

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

SEMCO Energy Gas Company - Morton Facility contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the Spark Ignition Internal Combustion Engine (EUENGINE4) at the SEMCO Energy Gas Company - Morton facility located in Marysville, Michigan. The tests were conducted to satisfy the emissions testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy, Division of Air Quality (EGLE) Permit No. 126-07B and 40 CFR Part 60, Subpart JJJJ.

The specific objectives were to:

- Verify the nitrogen oxides (NO_x) as NO₂, carbon monoxide (CO), and non-methane volatile organic compounds (NMVOC) emissions from EUENGINE4
- 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)
4/23/2020	EUENGINE4	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	7-12
4/23/2020	EUENGINE4	O ₂ , CO ₂	EPA 3A	3	60
4/23/2020	EUENGINE4	Moisture	EPA 4	3	30
4/23/2020	EUENGINE4	NO _x	EPA 7E	3	60
4/23/2020	EUENGINE4	CO	EPA 10	3	60
4/23/2020	EUENGINE4	TGO, CH ₄	EPA 25A	3	60

To simplify this report, a list of Units and Abbreviations is included in Appendix C.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.

SEMCO Energy Gas Company – Morton Facility
2020 Compliance Source Test Report

The testing was conducted by the Montrose personnel listed in Table 1-3 on April 23, 2020. The tests were conducted according to the test plan (protocol) dated March 24, 2020 that was submitted to and approved by EGLE.

**TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EUENGINE4
APRIL 23, 2020**

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x as NO₂) g/BHP-hr	0.55	1.0
Carbon Monoxide (CO) g/BHP-hr	0.0058	2.0
Non-methane Volatile Organic Compounds, as Propane (NMVOC) g/BHP-hr	0.31	0.7

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location: SEMCO Energy Gas Company - Morton
1100 Gratiot Avenue
Marysville, Michigan

Project Contact: Elisabeth Barr
Role: Environmental and Storage Analyst
Company: SEMCO Energy Gas Company
Telephone: 810-887-3081
Email: elisabeth.barr@semcoenergy.com

Agency Information

Regulatory Agency: EGLE	
Agency Contact: Karen Kajiya-Mills	Regina Angellotti
Telephone: 517-256-0880	313-456-4692
Email: kajiya-millsk@michigan.gov	angellottir1@michigan.gov

Testing Company Information

Testing Firm: Montrose Air Quality Services, LLC	
Contact: Mason Sakshaug	Matthew Young
Title: Field Project Manager	District Manager
Telephone: 248-548-8070	248-548-8070
Email: msakshaug@montrose-env.com	myoung@montrose-env.com

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

**TABLE 1-3
TEST PERSONNEL AND OBSERVERS**

Name	Affiliation	Role/Responsibility
Mason Sakshaug	Montrose	Field Project Manager, QI
Ben Durham	Montrose	Field Technician
Shane Rabideau	Montrose	Field Technician
Elisabeth Barr	SEMCO Energy Gas Company	Observer/Client Liaison/Test Coordinator
Regina Angelloti	EGLE	Observer

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The Spark Ignition Internal Combustion Engine (EUENGINE4) operated by the facility is a natural gas-fired compressor engine (Model 3516B LE) manufactured by Caterpillar. Emissions from EUENGINE4 were uncontrolled. EUENGINE4 was in operation during the test event.

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 Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
EUENGINE4 Exhaust	13.5	180 / 13.3	240 / 17.8	Flow: 12 (6/port), Moisture: 1 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. See Appendix A.1 for more information.

2.3 OPERATING CONDITIONS AND PROCESS DATA

The emissions test was performed while the source was operating at the conditions required by the permit. The unit was tested when operating normally/as found/at greater than 90% of rated.

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. Data collected includes the following parameters:

- Engine operating load, % of maximum BHP
- Exhaust catalyst pressure drop, in-H₂O
- Catalyst inlet temperature, °F
- Natural gas combustion rate, scfm

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.

3.1.3 EPA Method 3A, Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

EPA Method 3A is an instrumental test method used to measure the concentration of O₂ and CO₂ in stack gas. The effluent gas is continuously or intermittently sampled and conveyed to analyzers that measure the concentration of O₂ and CO₂. The performance requirements of the method must be met to validate data.

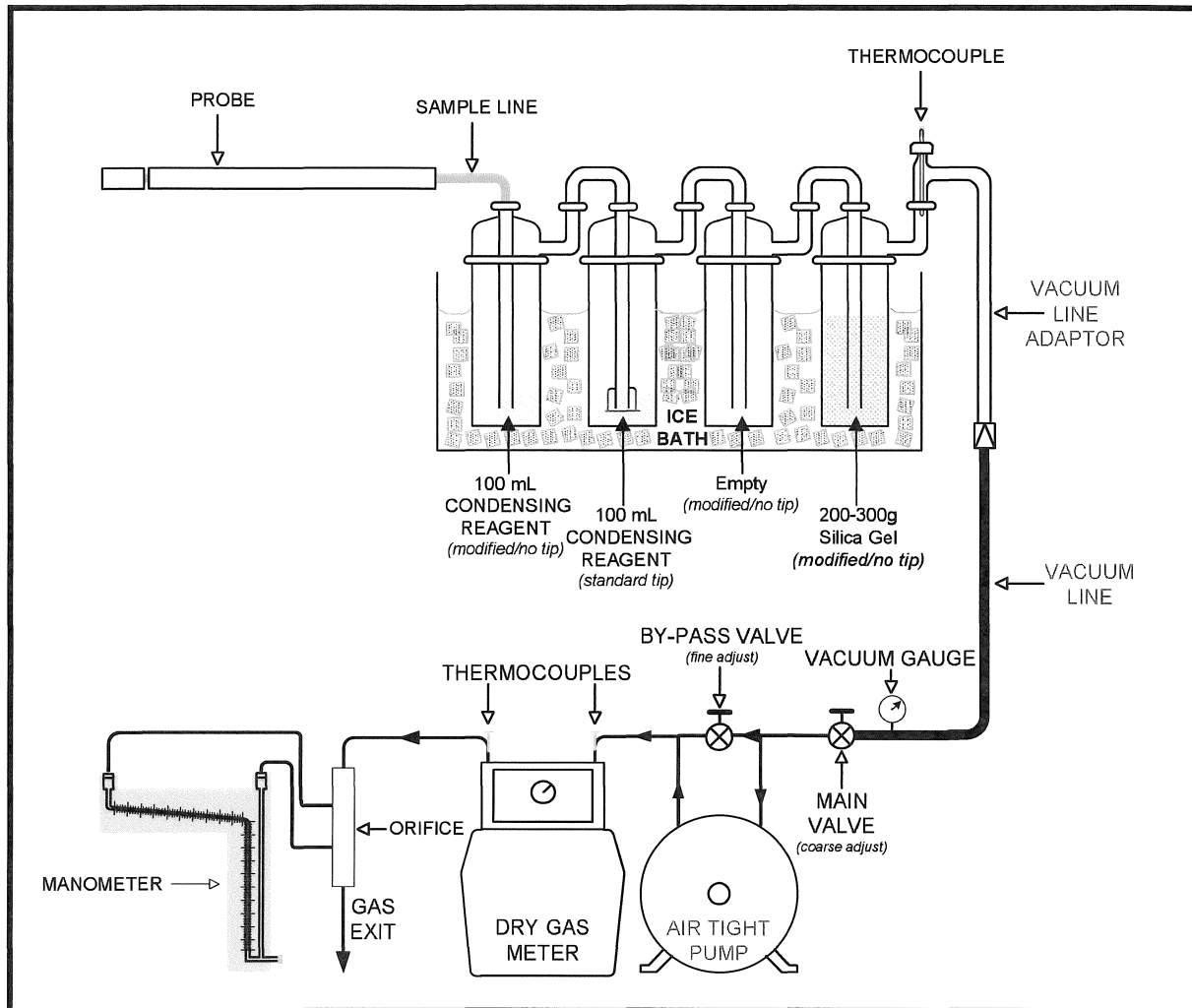
The sampling system is detailed in Figure 3-2.

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 sampling system is detailed in Figure 3-1.

**FIGURE 3-1
 EPA METHOD 4(DETACHED) SAMPLING TRAIN**



3.1.5 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 NO₂. Conditioned gas is sent to an analyzer to measure the concentration of NO_x. The performance requirements of the method must be met to validate the data.

The sampling system is detailed in Figure 3-2.

3.1.6 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.

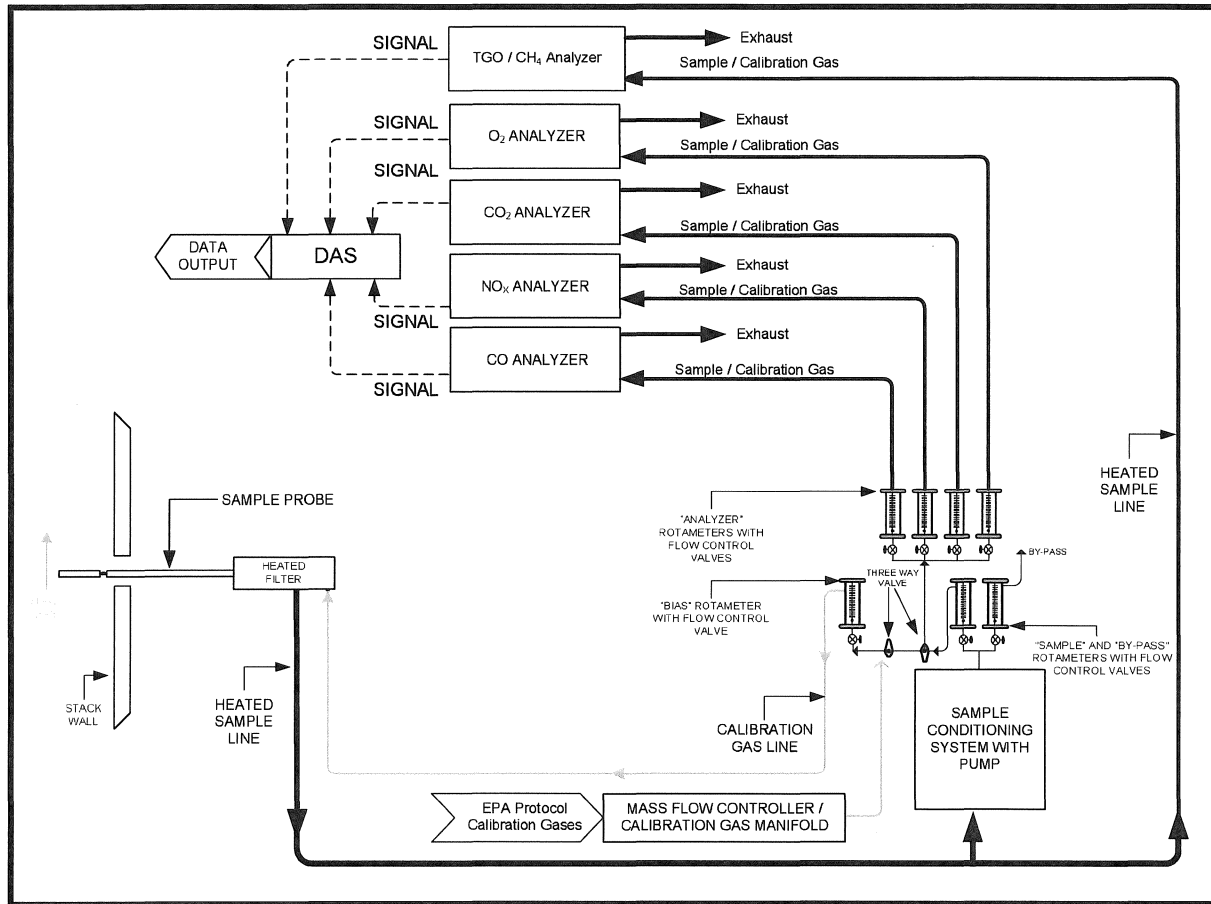
3.1.7 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of TGO 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.

For the purpose of this test, dual FIAs were utilized to measure TGO (as propane) and CH₄ (as methane).

The sampling system is detailed in Figure 3-2.

FIGURE 3-2
EPA METHODS 3A (O₂/CO₂), 7E, 10, 25A 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

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 Table 4-1. 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.

**TABLE 4-1
NO_x (AS NO₂) CO, AND VOC EMISSIONS RESULTS -
EUENGINE4**

Run Number	1	2	3	Average
Date	4/23/2020	4/23/2020	4/23/2020	--
Time	09:40-10:45	11:18-12:18	12:40-13:40	--
Process Data				
Engine Load, BHP	952	938.0	938.0	942.7
Flue Gas Parameters				
O ₂ , % volume dry	9.05	9.04	8.96	9.01
CO ₂ , % volume dry	6.77	6.77	6.82	6.79
flue gas temperature, °F	757.8	765.4	761.5	761.6
moisture content, % volume	10.84	12.44	12.05	11.77
volumetric flow rate, dscfm	2,090	2063	2182	2112
Nitrogen Oxides (NO_x as NO₂)				
ppmvd	76.0	75.2	75.6	75.6
lb/hr	1.1	1.1	1.2	1.1
g/BHP-hr	0.54	0.54	0.57	0.55
Carbon Monoxide (CO)				
ppmvd	1.31	1.37	1.25	1.31
lb/hr	0.012	0.012	0.012	0.012
g/BHP-hr	0.0057	0.0060	0.0057	0.0058
Total Gaseous Organics, as Propane (TGO)				
ppmvw	433.4	462.4	444.2	446.7
Methane (CH₄), as Propane				
ppmvw	353.0	382.4	377.1	370.8
Non-methane Volatile Organic Compounds, as Propane (NMVOC)				
ppmvw	45.5	42.2	29.8	39.2
lb/hr	0.73	0.68	0.51	0.64
g/BHP-hr	0.35	0.33	0.25	0.31

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

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

EPA Method 3A, 7E, and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

EPA Method 25A FIA calibration audits were within the measurement system performance specifications for the calibration drift checks and calibration error checks.

The NO₂ to NO converter efficiency check of the analyzer was conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiency met the criteria.

An EPA Method 205 field evaluation of the calibration gas dilution system was conducted. The dilution accuracy and precision QA specifications were met.

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).