

1.0 EXECUTIVE SUMMARY

Bluewater Renewables, LLC contracted Lemos Labs, LLC to conduct nitrogen oxide (NO_x), carbon monoxide (CO), volatile organic compound (VOC) and formaldehyde (HCHO) emission testing at two CAT G3520C engines located at the Bluewater Renewables, LLC facility in Smiths Creek, Michigan. Three one hour runs were conducted per engine to determine compliance with the limitations listed in ROP-N6207-2018, dated June 1, 2017. Testing was conducted using the principles of U.S. Environmental Protection Agency (EPA) Methods specified in 40 CFR, Part 60, Appendix A and Part 10 of the EGLE Rules, Intermittent Testing and Sampling. Testing was conducted on February 4, 2020.

Bluewater Renewables, LLC is located at 6797 Smiths Creek Road, Smiths Creek, Michigan. The facility is associated with the Smiths Creek Landfill. Bluewater Renewables, LLC operates two Caterpillar G3520C engines with associated generator sets. The engines are fueled by landfill gas generated by the landfill and produce electricity which is sent to the electric grid.

The engines are landfill gas-fired units. Fuel consumption varies with field pressure and heat content of the gas. Pertinent engine operating parameters were measured throughout each emissions test and are included in Appendix B.

The engines operate per contract with electricity providers on an as needed basis with load varying according to fuel supply. Operation is dependent on landfill gas field pressure. Two engines (EUIENGINE1 & 2) operate at the facility. Testing was performed on each engine 90-100% speed and torque to meet Subpart JJJJ Requirements.

Operating parameters used to regulate the engines includes speed (RPM) and torque. Additional parameters monitored include fuel flow, exhaust temperature, inlet temperature & pressure, torque (BHp) and fuel/air ratio.

The results demonstrate compliance with the EGLE permit limits. Tables 1 presents the test results summary of the emissions.

TABLE 1

**BLUEWATER RENEWABLES
SMITHS CREEK, MICHIGAN**

**CATERPILLAR G3520C ENGINES 1&2
MDEQ PERMIT NO. 163-09D**

TEST RESULTS SUMMARY

Parameter	Measured Average	Compliance Limit	Compliance Determination
ENGINE 2, February 4, 2020			
Nitrogen Oxides Emissions: ppmvd @ 15% O2	51.8	150.0	compliant
Carbon Monoxide Emissions: ppmvd @ 15% O2	304.5	610.0	compliant
Volatile Organic Compound Emissions: ppmvd @ 15% O2	1.5	80.0	compliant
Formaldehyde Emissions: lb/hr	1.085	2.12	compliant
ENGINE 1, February 4, 2020			
Nitrogen Oxides Emissions: ppmvd @ 15% O2	49.0	150.0	compliant
Carbon Monoxide Emissions: ppmvd @ 15% O2	326.6	610.0	compliant
Volatile Organic Compound Emissions: ppmvd @ 15% O2	2.0	80.0	compliant
Formaldehyde Emissions: lb/hr	1.245	2.12	compliant

2.0 SCOPE AND OBJECTIVES

The scope of this project is to conduct NO_x, CO, VOC, and HCHO emission testing at two CAT G3520C engines located at the Bluewater Renewables, LLC facility in Smiths Creek, Michigan using approved reference-sampling methods. The results of the tests are intended to determine compliance with the limitations listed in State of Michigan Renewable Operating Permit MI-ROP-N6207-2018, dated June 7, 2018, and Subpart JJJJ. The NO_x and CO emissions in terms of parts per million, volumetric dry, (ppmvd) and parts per million volumetric dry corrected to 15% oxygen (ppmvd @ 15% O₂) are calculated using the measured concentration data for each engine.

As per each Permit, the results of the tests are intended to demonstrate that each source do not exceed 150 ppmvd NO_x at 15% O₂, 610 ppmvd CO at 15%, 80 ppmvd VOC 15 % O₂ and 2.12 HCHO lb/hr. Three runs were conducted and the average of the three runs constitute each test per engine.

The following parameters were determined at a minimum for each of three test runs per engine:

- Gas Analysis CO₂ and O₂ % by volume
- Gas Moisture % by volume
- Sample Gas Volume dscf
- NO_x Emissions ppmvd, ppmvd @15% O₂
- CO Emissions ppmvd, ppmvd @15% O₂
- VOC Emissions ppm, ppmvd and ppmvd @15% O₂
- HCHO Emissions ppm, ppmvd and lb/hr

dscf	dry standard cubic feet
CO ₂	carbon dioxide
O ₂	oxygen
ppmvd	parts per million volumetric dry
ppmvd @ 15%O ₂	parts per million volumetric dry corrected to 15% O ₂
lb/hr	pounds per hour

The field-sampling program was performed on February 4, 2020. The Lemos Labs test personnel consisted of Messrs. Trevor Block (Meterbox Operator) and Roger Mellars (Trailer Operator). Mr. Rob Sanch served as plant liaison for this test program. The process data was collected by Bluewater Renewables, LLC.

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3.0 PROCESS DESCRIPTION

Bluewater Renewables, LLC is located at 6797 Smiths Creek Road, Smiths Creek, Michigan. The facility is associated with the Smiths Creek Landfill. Bluewater Renewables, LLC operates two Caterpillar G3520C engines with associated generator sets. The engines are fueled by landfill gas generated by the landfill and produce electricity which is sent to the electric grid.

The engines are landfill gas-fired units. Fuel consumption varies with field pressure and heat content of the gas. Pertinent engine operating parameters were measured throughout each emissions test.

The engines operate per contract with electricity providers on an as needed basis with load varying according to fuel supply. Operation is dependent on landfill gas field pressure.

4.0 PROCEDURES

4.1 FIELD WORK

4.1.1 Field Data Sheets

Copies of all field data sheets including the one-minute average concentration data for each engine are included in Appendix A.

4.1.2 Emission Testing Station

The sampling locations are at the engines' exhausts. There are two test ports located 90 degrees to center at the stack sampling location. The internal diameter of the stack is 16 inches. The nearest downstream disturbance is the stack exit, which is 24 inches or 1.5 diameters from the test ports. The nearest upstream disturbance is 72 inches or 4.5 diameters from the test ports. A drawing of the stack sampling locations is included in Figure 1.

Each stack met the stratification criteria for O₂. The stratification results are included in Appendix D.

4.1.3 Determination of Carbon Dioxide and Oxygen

The oxygen and carbon dioxide contents of the gas stream were measured using the principles of EPA Method 3A - Gas Determination of Oxygen (O₂) and Carbon Dioxide (CO₂) Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure). A gas sample was continuously extracted from each exhaust stack using a heated Teflon sample line and a portion of the sample was conveyed to two analyzers after the removal of moisture. The O₂/CO₂ sampling was conducted simultaneously with the NO_x, CO and VOC sampling using the same extraction system.

4.1.4 Determination of Moisture Content

Moisture sampling was conducted using the principles presented in EPA Method 4 - Determination of Moisture Content in Stack Gases. Parameters evaluated to determine the gas stream moisture content were: sample gas volume, sample gas temperature, sample gas pressure, impinger moisture gain, and silica gel moisture gain.

4.1.5 Determination of Nitrogen Oxides Emissions

The principles of EPA Method 7E - Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure) were used for this test program. A gas sample was continuously be extracted from the stack and a portion of the sample was conveyed to an analyzer. The analyzer measured the NO_x concentration using the principles of chemiluminescence. The NO_x sampling was conducted simultaneously with the CO and VOC sampling using the same extraction system.

4.1.6 Determination of Carbon Monoxide Emissions

The principles of EPA Method 10 - Determination of Carbon Monoxide Emissions from Stationary Sources were used for this test program. A gas sample was continuously extracted from the stack and a portion of the sample was conveyed to an analyzer. The analyzer measured the CO concentration using the principles of infrared radiation. The CO sampling was conducted simultaneously with the NO_x and VOC sampling using the same extraction system. A drawing of Methods 3A, 7E and 10 sampling trains are included in Figure 2.

4.1.7 Determination of Volatile Organic Compound Emissions

VOC was determined onsite using a flame ionization analyzer (FIA) that is equipped with an internal methane / non-methane hydrocarbon separation column; SRI 410C Methane/Non-Methane Hydrocarbon Analyzer (SRI Model 410C).

The SRI Model 410C Direct Methane, Non-Methane Hydrocarbon Analyzer is a back-flush gas chromatography (GC) system designed for automated measurement of methane and non-methane hydrocarbons. Unlike instruments that measure only methane and total hydrocarbons, the backflush GC method provides a direct measurement of non-methane concentrations. This allows accurate and precise measurement of low levels of non-methane hydrocarbons (NMHC), even in the presence of methane at much higher concentrations.

USEPA Method 25A with ALT-96, ALT-106, and calibration procedures from ALT-097a

VOC concentration in the engine exhaust was determined on-site using an instrument that is equipped with an internal methane / non-methane hydrocarbon separation column (SRI 410C). The sampled gas stream was delivered directly to the instrument, the column separates methane from non-methane hydrocarbons, and each was analyzed separately by the FIA. Additional information for the operation of the SRI 410C instrument is below.

The FIA was calibrated using the procedures in USEPA Method 25A. A gas dilution system was not used with the calibration gases.

The procedures of USEPA Alternate Test Method 097 were used to verify the methane / NMHC separation efficacy of the SRI 410C instrument. A USEPA Protocol 1 certified blend gas containing ethane, methane and propane was used for this demonstration. The blended gas was introduced to the analyzer prior to and following each test period to check analyzer error and drift.

A heated sample line was used to extract the exhaust gas from the stack and convey it to the SRI 410C analyzer. The heated sample line was heated to approximately 250°F and all components leading up to the analyzer were heated to greater than 220°F. The engine exhaust gas sample delivered to the SRI 410C was not conditioned (i.e., moisture was not removed).

The SRI 410C is an automated batch analyzer that repeatedly collects and analyzes samples of the exhaust gas stream that are drawn into the instrument by the internal sampling pump. The sampled gas is separated by an internal gas chromatography (GC) column into methane and non-methane fractions and each fraction is analyzed separately using a flame ionization detector (FID), in accordance with USEPA Method 25A.

The instrument is equipped with an internal rotary valve to control the introduction of the gas sample into the GC column. During injection mode, the rotary valve automatically allows a sample of the stack gas to enter the GC column. The sampled gas is carried through the GC column using an inert carrier gas (nitrogen). Due to its low molecular weight and high volatility, methane is separated from the non-methane components and emerges from the GC column first. The methane is directed to the FID and the methane concentration is recorded (as C1, methane) based on the calibrated detector signal. Once the methane peak has been detected (methane has a retention time of approximately 17 seconds within the GC column), the rotary valve automatically switches position so that the GC column is back-flushed with the carrier gas. All of the NMHC components remaining in the column (after being separated from methane) are directed to the FID and the NMHC concentration is recorded (as C3, propane) based on the calibrated detector signal. Once the NMHC peak is completed (i.e., the FID signal returns to zero for a period of time), the instrument automatically begins another injection sequence.

The SRI 410C is a batch-type instrument and was set to a cycle time such that approximately 30 samples are analyzed per 60-minute test period. VOC (as NMHC) mass emissions were measured as propane.

Before and after each test run, the analyzer was calibrated using low-range calibration (propane) and zero gas to determine analyzer calibration error and system bias.

A diagram of the EPA Method 25A sampling train is included in Figure 3.

4.1.8 Determination of Formaldehyde

Summary of EPA Method 320

1. Establish the test requirements.

Determine the detection limit (DL) required for the test and the errors or analytical uncertainties (AU) acceptable at or near this detection limit.

a) Measure system noise

System noise is determined by measuring two successive single beam spectra at minimal integration time (15 seconds) while the cell is purged with pure N₂. The short integration time is to assure that there is no change in the sample or system purge during measurements. The absorbance spectrum, resulting from using one of the single beams as background to the other, will then contain predominantly system noise since the spectral features will mostly cancel. Noise is then determined by measuring the Peak-to-peak and RMS absorbance noise at approximately 2450 to 2550 cm⁻¹ and 900 to 1000 cm⁻¹. These regions should be free of dominant H₂O or CO₂ lines and should be reasonable estimates of noise in the two dominant analysis regions. The 900 to 1000 cm⁻¹ region will have slightly larger noise because of incomplete cancellation of H₂O present in

this region.

2. Perform leak checks

Leak check both the sample system and the FTIR cell prior to any testing. For the sample system valve at the probe and monitor total flow through the system. Method 320 calls for a flow of less than 200 ml/min with the probe closed in order to pass. Testing the FTIR cell is important only for cells running at negative absolute pressure. In this case pump the cell to as low a pressure as possible and measure the pressure rise over 2 minutes. For 301, the leak must be less than 4% of the cell volume at the sampling pressure in order to pass. An alternative approach is to compute percent-dilution by:

$$\% \text{ Dilution} = \frac{\text{Leak Rate(Torr/min)} * \text{Cell Volume(Liters)}}{\text{Flow Rate(Liters/min)} * \text{Pressure(Torr)}}$$

Where the flow rate and the pressure in the denominator are the values to be used during routine testing.

3. Check detector linearity.

This is important only for quantum detectors (MCT, InSb etc.) and not for thermal detectors like the DTGS. Linearization is done by verifying that there is no signal in the single beam beyond detector cutoff (say at 100 cm⁻¹ to 300 cm⁻¹) and that the zero line in the single beam at opaque regions (e.g. water and CO₂ band centers) line up with the zero after detector cut-off. The CAI 700 hardware has a linearization circuit built into the detector preamplifier. This can be adjusted to provide linear response for the conditions of the test by following the CAI 700 linearization procedures.

4. Collect a background spectrum.

Prior to collecting the background, pump the cell to less than 5 mm of Hg and back fill with N₂ or flush it with 10 volumes of pure N₂. With pure N₂ flowing at a moderate rate (1-2 l/m), collect a background single-beam spectrum with 1 minute (or longer) averaging time to get a high signal to noise spectrum. Save this spectrum in the “Backgrounds” folder on the C-drive. If necessary generate a “synthetic I₀” and save this in the backgrounds folder as well. The background file in the CAI automatic collection software should then be set to this file._

5. Pre-test calculations

- a. Before any data is collected, collect a spectrum of the CTS gas. This is done by again pumping the system and backfilling it or by flowing 10 volumes of the gas through the cell prior to collecting the final spectrum. In automated systems, **it is recommended** that this be done by starting the flow of the CTS gas while acquiring data at a relatively short acquisition time (~1 minute). This will assist in determining system response time below. If the reported concentration for the CTS gas is then viewed in real time, when the concentration is clearly stable (not rising or falling) the cell has reached equilibrium. A CTS spectrum should then be acquired at the averaging time to be used during routine data collection. Acetaldehyde was used as the CTS gas.
- b. Perform Spiking. Formaldehyde or acetaldehyde at approximately 100.0 ppm and sulfur hexafluoride at approximately 10.0 ppm with a balance of nitrogen should be spiked into the sample stream as close as possible to the probe. The spikes should be injected at no more than 20% of total flow and should produce an observable change in the ambient concentrations. Independent spike samples (as determined from the system response time above) should be done with independent periods of no spiking between each. If the source

is varying slowly this is corrected for using the zero-spike levels before and after each analyte spike and fitting a regression line to the means of these periods. Method 320 requires that:

$$0.70 \leq \frac{\text{ave. spike value}}{\text{accepted spike value}} \geq 1.3$$

- c. Determine System Precision. System precision is the repeatability of the system. It can be determined by comparing successive spike samples. Method 320 requires the analyzed concentrations for the spiked gas to agree to $\pm 5\%$ to pass.

6. During testing

During data collection the baseline of the single beam spectra should be tracked to determine if there is any change in the background or I_0 spectrum. If the baseline in non-absorbing regions shifts by more than 5% a new background or I_0 should be collected and the data for that period reanalyzed using the CAI batch reprocessing software.

7. Post test calculations

The gas matrix (composition) should be checked by reviewing the spectra to make sure it is what was expected when the analysis routine was developed. If compounds are present in analysis regions that can cause interference, these must be added to the analysis routine before performing final data analysis.

Perform a post-test CTS spectrum. This spectrum should be compared to that taken at the beginning of the test period. The concentrations reported for the CTS gas should agree to within 5% to pass Method 320.

8. Additional Method 320 Requirements

- Appropriate spike recovery gases shall be chosen such that the same spectral region (IR bands) is used to measure the respective spike gas that is used to measure the target analyte.
- Formaldehyde should be used as the spike recovery gas for formaldehyde determinations, assuming certified standards are available at appropriate concentrations to meet the requirements specified in Method 320/ASTM D6348. If appropriate standards are not available, acetaldehyde may be used as a surrogate providing that the same spectral regions (IR bands) are used to measure the surrogate that are used to measure the target analyte.
- All constituents shall, at a minimum, be reported as the MAU/MDC, and the requirements in Sections 1.3-1.4 of Method 320 must be met.
- The entire sampling system, from the probe through to the analyzer, must be insulated, heated and maintained at a minimum of 300 °F. The temperature of each heated sampling line must be recorded at 15-minute intervals during testing and included in the test report.
- Minimize the sample line length to enhance sample recovery. Ensure the sample line has no upward or parallel sloped section where condensation can accumulate, and ensure the sample line is not in contact with the ground.

- Verification of proper validation of measurement system and quantification algorithm for all target analytes for this source category must be included in the test report. Rich-burn verses lean-burn and 4-stroke verses 2-stroke will be considered different source categories.
- All QA/QC data results, obtained while conducting required procedures specified in Method 320 Sections 8.6.2, 9.0 and 13.0, must be included in the test report.

4.1.9 Process Data

The process information was recorded at a minimum every 15 minutes during each testing period and is included in Appendix B. The process data collected includes:

- 1.) Engine speed (RPM),
- 2.) Load (kW & %),
- 3.) Gas fuel flow (scfm),
- 4.) Fuel/air ratio,
- 5.) Engine Coolant Temperature (deg. F),
- 6.) Inlet Air Temperature (deg. F), and
- 7.) Inlet Manifold Air Pressure (psi).

4.1.10 Test Parameters and Methods

The compliance emissions tests were performed for the parameters listed in Table 4 below. All test methods conducted for this compliance test conform to Title 40, Code of Federal Regulations, Part 60. The test methods will follow the current reference methods.

TABLE 4
TEST PARAMETERS AND METHODS

Parameter	EPA Method #	Sampling and Analytical Procedure	Variations
Sample and Velocity Traverses	1	Sample and Velocity Traverses for Stationary Sources	None
O ₂ , CO ₂	3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources	None
Moisture	4	Determination of Moisture Content in Stack Gases	None
NO _x	7E	Determination of Nitrogen Oxide Emissions from Stationary Sources	None
CO	10	Determination of Carbon Monoxide Emissions from Stationary Sources	None
VOC	25A	Determination of Total Gaseous Organic Concentration using a Flame Ionization Analyzer	None
HCHO	320	Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared	None

4.2 CALCULATIONS

Emission calculations were completed using a computer spreadsheet format. The results of each pertinent parameter for each engine were detailed on the spreadsheet for each sampling run and are included in Appendix C. An actual calculation of a run per engine is included in Appendix C.

4.3 FIELD EQUIPMENT CALIBRATIONS

The following field equipment calibration data is included in Appendix D:

- Dry Gas Meter and Orifice;
- Analyzers; and
- Calibration Gas Certificates.

5.0 SUMMARY OF RESULTS

Table 2 presents a summary of emissions and testing parameters for Engine 1. The NO_x emission concentration ranged from 96.0 to 97.6 ppmvd and the average was 96.9 ppmvd. The NO_x emission rate ranged from 48.7 to 49.4 ppmvd @ 15% O₂ and the average emission rate was 49.0 ppmvd @ 15% O₂. The CO emission concentration ranged from 623.0 to 663.9 ppmvd and the average was 645.1 ppmvd. The CO emission rate ranged from 312.9 to 333.9 ppmvd @ 15% O₂ and the average was 326.6 ppmvd @ 15% O₂. The VOC emission concentration ranged from 3.9 to 4.0 ppmvd and the average was 4.0 ppmvd. The VOC emission rate was 2.0 ppmvd @ 15% O₂ for all three runs. The Formaldehyde emission concentration ranged from 52.5 to 56.8 ppm and the average was 54.5 ppm. The Formaldehyde emission concentration ranged from 27.0 to 28.5 ppmvd @ 15% O₂ and the average was 27.6 ppmvd @ 15% O₂. The Formaldehyde emission rate ranged from 1.227 to 1.278 lb/hr and the average was 1.245 lb/hr.

Table 3 presents a summary of emissions and testing parameters for Engine 2. The NO_x emission concentration ranged from 102.8 to 106.0 ppmvd and the average was 103.9 ppmvd. The NO_x emission rate ranged from 50.9 to 52.6 ppmvd @ 15% O₂ and the average emission rate was 51.8 ppmvd @ 15% O₂. The CO emission concentration ranged from 602.8 to 622.3 ppmvd and the average was 610.1 ppmvd. The CO emission rate ranged from 299.7 to 309.0 ppmvd @ 15% O₂ and the average was 304.5 ppmvd @ 15% O₂. The VOC emission concentration ranged from 1.9 to 4.0 ppmvd and the average was 2.8 ppmvd. The VOC emission rate ranged from 1.0 to 2.3 ppmvd @ 15% O₂ and the average was 1.5 ppmvd @ 15% O₂. The Formaldehyde emission concentration ranged from 42.8 to 57.2 ppm and the average was 50.7 ppm. The Formaldehyde emission concentration ranged from 21.7 to 28.3 ppmvd @ 15% O₂ and the average was 25.3 ppmvd @ 15% O₂. The Formaldehyde emission rate ranged from 0.927 to 1.214 lb/hr and the average was 1.085 lb/hr.

TABLES

TABLE 1

**BLUEWATER RENEWABLES
SMITHS CREEK, MICHIGAN**

**CATERPILLAR G3520C ENGINES 1&2
MDEQ PERMIT NO. 163-09D**

TEST RESULTS SUMMARY

Parameter	Measured Average	Compliance Limit	Compliance Determination
ENGINE 2, February 4, 2020			
Nitrogen Oxides Emissions: ppmvd @ 15% O2	51.8	150.0	compliant
Carbon Monoxide Emissions: ppmvd @ 15% O2	304.5	610.0	compliant
Volatile Organic Compound Emissions: ppmvd @ 15% O2	1.5	80.0	compliant
Formaldehyde Emissions: lb/hr	1.085	2.12	compliant
ENGINE 1, February 4, 2020			
Nitrogen Oxides Emissions: ppmvd @ 15% O2	49.0	150.0	compliant
Carbon Monoxide Emissions: ppmvd @ 15% O2	326.6	610.0	compliant
Volatile Organic Compound Emissions: ppmvd @ 15% O2	2.0	80.0	compliant
Formaldehyde Emissions: lb/hr	1.245	2.12	compliant

TABLE 2

**BLUEWATER RENEWABLES
SMITHS CREEK, MICHIGAN
CATERPILLAR G3520C ENGINE 1**

LEMOS LABS, LLC PROJECT 0913

February 4, 2020

SUMMARY OF EMISSIONS AND TESTING PARAMETERS

Parameter	Run 1	Run 2	Run 3	Average
Gas moisture, % by volume	11.6	11.5	11.6	11.6
Oxygen content, % by volume	9.4	9.1	9.2	9.2
Carbon dioxide content, % by volume	9.7	10.0	10.0	9.9
Sample volume, dscf	43.175	42.602	42.922	42.900
Nitrogen Oxides Emissions:				
ppmvd	96.0	97.1	97.6	96.9
ppmvd @ 15% O2	49.4	48.7	49.0	49.0
Carbon Monoxide Emissions:				
ppmvd	648.4	663.9	623.0	645.1
ppmvd @ 15% O2	333.9	332.9	312.9	326.6
Volatile Organic Compound Emissions:				
ppmvd	4.0	3.9	4.0	4.0
ppmvd @ 15% O2	2.0	2.0	2.0	2.0

TABLE 3

**BLUEWATER RENEWABLES
SMITHS CREEK, MICHIGAN
CATERPILLAR G3520C ENGINE 2**

LEMOS LABS, LLC PROJECT 0913

February 4, 2020

SUMMARY OF EMISSIONS AND TESTING PARAMETERS

Parameter	Run 1	Run 2	Run 3	Average
Gas moisture, % by volume	9.0	11.5	11.6	10.7
Oxygen content, % by volume	9.0	9.0	9.2	9.1
Carbon dioxide content, % by volume	9.6	9.6	9.6	9.6
Sample volume, dscf	43.491	42.798	42.637	42.975
Nitrogen Oxides Emissions:				
ppmvd	106.0	102.8	102.8	103.9
ppmvd @ 15% O2	52.6	50.9	51.9	51.8
Carbon Monoxide Emissions:				
ppmvd	622.3	605.1	602.8	610.1
ppmvd @ 15% O2	309.0	299.7	304.7	304.5
Volatile Organic Compound Emissions:				
ppmvd	1.9	2.4	4.0	2.8
ppmvd @ 15% O2	1.0	1.3	2.3	1.5

TABLE 4

TEST PARAMETERS AND METHODS

Parameter	EPA Method #	Sampling and Analytical Procedure	Variations
Sample and Velocity Traverses	1	Sample and Velocity Traverses for Stationary Sources	None
O ₂ , CO ₂	3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources	None
Moisture	4	Determination of Moisture Content in Stack Gases	None
NO _x	7E	Determination of Nitrogen Oxide Emissions from Stationary Sources	None
CO	10	Determination of Carbon Monoxide Emissions from Stationary Sources	None
VOC	25A	Determination of Total Gaseous Organic Concentration using a Flame Ionization Analyzer	None
HCHO	320	Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive Fourier Transform Infrared	None

FIGURES

FIGURE 1

Bluewater Renewables, LLC
2 Caterpillar G3520C IC Engines
Smiths Creek, Michigan

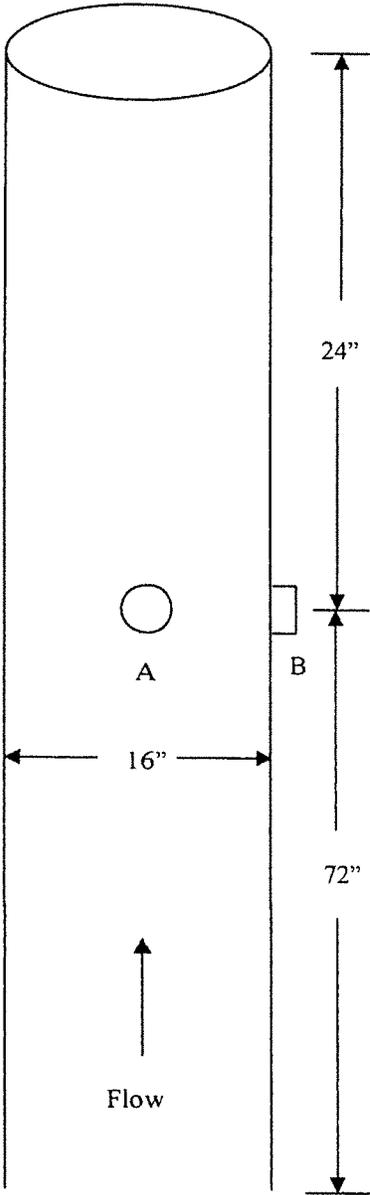


FIGURE 2

EPA METHODS 3A, 7E AND 10
SAMPLING TRAIN

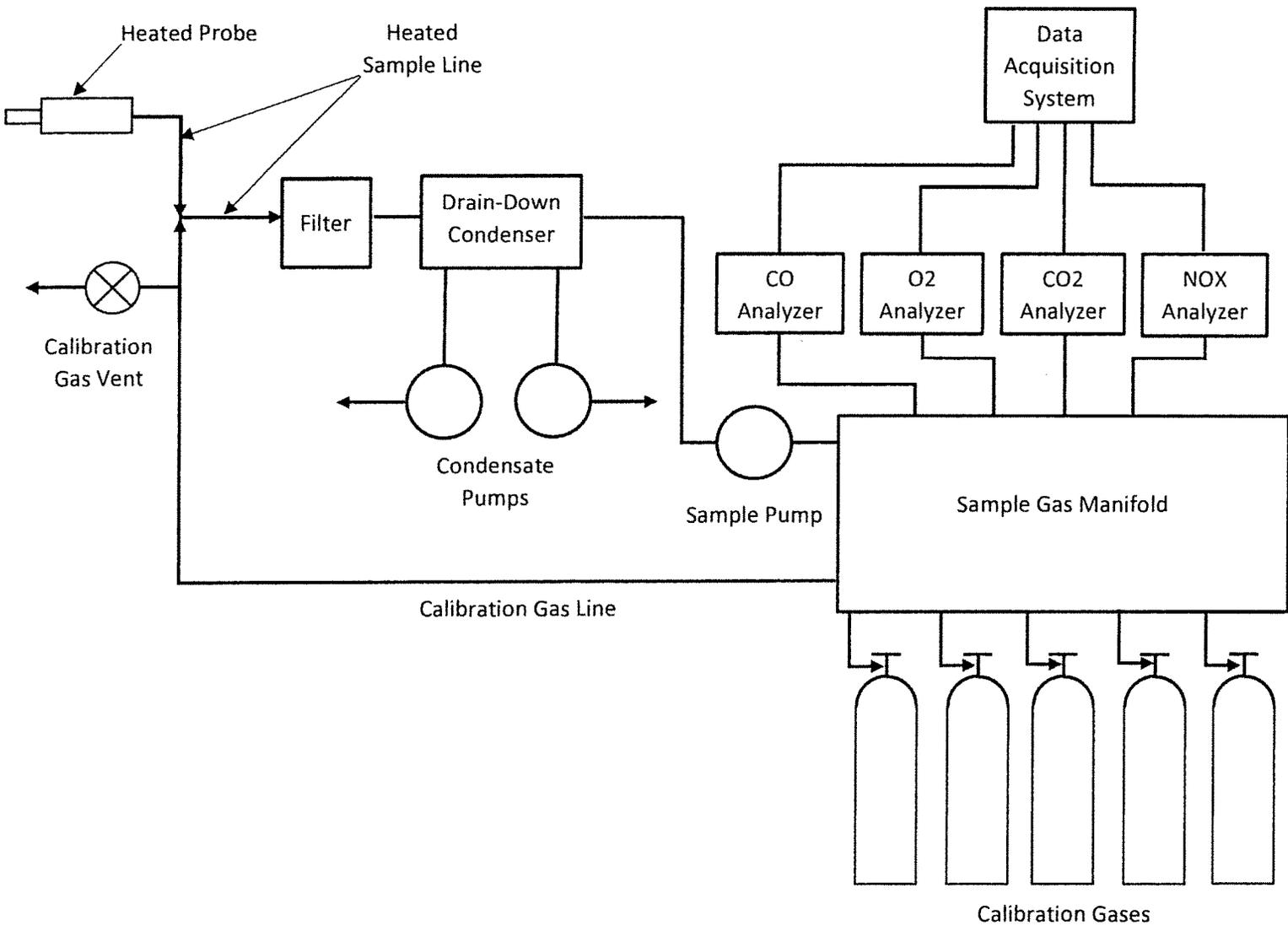


FIGURE 3

EPA Method 25A
Sampling Train

