SOURCE TEST REPORT
2021 COMPLIANCE EMISSIONS TESTING

GENERAL MOTORS LLC - SAGINAW METAL CASTING OPERATIONS (SMCO)
SAGINAW, MICHIGAN

EU-PSANDPROCESS AND EU-SPMPROCESSAND

Prepared For:

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1.0 INTRODUCTION

1.1 SUMMARY OF TEST PROGRAM

General Motors-Saginaw Metal Casting Operations (SMCO) (State Registration No.: B1991) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the EU-PSANDPROCESS and EU-SPMPROCESSAND at the General Motors-Saginaw Metal Casting Operations (SMCO) facility located in Saginaw, Michigan. Testing was performed on November 2-5, 2021, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Renewable Operating Permit No. MI-ROP-B1991-2021 and Permit-to-Install (PTI) 36-12L.

The specific objectives were to:

- Verify the emissions of filterable particulate matter (FPM), visible emissions (VE) and volatile organic compounds (VOC) from the baghouses, Z02-BH1 and Z02-BH2, serving PSANDPROCESS.
- Verify the emissions of FPM, VE, and VOC at the baghouse Z02-BH-4 serving SPMPROCESSAND
- 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)
11/2/2021	Z02-BH-4	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	120
11/2/2021	Z02-BH-4	O_2, CO_2	EPA 3	3	120
11/2/2021	Z02-BH-4	Moisture	EPA 4	3	120
11/2/2021	Z02-BH-4	FPM	EPA 5	3	120
11/2/2021	Z02-BH-4	Opacity	EPA 9	3	60
11/2/2021	Z02-BH-4	VOC	EPA 25A & 18	3	120

TABLE 1-1
SUMMARY OF TEST PROGRAM (CONTINUED)

Test Date	Unit ID/ Source Name	Activity/ Parameters	Test Methods	No. of Runs	Duration (Minutes)
11/3/2021	Z02-BH-2	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	120
11/3/2021	Z02-BH-2	O_2, CO_2	EPA 3	3	120
11/3/2021	Z02-BH-2	Moisture	EPA 4	3	120
11/3/2021	Z02-BH-2	FPM	EPA 5	3	120
11/3/2021	Z02-BH-2	Opacity	EPA 9	3	60
11/3/2021	Z02-BH-2	VOC	EPA 25A & 18	3	120
11/4/2021-11/5/2021	Z02-BH-1	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	120
11/4/2021-11/5/2021	Z02-BH-1	O_2, CO_2	EPA 3	3	120
11/4/2021-11/5/2021	Z02-BH-1	Moisture	EPA 4	3	120
11/4/2021-11/5/2021	Z02-BH-1	FPM	EPA 5	3	120
11/4/2021	Z02-BH-1	Opacity	EPA 9	3	60
11/4/2021-11/5/2021	Z02-BH-1	VOC	EPA 25A & 18	3	120

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 through 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 testing was conducted by the Montrose personnel listed in Table 1-4. The tests were conducted according to the revised Test Plan notification that was submitted to EGLE on October 19, 2021.

TABLE 1-2
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU-PSANDPROCESS
NOVEMBER 3-5, 2021

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (FPM)		
lb/hr	0.93	1.24*
Visible Emissions (VE)		
Highest 6-minute Average, %	0.0	10
Volatile Organic Compounds (VOC)		
lb/hr	1.11	4.12*

* Emission limits are from PTI 36-12L. The Rule 216 Minor Modification application to incorporate PTI 36-12L was submitted to Michigan EGLE on October 14, 2021.

TABLE 1-3
SUMMARY OF AVERAGE COMPLIANCE RESULTS -
EU-SPMPROCESSAND
NOVEMBER 2, 2021

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter (FPM)		
lb/hr	5.05	0.19*
Visible Emissions (VE)		
Highest 6-minute Average, %	0.0	10
Volatile Organic Compounds (VOC)		
lb/hr	1.02	1.22*

* Emission limits are from PTI 36-12L. The Rule 216 Minor Modification application to incorporate PTI 36-12L was submitted to Michigan EGLE on October 14, 2021.

1.2 KEY PERSONNEL

A list of project participants is included below:

Facility Information

Source Location:	General Motors - Saginaw Metal Casting Operations (SMCO) 1629 N. Washington Ave. Saginaw, MI 48601	
Project Contact:	Ken Fryer	Jeff Hummel
Role:	Sr. Environmental Engineer	Sr. Environmental Project Engineer
Company:	General Motors - SMCO	General Motors
Telephone:	248-534-8611	517-719-9053
Email:	Kenneth.fryer@gm.com	Jeffrey.hummel@gm.com

Agency Information

Regulatory Agency:	EGLE	
Agency Contact:	Karen Kajiya-Mills	Mark Dziadosz
Telephone:	517-256-0880	586-854-1611
Email:	Kajiya-millsk@michigan.gov	dziadoszm@michigan.gov

Testing Company Information

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

Laboratory Information

Laboratory:	Montrose Air Quality Services
City, State:	Elk Grove, Illinois
Method:	EPA 5 and EPA 18

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, QI
Sean Wheeler	Montrose	Field Project Manager, QI
Robert Salek	Montrose	Field Technician, QI
Paul Repuyan	Montrose	Field Technician, QI
David Kaponen	Montrose	Field Technician, VE
Ken Fryer	GM-SMCO	Observer/Client Liaison/Test Coordinator
Jeff Hummel	GM	Observer/Client Liaison/Test Coordinator
Mark Dziadosz	EGLE	Observer

2.0 PLANT AND SAMPLING LOCATION DESCRIPTIONS

2.1 PROCESS DESCRIPTION, OPERATION, AND CONTROL EQUIPMENT

The emission unit EU-PSANDPROCESS consists of a 220 ton sand storage silo with bin vent filter which receives sand via blower truck and two 30 ton pre-reclaim sand silos that receive process sand recovered in the facility. Sand from both silos is transported to two natural gas fired fluidized bed sand reclaim systems (sand reclaim furnace, sand cooler, sand screen, and deduster) for cleaning and preparation of sand. From there, sand is transferred to the prepared sand silo. PM emissions from the pre-reclaim sand silo, sand transfer system, fluidized bed sand reclaim and prepared sand silo are controlled by two 31,200 scfm fabric filter collectors, one for each sand reclaim system.

The emission unit EU-SPMPROCESSAND consists of a 120 ton sand storage silo with bin vent filter that receives sand via blower truck and a 30 ton pre-reclaim sand silo that receives process sand recovered in the facility. Sand from both silos is transported to the natural gas fired fluidized bed sand reclaim process system (sand reclaim furnace, sand cooler, sand screen, and deduster) for cleaning and preparation of sand. From there, sand is transferred to the prepared sand silo. Top core, scrap cores, broken cores and process sand collected from EU-SPMCASTLINE and scrap cores and process sand from EU-SPMCOREROOM are collected in a bin/hopper and taken to a Sand Load Out Station for reclaim or returned to the process by the receiving dump chute of EU-SPMPROCESSAND for transport by conveyor to the hopper/storage silo of EU-SPMPROCESSAND. PM emissions from these sand handling processes and sand handling transfer points including the pre-reclaim sand silo, sand transfer system, fluidized bed sand reclaim, and prepared sand silo in EU-SPMPROCESSAND are controlled by a single 34,000 scfm fabric filter collector. There is no emission control on the remaining sand handling or transfer points (bin/hopper, Sand Load Out Station, receiving dump chute).

2.2 FLUE GAS SAMPLING LOCATIONS

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

TABLE 2-1
SAMPLING LOCATIONS

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
Z02-BH-1 Exhaust Stack	50	384 / 7.7	204 / 4.1	Isokinetic: 12 (6/port); Gaseous: 1
Z02-BH-2 Exhaust Stack	50	384 / 7.7	204 / 4.1	Isokinetic: 12 (6/port); Gaseous: 1
Z02-BH-4 Exhaust Stack	50	384 / 7.7	204 / 4.1	Isokinetic: 12 (6/port); Gaseous: 1

The Sampling locations were 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

Emission tests were performed while PSANDPROCESS and SPMPROCESSAND and their air pollution control devices were operating at the conditions required by the permit. PSANDPROCESS and SPMPROCESSAND were tested following the process production capacities listed in Section 2.3 Table 1 of the Test Plan in Appendix E.

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:

- Sand throughput, ton/hr
- Hood Temperature, °F
- Natural gas usage of the fluidized bed sand reclaim systems, scfm
- Pressure drop across the control device, in-H_2O

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. The measurements are made at traverse points specified by EPA Method 1.

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

EPA Method 3 is used to calculate the dry molecular weight of the stack gas using one of three methods. The first choice is 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.

3.1.4 EPA Method 4, Determination of Moisture Content in Stack Gas

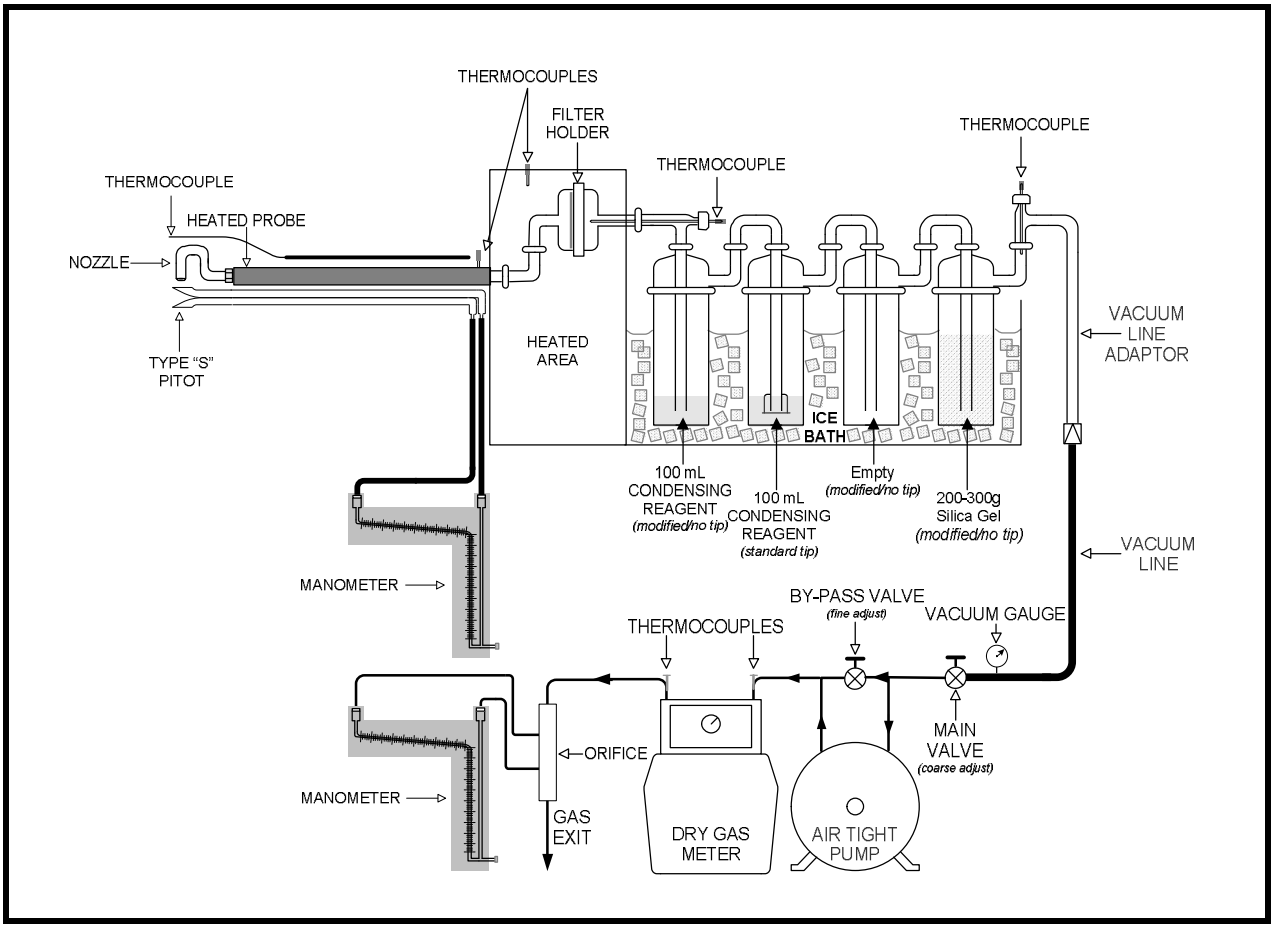
EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture.

3.1.5 EPA Method 5, Determination of Particulate Matter 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. FPM results are reported in emission concentration and emission rate units.

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

FIGURE 3-1
EPA METHOD 5 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.

3.1.7 EPA Method 18, Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

EPA Method 18 is used to measure gaseous organic compounds from stationary sources. The major organic components of a gas mixture are separated by gas chromatography (GC) and are individually quantified using a flame ionization detector (FID), photoionization detector (PID), electron capture detector (ECD), or other appropriate detection principles.

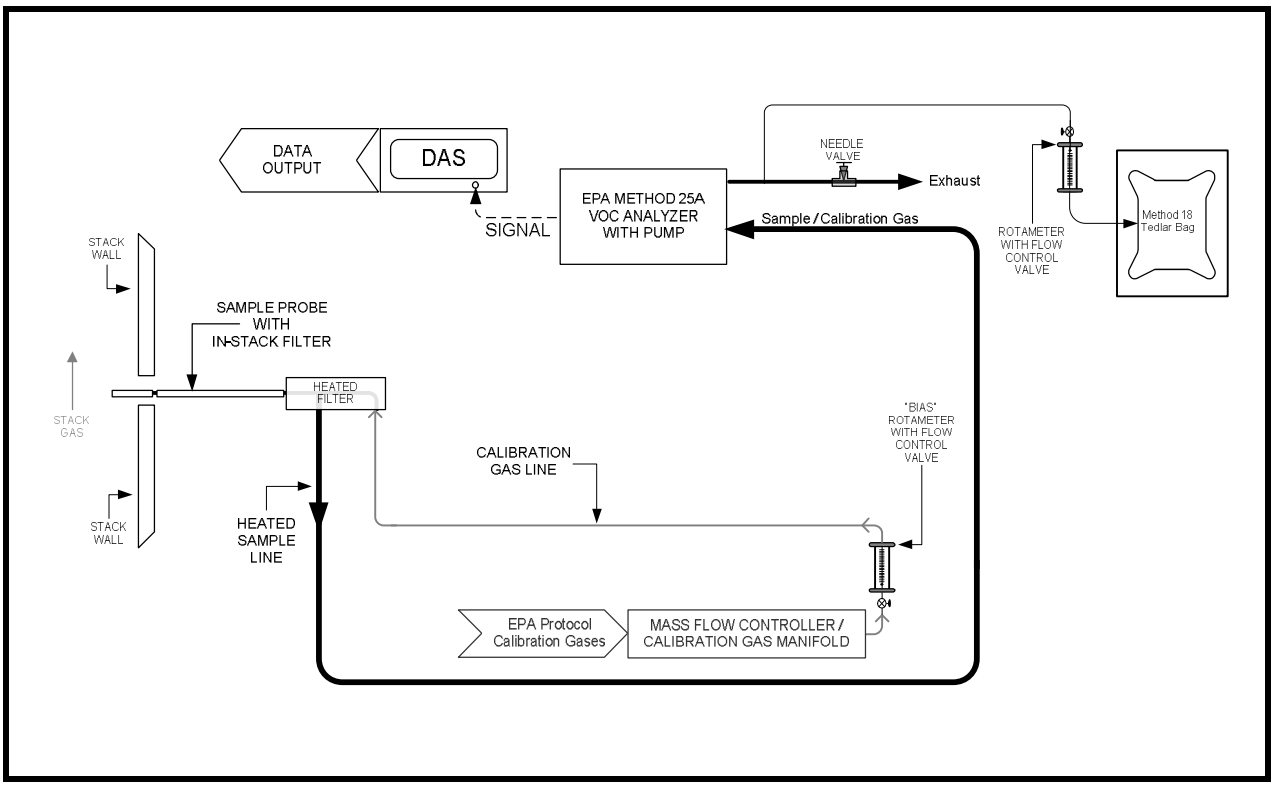
The typical sampling system is detailed in Figure 3-2.

3.1.8 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 THC in stack gas. A stack 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.

The typical sampling system is detailed in Figure 3-2

FIGURE 3-2
EPA METHOD 25A AND 18 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 Tables 1-2 and 1-3. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-3. 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.

The VOC mass emission rates displayed in Tables 1-2, 1-3, and 4-1 through 4-3 were calculated by subtracting the mass emission rates of methane (lb/hr) and ethane (lb/hr) (where applicable) from the TGO mass emission rate as propane (lb/hr).

TABLE 4-1
FPM, VE, AND VOC EMISSIONS RESULTS -
Z02-BH-1 EXHAUST

Run Number	1	2	3	Average
Date	11/4/2021	11/4/2021	11/5/2021	--
Time	8:44-10:46	11:02-13:05	8:40-10:43	--
Process Data*				
Sand processed, tonnes/hr	7.76	7.70	7.73	7.73
Flue Gas Parameters				
O_2, % volume dry	21.0	21.0	21.0	21.0
CO_2, % volume dry	0.00	0.00	0.00	0.00
flue gas temperature, °F	250.2	251.8	247.3	249.7
moisture content, % volume	1.78	2.01	1.47	1.76
volumetric flow rate, dscfm	21,194	21,122	21,691	21,336
Filterable Particulate Matter (FPM)				
gr/dscf	0.00103	0.00098	0.00088	0.00097
lb/hr	0.19	0.18	0.16	0.18
Visible Emissions				
Highest 6-minute average, %	0.0	0.0	0.0	--
Methane (CH_4)				
ppmvw, as CH_4	28.63	20.37	6.60	18.54
lb/hr	1.55	1.10	0.37	1.00
Total Gaseous Organic Compounds (TGO), as Propane				
ppmvd, as propane	13.7	9.5	10.4	11.2
lb/hr	2.00	1.37	1.54	1.64
Volatile Organic Compounds (VOC)				
lb/hr	0.45	0.28	1.18	0.64

* Process data was provided by General Motors-Saginaw Metal Casting Operations (SMCO) personnel.

TABLE 4-2
FPM, VE, AND VOC EMISSIONS RESULTS -
Z02-BH-2 EXHAUST

Run Number	1	2	3	Average
Date	11/3/2021	11/3/2021	11/3/2021	--
Time	9:04-11:10	11:30-13:31	13:51-16:51	--
Process Data*				
Sand processed, tonnes/hr	8.09	8.48	8.25	8.27
Flue Gas Parameters				
O_2, % volume dry	21.0	21.0	21.0	21.0
CO_2, % volume dry	0.00	0.00	0.00	0.00
flue gas temperature, °F	245.3	240.8	243.3	243.1
moisture content, % volume	1.25	1.04	1.19	1.16
volumetric flow rate, dscfm	30,012	33,618	32,396	32,008
Filterable Particulate Matter (FPM)				
gr/dscf	0.003	0.004	0.002	0.003
lb/hr	0.68	1.02	0.56	0.76
Visible Emissions				
Highest 6-minute average, %	0.0	0.0	0.0	0.0
Methane (CH_4)				
ppmvw, as CH_4	7.97	8.29	12.96	9.74
lb/hr	0.61	0.71	1.07	0.80
Total Gaseous Organic Compounds (TGO), as Propane				
ppmvd, as propane	6.22	4.98	6.16	5.78
lb/hr	1.28	1.15	1.37	1.27
Volatile Organic Compounds (VOC)				
lb/hr	0.67	0.44	0.30	0.47

* Process data was provided by General Motors-Saginaw Metal Casting Operations (SMCO) personnel.

TABLE 4-3
FPM, VE, AND VOC EMISSIONS RESULTS -
Z02-BH-4 EXHAUST

Run Number	1	2	3	Average
Date	11/2/2021	11/2/2021	11/2/2021	--
Time	10:22-12:23	12:43-14:44	15:06-17:07	--
Process Data*				
Sand processed, tonnes/hr	7.51	7.19	6.65	7.12
Flue Gas Parameters				
O_2, % volume dry	20.5	20.5	20.5	20.5
CO_2, % volume dry	0.50	0.50	0.50	0.50
flue gas temperature, °F	141.6	142.5	141.8	141.9
moisture content, % volume	5.26	5.13	4.83	5.07
volumetric flow rate, dscfm	27,683	27,751	28,406	27,947
Filterable Particulate Matter (FPM)				
gr/dscf	0.024	0.021	0.018	0.021
lb/hr	5.63	5.11	4.40	5.05
Visible Emissions				
Highest 6-minute average, %	0.0	0.0	0.0	--
Methane (CH_4)				
ppmvw, as CH_4	43.5	44.4	42.8	43.6
lb/hr	3.07	3.14	3.10	3.10
Ethane (C_2H_6)				
ppmvw, as C_2H_6	3.52	3.39	3.64	3.52
lb/hr	0.47	0.45	0.49	0.47
Total Gaseous Organic Compounds (TGO), as Propane				
ppmvw	24.1	23.0	21.1	22.7
lb/hr	4.85	4.62	4.32	4.59
Volatile Organic Compounds (VOC)				
lb/hr	1.31	1.03	0.73	1.02

* Process data was provided by General Motors-Saginaw Metal Casting Operations (SMCO) personnel.

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 blank. 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 the evaluator's back. Readings were taken every 15 seconds and made to the nearest 5% opacity.

EPA Method 18 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met.

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

5.2 QA/QC DISCUSSION

All QA/QC criteria were met during this test program.

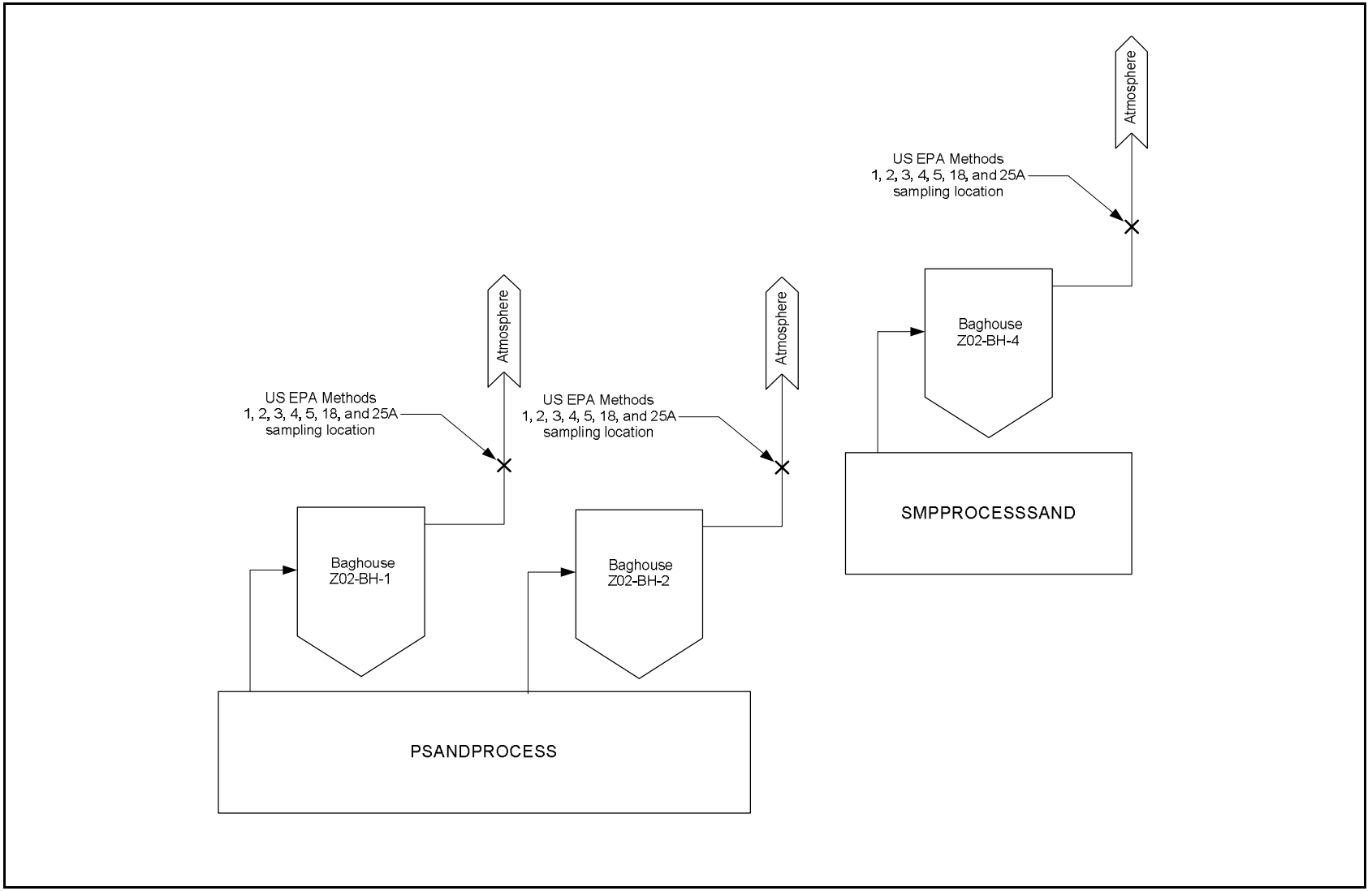
5.3 QUALITY STATEMENT

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).

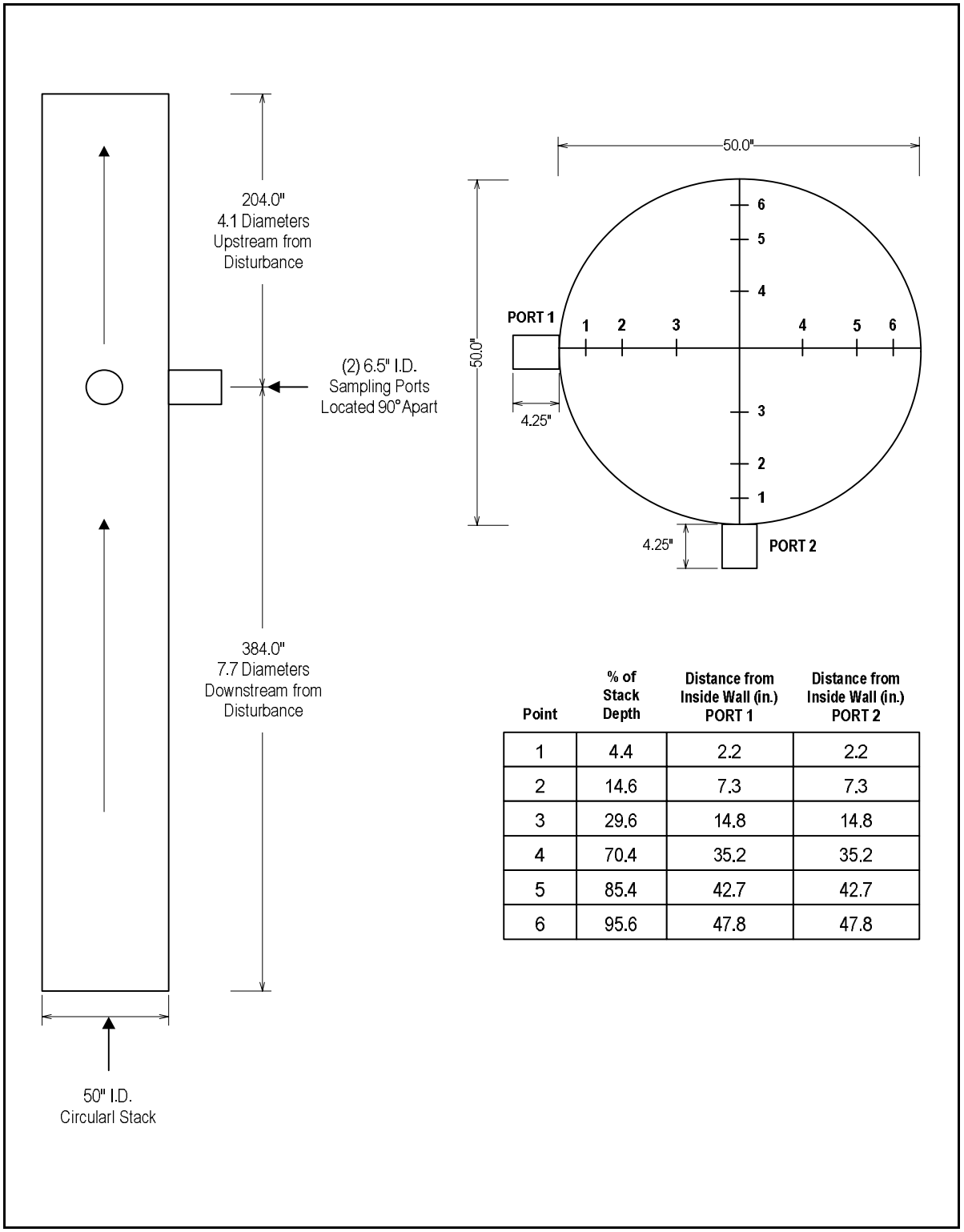
APPENDIX A
FIELD DATA AND CALCULATIONS

Appendix A.1
Sampling Locations

PSANDPROCESS AND SPMPROCESSSAND SAMPLING LOCATION SCHEMATIC



Z02-BH-1, 2, AND 4 EXHAUST STACKS TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	4.4	2.2	2.2
2	14.6	7.3	7.3
3	29.6	14.8	14.8
4	70.4	35.2	35.2
5	85.4	42.7	42.7
6	95.6	47.8	47.8