

FINAL REPORT



GENERAL MOTORS, LLC

LANSING, MICHIGAN

LANSING DELTA TOWNSHIP ASSEMBLY PLANT (LDT): ELPO RTO DESTRUCTION EFFICIENCY

RWDI #2206398

November 4, 2022

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) has been retained by General Motors, LLC (GM) to complete the emission sampling program at the Lansing Delta Township (LDT) plant located at 8175 Millett Hwy, Lansing, Michigan. The purpose of the emissions test program was to evaluate the destruction efficiency of the ELPO Regenerative Thermal Oxidizer (RTO) after the completion of the RTO block replacement and addition of saddles. The ELPO RTO falls under EU-ELECTROCOAT emission unit within the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit No. MI-ROP-N6950-2020a.

This emissions testing program included evaluation of volatile organic compounds (VOC) prior to and after the ELPO RTO. The testing program provides destruction efficiency for the ELPO. The test program was completed on September 28, 2022.

Executive Table iii: Destruction Efficiency Results

Parameter	Test 1	Test 2	Test 3	Average
<i>Results as THC</i>				
THC Inlet Concentration (ppmvd)	184.82	223.28	205.05	204.38
THC Inlet Emission Rate (lb/hr)	23.03	27.36	25.16	25.18
THC Outlet Concentration (ppmvd)	7.47	7.64	6.88	7.33
THC Outlet Emission Rate (lb/hr)	1.02	1.02	0.92	0.99
THC Destruction Efficiency (%)	95.6	96.3	96.3	96.1
<i>Results as NMOC</i>				
NMOC Inlet Concentration (ppmvd)	172.45	211.25	192.45	192.05
NMOC Inlet Emission Rate (lb/hr)	21.49	25.89	23.61	23.66
NMOC Outlet Concentration (ppmvd)	7.30	7.47	6.72	7.16
NMOC Outlet Emission Rate (lb/hr)	0.99	1.00	0.90	0.97
NMOC Destruction Efficiency (%)	95.4	96.1	96.2	95.9

Executive ii: Test Results Comparison to ROP Limit

Parameter	Limit	Test Data	
		Results as THC	Results as NMOC
VOC Destruction Efficiency	>95%	96.1%	95.9%



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1 INTRODUCTION

RWDI USA LLC (RWDI) has been retained by General Motors, LLC (GM) to complete the emission sampling program at the Lansing Delta Township (LDT) plant located at 8175 Millett Hwy, Lansing, Michigan. The purpose of the emissions test program was to evaluate the destruction efficiency of the ELPO Regenerative Thermal Oxidizer (RTO) after the completion of the RTO block replacement and addition of saddles. The ELPO RTO falls under EU-ELECTROCOAT emission unit within the Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit No. MI-ROP-N6950-2020a.

This emissions testing program included evaluation of volatile organic compounds (VOC) prior to and after the ELPO RTO. The testing program provides destruction efficiency for the ELPO RTO. The test program was completed on September 28, 2022.

1.1 Location and Dates of Testing

The test program was completed on September 28th, 2022 at the GM LDT facility.

1.2 Purpose of Testing

The emissions test program is required by EGLE permit number MI-ROP-N6960-2020a. The facility SRN number is N6960.

As outlined in the ROP, the following limits are provided for ELPO RTO.

Table 1.2.1: EU-ELECTOCOAT Permit Limits

Parameter	Limit	Time Period
VOC	67.9 lb/day	Per Calendar Day
	8.8 tons / year	12-month rolling timer period as determined at the end of each calendar month
Destruction Efficiency	>95%	Equipment Performance Limit

1.3 Description of Source

The ELPO system includes an electrocoat dip tank followed by an electrocoat curing oven. The VOC emissions from both dip tank and curing oven are controlled by an ELPO Thermal Oxidizer.

The ELPO RTO receives the VOC emissions from the process gases and destroys the VOCs within the specified efficiency of the RTO (95% of greater).



3 SOURCE DESCRIPTION

3.1 Description of Process and Emission Control Equipment

The dip tank and oven from the ELPO process is controlled via one (1) regenerative thermal oxidizer (RTO).

3.2 Process Flow Sheet or Diagram

ELPO RTO has a single inlet and single outlet. The figures can be found in the **Figure Section**. A flow diagram of the EU-ELECTROCOAT system is also provided in the **Figure Section**.

3.3 Type and Quantity of Raw and Finished Materials

Various raw materials are used for the assembly of vehicles. For the ELPO process, the vehicles are dipped into baths for the electrocoating process. The baths contain various products for the ELPO process.

3.4 Normal Rated Capacity of Process

The line rate is capable of achieving 60 jobs per hour. Typically, the line rate is between 45 and 55 jobs per hour depending on production needs. Process data is provided in **Appendix A**.

3.5 Process Instrumentation Monitored During the Test

Vehicle counts and RTO combustion chamber temperatures were recorded and monitored during the testing event.



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 $\pm 5\%$ 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 check was used to confirm that the analyzer did not drift greater than $\pm 3\%$ 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 tip 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 measures the pollutant or diluent concentrations in the gas. The probe tip was equipped with a sintered stainless-steel filter or heated filter system for particulate removal. 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 was designed to maintain the gas temperature above 250°F to prevent condensation of stack gas moisture within the line.

To subtract methane from THC, the methane must be converted from methane as methane to methane as propane and then subtracted from the THC number. The methane response factor (RF) was determined each test by introducing a known methane concentration to the analyzer and dividing the methane channel response by the THC channel response. Dividing methane by the RF gives methane as propane and was then subtracted from the THC concentration.

A schematic of the USEPA Method 25A is provided in **Figures Section**.

Results were reported as THC and as Non-Methane Organic Compounds (NMOC).

4.3 Gas Dilution System

Calibration gases were mixed using an Environics 4040 Gas Dilution System. 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. The calibration is done yearly, and the records are included in the Source Testing Report. A multi-point EPA Method 205 check was executed in the field prior to testing to ensure accurate gas-mixtures.

The gas dilution system consists of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within $\pm 2\%$ of predicted values. The gas divider is capable of diluting gases at set increments and were evaluated for accuracy in the field in accordance with US EPA Method 205 "Verification of Gas Dilution Systems for Field Instrument Calibrations". The gas divider dilutions were measured to evaluate that the responses are within $\pm 2\%$ of predicted values. In addition, a certified mid-level calibration gas within $\pm 10\%$ of one of the tested dilution gases was introduced into an analyzer to ensure the response of the gas calibration is within $\pm 2\%$ of gas divider dilution concentration

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5.2 Discussion of Results

The detailed results can be found in the following Graphs and Appendices:

- **Graphs 1 to 3 – Summary of VOC Results**
- **Appendix B – Summary of VOC Results**

5.3 Variations in Testing Procedures

There were no sampling variations.

5.4 Process Upset Conditions During Testing

There were normal process breaks during production.

5.5 Maintenance Performed in Last Three Months

The ELPO RTO underwent RTO block replacement and addition of saddles in April 2022. In the last three months, the site inspected the ELPO RTO gas train, gas train sealant, and the damper bearing. The site also lubricated the bearings and cleaned the air filters.

5.6 Re-Test

This was not a retest.

5.7 Audit Samples

This test did not require any audit samples.

5.8 Flows and Moisture

Flow and moisture determination results can be found in **Appendix C**.

5.9 Calibration Data

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

5.10 Process Data

Process data can be found in **Appendix A**.

TABLES



Table 1: Destruction Efficiency Results

Source: GM Lansing Delta - ELPO RTO

RWDI Project # 2206398

Test ID	Date	Start	End	TO Combustion Chamber Temperature (°F)	ELPO Vehicle Counts	Inlet THC (lb/hr) (as propane)	Inlet CH4 (lb/hr) (as propane)	Inlet NMOC ^[2] (lb/hr) (as Propane)	Outlet THC ^[1] (lb/hr) (as Propane)	Outlet Methane (lb/hr) (as Propane)	Outlet NMOC ^[2] (lb/hr) (as Propane)	Destruction Efficiency (THC)	Destruction Efficiency (NMOC)
1	9/28/2022	12:05	13:04	1558	37	23.0	1.54	21.5	1.02	0.023	0.99	95.6%	95.4%
2	9/28/2022	13:35	14:34	1559	39	27.4	1.47	25.9	1.02	0.022	1.00	96.3%	96.1%
3	9/28/2022	15:00	15:59	1559	40	25.2	1.55	23.6	0.92	0.021	0.90	96.3%	96.2%
Average				1559	39	25.2	1.52	23.7	0.99	0.022	0.97	96.1%	95.9%

Notes

[1] Total Hydrocarbons

[2] Non-Methane Organic Compounds

Concentrations and destruction efficiency calculated using dry results

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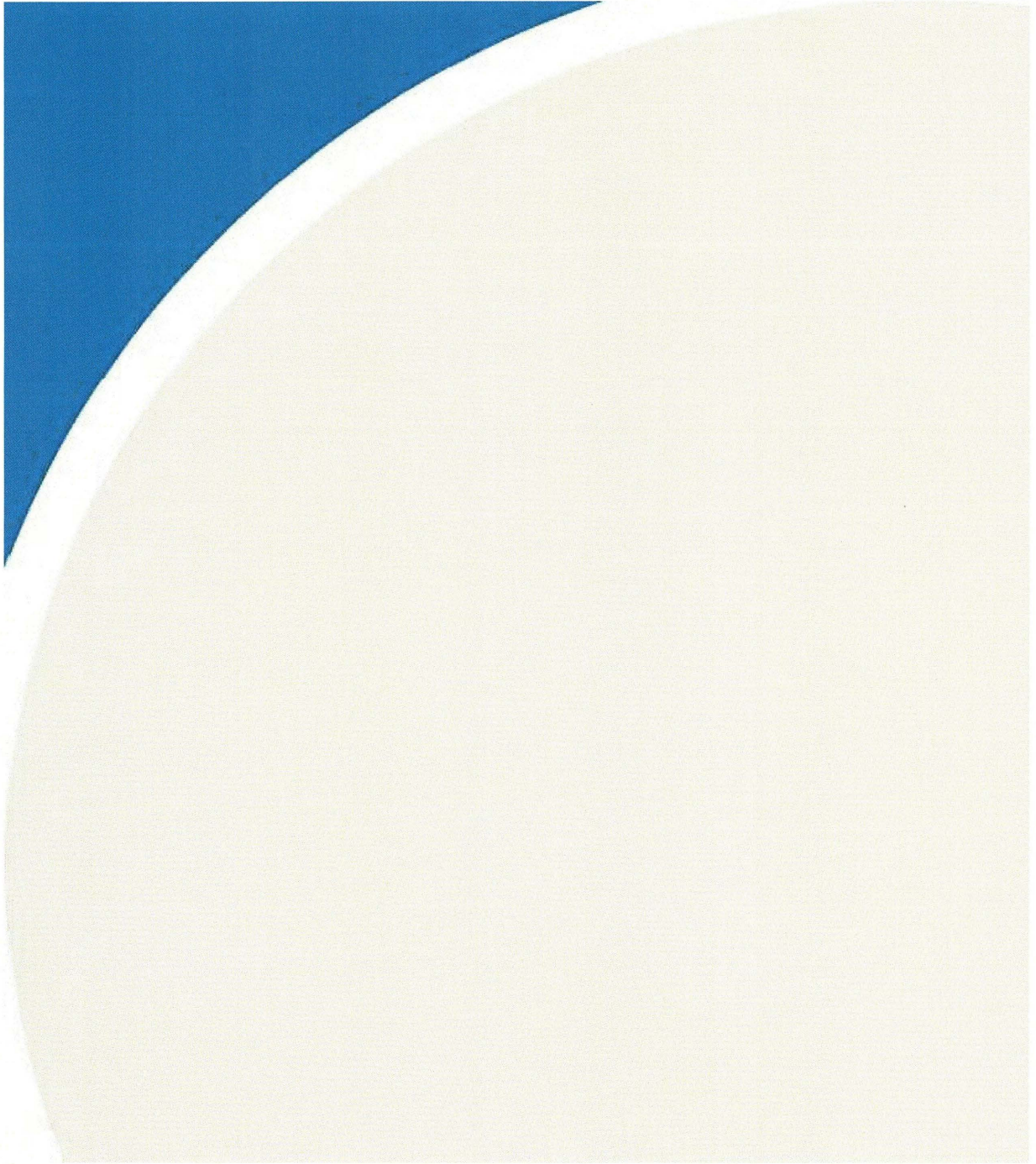
Table 2: THC/NMOC EMISSIONS TABLE

Source: GM Lansing Delta - ELPO RTO
 RWDI Project #2206398

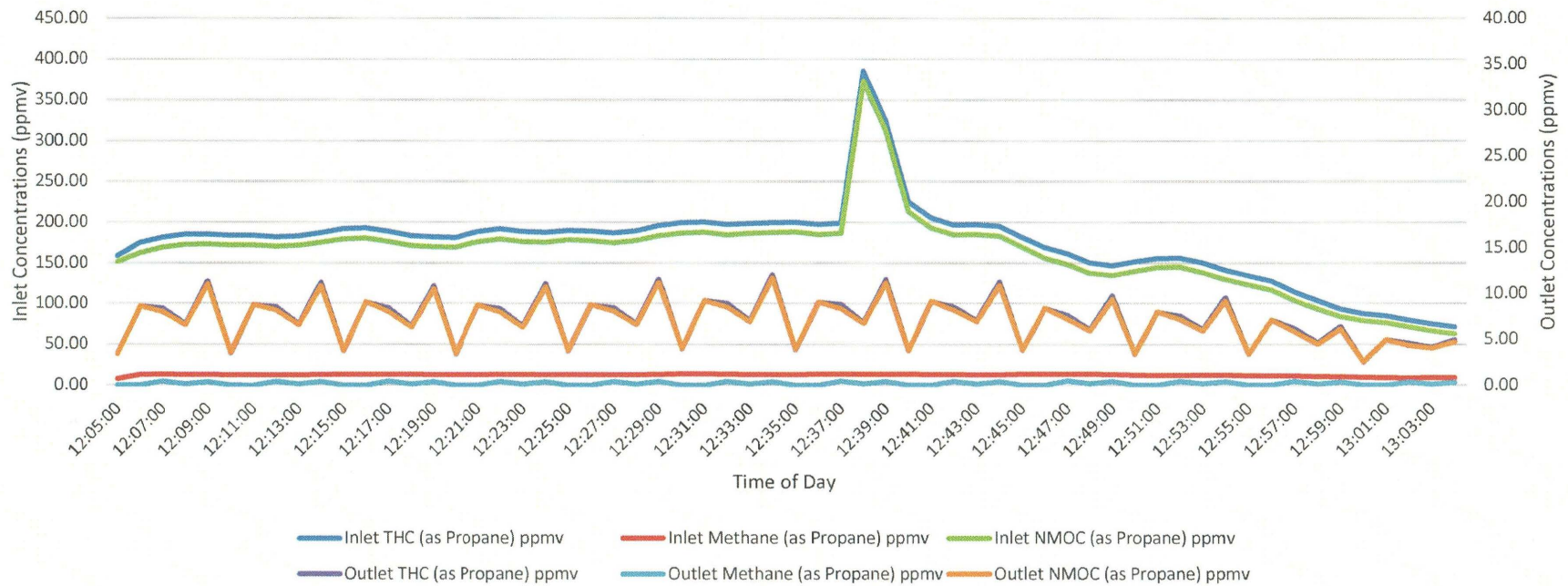
Parameter	1	2	3	Average
Date	28-Sep-22	28-Sep-22	28-Sep-22	--
Start Time:	12:05	13:35	15:00	--
Stop Time:	13:04	14:34	15:59	--
Duration (mins):	60	60	60	--
Average Production Number (ELPO):	37	39	40	39
Average Temperature for RTO (°F):	1558	1559	1559	1559
Inlet Flow Rate (dscfm):	18,150	17,857	17,878	17,962
Inlet Flow Rate (dm ³ /s):	8.57	8.43	8.44	8.48
Moisture:	0.055	0.044	0.050	0.050
Inlet THC Concentration (as propane) (ppm _w):	174.65	213.46	194.88	194.33
Inlet THC Concentration (as propane) (ppm _d):	184.82	223.28	205.05	204.38
Inlet THC Concentration (as propane) (mg/m ³ _d):	338.76	409.26	375.83	374.62
Inlet THC Concentration (as propane) (lb/hr _d):	23.03	27.36	25.16	25.18
Inlet Methane Correction Factor	2.32	2.35	2.32	2.33
Inlet Methane Concentration (as methane) (ppm _w):	27.12	27.05	27.79	27.32
Inlet Methane Concentration (as methane) (ppm _d):	28.70	28.29	29.24	28.74
Inlet Methane Concentration (as propane) (ppm _w):	11.69	11.50	11.97	11.72
Inlet Methane Concentration (as propane) (ppm _d):	12.37	12.03	12.60	12.33
Inlet Methane Concentration (as propane) (mg/m ³):	22.66	22.06	23.09	22.60
Inlet Methane Concentration (as propane) (lb/hr):	1.54	1.47	1.55	1.52
Inlet NMOC Concentration (as propane) (ppmv):	172.45	211.25	192.45	192.05
Inlet NMOC Concentration (as propane) (lbs/hr):	21.49	25.89	23.61	23.66
Outlet Flow Rate (dscfm):	19,854	19,552	19,564	19,657
Outlet Flow Rate (dm ³ /s):	9.37	9.23	9.23	9.28
Moisture:	0.042	0.054	0.050	0.049
Outlet THC Concentration (as propane) (ppm _w):	7.15	7.22	6.53	6.97
Outlet THC Concentration (as propane) (ppm _d):	7.47	7.64	6.88	7.33
Outlet THC Concentration (as propane) (mg/m ³ _d):	13.69	14.00	12.61	13.43
Outlet THC Concentration (as propane) (lb/hr _d):	1.02	1.02	0.92	0.99
Outlet Methane Correction Factor	2.50	2.49	2.51	2.50
Outlet Methane Concentration (as methane) (ppm _w):	0.40	0.39	0.38	0.39
Outlet Methane Concentration (as methane) (ppm _d):	0.42	0.41	0.40	0.41
Outlet Methane Concentration (as propane) (ppm _w):	0.16	0.16	0.15	0.16
Outlet Methane Concentration (as propane) (ppm _d):	0.17	0.16	0.16	0.16
Outlet Methane Concentration (as propane) (mg/m ³):	0.31	0.30	0.29	0.30
Outlet Methane Concentration (as propane) (lb/hr):	0.023	0.022	0.021	0.022
Outlet NMOC Concentration (as propane) (ppmv):	7.30	7.47	6.72	7.16
Outlet NMOC Concentration (as propane) (lbs/hr):	0.99	1.00	0.90	0.97
Destruction Efficiency (THC) (%):	95.6%	96.3%	96.3%	96.1%
Destruction Efficiency (NMOC) (%):	95.4%	96.1%	96.2%	95.9%

Note: "d" indicated based on dry conditions

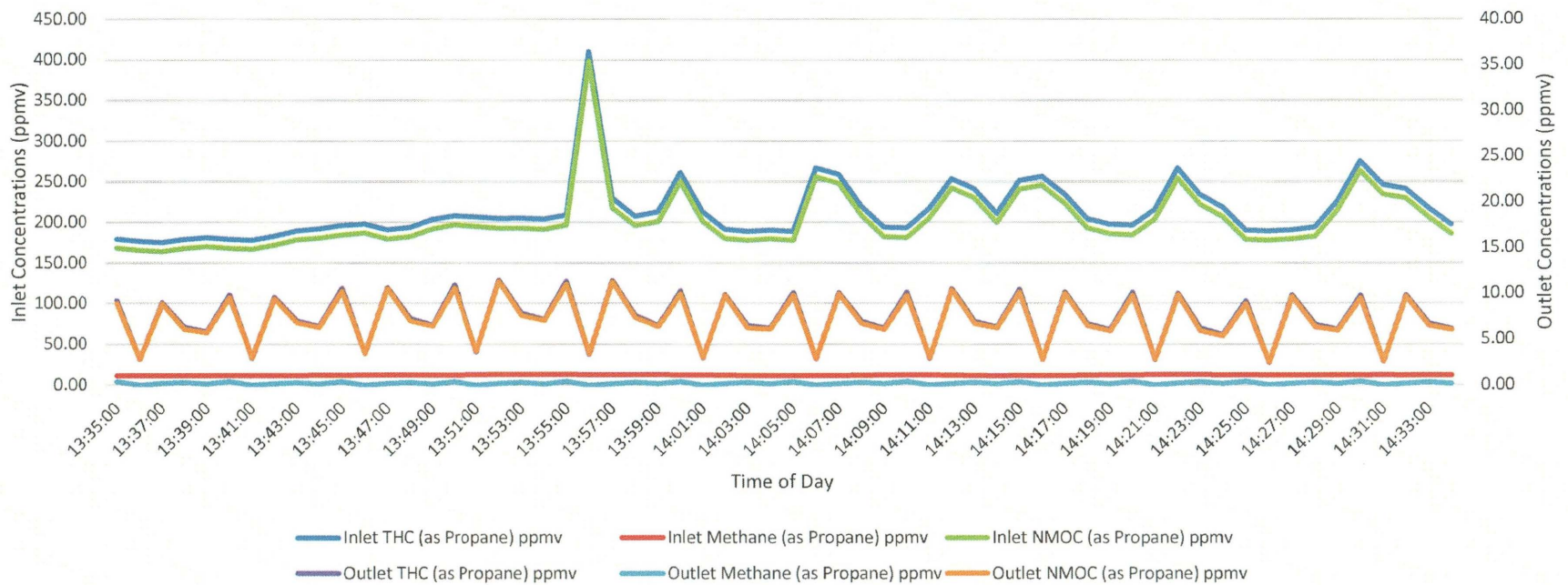
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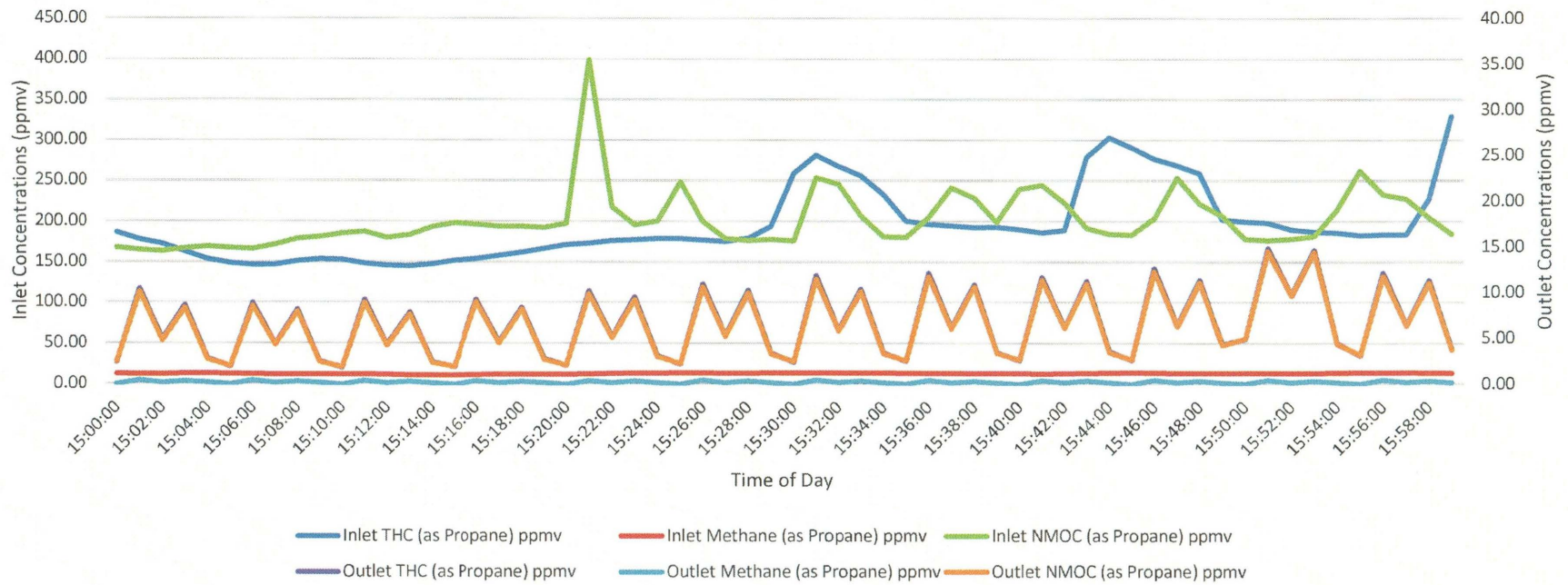
Graphs 1: ELPO RTOTest 1 - VOC Graphs



Graph 2: ELPO RTO Test 2 - VOC Graphs



Graph 3: ELPO RTO Test 3 - VOC Graphs





FIGURES



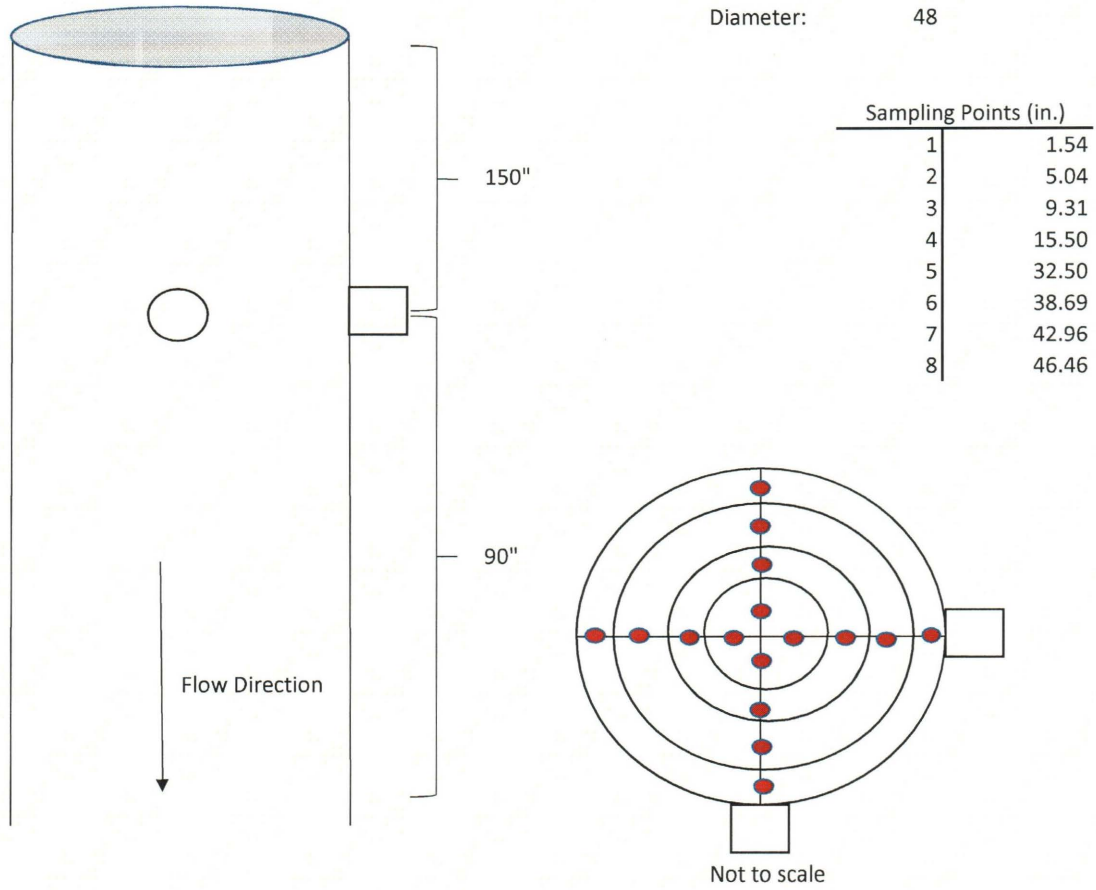
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Figure No. 1: ELPO Inlet



Source: ELPO Inlet
General Motors
GM Lansing Delta
Lansing, Michigan

Date:
28-Sep-22

RWDI USA LLC
2239 Star Court
Rochester Hills, MI 48309

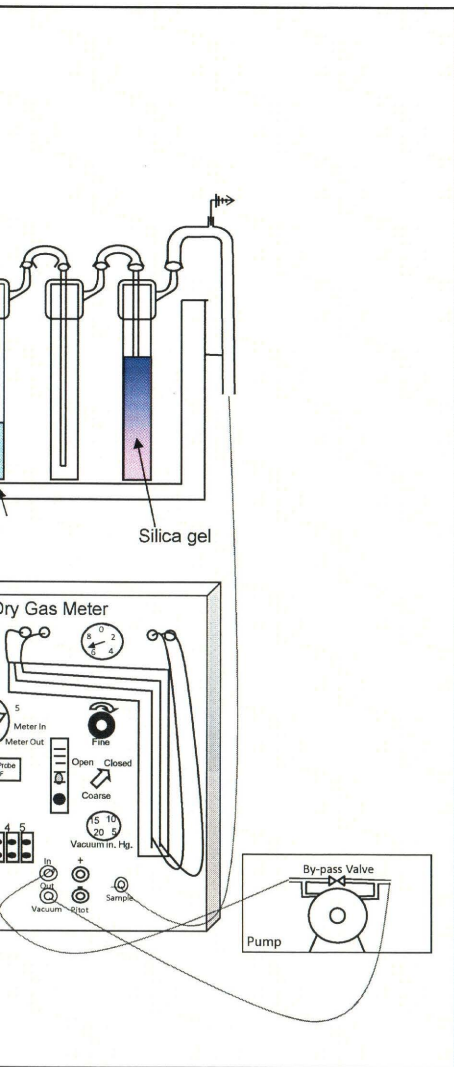
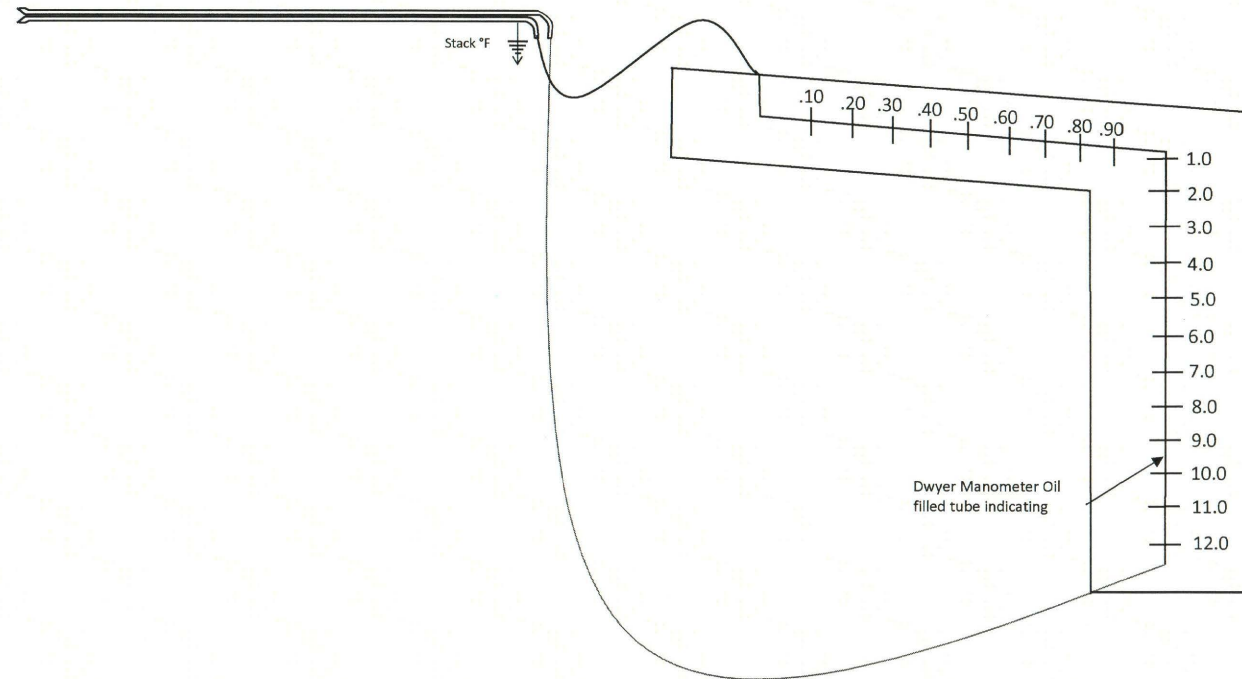


Figure No. 3



USEPA Method 2

GM
Lansing Delta Assembly Plant
ELPO RTO
Lansing, MI

Project #2206398

Date: September 28, 2022

