Performed for:

Wyandotte Municipal Services
2555 Van Alstyne
Wyandotte, MI 48192
Contact: Chris Brohl
Telephone: (734) 324-7192
Fax: (734) 324-7178
E-mail: cbrohl@wyandottemi.gov

Performed by:

Network Environmental, Inc.
2629 Remico Street, S.W.
Suite B
Grand Rapids, MI 49519
Contact: David D. Engelhardt
Telephone: (616) 530-6330
Fax: (616) 530-0001
E-mail: netenviro@aol.com

TABLE OF CONTENTS

Appendices

I. INTRODUCTION

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

- Oxides of Nitrogen = 35.9 Tons per year. The tested emission rate is used to develop an emission factor

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

- NO_x – U.S. EPA Method 7E
- O_2 & CO_2 – U.S. EPA Method 3A
- Exhaust Gas Parameters – U.S. EPA Methods 1-4

The sampling was performed over the period of September 14, 2022, by Stephan K. Byrd and Richard D. Eerdmans of Network Environmental, Inc. Assisting with the study were Mr. Nick Hansen and Alex Watzek of Barr Engineering and the operating staff of the facility. Mr. Stephen Weis of the Michigan Department of the Environment, Great Lakes and Energy (EGLE) - Air Quality Division was present to observe portions of the sampling and source operation.

II. PRESENTATION OF RESULTS

II.1 TABLE 1
NO_x EMISSION RESULTS
DIESEL ENGINES
CITY OF WYANDOTTE
WYANDOTTE, MICHIGAN

Source	Sample	Date	Time	NO_x PPM(1)	NO_x #/Hr(2)
Diesel Engine #2 (EU-WMSENGINE2)	1	9/14/22	09:40-10-40	744.3	18.89
	2	9/14/22	10:51-11:51	790.6	20.06
	3	9/14/22	12:02-13:02	829.9	21.06
	Average			**788.0**	**20.01**

(1) PPM = Parts Per Million (v/v) On A Dry Basis
(2) #/Hr was calculated using 3,566 DSCFM – Dry Standard Cubic Feet per Minute @ 68° F & 29.92" Hg.

III. DISCUSSION OF RESULTS

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

III.1 Oxides of Nitrogen (NO_x) Emission Results (Table 1)

Table 1 summarizes the NO_x emission results for the diesel engine systems as follows:

- Source
- Sample
- Date
- Time
- NO_x Concentrations (PPM) – Parts Per Million (v/v) On A Dry Basis
- NOx Pounds per hour (#/Hr)
- NO_x Tons per year

IV. SOURCE DESCRIPTION

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

V. SAMPLING AND ANALYTICAL PROTOCOL

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

V.1 Oxides of Nitrogen – The NO_x sampling was conducted in accordance with U.S. EPA Reference Method 7E. A Thermo Environmental Model 42H gas analyzer was used to monitor the outlet. A Heated Teflon sample line was used to transport the outlet gases to a gas conditioner to remove moisture and reduce the temperature. From the gas conditioner stack gases were passed to the analyzer. The analyzers produce instantaneous readouts of the NO_x concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 2020.0 PPM was used to establish the initial instrument calibration. Calibration gases of 484 PPM & 987 PPM 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 987 PPM gas to determine the system bias. After each sample, a system zero and system injection of 987 PPM were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified. A NO2 gas of 51.0 PPM was used to establish conversion efficiency. The conversion efficiency was 94.31%.

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

V.2 Oxygen and Carbon Dioxide – The O_2 and CO_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. Span gases of 20.85% O_2 and 21.1% CO_2 were used to establish the initial instrument calibration. Calibration gases of 12.0% and 5.9% O_2 and 12.06% and 5.95% CO_2 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 12.0% O_2 and the 5.95% CO_2 gas to determine the system bias. After each sample, a system zero and system injection of 12.0% O_2 and 5.95% CO_2 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 and CO_2 sampling train is shown in Figure 1.

V.3 Moisture – The moisture was determined in accordance with U.S. EPA Method 4. The sample was withdrawn from the stack and passed through a condensing coil with drop out before being passed through pre-weighed silica gel. The water collected was measured to the nearest 1 ml and the silica gel was re-weighed to the nearest 0.5 g. The moisture collected along with the sample volume was used to determine the percent moisture in the Engine #2 outlet. Each sample had a minimum sample volume of twenty-one (21) standard cubic feet. A diagram of the moisture sampling train is shown in Figure 2.

V.4 Air Flows – The air flow rates were determined in conjunction with the sampling by employing U.S. EPA Reference Methods 1 and 2. The sampling for the source was conducted on the 14 inch I.D. exhaust stack. A total of 12 traverse points (6 per sampling port) were used for the air flow determinations. The sample point dimensions are shown in Appendix E. Velocity pressures were determined using an S-Type pitot tube. Temperatures were measured using a Type K thermocouple. Oxygen and carbon dioxide content was determined in conjunction with the CO/NO_x sampling. A diagram of the air flow sampling train is shown in Figure 3.

This report was prepared by:

Stephan K. Byrd
Project Manager

This report was reviewed by:

David D. Engelhardt
Vice President

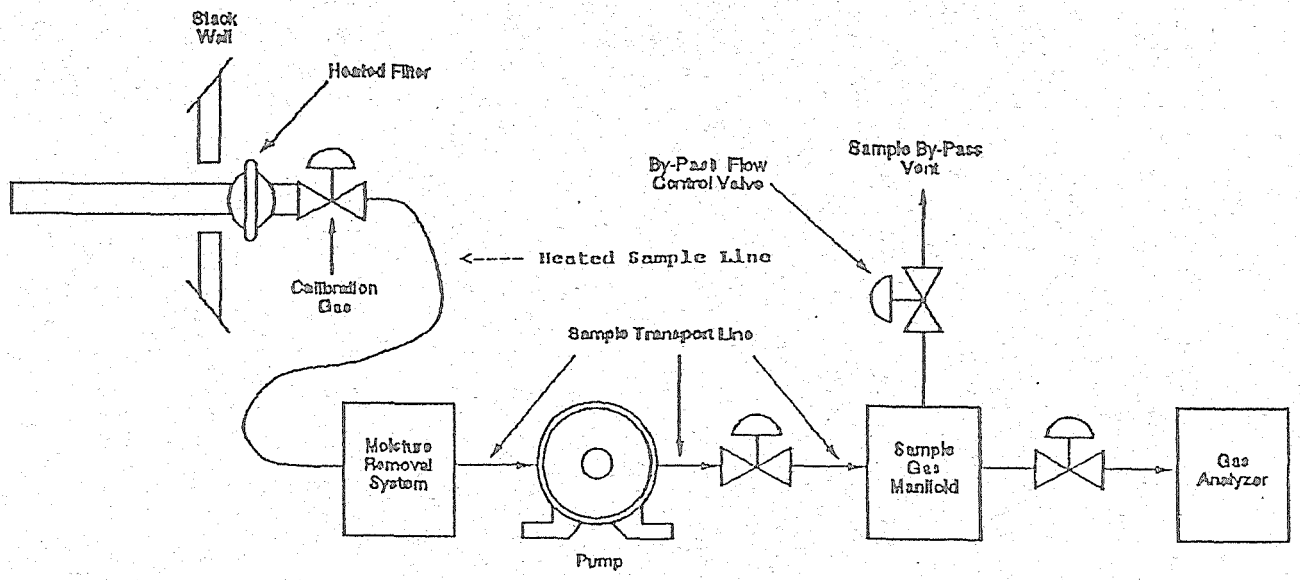

Figure 1

NO_x, O_2 & CO_2 Sampling Train

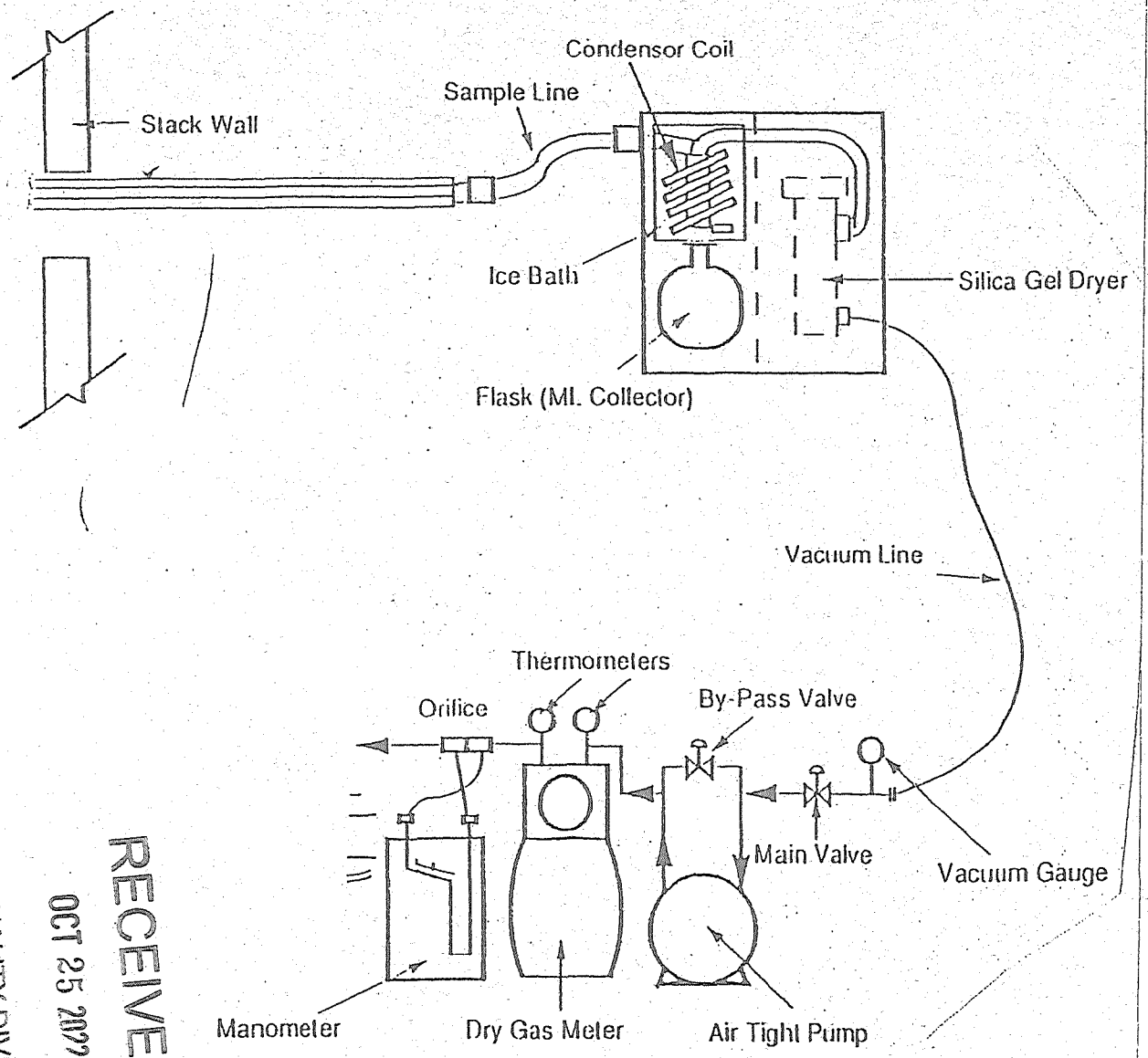

Figure 2

Moisture Sampling Train

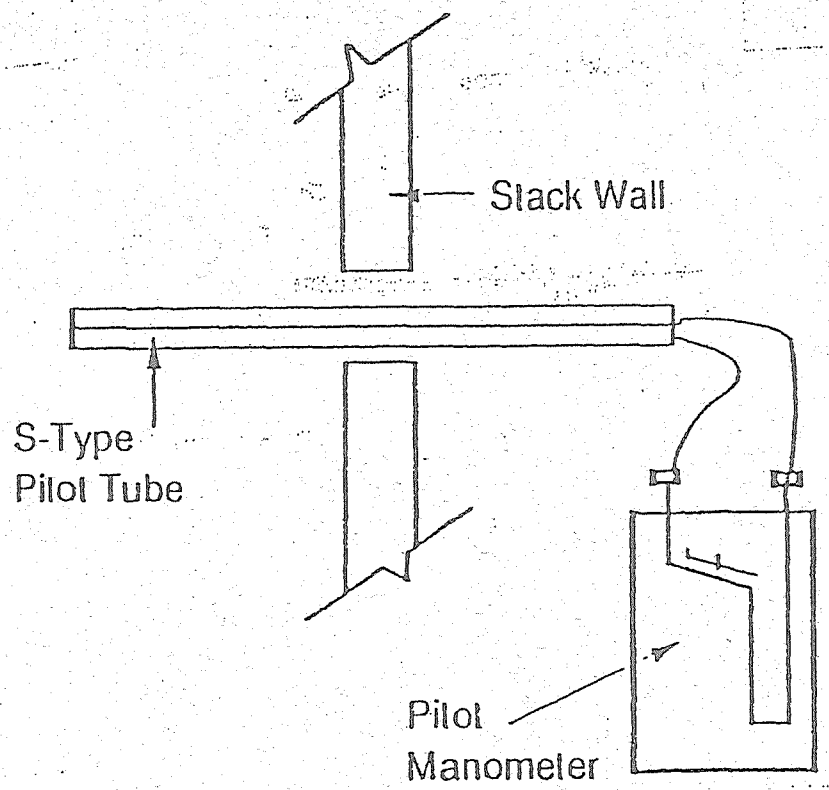

Figure 3

Air Flow Sampling Train