FINAL REPORT

FORD MOTOR COMPANY

FLAT ROCK, MICHIGAN

FLAT ROCK ASSEMBLY PLANT (FRAP): RCO OCM TEST REPORT

RWDI #2203057

June 14, 2022

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) has been retained by Ford Motor Company (Ford) to complete the emission sampling program at the Flat Rock Assembly Plant (FRAP) located at 1 International Drive, Flat Rock, Michigan. FRAP operates an automobile assembly plant that produces the Ford Mustang. The testing evaluated volatile organic compound (VOC) concentrations at the outlet of three (3) regenerative catalytic oxidizers (RCO). The test program was completed on April 20th, 2022.

Executive Table i: RCO Average

Parameter	Concentration			
	RCO A	RCO B	RCO C	Average
Outlet VOC (as propane)	2.5 ppmv	2.2 ppmv	2.3 ppmv	2.4 ppmv

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1 INTRODUCTION

RWDI USA LLC (RWDI) has been retained by Ford Motor Company (Ford) to complete the RCO Outlet Concentration Monitoring (OCM) emission sampling program at the Flat Rock Assembly Plant (FRAP) located at 1 International Drive, Flat Rock, Michigan. FRAP operates an automobile assembly plant that produces the Ford Mustang. The testing evaluated volatile organic compound (VOC) concentrations at the outlet of three (3) regenerative catalytic oxidizers (RCO).

1.1 Location and Dates of Testing

The test program was completed on April 20th, 2022 at the Ford FRAP facility.

1.2 Purpose of Testing

FRAP requires periodic monitoring of the VOC concentration of exhaust from each of the three (3) RCOs.

1.3 Description of Source

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 are then 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 booth, the vehicles are painted with primer, a color basecoat, and a protective clearcoat layer using automatic bells on robot spray applicators. The vehicles are then passed through an oven to cure the 3-wet applications. The 3-wet booths allow for paint application of one layer after the other without the 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.

1.4 Personnel Involved in Testing

Table 1.4.1: Testing Personnel

Susan Hicks Environmental Engineer Shicks3@ford.com	**Ford Motor Company**	(313) 594-3185
Katie Ernst Plant Environmental Control Engineer Kholcom3@ford.com	**Ford Motor Company**	(248) 496-4353
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2 SUMMARY OF RESULTS

2.1 Operating Data

Operational data collected during the testing includes the number of vehicles produced during each test. This information can be found in **Appendix A**.

2.2 Applicable Permit Number

The facility operates under State of Michigan Renewable Operating Permit MI-ROP-N0929-2018.

3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

FRAP operates three (3) RCOs for emission control. See 1.3 for further description of the process.

3.2 Process Flow Sheet or Diagram

Each RCO controls VOC emissions from the painting process.

3.3 Type and Quantity of Raw and Finished Materials

The units associated with this process are EU-ECOAT, U-GUIDECOAT, EU-TOPCOAT, and EU-ASSEMBLY PURGE & CLEAN. These include body sealing agents, top/basecoat color paints, protective coatings, and electro deposition primer.

3.4 Normal Rated Capacity of Process

The plant was operating at normal production for most of the testing.

3.5 Process Instrumentation Monitored During the Test

The RCO temperature was monitored during the test.

4 SAMPLING AND ANALYTICAL PROCEDURES

4.1 Description of Sampling Train and Field Procedures

4.1.1 Sampling for Volatile Organic Compounds - USEPA Method 25A

VOC testing was performed simultaneously on outlet of each RCO. The measurements were taken continuously following the USEPA Method 25A on the outlet on each RCO concurrently (using a non-methane/methane analyzer). As outlined in Method 25A, the measurement location was taken at the centroid of each source.

The testing program consisted of a three (3) test of at least 30-minutes on each RCO outlet at the preferred temperature. Regular performance checks on the CEMS were carried out by zero and span calibration checks using USEPA Protocol calibration gases. These checks verified the ongoing precision of the monitor with time by introducing pollutant-free (zero) air followed by known calibration gas (span) into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gases was reviewed frequently as an ongoing indication of analyzer performance.

Prior to testing, a 4-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, low, mid, and high-level calibration gases up the heated line to the probe tip. The calibration error check was performed to confirm that the analyzer response is within ±5% of the certified calibration gas introduced. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre- and post-test system bias checks. The system bias checks were used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and mid gas calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. During these checks, the calibration gases were introduced into the sampling system at the probe outlet so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to the gas analyzer, which measure the pollutant or diluent concentrations in the gas. The analyzers were calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe tip was equipped with a sintered stainless-steel filter for particulate removal or heated filter system. The end of the probe was connected to a heated Teflon sample line, which delivered the sample gases from the stack to the CEM system. The heated sample line is designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line.

The analyzers were able to monitor Total Hydrocarbon (as propane) and Methane concurrently for each test on each RCO unit. The response factor for Methane to Propane was determined for each run via obtain the concurrent response to methane calibration standard as both methane and THC (as Propane). This response factor was applied to each for the methane results to determine the total methane on the outlets of each RCO as Propane. During each run for each RCO, the Total Hydrocarbon (as Propane) and the Methane (corrected to as Propane) was determined and the methane response (as Propane) was subtracted from the Total Hydrocarbon (as Propane) value. This resulted in obtaining the Total Non-Methane Organic Compound (NMOC) values from each for the RCO outlets.

4.2 Description of Recovery and Analytical Procedures

There were no samples to recover during this test program. All testing used real time data from the analyzers.

4.3 Sampling Port Description

The sampling locations for inlet and outlet are located outside. Each RCO outlet is 107.5" and the RCO inlet is 165".

5 TEST RESULTS AND DISCUSSION

5.1 Detailed Results

Table 5.1.1: Table of Results

Parameter	Concentration			
	RCO A	RCO B	RCO C	Average
Outlet VOC (as propane)	2.5 ppmv	2.2 ppmv	2.3 ppmv	2.4 ppmv

Detailed Results are provided in **Tables, Graphs, and Appendix B**.

5.2 Discussion of Results

Each RCO had a result of under 5 ppm VOC.

5.3 Variations in Testing Procedures

Only variation to the original program is that RWDI completed the testing of all three (3) RCOs concurrently. Therefore, in order to obtain three different time periods, triplicate tests were completed on each RCO, each consisting of a minimum of 30 minutes.

5.4 Process Upset Conditions During Testing

There were normal process breaks during production.

5.5 Maintenance Performed in Last Three Months

For the testing, the RCOs temperature average temperatures were as follows:

- RCO A – 1220°F
- RCO B – 1318°F
- RCO C – 1176°F

5.6 Re-Test

This was not a retest.

5.7 Audit Samples

This test did not require any audit samples.

5.8 Calibration Sheets

Calibration sheets can be found in **Appendix D**.

5.9 Sample Calculations

Sample calculations can be found in **Appendix E**.

5.10 Field Data Sheets

Field data sheets can be found in **Appendix C**.

5.11 Laboratory Data

There was no laboratory data from this testing program.

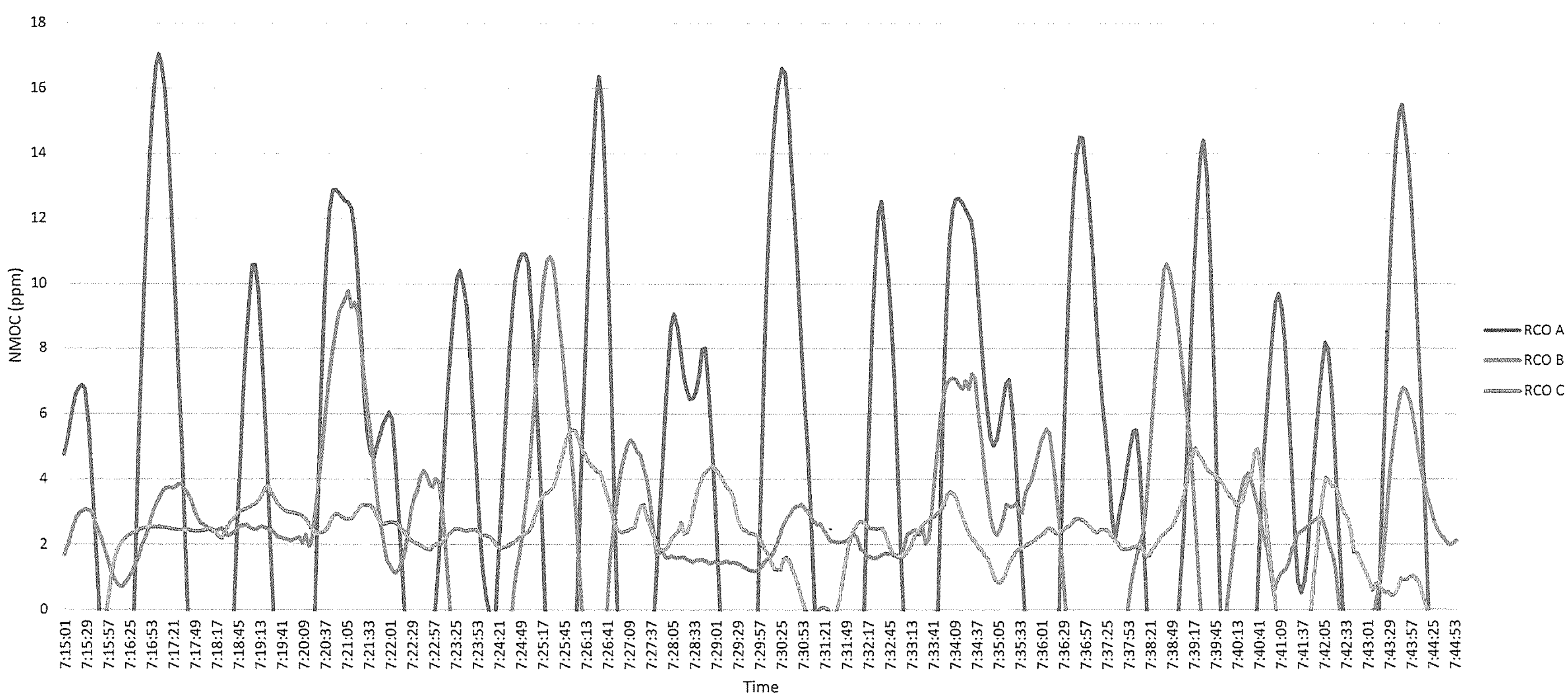
TABLES

Table 1: VOC Summary Results

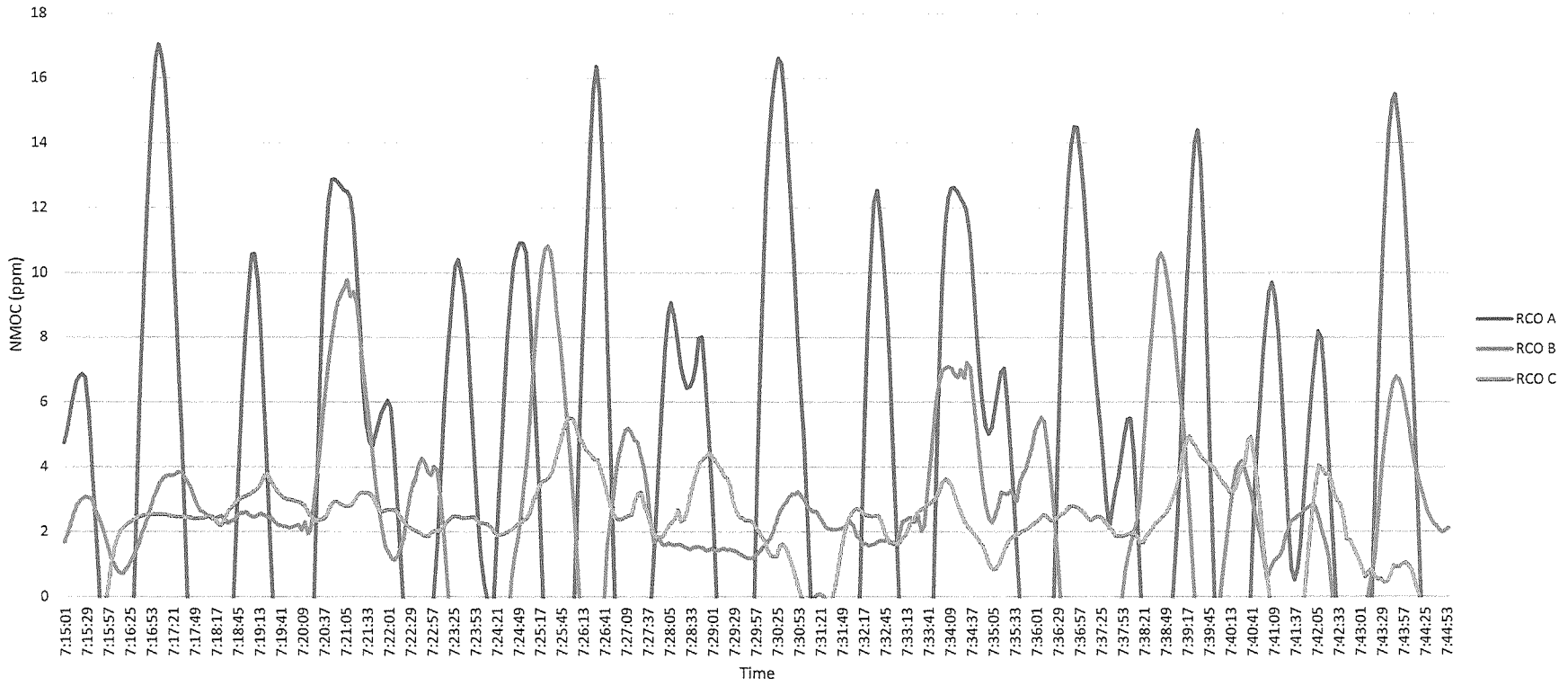
Stack Gas Parameter	RCO C			
	t #1	Test #2	Test #3	Average
Test Date	**/2022**	**4/20/2022**	**4/20/2022**	
Test Time	**-7:50**	**9:00-9:30**	**10:10-10:50**	
VOC (ppm)	7.2	17.0	14.5	**16.2**
Methane (ppm)	4.5	31.2	28.6	**31.4**
VOC (minus Methane ppm)	.2	3.4	1.4	**2.3**

GRAPHS

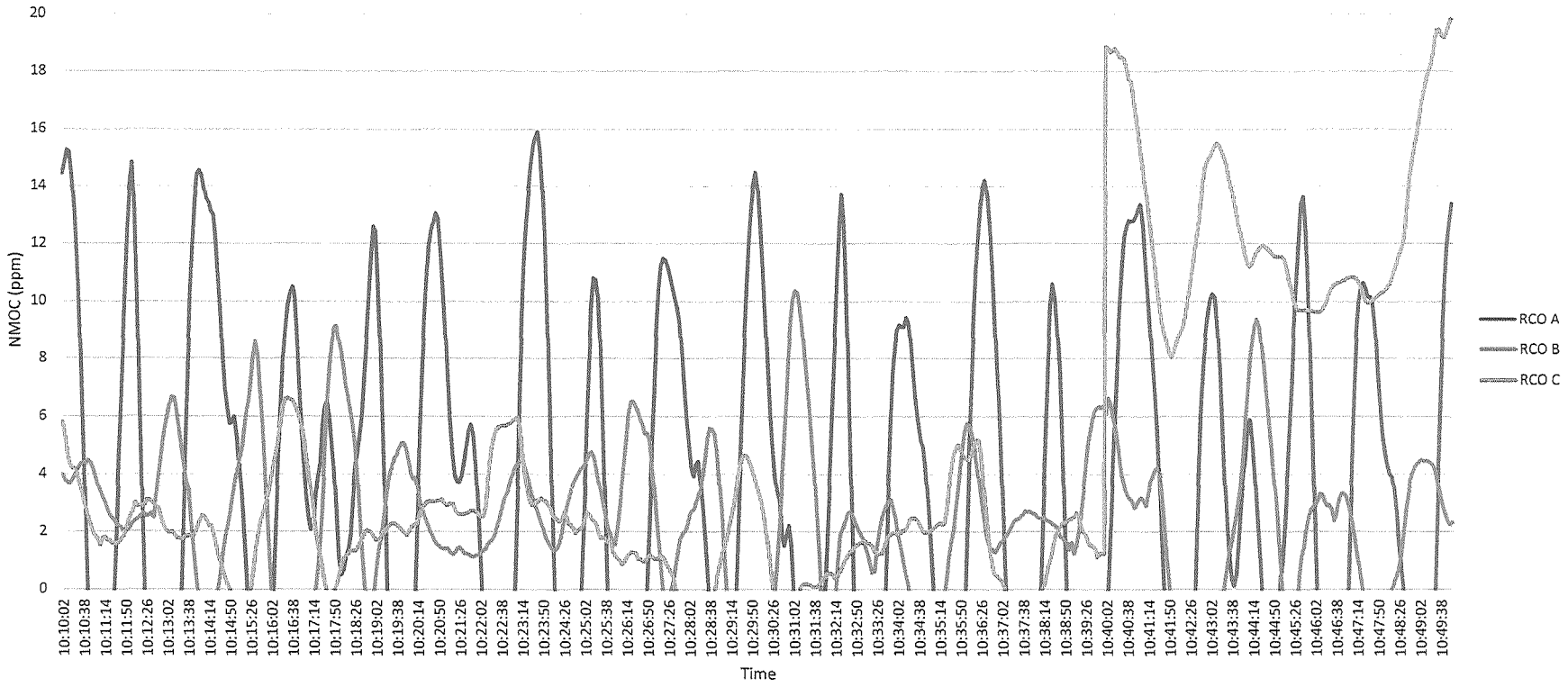
Graph 1 - RCO NMOC Concentrations - Test 1



Graph 2 - RCO NMOC Concentrations - Test 2



Graph 3 - RCO NMOC Concentrations - Test 3



FIGURES

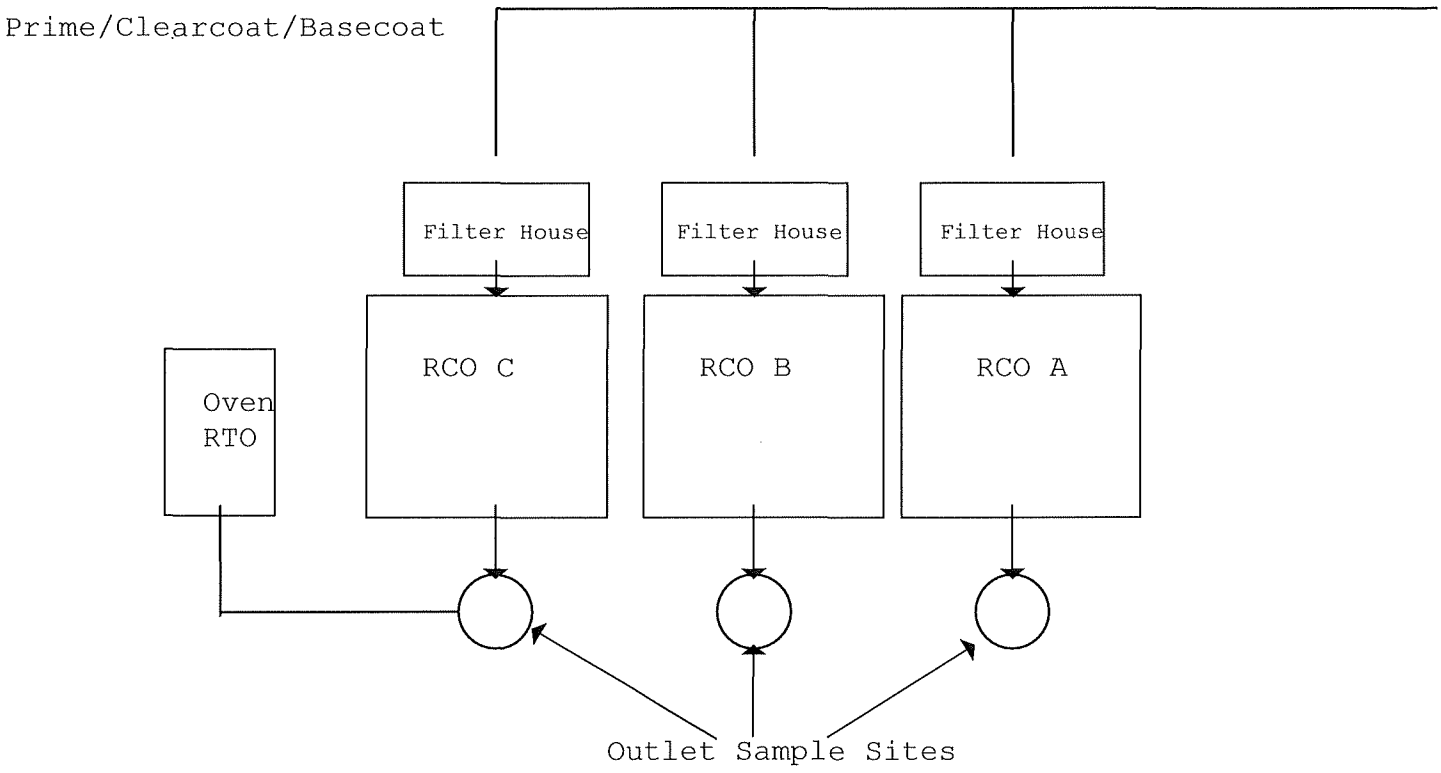
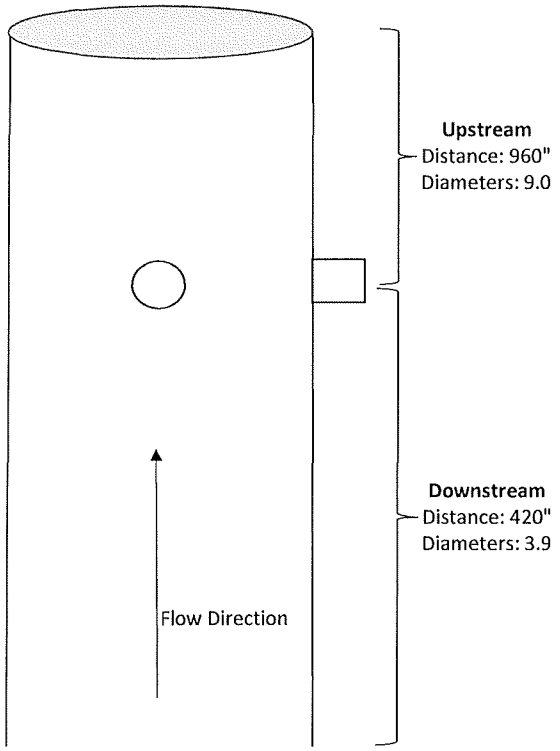


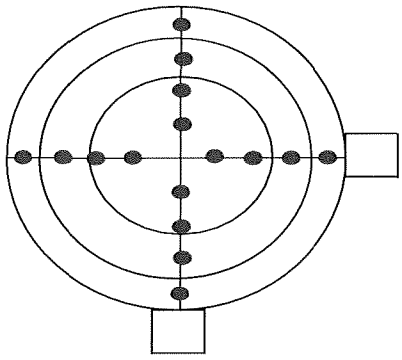
Figure 1
Flat Rock Assembly Plant
Abatement System Layout and Sampling Locations

Figure No. 2: RCO Outlets Traverse Points



Diameter (in.): 107

Sampling Points	(in.)
1	3.4
2	11.2
3	20.8
4	34.6
5	72.4
6	86.2
7	95.8
8	103.6



Not to Scale

RCO Outlet A,B,C
Ford Motor Company
Flat Rock Assembly Plant
Flat Rock, Michigan

Date:
21-Apr-22

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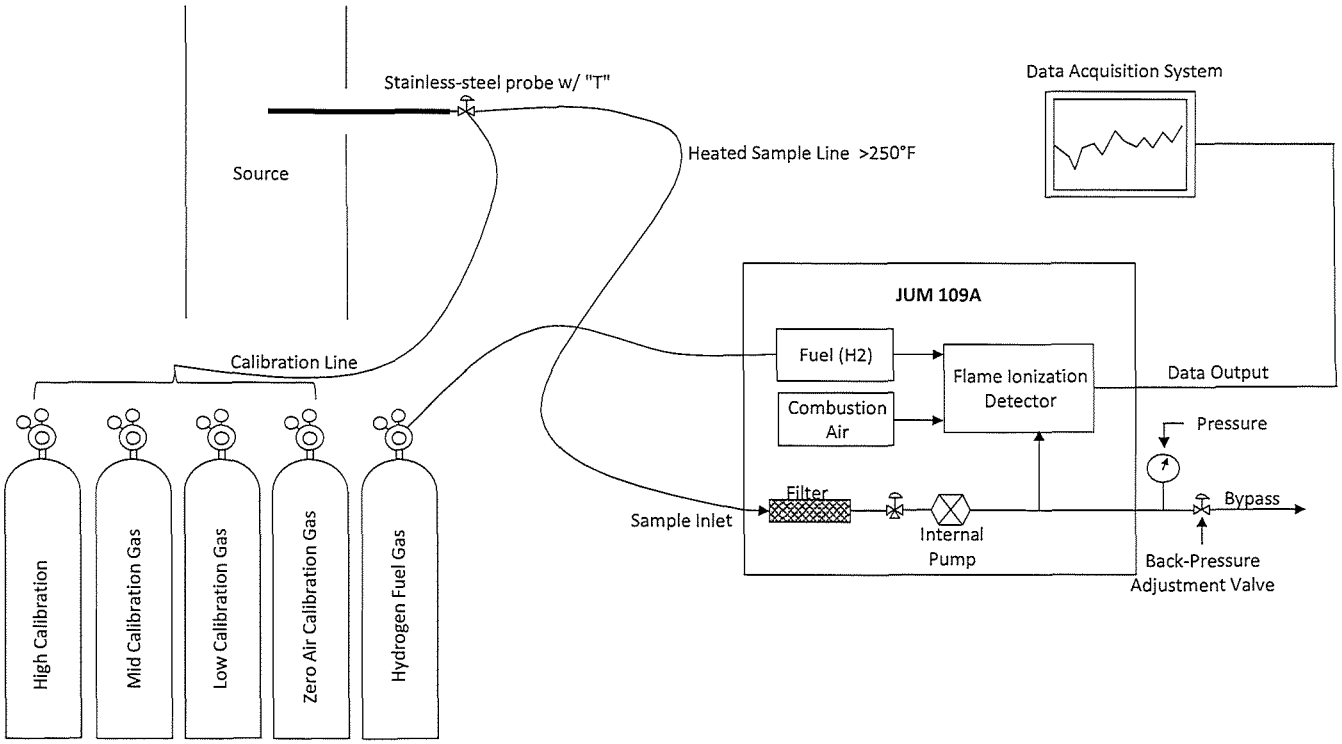
Figure No. 3: USEPA Method 25A Schematic



USEPA Method 25A

Ford Motor Company

Flat Rock Assembly Plant

Flat Rock, Michigan

Project# 2203057

Date: June 14, 2022