Source Test Report for 2022 Compliance Emissions Testing

Hot Dip Galvanizing Line (HDGL) Pre-Cleaning Process (EUHDGLCLEANER)

Cleveland-Cliffs Dearborn Works
Dearborn, Michigan

Prepared For:

Cleveland-Cliffs Dearborn Works
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Prepared By:

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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:	John Nestor	**Date:**	01 / 11 / 2023
Name:	John Nestor	**Title:**	District 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:**	01 / 11 / 2023
Name:	Robert J. Lisy, Jr.	**Title:**	Reporting Hub 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 Hot Dip Galvanizing Line (HDGL) Pre-Cleaning Process (EUHDGLCLEANER) at the Cleveland-Cliffs Dearborn Works facility (State Registration ID: A8640) located in Dearborn, Michigan. Testing was performed on November 16, 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. 120-16.

The specific objectives were to:

- Measure emissions of filterable particulate matter ≤10μm (PM_{10}) from the exhaust stack (SVEUHDGLCLEANER) of the scrubber serving the EUHDGLCLEANER.
- 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)
11/16/2022	EUHDGLCLEANER	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	60
11/16/2022	EUHDGLCLEANER	O_2, CO_2	EPA 3	3	60
11/16/2022	EUHDGLCLEANER	Moisture	EPA 4	3	60
11/16/2022	EUHDGLCLEANER	TPM (PM_{10})	EPA 5/202	3	60

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 October 14, 2022 that was submitted to the EGLE.

Table 1-2
Summary of Average Compliance Results – EUHDGLCLEANER

November 16, 2022

Parameter/Units	Average Results	Emission Limits
Filterable Particulate Matter ≤10µm (FPM_{10} (Caustic, Filterable))		
lb/hr	0.033	0.441
Total PM_{10}		
lb/hr*	<0.092	N/A

* The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 4.2 for details.

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:	Regina Angellotti	Dr. April Wendling
Telephone:	313-418-0895	313-588-0037
Email:	AngellottiR1@michigan.gov	WendlingA@michigan.gov

Testing Company Information

Testing Firm: Montrose Air Quality Services, LLC

Contact:	John Nestor	Robert J. Lisy, Jr.
Title:	District Manager	Reporting Hub Manager
Telephone:	248-548-8070	440-262-3760
Email:	jonestor@montrose-env.com	rlisy@montrose-env.com

Laboratory Information

Laboratory: Montrose-Royal Oak
City, State: Royal Oak, Michigan
Method: EPA Method 5

Company: Montrose-Elk Grove
Contact: Elk Grove Village, 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
Roy Zimmer	Montrose	Field Technician
Clayton DeRonne	Montrose	Field Technician
David Pate	CCDW	Test Coordinator

2.0 Plant and Sampling Location Descriptions

2.1 Process Description, Operation, and Control Equipment

Coils of steel are loaded into the entry end of the process and are uncoiled and straightened. Each leading edge of the next coil will be welded to the preceding coil in order to allow the process to run continuously while production is occurring. In the PreCleaner section of the HDGL process, the straightened coils are cleaned within caustic solution tanks, which are heated by a hot water and heat exchanger system. Emissions of dilute caustic generated in the cleaning process tanks are controlled by a scrubber and a mist eliminator that exhausts to the outer atmosphere through the Pre-Cleaner stack. After cleaning and rinsing, the coil is dried with hot air. After drying, the coil enters the Annealing Furnace. The coil is heated according to required specifications within the Annealing Furnace and then proceeds to the zinc pot where the steel is given a zinc coating (i.e. galvanized). Excess zinc is removed immediately upon exit of the molten zinc pot, and the zinc-coated steel strip is allowed to dry as it travels in a vertical direction. After air cooling, the strip is quenched in water, dried, inspected, and packaged for customer delivery.

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		Number of Traverse Points
		Downstream EPA "B" (in./dia.)	Upstream EPA "A" (in./dia.)	
SVEUHDGLCLEANER	22.5	960.0/42.7	180.0/8.0	Isokinetic: 12 (6/port)

SVEUHDGLCLEANER was 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 EUHDGLCLEANER and Scrubber were operating at the conditions required by the permit. The unit was tested with normal operations on the line and with a reduced flow rate for the scrubber. The scrubber flow rate during the test event will become the new operating minimum for the scrubber.

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:

- Scrubber water flow rate, LPM
- Scrubber pressure drop, mm W.C
- Pre-cleaner Section Line Speed, m/min
- Production Rate, TPH

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. 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 CO2 and percent O2 using either an Orsat or a Fyrite analyzer.

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

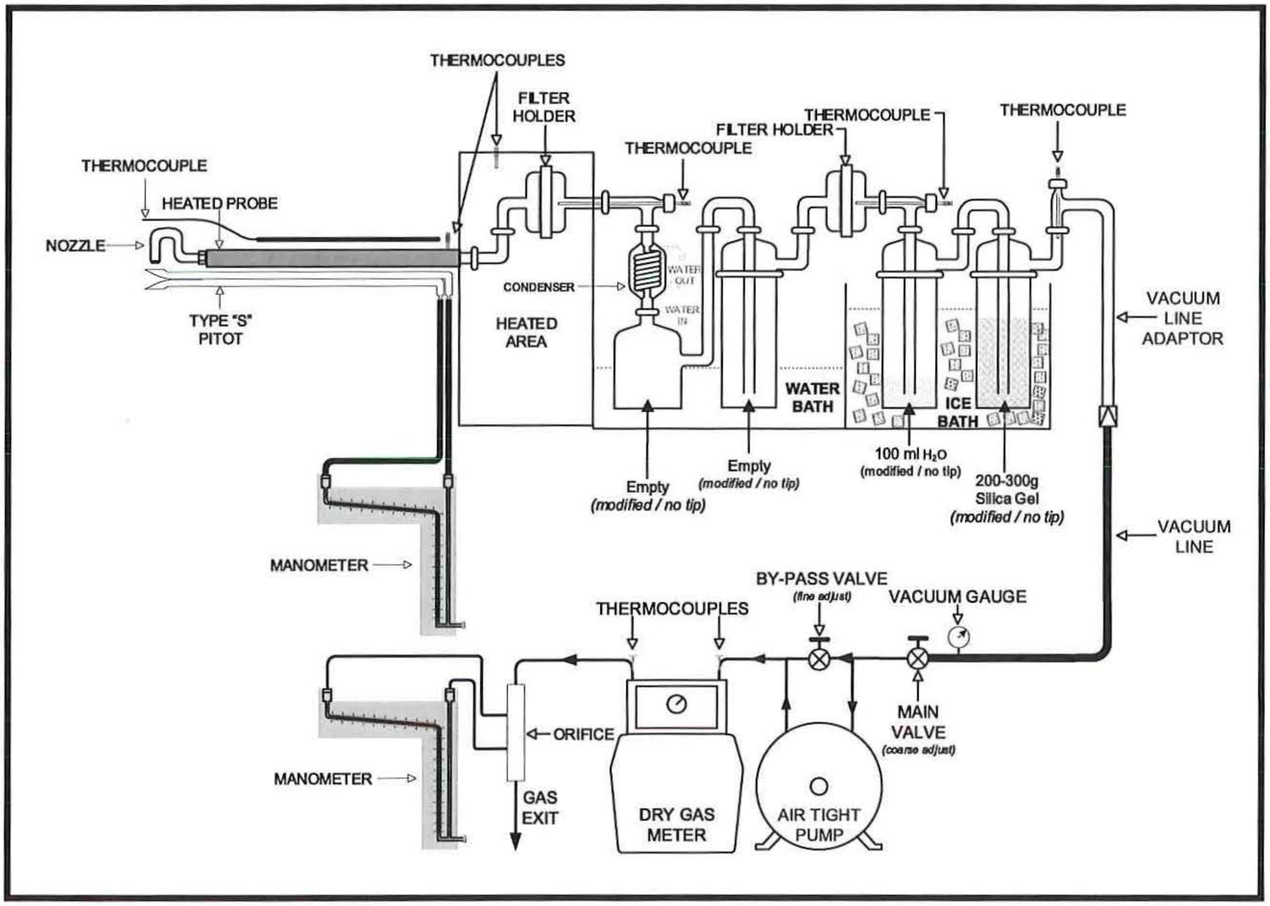
EPA Method 4 is a manual, non-isokinetic method used to measure the moisture content of gas streams. Gas is sampled at a constant sampling rate through a probe and impinger train. Moisture is removed using a series of pre-weighed impingers containing methodology-specific liquids and silica gel immersed 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 5/202 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 impinger. 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 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 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. It should be noted that while Cleveland-Cliffs Dearborn Works believes that the emission limit applies to filterable PM_{10} only, Cleveland-Cliffs also conducted condensable (EPA Method 202) during this test event to allow for reporting of Total PM_{10}.

Concentration values in Tables 1-2 and 4-1 denoted with a '<' were measured to be below the minimum detection limit (MDL) of the applicable analytical method. Emissions denoted with a '<' in Tables 1-2 and 4-1 were calculated utilizing the applicable MDL concentration value instead of the "as measured" concentration value.

Table 4-1
TPM Emissions Results -
EUHDGLCLEANER

Parameter/Units	Run 1	Run 2	Run 3	Average
Date	11/16/2022	11/16/2022	11/16/2022	--
Time	14:30-15:35	16:00-17:03	17:30-18:34	--
Process Data*				
Production Rate, TPH	64.16	65.17	57.43	62.25
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	--
O_2, % volume dry	20.80	20.80	20.80	20.80
CO_2, % volume dry	0.00	0.00	0.00	0.00
flue gas temperature, °F	127.1	119.4	119.1	121.9
moisture content, % volume	8.78	8.96	8.83	8.86
volumetric flow rate, dscfm	9,578	9,535	9,836	9,650
Filterable Particulate Matter (FPM)†				
gr/dscf	0.00050	0.00040	0.00029	0.00040
lb/hr	0.041	0.033	0.024	0.033
Condensable PM				
gr/dscf‡	0.00080	<0.00070	<0.00063	<0.00071
lb/hr‡	0.066	<0.057	<0.053	<0.059
Total PM				
lb/hr‡	0.107	<0.090	<0.078	<0.092

* Process data was provided by CCDW personnel.

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

‡ The "<" symbol indicates that compound was below the Minimum Detection Limit (MDL) of the analytical method. See Section 4.2 for details.

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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. The maximum allowable amount that can be subtracted is 0.002 g (2.0 mg). For this project, the FTRB had a mass of 1.0 mg, and 1.0 mg was subtracted.

5.2 QA/QC Discussion

Montrose did not have a Qualified Individual (QI) for EPA Methods 5 and 202 onsite during the test event as per ASTM D7036-04 requirements. However, upon data review, all EPA Method 5 and 202 data quality objectives were met.

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).