Table 6.4 Measured exhaust gas conditions and hydrogen chloride emission rates for EUDEGAS1 during non-A380 degassing

Test No. Test date Test period (24-hr clock)	26-1 02/29/2024 0758-0858	26-2 02/29/2024 0940-1041	26-3 02/29/2024 1113-1213	Three Test Average
Alloy Class	Non-A380	Non-A380	Non-A380	
Operating Conditions				
Flux events during test	3.0	3.0	2.0	2.7
Total flux added	3.0	3.0	2.0	2.7
Exhaust gas temperature (°F)	80.0	79.6	87.3	82.3
Exhaust gas flowrate (dscfm)	317	370	365	365
Hydrogen Chloride				
Sampled volume (dscf)	48.1	49.6	48.6	48.8
Total catch (ug)	45.1	27.5	1,263	445
Total HCl emissions (lb/hr)	0.000	0.000	0.001	0.000
Total HCl emissions (lb/lb-flux)	0.000	0.000	0.000	0.000
Permit Limit (lb/lb-flux)	-	-	-	*0.183*

Table 6.3 Measured exhaust gas conditions and hydrogen chloride emission rates for EUDEGAS1 during A380 degassing

Test No. Test date Test period (24-hr clock)	26-4 02/29/2024 1514-1614	26-5 02/29/2024 1625-1725	26-6 03/01/2024 0714-0957	Three Test Average
Alloy Class	A380	A380	A380	
Operating Conditions				
Flux events during test	1.0	2.0	1.0	1.3
Total flux added	1.0	2.0	1.0	1.3
Exhaust gas temperature (°F)	102	95.4	79.2	92.1
Exhaust gas flowrate (dscfm)	334	339	362	345
Hydrogen Chloride				
Sampled volume (dscf)	48.4	47.7	46.9	47.7
Total catch (ug)	176	19.4	21.2	72.2
Total HCl emissions (lb/hr)	0.000	0.000	0.000	0.000
Total HCl emissions (lb/lb-flux)	0.000	0.000	0.000	0.000
Permit Limit (lb/lb-flux)	-	-	-	*0.183*

Table 6.2 Measured exhaust gas conditions and particulate matter emission rates for EUDEGAS1 during non-A380 degassing

Test No. Test date Test period (24-hr clock)	202-2 02/27/2024 1159-1301	202-3 02/27/2024 1337-1439	202-4 02/27/2024 1529-1634	Three Test Average
Alloy Class	Non-A380	Non-A380	Non-A380	
Operating Conditions				
Flux events during test	2.0	3.0	1.0	2.0
Total flux added (lbs)	4.0	6.0	2.0	4.0
Exhaust gas temperature (°F)	128	129	117	124
Exhaust gas flowrate (dscfm)	294	315	310	306
Particulate Matter				
Sampled volume (dscf)	*51.2*	53.9	53.4	52.8
Filterable catch (mg)	44.4	103	21.9	56.5
Condensable catch (mg)	0.85	2.09	0.39	1.11
Total catch (mg)	45.2	105	22.3	57.6
Total PM emissions (lb/hr)	0.034	0.081	0.017	0.044
Total PM emissions (lb/tapout)	0.017	0.027	0.017	0.020
Permit Limit (lb/tapout)	-	-	-	*0.081*
Total PM10 emissions (lb/hr)	0.034	0.081	0.017	0.044
Total PM10 emissions (lb/tapout)	0.017	0.027	0.017	0.020
Permit Limit (lb/tapout)	-	-	-	*0.074*
Total PM2.5 emissions (lb/hr)	0.034	0.081	0.017	0.044
Total PM2.5 emissions (lb/tapout)	0.017	0.027	0.017	0.020
Permit Limit (lb/tapout)	-	-	-	*0.052*

Table 6.1 Measured exhaust gas conditions and particulate matter emission rates for EUDEGAS1 during A380 degassing

Test No. Test date Test period (24-hr clock)	202-5 02/28/2024 1420-1530	202-6 03/01/2024 1049-1154	202-7 03/01/2024 1243-1348	Three Test Average
Alloy Class	A380	A380	A380	
Operating Conditions				
Flux events during test	1.0	1.0	1.0	1.0
Total flux added (lbs)	1.0	1.0	1.0	1.0
Exhaust gas temperature (°F)	92.7	95.8	103	97.2
Exhaust gas flowrate (dscfm)	282	346	341	323
Particulate Matter				
Sampled volume (dscf)	47.8	59.1	58.4	55.1
Filterable catch (mg)	24.8	29.4	26.3	26.8
Condensable catch (mg)	3.35	0.57	0.69	1.54
Total catch (mg)	28.1	30.0	27.0	28.4
Total PM emissions (lb/hr)	0.022	0.023	0.020	0.022
Total PM emissions (lb/tapout)	0.022	0.023	0.020	0.022
Permit Limit (lb/tapout)	-	-	-	*0.081*
Total PM10 emissions (lb/hr)	0.022	0.023	0.020	0.022
Total PM10 emissions (lb/tapout)	0.022	0.023	0.020	0.022
Permit Limit (lb/tapout)	-	-	-	*0.074*
Total PM2.5 emissions (lb/hr)	0.022	0.023	0.020	0.022
Total PM2.5 emissions (lb/tapout)	0.022	0.023	0.020	0.022
Permit Limit (lb/tapout)	-	-	-	*0.052*

6.0 Results

The emission performance tests consisted of three (3) sampling periods per alloy class (A380 and non-A380) for particulate matter and hydrogen chloride for a total of twelve (12) test periods:

- EUDEGAS1; A380 PM
- EUDEGAS1; A380 HCl
- EUDEGAS1; Non-A380 PM
- EUDEGAS1; Non-A380 HCl

Each sampling period was planned for 60 minutes in duration. The degassing stations were operated normally at maximum routine conditions during the test periods.

Degassing operating data are presented in Attachment 3

6.1 PM Degassing Results and Emission Factors

Material is charged to the furnace in batches, it is not a continuous process. A ladle is tapped out from the furnace and brought to a degassing station, meaning one tap out is one degassing event. The measured PM/PM10/PM2.5 emission rate (lb/hr) was divided by the number of tapouts/degassing events to calculate an emission factor (lb/tapout) to compare to the applicable emission limits.

6.2 HCl Test Results and Emission Factors

Each degassing event requires approximately 7 minutes. The amount of flux used and the time it was added to the ladle during degassing was recorded by CCMI. HCl emissions were measured for a one-hour period, during which multiple degassing events may occur. The measured HCl emission rate (lb/hr) was divided by the amount of flux used per hour to calculate and emission factor (lb/lb-flux) to compare to the applicable emission limit.

Tables 6.1 through 6.4 present test results for EUDEGAS1 for the scenarios stated above.

6.3 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the submitted Test Protocol. Weather conditions significantly delayed the testing schedule on February 28, 2024. Run 202-1 had to be scratched due to a process breakdown of EUDEGAS2. Testing was completed in its entirety from EUDEGAS1.

5.4 Laboratory QA/AC Procedures

The particulate matter analyses were conducted by a qualified third-party laboratory according to the appropriate QA/QC procedures specified in the USEPA Methods 5 and 202 and are included in the final report in Attachment 5 provided by Enthalpy Analytical.

5.0 QA/QC Activities

5.1 Flow Measurement Equipment

Prior to arriving onsite (or onsite prior to beginning compliance testing), the instruments used during the source test to measure exhaust gas properties and velocity (pyrometer, Pitot tube, and scale) were calibrated to specifications in the sampling methods.

The absence of cyclonic flow for each sampling location was verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each of the velocity traverse points with the planes of the face openings of the Pitot tube perpendicular to the stack cross-sectional plane. The Pitot tube was then rotated to determine the null angle (rotational angle as measured from the perpendicular, or reference, position at which the differential pressure is equal to zero).

5.2 Isokinetic Sampling and Meter Box Calibrations

The dry gas meter sampling console used for moisture testing was calibrated prior to and after the testing program. This calibration uses the critical orifice calibration technique presented in USEPA Method 5. The metering console calibration exhibited no data outside the acceptable ranges presented in USEPA Method 5.

The digital pyrometer in the metering console was calibrated using a NIST traceable Omega® Model CL 23A temperature calibrator.

The sampling rate for all test periods was within the allowable isokinetic variation (i.e. within 10% of the calculated isokinetic sampling rate required by USEPA Method 5).

Attachment 6 presents test equipment quality assurance data; meter box calibration records, and field equipment calibration records.

5.3 Particulate Matter Recovery and Analysis

All recovered particulate matter samples were stored and shipped in certified trace clean amber glass sample bottles with Teflon® lined caps. The liquid level on each bottle was marked with a permanent marker prior to pick-up and the caps were secured closed with tape. Samples of the reagents used in the test event (200 milliliters each of deionized high-purity water, acetone and hexane) were submitted with the samples for analysis to verify that the reagents used to recover the samples have low particulate matter residues.

The glassware used in the condensable PM impinger trains was washed and rinsed prior to use in accordance with the procedures of USEPA Method 202. The glassware was not baked prior to use; therefore, ICT used the field train proof blank option provided in USEPA Method 202. The laboratory reported 0.86 milligrams (mg) for the field train proof blank rinses (sample train rinse performed prior to use) and 2.4 mg for the field train recovery proof blank. The reported condensable PM test results were blank-corrected according to the method (USEPA Method 202 allows a blank correction of up to 2 mg).

and recovered rinses were clearly and uniquely labeled and transferred to Enthalpy Analytical (Durham, North Carolina) for analysis.

Attachment 4 provides printouts of the PM calculations and scans of the field data sheets for each test run.

Attachment 5 provides a copy of the laboratory analytical report.

4.5 Measurement and Analysis of HCl (USEPA Method 4)

HCl concentrations in the turbine exhaust gas were determined using a modified version of USEPA Method 26. A sample of the exhaust gas was withdrawn from the exhaust stack at a constant rate (i.e., non-isokinetic rate) using a glass lined probe and a quartz filter. The gas sample was bubbled through chilled impingers containing 0.1 normality sulfuric acid (0.1N H2SO4). The NaOH portion of the Method 26 sampling train was not used since halogen (Cl2) concentrations were not included in the analysis.

The wetted portions of the sampling train were constructed of glass. At the end of each one-hour test period, the impinger solutions and rinses were recovered and shipped to a third-party laboratory (Enthalpy Analytical in Durham, North Carolina) for HCl analysis by ion chromatography (IC) analysis in accordance with USEPA Method 26.

Attachment 4 provides HCl calculation sheets. Attachment 5 provides a copy of the HCl laboratory analytical report.

4.3 Exhaust Gas Moisture Content (USEPA Method 4)

Exhaust gas moisture was determined in accordance with USEPA Method 4 as part of the particulate/HCl sampling trains. At the conclusion of each sampling period the moisture gain in the impingers was determined gravimetrically by weighing each impinger to determine net weight gain.

4.4 Measurement of PM/PM10 (USEPA Method 5 / 202)

Testing was performed using a combined filterable and condensable particulate matter PM sampling train. The filterable and condensable fractions were added to calculate total PM10 and PM2.5 emissions (i.e., as a worst-case scenario, all filterable and condensable PM emissions were assumed to be in the PM10 and PM2.5 size range).

Filterable Particulate Matter Sample Train (USEPA Method 5)

Filterable PM was determined using USEPA Method 5. Exhaust gas was withdrawn from each exhaust stack at an isokinetic sampling rate using an appropriately-sized stainless steel sample nozzle and heated probe. The collected exhaust gas was passed through a pre-tared glass fiber filter that was housed in a heated filter box. The back half of the filter housing was connected to the condensable PM impinger train.

Condensable Particulate Matter Sample Train (USEPA Method 202)

Condensable PM (CPM) content was measured in accordance with USEPA Method 202. Following the Method 5 filter assembly, the sample gas travelled through the impinger train which consisted of a condenser, a knock-out impinger, a standard Greenberg-Smith (G-S) impinger (dry), a Teflon-coated CPM filter (with exhaust thermocouple), a modified G-S impinger containing 100 milliliters of deionized water, and a modified G-S impinger containing a known amount of indicating silica gel.

The CPM components of the Method 202 sampling train (dry knockout impinger and dry GS impinger) were placed in a tempered water bath and a pump was used to circulate water through the condenser. The temperature of the bath was maintained such that the CPM filter outlet temperature remained between 65 and 85°F. Crushed ice was placed around the last two impingers to chill the gas to below 68°F.

Sample Recovery and Analysis (USEPA Method 5 / 202)

At the conclusion of each one-hour test period, the sample train was leak-checked and disassembled. The sample nozzle, probe liner, and filter holder were brushed and rinsed with acetone. The recovered particulate filter and acetone rinses were stored in sealed containers and transferred to Enthalpy Analytical, Inc. (Durham, North Carolina) for gravimetric measurements.

The impingers were transported to the recovery area where they were weighed. There was no condensate catch in the knockout impinger portion of the sample train. Therefore, the CPM portion of the sample train did not require the nitrogen purge step of Method 202. The glassware (between the particulate filter and CPM filter) was rinsed with DI water, acetone, and hexane in accordance with the Method 202 sample recovery procedures. The CPM filter

4.0 Sampling and Analytical Procedures

This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

4.1 Summary of Sampling Methods

The exhaust gas from the degassing exhaust stack was sampled and analyzed to determine the concentration of particulate matter. The following USEPA Reference Test Methods were used.

Parameter / Analyte	Sampling Methodology	Analytical Method
Velocity traverses Volumetric flowrate	USEPA Method 1 USEPA Method 2	Selection of sample and velocity traverse locations by physical stack measurements. Type S Pitot tube and inclined manometer.
Moisture	USEPA Method 4	Moisture determination by gravimetric water gain in chilled impingers
Particulate Matter Filterable	USEPA Method 5	Isokinetic sample train for filterable particulate matter
Particulate Matter Condensable	USEPA Method 202	Isokinetic sample train, dry impinger method for condensable particulate matter
Hydrogen chloride	USEPA Method 26	Non-isokinetic sampling train for hydrogen halide and halogen emissions

4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

The exhaust stack gas velocities and volumetric flow rates were determined using USEPA Method 2 throughout each test run for isokinetic sampling, and prior to each run for non-isokinetic sampling. An S-type Pitot tube connected to a red-oil manometer was used to determine velocity pressure at each traverse point across the stack cross section. Gas temperature was measured using a K-type thermocouple mounted to the Pitot tube. The Pitot tube and connective tubing were leak-checked periodically throughout the test periods to verify the integrity of the measurement system.

The dry molecular weight of the gas was assumed to be 29.0 lb/lb-mol, as allowed by Method 2 section 8.6 for gas streams that are virtually ambient air.

3.0 Source and Sampling Location Description

3.1 General Process Description / Capacities

CCMI operates four (4) molten aluminum degassing stations at its facility located in Battle Creek, Calhoun County. EUDEGAS1 was selected for this emission test event:

Emission Unit ID	Emission Unit Description	Flexible Group
EUDEGAS1	Station for nitrogen degassing of molten aluminum in ladles	FGDEGAS

3.2 Sampling Location

Exhaust gas from the degassing station is directed through a vertical exhaust stack that exits through the roof of the facility. EUDEGAS1 exhausts to SVDEGAS1 with an inner diameter of 8 inches. The nearest downstream disturbance (A measurement) was 29.5 inches (3.6 duct diameters). The nearest upstream disturbance was >80 inches (>10 duct diameters). Therefore, a total of twelve (12) traverse points were used.

Diagrams of the stacks and sampling locations are provided in Attachment 2.

Table 2.2 Average measured emission rates for A380 degassing

PM Results	Three-Test Average	Permit Limit
PM Emission Rate (lb/hr)	0.022	--
PM Emission Rate (lb/tapout)	0.022	0.081
PM10 Emission Rate (lb/hr)	0.022	--
PM10 Emission Rate (lb/tapout)	0.022	0.074
PM2.5 Emission Rate (lb/hr)	0.022	--
PM2.5 Emission Rate (lb/tapout)	0.022	0.052
HCl Results	**Three-Test Average**	**Permit Limit**
HCl Emission Rate (lb/hr)	0.000	--
HCl Emission Rate (lb/lb-flux)	0.000	0.183

Table 2.3 Average measured emission rates for non-A380 degassing

PM Results	Three-Test Average	Permit Limit
PM Emission Rate (lb/hr)	0.044	--
PM Emission Rate (lb/tapout)	0.020	0.081
PM10 Emission Rate (lb/hr)	0.044	--
PM10 Emission Rate (lb/tapout)	0.020	0.074
PM2.5 Emission Rate (lb/hr)	0.044	--
PM2.5 Emission Rate (lb/tapout)	0.020	0.052
HCl Results	**Three-Test Average**	**Permit Limit**
HCl Emission Rate (lb/hr)	0.000	--
HCl Emission Rate (lb/lb-flux)	0.000	0.183

2.3 Summary of Air Pollutant Sampling Results

Emissions testing was performed on the degas stack for three (3) test periods in each operating scenario (A380 and Non-A380) for both particulate matter and hydrogen chloride, for a total of twelve (12) test periods. No particulate sizing was performed; therefore, all filterable particulate matter was determined to be PM, PM10 and PM2.5 (worst-case scenario). Measured condensable emissions were added to the filterable emissions to calculate total PM10 and PM2.5 (worst-case scenario). The emission test results are less than (in compliance with) the permitted emission rates.

Table 2.2 presents the average measured emission rates for A380 degassing.

Table 2.3 presents the average measured emission rates for non-A380 degassing.

Test results for each sampling period are presented in Section 6.0 of this report.

Table 2.1 Test schedule and degassing operating conditions

Date	Test Time	Test No.	Alloy Type	Degas Events	Flux Added (lbs)
2/27/2024	11:59-13:01	202-2	Non-A380	2	4
2/27/2024	13:37-14:39	202-3	Non-A380	3	6
2/27/2024	15:29-16:34	202-4	Non-A380	1	2
2/28/2024	14:20-15:30	202-5	A380	1	1
2/29/2024	07:58-08:58	26-1	Non-A380	3	3
2/29/2024	09:40-10:41	26-2	Non-A380	3	3
2/29/2024	11:13-12:13	26-3	Non-A380	2	2
2/29/2024	15:14-16:14	26-4	A380	1	1
2/29/2024	16:25-17:25	26-5	A380	2	2
3/1/2024	07:14-09:57	26-6	A380	1	1
3/1/2024	10:49-11:54	202-6	A380	1	1
3/1/2024	12:43-13:48	202-7	A380	1	1

Run 26-6 paused due to process upset.

2.0 Summary of Test Results and Operating Conditions

2.1 Purpose and Objective of the Tests

Installation and operation of the CCMI degassing stations is permitted by EGLE Air Quality Division (AQD) Permit to Install (PTI) No. 166-13G, issued to CCMI on July 25, 2023. PTI No. 166-13G identifies four (4) nitrogen degassing stations grouped under flexible group FGDEGAS.

The TESTING / SAMPLING requirements of PTI 166-13G specify:

> *Within 180 days of permit issuance, the permittee shall verify PM, PM10, PM2.5, and hydrogen chloride emission rates in the SC I table from FGDEGAS by testing at owner's expense, in accordance with Department requirements. The testing can be performed in one representative unit for each alloy or across multiple units.*

One representative unit, under two operating scenarios, was selected for this compliance demonstration;

- EUDEGAS1, degassing ladles containing A380 alloy. Results from the testing are used as representative for all A380 degassing events in FGDEGAS.
- EUDEGAS1, degassing ladles containing alloys other than A380. Results from the testing are used as representative for all non-A380 degassing events in FGDEGAS.

A diagram for the exhaust stack testing location is presented in Attachment 2.

2.2 Operating Conditions During the Compliance Tests

During normal melting, aluminum ingots, customer returns and internal scrap are weighed and charged to the furnace in batches. Once melted, the molten aluminum is tapped (poured) from the furnace into portable ladles for degassing and transfer to the die casting processes.

For degassing operations, a ladle is brought from the melt furnace to the degassing station. Once the ladle is in place, the operator initiates the process via push button. The revolving spindle lowers into the molten aluminum slowly and begins bubbling nitrogen gas through the aluminum. After approximately 30-seconds, a pre-determined amount of flux is added from the degasser lid. The degassing process lasts approximately 7-minutes per ladle.

For the emission test event, the degas stations were operated in a matter consistent with normal plant operation.

Table 2.1 presents a summary of test times and degassing operating conditions.

Operational records provided by CCMI are presented in Attachment 3.

1.0 Introduction

Cosma Casting Michigan (CCMI) manufactures die cast aluminum parts and engine components for the automobile industry. The facility operates aluminum melting furnaces, degassing stations, high pressure die casters, heat treat furnaces, and other ancillary processes at its facility located in Battle Creek, Calhoun County, Michigan

This test report presents the results of particulate matter and hydrogen chloride (HCl) emission testing performed for one degassing station identified as EUDEGAS1 which is part of the flexible group FGDEGAS. The field sampling and measurements presented in this report were performed by Impact Compliance & Testing (ICT) representatives Clay Gaffey, Joshua Larson, and Blake Beddow on March 27 – April 1, 2024. Portions of the test event were observed by Michigan Department of Environment, Great Lakes, and Energy (EGLE) representatives Jared Edgerton and Daniel "DJ" Droste.

The exhaust gas sampling and analysis was performed using procedures described in United States Environmental Protection Agency (USEPA) reference test methods as presented in a test protocol that was submitted to, and reviewed by, EGLE.

Attachment 1 provides a copy of the test plan approval letter issued by EGLE.

Questions regarding this air emission test report should be directed to:

Test Method and Procedures	Clay Gaffey Project Manager Impact Compliance & Testing, Inc. 4180 Keller Rd, Suite B Holt, MI 48842 (517) 481-3645 Clay.Gaffey@ImpactCandT.com
Facility Operations and Compliance	Mr. Mason Tinch HSE Manager Cosma Casting Michigan 10 Clark Rd Battle Creek MI 49037 (423) 470-0400 Mason.Tinch@magna.com

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Report Certification

AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF PARTICULATE MATTER EMISSIONS
FROM
DEGASSING OPERATIONS

COSMA CASTINGS MICHIGAN
Battle Creek, MI

Report Certification

This report has been reviewed by Cosma Castings Michigan representatives and approved for submittal to the Michigan Department of Environment, Great Lakes, and Energy, Air Quality Division.

I certify that the testing was conducted in accordance with the reference test methods and submitted test plan unless otherwise specified in this report. I believe the information provided in this report and its attachments are true, accurate, and complete.

Impact Compliance & Testing, Inc.

Clay Gaffey
Project Manager

AIR EMISSION TEST REPORT
FOR THE
VERIFICATION OF PARTICULATE MATTER
EMISSIONS FROM
DEGASSING OPERATIONS

Prepared for:

COSMA CASTINGS MICHIGAN

Battle Creek, MI

Test Dates: February 27-March 1, 2024

ICT Project No.: 2300219

April 30, 2024

IMPACT
COMPLIANCE & TESTING