RTO
VOC Destruction Efficiency
Emissions Test Summary Report

Prepared for:

Ford Motor Company

Dearborn Truck Plant
3001 Miller Road
Dearborn, Michigan 48120

Project No. 049AS-570104
April 4, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073
(248) 548-8070

ACCREDITED
TO ASTM D7036 ONLY

Environmental Quality Office
Environmental and Safety Engineering

Ford Motor Company
Three Parklane Blvd., Suite 950
Dearborn, Michigan 48126-2477

April 8, 2019

Ms. Karen Kajiya-Mills

Department of Environmental Quality
Air Quality Division
Constitution Hall, 2nd Floor South
525 West Allegan Street
Lansing, MI 48909-7760

Ms. Wilhemina McLemore
Department of Environmental Quality
District Supervisor, Air Quality Division
Cadillac Place
3058 West Grand Boulevard, Suite 2-300
Detroit, MI 48202-6058

Subject: **Dearborn Truck Plant MI-ROP-A8648-2015A**
Test Report for Destruction Efficiency testing of the regenerative thermal oxidizer (RTO)

Dear Ms. Kajiya-Mills and Ms. McLemore:

Enclosed are the test results for the regenerative thermal oxidizer (RTO) Destruction Efficiency (DE) located at the Dearborn Truck Plant (DTP) in Dearborn, Michigan. The test results will be utilized in the monthly emissions calculations.

Device	Destruction Efficiency (%)
Regenerative Thermal Oxidizer (RTO)	97.8%

If you have any questions, please call me at (313) 594-3185 or by e-mail at shicks3@ford.com.

Sincerely,

Susan C. Hicks
Senior Environmental Engineer
Environmental Quality Office
Technical Services

Enclosure

CC: M. Larson – Dearborn Truck Plant
K. Cole – EQO ECE

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

RECEIVED
APR 11 2019
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 Dearborn Rock Assembly Plant County Wayne

Source Address 3001 Miller Road City Dearborn

AQD Source ID (SRN) A8648 RO Permit No. MI-ROP-A8648-2015a RO Permit Section No. 1

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 _____ To _____

Additional monitoring reports or other applicable documents required by the RO Permit are attached as described:

Air emissions test report

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.

Deborah Manzano	Plant Manager	313-845-2480
Name of Responsible Official (print or type)	Title	Phone Number
Deborah Manzano		4-9-19
Signature of Responsible Official		Date

* Photocopy this form as needed

EQP 5736 (Rev 9/01)

EXECUTIVE SUMMARY

Montrose Air Quality Services (MAQS) was retained by Ford Motor Company (Ford) to evaluate volatile organic compounds (VOC) destruction efficiency (DE) from the regenerative thermal oxidizer (RTO) at the Dearborn Truck Plant located in Dearborn, Michigan. The emissions test program was conducted on February 26, 2019.

Testing of the RTO system consisted of triplicate 60-minute test runs. The emissions test program was required by MDEQ Air Quality Division Renewable Operating Permit (ROP) No. MI-ROP-A8648-2015a. The results of the emission test program are summarized by Table I.

Table I
Overall Emission Summary
Test Date: February 26, 2019

Pollutant	Average Destruction Efficiency
VOC	97.8%

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

SUMMARY TABLES

FIGURES

APPENDIX

1. Introduction

Montrose Air Quality Services (MAQS) was retained by Ford Motor Company (Ford) to evaluate volatile organic compounds (VOC) destruction efficiency (DE) from the regenerative thermal oxidizer (RTO) at the Dearborn Truck Plant located in Dearborn, Michigan. The emissions test program was conducted on February 26, 2019.The purpose of this report is to document the results of the test program.

AQD 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 suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on February 26, 2019 at the Ford facility located in Dearborn, Michigan. The test program included evaluation of VOC DE emissions from the RTO system.

1.b Purpose of Testing

AQD issued Renewable Operating Permit No. MI-ROP-A8648-2015a to Ford. There are no specific emission limitations associated with FGCONTROLS.

1.c Source Description

The control device is a regenerative thermal oxidizer (RTO).

1.d Test Program Contacts

The contact for the source and test report is:

Ms. Susan Hicks
Senior Environmental Engineer
Ford Motor Company-Environmental Quality Office
Fairlane Plaza North, Suite 800
290 Town Center Drive
Dearborn, MI 48126
Phone: (313) 594-3185

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

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Mason Sakshaug Field Project Manager	Montrose Air Quality Detroit Office 4949 Fernlee Ave Royal Oak, Michigan 48073	(248)-548-8070
Mr. Mike Nummer Field Technician	Montrose Air Quality Detroit Office 4949 Fernlee Ave Royal Oak, Michigan 48073	(248)-548-8070
Mr. Ben Durham Field Technician	Montrose Air Quality Detroit Office 4949 Fernlee Ave Royal Oak, Michigan 48073	(248)-548-8070

2. Summary of Results

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

2.a Operating Data

Process data can be found in Appendix E.

2.b Applicable Permit

The applicable permit for this emissions test program is Renewable Operating Permit (ROP) No. MI-ROP-A8648-2015a.

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

Dearborn Assembly is an automotive assembly plant located in Dearborn, 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 pre-treatment 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 the Prime system. In the Prime system (spraybooth and oven), the bodies receive solvent-borne coatings: colored primer and tu-tone coatings. After exiting the prime oven, the vehicles are routed to the Topcoat system, where water-borne basecoat and solvent-borne clearcoat coatings are applied.

Air exhausted from the clearcoat zones are directed to the carbon concentrators. The concentrated exhaust from the carbon concentrators and oven exhausts are routed to the inlet of the RTO.

3.b Process Flow Diagram

Due to the simplicity of the RTO system, a process flow diagram is not necessary.

3.c Raw and Finished Materials

The raw material used by the process are VOCs.

3.d Process Capacity

DTP operates at a maximum of 72 jobs per hour. The RTO is equipped with two approximately 5.0 million BTU burners.

3.e Process Instrumentation

The RTO temperature was set to 1,400.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

USEPA Methods 1-4

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 the 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 null angle was determined to be less than 10 degrees at each sampling point.

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® combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted as part of the moisture sampling (see Section 3.2) 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.

USEPA Method 25A

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. 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 PC equipped with Labview® II data acquisition software. MAQS used a VIG Model 20 THC hydrocarbon analyzer to determine the VOC concentration at the inlet of the RTO.

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).

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. 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 PC equipped with IOtech® data acquisition software. MAQS used a JUM Model 109A Methane/Non-Methane THC hydrocarbon analyzer to determine the VOC concentration at the outlet of the RTO.

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (as methane). Upon entry, the analyzer splits the gas stream. 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 the data acquisition system (DAS), where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average ppmv for THC reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the THC sample, the methane gas concentration is sent to the DAS and recorded. The methane concentration, reported as methane, can then be converted to methane, reported as propane, by dividing the measured methane concentration by the analyzer's response factor. The response factor is obtained by dividing the methane (in ppmv) by the propane (ppmv) when a methane calibration gas is introduced to the JUM 109A analyzer. The response factor determined during testing was 2.27.

In accordance with Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the THC analyzer. Calibration drift checks were performed at the completion of each run.

In accordance with Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the THC analyzer. Calibration drift checks were performed at the completion of each run.

4.b Recovery and Analytical Procedures

This test program did not include laboratory samples, consequently, sample recovery and analysis was not applicable to this test program.

4.c Sampling Ports

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figures 3 and 4.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figure 3 and 4.

5. Test Results and Discussion

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

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Table 4.

Table 2
Overall Emission Summary
Test Date: February 26, 2019

Pollutant	Average Destruction Efficiency
VOC	97.8%

5.b Discussion of Results

The RTO achieved a 97.8% DE average.

5.c Sampling Procedure Variations

The first 2 sample runs were tested for VOC from a lower port on the outlet of the RTO. After discussion with Mark from the MDEQ, he wanted to verify the numbers for run 3 from a higher port on the outlet of the RTO. MAQS recalibrated the outlet analyzer and ran the third test. Run 3 numbers were similar to runs 1 and 2, so all of the testing was acceptable.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

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

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix C.

5.i Sample Calculations

Sample calculations are provided in Appendix D.

5.j Field Data Sheets

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

5.k Laboratory Data

There are no laboratory results for this test program. Raw CEM data is provided electronically in Appendix E.

MEASUREMENT UNCERTAINTY STATEMENT

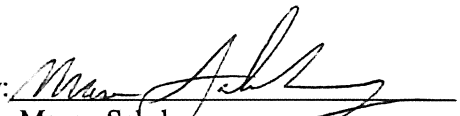
Both qualitative and quantitative factors contribute to field measurement uncertainty and should be taken into consideration when interpreting the results contained within this report. Whenever possible, Montrose Air Quality Services, LLC, (MAQS) personnel reduce the impact of these uncertainty factors 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: 

Mason Sakshaug
Field Project Manager

Table 3
RTO Destruction Efficiency Summary
Ford DTP
Dearborn, MI

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	2/26/2019	2/26/2019	2/26/2019	
Sampling Time	8:20-9:20	9:55-10:55	12:25-13:25	
Inlet Flowrate (scfm)	57,763	57,425	58,081	57,756
Outlet Flowrate (scfm)	62,111	61,935	61,113	61,720
Inlet VOC Concentration (ppmv propane)	505.1	461.4	433.6	466.7
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	510.1	469.5	440.8	473.5
Inlet VOC Mass Flowrate (lb/hr)	202.2	185.1	175.7	187.7
Outlet VOC Concentration (ppmv propane)	11.2	9.8	10.5	10.5
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	10.6	7.9	10.4	9.6
Outlet CH4 Concentration (ppmv methane)	0.3	0.3	0.3	0.3
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	0.2	0.2	0.2	0.2
Outlet VOC Concentration (- methane)	10.5	7.8	10.3	9.5
Outlet VOC Mass Emission Rate (lb/hr)	4.5	3.3	4.3	4.0
VOC Destruction Efficiency (%)	**97.8**	**98.2**	**97.5**	**97.8**

Inlet VOC Correction			
Co	2.75	9.82	12.80
Cma	500	500	500
Cm	495.18	490.70	490.12

Outlet VOC Correction			
Co	0.73	2.50	0.26
Cma	30.2	30.2	30.2
Cm	30.47	30.41	29.84

Outlet CH4 Correction			
Co	0.10	0.09	0.18
Cma	30.1	30.1	30.1
Cm	30.25	29.58	29.84

scfm: standard cubic feet per minute
ppmv: parts per million on a volume to volume basis
lb/hr: pounds per hour
VOC: volatile organic compound
MW = molecular weight (C_3H_8 = 44.10)
24.14: molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31: ft^3 per m^3
453600: mg per lb

RF=2.27

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

MONTROSE
AIR QUALITY SERVICES

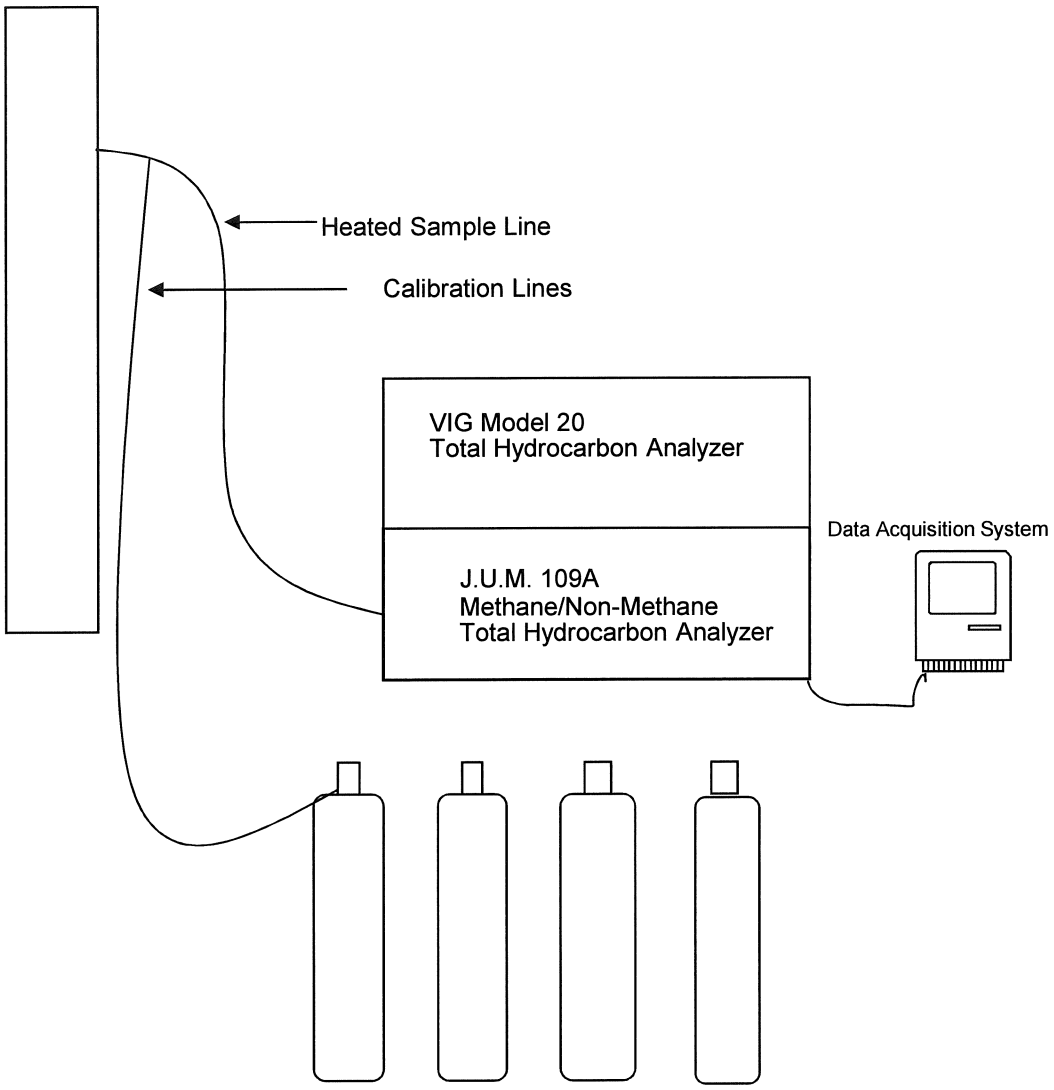


Figure No. 1

Site: **USEPA Method 25A** **Ford DTP** **Dearborn, Michigan**	**Sampling Date:** **February 26, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

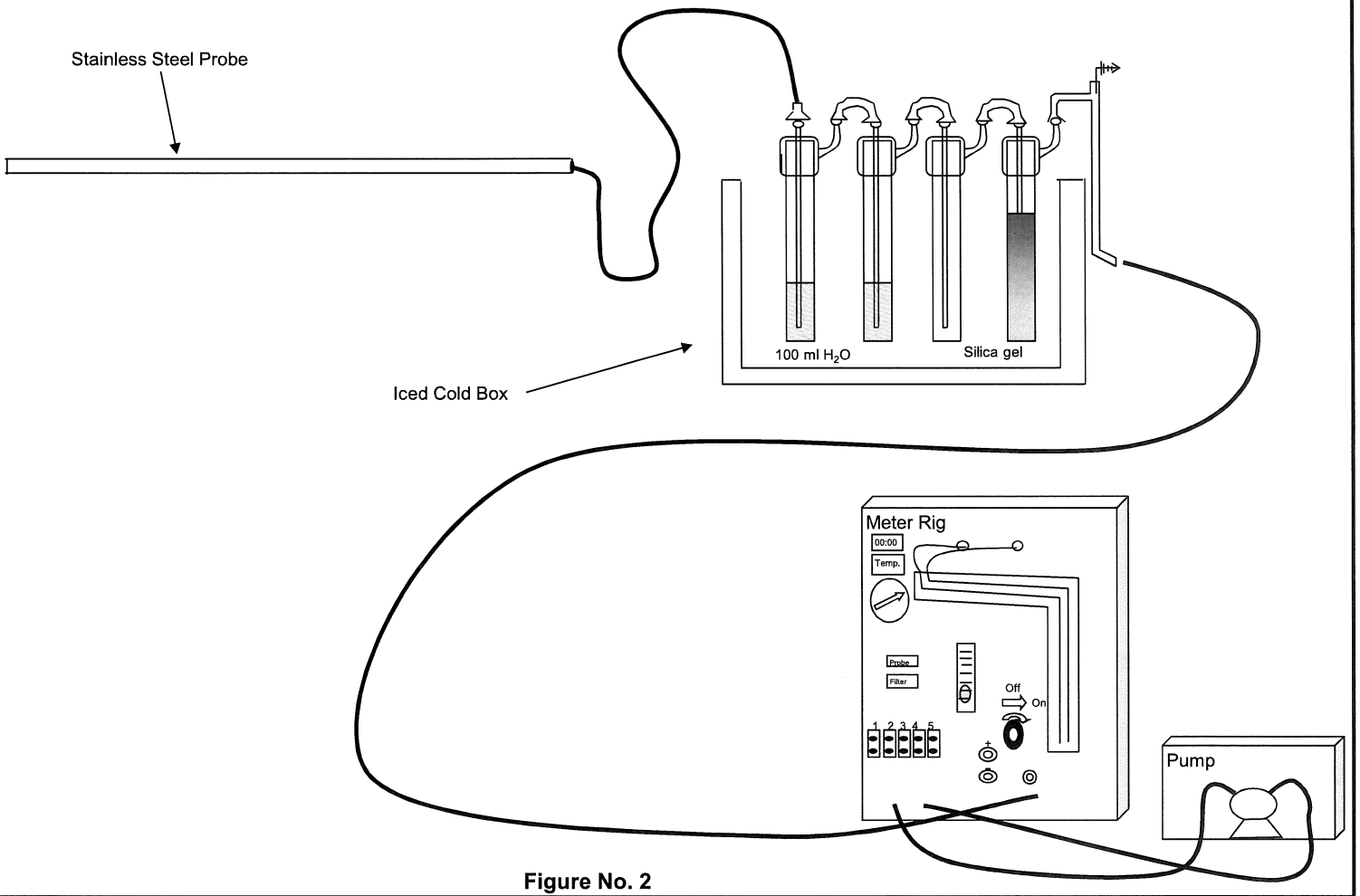
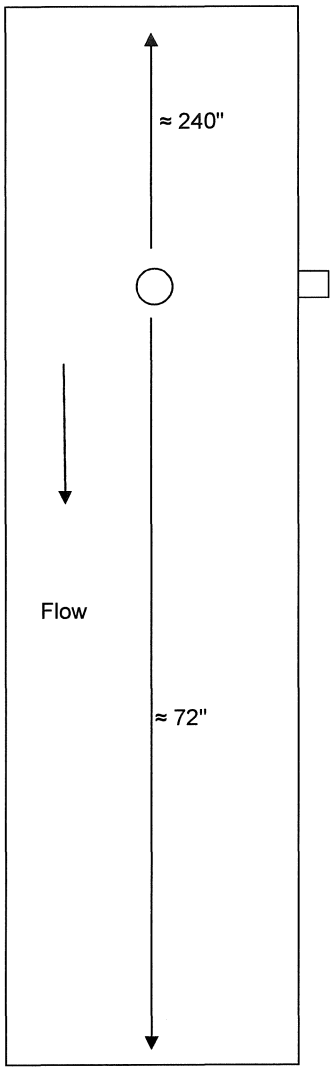


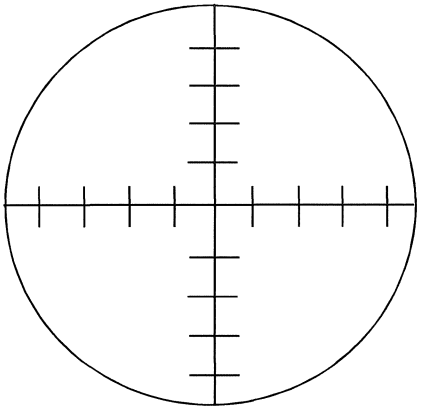
Figure No. 2

Site: **USEPA Method 4** **Ford DTP** **Dearborn, Michigan**	**Sampling Date:** **February 26, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

diameter = 69.5 inches





Not to Scale

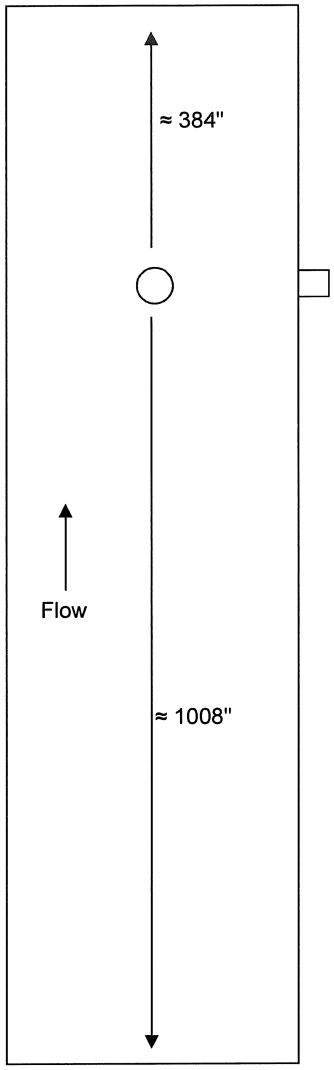
Points	Distance "
1	2.2
2	7.3
3	13.5
4	22.4
5	47.1
6	56.0
7	62.2
8	67.3

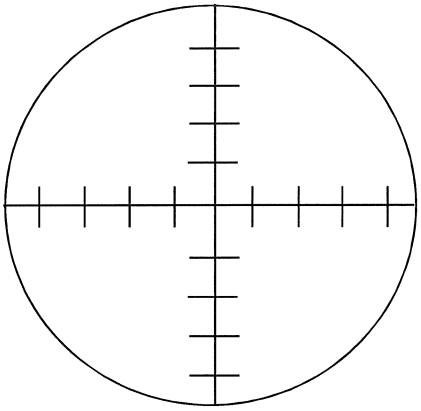
Figure No. 3

Site: **RTO Inlet** **Ford DTP** **Dearborn, Michigan**	**Sampling Date:** **February 26, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

MONTROSE
AIR QUALITY SERVICES

diameter = 83.5 inches





Not to Scale

Points	Distance "
1	2.7
2	8.8
3	16.2
4	27.0
5	56.5
6	67.3
7	74.7
8	80.8

Figure No. 4

Site: **RTO Outlet** **Ford DTP** **Dearborn, Michigan**	**Sampling Date:** **February 26, 2019**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**