# FINAL REPORT

# WYANDOTTE MUNICIPAL SERVICES POWER PLANT

WYANDOTTE, MI

## COMPLIANCE TESTING REPORT: EUWMSENGINE1, 2 AND 3 CARBON MONOXIDE DESTRUCTION EFFICIENCY TESTING

RWDI # 2403864.01

October 11, 2024

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# EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by Wyandotte Municipal Services Power Plant (WMSPP) to complete the emission sampling program at the facility located at 2555 Van Alstyne, Wyandotte, Michigan. The power plant operates under Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-B2132-2023. WMSPP operates three (3) diesel-fired CAT engines identified as EUWMSENGINE1, EUWMSENGINE2 and EUWMSENGINE3 (FGWMSENGINES). Testing was conducted to show compliance with the carbon monoxide (CO) emission limit of at least 70% destruction efficiency (DE) or a CO concentration of 23 ppmvd corrected to 15% oxygen ($O_2$) at the outlet.

Testing was completed August 27th, 2024 – August 28th, 2024.

**Executive Table i:** Average Emission Data – EUWMSENGINE1-3 – CO Concentration and DE Results

| Source | CO Concentration (ppmvd @ 15% $O_2$) | | Destruction Efficiency (DE) | Limit |
|---|---|---|---|---|
| | Inlet | Outlet | | |
| **EUWMSENGINE1** | 68.4 | 3.2 | 95.2% | 70% DE or 23 ppmvd @ 15% $O_2$ |
| **EUWMSENGINE2** | 74.8 | 3.5 | 95.3% | 70% DE or 23 ppmvd @ 15% $O_2$ |
| **EUWMSENGINE3** | 74.8 | 4.2 | 95.4% | 70% DE or 23 ppmvd @ 15% $O_2$ |

**Notes:** ppmvd – part per million by volume, dry basis
DE – destruction efficiency

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# 1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by Wyandotte Municipal Services Power Plant (WMSPP) to complete the emission sampling program for the power plant located at 2555 Van Alstyne, Wyandotte, Michigan. The power plant operates under Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-B2132-2023. WMSPP operates three (3) diesel-fired CAT engines identified as EUWMSENGINE1, EUWMSENGINE2 and EUWMSENGINE3 (FGWMSENGINES). Testing was conducted to show compliance with the carbon monoxide (CO) emission limit of at least 70% destruction efficiency (DE) or a CO concentration of 23 ppmvd corrected to 15% oxygen ($O_2$) at the outlet.

## 1.1 Location and Dates of Testing

Testing was completed at 100 James DeSana Drive in Wyandotte, Michigan and took place on August 27$^{th}$ to 28$^{th}$, 2024.

## 1.2 Purpose of Testing

This testing was conducted pursuant to condition V.1. of MI-ROP-B2132-2023 to show compliance with condition I.2.

## 1.3 Description of Source

The facility operates three (3) Caterpillar Model 3516B diesel-powered compression ignition engine generators (EUWMSENGINE1, EUWMSENGINE2, EUWMSENGINE3). Each engine is rated at 1,825 kilowatts (kW) and 2,593 horsepower (HP). Each engine is equipped with a catalytic oxidation emission control system to reduce CO emissions.

## 1.4 Personnel Involved in Testing

**Table 1.4.1:** Testing Personnel

| | | |
|---|---|---|
| **Jim Skarzynski**<br>Power Plant Superintendent<br>Jskarzynski@wyandottemi.gov | Wyandotte Municipal Service | (734) 231-3827 |
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# 2 SUMMARY OF RESULTS

## 2.1 Operating Data

During the emissions testing, plant process data was monitored and collected by WMSPP personnel to verify representative operation of the facility. The following information was collected:

1. Fuel Consumption, gal/hr
2. Power generated, kW
3. Inlet catalyst temperature, °F
4. Average pressure drop across catalyst, in $H_2O$

Operating parameters for each test can be found in **Appendix A**.

## 2.2 Applicable Permit Number

MI-ROP-B2132-2023

# 3 SOURCE DESCRIPTION

## 3.1 Description of Process and Emission Control Equipment

EUWMSENGINE1-3 are equipped with an oxidation catalyst which controls emissions.

## 3.2 Process Flow Sheet or Diagram (if applicable)

A process flow diagram is available upon request.

## 3.3 Type and Quantity of Raw and Finished Materials

EUWMSENGINE1-3 are diesel-powered compression ignition engine generators.

## 3.4 Normal Rated Capacity of Process

The engines are rated at 1,825 kilowatts (kW) and 2,593 horsepower (HP).

# 4 SAMPLING AND ANALYTICAL PROCEDURES

## 4.1 Carbon Monoxide and Oxygen

CO and $O_2$ concentrations were determined utilizing RWDI's continuous emissions monitoring (CEM) system. Prior to testing, a 3-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, mid and high-level calibration gases directly into the analyzer. The calibration error check was performed to confirm that the analyzer response was within ±2% of the certified calibration gas introduced. Prior to each test run, a system-bias test was performed where known concentrations of calibration gases were introduced at the probe tip to measure if the analyzers response was within ±5% of the introduced calibration gas concentrations. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre and post-test system bias checks. The system bias checks were used to confirm that the analyzer did not drift greater than ±3% throughout each test run.

Zero and upscale calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases were introduced into the sampling system at the probe outlet so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to a series of gas analyzers, which measure the pollutant or diluent concentrations in the gas. The analyzers were calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe tip was equipped with a sintered stainless-steel filter for particulate removal. The end of the probe was connected to a heated Teflon sample line, which delivered the sample gases from the stack to the CEM system. The heated sample line was designed to maintain the gas temperature above 250°F to prevent condensation of stack gas moisture within the line.

Before entering the analyzers, the gas sample passed directly into a refrigerated condenser, which cools the gas to approximately 35°F to remove the stack gas moisture. After passing through the condenser, the dry gas entered a Teflon-head diaphragm pump and a flow control panel, which delivered the gas in series to the CO and $O_2$ analyzers. Each of these analyzers measure the respective gas concentrations on a dry volumetric basis.

### 4.1.1 Modifications

Safe access to the engines' inlet port location was only accessible when the engine was not in operation. As a result, the stratification check on the inlet could not be safely completed. After consulting with and receiving approval from the on-site EGLE TPU representative Ms. Battershell, the inlet probe remained in the centroid of the stack for the duration of the testing, and stratification verification was completed on the outlet of each engine.

## 4.2 Verification of Gas Dilution Systems for Field Instrument Calibration

Calibration gas was mixed using an Environics 4040 Gas Dilution System. The mass flow controllers are factory calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. The calibration is done yearly, and the records are included in the Source Testing Report. A multi-point EPA Method 205 check was executed in the field prior to testing to ensure accurate gas mixtures. The gas dilution system consists of calibrated orifices for mass flow controllers and dilutes a high-level calibration gas to within ±2% of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with US EPA Method 205 "*Verification of Gas Dilution Systems for Field Instrument Calibrations*". The gas divider dilutions were measured to evaluate that the responses are within ±2% of predicted values. In addition, a certified mid-level calibration gas within ±10% of one of the tested dilution gases was introduced into an analyzer to ensure the response of the gas calibration was within ±2% of gas divider dilution concentration.

## 4.3 Description of Recovery and Analytical Procedures

There were no samples to recover during this test program. All testing used real time data from the analyzers.

## 4.4 Sampling Port Description

A figure of the testing sites is provided in the **Figures** section.

# 5 TEST RESULTS AND DISCUSSION

## 5.1 Detailed Results

The following tables give the averages for each permit requirement. The **Tables** section and **Appendix B** provide a detailed breakdown of each test.

**Table 5.1.1:** Average Emission Data – EUWMSENGINE1-3 – CO Concentration and DE Results

| Source | CO Concentration (ppmvd @ 15% $O_2$) | | Destruction Efficiency (DE) | Limit |
|---|---|---|---|---|
| | Inlet | Outlet | | |
| **EUWMSENGINE1** | 68.4 | 3.2 | 95.2% | 70% DE or 23 ppmvd @ 15% $O_2$ |
| **EUWMSENGINE2** | 74.8 | 3.5 | 95.3% | 70% DE or 23 ppmvd @ 15% $O_2$ |
| **EUWMSENGINE3** | 74.8 | 4.2 | 95.4% | 70% DE or 23 ppmvd @ 15% $O_2$ |

**Notes:** ppmvd – part per million by volume, dry basis
DE – destruction efficiency

## 5.2 Discussion of Results

Emission limits were verified and confirmed to be lower than the ROP defined limit for EUWMSENGINE1, EUWMSENGINE2, and EUWMSENGINE3.

## 5.3 Variations in Testing Procedures

There were no variations in the testing procedure.

## 5.4 Process Upset Conditions During Testing

There were no breaks in production during testing.

## 5.5 Maintenance Performed in Last Three Months

Only normal routine maintenance was completed on EUWMSENGINES1, 2 & 3 during the three (3) months prior to testing.

## 5.6 Re-Test

This was not a retest.

## 5.7 Audit Samples

This test did not require any audit samples.

## 5.8 Field Data Sheets

Field data sheets can be found in **Appendix C**.

## 5.9 Calibration Data

Calibration data can be found in **Appendix D**.

## 5.10 Example Calculations

Example calculations can be found in **Appendix E**.

## 5.11 Laboratory Data

There was no laboratory data from this testing program.

## 5.12 Test Plan and EGLE Correspondence

The submitted test plan and all EGLE correspondence is located in **Appendix F.**

# TABLES

## Table 1: Summary of Sampling Parameters and Methodology

| Source Location | No. of Tests per Stack | Sampling Parameter | Sampling Method |
|---|---|---|---|
| EUWMSENGINE1 | 3 | Oxygen | U.S. EPA [1] Method 3A |
| | 3 | Carbon Monoxide | U.S. EPA [1] Method 10 |
| EUWMSENGINE2 | 3 | Oxygen | U.S. EPA [1] Method 3A |
| | 3 | Carbon Monoxide | U.S. EPA [1] Method 10 |
| EUWMSENGINE3 | 3 | Oxygen | U.S. EPA [1] Method 3A |
| | 3 | Carbon Monoxide | U.S. EPA [1] Method 10 |

**Notes:**

*[1] U.S. EPA - United States Environmental Protection Agency*

## Table 2: Sampling Time Summary

| Source and Test # | Sampling Date | Start Time | End Time |
|---|---|---|---|
| **EUWMSENGINE1** | | | |
| Test #1 | 27-Aug-24 | 8:00 AM | 8:59 AM |
| Test #2 | 27-Aug-24 | 9:27 AM | 10:26 AM |
| Test #3 | 27-Aug-24 | 10:50 AM | 11:49 AM |
| **EUWMSENGINE2** | | | |
| Test #1 | 27-Aug-24 | 12:58 PM | 1:57 PM |
| Test #2 | 27-Aug-24 | 2:17 PM | 3:16 PM |
| Test #3 | 27-Aug-24 | 3:38 PM | 4:37 PM |
| **EUWMSENGINE3** | | | |
| Test #1 | 28-Aug-24 | 7:40 AM | 8:39 AM |
| Test #2 | 28-Aug-24 | 9:13 AM | 10:12 AM |
| Test #3 | 28-Aug-24 | 10:41 AM | 11:40 AM |

## Table 3: EUWMSENGINE1 Testing Summary

RWDI Project #2403864

| EUWMSENGINE1 | | | | $O_2$ | | CO | | CO Emission Rate | | Destruction Efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| Test ID | Date | Start | End | % | | ppm | | ppm corrected to 15% $O_2$ | | |
| | | | | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | DE % |
| 1 | 2024-08-27 | 8:00 | 8:59 | 10.8 | 11.0 | 112.0 | 4.8 | 65.4 | 2.9 | 95.6% |
| 2 | 2024-08-27 | 9:27 | 10:26 | 10.7 | 10.8 | 112.1 | 5.7 | 64.8 | 3.3 | 94.9% |
| 3 | 2024-08-27 | 10:50 | 11:49 | 10.7 | 10.7 | 119.6 | 5.7 | 68.9 | 3.3 | 95.2% |
| | | Average | | 10.7 | 10.8 | 114.5 | 5.4 | 66.4 | 3.2 | 95.2% |

**Limits:** Outlet 23 ppmvd @ 15% O2
DE 70%

## Table 4: EUWMSENGINE2 Testing Summary

RWDI Project #2403864

| EUWMSENGINE2 | | | | $O_2$ | | CO | | CO Emission Rate | | Destruction Efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| Test ID | Date | Start | End | % | | ppm | | ppm corrected to 15% $O_2$ | | |
| | | | | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | DE % |
| 1 | 2024-08-27 | 12:58 | 13:57 | 11.2 | 10.6 | 114.8 | 7.6 | 70.0 | 4.4 | 93.7% |
| 2 | 2024-08-27 | 14:17 | 15:16 | 11.8 | 10.5 | 112.7 | 5.7 | 73.5 | 3.2 | 95.6% |
| 3 | 2024-08-27 | 15:38 | 16:37 | 11.3 | 10.3 | 131.6 | 5.3 | 80.9 | 2.9 | 96.4% |
| | | Average | | 11.5 | 10.5 | 119.7 | 6.2 | 74.8 | 3.5 | 95.3% |

**Limits:** Outlet 23 ppmvd @ 15% O2
DE 70%

## Table 5: EUWMSENGINE3 Testing Summary

RWDI Project #2403864

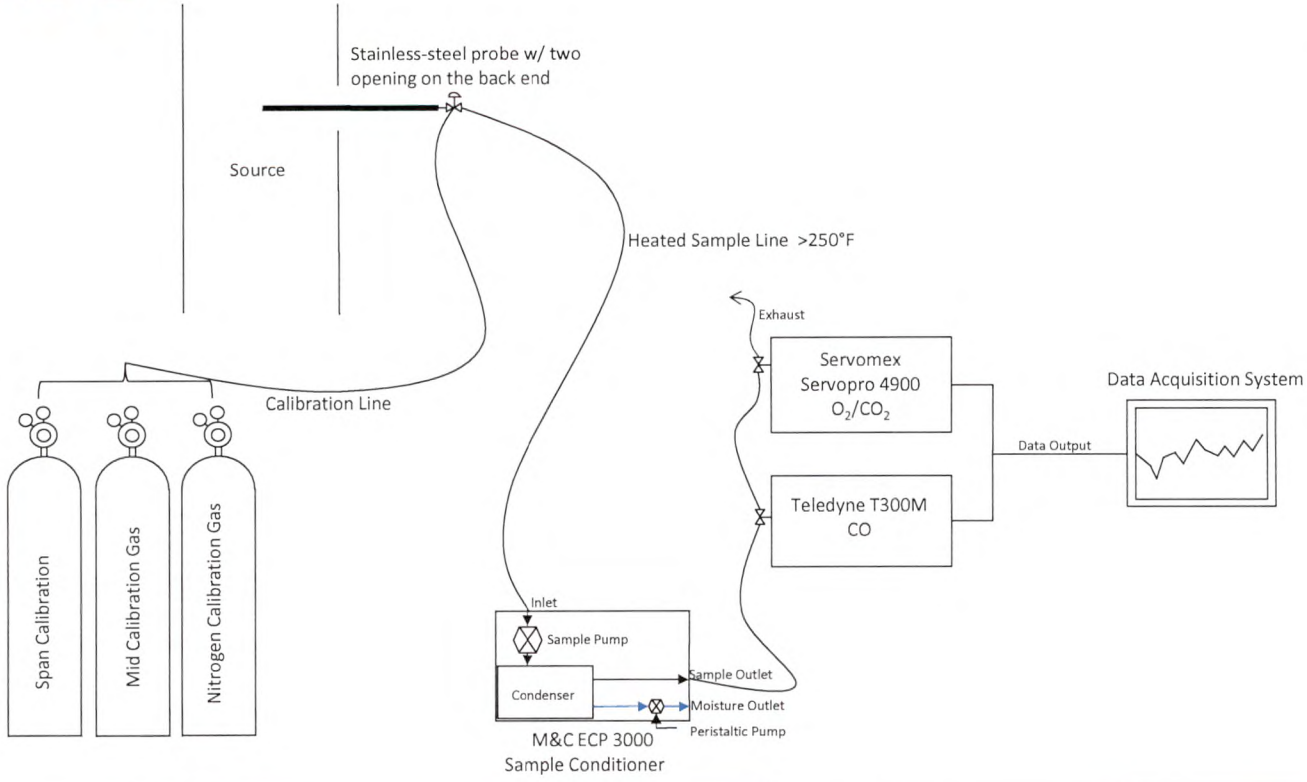
| EUWMSENGINE3 | | | | $O_2$ | | CO | | CO Emission Rate | | Destruction Efficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| Test ID | Date | Start | End | % | | ppm | | ppm corrected to 15% $O_2$ | | |
| | | | | Inlet | Outlet | Inlet | Outlet | Inlet | Outlet | DE % |
| 1 | 2024-08-28 | 7:40 | 8:39 | 9.2 | 10.6 | 136.6 | 7.9 | 69.1 | 4.5 | 93.4% |
| 2 | 2024-08-28 | 9:13 | 10:12 | 11.5 | 10.7 | 117.6 | 7.0 | 73.6 | 4.0 | 94.6% |
| 3 | 2024-08-28 | 10:41 | 11:40 | 12.0 | 10.7 | 123.5 | 6.9 | 81.7 | 4.0 | 95.1% |
| | | Average | | 10.9 | 10.7 | 125.9 | 7.3 | 74.8 | 4.2 | 94.4% |

**Limits:** Outlet 23 ppmvd @ 15% O2

DE 70%

# FIGURES

Figure No. 1: USEPA Method 3A & 10 Schematic




**USEPA Method 3A & 10**

**Wyandotte Municipal Power**

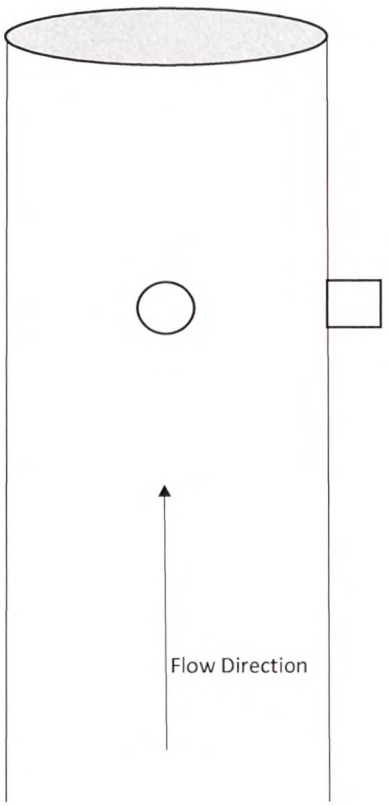
EUWMSENGINE1-3

Wyandotte, Michigan

Project# 2403864

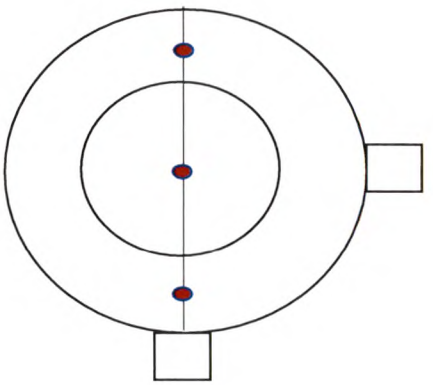
**Date: August 27 - 28, 2024**

**Figure No. 3: EUWMSENGINES1-3 Outlet Stacks Schematic**




Diameter("): 16.5

| Sampling Points (in.) | |
|---|---|
| 1 | 2.84 |
| 2 | 8.50 |
| 3 | 13.74 |



Not to Scale

**EUWMSENGINES1-3**
Wyandotte Municipal Power
Wyandotte, MI

Date:
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