

## 1.0 Introduction

Alliance Technical Group, LLC (Alliance) was retained by Real Alloy Recycling, Inc (RAR) to conduct compliance testing at the Coldwater, Michigan (MI) South Plant. Portions of the facility are subject to provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Secondary Aluminum Production facilities as detailed in 40 CFR 63, Subpart RRR and the Michigan Department of Environment, Great Lakes and Energy (EGLE) Title V Permit No MI-ROP-N5957-2022. Testing on Rotary Furnaces 1 and 2 was conducted to determine the emission rates of particulate matter (PM), particulate matter less than 10 microns (PM10), particulate matter less than 2.5 microns (PM2.5), sulfur dioxide (SO<sub>2</sub>), hydrogen chloride (HCl), nitrogen oxides (NO<sub>x</sub>), dioxins and furans (D/F), and total hydrocarbons minus methane (THC)/non-methane hydrocarbons (NMHC). Testing for NO<sub>x</sub>, NMHC, PM, PM10, PM2.5 and HCl was conducted during the dross condition. Testing for SO<sub>2</sub> and D/F was conducted during the scrap condition.

Testing was conducted at the inlet ducts for Rotary Furnaces 1 and 2 for D/F and HCl to determine the percent each furnace contributed to the baghouse exhaust emissions. That contribution was applied to the outlet emission emissions of D/F and HCl to demonstrate compliance with the NESHAP emission limits.

## 1.1 Facility Description

RAR 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 and/or specification 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 poured into 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 a lime reagent injected baghouse system for control of the regulated pollutants. The emission control system injects the lime 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.

**1.3 Project Team**

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

**Table 1-1: Project Team**

|                             |  |
|-----------------------------|--|
| <b>Facility Personnel</b>   | David Likens<br>Jennifer Zavoda<br>Trevor Drost  |
| <b>Regulatory Personnel</b> | Amanda Cross   |
| <b>Alliance Personnel</b>   | Kenji Kinoshita<br>Matthew Fulton<br>Michael Gray<br>Dennis Haynes<br>Lucas Kovach<br>Austin Mayfield<br>Tyler Wyatt |

**1.4 Site Specific Test Plan & Notification**

Testing was conducted in accordance with the site specific test protocol submitted to EGLE on May 19, 2023 and revised on July 5, 2023. .

**1.5 Test Program Notes**

Run 1 of the dross condition on July 11, 2023 was voided due to non-representative operating conditions. An additional test run was completed on July 12, 2023.

**2.0 Summary of Results**

Alliance conducted compliance testing at the RAR facility in Coldwater, MI on July 11-13, 2023. Testing consisted of determining the emission rates of PM, PM10, PM2.5, SO<sub>2</sub>, HCl, NO<sub>x</sub>, D/F, NMHC at the exhaust of Rotary Furnaces 1 & 2.

Tables 2-1 through 2-3 provide summaries of the emission testing results with comparisons to the applicable EGLE Title V Permit No. MI-ROP-N5957-2022 and NESHAP, Subpart RRR limits. Table 2-4 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 – Rotary Furnace 1 (EUMROT FURN1)

| Run Number                                      | Run 2   | Run 3   | Run 4   | Average |
|---|---------|---------|---------|---------|
| Date  | 7/11/23 | 7/12/23 | 7/12/23 | --      |
| <b>Filterable Particulate Matter Data</b>       |         |         |         |         |
| Emission Factor, lb/ton                         | 0.22    | 0.14    | 0.090   | 0.15    |
| NESHAP Limit, lb/ton                            | --      | --      | --      | 0.4     |
| Percent of Limit, %                             | --      | --      | --      | 37      |
| <b>Hydrogen Chloride Data</b>                   |         |         |         |         |
| Emission Factor, lb/ton                         | 0.057   | 0.094   | 0.0085  | 0.053   |
| NESHAP Limit, lb/ton                            | --      | --      | --      | 0.4     |
| Percent of Limit, %                             | --      | --      | --      | 13      |
| EGLE Limit, lb/ton                              | --      | --      | --      | 0.080   |
| Percent of Limit, %                             | --      | --      | --      | 66      |
| Run Number                                      | Run 1   | Run 2   | Run 3   | Average |
| Date  | 7/13/23 | 7/13/23 | 7/13/23 | --      |
| <b>Dioxin/Furan Data</b>                        |         |         |         |         |
| TEQ Emission Factor, grain TEQ/ton <sup>1</sup> | 5.0E-05 | 9.3E-05 | 4.1E-05 | 6.2E-05 |
| NESHAP Limit, grain TEQ/ton                     | --      | --      | --      | 2.1E-04 |
| Percent of Limit, %                             | --      | --      | --      | 29      |

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

Table 2-2: Summary of Results – Rotary Furnace 2 (EUMROT FURN2)

| Run Number                                      | Run 2   | Run 3   | Run 4   | Average |
|---|---------|---------|---------|---------|
| Date  | 7/11/23 | 7/12/23 | 7/12/23 | --      |
| <b>Filterable Particulate Matter Data</b>       |         |         |         |         |
| Emission Factor, lb/ton                         | 0.22    | 0.13    | 0.090   | 0.15    |
| NESHAP Limit, lb/ton                            | --      | --      | --      | 0.4     |
| Percent of Limit, %                             | --      | --      | --      | 37      |
| <b>Hydrogen Chloride Data</b>                   |         |         |         |         |
| Emission Factor, lb/ton                         | 0.030   | 0.130   | 0.0066  | 0.055   |
| NESHAP Limit, lb/ton                            | --      | --      | --      | 0.4     |
| Percent of Limit, %                             | --      | --      | --      | 14      |
| EGLE Limit, lb/ton                              | --      | --      | --      | 0.080   |
| Percent of Limit, %                             | --      | --      | --      | 69      |
| Run Number                                      | Run 1   | Run 2   | Run 3   | Average |
| Date  | 7/13/23 | 7/13/23 | 7/13/23 | --      |
| <b>Dioxin/Furan Data</b>                        |         |         |         |         |
| TEQ Emission Factor, grain TEQ/ton <sup>1</sup> | 5.2E-05 | 9.8E-05 | 3.0E-04 | 1.5E-04 |
| NESHAP Limit, grain TEQ/ton                     | --      | --      | --      | 2.1E-04 |
| Percent of Limit, %                             | --      | --      | --      | 71      |

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

Table 2-3: Summary of Results – Rotary Furnaces Baghouse Exhaust (SVIMROT1/2)

| Run Number                                  | Run 2   | Run 3   | Run 4   | Average |
|---|---------|---------|---------|---------|
| Date  | 7/11/23 | 7/12/23 | 7/12/23 | --      |
| <b>Filterable Particulate Matter Data</b>   |         |         |         |         |
| Emission Factor, lb/ton                     | 0.11    | 0.068   | 0.045   | 0.075   |
| EGLE Limit, lb/ton                          | --      | --      | --      | 0.4     |
| Percent of Limit, %                         | --      | --      | --      | 19      |
| <b>PM10/PM2.5 Matter Data</b>               |         |         |         |         |
| Emission Factor, lb/ton                     | 0.41    | 0.27    | 0.094   | 0.26    |
| EGLE Limit, lb/ton                          | --      | --      | --      | 0.5     |
| Percent of Limit, %                         | --      | --      | --      | 52      |
| <b>Nitrogen Oxides Data</b>                 |         |         |         |         |
| Emission Factor, lb/ton                     | 0.46    | 0.42    | 0.31    | 0.39    |
| EGLE Limit, lb/ton                          | --      | --      | --      | 0.6     |
| Percent of Limit, %                         | --      | --      | --      | 66      |
| <b>Non Methane Hydrocarbons Data</b>        |         |         |         |         |
| Emission Factor, lb/ton                     | 0.092   | 0.058   | 0.039   | 0.063   |
| EGLE Limit, lb/ton                          | --      | --      | --      | 0.9     |
| Percent of Limit, %                         | --      | --      | --      | 7       |
| <b>Hydrogen Chloride Data</b>               |         |         |         |         |
| Emission Factor, lb/ton                     | 0.044   | 0.11    | 0.0075  | 0.054   |
| EGLE Limit, lb/ton                          | --      | --      | --      | 0.080   |
| Percent of Limit, %                         | --      | --      | --      | 68      |
| Run Number                                  | Run 1   | Run 2   | Run 3   | Average |
| Date  | 7/13/23 | 7/13/23 | 7/13/23 | --      |
| <b>Dioxin/Furan Data</b>                    |         |         |         |         |
| Emission Factor, grain TEQ/ton <sup>1</sup> | 5.1E-05 | 9.6E-05 | 1.7E-04 | 1.0E-04 |
| EGLE Limit, grain TEQ/ton                   | --      | --      | --      | 2.1E-04 |
| Percent of Limit, %                         | --      | --      | --      | 50      |
| <b>Sulfur Dioxide Data</b>                  |         |         |         |         |
| Emission Factor, lb/ton                     | 0.15    | 0.15    | 0.30    | 0.20    |
| EGLE Limit, lb/ton                          | --      | --      | --      | 1.0     |
| Percent of Limit, %                         | --      | --      | --      | 20      |

<sup>1</sup> PM10/PM2.5 data is the summation of the filterable and condensable PM fractions. All filterable PM is assumed to be equivalent to filterable PM10 and filterable PM2.5

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

**Table 2-4: Summary of Process Data**

| <b>Process Operating / Control System Data – Dross Condition</b> |              |              |              |                |
|--|--------------|--------------|--------------|----------------|
| <b>Run Number</b>  | <b>Run 2</b> | <b>Run 3</b> | <b>Run 4</b> | <b>Average</b> |
| <b>Date</b>  | 7/11/23      | 7/12/23      | 7/12/23      | --             |
| RF 1 Feed Rate, lb/hr  | 14,212       | 14,195       | 14,187       | 14,198         |
| RF 2 Feed Rate, lb/hr  | 14,243       | 14,834       | 14,052       | 14,376         |
| RF 1 Flux Percent, %   | 21.91        | 33.90        | 27.53        | 27.78          |
| RF 2 Flux Percent, %   | 21.83        | 33.34        | 27.00        | 27.39          |
| Lime Injection Rate, lb/hr                                       | 175.0        | 159.6        | 174.6        | 169.7          |
| <b>Process Operating / Control System Data – Scrap Condition</b> |              |              |              |                |
| <b>Run Number</b>  | <b>Run 1</b> | <b>Run 2</b> | <b>Run 3</b> | <b>Average</b> |
| <b>Date</b>  | 7/13/23      | 7/13/23      | 7/13/23      | --             |
| RF 1 Feed Rate, lb/hr  | 14,376       | 14,633       | 14,793       | 14,601         |
| RF 2 Feed Rate, lb/hr  | 16,644       | 15,618       | 14,164       | 15,475         |
| Baghouse Inlet Temperature, °F + 25°                             | 263          | 284          | 284          | 277            |

### 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                               | Gravimetric Analysis    |
| Total Particulate Matter              | 5/202                           | Isokinetic Sampling     |
| Sulfur Dioxide                        | 6C                              | Instrumental Analysis   |
| Nitrogen Oxides                       | 7E                              | Instrumental Analysis   |
| Dioxins / Furans                      | 23/ALT-034                      | Isokinetic Sampling     |
| Non-Methane Hydrocarbons              | 25A                             | Instrumental Analysis   |
| Hydrogen Chloride & Hydrogen Fluoride | 26                              | Constant Rate Sampling  |
| Gas Dilution System Certification     | 205                             | ---                     |

#### 3.1 U.S. EPA Reference Test Methods 1 and 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. To determine the minimum number of traverse points, the upstream and downstream distances were equated into equivalent diameters and compared to Figure 1-1 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 3/3A. One (1) integrated Tedlar bag sample was collected during each test run. The bag samples were analyzed on site with a gas analyzer. The remaining stack gas constituent was assumed to be nitrogen for the stack gas molecular weight determination. 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 will consist of a series of chilled impingers. Prior to testing, each impinger was filled with a known quantity of water or silica gel. 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 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 ( $\text{SO}_2$ ) 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 ( $\text{NO}_x$ ) 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 Teflon 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 contained XAD trap, and the second 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  $120 \pm 14^{\circ}\text{C}$  ( $248 \pm 25^{\circ}\text{F}$ ), and the impinger temperature was maintained at  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ ) 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.

### **3.8 U.S. EPA Reference Test Method 25A– Non-Methane Hydrocarbons**

The total hydrocarbons (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. The quality control measures are described in Section 3.12.

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

The hydrogen chloride and hydrogen fluoride testing was conducted in accordance with U.S. EPA Reference Test Methods 5 and 26A. The complete sampling system consisted of a glass nozzle, heated glass-lined probe, pre-weighed 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  $\text{H}_2\text{SO}_4$ , 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  $248\text{-}273^{\circ}\text{F}$ , and the impinger temperature was maintained at  $20^{\circ}\text{C}$  ( $68^{\circ}\text{F}$ ) 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. 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.

### **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, 7E, and 10**

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 ppmv/% (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 ppmv/% (whichever was less restrictive) was recorded. If the Low-Level gas was zero gas, the response was 0.5 ppmv/% 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 percent of the Calibration Span or 0.5 ppmv/% absolute difference. If the drift exceeded 3 percent 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 percent or 0.5 ppmv/0.3% (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 percent or 1.0 ppmv/0.5% 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 percent or 1.0 ppmv/0.5% 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 and 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 Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance'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 Alliance server. All data was reviewed by the Field Team Leader before leaving the facility. Once arriving at Alliance's office, all written and electronic data was relinquished to the report coordinator and then a final review was performed by the Project Manager.