EMISSIONS TEST REPORT

for

OXIDES OF NITROGEN (NO_X), CARBON MONOXIDE (CO), AND NON METHANE ORGANIC COMPOUND (NMOC) EMISSIONS

RECIPROCATING INTERNAL COMBUSTION ENGINES 1-3

DETROIT METROPOLITAN AIRPORT
Metro Energy, LLC
Romulus, Michigan

July 22, 2014

September 11-12, 2014

Prepared By
Environmental Management & Resources
Environmental Field Services Group
DTE Corporate Services, LLC
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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 Permit (ROP) 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 specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name: Detroit Metropolitan Wayne County Airport — County: Wayne

Source Address: L.C. Smith Terminal, 3rd Floor — City: Romulus

AQD Source ID (SRN): M4174 — ROP No.: MI-ROP-M4174-2010 — ROP Section No.:

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

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 ROP, 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 ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, 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 ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

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

☐ 1. During the entire reporting period, ALL monitoring and associated recordkeeping requirements in the ROP 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 ROP 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 ROP are attached as described:

EU001, EU002 and EU003 Emission Tests

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

Bryan C. Wagoner	Director-Environmental Dept.	734-247-3686
Name of Responsible Official (print or type)	Title	Phone Number

Bryan C. Wag — 11 06 14

Signature of Responsible Official — Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

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EXECUTIVE SUMMARY

DTE Energy's Environmental Management & Resources (EM&R) Environmental Field Services Group performed emissions testing at the Detroit Metropolitan Airport located in Romulus, Michigan for Metro Energy, LLC. The fieldwork, performed on July 22, 2014 and September 11-12, 2014 was conducted to satisfy requirements of the Michigan Air Permit No. MI-ROP-M4174-2010. Emissions tests were performed on internal combustion engines 1, 2, and 3 for oxides of nitrogen (NO_x), carbon monoxide (CO), and non methane organic compounds (NMOC) while firing natural gas.

The results of the emissions testing are highlighted below:

Emissions Testing Summary – Internal Combustion Engines 1 - 3
DTE Metro Energy, LLC
Romulus, MI

	Oxides of Nitrogen (NOx)		Carbon Monoxide (CO)		Non-Methane Organic Compounds (NMOC)	
	(ppm_{dry})[1]	(lb/MMBtu)	(ppm_{dry})[1]	(lb/MMBtu)	(ppm_{wet})[1]	(lb/MMBtu)
Unit 1 (9/12/14)	81.2	0.186	12.5	0.017	25.9	0.02
Unit 2 (9/11/14)	83.6	0.188	14.67	0.020	12.8	0.01
Unit 3 (7/22/14)	84.2	0.191	36.21	0.050	0.0	<0.01
Permit Limit		**0.21**		**0.17**		**0.09**

[1] Corrected for analyzer drift as per USEPA Method 7E

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1.0 INTRODUCTION

DTE Energy's Environmental Management & Resources (EM&R) Environmental Field Services Group performed emissions testing at the Detroit Metropolitan Airport located in Romulus, Michigan for Metro Energy, LLC. The fieldwork, performed on July 22, 2014 and September 11-12, 2014 was conducted to satisfy requirements of the Michigan Air Permit No. MI-ROP-M4174-2010. Emissions tests were performed on internal combustion engines 1, 2, and 3 for oxides of nitrogen (NO_x), carbon monoxide (CO), and non methane organic compounds (NMOC) while firing natural gas.

Testing was performed pursuant to Title 40, *Code of Federal Regulations*, Part 60, Appendix A (40 CFR §60 App. A), Methods 3A, 7E, 10, and 25A.

The fieldwork was performed in accordance with EPA Reference Methods and EM&R's Intent to Test[1], which was approved by the Michigan Department of Environmental Quality (MDEQ). The following EM&R personnel participated in the testing program: Mr. Mark Grigereit, Senior Environmental Specialist, Mr. Thomas Snyder, Sr. Environmental Technician and Mr. Fred Meinecke, Sr. Environmental Technician. Mr. Grigereit was the project leader.

Mr. Thomas Shoemaker, Plant Manager, DTE Metro Energy, LLC, and Mr. Donald Januszek, Senior Environmental Engineer, DTE Energy Resources, provided on-site coordination of the test program. Mr. Nathan Hude, MDEQ, reviewed the Test Plan[2] and Mr. Stephen Weis, MDEQ, observed the testing.

2.0 SOURCE DESCRIPTION

The DTE Energy Services, Metro Energy LLC Energy Facility located at Detroit Metropolitan Airport, Romulus, Michigan, employs the use of three internal combustion engines (i.e. engines) rated at 5,762kW. Engines 1-3 are fueled with natural gas. The engines provide emergency and peak shaving electricity in the McNamara Terminal and Westin hotel.

The three engines are equipped with catalytic oxidizers to control carbon monoxide emissions.

A schematic representation of the engines exhaust and sampling locations are presented in Figure 1.

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[1] MDEQ, Test Plan, Submitted June 10, 2014. (Attached-Appendix A)
[2] MDEQ, Test Plan Review, June 18, 2014. (Attached-Appendix A)

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3.0 SAMPLING AND ANALYTICAL PROCEDURES

Emissions measurements were obtained in accordance with procedures specified in the USEPA *Standards of Performance for New Stationary Sources*. The sampling and analytical methods used in the testing program are indicated in the table below

Sampling Method	Parameter	Analysis
USEPA Method 3A	Oxygen	Instrumental Analyzer Method
USEPA Method 7E	Oxides of Nitrogen	Chemiluminecent Instrumental Analyzer Method
USEPA Method 10	Carbon Monoxide	NDIR Instrumental Analyzer Method
USEPA Method 25A	Volatile Organic Compounds	FID

3.1 OXYGEN (USEPA METHOD 3A)

3.1.1 Sampling Method

Oxygen (O_2) emissions were evaluated using USEPA Method 3A, "Gas Analysis for Carbon Dioxide, Oxygen, Excess Air, and Dry Molecular Weight (Instrumental Analyzer Method)". The analyzer utilizes a paramagnetic sensor. Testing was performed simultaneously with the NOx/CO/VOC emissions testing.

3.1.2 O_2 Sampling Train

The EPA Method 3A sampling system (Figure 2) consisted of the following:

(1) Stainless steel sampling probe (Moved across the exhaust stack per Method 7E)
(2) Heated Teflon™ sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) Servomax 1400 O_2 gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases
(7) pDaqview® Data Acquisition System

3.1.3 *Sampling Train Calibration*

The O_2 analyzer was calibrated according to procedures outlined in USEPA Methods 3A and 7E. Zero, span, and mid range calibration gases were introduced directly into the analyzer to verify the instruments linearity. A zero and mid range span gas for the diluent was then introduced through the entire sampling system to determine sampling system bias at the completion of each test.

3.1.4 *Quality Control and Assurance*

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 3A and 7E. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

3.1.5 *Data Reduction*

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The O_2 emissions were recorded in percent (%). The 1-minute readings collected during the testing can be found in Appendix B.

3.2 OXIDES OF NITROGEN AND CARBON MONOXIDE (USEPA METHODS 7E AND 10)

3.2.1 *Sampling Method*

Oxides of nitrogen (NO_x) emissions were evaluated using USEPA Method 7E, "Determination of Oxides of Nitrogen Emissions from Stationary Sources". The NO_x analyzer utilizes a Chemiluminecent detector. Carbon monoxide (CO) emissions were evaluated using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources". The CO analyzer utilizes an NDIR detector. Triplicate 60-minute tests were performed on each engine exhaust.

3.2.2 *NOx, and CO Sampling Train*

The EPA Methods 7E and 10 sampling system (Figure 2) consisted of the following:

(1) Stainless steel sampling probe (Moved across the exhaust stack per Method 7E)
(2) Heated Teflon™ sampling line
(3) MAK® gas conditioner with particulate filter
(4) Flexible unheated Teflon™ sampling line
(5) TECO 42i Chemilumenecent NO/NO_x gas analyzer, and TECO 48i NDIR CO gas analyzer
(6) Appropriate USEPA Protocol 1 calibration gases

(7) pDaqview® Data Acquisition System.

3.2.3 Sampling Train Calibration

The NO_x / CO sampling trains were calibrated according to procedures outlined in USEPA Method 7E and 10. Zero, span, and mid range calibration gases were introduced directly into each analyzer to verify the instruments linearity. A zero and mid range span gas for each pollutant was then introduced through the entire sampling system to determine sampling system bias for each analyzer at the completion of each test.

3.2.4 Quality Control and Assurance

All sampling and analytical equipment was calibrated according to the guidelines referenced in Methods 7E and 10. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (40-60% mid range and span) specified in Method 7E. Calibration gas certification sheets are located in Appendix C.

A NO_x converter efficiency test was performed each mobilization by directly challenging the NO_x analyzer with a nitrogen dioxide (NO_2) calibration gas of 49.94 ppm. Results from the converter efficiency test demonstrated that the analyzer met the requirements of Method 7E (Eq-1). Equation-1 shows the converter efficiency test results.

Eq. 1

$$Eff_{NO2} = \frac{C_{Dir}}{C_v} = \frac{46.04}{50.90} = 90.4\%$$

3.2.5 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The NO_x and CO emissions were recorded in parts per million dry, (ppm_{dry}). The 1-minute readings collected can be found in Appendix B.

Emissions calculations are based on calculations located in USEPA Methods 7E, 10, and 19 (Appendix D).

3.3 TOTAL VOLATILE ORGANIC COMPOUNDS (USEPA METHOD 25A)

3.3.1 Sampling Method

Total volatile organic compound (NMOC) emissions were evaluated using USEPA Method 25A, "Determination of Total Hydrocarbon Emissions from Stationary

Sources (Instrumental Analyzer Method)". The NMOC analyzer utilizes two flame ionization detectors (FIDs). The sample enters the analyzer and is split into two paths. One sample path enters an FID that measures total organic hydrocarbon compounds (as methane).

Triplicate 60-minute tests were performed on each engine exhaust, simultaneously with the other gaseous emission testing.

The Method 25A sampling system (Figure 4) consisted of the following:

(1) Single-point sampling probe (located in centroid of the exhaust stack)
(2) Heated Teflon™ sampling line
(3) JUM 109A® Total Hydrocarbon gas analyzer
(4) Appropriate certified methane calibration gases
(5) pDaqview® Data Acquisition System

3.3.2 Sampling Train Calibration

In accordance with USEPA Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the THC analyzer. The analyzer was calibrated with methane in the 0-1,500 ppm range. Calibration drift checks were performed at the completion of each run.

3.3.3 Quality Control and Assurance

The NMOC sampling equipment was calibrated according to the guidelines referenced in Methods 25A. Calibration gases were EPA Protocol 1 gases and the concentrations were within the acceptable ranges (25-35% low range, 45-55% mid range and 80-100% of span). Analyzer calibrations and calibration gas certification sheets are located in Appendix B.

3.3.4 Data Reduction

Data collected during the emissions testing was recorded at 10-second intervals and averaged in 1-minute increments. The THC emissions were recorded in parts per million (ppm) as methane (CH_4). The 1-minute readings collected can be found in Appendix B.

The NMOC emissions data collected during the testing was calculated and reported as g/BHp-Hr, ppm @ 15% O_2 (as propane), and lbs/MMBtu. Emissions calculations are based on equations located in USEPA Methods 25A and 19 and can be found in Appendix E and JJJJ.

4.0 OPERATING PARAMETERS

The test program included the collection of total fuel consumed (kscf), engine output (kW), catalyst inlet temp (°F), catalyst outlet temp (°F), and catalyst pressure drop (in. H_2O).

Operational data is located in Appendix E.

5.0 DISCUSSION OF RESULTS

Table Nos. 1 through 3 present the emission testing results from internal combustion engines 1, 2 and 3. Testing was performed while the engines were operating at their maximum capacity for each respective sampling date (unit load is limited by demand). The NOx, CO and NMOC emissions are presented in parts per million (ppm), corrected for analyzer drift per USEPA Method 7E, and pounds per million British thermal units (lb/MMBtu). NOx and CO emissions are in ppm_{dry}. NMOC emissions are in ppm_{wet}. Additional test data presented for each test includes the engine output.

Due to the extremely low concentrations of VOC in the exhaust gas, coupled with the limitations of the analyzers and drift correcting the test results, some of the VOC emissions were found to be negative. Negative values were reported as 0.0. Emission rates less than 0.01 lb/MMBtu were reported as <0.01 lb/MMBtu

The results from the testing indicate that internal combustion engines 1, 2, and 3 are in compliance with their permit limits of 0.21 lbs/MMBtu NOx, 0.17 lbs/MMBtu CO and 0.09 lbs/MMBtu VOC per Michigan Air Permit No. MI-ROP-M4174-2010.

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6.0 CERTIFICATION STATEMENT

"I certify that I believe the information provided in this document is true, accurate, and complete. Results of testing are based on the good faith application of sound professional judgment, using techniques, factors, or standards approved by the Local, State, or Federal Governing body, or generally accepted in the trade."

Thomas J. Snyder, QSTI

This report prepared by:

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Table No. 1
EMISSIONS TESTING RESULTS
IC Engine 1 - Metro Energy, LLC
September 12, 2014

Test	Test Time	Engine Output (kW)	O_2 (%)	CO Emissions (ppm_D)[1]	CO Emissions (lb/MMBtu)	NOx Emissions (ppm_D)[1]	NOx Emissions (lb/MMBtu)	NMOC Emissions (ppm_W)[1]	NMOC Emissions (lb/MMBtu)
1	10:50-12:00	5361	11.5	11.95	0.017	84.2	0.193	34.0	0.03
2	12:50-13:50	5400	11.5	12.50	0.017	81.8	0.188	26.0	0.02
3	14:15-15:15	5390	11.5	13.01	0.018	77.4	0.178	17.7	0.01
		5384	*11.5*	*12.49*	*0.017*	*81.1*	*0.186*	*25.9*	*0.02*

(1) Corrected for analzyer drift per USEPA Method 7E

ND = non-detect, Reported as <0.01

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Table No. 2
EMISSIONS TESTING RESULTS
IC Engine 2 - Metro Energy, LLC
September 11, 2014

Test	Test Time	Engine Output (kW)	O_2 (%)	CO Emissions (ppm_D)[1]	CO Emissions (lb/MMBtu)	NOx Emissions (ppm_D)[1]	NOx Emissions (lb/MMBtu)	NMOC Emissions (ppm_W)[1]	NMOC Emissions (lb/MMBtu)
1	9:50-10:50	5396	10.9	14.39	0.019	84.3	0.182	28.3	0.02
2	11:08-12:08	5401	11.5	14.74	0.021	83.7	0.192	5.9	0.01
3	12:25-13:25	5382	11.5	14.87	0.021	82.8	0.191	4.2	0.00
		5393	*11.3*	*14.67*	*0.020*	*83.6*	*0.188*	*12.8*	*0.01*

(1) Corrected for analzyer drift per USEPA Method 7E

ND = non-detect, Reported as <0.01

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Table No. 3
EMISSIONS TESTING RESULTS
IC Engine 3 - Metro Energy, LLC
July 22, 2014

Test	Test Time	Engine Output (kW)	O_2 (%)	CO Emissions (ppm_D)[1]	CO Emissions (lb/MMBtu)	NOx Emissions (ppm_D)[1]	NOx Emissions (lb/MMBtu)	NMOC Emissions (ppm_W)[1]	NMOC Emissions (lb/MMBtu)
1	8:25-9:25	5294	11.2	32.35	0.044	90.9	0.205	5.6	0.0
2	9:52-10:52	5273	11.2	36.42	0.050	86.7	0.196	0.0	0.0
3	11:13-12:13	5292	11.3	39.85	0.056	75.1	0.172	0.0	0.0
		5286	***11.2***	***36.21***	***0.050***	***84.2***	***0.191***	***1.9***	***0.0***

(1) Corrected for analzyer drift per USEPA Method 7E

ND = non-detect, Reported as 0.0

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Figure 1 – Sampling Location
Wayne County Midfield Terminal
July 22 & September 11-12, 2014

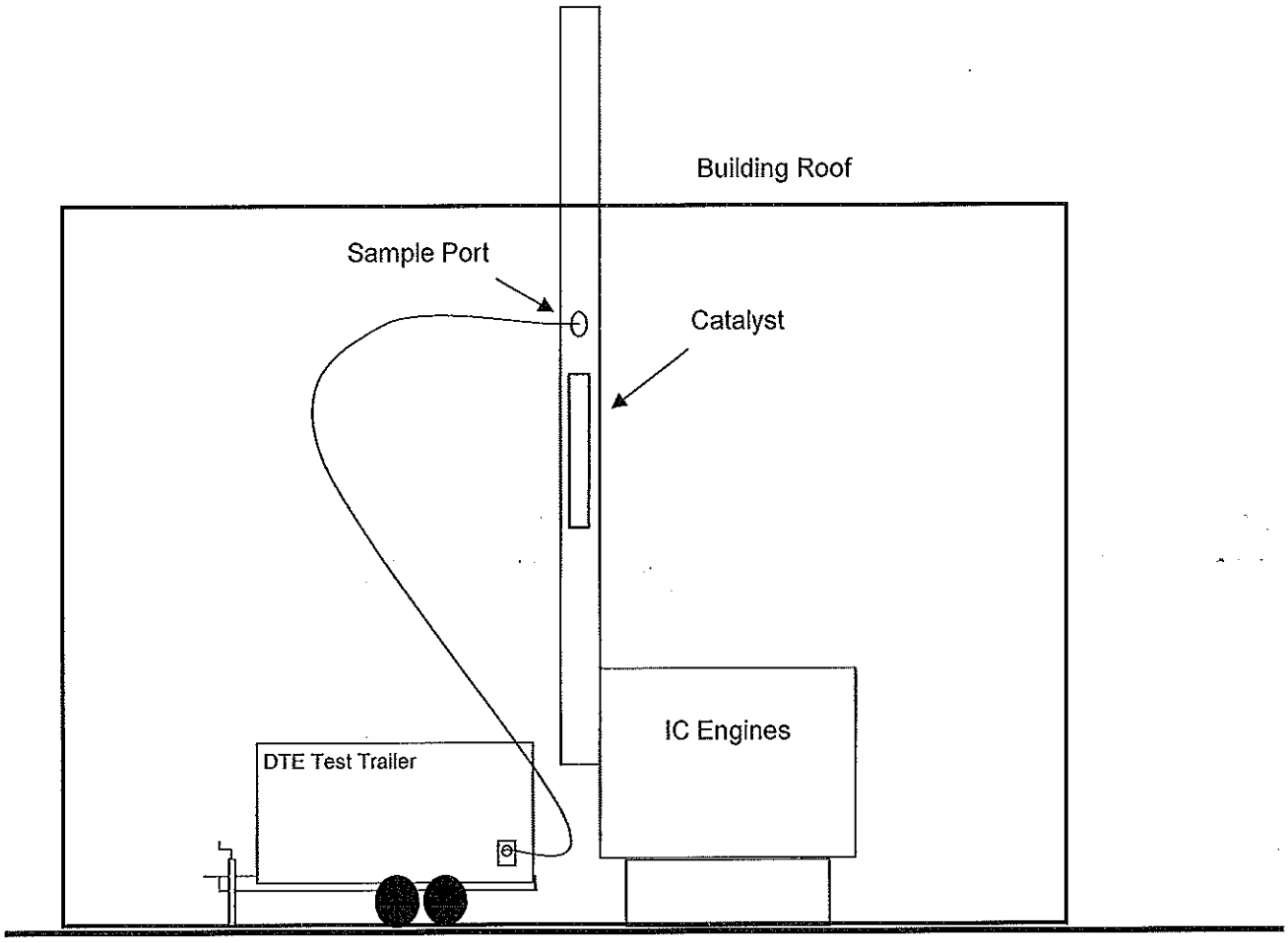

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Figure 2 – USEPA Methods 3A, 7E, and 10
Wayne County Midfield Terminal
July 22 & September 11-12, 2014

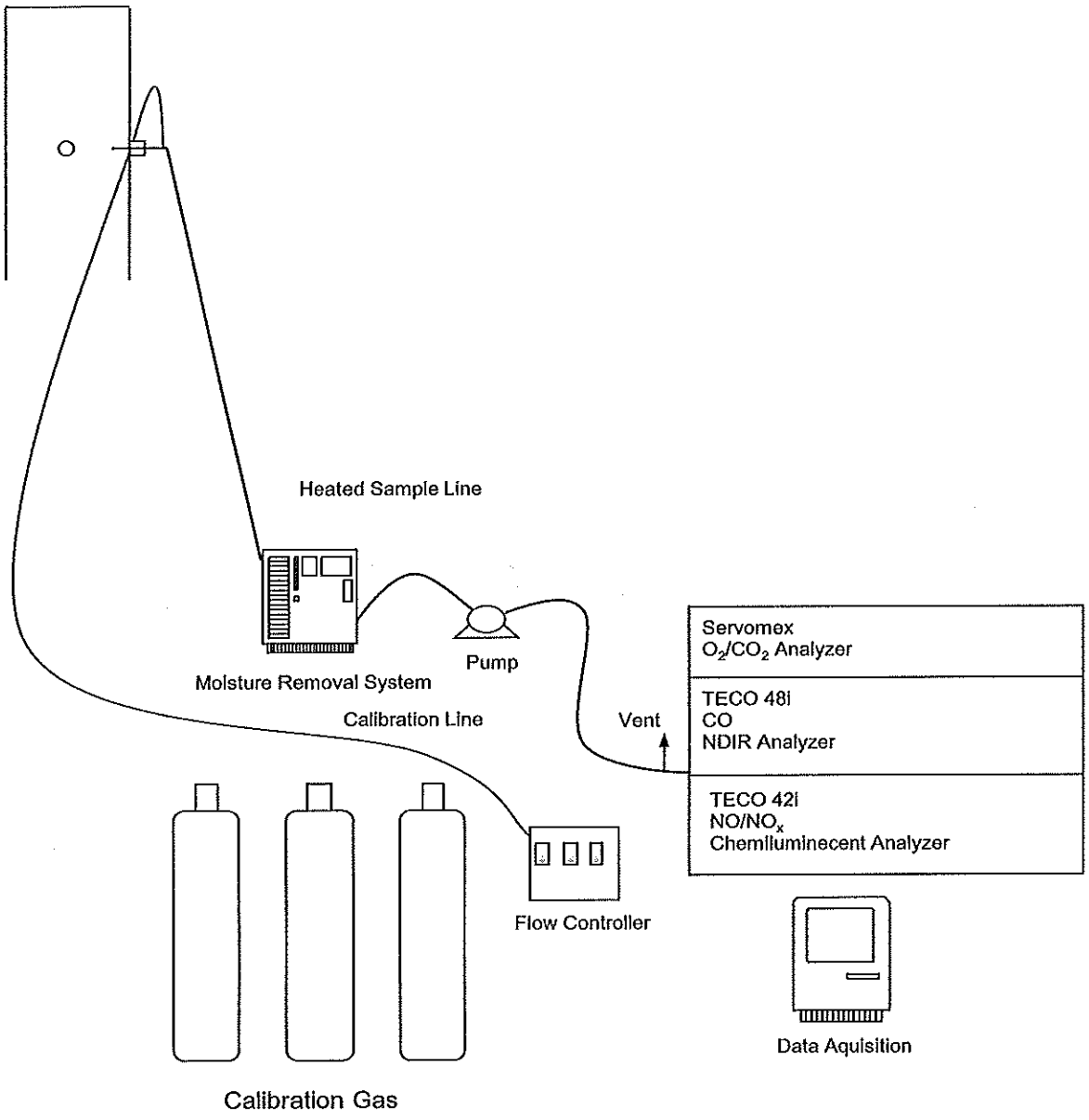

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Figure 3 – USEPA Methods 25A
Wayne County Midfield Terminal
July 22 & September 11-12, 2014