# AIR EMISSION TEST REPORT

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| Title | AIR EMISSION TEST REPORT FOR THE VERIFICATION OF CHIP DRYER DIOXIN AND FURAN EMISSIONS |
| Report Date | May 21, 2018 |
| Test Dates | April 3-6, 2018 |

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AIR QUALITY DIVISION

| Facility Information | |
|---|---|
| Name | Dicastal North America, Inc. |
| Street Address | 1 Dicastal Drive |
| City, County | Greenville, Montcalm |
| SRN | N7688 |

| Facility Permit Information | |
|---|---|
| Permit No. | 78-15D |
| Emission Units | EU-ChipDryer |

| Testing Contractor | |
|---|---|
| Company | Derenzo Environmental Services |
| Mailing Address | 39395 Schoolcraft Road<br>Livonia, MI 48150 |
| Phone | (734) 464-3880 |
| Project No. | 1801086 |

AIR EMISSION TEST REPORT
FOR THE VERIFICATION OF
CHIP DRYER DIOXIN AND FURAN EMISSIONS

DICASTAL NORTH AMERICA, INC.
GREENVILLE, MI

## 1.0 INTRODUCTION

Dicastal North America, Inc. (Dicastal) owns and operates a facility located in Greenville, Montcalm County, Michigan (State Registration No. N7688) that manufactures aluminum alloy wheels. The facility generally consists of foundry processes and finishing processes. In the foundry, ingots and chips are melted in natural-gas fired melting furnaces and the molten aluminum is poured into molds to form the wheels. The chips are recovered from downstream machining operations and conveyed to the foundry for remelting. Before melting, the chips are dried in a thermal chip dryer (emission unit EU-ChipDryer) to remove any machining fluids and oils. The effluent gas from the chip dryer is directed to a thermal oxidizer (TOX) for the reduction of organic compounds before being released to atmosphere.

The conditions of Permit to Install (PTI) No. 78-15D issued to Dicastal requires that dioxin/furan (D/F) emission rate testing be performed for EU-ChipDryer within 90 days of process startup. The D/F emission standard is specified in the National Emission Standards for Hazardous Air Pollutants for Secondary Aluminum Production (Secondary Aluminum NESHAP), 40 CFR Part 63 Subpart RRR.

Initial EU-ChipDryer D/F testing was performed May 24-25, 2017 following startup of Melt Furnace A (EU-Melt1). The test event presented in this report is a repeat of the initial testing performed following the startup of Melt Furnace B (EU-Melt2).

The compliance testing was performed by Derenzo Environmental Services (DES) representatives Andy Rusnak, Kevin Anderson, and Robert Harvey.

The exhaust gas sampling and analysis was performed using procedures specified in the Test Plan dated February 1, 2018 that was reviewed and approved by the Michigan Department of Environmental Quality (MDEQ). Thomas Gasloli and Eric Grinstern of the MDEQ Air Quality Division (AQD) were onsite to witness portions of the test event.

Questions regarding this testing program should be directed to:

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Environmental Health & Safety Specialist
Dicastal North America, Inc.
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**Report Certification**

This test report was prepared by Derenzo Environmental Services based on field sampling data collected by DES. Facility process data were collected and provided by Dicastal employees. This test report has been reviewed by Dicastal representatives and approved for submittal to the MDEQ.

I certify that the testing was conducted in accordance with the specified 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.

Report Prepared By:

Robert L. Harvey, P.E.
General Manager
Derenzo Environmental Services

I certify that the facility and emission units were operated at maximum routine operating conditions for the test event. Based on information and belief formed after reasonable inquiry, the statements and information in this report are true, accurate and complete.

Emission Source Certification:

Jake Kizer
Environmental Health & Safety Specialist
Dicastal North America, Inc.

## 2.0 SUMMARY OF TEST RESULTS AND OPERATING CONDITIONS

40 CFR §63.1505(c) of the Secondary Aluminum NESHAP specifies that… *the owner or operator of a thermal chip dryer must not discharge or cause to be discharged to the atmosphere emissions in excess of:*

> *(2) 2.50 micrograms (μg) of D/F TEQ per Mg ($3.5 \times 10^{-5}$ gr per ton) of feed/charge from a thermal chip dryer at a secondary aluminum production facility that is a major or area source*

The chip dryer TOX exhaust gas was sampled for three (3) four-hour test periods during the compliance testing performed April 3-6, 2018.

The testing was performed while the process operated at maximum normal operating conditions. Dicastal representatives provided the chip charge rate, oxidizer chamber temperature, oxidizer fan speed, cyclone inlet and outlet pressure, and chip dryer temperature data for each test period.

Table 3.1 below presents the average measured D/F emission rates and operating conditions for the test event (average of the three test periods). Test results for each four-hour sampling period are presented in Table 6.1. The measure D/F emission rate is less than (in compliance with) the regulatory standard of 3.5E-0.5 grains per ton of chips charged (gr/ton).

Table 3.1 Summary of measured D/F emission rates and operating conditions during the test periods (three-test averages)

| Parameter | EU-ChipDryer |
|---|---|
| D/F Emissions, TEQ (gr/ton charged) | 2.7E-06 |
| D/F Permit Limit, TEQ (gr/ton charged) | 3.5E-05 |
| | |
| Chip Charge Rate (ton/hour) | 1.95 |
| Oxidizer Chamber Temp (°C) | 730 |
| Chip Dryer Temperature (°C) | 182 |
| Oxidizer Fan Speed (scfm) | 5,374 |
| Cyclone Outlet Pressure (“$H_2O$) | -4.9 |
| Cyclone Inlet Pressure (“$H_2O$) | -0.6 |

# 3.0 SOURCE AND SAMPLING LOCATION DESCRIPTION

## 3.1 General Process Description

Dicastal operates an aluminum alloy wheel manufacturing facility. In the foundry, ingots and chips are melted in natural-gas fired melting furnaces and the molten aluminum is poured into molds to form the wheels. The chips are recovered from downstream machining operations and conveyed to the foundry for remelting. Before melting, the chips are dried in a thermal chip dryer (emission unit EU-ChipDryer) to remove any machining fluids and oils.

## 3.2 Rated Capacities and Air Emission Controls

In the chip dryer, a spinner uses centrifugal force to mechanically remove excess emulsion fluid from the chips, which is followed by a thermal chip dryer for volatilizing remaining emulsion on the chips using natural gas combustion (6.0 MMBtu/hr) for heat. The effluent gas from the chip dryer is directed to a high efficiency cyclone for PM control and a TOX for the reduction of organic compounds before being released to atmosphere.

The TOX consists of a natural gas fired oxidation chamber that operates at a minimum temperature of 1292°F (700°C) and is equipped with an air-to-air heat exchanger (recuperator) that preheats the incoming gas stream from the chip dryer and cools the exhaust gas stream from the oxidation chamber. The cooled exhaust is released to atmosphere through a vertical exhaust stack.

Conditions of the permit specify that the feedstock to EU-ChipDryer shall only be unpainted / uncoated chips.

Appendix 1 provides operating records provided by Dicastal representatives for the test periods.

## 3.3 Sampling Locations

The chip dryer / TOX exhaust gas is released to the atmosphere through a dedicated vertical exhaust stack that has an inner diameter of 32 inches. The stack is equipped with two (2) sample ports, opposed 90°, that provide a sampling location greater than 64 inches (>2 duct diameters) upstream and greater than 224 inches (>7 duct diameters) downstream from any flow disturbance and satisfies the USEPA Method 1 criteria for a representative sample location.

Individual traverse points were determined in accordance with USEPA Method 1.

Appendix 2 provides diagrams of the emission test sampling location.

## 4.0 SAMPLING AND ANALYTICAL PROCEDURES

A test protocol for the air emission testing was reviewed and approved by the MDEQ. This section provides a summary of the sampling and analytical procedures that were used during the testing periods.

Appendix 3 provides a copy of the MDEQ-AQD test plan approval letter.

### 4.1 Summary of Sampling Methods

| | |
|---|---|
| USEPA Method 1 | Exhaust gas velocity measurement locations were determined based on the physical stack arrangement and requirements in USEPA Method 1 |
| USEPA Method 2 | Exhaust gas velocity pressure was determined using a Type-S Pitot tube connected to a red oil incline manometer; temperature was measured using a K-type thermocouple connected to the Pitot tube. |
| USEPA Method 3A | Exhaust gas $O_2$ and $CO_2$ content was determined using zirconia ion/paramagnetic and infrared instrumental analyzers, respectively. |
| USEPA Method 4 | Exhaust gas moisture was determined based on the water weight gain in chilled impingers. |
| USEPA Method 23 | Isokinetic gas sampling. High resolution gas chromatography and high resolution mass spectrometry analysis. |
| USEPA ALT 034 | Broadly-applicable alternative to EPA Method 23 that eliminates the use of methylene chloride at secondary aluminum facilities. |

### 4.2 Exhaust Gas Velocity Determination (USEPA Method 2)

The exhaust stack gas velocity and volumetric flow rate were determined using USEPA Method 2 throughout each isokinetic test period. 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.

### 4.3 Exhaust Gas Molecular Weight Determination (USEPA Method 3A)

$CO_2$ and $O_2$ content in the exhaust gas stream was measured during each test period in accordance with USEPA Method 3A. A representative sample of the exhaust gas was collected from the outlet of the dry gas meter using a Tedlar® bag. The gas sample was then analyzed for $CO_2$ content using a single beam single wavelength (SBSW) infrared gas analyzer and $O_2$ content using a gas analyzer that uses a paramagnetic sensor.

Prior to, and at the conclusion of each test, the instruments were calibrated using upscale calibration and zero gas to determine analyzer calibration error and system bias (described in Section 5.0 of this document).

### 4.4 Exhaust Gas Moisture Content (USEPA Method 4)

Moisture content of the exhaust gas was determined in accordance with USEPA Method 4 using a chilled impinger sampling train as part of the D/F isokinetic sampling procedures (i.e., not as a separate measurement train). During each sampling period, a gas sample was extracted at an isokinetic rate from the source where moisture was removed from the sampled gas stream using impingers that were submersed in an ice bath. 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.

### 4.5 Dioxin and Furan Concentration Measurements (USEPA Methods 23 and ALT034)

Exhaust gas was sampled from the stack at an isokinetic rate using a USEPA Method 23 sampling train. The sampling train consisted of a "goose-neck" nozzle constructed of borosilicate glass connected via stainless steel coupling to a borosilicate glass probe liner within a heated stainless steel probe. The probe liner was attached to a heated glass filter holder containing a quartz filter. The back half of the filter holder was connected to a glass coil condenser, which was connected to XAD-2 resin trap (glass container charged with adsorbent XAD-2 resin material).

Chilled water was recirculated to the glass coil condenser and the gas temperature into the XAD-2 resin (at the outlet of the condenser) was monitored and recorded to verify that the gas into the resin was maintained at 68°F or less.

Chilled impingers followed the XAD-2 trap to remove any remaining moisture in the gas stream.

At the conclusion of each sample period, the sample recovery procedures in Method 23 were followed. The nozzle, probe, filter housing, and coil condenser were brushed and/or rinsed as described in Method 23. Methylene chloride rinses were omitted from the recovery procedures according to EPA Alternative Method 034 (only toluene and acetone were used). Nonmetallic probe and nozzle brushes were used during the sample recovery. Glass sample bottles with Teflon® caps were used to recover the impinger contents and rinses.

Train blank samples were collected by assembling a sampling train then performing sample recovery using the same procedures as a test run.

The XAD-2 resin was stored and shipped on ice to SGS North America, Inc. in Wilmington, NC for D/F analysis. The measured D/F TEQ emission rate is reported relative to the amount of chips charged during the emission test periods (mass D/F TEQ emissions per mass of chips charged) for comparison to the emission standard.

Appendix 4 provides isokinetic sampling field data sheets and D/F emission calculations.

Appendix 5 provides instrumental analyzer ($O_2$ and $CO_2$) data.

Appendix 6 provides the D/F laboratory analytical report.

## 5.0 QA/QC ACTIVITIES

### 5.1 Exhaust Gas Flow

Prior to arriving onsite, the instruments used during the source test to measure exhaust gas properties and velocity (barometer, pyrometer, and Pitot tube) were calibrated to specifications outlined in the sampling methods.

The Pitot tube and connective tubing were leak-checked prior to each traverse to verify the integrity of the measurement system.

The absence of significant cyclonic flow for the exhaust configurations were verified using an S-type Pitot tube and oil manometer. The Pitot tube was positioned at each velocity traverse point 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 Gas Divider Certification (USEPA Method 205)

A STEC Model SGD-710C 10-step gas divider was used to obtain appropriate calibration span gases. The ten-step STEC gas divider was NIST certified (within the last 12 months) with a primary flow standard in accordance with Method 205. When cut with an appropriate zero gas, the ten-step STEC gas divider delivered calibration gas values ranging from 0% to 100% (in 10% step increments) of the USEPA Protocol 1 calibration gas that was introduced into the system. The field evaluation procedures presented in Section 3.2 of Method 205 were followed prior to use of gas divider. The field evaluation yielded no errors greater than 2% of the triplicate measured average and no errors greater than 2% from the expected values.

### 5.3 Instrument Calibration and System Bias Checks

At the beginning of each day of the testing program, initial three-point instrument calibrations were performed for the $CO_2$ and $O_2$ analyzers by injecting calibration gas directly into the inlet sample port for each instrument. System bias checks were performed prior to and at the conclusion of each sampling period by introducing the upscale calibration gas and zero gas into the sampling system (at the base of the stainless steel sampling probe prior to the particulate filter and Teflon® heated sample line) and determining the instrument response against the initial instrument calibration readings.

The instruments were calibrated with USEPA Protocol 1 certified concentrations of $CO_2$ and $O_2$ in nitrogen and zeroed using hydrocarbon free nitrogen. A STEC Model SGD-710C ten-step gas divider was used to obtain intermediate calibration gas concentrations as needed.

### 5.4 Meter Box Calibrations and Isokinetic Sampling

The dry gas meter isokinetic sampling console, which was used for D/F 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 sampling nozzle diameter was verified with a micrometer using the 3-point measurement technique.

Calculations were performed to verify that the actual stack gas sampling rate was within 10% of the ideal isokinetic sampling rate for each four hour test period.

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

Appendix 7 presents test equipment quality assurance data (instrument calibration and system bias check records, calibration gas and gas divider certifications, dry gas meter calibration records, Pitot tube, nozzle, and probe calibration records, etc.).

# 6.0 RESULTS

## 6.1 Test Results and Allowable Emission Limits

Process data and air pollutant emission measurement results for each four hour test period are presented in Table 6.1.

The measured D/F emission rate for the EU-ChipDryer exhaust is less than the allowable limits specified in PTI 78-15D and 40 CFR Part 63 Subpart RRR; 3.5E-5 grains per ton of chips charged.

## 6.2 Variations from Normal Sampling Procedures or Operating Conditions

The testing for all pollutants was performed in accordance with USEPA methods and the approved test protocol unless noted in this section.

Exhaust gas diluent content ($O_2$ and $CO_2$) was not monitored continuously throughout each four-hour test period. Instead, a representative bag sample was obtained for each test period and analyzed using the Method 3A instruments. This was a slight deviation from the procedure described in the test plan and was approved on-site by the MDEQ.

Following Test 2 on April 4, 2018, the facility experienced significant delays due to a broken pump shaft on the chip furnace. Test 3 was aborted when a temporary replacement shaft failed partway through the test period. A permanent replacement shaft was installed and the third test period (Test 4) was completed the evening of April 6, which was approximately 78 hours from the beginning of Test 1. The MDEQ representatives were aware of the delays and encouraged Dicastal to complete the testing despite the delay. The test data collected for Test 3 is presented in the appendices, however, no samples from Test 3 were analyzed.

Table 6.1 Measured exhaust gas conditions and D/F emission rates for EU-ChipDryer

| Test No.[1]<br>Test date<br>Test period (24-hr clock) | DNA-1<br>4/3/18<br>16:00-20:25 | DNA-2<br>4/4/18<br>9:21-16:04 | DNA-4<br>4/6/18<br>17:50-22:15 | Three Test<br>Average |
|---|---|---|---|---|
| Chip charge rate (ton/hour) | 1.63 | 2.12 | 2.09 | 1.95 |
| Oxidizer temperature (°C) | 730 | 730 | 731 | 730 |
| Chip dryer temperature (°C) | 183 | 186 | 177 | 182 |
| Fan air flow (scfm) | 5,499 | 5,508 | 5,116 | 5,374 |
| Cyclone outlet/inlet pressure (in.$H_2O$) | -5.0/-0.6 | -4.9/-0.7 | -4.7/.0.6 | -4.9/-0.6 |
| **Exhaust Gas Composition** | | | | |
| $CO_2$ content (% vol) | 2.4 | 2.3 | 2.4 | 2.4 |
| $O_2$ content (% vol) | 16.7 | 17.1 | 16.5 | 16.8 |
| Moisture (% vol) | 4.8 | 4.5 | 4.5 | 4.6 |
| Exhaust gas temperature (°F) | 970 | 990 | 982 | 981 |
| Exhaust gas flowrate (scfm) | 6,622 | 6,607 | 6,826 | 6,685 |
| Exhaust gas flowrate (dscfm) | 6,306 | 6,309 | 6,521 | 6,379 |
| **Dioxin and Furan Emissions** | | | | |
| Sample volume (dscf) | 187 | 189 | 191 | 189 |
| D/F sample weight[2] (pg) | 1,310 | 18,500 | 349 | 6,720 |
| D/F sample weight[3], TEQ (pg) | 42.6 | 442 | 18.6 | 168 |
| Emission factor, TEQ (gr/dscf) | 3.70E-12 | 3.85E-11 | 1.60E-12 | 1.46E-11 |
| Emission rate, TEQ (gr/hr) | 1.40E-06 | 1.46E-05 | 6.24E-07 | 5.54E-06 |
| Emission rate, TEQ (gr/ton charged)[4] | 8.62E-07 | 6.88E-06 | 2.98E-07 | 2.68E-06 |
| *Permit limit TEQ (gr/ton charged)* | | | | *3.5E-5* |

1. Test 3 was aborted due to a broken pump shaft on the chip furnace during the test.
2. Specified in laboratory report as EMPC (estimated maximum possible concentration), picograms (pg).
3. Toxic equivalency factor (TEQ) calculated assuming all non-detect (ND) compounds are present at the detection limit (DL).
4. D/F emission rate, TEQ as grains per ton of chips charged (gr/ton)