

Report of...

# Compliance Emission Sampling

Performed for the...

**City of Wyandotte**  
Municipal Services  
Wyandotte, Michigan

**RECEIVED**  
FEB 11 2015  
AIR QUALITY DIV.

On...

**Diesel Engines #1, #2 & #3**

December 16-17, 2014

256.12

By...

Network Environmental, Inc.  
Grand Rapids, MI



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 City of Wyandotte Power Plant County Wayne

Source Address 2555 Van Alstyne City Wyandotte

AQD Source ID (SRN) B2132 RO Permit No. MI-ROP-B2132-2010 RO Permit Section No. \_\_\_\_\_

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 12/16/2014 To 12/17/2014

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:  
Compliance Emission Sampling Report on Diesel Engines #1, #2 & #3 dated December 16-17,  
2014 prepared by Network Environmental, Inc.

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.

<u>Charlene Hudson</u>	<u>Supervising Engineer</u>	<u>(734) 324-7158</u>
Name of Responsible Official (print or type)	Title	Phone Number
<u>Charlene Hudson</u>		<u>2-10-15</u>
Signature of Responsible Official		Date

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## 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-B2132-2010. MI-ROP-B2132-2010 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<sub>2</sub>
- Oxides of Nitrogen (NO<sub>x</sub>) 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. The NO<sub>x</sub> emissions were only required to be determined on one (1) engine. NO<sub>x</sub> was monitored on the Engine #1 exhaust only. In conjunction with the NO<sub>x</sub> sampling, the exhaust gas parameters (air flow rate, temperature, moisture & density) were also determined, in order to calculate the NO<sub>x</sub> mass emission rate (Lbs/Hr) for Engine #1.

The testing was designed to meet the requirements of MI-ROP-B2132-2010 and 40CFR Part 63 Subparts A & ZZZZ. The following reference test methods were employed to conduct the sampling:

- CO – U.S. EPA Method 10
- NO<sub>x</sub> – U.S. EPA Method 7E
- O<sub>2</sub> & CO<sub>2</sub> – U.S. EPA Method 3A
- Exhaust Gas Parameters (air flow rate, temperature, moisture & density) – U.S. EPA Reference Methods 1 through 4.

The sampling was performed over the period of December 16-17, 2014 by R. Scott Cargill and David D. Engelhardt of Network Environmental, Inc.. Assisting with the study were Mr. Chris Brohl and Ms. Kimberly Kemper of Wyandotte Municipal Services, Mr. Nick Hansen of Barr Engineering and the operating staff of the facility. Mr. Mark Dziadosz 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 <sup>(1)</sup>		CO % Destruction Efficiency
				Inlet	Outlet	
Diesel Engine #1 (EU-WMSENGINE1)	1	12/16/14	09:40-10:40	42.39	1.67	96.07
	2	12/16/14	11:00-12:00	45.53	1.80	96.06
	3	12/16/14	12:17-13:17	47.14	1.80	96.19
	<b>Average</b>			<b>45.02</b>	<b>1.75</b>	<b>96.11</b>
Diesel Engine #2 (EU-WMSENGINE2)	1	12/16/14	14:41-15:41	38.25	1.71	95.52
	2	12/16/14	15:56-16:56	39.92	1.70	95.73
	3	12/16/14	17:14-18:14	39.53	1.90	95.19
	<b>Average</b>			<b>39.24</b>	<b>1.77</b>	<b>95.48</b>
Diesel Engine #3 (EU-WMSENGINE3)	1	12/17/14	09:45-10:45	43.50	2.98	93.14
	2	12/17/14	11:00-12:00	43.29	2.89	93.33
	3	12/17/14	12:16-13:16	43.42	2.89	93.35
	<b>Average</b>			<b>43.40</b>	<b>2.92</b>	<b>93.28</b>

- (1) PPM = Parts Per Million (v/v) On A Dry Basis Corrected To 15% O<sub>2</sub>
- (2) The engines were operated at 1800 kW (99% of capacity) during all of the testing.
- (3) MI-ROP-B2132-2010 has established an emission limit of 70% CO reduction (destruction efficiency) for these engines.

**II.2 TABLE 2  
OXIDES OF NITROGEN (NO<sub>x</sub>) EMISSION RESULTS  
DIESEL ENGINE #1  
CITY OF WYANDOTTE  
WYANDOTTE, MICHIGAN**

Source	Sample	Date	Time	Air Flow Rate DSCFM <sup>(1)</sup>	NO <sub>x</sub> Concentration PPM <sup>(2)</sup>	NO <sub>x</sub> Emission Rate Lbs/Hr <sup>(3)</sup>
Diesel Engine#1 (EU-WMSENGINE1)	1	12/16/14	09:40-10:40	3,852	975.8	26.85
	2	12/16/14	11:00-12:00	3,853	979.7	26.96
	3	12/16/14	12:17-13:17	3,844	988.7	27.15
	<b>Average</b>			<b>3,850</b>	<b>981.4</b>	<b>26.99</b>

- (1) DSCFM = Dry Standard Cubic Feet Per Minute (Standard Temperature & Pressure = 68 °F & 29.92 In. Hg).  
(2) PPM = Parts Per Million (v/v) On A Dry Basis  
(3) Lbs/Hr = Pounds of NO<sub>x</sub> Per Hour

### **III. DISCUSSION OF RESULTS**

The results of the emission sampling are summarized in Tables 1 & 2 (Sections II.1 & II.2). 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<sub>2</sub>
- CO Percent Destruction Efficiency (DE)

#### **III.2 NO<sub>x</sub> Emissions – The Diesel Engine #1 NO<sub>x</sub> emissions are summarized in Table 2 as follows:**

- Source
- Sample
- Date
- Time
- Air Flow Rate (DSCFM) – Dry Standard Cubic Feet Per Minute (Standard Temperature and Pressure = 68 °F and 29.92 Inches Hg)
- NO<sub>x</sub> Concentration (PPM) – Parts Per Million (v/v) On A Dry Basis
- NO<sub>x</sub> Mass Emission Rates (Lbs/Hr) – Pounds of NO<sub>x</sub> Per Hour

### **IV. SOURCE DESCRIPTION**

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

## V. SAMPLING AND ANALYTICAL PROTOCOL

Pictures of the sampling locations can be found in Appendix E.

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 92.97 PPM (outlets) were used to establish the initial instrument calibrations. Calibration gases of 49.66 PPM & 92.97 PPM for the inlets and 49.66 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 49.66 PPM gas to determine the system bias. After each sample, a system zero and system injection of 49.66 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 Oxides of Nitrogen (Engine #1 Outlet Only)** – The NO<sub>x</sub> sampling was conducted in accordance with U.S. EPA Reference Method 7E. A Thermo Environmental Model 42H gas analyzer was used to monitor the Engine #1 outlet. 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 NO<sub>x</sub> concentrations (PPM).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 1,960 PPM was used to establish the initial instrument calibration. Calibration gases of 486.9 PPM and 980.0 PPM were used to determine the calibration error of the analyzer. A direct injection of 51.97 PPM nitrogen dioxide (NO<sub>2</sub>) was performed to show the conversion efficiency of the monitor. The conversion efficiency data can be found in

Appendix B. The sampling system (from the back of the stack probe to the analyzer) was injected using the 980.0 PPM gas to determine the system bias. After each sample, a system zero and system injection of 980.0 PPM 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 outlet. A diagram of the NO<sub>x</sub> sampling train is shown in Figure 1.

**V.3 Oxygen (Outlets Only)** – The O<sub>2</sub> 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<sub>2</sub> concentrations (%).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 21.03% was used to establish the initial instrument calibration. Calibration gases of 12.06% and 5.989% 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 12.06% gas to determine the system bias. After each sample, a system zero and system injection of 12.06% 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<sub>2</sub> sampling train is shown in Figure 1.

**V.4 Carbon Dioxide (Engine #1 Outlet Only)** – The CO<sub>2</sub> 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 Engine #1 outlet. 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 CO<sub>2</sub> concentrations (%).

The analyzer was calibrated by direct injection prior to the testing. A span gas of 20.42% was used to establish the initial instrument calibration. Calibration gases of 11.98% and 5.989% 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 5.989% gas to determine the system bias. After each sample, a

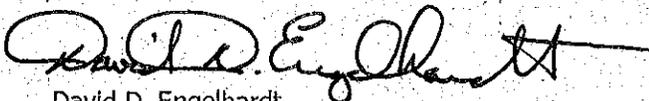
the analyzer) was injected using the 5.989% gas to determine the system bias. After each sample, a system zero and system injection of 5.989% were performed to establish system drift and system bias during the test period. All calibration gases were EPA Protocol 1 Certified.

The analyzer was calibrated to the output of the data acquisition system (DAS) used to collect the data from the outlet. A diagram of the CO<sub>2</sub> sampling train is shown in Figure 1.

**V.5 Moisture (Engine #1 Outlet Only)** – The moisture was determined in accordance with U.S. EPA Method 4. The samples were 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 #1 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.

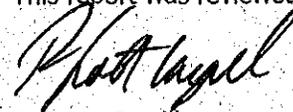
**V.6 Air Flows (Engine #1 Outlet Only)** – The air flow rates were determined in conjunction with the other sampling by employing U.S. EPA Reference Methods 1 and 2. The sampling for the source was conducted on the 14 inch I.D. exhaust stack. A total of 12 traverse points (6 per sampling port) were 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<sub>x</sub> sampling. A diagram of the air flow sampling train is shown in Figure 3.

This report was prepared by:

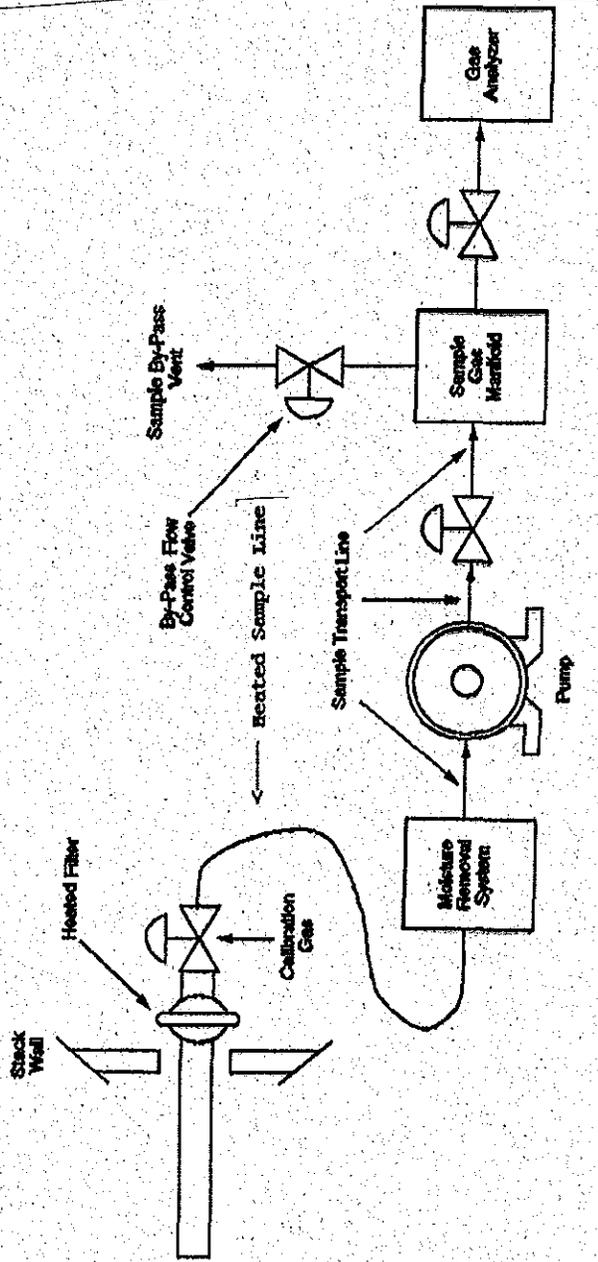


David D. Engelhardt  
Vice President

This report was reviewed by:



R. Scott Cargill  
Project Manager



**Figure 1**  
 $\text{NO}_x$ ,  $\text{CO}$ ,  $\text{O}_2$  &  $\text{CO}_2$   
 Sampling Train

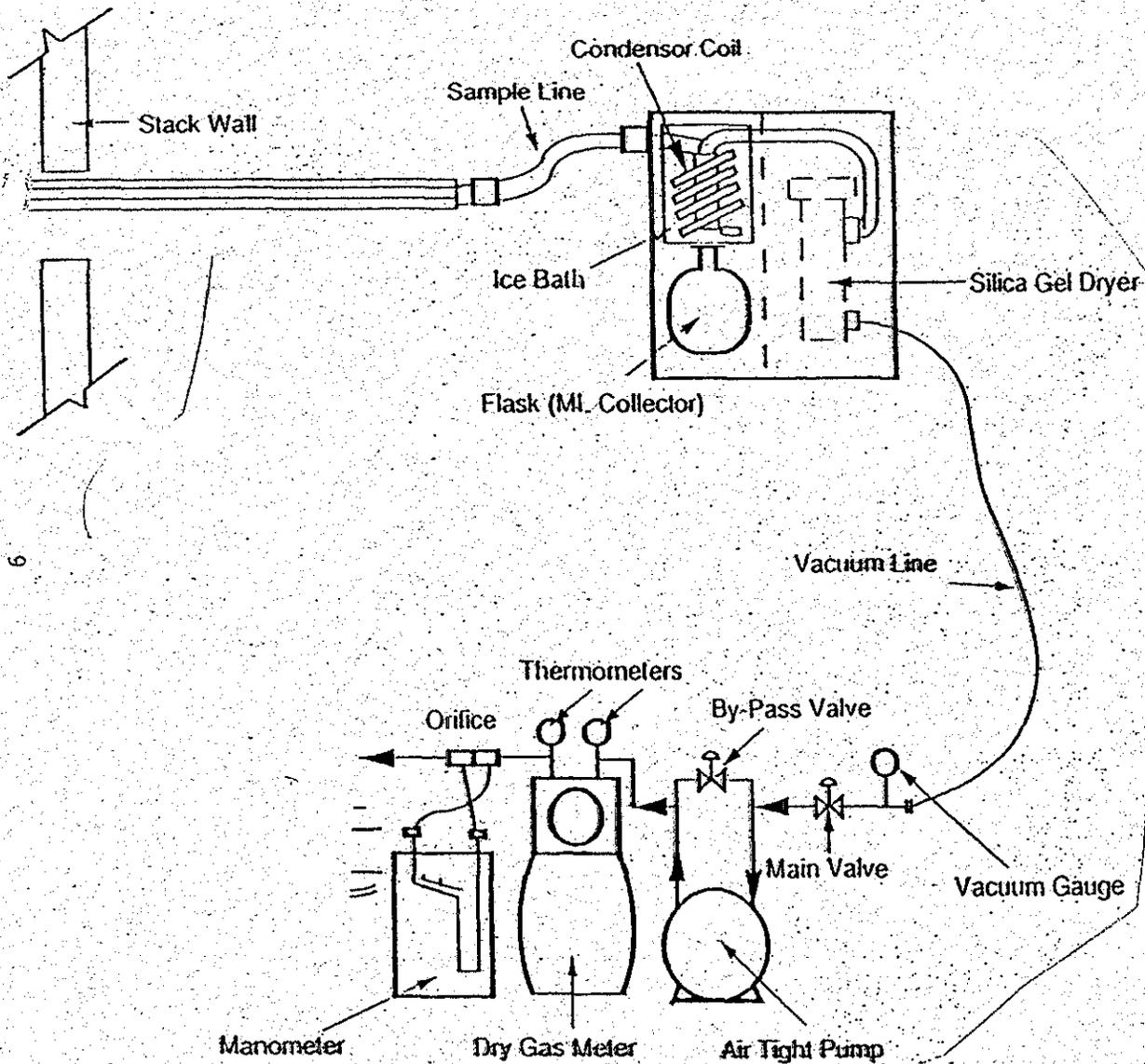


Figure 2  
Moisture  
Sampling Train

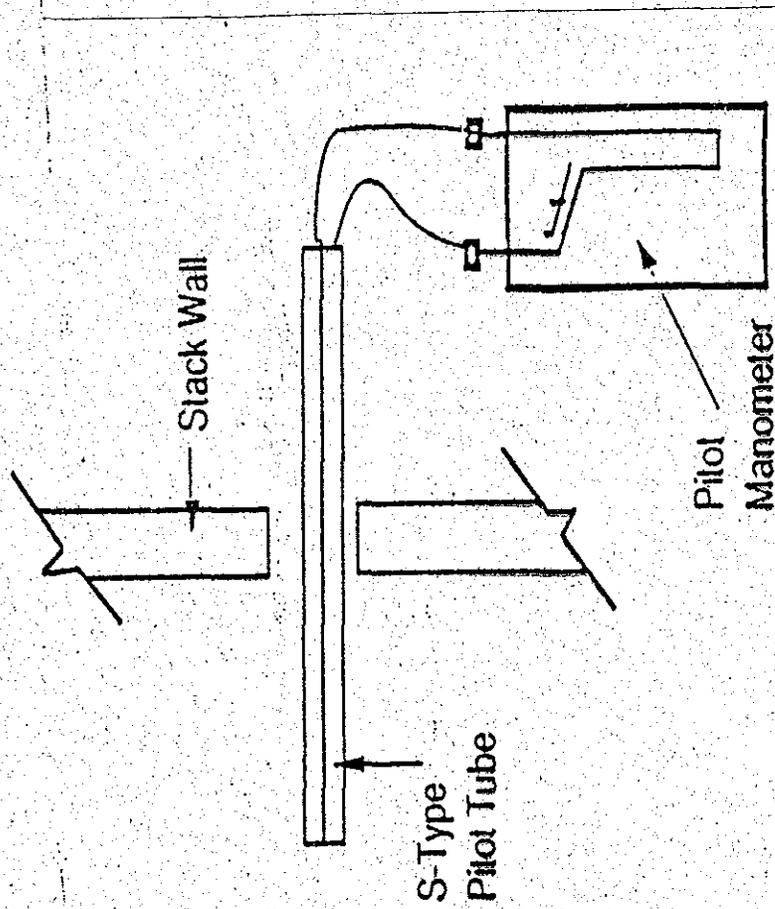


Figure 3

Air Flow  
Sampling Train