction      |   |

The table below summarizes the test methods used, as well as the number and duration of each at each test location:

| Unit ID/<br>Sample Location | Parameter Measured | Test Method | No. of Runs | Run Duration |
|-----------------------------|--------------------|-------------|-------------|--------------|
| Unit 5 and Unit 6           | O <sub>2</sub>     | USEPA 3A    | 3           | 60 min       |
|                             | CO                 | USEPA 10    | 3           | 60 min       |

## 3.0 DISCUSSION OF RESULTS

No problems were encountered with the testing equipment during the test program. Source operation appeared normal during the entire test program. No changes or problems were encountered that required modification of any procedures presented in the test plan. No adverse test or environmental conditions were encountered during the conduct of this test program.



## 4.0 SAMPLING AND ANALYSIS PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

### 4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to aid in the representative measurement of pollutant emissions and/or total volumetric flow rates from stationary sources. In order to qualify as an acceptable sample location, it must be located at a position at least two stack or duct equivalent diameters downstream and a half equivalent diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were then located in the center of these areas. The minimum number of points were determined from either Figure 1-1 (particulate) or Figure 1-2 (non-particulate) of USEPA Method 1.

### 4.2 Determination of the Concentration of Gaseous Pollutants Using a Multi-Pollutant Sampling System

Concentrations of the pollutants in the following sub-sections were determined using one sampling system.

A straight-extractive sampling system was used. A data logger continuously recorded pollutant concentrations and generated one-minute averages of those concentrations. All calibrations and system checks were conducted using USEPA Protocol 1 gases. Three-point linearity checks were performed prior to sampling, and in the event of a failing system bias or drift test (and subsequent corrective action). System bias and drift checks were performed using the low-level gas and either the mid- or high-level gas prior to and following each test run.

The Low Concentration Analyzers (those that routinely operate with a calibration span of less than 20 ppm) used by TRC are ambient-level analyzers. Per Section 3.12 of Method 7E, a Manufacturer's Stability Test is not required for ambient-level analyzers. Analyzer interference tests were conducted in accordance with the regulations in effect at the time that TRC placed an analyzer model in service.



#### **4.2.1 O<sub>2</sub> Determination by USEPA Method 3A**

This method is applicable for the determination of O<sub>2</sub> concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The O<sub>2</sub> analyzer was equipped with a paramagnetic-based detector.

#### **4.2.2 CO Determination by USEPA Method 10**

This method is applicable for the determination of CO concentrations in controlled and uncontrolled emissions from stationary sources only when specified within the regulations. The non-dispersive infrared analyzer (NDIR) CO analyzer was equipped with an internal gas correlation filter wheel, which eliminates potential detector interference. As such, use of an interference removal trap was not required.

### **5.0 QUALITY ASSURANCE PROCEDURES**

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third party audits of our activities, and maintain:

- Accreditation from the Louisiana Environmental Laboratory Accreditation Program (LELAP);
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

ASTM D7036-04 specifies that: *“AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be*



*demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found.”* TRC conforms with this section by using approved test protocols for all tests.



### 6.0 TEST RESULTS SUMMARY

Hillsdale Board of Public Utilities  
Hillsdale, MI  
August 17, 2016

| Unit   | Test No.       | Inlet<br>CO ppmvd<br>@ 15% O <sub>2</sub> | Outlet<br>CO ppmvd<br>@ 15% O <sub>2</sub> | Reduction<br>% |
|--------|----------------|---|--|----------------|
| Unit 5 | 1              | 144.0                                     | 22.6                                       | 84.3           |
|        | 2              | 142.1                                     | 22.4                                       | 84.2           |
|        | 3              | 141.3                                     | 22.3                                       | 84.2           |
|        | <b>Average</b> | <b>142.5</b>                              | <b>22.4</b>                                | <b>84.3</b>    |

$$\text{Reduction \%} = \frac{\text{Inlet (CO ppmvd @ 15\% O}_2\text{)} - \text{Outlet (CO ppmvd @ 15\% O}_2\text{)}}{\text{Inlet (CO ppmvd @ 15\% O}_2\text{)}} \times 100$$



**Hillsdale Board of Public Utilities**  
**Hillsdale, MI**  
**August 16, 2016**

| Unit          | Test No.       | Inlet<br>CO ppmvd<br>@ 15% O <sub>2</sub> | Outlet<br>CO ppmvd<br>@ 15% O <sub>2</sub> | Reduction<br>% |
|---------------|----------------|---|--|----------------|
| <b>Unit 6</b> | 1              | 259.5                                     | 46.2                                       | 82.2           |
|               | 2              | 258.3                                     | 45.7                                       | 82.3           |
|               | 3              | 260.7                                     | 45.4                                       | 82.6           |
|               | <b>Average</b> | <b>259.5</b>                              | <b>45.8</b>                                | <b>82.4</b>    |

$$\text{Reduction \%} = \frac{\text{Inlet (CO ppmvd @ 15\% O}_2) - \text{Outlet (CO ppmvd @ 15\% O}_2)}{\text{Inlet (CO ppmvd @ 15\% O}_2)} \times 100$$