Source Test Report for 2022 Compliance Emissions Testing

Gas-Fired Annealing Furnace and Water Heaters (FGHDGLSCR)

Cleveland-Cliffs Dearborn Works Dearborn, Michigan

Prepared For:

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For Submission To:

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STAC ACCREDITED TO ASTM D7036 ONLY CERT #3925.01

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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 (CCDW) contracted Montrose Air Quality Services, LLC (Montrose) to perform a compliance test program on the Gas-Fired Annealing Furnace and Water Heaters (FGHDGLSCR) at the CCDW facility (State Registration No.: A8640) located in Dearborn, Michigan. Testing was performed on November 15-16, 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 nitrogen oxides (NO_x) as NO_2 and ammonia (NH_3) from the exhaust stack (SVHDGL_SCR) of the selective catalytic reduction control unit serving the FGHDGLSCR.
- 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)
November 15-16, 2022	FGHDGLSCR	Velocity/Volumetric Flow Rate	EPA 1 & 2	3	~10
November 15-16, 2022	FGHDGLSCR	O_2, CO_2	EPA 3	3	~3*
November 15-16, 2022	FGHDGLSCR	NO_x	EPA 7E	3	60
November 15-16, 2022	FGHDGLSCR	Moisture, NH_3	EPA 320	3	60

* Grab sample of O_2 and CO_2 was obtained.

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 October 14, 2022 that was submitted to the EGLE.

Table 1-2
Summary of Average Compliance Results – FGHDGLSCR

November 15-16, 2022

Parameter/Units	Average Results	Emission Limits
Nitrogen Oxides (NO_x)		
lb/hr, as NO_2	0.50	3.21
Ammonia (NH_3)		
lb/hr	0.35	2.19

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:	jnestor@montrose-env.com	rlisy@montrose-env.com

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
Regina Angellotti	EGLE	Observer

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 is 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 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.

The emissions from the Annealing Furnace are controlled by a Selective Catalytic Reduction (SCR) control device. Emissions exiting the SCR are exhausted through the exhaust stack that also exhausts uncontrolled combustion by-product emissions from the HDGL Hot Water Heater system.

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.)	
SVHDGL_SCR	48.0	384.0 / 8.0	96.0 / 2.0	Flow: 16 (8/port) Gaseous: 1

SVHDGL_SCR 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 FGHDGLSCR and SCR were operating at the conditions required by the permit. The unit was tested when operating normally.

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:

- Production, TPH
- Furnace NG usage, mscf
- Hot Water Heater NG usage, mscf
- Urea Injected, L
- Urea Rate, L/hr
- Line Speed, m/min
- SCR Temperature, °C
- NO_x Monitor Outlet Reading, ppm

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.

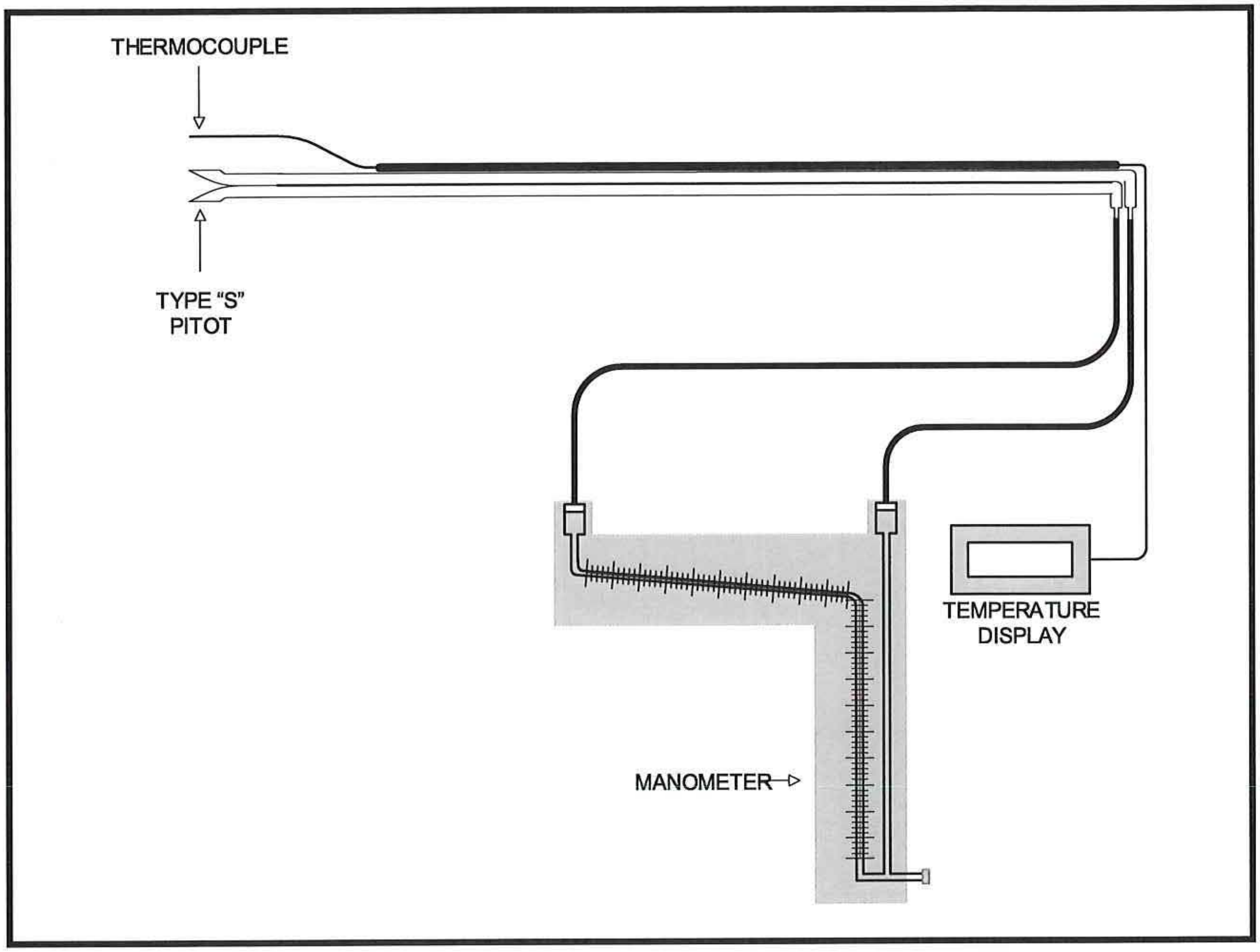
The sample port and traverse point locations are detailed in Appendix A.

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

Figure 3-1
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 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 7E, Determination of Nitrogen Oxides Emissions from Stationary Source (Instrumental Analyzer Procedure)

EPA Method 7E is an instrumental test method used to continuously measure emissions of NO_x as NO_2. Conditioned gas is sent to an analyzer (FTIR) to measure the concentration of

NO_x. NO and NO_2 can be measured separately or simultaneously together but, for the purposes of this method, NO_x is the sum of NO and NO_2. The performance requirements of the method must be met to validate the data.

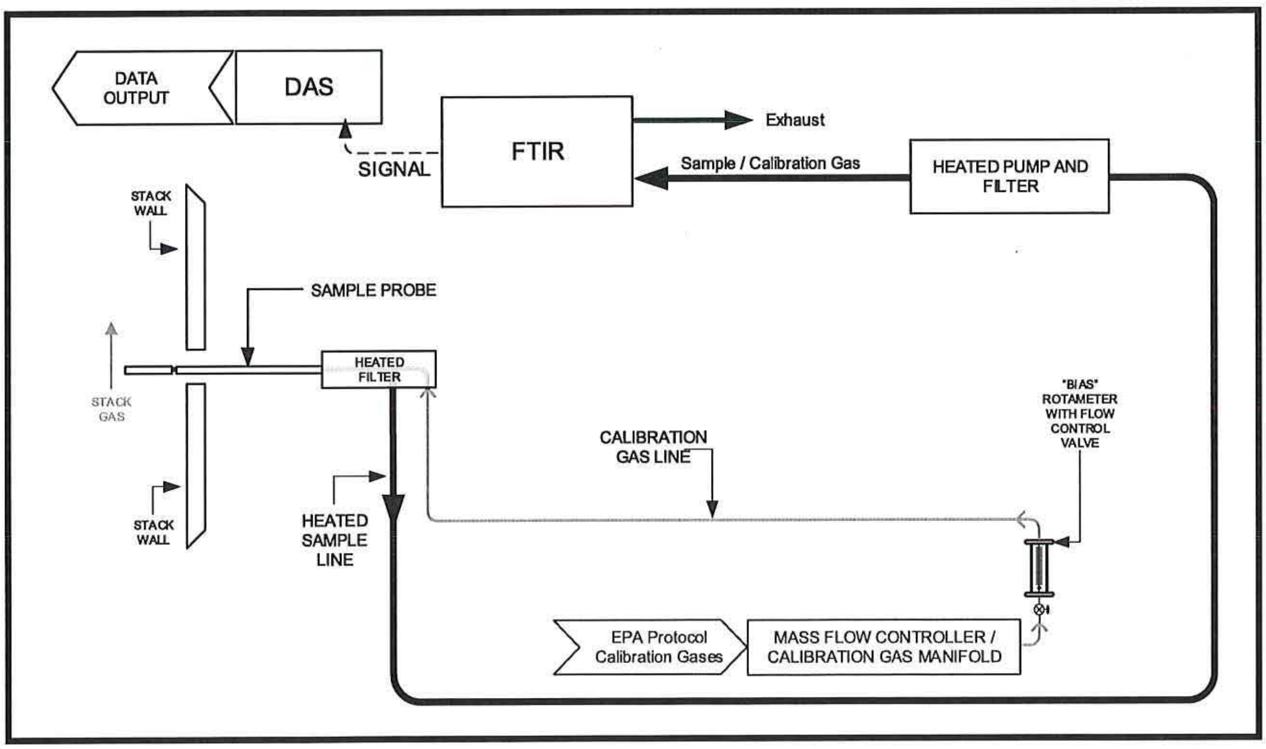
The typical sampling system is detailed in Figure 3-2.

3.1.5 EPA Method 320, Measurement of Vapor Phase Organic and Inorganic Emissions by Extractive FTIR Spectroscopy

EPA Method 320 is an instrumental test method used to measure specific analyte concentrations for which EPA reference spectra have been developed or prepared. Extractive emission measurements are performed using FTIR spectroscopy. The FTIR analyzer is composed of a spectrometer and detector, a high optical throughput sampling cell, analysis software, and a quantitative spectral library. The analyzer collects high resolution spectra in the mid infrared spectral region (400 to 4,000 cm-1), which are analyzed using the quantitative spectral library. This provides an accurate, highly sensitive measurement of gases and vapors.

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

Figure 3-2
EPA Method 7E (NO_x) /320 (NH_3) Sampling Train



3.2 Process Test Methods

The test plan did not require that process samples be collected during this test program; therefore, no process sample data are presented in this test report.

4.0 Test Discussion and Results

4.1 Field Test Deviations and Exceptions

It was determined by facility personnel that Run 1 did not have a representative production rate or natural gas usage rate. Therefore, emissions results from Run 1 are not included in Tables 1-2 and 4-1. Data for Run 1 is included in Appendix A.

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.

Table 4-1
NO_x and NH_3 Emissions Results - FGHDGLSCR

Parameter/Units	Run 2	Run 3	Run 4	Average
Date	11/15/2022	11/15/2022	11/16/2022	--
Time	13:50-14:49	15:20-15:19	13:10-14:09	--
Process Data*				
furnace production, ton/hr	63.6	70.8	65.7	66.7
furnace natural gas, mcf	46.04	45.46	47.28	46.26
water heater natural gas, mcf	4.79	4.79	4.79	4.79
urea injected, L	4.45	4.75	4.75	4.65
Sampling & Flue Gas Parameters				
sample duration, minutes	60	60	60	--
O_2, % volume dry	14.9	14.9	15.2	15.0
CO_2, % volume dry	5.6	5.6	5.0	5.4
flue gas temperature, °F	255.1	239.9	245.8	246.9
moisture content, % volume	9.0	9.6	9.5	9.4
volumetric flow rate, dscfm	20,265	15,778	17,869	17,971
Nitrogen Oxide (NO_x)				
ppmvd	2.77	4.32	4.72	3.94
lb/hr, as NO_2	0.40	0.49	0.60	0.50
Ammonia (NH_3)				
ppmvd	3.53	5.31	13.46	7.44
lb/hr	0.19	0.22	0.64	0.35

* Process data was provided by CCDW personnel.

5.0 Internal QA/QC Activities

5.1 QA/QC Audits

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.

The EPA Method 320 performance parameters measured included signal to noise tests, noise equivalent absorbance (NEA), detector linearity, background spectra, potential interferents, and cell and system leakage. Quality assurance procedures included baseline measurement with ultra-high purity nitrogen, measurement of a calibration transfer standard (~100 ppm ethylene), direct analyte calibration measurements, and measurements to determine baseline shift. SF_6 was also used as a tracer gas in the calibration gases to evaluate dilution ratios and verify the sample delivery system integrity. A dynamic matrix spike was performed using SF_6 as a tracer gas. The method QA/QC criteria were met, except where noted in Section 5.2.

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).