1 INTRODUCTION

RWDI USA LLC (RWDI) was retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) facility located at 21500 Mound Road, Warren, Michigan. WTAP operates an automobile assembly plant that produces the new Jeep Wagoneer and Ram 1500 Classic Models. Under Permit to Install (PTI) 13-19B this Source Testing Plan covers the required testing for validation of Volatile Organic Compound (VOC) emissions from a representative emission unit (EU) from Flexible Group FGEMERENG. A copy of the Source Testing Plan is provided in **Appendix A.** The test program included measurements of volatile organic compounds (VOCs, defined as non-methane hydrocarbons) on the one (1) and only engine (EUNGGEN1) per condition V.2 for the flexible group. For the emergency generator (EUNGGEN1) the emissions were calculated while the engine was operated under maximum load capacity while combusting natural gas.

Testing was conducted January 28th, 2022. Results from the sampling program are presented in the **Tables Section** of the report, with more detailed sampling results provided in the **Appendices**. A copy of the Source Testing Plan is provided in **Appendix A**.

2 SOURCE DESCRIPTION

2.1 Facility Description

The following source and source group, as identified in the PTI, were included in the program:

Table 2.1.1: Summary of Source Groups

Flexible Group	Emission Unit	Engine Rating	Generator Maximum Output
FGEMERENG	EUNGGEN1	737 HP	550 kW

WTAP operates an automobile assembly plant that produces the new Jeep Wagoneer and Ram 1500 Classic for FCA US LLC. EUNGGEN1 has a single exhaust configuration, and the engine is equipped with an oxidation catalyst that controls engine exhaust before venting into the atmosphere. For the purposes of the test protocol, EUNGGEN1 was required to be tested for VOCs to determine compliance with the air permit PTI 13-19B.

3 MODIFICATION

As approved on-site due to freezing issues related to the moisture train through discussions with Ms. Lindsey Wells and Mr. Iranna Konanahalli, it was agreed to use Method 19 along with Methods 25A and 3 (by fyrite) in lieu of Methods 2 and 4. As requested by Ms. Wells, RWDI has provided the flow data recorded and the invalid moisture data.

4 SAMPLING LOCATION

4.1 Sample Location Description

4.1.1 EUNGGEN1

The sampling location for the generator that was tested was located outside. The outlet sampling location for EUNGGEN 1 was a temporary stack constructed by RWDI. The temporary stack design met Method 1 criteria.

EUNGGEN1 exhaust was analyzed for VOCs. Samples were extracted from the sampling ports. To evaluate the VOC emissions from the source, triplicate 60-minute tests were conducted.

5 SAMPLING METHODOLOGY

The following section provides an overview of the sampling methodologies used in this program.

5.1 Continuous Emissions Monitoring for VOCs

5.1.1 Sampling for Volatile Organic Compounds (US EPA Method 25A)

Volatile Organic Compounds (VOC) testing was performed at the exhaust of one (1) emission unit from FGEMERENG flexible group. The measurements were taken continuously following USEPA Method 25A. As outlined in Method 25A, the measurement location was taken at the centroid of the EUNGGEN1 exhaust stack.

The compliance program consisted of triplicate 60-minute tests. Regular performance checks on the CEMS were carried out by zero and span calibration checks using USEPA Protocol calibration gases. These checks verified the ongoing precision of the monitor during each test by introducing pollutant-free (zero) air followed by known calibration gas (span) into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gas was reviewed frequently as an ongoing indication of analyzer performance.

Prior to testing, a 4-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, low, mid and high-level calibration gases up the heated line to the probe tip. The calibration error check was performed to confirm that the analyzer response is within ±5% of the certified calibration gas introduced. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre- and post-test system bias checks. The system bias checks were used to confirm that the analyzer did not drift greater than ±3% throughout each test run.

Zero and upscale calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases were introduced into the sampling system at the probe outlet so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to the VOC analyzer, which measures the pollutant or diluent concentrations in the gas. The analyzer was calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe was attached to a heated filter system for particulate removal. The heated filter was attached to a Teflon line which delivered the sample gases from the stack to the CEM system. The heated sample line was set to maintain the gas temperature above 250°F to prevent condensation of stack gas moisture within the line.

Methane subtraction requires the determination of a reaction factor coefficient. The reaction factor is determined by introducing a known methane calibration gas to the analyzer and dividing the methane channel response by the THC channel response. Dividing the one-hour average methane results by the reaction factor (which is determined prior to each test) gives a methane as propane value and can then be subtracted from the THC one-hour average to give NMOCs.

5.1.2 VOC Emission Rate Calculation (US EPA Method 19)

USEPA Method 19, "Determination of Sulfur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide and Nitrogen Oxide Emission Rates," was used to calculate a VOC emission factor based on Oxygen concentrations and appropriate F-factors. Equation 19-1 from the method was used. Table 19-1 was used to determine the conversion factor for concentration (1.143×10^{-7}) and was used for VOC (based on a mole conversion from sulfur dioxide factor on Table 19-1 to propane). Table 19-2 was used for the F-Factor (natural gas 10,610 wscf/10^6 BTU).

Conversion Factor for Concentrations:

Conversion Factor for VOCs = Conversion of SO_2 (Table 19-1) x MW of Propane / MW of SO_2

$1.143 \times 10^{-7} = 1.660 \times 10^{-7} \times 44.1$ (MW of Propane / 66.07 MW of SO_2)

Emission Calculation:

$E = (1.143 \times 10^{-7}) \times C_d \times F_w \times ((20.9/(20.9 - \%O_{2w}))$

Where:

E = Pollutant Emission Rate (lb./10^6 BTU)
C_d = Pollutant Concentration, Wet Basis (ppm_w)
F_w = Fuel Factor, Wet Basis (wscf/10^6 BTU)
$\%O_2$ = Oxygen Concentration

5.1.3 Sampling for Oxygen (US EPA Method 3)

The oxygen concentration was analyzed following US EPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight" (by fyrite). The sample was taken directly from the exhaust stack by fyrite.

5.2 Quality Assurance/Quality Control Activities

Applicable quality assurance measures were implemented during the sampling program to ensure the integrity of the results. These measures included detailed documentation of field data, and equipment calibrations for all measured parameters.

Quality control procedures specific to the CEM monitoring equipment included linearity checks to determine the instrument performance and reproducibility checks prior to its use in the field. Regular performance drift checks on the analyzer were also carried out during the testing program by performing hourly zero checks and span calibration checks using primary gas standards. These checks were used to verify the ongoing accuracy of the monitor and sampling system over time. Pollutant-free air was introduced to perform the zero checks, followed by a known calibration (span) gas into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gas was recorded regularly during the tests.

Pre and post test leak checks were done on the flow system by pressurizing and plugging the positive and negative side of the pitot separately. Daily temperature sensor audits were completed by noting the ambient temperature, as measured by a reference thermometer, and comparing these values to those obtained from the stack sensor.

6 RESULTS

The flow and emissions data for this study are presented in the **Tables** section of this report. Detailed information regarding each test run can be found in the corresponding appendix. Below is a summary of the applicable Table ID for each corresponding test parameter.

Table 6.1: Summary of Data

Parameter	Table	Appendix
VOCs	1	B

Field notes are presented in **Appendix C.** All calibration information for the equipment used for the program is included in **Appendix D**. Detailed example calculations for each measured pollutant are provided in **Appendix F**.

6.1 EUNGGEN1 Results

The following section outlines the results from the testing program for EUNGGEN1.

Table 6.1.1a: Summary of EUNGGEN1 Emission Data

Parameter	Symbol	Units	Average	Limits
VOCs (as propane)	VOC	g/HP-hr	<0.0007	0.50

Table 6.1.1b: Summary of EUNGGEN1 Power Ratings

Parameter	Units	Average
BTU per Hour	BTU/hr	7,126,400
Average Horsepower	HP	730
Generator Output	kW	544

7 OPERATING CONDITIONS

Operating conditions during the sampling were monitored by FCA Operations and RWDI personnel. During the test, RWDI personnel recorded the load output (either HP or kW). All process data is provided in **Appendix E**.

Volume of fuel consumed was not available during the stack test and is not included with the process data.

Radio contact was maintained between the process operators and the sampling team throughout the testing. A member of the RWDI sampling team contacted the operator before each test, to ensure that the process was at normal operating conditions.

8 CONCLUSIONS

Testing was successfully completed on of January 28th, 2022. The source was tested in accordance with referenced methodologies following the protocols provided in the Source Testing Plan and modifications approved by EGLE in the field.