

1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

General Motors - Pontiac Engineering Center contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the FG-RACINGTCS (Diesel Engine (E104)) at the General Motors - Pontiac Engineering Center facility located in Pontiac, Michigan. The tests were conducted to satisfy the emissions testing requirements pursuant to Department of Environment, Great Lakes, and Energy (EGLE) Permit No. MI-ROP-B4032-2020. Please note, that due to the Covid-19 shutdown, EGLE granted a 60-day extension past the permit due date. The extension extended the test due date to June 8, 2020.

The specific objectives were to:

- Verify the NO_x (as NO₂) emissions (lb/MMBtu) from E104
- 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)
06/04/2020	E104/ Diesel Engine Exhaust	O ₂ , NO _x	EPA 3A EPA 7E	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 on June 4, 2020. The tests were conducted according to the test plan (protocol) dated February 26, 2020 that was submitted to EGLE.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
DIESEL ENGINE (E104)
June 4, 2020

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO _x as NO ₂) lb/MMBtu	0.64	2.20

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location: General Motors, LLC
 Pontiac Engineering Center
 850 Glenwood Avenue
 Pontiac, MI 48340

Project Contact: Jessica Alderton
 Role: Senior Environmental Project Engineer
 Company: General Motors, LLC
 Telephone: 586-863-8490
 Email: jessica.alderton@gm.com

Rachel Gribas
 Environmental Engineer
 Pontiac Engineering Center
 248-828-5929
 rachel.gribas@gm.com

Agency Information

Regulatory Agency: EGLE
 Agency Contact: Mark Dziadosz
 Telephone: 586-854-1611
 Email: dziadoszm@michigan.gov

Testing Company Information

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

Matthew Young
 District Manager
 248-548-8070
 myoung@montrose-env.com

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

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

Name	Affiliation	Title
Mason Sakshaug	Montrose	Field Project Manager, QI
Ryan Mcwhinnie	Montrose	Field Technician
Jessica Alderton	General Motors, LLC	Observer/Client Liaison
Rachel Gribas	General Motors, LLC	Observer/Client Liaison
Mark Dziadosz	EGLE	Observer

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

General Motors owns and operates an extensive engine testing facility for research and development of internal combustion engines using a wide variety of fuels and test protocols mandated by the United States Environmental Protection Agency (U.S. EPA). Depending on the engine type, the engines can be fueled by unleaded gasoline, leaded gasoline, diesel, and other fuels running a variety of tests on engines and engine components. A variety of test cycles are used depending on the purpose of the test program and the type of the engine. The engines are tested with or without control equipment, such as catalytic converters and particulate traps. Diesel Engine 104 was in operation during this test event. See the Test Plan in Appendix E for more details.

Emissions from E104 were uncontrolled.

2.2 FLUE GAS SAMPLING LOCATION

NO_x and O₂ concentrations were measured at the E104 Exhaust Stack.

2.3 OPERATING CONDITIONS AND PROCESS DATA

Emission tests are performed while the source/units are operating at the conditions required by the permit. Compliance tests are performed when the unit is operating normally.

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

- Air/Fuel Ratio
- Test Cell Air Temperature, °C
- Cell Barometric Pressure, kPa
- Engine RPM. rpm
- Exhaust Gas Temperature, °C
- Demand Throttle Position, %
- Fuel Consumption, gal

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 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. Conditioned gas is sent to analyzers that measure the concentration of O₂ and CO₂. The performance requirements of the method must be met to validate data.

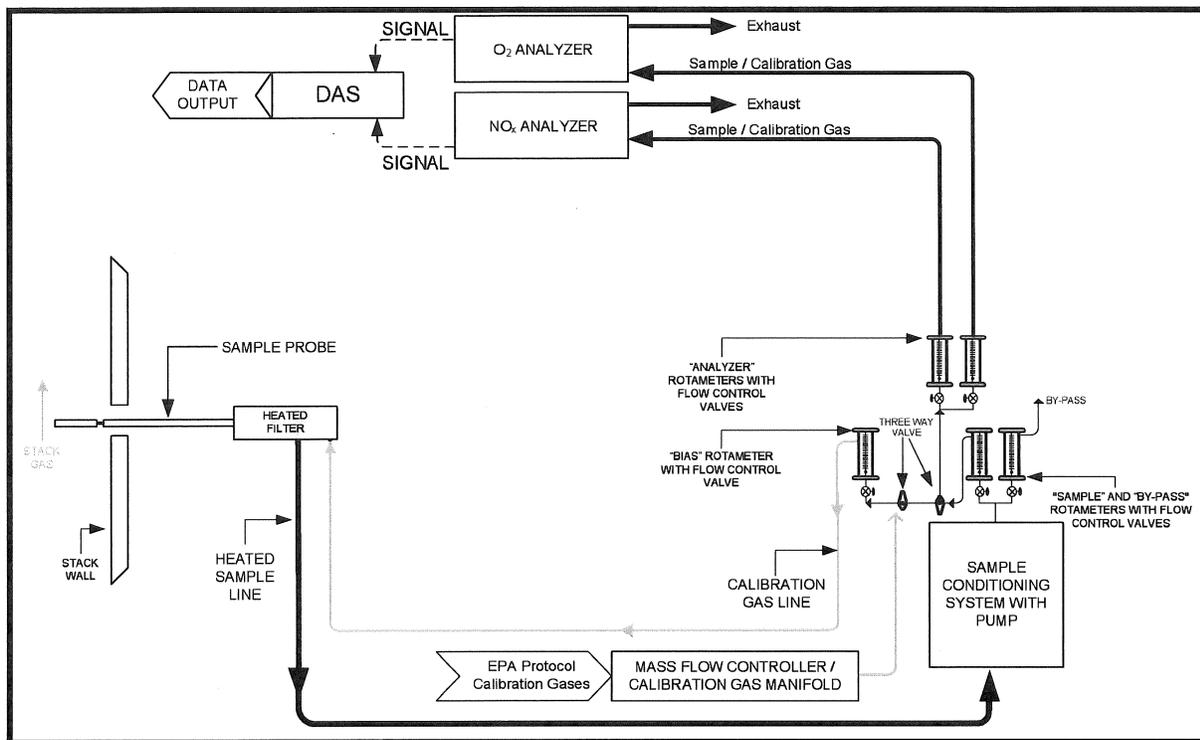
The typical sampling system is detailed in Figure 3-1.

3.1.2 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. For the purposes of this method, NO_x is the sum of NO and NO₂. The performance requirements of the method must be met to validate the data.

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

**FIGURE 3-1
 EPA METHODS 3A (O₂), 7E SAMPLING TRAIN**



3.1.3 EPA Method 19, Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide, and Nitrogen Oxide Emission Rates

EPA Method 19 is used to calculate emissions in lb/MMBtu. For this test the F factor is calculated from analysis of fuel samples collected on the day of testing.

3.2 PROCESS TEST METHODS

A single fuel (ultra low sulfur diesel) sample was collected GM facility personnel during the test event. The sample was delivered by Montrose personnel to Paragon Laboratories located in Livonia, Michigan for fuel analysis.

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 event.

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.

**TABLE4-1
EMISSIONS RESULTS -
DIESEL ENGINE (E104) EXHAUST**

Run Number	1	2	3	Average
Date	06/04/2020	06/04/2020	06/04/2020	--
Time	09:07-10:11	10:49-11:49	12:14-13:14	--
Process Data				
Fuel Consumption, lb	6.0	5.56	4.72	5.43
Duration, min	64	60	60	61.3
Fuel Consumption, lb/min	0.094	0.093	0.079	0.088
Fuel Consumption, lb/hr	5.63	5.56	4.72	5.30
Engine Load, MMBtu/hr	0.11	0.11	0.093	0.10
Flue Gas Parameters				
O ₂ , % volume dry	18.8	18.8	18.8	18.8
NO_x				
lb/MMBtu (as NO ₂)	0.63	0.61	0.69	0.64
ppmvd	58.2	56.0	63.0	59.1

5.0 INTERNAL QA/QC ACTIVITIES

5.1 QA/QC AUDITS

EPA Method 3A and 7E calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks, except where noted in Section 5.2.

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.

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).