

## 1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Aleris Recycling, Inc. (AR) to conduct investigative testing at the Coldwater, MI facility. Testing was conducted pursuant to Permit to Install (PTI) 76-12A issued by the Michigan Department of Environment Quality (MDEQ) on October 16, 2013 and consisted of quantifying the emission rates of condensable particulate matter (CPM), PM less than 10 microns (PM10) and PM less than 2.5 microns (PM2.5) from the rotary furnaces baghouse exhaust. The purpose of the testing was to determine if the addition of Trona to the rotary furnaces exhaust could impact the quantity of condensable PM2.5 formed.

## 1.1 Facility Description

AR 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 the United States Environmental Protection Agency (EPA) as secondary aluminum production processes.

## 1.2 Source and Control System Descriptions

The rotary furnaces are used to process aluminum dross and scrap aluminum. Each furnace is designed to rotate on its axis, mixing and tumbling the charge while heating. The furnace then tilts forward to pour out the molten aluminum (tapping) and dump out the remaining slag or Salt Cake.

Included with the metal charge is the feed of a salt flux material. The scrap or dross charge and salt mixture is rotated in the furnace while a natural gas burner directed into the open end of the furnace heats the mixture. When all of the aluminum in the batch has melted, the furnace is tilted forward and the molten aluminum is poured into crucibles for transport, transferred to the reverberatory furnace or sow molds to solidify. The remaining slag or salt cake is dumped out of the furnace by tilting and rotating into pans for cooling and ultimately disposal.

Emissions from these process units are captured by a hood and directed to an alkaline reagent injected baghouse system for control of the regulated pollutants. The emission control system injects an alkaline reagent into the air stream prior to the inlet of the baghouse to reduce the concentration of specific pollutants present in the exhaust gases. The baghouse then captures the reacted material and other particulate matter from the melting process.

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**1.3 Project Team**

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

**Table 1-1  
Project Team**

<b>Aleris Personnel</b>	Scott Pennington Gary Barnett
<b>MDEQ Agency Personnel</b>	Rex Lane Nathan Hude David Patterson
<b>AST Personnel</b>	Chris LeMay Andy Roth Scott Cole Drew Sloan Jim Boozer Ricky Flores Jordan Laster Pete Merranko

**1.4 Site Specific Test Plan & Notification**

Testing was conducted in accordance with the Site Specific Test Plan (SSTP) submitted to Ms. Karen Kajiya-Mills of the Michigan Department of Environmental Quality on December 20, 2013.

## Summary of Results

## 2.0 Summary of Results

AST conducted investigative testing at the AR facility in Coldwater, MI on February 10-14, 2014. Testing consisted of determining the emission rates of CPM, PM10 and PM2.5 from the rotary furnaces baghouse exhaust.

Table 2-1 provides a summary of the testing results and 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 Appendix B is due to rounding for presentation.

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**Table 2-1  
Summary of Results**

Emissions Data										
Run Number	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Run 10
Date	2/10/14	2/10/14	2/11/14	2/11/14	2/12/14	2/12/14	2/13/14	2/13/14	2/14/14	2/14/14
<b>Filterable PM Data</b>										
FPM2.5 Emission Rate, lb/hr	1.88	2.27	1.50	1.23	1.34	1.22	1.28	0.48	0.90	0.89
FPM2.5 Emission Factor, lb/ton	0.18	0.22	0.14	0.12	0.13	0.12	0.11	0.05	0.08	0.08
FPM10 Emission Rate, lb/hr	0.84	1.02	0.68	0.59	0.67	0.53	0.68	0.55	0.33	0.15
FPM10 Emission Factor, lb/ton	0.08	0.10	0.06	0.06	0.06	0.05	0.06	0.05	0.03	0.01
<b>Condensable PM Data</b>										
CPM Emission Rate, lb/hr	1.82	2.45	0.87	6.85	3.93	1.69	2.79	2.78	1.32	1.08
CPM Emission Factor, lb/ton	0.17	0.23	0.08	0.68	0.37	0.16	0.25	0.27	0.12	0.10
<b>Total PM Data</b>										
PM2.5 Emission Rate, lb/hr <sup>1</sup>	3.70	4.72	2.37	8.08	5.28	2.91	4.07	3.26	2.22	1.97
PM2.5 Emission Factor, lb/ton <sup>1</sup>	0.35	0.45	0.22	0.80	0.50	0.28	0.36	0.32	0.21	0.18
PM10 Emission Rate, lb/hr <sup>2</sup>	4.54	5.73	3.05	8.67	5.95	3.45	4.76	3.81	2.55	2.12
PM10 Emission Factor, lb/ton <sup>2</sup>	0.42	0.55	0.28	0.86	0.57	0.34	0.42	0.37	0.24	0.19
Process / Control System Data										
Run Number	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Run 7	Run 8	Run 9	Run 10
Rotary Furnace No. 1 Feed Rate, lb/hr	10,754	10,716	11,202	9,658	11,028	10,053	11,382	10,457	11,251	10,954
Rotary Furnace No. 2 Feed Rate, lb/hr	10,633	10,166	10,811	10,485	9,962	10,510	11,136	10,102	10,301	10,843
Rotary Furnace No. 1 Flux Percentage, %	20.9	21.1	21.1	20.3	20.6	20.4	15.4	14.3	12.4	11.1
Rotary Furnace No. 2 Flux Percentage, %	21.5	21.1	20.6	20.1	20.5	14.0	14.9	14.8	12.3	11.0
Rotary Furnace No. 1 Lime Injection Rate, lb/hr	166.0	167.0	116.3	118.7	51.7	101.3	102.3	107.0	85.7	86.0
Rotary Furnace No. 2 Lime Injection Rate, lb/hr	167.0	167.3	117.7	118.3	51.3	102.3	103.0	103.7	88.7	87.0
Rotary Furnace No. 1 Trona Injection Rate, lb/hr	51.2	51.4	51.4	50.8	50.6	80.3	100.7	100.7	80.8	80.8
Rotary Furnace No. 2 Trona Injection Rate, lb/hr	49.4	50.8	50.8	51.4	50.3	79.7	100.8	100.8	81.0	80.3
Baghouse Inlet Temperature, °F	195	183	174	182	175	197	180	194	191	191

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

<sup>2</sup> PM10 emission data is the summation of the filterable PM2.5, filterable PM10 and condensable PM fractions.

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## 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 less than 10 microns / Particulate Matter less than 2.5 microns	201A/202	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. The stack gas temperature was measured with a K-type thermocouple and pyrometer. Oxygen and carbon dioxide concentrations were estimated based on previous test data.

**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. Prior to testing, each impinger was filled with a known quantity of water or silica gel. Post testing, the quantities of water and silica gel were measured again to determine the amount of moisture condensed during the test run. Alternatively, each impinger was pre and post-weighed on the same analytical balance to determine the amount of moisture condensed during each test run.

**3.3 U.S. EPA Reference Test Methods 201A/202 – Particulate Matter**

The PM2.5 and PM10 testing was conducted in accordance with U.S. EPA Reference Test Methods 201A and 202. The complete sampling system consisted of a stainless nozzle, in-stack cyclone and pre-weighed quartz filter, heated stainless-lined probe, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of five (5) impingers. The first, second and fourth impingers were initially empty, the third contained 100 milliliters (mL) of de-ionized water and the fifth impinger contained approximately 200-300 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. 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 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 condensable 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.

The pre-weighed filter was carefully removed and placed in Container 4. The back-half of the PM2.5 cyclone and front half of the filter holder were rinsed with acetone to remove any adhering particulate matter, and these rinses were recovered in Container 5. The back-half of the PM10 cyclone, front half of the PM2.5 cyclone and the connecting stainless tubing were rinsed with acetone, and these rinses were recovered in Container 6.

To determine the condensable particulate matter (CPM) mass, the Teflon filter from Container 3 was placed in an extraction tube, rinsed with water, acetone and hexane and sonicated. The water rinse was added to Container 1 while the solvent rinse was added to Container 2. The contents of Container 1 was added to a separatory funnel and mixed with hexane. Hexane extractions were conducted, and the organic fraction was drained from the funnel and added to Container 2. After the organic and inorganic fractions were separated, the mass of each fraction was determined by evaporating the applicable solvents in pre-weighed beakers and then weighing the residue in each beaker until a constant weight was obtained. All weight measurements were performed on the same balance (accurate to 0.1 mg).

The mass of filterable PM2.5 and PM10 was determined by evaporating the acetone rinses from Containers 5 and 6 in separate pre-weighed dishes and then weighing the residue until a constant weight was obtained. The filter loading was determined by subtracting the initial constant filter weight from the final constant weight. The filterable PM2.5 loading was determined by adding the PM2.5 rinse and the filter weight. All weight measurements were performed on the same balance (accurate to 0.1 mg).

All particulate matter analyses were conducted on site by AST personnel. Samples weights were confirmed at AST's laboratory in Decatur, AL.