1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

The Andersons Marathon Holdings LLC contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the FGOXID2 ~~Reverse~~ Thermal Oxidizer (FGOXID2 C-10A) stack at the Andersons Marathon Holdings LLC facility located in Albion, Michigan. The tests were conducted to satisfy the emissions testing requirements of the Title V Renewable Operating Permit No. MI-ROP-B8570-2015 issued by the Michigan Department of Environment, Great Lakes, and Energy (EGLE).

"Regenerative" ETD 2-13-23

The specific objectives were to:

- Verify the Total Particulate Matter (TPM) emissions of the FGOIXD2 C-10A
- Verify the Volatile Organic Compound (VOC) emissions of the FGOXID2 C-10A
- Verify the destruction removal efficiency (DRE) of the FGOXID2 C-10A
- Verify the emission rates of carbon monoxide (CO), oxides of nitrogen (NOx), sulfur dioxide (SO2) of the FGOXID2 C-10A
- Verify the emission rates of Acetaldehyde
- Conduct the test program with a focus on safety

Montrose performed the tests to measure the emission parameters listed in Table 1-1.

TABLE 1-1
SUMMARY OF TEST PROGRAM

Test Date(s)	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
12/9/2022	FGOXID2 C-10A	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	60
12/9/2022	FGOXID2 C-10A	O_2, CO_2	EPA 3	3	60
12/9/2022	FGOXID2 C-10A	Moisture	EPA 4	3	60
12/9/2022	FGOXID2 C-10A	Total $PM_{10}/PM_{2.5}$	EPA 5/202	3	60
12/9/2022	FGOXID2 C-10A	SO2	EPA 6C	3	60
12/9/2022	FGOXID2 C-10A	NOx	EPA 7E	3	60
12/9/2022	FGOXID2 C-10A	CO	EPA 10	3	60
12/9/2022	FGOXID2 C-10A	DRE	EPA 25A	3	60
12/9/2022	FGOXID2 C-10A	VOC	EPA 320	3	60
12/9/2022	FGOXID2 C-10A	Acetaldehyde	EPA 320	3	60

To simplify this report, a list of Units and Abbreviations is included in Appendix D.1. Throughout this report, chemical nomenclature, acronyms, and reporting units are not defined. Please refer to the list for specific details.

This report presents the test results and supporting data, descriptions of the testing procedures, descriptions of the facility and sampling locations, and a summary of the quality assurance procedures used by Montrose. The average emission test results are summarized and compared to their respective permit limits in Table 1-2. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The testing was conducted by the Montrose personnel listed in Table 1-3. The tests were conducted according to the test plan (MW024AS-018984-PP-517) dated September 8, 2022 that was submitted to EGLE.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
FGOXID2 C-10A
DECEMBER 12, 2022

Parameter/Units	Average Results	Emission Limits
Total $PM_{10}/PM_{2.5}$		
lb/hr*	3.55	5.01
SO_2		
lb/hr*	1.9	10.8
NOx		
lb/hr*	8.7	10.8
CO		
lb/hr*	6.0	9.1
DRE		
%	98	98
Total VOCs		
Lb/hr**	<4.5	4.5
Acetaldehyde		
Lb/hr**	0.27	0.33

* Total Particulate Matter was determined by the summation of all filterable and condensable particulate matter captured by the USEPA Method 5/202 Train.

** Total VOC by FTIR includes acetaldehyde, acetic acid, acrolein, ethanol, ethyl acetate, formaldehyde, formic acid, 2-furaldehyde, methanol. Methane was detected, but was not included as it is an exempt VOC.

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location: The Andersons Marathon Holdings LLC
26250 B Drive North
Albion, MI 49224
Contact: Evan Dankert
Role: EHS Senior Specialist
Company: The Andersons Marathon Holdings
Email: Evan_Dankert@andersonsinc.com

Agency Information

Regulatory Agency: EGLE

Testing Company Information

Testing Firm: Montrose Air Quality Services, LLC

Contact: John Nestor
Title: District Manager
Telephone: 248-765-5032
Email: jonestor@montrose-env.com

Laboratory Information

Laboratory: Montrose Detroit
City, State: Royal Oak, Michigan
Method: EPA Method 17

Laboratory: Montrose Elk Grove
City, State: Elk Grove, Illinois
Method: EPA Method 202

Test personnel and observers are summarized in Table 1-3.

TABLE 1-3
TEST PERSONNEL AND OBSERVERS

Name	Affiliation	Role/Responsibility
John Nestor	Montrose	Field Project Manager, QI
Roy Zimmer	Montrose	Field Technician
Clayton Deronne	Montrose	Field Technician
Evan Dankert	The Andersons, Inc.	Observer/Client Liaison/Test Coordinator

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The Andersons Marathon Holdings LLC operates an ethanol process that produces ethanol from grain product. This facility utilizes a thermal oxidizer to control volatile organic emissions from the distiller's grain drying process. During this process, the wet mash is passed through rotary dryers to remove any remaining moisture. The final product is known as dried distiller's grain and utilized primarily as livestock feed.

2.2 FLUE GAS SAMPLING LOCATION

Information regarding the sampling location is presented in Table 2-1.

TABLE 2-1
SAMPLING LOCATION

Sampling Location	Stack Inside Dimensions (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
FGOXID2 C-10A	84"	516 / 6.1	960 / 11.4	Isokinetic: 16 (8/port)

Sample location(s) were verified in the field to conform to EPA Method 1. Acceptable cyclonic flow conditions were confirmed prior to testing using EPA Method 1, Section 11.4. See Appendices A.1 and A.2 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests were performed while the source/units and air pollution control devices were operating at the conditions required by the permit. The unit were tested while operating at normal conditions.

Plant personnel were responsible for establishing the test conditions and collecting all applicable unit-operating data. The process data that was provided is presented in Appendix B.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 TEST METHODS

The test methods for this test program were presented previously in Table 1-1. Additional information regarding specific applications or modifications to standard procedures is presented below.

3.1.1 EPA Method 1, Sample and Velocity Traverses for Stationary Sources

EPA Method 1 is used to assure that representative measurements of volumetric flow rate are obtained by dividing the cross-section of the stack or duct into equal areas, and then locating a traverse point within each of the equal areas. Acceptable sample locations must be located at least two stack or duct equivalent diameters downstream from a flow disturbance and one-half equivalent diameter upstream from a flow disturbance.

The sample port and traverse point locations are detailed in Appendix A.

3.1.2 EPA Method 2, Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)

EPA Method 2 is used to measure the gas velocity using an S-type pitot tube connected to a pressure measurement device, and to measure the gas temperature using a calibrated thermocouple connected to a thermocouple indicator. Typically, Type S (Stausscheibe) pitot tubes conforming to the geometric specifications in the test method are used, along with an inclined manometer.

3.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is to measure the percent O_2 and CO_2 in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2 and percent O_2 using either an Orsat or a Fyrite analyzer.

3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

The typical sampling system is detailed in Figure 3-1.

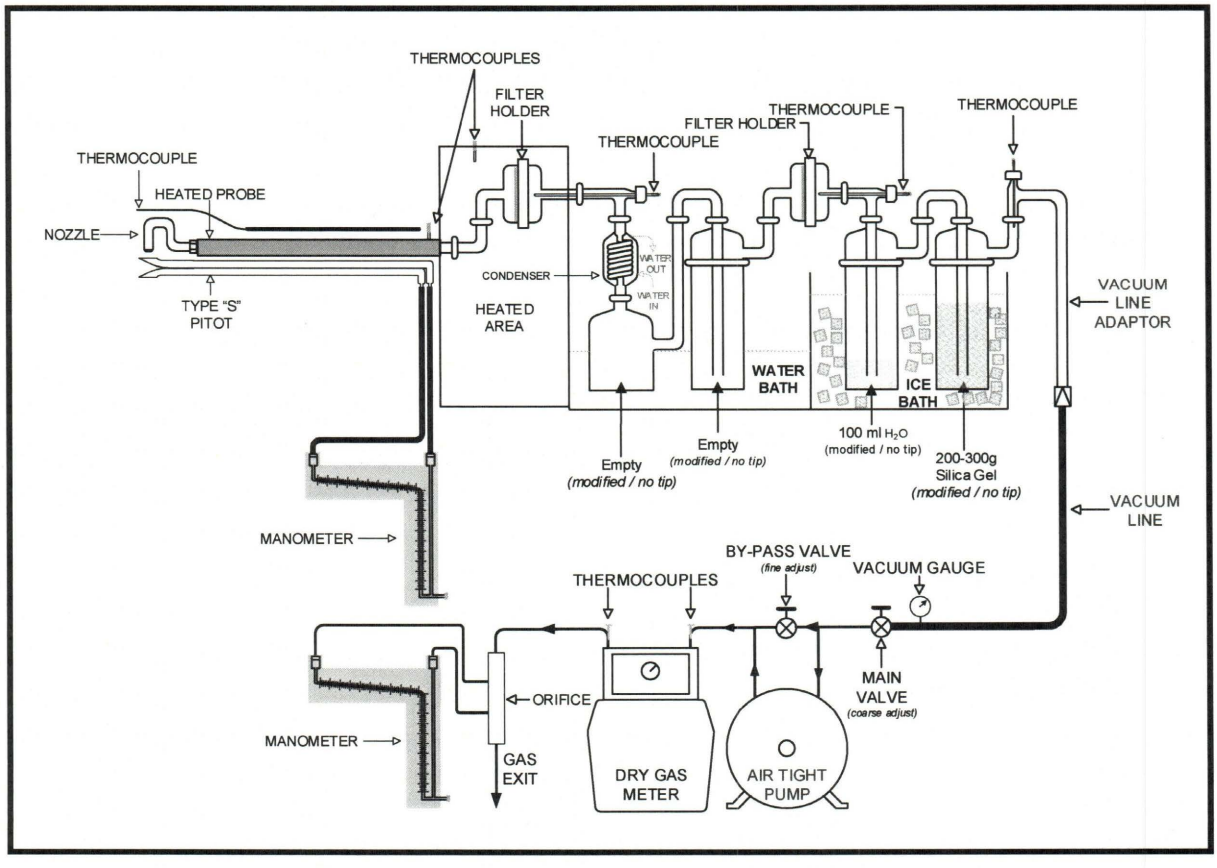
3.1.5 EPA Method 5/202, Determination of Total Particulate Matter Emissions from Stationary Sources

EPA Method 5/202 is a manual, isokinetic test method used to measure emissions of FPM and Condensable particulate matter (CPM). CPM and FPM are then summed together to determine a total PM emission rate less than 10 microns and 2.5 microns. Particulate matter is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at 248 ±25 °F. The CPM is collected in dry impingers after filterable PM has been collected on a filter

maintained as specified in either Method 5 of Appendix A-3 to 40 CFR 60, Method 17 of Appendix A-6 to 40 CFR 60, or Method 201A of Appendix M to 40 CFR 51. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter are then taken to dryness and weighed. The total of the impinger fractions and the CPM filter represents the CPM. Compared to the version of Method 202 that was promulgated on December 17, 1991, this method eliminates the use of water as the collection media in impingers and includes the addition of a condenser followed by a water dropout impinger immediately after the final instack or heated filter. This method also includes the addition of one modified Greenburg Smith impinger (backup impinger) and a CPM filter following the water dropout impinger. CPM is collected in the water dropout impinger, the modified Greenburg Smith impinger, and the CPM filter of the sampling train as described in this method. The impinger contents are purged with nitrogen immediately after sample collection to remove dissolved SO2 gases from the impinger The CPM filter is extracted with water and hexane. The impinger solution is then extracted with hexane. The organic and aqueous fractions are dried and the residues are weighed. The total of the aqueous and organic fractions represents the CPM. The potential artifacts from SO2 are reduced using a condenser and water dropout impinger to separate CPM from reactive gases. No water is added to the impingers prior to the start of sampling. To improve the collection efficiency of CPM, an additional filter (the "CPM filter") is placed between the second and third impingers.

The Typical Sampling System is detailed in Figure 3-1.

FIGURE 3-1
US EPA METHOD 5/202 SAMPLING TRAIN



3.1.6 EPA Method 6C, Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 6C is an instrumental test method used to continuously measure emissions of SO_2. Conditioned gas is sent to an analyzer to measure the concentration of SO_2. The performance requirements of the method must be met to validate the data.

The sampling system is detailed in Figure 3-2.

3.1.7 EPA Method 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2. Conditioned gas is sent to an analyzer to measure the concentration of NO_x. NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2. The performance requirements of the method must be met to validate the data.

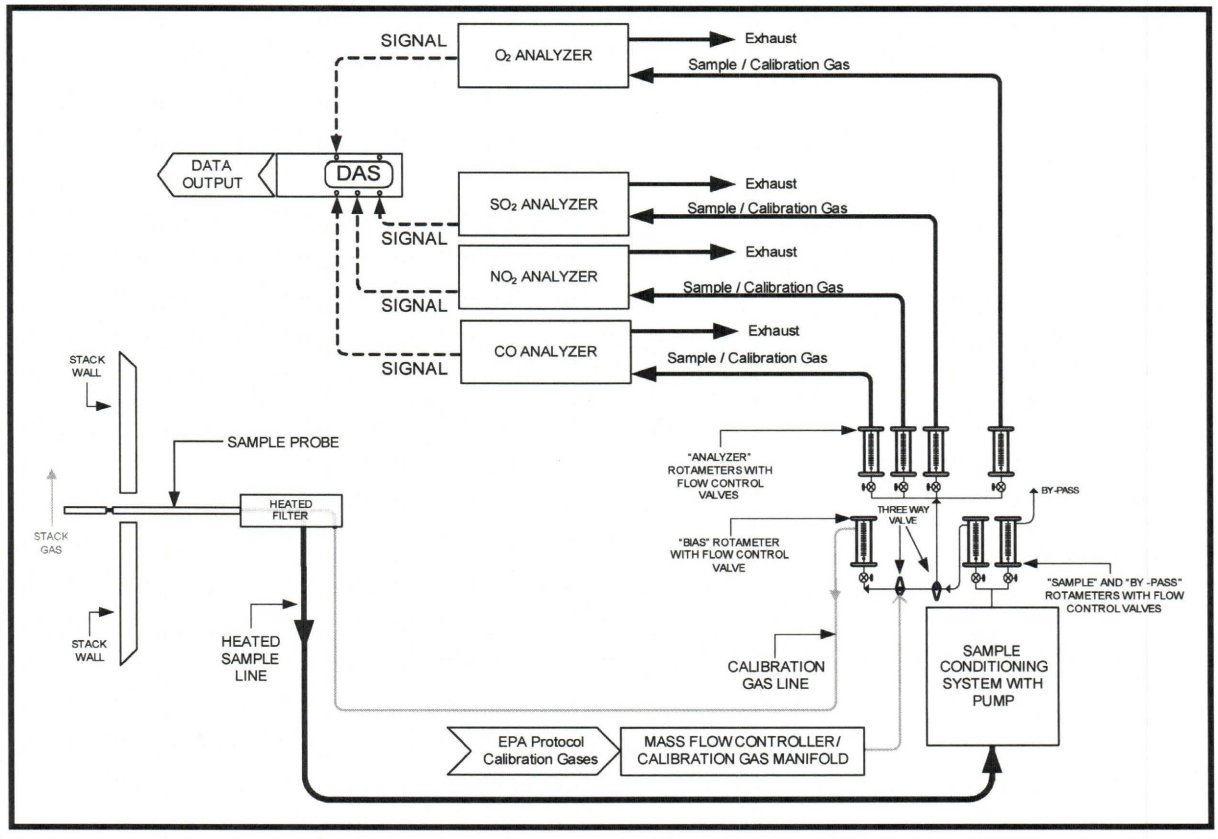
The sampling system is detailed in Figure 3-2.

3.1.8 EPA Method 10, Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 10 is an instrumental test method used to continuously measure emissions of CO. Conditioned gas is sent to an analyzer to measure the concentration of CO. The performance requirements of the method must be met to validate the data.

The sampling system is detailed in Figure 3-2.

FIGURE 3-2
EPA METHODS 3A (O_2), 6C, 7E, 10 SAMPLING TRAIN

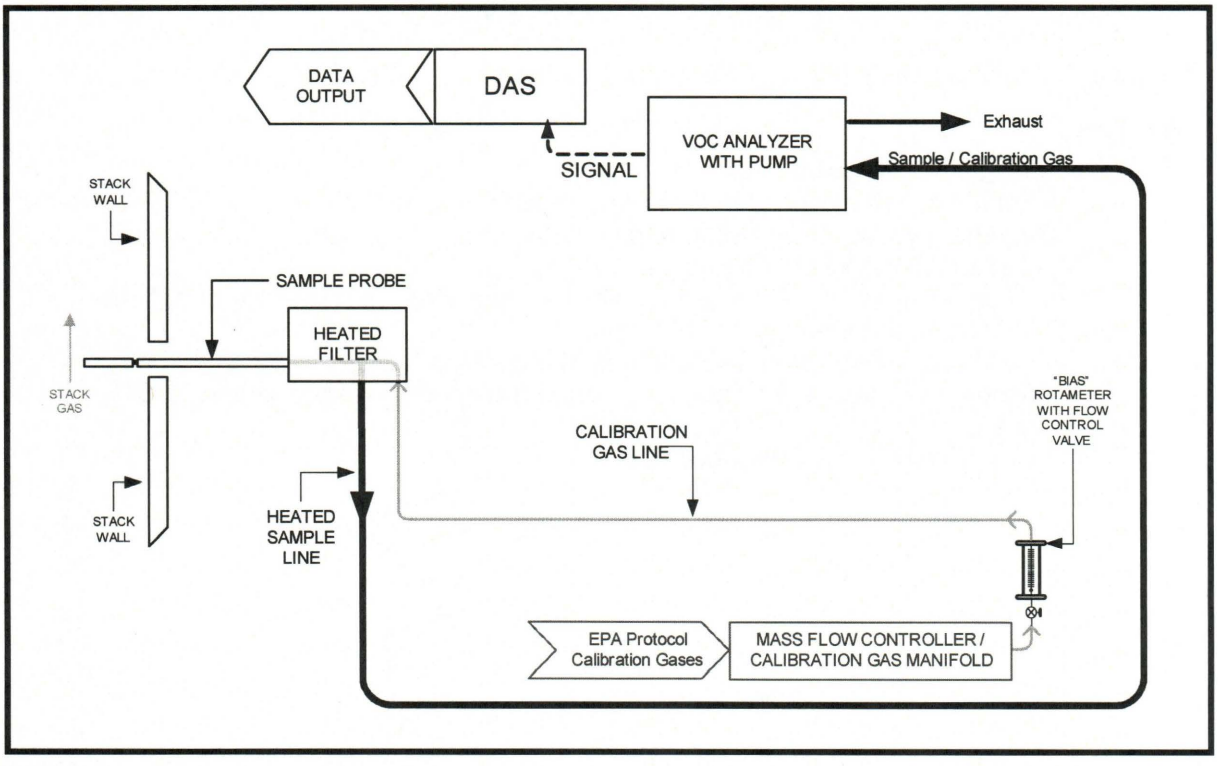


3.1.9 EPA Method 25A, Determination of Total Gaseous Organic Concentration Utilizing a Flame Ionization Detector

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to an FIA. Results are reported as volume concentration equivalents of the calibration gas or as carbon equivalents.

The typical sampling system is detailed in Figure 3-2.

Figure 3-2
EPA Method 25A Sampling Train



3.1.10 EPA Method 320, VOC and HAP Determination using FTIR Spectroscopy

Speciated VOC and HAP sampling was conducted using FTIR instrumentation following the principles of USEPA Method 320 and ASTM Method D6348-12.

An MKS Model MultiGas 2030 FTIR analyzer was used to measure the specific VOC and HAP compounds. The analyzer is composed of a mks 2030 FTIR spectrometer, a high optical throughput sampling cell, analysis software, and a quantitative spectral library. The analyzer collects high resolution spectra in the mid infrared spectral region (400 to 4,000 cm^{-1}), which are analyzed using the quantitative spectral library. This provides an accurate, highly sensitive measurement of gases and vapors.

As shown in Figure 3-3, the sample delivery system consisted of a stainless steel sampling probe, calibration tee assembly, Teflon sampling line, fast loop bypass pump, and sample manifold. The gas sample was continuously extracted from each source at approximately 6 liters per minute.

Independent calculations of optical path length were not performed because the instrument has a fixed path of 5.11 meters. A signal to noise ratio test (S/N) was performed using MKS software to verify instrument performance.

Performance parameters measured included signal to noise tests, noise equivalent absorbance (NEA), detector linearity, background spectra, potential interferents, and cell and system leakage.

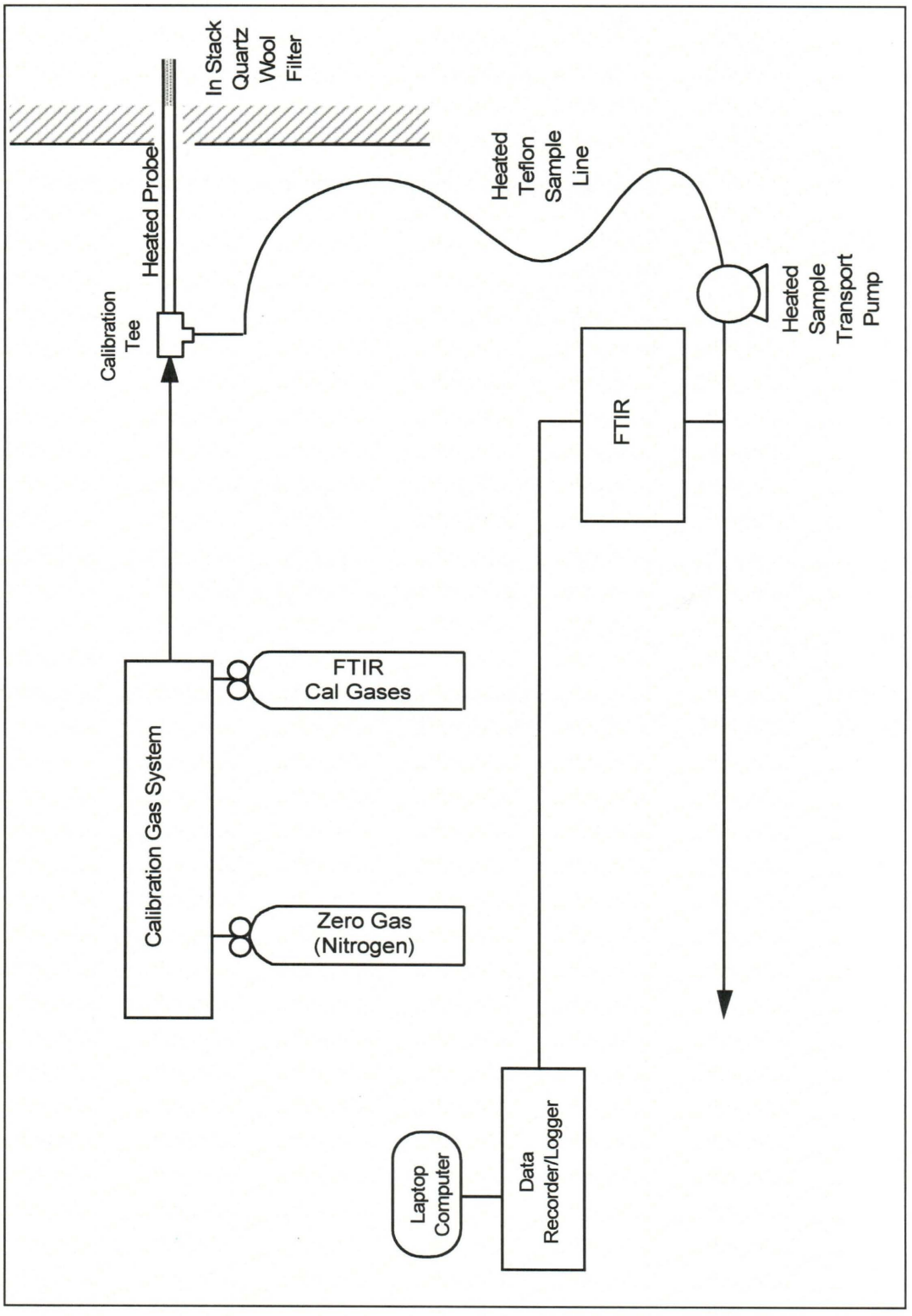
Quality assurance procedures included baseline measurement with ultra high purity nitrogen, measurement of a calibration transfer standard (~ 100 ppm methane), direct analyte calibration measurements, and measurements to determine baseline shift. SF_6 was used as a tracer gas in the calibration gases to verify the sample delivery system integrity.

The general FTIR field sampling procedure was as follows:

PRE-TEST

1) Background spectrum
   - Evaluate diagnostics of the instrumentation
2) Baseline (cylinder UHP-N_2 for zero check)
   - Determine the level of background noise
   - Observe spectrum for baseline tilt, i.e., indicates vibrations/perturbations affecting instrument
3) Calibration transfer standard (cylinder 100 ppm methane)
   - Determine level of response to evaluate the spectral response and stability of the instrument
   - Create a field reference spectrum

3-3
US EPA Method 320 Sampling System



4) Baseline evaluation
   - Note baseline flush/clean out FTIR sample cell
   - Observe spectrum for baseline tilt
5) Collection of spectra stack gas
   - Determine stack gas analyte concentrations
6) Measurement of analyte calibration gas
7) Perform dynamic spiking recovery study (recovery must be $0.7 \leq R \leq 1.3$)

TEST (REPEAT EACH RUN)

1) Baseline Determination
2) Measurement of dynamic spike
3) Collect sequential spectra of stack gas
4) Baseline Determination
5) Measurement of Calibration Transfer Standard

POST-TEST

1) Baseline Determination
2) Measurement of Calibration Transfer Standard (i.e. span check)
3) Measurement of analyte calibration gas (optional)

A post test manual validation determined that ammonia and methane were present in the effluent. FTIR spectra were reprocessed to include ammonia and methane.

3.2 PROCESS TEST METHODS

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 TEST DISCUSSION AND RESULTS

4.1 FIELD TEST DEVIATIONS AND EXCEPTIONS

No field deviations or exceptions from the test plan or test methods occurred during this test program.

4.2 PRESENTATION OF RESULTS

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-3. Emissions are reported in units consistent with those in the applicable regulations or requirements. Additional information is included in the appendices as presented in the Table of Contents.

Concentration values in Table 4-1 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Emissions denoted with a '<' in Table 4-1 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

TABLE 4-1
TOTAL PM EMISSIONS RESULTS -
FGOXID2 C-10A EXHAUST

Run Number	1	2	3	Average
Date	12/9/2022	12/9/2022	12/9/2022	--
Time	8:30-9:45	11:15-12:21	13:20-14:28	--
Flue Gas Parameters				
CO_2, % volume dry	5.2	5.4	5.4	5.33
O_2, % volume dry	11.2	11.0	11.2	11.13
flue gas temperature, °F	302.8	300.4	298.6	300.6
moisture content, % volume*	44.60	50.48	50.77	48.62
Wet volumetric flow rate at actual condictions, acfm	88,210	82,779	80,531	83,840
Wet volumetric flow rate at standard conditions, scfm	61,051	57,476	56,049	58,192
Dry volumetric flow rate at standard conditions, dscfm	33,823	28,462	27,594	27,594
Filterable PM				
lb/hr	0.528	0.199	0.324	0.350
Condensible PM				
lb/hr	2.578	3.424	3.588	3.196
Total PM				
lb/hr**	3.106	3.623	3.912	3.547

TABLE 4-2
GASEOUS EMISSIONS RESULTS -
FGOXID2 C-10A EXHAUST

Run Number	1	2	3	Average
Date	12/9/2022	12/9/2022	12/9/2022	--
Time	8:30-9:29	11:15-12:14	13:20-14:19	--
Flue Gas Parameters				
CO_2, % volume dry	5.2	5.4	5.4	5.33
O_2, % volume dry	11.2	11.0	11.2	11.13
flue gas temperature, °F	302.8	300.4	298.6	300.6
moisture content, % volume*	44.60	50.48	50.77	48.62
Wet volumetric flow rate at actual condictions, acfm	88,210	82,779	80,531	83,840
Wet volumetric flow rate at standard conditions, scfm	61,051	57,476	56,049	58,192
Dry volumetric flow rate at standard conditions, dscfm	33,823	28,462	27,594	27,594
Sulfur Dioxide Emissions				
ppmvd	6.7	6.36	6.2	6.4
lb/hr	2.3	1.80	1.7	1.9
Nitrogen Oxide Emissions				
ppmvd	40.9	40.7	40.8	40.8
lb/hr	9.9	8.3	8.1	8.7
Carbon Monoxide Emissions				
pmvd	48.4	45.1	43.6	45.7
lb/hr	7.1	5.6	5.2	6.0
Inlet THC Emissions				
lb/hr	250.4	232.1	212.7	231.8
Outlet THC				
lb/hr	3.5	3.5	3.4	3.5
Destruction Removal Efficiency				
%	99	98	98	98

TABLE 4-3
SPECIATED VOC EMISSIONS RESULTS - FGOXID2 C-10A EXHAUST

Client: The Anderson's Marathon Holdings, LLC
Facility: Albion, MI
Test Location: FGOXID2 C-10A
Test Method: Method 320

Source Condition							
Date	12/9/2022		12/9/2022		12/9/2022		
Start Time	8:30		11:16		13:21		
End Time	9:29		12:15		14:20		
	Run 1		Run 2		Run 3		
Stack Conditions							
Average Gas Temperature °F	302.8125		300.375		298.5625		
Effluent Moisture, percent by volume	50.6		50.6		50.7		
Average Effluent Pressure in. hg	-0.3		-0.3		-0.3		
Effluent Volumetric Flow Rate, acfm	88,210		82,779		80,531		
Effluent Volumetric Flow Rate, dscfm	33,823		28,462		27,594		
Effluent Volumetric Flow Rate, scfm	61,051		57,476		56,049		
Acetaldehyde							
ppmv wet	0.8		0.7		0.5		0.7
ppmv dry	1.6		1.5		1.1		1.4
lb/hr	0.33		0.30		0.21		0.28
Acetic Acid							
ppmv wet	< 0.5	<	0.5	<	0.5		0.5
ppmv dry	< 1.0	<	1.0	<	1.0		1.0
lb/hr	< 0.3	<	0.3	<	0.3		0.3
Acrolein							
ppmv wet	< 0.3	<	0.3	<	0.3	<	0.3
ppmv dry	< 0.6	<	0.6	<	0.6	<	0.6
lb/hr	< 0.2	<	0.2	<	0.1	<	0.2
Ethanol							
ppmv wet	5.9		5.7		6.1		5.9
ppmv dry	12.0		11.5		12.4		12.0
lb/hr	2.6		2.4		2.5		2.5
Ethyl Acetate							
ppmv wet	< 0.3	<	0.3	<	0.3		0.3
ppmv dry	< 0.6	<	0.6	<	0.6		0.6
lb/hr	< 0.3	<	0.2	<	0.2		0.2
Formaldehyde							
ppmv wet	0.7		0.7		0.7		0.7
ppmv dry	1.4		1.5		1.4		1.4
lb/hr	0.2		0.2		0.2		0.2
Formic Acid							
ppmv wet	0.4		0.5		0.3		0.4
ppmv dry	0.8		1.0		0.7		0.8
lb/hr	0.2		0.2		0.1		0.2
2-Furaldehyde							
ppmv wet	< 0.7	<	0.7	<	0.7	<	0.7
ppmv dry	< 1.4	<	1.4	<	1.4	<	1.4
lb/hr	< 0.6	<	0.6	<	0.6	<	0.6
Methanol							
ppmv wet	< 0.3	<	0.3	<	0.3	<	0.3
ppmv dry	< 0.6	<	0.6	<	0.6	<	0.6
lb/hr	< 0.1	<	0.1	<	0.1	<	0.1
Total VOCs							
lb/hr	< 4.7	<	4.4	<	4.3	<	4.5

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

The meter box and sampling train(s) used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes, minimum sample durations, and percent isokinetics met the applicable QA/QC criteria.

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

5.3 QUALITY STATEMENT

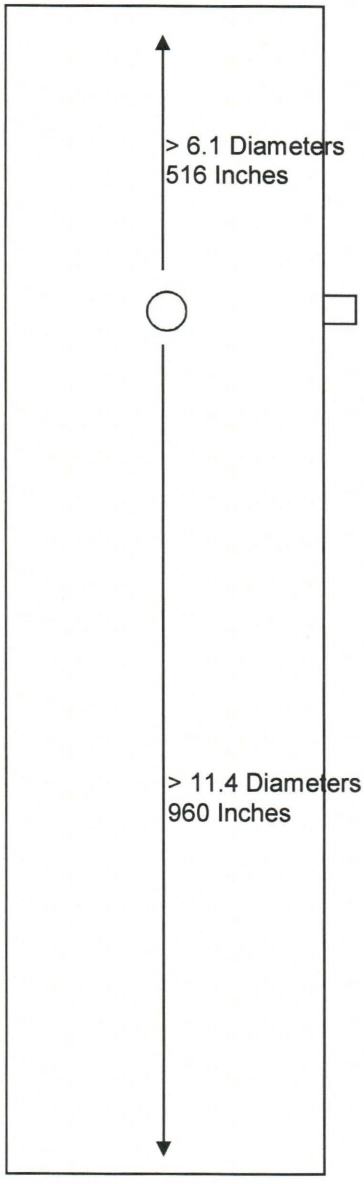
Montrose is qualified to conduct this test program and has established a quality management system that led to accreditation with ASTM Standard D7036-04 (Standard Practice for Competence of Air Emission Testing Bodies). Montrose participates in annual functional assessments for conformance with D7036-04 which are conducted by the American Association for Laboratory Accreditation (A2LA). All testing performed by Montrose is supervised on site by at least one Qualified Individual (QI) as defined in D7036-04 Section 8.3.2. Data quality objectives for estimating measurement uncertainty within the documented limits in the test methods are met by using approved test protocols for each project as defined in D7036-04 Sections 7.2.1 and 12.10. Additional quality assurance information is included in the report appendices. The content of this report is modeled after the EPA Emission Measurement Center Guideline Document (GD-043).

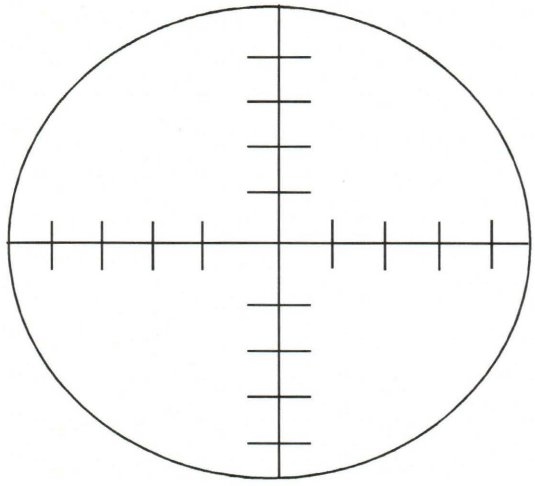
APPENDIX A
FIELD DATA AND CALCULATIONS

Appendix A.1
Sampling Locations

MONTROSE
AIR QUALITY SERVICES

diameter = 84





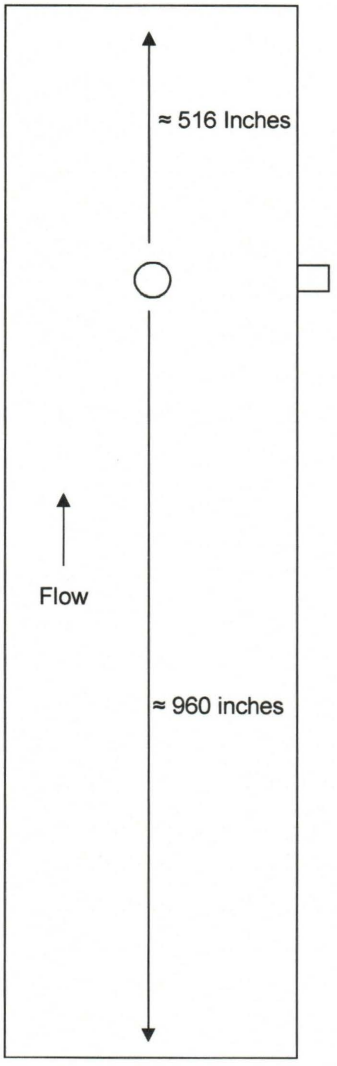
Not to Scale

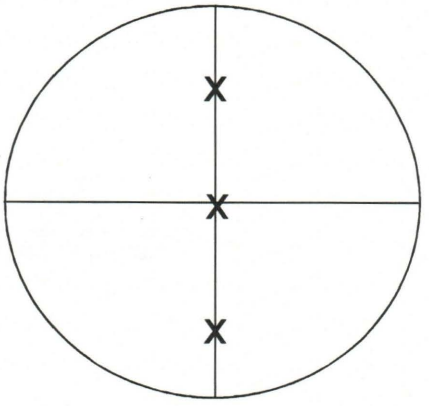
Points	Distance "
1	2.7
2	8.8
3	16.3
4	27.1
5	56.9
6	67.7
7	75.2
8	81.3

Site:	Sampling Dates:	Montrose Air Quality Services, LLC
The Andersons Ethanol Albion, Michigan	12/9/2022	4949 Fernlee Royal Oak, Michigan

MONTROSE
AIR QUALITY SERVICES

diameter = 84 inches





Not to Scale

Points	Distance "
1	14.0
2	42.0
3	70.0

Figure No. 2

Site: **FGOXID** **The Andersons Albion** **Albion, Michigan**	**Sampling Date:** **December 9, 2022**	**Montrose Air Quality Services** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

Appendix A.2
FGOXID2 Data Sheets