

FINAL REPORT



WESTSIDE GAS PRODUCERS, LLC

THREE RIVERS, MI

**SOURCE TESTING REPORT:
EUKRYOSOLPROCESS THERMAL OXIDIZER DESTRUCTION
EFFICIENCY**

RWDI #2400335

January 4, 2024

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI USA LLC (RWDI) was retained by Westside Gas Producers (LLC) to complete the source testing program at their facility in Three Rivers, Michigan. This source testing report includes compliance verification for the following:

- EUKRYOSOLPROCESS Thermal Oxidizer with the non-methane organic compounds (NMOC) destruction efficiency of 98% **or** the reduction of the NMOC concentration to less than 20 ppm by volume (dry basis as hexane at three percent oxygen) as outlined in Michigan EGLE MI-ROP-N1216-2023. Testing will be completed in accordance with 40 CFR Part 60, Appendix A.

The test program was completed on November 14th, 2023.

Executive Summary Table i: EUKRYOSOLPROCESS RTO Destruction Efficiency & Outlet Concentration

Test	NMOC Inlet (lb/hr) (as Carbon)	NMOC Outlet (lb/hr) (as Carbon)	NMOC Concentration (as Hexane) ppmvd @ 3% O ₂	Destruction Efficiency (%) ^[1]	Permit Limit
1	2.37	0.04	2.90	98.49%	98% DE or 20 ppmvd as Hexane @ 3% O ₂
2	2.31	<0.0004	0.04	99.98%	
3	2.69	<0.0005	<0.04	>99.98%	
Average	2.46	<0.0122	<0.99	>99.48%	

Notes:

[1] Destruction efficiency was calculated based on total non-methane concentrations (NMOC)

NMOC – Non-methane organic compound

ppmvd – parts per million by volume, dry basis

"<" – resultant NMOC was negative and therefore 0.1 ppmvd was used as a detection limit

Executive Summary Table ii: EUKRYOSOLPROCESS RTO Residence Time

	Test 1	Test 2	Test 3	Average	Permit Limit
Residence Time	3.58 seconds	3.78 seconds	3.66 seconds	3.67 seconds	0.5 seconds

Based on the results, the EUKRYOSOLPROCESS TO was able to comply with the destruction efficiency (DE) of 98% and the reduction of the NMOC concentration to less than 20 ppm by volume (dry basis as hexane at three percent oxygen) as outlined in Michigan EGLE MI-ROP-N1216-2023.



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1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by Westside Gas Producers (LLC) to complete the source testing program at their facility in Three Rivers, Michigan. This source testing report includes compliance verification for the following:

- EUKRYOSOLPROCESS Thermal Oxidizer (TO) with the non-methane organic compounds (NMOC) destruction efficiency of 98% **or** the reduction of the NMOC concentration to less than 20 ppm by volume (dry basis as hexane at three percent oxygen) as outlined in Michigan EGLE MI-ROP-N1216-2023. Testing will be completed in accordance with 40 CFR Part 60, Appendix A.

Three 1-hour tests were completed concurrently at the inlet and outlet of the EUKRYOSOLPROCESS TO in order to determine the destruction efficiency of the unit or outlet concentration. The sampling was conducted on November 14th, 2023.

1.1 Location and Dates of Testing

The test program was completed on November 14th, 2023 at the site in Three Rivers, Michigan.

1.2 Personnel Involved in Testing

Table 1.2.1: Testing Personnel

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<p>Steve Smith Project Manager Steve.Smith@rwdi.com</p>	<p>RWDI USA LLC 2239 Star Court Rochester Hills, MI 48309</p>	<p>(734) 751-9701</p>
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<p>Mike Nummer Senior Field Technician Mike.Nummer@rwdi.com</p>		<p>(248) 841-8442</p>
<p>Cade Smith Field Technician Cade.Smith@rwdi.com</p>		



2 SOURCE DESCRIPTION

2.1 Description of Source and Emission Controls

EUKRYOSOLPROCESS consists of the following processing equipment: flash separators, flash tanks, absorber column, and a 5 MM/btu per hour thermal oxidizer controlling atmospheric vents. The EUKRYOSOLPROCESS treats landfill gas before its subsequent use for sale and would meet the definition of a treatment system in that it removes particulate to at least the 10 micron level, compresses the landfill gas, and removes enough moisture for subsequent use.

2.2 Operating Data

During the emissions test, the process was operated at maximum normal production. EUKRYOSOLPROCESS was operated according to standard procedure and at the standard settings. During each test run the following information was recorded:

- Combustion temperature; and
- Retention time.

All process data can be found in **Appendix A**:

2.3 Applicable Permit Number

The testing was required per Michigan EGLE Renewable Operating Permit (ROP) MI-ROP-N1216-2023.

2.4 Process Flow Sheet or Diagram

Stack figures with dimensions, upstream and downstream distances, and point selection can be found in the **Figures** section. A process diagram can be made available upon request.

2.5 Type and Quantity of Raw and Finished Materials

Raw materials landfill gas.

2.6 Rated Capacity and Efficiency

The facility was operating under normal operating conditions during the testing periods.



2.7 Process Instrumentation Monitored During the Test

There are no instruments monitoring the process.

2.8 Maintenance on Equipment in Last Three Months

Only routine maintenance per the Preventative Maintenance Plan has been conducted.

3 SAMPLE LOCATION

3.1 Sampling Locations Overview

The following table summarizes the sampling locations.

Table 3.1.1: Summary of the Stack Characteristics

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test
TO Unit Inlet	Flow Rate, Moisture, O ₂ , CO ₂ , NMOC	12"	Upstream 4.4 dia Downstream 5.5 dia	2	8 Flow 1 Moisture 1 Gaseous	16
TO Unit Outlet	Flow Rate, Moisture, O ₂ , CO ₂ , NMOC	14"	Upstream 11 dia. Downstream 18 dia.	2	6 Flow 1 Moisture 1 Gaseous	12

4 EMISSION LIMITS

Table 4.1: Summary of Emission Limits for EUKRYOSOLPROCESS Thermal Oxidizer

Parameter	Permit Limits
	EUKRYOSOLPROCESS
NMOC DE	98% or 20 ppmvd NMOC as Hexane @ 3% O ₂
Residence Time	0.5 seconds



5.5 Verification of Gas Dilution Systems for Field Instrument Calibration (USEPA Method 205)

Calibration gas was 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 utilized 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 consisting 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 was 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 were introduced into an analyzer to ensure the response of the gas calibration is within $\pm 2\%$ of gas divider dilution concentration.

6 TEST RESULTS AND DISCUSSION

6.1 Detailed Results

Detailed results for NMOC determination and destruction efficiency are provided in **Appendices B and C**.

Table 6.1.1: EUKRYOSOLPROCESS RTO Destruction Efficiency

Test	NMOC Inlet (lb/hr) (as Carbon)	NMOC Outlet (lb/hr) (as Carbon)	NMOC Concentration (as Hexane) ppmvd @ 3% O ₂	Destruction Efficiency (%) ^[1]	Permit Limit
1	2.37	0.04	2.90	98.49%	98% DE or 20 ppmvd as Hexane @ 3% O ₂
2	2.31	<0.0004	0.04	99.98%	
3	2.69	<0.0005	<0.04	>99.98%	
Average	2.46	<0.0122	<0.99	>99.48%	

Notes:

[1] Destruction efficiency was calculated based on total non-methane concentrations (NMOC)

NMOC - Non-methane organic compound

ppmvd - parts per million by volume, dry basis

"<" - resultant NMOC was negative and therefore 0.1 ppmvd was used as a detection limit



Table 6.1.2: EUKRYOSOLPROCESS RTO Residence Time

	Test 1	Test 2	Test 3	Average	Permit Limit
Residence Time	3.58 seconds	3.78 seconds	3.66 seconds	3.67 seconds	0.5 seconds

6.2 Variations in Testing Procedures

There were no variations in planned testing procedures.

6.3 Process Upset Conditions During Testing

Westside Gas Producers, LLC representatives were monitoring the process during testing to ensure that the process was operating under normal conditions.

6.4 Audit Samples

This test did not require any audit samples.

6.5 Process Data

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

6.6 Continuous Monitoring Data, Flows and Moisture

Results can be found in **Appendices B and C**.

6.7 Field Data Sheets

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

6.8 Calibration Data

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

6.9 Laboratory Data

Laboratory data can be found in **Appendix E**.



6.10 Example Calculations

Example calculations can be found in **Appendix F**

6.11 Source Testing Plan and Approval Letter

A copy of the Source Testing Plan and Approval Letter from EGLE can be found in **Appendix G**.

7 CONCLUSIONS

Testing was successfully completed on November 14th, 2023. All parameters were tested in accordance with USEPA referenced methodologies as approved via the Source Testing Plan and were determined to be operating in compliance with the State of Michigan Renewable Operating Permit for EUKRYOSOLPROCESS Thermal Oxidizer.

TABLES





Table 1: Summary of Sampling Parameters and Methodology EUKRYOSOLPROCESS Thermal Oxidizer

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
EUKRYOSOLPROCESS Thermal Oxidizer	3	Velocity, Temperature and Flow Rate	U.S. EPA [1] Methods 1, 2C, 3C and 4
	3	NMOCs	U.S. EPA [1] Method 25A Outlet and 25 Inlet
	3	Oxygen & Carbon Dioxide	U.S. EPA [1] Method 3C (Inlet) and 3A (Outlet)

Notes:

[1] U.S. EPA - United States Environmental Protection Agency



Table 2: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time
EUKRYOSOLPROCESS Thermal Oxidizer			
Test #1	14-Nov-23	8:35	9:34
Test #2	14-Nov-23	10:15	11:14
Test #3	14-Nov-23	11:50	12:49



Table 3A: Sampling Summary - Flow Characteristics -EUKRYOSOLPROCESS Thermal Oxidizer Inlet

Stack Gas Parameter		Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		14-Nov-23	14-Nov-23	14-Nov-23	
Stack Temperature	°F	53	52	53	53
Moisture	%	1.0%	1.0%	1.1%	1.0%
Velocity	ft/s	32.38	32.41	34.96	33.25
Referenced Flow Rate	CFM	1,541	1,543	1,661	1,582

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen



Table 3B: Sampling Summary - Flow Characteristics - EUKRYOSOLPROCESS Thermal Oxidizer Outlet

Stack Gas Parameter		Test No. 1	Test No. 2	Test No. 3	Average
Testing Date		14-Nov-23	14-Nov-23	14-Nov-23	
Stack Temperature	°F	944	936	944	941
Moisture	%	7.9%	7.0%	4.9%	6.6%
Velocity	ft/s	114	108	112	111.38
Referenced Flow Rate	CFM	2,504	2,406	2,525	2,478

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen



Table 4: THC, Methane, and NMOC EMISSIONS TABLE

Source: DTE West Side

RWDI Project # 2400345

Parameter	Test 1	Test 2	Test 3	Average
Date	14-Nov-23	14-Nov-23	14-Nov-23	--
Start Time:	8:35	10:15	11:50	--
Stop Time:	9:34	11:14	12:49	--
Duration (mins):	60	60	60	--
Inlet RTO THC Concentration (as propane) (ppmw):	16064.5	14900.6	16967.5	15977.6
Inlet RTO THC Concentration (as propane) (ppmd):	16226.8	15055.7	17151.0	16144.5
Inlet RTO THC Concentration (as propane) (mg/m3d):	29742.4	27595.8	31436.5	29591.6
Inlet RTO THC Concentration (as propane) (lb/hrd):	171.5	159.3	195.3	175.4
Inlet RTO Methane Correction Factor	2.29	2.29	2.29	2.29
Inlet RTO CH4 Concentration (as methane) (ppmw):	32426.82	29307.81	50411.32	37381.99
Inlet RTO CH4 Concentration (as Methane) (ppmd):	32754.36	29612.83	50956.56	37774.58
Inlet RTO CH4 Concentration (as Propane) (ppmd):	1.07	12934.18	22256.61	11730.62
Inlet RTO CH4 Concentration (as propane) (mg/m3d):	1.96	23707.28	40794.54	21501.26
Inlet RTO CH4 Concentration (as propane) (lb/hrd):	0.01	136.87	253.47	130.12
Inlet RTO NMOC Concentration (as Carbon) (ppmd):	821.9	803.1	867.2	830.7
Inlet RTO NMOC Concentration (as Carbon) (mg/m3d):	410.3	400.9	432.9	414.7
Inlet RTO NMOC Concentration (as Carbon) (lb/hrd):	2.37	2.31	2.69	2.46
Inlet RTO Flow Rate (dscfm):	1,541	1,543	1,661	1,581
Inlet RTO Flow Rate (dm3/s):	0.73	0.73	0.78	0.75
Moisture:	1.0%	1.0%	1.1%	1.0%
Outlet Flow Rate (dscfm):	2,504	2,406	2,525	2,478
Moisture:	7.9%	7.0%	4.9%	6.6%
Outlet THC Concentration (as propane) (ppm _w):	47.06	44.14	34.83	42.01
Outlet THC Concentration (as propane) (ppm _d):	51.12	47.45	36.61	45.06
Outlet THC Concentration (as Carbon) (ppm _d):	153.37	142.36	109.83	135.19
Outlet THC Concentration (as Carbon) (lb/hr _d):	0.72	0.64	0.52	0.62
Outlet Methane Correction Factor	2.29	2.19	2.14	2.21
Outlet CH4 Concentration (as Methane) (ppm _w):	120.81	114.89	121.59	119.10
Outlet CH4 Concentration (as Propane) (ppm _w):	52.77	52.39	56.73	53.96
Outlet CH4 Concentration (as Propane) (ppm _d):	48.58	48.73	53.97	50.43
Outlet CH4 Concentration (as Carbon) (ppm _d):	145.73	146.19	161.91	151.28
Outlet CH4 Concentration (as Carbon) (lb/hr _d):	0.68	0.66	0.76	0.70
Outlet NMOC Concentration (as Carbon) (ppm _d):	7.64	<0.10	<0.10	<2.61
Outlet NMOC Concentration (as Carbon) (lb/hr _d):	0.04	<0.0004	<0.0005	<0.0122
Destruction Efficiency (NMOC) (%):	98.49%	>99.98%	>99.98%	>99.48%
Outlet NMOC Concentration (as Hexane) (ppm _d) (actual O2):	1.27	0.02	<0.02	<0.44
Outlet NMOC Concentration (as Hexane) (ppm _d) (3% O2):	2.90	0.04	<0.04	<0.99
Outlet O2 (%):	13.04	13.00	13.09	13.04

Note: "d" indicated based on dry conditions



Table 5: RTO Residence Time Results

Westside RTO - Test 1

Oxidizer Temp	(°F)	1470
Oxidizer Flowrate @ Temp	(cfm)	10084
Oxidizer Flowrate	(ft ³ /s)	168.1
Total Volume of Air Path	(ft ³)	602.5
Residence Time	(s)	3.58

Westside RTO - Test 2

Oxidizer Temp	(°F)	1476
Oxidizer Flowrate @ Temp	(cfm)	9570
Oxidizer Flowrate	(ft ³ /s)	159.5
Total Volume of Air Path	(ft ³)	602.5
Residence Time	(s)	3.78

Westside RTO - Test 3

Oxidizer Temp	(°F)	1478
Oxidizer Flowrate @ Temp	(cfm)	9882
Oxidizer Flowrate	(ft ³ /s)	164.7
Total Volume of Air Path	(ft ³)	602.5
Residence Time	(s)	3.66



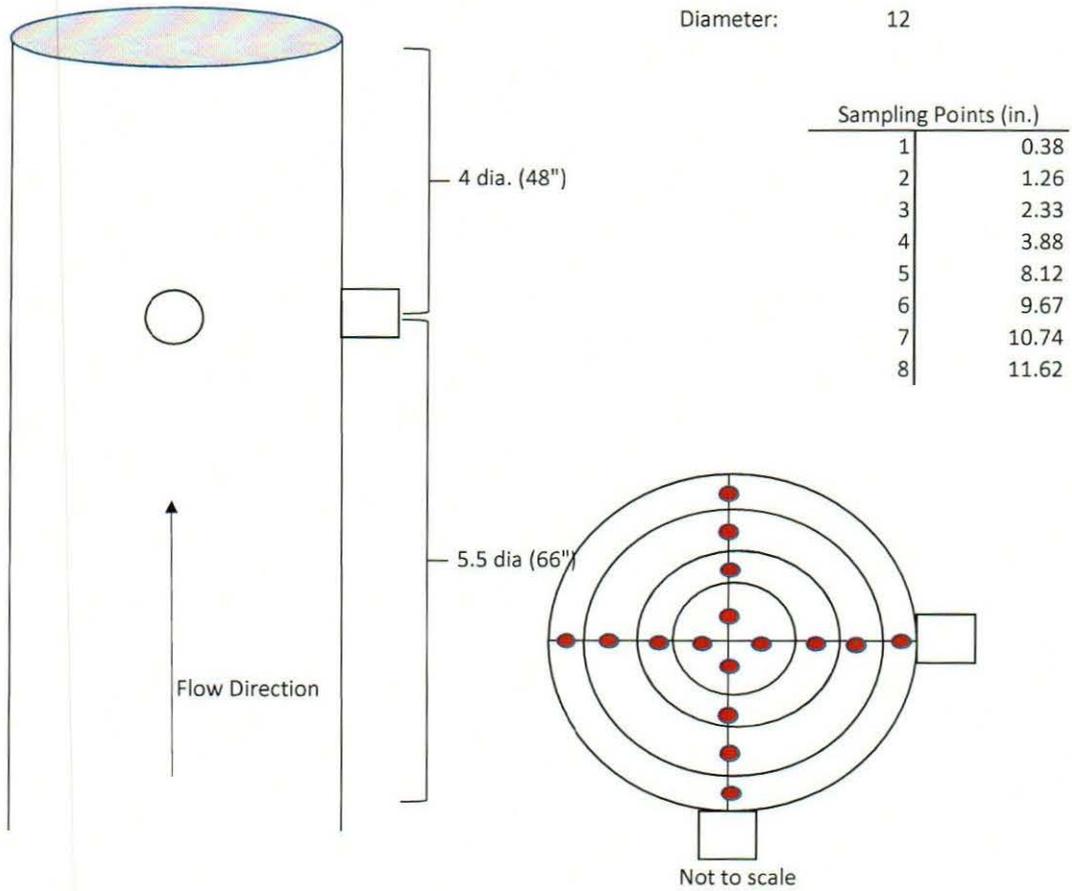
FIGURES







Figure No. 1 - EUKYROSOLPROCESS TO Inlet



EUKRYOSOLPROCESS Thermal Oxidizer Inlet
 Westside Gas Producers, LLC
 Three Rivers, Michigan
 City, State

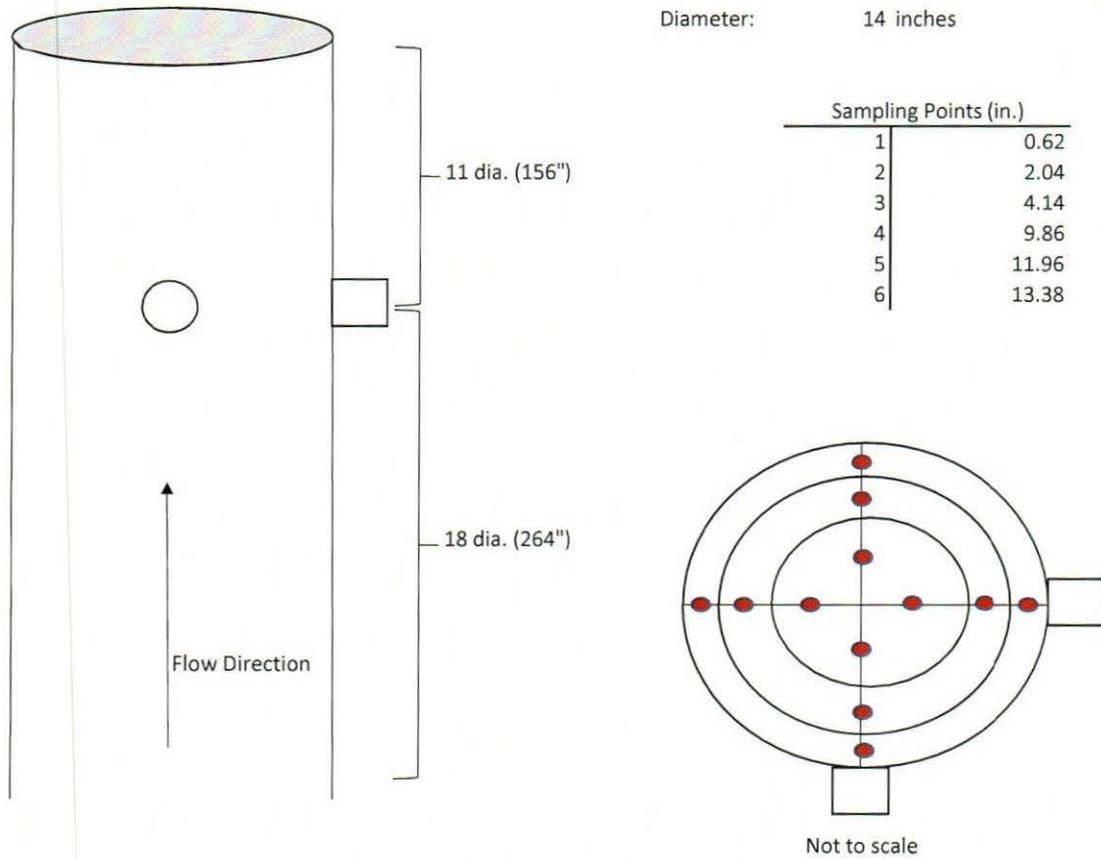
Date:
 November 14th, 2023

RWDI USA LLC
 2239 Star Court
 Rochester Hills, MI 48309





Figure No. 2 - EUKYROSOLPROCESS TO Outlet



EUKRYOSOLPROCESS Thermal Oxidizer Outlet
 Westside Gas Producers, LLC
 Three Rivers, Michigan
 City, State

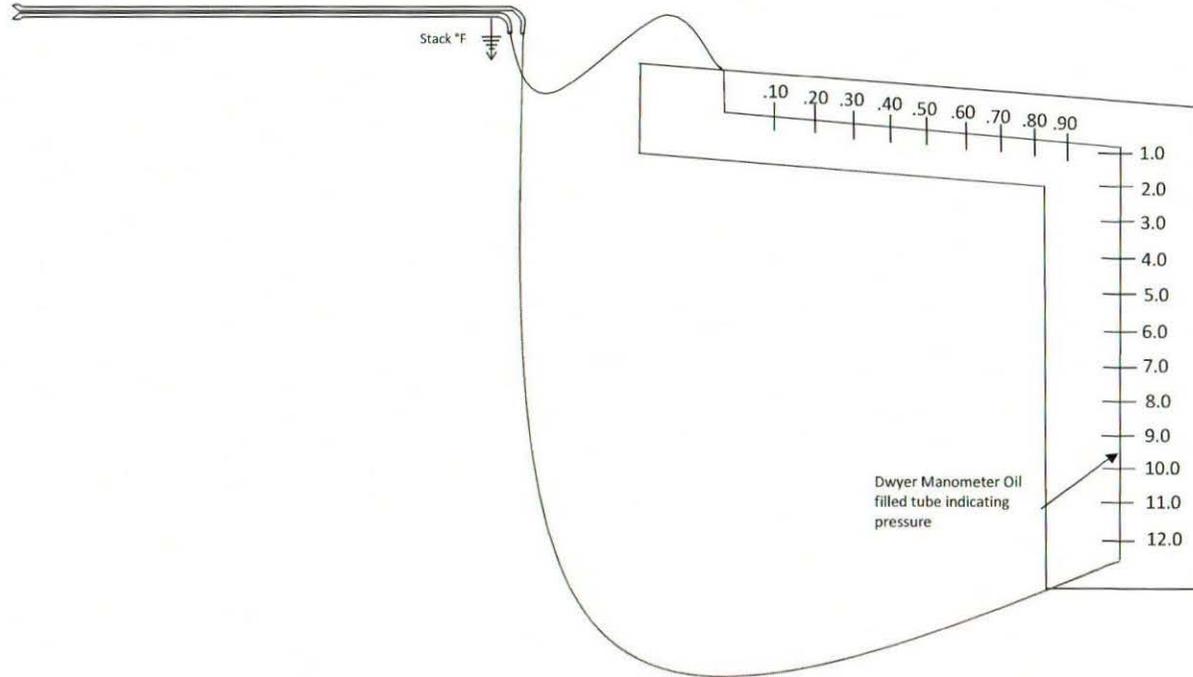
Date:
 November 14th, 2023

RWDI USA LLC
 2239 Star Court
 Rochester Hills, MI 48309





Figure 3: Schematic of USEPA Method 2



USEPA Method 2
Westside Gas Producers, LLC

TO Inlet and Outlet
Three Rivers, MI

Project #2400335

Figure No. 3: Schematic of USEPA Method 2

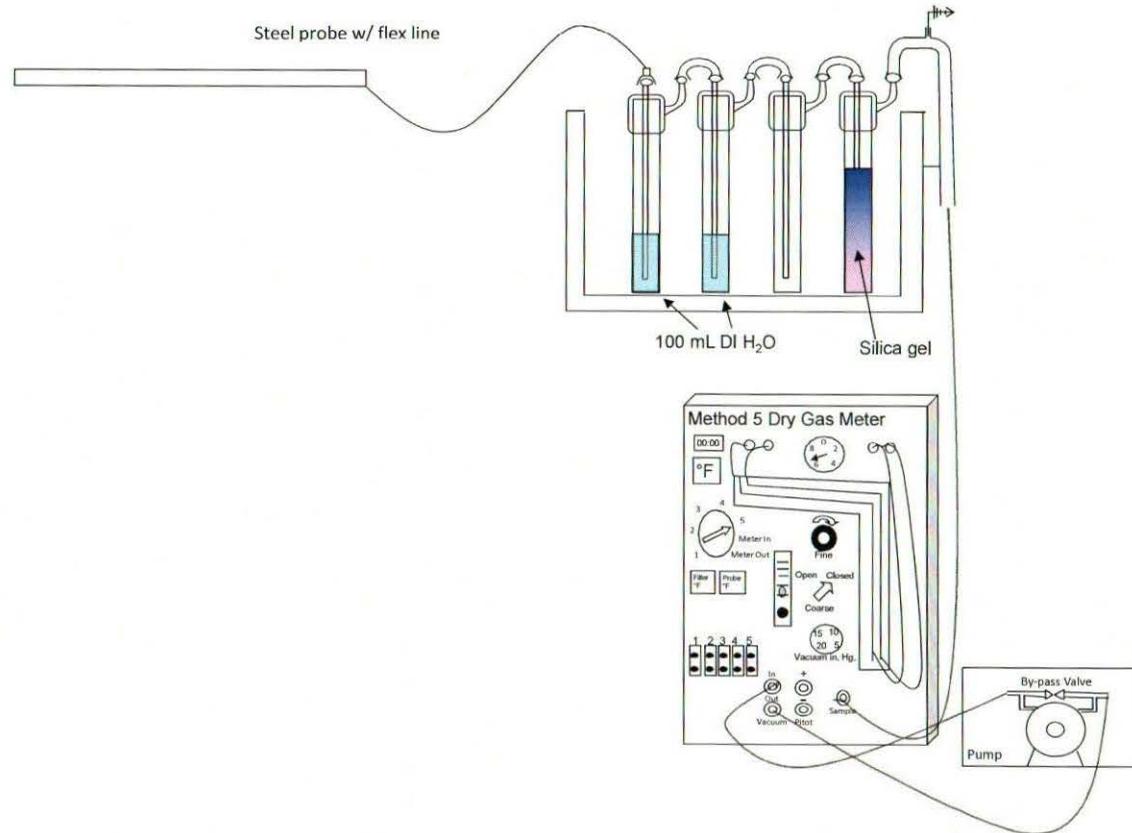
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Figure No. 4 Schematic of USEPA Method 4



USEPA Method 4
Westside Gas Producers, LLC

TO Inlet and Outlet
Three Rivers, MI.

Project 2400335

Figure 4: Schematic of USEPA Method 4

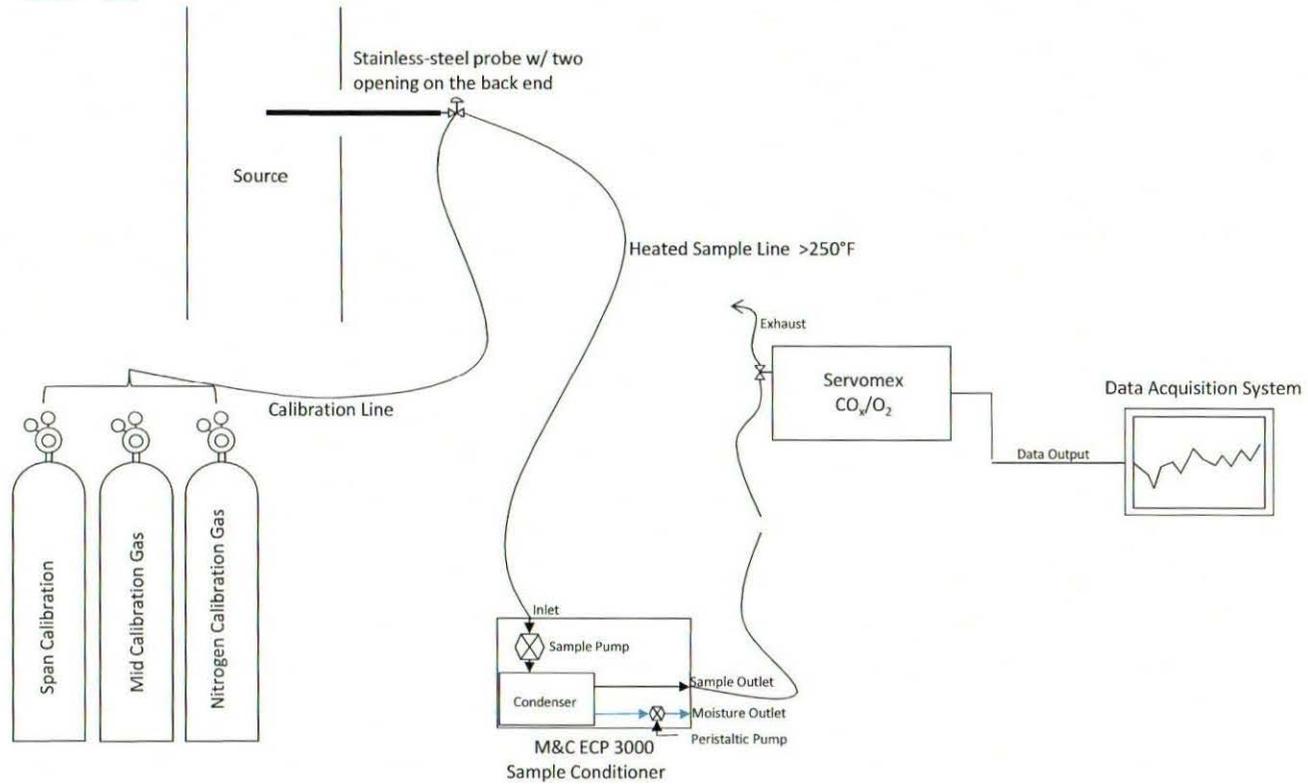
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Figure No. 5: USEPA Method 3A Schematic



USEPA Method 3A
Westside Gas Producers, LLC

Three Rivers, MI

Project# 2400335

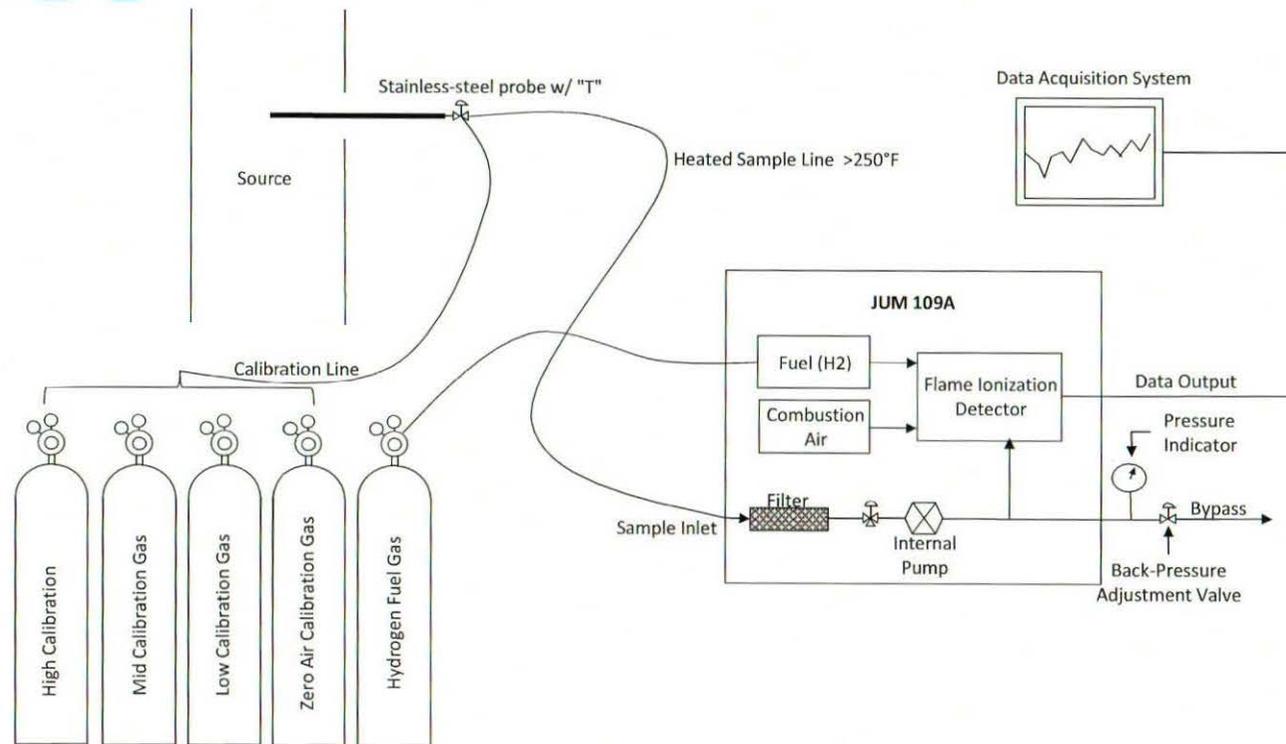
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Figure No. 6: USEPA Method 25A Schematic



USEPA Method 25A
Westside Gas Producers, LLC

Three Rivers, MI

Project# 2400335

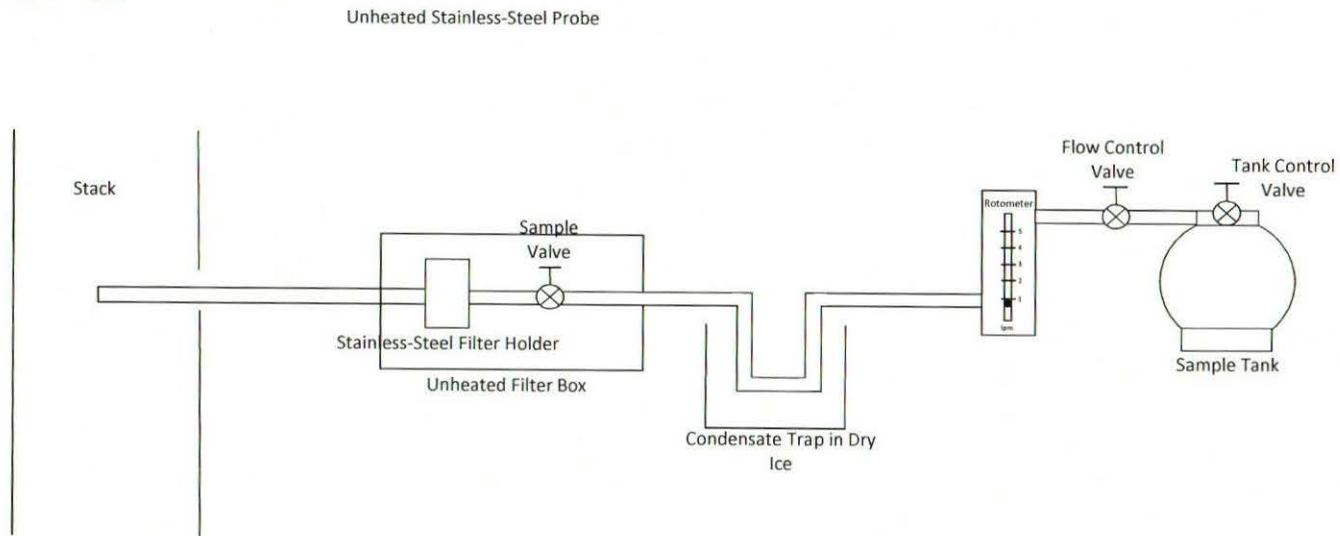
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Figure No. 7: USEPA Method 25



USEPA Method 25
Westside Gas Producers, LLC

TO Inlet
Three Rivers, MI

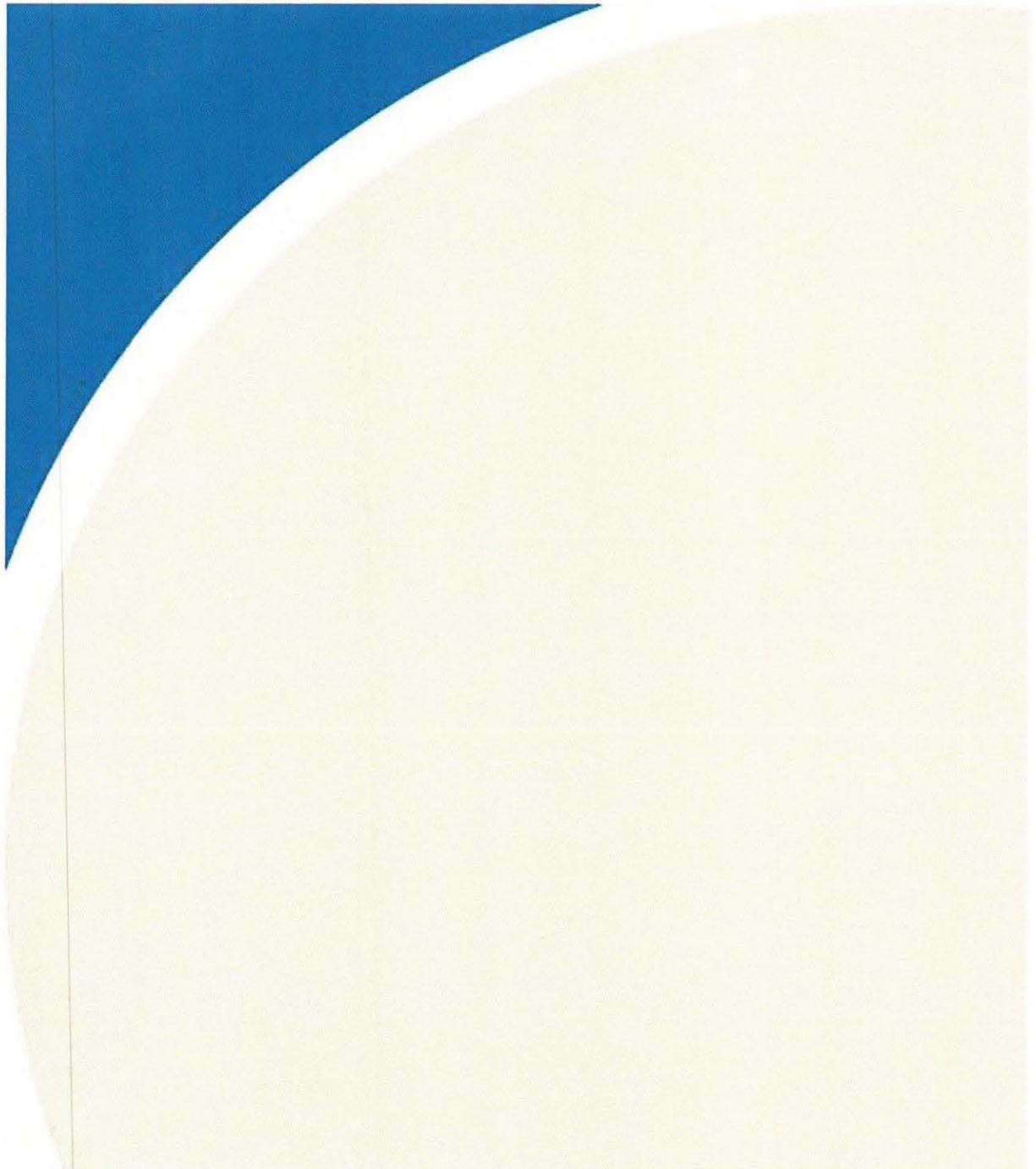
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Date: November 14, 2023



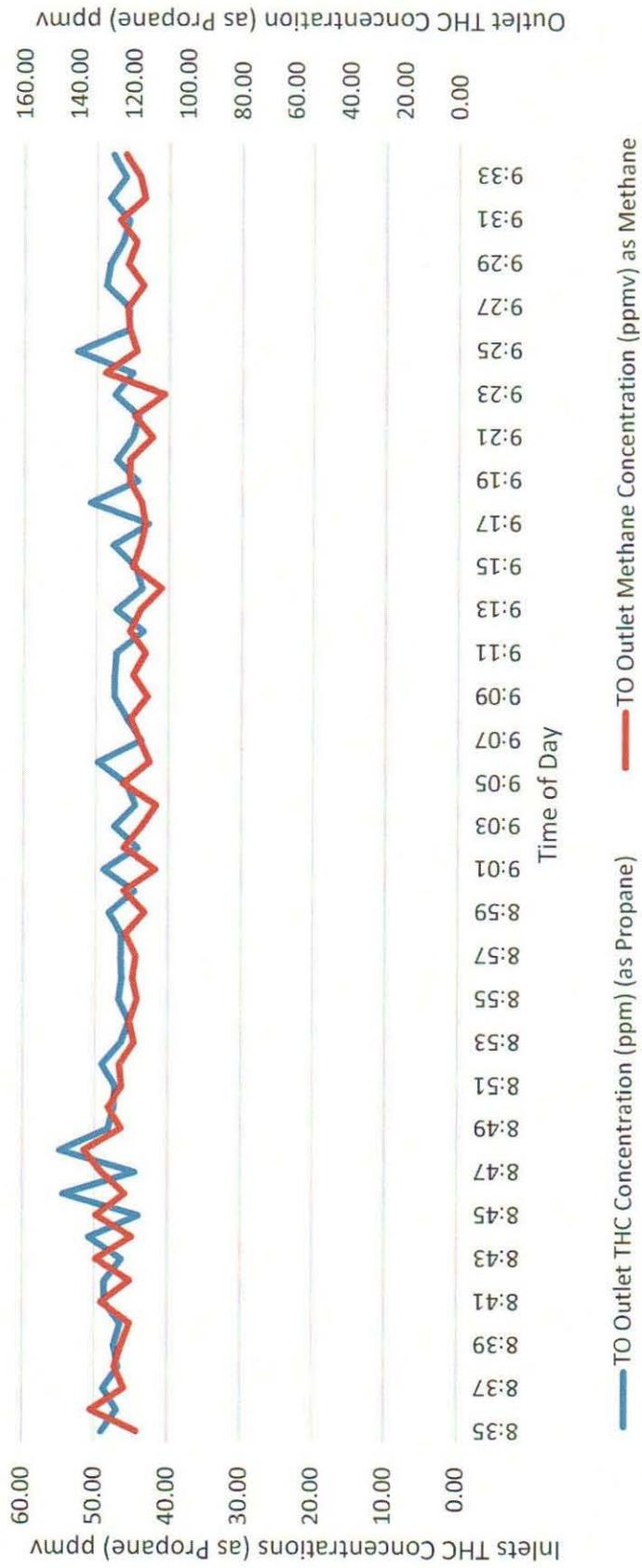


GRAPHS



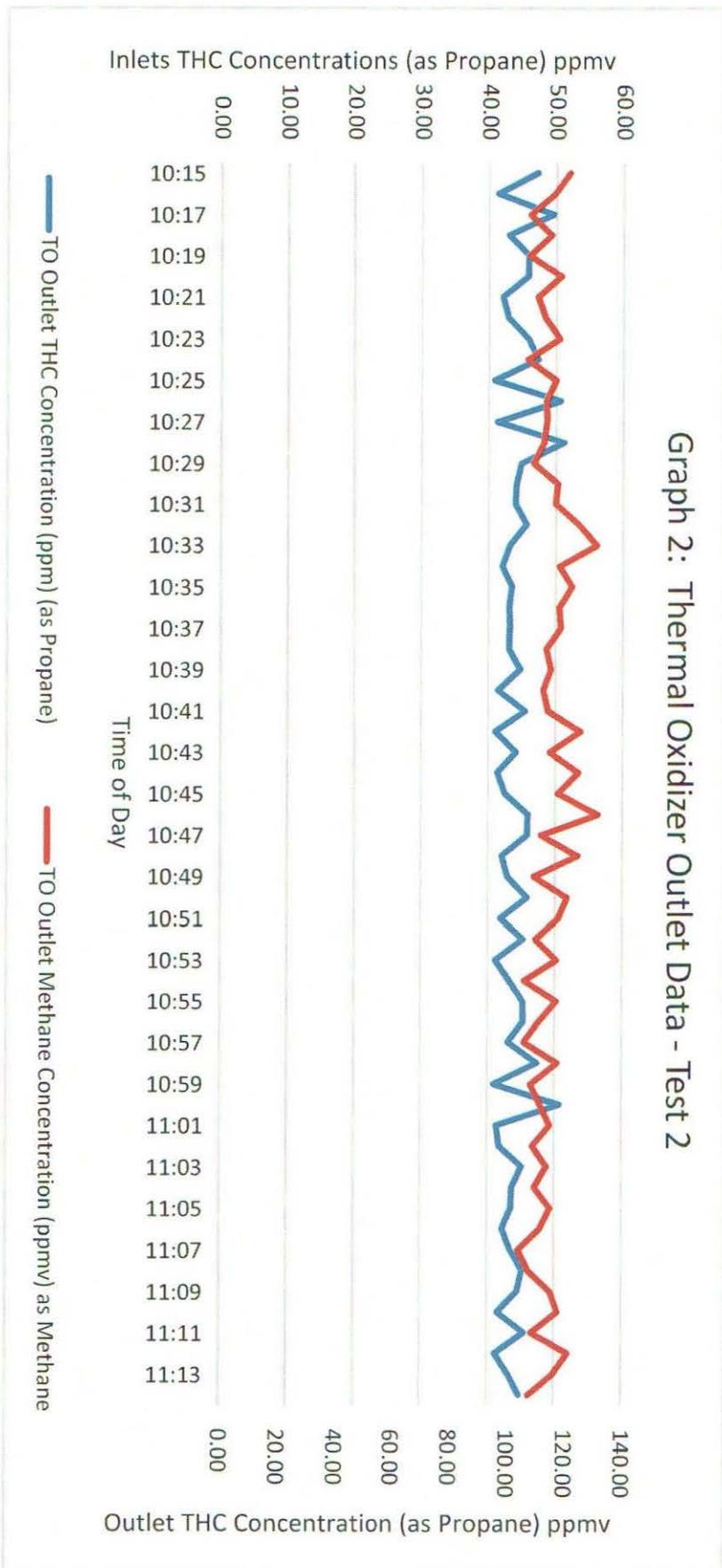


Graph 1: Thermal Oxidizer Outlet Data - Test 1





Graph 2: Thermal Oxidizer Outlet Data - Test 2





Graph 3: Thermal Oxidizer Outlet Data - Test 3

