Report of...

Compliance Emission Sampling

Performed for the...

City of Wyandotte
Municipal Services
Wyandotte, Michigan

On...

Diesel Engines #1, #2 & #3

October 22-23, 2018

256.16

By...

Network Environmental, Inc.
Grand Rapids, MI

I. INTRODUCTION

Network Environmental, Inc. was retained by the City of Wyandotte, Department of Municipal Services, to perform an emission study on their Diesel Engines #1, #2 & #3 (permitted as EU-WMSENGINE1, EU-WMSENGINE2 AND EU-WMSENGINE3). The purpose of the study was to document compliance with MDEQ Air Quality Division ROP No. MI-ROP-B2132-2017. MI-ROP-B2132-2017 has established the following emission limits for these engines under flexible group, FGWMSENGINES:

- Carbon Monoxide (CO) reduction (destruction efficiency) of 70% **Or** a formaldehyde emission limit of 580 parts per billion (v/v), Dry @ 15% O_2
- Oxides of Nitrogen (NO_x) emission limit of 35.9 Tons/Year (per 12 month rolling time period). The tested emission rate is used to develop an emission factor.

The CO reduction was determined by monitoring the CO concentrations at the inlet and outlet of each engine's catalytic oxidation emission control system. MI-ROP-B2132-2017 requires that the NO_x emission rates from one of the engines be verified at a minimum of every five years from the date of the last test. Since the NO_x emissions from EU-WMSENGINE1 were determined in October 2017, NO_x emissions testing was not required this year.

The testing was designed to meet the requirements of MI-ROP-B2132-2017 and 40CFR Part 63 Subparts A & ZZZZ. The following reference test methods were employed to conduct the sampling:

- CO – U.S. EPA Method 10
- O_2 – U.S. EPA Method 3A

The sampling was performed over the period of October 22-23, 2018 by Stephan K. Byrd, Richard D. Eerdmans and David D. Engelhardt of Network Environmental, Inc. Assisting with the study were Ms. Kimberly Agee of Wyandotte Municipal Services, Mr. Nick Hansen of Barr Engineering and the operating staff of the facility. Ms. Regina Hines of the Michigan Department of Environmental Quality (MDEQ) - Air Quality Division was present to observe portions of the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
CO DESTRUCTION EFFICIENCY RESULTS
DIESEL ENGINES
CITY OF WYANDOTTE
WYANDOTTE, MICHIGAN

Source	Sample	Date	Time	CO Concentration PPM (1)		CO % Destruction Efficiency
				Inlet	Outlet	
Diesel Engine #1 (EU-WMSENGINE1)	1	10/23/18	08:42-09:42	39.79	2.41	93.95
	2	10/23/18	09:52-10:52	42.81	2.53	94.09
	3	10/23/18	11:02-12:02	44.19	2.71	93.87
	Average			**42.26**	**2.55**	**93.97**
Diesel Engine #2 (EU-WMSENGINE2)	1	10/22/18	13:42-14:42	36.88	2.21	94.00
	2	10/22/18	14:50-15:50	36.63	2.27	93.79
	3	10/22/18	15:59-16:59	36.98	2.25	93.91
	Average			**36.83**	**2.25**	**93.90**
Diesel Engine #3 (EU-WMSENGINE3)	1	10/22/18	09:09-10:09	42.58	2.62	93.86
	2	10/22/18	10:19-11:19	43.71	2.83	93.53
	3	10/22/18	11:30-12:30	46.84	3.01	93.57
	Average			**44.37**	**2.82**	**93.65**

(1) PPM = Parts Per Million (v/v) On A Dry Basis Corrected To 15% O_2
(2) The engines were operated at approximately 1800 kW (99% of capacity) during all of the testing.
(3) MI-ROP-B2132-2017 has established an emission limit of 70% CO reduction (destruction efficiency) for these engines.

III. DISCUSSION OF RESULTS

The results of the emission sampling are summarized in Table 1 (Section II.1). The results are presented as follows:

III.1 Carbon Monoxide (CO) Destruction Efficiency Results (Table 1)

Table 1 summarizes the CO DE results for the diesel engine catalytic oxidation systems as follows:

- Source
- Sample
- Date
- Time
- Inlet & Outlet CO Concentrations (PPM) – Parts Per Million (v/v) On A Dry Basis Corrected To 15% O_2
- CO Percent Destruction Efficiency (DE)

IV. SOURCE DESCRIPTION

The engines tested are 1,825 kW compression ignition diesel fuel fired engine generators, each equipped with a catalytic oxidation emission control system. Testing was performed at approximately 1800 kW (99% of load capacity) for all the engines. Process operating data collected during the sampling can be found in Appendix E.

V. SAMPLING AND ANALYTICAL PROTOCOL

The sampling methods used for the reference method determinations were as follows:

V.1 Carbon Monoxide – The CO sampling was conducted in accordance with U.S. EPA Reference Method 10. A Thermo Environmental Model 48C gas analyzer was used to monitor the catalyst inlets. A Thermo Environmental Model 48 gas analyzer was used to monitor the catalyst outlets. Heated Teflon sample lines were used to transport the inlet and outlet gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzers. The analyzers produce instantaneous readouts of the CO concentrations (PPM).

The analyzers were calibrated by direct injection prior to the testing. Span gases of 169.2 PPM (inlets) and 15.0 PPM (outlets) were used to establish the initial instrument calibrations. Calibration gases of 49.5 PPM & 89.7 PPM for the inlets and 7.1 PPM for the outlets were used to determine the calibration error of the

analyzers. The sampling systems (from the back of the stack probes to the analyzers) were injected using the 7.1 PPM gas (outlets) and the 89.7 PPM gas (inlets) to determine the system bias. After each sample, a system zero and system injection of either 7.1 PPM or 89.7 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzers were calibrated to the output of the data acquisition system (DAS) used to collect the data from the engines. A diagram of the CO sampling train is shown in Figure 1.

V.2 Oxygen (Outlets Only) – The O_2 sampling was conducted in accordance with U.S. EPA Reference Method 3A. A Servomex Model 1400M portable stack gas analyzer was used to monitor the outlets. A heated Teflon sample line was used to transport the exhaust gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzer. The analyzer produces instantaneous readouts of the O_2 concentrations (%).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 21.0% was used to establish the initial instrument calibration. Calibration gases of 12.1% and 6.0% were used to determine the calibration error of the analyzer. The sampling system (from the back of the stack probe to the analyzer) was injected using the 12.1% gas to determine the system bias. After each sample, a system zero and system injection of 12.1% were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the outlets. A diagram of the O_2 sampling train is shown in Figure 1.

V.3 Oxygen (Inlets Only) – Integrated bag samples were collected on the inlets of each engine during each of the three (3) test runs. The bags were run on the O_2 analyzer to confirm that the inlet concentrations equaled the outlet.

V.4 Gas Stratification Test – Stratification tests (on each of the engine exhausts) were conducted in 2014. The results of these tests can be found in Appendix A and show no stratification.

This report was prepared by:

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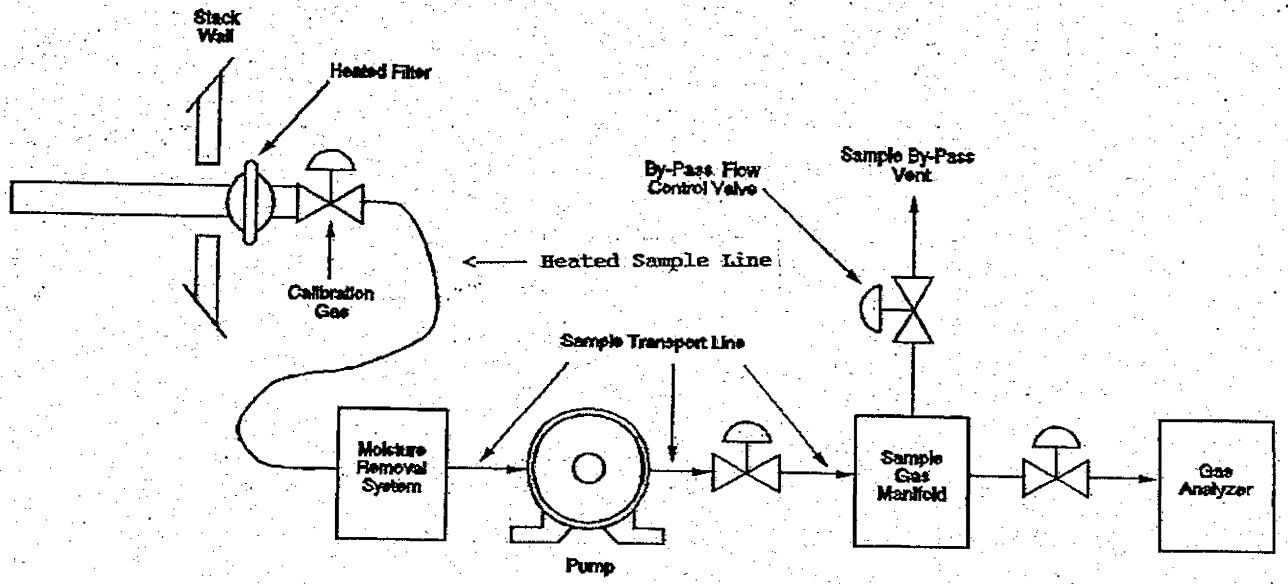

Figure 1

CO & O_2
Sampling Train