



# **VOC Destruction Efficiency Emissions Test Report**

**Test Date: December 13, 2018**

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**FEB 08 2019**

**AIR QUALITY DIVISION**

*Prepared for:*

**Ford Motor Company**

Flat Rock, Michigan

Flat Rock Assembly Plant  
1 International Drive  
Flat Rock, MI 48134

Project No. 049AS-406749  
February 4, 2019

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### EXECUTIVE SUMMARY

Montrose Air Quality Services (MAQS) was retained by Ford Motor Company (Ford) to evaluate volatile organic compound (VOC) destruction efficiency (DE) and outlet concentration (in parts per million (ppm) as propane) on three (3) regenerative catalytic oxidizers (RCOs) and a single thermal oxidizer (RTO) at the Flat Rock Assembly Plant (FRAP) located in Flat Rock, Michigan. Sampling and analysis for this emission test program was conducted on December 13, 2018. Prior to this emissions test program, MAQS completed outlet verification testing on November 7<sup>th</sup>-8<sup>th</sup>, 2018. Results from this outlet verification testing have been enclosed in Appendix E.

Testing consisted of four 60-minute test runs for VOC at each source. The emissions test program is required by Michigan Department of Environmental Quality Air Quality Division Permit No. MI-ROP-N0929-2018. The permit states, "... satisfactory operation of the three regenerative catalytic oxidizers and the one regenerative thermal oxidizer includes maintaining a minimum VOC destruction efficiency of 95 percent or an average control system outlet VOC concentration of less than or equal to 5 ppm as propane."

The results of the emission test program are summarized by Table 2. Detailed emissions test results are summarized by Table 3.

**Table I**  
**Control System Outlet Summary**

Test Parameter	Results
Destruction Efficiency	91%*
THC Concentration <sup>1</sup> (-methane)(ppmv, wet, corrected as per USEPA 7E)	5*

<sup>1</sup> Flow-Weighted average across all three test runs

\* Average of runs 2-4. Given that the first test run appears to be an anomaly when compared to the subsequent testing and that the approved testing protocol stipulated three 1-hour tests, the data from the first test has not been included in the average.

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Appendix E	November 7 <sup>th</sup> -8 <sup>th</sup> , 2018 RCO Outlet Verification Testing

## **1. Introduction**

Montrose Air Quality Services (MAQS) was retained by Ford Motor Company (Ford) to evaluate volatile organic compound (VOC) destruction efficiency (DE) and outlet concentration (in parts per million (ppm) as propane) on three (3) regenerative catalytic oxidizers (RCOs) and a single thermal oxidizer (RTO) at the Flat Rock Assembly Plant (FRAP) located in Flat Rock, Michigan. Sampling and analysis for this emission test program was conducted on December 13, 2018 after verification testing performed on November 7<sup>th</sup>-8<sup>th</sup>, 2018 yielded acceptable results. Results from this outlet verification testing have been enclosed in Appendix E.

The Air Quality Division (AQD) of Michigan's Department of Environmental Quality has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (March 2018). The following is a summary of the emissions test program and results in the format outlined by the AQD document.

### **1.a Identification, Location, and Dates of Test**

Sampling and analysis for the emission test program was conducted on December 13, 2018 at the FRAP facility located in Flat Rock, Michigan.

### **1.b Purpose of Testing**

The emissions test program is required by Michigan Department of Environmental Quality Air Quality Division Permit No. MI-ROP-N0929-2018.

### **1.c Source Description**

The FRAP coating operations are controlled by three (3) RCOs (identified as RCO A, RCO B, and RCO C) and one (1) regenerative thermal oxidizer (RTO) as pollution control equipment. All three (3) RCO units share a common inlet duct. The RTO exhaust combines with RCO C exhaust before it is exhausted through the RCO C stack.

### **1.d Test Program Contact**

The contact for the source and test program is:

Mr. Jamie Hayward  
Plant Environmental Control Engineer  
Flat Rock Assembly Plant  
1 International Dr.  
Flat Rock, Michigan 48134  
(313) 805-9166

## 1.e Testing Personnel

Names and affiliations for personnel who were present during the testing program are summarized by Table 1.

**Table 1**  
**Test Personnel**

<b>Name and Title</b>	<b>Affiliation</b>	<b>Telephone</b>
Mr. Jamie Hayward Plant Environmental Control Engineer	Flat Rock Assembly Plant 1 International Dr. Flat Rock, MI 48134	(313) 805-9166
Ms. Susan Hicks Senior Environmental Engineer	Ford Motor Company Fairlane Plaza North, Suite 800 290 Town Center Drive Dearborn, MI 48126	(313) 594-3185
Mr. Barry Boulianne District Manager	MAQS 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8070
Mr. Steve Smith Field Project Manager		
Mr. Matt Young Client Project Manager		
Mr. Mike Nummer Environmental Technician		
Mr. Ben Durham Environmental Technician		
Mr. Jacob Young Environmental Technician		
Mr. Paul Diven Field Project Manager		
Mr. Mason Sakshaug Environmental Technician		
Mr. John Lamb Air Quality Division	MDEQ	

## 2. Summary of Results

Sections 2.a through 2.c summarize the results of the emissions compliance test program.

### 2.a Operating Data

Operational data collected during the testing includes the number of vehicles produced during each test run and operating temperatures for each RCO and the RTO at varying points during each test run. See Appendix D for this information.

### 2.b Applicable Permit

The applicable permit for this emissions test program is Permit No. MI-ROP-N0929-2018.

## **2.c Results**

The overall results of the emission test program are summarized by Table 2 (see Section 5.a).

## **3. Source Description**

Sections 3.a through 3.e provide a detailed description of the process.

### **3.a Process Description**

FRAP is an automotive assembly plant located in Flat Rock, Michigan. Vehicle body panels are stamped and assembled on-site from sheet metal components. The bodies are cleaned, treated, and prepared for painting in the phosphate system. Drawing compounds, mill oils, and dirt are removed from the vehicle bodies utilizing both high pressure spray and immersion cleaning/rinsing techniques. Vehicle bodies then are dip coated in electro deposition corrosion primer paint for protection. The electro primer (e-coat) is heat-cured to the vehicle body in a high-temperature bake oven. After completing the e-coat operation, vehicle bodies are conveyed to the sealer area for application of various sealants to body seams and joints. Vehicle bodies are then conveyed to an oven to cure the sealers.

After the sealer oven, the vehicles are routed to one of the two identical 3-Wet paint systems. In the 3-Wet paint booth, the vehicle is painted with primer, a color basecoat and a protective clearcoat layer using automatic bells on robot spray applicators. The vehicle then passes through an oven to cure the 3-Wet applications. The 3-Wet booths allow for paint application of one layer after the other without an intermediate drying stage.

The vehicle paint process includes the e-coat priming, guidecoat surface priming, base/clearcoat and vehicle sealing operations. The majority of the process emissions associated with these coating activities are oxidized at elevated temperatures by the RCO and RTO emission control equipment that is part of this test program.

### **3.b Process Flow Sheet or Diagram**

Each RCO and the RTO controls VOC emissions from the corresponding equipment by oxidizing organics present in the exhaust gas at elevated temperatures.

### **3.c Raw and Finished Materials**

The raw materials include various automotive coatings that are used in the following emission units: EGECOAT, EGGUIDECOAT/EGTOPCOAT, and EGCOAT. They include body sealing agents, electro deposition primer, surface primers, topcoat (basecoat and clearcoat) coatings.

### **3.d Process Capacity**

FRAP operates under a process limitation of 4.8 lb/job.

### **3.e Process Instrumentation**

The only process operating parameters relevant to the emissions test program are RCO and RTO operating temperatures.

## **4. Sampling and Analytical Procedures**

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used to verify the DE and outlet concentration of each RCO.

### **4.a Sampling Train and Field Procedures**

Measurement of exhaust gas velocity, molecular weight, and moisture content was conducted using the following reference test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - *"Location of the Sampling Site and Sampling Points"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
- Method 3 - *"Determination of Molecular Weight of Dry Stack Gas" (Fyrite)*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The s-type pitot tube dimensions outlined in Sections 2-6 through 2-8 were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned.

Cyclonic flow checks were performed at each sampling location. The existence of cyclonic flow is determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. The average of the absolute values of the flow angles was less than 20 degrees at each sampling location.

Molecular weight determinations were evaluated according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite<sup>®</sup> combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite<sup>®</sup> procedure.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted as part of the moisture sampling and passed through (i) two impingers, each with 100 ml deionized water, (ii) an empty impinger, and (iii) an impinger filled with silica gel. Exhaust gas moisture content is then determined gravimetrically. Moisture evaluations

consisted of a single 30-minute sample run at the RTO Inlet, Outlet, and each RCO Exhaust stack. Wet bulb/dry bulb was used at the RCO Inlet.

Measurement of exhaust gas VOC and methane concentrations was conducted using the following reference test methods codified at 40 CFR 60, Appendix A:

- Method 25A- *"Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer"*

VOC concentrations were measured using the procedures found in 40 CFR 60, Appendix A, Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer."

The RCO outlet VOC concentrations were measured using a JUM 109A Methane/Non-Methane Analyzer. For each sampling location, a sample of the gas stream was drawn through a stainless-steel probe with an in-line glass fiber filter to remove any particulate and a heated Teflon® sample line to prevent the condensation of any moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a Laptop PC equipped with data acquisition software.

The J.U.M. Model 109A utilizes two flame ionization detectors (FID) to determine the average concentration (ppm) for THC (as propane) and the average concentration for methane. Upon entry, the gas stream is split by the analyzer. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of THC is then sent to a data acquisition system (DAS), where 4-second interval data points are recorded to produce an average based on the overall duration of the test. This average is then used to determine the average concentration for THC reported as the calibration gas, propane, in equivalent units.

The analyzer's response factor is obtained by introducing a methane calibration gas to the calibrated J.U.M. 109A. The response of the analyzer's THC FID to the methane calibration gas, in ppm, as propane, is divided by the methane analyzer's response to the methane calibration gas, in ppm as methane.

The RCO inlet, and RTO inlet and outlet locations were measured using a VIG Model 20 THC analyzer. The VIG THC hydrocarbon analyzer channels a fraction of the gas sample through a capillary tube that directs the sample to the flame ionization detector (FID), where the hydrocarbons present in the sample are ionized into carbon. The carbon concentration is then determined by the detector in parts per million (ppm). This concentration is transmitted to the data acquisition system (DAS) at 4-second intervals in the form of an analog signal, specifically voltage, to produce data that can be averaged over the duration of the testing program. This data is then used to determine the average ppm for total hydrocarbons (THC) using the equivalent units of propane (calibration gas).

For analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a

single chassis with four mass flow controllers. 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. A field quality assurance check of the system was performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

A drawing of the Method 25A sampling train used for the testing program is presented as Figure 5. Protocol 1 gas certification sheets for the calibration gases used for this testing program are presented in Appendix B.

#### **4.b Recovery and Analytical Procedures**

Because all measurements were conducted using on-line analyzers, no samples were recovered during the test program.

#### **4.c Sampling Ports**

A diagram of the stacks showing sampling ports in relation to upstream and downstream disturbances are included as Figures 1-4.

#### **4.d Traverse Points**

A diagram of the stacks showing sampling ports in relation to upstream and downstream disturbances are included as Figures 1-4.

### **5. Test Results and Discussion**

Sections 5.a through 5.j provide a summary of the test results.

#### **5.a Results Tabulation**

The results of the emission test program are summarized by Table 2. Detailed emissions test results are summarized by Table 3.

**Table 2**  
**Control System Outlet**

<b>Test Parameter</b>	<b>Results</b>
<b>Destruction Efficiency</b>	<b>91%*</b>
<b>THC Concentration</b> <sup>1</sup> (-methane)(ppmv, wet, corrected as per USEPA 7E)	<b>5*</b>

<sup>1</sup> Flow-Weighted average across all three test runs

\*Average of runs 2-4. Given that the first test run appears to be an anomaly when compared to the subsequent testing and that the approved testing protocol stipulated three 1-hour tests, the data from the first test has not been included in the average.

#### **5.b Sampling Procedure Variations**

There were no sampling procedure variations.

#### **5.c Process or Control Device Upsets**

No upset conditions occurred during testing.

#### **5.d Control Device Maintenance**

Prior to this test event, Ford had not completed any major maintenance.

#### **5.e Re-test**

This emissions test program was not a re-test.

#### **5.f Audit Sample Analyses**

No audit samples were collected as part of the test program.

#### **5.g Calibration Sheets**

Relevant equipment calibration documents are provided as Appendix B.

#### **5.h Sample Calculations**

Sample calculations are provided in Appendix C.

#### **5.i Field Data Sheets**

Field documents relevant to the emissions test program are presented in Appendix A.

## 5.j Laboratory Data

There are no laboratory results for this test program.

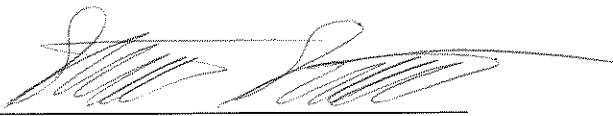
### **MEASUREMENT UNCERTAINTY STATEMENT**

Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose Air Quality Services, LLC, (MAQS) personnel reduce the impact of these uncertainty factors through the use of approved and validated test methods. In addition, MAQS personnel perform routine instrument and equipment calibrations and ensure that the calibration standards, instruments, and equipment used during test events meet, at a minimum, test method specifications as well as the specifications of our Quality Manual and ASTM D 7036-04. The limitations of the various methods, instruments, equipment, and materials utilized during this test have been reasonably considered, but the ultimate impact of the cumulative uncertainty of this project is not fully identified within the results of this report.

### **Limitations**

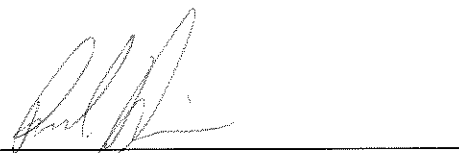
All testing performed was done in conformance to the ASTM D7036-04 standard. The information and opinions rendered in this report are exclusively for use by Ford Motor Company. MAQS will not distribute or publish this report without Ford Motor Company's consent except as required by law or court order. MAQS accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by:



Steve Smith  
Client Project Manager

This report was reviewed by:



Paul Diven  
Field Project Manager

# Tables

Table 1: Summary of data for the first table.

Table 2: Summary of data for the second table.

Table 3: Summary of data for the third table.

Table 4: Summary of data for the fourth table.

Table 5: Summary of data for the fifth table.

Table 6: Summary of data for the sixth table.

Table 7: Summary of data for the seventh table.

Table 8: Summary of data for the eighth table.

Table 9: Summary of data for the ninth table.

Table 10: Summary of data for the tenth table.

**Table 3**  
**RTO & RCO VOC Destruction Efficiency and Outlet Concentration Summary**  
**2 Inlet / 4 Outlet**  
**Ford FRAP**  
**Flatrock, MI**  
**December 13, 2018**

Parameter	Run 1 <sup>1</sup>	Run 2	Run 3	Run 4	Average (Run 2-4)
Sampling Time	7:55-8:55	9:30-10:30	11:45-12:45	14:35-15:35	
RTO Inlet Flowrate (scfm)	27,012	27,459	26,958	26,952	27,123
RCO Inlet Flowrate (scfm)	331,435	326,147	324,459	329,009	326,538
RCO A Flowrate (scfm)	112,594	114,990	111,299	109,996	112,095
RCO B Flowrate (scfm)	110,266	116,484	120,198	114,907	117,196
RCO C Flowrate (scfm)(includes the RTO exhaust flowrate)	144,353	148,963	147,234	149,425	148,540
RTO Outlet Flowrate (scfm)	27,435	27,747	27,653	27,366	27,589
RTO Inlet THC Concentration (ppmv propane)	134.47	141.23	117.04	167.00	141.76
RTO Inlet THC Concentration (ppmv, corrected as per USEPA 7E)	129.42	131.35	104.93	151.75	129.35
RTO Inlet THC Mass Flowrate (standard lb/hr)	23.92	24.68	19.36	27.99	24.01
RTO Outlet THC Concentration (ppmv propane)	3.65	6.56	3.76	4.25	4.86
RTO Outlet THC Concentration (ppmv, corrected as per USEPA 7E)	2.71	5.08	2.40	2.73	3.40
RTO Outlet THC Mass Emission Rate (standard lb/hr)	0.51	0.96	0.45	0.51	0.64
RCO Inlet THC Concentration (ppmv propane)	68.25	57.66	60.03	55.65	57.78
RCO Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	68.48	57.61	60.02	55.73	57.79
RCO Inlet THC Mass Flowrate (standard lb/hr)	165.33	128.59	133.27	125.48	129.12
RCO A Outlet THC Concentration (ppmv propane)	22.99	23.77	23.46	19.98	22.07
RCO A Outlet THC Concentration (ppmv, corrected as per USEPA 7E)	22.78	22.30	23.69	19.78	21.93
RCO A Outlet CH4 Concentration (ppmv methane)	40.95	40.68	39.73	36.73	39.05
RCO A Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	40.78	40.90	39.30	36.73	38.98
RCO A Outlet THC Concentration (- methane) (ppmv, corrected as per USEPA 7E)	8.91	7.43	9.45	7.16	8.01
RCO A Outlet THC Mass Emission Rate (standard lb/hr)	6.87	5.85	7.20	5.39	6.15
RCO B Outlet THC Concentration (ppmv propane)	17.73	16.96	16.47	15.00	16.14
RCO B Outlet THC Concentration (ppmv, corrected as per USEPA 7E)	17.49	16.65	16.62	15.31	16.19
RCO B Outlet CH4 Concentration (ppmv methane)	29.74	29.85	27.48	25.28	27.54
RCO B Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	29.33	29.38	27.37	25.39	27.38
RCO B Outlet THC Concentration (- methane) (ppmv, corrected as per USEPA 7E)	6.08	2.92	3.83	3.87	3.54
RCO B Outlet THC Mass Emission Rate (standard lb/hr)	4.59	2.33	3.15	3.05	2.84
RCO C Outlet THC Concentration (ppmv propane)	20.32	13.14	13.10	12.23	12.82
RCO C Outlet THC Concentration (ppmv, corrected as per USEPA 7E)	19.74	12.31	12.63	11.71	12.22
RCO C Outlet CH4 Concentration (ppmv methane)	20.88	17.50	15.57	15.71	16.26
RCO C Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	20.49	17.28	15.71	15.91	16.30
RCO C Outlet THC Concentration (- methane) (ppmv, corrected as per USEPA 7E)	10.17	3.80	4.97	4.28	4.35
RCO C Outlet THC Mass Emission Rate (standard lb/hr)	10.04	3.88	5.01	4.37	4.42
RCO A, B, and C Flow-weighted THC Concentration (-methane) (ppmv, corrected as per USEPA 7E)	9	5	6	5	5
RCO A, B, and C and RTO Combined DE (%)	88	92	90	92	91

1: not included in average

\*Given that the first test run appears to be an anomaly when compared to the subsequent testing and that the approved testing protocol stipulated three 1-hour tests, the data from the first test has not been included in the average.

scfm: standard cubic feet per minute

ppmv: parts per million on a volume to volume basis

lb/hr: pounds per hour

THC: total hydrocarbons

MW: molecular weight

24.14: molar volume of air at standard conditions (70°F, 29.92" Hg)

35.31: ft<sup>3</sup> per m<sup>3</sup>

453600: mg per lb

Equations

lb/hr = ppmv \* MW/24.14 \* 1/35.31 \* 1/453,600 \* scfm\* 60

Flow-weighted concentration = (F<sub>A</sub>\*C<sub>A</sub> + F<sub>B</sub>\*C<sub>B</sub> + F<sub>C</sub>\*C<sub>C</sub> - F<sub>RTO</sub>\*C<sub>RTO</sub>) / (F<sub>A</sub> + F<sub>B</sub> + F<sub>C</sub> - F<sub>RTO</sub>), where F = flowrate (scfm) and C = THC concentration (-methane) (ppmv, corrected as per USEPA 7E)

RTO A, B and C Combined DE = [RCO Inlet pph - (RCO A outlet pph + RCOB outlet pph + (RCO C outlet pph - RTO outlet pph))]/RCO Inlet pph

RCO A  
RCO B  
RCO C

RCO Response Factors			
2.94	2.75	2.76	2.91
2.57	2.14	2.14	2.22
2.14	2.03	2.05	2.14

RTO Inlet VOC Correction				
Co	6.01	11.26	13.51	17.91
Cma	299	299	299	299
Cm	302.79	307.12	308.52	311.67

RCO A Outlet VOC Correction				
Co	-0.19	-0.19	-0.06	-0.04
Cma	25	25	25	25
Cm	25.25	25.55	24.76	25.26

RCO A Outlet CH4 Correction				
Co	-0.50	-0.95	-0.82	0.06
Cma	25	25	25	25
Cm	24.91	24.50	24.98	25.02

RCO B Outlet VOC Correction				
Co	0.23	0.28	0.02	-0.24
Cma	25	25	25	25
Cm	25.24	25.33	24.77	24.64

RCO B Outlet CH4 Correction				
Co	0.30	0.34	0.31	0.30
Cma	25	25	25	25
Cm	25.39	25.45	25.13	24.90

RCO C Outlet VOC Correction				
Co	0.55	1.10	0.68	0.56
Cma	25	25	25	25
Cm	25.59	25.55	25.26	25.48

RCO C Outlet CH4 Correction				
Co	0.83	0.50	-0.31	-0.16
Cma	25	25	25	25
Cm	25.30	25.10	24.96	24.78

RCO Inlet VOC Correction				
Co	1.25	1.78	1.63	0.97
Cma	50.37	50.37	50.37	50.37
Cm	50.53	50.64	50.64	50.39

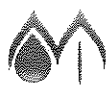
RTO Outlet VOC Correction				
Co	0.97	1.57	1.40	1.57
Cma	29.9	29.9	29.9	29.9
Cm	30.51	30.95	30.82	31.00

# Figures

Figure 1: A line graph showing the relationship between the number of hours spent studying and the score on a math test. The x-axis represents 'Hours Studied' (0 to 10) and the y-axis represents 'Test Score' (0 to 100). The data points are as follows:

Hours Studied	Test Score
0	55
1	60
2	65
3	70
4	75
5	80
6	85
7	90
8	95
9	100
10	100

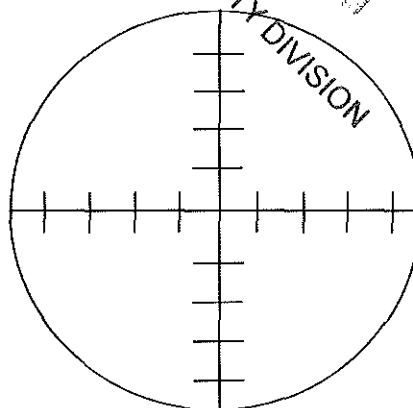
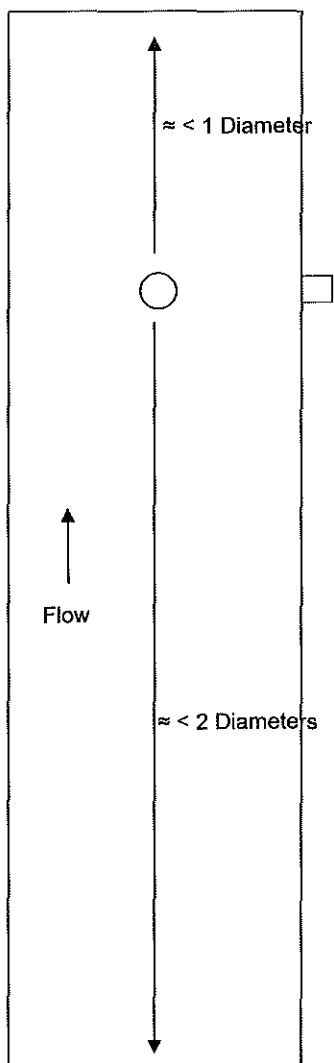
The graph shows a positive correlation between study hours and test scores, with the score increasing from 55 at 0 hours to 100 at 10 hours.



**MONTROSE**  
AIR QUALITY SERVICES

diameter = 107 inches

RECEIVED  
FEB 08 2019  
AIR QUALITY DIVISION



Not to Scale

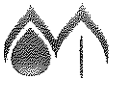
Points	Distance "
1	3.4
2	11.2
3	20.8
4	34.6
5	72.4
6	86.2
7	95.8
8	103.6

Figure No. 1

Site:  
RCO A, B, C  
Ford FRAP  
Flat Rock, Michigan

Sampling Date:  
December 13, 2018

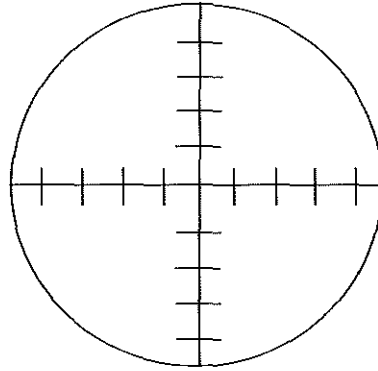
Montrose Air Quality Services  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073



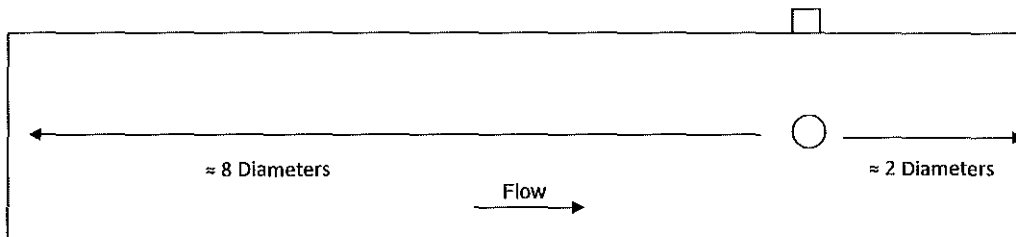
**MONTROSE**  
AIR QUALITY SERVICES

diameter = 10 inches

Points	Distance "
1	5.4
2	17.6
3	32.6
4	54.3
5	113.7
6	135.4
7	150.4
8	162.6



Not to Scale

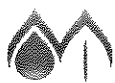


**Figure No. 2**

Site:  
RCO Inlet  
Ford FRAP  
Flat Rock, Michigan

Sampling Date:  
December 13, 2018

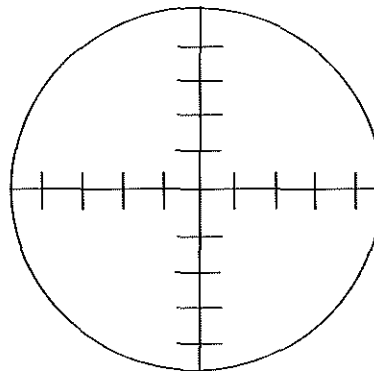
**Montrose Air Quality Services**  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073



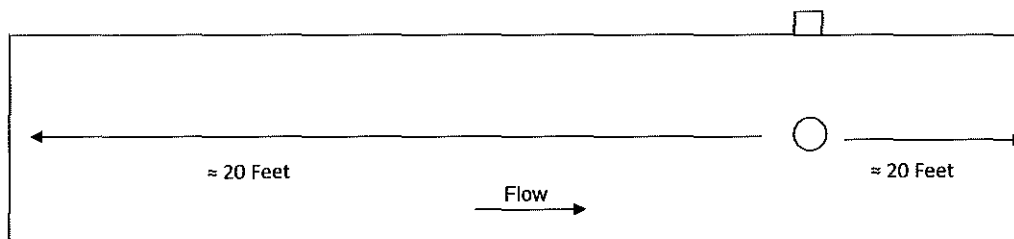
**MONTROSE**  
AIR QUALITY SERVICES

diameter = 10 ~~10.5~~ inches

Points	Distance "
1	1.6
2	5.2
3	9.6
4	16.0
5	33.5
6	39.9
7	44.3
8	47.9



Not to Scale



**Figure No. 3**

Site:  
RTO Inlet  
Ford FRAP  
Flat Rock, Michigan

Sampling Date:  
December 13, 2018

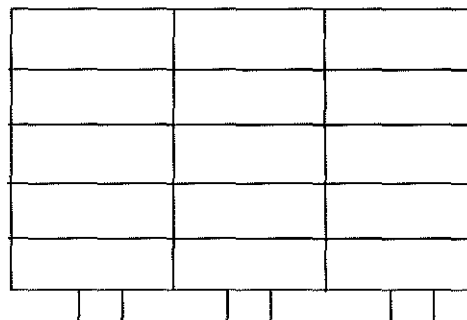
Montrose Air Quality Services  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073



Stack Dimensions:

Depth: 42 inches

Width: 46 inches



Not to Scale

Points	Distance "
1	4.2
2	12.6
3	21.0
4	29.4
5	37.8

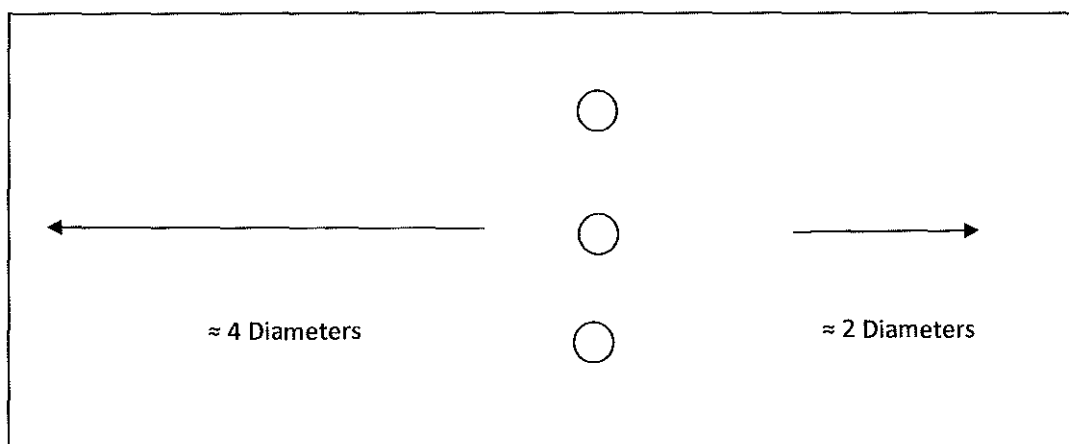
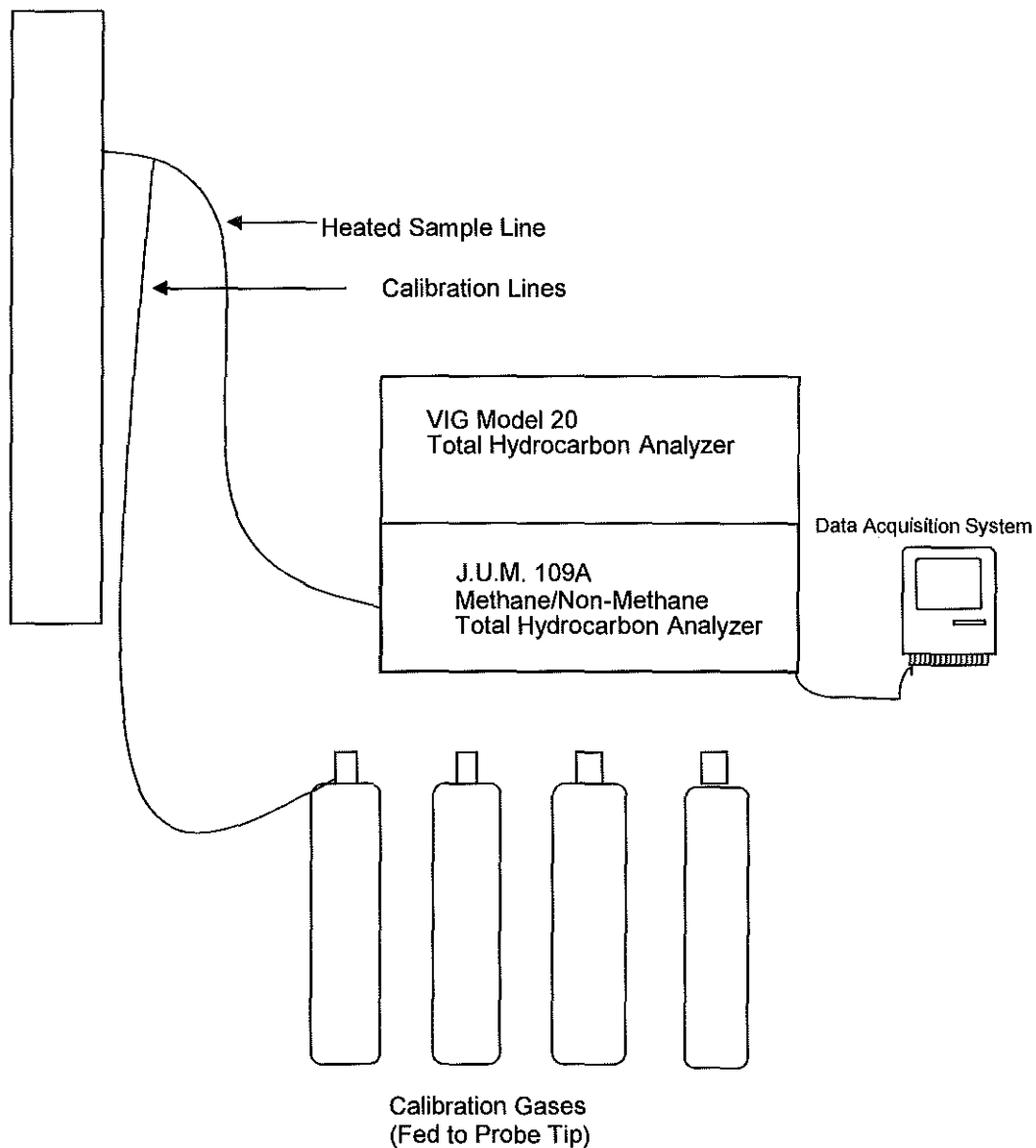


Figure No. 4

Site:  
RTO Outlet  
Ford FRAP  
Flat Rock, Michigan

Sampling Date:  
December 13, 2018

Montrose Air Quality Services  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073

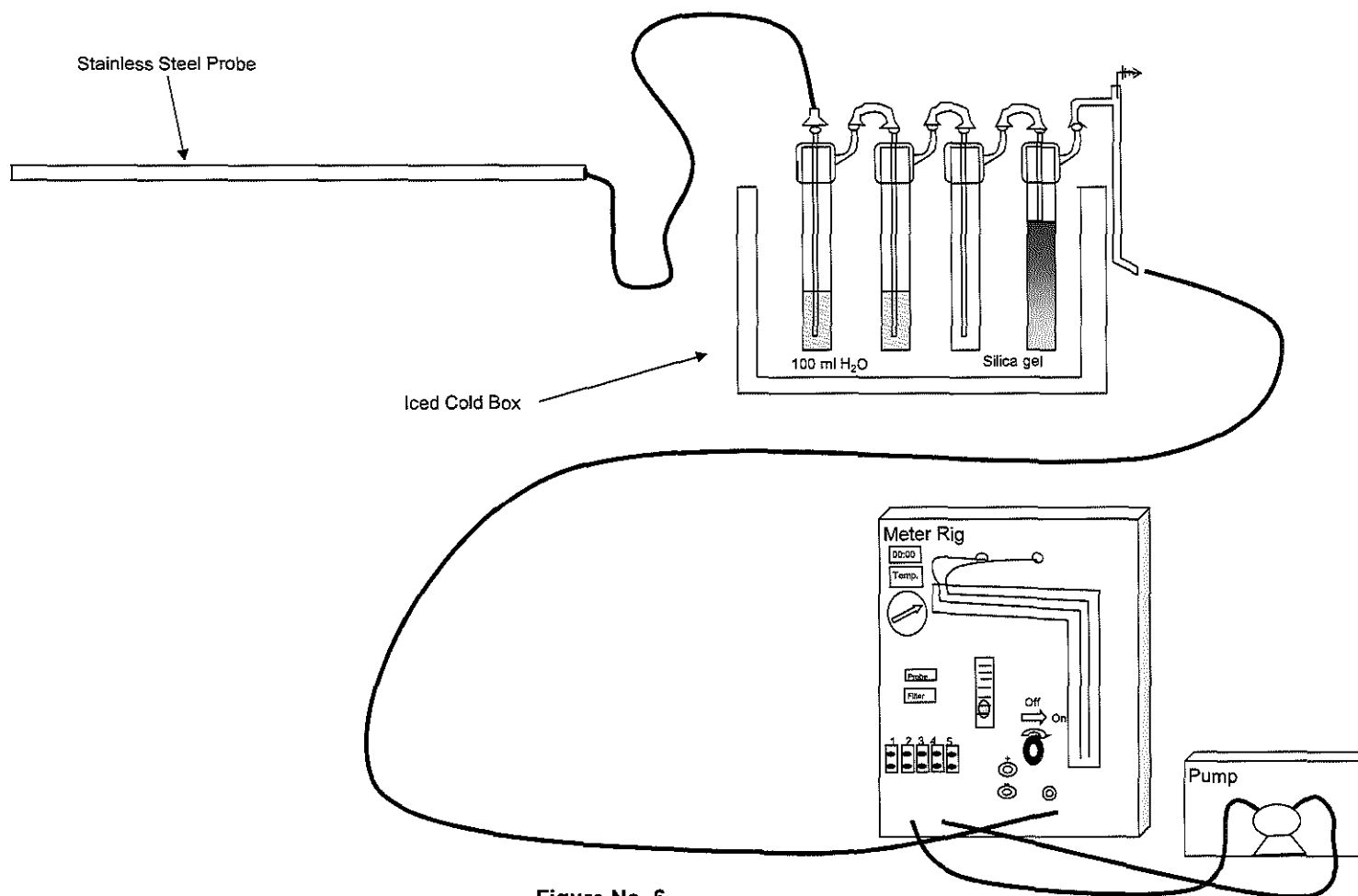


**Figure No. 5**

**Site:**  
USEPA Method 25A  
Ford FRAP  
Flat Rock, Michigan

**Sampling Date:**  
December 13, 2018

**Montrose Air Quality Services**  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073



**Figure No. 6**

Site:  
USEPA Method 4  
Ford FRAP  
Flat Rock, Michigan

Sampling Date:  
December 13, 2018

Montrose Air Quality Services  
4949 Fernlee Avenue  
Royal Oak, Michigan 48073