

## 1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Real Alloy Specification, Inc. (RAS) to conduct compliance testing at the Coldwater (North), Michigan facility. The facility is subject to Michigan Department of Environment Quality (MDEQ) Title V Permit No. M1-ROP-N5957-2012e and PTI No. 109-16. Testing was conducted to demonstrate compliance with the provisions in the latest MDEQ operating permit issued in March 2012 and the PTI permit issued in August 2016.

Testing was conducted to determine emission rate and emission factor of nitrogen oxides (NO<sub>x</sub>) from the Reverberatory Furnace No. 7 Flue (Reverb No. 7 Flue) and Reverberatory Furnace No. 8 Flue (Reverb No. 8 Flue) while firing the flue duct heaters installed in 3Q2016 per MDEQ PTI No. 109-16. The duct burners are used to maintain flue exhaust temperature above the dew point during the winter.

## 1.1 Facility Description

RAS is a secondary aluminum production facility (SIC 3341) which produces molten aluminum and specification ingot from the melting and recovery of aluminum from aluminum scrap, sow and pig. 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 Descriptions

The two (2) reverberatory furnaces – No. 7 and No. 8 – are designed as sidewall melter/holder units. The reverberatory furnaces are used to melt aluminum scrap that has been processed by the aluminum shredder, thermal chip dryer or directly charged. The main scrap types consumed include turnings, cast, extrusions, twitch, clips and alloying materials. The scrap is charged to the sidewall of the furnace along with solid flux material, alloying agents and gaseous Cl<sub>2</sub> that are required for the production order. Clean charge consumed includes sow, ingot and molten metal. Once the materials are molten, the metal flows through a submerged opening to the hearth. Once properly alloyed, the furnace is tapped and the molten aluminum is either transferred to a holding furnace, refractory lined crucibles or cast into ingot.

To capture process emissions, the reverberatory furnaces were built with hooding systems over the side wells. To control process emissions, the exhausts from the capture hoods are ducted to lime-injected baghouse systems. In addition, the Reverb No. 7 and Reverb No. 8 flue stacks are now equipped with direct fired natural gas heaters to minimize the condensation of water from the flue gases before being ducted to separate lime-injection baghouse systems for control of PM and HCl. Both baghouse systems exhaust through a common stack to the atmosphere.

**RECEIVED**

**MAR 23 2017**

**AIR QUALITY DIV.**

**1.3 Project Team**

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

**Table 1-1  
Project Team**

<b>Facility Personnel</b>	Jeff Ferg – RAS Janine Grossheim – RAS
<b>Regulatory Personnel</b>	Rex Lane – MDEQ Dave Patterson – MDEQ
<b>AST Personnel</b>	Kenji Kinoshita Justin Bernard Matt Biddle

**1.4 Site Specific Test Plan & Notification**

Testing was conducted in accordance with the Site Specific Test Plan (SSTP) submitted to MDEQ on January 31, 2017 and MDEQ approval letter dated February 13, 2017.

**1.5 Test Program Notes**

On February 22, 2017, Run 1 on Flue No. 7 was voided due to mechanical issues with the hot well circulation pump. The data presented in Table 2-1 is the average of three (3) valid test runs. A copy of the voided field data is provided in Appendix E.

On February 22, 2017, Run 1 on Flue No. 8 was extended to approximately 6 hours due to an extended startup of the furnace. All other valid test runs were shortened to approximately 2 hours duration since NOx rate variations were minimal. This was at the discretion of and with the approval of MDEQ observers, Rex Lane and Dave Patterson. Operation of both primary and flue duct burners were verified during each valid test run.

**2.0 Summary of Results**

AST conducted compliance testing at the RAS Coldwater North facility in Coldwater, Michigan on February 22-24, 2017. Testing consisted of determining the emission rate and emission factor of NOx from the Reverb No. 7 Flue and Reverb No. 8 Flu) while firing the flue duct heaters at the facility.

Tables 2-1 and 2-2 provide summaries of the emission testing results with comparisons to the applicable MDEQ permit limits. These tables also provide a summary of the process operating and control system data collected during testing. Any differences between the summary results listed in the following tables and the detailed results contained in appendices are due to rounding for presentation.

**Table 2-1  
Summary of Flue No. 7 Results**

<b>Emissions Data</b>				
<b>Run Number</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Run 4</b>	<b>Average *</b>
<b>Date</b>	<b>2/23/17</b>	<b>2/23/17</b>	<b>2/23/17</b>	<b>--</b>
<b>Nitrogen Oxides Data</b>				
Concentration, ppmvd	4.7	4.9	4.7	4.7
Emission Rate, lb/hr	1.0	1.0	1.0	1.0
Emission Factor, lb/ton	0.25	0.26	0.26	0.25
Permit Limit, lb/ton	--	--	--	0.231
Percent of Limit, %	--	--	--	>100
<b>Process Operating / Control System Data</b>				
<b>Run Number</b>	<b>Run 2</b>	<b>Run 3</b>	<b>Run 4</b>	<b>Average *</b>
<b>Date</b>	<b>2/23/17</b>	<b>2/23/17</b>	<b>2/23/17</b>	<b>--</b>
Feed Rate, lb/hr	8,106	8,173	7,638	7,972
Flux Usage, lb	240	360	320	307
Percent Flux, %	1.10	1.73	1.58	1.47
Duct Burner Firing Rate, cfh	708	708	708	708

\*Run 1 on February 22, 2017 was voided mechanical issues with the hot well circulation pump.

**Table 2-2**  
**Summary of Flue No. 8 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>2/22/17</b>	<b>2/24/17</b>	<b>2/24/17</b>	<b>--</b>
<b>Nitrogen Oxides Data</b>				
Concentration, ppmvd	4.4	4.7	4.2	4.5
Emission Rate, lb/hr	0.92	0.95	0.87	0.91
Emission Factor, lb/ton <sup>1</sup>	0.40	0.36	0.32	0.36
Permit Limit, lb/ton	--	--	--	0.095
Percent of Limit, %	--	--	--	>100
<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>2/22/17</b>	<b>2/24/17</b>	<b>2/24/17</b>	<b>--</b>
Feed Rate, lb/hr	4,630	5,286	5,394	5,103
Flux Usage, lb	720	620	200	513
Percent Flux, %	2.61	3.89	1.14	2.55
Duct Burner Firing Rate, cfh	708	708	708	708

**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 C.

**Table 3-1  
Source Testing Methodology**

<b>Parameter</b>	<b>U.S. EPA Reference Test Methods</b>	<b>Notes/Remarks</b>
Volumetric Flow Rate	1 & 2	Full Velocity Traverses
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Volumetric / Gravimetric Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Gas Dilution System Certification	205	--

**3.1 U.S. EPA Reference Test Methods 1 and 2 – Sampling/Traverse Points and Volumetric Flow Rate**

The sampling location and number of traverse (sampling) points were selected in accordance with U.S. EPA Reference Test Method 1. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-2 in U.S. EPA Reference Test Method 1.

Full velocity traverses were 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 a pitot tube and inclined manometer. The stack gas temperature was measured with a K-type thermocouple and pyrometer.

**3.2 U.S. EPA Reference Test Method 3A – Oxygen/Carbon Dioxide**

The oxygen and carbon dioxide testing was conducted in accordance with U.S. EPA Reference Test Method 3A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.6.

**3.3 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 to determine the amount of moisture condensed during the test run. Alternatively, each impinger was analyzed gravimetrically before and after each test run on the same analytical balance to determine the amount of moisture condensed.

### 3.4 U.S. EPA Reference Test Method 7E – Nitrogen Oxides

The nitrogen oxides (NO<sub>x</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 7E. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless steel probe, Teflon sample line(s), gas conditioning system and the identified gas analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the stack gas. If an unheated Teflon sample line was used, then a portable non-contact condenser was placed in the system directly after the probe. Otherwise, a heated Teflon sample line was used. The quality control measures are described in Section 3.6.

### 3.5 U.S. EPA Reference Test Method 205 – Gas Dilution System Certification

A calibration gas dilution system field check was conducted in accordance with U.S. EPA Reference Method 205. Multiple dilution rates and total gas flow rates were utilized to force the dilution system to perform two dilutions on each mass flow controller. The diluted calibration gases were sent directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The analyzer response agreed within 2% of the actual diluted gas concentration. A second Protocol 1 calibration gas, with a cylinder concentration within 10% of one of the gas divider settings described above, was introduced directly to the analyzer, and the analyzer response recorded in an electronic field data sheet. The cylinder concentration and the analyzer response agreed within 2%. These steps were repeated three (3) times. Copies of the Method 205 data can be found in the Quality Assurance/Quality Control Appendix.

### 3.6 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A and 7E

Cylinder calibration gases used met EPA Protocol 1 (+/- 2%) standards. Copies of all calibration gas certificates can be found in the Quality Assurance/Quality Control Appendix.

Low Level gas was introduced directly to the analyzer. After adjusting the analyzer to the Low Level gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the Mid Level gas. Next, High Level gas was introduced directly to the analyzer, and the response recorded when it was stable. All values were within 2.0 percent of the Calibration Span or 0.5 ppmv absolute difference.

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe and the time required for the analyzer reading to reach 95 percent or 0.5 ppm (whichever was less restrictive) of the gas concentration was recorded. The analyzer reading was observed until it reached a stable value, and this value was recorded. Next, Low Level gas was introduced at the probe and the time required for the analyzer reading to decrease to a value within 5.0 percent or 0.5 ppm (whichever was less restrictive) was recorded. If the Low Level gas was zero gas, the response was 0.5 ppm or 5.0 percent of the upscale gas concentration (whichever was less restrictive). The analyzer reading was observed until it reached a stable value and this value was recorded. The measurement system response time and initial system bias were determined from these data. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference

High or Mid Level gas (whichever was closer to the stack gas concentration) was introduced at the probe. After the analyzer response was stable, the value was recorded. Next, Low Level gas was introduced at the probe, and the analyzer value recorded once it reached a stable response. The System Bias was within 5.0 percent of the Calibration Span or 0.5 ppmv absolute difference or the data was invalidated and the Calibration Error Test and System Bias were repeated.

Drift between pre- and post-run System Bias was within 0.5 ppmv absolute difference or the Calibration Error Test and System Bias were repeated.

To determine the number of sampling points, a gas stratification check was conducted prior to initiating testing. The pollutant concentrations were measured at three points (16.7, 50.0 and 83.3 percent of the measurement line). Each traverse point was sampled for a minimum of twice the system response time.

If the pollutant concentration at each traverse point did not differ more than 5% or 0.5 ppm (whichever was less restrictive) of the average pollutant concentration, then single point sampling was conducted during the test runs. If the pollutant concentration did not meet these specifications but differed less than 10% or 1.0 ppm from the average concentration, then three (3) point sampling was conducted (stacks less than 7.8 feet in diameter - 16.7, 50.0 and 83.3 percent of the measurement line; stacks greater than 7.8 feet in diameter - 0.4, 1.0, and 2.0 meters from the stack wall). If the pollutant concentration differed by more than 10% or 1.0 ppm from the average concentration, then sampling was conducted at a minimum of twelve (12) traverse points. Copies of stratification check data can be found in the Quality Assurance/Quality Control Appendix.

An NO<sub>2</sub> – NO converter check was performed on the analyzer prior to initiating testing. An approximately 50 ppm nitrogen dioxide cylinder gas was introduced directly to the NO<sub>x</sub> analyzer and the instrument response was recorded in an electronic data sheet. The instrument response was within +/- 10 percent of the cylinder concentration.

A Data Acquisition System (Dutech Analog Signal Modules) with battery backup was used to record the instrument response in one (1) minute averages. The data was continuously stored as a \*.CSV file in Excel format on the hard drive of a computer. At the completion of testing, the data was also saved to the AST server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at AST's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.