CONESTOGA-ROVERS & ASSOCIATES

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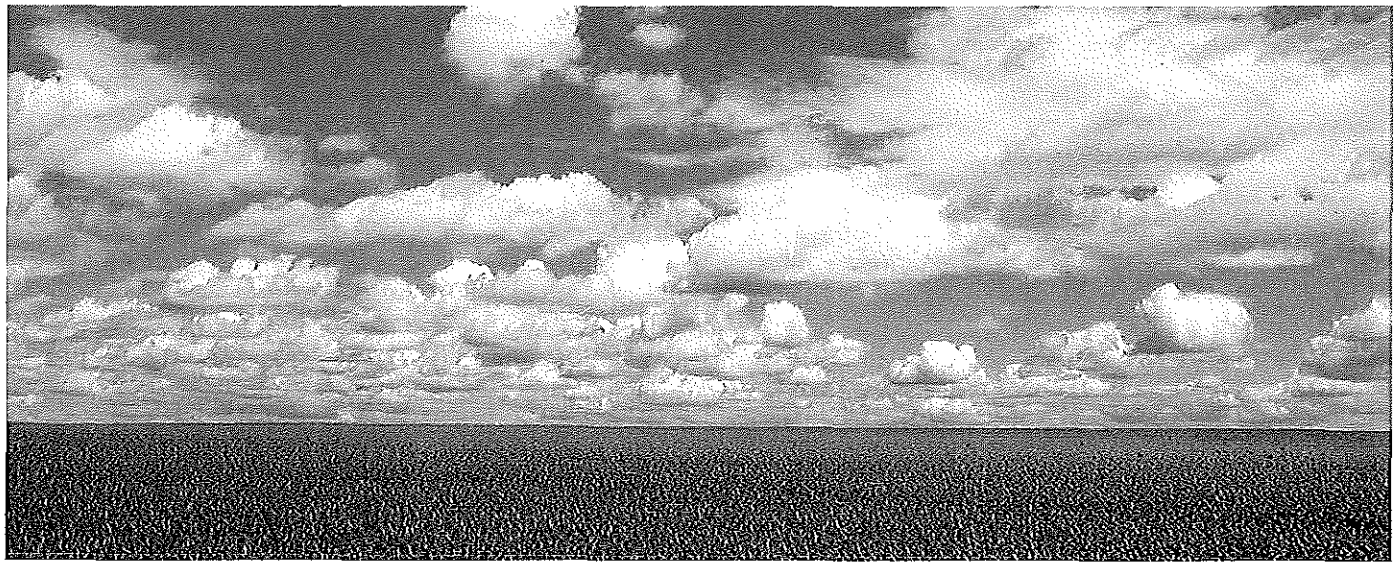

# EUBOIL5 Emission Test Report for $NO_x$ and CO

Ford Motor Company
Dearborn, MI

Conestoga-Rovers & Associates
2055 Niagara Falls Boulevard, Suite 3
Niagara Falls, New York 14304

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Partners in Sustainability

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

# RENEWABLE OPERATING PERMIT
# REPORT CERTIFICATION

*Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.*

**Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating (RO) Permit program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as described in General Condition No. 22 in the RO Permit and be made available to the Department of Environmental Quality, Air Quality Division upon request.**

Source Name: Ford Motor Company - Elm Street Boiler House  County: Wayne

Source Address: 1200 Elm Street  City: Dearborn

AQD Source ID (SRN): 48121  RO Permit No.: MI-ROP-M4764-2014  RO Permit Section No.: 1

Please check the appropriate box(es):

☐ **Annual Compliance Certification (General Condition No. 28 and No. 29 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the RO Permit.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the RO Permit, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the RO Permit, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (General Condition No. 23 of the RO Permit)**

Reporting period (provide inclusive dates): From _____ To _____

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the RO Permit were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From _____ To _____

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Air Emissions Test Report Submission for Required ROP Testing for FGBOILER4&5

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete.

| Joseph Vicari | Manager | 313-999-0364 |
|---|---|---|
| Name of Responsible Official (print or type) | Title | Phone Number |
| Joseph Vicari | | 1-21-15 |
| Signature of Responsible Official | | Date |

* Photocopy this form as needed.

EQP 5736 (Rev 9/01)

# Section 1.0 Introduction

## 1.1 Overview

Ford Motor Company contracted Conestoga-Rovers & Associates, Inc. (CRA) to conduct an air emissions testing program on one (1) boiler (EUBOIL5) located at their Dearborn, MI facility. The Cleaver Brooks Boiler is rated at 99.8 Million Brittish Thermal Units per hour (MMBtu/hr) of heat input. The objective of this test program was to quantify the emissions of oxides of nitrogen ($NO_x$) and carbon monoxide (CO) as permitted in Renewable Operating Permit (ROP) No. MI-ROP-M4764-2014. The permitted $NO_x$ emission limit is 0.06 lbs $NO_x$/MMBtu, and the CO emission limit is 10.0 lb/hr. Testing was completed on December 10, 2014.

## 1.2 Project Organization

The Ford contacts were as follows:

Mr. Nathaniel Ampunan
Site Management & Operations
Elm Street Boilerhouse
1751 Village Road
Dearborn, MI 48121
(313) 322-7864

Ms. Julia Guernsey, QSTI
Environmental Engineer
Ford Motor Company-Environmental Quality Office
290 Town Center Drive
Dearborn, MI 48126
(313) 845-0362

The CRA project manager was:

Mr. Keith Jaworski, QSTI
Conestoga-Rovers & Associates
2055 Niagara Falls Boulevard
Niagara Falls, NY 14304
(716) 297-6150

Other project personnel included Mr. Steve Zimmerman from CRA.

### 1.3 Test Plan

CRA conducted three (3) 1-hour test runs on EUBOIL5. All testing was conducted in accordance with the reference methods (RMs) described in the United States Code of Federal Regulations, Title 40 Part 60 (40 CFR 60) Appendix A. These versions of the reference methods were obtained from the United States Environmental Protection Agency (USEPA) Emission Measurement Center (EMC) website (www.epa.gov/ttn/emc).

Table 1.1 is a summary of the test methods for this test program.

## Section 2.0 Summary of Results

This testing was performed to demonstrate compliance with the emission limits contained in Elm Street Boilerhouse Permit No. MI-ROP-M4764-2014.
The results of the test program as compared to the permit limits are as follows:

| *Parameter* | *Average Result* | *Permit Limit* |
|---|---|---|
| *NOx* | *0.04 lbs/MMBtu* | *0.06 lbs/MMBtu* |
| *CO* | *0.53 lbs/hr* | *10.0 lbs/hr* |

These results indicate that EUBOIL5 meets the emission limits as stated in the facility's operating permit. The complete results are summarized in Table 2.1.

## Section 3.0 Source Description

### 3.1 Process Description

Ford owns and operates two (2) boilers at the Elm Street Boilerhouse. The boilers, EUBOIL4 and EUBOIL5 are rated at 99.8 MMBtu/hr heat input. These steam-generating units are capable of burning natural gas or No. 2 fuel oil. The units are also equipped with a Peabody low $NO_x$ natural gas burner and a flue gas recirculation (FGR) system to help further reduce the $NO_x$ emissions. For the purpose of this test program only natural gas was used as a fuel source. Additionally, as allowed by the ROP, one boiler, EUBOIL5 was tested under this test program.

### 3.2 Process Instrumentation Monitoring

During this test program, process parameters were monitored and recorded. These parameters included process steam flow which was recorded to determine the load at which the boiler was operating, and process fuel flow which was used in conjunction with Reference Method(RM) 19

equations to calculate emissions. Calibration sheets for the fuel meters are included in Appendix B.

# Section 4.0 Sampling and Analytical Procedures

## 4.1 Test location

### 4.1.1 Cleaver Brooks Boiler 5 (EUBOIL5)

EUBOIL5 is exhausted to atmosphere via a circular steel stack. The sampling location was in a rectangular steel duct that was located inside the building. This duct was approximately 3 feet wide. Sampling of the stack was performed through a 1-inch diameter sample port. This test port is located in the centroid the duct and 10 feet above ground. Exact dimensions could not be measured due to the nature of the boiler configuration. The Sampling Location is presented in Figure 4.1.

## 4.2 Oxygen ($O_2$) Sampling and Analysis (USEPA Method 3A)

$O_2$ analysis was performed in accordance with USEPA Method 3A. $O_2$ concentrations were determined using a Servomex Model 1400 paramagnetic analyzer, operated in the 0-25 percent range. $O_2$ analysis was continuous with one-minute average concentrations recorded on a DAS. Three (3), 1-hour test runs were performed. $O_2$ data was used to calculate emission rates in accordance with RM 19.

## 4.3 $NO_x$ Sampling and Analysis (USEPA Method 7E)

$NO_x$ analysis was performed in accordance with USEPA Method 7E. Exhaust gas was extracted from the centroid of the source via a stainless steel probe. The sample gas was transported via heated Teflon sample line maintained at 300°F to a gas conditioner for removal of moisture. The dry sample was analyzed for $NO_x$ concentration using Thermo Environmental Model 42 analyzer. The operational range was 0-100 ppm. $NO_x$ analysis was continuous with one-minute average concentrations recorded on a DAS. Three (3), 1-hour test runs were performed.

## 4.4 Carbon Monoxide (RM 10)

CO analysis was performed in accordance with RM 10. Analysis was performed on a TECO Model 48H Gas Filter Correlation, Non-dispersive Infrared Analyzer (GFC-NDIR). The GFC eliminates the interferences from moisture or $CO_2$. The operational range was 0-100 ppm. CO analysis was continuous with one-minute average concentrations recorded on a DAS. Three (3), 1-hour test runs were performed.

## 4.5 System Response Time

The system response time was measured during set up activities in accordance with RM 7E. The high level gas for each analyzer was introduced to the probe. The time to achieve 95 percent of the certified value was measured and recorded as the upscale response time for each analyzer. Upon achieving a stable high level response, zero gas was introduced. The time to achieve 5 percent or 0.5 ppmv of the span value was recorded as the downscale response time. The longest of all upscale and downscale response times was used as the system response time.

## 4.6 RM 3A, 7E and 10 Analyzer Calibration Error (CE) Test

The CE tests were performed following the procedures outlined in RM 7E, Section 8.2.3 by first introducing the zero calibration gas and adjusting the instrument to read zero. Next, the high level span gas was introduced with the analyzer's response adjusted to match this calibration gas concentration. Finally, the low, mid, and high level gases were introduced without any adjustments to the analyzer. The analyzer's response was within ± 2 percent of calibration spans at each point.

Analyzer calibrations were performed using USEPA Protocol 1 standards and CEMS-zero grade nitrogen. An Environics Model 4040 Series Gas Dilution System was used to generate appropriate calibration gases.

## 4.7 RM 3A, 7E and 10 Analyzer System Bias Check

A system bias check was conducted immediately following the CE test in accordance with RM 7E, Section 8.2.5. The system bias was determined by introducing both the zero gas and both upscale gases at the probe and recording the analyzers response. The system bias is acceptable if the analyzer response does not differ from the target value by more than ±5 percent of the calibration span, or the difference is less than or equal to 0.5 ppmv, whichever is less restrictive. All results indicate the system bias checks were acceptable.

## 4.8 RM 3A, 7E and 10 Post-Run Drift Checks

A drift check was conducted at the conclusion of each run following the procedures outlined in RM 7E, Section 8.5. The zero and the appropriate upscale gas for each method were sequentially introduced into the system and responses recorded. The zero and upscale responses must agree with the target by ±3 percent of span. All results indicate the drift check were acceptable.

### 4.9 $NO_x$ Converter Efficiency Test

Prior to testing, a $NO_x$ converter efficiency test was conducted in accordance with RM 7E, Section 8.2.4 to prove that the analyzer converts nitrogen dioxide ($NO_2$) to nitrogen oxide (NO) efficiently. The test was conducted using a USEPA Protocol 1 $NO_2$ standard in a balance of nitrogen with a concentration of 51.26. The gas was introduced directly to the analyzer while operating in the $NO_x$ mode. Once the reading stabilized, the response was recorded and the efficiency calculated. The result of $NO_x$ converter efficiency test is located in Appendix B.

### 4.10 Verification of Gas Dilution System (USEPA Method 205)

RM 205 was used to evaluate the calibration gas dilution system. The field verification was conducted according to procedures given in RM 205 Section 3 of the method. The results of the RM 205 check are included in Appendix B.

## Section 5.0 Test Results and Discussion

### 5.1 Test Results

All test results are included in Table 2.1. During the test program Ford personnel recorded all pertinent process information. These data are located in Appendix C.

### 5.2 Test Deviations

Due to the nature of the port location, a stratification test could not be performed. All other sampling was completed as per the protocol.

### 5.3 Calculations

### 5.3.1 Oxides of Nitrogen and Carbon Monoxide Concentrations, Reference Methods 7E and 10

$$C_{gas} = (\bar{C} - C_o)\frac{C_{ma}}{C_m - C_o}$$

Where:

$C_{gas}$ = Effluent gas concentration, dry basis, ppm.

$\overline{C}$ = Average gas concentration indicated by gas analyzer, dry basis, ppm.

$C_o$ = Average of initial and final system calibration bias check responses for the zero gas, ppm.

$C_m$ = Average of initial and final system calibration bias check responses for the upscale calibration gas, ppm.

$C_{ma}$ = Actual concentration of the upscale calibration gas, ppm.

### 5.3.2 Pollutant Emission Rate, lb/MMbtu

$$E = \frac{C_d}{10^6} x \frac{MW}{385.3} x F_d x \frac{20.9}{20.9 - \%O_2}$$

Where:

E = Emission rate, lb/MMbtu

$\frac{C_d}{10^6}$ = Pollutant concentration, parts per million, dry basis

MW = Pollutant molecular weight, g/g-mol

385.3 = Conversion, l/g-mol to $ft^3$/lb-mol

$F_d$ = Oxygen-based fuel factor, standard cubic feet per MMbtu

$\%O_2$ = Average oxygen concentration, dry basis

### 5.3.3 Stack Gas Flow Rate, Standard Cubic Feet Per Minute

$$Q_s = \frac{F_r \times F_{hv} F_d \times \frac{20.9}{20.9 - \%O_2}}{10^6}$$

Where:

$Q_s$ = Stack gas flow rate, standard cubic feet per minute, dry basis

$F_r$ = Fuel rate, standard cubic feet per minute

$F_{hv}$ - Fuel heating value, btu per standard cubic foot

$F_d$ = Oxygen-based fuel factor, standard cubic feet per MMbtu

$\%O_2$ Average oxygen concentration, dry basis

### 5.3.4 Mass Emission Rate, lb/hr

$$E_v = \frac{C_s}{10^6} * \frac{MW * Qsd}{385.3} * 60$$

Where:
$E_V$ = Mass emission rate, pounds per hour (lb/hr)
$\frac{C_s}{10^6}$ = Stack concentration, parts per million (ppmv)
MW = Molecular weight, pounds per pound-mole
Qsd = Volumetric flow rate, standard cubic feet per minute
385.3 = Standard cubic feet per pound mole of air
60 = Minutes per hour

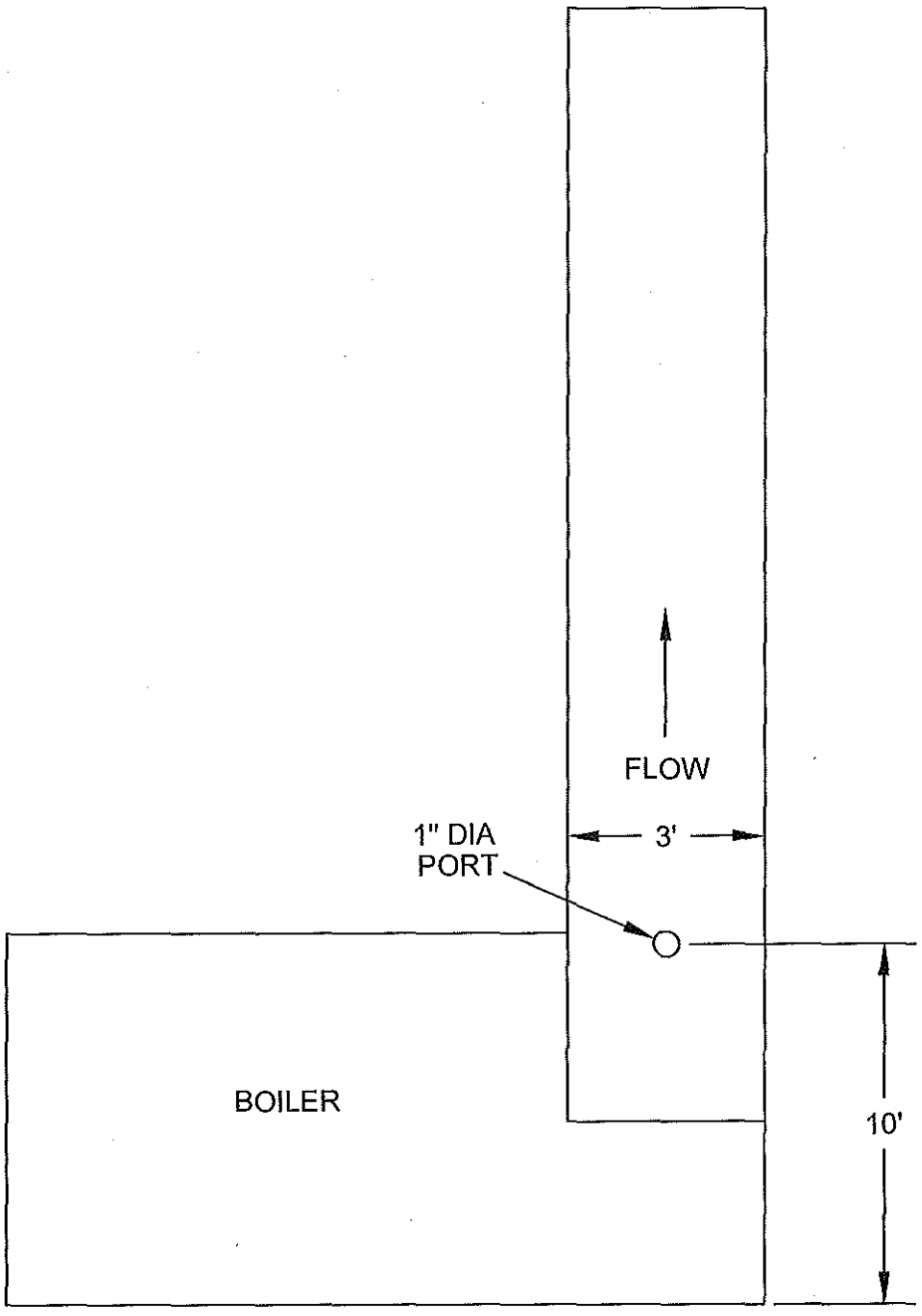


figure 4.1
EUBOIL5 SAMPLING LOCATION
FORD ELM STREET BOILERHOUSE
*Dearborn, Michigan*

89125-00(002)GN-NI001 JAN 23/2015

**TABLE 1.1**

**EUBOIL5 TEST SUMMARY**
**FORD MOTOR COMPANY**
**ELM STREET BOILERHOUSE**
**DEARBORN, MICHIGAN**

| *Parameter* | *Test Method* | *Location* | *No. of Test Runs* | *Run Duration* | *Comments* |
|---|---|---|---|---|---|
| Oxygen | RM 3A | Outlet | 3 | 60 minutes | |
| Oxides of Nitrogen | RM 7E | Outlet | 3 | 60 minutes | |
| Carbon Monoxide | RM 10 | Outlet | 3 | 60 minutes | |
| Calibration Gas | RM 205 | N/A | N/A | N/A | Calibration gas dilution |

**TABLE 2.1**

**EUBOIL5 SUMMARY OF RESULTS**
**FORD MOTOR COMPANY**
**ELM STREET BOILERHOUSE**
**DEARBORN, MICHIGAN**

| *Location* | *Parameter* | *Units* | *Run 1* | *Run 2* | *Run 3* | *Average* | *Limit* |
|---|---|---|---|---|---|---|---|
| | | *Date* | *12/10/2014* | *12/10/2014* | *12/10/2014* | | |
| | | *Start Time* | *8:00* | *9:30* | *11:00* | | |
| | | *End Time* | *9:00* | *10:30* | *12:00* | | |
| EUBOIL5 Outlet | Flow Rate | scfm[1] | 14788 | 14723 | 14764 | 14758 | |
| | $O_2$ | % | 3.3 | 3.2 | 3.3 | 3.3 | |
| | NOx | ppmvd | 33.8 | 33.8 | 33.9 | 33.8 | |
| | | lb/MMbtu | 0.04 | 0.04 | 0.04 | 0.04 | **0.06** |
| | CO | ppmvd | 9.10 | 7.60 | 8.10 | 8.27 | |
| | | lbs/hr | 0.58 | 0.49 | 0.52 | 0.53 | **10.0** |

[1] Flow rate corrected to actual $O_2$