

## 1.0 INTRODUCTION

### 1.1 SUMMARY OF TEST PROGRAM

The Andersons Marathon Holdings LLC (The Andersons) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test on the TO System at their facility located in Albion, Michigan.

The specific objectives were to:

- Determine the FPM, CPM, and TPM as PM<sub>10</sub> concentrations (gr/dscf and lb/dscf) and emission rates (lb/hr)
- Determine the NO<sub>x</sub> and CO concentrations (ppmvd and lb/dscf) and emission rates (lb/hr)
- Determine the VE opacity (%)
- Determine the SO<sub>2</sub>, VOC and HAP concentrations (ppmvw and lb/scf) and emission rates (lb/hr)
- Determine the total VOC DE (%)
- 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	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
1/14/21	TO Stack (C10)	Velocity/Volumetric Flow	EPA 1 & 2	4	60
		O <sub>2</sub> , CO <sub>2</sub>	EPA 3A	4	60
		Moisture	EPA 320/4	1/3	60
		FPM, CPM, TPM as PM <sub>10</sub>	EPA 5/202	4	60
		NO <sub>x</sub>	EPA 7E	3	60
		CO	EPA 10	3	60
		VE	EPA 9	4	60
		SO <sub>2</sub> , VOC, HAP	EPA 320	3	60
		Total VOC	EPA 25A	3	60
		Dilution System Verification	EPA 205	--	--
		1/14/21	TO Inlet*	Total VOC	EPA 25A

\*The volumetric flow rates measured at the TO stack were used to calculate the inlet loading rate to determine DE.

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.

The Andersons Marathon Holdings LLC: Albion, Michigan  
 Thermal Oxidizer System (C10) Compliance Emission Test

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 tests were conducted according to Test Plan No. MW024AS-005381-PP-247 dated December 11, 2020.

**TABLE 1-2  
 SUMMARY OF AVERAGE COMPLIANCE RESULTS -  
 TO SYSTEM  
 JANUARY 14, 2021**

<b>Parameter</b>	<b>Units</b>	<b>Average Result<sup>1</sup></b>	<b>Compliance Limit</b>
TPM as PM <sub>10</sub>	lb/hr	1.85	3.1
VE	Opacity %	0	5
SO <sub>2</sub>	lb/hr	< 0.11	--
NO <sub>x</sub>	lb/hr	9.65	27.50
CO	lb/hr	2.46	21.40
Total VOC (Method 25A)	DE %	99.21	> 98
Total VOC (FTIR)	lb/hr	< 1.92	4.20
Acetaldehyde	lb/hr	< 0.10	0.35
Formaldehyde	lb/hr	< 0.05	--
Methanol	lb/hr	< 0.08	--
Acrolein	lb/hr	< 0.16	--
Total HAP	lb/hr	< 0.39	3.00

<sup>1</sup>Average values labeled as 'less than' identify emission rates which include one or more compounds reported at the method detection limit.



## 2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

### 2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The compliance test was conducted on the TO System (C10) at The Andersons facility in Albion, Michigan.

### 2.2 SAMPLING LOCATION

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

**TABLE 2-1  
SAMPLING LOCATION**

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
TO Stack	84	184 / 2.2	500 / 6.0	Isokinetic: 24 (12/port); Gaseous: 3

The sample location was 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.

### 2.3 OPERATING CONDITIONS AND PROCESS DATA

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.

##### **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. The measurements are made at traverse points specified by EPA Method 1. The molecular weight of the gas stream is determined from independent measurements of O<sub>2</sub>, CO<sub>2</sub>, and moisture. The stack gas volumetric flow rate is calculated using the measured average velocity head, the area of the duct at the measurement plane, the measured average temperature, the measured duct static pressure, the molecular weight of the gas stream, and the measured moisture.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - S-type pitot tube coefficient is 0.84

##### **3.1.3 EPA Methods 3A, 7E, and 10, Determination of Oxygen, Carbon Dioxide, Nitrogen Oxides, and Carbon Monoxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedures)**

Concentrations of O<sub>2</sub>, CO<sub>2</sub>, NO<sub>x</sub>, and CO are measured simultaneously using EPA Methods 3A, 6C, 7E, and 10, which are instrumental test methods. Conditioned gas is sent to a series of analyzers to measure the gaseous emission concentrations. The performance requirements of the method must be met to validate the data.

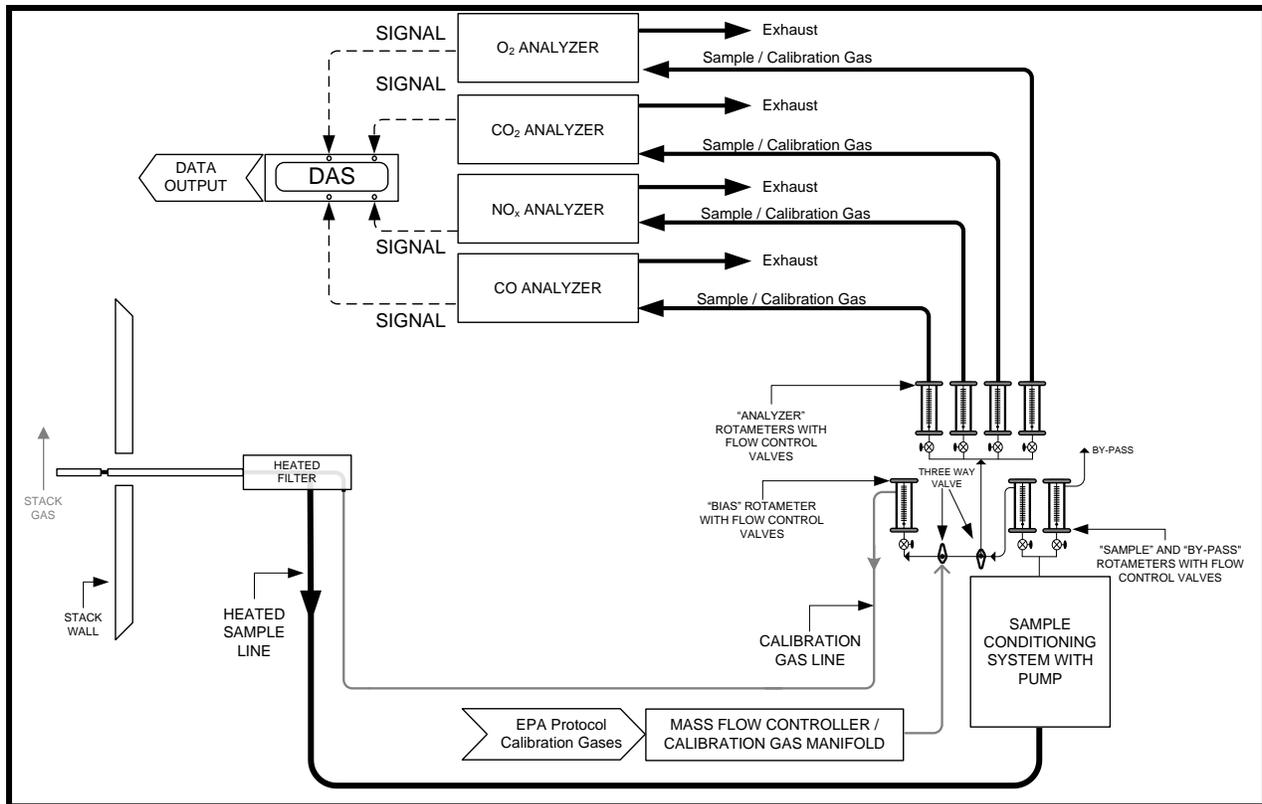
Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - A dry extractive sampling system is used to report emissions on a dry basis
  - A paramagnetic analyzer is used to measure O<sub>2</sub>
  - A nondispersive infrared analyzer is used to measure CO<sub>2</sub>

- A chemiluminescent analyzer is used to measure NO<sub>x</sub>
- A gas filter correlation nondispersive infrared analyzer is used to measure CO
- Target and/or Minimum Required Sample Duration: 60 minutes

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

**FIGURE 3-1**  
**EPA METHODS 3A (O<sub>2</sub>/CO<sub>2</sub>), 7E, 10 SAMPLING TRAIN**



### 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.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Moisture sampling is performed as part of the pollutant sample trains

### **3.1.5 EPA Methods 5 and 202, Determination of Particulate Matter from Stationary Sources and Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources**

EPA Methods 5 and 202 are manual, isokinetic methods used to measure FPM and CPM emissions. The methods are performed in conjunction with EPA Methods 1 through 4. The stack gas is sampled through a nozzle, probe, heated filter, unheated CPM filter, condenser, and impinger train. FPM is collected from the probe and heater filter. CPM is collected from the unheated CPM filter and the impinger train. The samples are analyzed gravimetrically. The sum of FPM and CPM represents TPM. Pertinent information regarding the performance of the method is presented below:

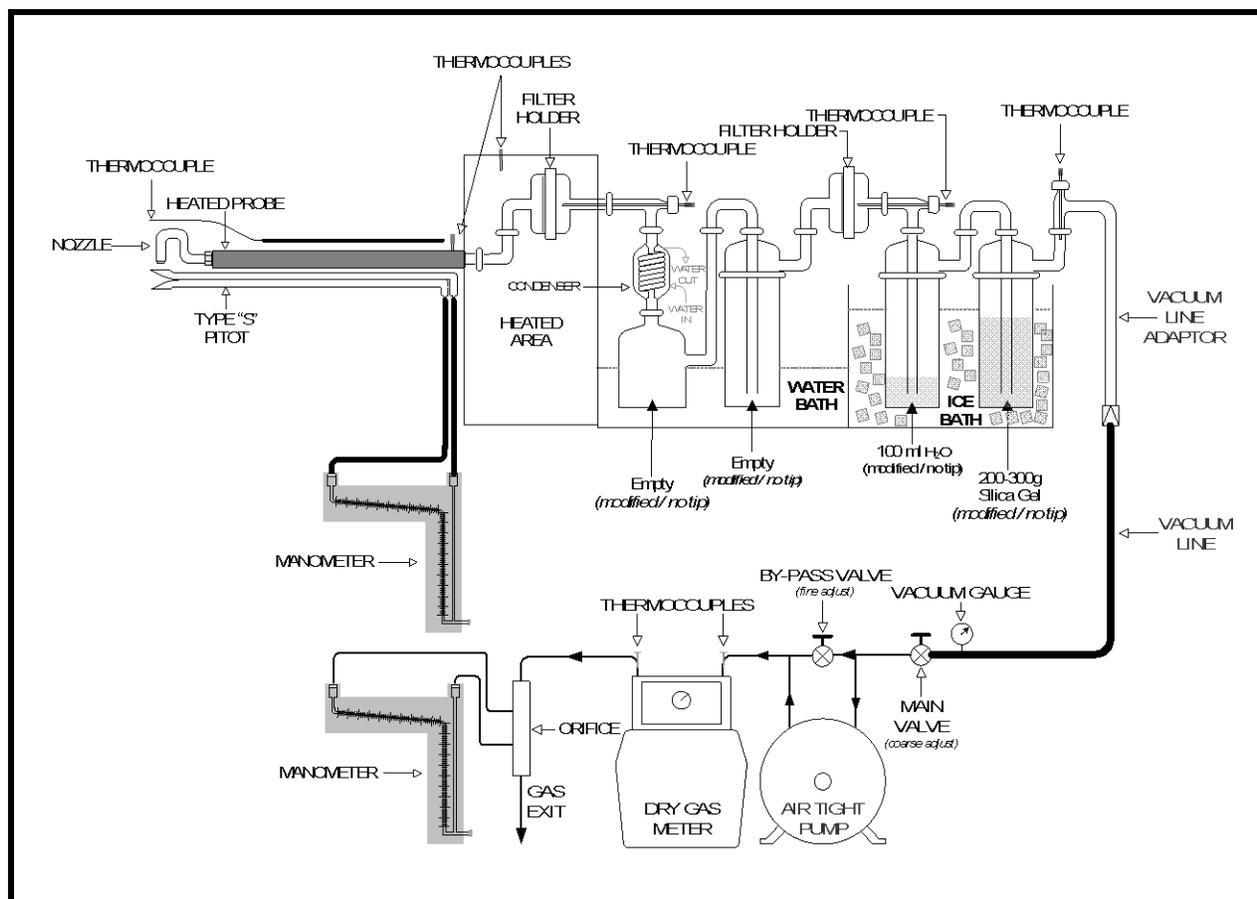
- Method Options:
  - Stainless steel sample nozzles and glass probe liners are used
  - Condensed water is measured gravimetrically
  - The post-test nitrogen purge is performed by passing nitrogen through the train under pressure

Target and/or Minimum Required Sample Duration: 60 minutes

Analytical Laboratory: Montrose, Wauconda, Illinois

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

**FIGURE 3-2  
EPA METHOD 5/202 SAMPLING TRAIN**



### 3.1.6 EPA Method 9, Visual Determination of the Opacity of Emissions

EPA Method 9 is used to observe the visual opacity of emissions (opacity). The observer stands at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to their back. The line of vision is perpendicular to the plume direction and does not include more than one plume diameter. Observations are recorded at 15-second intervals and are made to the nearest 5% opacity. The qualified observer is certified according to the requirements of EPA Method 9, section 3.1.

### 3.1.7 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

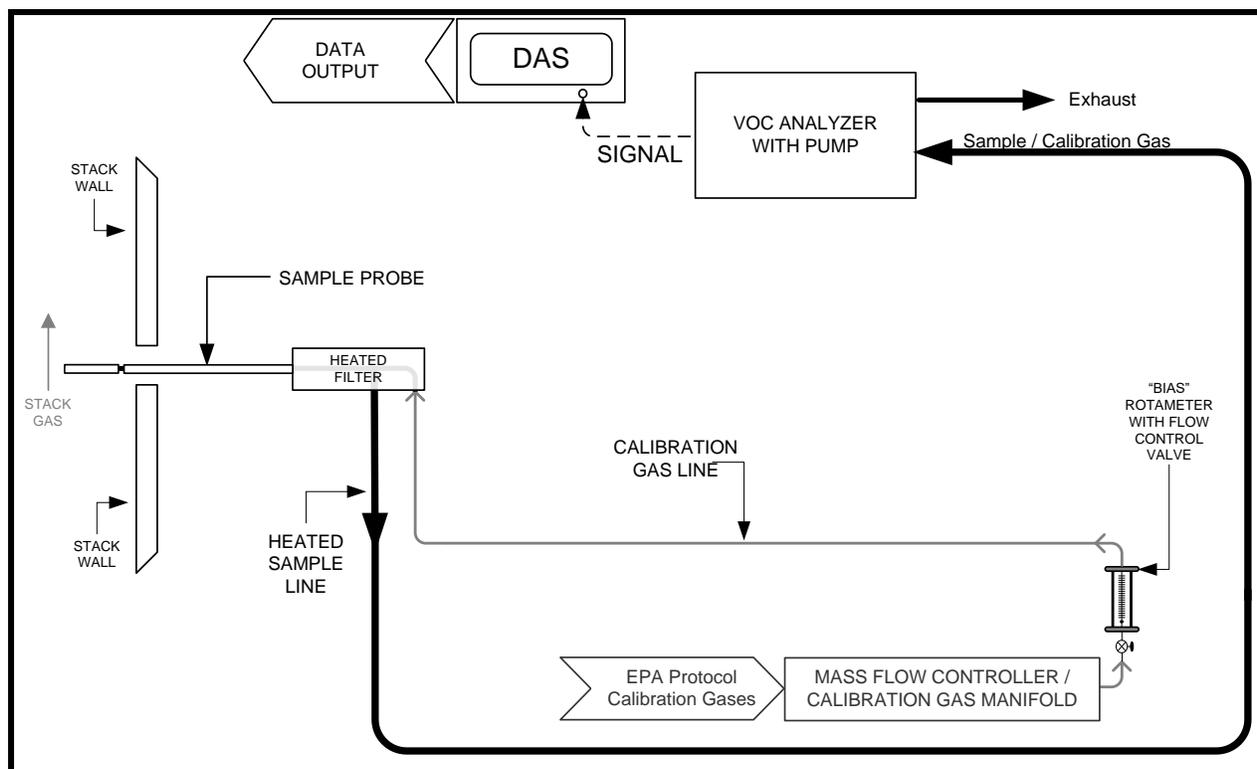
EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to a flame ionization analyzer (FIA). Results are reported as volume concentration equivalents of the calibration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

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Results are reported in terms of propane

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

**FIGURE 3-3  
EPA METHOD 25A SAMPLING TRAIN**



### 3.1.8 EPA Method 205, Verification of Gas Dilutions Systems for Field Instrument Calibrations

EPA Method 205 is used to accurately dilute high-level EPA Protocol 1 calibration gases to intermediate levels for use when calibrating instrumental analyzers. A calibrated gas dilution system is used for these dilutions. The gas dilution system is recalibrated once per calendar year using NIST-traceable primary flow standards with an uncertainty  $\leq 0.25$  percent. A field evaluation is also performed to verify the dilution ratios for each project.

To perform the field evaluation, two diluted standards are prepared using the high-level supply gas. The diluted gas is alternately introduced in triplicate to a pre-calibrated analyzer, the average instrument response is calculated, and the average predicted concentration is calculated using the dilution ratios. No single injection should differ by more than  $\pm 2\%$  from the average instrument response for that dilution. For each level of dilution, the difference between the average concentration output recorded by the analyzer and the predicted concentration is calculated. The average concentration output from the analyzer should be within  $\pm 2\%$  of the predicted value.

Next, a mid-level supply gas is injected three different times directly into the analyzer while bypassing the dilution system. The average analyzer output is calculated. The difference between the certified concentration of the mid-level supply gas and the average instrument response should be within  $\pm 2\%$ . If the gas dilution system meets the criteria listed above, it may be used throughout the field test.

### **3.1.9 EPA Method 320, Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive FTIR Spectroscopy**

EPA Method 320 is an instrumental test method used to measure specific analyte concentrations for which EPA reference spectra have been developed or prepared. Extractive emission measurements are performed using FTIR spectroscopy. The FTIR analyzer is composed of a spectrometer and detector, 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  $\text{cm}^{-1}$ ), which are analyzed using the quantitative spectral library. This provides an accurate, highly sensitive measurement of gases and vapors.

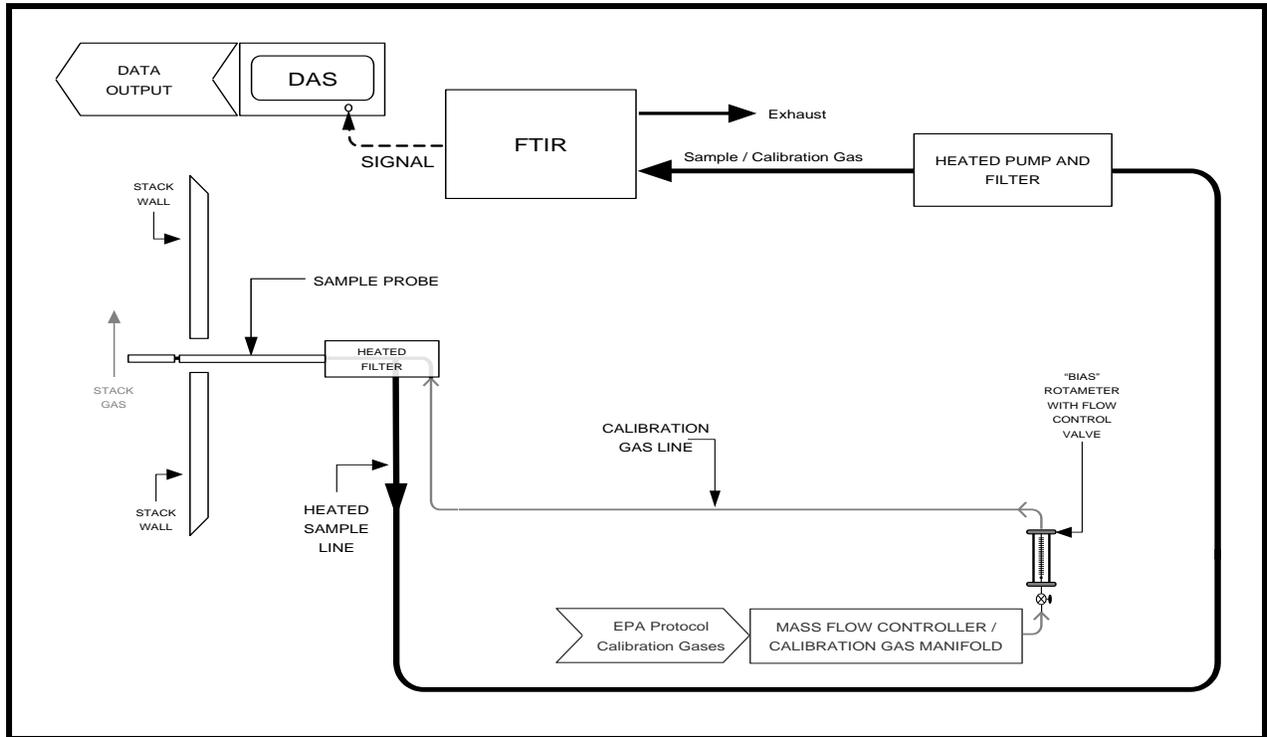
Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - The specific analyte concentrations include  $\text{H}_2\text{O}$ ,  $\text{SO}_2$ , acetaldehyde, acetic acid, acrolein, ethanol, ethyl acetate, formaldehyde, formic acid, 2-furaldehyde, and methanol
  - Continuous static sampling is performed at a flow rate of approximately 4 liters per minute
  - Previous spiking studies validate the use of FTIR spectroscopy to accurately measure the concentrations of the specific analytes from similar sources
  - A dynamic matrix spike is performed using acetaldehyde and  $\text{SF}_6$  as a tracer gas
- Method Exceptions:
  - To calculate the MDL for the target analytes, the guidelines in Appendix B of 40 CFR 136 are followed using the Student t-test to calculate the MDL for each analyte at a 99% confidence level. This follows EPA guidelines for reporting of zeroes or non-detects and meets the NELAC requirements for determination of MDL values.
  - Independent calculations of optical path length are not performed because the instrument has a fixed path of 5.11 meters

Target and/or Minimum Required Sample Duration: 60 minutes

The typical sampling system is detailed in Figure 3-4.

**FIGURE 3-4**  
**EPA METHOD 320 SAMPLING TRAIN**



### 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**

Due to problems with the Method 6C SO<sub>2</sub> analyzer, the SO<sub>2</sub> concentration was measured using the FTIR analyzer. This was approved by Lindsey Wells of the Michigan EGLE.

A total of four test runs were conducted for particulate matter. The Run No. 1 post-test leak check failed, and an additional test run was performed. Therefore, Table 4-1 presents the results of Test Run Nos. 2, 3, and 4.

The stack gas moisture content for Test Run No. 1 for the gaseous pollutants was determined using FTIR measurements.

The test plan indicated that the total VOC emission rate would also be determined using the EPA Midwest Scaling Factor (MSF) sampling procedures and subsequent calculations. However, because the Michigan EGLE does not require the MSF VOC emission rate, it is not included in this report.

### **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.