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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:	[signature]	**Date:**	October 12, 2023
Name:	John Nestor	**Title:**	District Manager

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1.0 Introduction

1.1 Summary of Test Program

Cleveland-Cliffs Dearborn Works contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the PLTCM Tandem Mill Fume Exhaust stack (EUTANDMILL) at the Cleveland-Cliffs Dearborn Works (CCDW) facility (State Registration ID: A8640) located in Dearborn, Michigan. Testing was performed on August 17, 2023, 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. 120-16.

The specific objectives were to:

- Measure emissions of filterable particulate matter ≤10µm (PM_{10} Filterable) and total emissions of particulate matter ≤10µm (PM_{10}) EUTANDMILL.
- 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(s)	Unit ID/ Source Name	Activity/Parameters	Test Methods	No. of Runs	Duration (Minutes)
8/17/2023	EUTANDMILL	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	60
8/17/2023	EUTANDMILL	O_2, CO_2	EPA 3	3	N/A
8/17/2023	EUTANDMILL	Moisture	EPA 4	3	60
8/17/2023	EUTANDMILL	TPM* (PM_{10})	EPA 5/202	3	60

*All filterable PM collected will be reported as filterable PM less than 10 microns (PM10). The summation of the filterable particulate matter and condensable particulate matter will be used to determine total particulate matter less than 10 microns.

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. 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 June 12, 2023 that was submitted to EGLE.

Table 1-2
Summary of Average Compliance Results – EUTANDMILL

August 17, 2023

Parameter/Units	Average Results	Emission Limits
Particulate Matter less than 10 Microns Filterable		
Gr/dscf	0.001	0.004
Lb/hr	1.64	N/A
Particulate Matter Less than 10 microns (Total)		
Gr/dscf	0.002	N/A
Lb/hr	3.34	N/A

1.2 Key Personnel

A list of project participants is included below:

Facility Information

Source Location:	Cleveland-Cliffs Dearborn Works 4001 Miller Road Dearborn, MI 48120
Project Contact:	David Pate
Role:	Senior Environmental Engineer
Company:	Cleveland-Cliffs Dearborn Works
Telephone:	313-323-1261
Email:	david.pate@clevelandcliffs.com

Agency Information

Regulatory Agency:	Michigan Department of Environment, Great Lakes, and Energy (EGLE)	
Agency Contact:	Jeremy Howe	Dr. April Wendling
Telephone:	231-878-6687	313-588-0037
Email:	HoweJ1@Michigan.gov	WendlingA@michigan.gov

Testing Company Information

Testing Firm:	Montrose Air Quality Services, LLC
Contact:	John Nestor
Title:	District Manager-Royal Oak
Telephone:	248-765-5032
Email:	jonestor@montrose-env.com

Laboratory Information

Laboratory:	Montrose-Royal Oak
City, State:	Royal Oak, Michigan
Method:	EPA Method 5
Company:	Montrose-Wauconda
Contact:	Wauconda, Illinois
Method	EPA Method 202

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

Table 1-3
Test Personnel and Observers

Name	Affiliation	Role/Responsibility
John Nestor	Montrose	District Manager – Royal Oak Office
Shane Rabideau	Montrose	Field Technician
Jeff Peitzsch	Montrose	Field Technician
Cedric Ebbeler	Montrose	Field Technician
Regina Angellotti	EGLE	Observation
Katherine Koster	EGLE	Observation
David Pate	CCDW	Test Coordinator

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2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

The pickling process uses a mineral acid (hydrochloric acid) to remove metal oxides formed when steel is hot rolled and cooled in the presence of oxygen. These oxides need to be removed to provide a smooth, clean surface for use as hot roll steel and/or to perform subsequent cold forming operations. The tandem mill operation is coupled to the pickling line and is a cold-rolling mill consisting of a series of five stands that compress the pickled coil in order to achieve a desired thickness and surface quality. Cold rolling imparts greater strength, a uniform and smoother surface, and reduces the steel sheet thickness. During the cold rolling operations, oil is used as a lubricant between the rolls and steel coil. Oil mist generated from this process is collected and ducted to an oil mist eliminator rated at approximately 230,000 acfm. Steel is processed on a coil-by-coil basis; once the steel enters the process, it continues from the scale breaker to the pickling line and then to the tandem cold mill. Steel coils range from approximately 15 to 20 tons, depending on specific customer orders. Hourly production rates are approximately 175 to 250 tons/hour. Rolling oil is applied to the tandem cold mill stands in a very dilute concentration (typically 1 to 3% for stands 1-4 and 0.1 – 0.5% for stand 5, with water) and is kept at a relatively constant concentration; however, the concentration will purposely vary slightly from stand to stand depending on the function of the specific stand. Based on the concentration of oil in the stands, makeup oil is added into the system as needed. The oil mist eliminator is rated for 95% removal efficiency.

2.2 Flue Gas Sampling Location

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

Table 2-1
Sampling Location

Sampling Location	Stack Inside Diameter (in.)	Distance from Nearest Disturbance: Downstream EPA "B" (in./dia.)	Distance from Nearest Disturbance: Upstream EPA "A" (in./dia.)	Number of Traverse Points
EUTANDMILL	142	552/3.9	360/2.5	Isokinetic: 24 (6/port) Gaseous: 1

Dimensions for the EUTANDMILL 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

Steel was processed on a coil-by-coil basis; once a coil enters the process, it continues from the Scale Breaker to the Pickling Section and then to the Tandem Cold Mill. Steel coils ranged from approximately 15 to 35 tons, depending on specific customer orders. Rolling oil was applied to the tandem cold mill stands in a very dilute concentration (typically 1 to 3% for stands 1-4 and 0.1-0.5% for stand 5, with water) and was kept at a relatively constant concentration; however, the concentration will purposely vary slightly from stand to stand depending on the function of the specific stand. Usage of rolling oil is tracked on a monthly basis and is calculated based on inventory consignment. Hourly production rates averaged 228 tons/hour during this test. The oil mist eliminator operated normally during the test.

For this test, the following was recorded:

1. Production Rate in tons per hour and tons per run
2. Pressure drop across the mist eliminator at no less than 15-minute intervals
3. Oil concentration in stands 1-4 and stand 5 once per run.

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.

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 O2 and CO2 in the gas stream using either an Orsat or a Fyrite Analyzer. 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. In this case, a single-point grab sample was analyzed with a fyrite analyzer to confirm ambient conditions.

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

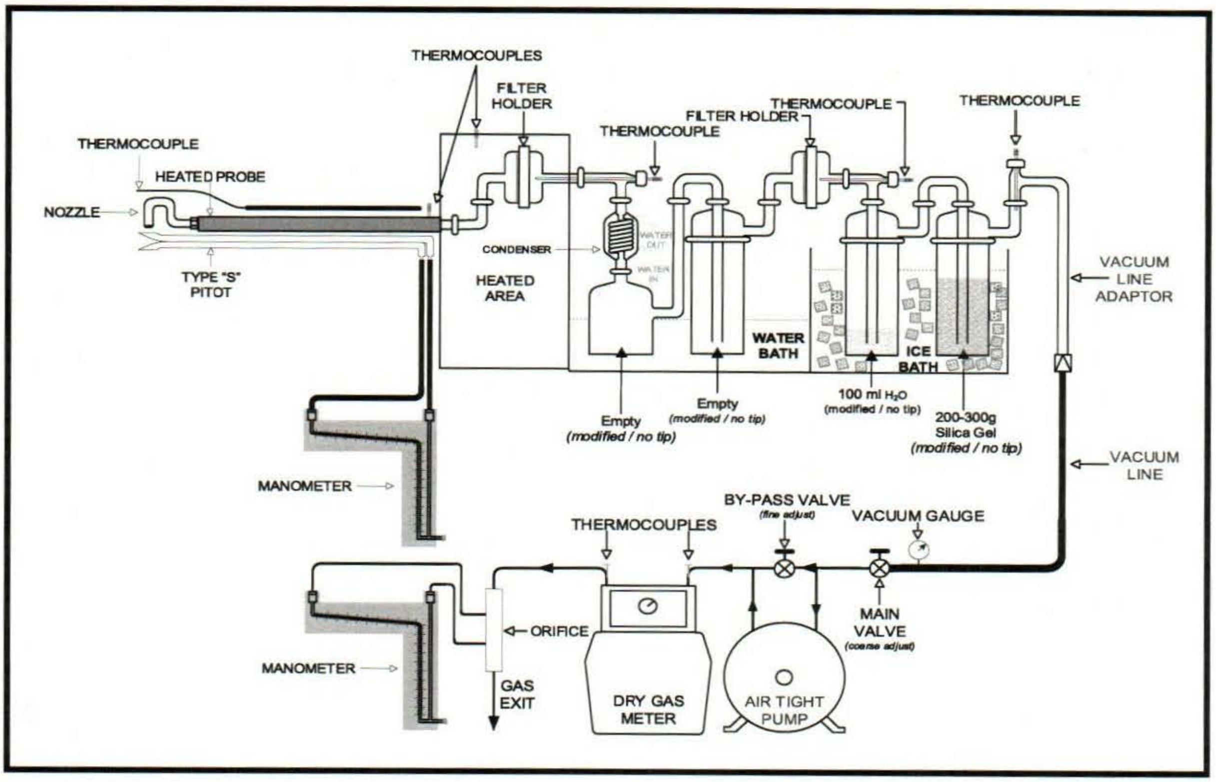
EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed in an ice water bath. The impingers are weighed after each run to determine the percent moisture. In this case, EPA method 4 was conducted in conjunction with method 5 and 202

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 5/202 Sampling Train



3.1.6 EPA Method 202, Dry Impinger Method for Determining Condensable Particulate Emissions from Stationary Sources

The CPM is collected in dry impingers after filterable PM has been collected on a filter maintained as specified in either Method 5 of Appendix A-3 to 40 CFR 60, Method 17 of Appendix A-6 to 40 CFR 60, or Method 201A of Appendix M to 40 CFR 51. The organic and aqueous fractions of the impingers and an out-of-stack CPM filter are then taken to dryness and weighed. The total of the impinger fractions and the CPM filter represents the CPM. Compared to the version of Method 202 that was promulgated on December 17, 1991, this method eliminates the use of water as the collection media in impingers and includes the addition of a condenser followed by a water dropout impinger immediately after the final in-stack or heated filter. This method also includes the addition of one modified Greenburg Smith impinger (backup impinger) and a CPM filter following the water dropout impinger.

CPM is collected in the water dropout impinger, the modified Greenburg Smith impinger, and the CPM filter of the sampling train as described in this method. The impinger contents are purged with nitrogen immediately after sample collection to remove dissolved SO_2 gases from the impingers. The CPM filter is extracted with water and hexane. The impinger solution is then extracted with hexane. The organic and aqueous fractions are dried and the residues are weighed. The total of the aqueous and organic fractions represents the CPM.

The potential artifacts from SO_2 are reduced using a condenser and water dropout impinger to separate CPM from reactive gases. No water is added to the impingers prior to the start of sampling. To improve the collection efficiency of CPM, an additional filter (the "CPM filter") is placed between the second and third impingers

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

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 is 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

Due to PLTCM mill issues, testing was not completed during the first two mobilizations. Two runs were completed on July 27 before the test was terminated due to process issues. Samples from the aborted testing were collected and are presented in appendix A.2.2 for review. Process data for the aborted testing is presented in appendix B.2. EGLE personnel were notified of the aborted test runs and correspondence can be found in Appendix E.1.

The average results are compared to the permit limits in Table 1-2. The results of individual compliance test runs performed are presented in Table 4-1. 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.

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Table 4-1
TPM Emissions Results -
EUTANDMILL

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	8/17/2023	8/17/2023	8/17/2023	--
Time	8:45-9:55	12:10-16:31	17:50-19:35	--
Process Data*				
Production Rate, TPH	281.48	193.18	209.01	227.89
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	--
O_2, % volume dry	20.90	20.90	20.90	20.90
CO_2, % volume dry	0.00	0.00	0.00	0.00
flue gas temperature, °F	101.0	97.5	97.7	98.7
moisture content, % volume	4.01	3.24	4.58	3.94
volumetric flow rate, dscfm	180,860	194,691	179,368	184,973
Filterable Particulate Matter (FPM)†				
gr/dscf	0.0012	0.0011	0.0008	0.0010
lb/hr	1.807	1.887	1.225	1.640
Condensable PM				
gr/dscf	0.0012	0.0009	0.0011	0.0011
lb/hr	1.830	1.584	1.697	1.704
Total PM_{10}				
gr/dscf	0.0023	0.0021	0.0019	0.0021
lb/hr	3.64	3.47	2.92	3.34

* Process data was provided by CCDW personnel.

† FPM is considered PM_{10} (caustic) (filterable) for compliance determination.

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

The meter box 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.

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 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 202 analytical QA/QC results are included in the laboratory report. The method QA/QC criteria were met. An EPA Method 202 Field Train Recovery Blank (FTRB) was performed for each source category. An EPA method 202 Field Train Proof Blank (FTPB) was performed for all sets of impingers used.

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).

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Appendix A
Field Data and Calculations

Appendix A.1
Sampling Locations

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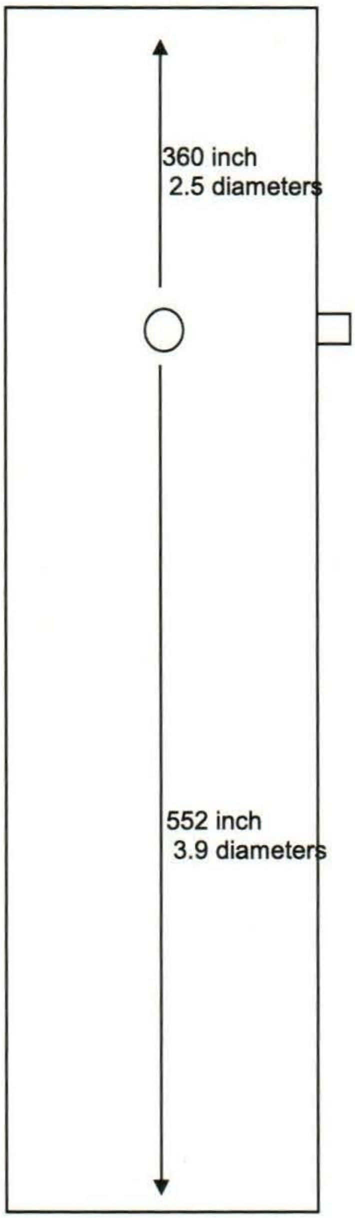
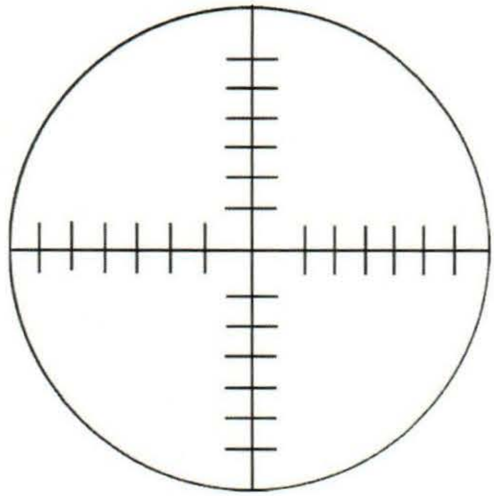
diameter = 142





Not to Scale

Points	Distance "
1	3.0
2	9.5
3	16.8
4	25.1
5	35.5
6	50.6

Site: **Sampling Dates:** **PLTCM Tandem Mill Fume Exhaust stack 8/17/2023** **Cleveland Cliffs Dearborn Works** **Dearborn, Michigan**	**Montrose Air Quality Services, LLC** **4949 Fernlee** **Royal Oak, Michigan**