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SOURCE TESTING



## Source Test Report

Real Alloy Specification, Inc.  
368 West Garfield Avenue  
Coldwater, MI 49036  
(North)

Test Dates: May 22-25, 2018

AST Project No. 2018-0419

The  
**Alliance**  
Advantage



**1.0 Introduction**

Alliance Source Testing, LLC (AST) was retained by Real Alloy Specification, Inc. (RAS) to conduct compliance testing at the Coldwater (N), Michigan facility. The facility is subject to provisions of the 40 CFR 63, Subpart RRR and the Michigan Department of Environmental Quality (MDEQ) Operating Permit No. MI-ROP-N5957-2012e. Testing was conducted to determine the emission rates of the following parameters from the identified sources.

<i>Source Name</i>	<i>Source ID</i>	<i>Target Parameters</i>
Furnace No. 1N Sidewell (BH2)	EUALFURN1	PM, HCl, Cl <sub>2</sub> , D/F, NO <sub>x</sub> , SO <sub>2</sub> , PM <sub>10</sub> , THC, PM <sub>10</sub>
Furnace No. 1N Flue	SVALFURN1	PM, PM <sub>10</sub> , HCl, HF, Cl <sub>2</sub> , NO <sub>x</sub> , THC
Shredder	EUALSHREDDER	PM, PM <sub>10</sub> , THC
Thermal Chip Dryer	EUALDRYER3	PM, PM <sub>10</sub> , THC, D/F, NO <sub>x</sub> , SO <sub>2</sub>
1Dross Cooler	EUALDROSS	PM

Testing on the Thermal Chip Dryer was conducted concurrently on two (2) baghouse exhaust stacks – Dryer Afterburner and Shredder/Dryer Fugitive. Primary off gas from the dryer is routed through an afterburner and then to a baghouse for control. A series of hoods collect fugitive gases from the dryer seals. The dryer fugitive ductwork combines with the shredder ductwork. The combined gases are routed to a common baghouse for control. Due to ductwork configuration, inlet testing to determine percent contribution from the dryer fugitive gases and the shredder gases was not possible. Therefore, all emissions exhausting from the Shredder/Dryer Fugitive baghouse stack was assumed to be from the Dryer and from the Shredder system. To determine the total emission rate of pollutants from the Thermal Chip Dryer, emission rates from the Afterburn stack and Shredder/Fugitive stack were combined.

**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 Reverberatory Furnace #1N is designed as sidewell melter/holder unit. The reverberatory furnace is 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 lined crucibles or cast into ingot. To capture process emissions, the reverberatory furnace was built with hooding systems over the side wells. To control process emissions, the exhaust from the capture hood is ducted to lime-injected baghouse systems. In addition, the reverberatory furnace is equipped with a flue stack to discharge the products of natural gas combustion to the atmosphere.

The thermal chip dryer is used to remove lubricants from turnings and chips. The scrap is charged into the thermal chip dryer via a conveyor belt where hot combustion gases volatilize and burn-off the lubricant. The turnings and chips can then be charged directly into the sidewell of the reverberatory furnaces. The thermal chip dryer uses a

series of ducts to capture the emissions. To control process emissions, off gas first flows through an afterburner, then exhausts to a baghouse system. In addition, multiple hoods are used to capture fugitive dryer emissions, and these emissions are routed to a baghouse system for control.

The shredding mill is used to properly size and remove non-aluminum materials from the scrap. These emissions are routed to a baghouse system for control. The gross handling and loadout equipment are equipped with a baghouse system for control.

### 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 Doug Bryant
<b>Regulatory Personnel</b>	Dave Patterson Rex Lane Cody Yazzie
<b>AST Personnel</b>	Kenji Kinoshita Pete Merranko Justin Bernard Ben Updegrave Tyler Branca Keith Rhodes Brendan Price

### 1.4 Site Specific Test Plan & Notification

Testing was conducted in accordance with the Site-Specific Test Plan (SSTP) submitted to the Michigan Department of Environmental Quality (DEQ) on March 23, 2018.

### 1.5 Test Program Notes

Shredder/Dryer Run 2 was voided on May 22, 2018 due to production issues (low throughput not representative of the maximum capacity of the equipment); an additional test run was completed, and compliance was based on the average of three (3) valid test runs. Voided test run data is provided in Appendix G – Voided Data.

The Furnace 2N Flue was not testing as listed in the SSTP due to time constraints. Notification was submitted to MDEQ for testing Furnace 2N Flue in July 2018.

## 2.0 Summary of Results

AST conducted compliance testing at the RAS facility in Coldwater (N), Michigan on May 22-25, 2018. Testing was conducted to determine the emission rates of the following parameters from the identified sources.

Source Name	Source ID	Target Parameters
Furnace No. 1N Sidewell (BH2)	EUALFURN1	PM, HCl, Cl <sub>2</sub> , D/F, NO <sub>x</sub> , SO <sub>2</sub> , PM10, THC, PM10
Furnace No. 1N Flue	SVALFURN1	PM, PM10, HCl, HF, Cl <sub>2</sub> , NO <sub>x</sub> , THC
Shredder	EUALSHREDDER	PM, PM10, THC
Thermal Chip Dryer	EUALDRYER3	PM, PM10, THC, D/F, NO <sub>x</sub> , SO <sub>2</sub>
Dross Cooler	EUALDROSS	PM

Tables 2-1 through 2-5 provide summaries of the emission testing results with comparisons to the applicable NESHAP and/or state permit limits. Table 2-6 provides a summary of the process operating and control system data collected during testing for each unit. 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 - Shredder**

Run Number	Run 1	Run 2	Run 3	Average
Date	5/22/18	5/22/18	5/23/18	--
<b>Filterable Particulate Matter Data</b>				
Concentration, grain/dscf	0.0012	0.00089	0.00023	0.00077
NESHAP Emission Limit, grain/dscf	--	--	--	0.010
Percent of Limit, %	--	--	--	8
Emission Factor, lb/ton	0.029	0.019	0.0045	0.018
<b>Particulate Matter &lt;10 Microns Data</b>				
Emission Factor, lb/ton <sup>1</sup>	0.034	0.025	0.0090	0.023
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.095
Percent of Limit, %	--	--	--	24
<b>Total Hydrocarbon Data</b>				
Emission Factor, lb/ton	0.013	0.052	0.011	0.025
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.540
Percent of Limit, %	--	--	--	5

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

**Table 2-2**  
**Summary of Results – Thermal Chip Dryer**

Run Number	Run 1	Run 3	Run 4	Average
Date	5/22/18	5/22/18	5/23/18	--
<b>Dioxin/Furan Data <sup>1</sup></b>				
Thermal Chip Dryer Emission Factor, grain/ton	4.2E-06	2.8E-06	2.4E-06	3.1E-06
Dryer Fugitive Emission Factor, grain/ton	8.9E-07	1.3E-06	1.3E-06	1.2E-06
Combined Emission Factor, grain/ton	5.1E-06	4.1E-06	3.7E-06	4.3E-06
NESHAP Emission Limit, grain/ton	--	--	--	3.5E-05
Percent of Limit, %	--	--	--	12
<b>Total Hydrocarbon Data</b>				
Thermal Chip Dryer Emission Factor, lb/ton	0.0056	0.0069	0.0021	0.0048
Dryer Fugitive Emission Factor, lb/ton	0.050	0.22	0.035	0.10
Combined Emission Factor, lb/ton	0.055	0.22	0.037	0.11
NESHAP Emission Limit, lb/ton	--	--	--	0.80
Percent of Limit, %	--	--	--	13
<b>Particulate Matter &lt;10 Microns Data <sup>2</sup></b>				
Thermal Chip Dryer Emission Factor, lb/ton	0.29	0.28	0.25	0.28
Dryer Fugitive Emission Factor, lb/ton	0.13	0.11	0.030	0.088
Combined Emission Factor, lb/ton	0.42	0.38	0.28	0.36
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.39
Percent of Limit, %	--	--	--	93
<b>Nitrogen Oxides Data</b>				
Thermal Chip Dryer Emission Factor, lb/ton	0.61	0.55	0.47	0.55
Dryer Fugitive Emission Factor, lb/ton	0.011	0.016	0.023	0.017
Combined Emission Factor, lb/ton	0.62	0.57	0.49	0.56
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.578
Percent of Limit, %	--	--	--	97
<b>Sulfur Dioxide Data</b>				
Thermal Chip Dryer Emission Factor, lb/ton	0.031	0.020	0.0026	0.018
Shredder Emission Factor, lb/ton	0.037	0.025	0.0076	0.023
Combined Emission Factor, lb/ton	0.068	0.045	0.010	0.041
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.070
Percent of Limit, %	--	--	--	59

<sup>1</sup> D/F TEQ values were calculated using 1989 NATO TEFs.

<sup>2</sup> PM10 Data is the summation of the filterable PM and condensable PM fractions.

**Table 2-3  
Summary of Results – Furnace 1N (BH2)**

Run Number	Run 1	Run 2	Run 3	Average
Date	5/23/18	5/23/18	5/23/18	--
<b>Filterable Particulate Matter Data</b>				
Emission Factor, lb/ton	0.026	0.051	0.046	0.041
NESHAP Emission Limit, lb/ton	--	--	--	0.40
Percent of Limit, %	--	--	--	10
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.012
Percent of Limit, %	--	--	--	>100
<b>Particulate Matter &lt;10 Microns Data</b>				
Emission Factor, lb/ton <sup>1</sup>	0.042	0.064	0.064	0.057
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.034
Percent of Limit, %	--	--	--	>100
<b>Dioxin/Furan Data</b>				
Emission Factor, grain TEQ/ton <sup>2</sup>	6.7E-06	9.4E-06	8.7E-06	8.3E-06
NESHAP Limit, grain TEQ/ton	--	--	--	2.1E-04
Percent of Limit, %	--	--	--	4
<b>Hydrogen Chloride Data</b>				
Emission Factor, lb/ton <sup>3</sup>	0.0012	0.0011	0.0011	0.0011
NESHAP Emission Limit, lb/ton	--	--	--	0.40
Percent of Limit, %	--	--	--	<1
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.35
Percent of Limit, %	--	--	--	<1
<b>Chlorine Data <sup>3</sup></b>				
Emission Factor, lb/ton	0.0012	0.0012	0.0011	0.0012
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.659
Percent of Limit, %	--	--	--	<1
<b>Nitrogen Oxides Data</b>				
Emission Factor, lb/ton	0.039	0.033	0.043	0.038
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.205
Percent of Limit, %	--	--	--	19
<b>Sulfur Dioxide Data</b>				
Emission Factor, lb/ton	0.018	0.063	0.063	0.048
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.149
Percent of Limit, %	--	--	--	32
<b>Total Hydrocarbon (minus methane) Data</b>				
Emission Factor, lb/ton	0.15	0.18	0.24	0.19
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.304
Percent of Limit, %	--	--	--	63

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

<sup>2</sup> D/F TEQ values were calculated using 1989 NATO TEFs.

<sup>3</sup> The laboratory results for HCl and Cl2 for all runs were below the detection limit. The detection limit was used for emission calculation purposes.

**Table 2-4  
Summary of Results – Furnace 1N Flue**

Run Number	Run 1	Run 2	Run 3	Average
Date	5/23/18	5/24/18	5/24/18	--
<b>Filterable Particulate Matter Data</b>				
Emission Factor, lb/ton	0.49	0.21	0.10	0.26
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.524
Percent of Limit, %	--	--	--	<b>50</b>
<b>Particulate Matter &lt;10 Microns Data <sup>1</sup></b>				
Emission Factor, lb/ton	1.2	0.76	0.27	0.74
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.530
Percent of Limit, %	--	--	--	<b>&gt;100</b>
<b>Hydrogen Chloride Data</b>				
Emission Factor, lb/ton	0.38	0.76	0.66	0.60
MDEQ Permit Emission Limit, lb/ton	--	--	--	1.608
Percent of Limit, %	--	--	--	<b>37</b>
<b>Hydrogen Fluoride Data</b>				
Emission Factor, lb/ton	0.030	0.016	0.015	0.021
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.098
Percent of Limit, %	--	--	--	<b>21</b>
<b>Chlorine Data</b>				
Emission Factor, lb/ton	0.0025	0.0041	0.0026	0.0031
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.055
Percent of Limit, %	--	--	--	<b>6</b>
<b>Nitrogen Oxides Data</b>				
Emission Factor, lb/ton	0.170	0.183	0.174	0.176
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.176
Percent of Limit, %	--	--	--	<b>100</b>
<b>Total Hydrocarbon (minus methane) Data</b>				
Emission Factor, lb/ton	0.015	0.015	0.011	0.014
MDEQ Permit Emission Limit, lb/ton	--	--	--	0.021
Percent of Limit, %	--	--	--	<b>66</b>

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

**Table 2-5**  
**Summary of Results – Dross Cooler**

Run Number	Run 1	Run 2	Run 3	Average
Date	5/25/18	5/25/18	5/25/18	--
<b>Filterable Particulate Matter Data</b>				
Emission Rate, lb/hr	0.36	0.34	0.49	0.39
Emission Factor, lb/1,000 lb exhaust gases	0.0027	0.0026	0.0038	0.0030
MDEQ Permit Emission Limit, lb/1,000 lb exhaust gases	--	--	--	0.10
Percent of Limit, %	--	--	--	3



**Table 2-6  
Process/Control System Data**

Run Number	Run 1	Run 3	Run 5	Average
Date	5/22/18	5/22/18	5/23/18	--
<b>Shredder</b>				
Feed Rate, lb/hr	20,513	24,318	26,835	23,889
<b>Thermal Chip Dryer</b>				
Feed Rate, lb/hr	5,418	5,840	8,099	6,452
AB Baghouse Inlet Temperature, °F	391	376	383	383
Fugitive Baghouse Inlet Temperature, °F	90	86	104	93
AB Combustion Temperature, °F	1,496	1,405	1,429	1,443
Run Number	Run 1	Run 2	Run 3	Average
Date	5/23/18	5/24/18	5/24/18	--
<b>Furnace No. 1 (BH2)</b>				
Feed Rate, lb/hr	16,119	13,979	17,820	15,972
Flux Percent, %	5.6	5.3	5.5	5.5
Cl <sub>2</sub> Feed, lb	291	407	370	356
Lime Injection Rate, lb/hr	120.4	123.9	109.8	118.0
Baghouse Inlet Temperature, °F	110	108	114	111
<b>Furnace No. 1 Flue</b>				
Feed Rate, lb/hr	16,119	13,979	17,820	15,972
Run Number	Run 1	Run 2	Run 3	Average
Date	5/25/18	5/25/18	5/25/18	--
<b>Dross Cooler</b>				
Feed Rate, lb/hr	40,909	40,369	39,083	40,120
1000 lb exhaust gases/hr	133	129	128	130

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### 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 Dioxide	6C	Instrumental Analysis
Nitrogen Oxides	7E	Instrumental Analysis
Dioxins / Furans	23 / ALT-034	Isokinetic Sampling
Total Hydrocarbons	25A	Instrumental Analysis
Hydrogen Chloride, Hydrogen Fluoride, Chlorine	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.

The O<sub>2</sub> and CO<sub>2</sub> concentration were assumed to be ambient for molecular weight and volumetric flow rate calculations for the Dross Cooler.

#### 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.

### **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**

The total particulate matter (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 four (4) chilled impingers. The first, and second impingers were initially empty, the third contained 100 mL of de-ionized water and the last impinger 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  $248 \pm 25^\circ\text{F}$ , and the impinger temperature was maintained at  $68^\circ\text{F}$  or less throughout testing. The temperature of the Teflon filter was maintained greater than  $65^\circ\text{F}$  but less than or equal to  $85^\circ\text{F}$ .

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 five (5) 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 impinger was 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 concentrations at the Furnace 1N (BH2) exhaust were quantified using a FID equipped with a methane cutter. The average methane concentration was subtracted from the THC to determine the THC (minus methane) concentration. For all other sample locations, methane concentrations were assumed to be zero. The quality control measures are described in Section 3.12.

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

The hydrogen chloride (HCl), hydrogen fluoride (HF) and chlorine (Cl<sub>2</sub>) 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 and fourth impingers contained 100 mL of 0.1N NaOH and the fifth 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 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 pre-weighed Teflon filter was carefully removed and placed in container 1. The probe and nozzle were rinsed and brushed three (3) times with acetone to remove any adhering particulate matter and these rinses placed in container 2. The front half of the filter holder was rinsed three (3) times with acetone and this rinse was added to container 2. 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. The absorbing solution (0.1 N NaOH) from the third and fourth impingers was placed into sample container 4. The third and fourth impingers and all associated glassware were rinsed with DI water and the rinses were added to container 4. Containers 1-2 were sealed, labeled and liquid levels marked for transport to the identified laboratory for particulate analysis. Container 3 was sealed, labeled and liquid levels marked for transport to the identified laboratory for halide analysis. Container 4 was sealed, labeled and liquid levels marked for transport to the identified laboratory for halogen 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.