

## 1.0 Introduction

Alliance Source Testing, LLC (AST) was retained by Real Alloy Specification, LLC (RAS) to conduct compliance testing at the Coldwater (North), Michigan facility. The facility is subject to provisions of 40 CFR 63, Subpart RRR and the Michigan Department of Environmental Quality (MDEQ) Permit MI-ROP-N5957-2012e. Testing was conducted to determine the emission rates of particulate matter (PM), particulate matter less than 10 microns (PM10), sulfur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>), total hydrocarbons (THC), hydrogen chloride (HCl) and dioxins and furans (D/F) at the shared baghouse exhaust (BH1) for Furnaces No. 7 and 8 side well. Testing also included determining the emission rates of PM, PM10, NO<sub>x</sub> and THC at the Furnace No. 2N Flue and THC at the Furnace No. 7 and 8 Flues.

## 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 the subsequent production of molten aluminum have been defined by the U.S. 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 sidewell 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 sidewell 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 line crucibles or cast into ingot.

To capture process emissions, the reverberatory furnaces were built with hooding systems over the side well. To control process emissions, the exhausts from the capture hoods are ducted to a lime-injected baghouse system (Baghouse 1). In addition, the Reverb No. 7 and No. 8 flues ducts are equipped with direct fired natural gas heaters to minimize the condensation of water from the flue gases before being routed to separate lime-injection baghouse systems for control of PM and HCl. Both baghouse systems exhaust through a common stack to the atmosphere.

The facility operates one (1) Group 2 furnace – Furnace 2N. Furnace 2N processes only clean charge and does not use reactive flux.

**1.3 Project Team**

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

**Table 1-1  
Project Team**

<b>RAS Personnel</b>	Jeff Ferg Janine Caldwell
<b>Regulatory Personnel</b>	Rex Lane – MDEQ Tom Gasloli – MDEQ
<b>AST Personnel</b>	Kenji Kinoshita Justin Bernard Keith Rhodes Kyle Porter Mark Godman

**1.4 Site Specific Test Plan & Notification**

Testing was conducted in accordance with the Site-Specific Test Plan (SSTP) submitted to MDEQ on May 7, 2018.

**1.5 Test Program Notes**

Run 1 for D/F on July 11, 2018 for on Baghouse 1 testing was voided due to a failed post-test leak check on the sample train. The voided field data is provided in Appendix H.

## Summary of Results

## 2.0 Summary of Results

AST conducted compliance testing at the RAS facility in Coldwater (N), Michigan on July 10-12, 2018. Testing consisted of determining the emission rates of PM, PM10, SO<sub>2</sub>, NO<sub>x</sub>, THC, HCl and D/F at the shared baghouse exhaust (BH1) for Furnaces No. 7 and 8 side well. Testing also include determining the emission rates of PM, PM10, NO<sub>x</sub> and THC from the exhaust of Furnace No. 2N Flue and THC from the exhaust of the Furnace No. 7 and 8 Flues.

Tables 2-1 through 2-6 provide summaries of the emission testing results with comparisons to the applicable NESHAP and/or state permit limits. These 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 tables and the detailed results contained in appendices is due to rounding for presentation.

**Table 2-1**  
**Summary of Results – Furnaces 7N & 8N NESHAP**

Run Number	Run 1	Run 2	Run 3	Run 4	Average
Date	7/11/18	7/11/18	7/12/18	7/12/18	--
<b>Furnace No. 7N</b>					
FPM Emission Factor, lb/ton	0.13	0.030	0.055	0.011	0.056
NESHAP Limit, lb/ton	--	--	--	--	0.4
<b>Percent of Limit, %</b>	--	--	--	--	<b>14</b>
HCl Emission Factor, lb/ton	0.15	0.078	0.0054	0.0051	0.060
NESHAP Limit, lb/ton	--	--	--	--	0.4
<b>Percent of Limit, %</b>	--	--	--	--	<b>15</b>
D/F Emission Factor, grain TEQ/ton	--	1.0E-04	7.3E-05	9.3E-05	9.0E-05
NESHAP Limit, grain TEQ/ton	--	--	--	--	2.1E-04
<b>Percent of Limit, %</b>	--	--	--	--	<b>43</b>
<b>Furnace No. 8N</b>					
FPM Emission Factor, lb/ton	0.097	0.035	0.052	0.010	0.049
Permit Limit, lb/ton	--	--	--	--	0.4
<b>Percent of Limit, %</b>	--	--	--	--	<b>12</b>
HCl Emission Factor, lb/ton	0.12	0.092	0.0051	0.0048	0.054
NESHAP Limit, lb/ton	--	--	--	--	0.4
<b>Percent of Limit, %</b>	--	--	--	--	<b>14</b>
D/F Emission Factor, grain TEQ/ton *	--	1.2E-04	7.0E-05	8.6E-05	9.2E-05
NESHAP Limit, grain TEQ/ton	--	--	--	--	2.1E-04
<b>Percent of Limit, %</b>	--	--	--	--	<b>44</b>

\*D/F TEQ values were calculated using 1989 NATO TEFs.

**Table 2-2**  
**Summary of Results – Furnaces 7N & 8N (BH1) MDEQ Permit**

Run Number	Run 1	Run 2	Run 3	Run 4	Average
Date	7/11/18	7/11/18	7/12/18	7/12/18	--
<b>Particulate Matter Data</b>					
Furnaces 7N & 8N PM Emission Factor, lb/ton	0.055	0.016	0.027	0.0052	0.026
PM Permit Limit, lb/ton	--	--	--	--	0.023
Percent of Limit, %	--	--	--	--	>100
Furnaces 7N & 8N PM10 Emission Factor, lb/ton *	0.22	0.15	0.055	0.048	0.12
PM10 Permit Limit, lb/ton	--	--	--	--	0.036
Percent of Limit, %	--	--	--	--	> 100
<b>Nitrogen Oxides Data</b>					
Furnaces 7N & 8N Emission Factor, lb/ton	0.16	0.11	0.11	0.10	0.12
Permit Limit, lb/ton	--	--	--	--	0.115
Percent of Limit, %	--	--	--	--	>100
<b>Total Hydrocarbons (minus Methane) Data</b>					
Furnaces 7N & 8N Emission Factor, lb/ton	1.1	1.0	0.52	0.76	0.84
Permit Limit, lb/ton	--	--	--	--	0.939
Percent of Limit, %	--	--	--	--	90
<b>Sulfur Dioxide Data</b>					
Furnaces 7N & 8N Emission Factor, lb/ton	0.29	0.15	0.062	0.11	0.15
Permit Limit, lb/ton	--	--	--	--	0.080
Percent of Limit, %	--	--	--	--	> 100

\*PM10 is the summation of the filterable and condensable PM fractions.

**Table 2-3**  
**Process/Control System Data – Furnaces 7N & 8N**

Run Number	Run 1	Run 2	Run 3	Run 4	Average
Date	7/11/18	7/11/18	7/12/18	7/12/18	--
Furnace 7N Feed Rate, lb/hr	6,527	10,946	8,272	10,121	8,966
Furnace 8N Feed Rate, lb/hr	8,469	9,364	8,674	10,850	9,339
Furnace 7N Flux Percentage, %	6.73	4.86	4.84	4.79	5.31
Furnace 8N Flux Percentage, %	5.83	4.94	4.33	4.66	4.94
Furnace 7N Cl <sub>2</sub> Feed, lb	350	352	463	591	439
Furnace 8N Cl <sub>2</sub> Feed, lb	372	526	315	275	372
Baghouse Inlet Temperature, °F	145	148	136	146	144
Lime Injection Rate, lb/hr	74.4	74.5	75.7	80.3	76.2

**Table 2-4**  
**Summary of Results – Furnace No. 7N Flue**

<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>7/11/18</b>	<b>7/11/18</b>	<b>7/12/18</b>	<b>--</b>
<b>Total Hydrocarbons (minus Methane) Data</b>				
Emission Factor, lb/hr	0.022	0.011	0.023	0.019
Permit Limit, lb/hr	--	--	--	0.027
Percent of Limit, %	--	--	--	<b>69</b>
<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>7/11/18</b>	<b>7/11/18</b>	<b>7/12/18</b>	<b>--</b>
Feed Rate, lb/hr	6,527	10,946	8,272	8,581

**Table 2-5**  
**Summary of Results – Furnace No. 8N Flue**

<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>7/11/18</b>	<b>7/11/18</b>	<b>7/12/18</b>	<b>--</b>
<b>Total Hydrocarbons (minus Methane) Data</b>				
Emission Factor, lb/hr	0.012	0.016	0.016	0.015
Permit Limit, lb/hr	--	--	--	0.049
Percent of Limit, %	--	--	--	<b>30</b>
<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>7/11/18</b>	<b>7/11/18</b>	<b>7/12/18</b>	<b>--</b>
Feed Rate, lb/hr	8,469	9,364	8,674	8,836

**Table 2-6**  
**Summary of Results – Furnace No. 2N Flue**

<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>7/10/18</b>	<b>7/10/18</b>	<b>7/10/18</b>	<b>--</b>
<b>Filterable Particulate Matter Data</b>				
Emission Rate, lb/hr	0.086	0.072	0.068	0.075
Permit Limit, lb/hr	--	--	--	0.043
Percent of Limit, %	--	--	--	> 100
<b>Particulate Matter &lt;10 Microns Data <sup>1</sup></b>				
Emission Rate, lb/hr	0.19	0.11	0.11	0.14
Permit Limit, lb/hr	--	--	--	0.315
Percent of Limit, %	--	--	--	43
<b>Nitrogen Oxides Data</b>				
Emission Rate, lb/hr	0.46	0.28	0.41	0.38
Permit Limit, lb/hr	--	--	--	0.253
Percent of Limit, %	--	--	--	> 100
<b>Total Hydrocarbons (minus Methane) Data</b>				
Emission Rate, lb/hr	0.17	0.30	0.18	0.21
Permit Limit, lb/hr	--	--	--	0.219
Percent of Limit, %	--	--	--	97
<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>7/10/18</b>	<b>7/10/18</b>	<b>7/10/18</b>	<b>--</b>
Feed Rate, lb/hr	17,411	17,787	20,801	18,666

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

## 2.0 Summary of Results

AST conducted compliance testing at the RAS facility in Coldwater (N), Michigan on July 10-12, 2018. Testing consisted of determining the emission rates of PM, PM10, SO<sub>2</sub>, NO<sub>x</sub>, THC, HCl and D/F at the shared baghouse exhaust (BH1) for Furnaces No. 7 and 8 side well. Testing also include determining the emission rates of PM, PM10, NO<sub>x</sub> and THC from the exhaust of Furnace No. 2N Flue and THC from the exhaust of the Furnace No. 7 and 8 Flues.

Tables 2-1 through 2-6 provide summaries of the emission testing results with comparisons to the applicable NESHAP and/or state permit limits. These 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 tables and the detailed results contained in appendices is due to rounding for presentation.

**Table 2-1**  
**Summary of Results – Furnaces 7 & 8 NESHAP**

Run Number	Run 1	Run 2	Run 3	Run 4	Average
Date	7/11/18	7/11/18	7/12/18	7/12/18	--
<b>Furnace No. 7</b>					
FPM Emission Factor, lb/ton	0.13	0.030	0.055	0.011	0.056
NESHAP Limit, lb/ton	--	--	--	--	0.4
Percent of Limit, %	--	--	--	--	14
HCl Emission Factor, lb/ton	0.15	0.078	0.0054	0.0051	0.060
NESHAP Limit, lb/ton	--	--	--	--	0.4
Percent of Limit, %	--	--	--	--	15
D/F Emission Factor, grain TEQ/ton	--	1.0E-04	7.3E-05	9.3E-05	9.0E-05
NESHAP Limit, grain TEQ/ton	--	--	--	--	2.1E-04
Percent of Limit, %	--	--	--	--	43
<b>Furnace No. 8</b>					
FPM Emission Factor, lb/ton	0.097	0.035	0.052	0.010	0.049
Permit Limit, lb/ton	--	--	--	--	0.4
Percent of Limit, %	--	--	--	--	12
HCl Emission Factor, lb/ton	0.12	0.092	0.0051	0.0048	0.054
NESHAP Limit, lb/ton	--	--	--	--	0.4
Percent of Limit, %	--	--	--	--	14
D/F Emission Factor, grain TEQ/ton *	--	1.2E-04	7.0E-05	8.6E-05	9.2E-05
NESHAP Limit, grain TEQ/ton	--	--	--	--	2.1E-04
Percent of Limit, %	--	--	--	--	44

\*D/F TEQ values were calculated using 1989 NATO TEFs.



**Table 2-2**  
**Summary of Results – Furnaces 7 & 8 MDEQ Permit**

Run Number	Run 1	Run 2	Run 3	Run 4	Average
Date	7/11	7/11/18	7/12/18	7/12/18	--
<b>Particulate Matter Data</b>					
Furnaces 7 & 8 PM Emission Factor, lb/ton	0.055	0.016	0.027	0.0052	0.026
PM Permit Limit, lb/ton	--	--	--	--	0.023
Percent of Limit, %	--	--	--	--	>100
Furnaces 7 & 8 PM10 Emission Factor, lb/ton *	0.22	0.15	0.055	0.048	0.12
PM10 Permit Limit, lb/ton	--	--	--	--	0.036
Percent of Limit, %	--	--	--	--	> 100
<b>Nitrogen Oxides Data</b>					
Furnaces 7 & 8 Emission Factor, lb/ton	0.16	0.11	0.11	0.10	0.12
Permit Limit, lb/ton	--	--	--	--	0.115
Percent of Limit, %	--	--	--	--	>100
<b>Total Hydrocarbons (minus Methane) Data</b>					
Furnaces 7 & 8 Emission Factor, lb/ton	1.1	1.0	0.52	0.76	0.84
Permit Limit, lb/ton	--	--	--	--	0.939
Percent of Limit, %	--	--	--	--	90
<b>Sulfur Dioxide Data</b>					
Furnaces 7 & 8 Emission Factor, lb/ton	0.29	0.15	0.062	0.11	0.15
Permit Limit, lb/ton	--	--	--	--	0.080
Percent of Limit, %	--	--	--	--	> 100

\*PM10 is the summation of the filterable and condensable PM fractions.

**Table 2-3**  
**Process/Control System Data – Furnaces 7 & 8**

Run Number	Run 1	Run 2	Run 3	Run 4	Average
Date	7/11/18	7/11/18	7/12/18	7/12/18	--
Furnace 7 Feed Rate, lb/hr	6,527	10,946	8,272	10,121	8,966
Furnace 8 Feed Rate, lb/hr	8,469	9,364	8,674	10,850	9,339
Furnace 7 Flux Percentage, %	6.73	4.86	4.84	4.79	5.31
Furnace 8 Flux Percentage, %	5.83	4.94	4.33	4.66	4.94
Furnace 7 Cl <sub>2</sub> Feed, lb	350	352	463	591	439
Furnace 8 Cl <sub>2</sub> Feed, lb	372	526	315	275	372
Baghouse Inlet Temperature, °F	145	148	136	146	144
Lime Injection Rate, lb/hr	74.4	74.5	75.7	80.3	76.2

**Table 2-4**  
**Summary of Results – Furnace No. 7 Flue**

<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>	7/11/18	7/11/18	7/12/18	–
<b>Total Hydrocarbons (minus Methane) Data</b>				
Emission Factor, lb/hr	0.022	0.011	0.023	0.019
Permit Limit, lb/hr	--	--	--	0.027
Percent of Limit, %	--	--	--	69
<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>	7/11/18	7/11/18	7/12/18	--
Feed Rate, lb/hr	6,527	10,946	8,272	8,581

**Table 2-5**  
**Summary of Results – Furnace No. 8 Flue**

<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>	7/11/18	7/11/18	7/12/18	–
<b>Total Hydrocarbons (minus Methane) Data</b>				
Emission Factor, lb/hr	0.012	0.016	0.016	0.015
Permit Limit, lb/hr	--	--	--	0.049
Percent of Limit, %	--	--	--	30
<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>	7/11/18	7/11/18	7/12/18	–
Feed Rate, lb/hr	8,469	9,364	8,674	8,836

**Table 2-6**  
**Summary of Results – Furnace No. 2N Flue**

<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>7/10/18</b>	<b>7/10/18</b>	<b>7/10/18</b>	<b>–</b>
<b>Filterable Particulate Matter Data</b>				
Emission Rate, lb/hr	0.086	0.072	0.068	0.075
Permit Limit, lb/hr	--	--	--	0.043
Percent of Limit, %	--	--	--	> 100
<b>Particulate Matter &lt;10 Microns Data <sup>1</sup></b>				
Emission Rate, lb/hr	0.19	0.11	0.11	0.14
Permit Limit, lb/hr	--	--	--	0.315
Percent of Limit, %	--	--	--	43
<b>Nitrogen Oxides Data</b>				
Emission Rate, lb/hr	0.46	0.28	0.41	0.38
Permit Limit, lb/hr	--	--	--	0.253
Percent of Limit, %	--	--	--	> 100
<b>Total Hydrocarbons (minus Methane) Data</b>				
Emission Rate, lb/hr	0.17	0.30	0.18	0.21
Permit Limit, lb/hr	--	--	--	0.219
Percent of Limit, %	--	--	--	97
<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>7/10/18</b>	<b>7/10/18</b>	<b>7/10/18</b>	<b>–</b>
Feed Rate, lb/hr	17,411	17,787	20,801	18,666

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

**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
Oxygen/Carbon Dioxide	3A	Instrumental Analysis
Moisture Content	4	Volumetric / Gravimetric Analysis
Particulate Matter / Particulate Matter < 10 Microns	5 / 202	Isokinetic Sampling
Sulfur Dioxides	6C	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Dioxins / Furans	23 / ALT-034	Isokinetic Sampling
Total Hydrocarbons (Minus Methane)	25A	Instrumental Analysis
Hydrogen Chloride	26	Constant Rate Sampling
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 1-1 (for isokinetic sampling) and/or Figure 1-2 (measuring velocity alone) 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 (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) 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 3.11.

Integrated bag samples were collected for the CO<sub>2</sub> testing on the Furnace 8 Flue. The bags were analyzed onsite using a CO<sub>2</sub> analyzer.

### 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 balance to determine the amount of moisture condensed.

### 3.4 U.S. EPA Reference Test Methods 5 and 202 – Total Particulate Matter less than 10 Microns

The particulate matter and particulate matter less than 10 microns (filterable and condensable PM) testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 202. The complete sampling system consisted of a glass nozzle, glass-lined probe, pre-weighed quartz filter, coil condenser, un-weighed Teflon filter, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning train consisted of a coiled condenser and five (5) chilled impingers. The first, and second impingers were initially empty, the third contained 100 mL of de-ionized water, the fourth was initially empty and the last impinger contained 200-300 grams of silica gel. The PM testing on Baghouse 1 contained a 6<sup>th</sup> impinger that contained 200-300 grams of silica gel. The un-weighed 90 mm Teflon filter was placed between the second and third impingers. The probe liner heating system was maintained at a temperature of 248 ±25°F, and the impinger temperature was maintained at 68°F or less throughout testing. The temperature of the Teflon filter was maintained greater than 65°F but less than or equal to 85°F.

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. Condensate was collected in the first dry impinger, therefore the front-half of the sample train (the nozzle, probe, and heated pre-weighed filter) was removed in order to purge the back-half of the sample train (coil condenser, first and second impingers and CPM filter). A glass bubbler was inserted into the first impinger. If needed, de-ionized ultra-filtered (DIUF) water was added to the first impinger to raise the water level above the bubbler, then the coil condenser was replaced. Zero nitrogen was connected to the condenser, and a 60-minute purge at 14 liters per minute was conducted. After the completion of the nitrogen purge the impinger contents were measured for moisture gain.

The pre-weighed quartz filter was carefully removed and placed in container 1. 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 2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for filterable particulate matter analysis.

The contents of impingers 1 and 2 were recovered in container CPM Cont. #1. The back half of the filterable PM filter holder, the coil condenser, impingers 1 and 2 and all connecting glassware were rinsed with DIUF water and then rinsed with acetone, followed by hexane. The water rinses were added to container CPM Cont. #1 while the solvent rinses were recovered in container CPM Cont. #2. The Teflon filter was removed from the filter holder and placed in container CPM Cont. #3. The front half of the condensable PM filter holder was rinsed with DIUF water and then with acetone, followed by hexane. The water rinse was added to container CPM Cont. #1 while the solvent rinses were added to container CPM Cont. #2. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for condensable particulate matter analysis.

### 3.5 U.S. EPA Reference Test Method 6C – Sulfur Dioxide

The sulfur dioxide (SO<sub>2</sub>) testing was conducted in accordance with U.S. EPA Reference Test Method 6C. Data was collected online and reported in one-minute averages. The sampling system consisted of a heated stainless-steel probe, Teflon sample line(s), gas conditioning system and the identified analyzer. The gas conditioning system was a non-contact condenser used to remove moisture from the source 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 3.11.

### 3.6 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 3.11.

### 3.7 U.S. EPA Reference Test Method 23/Alternative Method 034 – Dioxins/Furans

The dioxins and furans (D/F) testing was conducted in accordance with U.S. EPA Reference Test Method 23 with guidance from Alternative Method 034. The sampling system consisted of a glass nozzle, heated glass-lined probe, glass filter holder with pre-cleaned heated glass-fiber filter, condenser coil, XAD sorbent module, gas conditioning train, pump and calibrated dry gas meter. The gas conditioning system consisted of six (6) chilled impingers. The first impinger was empty. The next two (2) impingers each contained 100 mL of water. The fourth impinger was empty while the fifth and sixth impingers were charged with 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at a temperature of 120 ± 14°C (248 ± 25°F), and the impinger temperature was maintained at 20°C (68°F) or less throughout testing.

All glassware leading to the XAD adsorbing resin trap was cleaned and sealed before mobilizing to the site. Glassware cleaning consisted of washing with warm soapy water and rinsing with distilled water and acetone. The sampling train was assembled in the sample recovery area. The glass-fiber filter was placed in a glass filter holder with a Teflon 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.

Following the completion of each test run, the sampling train was leak checked at vacuum pressure greater than or equal to the highest vacuum pressure observed during the run and the contents of the impingers were measured for moisture gain. The XAD sorbent module was sealed on both ends and placed on ice. The filter was removed from the filter holder and placed in sample container 1. The nozzle, probe liner, filter holder, condenser and all connecting glassware were triple-rinsed and brushed with acetone, and these rinses were recovered in sample container 2. All glassware cleaned for sample container 2 was also triple-rinsed with toluene and recovered into sample container 3. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

A field blank was collected after the first test run. A complete sampling system was placed at the sampling location and multiple leak checks were performed on the system similar to an actual testing scenario. The sample train was then moved to the mobile laboratory for recovery. A full set of reagent blanks including a filter and a trap were also submitted to the laboratory.

### **3.8 U.S. EPA Reference Test Method 25A – Total Hydrocarbon**

The total hydrocarbon (THC) testing was conducted in accordance with U.S. EPA Reference Test Method 25A. Data was collected online and reported in one-minute averages. The sampling system consisted of a stainless-steel probe, heated Teflon sample line(s) and the identified gas analyzer. Methane data was collected using an FID equipped with a methane cutter. The average methane data was subtracted from the THC to determine non-methane THC. The quality control measures are described in Section 3.12.

### **3.9 U.S. EPA Reference Test Method 26 – Hydrogen Chloride**

The hydrogen chloride (HCl) testing was conducted in accordance with U.S. EPA Reference Test Method 26. The complete sampling system consisted of a glass nozzle, heated glass-lined probe, heated Teflon 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 contained 100 mL of 0.1 N H<sub>2</sub>SO<sub>4</sub>, the third was initially empty and the fourth contained 200-300 grams of silica gel. The probe liner and filter heating systems were maintained at 248-273°F, and the impinger temperature was maintained at 20°C (68°F) or less 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 and the contents of the impingers were measured for moisture gain. The absorbing solution (0.1 N H<sub>2</sub>SO<sub>4</sub>) from the first and second impingers was placed into sample container 3. The back-half of the filter holder, first, second and third impingers and all glassware leading to the outlet of the third impinger were rinsed with de-ionized (DI) water. These rinses were also placed in container 3. All containers were sealed, labeled and liquid levels marked for transport to the identified laboratory for analysis.

### **3.10 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.

### **3.11 Quality Assurance/Quality Control – U.S. EPA Reference Test Methods 3A, 6C 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 High-Level gas. For the Calibration Error Test, Low, Mid, and High-Level calibration gases were sequentially introduced directly to the analyzer. 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 3% of the Calibration Span or 0.5 ppmv absolute difference. If the drift exceeded 3% or 0.5 ppmv, 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 at the completion of 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 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.



### 3.12 Quality Assurance/Quality Control – U.S. EPA Reference Test Method 25A

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.

Within two (2) hours prior to testing, zero gas was introduced through the sampling system to the analyzer. After adjusting the analyzer to the Zero gas concentration and once the analyzer reading was stable, the analyzer value was recorded. This process was repeated for the High-Level gas, and the time required for the analyzer reading to reach 95 percent of the gas concentration was recorded to determine the response time. Next, Low and Mid-Level gases were introduced through the sampling system to the analyzer, and the response was recorded when it was stable. All values were less than +/- 5 percent of the calibration gas concentrations.

Mid-Level gas was introduced through the sampling system. After the analyzer response was stable, the value was recorded. Next, zero gas was introduced through the sampling system, and the analyzer value recorded once it reached a stable response. The Analyzer Drift was less than +/- 3 percent of the span value.

A Data Acquisition System 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.