



# Alliance

SOURCE TESTING

## Source Test Report

Alloy Resources  
2281 Port City Industrial Blvd  
Muskegon, MI 49442

Test Dates: February 1-2, 2016

The  
**Alliance**  
Advantage



AST Project No. 2016-0038

**Regulatory Information**

|                                  |   |
|----------------------------------|---|
| <i>Permit No.</i>                | Michigan DEQ Permit to Install No. 340-07C                        |
| <i>State Registration Number</i> | N7888   |
| <i>Regulatory Citation</i>       | 40 CFR 63, Subpart RRR – NESHAP for Secondary Aluminum Production |

**Source Information**

| <i>Source Name</i>                              | <i>Flexible Group ID</i> | <i>Target Parameters</i>               |
|---|--------------------------|--|
| SAPU consisting of:<br>EUALREVERB<br>EUREBERB50 | FGFURNACES               | PM, CPM, HCl, Cl <sub>2</sub> , HF, DF |

**Contact Information**

| <i>Test Location</i>   | <i>Test Company</i>  | <i>Analytical Laboratories</i>  |
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Alliance Source Testing, LLC (AST) has completed the source testing as described in this report. Results apply only to the source(s) tested and operating condition(s) for the specific test date(s) and time(s) identified within this report. All results are intended to be considered in their entirety, and AST is not responsible for use of less than the complete test report without written consent. This report shall not be reproduced in full or in part without written approval from the customer.

To the best of my knowledge and abilities, all information, facts and test data are correct. Data presented in this report has been checked for completeness and is accurate, error-free and legible. Onsite testing was conducted in accordance with approved internal Standard Operating Procedures. Any deviations or problems are detailed in the relevant sections on the test report.

This report is only considered valid once an authorized representative of AST has signed in the space provided below; any other version is considered draft. This document was prepared in portable document format (.pdf) and contains pages as identified in the bottom footer of this document.



Chris LeMay  
Alliance Source Testing, LLC

2/23/16

Date

**TABLE OF CONTENTS**

1.0 Introduction ..... 1-1

    1.1 Facility Description ..... 1-1

    1.2 Source and Control System Description ..... 1-1

    1.3 Project Team ..... 1-2

    1.4 Site Specific Test Plan & Notification ..... 1-2

    1.5 Test Program Notes ..... 1-2

2.0 Summary of Results ..... 2-1

3.0 Testing Methodology ..... 3-1

    3.1 U.S. EPA Reference Test Methods 1 & 2 – Volumetric Flow Rate ..... 3-1

    3.2 U.S. EPA Reference Test Method 4 – Moisture Content ..... 3-1

    3.3 U.S. EPA Reference Test Method 17 / 202 – Particulate Matter ..... 3-1

    3.4 U.S. EPA Reference Test Method 23/Alternative Method 034 – Dioxin/Furan ..... 3-2

    3.5 U.S. EPA Reference Test Method 26 – Hydrogen Chloride, Chlorine, Hydrogen Fluoride ..... 3-2

**LIST OF TABLES**

Table 1-1 Project Team ..... 1-2

Table 2-1 Summary of Results ..... 2-2

Table 3-1 Source Testing Methodology ..... 3-1

**APPENDICES**

Appendix A Sample Calculations

Appendix B Field Data

Appendix C Laboratory Data

Appendix D Quality Assurance/Quality Control Data

Appendix E Process Operating/Control System Data

Appendix F SSAS Report

## Introduction

## 1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Alloy Resources Corporation (ARC) to conduct compliance demonstration testing at the Muskegon, MI facility. This facility is subject to the provisions of the Michigan Department of Environment Quality (MDEQ) issued Permit To Install (PTI) 340-07C and portions of the facility are subject to provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Secondary Aluminum Production facilities as detailed in 40 CFR 63, Subpart RRR.

Testing was conducted to determine the emission rates of filterable particulate matter (PM), condensable particulate matter (CPM), hydrogen chloride (HCl), chlorine (Cl<sub>2</sub>), hydrogen fluoride, (HF) and dioxins/furans (D/F) from two (2) reverberatory furnaces (EUALREVERB and EUREVERB50). A new rotary furnace (EUROTARY) has been installed but was not processing any material during the test program. D/F testing was conducted to demonstrate compliance with the NESHAP, while PM, CPM, HCl, Cl<sub>2</sub> and HF testing was conducted to demonstrate compliance with the state permit.

Emissions from the two (2) reverberatory furnaces are commonly ducted and routed to a lime and carbon injected baghouse system for control per PTI 340-07C. The furnaces are considered to be Group 1 furnaces and are treated as emission units within a secondary aluminum processing unit (SAPU). There is also a rotary furnace on site that is ducted to the same lime injected baghouse; however, the rotary furnace has not commenced operation and was not operating during the test program.

### 1.1 Facility Description

ARC is a secondary aluminum production facility (SIC 3341) which produces molten aluminum and recycled scrap ingot (RSI) from the melting and recovery of aluminum from aluminum scrap and aluminum dross. The recovery of aluminum from aluminum scrap and aluminum dross and the subsequent production of aluminum ingot have been defined by EPA as secondary aluminum production processes.

### 1.2 Source and Control System Description

EUALREVERB is an 80,000 lb capacity reverberatory furnace with a design aluminum melt rate of 12,000 lb/hr. The natural gas burners are rated at 20 MMBtu/hr. Aluminum scrap or materials other than clean charge may be melted in the furnace. Chlorine gas is injected and alloys are added to further refine the aluminum to required specifications. A cover flux is also added to minimize oxidation of the aluminum. EUREVERB50 is a reverberatory furnace with a 5,000 lb/hr charge capability. The natural gas burners are rated at 8.75 MMBtu/hr.

Emissions from the SAPU are captured and routed to a lime and carbon injected baghouse. Testing was conducted on the outlet of the baghouse. Continuous monitoring for all key control system parameters was conducted throughout the test program.

**1.3 Project Team**

Personnel involved in this project are identified in the following table.

**Table 1-1  
Project Team**

|                       |  |
|-----------------------|--|
| <b>ARC Personnel</b>  | Dennis Flanagan<br>Jerry Garman<br>Bruce Bergeson                |
| <b>MDEQ Personnel</b> | Jeremy Howe<br>Eric Grinstern                                    |
| <b>AST Personnel</b>  | Pete Merranko<br>Jared Wansor<br>Mike Belfoure<br>Justin Bernard |

**1.4 Site Specific Test Plan & Notification**

A Site Specific Test Plan (SSTP) submitted to MDEQ on December 29, 2015. Testing was conducted in accordance with the SSTP and the MDEQ test protocol approval letter dated January 8, 2016.

**1.5 Test Program Notes**

Due to the use of Method 17 for FPM rather than Method 5, an external heating system was required to maintain the CPM filter temperature above 65 °F. AST experienced issues with the external heating system during Run 1 and most of the CPM filter temperatures were below 65 °F. The lower temperatures may have resulted in more CPM being collected during Run 1 and biasing the reported emission rate high. Based on the test results, this deviation did not have a significant impact on the test program. The external heating issue was resolved following Run 1, and all CPM filtration temperatures were between 65-85 °F during Runs 2 and 3.

AST experienced probe heating issues during Run 2 on the Method 26 sampling system. A few of the probe temperature readings were below 248 °F, and the average probe temperature was 245 °F during the run. Based on the test results, this deviation did not have a significant impact on the test program.

## Summary of Results



## **2.0 Summary of Results**

AST conducted compliance testing at the ARC facility in Muskegon, Michigan on February 1-2, 2016. Testing consisted of determining the emission rates of PM, CPM, HCl, Cl<sub>2</sub>, HF and D/F at the combined baghouse exhaust for the FGFURNACES SAPU.

Table 2-1 provides a summary of the emission testing results with comparisons to the applicable NESHAP and permit limits. This table also provides a summary of the process operating and control system data collected during testing. Any difference between the summary results listed in the following table and the detailed results contained in the appendices is due to rounding for presentation.

**Table 2-1  
Summary of Results**

| <b>Emissions Data</b>                          |               |               |               |                |
|--|---------------|---------------|---------------|----------------|
| <b>Run Number</b>                              | <b>Run 1</b>  | <b>Run 2</b>  | <b>Run 3</b>  | <b>Average</b> |
| <b>Date</b>                                    | <b>2/1/16</b> | <b>2/2/16</b> | <b>2/2/16</b> | <b>--</b>      |
| <b>Filterable Particulate Matter Data</b>      |               |               |               |                |
| Concentration, grain/dscf                      | 0.00077       | 0.0010        | 0.00075       | 0.00084        |
| PTI Limit, grain/dscf                          | --            | --            | --            | 0.010          |
| Percent of Limit, %                            | --            | --            | --            | 8              |
| <b>PM10 / PM2.5</b>                            |               |               |               |                |
| Emission Rate, lb/hr <sup>1</sup>              | 1.0           | 0.94          | 0.62          | 0.87           |
| PTI Limit, lb/hr                               | --            | --            | --            | 3.3            |
| Percent of Limit, %                            | --            | --            | --            | 26             |
| <b>Hydrogen Chloride Data</b>                  |               |               |               |                |
| Emission Factor, lb/ton                        | 0.030         | 0.026         | 0.026         | 0.027          |
| PTI Limit, lb/ton                              | --            | --            | --            | 0.34           |
| Percent of Limit, %                            | --            | --            | --            | 8              |
| <b>Chlorine Data</b>                           |               |               |               |                |
| Emission Rate, lb/hr <sup>2</sup>              | 0.089         | 0.092         | 0.087         | 0.089          |
| PTI Limit, lb/hr                               | --            | --            | --            | 0.26           |
| Percent of Limit, %                            | --            | --            | --            | 34             |
| <b>Hydrogen Fluoride Data</b>                  |               |               |               |                |
| Emission Factor, lb/ton <sup>2</sup>           | 2.7E-03       | 2.6E-03       | 2.4E-03       | 2.6E-03        |
| PTI Limit, lb/ton                              | --            | --            | --            | 0.34           |
| Percent of Limit, %                            | --            | --            | --            | 1              |
| <b>Dioxin/Furan Data</b>                       |               |               |               |                |
| Emission Rate, lb/hr                           | 1.6E-07       | 1.5E-07       | 1.1E-07       | 1.4E-07        |
| PTI Limit, lb/hr                               | --            | --            | --            | 3.6E-07        |
| Percent of Limit, %                            | --            | --            | --            | 38             |
| Emission Factor, grain TEQ/ton <sup>3</sup>    | 2.0E-04       | 1.8E-04       | 1.2E-04       | 1.7E-04        |
| NESHAP Limit, grain TEQ/ton                    | --            | --            | --            | 2.1E-04        |
| Percent of Limit, %                            | --            | --            | --            | 80             |
| <b>Process Operating / Control System Data</b> |               |               |               |                |
| <b>Run Number</b>                              | <b>Run 1</b>  | <b>Run 2</b>  | <b>Run 3</b>  | <b>Average</b> |
| <b>Date</b>                                    | <b>2/1/16</b> | <b>2/2/16</b> | <b>2/2/16</b> | <b>--</b>      |
| Feed Rate, lb/hr                               | 10,820        | 11,963        | 12,047        | 11,610         |
| Flux Percent, %                                | 7.6           | 9.9           | 8.9           | 8.9            |
| Chlorine Injection Rate, lb/hr                 | 68.0          | 89.7          | 105.3         | 87.7           |
| Lime Injection Rate, lb/hr                     | 41.7          | 36.0          | 35.3          | 37.7           |
| Carbon Injection, lb/hr                        | 5.7           | 5.7           | 5.0           | 5.4            |
| Baghouse Temperature, °F                       | 189.3         | 190.4         | 187.5         | 189.1          |

<sup>1</sup> PM10/PM2.5 data is the summation of the filterable and condensable PM fractions.

<sup>2</sup> All chlorine and hydrogen fluoride fractions were below the laboratory detection limit. The detection limit was used for emission calculation purposes.

<sup>3</sup> D/F TEQ values were calculated using 1989 NATO TEFs.

## Testing Methodology

### 3.0 Testing Methodology

The emission testing program was conducted in accordance with the test methods listed in Table 3-1. Method descriptions are provided below while quality assurance/quality control data is provided in Appendix D.

**Table 3-1  
Source Testing Methodology**

| Parameter                                       | U.S. EPA Reference Test Methods | Notes/Remarks                     |
|---|---------------------------------|-----------------------------------|
| Volumetric Flow Rate                            | 1 & 2                           | Full Velocity Traverses           |
| Moisture Content                                | 4                               | Volumetric / Gravimetric Analysis |
| Particulate Matter                              | 17 / 202                        | Isokinetic Sampling               |
| Dioxin/Furans                                   | 23 / Alt 034                    | Isokinetic Sampling               |
| Hydrogen Chloride, Chlorine & Hydrogen Fluoride | 26                              | Constant Rate Sampling            |

#### 3.1 U.S. EPA Reference Test Methods 1 & 2 – Volumetric Flow Rate

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. A full velocity traverse was conducted in accordance with U.S. EPA Reference Test Method 2 to determine the average stack gas velocity pressure, static pressure and temperature. The velocity and static pressure measurement system consisted of an S-type pitot tube and inclined manometer while the stack gas temperature was measured with a K-type thermocouple and pyrometer. The oxygen and carbon dioxide concentrations were assumed ambient for volumetric flow rate calculations.

#### 3.2 U.S. EPA Reference Test Method 4 – Moisture Content

The stack gas moisture content was determined in accordance with U.S. EPA Reference Test Method 4. The gas conditioning train consisted of a series of chilled impingers. The impinger contents were pre and post-measured to determine the amount of moisture condensed during each test run.

#### 3.3 U.S. EPA Reference Test Method 17 / 202 – Particulate Matter

The particulate matter testing was conducted in accordance with U.S. EPA Reference Test Methods 17 and 202. The complete sampling system consisted of a Teflon-coated nozzle, in-stack filter holder, pre-weighed quartz filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of four (4) chilled impingers – the first and second impingers were empty, the third impinger contained DI water and the fourth containing approximately 200 grams of silica gel. An un-weighed 90 mm Teflon filter was placed between the second and third impinger.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. A nitrogen purge was not conducted due to the low volume of condensate collected.

The contents of the impingers were measured volumetrically to determine the moisture gain. The contents of impingers 1 and 2 were recovered in container 1. Impingers 1 and 2, the coil condenser and all connecting glassware were rinsed with DIUF water and then rinsed with acetone and hexane. The water rinses were added to

container 1 while the solvent rinses were recovered in container 2. The un-heated Teflon filter was removed from the filter holder and placed in container 3. The front half of the filter holder was rinsed with water and then with acetone and hexane. The water rinse was added to container 1 while the solvent rinses were added to container 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

The pre-weighed filter was carefully removed and placed in container 4. The probe, nozzle and front half of the filter holder were rinsed three (3) times with acetone to remove any adhering particulate matter and these rinses were recovered in container 5. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

### **3.4 U.S. EPA Reference Test Method 23/Alternative Method 034 – Dioxin/Furan**

The dioxin and furan concentrations were determined in accordance with EPA Reference Method 23 with guidance from Alternative Method 034. All glassware leading to the XAD adsorbing resin was cleaned at AST's laboratory before mobilizing to the site. Glassware cleaning consisted of washing with warm soapy water and rinsing with distilled water and acetone. Once the glassware was dry, the open ends were sealed with Teflon tape. The analytical laboratory provided the pre-cleaned filters and pre-cleaned, packed and spiked XAD resin traps.

The impinger train was assembled in the sample recovery area. The first impinger (shortened stem) was empty and used for a knockout impinger. The next two (2) impingers were standard Greenberg-Smith impingers with each containing 100 mL of high performance liquid chromatography grade water. The fourth impinger was empty while the fifth impinger was charged with approximately 200 grams of indicating silica gel. The pre-cleaned glass fiber filter was placed in a glass filter holder with a Teflon-coated filter support and connected to the condenser coil. All open ends of the sampling train were sealed with Teflon tape prior to complete assembly at the sampling location.

The complete sampling system consisted of a Teflon-coated nozzle, heated glass-lined probe, glass filter holder with pre-cleaned glass-fiber filter, condenser coil, XAD resin trap, gas conditioning train, pump and calibrated dry gas meter. The probe and filter box temperatures were maintained at approximately 250°F. The sorbent module resin and impinger temperatures were maintained at or below 68°F throughout the testing.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. The filter was removed from the filter holder and placed in sample Container 1. The XAD sorbent module was sealed on both ends and placed on ice. The nozzle, probe liner, filter holder, condenser and all connecting glassware were triple-rinsed with acetone, and these rinses were recovered in sample Container 2. All glassware cleaned for sample Container 2, except the condenser, was also triple-rinsed with toluene. Three (3) 5-minute soaks with toluene were conducted on the condenser. The toluene rinses were recovered in sample Container 3. All samples were sealed, labeled, stored on ice and shipped to the identified laboratory.

### **3.5 U.S. EPA Reference Test Method 26 – Hydrogen Chloride, Chlorine, Hydrogen Fluoride**

The hydrogen chloride, chlorine and hydrogen fluoride concentrations were determined in accordance with U.S. EPA Reference Method Test 26. The complete sampling system consisted of a heated glass-lined probe, Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of five (5) impingers contained in an ice/water bath. The first and second impingers contained 0.1 N H<sub>2</sub>SO<sub>4</sub>, the third and fourth contained 0.1

N NaOH and the fifth impinger contained silica gel. The probe and filter box temperatures were maintained above 250°F, and the impinger temperature was maintained below 68°F throughout the testing.

Following the completion of each test run, the sampling train was leak checked at a vacuum pressure greater than or equal to the highest vacuum pressure observed during the run. The absorbing solution (0.1 N H<sub>2</sub>SO<sub>4</sub>) from the first and second impingers and absorbing solution (0.1 N NaOH) from the third and fourth impingers were placed into separate sample containers (container 1 and container 2). The back-half of the filter holder, first and second impingers and all glassware leading to the outlet of the second impinger were triple-rinsed with DI water. These rinses were placed in container 1. The third and fourth impingers and all associated glassware were triple-rinsed with DI water. These rinses were recovered in container 2. The samples were sealed, labeled and liquid levels marked for transport to the identified laboratory.