Air Emission Test for Emergency Reciprocating Internal Combustion Engine

FCA US LLC
Sterling Heights Assembly Plant
Sterling Heights, MI

FIAT CHRYSLER AUTOMOBILES

Renewable Operating Permit MI-ROP-B7248-2014a

Prepared for:
FCA US LLC
Auburn Hills, Michigan

Bureau Veritas Project No. 11016-000157.00

November 17, 2016

BUREAU VERITAS 1828

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RENEWABLE OPERATING PERMIT REPORT CERTIFICATION

Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.

Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.

Source Name FCA US LLC - Sterling Heights Assembly Plant County Macomb

Source Address 38111 Van Dyke Avenue City Sterling Heights

AQD Source ID (SRN) B7248 ROP No. MI-ROP-B7248-2014a ROP Section No. D

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From ______ To ______

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From ______ To ______

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From NA To NA

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Test Report evaluating air emissions from EU-ENG-NEW PSHOP2.

This form shall certify that the testing was conducted in accordance with the approved test plan and that the facility was operating in compliance with permit conditions.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

DAN OMAHEN | PLANT MANAGER | 519-818-6836
Name of Responsible Official (print or type) | Title | Phone Number

[signature] | 11/22/16
Signature of Responsible Official | Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

Executive Summary

FCA US LLC retained Bureau Veritas North America, Inc. to test air emissions from an emergency reciprocating internal combustion engine (RICE) at the Sterling Heights Assembly Plant in Sterling Heights, Michigan. The purpose of the testing was to measure gaseous emissions from an emergency RICE as required by the facility's Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B7248-2014a, dated November 18, 2014.

The concentrations and mass emission rates of the following were measured at two exhaust stacks:

- Nitrogen oxides (NO_x)
- Carbon monoxide (CO)
- Volatile organic compounds (VOCs)

This report summarizes the air emission test program, which was conducted on October 3, 2016. The following source was tested:

- EU-ENG-NEW PSHOP2 - A 701-horsepower Cummins Model GTA28CC natural-gas-fired stationary emergency spark ignition internal combustion engine.

The sampling was conducted in accordance with United States Environmental Protection Agency (USEPA) Methods 1A, 2, 3A, 4, 7E, 10, 25A, and 205 as described in the Intent-to-Test Plan submitted to MDEQ on July 14, 2016. The MDEQ Intent-to-Test Plan acceptance letter is included as Appendix E.

Three 60-minute test runs were performed. The results of the testing are summarized in the following table.

Emergency RICE Test Results

Emission Unit ID	Parameter	Unit	Result			Average
			Run 1	Run 2	Run 3	
EU-ENG-NEW PSHOP2	NO_x	ppmvd @ 15% O_2	69	79	57	68
		g/hp-hr	1.0	1.0	0.77	0.93
	CO	ppmvd @ 15% O_2	162	110	208	160
		g/hp-hr	1.4	0.88	1.7	1.3
	VOCs	ppmvd @ 15% O_2	18	19	23	20
		g/hp-hr	0.25	0.24	0.30	0.27

NO_x = nitrogen oxide
CO = carbon monoxide
VOCs = volatile organic compounds
ppmvd @ 15% O_2 = part per million by volume, dry, corrected to 15% oxygen
g/hp-hr = gram per horsepower-hour

1.0 Introduction

1.1 Summary of Test Program

FCA US LLC retained Bureau Veritas North America, Inc. to test air emissions from an emergency reciprocating internal combustion engine (RICE) at the Sterling Heights Assembly Plant in Sterling Heights, Michigan. The purpose of the testing was to measure gaseous emissions from an emergency RICE as required by the facility's Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit (ROP) MI-ROP-B7248-2014a, dated November 18, 2014.

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Based on the air permit, Table 1-1 identifies the emission unit tested.

Table 1-1
Identification of Source

Emission Unit ID	Emission Unit Description	Flexible Group ID
EU-ENG-NEW PSHOP2	701-horsepower, natural-gas-fueled emergency reciprocating internal combustion engine	FG-NSPS JJJJ Emergency >500 hp

1.2 Key Personnel

Contact information is listed in Table 1-2. Messrs. Brian Young, Senior Project Manager, David Kawasaki, Li Wu, and Trevor Zalewski, all with Bureau Veritas, conducted the emissions testing program. Mr. Adekunle Sanni, Environmental Specialist with FCA US LLC, provided process coordination and arranged for facility operating parameters to be recorded. Mr. Mark Dziadosz, with MDEQ, witnessed the testing.

Table 1-2
Key Personnel

Facility Contact	Emission Testing Project Manager
Rohit Patel Air Compliance Manager **FCA US LLC** 38111 Van Dyke Avenue Sterling Heights, Michigan Telephone: 248.512.1599 rohitkumar.patel@fca.com Adekunle Sanni Environmental Specialist **FCA US LLC** Sterling Heights Assembly Plant 38111 Van Dyke Avenue Sterling Heights, Michigan Telephone: 586.978.6279	Brian Young Senior Project Manager **Bureau Veritas North America, Inc.** 22345 Roethel Drive Novi, Michigan 48375 Telephone: 248.344.3020 Facsimile: 248.344.2656 brian.young@us.bureauveritas.com
Regulatory Agency	
Karen Kajiya-Mills Technical Programs Unit Supervisor **Michigan Department of Environmental Quality** Air Quality Division – Technical Programs Unit Constitution Hall, 2nd Floor South Tower 525 West Allegan Street Lansing, Michigan 48933 Telephone: 517. 284.6780 Facsimile: 517.335.3122 kajiya-millsk@michigan.gov Mark Dziadosz Environmental Quality Analyst **Michigan Department of Environmental Quality** Air Quality Division Southeast Michigan District Office 27700 Donald Court Warren, Michigan 48092 Telephone: 586.753.3745 Facsimile: 586.753.3731 dziadoszm@michigan.gov	Joyce Zhu Southeast Michigan Acting District Supervisor **Michigan Department of Environmental Quality** Air Quality Division Southeast Michigan District Office 27700 Donald Court Warren, Michigan 48902 Telephone: 586.753.3748 Facsimile: 586.753.3731 zhuj@michigan.gov

2.0 Source and Sampling Locations

2.1 Process Description

FCA US LLC manufactures the Chrysler 200 automobile at its Sterling Heights Assembly Plant located in Sterling Heights Michigan. Emissions from the emergency RICE are regulated by MDEQ ROP MI-ROP-B7248-2014a, dated November 18, 2014.

Natural gas is used to fuel the emergency RICE. The emergency RICE was operated within 10% of the highest achievable load during testing. The rated capacity of the process is a maximum of 5,890 cubic feet of natural gas per hour at 450 kilowatts (kW). While onsite during testing, a representative from Cummins indicated that engine power of the emergency RICE was 408 kW while the testing was being conducted.

2.2 Control Equipment

The emergency RICE is equipped with a non-selective catalytic reduction (NSCR) system for passively controlling carbon monoxide (CO), nitrogen oxides (NO_x), and hydrocarbon emissions.

The NSCR system is a catalyst bed that results in control of CO and hydrocarbons emissions. The engine is equipped with controls to adjust the fuel-air ratio of the engine intake manifold.

2.3 Flue Gas Sampling Location

Because the emergency RICE has two exhausts, each exhaust was sampled for half of each run duration as approved onsite by Mr. Mark Dziadosz with MDEQ. In order to conduct the testing, two stack extensions, of the same configuration, were installed at the two exhaust locations on top of the emergency RICE. Each exhaust was routed into an 8-inch-internal-diameter stack extension; each extension was equipped with sampling ports in accordance with USEPA Method 1A.

The upper two sampling ports, which were used to measure flowrate, are 1-inch diameter sampling ports that are oriented at 90° to one another and are located:

- Approximately 64 inches (8 duct diameters) from the nearest upstream disturbance (the lower sampling ports).
- Approximately 16 inches (2 duct diameters) from the nearest downstream disturbance (the stack exit).

The lower two sampling ports, which were used to measure gaseous emissions, are 1-inch diameter sampling ports that are oriented at 90° to one another and are located:

- 64 inches (8 duct diameters) from the nearest upstream disturbance (the connection to the engine exhaust pipe).
- 64 inches (8 duct diameters) from the nearest downstream disturbance (the upper sampling ports).

The sampling ports were accessible via man lift. Figure 2-1 depicts the emergency RICE with stack extensions. Figure 1 in the Appendix depicts the sampling ports and traverse point locations of one representative exhaust stack extension for the emergency RICE.

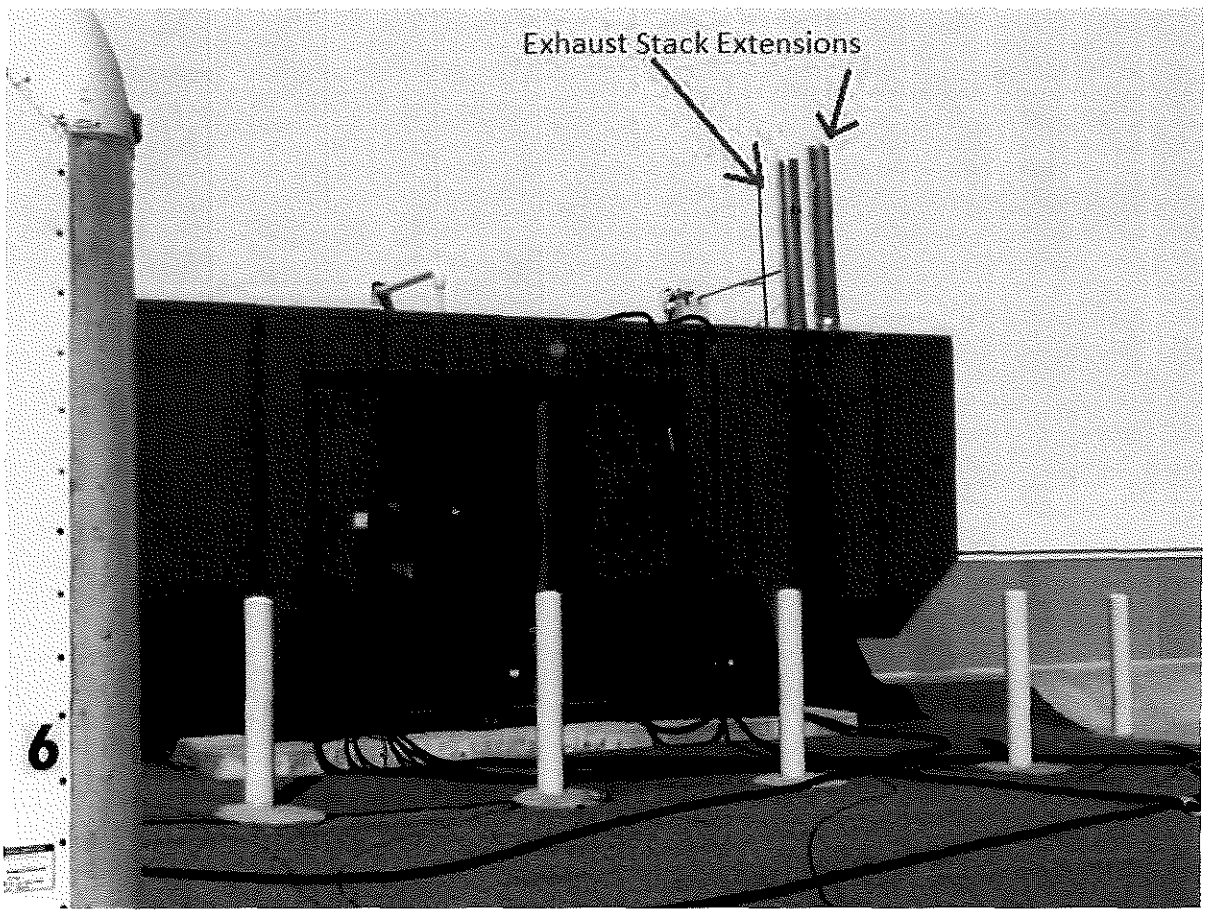

Figure 2-1. Emergency RICE Stack Locations

2.4 Process Sampling Locations

Process sampling was not required during this test program. A process sample is a sample that is analyzed for operational parameters, such as calorific value of a fuel (e.g., natural gas, coal), organic compound content (e.g., paint coatings), or composition (e.g., polymers).

3.0 Summary and Discussion of Results

3.1 Objectives and Test Matrix

The objective of the testing was to measure NO_x, CO, and VOC concentrations and emission rates from the emergency RICE source as required by the facility's MDEQ ROP MI-ROP-B7248-2014a, dated November 18, 2014. Table 3-1 summarizes the sampling and analytical test matrix.

Table 3-1
Test Matrix

Emission Unit ID	Sample/Type of Pollutant	USEPA Sampling Method	No. of Test Runs and Duration	Analytical Method	Analytical Laboratory
EU-ENG-NEW PSHOP2	NO_x, CO, and VOCs	1A, 2, 3A, 4, 7E, 10, 25A, and 205	Three 60-minute runs	Field measurement, Pitot tube, gravimetric, chemiluminescence and infrared gas analyzers, flame ionization detector	Bureau Veritas

3.2 Field Test Changes and Issues

Field test changes were not required to complete the emissions testing with the exception of the following:

- **Test Date Change** - Testing was originally scheduled for September 14, 2016. Because a load bank was required for the testing, and not available that day, the testing was postponed until October 3, 2016 when a load bank was available.

- **Recording Operating Parameters** - The natural gas use and air-to-fuel ratio were not recorded during testing as stated in the Intent-to-Test Plan. While onsite during testing, Mr. Mark Dziadosz, with MDEQ, indicated that recording these operating parameters were not necessary.

Communication between FCA USA LLC, Bureau Veritas, and MDEQ allowed the testing to be performed in accordance with requirements.

3.3 Summary of Results

The results are summarized in Table 3-2. Detailed results of the testing are presented in Table 1 in the Tables tab of the Appendix. Graphs of concentrations measured during testing are provided in the Graphs tab of the Appendix. Sample calculations are presented in Appendix B.

Table 3-2
Emergency RICE Test Results

Emission Unit ID	Parameter	Unit	Result			Average
			Run 1	Run 2	Run 3	
EU-ENG-NEW PSHOP2	NO_x	ppmvd @ 15% O_2	69	79	57	68
		g/hp-hr	1.0	1.0	0.77	0.93
	CO	ppmvd @ 15% O_2	162	110	208	160
		g/hp-hr	1.4	0.88	1.7	1.3
	VOCs	ppmvd @ 15% O_2	18	19	23	20
		g/hp-hr	0.25	0.24	0.30	0.27

NO_x = nitrogen oxide
CO = carbon monoxide
VOCs = volatile organic compounds
ppmvd @ 15% O_2 = part per million by volume, dry, corrected to 15% oxygen
g/hp-hr = gram per horsepower-hour

4.0 Sampling and Analytical Procedures

4.1 Test Methods

Bureau Veritas measured emissions in accordance with the USEPA Methods listed in Table 4-1. Descriptions of the sampling methods and analysis procedures are presented in the following sections.

Table 4-1
Emission Test Parameters and Sampling Method

Parameter	Source		USEPA Reference
	EU-ENG-NEW PSHOP2	Method	Title
Sampling ports and traverse points	•	1A	Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts
Velocity and flowrate	•	2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)
Molecular weight (O_2 and CO)	•	3A	Determination of Oxygen and Carbon Dioxide Concentrations in Emissions From Stationary Sources (Instrumental Analyzer Procedure)
Moisture content	•	4	Determination of Moisture Content in Stack Gases
Nitrogen oxides (NO_2, NO, NO_x)	•	7E	Determination of Nitrogen Oxides Emissions from Stationary Sources
Carbon monoxide (CO)	•	10	Determination of Carbon Monoxide Emissions from Stationary Sources
Volatile organic compounds	•	25A	Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer
Gas dilution calibration	•	205	Verification of Gas Dilution Systems for Field Instrument Calibrations

4.1.1 Volumetric Flowrate (USEPA Methods 1A and 2)

USEPA Method 1A, "Sample and Velocity Traverses for Stationary Sources with Small Stacks or Ducts," from the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A, was used to evaluate the sampling location and the number of traverse points for the measurement of velocity profiles. Figure 1 (see Figures Tab) depicts the sampling location and traverse points.

Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)," was used to measure flue gas velocity and calculate volumetric flowrate. A standard Pitot tube and thermocouple assembly connected to a digital manometer and thermometer was used. Because the dimensions of Bureau Veritas' Pitot tubes meet the requirements outlined in Method 2, Section 10.2, a baseline Pitot tube coefficient of 0.99 (dimensionless) was assigned.

The digital manometer and thermometer are calibrated using calibration standards, which are traceable to National Institute of Standards (NIST). The Pitot tube inspection and calibration sheets will be included in the final test report.

Cyclonic Flow Check. Bureau Veritas evaluated whether cyclonic flow was present at the sampling locations.

Cyclonic flow is defined as a flow condition with an average null angle greater than 20°. The direction of flow can be determined by aligning the Pitot tube to obtain zero (null) velocity head readings—the direction would be parallel to the Pitot tube face openings or perpendicular to the null position. By measuring the angle of the Pitot tube face openings in relation to the stack wall when a null angle is obtained, the direction of flow is measured. If the absolute average of the flow direction angles is greater than 20°, the flue gas flow is considered to be cyclonic at that sampling location and an alternative location should be used.

The measured traverse point flue gas velocity null angle was 0° at each sampling location. The measurements indicate the absence of cyclonic flow at the sampling locations.

Field data sheets are included in Appendix C. Computer-generated field data sheets are included in Appendix D.

4.1.2 Oxygen, Nitrogen Oxides, and Carbon Monoxide (USEPA Methods 3A, 7E, and 10)

USEPA Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrument Analyzer Procedure)," was used to measure the oxygen concentration of the flue gas. USEPA Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Method)" was used to measure NO_x concentrations. Carbon monoxide concentrations were measured using USEPA Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources." The sampling trains for USEPA Methods 3A, 7E, and 10 are similar and the flue gas was extracted from the stack through:

- A stainless-steel probe.
- Heated Teflon® sample line to prevent condensation.

- A chilled Teflon condenser with peristaltic pump to remove moisture from the sampled gas stream prior to entering the analyzer.

- Paramagnetic (O_2), chemiluminescence (NO_x), and infrared (CO) gas analyzers.

Figure 4-1 depicts the USEPA Methods 3A, 7E, and 10 sampling train.

Data were recorded at 1-second intervals on a computer equipped with data acquisition software. Recorded concentrations were reported in 1-minute averages over the duration of each test run.

Before testing, a three-point stratification test was conducted by measuring the O_2 gas concentration at a location positioned at 17, 50, and 83% of the stack diameter for at least twice the analyzer response time. The O_2 concentrations measured were uniform in the stack cross section and less than ±5% or 0.5 part per million (ppm) of the mean concentration for all traverse points so the gas stream was considered to be unstratified and a single sampling point, located near the centroid of the duct, was used for sampling.

A calibration error check was performed by introducing zero-, mid-, and high-level calibration gases directly into the analyzer. The calibration error check was performed to evaluate the analyzer response is within ±2% of the calibration gas span. Prior to each test run, a system-bias test was performed in which known concentrations of calibration gases were introduced at the probe tip to measure if the analyzers response is within ±5% of the calibration span.

An NO/NO_2 conversion check was performed prior to the first test day by introducing an approximate 50 ppm NO_2 calibration gas into the NO_x analyzer. The analyzer's NO_x concentration response was greater than 90% of the introduced NO_2 calibration gas concentration, so the analyzer's NO/NO_2 conversion met the converter efficiency requirement of Section 13.5 of USEPA Method 7E.

At the conclusion of the each test run, an additional system-bias check was performed to evaluate the drift from pre- and post-test system-bias checks. The system-bias checks evaluated if the analyzer drift is within the allowable criterion of ±3% from pre-test to post-test system bias checks. The analyzer drift data was used to correct the measured flue gas concentration.

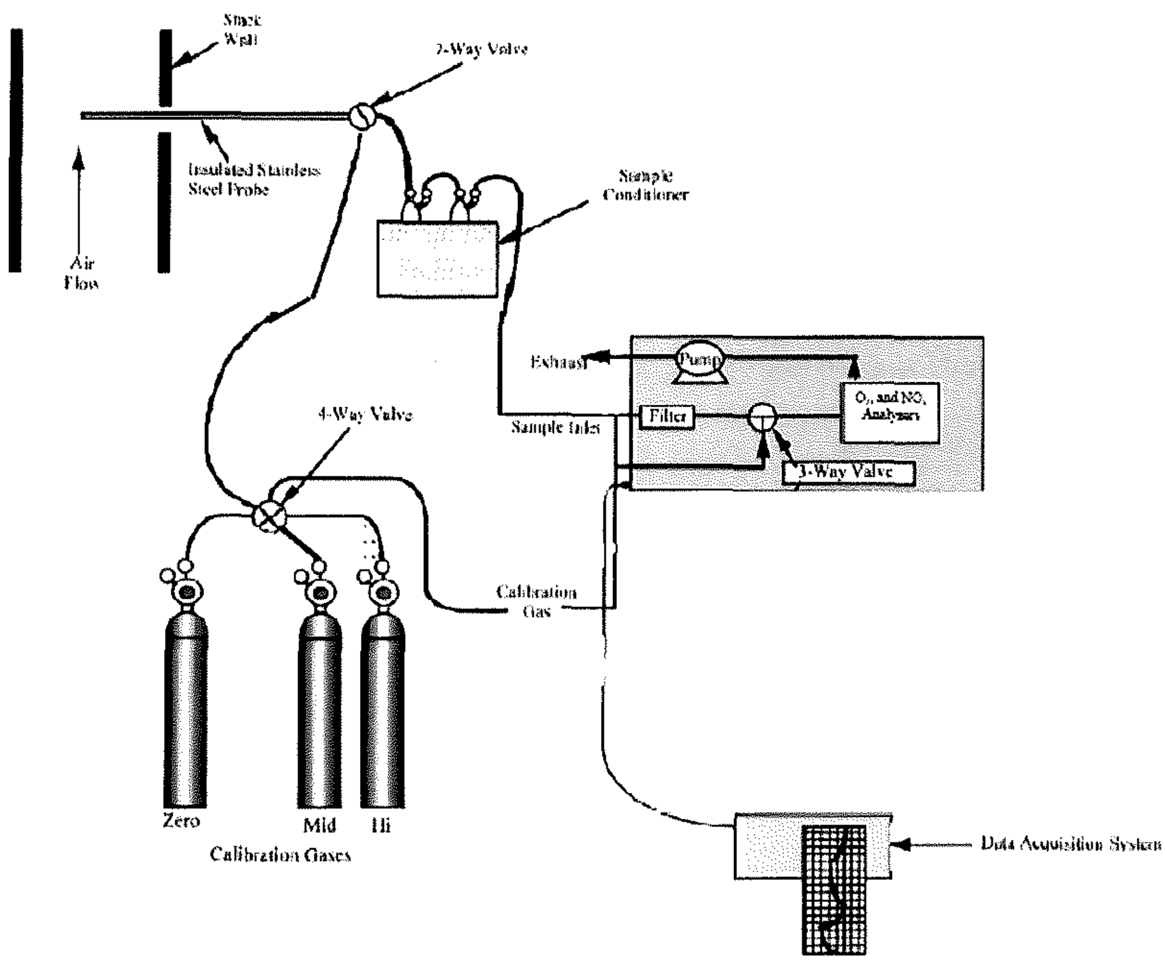

Figure 4-1. USEPA Methods 3A, 7E, and 10 Sampling Train

4.1.3 Moisture Content (USEPA Method 4)

The moisture content at the exhaust to atmosphere locations was measured using USEPA Method 4, "Determination of Moisture Content in Stack Gases." Bureau Veritas' modular USEPA Method 4 stack sampling system consists of:

- A stainless steel probe.
- Tygon® umbilical line connecting the probe to the impingers.
- A set of four Greenburg-Smith (GS) impingers with the configuration shown in Table 4-2 situated in a chilled ice bath.
- A sampling line.

- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Table 4-2
USEPA Method 4 Impinger Configuration

Impinger	Type	Contents	Amount
1	Modified	Water	~100 milliliters
2	Greenburg Smith	Water	~100 milliliters
3	Modified	Empty	0 milliliters
4	Modified	Silica desiccant	~300 grams

Before initiating a test run, the sampling train was leak-checked by capping the probe tip and applying a vacuum of approximately 10 inches of mercury to the sampling train. The dry-gas meter was then monitored for approximately 1 minute to verify that the sample train leak rate was less than 0.02 cubic feet per minute (cfm). The sample probe was inserted into the sampling port near the centroid of the stack in preparation of sampling. Flue gas was extracted at a constant rate from the stack, with moisture removed from the sample stream by the chilled impingers.

At the conclusion of the test run, a post-test leak check was conducted and the impinger train was carefully disassembled. The weight of liquid or silica gel in each impinger was measured with a scale capable of measuring ±0.5 gram. The weight of water collected within the impingers and volume of flue gas sampled was used to calculate the percent moisture content. One moisture content sample was collected during each test run. Figure 4-2 depicts the USEPA Method 4 sampling train.

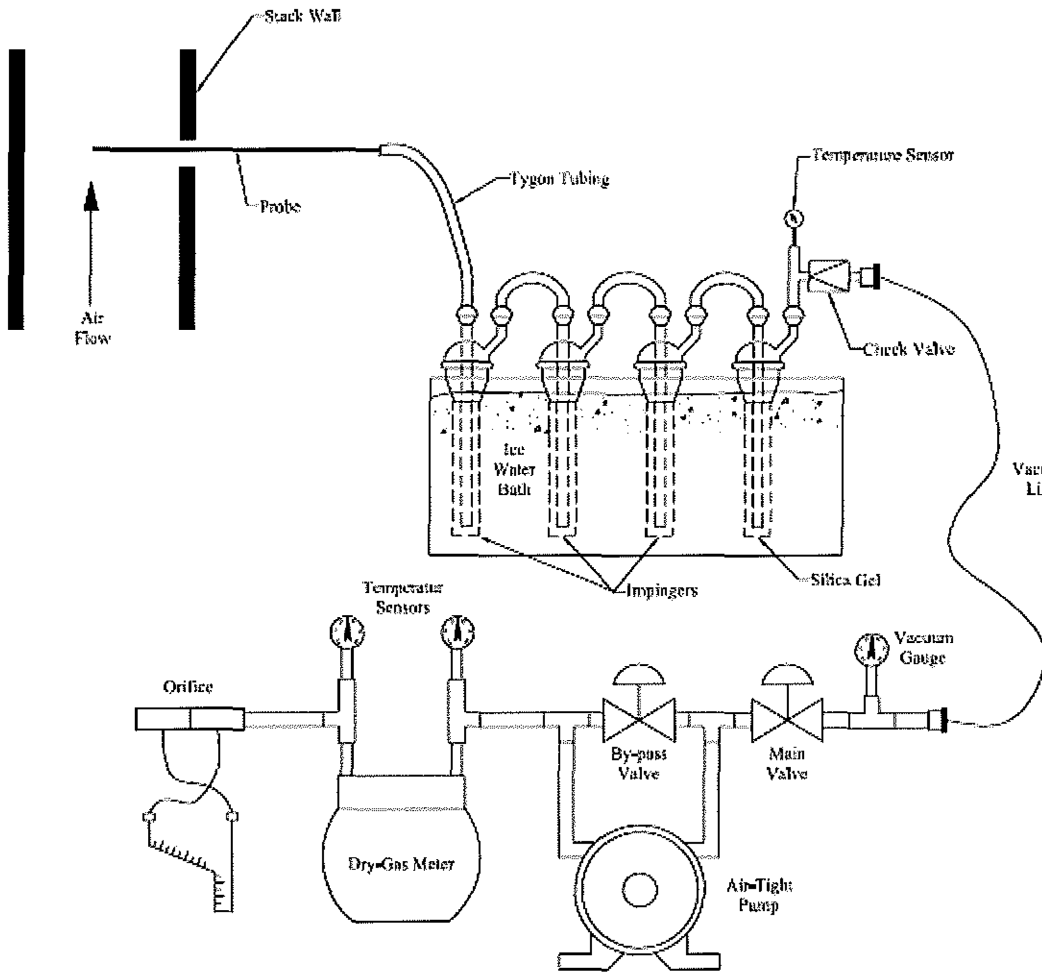

Figure 4-2. USEPA Method 4 Sampling Train

4.1.4 Volatile Organic Compounds (USEPA Method 25A)

VOC concentrations were measured following USEPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." Samples were collected through a stainless steel probe and heated sample line that was inserted into the analyzer's sample port. Bureau Veritas used a J.U.M. 3-300A flame ionization detector-based hydrocarbon analyzer.

A flame ionization detector (FID) measures an average hydrocarbon concentration in parts per million by volume (ppmv) of VOC relative to the calibration gas propane. The FID is fueled by 100% hydrogen, which generates a flame with a negligible number of ions. Flue gas is introduced into the FID and enters the flame chamber. The combustion of flue gas generates electrically charged ions. The analyzer applies a polarizing voltage between two electrodes around the flame, producing an electrostatic field. Negatively charged ions (anions) migrate to a collector electrode, while positive charged ions (cations) migrate to a high-voltage electrode. The current between the electrodes is directly proportional to the hydrocarbon concentration in the sample. The flame chamber is depicted in Figure 4-3.

Using the voltage analog signal, measured by the FID, the concentration of VOCs is recorded by a data acquisition system (DAS). The average concentration of VOCs is reported as the calibration gas (i.e., propane) in equivalent units.

Before testing, the FID analyzers were calibrated by introducing a zero-calibration range gas (<1% of span value) and high-calibration range gas (80-90% span value) to the tip of the sampling probe. The span value was set to 1.5 to 2.5 times the expected concentration (e.g., 0-100 ppmv). Next, a low-calibration range gas (25-35% of span value) and mid-calibration range gas (45-55% of span value) were introduced. The analyzers were considered to be calibrated when the analyzer response was ±5% of the calibration gas value.

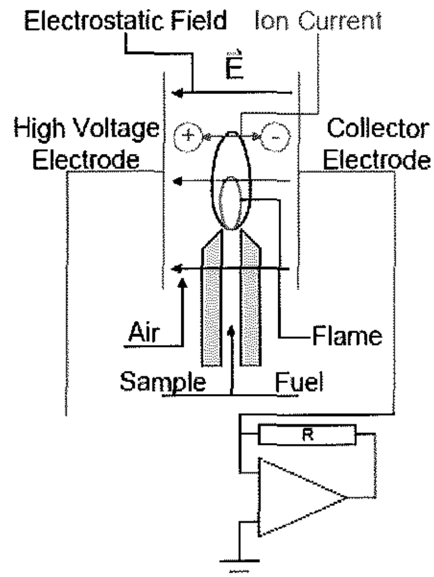

Figure 4-3. FID Flame Chamber

At the conclusion of a test run a calibration drift test was performed by introducing the zero- and mid- or low-calibration gas to the tip of the sampling probe. The test run data were considered valid if the calibration drift test demonstrated that the analyzers were responding within ±3% from pre-test to post-test calibrations. Refer to Figure 4-4 for a drawing the USEPA Method 25A sampling train. See Appendix A for calibration data.

4.1.5 Gas Dilution (USEPA Method 205)

A gas dilution system was used to introduce known values of calibration gases into the analyzers. The gas dilution system consists of calibrated orifices or mass flow controls and dilutes a high-level calibration gas to within ±2% of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with USEPA Method 205, "Verification of Gas Dilution Systems for Field Instrument Calibrations."

Before testing, the gas divider dilutions were measured to evaluate that they were within ±2% of predicted values. Three sets of three dilutions of the high-level calibration gas were performed. In addition, a certified mid-level calibration gas was introduced into an analyzer; this calibration gas concentration was within ± 10% of a gas divider dilution concentration.

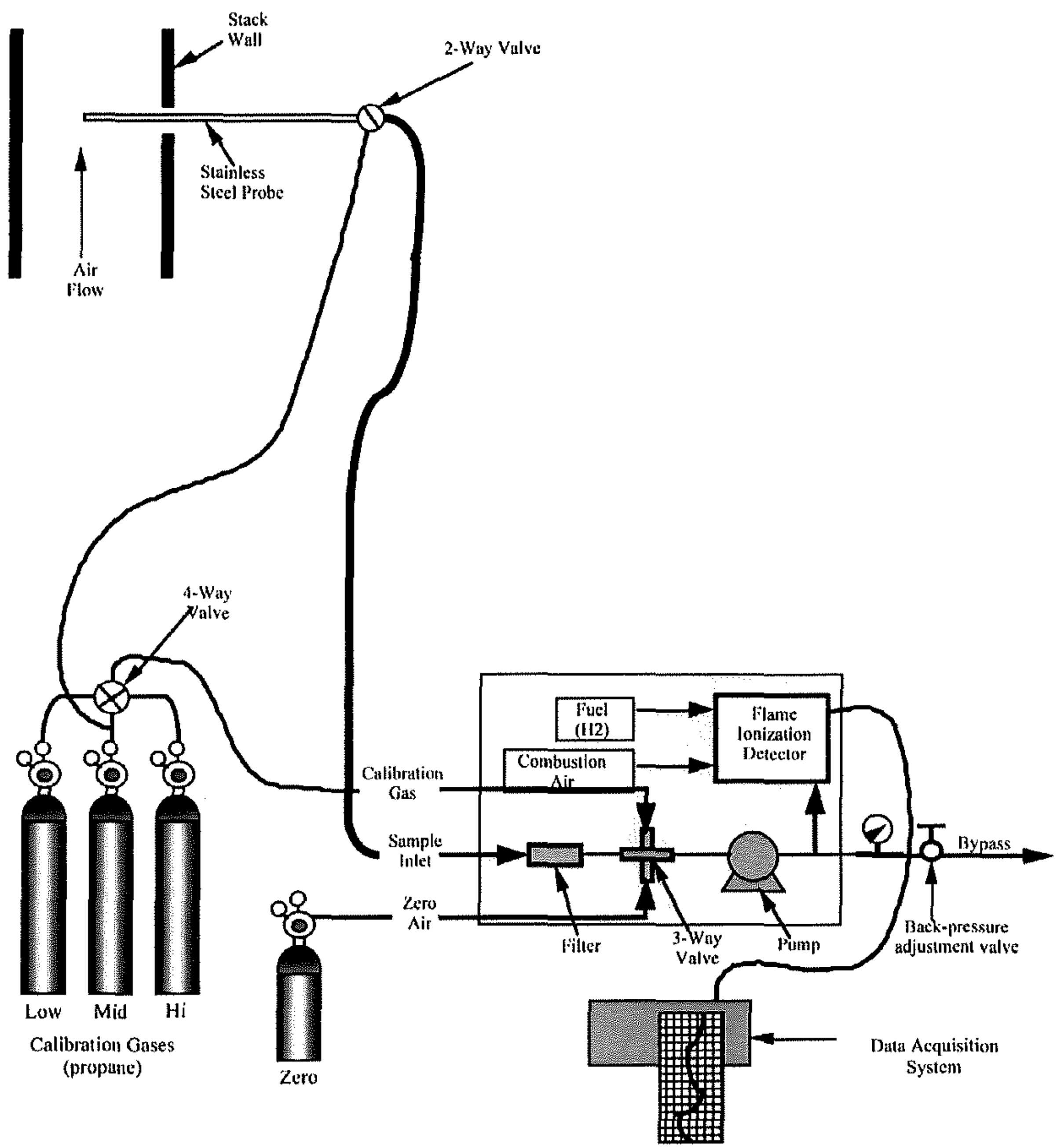

Figure 4-4. USEPA Method 25A Sampling Train

4.2 Procedures for Obtaining Process Data

While onsite during testing, a representative from Cummins indicated that engine power of the emergency RICE was 408 kW while the testing was being conducted.

The natural gas use and air-to-fuel ratio were not recorded during testing as stated in the Intent-to-Test Plan. While onsite during testing, Mr. Mark Dziadosz, with MDEQ, indicated that recording these operating parameters were not necessary.

4.3 Sampling Identification and Custody

Chain of Custody procedures are not applicable to this test program. The emissions test methods used during this test program provide onsite results and do not require laboratory analysis.

5.0 QA/QC Activities

Equipment used in this emissions test program passed quality assurance/quality control (QA/QC) procedures. Refer to Appendix A for equipment calibration and inspection sheets. Field data sheets are presented in Appendix C. Computer-generated Data Sheets are presented in Appendix D.

5.1 Pretest QA/QC Activities

Before testing, the sampling equipment was cleaned, inspected, and calibrated according to procedures outlined in the applicable USEPA sampling methods and USEPA's "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods."

5.2 QA/QC Audits

The results of select sampling and equipment QA/QC audits and the acceptable tolerance are presented in the following sections. Calibration and inspection sheets for analyzers, dry-gas meters (DGMs), thermocouples, and Pitot tubes are presented in Appendix A.

5.2.1 Instrument Analyzer QA/QC Audits

The instrument analyzer sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. The analyzers passed the applicable calibration criteria. Table 5-1 summarizes the gas cylinders used during this test program. Calibration gas selection, bias, and drift checks are included in Appendix A.

Table 5-1
Calibration Gas Cylinder Information

Parameter	Gas Vendor	Cylinder Serial Number	Cylinder Value	Expiration Date
Air	Airgas	5383490Y	-	February 10, 2024
Hydrogen	Airgas	CC20386	99.999%	NA
Propane	Airgas	CC313717	301.5 ppm	September 13, 2024
Nitrogen	Airgas	CC173587	-	March 18, 2024
O_2/CO_2	Airgas	CC3829B	19.94/19.78 ppm	June 2, 2024
O_2/CO_2	Airgas	CC465807	11.09/11.04 ppm	June 8, 2024
CO	Airgas	XC032359B	4408 ppm	October 30, 2022
NO_X	Airgas	XC033685B	491.7 ppm	December 2, 2021
NO_2	Airgas	CC500773	50.18 ppm	November 11, 2017

5.2.2 Thermocouple QA/QC Audits

Temperature measurements using thermocouples and digital pyrometers were compared to reference temperatures (i.e., ice water bath, boiling water) to evaluate accuracy of the equipment. The thermocouples and pyrometers measured temperatures within ±1.5% (i.e., the USEPA acceptance criterion) of the reference temperatures. Thermocouple and pyrometer calibration results are presented in the Appendix A.

5.3 QA/QC Checks for Data Reduction and Validation

Mr. Li Wu validated the computer spreadsheets onsite. The computer spreadsheets were used to evaluate the accuracy of field calculations. The field data sheets were reviewed to evaluate whether data has been recorded and inputted appropriately. The computer data sheets were checked against the raw field data sheets for accuracy during review of the draft report. Sample calculations were performed to verify computer spreadsheet computations.

5.4 QA/QC Problems

Equipment audits and QA/QC procedures demonstrate sample collection accuracy for the test runs.

Limitations

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This report prepared by:

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BUREAU VERITAS

Table 1

Emergency RICE NO_x, CO, and VOC Results

FCA US LLC Sterling Heights Assembly Plant

Sterling Heights, Michigan

Bureau Veritas Project No. 11016-0000157.00

Sampling Date: October 3, 2016

Parameter	Units	Run 1	Run 2	Run 3	
Date		**Oct 3, 2016**	**Oct 3, 2016**	**Oct 3, 2016**	**Average**
Start Time	hr:min	13:00	14:25	15:50	
Duration	min	60	60	60	60
Engine Power	kW	408	408	408	408
Volumetric Flowrate	dscf/min	856	889	905	883
O_2 Concentration (C_{avg})	%, dry	4.5	6.1	5.8	5.5
Corrected O_2 Concentration (C_{gas})†	**%, dry**	**4.4**	**6.3**	**6.0**	**5.5**
CO_2 Concentration (C_{avg})	%, dry	10	8.4	8.4	9.0
Corrected CO_2 Concentration (C_{gas})†	**%, dry**	**9.9**	**8.3**	**8.4**	**8.9**
NO_x Concentration (C_{avg})	ppmvd	189	191	143	174
Corrected NO_x Concentration (C_{gas})†	**ppmvd**	**195**	**195**	**144**	**178**
Corrected NO_x Concentration (C_{gas})†, @ 15% O2	**ppmvd**	**69**	**79**	**57**	**68**
NO_x Mass Emission Rate	**lb/hr**	**1.2**	**1.2**	**0.93**	**1.1**
NO_x Mass Emission Rate	**g/hp-hr**	**1.0**	**1.0**	**0.77**	**0.93**
CO Concentration (C_{avg})	ppmvd	445	263	512	407
Corrected CO Concentration (C_{gas})†	**ppmvd**	**454**	**272**	**525**	**417**
Corrected CO Concentration (C_{gas})†, @ 15% O2	**ppmvd**	**162**	**110**	**208**	**160**
CO Mass Emission Rate	**lb/hr**	**1.7**	**1.1**	**2.1**	**1.6**
CO Mass Emission Rate	**g/hp-hr**	**1.4**	**0.88**	**1.7**	**1.3**
VOC Concentration (C_{avg})	ppmv	53	49	60	54
Corrected VOC Concentration (C_{gas})†	**ppmv**	**52**	**48**	**59**	**53**
Corrected VOC Concentration (C_{gas})†, @ 15% O2	**ppmv**	**18**	**19**	**23**	**20**
VOC Mass Emission Rate	**lb/hr**	**0.30**	**0.29**	**0.37**	**0.32**
VOC Mass Emission Rate	**g/hp-hr**	**0.25**	**0.24**	**0.30**	**0.27**

† corrected for analyzer drift

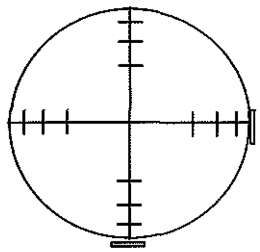
lb/hr: pound per hour

dscf/min: dry standard cubic foot per minute

ppmvd: part per million by dry volume

g/hp-hr: gram per horsepower-hour

8" INTERNAL DIAMETER



TRAVERSE POINT	DISTANCE FROM STACK WALL (INCHES)
4	0.54
3	2.00
2	6.00
1	7.46

	DISTANCE FROM PORTS TO NEAREST UPSTREAM BEND/ DISTURBANCE	DISTANCE FROM PORTS TO NEAREST DOWNSTREAM BEND/DISTURBANCE
Emergency RICE Gas Sampling Port	64 INCHES (8 DIAMETERS)	64 INCHES (8 DIAMETERS)
Emergency RICE Flow Sampling Port	64 INCHES (8 DIAMETERS)	16 INCHES (2 DIAMETER)

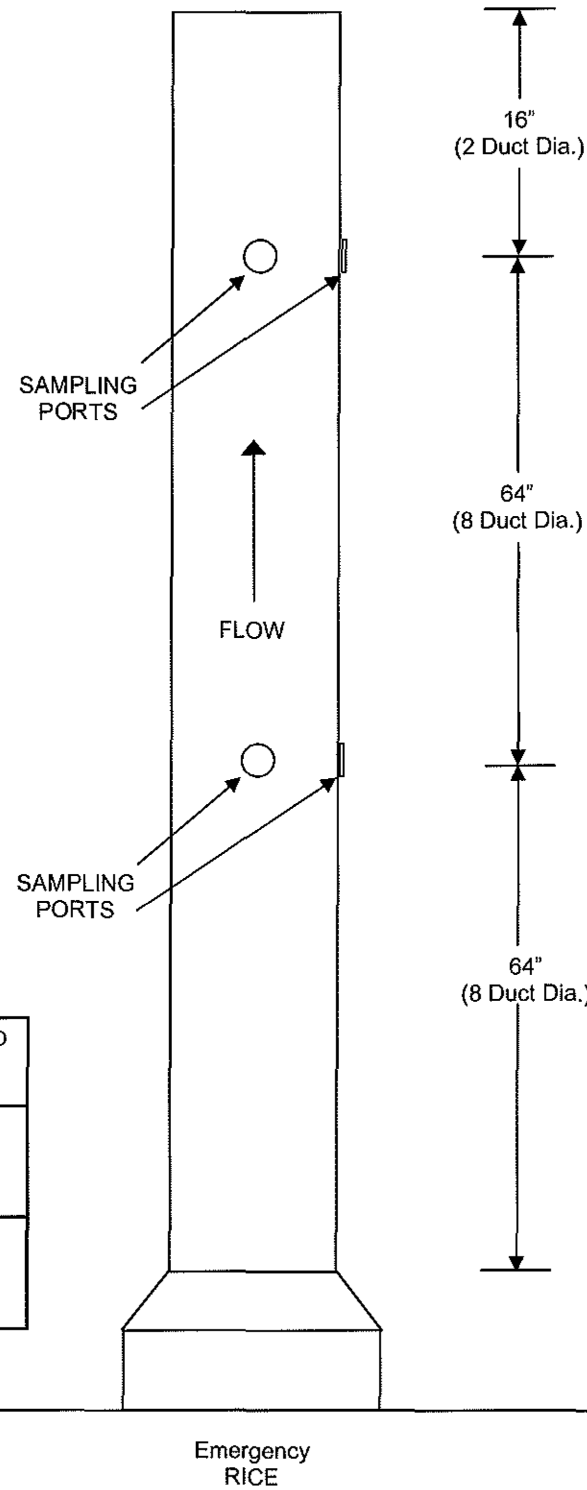
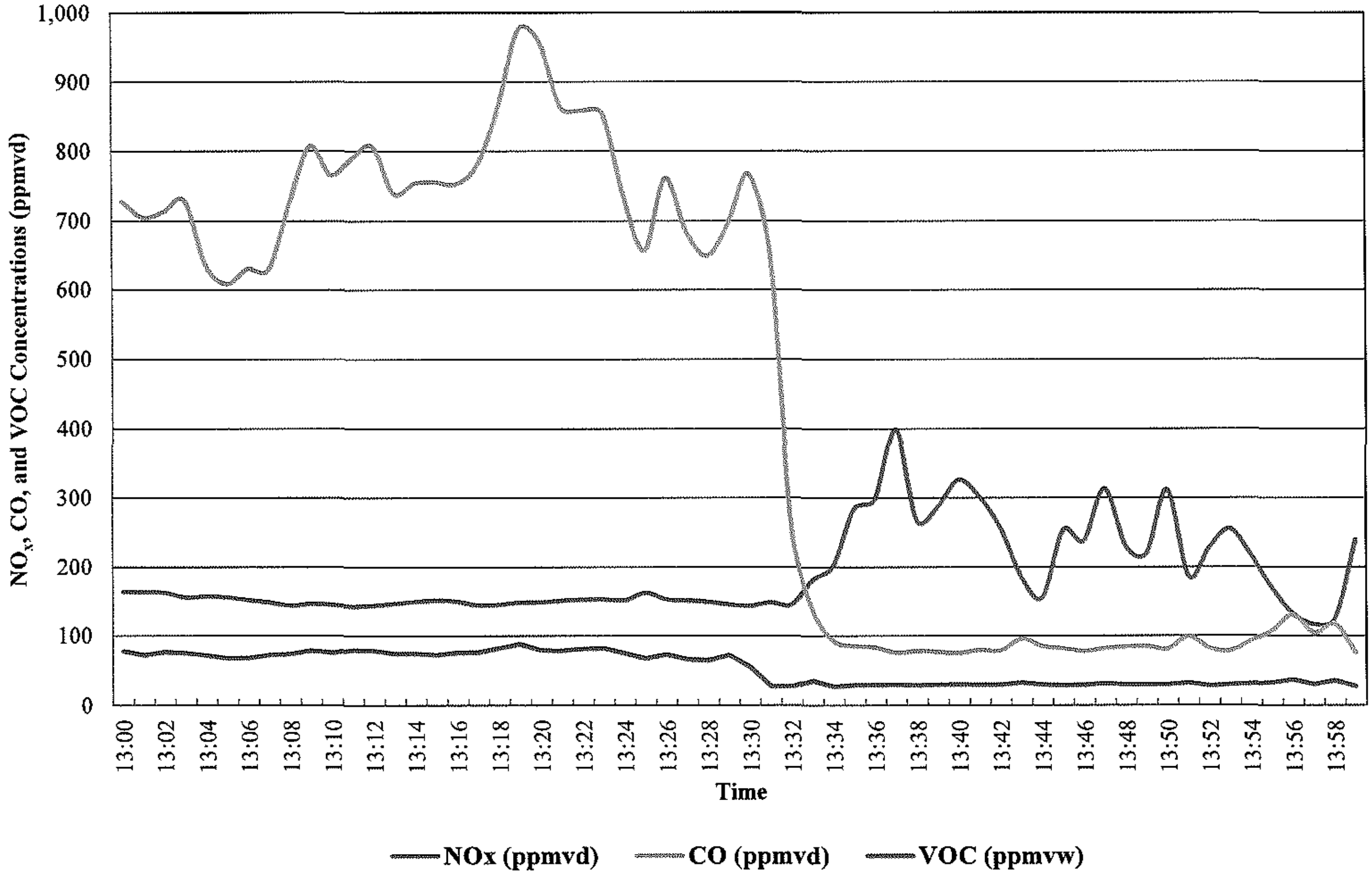
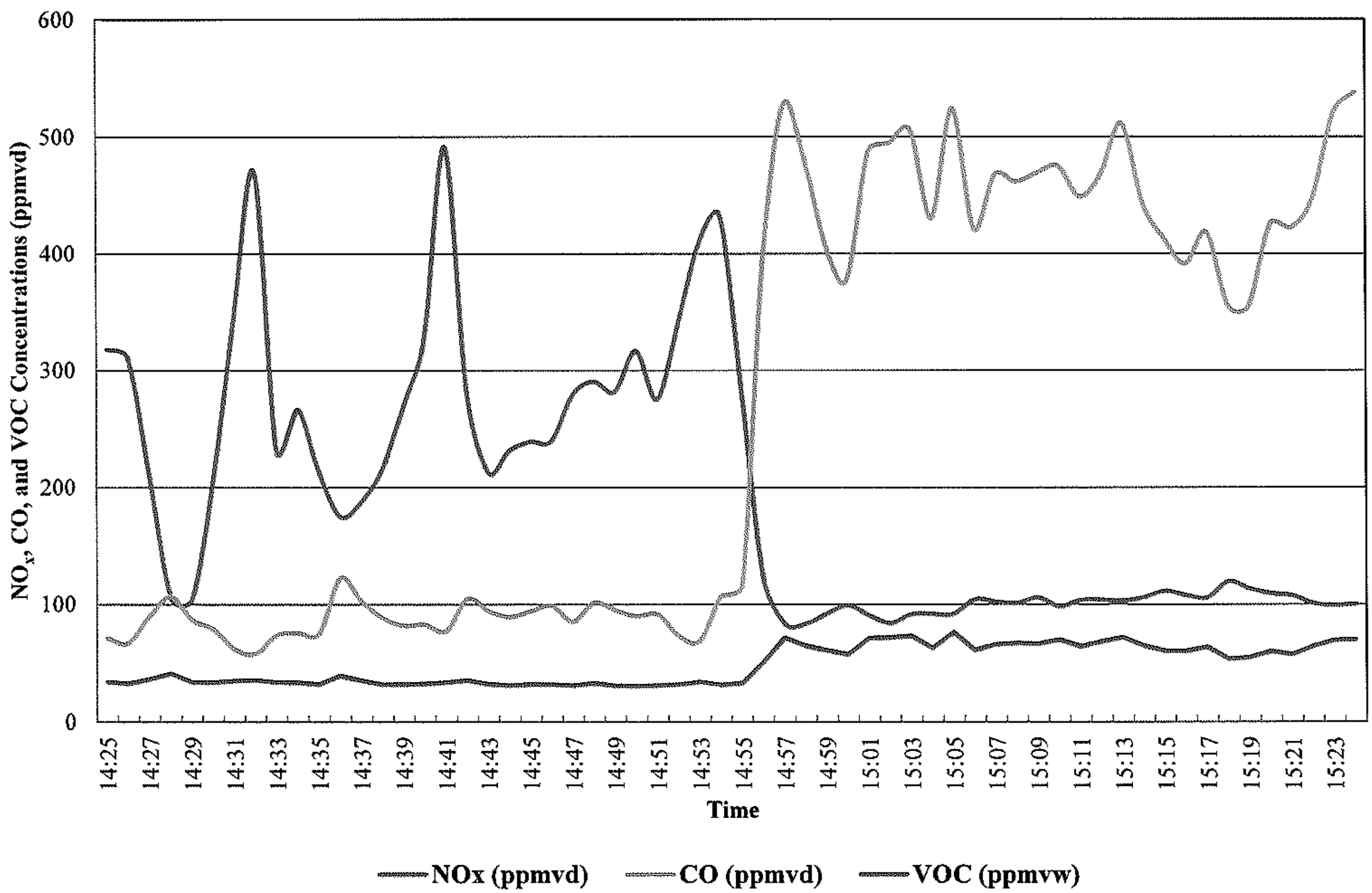


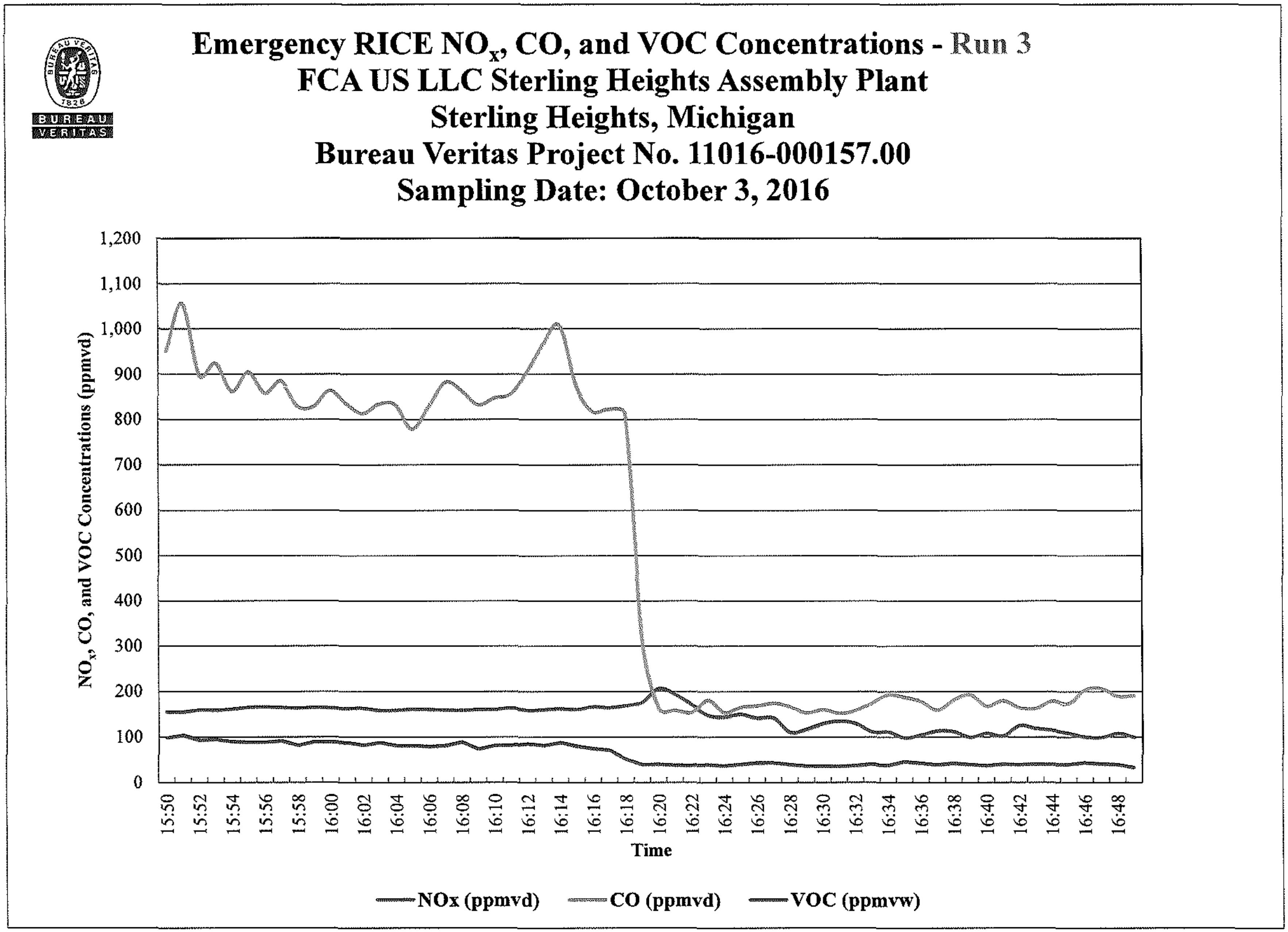
Figure 1 Emergency RICE Sampling Ports and Traverse Point Locations	BUREAU VERITAS	FCA US LLC Sterling Heights Assembly Plant Sterling Heights, Michigan
		Project No. 11016-000157.00
		Last Revision: October 14, 2016

Emergency RICE NO_x, CO, and VOC Concentrations - Run 1
FCA US LLC Sterling Heights Assembly Plant
Sterling Heights, Michigan
Bureau Veritas Project No. 11016-000157.00
Sampling Date: October 3, 2016



Emergency RICE NO_x, CO, and VOC Concentrations - Run 2
FCA US LLC Sterling Heights Assembly Plant
Sterling Heights, Michigan
Bureau Veritas Project No. 11016-000157.00
Sampling Date: October 3, 2016





Emergency RICE NO_x, CO, and VOC Concentrations - Run 3
FCA US LLC Sterling Heights Assembly Plant
Sterling Heights, Michigan
Bureau Veritas Project No. 11016-000157.00
Sampling Date: October 3, 2016
NO_x, CO, and VOC Concentrations (ppmvd)
1,200
1,100
1,000
900
800
700
600
500
400
300
200
100
0
15:50
15:52
15:54
15:56
15:58
16:00
16:02
16:04
16:06
16:08
16:10
16:12
16:14
16:16
16:18
16:20
16:22
16:24
16:26
16:28
16:30
16:32
16:34
16:36
16:38
16:40
16:42
16:44
16:46
16:48
Time
NOx (ppmvd)
CO (ppmvd)
VOC (ppmvw)