

**Source Test Report for 2024 Compliance Testing
Metals Technologies, Inc.
Ravenna Ductile Iron (SRN N5866)
Ravenna, Michigan**

Prepared For:

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For Submission To:

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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: James Christ **Date:** 10 / 04 / 2024
Name: James Christ **Title:** Client 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: Scott Brown **Date:** 10 / 04 / 2024
Name: Scott Brown **Title:** Reporting Hub Manager

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1.0 Introduction

1.1 Summary of Test Program

Metals Technologies, Inc. (MTI) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance emissions test program on the sources listed in Table 1-1 at the Ravenna Ductile Iron (SRN N5866) facility located in Ravenna, Michigan.

The tests were conducted to determine compliance with the source testing limitations of the Michigan Department of Environmental Quality, Permit No. MI-ROP-N5866-2014b, and 40 CFR Part 63, Subpart EEEEE – National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries, as applicable.

The specific objectives were to:

- Determine the emissions of Particulate Matter (PM), Nitrogen Oxides (NO_x), Visible Emissions (VE), Carbon Monoxide (CO), Lead (Pb), Chromium (Cr), and Total Non-Methane Hydrocarbons (TNMHC) at the outlet of the FG-MELTING and SV-INOCULATION
- Determine Visible Fugitive Emissions (FE) of the FG-MELTING
- Determine the emissions of PM, VE, CO, and Cr at the outlet of the FG-SAND
- Determine the emissions of PM and VE at the outlet of the EU-CLEAN
- 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 Dates	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
9/4/2024	FG-SAND	PM, CO, Cr	1, 2, 3A, 4, 5/29, 10	3	96 mins
	FG-SAND	VE	9	3	60 mins
	EU-CLEAN	PM	1, 2, 4, 5	3	96 mins
	EU-CLEAN	VE	9	3	60 mins
9/5/2024	FG-MELTING	PM, NOX, CO, Pb, TNMHC, Cr	1, 2, 3A, 4, 5/29, 7E, 10, 18, 25A	3	108 mins
	FG-MELTING	VE / FE ¹	9	3	60 mins
	SV- INOCULATION	PM, NOX, CO, Pb, TNMHC, Cr	1, 2, 3A, 4, 5/29, 7E, 10, 18, 25A	3	108 mins
	SV- INOCULATION	VE	9	3	60 mins

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 through 1-5. 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 1-6. The tests were conducted according to the test plan (protocol) dated June 10, 2024 that was submitted to and approved by the Michigan Department of Environmental Quality Air.

¹ 2 vents are observed for fugitive emissions at FG-MELTING to show compliance with 40 CFR Part 63, Subpart EEEEE.



Table 1-2
Summary of Average Compliance Results – FG-SAND
September 4, 2024

Parameter/Units	Average Results	Emission Limits
Carbon Monoxide (CO)		
lb/hr	36.3	98.5
Chromium (Cr)		
lb/hr	0.000471	0.00168
Particulate Matter (PM)		
gr/dscf	0.000428	0.010
lb/hr	0.376	6.0
lb/1,000 lb exhaust gas	0.000817	0.01
Visible Emissions (VE)		
avg. highest 6-minute opacity, %	0	5

Table 1-3
Summary of Average Compliance Results – EU-CLEAN
September 4, 2024

Parameter/Units	Average Results	Emission Limits
Particulate Matter (PM)		
lb/hr	0.204	2.2
lb/1,000 lb exhaust gas	0.000797	0.01
Visible Emissions (VE)		
avg. highest 6-minute opacity, %	0	5

Table 1-4
Summary of Average Compliance Results – FG-MELTING MACT Subpart EEEEE
September 5, 2024

Parameter/Units	Average Results	Emission Limits
Particulate Matter (PM)		
gr/dscf	0.000452	0.005
Visible Emissions (VE) at FG-MELTING		
avg. highest 6-minute opacity, %	0	5
Fugitive Emissions (FE) – Left Vent		
avg. highest 6-minute opacity, %	0.35	20
Fugitive Emissions (FE) – Right Vent		
avg. highest 6-minute opacity, %	0.35	20

Table 1-5
Summary of Average Compliance Results – FG-MELTING & SV-INOCULATION²
September 5, 2024

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxide (NO_x)		
lb/hr	0.823	3.1
Carbon Monoxide (CO)		
lb/hr	3.75	15.1
Chromium (Cr)		
lb/hr	0.0000288	0.000876
Lead (Pb)		
lb/hr	0.0000192	0.07
Particulate Matter (PM)		
lb/hr	0.353	2.5
lb/1,000 lb exhaust gas	0.00144	0.01
Total Non-Methane Hydrocarbons, as Propane (TNMHC)		
lb/hr	1.26	4.4
Visible Emissions (VE) at SV-INOCULATION		
avg. highest 6-minute opacity, %	0	5

² The results in Table 1-5 are the combined averages of FG-MELTING & SV-INOCULATION.



1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location: Ravenna Ductile Iron
3800 Adams Road
Ravenna, MI 49451
Project Contact: Dan Plant
Role: Corporate Environmental Manager
Company: Metals Technologies, Inc.
Telephone: 260-920-2137

Agency Information

Regulatory Agency: MDEQ

Testing Company Information

Testing Firm: Montrose Air Quality Services, LLC
Contact: James Christ
Title: Client Project Manager
Telephone: 630-625-2112
Email: jchrist@montrose-env.com

Laboratory Information

Laboratory: MAQS
City, State: Elk Grove Village, IL
Method: EPA Method 5 & 18

Element One, Inc.
Wilmington, NC
EPA Method 29

Test personnel and observers are summarized in Table 1-6.

Table 1-6
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
James Christ	Montrose	Project Manager/Field Team Leader/Qualified Individual (QI)/Trailer operator
Scott Dater	Montrose	Project Manager/Qualified Individual (QI)/Trailer operator
John Ziber	Montrose	Field Support
Chris Ziber	Montrose	Field Support
Emily Mazurek	Montrose	Field Support
Jeremiah Mukanda	Montrose	Field Support
Jacob Kaput	Montrose	Field Support
Joshua Roberts	Montrose	Field Support
Levi Butler	Montrose	Calculations and report preparation
Dan Plant	MTI	Client Liaison/Test Coordinator
Ann Schrader	RDI	Client Liaison/Test Coordinator
Trevor Dost	MDEQ	Observer

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

Metal Technologies Ravenna Ductile Iron (RDI) facility is a ductile iron foundry specializing in high volume and high requirement castings. Quality and production at this foundry are set up to meet casting requirements for safety and braking applications. RDI processes a significant portion of their products through automated trim cells or CNC grinders that help contribute to a safer work environment for their employees and maximum quality for their customers.

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 Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	Number of Traverse Points
FG-SAND	83	216 / 2.6	382 / 4.6	Isokinetic: 24 (12/port) Gaseous: 1
EU-CLEAN	59	171 / 2.9	431 / 7.3	Isokinetic: 24 (12/port) Gaseous: 1
FG-MELTING	58.5	135 / 2.3	299 / 5.1	Isokinetic: 24 (12/port) Gaseous: 1
FG-INOCULATION	52	255 / 4.9	296 / 5.7	Isokinetic: 24 (12/port) Gaseous: 1

The 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.1 for more information.

2.3 Operating Conditions and Process Data

Emission tests were performed while the units and air pollution control devices were operating at the conditions required by the permit. The units were tested when operating at greater than 90% capacity.

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:

- Baghouse pressure drops, in. H₂O
- Production, tons/hr melt

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 Source

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

3.1.2 EPA Method 2, Determination of 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 O₂, CO₂, 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
 - Since historical data shows the EU-Clean location emits essentially air, Section 8.6 Determine the stack gas dry molecular weight. For processes emitting essentially air, an analysis need not be conducted; use a dry molecular weight of 29.0.

3.1.3 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
 - The reference method is used to measure moisture
 - 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:
 - Montrose used knockout jars with flexible gum rubber tubing in place of the Greenburg-Smith impinger train per 40 CFR Part 60, Appendix A, Method 5 §6.1.1.8 at the EU-Clean location.

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

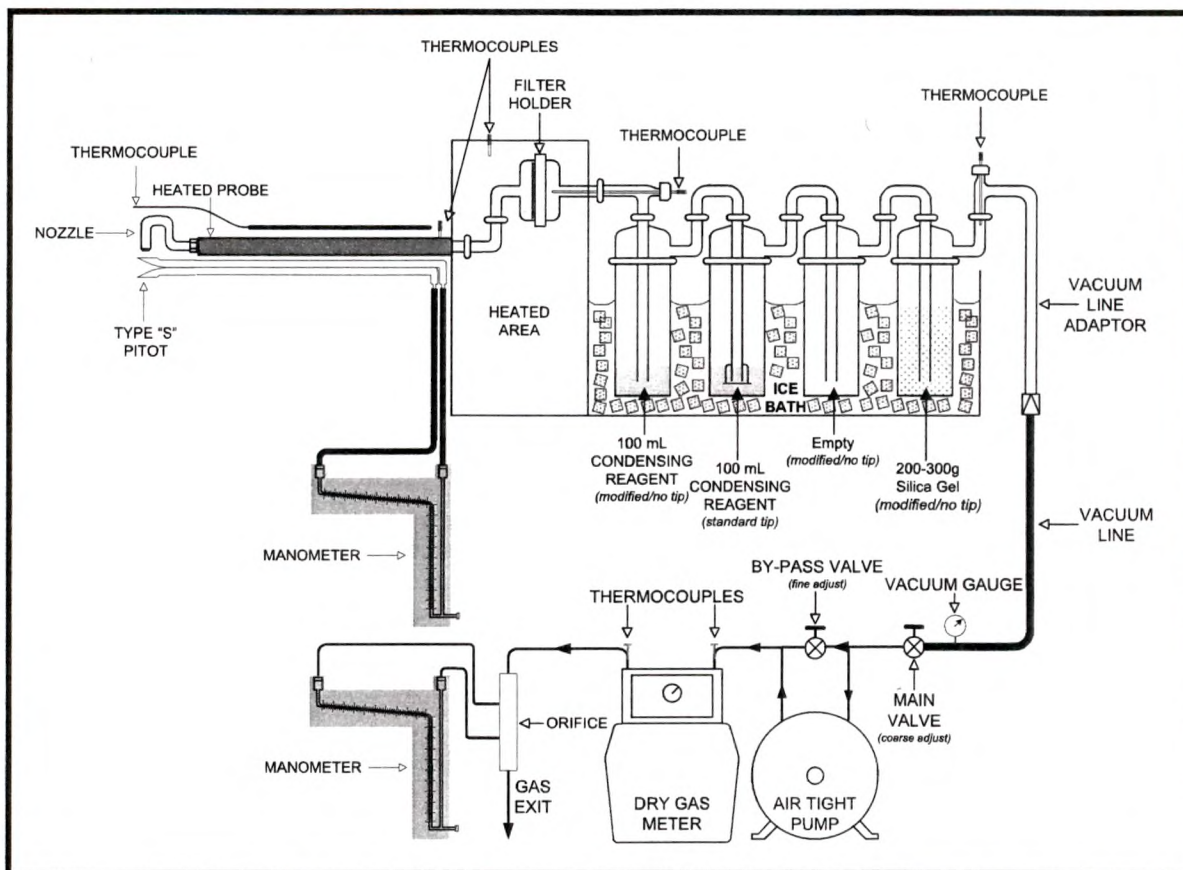
EPA Method 5 is a manual, isokinetic method used to measure FPM emissions. FPM is withdrawn isokinetically from the source and collected on a glass fiber filter maintained at a temperature of 120 ± 14 °C (248 ± 25 °F) or such other temperature as specified by an applicable subpart of the standards or approved by the Administrator for a particular application. The FPM mass, which includes any material that condenses at or above the filtration temperature, is determined gravimetrically after the removal of uncombined water.

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

- Method Options:
 - Glass sample nozzles and probe liners are used
 - Polyethylene wash bottles are used
- Method Exceptions:
 - None
- Target and/or Minimum Required Sample Volume: 60 dscf

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

**FIGURE 3-1
USEPA METHOD 5 SAMPLING TRAIN**



3.1.5 EPA Methods 3A, 7E, and 10, Determination of Oxygen, Carbon Dioxide, Nitrogen Oxides, and Carbon Monoxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)

Concentrations of O₂, CO₂, NO_x, and CO are measured simultaneously using EPA Methods 3A, 7E, and 10, which are instrumental test methods. Conditioned gas is sent to a series of analyzers to measure the gaseous emission concentrations. The performance requirements of the method must be met to validate the data.

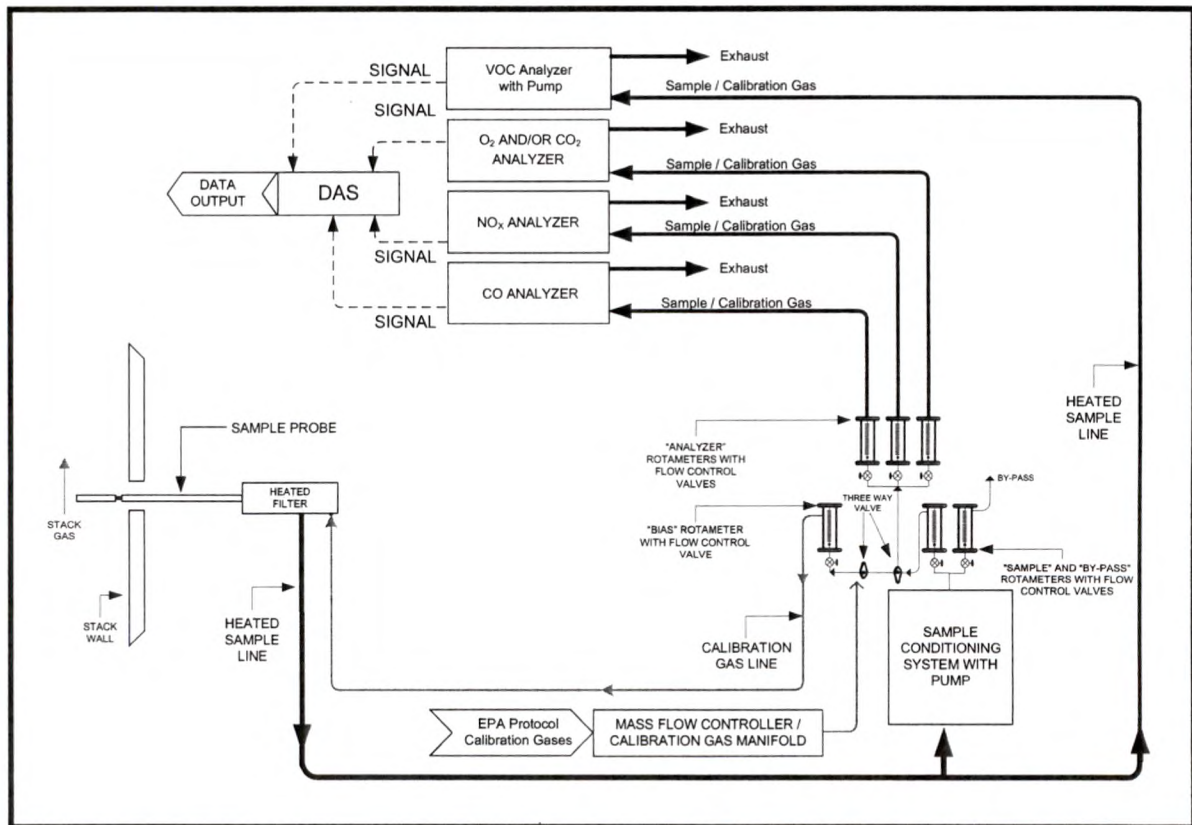
Pertinent information regarding the performance of the method is presented below:

- Method Options
 - No filter is used since low PM is expected
 - A paramagnetic analyzer is used to measure O₂
 - A paramagnetic analyzer is used to measure CO₂

- A chemiluminescent analyzer is used to measure NO_x
- A gas filter correction nondispersive infrared analyzer is used to measure CO
- Tedlar bag approach for CO was used at the FG-Sand location
- A dry extractive sampling system is used to report emissions on a dry basis
- The alternative NO_x converter efficiency test described in EPA Method 7E Section 16.2 is used (bag procedure)

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

Figure 3-2
USEPA Method 3A, 7E, 10, and 25A 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.

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

- Method Options:
 - Two locations are observed during the same observation period
 - EPA Method 9 is used to determine the fugitive emissions (FE) from the building openings associated with the melting furnace. A complete visual survey of any vents associated with the furnace will be conducted to identify possible locations of FE. During the evaluation, all fugitive emitting points will be observed prior to any VE readings and the highest emitting points will be noted. The VE readings will then be taken on the three (3) highest emitting FE points. Five, six-minute FE readings will be taken at each identified vent. The average six-minute reading will be compared to the 20% opacity limit for fugitives to determine compliance under 40 CFR Part 63 Subpart EEEEE.
- Method Exceptions:
 - None

3.1.7 EPA Method 29, Determination of Metals Emissions from Stationary Sources

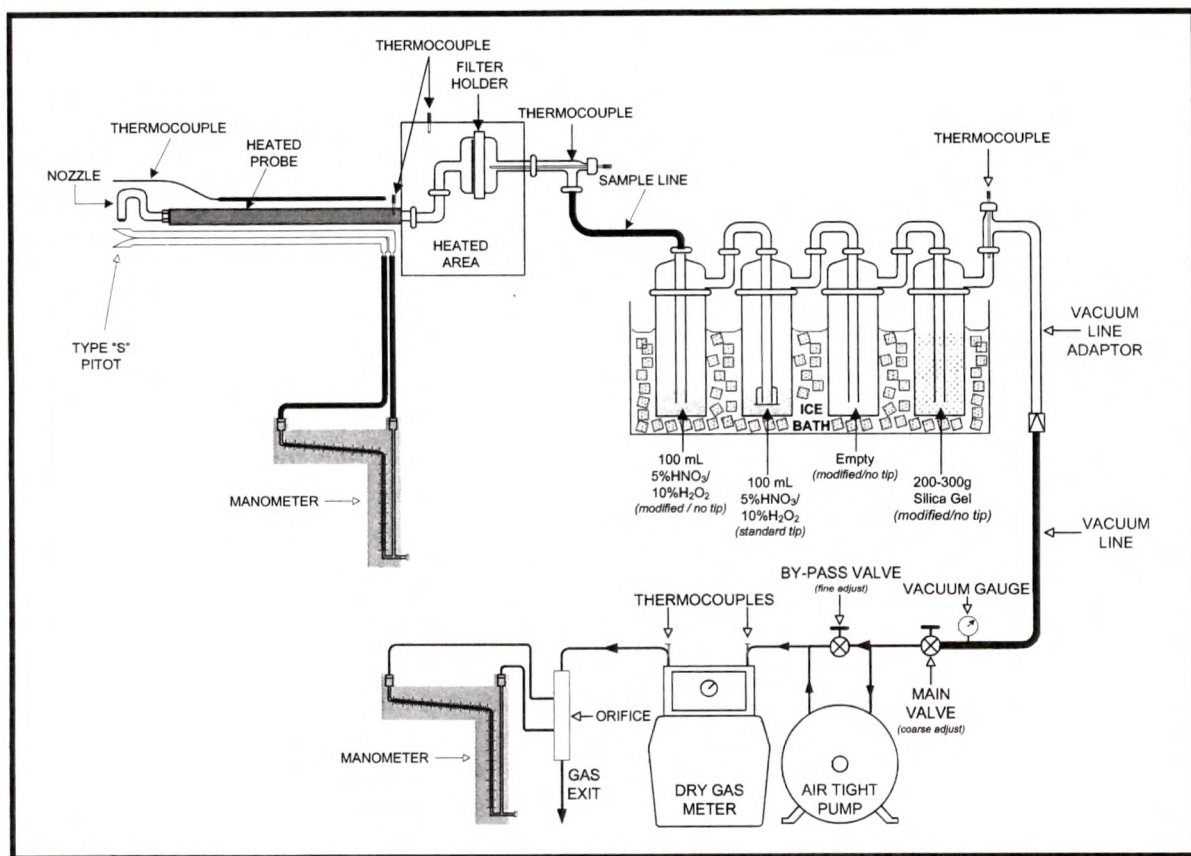
EPA Method 29 is a manual, isokinetic test method to measure a variety of metals using inductively coupled argon plasma emission spectroscopy (ICAP) and cold vapor atomic absorption (CVAA) spectroscopy. This method is performed in conjunction with EPA Methods 1-4. A stack sample is withdrawn isokinetically from the source, filterable emissions are collected in the probe and on a heated filter, and condensable emissions are collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all target analytes) and an optional aqueous acidic solution of potassium permanganate (required only when Hg is a target analyte). The recovered samples are digested, and appropriate fractions are analyzed for the target analytes which may include Hg by CVAAS and for Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Ag, Tl, and Zn by ICAP or atomic absorption spectroscopy (AAS). Graphite furnace atomic absorption spectroscopy (GFAAS) is used for analysis of Sb, As, Cd, Co, Pb, Se, and Tl if these elements require greater analytical sensitivity than can be obtained using ICAP. AAS may be used for analysis of all target analytes if the resulting in-stack method detection limits meet the goal of the testing program. Similarly, inductively coupled plasma-mass spectroscopy (ICP-MS) may be used for analysis of Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag, Tl and Zn. The results from analysis of individual fractions of the sample train are summed to obtain the total concentration of each metal per sample train.

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

- Method Options:
 - The method is performed for the following target analytes: Cr and Pb
 - The acetone rinse (Container No. 2) is recovered when PM emissions are quantified
- Method Exceptions:
 - Front-half and back-half of the sample train are separated and connected with a flex-line
- Target and/or Minimum Required Sample Volume: 60 dscf

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

Figure 3-3
USEPA Method 5/29 (No Hg) Detached Sampling Train



3.1.8 EPA Methods 25A and 18, Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer and Measurement of Gaseous Organic Compound Emissions by Gas Chromatography

EPA Method 25A is an instrumental test method used for the determination of total gaseous organic concentration of vapors in stack gas. A gas sample is extracted from the source through a heated sample line and glass fiber filter to an FIA. Results are reported as THC as volume concentration equivalents of the calibration gas, typically propane, or as carbon equivalents.

EPA Method 18 is used to measure gaseous organic compounds from stationary sources. The major organic components of a gas mixture are separated by GC and are individually quantified using a FID, PID, ECD, or other appropriate detection principles. The retention times of each separated component are compared with those of known compounds under identical conditions. The GC analyst confirms the identity and approximate concentrations of the organic emission components beforehand. With this information, the analyst then prepares or purchases commercially available standard mixtures to calibrate the GC under conditions identical to those of the samples. The analyst also determines the need for sample dilution to avoid detector saturation, gas stream filtration to eliminate particulate matter, and prevention of moisture condensation.

Total non-methane hydrocarbons concentrations are determined by subtracting methane from THC.

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

- Method Options:
 - Integrated bag sampling and analysis is performed for Method 18
- Method Exceptions:
 - For gaseous emissions sampling, MDL are calculated for each analyzer. The ISDL is equal to the sensitivity of the instrumentation, which is 2% of the span value.
- Target Analytes: Total non-methane hydrocarbons excluding exempt compounds as defined by agency

The typical sampling system is detailed as part of Figure 3-2.

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 except for the test method exceptions listed in Sections 3.1.3, 3.1.7, and 3.1.8.

Method 29 results are not blank corrected as they show a worst-case scenario in this report.

4.2 Presentation of Results

The average results are compared to the permit limits in Tables 1-2 through 1-5. The results of individual compliance test runs performed are presented in Tables 4-1 through 4-4. 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
CO, Cr, PM, and VE Emissions Results -
FG-SAND

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	9/4/2024	9/4/2024	9/4/2024	--
Start Time	7:48	10:50	13:38	--
Stop Time	9:28	12:30	15:18	--
Flue Gas Parameters				
flue gas temperature, °F	116	127	129	124
volumetric flow rate, acfm	115,979	118,645	120,767	118,464
volumetric flow rate, scfm	105,225	104,240	107,029	105,498
volumetric flow rate, dscfm	103,921	100,004	103,592	102,506
CO ₂ , % volume dry	0.1	0.1	0.1	0.1
O ₂ , % volume dry	20.7	20.7	20.8	20.7
moisture content, % volume	1.28	4.10	3.25	2.88
Carbon Monoxide (CO)				
ppmvd	58.5	90.1	95.0	81.2
lb/hr	26.5	39.3	42.9	36.3
Chromium (Cr)				
µg	2.63	2.19	2.63	2.48
lb/hr	0.000540	0.000401	0.000473	0.000471
Particulate matter (PM)				
gr/dscf	0.000288	0.000470	0.000526	0.000428
lb/hr	0.257	0.403	0.467	0.376
lb/1,000 lb exhaust gas	0.000550	0.000897	0.00100	0.000817
Visible Emissions (VE)				
%*	0	0	0	0

*The average opacity is based on the highest six-minute reading at each of the four sources.

Table 4-2
PM and VE Emissions Results -
EU-CLEAN

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	9/4/2024	9/4/2024	9/4/2024	--
Start Time	7:48	9:50	11:57	--
Stop Time	9:26	11:25	13:35	--
Flue Gas Parameters				
flue gas temperature, °F	83.2	90.6	97.8	90.5
volumetric flow rate, acfm	62,442	59,731	60,559	60,911
volumetric flow rate, scfm	60,050	56,674	56,717	57,814
volumetric flow rate, dscfm	59,498	55,919	56,092	57,170
moisture content, % volume	0.96	1.37	1.14	1.16
Particulate matter (PM)				
gr/dscf	0.000227	0.000302	0.000731	0.000420
lb/hr	0.116	0.145	0.352	0.204
lb/1,000 lb exhaust gas	0.000430	0.000573	0.001388	0.000797
Visible Emissions (VE)				
%	0	0	0	0



Table 4-3

**NO_x, CO, Cr, Pb, PM, TNMHC, and VE Emissions Results -
FG-MELTING**

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	9/5/2024	9/5/2024	9/5/2024	--
Start Time	9:15	12:05	14:55	--
Stop Time	11:05	13:55	16:47	--
Flue Gas Parameters				
flue gas temperature, °F	142	153	147	147
moisture content, % volume	1.42	2.77	1.03	1.74
CO ₂ , % volume dry	0.3	0.3	0.2	66,241
O ₂ , % volume dry	20.4	20.5	20.7	56,805
volumetric flow rate, acfm	65,955	66,199	66,570	66,241
volumetric flow rate, scfm	57,054	56,268	57,092	56,805
volumetric flow rate, dscfm	56,268	54,732	56,524	55,841
Nitrogen Oxide (NO_x)				
ppmvd	1.10	1.08	0.84	1.01
lb/hr	0.445	0.425	0.341	0.404
Carbon Monoxide (CO)				
ppmvd	8.43	11.4	8.83	9.55
lb/hr	2.07	2.72	2.18	2.32
Chromium (Cr)				
µg	2.10	2.42	2.35	2.29
lb/hr	0.0000143	0.0000167	0.0000167	0.0000159
Lead (Pb)				
µg	1.41	0.910	0.880	1.07
lb/hr	0.00000958	0.00000630	0.00000627	0.00000738
Particulate matter (PM)				
gr/dscf	0.000452	0.000299	0.000607	0.000452
lb/hr	0.218	0.140	0.294	0.217
lb/1,000 lb exhaust gas	0.000861	0.000554	0.00116	0.000859
Total Non-Methane Hydrocarbons, as Propane (TNMHC)				
lb/hr	0.808	1.12	0.808	0.911
Fugitive Emissions (FE) – Left Vent				
%	0	0.42	0.63	0.35
Fugitive Emissions (FE) – Right Vent				
%	0	0.63	0.42	0.35
Visible Emissions (VE)				
%	0	0	0	0



Table 4-4
NO_x, CO, Cr, Pb, PM, TNMHC, and VE Emissions Results -
SV-INOCULATION

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	9/5/2024	9/5/2024	9/5/2024	--
Start Time	9:15	12:05	14:32	--
Stop Time	11:03	13:54	16:48	--
Flue Gas Parameters				
flue gas temperature, °F	104	115	118	112
moisture content, % volume	1.63	1.58	1.73	1.65
CO ₂ , % volume dry	0.0	0.0	0.0	0.0
O ₂ , % volume dry	20.8	20.8	20.8	20.8
volumetric flow rate, acfm	57,174	55,449	55,481	56,035
volumetric flow rate, scfm	52,745	50,150	49,984	50,959
volumetric flow rate, dscfm	51,907	49,375	49,139	50,140
Nitrogen Oxide (NO_x)				
ppmvd	1.17	1.18	1.15	1.17
lb/hr	0.435	0.418	0.405	0.420
Carbon Monoxide (CO)				
ppmvd	5.70	7.29	6.65	6.55
lb/hr	1.29	1.57	1.43	1.43
Chromium (Cr)				
µg	2.58	2.65	2.18	2.47
lb/hr	0.0000138	0.0000142	0.0000108	0.0000129
Lead (Pb)				
µg	2.15	3.75	0.797	2.23
lb/hr	0.0000115	0.0000201	0.00000396	0.0000119
Particulate matter (PM)				
gr/dscf	0.000177	0.000500	0.000280	0.000319
lb/hr	0.0789	0.211	0.118	0.136
lb/1,000 lb exhaust gas	0.000338	0.000907	0.000506	0.000584
Total Non-Methane Hydrocarbons, as Propane (TNMHC)				
lb/hr	0.274	0.451	0.318	0.348
Visible Emissions (VE)				
%	0	0	0	0



MONTROSE
AIR QUALITY SERVICES

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 7E and 10 calibration audits were all within the measurement system performance specifications for the calibration drift checks, system calibration bias checks, and calibration error checks.

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

The NO₂ to NO converter efficiency checks of each analyzer were conducted per the procedures in EPA Method 7E, Section 8.2.4. The conversion efficiencies met the criteria.

EPA Method 5 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met, except if noted in Section 5.2. 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 18 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria 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



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AIR QUALITY SERVICES

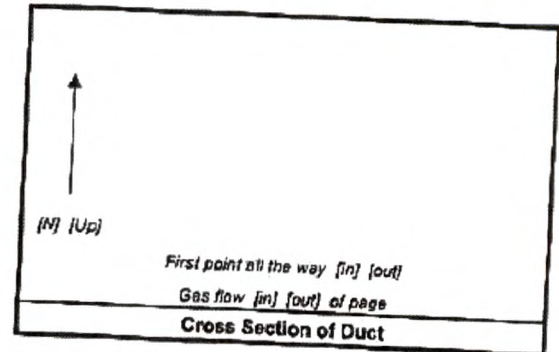
Appendix A.1

Sampling Locations

MONTROSE AIR QUALITY SERVICES
EPA Method 1
Sample and Velocity Traverses Datasheet

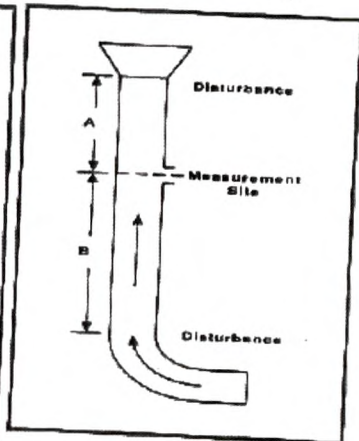
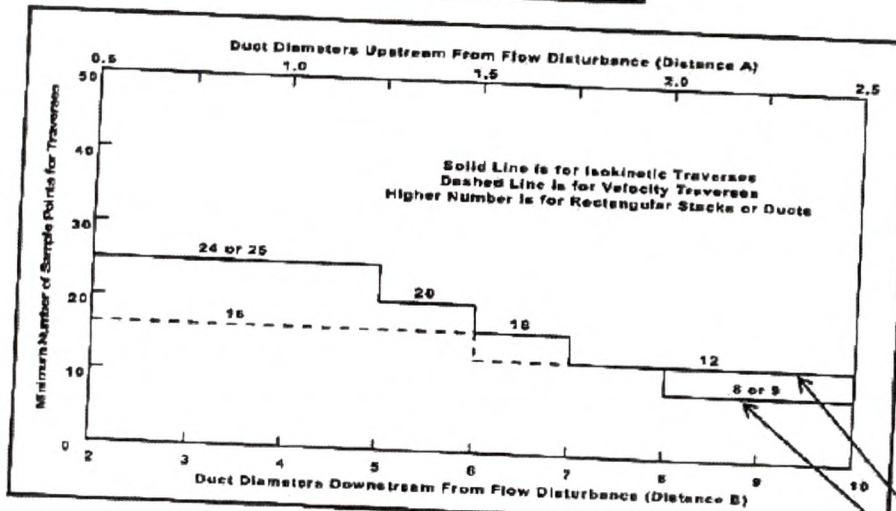
LOCATION FG-Sand

Client	MTI - RDI
Project No:	42725
Plant	Ravenna, Mj
Date	9/3/24
Technician	JL
Duct Diameter (in.)	83
Port Diameter (in.)	6
Port Length (in.)	1.8
Port Type	Female
Distance A (in.)	382
Distance B (in.)	216
Distance A (Duct Diameters)	4.6
Distance B (Duct Diameters)	2.6



For rectangular ducts

$$ED = \frac{2LW}{(L + W)}$$



Stacks D > 24" min. ≥ 1.00' away from wall
Stacks D ≤ 24" min. ≥ 0.50' away from wall

Location Schematic and Notes

Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc.

Traverse Point	Distance (in.)	Dist. w/Port (in.)
1	1.1	6.1
2	3.5	8.5
3	6.1	11.1
4	9.2	14.2
5	13.0	18.0
6	18.5	23.5
7	33.5	38.5
8	39.0	44.0
9	42.8	47.8
10	45.9	50.9
11	48.5	53.5
12	50.9	55.9
13		
14		
15		
16		

Cyclonic Flow Traverse Datasheet

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Client	MTI - RDI
Project No.	42725
Plant	Ravenna, MI

Location		FG-Sand	Location		SV-Inoculation	Location		
Test Crew		JR, JK	Test Crew			Test Crew		
Date		9-3-24	Date			Date		
Start Time		3:55	Start Time			Start Time		
Stop Time		4:03	Stop Time			Stop Time		
Probe ID		AED-6-6	Probe ID			Probe ID		
Pre Leak Check		+ ✓ - ✓	Pre Leak Check (-)		+ -	Pre Leak Check (-) + -		
Post Leak Check		+ ✓ - ✓	Pre Leak Check (+)		+ -	Pre Leak Check (+) + -		
Traverse Point	Angle α	Notes	Traverse Point	Angle α	Notes	Traverse Point	Angle α	Notes
-1	1							
-2	0							
-3	0							
-4	2							
-3	.5							
-6	1							
-7	0							
-8	0							
-9	3							
-10	1							
-11	0							
-12	4							
-1	0							
-2	0							
-3	1							
-4	3							
-3	2							
-6	1							
-7	1							
-8	0							
-9	4							
-10	1							
-11	0							
-12	3							
Total	28.5		Total			Total		
Average	1.2		Average			Average		

QA/QC Check: Completeness Legibility Accuracy Specifications Checked By: Team Leader:

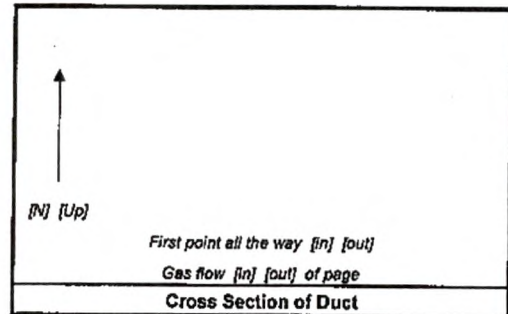
MONTROSE AIR QUALITY SERVICES

EPA Method 1

Sample and Velocity Traverses Datasheet

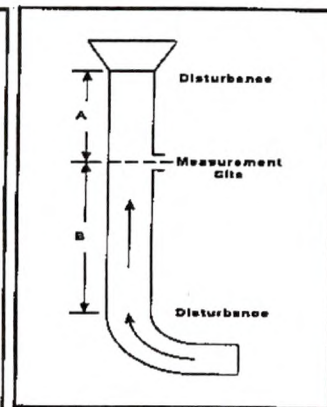
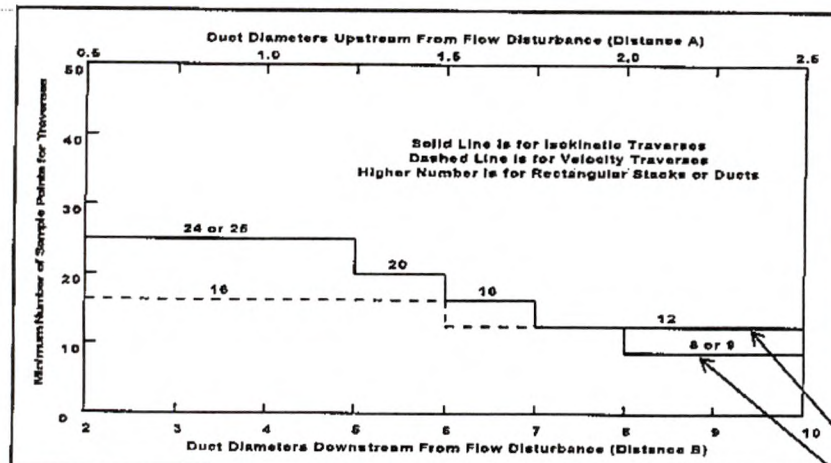
LOCATION EU-Clean

Client	MTI - RDI
Project No:	42725
Plant	Ravenna, MI
Date	9/3/24
Technician	JE
Duct Diameter (in.)	59
Port Diameter (in.)	6
Port Length (in.)	2
Port Type	Female
Distance A (in.)	431
Distance B (in.)	171
Distance A (Duct Diameters)	7.3
Distance B (Duct Diameters)	2.9



For rectangular ducts

$$ED = \frac{2LW}{(L + W)}$$



Stacks $D > 24"$ min. $\geq 1.00'$ away from wall
Stacks $D \leq 24"$ min. $\geq 0.50'$ away from wall

Location Schematic and Notes		Traverse Point	Distance (in.)	Dist. w/Port (in.)
		1	1.3	3.3
		2	4.0	6
		3	6.9	9
		4	10.4	12.5
		5	14.6	16.8
		6	20.8	22.8
		7	37.7	39.7
		8	43.9	45.9
		9	48.1	50.1
		10	51.6	53.6
		11	54.6	56.6
		12	57.3	59.3
		13		
		14		
		15		
		16		

Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc.

Cyclonic Flow Traverse Datasheet

of

Client	MTI - RDI
Project No.	42725
Plant	Ravenna, MI

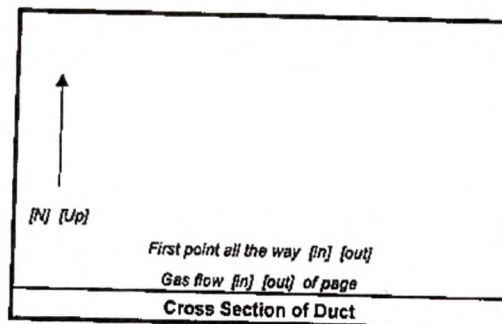
Location		EU-Clean	Location			Location		
Test Crew		R-CL	Test Crew			Test Crew		
Date		9-3-24	Date			Date		
Start Time		1500	Start Time			Start Time		
Stop Time		1510	Stop Time			Stop Time		
Probe ID		AED-6-G	Probe ID			Probe ID		
Pre Leak Check		+ $\frac{1}{15}$ - $\frac{1}{15}$	Pre Leak Check (-)		+ -	Pre Leak Check (-)		+ -
Post Leak Check		+ $\frac{1}{15}$ - $\frac{1}{15}$	Pre-Leak Check (+)		+ -	Pre Leak Check (+)		+ -
Traverse Point	Angle α	Notes	Traverse Point	Angle α	Notes	Traverse Point	Angle α	Notes
-1	5							
-2	2							
-3	2							
-4	7							
-3	7							
-6	2							
-7	4							
-8	2							
-9	2							
-10	1							
-11	2							
-12	3							
-1	4							
-2	3							
-3	2							
-4	2							
-3	3							
-6	3							
-7	2							
-8	4							
-9	4							
-10	3							
-11	3							
-12	2							
Total	66		Total			Total		
Average	5.5		Average			Average		

QA/QC Check: Completeness _____ Legibility _____ Accuracy _____ Specifications _____ Checked By: _____ Team Leader: _____

MONTROSE AIR QUALITY SERVICES
EPA Method 1
Sample and Velocity Traverses Datasheet

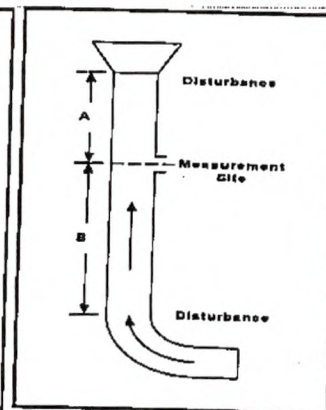
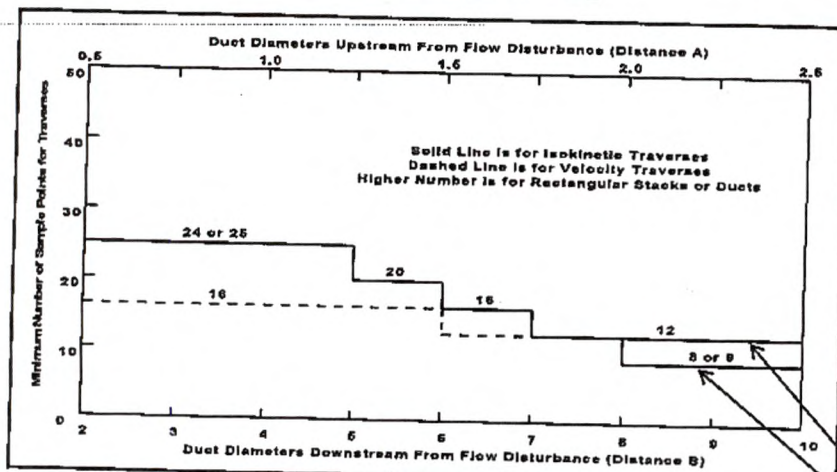
LOCATION FG-Melt

Client	MTI - RDI
Project No:	42725
Plant	Ravenna, MI
Date	
Technician	
Duct Diameter (in.)	58.5
Port Diameter (in.)	6
Port Length (in.)	2
Port Type	Female
Distance A (in.)	299
Distance B (in.)	135
Distance A (Duct Diameters)	5.1
Distance B (Duct Diameters)	2.3



For rectangular ducts

$$ED = \frac{2LW}{(L + W)}$$



Stacks D > 24" min. ≥ 1.00" away from wall
Stacks D ≤ 24" min. ≥ 0.50" away from wall

Location Schematic and Notes	Traverse Point	Distance (in.)	Dist. w/Port (in.)
Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc.	1	1.3	3.3
	2	3.9	5.9
	3	6.9	8.9
	4	10.4	12.4
	5	14.6	16.6
	6	20.8	22.8
	7	37.7	39.7
	8	43.9	45.9
	9	48.1	50.1
	10	51.6	53.6
	11	54.8	56.6
	12	57.3	59.3
	13		
	14		
	15		
	16		

MONTROSE AIR QUALITY SERVICES

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Client	MTI - RDI
Project No.	42725
Plant	Ravenna, MI

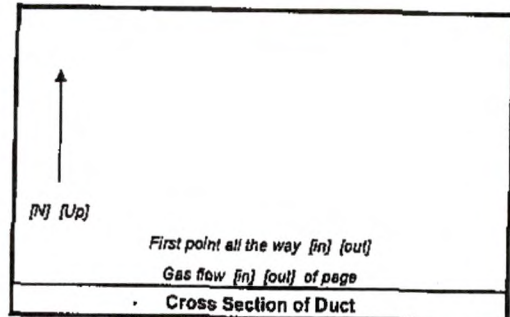
Location		FG-Melt	Location		BV-Inoculation	Location		
Test Crew		JR	Test Crew			Test Crew		
Date		9-5-24	Date			Date		
Start Time		7:30	Start Time			Start Time		
Stop Time		7:38	Stop Time			Stop Time		
Probe ID		AES-S-1	Probe ID			Probe ID		
Pre Leak Check		+ ✓ - ✓	Pre Leak Check (-)		+ -	Pre Leak Check (-)		+ -
Post Leak Check		+ ✓ - ✓	Pre Leak Check (+)		+ -	Pre Leak Check (+)		+ -
Traverse Point	Angle α	Notes	Traverse Point	Angle α	Notes	Traverse Point	Angle α	Notes
-1	4							
-2	9.5							
-3	3							
-4	7.8							
-3	2.3							
-6	2							
-7	4.8							
-8	5							
-9	3.1							
-10	3.8							
-11	1							
-12	2							
-1	9							
-2	10.6							
-3	6.1							
-4	6.9							
-3	6.1							
-6	4.8							
-7	8.1							
-8	2							
-9	6.3							
-10	5.1							
-11	4							
-12	6.7							

QA/QC Check: Completeness ____ Legibility ____ Accuracy ____ Specifications ____ Checked By: ____ Team Leader: ____

MONTROSE AIR QUALITY SERVICES
 EPA Method 1
 Sample and Velocity Traverses Datasheet

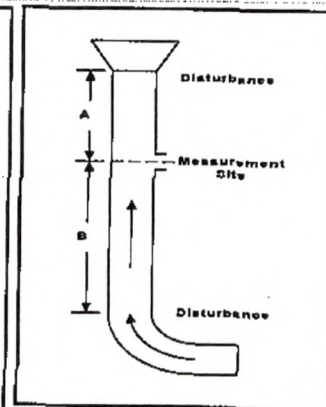
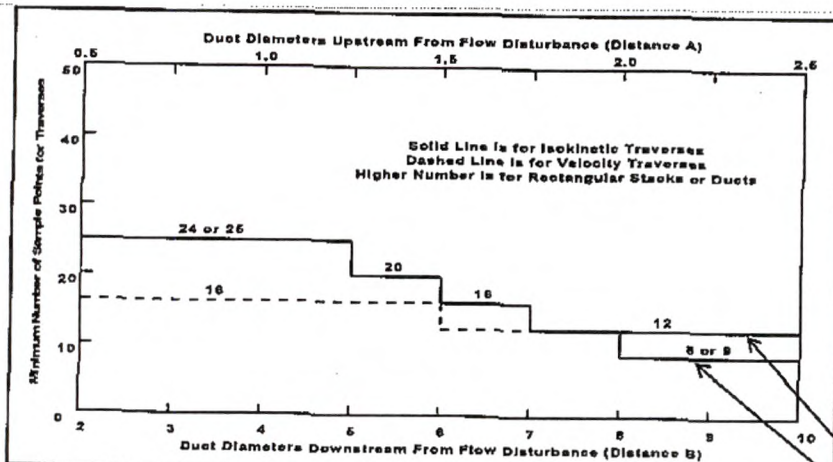
LOCATION SV-Inoculation

Client	MTI - RDI
Project No:	42725
Plant	Ravenna, MI
Date	
Technician	
Duct Diameter (in.)	52
Port Diameter (in.)	6
Port Length (in.)	5
Port Type	Female
Distance A (in.)	296
Distance B (in.)	255
Distance A (Duct Diameters)	5.7
Distance B (Duct Diameters)	4.9



For rectangular ducts

$$ED = \frac{2LW}{(L + W)}$$



Stacks D > 24" min. ≥ 1.00' away from wall
 Stacks D ≤ 24" min. ≥ 0.50' away from wall

Location Schematic and Notes	Traverse Point	Distance (in.)	Dist. w/Port (in.)
	1	1.1	6.1
	2	3.5	8.5
	3	6.1	11.1
	4	9.2	14.2
	5	13.0	18.0
	6	18.5	23.5
	7	33.5	38.5
	8	39.0	44.0
	9	42.8	47.8
	10	45.9	50.9
	11	48.5	53.5
	12	50.9	55.9
	13		
	14		
	15		
	16		

Indicate sample ports, height from grade, types of disturbances, access, unistrut configuration, etc.

MONTROSE AIR QUALITY SERVICES

Cyclonic Flow Traverse Datasheet

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Client	MTI - RDI
Project No.	42725
Plant	Ravenna, MI

Q.

Location		SV-Inoculation		Location		SV-Inoculation		Location		SV-Inoculation	
Test Crew				Test Crew				Test Crew			
Date				Date				Date			
Start Time				Start Time				Start Time			
Stop Time				Stop Time				Stop Time			
Probe ID				Probe ID				Probe ID			
Pre Leak Check		+ -		Pre Leak Check (-)		+ -		Pre Leak Check (-)		+ -	
Post Leak Check		+ -		Pre Leak Check (+)		+ -		Pre Leak Check (+)		+ -	
Traverse Point	Angle α	Notes		Traverse Point	Angle α	Notes		Traverse Point	Angle α	Notes	
-1	7										
-2	0										
-3	0										
-4	2										
-3	0										
-6	2										
-7	3										
-8	5										
-9	8										
-10	7										
-11	9										
-12	9										
-1	6										
-2	5										
-3	4										
-4	3										
-3	0										
-6	3										
-7	3										
-8	3										
-9	4										
-10	5										
-11	6										
-12	4										
Total				Total				Total			
Average	1,1024			Average				Average			

QA/QC Check: Completeness _____ Legibility _____ Accuracy _____ Specifications _____ Checked By: _____ Team Leader: _____