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1.0 Introduction

1.1 Summary of Test Program

Metal Technologies (MTI) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test on the sources listed in Table 1-1 at the Three Rivers Gray Iron facility located in Three Rivers, Michigan.

The tests were conducted to meet the requirements of the Michigan Department of Great Lakes, Environment, and Energy (EGLE) Permit No. MI-PT-B2015-2019 and Part 63, Subpart EEEEE - National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries.

The specific objectives were to:

- Determine the concentrations and emission rates of FPM
- Determine the opacity of VE
- Determine the fugitive emissions
- 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	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
8/23/22	FGMACTEEEE	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	96-120
		O_2, CO_2	EPA 3	3	96-120
		Moisture	EPA 4	3	96-120
		FPM	EPA 5	3	96-120
		Fugitive emissions	EPA 9	3	60
		Post-test meter calibration check	EPA ALT-009	--	--
8/23/22	FGGRAYIRON	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	96-120
		O_2, CO_2	EPA 3	3	96-120
		Moisture	EPA 4	3	96-120
		FPM	EPA 5	3	96-120
		Opacity	EPA 9	3	60
		Post-test meter calibration check	EPA ALT-009	--	--

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 Tables 1-2 and 1-3. Detailed results for individual test runs can be found in Section 4.0. All supporting data can be found in the appendices.

The tests were conducted according to Test Plan No. MW023AS—025681-PP-479 Rev 1 dated July 8, 2022.

Table 1-2
Summary of Average Compliance Results – FGMACTEEEEE (South Fuller/Small Dustar)

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (FPM)		
gr/dscf	0.0006	0.005
lb/hr	0.13	--
Fugitive emissions (FE)		
opacity, %	0	20 or 27[1]

Table 1-3
Summary of Average Compliance Results – FGGRAYIRON (South Fuller/Small Dustar & ETA)

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (FPM)		
lb/hr	0.488	1.7
lb/1,000 lb of exhaust gas	0.0022	0.01

[1]20% 6-minute average, except for one 6-minute average per hour that does not exceed 27%

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location:	Metal Technologies Three Rivers Gray Iron 429 4th Street Three Rivers, MI 49093
Project Contact:	Dan Plant
Role:	Director of Environmental Engineering
Telephone:	260-920-2137
Email:	dplant@metals-technologies.com

Agency Information

Regulatory Agency:	Michigan Department of Environment, Great Lakes, and Energy
Agency Contact:	Amanda Chapel

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC
Contact:	James Christ
Title:	Client Project Manager
Telephone:	630-860-4740
Email:	jchrist@montrose-env.com

Laboratory Information

Laboratory:	Montrose Air Quality Services, LLC
City, State:	Elk Grove Village, Illinois
Method:	5

Test personnel and observers are summarized in Table 1-4.

Table 1-4
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
James Christ	Montrose	Client Project Manager/Field Team Leader/QSTI/Sample recovery/VE observer
Paul Repuyan	Montrose	Senior Technician/QI/Sample recovery/Sample train operator
Chris Ziber	Montrose	Field Technician/Sample recovery/Sample train operator
Jacob Cartee	Montrose	Report preparation
Dan Plant	MTI	Client Liaison/Test Coordinator

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

Metal preheating, charge unloading, melting and pouring.
Emission Units: EUVANETTA, EUBBFURN1, EUBBFURN2, EUBBFURN3, EUBBFURN4

The affected source is a new preexisting iron and steel foundry, that is (or is part of) a major source of hazardous air pollutant (HAP) emissions. An existing affected source is a source that commences construction or reconstruction before December 23, 2002. A new affected source is a source that commences construction or reconstruction on or after December 23, 2002.The regulations cover emissions from metal melting furnaces, scrap preheaters, new pouring areas, pouring stations, new automated conveyor and new pallet cooling lines, new automated shakeout lines, mold and core making lines, and fugitive emissions from foundry operations.

Emission Units: EUVANETTA, EUBBFURN1, EUBBFURN2, EUBBFURN3, EUBBFURN4

2.2 Flue Gas Sampling Locations

Information regarding the sampling locations is presented in Table 2-1.

Table 2-1
Sampling Locations

Sampling Locations	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
FGMACTEEEEE	52	154/2.96	72/1.30	Isokinetic: 24 (12/port)
FGGRAYIRON	62	192/3.10	340/5.48	Isokinetic: 24 (12/port)

The sample locations were verified in the field to conform to EPA Method 1. Absence of cyclonic flow conditions was confirmed following EPA Method 1, Section 11.4. See Appendix A.1 for more information.

2.3 Operating Conditions and Process Data

The emission tests were performed while the units and air pollution control devices were operating at the conditions required by the permit.

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.

3.0 Sampling and Analytical Procedures

3.1 Test Methods

The test methods for this test program have been presented 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.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - None
- Method Exceptions:
  - None

The sample port and traverse point locations are detailed in Appendix A.

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. The measurements are made at traverse points specified by EPA Method 1. The molecular weight of the gas stream is determined from independent measurements of O_2, CO_2, and moisture. The stack gas volumetric flow rate is calculated using the measured average velocity head, the area of the duct at the measurement plane, the measured average temperature, the measured duct static pressure, the molecular weight of the gas stream, and the measured moisture.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - S-type pitot tube coefficient is 0.84
- Method Exceptions:
  - None

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

3.1.3 EPA Method 3, Gas Analysis for the Determination of Dry Molecular Weight

EPA Method 3 is used to measure the percent O_2 and CO_2 in the gas stream. A gas sample is extracted from a stack by one of the following methods: (1) single-point, grab sampling; (2) single-point, integrated sampling; or (3) multi-point, integrated sampling. The gas sample is analyzed for percent CO_2 and percent O_2 using either an Orsat or a Fyrite analyzer.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - An Orsat analyzer was used to measure the analyte concentrations
- Method Exceptions:
  - The sample is collected into a Tedlar bag from the back of the sample train for the duration of each test run
- Target and/or Minimum Required Sample Duration: 96-120 minutes

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.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Moisture sampling is performed as part of the pollutant sample trains
  - Since it is theoretically impossible for measured moisture to be higher than psychrometric moisture, the psychrometric moisture is also calculated, and the lower moisture value is used in the calculations
- Method Exceptions:
  - None
- Target and/or Minimum Required Sample Volume: 60 dscf

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

3.1.5 EPA Method 5, Determination of Particulate Matter Emissions from Stationary Sources

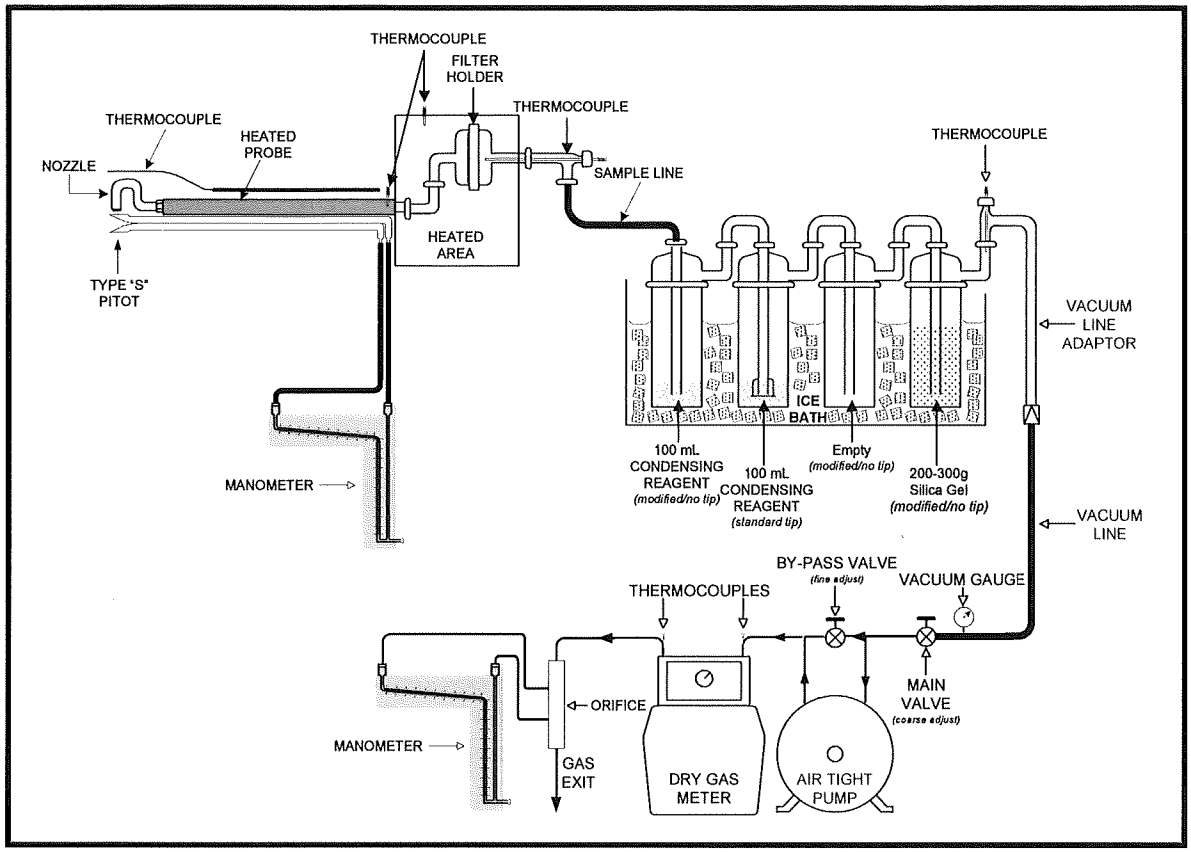
EPA Method 5 is a manual, isokinetic method used to measure FPM emissions. The samples are analyzed gravimetrically. This method is performed in conjunction with EPA Methods 1 through 4. The stack gas is sampled through a nozzle, probe, filter, and impinger train.

Pertinent information regarding the performance of the method is presented below:

- Method Options:
  - Glass sample nozzles and probe liners are used
- Method Exceptions:
  - None
- Target and/or Minimum Required Sample Volume: 60 dscf
- Analytical Laboratory: Montrose, Elk Grove Village, Illinois

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

FIGURE 3-1
EPA METHOD 5 (DETACHED) SAMPLING TRAIN



3.1.6 EPA Method 9, Visual Determination of the Opacity of Emissions

EPA Method 9 is used to observe the visual opacity of emissions (opacity). The observer stands at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to their back. The line of vision is perpendicular to the plume direction and does not include more than one plume diameter. Observations are recorded at 15-second intervals and are made to the nearest 5% opacity. The qualified observer is certified according to the requirements of EPA Method 9, section 3.1.

- Method Options:
  - Observations are attempted to be made 30 minutes before, during, or within 30 minutes after each concurrent particulate run, unless weather conditions are unfavorable.
- Method Exceptions:
  - None

3.1.7 EPA Method ALT-009, Alternative Method 5 Post-Test Calibration

EPA Approved Alternative Method 009 (ALT-009) is used as an alternative to a two-point post-test meter box calibration. This procedure uses a calculation to check the meter box calibration factor rather than requiring a physical post-test meter box calibration using a standard dry gas meter. The average calculated meter box percent (%) error must result in a percent error within ±5% of Y. If not, a full calibration is performed, and the results are presented using the Y factor that yields the highest emissions.

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

Besides the test method exception listed in Section 3.1.3, no other 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 Tables 1-2 and 1-3. The results of individual compliance test runs performed are presented in Tables 4-1 and 4-2. 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
FPM Emissions and VE Results -
FGGRAYIRON

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	8/23/2022	8/23/2022	8/23/2022	--
Time	07:46-09:46	10:41-12:44	13:34-15:41	--
Sampling & Flue Gas Parameters				
sample duration, minutes	120	120	96	--
sample volume, dscf	79.21	75.37	68.17	--
isokinetic rate, %	102.6	103.0	96.1	--
O_2, % volume dry	20.8	20.8	20.8	20.8
CO_2, % volume dry	0.0	0.0	0.0	0.0
flue gas temperature, °F	105	118	126	116
moisture content, % volume	1.3	1.4	1.5	1.4
volumetric flow rate, dscfm	82,660	78,360	77,929	79,650
Filterable Particulate Matter (PM)				
g	0.0024	0.0020	0.0022	0.0022
gr/dscf	0.0005	0.0004	0.0005	0.0005
lb/hr	0.33	0.28	0.34	0.32
lb/1,000 lb of exhaust gas	0.00089	0.00075	0.00091	0.00085
Visible Emissions (VE)				
time	07:35-09:44	11:43-12:43	14:36-15:36	--
opacity, %	1.7	0.2	4.4	2.1

Table 4-2
FPM Emissions and VE Results -
FGMACTEEEEE

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	8/23/2022	8/23/2022	8/23/2022	--
Time	07:33-09:46	10:41-12:44	13:34-15:41	--
Sampling & Flue Gas Parameters				
sample duration, minutes	120	120	96	--
sample volume, dscf	59.97	58.89	61.95	--
isokinetic rate, %	100.7	96.7	103.3	--
O_2, % volume dry	20.8	20.8	20.8	20.8
CO_2, % volume dry	0.0	0.0	0.0	0.0
flue gas temperature, °F	124	138	161	141
moisture content, % volume	2.39	2.54	2.59	2.50
volumetric flow rate, dscfm	27,729	25,968	25,000	26,233
Filterable Particulate Matter (PM)				
g	0.0028	0.0017	0.0020	0.0022
gr/dscf	0.0007	0.0004	0.0005	0.0006
lb/hr	0.17	0.10	0.11	0.13
Fugitive Emissions (FE)				
time	07:33-08:33	10:41-11:41	13:34-14:34	--
opacity, %	0	0	0	0

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

The meter boxes and sampling trains used during sampling performed within the requirements of their respective methods. All post-test leak checks, minimum metered volumes, minimum sample durations, and percent isokinetics met the applicable QA/QC criteria.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. An EPA Method 5 reagent blank was analyzed. The maximum allowable amount that can be subtracted is 0.001% of the weight of the acetone used. The blank did not exceed the maximum residue allowed.

EPA Method 9 was performed by a certified Visible Emissions Evaluator. For quality assurance, the observer obtained a view of the emissions with the best available contrasting background and with the sun oriented in the 140° sector to their back. Readings were taken every 15 seconds and made to the nearest 5% opacity.

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 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).

Appendix A
Field Data and Calculations

Appendix A.1
Sampling Locations