Source Test Report for 2022 Compliance Emissions Testing

EU-CoaterC and EU-NewMixroom (FG-C&NewMixroom)

General Formulations, Inc. Sparta, Michigan

Prepared For:

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For Submission To:

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AIR QUALITY SERVICES

Review and Certification

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: [signature] **Date:** 05 / 19 / 2022

Name: Chris Trevillian **Title:** Field Project Manager

I have reviewed, technically and editorially, details, calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: robert j lisy jr **Date:** 05 / 19 / 2022

Name: Robert J. Lisy, Jr. **Title:** Reporting Hub Manager

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1.0 Introduction

1.1 Summary of Test Program

General Formulations, Inc. (State Registration No.: M3554) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the FG-C&NewMixroom (EU-CoaterC and EU-NewMixroom) at the General Formulations, Inc. facility located in Sparta, Michigan. Testing was performed on April 21, 2022, for the purpose of satisfying the emission testing requirements pursuant to Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permit-to-Install (PTI) No. 192-03G and 40 CFR Part 60 Subpart FFF.

The specific objectives were to:

- Verify the emissions of volatile organic compounds (VOC) at the regenerative thermal oxidizer (RTO) exhaust stack serving FG-C&NewMixroom
- Verify the VOC destruction efficiency (DE) of the RTO serving FG-C&NewMixroom
- Verify the VOC capture efficiency (CE) of the permanent total enclosure (PTE) associated with FG-C&NewMixroom in accordance with EPA Method 204 requirements
- Verify the overall control efficiency of FG-C&NewMixroom
- 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)
4/21/2022	FG-C& NewMixroom RTO	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	5-6
4/21/2022	FG-C& NewMixroom RTO	O_2, CO_2- RTO Exhaust	EPA 3	3	60
4/21/2022	FG-C& NewMixroom RTO	Moisture (wb/db)- Inlet	EPA 4	3	1
4/21/2022	FG-C& NewMixroom RTO	Moisture- Exhaust	EPA 4	3	60
4/21/2022	FG-C& NewMixroom RTO	THC	EPA 25A	3	60
4/21/2022	FG-C& NewMixroom PTE	PTE CE	EPA 204	1	60

To simplify this report, a list of Units and Abbreviations is included in Appendix C.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. The tests were conducted according to the test plan (protocol) dated February 3, 2022 that was submitted to EGLE.

Table 1-2
Summary of Average Compliance Results – FG-C&NewMixroom

April 21, 2022

Parameter/Units	Average Results	Allowable
Volatile Organic Compound (VOC) Destruction Efficiency (DE)		
%	95.0	95
VOC Capture Efficiency (CE)		
%	100	100
Overall Control Efficiency		
%	95.0	95

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location: General Formulations, Inc.
309 S. Union St.
Sparta, MI 49345
Project Contact: Rob Bachholzky
Role: Quality Control Manager
Company: General Formulations, Inc.
Telephone: 616-887-7387
Email: rbachholzky@generalformulations.com

Agency Information

Regulatory Agency: Michigan Department of Environment, Great Lakes, and Energy
Agency Contact: Lindsey Wells
Telephone: 517-282-2345
Email: wellsL8@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC	
Contact:	Robert J. Lisy, Jr.	Christopher Trevillian
Title:	Reporting Hub Manager	Field Project Manager
Telephone:	440-262-3760	440-262-3760
Email:	rlisy@montrose-env.com	ctrevillian@montrose-env.com

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

Table 1-3
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
Christopher Trevillian	Montrose	Field Project Manager, QI
Jonathan Grech	Montrose	Senior Field Technician, QI
Shawn Jaworski	Montrose	Senior Field Technician, QI
Ian Fisher	Montrose	Field Technician
Rob Bachholzky	General Formulations, Inc.	Observer/Client Liaison/Test Coordinator
Lindsey Wells	EGLE	Observer
Michael Kovalchick	EGLE	Observer

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The FG-C&NewMixroom process includes Roll Laminators (coater), a natural gas fired oven, and a new mix room. Coater C uses only solvent-based coatings. EU-NewMixroom is a batch process where coatings and adhesives are produced for internal use and external sales. Both are controlled by a Permanent Total Enclosure (PTE) and an existing regenerative thermal oxidizer (RTO). Each emission unit is equipped with a filtration system to control particulate matter.

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.)	
FG-C& NewMixroom RTO Inlet Duct	43.7	111.0 / 2.5	61.0 / 1.4	Flow: 16 (8/port) Gaseous: 1
FG-C& NewMixroom RTO Exhaust Stack	32.0 X 55.5 Rectangular	198.0 / 4.9	162.0 / 4.0	Flow: 12 (3/port) Gaseous: 1

Sample 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 for more information.

2.3 Operating Conditions and Process Data

Emission tests were performed while the FG-C&NewMixroom and RTO were operating at the conditions required by the permit. FG-C&NewMixroom were tested when operating during normal conditions.

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:

- Oven Temperature, °F
- Run Speed, ft/min
- RTO Inlet, Outlet, and Chamber Temperature, °F
- PTE Pressure Drop, in H_2O

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.

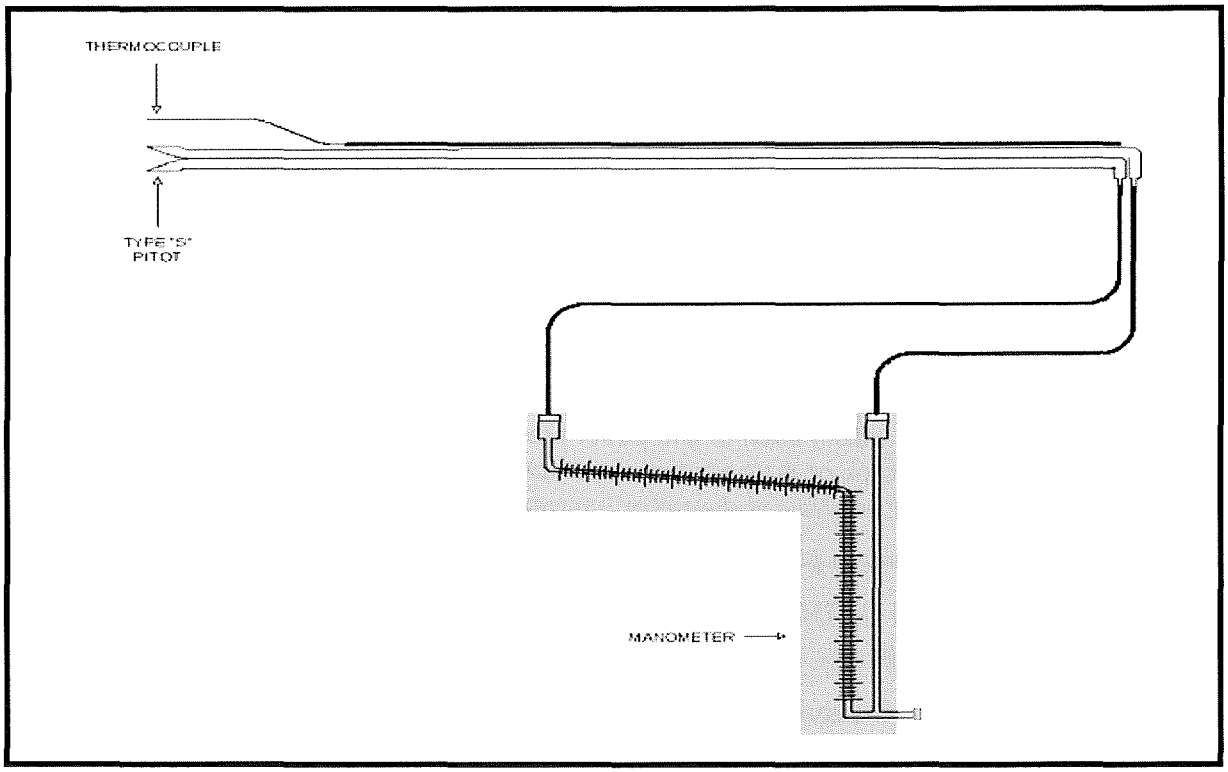
The sample port and traverse point locations are detailed in Appendix A.

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 (Stauβcheibe) 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 typical sampling system is detailed in Figure 3-1.

Figure 3-1
US EPA Method 2 Sampling Train



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.

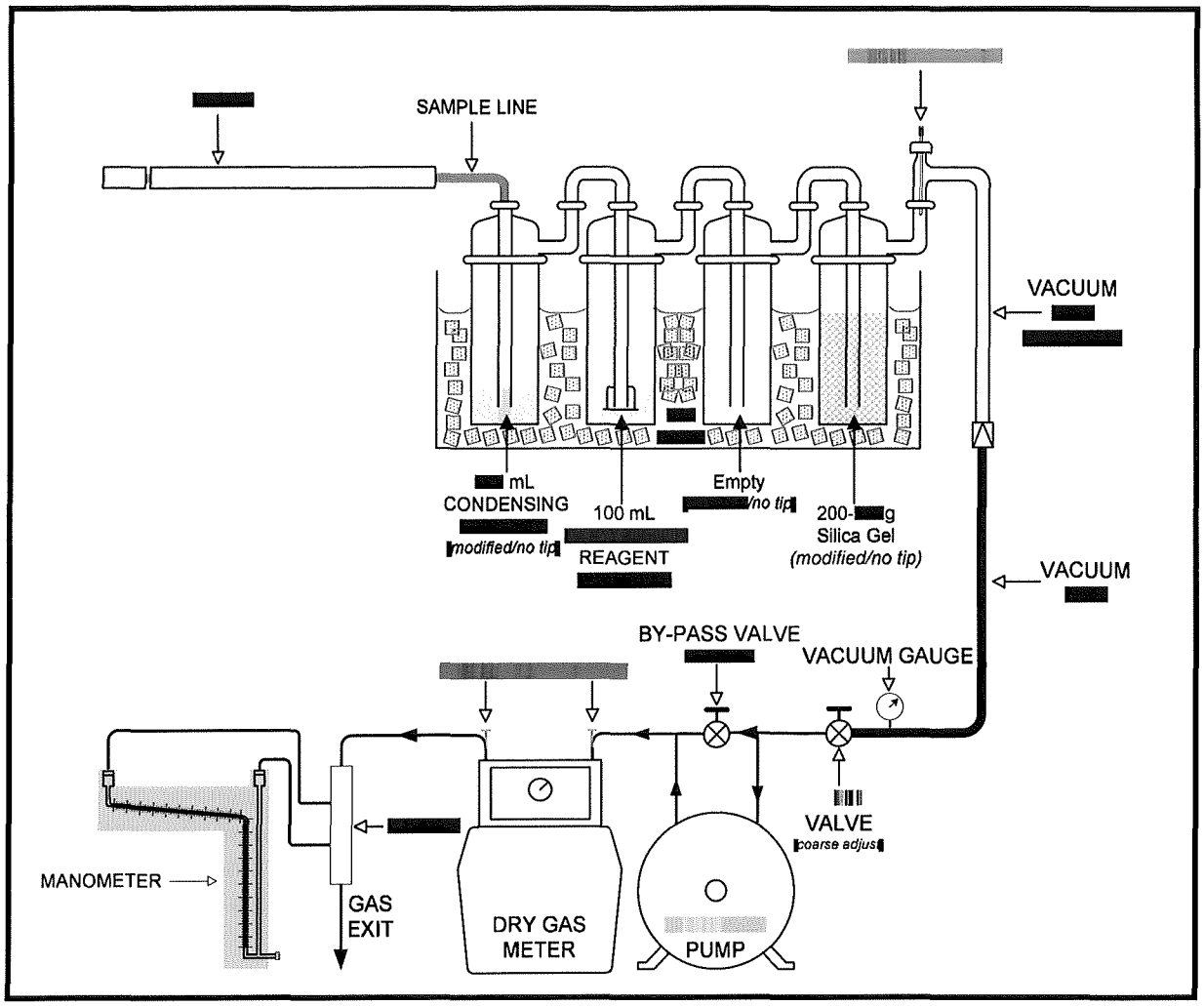
During this compliance test program, single-point, integrated sampling, was utilized to measure O_2 and CO_2 concentrations.

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.

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

Figure 3-2
US EPA Method 4 Sampling Train

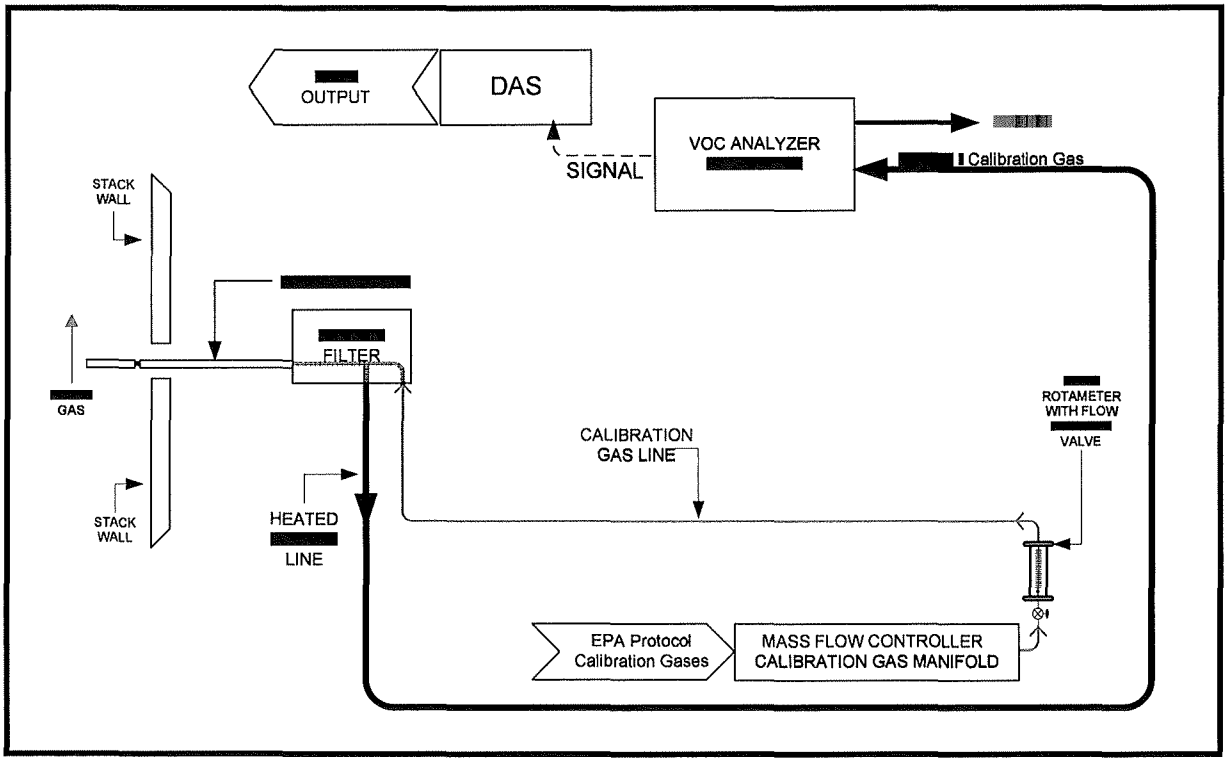


3.1.5 EPA Method 25A, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer

EPA Method 25A is an instrumental test method used to measure the concentration of THC in stack gas. A 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 3-3.

Figure 3-3
US EPA Method 25A Sampling Train



3.1.6 EPA Method 204, Criteria for and Verification of a Permanent or Temporary Total Enclosure

An enclosure is evaluated against a set of criteria. If the criteria are met and if all the exhaust gases from the enclosure are ducted to a control device, then the volatile organic compounds (VOC) capture efficiency (CE) is assumed to be 100 percent, and CE need not be measured. However, if part of the exhaust gas stream is not ducted to a control device, CE must be determined.

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

All sampling runs at the FG-C&NewMixroom RTO Exhaust Stack during this compliance test program, utilized a twelve (12) point traverse instead of the required sixteen (16) to measure stack gas volumetric flowrate per EPA Method 1. The discrepancy was not discovered until after the test was completed. Since the flows obtained during all three runs appear to be in fairly good agreement, it is the opinion of Montrose that utilizing a reduced number of traverse points had a negligible effect on the reported results.

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 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.

The PTE associated with FG-C&NewMixroom was evaluated against EPA Method 204 criteria to verify 100% VOC CE. Table 4-3 displays the results. As shown, the FG-C&NewMixroom PTE met EPA Method 204, Section 5 and Section 8 criteria. Therefore, the VOC CE for the FG-C&NewMixroom PTE was determined to be 100% during this test event.

Table 4-1
VOC Emissions Results -
FG-C&NewMixroom RTO Inlet

Run Number	1	2	3	Average
Date	4/21/2022	4/21/2022	4/21/2022	--
Time	11:00-12:00	12:35-13:35	14:05-15:05	--
Sampling & Flue Gas Parameters				
flue gas temperature, °F	89.8	91.3	92.9	91.3
moisture content, % volume	1.68	1.52	2.33	1.84
volumetric flow rate, scfm	25,855	25,357	25,666	25,626
Volatile Organic Compounds (VOC), as propane				
ppmvw	689.1	636.2	667.4	664.2
lb/hr	122.3	110.8	117.6	116.9

Table 4-2
VOC Emissions and DE Results -
FG-C&NewMixroom RTO Exhaust

Run Number	1	2	3	Average
Date	4/21/2022	4/21/2022	4/21/2022	--
Time	11:00-12:00	12:35-13:35	14:05-15:05	--
Process Data*				
Line Speed, ft/min	55	55	55	55
RTO chamber temp., °F	1581	1577	1579	1579
Sampling & Flue Gas Parameters				
O_2, % volume dry	20.00	20.25	20.25	20.17
CO_2, % volume dry	0.00	0.00	0.00	0.00
flue gas temperature, °F	196.3	213.8	205.2	205.1
moisture content, % volume	1.75	1.64	1.34	1.58
volumetric flow rate, scfm	29,849	26,296	27,815	27,987
Volatile Organic Compounds (VOC), as propane				
ppmvw	30.9	29.4	31.2	30.5
lb/hr	6.34	5.32	5.96	5.87
VOC Destruction Efficiency (DE)				
%	94.8	95.2	94.9	95.0

* Process data provided by General Formulations, Inc. personnel.

Table 4-3
PTE and CE Verification -
FG-C&NewMixroom PTE

Parameter/Units	Results	Allowable
Date	4/21/2022	--
Time	11:00-12:00	--
NDO 1 - Lower Primer Coater (North Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0580	≥0.007
Distance to Nearest VOC Emitting Point, in.	76.0	≥45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 2 - Lower Primer Coater (North Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0575	≥0.007
Distance to Nearest VOC Emitting Point, in.	66.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 3 - Lower Primer Coater (East Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H_2O	0.0645	≥0.007
Distance to Nearest VOC Emitting Point, in.	94.0	63.2
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 4 - Lower Primer Coater (East Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H_2O	0.0520	≥0.007
Distance to Nearest VOC Emitting Point, in.	93.0	63.2
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 5 - Lower Primer Coater (South Elevation)		
Equivalent Diameter, in.	19.85	--
Differential Pressure, in-H_2O	0.0480	≥0.007
Distance to Nearest VOC Emitting Point, in.	113.0	79.4
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--

Table 4-3 (Continued)
PTE and CE Verification -
FG-C&NewMixroom PTE

Parameter/Units	Results	Allowable
NDO 6 - Lower Primer Coater (West Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H_2O	0.0645	≥0.007
Distance to Nearest VOC Emitting Point, in.	94.0	63.2
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 7 - Lower Primer Coater (West Elevation)		
Equivalent Diameter, in.	7.53	--
Differential Pressure, in-H_2O	0.0675	≥0.007
Distance to Nearest VOC Emitting Point, in.	70.0	30.1
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 8 - Lower Primer Coater (West Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H2O	0.0355	≥0.007
Distance to Nearest VOC Emitting Point, in.	70.0	63.2
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 9 - Lower Coater (South Elevation)		
Equivalent Diameter, in.	18.90	--
Differential Pressure, in-H_2O	0.0130	≥0.007
Distance to Nearest VOC Emitting Point, in.	85.0	75.6
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 10 - Lower Coater (South Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H_2O	0.0245	≥0.007
Distance to Nearest VOC Emitting Point, in.	95.0	63.2
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 11 - Lower Coater (South Elevation)		
Equivalent Diameter, in.	14.46	--
Differential Pressure, in-H_2O	0.0170	≥0.007
Distance to Nearest VOC Emitting Point, in.	98.0	57.8
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--

Table 4-3 (Continued)
PTE and CE Verification -
FG-C&NewMixroom PTE

Parameter/Units	Results	Allowable
NDO 12 - Lower Coater (West Elevation)		
Equivalent Diameter, in.	15.82	--
Differential Pressure, in-H_2O	0.0245	≥0.007
Distance to Nearest VOC Emitting Point, in.	240.0	63.3
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 13 - Lower Coater (West Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H_2O	0.0255	≥0.007
Distance to Nearest VOC Emitting Point, in.	108.0	63.2
Equivalent Diameter, in.	15.80	--
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 14 - Lower Coater (West Elevation)		
Equivalent Diameter, in.	19.41	--
Differential Pressure, in-H_2O	0.0290	≥0.007
Distance to Nearest VOC Emitting Point, in.	80.0	77.7
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 15 - Lower Coater (West Elevation)		
Equivalent Diameter, in.	15.80	--
Differential Pressure, in-H_2O	0.0150	≥0.007
Distance to Nearest VOC Emitting Point, in.	108.0	63.2
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 16 - Lower Coater (West Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0140	≥0.007
Distance to Nearest VOC Emitting Point, in.	70.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--

Table 4-3 (Continued)
PTE and CE Verification -
FG-C&NewMixroom PTE

Parameter/Units	Results	Allowable
NDO 17 - Upper Primer Coater (North Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0080	≥0.007
Distance to Nearest VOC Emitting Point, in.	120.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 18 - Upper Primer Coater (East Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0090	≥0.007
Distance to Nearest VOC Emitting Point, in.	120.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 19 - Upper Primer Coater (South Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0090	≥0.007
Distance to Nearest VOC Emitting Point, in.	120.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 20 - Upper Coater (North Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0125	≥0.007
Distance to Nearest VOC Emitting Point, in.	320.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 21 - Upper Coater (South Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0245	≥0.007
Distance to Nearest VOC Emitting Point, in.	320.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--

Table 4-3 (Continued)
PTE and CE Verification -
FG-C&NewMixroom PTE

Parameter/Units	Results	Allowable
NDO 22 - Upper Coater (South Elevation)		
Equivalent Diameter, in.	11.37	--
Differential Pressure, in-H_2O	0.0260	≥0.007
Distance to Nearest VOC Emitting Point, in.	230.0	45.5
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO 23 - Upper Coater (West Elevation)		
Equivalent Diameter, in.	25.33	--
Differential Pressure, in-H_2O	0.0195	≥0.007
Distance to Nearest VOC Emitting Point, in.	216.0	101.3
Inward Flow Verified with Smoke Tubes (Y/N)	Y	--
NDO to Enclosure Area Ratio (NEAR)		
Total Area of NDO's (A_N), ft.^{2}	29.5	--
Total Surface Area of Enclosure (A_T), ft.^{2}	4,055	--
NEAR (A_N/A_T)	0.0073	≤0.05

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 and minimum sample durations met the applicable QA/QC criteria.

Fyrite analyzer audits were performed during this test in accordance with EPA Method 3, Section 10.1 requirements. The results were within ± 0.5% of the respective audit gas concentrations.

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

An EPA Method 205 field evaluation of the calibration gas dilution system was conducted. The dilution accuracy and precision QA specifications were met.

5.2 QA/QC Discussion

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

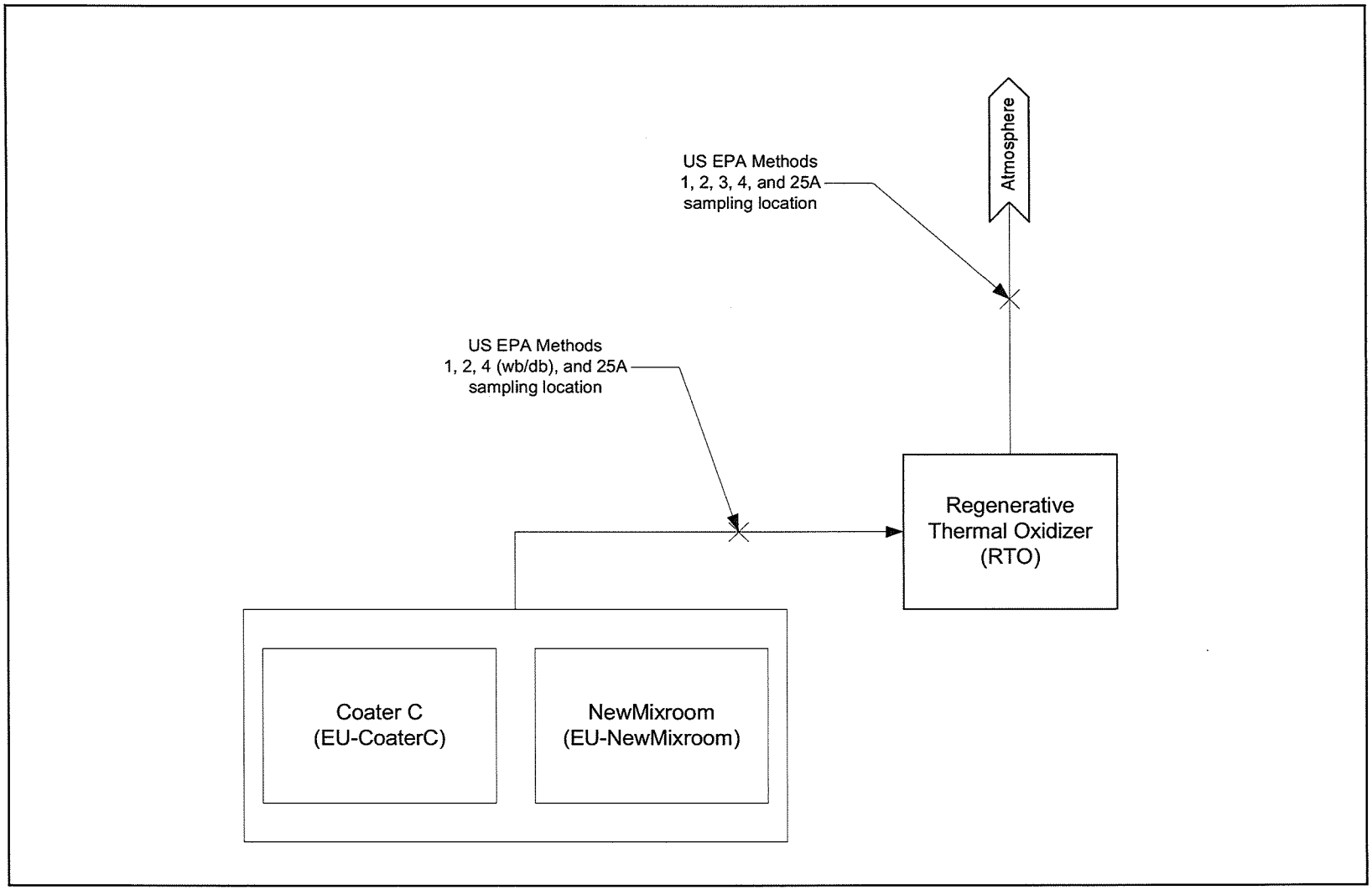
5.3 Quality Statement

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).

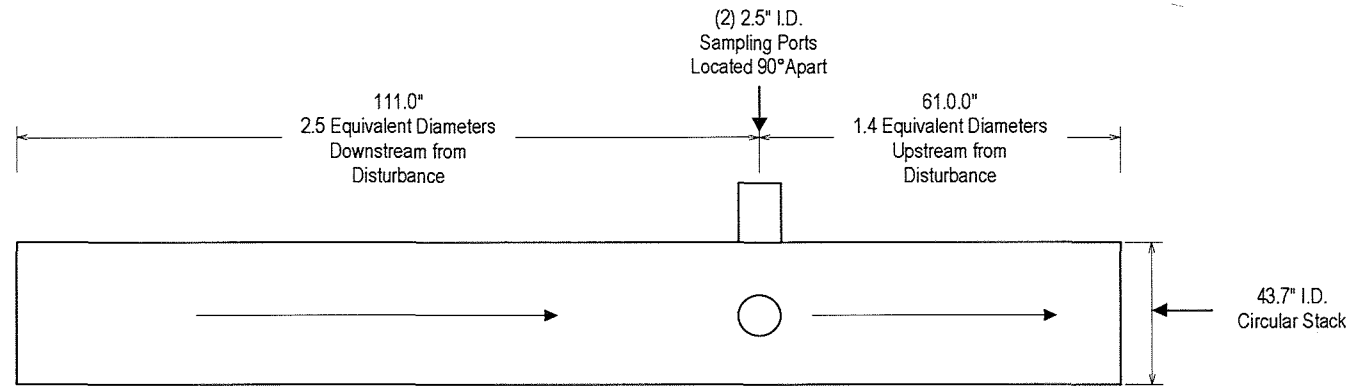
Appendix A
Field Data and Calculations

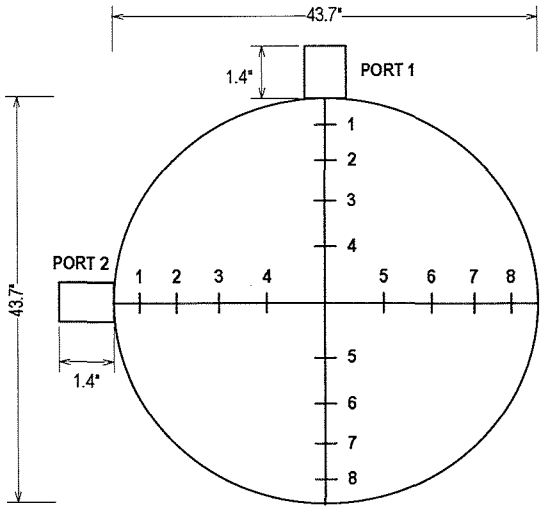
Appendix A.1
Sampling Locations

EU-COATERC AND EU-NEWMIXROOM PROCESS AND SAMPLING LOCATION SCHEMATIC



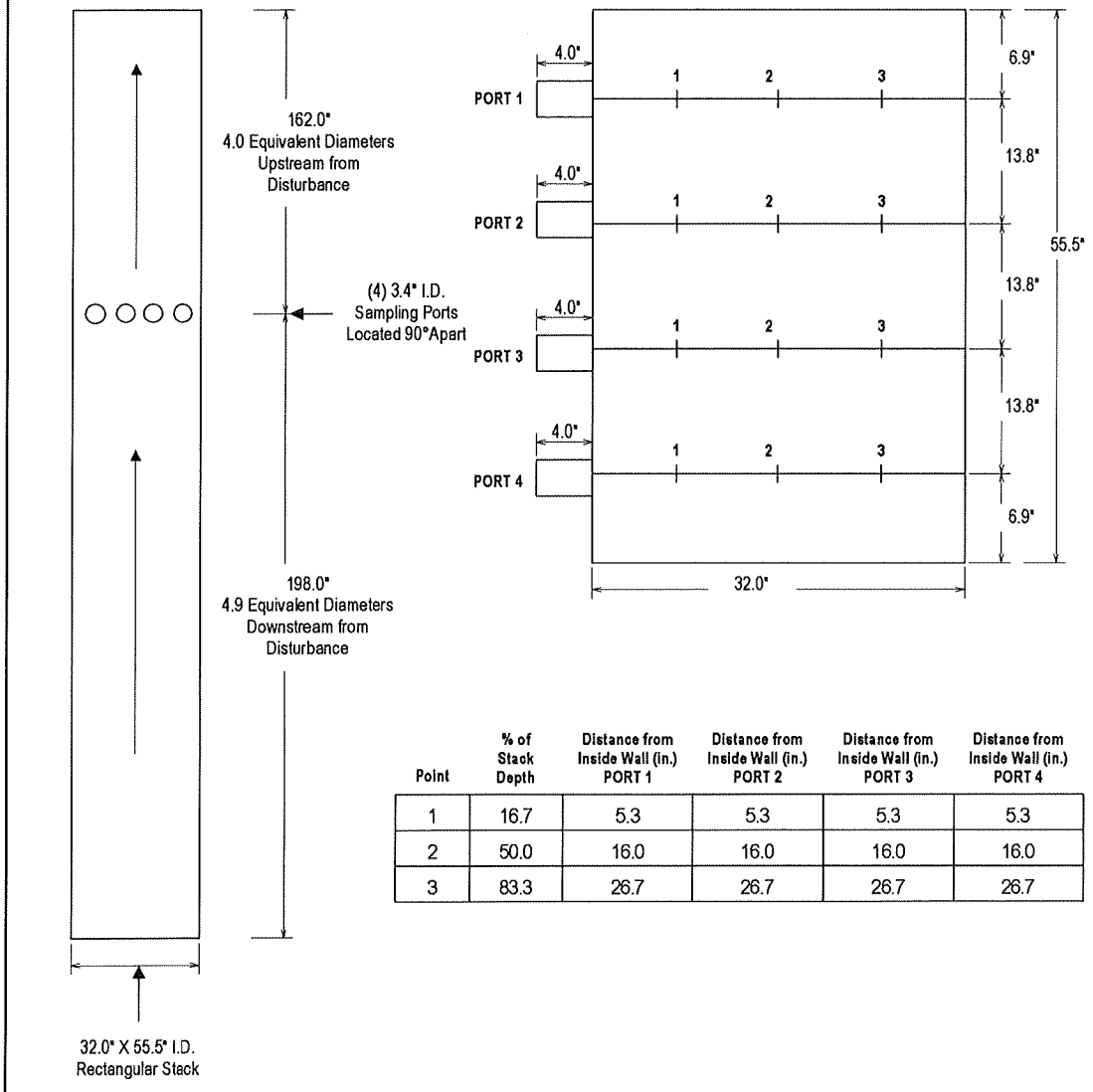
EU-COATERC AND EU-NEWMIXROOM RTO INLET TRAVERSE POINT LOCATION DRAWING





Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2
1	3.2	1.4	1.4
2	10.5	4.6	4.6
3	19.4	8.5	8.5
4	32.3	14.1	14.1
5	67.7	29.6	29.6
6	80.6	35.2	35.2
7	89.5	39.1	39.1
8	96.8	42.3	42.3

EU-COATERC AND EU-NEWMIXROOM RTO EXHAUST TRAVERSE POINT LOCATION DRAWING



Point	% of Stack Depth	Distance from Inside Wall (in.) PORT 1	Distance from Inside Wall (in.) PORT 2	Distance from Inside Wall (in.) PORT 3	Distance from Inside Wall (in.) PORT 4
1	16.7	5.3	5.3	5.3	5.3
2	50.0	16.0	16.0	16.0	16.0
3	83.3	26.7	26.7	26.7	26.7

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