

**CERAMIC FILTRATION UNITS  
114 AND 117  
VERIFICATION OF EMISSION  
FACTORS  
TEST REPORT**

**HOLLINGSWORTH & VOSE  
FIBER COMPANY**

*Prepared for:*



**Hollingsworth  
& Vose**

Hollingsworth & Vose Fiber Company  
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*Prepared by:*



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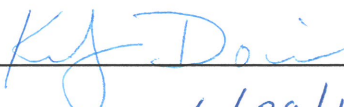
Report Date:  
June 29, 2018

## CERTIFICATION OF REPORT INTEGRITY

Bison Engineering, Inc. certifies that this report represents the emissions tested at the Hollingsworth & Vose facility located in Corvallis, Oregon. Every effort was made to obtain accurate and representative data according to the emission testing requirements of the methods employed.

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Date: \_\_\_\_\_ 6/29/18 \_\_\_\_\_



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## 1.0 INTRODUCTION

### 1.1 Introduction, Project Objective and Summary

Bison Engineering, Inc. (Bison) was retained by Hollingsworth & Vose (H&V) to perform emissions testing for emission factor verification on two newly installed ceramic filtration units (CFUs) at their glass fiber manufacturing facility located in Corvallis, Oregon. Bison conducted testing at Glass Plant 2, CFUs 114 (Flame Blown) and 117 (Rotary Fine). Testing was performed according to the approved pretest protocol submitted to Oregon Department of Environmental Quality (ODEQ) on April 17, 2018. Emissions factor verification was conducted pursuant to State of Oregon Mutual Agreement Order #AQ/V-WR-15-132, Addendum No. 2, signed on April 19, 2017. Testing strictly followed EPA methodologies found in 40 CFR 60, Appendix A and the State of Oregon Department of Environmental Quality Source Sampling Manual Volume I, April 2015 Edition. The following pollutants were quantified: particulate matter (PM), oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO), non-methane volatile organic compounds (VOCs), total fluorides, hydrogen fluoride (HF), formaldehyde and metals. Oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) levels were also measured for molecular weight determination. The table below describes the test methods used to determine pollutant emission rates.

**Table 1: Test Matrix**

| Hollingsworth & Vose<br>Emissions Factor Verification Testing |            |                                                                    |                                       |
|---------------------------------------------------------------|------------|--------------------------------------------------------------------|---------------------------------------|
| Sources                                                       | Method     | Parameter                                                          | Comments                              |
| CFU 114<br>(Flame Blown)                                      | Method 1   | Measurement Locations                                              | Determined prior to testing           |
|                                                               | Method 2   | Volumetric Flow                                                    | Concurrent with each test run         |
|                                                               | Method 3A  | Molecular Weight, O <sub>2</sub> and CO <sub>2</sub> Determination |                                       |
|                                                               | Method 4   | Moisture                                                           | Incorporated with Method 5            |
|                                                               | Method 5   | Particulate Matter (with Oregon back-half)                         | Three 120-minute test runs per source |
|                                                               | Method 7E  | NO <sub>x</sub>                                                    | Three 60-minute test runs per source  |
|                                                               | Method 10  | CO                                                                 |                                       |
|                                                               | Method 13B | Total Fluorides                                                    |                                       |
|                                                               | Method 25A | Non-Methane VOCs                                                   |                                       |
|                                                               | Method 26A | Hydrogen Fluoride                                                  |                                       |
| CFU 117<br>(Rotary Fine)                                      | Method 29  | Specific Metals                                                    | Three 180-minute test runs per source |
|                                                               | Method 30B | Mercury (Hg)                                                       |                                       |
|                                                               | Method 316 | Formaldehyde                                                       | Three 120-minute test runs per source |

## **1.2 Test Program Organization**

The following personnel were on-site during the emissions test or were associated with the project.

### **1.2.1 Bison Engineering, Inc.**

Onsite testing was led by David Blankenship, QI, Helena Source Team Lead. Other team members were Adam Bender, Environmental Scientist; Kellen Sullivan, Environmental Scientist; Robert Rogge, Staff Engineer; and Chris Whitten, Environmental Technician. Ms. Dorsi served as project manager, processed the test data and authored this report. Bo Wilkins, QSTI, Environmental Scientist, performed a final quality assurance review of the data and test report. The primary contact for this report is:

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### **1.2.2 Hollingsworth & Vose**

Ms. Anita Ragan is the primary contact for H&V. Ms. Ragan was present onsite for the duration of the testing. H&V staff members were responsible for monitoring process parameters during testing.

Anita Ragan, EHS Manager  
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### **1.2.3 Maul Foster & Alongi, Inc. (MFA)**

Chad Darby is the primary contact for MFA. MFA representatives organized and provided process data to Bison.

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#### **1.2.4 Oregon Department of Environmental Quality**

Ms. Suzanne Blackburn is the primary ODEQ contact for this project. Ms. Blackburn was present onsite to observe testing.

Suzanne Blackburn  
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## **2.0 SOURCE DESCRIPTION**

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### **2.1 Facility Description**

H&V owns and operates two glass fiber manufacturing facilities located in Corvallis, Oregon. H&V manufactures specialty glass fiber for use in air and liquid filtration media and in batteries. A detailed facility and emission source description was included as part of the pretest protocol and will not be repeated here. H&V is currently in the process of converting emission controls on the glass melt furnace and all fiberizers from wet scrubbers to ceramic filtration units (CFUs). The results presented in this report are intended to verify emission factors for rotary fine and flame blown fiberizer production.

### **2.2 Emission Sources Descriptions**

The following sections describe the source testing locations for this campaign.

#### **2.2.1 CFU 114 – Glass Plant 2 (GP2)**

Stack diameter: 36 inches  
Distance A (Method 1): 45 inches (1.25 duct diameters)  
Distance B (Method 1): 134 inches (3.72 duct diameters)  
Port depth: 4 inches  
Number of traverse points utilized: 24

This unit controls the Flame Blown process. Testing was conducted on the vertical outlet stack using two orthogonal ports. The ports were accessed using scaffolding.

#### **2.2.2 CFU 117 – GP2**

Stack diameter: 30 inches  
Distance A (Method 1): 42 inches (1.40 duct diameters)  
Distance B (Method 1): 152 inches (5.07 duct diameters)  
Port depth: 4 inches  
Number of traverse points utilized: 20

CFU 117 is also located at GP2. The Rotary Fine process was tested on this stack. Two orthogonal sampling ports are located on vertical ductwork accessed via scaffolding.

## 3.0 EMISSION TEST RESULTS

### 3.1 Summary of Results

The following tables summarize the run schedule and test results for both sources. Additional material, including raw data, example calculations and calibration records, can be found in the appendices to this report.

All isokinetic test methods were performed individually using separate trains. Methods 25A, 10 and 7E for VOCs, CO and NO<sub>x</sub> were always run concurrent to Methods 5 and 316. Thus, formaldehyde results could be added to total VOCs results from Method 25A. Methods 26A and 13B, both fluoride methods, were always run concurrently using opposing ports. Methods 29 and 30B for speciated metals and mercury were also run concurrently. Table 2 presents the timeline that was followed for testing:

**Table 2: Test Schedule**

| <b>Hollingsworth &amp; Vose<br/>Test Schedule<br/>April 26 – May 1, 2018</b> |           |                        |     |            |          |              |
|------------------------------------------------------------------------------|-----------|------------------------|-----|------------|----------|--------------|
| Source                                                                       | Date      | Method                 | Run | Start Time | End Time | Run Duration |
| CFU 114<br>Flame Blown                                                       | 4/26/2018 | M13B – Total Fluorides | 1   | 15:18      | 16:27    | 1:09         |
|                                                                              | 4/26/2018 | M13B – Total Fluorides | 2   | 17:15      | 18:33    | 1:18         |
|                                                                              | 4/26/2018 | M13B – Total Fluorides | 3   | 18:55      | 20:01    | 1:06         |
|                                                                              | 4/26/2018 | M26 - HF               | 1   | 15:18      | 16:27    | 1:09         |
|                                                                              | 4/26/2018 | M26 - HF               | 2   | 17:15      | 18:33    | 1:18         |
|                                                                              | 4/26/2018 | M26 - HF               | 3   | 18:55      | 20:01    | 1:06         |
|                                                                              | 4/27/2018 | M5 - Particulate       | 1   | 9:30       | 11:40    | 2:10         |
|                                                                              | 4/27/2018 | M5 - Particulate       | 2   | 12:45      | 15:00    | 2:15         |
|                                                                              | 4/27/2018 | M5 - Particulate       | 3   | 15:45      | 17:50    | 2:05         |
|                                                                              | 4/27/2018 | M316 -Formaldehyde     | 1   | 9:30       | 11:40    | 2:10         |
|                                                                              | 4/27/2018 | M316 -Formaldehyde     | 2   | 12:53      | 15:00    | 2:07         |
|                                                                              | 4/27/2018 | M316 -Formaldehyde     | 3   | 15:45      | 17:50    | 2:05         |
|                                                                              | 4/27/2018 | Gases                  | 1   | 9:30       | 11:40    | 2:10         |
|                                                                              | 4/27/2018 | Gases                  | 2   | 12:45      | 15:00    | 2:15         |
|                                                                              | 4/27/2018 | Gases                  | 3   | 15:45      | 17:50    | 2:05         |
|                                                                              | 4/28/2018 | M29 – Metals           | 1   | 9:18       | 12:28    | 3:10         |
|                                                                              | 4/28/2018 | M29 – Metals           | 2   | 13:09      | 16:16    | 3:07         |
|                                                                              | 4/28/2018 | M29 – Metals           | 3   | 16:45      | 19:53    | 3:08         |
|                                                                              | 4/28/2018 | M30B – Mercury         | 1   | 9:18       | 12:28    | 3:10         |
|                                                                              | 4/28/2018 | M30B – Mercury         | 2   | 13:09      | 16:16    | 3:07         |
|                                                                              | 4/28/2018 | M30B - Mercury         | 3   | 16:45      | 19:53    | 3:08         |
| CFU 117<br>Rotary Fine                                                       | 4/29/2018 | M29 – Metals           | 1   | 8:42       | 11:50    | 3:08         |
|                                                                              | 4/29/2018 | M29 – Metals           | 2   | 12:36      | 15:46    | 3:10         |
|                                                                              | 4/29/2018 | M29 – Metals           | 3   | 16:02      | 19:06    | 3:04         |
|                                                                              | 4/29/2018 | M30B – Mercury         | 1   | 8:42       | 11:50    | 3:08         |
|                                                                              | 4/29/2018 | M30B – Mercury         | 2   | 12:36      | 15:46    | 3:10         |
|                                                                              | 4/29/2018 | M30B - Mercury         | 3   | 16:02      | 19:06    | 3:04         |
|                                                                              | 4/30/2018 | M5 - Particulate       | 1   | 8:42       | 10:47    | 2:05         |

|                        |           |                        |   |       |       |      |
|------------------------|-----------|------------------------|---|-------|-------|------|
| CFU 117<br>Rotary Fine | 4/30/2018 | M5 - Particulate       | 2 | 11:35 | 13:39 | 2:04 |
|                        | 4/30/2018 | M5 - Particulate       | 3 | 14:29 | 16:34 | 2:05 |
|                        | 4/30/2018 | Gases                  | 1 | 8:42  | 10:47 | 2:05 |
|                        | 4/30/2018 | Gases                  | 2 | 11:35 | 13:39 | 2:04 |
|                        | 4/30/2018 | Gases                  | 3 | 14:29 | 16:34 | 2:05 |
|                        | 4/30/2018 | M316 -Formaldehyde     | 1 | 8:42  | 10:47 | 2:05 |
|                        | 4/30/2018 | M316 -Formaldehyde     | 2 | 11:35 | 13:39 | 2:04 |
|                        | 4/30/2018 | M316 -Formaldehyde     | 3 | 14:29 | 16:34 | 2:05 |
|                        | 5/1/2018  | M13B – Total Fluorides | 1 | 8:40  | 9:44  | 1:04 |
|                        | 5/1/2018  | M13B – Total Fluorides | 2 | 9:57  | 11:01 | 1:04 |
|                        | 5/1/2018  | M13B – Total Fluorides | 3 | 11:10 | 12:14 | 1:04 |
|                        | 5/1/2018  | M26 - HF               | 1 | 8:40  | 9:44  | 1:04 |
|                        | 5/1/2018  | M26 - HF               | 2 | 9:57  | 11:01 | 1:04 |
|                        | 5/1/2018  | M26 - HF               | 3 | 11:10 | 12:14 | 1:04 |

Stack flows and conditions shown in the tables below (\*) correspond to measurements from Method 5 sampling runs; these results are representative of the same values measured for the other methods. Point-by-point measurements of all stack characteristics can be found in the appendices of this report. Emission rates for NO<sub>x</sub>, CO and VOCs were calculated using flows measured during coincident Method 5 sampling runs. Emission rates for mercury were calculated using flows measured during coincident Method 29 metals runs.

**Table 3: CFU 114 (Flame Blown) Non-Metals Test Results**

| <b>Hollingsworth &amp; Vose<br/>Corvallis, OR<br/>CFU 114 - Flame Blown<br/>Results Summary<br/>April 26-27, 2018</b> |              |              |              |              |                |
|-----------------------------------------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|----------------|
| <b>Parameters</b>                                                                                                     | <b>Units</b> | <b>Run 1</b> | <b>Run 2</b> | <b>Run 4</b> | <b>Average</b> |
| M5/M316/Gases                                                                                                         | -            | 4/27/2018    | 4/27/2018    | 4/27/2018    | -              |
| Stack Temperature*                                                                                                    | °F           | 264.6        | 258.5        | 267.0        | 263.4          |
| Stack Moisture*                                                                                                       | % v/v        | 2.17         | 2.28         | 2.08         | 2.18           |
| Oxygen Content*                                                                                                       | %            | 19.90        | 19.92        | 19.96        | 19.93          |
| CO <sub>2</sub> Content*                                                                                              | %            | 0.68         | 0.67         | 0.68         | 0.68           |
| Stack Flow Rate*                                                                                                      | DSCFM        | 19,960.2     | 20,258.2     | 20,296.8     | 20,171.8       |
| Sample Volume*                                                                                                        | dscf         | 120.926      | 122.784      | 122.481      | 122.064        |
| Filterable Particulate Matter (PM)                                                                                    | gr/dscf      | 1.56E-04     | 3.51E-04     | 2.37E-04     | 2.48E-04       |
|                                                                                                                       | lbs/hr       | 2.67E-02     | 6.09E-02     | 4.13E-02     | 4.29E-02       |
|                                                                                                                       | lb/lb glass  | 4.37E-04     | 9.98E-04     | 6.77E-04     | 7.04E-04       |
| Condensable PM Inorganic                                                                                              | gr/dscf      | 2.48E-04     | 2.44E-04     | 2.53E-04     | 2.48E-04       |
|                                                                                                                       | lbs/hr       | 4.24E-02     | 4.23E-02     | 4.40E-02     | 4.29E-02       |
|                                                                                                                       | lb/lb glass  | 6.95E-04     | 6.94E-04     | 7.21E-04     | 7.03E-04       |
| Condensable PM Organic                                                                                                | gr/dscf      | 6.08E-05     | 2.78E-05     | 5.74E-05     | 4.86E-05       |
|                                                                                                                       | lbs/hr       | 1.04E-02     | 4.82E-03     | 9.98E-03     | 8.40E-03       |
|                                                                                                                       | lb/lb glass  | 1.70E-04     | 7.91E-05     | 1.64E-04     | 1.38E-04       |
| Total PM (Measured) <sup>†</sup>                                                                                      | gr/dscf      | 4.64E-04     | 6.22E-04     | 5.48E-04     | 5.45E-04       |
|                                                                                                                       | lbs/hr       | 7.94E-02     | 1.08E-01     | 9.53E-02     | 9.42E-02       |
|                                                                                                                       | lb/lb glass  | 1.30E-03     | 1.77E-03     | 1.56E-03     | 1.54E-03       |
| Nitrogen Oxides (NO <sub>x</sub> ) Emissions                                                                          | ppmvd        | 5.63         | 5.60         | 5.49         | 5.57           |
|                                                                                                                       | lb/hr        | 8.05E-01     | 8.12E-01     | 7.98E-01     | 8.05E-01       |
|                                                                                                                       | lb/lb glass  | 1.32E-02     | 1.33E-02     | 1.31E-02     | 1.32E-02       |
|                                                                                                                       | lb/Mscf n.g. | 1.52E-01     | 1.53E-01     | 1.50E-01     | 1.52E-01       |
| Volatile Organic Compounds (VOCs) (Method 25A)                                                                        | ppmvw        | 5.50E-01     | 4.80E-01     | 6.10E-01     | 5.47E-01       |
|                                                                                                                       | lbs/hr       | 7.69E-02     | 6.82E-02     | 8.67E-02     | 7.73E-02       |
|                                                                                                                       | lb/lb glass  | 1.26E-03     | 1.12E-03     | 1.42E-03     | 1.27E-03       |
|                                                                                                                       | lb/Mscf n.g. | 1.45E-02     | 1.29E-02     | 1.63E-02     | 1.46E-02       |



**Hollingsworth & Vose  
Corvallis, OR  
CFU 114 - Flame Blown  
Results Summary  
April 26-27, 2018**

| Parameter                                | Units        | Run 1     | Run 2     | Run 3     | Average   |
|------------------------------------------|--------------|-----------|-----------|-----------|-----------|
| Test Date – M5/M316/Gases                | -            | 4/27/2018 | 4/27/2018 | 4/27/2018 | -         |
| Carbon Monoxide (CO)                     | ppmvd        | 126.3     | 125.5     | 129.2     | 127.0     |
|                                          | lb/hr        | 11.00     | 11.09     | 11.44     | 11.17     |
|                                          | lb/lb glass  | 1.80E-01  | 1.82E-01  | 1.88E-01  | 1.83E-01  |
|                                          | lb/Mscf n.g. | 2.07      | 2.09      | 2.15      | 2.11      |
| Formaldehyde (CH <sub>2</sub> O)         | lb/hr        | 1.33E-02  | 1.02E-02  | 1.22E-02  | 1.19E-02  |
|                                          | lb/lb glass  | 2.18E-04  | 1.68E-04  | 2.01E-04  | 1.95E-04  |
|                                          | lb/Mscf n.g. | 2.50E-03  | 1.93E-03  | 2.30E-03  | 2.24E-03  |
| Total VOCs<br>(M25A + CH <sub>2</sub> O) | lb/hr        | 9.02E-02  | 7.84E-02  | 9.89E-02  | 8.92E-02  |
|                                          | lb/lb glass  | 1.48E-03  | 1.29E-03  | 1.62E-03  | 1.46E-03  |
|                                          | lb/Mscf n.g. | 1.70E-02  | 1.48E-02  | 1.86E-02  | 1.68E-02  |
| Test Date – M13B/26A                     | -            | 4/26/2018 | 4/26/2018 | 4/26/2018 | -         |
| Hydrogen Fluorides (HF)                  | ppmvd        | 4.02E-02  | 3.97E-02  | 4.04E-02  | 4.01E-02  |
|                                          | lb/hr        | 2.52E-03  | 2.52E-03  | 2.59E-03  | 2.54E-03  |
|                                          | lb/lb glass  | 4.13E-05  | 4.14E-05  | 4.25E-05  | 4.17E-05  |
| Total Fluorides                          | ppmvd        | 4.67E-02  | <2.90E-02 | <2.90E-02 | <3.49E-02 |
|                                          | lb/hr        | 2.87E-03  | <1.75E-03 | <1.76E-03 | <2.13E-03 |
|                                          | lb/lb glass  | 4.70E-05  | <2.87E-05 | <2.89E-05 | <3.49E-05 |

n.g. = natural gas

\* Representative data from Method 5 particulate test

† Actual measured values are shown. The measured values are below the analytical detection limits specified in the Oregon Source Sampling Manual, revised April 2015. Results calculated based on the analytical detection limit for total particulate, 7 mg per sample train, can be found in Appendix B.

'<' represents results below the minimum detection limit (MDL) that have been calculated at the MDL.

**Table 4: CFU 114 (Flame Blown) Metals Results**

| <b>Hollingsworth &amp; Vose<br/>Corvallis, OR<br/>CFU 114 - Flame Blown<br/>Metals Results Summary<br/>April 28, 2018<br/>Average Results</b> |                |                |              |                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|--------------|--------------------|
| <b>Parameter</b>                                                                                                                              | <b>Species</b> | <b>µg/dscm</b> | <b>lb/hr</b> | <b>lb/lb glass</b> |
| Metals<br>(Method 29)                                                                                                                         | Antimony       | <0.335         | <2.55E-05    | <4.19E-07          |
|                                                                                                                                               | Arsenic        | <0.468         | <3.57E-05    | <5.86E-07          |
|                                                                                                                                               | Barium         | 0.089          | 6.78E-06     | 1.11E-07           |
|                                                                                                                                               | Beryllium      | <0.013         | <1.02E-06    | <1.67E-08          |
|                                                                                                                                               | Cadmium        | <0.052         | <3.95E-06    | <6.48E-08          |
|                                                                                                                                               | Chromium       | 0.022          | 1.70E-06     | 2.79E-08           |
|                                                                                                                                               | Cobalt         | <0.033         | <2.55E-06    | <4.19E-08          |
|                                                                                                                                               | Copper         | <0.430         | <3.28E-05    | <5.38E-07          |
|                                                                                                                                               | Lead           | <0.335         | <2.55E-05    | <4.19E-07          |
|                                                                                                                                               | Manganese      | 0.102          | 7.75E-06     | 1.27E-07           |
|                                                                                                                                               | Nickel         | <0.209         | <1.60E-05    | <2.62E-07          |
|                                                                                                                                               | Phosphorus     | <0.900         | <6.86E-05    | <1.13E-06          |
|                                                                                                                                               | Selenium       | <1.004         | <7.66E-05    | <1.26E-06          |
|                                                                                                                                               | Zinc           | 3.008          | 2.29E-04     | 3.76E-06           |
| Mercury<br>(Method 30B)                                                                                                                       | Mercury        | 4.26E-03       | 3.26E-07     | 5.34E-09           |

'<' denotes results calculated using the MDL for front half or back half results that were non-detect.

**Table 5: CFU 117 (Rotary Fine) Non-Metals Results**

| <b>Hollingsworth &amp; Vose<br/>Corvallis, OR<br/>CFU 117 – Rotary Fine<br/>Results Summary<br/>April 30- May 1, 2018</b> |              |              |              |              |                |
|---------------------------------------------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|----------------|
| <b>Parameters</b>                                                                                                         | <b>Units</b> | <b>Run 1</b> | <b>Run 2</b> | <b>Run 4</b> | <b>Average</b> |
| M5/M316/Gases                                                                                                             | -            | 4/30/2018    | 4/30/2018    | 4/30/2018    | -              |
| Stack Temperature*                                                                                                        | °F           | 244.0        | 252.9        | 256.0        | 251.0          |
| Stack Moisture*                                                                                                           | % v/v        | 1.66         | 1.70         | 1.66         | 1.67           |
| Oxygen Content*                                                                                                           | %            | 20.14        | 20.19        | 20.24        | 20.19          |
| CO <sub>2</sub> Content*                                                                                                  | %            | 0.64         | 0.65         | 0.55         | 0.61           |
| Stack Flow Rate*                                                                                                          | DSCFM        | 17,641.1     | 18,284.5     | 18,277.1     | 18,067.6       |
| Sample Volume*                                                                                                            | dscf         | 107.445      | 111.564      | 111.569      | 110.193        |
| Filterable Particulate Matter (PM)                                                                                        | gr/dscf      | 3.20E-04     | 2.13E-04     | 1.04E-04     | 2.13E-04       |
|                                                                                                                           | lbs/hr       | 4.84E-02     | 3.34E-02     | 1.64E-02     | 3.27E-02       |
|                                                                                                                           | lb/lb glass  | 4.18E-04     | 3.05E-04     | 1.49E-04     | 2.91E-04       |
| Condensable PM Inorganic                                                                                                  | gr/dscf      | 2.55E-04     | 2.28E-04     | 1.79E-04     | 2.21E-04       |
|                                                                                                                           | lbs/hr       | 3.86E-02     | 3.58E-02     | 2.81E-02     | 3.41E-02       |
|                                                                                                                           | lb/lb glass  | 3.33E-04     | 3.27E-04     | 2.57E-04     | 3.05E-04       |
| Condensable PM Organic                                                                                                    | gr/dscf      | 1.78E-04     | 1.48E-04     | 1.20E-04     | 1.49E-04       |
|                                                                                                                           | lbs/hr       | 2.70E-02     | 2.32E-02     | 1.88E-02     | 2.30E-02       |
|                                                                                                                           | lb/lb glass  | 2.33E-04     | 2.12E-04     | 1.72E-04     | 2.06E-04       |
| Total PM (Measured) <sup>†</sup>                                                                                          | gr/dscf      | 7.54E-04     | 5.90E-04     | 4.04E-04     | 5.82E-04       |
|                                                                                                                           | lbs/hr       | 1.14E-01     | 9.24E-02     | 6.33E-02     | 8.99E-02       |
|                                                                                                                           | lb/lb glass  | 9.83E-04     | 8.44E-04     | 5.78E-04     | 8.02E-04       |
| Nitrogen Oxides (NO <sub>x</sub> ) Emissions                                                                              | ppmvd        | 3.62         | 3.62         | 3.42         | 3.55           |
|                                                                                                                           | lb/hr        | 4.57E-01     | 4.74E-01     | 4.47E-01     | 4.60E-01       |
|                                                                                                                           | lb/lb glass  | 4.06E-03     | 4.24E-03     | 4.09E-03     | 4.13E-03       |
|                                                                                                                           | lb/Mscf n.g. | 8.48E-02     | 8.72E-02     | 8.12E-02     | 8.44E-02       |
| Volatile Organic Compounds (VOCs) (Method 25A)                                                                            | ppmvw        | 2.29         | 1.94         | 1.34         | 1.86           |
|                                                                                                                           | lbs/hr       | 2.82E-01     | 2.47E-01     | 1.71E-01     | 2.33E-01       |
|                                                                                                                           | lb/lb glass  | 2.50E-03     | 2.21E-03     | 1.56E-03     | 2.09E-03       |
|                                                                                                                           | lb/Mscf n.g. | 5.22E-02     | 4.55E-02     | 3.10E-02     | 4.29E-02       |

**Hollingsworth & Vose  
Corvallis, OR  
CFU 117 – Rotary Fine  
Results Summary  
April 30-May 1, 2018**

| Parameter                                | Units        | Run 1     | Run 2     | Run 3     | Average   |
|------------------------------------------|--------------|-----------|-----------|-----------|-----------|
| Test Date – M5/M316/Gases                | -            | 4/30/2018 | 4/30/2018 | 4/30/2018 | -         |
| Carbon Monoxide (CO)                     | ppmvd        | 159.7     | 164.6     | 165.8     | 163.4     |
|                                          | lb/hr        | 12.29     | 13.13     | 13.22     | 12.88     |
|                                          | lb/lb glass  | 1.09E-01  | 1.17E-01  | 1.21E-01  | 1.16E-01  |
|                                          | lb/Mscf n.g. | 2.28      | 2.42      | 2.40      | 2.36      |
| Formaldehyde (CH <sub>2</sub> O)         | lb/hr        | 4.22E-02  | 4.41E-02  | 4.42E-02  | 4.35E-02  |
|                                          | lb/lb glass  | 3.74E-04  | 3.94E-04  | 4.04E-04  | 3.91E-04  |
|                                          | lb/Mscf n.g. | 7.82E-03  | 8.12E-03  | 8.03E-03  | 7.99E-03  |
| Total VOCs<br>(M25A + CH <sub>2</sub> O) | lb/hr        | 3.24E-01  | 2.92E-01  | 2.15E-01  | 2.77E-01  |
|                                          | lb/lb glass  | 2.87E-03  | 2.61E-03  | 1.96E-03  | 2.48E-03  |
|                                          | lb/Mscf n.g. | 6.00E-02  | 5.36E-02  | 3.90E-02  | 5.09E-02  |
| Test Date – M13B/26A                     | -            | 5/1/2018  | 5/1/2018  | 5/1/2018  | -         |
| Hydrogen Fluorides (HF)                  | ppmvd        | 6.28E-02  | 5.11E-02  | 5.78E-02  | 5.72E-02  |
|                                          | lb/hr        | 3.70E-03  | 2.96E-03  | 3.34E-03  | 3.33E-03  |
|                                          | lb/lb glass  | 3.33E-05  | 2.67E-05  | 3.01E-05  | 3.00E-05  |
| Total Fluorides                          | ppmvd        | <3.12E-02 | <3.16E-02 | <3.17E-02 | <3.15E-02 |
|                                          | lb/hr        | <1.72E-03 | <1.72E-03 | <1.73E-03 | <1.72E-03 |
|                                          | lb/lb glass  | <1.55E-05 | <1.55E-05 | <1.55E-05 | <1.55E-05 |

n.g. = natural gas

\* Representative data from Method 5 particulate test

† Actual measured values are shown. The measured values are below the analytical detection limits specified in the Oregon Source Sampling Manual, revised April 2015. Results calculated based on the analytical detection limit for total particulate, 7 mg per sample train, can be found in Appendix C.

\*Data from Method 5 (particulate) test

"<" represents results below the MDL that have been calculated at the MDL.

**Table 6: CFU 117 (Rotary Fine) Metals Results**

| <b>Hollingsworth &amp; Vose<br/>Corvallis, OR<br/>CFU 117 – Rotary Fine<br/>Metals Results Summary<br/>April 29, 2018<br/>Average Results</b> |                |                |              |                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------|--------------|--------------------|
| <b>Parameter</b>                                                                                                                              | <b>Species</b> | <b>µg/dscm</b> | <b>lb/hr</b> | <b>lb/lb glass</b> |
| Metals<br>(Method 29)                                                                                                                         | Antimony       | <0.371         | <2.52E-05    | <2.26E-07          |
|                                                                                                                                               | Arsenic        | <0.520         | <3.53E-05    | <3.17E-07          |
|                                                                                                                                               | Barium         | 0.009          | 6.48E-07     | 5.83E-09           |
|                                                                                                                                               | Beryllium      | <0.015         | <1.01E-06    | <9.05E-09          |
|                                                                                                                                               | Cadmium        | <0.030         | <2.02E-06    | <1.81E-08          |
|                                                                                                                                               | Chromium       | 0.008          | 5.48E-07     | 4.90E-09           |
|                                                                                                                                               | Cobalt         | <0.037         | <2.52E-06    | <2.26E-08          |
|                                                                                                                                               | Copper         | <0.409         | <2.76E-05    | <2.49E-07          |
|                                                                                                                                               | Lead           | <0.371         | <2.52E-05    | <2.26E-07          |
|                                                                                                                                               | Manganese      | 0.065          | 4.39E-06     | 3.94E-08           |
|                                                                                                                                               | Nickel         | <0.091         | <6.15E-06    | <5.52E-08          |
|                                                                                                                                               | Phosphorus     | <1.100         | <7.42E-05    | <6.69E-07          |
|                                                                                                                                               | Selenium       | <1.114         | <7.57E-05    | <6.78E-07          |
|                                                                                                                                               | Zinc           | 0.926          | 6.25E-05     | 5.64E-07           |
| Mercury<br>(Method 30B)                                                                                                                       | Mercury        | 3.36E-03       | 2.28E-07     | 2.05E-09           |

'<' denotes results calculated using the MDL for front half or back half results that were non-detect.

### 3.2 Plant Operations

All details of plant operations, including glass production rates and natural gas firing rates, were recorded by representatives of H&V during testing. Process data used for calculations shown throughout this report are based on values provided by MFA personnel who compiled and reduced the raw process data collected by H&V. These values are given in Appendix D. Both CFU units ran normally at the time of the tests.

### 3.3 Field Notes

No adverse or unusual environmental conditions existed that could have influenced the outcome of these tests. All testing was performed as outlined in the test plan dated April 17, 2018 and associated approval letter, with the following exceptions.

An analyst at Ohio Lumex, the outside laboratory performing the low-level mercury analysis, dropped and broke the Run 1, Side A, mercury trap for CFU 114. Results for Runs 2 and 3 are consistent so Bison requested, and was granted, approval to use a two-run average for calculating Flame Blown mercury emissions. A written statement from Ohio Lumex that discusses this incident has been included in the report appendices along with the Ohio Lumex laboratory report.

Very low levels of volatile organic compounds present in the gas stream meant that the VOC analyzer was calibrated to the extreme lower limit of its working range. The instrument was spanned to between 4 and 25 ppm during this testing campaign. Method 25A quality assurance requirements stipulate that instrument drift should be less than or equal to 3% of the instrument span. 3% or less of a low analyzer span leaves an allowable margin of drift smaller than can be expected of the analyzer near its detection limit. For this reason, Bison requested, and was granted, approval to proceed with sampling if there was an absolute difference of less than 0.5 ppm between pre- and post-run instrument drift checks. This follows the alternative standards for NO<sub>x</sub> and CO outlined in Method 7E.

Following Ms. Blackburn's test plan approval letter, Bison made every reasonable attempt to ensure that total PM captured would be above ODEQ's analytical detection limit of 7 mg. Method 5 run times were doubled from 1 hour to 2 hours in the revised version of the test protocol dated April 17, 2018. Nozzles used for sampling were as large as practically possible, while still allowing dry gas meter operation within the calibrated instrument range. Resulting sample volumes were between 3.5 and 3.8 times the minimum allowable sample volume (31.8 dscf) and nearly twice the 60 dscf recommended by DEQ. Despite these efforts, collected PM, although well within the limits of measurability of our lab scales, is still below ODEQ's Method 5 threshold. For this reason, PM results have been reported using both measured values and as less than the 7 mg analytical detection limit. These side-by-side calculations can be found in Appendices B and C.

## **4.0 EMISSION TEST METHODS AND PROCEDURES**

---

### **4.1 Minimum Detection Limits**

Results that are below the minimum detection limit (MDL) have been indicated in results tables and throughout this report using the '<' symbol. Most MDLs were provided by the outside laboratories along with their reports. For Method 5, a method detection limit of 7 mg was used as per ODEQ stipulations. Where results are below the MDL, emission factors have been calculated based on the MDL value of the associated method; actual emissions rates will be less than the value indicated. Where reagent blank values are below the MDL they are considered zero and no blank correction was performed. Where the allowable blank correction is larger than a sample result, the corrected result is shown as zero.

### **4.2 Testing Methods and Procedures**

Bison testing personnel performed the following methods described in Title 40, Code of Federal Regulations (CFR), Part 60, Appendix A and the State of Oregon Department of Environmental Quality Source Sampling Manual Volume I, April 2015 Edition.

#### **EPA Reference Method 1, "*Sample and Velocity Traverses for Stationary Sources.*"**

The objective of Method 1 is to determine a suitable location for testing and to determine the velocity and/or sample points for the source. The distance upstream to atmosphere from the sampling ports (Distance A) is measured and the distance downstream to the nearest disturbance from the sample points (Distance B) is measured. Distances A and B are applied to Method 1, Figure 1-1 for particulate matter (PM) sampling points or Figure 1-2 for velocity measurement points. These figures give the minimum number of sample points according to the dimensions of the source. The number of points and the stack diameter are then applied to Method 1, Table 1-2 to determine equal area measurement points within the source. The results of Method 1 sampling location and sample or velocity point measurement locations are included in a report appendix.

#### **EPA Reference Method 2, "*Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube).*" Concurrent with Method 5.**

The objective of Method 2 is to measure stack gas velocity, collect temperature data, and calculate a volumetric flow. Method 2 velocity measurements were performed using a Type S pitot tube attached to a Method 5 particulate sampling probe. Differential pressures are measured using an inclined manometer, and temperatures are measured using a k-type thermal indicator. Bison has incorporated 0.84 as the Type S pitot tube coefficient (Cp). The average velocity, temperature, static pressure, and source area are used to calculate volumetric flow for the source. This isokinetic run data is recorded on electronic field data sheets. Copies of the field data sheets, results from the flow calculations, and calibration data are included in the report appendices.

**EPA Reference Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)."** The objective of Method 3A is to determine the oxygen (O<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) concentrations in the stack gas stream. The principle is to extract a gas sample from a stationary source and route the sample through a conditioning system to a paramagnetic oxygen analyzer and an infrared carbon dioxide analyzer for the measurement of O<sub>2</sub> and CO<sub>2</sub> in percentages (%). The calibration adjustments of the O<sub>2</sub> and CO<sub>2</sub> analyzers are performed by sending EPA Protocol 1 gas directly to the analyzers. A system calibration is performed by sending calibration gas to the probe and through the system to the analyzers. The calibration error, system bias and system drift data, and measured concentrations are recorded on an automated data acquisition system (DAS).

**Method 4, "Determination of Moisture Content in the Stack Gases." Concurrent with Method 5.** Method 5 testing allows the option to obtain Method 4 moistures via the Method 5 sampling system sampled while maintaining an isokinetic sampling rate. The objective of Method 4 is to determine the moisture content of a gas stream. The principle of the method is to impinge a sample through chilled water and silica gel which captures any source gas moisture. The moisture is removed from the sample stream and the volume (or mass) of water extracted is determined. The sample volume and water volume (or mass) are used to calculate the moisture content of the stack gas. Method quality assurance is to perform a pre- and post-test dry gas meter (DGM) calibration. The DGM calibration data can be found in an appendix of this report. The impinger waters are volumetrically measured on-site and the silica gels are weighed on-site. The sampling data is recorded on field data sheets and then entered into spreadsheets for moisture determination calculations. Where a stack is shown to be saturated the moisture at saturation is used for all calculations.

**Method 5, "Determination of Particulate Emissions from Stationary Sources" (Methods 2 & 4 Inclusive).** The objective of Method 5 is to determine the filterable particulate matter (PM) from a source. Method 5 is an isokinetic sampling method (i.e., the velocity of sample stream entering the nozzle is approximately equal to the velocity of the approaching sample stream) for determination of PM. The exhaust gas stream is sampled along a cross-section of the stack and PM is captured within the nozzle, probe, filter-bell and on a 0.3 micron pore size glass fiber filter. The filter is maintained at a temperature of 248°F±25°F followed by impingers maintained at a temperature below 68°F. Bison used a Method 5 sampling train with a glass probe liner and nozzles to gather particulate samples. Method 5 incorporates Method 2 "velocity measurements" and Method 4 "moisture measurements." Following the State of Oregon Department of Environmental Quality Source Sampling Manual, the back-half impinger catch was also analyzed for inorganic and organic condensable particulate matter.

**EPA Reference Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources."** The objective of Method 7E testing is to determine the NO<sub>x</sub> concentration from the source. Method 7E entails extraction of a gas sample from a stationary source and routing the sample through a conditioning system to an analyzer



for the measurement of NO<sub>x</sub> (NO and NO<sub>2</sub>) in ppmvd. Method 7E testing was performed on each source for the determination of NO<sub>x</sub>. The calibration error, system bias and system drift data were within the tolerances of the method. The previously mentioned data and the testing data were recorded on a DAS. This data and test results can be found in the report appendices along with calibration records and gas certificates.

**EPA Reference Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)."** The objective of Method 10 is to determine the CO concentrations from the source. Method 10 entails extraction of a gas sample from a stationary source and routing the sample through a conditioning system to an analyzer for the measurement of CO in ppmvd. The CO analyzer calibration adjustment is performed by sending EPA Protocol 1 gas directly to the analyzer. A system bias check is performed by sending calibration gas to the probe and through the system to the analyzer. The calibration error, system bias and system drift data, and measured concentrations are recorded on a DAS for permanent record.

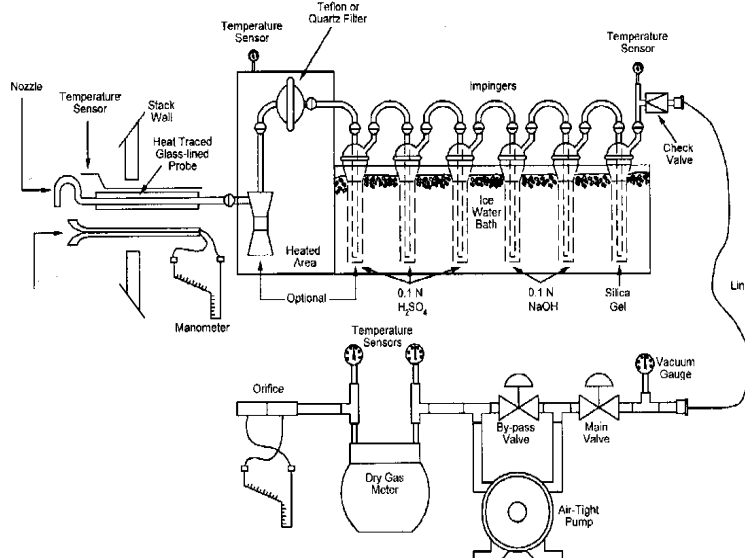
**EPA Reference Method 13B "Determination of Total Fluoride Emissions from Stationary Sources."** The objective of the method is to determine the fluoride (F<sup>-</sup>) emissions from sources as specified in the regulations; it does not measure fluorocarbons, such as freons. Stack gas is withdrawn isokinetically from the source and collected in water and on a filter. The filter and water are combined and total F<sup>-</sup> is then determined by the specific ion electrode method.

**EPA Reference Method 25A, "Determination of Total Gaseous Organic Concentration using a Flame Ionization Analyzer."** The objective of Method 25A is to determine the total gaseous organic concentrations (TGOC) from a source using a flame ionization detector (FID). Bison utilizes a gas chromatograph/flame ionization detector (GC/FID) for determination of the TGOC. Testing is performed by extracting a gas sample from the source through a heated sample line directly to the GC/FID for the measurement of methane and non-methane hydrocarbons which can be combined to produce a total hydrocarbon (THC) concentration value. The non-methane organic compound (NMOC) value is used to report volatile organic compound (VOC) concentrations since EPA's definition of a VOC does not include methane. The analyzer measurements are in parts per million by volume wet (ppmvw) and are reported as propane (C<sub>3</sub>H<sub>8</sub>). The gaseous measurement primarily consists of vaporous aromatic hydrocarbons: alkanes, alkenes and arenes.

**EPA Reference Method 26A, "Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method."** The objective of Method 26A is to isokinetically sample a source stream (i.e., the velocity of sample stream entering the nozzle is approximately equal to the velocity of the approaching sample stream) for determination of hydrogen chloride (HCl); hydrogen bromide (HBr); hydrogen fluoride (HF); chlorine (Cl<sub>2</sub>), and bromine (Br<sub>2</sub>) emissions. Method 26A is used on sources controlled by wet scrubbers, emitting acid PM (e.g., hydrogen halides dissolved in water droplets). The sample system is that of Method 5 with Method 26 solutions of 0.1 normal sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and 0.1 normal sodium hydroxide (NaOH). The impinger solutions

are recovered and sent to a laboratory for Cl and/or F analysis.

**Figure 1: Typical Method 26A Sample Train Schematic**

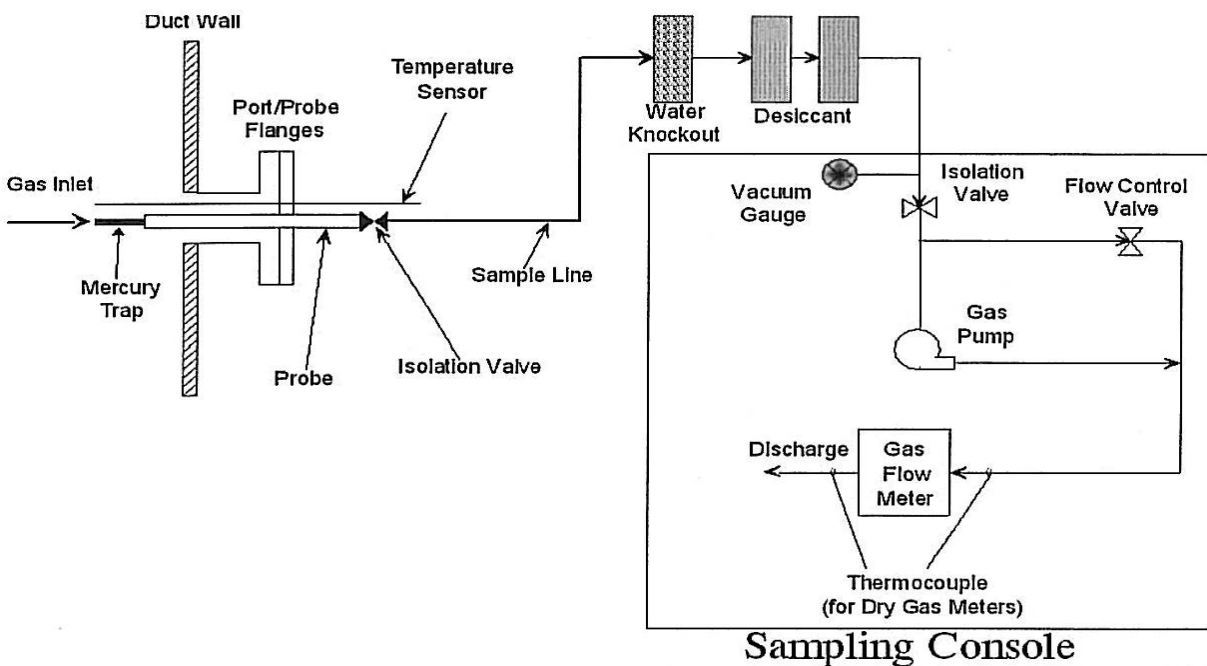


**EPA Reference Method 29, "Determination of Metals Emissions From Stationary Sources."** A stack sample is withdrawn isokinetically from the source, particulate emissions are collected in the probe and on a heated filter, and gaseous emissions are then collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all metals including Hg) and an aqueous acidic solution of potassium permanganate (analyzed only for Hg). The recovered samples are digested, and appropriate fractions are analyzed for Hg by cold vapor atomic absorption spectroscopy (CVAAS) and for Sb, As, Ag, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Tl, and Zn by inductively coupled argon plasma emission spectroscopy (ICAP) or atomic absorption spectroscopy (AAS). Graphite furnace atomic absorption spectroscopy (GFAAS) is used for analysis of Sb, As, Cd, Co, Pb, Se, and Tl if these elements require greater analytical sensitivity than can be obtained by ICAP. If one so chooses, AAS may be used for analysis of all listed metals if the resulting in-stack method detection limits meet the goal of the testing program. Similarly, inductively coupled plasma-mass spectroscopy (ICP-MS) may be used for analysis of Sb, As, Ag, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Tl, and Zn.

**EPA Reference Method 30B, "Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps."**

The objective of Method 30B is to determine elemental mercury ( $\text{Hg}^0$ ) and oxidized mercury ( $\text{Hg}^{2+}$ ) emissions from a source. The exhaust gas stream is sampled at a single point within the stack at a controlled sample rate. The sample is drawn through a carbon sorbent tube which is then analyzed by Ultra Violet Atomic Absorption (UV AA) or Ultra Violet Atomic Fluorescence (UV AF) cold vapor analysis. The analytical range is 0.1  $\mu\text{g}/\text{dscm}$  to  $>50 \mu\text{g}/\text{dscm}$ .

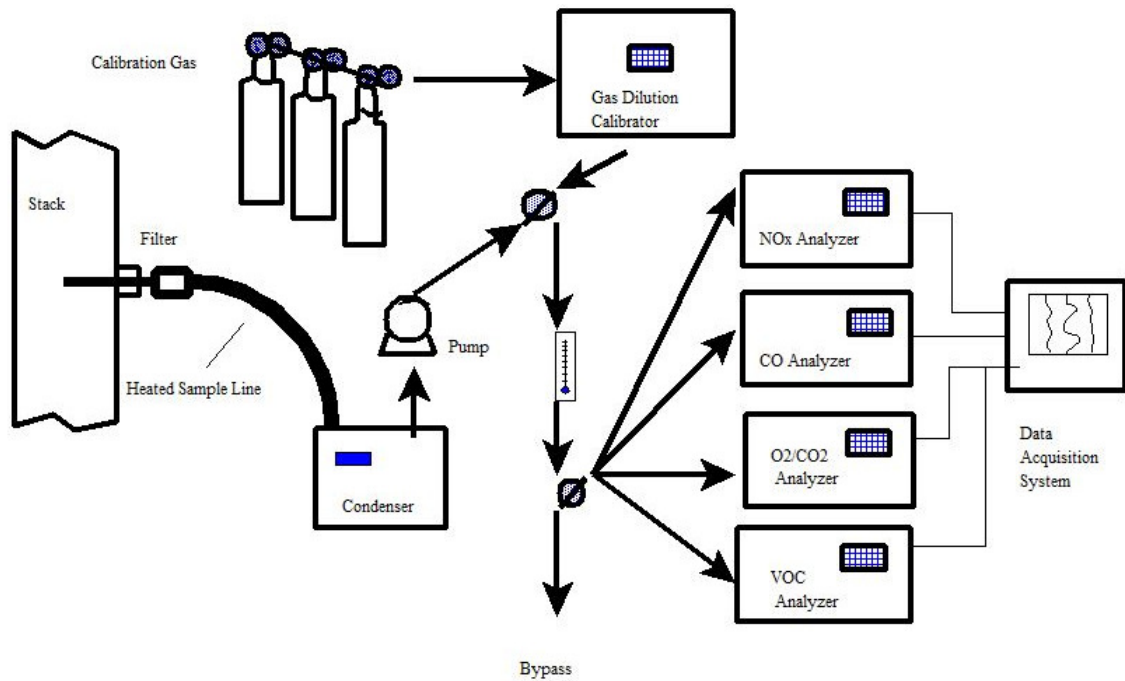
**Figure 2: Method 30B Sampling Train**



**EPA Reference Method 316, "Sampling and Analysis For Formaldehyde Emissions From Stationary Sources In The Mineral Wool And Wool Fiberglass Industries."** Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in high purity water. Formaldehyde present in the emissions is highly soluble in high purity water. The high purity water containing formaldehyde is then analyzed using the modified pararosaniline method. Formaldehyde in the sample reacts with acidic pararosaniline, and the sodium sulfite, forming a purple chromophore. The intensity of the purple color, measured spectrophotometrically, provides an accurate and precise measure of the formaldehyde concentration in the sample.

**EPA Reference Method 205, "Verification of Gas Dilution Systems for Field Instrument Calibrations."** The objective of Method 205 is to produce a set of calibration gases that are used in instrumental analysis emission testing. This is achieved by diluting a concentrated gas to lower concentrations. The diluted gases are then to be used in calibrating analyzers, performing a system check and performing post-test bias checks. The dilution of the gases is performed by a dilution mass flow instrument. Method 205 stipulates the procedure and steps to evaluate the dilution instrument and confirm it is suitable for field use. Once the system has met the criteria cited, the dilution instrument is certified to be used in the field.

**Figure 3: Instrumental Sampling Gas Flow for O<sub>2</sub>, CO<sub>2</sub>, NO<sub>x</sub>, VOCS and CO**



## **APPENDIX A: TEST PROTOCOL & CORRESPONDENCE**

**TEST PROTOCOL FOR YEAR 2018**

**EMISSION FACTOR  
VERIFICATION TESTING**

**HOLLINGSWORTH & VOSE  
GLASS FIBER MANUFACTURING PLANT**

*Submitted to:* Oregon Department of Environmental Quality

*Prepared for:*



**Hollingsworth  
& Vose**

1115 SE Crystal Lake Drive  
Corvallis, OR 97333

*Prepared by:*



**BISON  
ENGINEERING, INC.**

1400 11<sup>th</sup> Ave., Ste. 200  
Helena, MT 59601  
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Version 2  
Revised: April 17, 2018

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## APPENDICES

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APPENDIX A: PROPOSED TESTING SCHEDULE

## 1.0 INTRODUCTION

---

Bison Engineering, Inc. (Bison) has been retained by Hollingsworth & Vose Fiber Company (H&V) to perform emission factor verification testing of their glass fiber manufacturing plant located in Corvallis, Oregon. This testing campaign is required by the Mutual Agreement and Final Order (MAO), Addendum No. 2, signed on April 19, 2017. Specifically, this testing campaign meets requirement 7E in the MAO. Testing will be performed according to the details listed in this protocol. This protocol covers all testing required by the MAO that will occur in 2018.

### 1.1 Contact Information

***Company Information:*** Hollingsworth & Vose Fiber Company

Address: 1115 SE Crystal Lake Drive  
Corvallis, OR 97333  
Contact: Anita Ragan  
anita.ragan@hovo.com  
Phone: (541) 738-5382

***Testing Consultant:*** Bison Engineering, Inc.

Address: 1400 11<sup>th</sup> Ave., Ste. 200  
Helena, MT 59601  
Contact: Kelly Dorsi, PhD  
kdorsi@bison-eng.com  
Phone: (406) 442-5768

***State Authority:*** Oregon Department of Environmental Quality (ODEQ)

Address: 4026 Fairview Industrial Dr. SE  
Salem, OR 97302  
Contact: Suzanne Blackburn,  
blackburn.suzanne@deq.state.or.us  
Phone: (503) 378-5034

***M29, M26A and M13B Outside Laboratory:***

Chester LabNet  
Address: 12242 SW Garden Place  
Tigard, OR 97223-8246  
Contact: Paul Duda  
Phone: (503) 624-2183  
Website: www.chesterlab.net



### ***M30B Outside Laboratory:***

Ohio Lumex Co.  
Address: 30350 Bruce Industrial Pkway  
Cleveland, OH 44139  
Phone: (440) 264-2500  
Website: www.ohiolumex.com

### ***M316 Outside Laboratory:***

Enthalpy Analytical, Inc.  
Address: 800-1 Capitola Dr.  
Durham, NC 27713-4385  
Phone: (919) 850-4392  
Website: www.enthalpy.com

## **1.2 Test Project Objective**

The objectives of the 2018 testing campaigns are to conduct emission factor verification testing for multiple pollutants and production types at the H&V Corvallis, Oregon, facility. Throughout calendar year 2018, H&V will conduct source testing on four different product types and the furnace at the facility to measure outlet concentrations and mass flow rates of particulate and specific gases, including:

### Particulate

- Filterable, condensable (Oregon back-half), and total particulate matter (PM)
- Speciated metals (filterable and condensable), excluding mercury, thallium, and silver
- Vapor phase mercury (Hg)

### Gases

- Oxides of nitrogen (NO<sub>x</sub>)
- Non-methane volatile organic compounds (VOCs)
- Total fluorides (F<sup>-</sup>)
- Hydrogen fluoride (HF)
- Formaldehyde (CH<sub>2</sub>O)

Results for each pollutant will be reported in the following units:

- **PM** – grains per dry standard cubic feet (gr/dscf), pounds per hour (lb/hr) and pounds per ton glass processed (lb/ton glass processed)
- **Speciated metals** – micrograms per dry standard cubic meter (µg/dscm), milligrams per dry standard cubic meter (mg/dscm), lb/hr and lb/ton glass processed
- **Hg** – µg/dscf, lb/hr and lb/ton glass processed
- **NO<sub>x</sub>** – parts per million volume on dry basis (ppmvd), lb/hr and lb/ton glass processed, lb/1,000 scf of natural gas
- **CO** – ppmvd, lb/hour, lb/ton of glass processed, lb/1,000 scf of natural gas
- **VOC** – ppmvd, lb/hr, lb/ton glass processed, lb/1,000 scf of natural gas

- **F<sup>-</sup>** – ppmvd, lb/hr and lb/ton glass processed
- **HF** – ppmvd, lb/hr and lb/ton glass processed
- **CH<sub>2</sub>O** – ppmvd, lb/hr and lb/ton glass processed, lb/1,000 scf of natural gas

The following products and production units are each to be tested twice in 2018:

Rotary Coarse Fiber Production- Glass Plant 1 – Ceramic Filter Unit (CFU) 107

Ultra Rotary Coarse Fiber Production– Glass Plant 1 – CFU 112

Rotary Fine Fiber Production – Glass Plant 2 – CFU 117

Flame Blown Fiber Production – Glass Plant 2 – CFU 114

Furnace Stack – Glass Plant 1 – CFU 113

## **2.0 EMISSION SOURCE INFORMATION**

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### **2.1 Facility Description, Emission Sources**

The first stage of manufacturing the glass fiber produced by H&V is achieved by melting solid raw materials in an electrically-heated melting furnace. The molten glass is then delivered via forehearths to stations that produce the fiber by either a rotary or flame blown fiberizer. Natural gas is combusted to maintain molten glass temperature as it passes through the forehearths. The fiberizers are classified as rotary fine, rotary coarse, rotary ultra coarse, or flame blown. The following is a description of the manufacturing processes specific to glass melting and fiberizing.

#### **2.1.1 Glass Melt Furnaces**

There are two electrically-heated glass melt furnaces (Line 1 and Line 2) that vent to a common control device and emission point. Inside the furnaces, fresh processed material of a specific recipe is added to the surface of the molten glass already present, thereby ensuring a continuous homogeneous mixture. All glass melting furnaces are electrically heated. Gaseous emissions resulting from the melting of the bulk materials in the two furnaces at GP1 are vented to the newly installed CFU 113.

#### **2.1.2 Forehearths**

Each glass melting furnace is serviced by a forehearth that receives molten glass at high temperatures and delivers it to the fiberizers. The forehearths, unlike the glass melting furnaces, are heated by natural gas combustion. Natural gas combustion emissions from each forehearth are captured by suspended rectangular hoods and conveyed through ductwork to vent with the furnace emissions.

The forehearths can also deliver molten glass to a glass patty former or to a station that produces glass cullet. Glass patties and cullet are glass that has hardened but can be liquefied later in a remelt unit upstream of a fiberizer when needed. No furnaces are located in the GP2 building, and there are no forehearths in that building. All fiberizers in GP2 are fed by remelt units that use cullet or glass patties.

#### **2.1.3 Fiberizers (Rotary and Flame blown)**

Rotary fiberizers receive molten glass from the forehearths (in Glass Plant 1 - GP1) or electric remelt units (in GP1 and Glass Plant 2 - GP2). The molten glass is fed to a rotary spinner disk which utilizes centrifugal forces to force the molten glass to flow outward through small holes in the rotary fiberizers. Flame attenuation results in glass fibers. The newly formed glass fibers are pneumatically conveyed to collection drums (in GP1 and GP2) or a former (in GP1) for capture and packaging.

H&V also utilizes four flame blown fiberizers. Flame blown fiberizers receive molten glass from electric remelt units in GP2. Molten glass flows by gravity through numerous small orifices to create threads that are then attenuated (stretched to the point of breaking) by

high velocity hot air and flame. The newly formed glass fibers are pneumatically conveyed to drums for capture and packaging.

#### **2.1.4 Emission Control**

At the time of testing, the glass melting furnaces and fiberizers will be controlled by ceramic filter units (CFU). All furnaces and fiberizers are in the process of being converted to CFU controls. This testing campaign is intended to verify emission factors for the CFUs.

## **2.2 Client Responsibilities, Process Data**

***Hollingsworth & Vose will be responsible for:***

- Assuring availability of the manufacturing processes during the scheduled test day as needed to facilitate the test program.
- Providing safe and secure access to the sampling ports whether through a permanent fixed landing or providing a man-lift for test team access. All Bison personnel are trained in the proper use of aerial lifts.
- Recording pertinent process details at 15-minute intervals during the test program.
- Reviewing production data from the day of testing and reducing the production data to production rates (tons/hr) during each test interval.
- Supplying CFU pressure drop (inches of water).
- Supplying natural gas usage rates (Mcf/hr), where applicable.
- Product type
- At least 90% of the design capacity for new or modified equipment.
- At least 90% of the maximum operating rate for existing equipment; or
- At 90 to 110% of the normal maximum operating rate for exiting equipment. The normal maximum operating rate is defined as the 90<sup>th</sup> percentile of the average hourly operating rates during a 12-month period. Data supporting the normal maximum operating rate must be included with the source test report.
- Glass production rate (tons/hour)

Note: Only regular operating staff may adjust the production process and emission control parameters during the source performance tests and within two hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid.

## 3.0 SOURCE TEST PROGRAM DESCRIPTION

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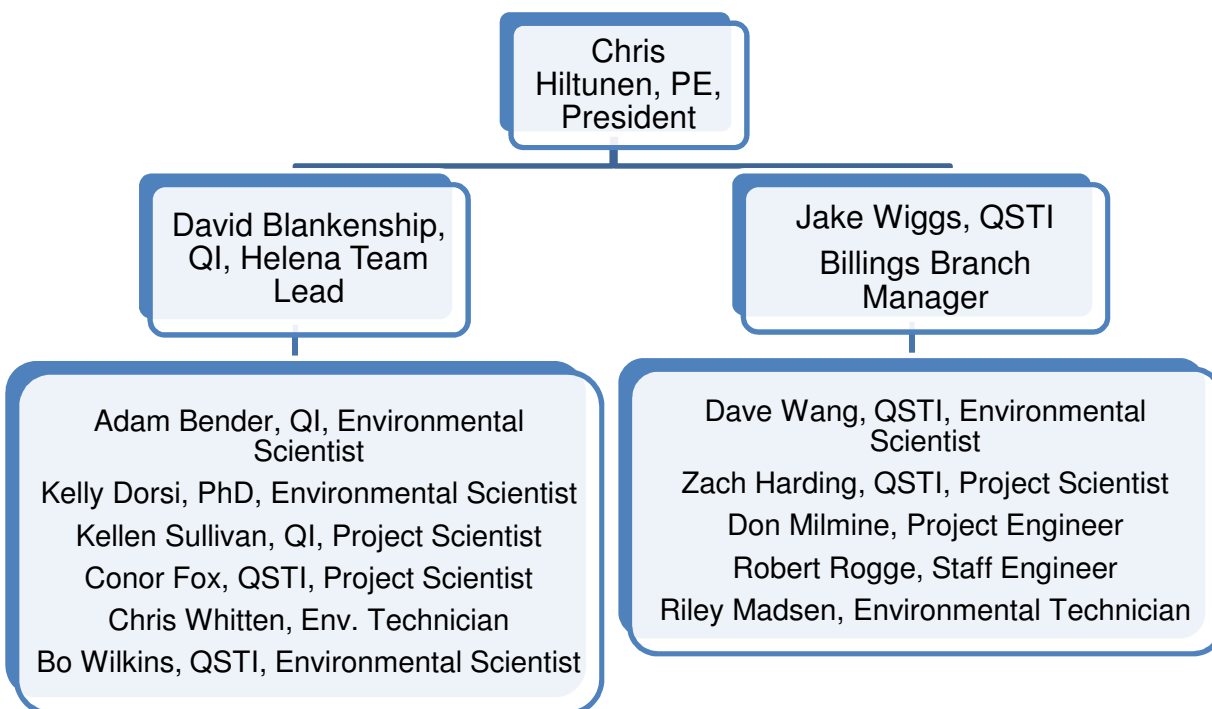
### 3.1 Testing Contractor

Bison Engineering Inc. is a full-service air quality consulting company that provides ambient air and meteorological monitoring, air quality permitting, air quality modeling, regulatory negotiations, process-to-emissions optimization and source testing services. Bison has performed hundreds of particulate performance tests on various industrial facilities over the past 30+ years and our field personnel are highly experienced stack testers. Bison has extensively invested in improving our quality systems and procedures and has recently completed our accreditation process through American Association for Laboratory Accreditation (A2LA).

### 3.2 Test Program Organization

The following chart shows the internal structure of Bison's stack testing teams. The 2018 testing will be led by Bison's Helena office with additional personnel support from Bison's Billings office. Tentatively, Kelly Dorsi, PhD, will serve as project manager. Dave Blankenship, QI, Helena Team Lead; Kellen Sullivan, QI; Zach Harding, QSTI; Conor Fox, QSTI, and Chris Whitten, Environmental Technician, will assist in performing the testing. Kelly Dorsi, PhD, will process the test data and prepare the final report. Personnel selected may be subject to change.

**Bison Engineering Organizational Chart**



### **3.3 Test Dates**

See Appendix A for the 2018 proposed testing schedule. The 2018 test dates are preliminary and subject to change. ODEQ will be notified of any changes to the test dates that have been submitted with this protocol.

### **3.4 Report Date**

Bison will submit a compliance test report to ODEQ no later than 60 days following the conclusion of each test campaign. Although the MAO states the report shall be provided within 45 days, due to the time required for lab analysis for the variety of tests being performed, Bison proposes that the 45-day time frame be extended to 60 days. *The request to extend the test report due date to 60 days after the conclusion of each test campaign has been approved by ODEQ.*

### **3.5 Safety Considerations and Working Conditions**

Bison personnel will adhere to facility safety requirements. Bison personnel may be required to hoist the sampling equipment to the source being tested. Yellow caution tape may be placed to alert people to overhead work. When required, radio or hand signals will be used for safe lifting. Hazards associated with this facility include elevated working heights, ladders, electrical usage, overhead power lines, heated equipment and hot surfaces. These sources may require the use of powered man-lift equipment or scaffolding. Test equipment may need to be rope-hoisted, lifted or carried up staircases. Testers will have the following safety equipment at hand: hard hat; full-length pants, shirt, and/or coveralls; goggles (as required); full-height (over the ankle) work boots; hearing protection; work gloves; appropriate half- or full-face respirators.

## 4.0 SOURCE TESTING PROCEDURES

### 4.1 Sampling Site Location

Velocity/flow measurements will be performed at sample locations dictated by Method 1.

### 4.2 Test Plan

Testing at the five locations will be in accordance with the EPA methods specified in the following table:

**Table 1: Test Matrix**

| <b>Hollingsworth &amp; Vose<br/>Corvallis, OR<br/>Emissions Performance Testing<br/>Test Matrix</b> |                           |                                                                    |                                                 |
|-----------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------|-------------------------------------------------|
| <b>Sources</b>                                                                                      | <b>Method</b>             | <b>Parameter</b>                                                   | <b>Test Plan and Comments</b>                   |
| Rotary Fine,<br>Flame Blown,<br>Rotary Coarse,<br>Ultra-Rotary Coarse,<br>Furnace Stack             | Method 1                  | Measurement Locations                                              | Determined prior to testing                     |
|                                                                                                     | Method 2                  | Volumetric Flow                                                    | Concurrent with each test run                   |
|                                                                                                     | Method 3A                 | Molecular Weight, O <sub>2</sub> and CO <sub>2</sub> Determination |                                                 |
|                                                                                                     | Method 4 or ODEQ Method 4 | Moisture                                                           | Incorporated with Method 5                      |
|                                                                                                     | Method 5                  | Filterable Particulate (with Oregon back-half)                     | Three 120-minute test runs per source           |
|                                                                                                     | Method 7E                 | NO <sub>x</sub>                                                    | Three 60-minute test runs (minimum) per source  |
|                                                                                                     | Method 10                 | CO                                                                 |                                                 |
|                                                                                                     | Method 13B                | Total Fluorides                                                    |                                                 |
|                                                                                                     | Method 25A                | Non-Methane VOCs                                                   |                                                 |
|                                                                                                     | Method 26A                | Hydrogen Fluoride                                                  |                                                 |
|                                                                                                     | Method 29                 | Specific Metals                                                    | Three 180-minute test runs (minimum) per source |
|                                                                                                     | Method 30B                | Mercury (Hg)                                                       |                                                 |
|                                                                                                     | Method 316                | Formaldehyde                                                       | Three 60-minute (minimum) test runs per source  |

### 4.3 Test Methods

The test will follow Environmental Protection Agency (EPA) methods described in Title 40, Code of Federal Regulations, Part 60, Appendix A (40 CFR 60, Appendix A) as follows:

**EPA Reference Method 1, "Sample and Velocity Traverses for Stationary Sources."**

The objective of Method 1 is to determine a suitable location for testing and to determine the velocity measurement points for the source. The distance upstream to atmosphere from the sampling ports (Distance A) is measured and the distance downstream to the nearest disturbance from the sample points (Distance B) is measured. Distances A and B are applied to Method 1, Figure 1-2 for velocity measurement points. These figures give the minimum number of measurement points according to the dimensions of the source. The number of points and the stack diameter are then applied to Method 1, Table 1-2 to determine equal area measurement points within the source. The results of Method 1 location and velocity point measurement locations will be included in a report appendix.

**EPA Reference Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)."**

The objective of Method 2 is to measure stack gas velocity, collect temperature data, and calculate a volumetric flow. Method 2 velocity measurements are performed using a Type S pitot tube. Differential pressures are measured using an inclined manometer, and temperatures are measured using a k-type thermal indicator. Bison has incorporated 0.84 as the Type S pitot tube coefficient ( $C_p$ ). The average velocity, temperature, static pressure, and source area are used to calculate volumetric flow within the source. This field data is recorded on field data sheets. Copies of the field data, results from the flow calculations, and calibration data will be included in the appendices to the report. *The exhaust ducts must be checked for cyclonic flow prior to starting the test. Documentation of this must be provided in the test report*

**EPA Reference Method 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)."**

The objective of Method 3A is to determine the molecular weight of the source stream by determining oxygen ( $O_2$ ) and carbon dioxide ( $CO_2$ ) concentrations in the stack gas stream. The principle is to extract a gas sample from a stationary source and route the sample through a conditioning system to a paramagnetic oxygen analyzer and an infrared carbon dioxide analyzer for the measurement of  $O_2$  and  $CO_2$  in percentages (%). The  $O_2$  and  $CO_2$  analyzers calibration adjustments are performed by sending EPA Protocol 1 gas directly to the analyzers. A system calibration is performed by sending calibration gas to the probe and through the system to the analyzers. Bison's  $CO_2/O_2$  analyzer is a Servomex Series 1400 (Serial Numbers 01415/B198 and 014208/901, respectively). The calibration error, system bias and system drift data, and measured concentrations are recorded on a data acquisition system (DAS). *Each Method 3A sampling system will be leak-checked before and after the testing program (before and after the last run). Results of the leak check will be documented in the test report.*



**EPA Reference Method 4, "Determination of Moisture Content in the Stack Gases."**

The objective of Method 4 is to determine the moisture content of a gas stream. The principle of the method is to extract a sample from the source at a constant rate and impinge it through chilled water and silica gel. The moisture is removed from the sample stream and the volume (or mass) of water extracted is determined. The sample volume and water volume (or mass) are used to calculate the moisture content of the stack gas. The results of pre- and post-test dry gas meter (DGM) calibrations can be found in the DGM calibrations table. The DGM calibration data can be found in an appendix of this report. The impinger waters are volumetrically measured on-site and the silica gels are transported to Bison's lab and weighed. The test data is hand- recorded on field data sheets and then entered into spreadsheets for moisture determination calculations.

**Method 5, "Determination of Particulate Emissions from Stationary Sources" (Methods 2 & 4 and Oregon Method 5 Inclusive).**

The objective of Method 5 is to determine the filterable particulate matter (PM) from a source. Method 5 is an isokinetic sampling method (i.e., the velocity of sample stream entering the nozzle is approximately equal to the velocity of the approaching sample stream) for determination of PM. The exhaust gas stream is sampled along a cross-section of the stack and PM is captured within the nozzle, probe, filter-bell and on the 0.3 micron pore size glass fiber filter. The filter is maintained at a temperature of 248°F±25°F followed by impingers maintained at a temperature below 68°F. Bison uses a Method 5 sampling train with a glass probe liner and nozzles to gather the particulate sample. Method 5 incorporates Method 2 "velocity measurements" and Method 4 "moisture measurements." Following the State of Oregon Department of Environmental Quality Source Sampling Manual the back-half impinger catch will also be analyzed for inorganic and organic condensable particulate matter.

**EPA Reference Method 7E, "Determination of Nitrogen Oxides Emissions from Stationary Sources."**

The objective of Method 7E testing is to determine the NO<sub>x</sub> concentration from the source. Method 7E entails extraction of a gas sample from a stationary source and routing the sample through a conditioning system to an analyzer for the measurement of NO<sub>x</sub> (NO and NO<sub>2</sub>) in ppmvd. The NO<sub>2</sub> analyzer calibration adjustment is performed by sending EPA Protocol 1 gas directly to the analyzer. A system bias check is performed by sending calibration gas to the probe and through the system to the analyzer. Bison uses a Thermo Environmental 42i (NO-NO<sub>2</sub>-NO<sub>x</sub>) analyzer. The calibration error, system bias and system drift data, and measured concentrations are recorded on a DAS for permanent record. Each Method 7E sampling system will be leak-checked before and after the testing program (before and after the last run). Results of the leak check will be documented within the test report. Measured emissions will be between 20 to 100 percent of the calibration span per Method 7E. *Each Method 7E sampling system will be leak-checked before and after the testing program (before and after the last run). Results of the leak check will be documented in the test report.*

**EPA Reference Method 10, "Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)."**

The objective of Method 10 is to determine the CO concentrations from the source. Method 10 entails extraction of a

gas sample from a stationary source and routing the sample through a conditioning system to an analyzer for the measurement of CO in ppmvd. The CO analyzer calibration adjustment is performed by sending EPA Protocol 1 gas directly to the analyzer. A system bias check is performed by sending calibration gas to the probe and through the system to the analyzer. The calibration error, system bias and system drift data, and measured concentrations are recorded on a DAS for permanent record. *Each Method 10 sampling system will be leak-checked before and after the testing program (before and after the last run). Results of the leak check will be documented in the test report.*

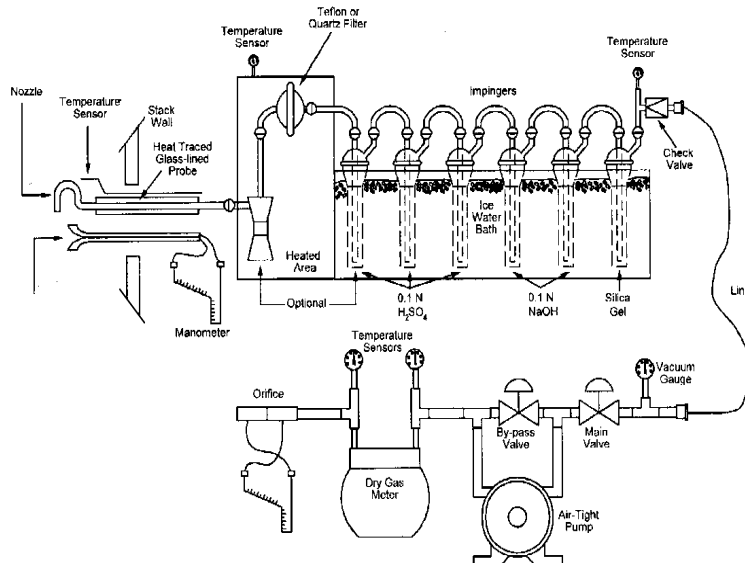
**EPA Reference Method 13B “Determination of Total Fluoride Emissions from Stationary Sources.”** The objective of the method is to determine the fluoride (F<sup>-</sup>) emissions from sources as specified in the regulations; it does not measure fluorocarbons, such as freons. Stack gas is withdrawn isokinetically from the source and collected in water and on a filter. The filter and water are combined and total F<sup>-</sup> is then determined by the specific ion electrode method. Isokinetic sampling rates will be maintained below 1.0 cfm. Bison will be using Whatman #1 filters during 2018 testing campaigns. Three filter blanks will be collected and submitted for analysis.

**EPA Reference Method 25A, “Determination of Total Gaseous Organic Concentration using a Flame Ionization Analyzer.”** The objective of Method 25A is to determine the total gaseous organic concentrations (TGOC) from a source using a flame ionization detector (FID). Bison utilizes a gas chromatograph/flame ionization detector (GC/FID) for determination of the TGOC. Testing is performed by extracting a gas sample from the source through a heated sample line directly to the GC/FID for the measurement of methane and non-methane hydrocarbons which can be combined to produce a total hydrocarbon (THC) concentration value. The non-methane organic compound (NMOC) value is used to report volatile organic compound (VOC) concentrations since EPA’s definition of a VOC does not include methane. The analyzer measurements are in parts per million by volume wet (ppmvw) and are reported as propane (C<sub>3</sub>H<sub>8</sub>). The gaseous measurement primarily consists of vaporous aromatic hydrocarbons: alkanes, alkenes and arenes. The VOC analyzer calibration adjustment is performed by sending EPA Protocol 1 gas through the sample line to the probe tip. A system drift check is performed by sending calibration gas to the probe and through the system to the analyzer. The calibration error, system bias and system drift data, and measured concentrations are recorded on a DAS for permanent record. *Each Method 25A sampling system must be leak-checked before and after the testing program (before the first run and after the last run). The methodology used to leak check the sample train must include the portion of sampling train within the analyzer. The results of the leak check must be reported in the test report. VOC emissions will include formaldehyde.*

Note: QA/QC procedures outlined in EPA Alt-106 will be utilized to make sure the GC column is properly removing methane and ethane from the sample. If ethane is not removed by the GC column use methane instead of ethane in the calibration gas.

**EPA Reference Method 26A, "Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method."** The objective of Method 26A is to isokinetically sample a source stream (i.e., the velocity of sample stream entering the nozzle is approximately equal to the velocity of the approaching sample stream) for determination of hydrogen chloride (HCl); hydrogen bromide (HBr); hydrogen fluoride (HF); chlorine (Cl<sub>2</sub>), and bromine (Br<sub>2</sub>) emissions. Method 26A is used on sources controlled by wet scrubbers, emitting acid PM (e.g., hydrogen halides dissolved in water droplets). The sample system is that of Method 5 with Method 26 solutions of 0.1 normal sulfuric acid (H<sub>2</sub>SO<sub>4</sub>) and 0.1 normal sodium hydroxide (NaOH). The impinger solutions are recovered and sent to a laboratory for Cl and/or F analysis. *Probe and oven temperatures will be maintained at a temperature greater than 248°F.*

**Figure 1: Typical Method 26A Sample Train Schematic**

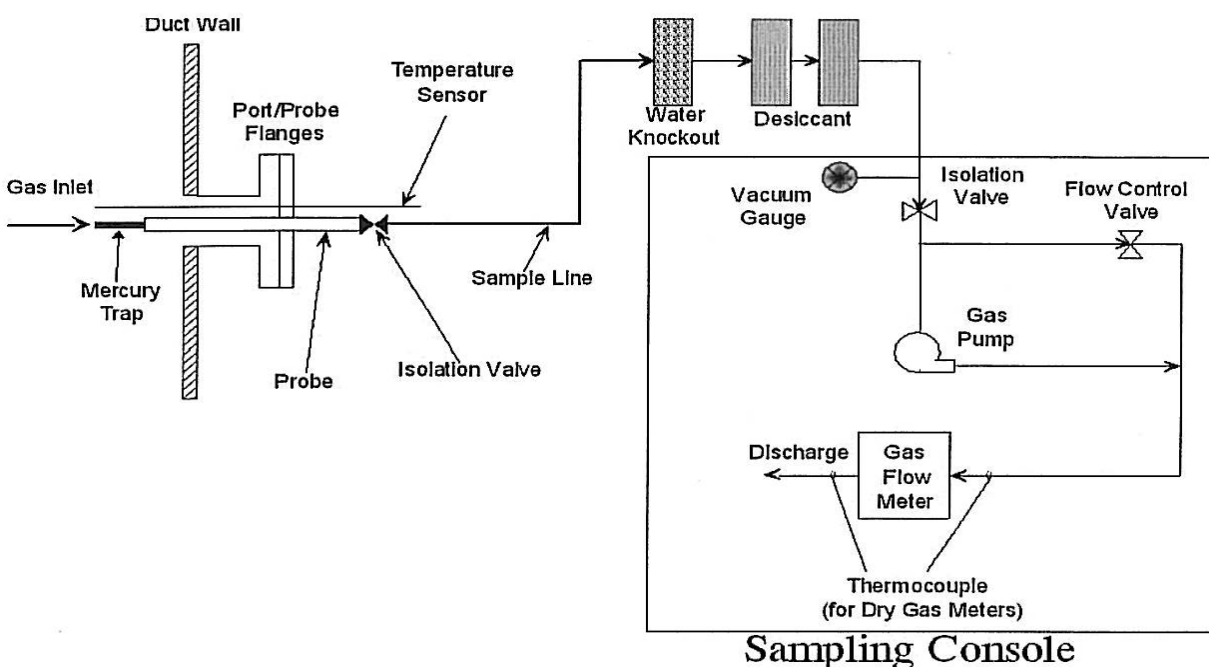


**EPA Reference Method 29, "Determination of Metals Emissions From Stationary Sources."** A stack sample is withdrawn isokinetically from the source, particulate emissions are collected in the probe and on a heated filter, and gaseous emissions are then collected in an aqueous acidic solution of hydrogen peroxide (analyzed for all metals including Hg) and an aqueous acidic solution of potassium permanganate (analyzed only for Hg). The recovered samples are digested, and appropriate fractions are analyzed for Hg by cold vapor atomic absorption spectroscopy (CVAAS) and for Sb, As, Ag, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Tl, and Zn by inductively coupled argon plasma emission spectroscopy (ICAP) or atomic absorption spectroscopy (AAS). Graphite furnace atomic absorption spectroscopy (GFAAS) is used for analysis of Sb, As, Cd, Co, Pb, Se, and Tl if these elements require greater analytical sensitivity than can be obtained by ICAP. If one so chooses, AAS may be used for analysis of all listed metals if the resulting in-stack method detection limits meet the goal of the testing program. Similarly, inductively coupled plasma-mass spectroscopy (ICP-MS) may be used for analysis of Sb, As, Ag, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Tl, and Zn.

**EPA Reference Method 30B, "Determination of Total Vapor Phase Mercury Emissions from Coal-Fired Combustion Sources Using Carbon Sorbent Traps."**

The objective of Method 30B is to determine elemental mercury ( $\text{Hg}^0$ ) and oxidized mercury ( $\text{Hg}^{2+}$ ) emissions from a source. The exhaust gas stream is sampled at a single point within the stack at a controlled sample rate. The sample is drawn through a carbon sorbent tube which is then analyzed by Ultra Violet Atomic Absorption (UV AA) or Ultra Violet Atomic Fluorescence (UV AF) cold vapor analysis. The analytical range is  $0.1 \mu\text{g/dscm}$  to  $>50 \mu\text{g/dscm}$ . *Each Method 30B sampling system must be leak-checked before and after each test run. A leak is defined as greater than 4% of the sampling rate. Results of the leak check are to be documented within the test report.*

**Figure 2: Method 30B Sampling Train**

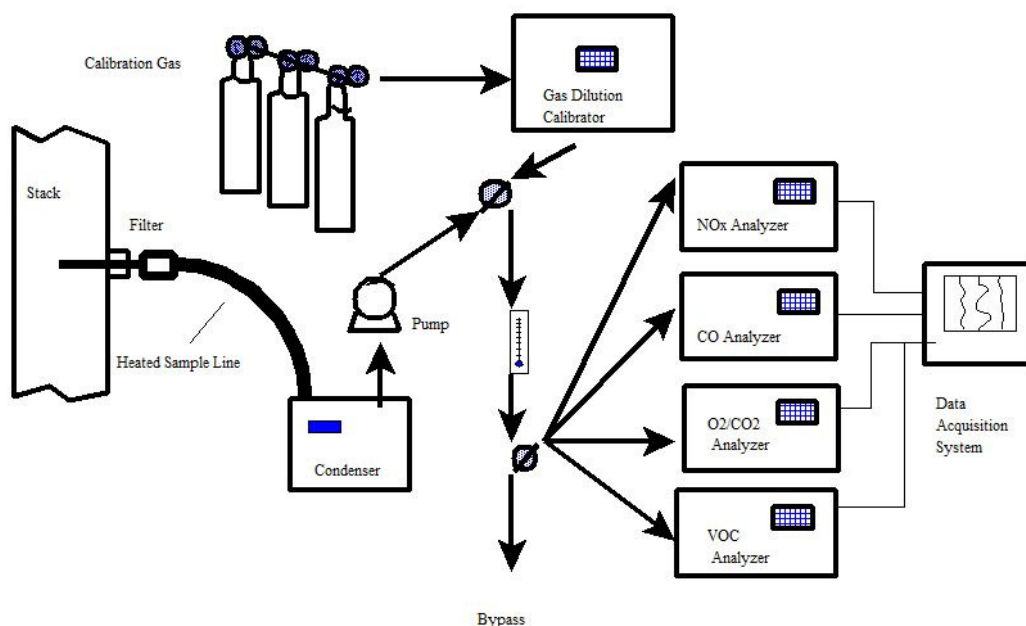


**EPA Reference Method 316, "Sampling and Analysis For Formaldehyde Emissions From Stationary Sources In The Mineral Wool And Wool Fiberglass Industries."**

Gaseous and particulate pollutants are withdrawn isokinetically from an emission source and are collected in high purity water. Formaldehyde present in the emissions is highly soluble in high purity water. The high purity water containing formaldehyde is then analyzed using the modified pararosaniline method. Formaldehyde in the sample reacts with acidic pararosaniline, and the sodium sulfite, forming a purple chromophore. The intensity of the purple color, measured spectrophotometrically, provides an accurate and precise measure of the formaldehyde concentration in the sample. *Field duplicate samples, field spike samples and field blank samples will be performed as outlined in the test method.*

**EPA Reference Method 205, “Verification of Gas Dilution Systems for Field Instrument Calibrations.”** The objective of Method 205 is to produce a set of calibration gases that are used in instrumental analysis emission testing. This is achieved by diluting a concentrated gas to lower concentrations. The diluted gases are then to be used in calibrating analyzers, performing a system check and performing post-test bias checks. The dilution of the gases is performed by a dilution mass flow instrument. Method 205 stipulates the procedure and steps to evaluate the dilution instrument and confirm it is suitable for field use. Once the system has met the criteria cited, the dilution instrument is certified to be used in the field.

**Figure 3: Gaseous Sampling System Schematic**



#### 4.4 Analytical Methods

All Method 4 field water samples will be volumetrically measured on-site and analyzed as per sampling method. The silica gels are weighed on Bison's field scale. The test data is hand- recorded on field data sheets and then entered into spreadsheets for moisture determination calculations.

#### 4.5 Minimum Detection Limitations

Should sampling result in non-detection with respect to the instrumentation or method parameters, emission data may be calculated at the minimum detection limit, pending state agency guidelines.

## **5.0 QUALITY ASSURANCE AND QUALITY CONTROL PROCEDURES**

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### **5.1 Documentation, Tracking and Certifications**

Bison uses a unique project number for document control and tracking of all projects. All documentation pertaining to that project is filed according to project number.

The tracking number for this project is **HAV218610**.

Electronic project records are maintained on the server indefinitely. The test project manager and a quality manager will sign a certification page to document and authenticate that testing was performed according to the methods, applicable regulatory requirements and Bison's quality manual. This certification page will accompany the final report.

Should a situation arise that warrants a deviation from the approved protocol, it will be discussed with the client and/or regulatory agency. If necessary, approval to modify the test plan will be obtained from the regulatory agency. Any modification to the test plan or deviation from approved test methods will be documented in the final test report.

### **5.2 Sampling Protocol and Collection Procedures**

All testing will be performed in accordance with the specified test methods and their prescribed quality control procedures.

The run number, date, location and source uniquely identify samples obtained in the field. Subdivisions of a sample are labeled and recorded as such (i.e., Sample 1 of 2). Samples are maintained in a manner to prevent deterioration, loss or damage. Samples remain in the control of the emissions testing team until/unless they are released to an outside laboratory for analysis. A chain of custody will be employed for tracking all samples. Sample preservation follows the applicable method recommendations.

Bison's test, laboratory, reporting, and quality assurance procedures will conform to the requirements specified in Bison's Quality Manual and ASTM D7036.

The individual test methods specify handling procedures for physical samples (liquids, traps, etc.). Bison will follow the procedures outlined in the appropriate methods as described in EPA 40 CFR Part 60, Appendix A and Appendix B.

Lab data is directly entered into computer spreadsheets; no written data is created unless upon request.

Method 5 particulate samples will be processed in-house by Bison at their Helena, Montana, laboratory. Bison will send other samples to the following outside laboratories

for analysis: Method 29, M26A and M13B samples will be sent to Chester LabNet, Method 30B samples will be sent to Ohio Lumex, and Method 316 samples will be sent to Enthalpy Analytical, Inc. Contact information for the individual outside laboratories is given in Section 1.1 of this protocol.

### **5.3 Equipment and Instrument Calibration, Audits and Maintenance**

Ongoing calibrations and audits of the testing equipment comprise a preventive maintenance program. Bison personnel calibrate equipment and instruments according to a set schedule and with standards traceable to the National Institute of Standards and Technology (NIST) and ASTM D7036. All equipment requiring calibrations for the methods described in this protocol also meet the appropriate criteria as specified in EPA 40 CFR Part 60 Appendix A. Equipment and instrument calibration results will be included in an appendix to the test report.

### **5.4 Instrument Calibration Gases**

The calibration gases used in this project are all certified as EPA Protocol 1 gases and are purchased from AirGas. The calibration gas certifications will be included in the test report as an appendix.

### **5.5 Data Collection, Reduction and Validation**

#### **5.5.1 Data validation and editing procedures**

Emissions test data is subject to multiple levels of validation. Bison has self-auditing spreadsheets that alert the field technician when data may be entered incorrectly by flagging calculation results that are outside of expected or reasonable values. Data is next audited during data processing and report generation. QA/QC checks associated with the testing (such as on-site analyzer calibrations and pre- or post-test equipment certifications) are rechecked during the review process.

A final draft of the test report is reviewed for technical content first by the project manager, and then by one of Bison's quality managers. All field data and spreadsheets will be supplied in an appendix to the report.

#### **5.5.2 Type of personnel performing data validation**

Personnel performing data validation and audits are trained in the applicable test methodology and authorized to review test data.

#### **5.5.3 Sources of validation information used by data editors**

The Bison staff member processing data uses the current emission test methods that are found on the EPA website.

#### **5.5.4 Specific validation procedures for each source test method**

The specific validation procedures are cited in each method. Please refer to the methods for details.

### **5.6 Internal Audits and Corrective Action**

Stack flow measuring equipment is audited in accordance with the corresponding test methods.

When departures from policies or procedures in the Bison quality system or technical operations have been identified, Bison's quality manager meets with the Bison personnel involved to evaluate the significance of the non-conforming work and discuss appropriate corrective action. Corrective actions are given the highest priority and determined immediately after identifying non-conforming work. The format for implementing corrective action follows ASTM D7036.

### **5.7 Audit Request**

Bison understands that ODEQ will require Stationary Source Audit Samples (SSAS) laboratory samples. Bison will obtain the following samples:

Fluoride in Impinger Solution for Method 13B

Hydrogen Fluoride in Impinger Solution for Method 26A

Metals in Impinger Solution for Method 29

The samples will come from:

Sigma-Aldrich Corporation  
2931 Soldier Springs Rd  
Laramie, WY 82070  
Phone: (307) 742-5452

The samples will be submitted to the outside laboratory contractor and be processed at the same time as the stack samples. All audit results will be reported in the final stack test report alongside the emissions values.



## APPENDIX A:

### Proposed 2018 Testing Schedule

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**Table A-1: April Testing Schedule**

| <b>Proposed Sampling Schedule<br/>Compliance Testing<br/>Rotary Fine (CFU-117) and Flame Blown (CFU-114)<br/>April 24, 2018 – May 2, 2018</b> |                      |                                                                |                 |                 |                |              |
|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------|-----------------|-----------------|----------------|--------------|
| Day                                                                                                                                           | Date                 | Source                                                         | Sampling Method | Parameter       | Number of Runs | Run Duration |
| 0                                                                                                                                             | Monday<br>4/23/18    | Travel Helena, MT to Corvallis, OR. Set up and prep equipment. |                 |                 |                |              |
| 1                                                                                                                                             | Tuesday<br>4/24/18   | CFU-117<br>(RF #1)                                             | M5              | PM              | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | 7E              | NO <sub>x</sub> | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | 10              | CO              | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | 25A             | VOC             | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | M316            | Formaldehyde    | 3              | 120 minutes  |
| 2                                                                                                                                             | Wednesday<br>4/25/18 | CFU-117<br>(RF #1)                                             | 13B             | Total Fluoride  | 3              | 60 minutes   |
|                                                                                                                                               |                      |                                                                | 26A             | HF              | 3              | 60 minutes   |
| 3                                                                                                                                             | Thursday<br>4/26/18  | CFU-117<br>(RF #1)                                             | M29             | Specific Metals | 3              | 180 minutes  |
|                                                                                                                                               |                      |                                                                | M30B            | Mercury         | 3              | 180 minutes  |
| 4                                                                                                                                             | Friday<br>4/27/18    | CFU-114<br>(FB #1)                                             | M29             | Specific Metals | 3              | 180 minutes  |
|                                                                                                                                               |                      |                                                                | M30B            | Mercury         | 3              | 180 minutes  |
| 5                                                                                                                                             | Saturday<br>4/28/18  | CFU-114<br>(FB #1)                                             | M5              | PM              | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | 7E              | NO <sub>x</sub> | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | 10              | CO              | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | 25A             | VOC             | 3              | 120 minutes  |
|                                                                                                                                               |                      |                                                                | M316            | Formaldehyde    | 3              | 120 minutes  |
| 6                                                                                                                                             | Sunday<br>4/29/18    | CFU-114<br>(FB #1)                                             | 13B             | Total Fluoride  | 3              | 60 minutes   |
|                                                                                                                                               |                      |                                                                | 26A             | HF              | 3              | 60 minutes   |

**Table A-2: June Testing Schedule**

| <b>Proposed Sampling Schedule<br/>Compliance Testing<br/>Rotary Fine (CFU-117), Flame Blown (CFU-114) and Rotary Coarse (CFU-107)<br/>June 5, 2018 – June 18, 2018</b> |                      |                                                                |                        |                  |                       |                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------|------------------------|------------------|-----------------------|---------------------|
| <b>Day</b>                                                                                                                                                             | <b>Date</b>          | <b>Source</b>                                                  | <b>Sampling Method</b> | <b>Parameter</b> | <b>Number of Runs</b> | <b>Run Duration</b> |
| 0                                                                                                                                                                      | Monday<br>6/4/18     | Travel Helena, MT to Corvallis, OR. Set up and prep equipment. |                        |                  |                       |                     |
| 1                                                                                                                                                                      | Tuesday<br>6/5/18    | CFU-117<br>(RF #2)                                             | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                                        |                      |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                                        |                      |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 2                                                                                                                                                                      | Wednesday<br>6/6/18  | CFU-117<br>(RF #2)                                             | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 10                     | CO               | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 26A                    | HF               | 3                     | 60 minutes          |
| 3                                                                                                                                                                      | Thursday<br>6/7/18   | CFU-117<br>(RF #2)                                             | M29                    | Specific Metals  | 2                     | 180 minutes         |
|                                                                                                                                                                        |                      |                                                                | M30B                   | Mercury          | 2                     | 180 minutes         |
| 4                                                                                                                                                                      | Friday<br>6/8/18     | CFU-117<br>(RF #2)                                             | M29                    | Specific Metals  | 1                     | 180 minutes         |
|                                                                                                                                                                        |                      |                                                                | M30B                   | Mercury          | 1                     | 180 minutes         |
| 5                                                                                                                                                                      | Saturday<br>6/9/18   | OFF                                                            |                        |                  |                       |                     |
| 6                                                                                                                                                                      | Sunday<br>6/10/18    | CFU-114<br>(FB #2)                                             | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                                        |                      |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                                        |                      |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 7                                                                                                                                                                      | Monday<br>6/11/18    | CFU-114<br>(FB #2)                                             | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 10                     | CO               | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 26A                    | HF               | 3                     | 60 minutes          |
| 8                                                                                                                                                                      | Tuesday<br>6/12/18   | CFU-114<br>(FB #2)                                             | M29                    | Specific Metals  | 2                     | 180 minutes         |
|                                                                                                                                                                        |                      |                                                                | M30B                   | Mercury          | 2                     | 180 minutes         |
| 9                                                                                                                                                                      | Wednesday<br>6/13/18 | CFU-114<br>(FB #2)                                             | M29                    | Specific Metals  | 1                     | 180 minutes         |
|                                                                                                                                                                        |                      |                                                                | M30B                   | Mercury          | 1                     | 180 minutes         |
| 10                                                                                                                                                                     | Thursday<br>6/14/18  | OFF                                                            |                        |                  |                       |                     |
| 11                                                                                                                                                                     | Friday<br>6/15/18    | CFU-107<br>(RC #1)                                             | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                                        |                      |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                                        |                      |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 12                                                                                                                                                                     | Saturday<br>6/16/18  | CFU-107<br>(RC #1)                                             | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 10                     | CO               | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                                        |                      |                                                                | 26A                    | HF               | 3                     | 60 minutes          |

|    |                   |                    |      |                 |   |             |
|----|-------------------|--------------------|------|-----------------|---|-------------|
| 13 | Sunday<br>6/17/18 | CFU-107<br>(RC #1) | M29  | Specific Metals | 2 | 180 minutes |
|    |                   |                    | M30B | Mercury         | 2 | 180 minutes |
| 14 | Monday<br>6/18/18 | CFU-107<br>(RC #1) | M29  | Specific Metals | 2 | 180 minutes |
|    |                   |                    | M30B | Mercury         | 2 | 180 minutes |

**Table A-3: September Testing Schedule**

| <b>Proposed Sampling Schedule<br/>Compliance Testing<br/>Rotary Coarse (CFU-107), Ultra Rotary Coarse (CFU-112) and<br/>Melter Stack (CFU-113)<br/>September 5, 2018 – September 18, 2018</b> |                      |                                                                |                        |                  |                       |                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------------------------------------------------|------------------------|------------------|-----------------------|---------------------|
| <b>Day</b>                                                                                                                                                                                    | <b>Date</b>          | <b>Source</b>                                                  | <b>Sampling Method</b> | <b>Parameter</b> | <b>Number of Runs</b> | <b>Run Duration</b> |
| 0                                                                                                                                                                                             | Tuesday<br>9/4/18    | Travel Helena, MT to Corvallis, OR. Set up and prep equipment. |                        |                  |                       |                     |
| 1                                                                                                                                                                                             | Wednesday<br>9/5/18  | CFU-107<br>(RC #2)                                             | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 2                                                                                                                                                                                             | Thursday<br>9/6/18   | CFU-107<br>(RC #2)                                             | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 10                     | CO               | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 26A                    | HF               | 3                     | 60 minutes          |
| 3                                                                                                                                                                                             | Friday<br>9/7/18     | CFU-107<br>(RC #2)                                             | M29                    | Specific Metals  | 2                     | 180 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M30B                   | Mercury          | 2                     | 180 minutes         |
| 4                                                                                                                                                                                             | Saturday<br>9/8/18   | CFU-107<br>(RC #2)                                             | M29                    | Specific Metals  | 1                     | 180 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M30B                   | Mercury          | 1                     | 180 minutes         |
| 5                                                                                                                                                                                             | Sunday<br>9/9/18     | OFF                                                            |                        |                  |                       |                     |
| 6                                                                                                                                                                                             | Monday<br>9/10/18    | CFU-112<br>(URC #1)                                            | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 7                                                                                                                                                                                             | Tuesday<br>9/11/18   | CFU-112<br>(URC #1)                                            | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 10                     | CO               | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 26A                    | HF               | 3                     | 60 minutes          |
| 8                                                                                                                                                                                             | Wednesday<br>9/12/18 | CFU-112<br>(URC #1)                                            | M29                    | Specific Metals  | 2                     | 180 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M30B                   | Mercury          | 2                     | 180 minutes         |
| 9                                                                                                                                                                                             | Thursday<br>9/13/18  | CFU-112<br>(URC #1)                                            | M29                    | Specific Metals  | 1                     | 180 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M30B                   | Mercury          | 1                     | 180 minutes         |
| 10                                                                                                                                                                                            | Friday<br>9/14/18    | OFF                                                            |                        |                  |                       |                     |
| 11                                                                                                                                                                                            | Saturday<br>9/15/18  | CFU-113<br>(MELT #1)                                           | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                                                               |                      |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 12                                                                                                                                                                                            | Sunday<br>9/16/18    | CFU-113<br>(MELT #1)                                           | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                                                               |                      |                                                                | 10                     | CO               | 3                     | 60 minutes          |

|    |                    |                      |      |                 |   |             |
|----|--------------------|----------------------|------|-----------------|---|-------------|
|    |                    |                      | 13B  | Total Fluoride  | 3 | 60 minutes  |
|    |                    |                      | 26A  | HF              | 3 | 60 minutes  |
| 13 | Monday<br>9/17/18  | CFU-113<br>(MELT #1) | M29  | Specific Metals | 2 | 180 minutes |
|    |                    |                      | M30B | Mercury         | 2 | 180 minutes |
| 14 | Tuesday<br>9/18/18 | CFU-113<br>(MELT #1) | M29  | Specific Metals | 1 | 180 minutes |
|    |                    |                      | M30B | Mercury         | 1 | 180 minutes |

**Table A-4: October Testing Schedule**

| <b>Proposed Sampling Schedule<br/>Compliance Testing<br/>Ultra Rotary Coarse (CFU-112) and Melter Stack (CFU-113)<br/>October 1, 2018 – October 10, 2018</b> |                       |                                                                |                        |                  |                       |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------------------------------------------------------|------------------------|------------------|-----------------------|---------------------|
| <b>Day</b>                                                                                                                                                   | <b>Date</b>           | <b>Source</b>                                                  | <b>Sampling Method</b> | <b>Parameter</b> | <b>Number of Runs</b> | <b>Run Duration</b> |
| 0                                                                                                                                                            | Monday<br>10/01/18    | Travel Helena, MT to Corvallis, OR. Set up and prep equipment. |                        |                  |                       |                     |
| 1                                                                                                                                                            | Tuesday<br>10/02/18   | CFU-112<br>(URC #2)                                            | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                              |                       |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                              |                       |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 2                                                                                                                                                            | Wednesday<br>10/03/18 | CFU-112<br>(URC #2)                                            | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                              |                       |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                              |                       |                                                                | 26A                    | HF               | 3                     | 60 minutes          |
| 3                                                                                                                                                            | Thursday<br>10/04/18  | CFU-112<br>(URC #2)                                            | M29                    | Specific Metals  | 2                     | 180 minutes         |
|                                                                                                                                                              |                       |                                                                | M30B                   | Mercury          | 2                     | 180 minutes         |
| 4                                                                                                                                                            | Friday<br>10/05/18    | CFU-112<br>(URC #2)                                            | M29                    | Specific Metals  | 1                     | 180 minutes         |
|                                                                                                                                                              |                       |                                                                | M30B                   | Mercury          | 1                     | 180 minutes         |
| 5                                                                                                                                                            | Saturday<br>10/06/18  | OFF                                                            |                        |                  |                       |                     |
| 6                                                                                                                                                            | Sunday<br>10/07/18    | CFU-113<br>(MELT #2)                                           | M5                     | PM               | 3                     | 120 minutes         |
|                                                                                                                                                              |                       |                                                                | M25A                   | VOC              | 3                     | 120 minutes         |
|                                                                                                                                                              |                       |                                                                | M316                   | Formaldehyde     | 3                     | 120 minutes         |
| 7                                                                                                                                                            | Monday<br>10/08/18    | CFU-113<br>(MELT #2)                                           | 7E                     | NO <sub>x</sub>  | 3                     | 60 minutes          |
|                                                                                                                                                              |                       |                                                                | 13B                    | Total Fluoride   | 3                     | 60 minutes          |
|                                                                                                                                                              |                       |                                                                | 26A                    | HF               | 3                     | 60 minutes          |
| 8                                                                                                                                                            | Tuesday<br>10/09/18   | CFU-113<br>(MELT #2)                                           | M29                    | Specific Metals  | 2                     | 180 minutes         |
|                                                                                                                                                              |                       |                                                                | M30B                   | Mercury          | 2                     | 180 minutes         |
| 9                                                                                                                                                            | Wednesday<br>10/10/18 | CFU-113<br>(MELT #2)                                           | M29                    | Specific Metals  | 1                     | 180 minutes         |
|                                                                                                                                                              |                       |                                                                | M30B                   | Mercury          | 1                     | 180 minutes         |

This is the last page  
of the protocol.



# Oregon

Kate Brown, Governor

## Department of Environmental Quality

Western Region Salem Office

4026 Fairview Industrial Dr. SE

Salem, OR 97302

(503) 378-8240

FAX (503) 373-7944

TTY 711

April 18, 2018

Anita Ragan  
Hollingsworth & Vose Fiber Company  
PO Box E  
Corvallis, OR 97339

Chris Hiltunen  
Bison Engineering, Inc.  
1400 11<sup>th</sup> Ave., Suite 200  
Helena, MT 59601

Re: Hollingsworth & Vose Fiber  
Permit Number 02-2173-ST-01  
April 2018 Source Test Plan - Rev. 2

Ms. Ragan and Mr. Hiltunen:

The source test plan received on March 23, 2018 for source testing at the Hollingsworth & Vose Fiber facility located in Corvallis, OR has been reviewed. DEQ understands emissions of the rotary coarse, rotary fine, flame blown, ultra rotary coarse and furnace exhausts will be tested for emissions of: filterable, condensable and total particulate matter (PM), carbon monoxide (CO), oxides of nitrogen (NO<sub>x</sub>), hydrogen fluoride (HF), total fluorides (F<sup>-</sup>), mercury (Hg), specific metals, and volatile organic compounds (VOCs) including formaldehyde.

The testing will be done to determine compliance and to verify emission factors (EF). The source test plan for testing in April 2018 is approved with the following conditions:

### GENERAL PROCESS CONDITIONS

1. Only regular operating staff may adjust the production process and emission control parameters during the source performance tests and within two (2) hours prior to the tests. Any operating adjustments made during the source performance tests, which are a result of consultation during the tests with source testing personnel, equipment vendors or consultants, may render the source performance test invalid.
2. For compliance tests, source testing must be performed as follows:
  - At least 90% of the design capacity for new or modified equipment.
  - At least 90% of the maximum operating rate for existing equipment; or
  - At 90 to 110% of the normal maximum operating rate for exiting equipment. The normal maximum operating rate is defined as the 90<sup>th</sup> percentile of the average hourly operating rates during a 12 month period. Data supporting the normal maximum operating rate must be included with the source test report.
3. All documentation of sampling equipment calibrations and analytical results should be maintained for a minimum of five years.



4. In general, the unanalyzed portions (aliquots) of the source test samples must be preserved up to the maximum holding times as specified by test method. Sample filters gravimetrically analyzed for particulate matter are to be archived for a minimum of 6 months. However, sample archiving specifications pertaining to laboratory glassware is left to the discretion of the analyzing laboratory and the testing contractor.
5. It is acceptable to postpone a scheduled test or suspend a test in progress if the discontinuation is due to equipment failure beyond the facility's control, construction delays beyond the facility's control, severe meteorological conditions, and situations that would jeopardize the safety of the testing contractors and/or operators. If the test is underway, the permittee should make every effort to complete the test run. All recoverable test information (process & sample data) must be available for DEQ review.

It is unacceptable to postpone or suspend a test run in progress if it is discontinued because the source is not able to comply with an emission limit or verify an emission factor. The permittee must provide DEQ written documentation explaining the reasons for the postponement or stoppage, and any data collected prior to the stoppage.

6. During source testing the following process parameters must be monitored and recorded. All process parameters are to be reported for each individual test run and averaged for all test runs if appropriate.
  - Glass production rate, tons/hour
  - Product type
  - Natural gas usage where applicable, cf/hr
  - CFU pressure drop, inches of water
  - If a dry bulking agent is used in the CFU, the injection rate in lb/hr (if possible), and the bulking agent composition.
7. For source testing on a single CFU that spans several days, care should be taken to ensure that the process is running at a consistent rate over the several days of the test.
  - Glass product
  - Production rate, tons/hour
  - Bulking agent injection rate, lb/hr
  - CFU pressure drop, inches of water

#### **EPA/ODEQ METHODS 1-4 CONDITIONS**

8. The exhaust duct flow measurements must meet the EPA Methods 1 & 2 criteria. Documentation including clear diagrams must be provided in the source test report.
9. The exhaust ducts must be checked for cyclonic flow prior to starting the test. Documentation of this must be provided in the test report.
10. Each Method 3A sampling system must be leak-checked before and after the testing program (before the first run and after the last run). Results of the leak check are to be documented within the test report.
11. Moisture content of the exhaust stack gas must be determined by EPA Method 4 (incorporated into ODEQ Method 5 / EPA Method 13B / EPA Method 26A / EPA Method 29) for each test run. In addition, Section 12.1.7 of EPA Method 4 states "In saturated or moisture droplet-laden gas streams, two calculations of the moisture content of the stack gas shall be made, one using a value based upon the saturated conditions (alternate method) and one based upon the results of the impinger analysis (EPA Method 4). If this is the case, then ODEQ

Method 4 (wet bulb/dry bulb) shall be used as the alternative method. At minimum, two measurements of moisture content (Bws) using ODEQ Method 4 shall be made for each run and averaged for the run. The lower of the two values of Bws as determined by EPA Method 4 and ODEQ Method 4 shall be considered correct for each run.

#### **EPA / ODEQ METHOD 5 CONDITIONS (Filterable, Condensable & Total PM)**

12. During sampling, make sure other sampling probes are not interfering with isokinetic sampling.
13. The minimum sample volume is 31.8 dscf. DEQ recommends at least 60 dscf, so that the minimum weight of PM can be met.
14. For ODEQ Method 5, the method quantifiable limit (MQL) is 7 mg of PM, which should be taken into consideration when targeting a minimum sample volume and when calculating results. Since emission factors and compliance with permit limits are to be determined, it is very important that 7 mg or more are collected.

If less than 7 mg is collected, compliance limit calculations shall be based not on the actual mass of PM collected but on the MQL of 7 mg as a "less than quantifiable limit" value. If that is the case, then the calculated grain loading concentrations reported will most likely be greater than the true concentrations.

To avoid this situation, the sampling times should be long enough to collect a sample volume large enough to obtain at least 7 mg of PM per test run.

15. Filterable, condensable and total PM test results must be reported as follows for each test run and averaged for all three test runs. Complete example calculations must be provided for at least one test run.
  - gr/dscf
  - lb/hour
  - lb/ton of glass processed

Note 1: If the values measured are below the detection limit of the method (7 mg) results should be reported as measured and as less than the detection limit.

#### **EPA METHOD 7E CONDITIONS**

16. The converter efficiency of the NO<sub>x</sub> analyzer must be documented within the test report.
17. Each Method 7E sampling system must be leak-checked before and after the testing program (before the first run and after the last run). Results of the leak check are to be documented within the test report.
18. Measured emissions should be between 20 to 100 percent of the calibration span.
19. NO<sub>x</sub> emissions as NO<sub>2</sub> must be reported as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.
  - ppmvd
  - lb/hour
  - lb/ton of glass processed
  - lb/1000 scf of natural gas

#### **EPA METHOD 10 CONDITIONS**

20. Each Method 10 sampling system must be leak-checked before and after the testing program (before the first run and after the last run). Results of the leak check are to be documented within the test report.

21. Measured emissions should be between 20 to 100 percent of the calibration span.
22. CO emissions must be reported as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.
  - ppmvd
  - lb/hour
  - lb/ton of glass processed
  - lb/1000 scf of natural gas

#### **EPA METHOD 13B CONDITIONS**

23. An audit sample must be obtained from an EPA approved audit sample provider and be onsite during testing. The DEQ SSAS ID is R0032.
24. During sampling, make sure other sampling probes are not interfering with isokinetic sampling.
25. Before the test series, determine the average fluoride blank value of at least three filters (from the lot to be used for sampling) using the applicable procedures described in sections 8.3 and 8.4 of this method.
26. Select a nozzle size such that isokinetic sampling rates below 1.0 cfm can be maintained.
27. Total fluorides emissions must be reported as F as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.
  - ppmvd
  - lb/hour
  - lb/ton of glass processed

#### **EPA METHOD 25A / EPA ALTERNATIVE METHOD 106 CONDITIONS**

28. Each Method 25A sampling system must be leak-checked before and after the testing program (before the first run and after the last run). The methodology used to leak check the sample train must include the portion of sampling train within the analyzer. The results of the leak check must be reported in the test report.
29. Since EPA Method 25A does not measure formaldehyde and it will need to be measured using EPA Method 316. The formaldehyde emission rates must be included in the VOC emission rates.
30. The span of the analyzer used to perform EPA Method 25A should be equivalent to 1.5 to 2.5 times the expected concentration. Be prepared to utilize the analyzer's lowest span value.
31. Results may not be drift corrected.
32. The calibration gases shall be the following percent of the instrument's span.
  - zero < 0.1%
  - low-level = 25 - 35%
  - mid-level = 45 - 55%
  - high-level = 80 - 90%
33. QA/QC procedures outlined in EPA Alt-106 must be utilized to make sure the GC column is properly removing methane and ethane from the sample. If ethane is not removed by the GC column use methane instead of ethane in the calibration gas.

The procedures in Alternative Method 106 for methane must be followed for the FID / GC analyzer. <https://www3.epa.gov/ttn/emc/approalt/ALT106.pdf>

- A direct interface and heated sampling line from the sampling point to the GC injection valve must be used. All sampling components leading to the analyzer must be heated to greater than 220 F.
  - Calibrate the instrument with a mixture of methane and propane. Linearity, calibration error, and calibration drift must be demonstrated.
34. VOC emissions must include formaldehyde and must be reported as indicated below for each individual test run and averaged for all three test runs on a propane basis. Results should include example calculations must be provided for at least one test run.
- ppmvd
  - lb/hour
  - lb/ton of glass processed
  - lb/1000 scf of natural gas

#### **EPA METHOD 26A CONDITIONS**

35. An audit sample must be obtained from an EPA approved audit sample provider and be onsite during testing. The DEQ SSAS ID is R0032.
36. During sampling, make sure other sampling probes are not interfering with isokinetic sampling.
37. Probe and oven temperatures must be maintained at a temperature greater than 248F.
38. If condensation appears at or before the filter follow procedures outlined in Section 8.1.6 of the method.
39. HF emissions must be reported as indicated below for each individual test run and averaged for all three test runs. Hand calculations must be provided for at least one test run.
- ppmvd
  - lb/hour
  - lb/ton of glass processed

#### **EPA METHOD 29 CONDITIONS**

40. An audit sample must be obtained from an EPA approved audit sample provider and be onsite during testing. The DEQ SSAS ID is R0032.
41. DEQ understands that you will not be performing sampling for Hexavalent Chromium. The total Chromium results will all be assumed to be Hexavalent Chromium.
42. All samples do not need to be analyzed for Silver and Thallium.
43. During metals testing, oxygen and carbon dioxide content of the stack gas shall be determined by EPA Method 3A.
44. At a minimum, 1.7 dscm (60 dscf) must be sampled each run.  
DEQ recommends at least 120 dscf be sampled to achieve the low detection levels that are desired.
45. During sampling, make sure other sampling probes are not interfering with isokinetic sampling.
46. Test results must be reported as follows for each test run and averaged for all three test runs. Test results shall not be blank corrected. Example calculations should be provided for at least one test run.
- mg/dscm
  - lb/hr
  - lb/ton of glass processed

### **EPA METHOD 30B CONDITIONS**

47. Follow Method 30A section 8.1 to select the sample traverse locations.
48. Each Method 30B sampling system must be leak-checked before and after the each test run. A leak is defined as greater than 4% of the sampling rate. Results of the leak check are to be documented within the test report.
49. Test results must be reported as follows for each test run and averaged for all three test runs. Example calculations should be provided for at least one test run.
  - µg/dscm
  - lb/hr
  - lb/ton of glass processed

### **EPA METHOD 205 CONDITIONS**

50. If a gas dilution system is to be used to provide calibration gases for other source test methods, then the system shall be evaluated once during the source test in accordance with the requirements of EPA method 205 to make sure it meets specifications.

### **EPA METHOD 316 CONDITIONS**

51. During sampling, make sure other sampling probes are not interfering with isokinetic sampling.
52. Follow sample storage and handling procedures outlined in sections 8.7.1 and 8.7.2.
53. Field Duplicate Samples, Field Spike Samples and Field Blank Samples are required as outlined in the test method.
54. Lab Blank Samples, Lab Duplicate Samples, and Lab Matrix Spike samples are required as outlined in the test method.
55. Formaldehyde emissions must be reported as indicated below for each individual test run and averaged for all three test runs. Results should include example calculations must be provided for at least one test run.
  - ppmvd
  - lb/hour
  - lb/ton of glass processed
  - lb/1000 scf of natural gas

### **GENERAL TESTING CONDITIONS**

56. The request to extend the test report due date to 60 days after the conclusion of each test campaign is approved.
57. Please include a full lab data package for all samples analyzed by a lab. The detailed data can be sent by CD.
58. DEQ must be notified of any changes in the source test plan and/or the specified methods prior to testing. Significant changes not acknowledged by the DEQ could be basis for invalidating an entire test run and potentially the entire testing program. Documentation of any deviations must include an evaluation of the impact of the deviation on the test data.
59. Method-specific quality assurance/quality control (QA/QC) procedures must be performed to ensure that the data is valid for determining source compliance. This must be done whether or not DEQ representatives are on-site to observe the testing and whether or not a QA/QC requirement has been specifically acknowledged and approved by DEQ. Only method-specific

requirements explicitly exempted by the EPA and/or DEQ need not be performed. Documentation of the procedures and results shall be presented in the source test report for review. Omission of this critical information will result in rejection of the data, requiring a retest.

60. A copy of a completed Source Test Audit Report (STAR) for all applicable Methods performed must accompany the submittal of the Source Test Report. A copy of the STAR forms is available electronically from the regional source test coordinator.
61. In an attempt to conserve natural resources and to minimize storage space requirements, the test report should be printed on both sides of each page within the document. The Department recognizes this may not be feasible for some supporting documentation (i.e. figures, maps, etc.).

The Department understands that the source test has been scheduled for April 24-29, 2018.

Please let me know if the schedule changes. I plan to observe these tests.  
If you have any questions or concerns, please contact me at 503-378-5034.

Sincerely,

A handwritten signature in black ink, appearing to read 'S. Blackburn', with a long horizontal flourish extending to the right.

Suzanne Blackburn  
Environmental Engineer  
Source Test Coordinator  
DEQ Western Region-Salem

cc: Karen White-Fallon, DEQ

## **APPENDIX B: CFU 114 (FLAME BLOWN) TEST DATA**



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 114              |
| DATE      | 04/26/18             |
| METHOD    | M26A                 |
| POLLUTANT | HF                   |



**EPA Method 1**  
**Stack Parameters and Traverse Points**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Facility:** GP2

Type of Testing: P (P for Particulate; V for Velocity/Nonparticulate)  
Type of Duct: C (C for circular; R for rectangular)

Number of ports available: 2  
Number of ports to be used: 2  
Port diameter: 5 inches

Circular ID (Rectangular Depth): 36.00 inches  
Port depth and/or wall thickness: 4.00 inches  
Stack width (Rectangular only): inches

Equivalent Diameter  
If rectangular =  $\frac{2 * \text{Depth} * \text{Width}}{\text{Depth} + \text{Width}} =$  36.00 inches (If circular = duct ID)

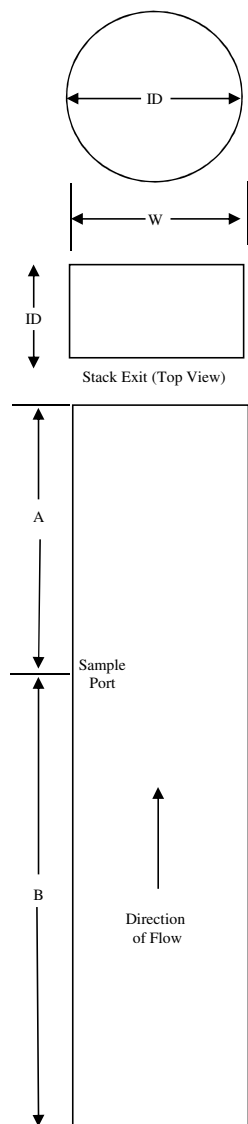
Stack/duct area = 7.069 sq.feet 1017.9 sq.inches

|                       |                                                            |                                                         |
|-----------------------|------------------------------------------------------------|---------------------------------------------------------|
| Sample Port Location: | Downstream from<br>flow disturbance<br><u>from process</u> | Upstream from<br>flow disturbance<br><u>toward exit</u> |
|                       | B                                                          | A                                                       |
| Number of Inches:     | 134.00                                                     | 45.00                                                   |
| Number of Diameters:  | 3.72                                                       | 1.25                                                    |

Minimum Number of Traverse Points: 24

| Points | % of<br>diameter | Distance from<br>inside wall (in.) | Distance including<br>port (in.) |
|--------|------------------|------------------------------------|----------------------------------|
| 1      | 2.1              | 0.76                               | 4 3/4                            |
| 2      | 6.7              | 2.41                               | 6 3/8                            |
| 3      | 11.8             | 4.25                               | 8 1/4                            |
| 4      | 17.7             | 6.37                               | 10 3/8                           |
| 5      | 25.0             | 9.00                               | 13                               |
| 6      | 35.6             | 12.82                              | 16 7/8                           |
| 7      | 64.4             | 23.18                              | 27 1/8                           |
| 8      | 75.0             | 27.00                              | 31                               |
| 9      | 82.3             | 29.63                              | 33 5/8                           |
| 10     | 88.2             | 31.75                              | 35 3/4                           |
| 11     | 93.3             | 33.59                              | 37 5/8                           |
| 12     | 97.9             | 35.24                              | 39 1/4                           |

**Reference Diagram**



Drawing NOT to scale and  
NOT an accurate representation of stack.

## Pre Traverse Flow Information

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114

**Stack Temp:** 270

| Traverse Point | Velocity<br>$\Delta P$ ("H <sub>2</sub> O) | Null Angle |
|----------------|--------------------------------------------|------------|
| 1              | 0.93                                       | 5.0        |
| 2              | 1.10                                       | 7.0        |
| 3              | 1.10                                       | 7.0        |
| 4              | 1.10                                       | 10.0       |
| 5              | 1.10                                       | 14.0       |
| 6              | 1.10                                       | 11.0       |
| 7              | 1.00                                       | 11.0       |
| 8              | 0.94                                       | 5.0        |
| 9              | 0.88                                       | 8.0        |
| 10             | 0.90                                       | 10.0       |
| 11             | 0.85                                       | 10.0       |
| 12             | 0.81                                       | 5.0        |
| 13             | 0.93                                       | 7.0        |
| 14             | 0.99                                       | 10.0       |
| 15             | 1.00                                       | 12.0       |
| 16             | 1.10                                       | 12.0       |
| 17             | 1.10                                       | 8.0        |
| 18             | 1.10                                       | 7.0        |
| 19             | 1.10                                       | 5.0        |
| 20             | 1.00                                       | 11.0       |
| 21             | 0.95                                       | 10.0       |
| 22             | 0.94                                       | 10.0       |
| 23             | 0.89                                       | 7.0        |
| 24             | 0.80                                       | 5.0        |
| 25             |                                            |            |
| 26             |                                            |            |
| 27             |                                            |            |
| 28             |                                            |            |
| 29             |                                            |            |
| 30             |                                            |            |

Average: 0.988 8.6

Flow is found to be:

Non-cyclonic x  
Cyclonic

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M26A  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Sunny, 70 degrees

**Run:** 1  
**Start Time:** 15:18  
**End Time:** 16:27  
**Date:** 4/26/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
ΔH@ 1.8073  
Probe ID 4A  
Nozzle ID 0.225  
Hot box ID 1  
Pitot Cp 0.84  
Liner type Glass  
Nozzle size 0.2550 inches  
Nozzle area 0.000355 sq.ft.  
Probe heat 260 F  
Filter heat 250 F

**Source Information:**

Barometric Pressure 29.83 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Ave. ΔP 0.988 "H<sub>2</sub>O  
Stack Temperature 270 F  
Assumed moisture 1.5 %  
Assumed meter temp. 70 F  
Total number of points 24  
Time per point 2.5  
Total run time 60

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 15       | 15        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 61.934 dcf  
Wet mol. weight 28.65 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 2.15 %  
Std. meter vol. 61.002 dscf  
Isokinetic Average 100.9 %

**Moisture/Lab:**

|                   | Filter | NA # | Initial | Final | Gain |
|-------------------|--------|------|---------|-------|------|
| Impingers, g      |        |      | 200.0   | 208   | 8.0  |
| Silica gel, g     |        |      | 257.4   | 277.9 | 20.5 |
| Total water gain: |        |      |         |       | 28.5 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 2.5         | 286.857            | 0.81                            | 260              | 69               | 2.72     | 2.70   | 4            | 254             | 61                     |
| 2              | 5           | 291.710            | 0.90                            | 265              | 69               | 3.00     | 3.00   | 4            | 253             | 60                     |
| 3              | 7.5         | 294.180            | 0.95                            | 265              | 69               | 3.17     | 3.20   | 4            | 252             | 58                     |
| 4              | 10          | 296.700            | 1.00                            | 270              | 69               | 3.31     | 3.30   | 4            | 255             | 58                     |
| 5              | 12.5        | 299.360            | 1.10                            | 270              | 69               | 3.64     | 3.60   | 4            | 255             | 57                     |
| 6              | 15          | 302.040            | 1.10                            | 270              | 69               | 3.64     | 3.60   | 4            | 257             | 57                     |
| 7              | 17.5        | 304.600            | 1.00                            | 271              | 69               | 3.31     | 3.30   | 5            | 254             | 56                     |
| 8              | 20          | 307.140            | 1.00                            | 270              | 69               | 3.31     | 3.30   | 5            | 253             | 57                     |
| 9              | 22.5        | 309.830            | 1.10                            | 269              | 69               | 3.65     | 3.70   | 5            | 254             | 57                     |
| 10             | 25          | 312.510            | 1.10                            | 269              | 69               | 3.65     | 3.70   | 5            | 256             | 58                     |
| 11             | 27.5        | 315.230            | 1.10                            | 269              | 69               | 3.65     | 3.70   | 5            | 255             | 59                     |
| 12             | 30          | 317.895            | 1.10                            | 268              | 69               | 3.65     | 3.70   | 5            | 254             | 61                     |
| 13             | 32.5        | 320.310            | 0.89                            | 255              | 69               | 3.01     | 3.00   | 5            | 253             | 57                     |
| 14             | 35          | 322.760            | 0.93                            | 262              | 69               | 3.11     | 3.10   | 5            | 253             | 56                     |
| 15             | 37.5        | 325.290            | 1.00                            | 268              | 69               | 3.32     | 3.30   | 5            | 255             | 56                     |
| 16             | 40          | 327.830            | 1.00                            | 267              | 69               | 3.32     | 3.30   | 5            | 255             | 57                     |
| 17             | 42.5        | 330.500            | 1.10                            | 269              | 69               | 3.65     | 3.70   | 5            | 255             | 59                     |
| 18             | 45          | 333.320            | 1.20                            | 270              | 69               | 3.97     | 4.00   | 5            | 255             | 59                     |
| 19             | 47.5        | 335.950            | 1.10                            | 270              | 69               | 3.64     | 3.60   | 5            | 253             | 60                     |
| 20             | 50          | 338.660            | 1.10                            | 268              | 69               | 3.65     | 3.70   | 5            | 255             | 61                     |
| 21             | 52.5        | 341.190            | 1.00                            | 267              | 69               | 3.32     | 3.30   | 5            | 256             | 61                     |
| 22             | 55          | 343.740            | 1.00                            | 266              | 69               | 3.33     | 3.30   | 5            | 255             | 61                     |
| 23             | 57.5        | 346.330            | 1.00                            | 266              | 69               | 3.33     | 3.30   | 5            | 256             | 62                     |
| 24             | 60          | 348.791            | 0.88                            | 265              | 69               | 2.93     | 2.90   | 5            | 253             | 62                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M26A  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Sunny, 70 degrees

**Run:** 2  
**Start Time:** 17:15  
**End Time:** 18:33  
**Date:** 4/26/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 4A Liner type: Glass  
Y factor 0.9820 Nozzle ID 0.225 Nozzle size: 0.2550 inches  
 $\Delta H@$  1.8073 Hot box ID 1 Nozzle area: 0.000355 sq.ft.  
Pitot Cp 0.84 Probe heat: 260 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.74 "Hg  $O_2$  19.62 %  
Static Pressure 0.56 "H<sub>2</sub>O  $CO_2$  0.68 %  
Ave.  $\Delta P$  0.988 "H<sub>2</sub>O Rec. Nz. 0.221 inches  
Stack Temperature 270 F  
Assumed moisture 2.15 %  
Assumed meter temp. 69 F  
Total number of points 24  
Time per point 2.5  
Total run time 60

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 10       | 15        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 62.114 dcf Ave.  $\Delta P$  1.039 "H<sub>2</sub>O  
Wet mol. weight 28.72 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.0183 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 1.59 % Ave.  $\Delta H$  3.45 "H<sub>2</sub>O  
Std. meter vol. 61.378 dscf Ave. T<sub>s</sub> 262 °F  
Isokinetic Average 99.8 % Ave. T<sub>m</sub> 65.8 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 206   | 6.0  |
| Silica gel, g     | 262.0   | 277.1 | 15.1 |
| Total water gain: |         |       | 21.1 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 2.5         | 349.007            | 0.81                                    | 261              | 67               | 2.67             | 2.70           | 4            | 255             | 52                     |
| 2              | 5           | 353.720            | 0.94                                    | 258              | 67               | 3.12             | 3.20           | 4            | 254             | 46                     |
| 3              | 7.5         | 356.230            | 0.98                                    | 262              | 67               | 3.23             | 3.30           | 4            | 254             | 45                     |
| 4              | 10          | 358.780            | 1.00                                    | 259              | 68               | 3.32             | 3.40           | 4            | 251             | 47                     |
| 5              | 12.5        | 361.480            | 1.10                                    | 266              | 67               | 3.61             | 3.70           | 4            | 256             | 48                     |
| 6              | 15          | 364.260            | 1.20                                    | 265              | 67               | 3.94             | 4.00           | 4            | 256             | 50                     |
| 7              | 17.5        | 366.970            | 1.10                                    | 264              | 67               | 3.62             | 3.70           | 4            | 253             | 51                     |
| 8              | 20          | 369.650            | 1.10                                    | 263              | 67               | 3.62             | 3.70           | 4            | 254             | 51                     |
| 9              | 22.5        | 372.350            | 1.10                                    | 262              | 67               | 3.63             | 3.70           | 4            | 256             | 52                     |
| 10             | 25          | 375.020            | 1.10                                    | 262              | 67               | 3.63             | 3.70           | 4            | 255             | 52                     |
| 11             | 27.5        | 377.580            | 1.00                                    | 261              | 67               | 3.30             | 3.30           | 5            | 256             | 53                     |
| 12             | 30          | 380.109            | 0.99                                    | 259              | 67               | 3.28             | 3.30           | 5            | 255             | 52                     |
| 13             | 32.5        | 382.490            | 0.91                                    | 258              | 65               | 3.01             | 3.00           | 5            | 255             | 57                     |
| 14             | 35          | 384.890            | 0.91                                    | 258              | 65               | 3.01             | 3.00           | 5            | 256             | 49                     |
| 15             | 37.5        | 387.450            | 0.99                                    | 261              | 65               | 3.26             | 3.30           | 5            | 254             | 46                     |
| 16             | 40          | 390.100            | 1.10                                    | 263              | 65               | 3.61             | 3.60           | 5            | 255             | 48                     |
| 17             | 42.5        | 392.750            | 1.10                                    | 266              | 65               | 3.59             | 3.60           | 5            | 255             | 50                     |
| 18             | 45          | 395.410            | 1.10                                    | 263              | 65               | 3.61             | 3.60           | 5            | 255             | 50                     |
| 19             | 47.5        | 398.100            | 1.10                                    | 263              | 65               | 3.61             | 3.60           | 5            | 256             | 51                     |
| 20             | 50          | 400.660            | 1.00                                    | 263              | 64               | 3.27             | 3.30           | 5            | 255             | 52                     |
| 21             | 52.5        | 403.340            | 1.10                                    | 263              | 64               | 3.60             | 3.60           | 5            | 256             | 52                     |
| 22             | 55          | 405.960            | 1.10                                    | 263              | 64               | 3.60             | 3.60           | 5            | 255             | 52                     |
| 23             | 57.5        | 408.470            | 1.00                                    | 263              | 64               | 3.27             | 3.30           | 5            | 256             | 52                     |
| 24             | 60          | 411.121            | 1.10                                    | 262              | 64               | 3.61             | 3.60           | 5            | 256             | 51                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M26A  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Sunny, 70 degrees

**Run:** 3  
**Start Time:** 18:55  
**End Time:** 20:01  
**Date:** 4/26/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 4A Liner type: Glass  
Y factor 0.9820 Nozzle ID 0.225 Nozzle size: 0.2550 inches  
 $\Delta H@$  1.8073 Hot box ID 1 Nozzle area: 0.000355 sq.ft.  
Pitot Cp 0.84 Probe heat: 260 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.74 "Hg O<sub>2</sub> 19.65 %  
Static Pressure 0.56 "H<sub>2</sub>O CO<sub>2</sub> 0.68 %  
Ave.  $\Delta P$  0.988 "H<sub>2</sub>O Rec. Nz. 0.221 inches  
Stack Temperature 270 F  
Assumed moisture 1.59 %  
Assumed meter temp. 65.8 F  
Total number of points 24  
Time per point 2.5  
Total run time 60

**Leak Checks:** Pre-test Post-test  
Pitot: x x  
Train leak rate, dcf: 0.000 0.000  
Leak check vacuum, "Hg: 11 9

**Nozzle check for roundness:**

1 2 3  
0.255 0.255 0.255 inches  
Caliper ID# HLN1

**Post Test Calculations:**

Sample volume 61.676 dcf Ave.  $\Delta P$  1.048 "H<sub>2</sub>O  
Wet mol. weight 28.73 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.0226 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 1.48 % Ave.  $\Delta H$  3.429 "H<sub>2</sub>O  
Std. meter vol. 61.538 dscf Ave. T<sub>s</sub> 259.7 °F  
Isokinetic Average 99.4 % Ave. T<sub>m</sub> 60.7 °F

**Moisture/Lab:**

Filter NA #  
Initial Final Gain  
Impingers, g 200.0 204 4.0  
Silica gel, g 257.5 273.2 15.7  
Total water gain: 19.7

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 2.5         | 411.378            | 1.10                                    | 261              | 62               | 3.63             | 3.60           | 4            | 255             | 50                     |
| 2              | 5           | 416.630            | 1.10                                    | 261              | 62               | 3.63             | 3.60           | 4            | 253             | 46                     |
| 3              | 7.5         | 419.260            | 1.10                                    | 262              | 62               | 3.63             | 3.60           | 4            | 254             | 45                     |
| 4              | 10          | 421.830            | 1.00                                    | 263              | 62               | 3.29             | 3.30           | 4            | 254             | 45                     |
| 5              | 12.5        | 424.350            | 1.00                                    | 263              | 62               | 3.29             | 3.30           | 4            | 255             | 49                     |
| 6              | 15          | 426.960            | 1.10                                    | 262              | 62               | 3.63             | 3.60           | 4            | 254             | 49                     |
| 7              | 17.5        | 429.570            | 1.10                                    | 262              | 61               | 3.62             | 3.60           | 4            | 253             | 50                     |
| 8              | 20          | 432.050            | 1.00                                    | 262              | 61               | 3.29             | 3.30           | 4            | 259             | 50                     |
| 9              | 22.5        | 434.530            | 0.98                                    | 262              | 61               | 3.23             | 3.20           | 5            | 255             | 50                     |
| 10             | 25          | 437.000            | 0.99                                    | 262              | 60               | 3.25             | 3.20           | 5            | 254             | 51                     |
| 11             | 27.5        | 439.430            | 0.91                                    | 260              | 61               | 3.00             | 3.00           | 5            | 254             | 52                     |
| 12             | 30          | 441.793            | 0.88                                    | 257              | 61               | 2.92             | 2.80           | 5            | 256             | 53                     |
| 13             | 32.5        | 444.290            | 1.00                                    | 259              | 61               | 3.30             | 3.30           | 5            | 258             | 56                     |
| 14             | 35          | 446.890            | 1.10                                    | 257              | 61               | 3.65             | 3.60           | 5            | 256             | 53                     |
| 15             | 37.5        | 449.530            | 1.10                                    | 257              | 60               | 3.64             | 3.60           | 5            | 260             | 48                     |
| 16             | 40          | 452.200            | 1.10                                    | 259              | 60               | 3.63             | 3.60           | 5            | 255             | 50                     |
| 17             | 42.5        | 454.840            | 1.10                                    | 259              | 60               | 3.63             | 3.60           | 5            | 258             | 51                     |
| 18             | 45          | 457.590            | 1.20                                    | 258              | 60               | 3.96             | 3.90           | 5            | 255             | 52                     |
| 19             | 47.5        | 460.350            | 1.20                                    | 258              | 60               | 3.96             | 3.90           | 5            | 257             | 52                     |
| 20             | 50          | 462.980            | 1.10                                    | 260              | 60               | 3.62             | 3.60           | 5            | 254             | 52                     |
| 21             | 52.5        | 465.620            | 1.10                                    | 260              | 60               | 3.62             | 3.60           | 5            | 255             | 52                     |
| 22             | 55          | 468.150            | 1.00                                    | 259              | 60               | 3.30             | 3.30           | 5            | 255             | 52                     |
| 23             | 57.5        | 470.650            | 0.98                                    | 253              | 59               | 3.25             | 3.20           | 5            | 257             | 52                     |
| 24             | 60          | 473.054            | 0.90                                    | 256              | 59               | 2.98             | 3.00           | 5            | 258             | 52                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 26A

**Run:** 1  
**Start Time:** 15:18  
**End Time:** 16:27  
**Date:** 4/26/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 286.857                  |                                 |                            |                   |                         |                            |             |
| 2.5           | 289.250                  | 2.70                            | 69                         | 1                 | 0.81                    | 260                        | 0.9000      |
| 5.0           | 291.710                  | 3.00                            | 69                         | 2                 | 0.90                    | 265                        | 0.9487      |
| 7.5           | 294.180                  | 3.20                            | 69                         | 3                 | 0.95                    | 265                        | 0.9747      |
| 10.0          | 296.700                  | 3.30                            | 69                         | 4                 | 1.00                    | 270                        | 1.0000      |
| 12.5          | 299.360                  | 3.60                            | 69                         | 5                 | 1.10                    | 270                        | 1.0488      |
| 15.0          | 302.040                  | 3.60                            | 69                         | 6                 | 1.10                    | 270                        | 1.0488      |
| 17.5          | 304.600                  | 3.30                            | 69                         | 7                 | 1.00                    | 271                        | 1.0000      |
| 20.0          | 307.140                  | 3.30                            | 69                         | 8                 | 1.00                    | 270                        | 1.0000      |
| 22.5          | 309.830                  | 3.70                            | 69                         | 9                 | 1.10                    | 269                        | 1.0488      |
| 25.0          | 312.510                  | 3.70                            | 69                         | 10                | 1.10                    | 269                        | 1.0488      |
| 27.5          | 315.230                  | 3.70                            | 69                         | 11                | 1.10                    | 269                        | 1.0488      |
| 30.0          | 317.895                  | 3.70                            | 69                         | 12                | 1.10                    | 268                        | 1.0488      |
| 32.5          | 320.310                  | 3.00                            | 69                         | 13                | 0.89                    | 255                        | 0.9434      |
| 35.0          | 322.760                  | 3.10                            | 69                         | 14                | 0.93                    | 262                        | 0.9644      |
| 37.5          | 325.290                  | 3.30                            | 69                         | 15                | 1.00                    | 268                        | 1.0000      |
| 40.0          | 327.830                  | 3.30                            | 69                         | 16                | 1.00                    | 267                        | 1.0000      |
| 42.5          | 330.500                  | 3.70                            | 69                         | 17                | 1.10                    | 269                        | 1.0488      |
| 45.0          | 333.320                  | 4.00                            | 69                         | 18                | 1.20                    | 270                        | 1.0954      |
| 47.5          | 335.950                  | 3.60                            | 69                         | 19                | 1.10                    | 270                        | 1.0488      |
| 50.0          | 338.660                  | 3.70                            | 69                         | 20                | 1.10                    | 268                        | 1.0488      |
| 52.5          | 341.190                  | 3.30                            | 69                         | 21                | 1.00                    | 267                        | 1.0000      |
| 55.0          | 343.740                  | 3.30                            | 69                         | 22                | 1.00                    | 266                        | 1.0000      |
| 57.5          | 346.330                  | 3.30                            | 69                         | 23                | 1.00                    | 266                        | 1.0000      |
| 60.0          | 348.791                  | 2.90                            | 69                         | 24                | 0.88                    | 265                        | 0.9381      |

**Client:** Hollingsworth & Vose  
**Source:** CFU 114

**Run:** 1  
**Date:** 04/26/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 60 min  
Sample Time Interval 2.5 min  
Meter Volume,  $V_m$  61.934 dcf  
Water Volume 28.5 ml (g)  
Nozzle Diameter,  $N_z$  0.2550 in.  
Nozzle Area 0.000355 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  29.83 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.65 %vd  
O<sub>2</sub> Average 19.48 %vd

### Field Data Averages

#### Meter

$\Delta H$  3.388 "H<sub>2</sub>O  
Temperature,  $T_m$  69.0 °F  
Temperature,  $T_m$  529.0 °A (°R)  
Pressure Meter,  $P_m$  30.079 "Hg

#### Stack

$\sqrt{Dp}$  1.0085 "H<sub>2</sub>O  
Temperature,  $T_s$  267.0 °F  
Temperature,  $T_s$  727.0 °A (R)  
Pressure Stack,  $P_s$  29.871 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  61.002 dscf  
1.727 dscm  
Actual Volume,  $V_{m(actual)}$  86.015 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  66.75 fps  
Volume (actual) 28,311.3 awcfm  
27,702.6 adcfm  
Volume (standard) 1,231,684.4 wscf/hr  
1,205,203.2 dscf/hr  
20,086.7 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.341 scf  
Moisture,  $B_{ws}$  0.0215  
Moisture EPA M4 2.15 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.88 lb/lb-mole  
Wet,  $M_s$  28.65 lb/lb-mole

Volume/Mole, V/M 531.344

Percent Isokinetic 100.9 %

### Laboratory Results

|    |          |           |       |              |
|----|----------|-----------|-------|--------------|
| HF | 57.9     | µg/sample |       |              |
| HF | 5.79E-05 | grams     | MW HF | 20.01 g/mole |

#### **Emissions:**

|                         |          |         |
|-------------------------|----------|---------|
| Concentration HF, $C_s$ | 1.46E-05 | gr/dscf |
|                         | 33.50    | µg/dscm |
|                         | 4.02E-02 | ppmvd   |
| Mass Emissions HF       | 2.52E-03 | lb/hr   |

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 26A

**Run:** 2  
**Start Time:** 17:15  
**End Time:** 18:33  
**Date:** 04/26/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 349.007                  |                                 |                            |                   |                         |                            |             |
| 2.5           | 351.270                  | 2.70                            | 67                         | 1                 | 0.81                    | 261                        | 0.9000      |
| 5.0           | 353.720                  | 3.20                            | 67                         | 2                 | 0.94                    | 258                        | 0.9695      |
| 7.5           | 356.230                  | 3.30                            | 67                         | 3                 | 0.98                    | 262                        | 0.9899      |
| 10.0          | 358.780                  | 3.40                            | 68                         | 4                 | 1.00                    | 259                        | 1.0000      |
| 12.5          | 361.480                  | 3.70                            | 67                         | 5                 | 1.10                    | 266                        | 1.0488      |
| 15.0          | 364.260                  | 4.00                            | 67                         | 6                 | 1.20                    | 265                        | 1.0954      |
| 17.5          | 366.970                  | 3.70                            | 67                         | 7                 | 1.10                    | 264                        | 1.0488      |
| 20.0          | 369.650                  | 3.70                            | 67                         | 8                 | 1.10                    | 263                        | 1.0488      |
| 22.5          | 372.350                  | 3.70                            | 67                         | 9                 | 1.10                    | 262                        | 1.0488      |
| 25.0          | 375.020                  | 3.70                            | 67                         | 10                | 1.10                    | 262                        | 1.0488      |
| 27.5          | 377.580                  | 3.30                            | 67                         | 11                | 1.00                    | 261                        | 1.0000      |
| 30.0          | 380.109                  | 3.30                            | 67                         | 12                | 0.99                    | 259                        | 0.9950      |
| 32.5          | 382.490                  | 3.00                            | 65                         | 13                | 0.91                    | 258                        | 0.9539      |
| 35.0          | 384.890                  | 3.00                            | 65                         | 14                | 0.91                    | 258                        | 0.9539      |
| 37.5          | 387.450                  | 3.30                            | 65                         | 15                | 0.99                    | 261                        | 0.9950      |
| 40.0          | 390.100                  | 3.60                            | 65                         | 16                | 1.10                    | 263                        | 1.0488      |
| 42.5          | 392.750                  | 3.60                            | 65                         | 17                | 1.10                    | 266                        | 1.0488      |
| 45.0          | 395.410                  | 3.60                            | 65                         | 18                | 1.10                    | 263                        | 1.0488      |
| 47.5          | 398.100                  | 3.60                            | 65                         | 19                | 1.10                    | 263                        | 1.0488      |
| 50.0          | 400.660                  | 3.30                            | 64                         | 20                | 1.00                    | 263                        | 1.0000      |
| 52.5          | 403.340                  | 3.60                            | 64                         | 21                | 1.10                    | 263                        | 1.0488      |
| 55.0          | 405.960                  | 3.60                            | 64                         | 22                | 1.10                    | 263                        | 1.0488      |
| 57.5          | 408.470                  | 3.30                            | 64                         | 23                | 1.00                    | 263                        | 1.0000      |
| 60.0          | 411.121                  | 3.60                            | 64                         | 24                | 1.10                    | 262                        | 1.0488      |



Client: Hollingsworth &amp; Vose

Run:

2

Source: CFU 114

Date:

04/26/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 2.5 min  
 Meter Volume,  $V_m$  62.114 dcf  
 Water Volume 21.1 ml (g)  
 Nozzle Diameter,  $N_z$  0.2550 in.  
 Nozzle Area 0.000355 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.74 "Hg  
 Static Pressure 0.56 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.68 %vd  
 O<sub>2</sub> Average 19.62 %vd

**Field Data Averages**Meter

$\Delta H$  3.450 "H<sub>2</sub>O  
 Temperature,  $T_m$  65.8 °F  
 Temperature,  $T_m$  525.8 °A (°R)  
 Pressure Meter,  $P_m$  29.994 "Hg

Stack

$\sqrt{D_p}$  1.0183 "H<sub>2</sub>O  
 Temperature,  $T_s$  262.0 °F  
 Temperature,  $T_s$  722.0 °A (R)  
 Pressure Stack,  $P_s$  29.781 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  61.378 dscf  
 1.738 dscm  
 Actual Volume,  $V_{m(actual)}$  85.718 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  67.19 fps  
 Volume (actual) 28,498.0 awcfm  
 28,044.9 adcfm  
 Volume (standard) 1,244,627.9 wscf/hr  
 1,224,838.3 dscf/hr  
 20,414.0 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.993 scf  
 Moisture,  $B_{ws}$  0.0159  
 Moisture EPA M4 1.59 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.89 lb/lb-mole  
 Wet,  $M_s$  28.72 lb/lb-mole

Volume/Mole,  $V/M$  529.284

Percent Isokinetic 99.8 %

**Laboratory Results**

|    |          |           |       |              |
|----|----------|-----------|-------|--------------|
| HF | 57.4     | μg/sample |       |              |
| HF | 5.74E-05 | grams     | MW HF | 20.01 g/mole |

**Emissions:**

|                         |          |         |
|-------------------------|----------|---------|
| Concentration HF, $C_s$ | 1.44E-05 | gr/dscf |
|                         | 33.00    | μg/dscm |
|                         | 3.97E-02 | ppmvd   |
| Mass Emissions HF       | 2.52E-03 | lb/hr   |

"&lt;" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 26A

**Run:** 3  
**Start Time:** 18:55  
**End Time:** 20:01  
**Date:** 04/26/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 411.378                  |                                 |                            |                   |                         |                            |             |
| 2.5           | 413.990                  | 3.60                            | 62                         | 1                 | 1.10                    | 261                        | 1.0488      |
| 5.0           | 416.630                  | 3.60                            | 62                         | 2                 | 1.10                    | 261                        | 1.0488      |
| 7.5           | 419.260                  | 3.60                            | 62                         | 3                 | 1.10                    | 262                        | 1.0488      |
| 10.0          | 421.830                  | 3.30                            | 62                         | 4                 | 1.00                    | 263                        | 1.0000      |
| 12.5          | 424.350                  | 3.30                            | 62                         | 5                 | 1.00                    | 263                        | 1.0000      |
| 15.0          | 426.960                  | 3.60                            | 62                         | 6                 | 1.10                    | 262                        | 1.0488      |
| 17.5          | 429.570                  | 3.60                            | 61                         | 7                 | 1.10                    | 262                        | 1.0488      |
| 20.0          | 432.050                  | 3.30                            | 61                         | 8                 | 1.00                    | 262                        | 1.0000      |
| 22.5          | 434.530                  | 3.20                            | 61                         | 9                 | 0.98                    | 262                        | 0.9899      |
| 25.0          | 437.000                  | 3.20                            | 60                         | 10                | 0.99                    | 262                        | 0.9950      |
| 27.5          | 439.430                  | 3.00                            | 61                         | 11                | 0.91                    | 260                        | 0.9539      |
| 30.0          | 441.793                  | 2.80                            | 61                         | 12                | 0.88                    | 257                        | 0.9381      |
| 32.5          | 444.290                  | 3.30                            | 61                         | 13                | 1.00                    | 259                        | 1.0000      |
| 35.0          | 446.890                  | 3.60                            | 61                         | 14                | 1.10                    | 257                        | 1.0488      |
| 37.5          | 449.530                  | 3.60                            | 60                         | 15                | 1.10                    | 257                        | 1.0488      |
| 40.0          | 452.200                  | 3.60                            | 60                         | 16                | 1.10                    | 259                        | 1.0488      |
| 42.5          | 454.840                  | 3.60                            | 60                         | 17                | 1.10                    | 259                        | 1.0488      |
| 45.0          | 457.590                  | 3.90                            | 60                         | 18                | 1.20                    | 258                        | 1.0954      |
| 47.5          | 460.350                  | 3.90                            | 60                         | 19                | 1.20                    | 258                        | 1.0954      |
| 50.0          | 462.980                  | 3.60                            | 60                         | 20                | 1.10                    | 260                        | 1.0488      |
| 52.5          | 465.620                  | 3.60                            | 60                         | 21                | 1.10                    | 260                        | 1.0488      |
| 55.0          | 468.150                  | 3.30                            | 60                         | 22                | 1.00                    | 259                        | 1.0000      |
| 57.5          | 470.650                  | 3.20                            | 59                         | 23                | 0.98                    | 253                        | 0.9899      |
| 60.0          | 473.054                  | 3.00                            | 59                         | 24                | 0.90                    | 256                        | 0.9487      |

Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU 114

Date:

04/26/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 2.5 min  
 Meter Volume,  $V_m$  61.676 dcf  
 Water Volume 19.7 ml (g)  
 Nozzle Diameter,  $N_z$  0.2550 in.  
 Nozzle Area 0.000355 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.74 "Hg  
 Static Pressure 0.56 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.68 %vd  
 O<sub>2</sub> Average 19.65 %vd

**Field Data Averages**Meter

$\Delta H$  3.429 "H<sub>2</sub>O  
 Temperature,  $T_m$  60.7 °F  
 Temperature,  $T_m$  520.7 °A (°R)  
 Pressure Meter,  $P_m$  29.992 "Hg

Stack

$\sqrt{D_p}$  1.0226 "H<sub>2</sub>O  
 Temperature,  $T_s$  259.7 °F  
 Temperature,  $T_s$  719.7 °A (R)  
 Pressure Stack,  $P_s$  29.781 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  61.538 dscf  
 1.743 dscm  
 Actual Volume,  $V_{m(actual)}$  85.572 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  67.35 fps  
 Volume (actual) 28,565.8 awcfm  
 28,143.0 adcfm  
 Volume (standard) 1,251,578.8 wscf/hr  
 1,233,055.4 dscf/hr  
 20,550.9 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.927 scf  
 Moisture,  $B_{ws}$  0.0148  
 Moisture EPA M4 1.48 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.89 lb/lb-mole  
 Wet,  $M_s$  28.73 lb/lb-mole

Volume/Mole,  $V/M$  527.598

Percent Isokinetic 99.4 %

**Laboratory Results**

|    |          |           |       |              |
|----|----------|-----------|-------|--------------|
| HF | 58.7     | μg/sample |       |              |
| HF | 5.87E-05 | grams     | MW HF | 20.01 g/mole |

**Emissions:**

|                         |          |         |
|-------------------------|----------|---------|
| Concentration HF, $C_s$ | 1.47E-05 | gr/dscf |
|                         | 33.65    | μg/dscm |
|                         | 4.04E-02 | ppmvd   |
| Mass Emissions HF       | 2.59E-03 | lb/hr   |

&lt;" represents MDL value

**EPA Method 26A**  
**Laboratory Results**  
**HF**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114

| Lab ID  | Sample ID          | Sample Date | Result | MDL  | Sample Vol.<br>(ml) | Units     |
|---------|--------------------|-------------|--------|------|---------------------|-----------|
| 18-S685 | M26A Cont. 3 Run 1 | 4/26/2018   | 63.5   | 3.1  | 294.0               | µg/sample |
| 18-S686 | M26A Cont. 3 Run 2 | 4/26/2018   | 63.0   | 3.7  | 350.0               | µg/sample |
| 18-S687 | M26A Cont. 3 Run 3 | 4/26/2018   | 64.3   | 3.6  | 345.0               | µg/sample |
| 18-S689 | H2O Blank          | 4/26/2018   | 5.65   | 2.6  | 244.0               | µg/sample |
| 18-S688 | 0.1N H2SO4 Blank   | 4/26/2018   | < MDL  | 2.06 | 196.0               | µg/sample |

\*If sample results are below MDL, MDL value is shown. A "<" sign designates less than MDL.  
 If blank values are below MDL, no blank corrections are performed.

# EPA Method 26A

## Results Summary

Client: Hollingsworth & Vose

Location: Corvallis, OR

Source: CFU 114

| Run                              |                               |             | 1         | 2         | 3         | Average  |
|----------------------------------|-------------------------------|-------------|-----------|-----------|-----------|----------|
| Date                             |                               |             | 4/26/2018 | 4/26/2018 | 4/26/2018 |          |
| Run Start Time                   |                               |             | 15:18     | 17:15     | 18:55     |          |
| Run End Time                     |                               |             | 16:27     | 18:33     | 20:01     |          |
| Duration, min.                   |                               |             | 60        | 60        | 60        |          |
| Barometric Pressure, "Hg         |                               |             | 29.83     | 29.74     | 29.74     | 29.77    |
| Nozzle Dia., in.                 |                               |             | 0.2550    | 0.2550    | 0.2550    | 0.2550   |
| Isokinetic Average, %            |                               |             | 100.9     | 99.8      | 99.4      | 100.0    |
| Sample Volume, dscf              |                               |             | 61.002    | 61.378    | 61.538    | 61.306   |
| Sample Volume, dscm              |                               |             | 1.727     | 1.738     | 1.743     | 1.736    |
| Stack Diameter, in.              |                               |             | 36.00     | 36.00     | 36.00     | 36.00    |
| Stack Area, sq.ft.               |                               |             | 7.069     | 7.069     | 7.069     | 7.069    |
| CO <sub>2</sub> %vd              |                               |             | 0.65      | 0.68      | 0.68      | 0.67     |
| O <sub>2</sub> %vd               |                               |             | 19.48     | 19.62     | 19.65     | 19.58    |
| Static Press., "H <sub>2</sub> O |                               |             | 0.56      | 0.56      | 0.56      | 0.56     |
| H <sub>2</sub> O %v              |                               |             | 2.15      | 1.59      | 1.48      | 1.74     |
| Wet Molecular Weight, lb/lb-mole |                               |             | 28.65     | 28.72     | 28.73     | 28.70    |
| Velocity, FPS                    |                               |             | 66.75     | 67.19     | 67.35     | 67.10    |
| ADCFM                            |                               |             | 27,702.6  | 28,044.9  | 28,143.0  | 27,963.5 |
| AWCFM                            |                               |             | 28,311.3  | 28,498.0  | 28,565.8  | 28,458.4 |
| DSCFM                            |                               |             | 20,086.7  | 20,414.0  | 20,550.9  | 20,350.5 |
| Stack Temperature, °F            |                               |             | 267.0     | 262.0     | 259.7     | 262.9    |
| HF                               | Concentration, C <sub>s</sub> | gr/dscf     | 1.46E-05  | 1.44E-05  | 1.47E-05  | 1.46E-05 |
|                                  |                               | µg/dscm     | 33.50     | 33.00     | 33.65     | 33.38    |
|                                  |                               | ppmvd       | 4.02E-02  | 3.97E-02  | 4.04E-02  | 4.01E-02 |
|                                  | Mass                          | lb/hr       | 2.52E-03  | 2.52E-03  | 2.59E-03  | 2.54E-03 |
|                                  |                               | lb/lb glass | 4.13E-05  | 4.14E-05  | 4.25E-05  | 4.17E-05 |
| Production Data                  | Glass Production              | lbs/hr      | 61.0      | 61.0      | 61.0      | 61.0     |

"<" represents MDL value

**EPA Methods 1-4, 26A**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 114**  
**Method: 26A**

**Run: 1**  
**Start Time: 15:18**  
**End Time: 16:27**  
**Date: 4/26/2018**

**EPA Methods 1-4:**

$$1) P_m = P_b + (\Delta H/13.6) = 30.079 \text{ "Hg}$$

where  $P_b$ : 29.83 "Hg  
 $\Delta H$ : 3.388 "H<sub>2</sub>O

$$2) P_s = P_b + (\text{Static Press.}/13.6) = 29.871 \text{ "Hg}$$

where  $P_b$ : 29.83 "Hg  
Static Press.: 0.56 "H<sub>2</sub>O

$$3) V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 61.002 \text{ dscf}$$

where  $V_m$ : 61.934 dcf  
 $Y$ : 0.9820  
 $P_m$ : 30.079 "Hg  
 $T_m$ : 529.0 °A

$$4) V_w(\text{std}) = (0.04706)(H_2O) = 1.341 \text{ scf}$$

where  $H_2O$ : 28.50 g

$$5) Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0215$$

where  $Vw(\text{std})$ : 1.341 scf  
 $Vm(\text{std})$ : 61.002 dscf

$$6) \% H_2O = Bws \times 100 = 2.15 \%v$$

$$7) V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 86.015 \text{ awcf}$$

where  $Y$ : 0.9820  
 $V_m$ : 61.9340 dcf  
 $Bws$ : 0.0215  
 $T_s$ : 727.0 °A  
 $T_m$ : 529.0 °A  
 $P_m$ : 30.079 "Hg  
 $P_s$ : 29.871 "Hg

$$8) M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.88 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.65 %vd  
 $O_2$ : 19.48 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.87 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.65 \text{ lb/lb-mole}$$

where  $M_d$ : 28.88 lb/lb-mole  
 $Bws$ : 0.0215

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 7.069 \text{ sq. ft.}$$

where Stack ID: 36 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 66.75 \text{ fps}$$

where  $Cp$ : 0.84  
Ave. Sqrt  $\Delta P$ : 1.0085  
 $T_s$ : 727.0 °A  
 $P_s$ : 29.871 "Hg  
 $M_s$ : 28.65 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 28,311.3 \text{ AWCfm}$$

where  $V_s$ : 66.75 ft/sec  
Stack Area: 7.069 sq. ft

$$13) \text{ ADCfm} = (\text{AWCfm})(1-Bws) = 27,702.6 \text{ ADCfm}$$

where AWCfm: 28,311.3  
 $Bws$ : 0.0215

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,231,684.4 \text{ wscf/hr}$$

where  $V_s$ : 66.75 ft/sec  
Stack Area: 7.0690 sq. ft.  
 $T_s$ : 727.0 °A  
 $P_s$ : 29.871 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1-Bws) = 1,205,203.2 \text{ dscf/hr}$$

where wscf/hr: 1,231,684.4  
 $Bws$ : 0.0215

$$16) \text{ DSCfm} = (\text{dscf/hr})/60 \text{ mins/hr} = 20,086.7 \text{ DSCfm}$$

where dscf/hr: 1,205,203.2

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000355 \text{ sq. ft.}$$

where Nozzle Size: 0.2550 inches

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 1  
Date: 4/26/2018

$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(T_s)(V_m(std))}{P_s(V_s)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 100.8 \%$$

where Ts: 727.0 °A  
Vm(Std): 61.002 dscf  
Ps: 29.871 "Hg  
Vs: 66.75 ft/sec  
Nozzle Area: 0.000355 sq. ft.  
Sampling Time: 60 min.  
Bws: 0.0215

#### EPA Method 26A:

$$19) \text{ HF laboratory results} = 63.5 \text{ } \mu\text{g/sample}$$

$$20) \text{ Blank correction} = \text{laboratory results} - \text{blank value} = 57.9 \text{ } \mu\text{g/sample}$$

where lab result: 63.5  $\mu\text{g/sample}$   
H<sub>2</sub>O blank value: 5.65  $\mu\text{g/sample}$

$$21) \text{ HF} = (\mu\text{g/sample}) / 1,000,000 = 5.79\text{E-}05 \text{ grams/sample}$$

$$22) \text{ Cs} = (\text{Sample grams} / V_m(\text{Std})) (15.43 \text{ grains/gram}) = 1.46\text{E-}05 \text{ gr/dscf}$$

where Sample: 0.00006 grams  
Vm(std): 61.002 dscf

$$23) \text{ Cs} = (\text{Sample grams} * 1,000,000 \text{ } \mu\text{g/gram}) / V_m(\text{std}) = 33.5 \text{ } \mu\text{g/dscm}$$

where Sample: 0.00006 grams  
Vm(std): 1.727 dscm

$$24) \text{ Volume/Mole} = \left( \frac{359(T_s)(29.92 \text{ "Hg})}{492(P_s)} \right) = 531.344 \text{ Vol./Mole}$$

where Ts: 727.0 °A  
Ps: 29.871 "Hg

$$25) \text{ ppmvd} = \left( \frac{\frac{\text{lb}}{\text{hr}} \times \frac{\text{Vol.}}{\text{Mole}}}{(MW \times 0.00006 \times \text{ADCFM})} \right) = 4.02\text{E-}02 \text{ ppmvd}$$

where MW: 20.01 g/mol  
lb/hr: 0.00  
Vol./Mole: 531.344  
ADCFM: 27702.6

$$26) \text{ Mass Emission Rate} = (\text{Cs})(\text{Stack flow}) / 7000 \text{ gr/lb} = 2.52\text{E-}03 \text{ lb/hr}$$

where Cs: 1.46E-05 gr/dscf  
Stack Flow: 1,205,203.2 dscf/hr





|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 114              |
| DATE      | 04/26/18             |
| METHOD    | M13B                 |
| POLLUTANT | Fluorides            |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M13B  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Sunny, 70 degrees

**Run:** 1  
**Start Time:** 15:18  
**End Time:** 16:27  
**Date:** 4/26/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

|             |        |            |      |             |                 |
|-------------|--------|------------|------|-------------|-----------------|
| Meterbox ID | 13     | Probe ID   | 4D   | Liner type  | Glass           |
| Y factor    | 0.9966 | Nozzle ID  | 220  | Nozzle size | 0.2203 inches   |
| ΔH@         | 1.8316 | Hot box ID | 2    | Nozzle area | 0.000265 sq.ft. |
|             |        | Pitot Cp   | 0.84 | Probe heat  | 250 F           |
|             |        |            |      | Filter heat | 250 F           |

**Source Information:**

|                        |                         |                 |              |
|------------------------|-------------------------|-----------------|--------------|
| Barometric Pressure    | 29.83 "Hg               | O <sub>2</sub>  | 19.48 %      |
| Static Pressure        | 0.56 "H <sub>2</sub> O  | CO <sub>2</sub> | 0.65 %       |
| Ave. ΔP                | 0.988 "H <sub>2</sub> O | Rec. Nz.        | 0.221 inches |
| Stack Temperature      | 270 F                   |                 |              |
| Assumed moisture       | 1.5 %                   |                 |              |
| Assumed meter temp.    | 70 F                    |                 |              |
| Total number of points | 24                      |                 |              |
| Time per point         | 2.5                     |                 |              |
| Total run time         | 60                      |                 |              |

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 11       | 5         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.220       | 0.220 | 0.221 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

|                         |                               |                     |                          |
|-------------------------|-------------------------------|---------------------|--------------------------|
| Sample volume           | 47.019 dcf                    | Ave. ΔP             | 1.08 "H <sub>2</sub> O   |
| Wet mol. weight         | 28.69 M <sub>s</sub> (actual) | Ave. √ΔP            | 1.0378 "H <sub>2</sub> O |
| Actual H <sub>2</sub> O | 1.75 %                        | Ave. ΔH             | 2.038 "H <sub>2</sub> O  |
| Std. meter vol.         | 46.899 dscf                   | Ave. T <sub>s</sub> | 266.9 °F                 |
| Isokinetic Average      | 100.6 %                       | Ave. T <sub>m</sub> | 68.4 °F                  |

**Moisture/Lab:**

| Filter        | NA #              |       |      |
|---------------|-------------------|-------|------|
|               | Initial           | Final | Gain |
| Impingers, g  | 200.0             | 203.0 | 3.0  |
| Silica gel, g | 242.3             | 257.0 | 14.7 |
|               | Total water gain: |       | 17.7 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 2.5         | 1.880              | 1.00                            | 259              | 68               | 1.89     | 1.90   | 2            | 251             | 62                     |
| 2              | 5           | 3.850              | 1.10                            | 259              | 68               | 2.08     | 2.10   | 2            | 250             | 63                     |
| 3              | 7.5         | 5.920              | 1.20                            | 265              | 68               | 2.25     | 2.30   | 3            | 251             | 63                     |
| 4              | 10          | 7.910              | 1.10                            | 268              | 68               | 2.06     | 2.10   | 3            | 250             | 62                     |
| 5              | 12.5        | 9.980              | 1.20                            | 269              | 68               | 2.24     | 2.20   | 3            | 252             | 63                     |
| 6              | 15          | 12.020             | 1.20                            | 269              | 68               | 2.24     | 2.20   | 3            | 250             | 63                     |
| 7              | 17.5        | 14.070             | 1.20                            | 268              | 68               | 2.24     | 2.20   | 3            | 251             | 65                     |
| 8              | 20          | 16.130             | 1.20                            | 269              | 68               | 2.24     | 2.20   | 3            | 251             | 62                     |
| 9              | 22.5        | 18.110             | 1.10                            | 270              | 68               | 2.05     | 2.10   | 3            | 251             | 61                     |
| 10             | 25          | 20.090             | 1.10                            | 269              | 68               | 2.05     | 2.10   | 3            | 250             | 60                     |
| 11             | 27.5        | 21.970             | 0.98                            | 266              | 68               | 1.84     | 1.80   | 3            | 252             | 62                     |
| 12             | 30          | 23.717             | 0.85                            | 265              | 69               | 1.60     | 1.60   | 2            | 250             | 62                     |
| 13             | 32.5        | 25.680             | 1.10                            | 265              | 68               | 2.07     | 2.10   | 3            | 251             | 63                     |
| 14             | 35          | 27.670             | 1.10                            | 265              | 68               | 2.07     | 2.10   | 3            | 250             | 59                     |
| 15             | 37.5        | 29.640             | 1.10                            | 268              | 68               | 2.06     | 2.10   | 3            | 251             | 56                     |
| 16             | 40          | 31.600             | 1.10                            | 269              | 69               | 2.06     | 2.10   | 3            | 250             | 55                     |
| 17             | 42.5        | 33.590             | 1.10                            | 269              | 69               | 2.06     | 2.10   | 3            | 251             | 56                     |
| 18             | 45          | 35.500             | 1.00                            | 269              | 69               | 1.87     | 1.90   | 2            | 250             | 57                     |
| 19             | 47.5        | 37.570             | 1.20                            | 268              | 69               | 2.25     | 2.30   | 3            | 251             | 57                     |
| 20             | 50          | 39.560             | 1.10                            | 268              | 69               | 2.06     | 2.10   | 3            | 251             | 57                     |
| 21             | 52.5        | 41.550             | 1.10                            | 268              | 69               | 2.06     | 2.10   | 3            | 250             | 58                     |
| 22             | 55          | 43.440             | 1.00                            | 268              | 69               | 1.87     | 1.90   | 3            | 250             | 58                     |
| 23             | 57.5        | 45.270             | 0.93                            | 267              | 69               | 1.74     | 1.70   | 2            | 251             | 58                     |
| 24             | 60          | 47.019             | 0.85                            | 265              | 69               | 1.60     | 1.60   | 2            | 251             | 58                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M13B  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Sunny, 70 degrees

**Run:** 2  
**Start Time:** 17:15  
**End Time:** 18:33  
**Date:** 4/26/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 13 Probe ID 4D Liner type: Glass  
Y factor 0.9966 Nozzle ID 220 Nozzle size: 0.2203 inches  
 $\Delta H@$  1.8316 Hot box ID 2 Nozzle area: 0.000265 sq.ft.  
Pitot Cp 0.84 Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.74 "Hg  $O_2$  19.62 %  
Static Pressure 0.56 "H<sub>2</sub>O  $CO_2$  0.68 %  
Ave.  $\Delta P$  0.988 "H<sub>2</sub>O Rec. Nz. 0.221 inches  
Stack Temperature 270 F  
Assumed moisture 1.75 %  
Assumed meter temp. 68.4 F  
Total number of points 24  
Time per point 2.5  
Total run time 60

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 8        | 10        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.220       | 0.220 | 0.221 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 46.284 dcf Ave.  $\Delta P$  1.049 "H<sub>2</sub>O  
Wet mol. weight 28.66 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.0233 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 2.07 % Ave.  $\Delta H$  1.992 "H<sub>2</sub>O  
Std. meter vol. 46.293 dscf Ave. T<sub>s</sub> 261.6 °F  
Isokinetic Average 100.8 % Ave. T<sub>m</sub> 65.3 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 210.0 | 10.0 |
| Silica gel, g     | 261.5   | 272.3 | 10.8 |
| Total water gain: |         |       | 20.8 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 2.5         | 1.960              | 1.10                                    | 265              | 66               | 2.05             | 2.10           | 3            | 252             | 58                     |
| 2              | 5           | 3.860              | 1.00                                    | 262              | 67               | 1.88             | 1.90           | 3            | 252             | 54                     |
| 3              | 7.5         | 5.840              | 1.10                                    | 263              | 67               | 2.06             | 2.10           | 3            | 253             | 53                     |
| 4              | 10          | 7.810              | 1.10                                    | 264              | 67               | 2.06             | 2.10           | 3            | 251             | 53                     |
| 5              | 12.5        | 9.780              | 1.10                                    | 264              | 66               | 2.05             | 2.10           | 3            | 252             | 53                     |
| 6              | 15          | 11.670             | 1.00                                    | 264              | 66               | 1.87             | 1.90           | 3            | 250             | 54                     |
| 7              | 17.5        | 13.720             | 1.20                                    | 264              | 66               | 2.24             | 2.30           | 3            | 251             | 54                     |
| 8              | 20          | 15.710             | 1.10                                    | 263              | 66               | 2.06             | 2.10           | 3            | 250             | 55                     |
| 9              | 22.5        | 17.670             | 1.10                                    | 263              | 66               | 2.06             | 2.10           | 3            | 251             | 54                     |
| 10             | 25          | 19.580             | 1.00                                    | 263              | 66               | 1.87             | 1.90           | 3            | 251             | 55                     |
| 11             | 27.5        | 21.440             | 0.96                                    | 262              | 66               | 1.80             | 1.80           | 3            | 252             | 55                     |
| 12             | 30          | 23.196             | 0.87                                    | 261              | 66               | 1.63             | 1.60           | 3            | 251             | 56                     |
| 13             | 32.5        | 25.030             | 0.96                                    | 260              | 64               | 1.80             | 1.80           | 3            | 252             | 58                     |
| 14             | 35          | 26.910             | 0.99                                    | 260              | 65               | 1.85             | 1.90           | 3            | 251             | 51                     |
| 15             | 37.5        | 28.900             | 1.10                                    | 260              | 65               | 2.06             | 2.10           | 3            | 250             | 50                     |
| 16             | 40          | 30.870             | 1.10                                    | 260              | 65               | 2.06             | 2.10           | 3            | 252             | 49                     |
| 17             | 42.5        | 32.850             | 1.10                                    | 260              | 64               | 2.06             | 2.10           | 3            | 251             | 50                     |
| 18             | 45          | 34.880             | 1.20                                    | 260              | 64               | 2.24             | 2.20           | 3            | 250             | 50                     |
| 19             | 47.5        | 36.860             | 1.10                                    | 261              | 64               | 2.05             | 2.10           | 3            | 251             | 50                     |
| 20             | 50          | 38.840             | 1.10                                    | 262              | 64               | 2.05             | 2.10           | 3            | 250             | 51                     |
| 21             | 52.5        | 40.820             | 1.10                                    | 262              | 64               | 2.05             | 2.10           | 3            | 252             | 50                     |
| 22             | 55          | 42.710             | 1.00                                    | 260              | 64               | 1.87             | 1.90           | 3            | 253             | 51                     |
| 23             | 57.5        | 44.570             | 0.96                                    | 259              | 64               | 1.80             | 1.80           | 3            | 252             | 51                     |
| 24             | 60          | 46.284             | 0.84                                    | 257              | 64               | 1.58             | 1.60           | 3            | 251             | 50                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M13B  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Sunny, 70 degrees

**Run:** 3  
**Start Time:** 18:55  
**End Time:** 20:01  
**Date:** 4/26/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 13  
Y factor 0.9966  
 $\Delta H@$  1.8316  
Probe ID 4D  
Nozzle ID 220  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.2203 inches  
Nozzle area: 0.000265 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.74 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Ave.  $\Delta P$  0.988 "H<sub>2</sub>O  
Stack Temperature 270 F  
Assumed moisture 2.07 %  
Assumed meter temp. 65.3 F  
Total number of points 24  
Time per point 2.5  
Total run time 60

**Leak Checks:** Pre-test Post-test  
Pitot: x x  
Train leak rate, dcf: 0.000 0.000  
Leak check vacuum, "Hg: 12 14

**Nozzle check for roundness:**

1 2 3  
0.220 0.220 0.221 inches  
Caliper ID# HLN1

**Post Test Calculations:**

Sample volume 45.763 dcf  
Wet mol. weight 28.73 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.47 %  
Std. meter vol. 46.207 dscf  
Isokinetic Average 100.0 %  
Ave.  $\Delta P$  1.045 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.021 "H<sub>2</sub>O  
Ave.  $\Delta H$  1.95 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 257.7 °F  
Ave. T<sub>m</sub> 60.3 °F

**Moisture/Lab:**

Filter NA #  
Initial Final Gain  
Impingers, g 200.0 204.0 4.0  
Silica gel, g 257.7 268.3 10.6  
Total water gain: 14.6

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 2.5         | 1.750              | 0.88                                    | 255              | 61               | 1.64             | 1.70           | 2            | 253             | 52                     |
| 2              | 5           | 3.580              | 0.97                                    | 256              | 62               | 1.81             | 1.80           | 2            | 252             | 49                     |
| 3              | 7.5         | 5.540              | 1.10                                    | 256              | 62               | 2.05             | 2.10           | 3            | 252             | 48                     |
| 4              | 10          | 7.480              | 1.10                                    | 261              | 61               | 2.03             | 2.00           | 3            | 252             | 47                     |
| 5              | 12.5        | 9.520              | 1.20                                    | 262              | 61               | 2.21             | 2.20           | 3            | 251             | 48                     |
| 6              | 15          | 11.560             | 1.20                                    | 262              | 61               | 2.21             | 2.20           | 3            | 250             | 48                     |
| 7              | 17.5        | 13.520             | 1.10                                    | 262              | 61               | 2.03             | 2.00           | 3            | 251             | 49                     |
| 8              | 20          | 15.490             | 1.10                                    | 260              | 60               | 2.03             | 2.00           | 3            | 249             | 50                     |
| 9              | 22.5        | 17.430             | 1.10                                    | 260              | 61               | 2.03             | 2.10           | 3            | 250             | 50                     |
| 10             | 25          | 19.290             | 1.00                                    | 259              | 60               | 1.85             | 1.90           | 3            | 251             | 50                     |
| 11             | 27.5        | 21.160             | 0.99                                    | 258              | 61               | 1.84             | 1.90           | 3            | 250             | 50                     |
| 12             | 30          | 22.961             | 0.92                                    | 255              | 61               | 1.71             | 1.70           | 3            | 251             | 52                     |
| 13             | 32.5        | 24.710             | 0.85                                    | 251              | 60               | 1.59             | 1.60           | 3            | 251             | 52                     |
| 14             | 35          | 26.540             | 0.98                                    | 255              | 60               | 1.82             | 1.80           | 3            | 251             | 50                     |
| 15             | 37.5        | 28.410             | 1.00                                    | 252              | 60               | 1.87             | 1.90           | 3            | 252             | 49                     |
| 16             | 40          | 30.360             | 1.10                                    | 257              | 60               | 2.04             | 2.10           | 3            | 250             | 50                     |
| 17             | 42.5        | 32.330             | 1.10                                    | 258              | 60               | 2.04             | 2.10           | 3            | 252             | 51                     |
| 18             | 45          | 34.370             | 1.20                                    | 259              | 60               | 2.22             | 2.20           | 3            | 251             | 51                     |
| 19             | 47.5        | 36.330             | 1.10                                    | 258              | 59               | 2.03             | 2.00           | 3            | 250             | 50                     |
| 20             | 50          | 38.220             | 1.00                                    | 258              | 59               | 1.85             | 1.90           | 3            | 250             | 51                     |
| 21             | 52.5        | 40.160             | 1.10                                    | 258              | 59               | 2.03             | 2.00           | 3            | 251             | 51                     |
| 22             | 55          | 42.030             | 1.00                                    | 258              | 59               | 1.85             | 1.90           | 3            | 249             | 51                     |
| 23             | 57.5        | 43.910             | 1.00                                    | 258              | 59               | 1.85             | 1.90           | 3            | 250             | 50                     |
| 24             | 60          | 45.763             | 0.98                                    | 257              | 59               | 1.81             | 1.80           | 3            | 251             | 50                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 13B

**Run:** 1  
**Start Time:** 15:18  
**End Time:** 16:27  
**Date:** 4/26/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 2.5           | 1.880                    | 1.90                            | 68                         | 1                 | 1.00                    | 259                        | 1.0000      |
| 5.0           | 3.850                    | 2.10                            | 68                         | 2                 | 1.10                    | 259                        | 1.0488      |
| 7.5           | 5.920                    | 2.30                            | 68                         | 3                 | 1.20                    | 265                        | 1.0954      |
| 10.0          | 7.910                    | 2.10                            | 68                         | 4                 | 1.10                    | 268                        | 1.0488      |
| 12.5          | 9.980                    | 2.20                            | 68                         | 5                 | 1.20                    | 269                        | 1.0954      |
| 15.0          | 12.020                   | 2.20                            | 68                         | 6                 | 1.20                    | 269                        | 1.0954      |
| 17.5          | 14.070                   | 2.20                            | 68                         | 7                 | 1.20                    | 268                        | 1.0954      |
| 20.0          | 16.130                   | 2.20                            | 68                         | 8                 | 1.20                    | 269                        | 1.0954      |
| 22.5          | 18.110                   | 2.10                            | 68                         | 9                 | 1.10                    | 270                        | 1.0488      |
| 25.0          | 20.090                   | 2.10                            | 68                         | 10                | 1.10                    | 269                        | 1.0488      |
| 27.5          | 21.970                   | 1.80                            | 68                         | 11                | 0.98                    | 266                        | 0.9899      |
| 30.0          | 23.717                   | 1.60                            | 69                         | 12                | 0.85                    | 265                        | 0.9220      |
| 32.5          | 25.680                   | 2.10                            | 68                         | 13                | 1.10                    | 265                        | 1.0488      |
| 35.0          | 27.670                   | 2.10                            | 68                         | 14                | 1.10                    | 265                        | 1.0488      |
| 37.5          | 29.640                   | 2.10                            | 68                         | 15                | 1.10                    | 268                        | 1.0488      |
| 40.0          | 31.600                   | 2.10                            | 69                         | 16                | 1.10                    | 269                        | 1.0488      |
| 42.5          | 33.590                   | 2.10                            | 69                         | 17                | 1.10                    | 269                        | 1.0488      |
| 45.0          | 35.500                   | 1.90                            | 69                         | 18                | 1.00                    | 269                        | 1.0000      |
| 47.5          | 37.570                   | 2.30                            | 69                         | 19                | 1.20                    | 268                        | 1.0954      |
| 50.0          | 39.560                   | 2.10                            | 69                         | 20                | 1.10                    | 268                        | 1.0488      |
| 52.5          | 41.550                   | 2.10                            | 69                         | 21                | 1.10                    | 268                        | 1.0488      |
| 55.0          | 43.440                   | 1.90                            | 69                         | 22                | 1.00                    | 268                        | 1.0000      |
| 57.5          | 45.270                   | 1.70                            | 69                         | 23                | 0.93                    | 267                        | 0.9644      |
| 60.0          | 47.019                   | 1.60                            | 69                         | 24                | 0.85                    | 265                        | 0.9220      |

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 1  
Date: 04/26/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 60 min  
Sample Time Interval 2.5 min  
Meter Volume,  $V_m$  47.019 dcf  
Water Volume 17.7 ml (g)  
Nozzle Diameter,  $N_z$  0.2203 in.  
Nozzle Area 0.000265 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  29.83 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9966 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.65 %vd  
O<sub>2</sub> Average 19.48 %vd

### Field Data Averages

#### Meter

$\Delta H$  2.038 "H<sub>2</sub>O  
Temperature,  $T_m$  68.4 °F  
Temperature,  $T_m$  528.4 °A (°R)  
Pressure Meter,  $P_m$  29.980 "Hg

#### Stack

$\sqrt{D_p}$  1.0378 "H<sub>2</sub>O  
Temperature,  $T_s$  266.9 °F  
Temperature,  $T_s$  726.9 °A (R)  
Pressure Stack,  $P_s$  29.871 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  46.899 dscf  
1.328 dscm  
Actual Volume,  $V_{m(actual)}$  65.850 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  68.64 fps  
Volume (actual) 29,113.0 awcfm  
28,603.5 adcfm  
Volume (standard) 1,266,733.3 wscf/hr  
1,244,565.5 dscf/hr  
20,742.8 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.833 scf  
Moisture,  $B_{ws}$  0.0175  
Moisture EPA M4 1.75 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.88 lb/lb-mole  
Wet,  $M_s$  28.69 lb/lb-mole

Volume/Mole,  $V/M$  531.271

Percent Isokinetic 100.6 %

### Laboratory Results

|          |          |           |      |             |
|----------|----------|-----------|------|-------------|
| Fluoride | 49.0     | μg/sample |      |             |
| Fluoride | 4.90E-05 | grams     | MW F | 19.0 g/mole |

#### Emissions:

|                      |          |         |
|----------------------|----------|---------|
| Concentration, $C_s$ | 1.61E-05 | gr/dscf |
|                      | 36.90    | μg/dscm |
|                      | 4.67E-02 | ppmvd   |
| Mass Emissions       | 2.87E-03 | lb/hr   |

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 13B

**Run:** 2  
**Start Time:** 17:15  
**End Time:** 18:33  
**Date:** 04/26/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 2.5           | 1.960                    | 2.10                            | 66                         | 1                 | 1.10                    | 265                        | 1.0488      |
| 5.0           | 3.860                    | 1.90                            | 67                         | 2                 | 1.00                    | 262                        | 1.0000      |
| 7.5           | 5.840                    | 2.10                            | 67                         | 3                 | 1.10                    | 263                        | 1.0488      |
| 10.0          | 7.810                    | 2.10                            | 67                         | 4                 | 1.10                    | 264                        | 1.0488      |
| 12.5          | 9.780                    | 2.10                            | 66                         | 5                 | 1.10                    | 264                        | 1.0488      |
| 15.0          | 11.670                   | 1.90                            | 66                         | 6                 | 1.00                    | 264                        | 1.0000      |
| 17.5          | 13.720                   | 2.30                            | 66                         | 7                 | 1.20                    | 264                        | 1.0954      |
| 20.0          | 15.710                   | 2.10                            | 66                         | 8                 | 1.10                    | 263                        | 1.0488      |
| 22.5          | 17.670                   | 2.10                            | 66                         | 9                 | 1.10                    | 263                        | 1.0488      |
| 25.0          | 19.580                   | 1.90                            | 66                         | 10                | 1.00                    | 263                        | 1.0000      |
| 27.5          | 21.440                   | 1.80                            | 66                         | 11                | 0.96                    | 262                        | 0.9798      |
| 30.0          | 23.196                   | 1.60                            | 66                         | 12                | 0.87                    | 261                        | 0.9327      |
| 32.5          | 25.030                   | 1.80                            | 64                         | 13                | 0.96                    | 260                        | 0.9798      |
| 35.0          | 26.910                   | 1.90                            | 65                         | 14                | 0.99                    | 260                        | 0.9950      |
| 37.5          | 28.900                   | 2.10                            | 65                         | 15                | 1.10                    | 260                        | 1.0488      |
| 40.0          | 30.870                   | 2.10                            | 65                         | 16                | 1.10                    | 260                        | 1.0488      |
| 42.5          | 32.850                   | 2.10                            | 64                         | 17                | 1.10                    | 260                        | 1.0488      |
| 45.0          | 34.880                   | 2.20                            | 64                         | 18                | 1.20                    | 260                        | 1.0954      |
| 47.5          | 36.860                   | 2.10                            | 64                         | 19                | 1.10                    | 261                        | 1.0488      |
| 50.0          | 38.840                   | 2.10                            | 64                         | 20                | 1.10                    | 262                        | 1.0488      |
| 52.5          | 40.820                   | 2.10                            | 64                         | 21                | 1.10                    | 262                        | 1.0488      |
| 55.0          | 42.710                   | 1.90                            | 64                         | 22                | 1.00                    | 260                        | 1.0000      |
| 57.5          | 44.570                   | 1.80                            | 64                         | 23                | 0.96                    | 259                        | 0.9798      |
| 60.0          | 46.284                   | 1.60                            | 64                         | 24                | 0.84                    | 257                        | 0.9165      |

Client: Hollingsworth &amp; Vose

Run:

2

Source: CFU 114

Date:

04/26/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 2.5 min  
 Meter Volume,  $V_m$  46.284 dcf  
 Water Volume 20.8 ml (g)  
 Nozzle Diameter,  $N_z$  0.2203 in.  
 Nozzle Area 0.000265 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.74 "Hg  
 Static Pressure 0.56 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9966 Y

Molecular Weight:

CO<sub>2</sub> Average 0.68 %vd  
 O<sub>2</sub> Average 19.62 %vd

**Field Data Averages**Meter

$\Delta H$  1.992 "H<sub>2</sub>O  
 Temperature,  $T_m$  65.3 °F  
 Temperature,  $T_m$  525.3 °A (°R)  
 Pressure Meter,  $P_m$  29.886 "Hg

Stack

$\sqrt{D_p}$  1.0233 "H<sub>2</sub>O  
 Temperature,  $T_s$  261.6 °F  
 Temperature,  $T_s$  721.6 °A (R)  
 Pressure Stack,  $P_s$  29.781 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  46.292 dscf  
 1.311 dscm  
 Actual Volume,  $V_{m(actual)}$  64.931 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  67.57 fps  
 Volume (actual) 28,659.1 awcfm  
 28,065.9 adcfm  
 Volume (standard) 1,252,360.9 wscf/hr  
 1,226,437.0 dscf/hr  
 20,440.6 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.979 scf  
 Moisture,  $B_{ws}$  0.0207  
 Moisture EPA M4 2.07 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.89 lb/lb-mole  
 Wet,  $M_s$  28.66 lb/lb-mole

Volume/Mole,  $V/M$  528.991

Percent Isokinetic 100.8 %

**Laboratory Results**

|          |            |           |      |             |
|----------|------------|-----------|------|-------------|
| Fluoride | < 30.0     | μg/sample |      |             |
| Fluoride | < 3.00E-05 | grams     | MW F | 19.0 g/mole |

**Emissions:**

Concentration,  $C_s$  < 1.00E-05 gr/dscf  
 < 22.88 μg/dscm  
 < 2.90E-02 ppmvd  
 Mass Emissions < 1.75E-03 lb/hr

&lt;" represents MDL value



**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 13B

**Run:** 3  
**Start Time:** 18:55  
**End Time:** 20:01  
**Date:** 04/26/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 2.5           | 1.750                    | 1.70                            | 61                         | 1                 | 0.88                    | 255                        | 0.9381      |
| 5.0           | 3.580                    | 1.80                            | 62                         | 2                 | 0.97                    | 256                        | 0.9849      |
| 7.5           | 5.540                    | 2.10                            | 62                         | 3                 | 1.10                    | 256                        | 1.0488      |
| 10.0          | 7.480                    | 2.00                            | 61                         | 4                 | 1.10                    | 261                        | 1.0488      |
| 12.5          | 9.520                    | 2.20                            | 61                         | 5                 | 1.20                    | 262                        | 1.0954      |
| 15.0          | 11.560                   | 2.20                            | 61                         | 6                 | 1.20                    | 262                        | 1.0954      |
| 17.5          | 13.520                   | 2.00                            | 61                         | 7                 | 1.10                    | 262                        | 1.0488      |
| 20.0          | 15.490                   | 2.00                            | 60                         | 8                 | 1.10                    | 260                        | 1.0488      |
| 22.5          | 17.430                   | 2.10                            | 61                         | 9                 | 1.10                    | 260                        | 1.0488      |
| 25.0          | 19.290                   | 1.90                            | 60                         | 10                | 1.00                    | 259                        | 1.0000      |
| 27.5          | 21.160                   | 1.90                            | 61                         | 11                | 0.99                    | 258                        | 0.9950      |
| 30.0          | 22.961                   | 1.70                            | 61                         | 12                | 0.92                    | 255                        | 0.9592      |
| 32.5          | 24.710                   | 1.60                            | 60                         | 13                | 0.85                    | 251                        | 0.9220      |
| 35.0          | 26.540                   | 1.80                            | 60                         | 14                | 0.98                    | 255                        | 0.9899      |
| 37.5          | 28.410                   | 1.90                            | 60                         | 15                | 1.00                    | 252                        | 1.0000      |
| 40.0          | 30.360                   | 2.10                            | 60                         | 16                | 1.10                    | 257                        | 1.0488      |
| 42.5          | 32.330                   | 2.10                            | 60                         | 17                | 1.10                    | 258                        | 1.0488      |
| 45.0          | 34.370                   | 2.20                            | 60                         | 18                | 1.20                    | 259                        | 1.0954      |
| 47.5          | 36.330                   | 2.00                            | 59                         | 19                | 1.10                    | 258                        | 1.0488      |
| 50.0          | 38.220                   | 1.90                            | 59                         | 20                | 1.00                    | 258                        | 1.0000      |
| 52.5          | 40.160                   | 2.00                            | 59                         | 21                | 1.10                    | 258                        | 1.0488      |
| 55.0          | 42.030                   | 1.90                            | 59                         | 22                | 1.00                    | 258                        | 1.0000      |
| 57.5          | 43.910                   | 1.90                            | 59                         | 23                | 1.00                    | 258                        | 1.0000      |
| 60.0          | 45.763                   | 1.80                            | 59                         | 24                | 0.98                    | 257                        | 0.9899      |

Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU 114

Date:

04/26/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 2.5 min  
 Meter Volume,  $V_m$  45.763 dcf  
 Water Volume 14.6 ml (g)  
 Nozzle Diameter,  $N_z$  0.2203 in.  
 Nozzle Area 0.000265 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.74 "Hg  
 Static Pressure 0.56 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9966 Y

Molecular Weight:

CO<sub>2</sub> Average 0.68 %vd  
 O<sub>2</sub> Average 19.65 %vd

**Field Data Averages**Meter

$\Delta H$  1.950 "H<sub>2</sub>O  
 Temperature,  $T_m$  60.3 °F  
 Temperature,  $T_m$  520.3 °A (°R)  
 Pressure Meter,  $P_m$  29.883 "Hg

Stack

$\sqrt{D_p}$  1.0210 "H<sub>2</sub>O  
 Temperature,  $T_s$  257.7 °F  
 Temperature,  $T_s$  717.7 °A (R)  
 Pressure Stack,  $P_s$  29.781 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  46.207 dscf  
 1.308 dscm  
 Actual Volume,  $V_{m(actual)}$  64.068 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  67.15 fps  
 Volume (actual) 28,481.0 awcfm  
 28,062.3 adcfm  
 Volume (standard) 1,251,339.5 wscf/hr  
 1,232,944.8 dscf/hr  
 20,549.1 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.687 scf  
 Moisture,  $B_{ws}$  0.0147  
 Moisture EPA M4 1.47 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.89 lb/lb-mole  
 Wet,  $M_s$  28.73 lb/lb-mole

Volume/Mole,  $V/M$  526.132

Percent Isokinetic 100.0 %

**Laboratory Results**

|          |            |           |      |             |
|----------|------------|-----------|------|-------------|
| Fluoride | < 30.0     | μg/sample |      |             |
| Fluoride | < 3.00E-05 | grams     | MW F | 19.0 g/mole |

**Emissions:**

|                      |            |         |
|----------------------|------------|---------|
| Concentration, $C_s$ | < 1.00E-05 | gr/dscf |
|                      | < 22.94    | μg/dscm |
|                      | < 2.90E-02 | ppmvd   |
| Mass Emissions       | < 1.76E-03 | lb/hr   |

&lt;" represents MDL value

**EPA Method 13B**  
**Laboratory Results**  
**Total Fluoride**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114

| Lab ID  | Sample ID          | Sample Date |   | Result | MDL  | Units     |
|---------|--------------------|-------------|---|--------|------|-----------|
| 18-S658 | M13B Cont. 1 Run 1 | 4/26/2018   |   | 49.0   | 30.0 | µg/sample |
| 18-S659 | M13B Cont. 1 Run 2 | 4/26/2018   | < | MDL    | 30.0 | µg/sample |
| 18-S660 | M13B Cont. 1 Run 3 | 4/26/2018   | < | MDL    | 30.0 | µg/sample |
| 18-S661 | H2O + Filter Blank | 4/26/2018   | < | MDL    | 30.0 | µg/sample |

\*If sample results are below MDL, MDL value is shown. A "<" sign designates less than MDL.  
If blank values are below MDL, no blank corrections are performed.

**EPA Method 13B**

**Results Summary**

**Client:** Hollingsworth & Vose

**Location:** Corvallis, OR

**Source:** CFU 114

| Run                              |                               |             | 1         | 2          | 3          | Average           |
|----------------------------------|-------------------------------|-------------|-----------|------------|------------|-------------------|
| Date                             |                               |             | 4/26/2018 | 4/26/2018  | 4/26/2018  |                   |
| Run Start Time                   |                               |             | 15:18     | 17:15      | 18:55      |                   |
| Run End Time                     |                               |             | 16:27     | 18:33      | 20:01      |                   |
| Duration, min.                   |                               |             | 60        | 60         | 60         |                   |
| Barometric Pressure, "Hg         |                               |             | 29.83     | 29.74      | 29.74      | <b>29.77</b>      |
| Nozzle Dia., in.                 |                               |             | 0.2203    | 0.2203     | 0.2203     | <b>0.2203</b>     |
| Isokinetic Average, %            |                               |             | 100.6     | 100.8      | 100.0      | <b>100.5</b>      |
| Sample Volume, dscf              |                               |             | 46.899    | 46.292     | 46.207     | <b>46.466</b>     |
| Sample Volume, dscm              |                               |             | 1.328     | 1.311      | 1.308      | <b>1.316</b>      |
| Stack Diameter, in.              |                               |             | 36.00     | 36.00      | 36.00      | <b>36.00</b>      |
| Stack Area, sq.ft.               |                               |             | 7.069     | 7.069      | 7.069      | <b>7.069</b>      |
| CO <sub>2</sub> %vd              |                               |             | 0.65      | 0.68       | 0.68       | <b>0.67</b>       |
| O <sub>2</sub> %vd               |                               |             | 19.48     | 19.62      | 19.65      | <b>19.58</b>      |
| Static Press., "H <sub>2</sub> O |                               |             | 0.56      | 0.56       | 0.56       | <b>0.56</b>       |
| H <sub>2</sub> O %v              |                               |             | 1.75      | 2.07       | 1.47       | <b>1.76</b>       |
| Wet Molecular Weight, lb/lb-mole |                               |             | 28.69     | 28.66      | 28.73      | <b>28.69</b>      |
| Velocity, FPS                    |                               |             | 68.64     | 67.57      | 67.15      | <b>67.79</b>      |
| ADCFM                            |                               |             | 28,603.5  | 28,065.9   | 28,062.3   | <b>28,243.9</b>   |
| AWCFM                            |                               |             | 29,113.0  | 28,659.1   | 28,481.0   | <b>28,751.0</b>   |
| DSCFM                            |                               |             | 20,742.8  | 20,440.6   | 20,549.1   | <b>20,577.5</b>   |
| Stack Temperature, °F            |                               |             | 266.9     | 261.6      | 257.7      | <b>262.1</b>      |
| Fluoride                         | Concentration, C <sub>s</sub> | gr/dscf     | 1.61E-05  | < 1.00E-05 | < 1.00E-05 | < <b>1.20E-05</b> |
|                                  |                               | µg/dscm     | 36.90     | < 22.88    | < 22.94    | < <b>27.57</b>    |
|                                  |                               | ppmvd       | 4.67E-02  | < 2.90E-02 | < 2.90E-02 | < <b>3.49E-02</b> |
|                                  | Mass                          | lb/hr       | 2.87E-03  | < 1.75E-03 | < 1.76E-03 | < <b>2.13E-03</b> |
|                                  |                               | lb/lb glass | 4.70E-05  | < 2.87E-05 | < 2.89E-05 | < <b>3.49E-05</b> |
| Production Data                  | Glass Production              | lbs/hr      | 61.0      | 61.0       | 61.0       | <b>61.0</b>       |

"<" represents MDL value

**EPA Methods 1-4, 13B**  
**Example Calculations**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 13B

**Run:** 1  
**Start Time:** 15:18  
**End Time:** 16:27  
**Date:** 4/26/2018

**EPA Methods 1-4:**

$$1) \quad P_m = P_b + (\Delta H/13.6) = 29.980 \text{ "Hg}$$

where  $P_b$ : 29.83 "Hg  
 $\Delta H$ : 2.038 "H<sub>2</sub>O

$$2) \quad P_s = P_b + (\text{Static Press.}/13.6) = 29.871 \text{ "Hg}$$

where  $P_b$ : 29.83 "Hg  
 Static Press.: 0.56 "H<sub>2</sub>O

$$3) \quad V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 46.899 \text{ dscf}$$

where  $V_m$ : 47.019 dcf  
 $Y$ : 0.9966  
 $P_m$ : 29.980 "Hg  
 $T_m$ : 528.4 °A

$$4) \quad V_w(\text{std}) = (0.04706)(H_2O) = 0.833 \text{ scf}$$

where  $H_2O$ : 17.70 g

$$5) \quad Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0175$$

where  $Vw(\text{std})$ : 0.833 scf  
 $Vm(\text{std})$ : 46.899 dscf

$$6) \quad \% H_2O = Bws \times 100 = 1.75 \%v$$

$$7) \quad V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 65.850 \text{ awcf}$$

where  $Y$ : 0.9966  
 $V_m$ : 47.0189 dcf  
 $Bws$ : 0.0175  
 $T_s$ : 726.9 °A  
 $T_m$ : 528.4 °A  
 $P_m$ : 29.980 "Hg  
 $P_s$ : 29.871 "Hg

$$8) \quad M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.88 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.65 %vd  
 $O_2$ : 19.48 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.87 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.69 \text{ lb/lb-mole}$$

where  $M_d$ : 28.88 lb/lb-mole  
 $Bws$ : 0.0175

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 7.069 \text{ sq. ft.}$$

where Stack ID: 36 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 68.64 \text{ fps}$$

where  $Cp$ : 0.84  
Ave. Sqrt  $\Delta P$ : 1.0378  
 $T_s$ : 726.9 °A  
 $P_s$ : 29.871 "Hg  
 $M_s$ : 28.69 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 29,113.0 \text{ AWCfm}$$

where  $V_s$ : 68.64 ft/sec  
Stack Area: 7.069 sq. ft

$$13) \text{ ADCfm} = (\text{AWCFM})(1-Bws) = 28,603.5 \text{ ADCfm}$$

where AWCfm: 29,113.0  
 $Bws$ : 0.0175

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,266,733.3 \text{ wscf/hr}$$

where  $V_s$ : 68.64 ft/sec  
Stack Area: 7.0690 sq. ft.  
 $T_s$ : 726.9 °A  
 $P_s$ : 29.871 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1-Bws) = 1,244,565.5 \text{ dscf/hr}$$

where wscf/hr: 1,266,733.3  
 $Bws$ : 0.0175

$$16) \text{ DSCFM} = (\text{dscf/hr})/60 \text{ mins/hr} = 20,742.8 \text{ DSCFM}$$

where dscf/hr: 1,244,565.5

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000265 \text{ sq. ft.}$$

where Nozzle Size: 0.2203 inches

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 1  
Date: 4/26/2018

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$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(Ts)(Vm(std))}{Ps(Vs)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 100.6 \%$$

where Ts: 726.9 °A  
Vm(std): 46.899 dscf  
Ps: 29.871 "Hg  
Vs: 68.64 ft/sec  
Nozzle Area: 0.000265 sq. ft.  
Sampling Time: 60 min.  
Bws: 0.0175

### EPA Method 13B:

$$19) \text{ Fluoride laboratory results} = 49.0 \text{ } \mu\text{g/sample}$$

$$20) \text{ Fluoride} = (\mu\text{g/sample})/1,000,000 = 4.90\text{E-}05 \text{ grams/sample}$$

$$21) \text{ Cs} = (\text{Sample grams}/Vm(\text{Std}))(\text{15.43grains/gram}) = 1.61\text{E-}05 \text{ gr/dscf}$$

where Sample: 0.00005 grams  
Vm(std) 46.899 dscf

$$22) \text{ Cs} = (\text{Sample grams} \times 1,000,000 \text{ } \mu\text{g/gram})/Vm(\text{std}) = 36.90 \text{ } \mu\text{g/dscm}$$

where Sample: 0.00005 grams  
Vm(std) 1.328 dscm

$$23) \text{ Volume/Mole} = \left( \frac{359(Ts)(29.92"Hg)}{492(Ps)} \right) = 531.271 \text{ Vol./Mole}$$

where Ts: 726.9 °A  
Ps: 29.871 "Hg

$$24) \text{ ppmvd} = \left( \frac{\frac{\text{lb}}{\text{hr}} \times \frac{\text{Vol.}}{\text{Mole}}}{(MW \times 0.00006 \times \text{ADCFM})} \right) = 4.67\text{E-}02 \text{ ppmvd}$$

where MW: 19.0 g/mol  
lb/hr: 0.00  
Vol./Mole: 531.271  
ADCFM: 28603.5

$$25) \text{ Mass Emission Rate} = (\text{Cs})(\text{Stack flow})/7000\text{gr/lb} = 2.87\text{E-}03 \text{ lb/hr}$$

where Cs: 1.61E-05 gr/dscf  
Stack Flow: 1,244,565.5 dscf/hr

## BISON ENGINEERING GASEOUS SUMMARY SPREADSHEET

|          |                      |        |                |
|----------|----------------------|--------|----------------|
| Company  | Hollingsworth & Vose | Source | CFU 114        |
| Facility | Glass Plant 2        | Date   | April 26, 2018 |
| Location | Corvallis, OR        |        |                |

|            |           |           |           |
|------------|-----------|-----------|-----------|
| Test date  | 4/26/2018 | 4/26/2018 | 4/26/2018 |
| Start time | 15:18     | 17:14     | 18:54     |
| End time   | 16:28     | 18:34     | 20:01     |
| Test run   | 1         | 2         | 3         |

| E M I S S I O N S |                              |                 |   |       |       |       | Average |
|-------------------|------------------------------|-----------------|---|-------|-------|-------|---------|
| Meth 3A           | Oxygen Concentration         | O <sub>2</sub>  | % | 19.48 | 19.62 | 19.65 | 19.58   |
|                   | Carbon Dioxide Concentration | CO <sub>2</sub> | % | 0.65  | 0.68  | 0.68  | 0.67    |



**Bison Engineering, Inc.**  
**Method 3A Oxygen**  
*Calibration Error, System Bias and System Drift*

|           |                      |        |                |                      |              |
|-----------|----------------------|--------|----------------|----------------------|--------------|
| Company:  | Hollingsworth & Vose | Source | CFU 114        | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2        | Date   | April 26, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR        |        |                | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.04                   | 0.05                | 0.05                                | pass      | 0.11                | 0.35                                 | pass      | 0.30                   | pass      |               |                  |                    |                               |
|       | upscale | 10.03                  | 10.08               | 0.25                                | pass      | 9.94                | -0.45                                | pass      | -0.70                  | pass      | 20            | 19.42            | 19.48              | 10                            |
| Run 2 | zero    | 0.04                   | 0.11                | 0.35                                | pass      | 0.02                | -0.10                                | pass      | -0.45                  | pass      |               |                  |                    |                               |
|       | upscale | 10.03                  | 9.94                | -0.45                               | pass      | 9.93                | -0.50                                | pass      | -0.05                  | pass      | 20            | 19.43            | 19.62              | 10                            |
| Run 3 | zero    | 0.04                   | 0.02                | -0.10                               | pass      | 0.04                | 0.00                                 | pass      | 0.10                   | pass      |               |                  |                    |                               |
|       | upscale | 10.03                  | 9.93                | -0.50                               | pass      | 9.88                | -0.75                                | pass      | -0.25                  | pass      | 20            | 19.43            | 19.65              | 10                            |
|       |         |                        |                     | < 5%*                               |           | < 5%*               |                                      | < 3%*     |                        |           |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High  |
|----------------------------|------|-------|-------|
| Calibration gas standards  | 0    | 10    | 20    |
| Cal gas analyzer response  | 0.04 | 10.03 | 20.06 |
| Analyzer Cal. Error        | 0.20 | 0.15  | 0.30  |
| Analyzer Cal. Error <2%*   | pass | pass  | pass  |

\*Or <0.5% O<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 3A Carbon Dioxide**  
*Calibration Error, System Bias and System Drift*

|                                          |                            |                                          |
|------------------------------------------|----------------------------|------------------------------------------|
| Company: <b>Hollingsworth &amp; Vose</b> | Source <b>CFU 114</b>      | Instrument Make: <b>Servomex</b>         |
| Facility: <b>Glass Plant 2</b>           | Date <b>April 26, 2018</b> | Instrument Model: <b>1440</b>            |
| Location: <b>Corvallis, OR</b>           |                            | Instrument Serial #: <b>01440D1-5041</b> |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.07                   | 0.02                | -1.25                               | pass      | 0.05                | -0.50                                | pass      | 0.75                   | pass      |               |                  |                    |                               |
|       | upscale | 2.07                   | 2.02                | -1.25                               | pass      | 1.93                | -3.50                                | pass      | -2.25                  | pass      | 4.0           | 0.67             | 0.65               | 2                             |
| Run 2 | zero    | 0.07                   | 0.05                | -0.50                               | pass      | 0.05                | -0.50                                | pass      | 0.00                   | pass      |               |                  |                    |                               |
|       | upscale | 2.07                   | 1.93                | -3.50                               | pass      | 1.93                | -3.50                                | pass      | 0.00                   | pass      | 4.0           | 0.69             | 0.68               | 2                             |
| Run 3 | zero    | 0.07                   | 0.05                | -0.50                               | pass      | 0.05                | -0.50                                | pass      | 0.00                   | pass      |               |                  |                    |                               |
|       | upscale | 2.07                   | 1.93                | -3.50                               | pass      | 1.92                | -3.75                                | pass      | -0.25                  | pass      | 4.0           | 0.69             | 0.68               | 2                             |
|       |         |                        |                     | < 5%*                               |           | < 5%*               |                                      | < 3%*     |                        |           |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid  | High |
|----------------------------|------|------|------|
| Calibration gas standards  | 0    | 2    | 4.0  |
| Cal gas analyzer response  | 0.07 | 2.07 | 4.04 |
| Analyzer Cal. Error        | 1.75 | 1.75 | 1.00 |
| Analyzer Cal. Error < 2%*  | pass | pass | pass |

\*Or <0.5% CO<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 205 Dilution System Check**

|           |                      |         |                |                      |            |
|-----------|----------------------|---------|----------------|----------------------|------------|
| Company:  | Hollingsworth & Vose | Source: | CFU 114        | Instrument Make:     | EnviroNics |
| Facility: | Glass Plant 2        | Date:   | April 24, 2018 | Instrument Model:    | 4040       |
| Location: | Corvallis, OR        |         |                | Instrument Serial #: | 3880       |

|                                                |                 | First | Second | Third | Average |
|------------------------------------------------|-----------------|-------|--------|-------|---------|
| High Level                                     | 10 % oxygen     | 9.99  | 10.02  | 10.02 | 10.01   |
| Percent diff from avg recorded value           | dilution system | -0.2% | 0.1%   | 0.1%  |         |
| Pass or Fail +/- 2%                            |                 | PASS  | PASS   | PASS  |         |
| Percent diff from target of 10% O <sub>2</sub> |                 | -0.1% | 0.2%   | 0.2%  | 0.1%    |
| Pass or Fail +/- 2% from target value          |                 |       |        |       | PASS    |

|                                               |                 |       |      |      |      |
|-----------------------------------------------|-----------------|-------|------|------|------|
| Mid Level                                     | 5 % oxygen      | 5.04  | 5.06 | 5.06 | 5.05 |
| Percent diff from avg recorded value          | dilution system | -0.3% | 0.1% | 0.1% |      |
| Pass or Fail +/- 2%                           |                 | PASS  | PASS | PASS |      |
| Percent diff from target of 5% O <sub>2</sub> |                 | 0.8%  | 1.2% | 1.2% | 1.1% |
| Pass or Fail +/- 2% from target value         |                 |       |      |      | PASS |

|                             |             |      |      |      |      |            |       |
|-----------------------------|-------------|------|------|------|------|------------|-------|
| Independent Mid Level Check | 5% oxygen   | 9.95 | 9.95 | 9.96 | 9.95 | Tank value | 9.893 |
|                             | independent |      |      |      |      | 0.61%      |       |
|                             | tank check  |      |      |      |      | PASS       |       |

**Summary - Method 205 - Verification of Gas Dilution Systems for Field Instrument Calibrations**

A gas dilution system can provide known values of calibration gases through controlled dilution of high-level calibration gases with an appropriate dilution gas. The calibration gases with an appropriate dilution gas. The instrumental test methods in 40 CFR part 60 - e.g., Methods 3A, 6C, 7E, 10, 15, 16, 20, 25A and 25B require on-site, multi-point point calibration using gases of known concentrations. A gas dilution system that produces known low level calibration gases from high-level calibration gases, with a degree of confidence similar to that for Protocol 1 gases, may be used for compliance tests in lieu of multiple calibration gases when the gas dilution system is demonstrated to meet the requirements of this method.

The gas dilution system shall be evaluated on one analyzer once during each field test. A precalibrated analyzer is chosen, at the discretion of the source owner or operator, to demonstrate that the gas dilution system produces predictable gas concentrations spanning a range of concentrations. After meeting the requirements of this method, the remaining analyzers may be calibrated with the dilution system in accordance to the requirements of the applicable method for the duration of the field test.

The gas dilution system shall produce calibration gases whose measured values are within  $\pm 2$  percent of the predicted values.

**Instructions from Method 205**

3.2.2 Calculate the predicted concentration for each of the dilutions based on the flow rates through the gas dilution system (or the dilution ratios) and the certified concentration of the high - level supply gas.

3.2.3 Introduce each of the dilutions from Section 3.2.1 into the analyzer or monitor one at a time and determine the instrument response for each of the dilutions.

3.2.4 Repeat the procedure in Section 3.2.3 two times, i.e., until three injections are made at dilution level. Calculate the average instrument response for each triplicate injection at each dilution level. No single injection shall differ by more than  $\pm 2$  percent from the average instrument response for that dilution.

3.2.5 For each level of dilution, calculate the difference between the average concentration output recorded by the analyzer and the predicted concentration calculated in Section 3.2.2. The average concentration output from the analyzer shall be within  $\pm 2$  percent of the predicted value.

3.2.6 Introduce the mid - level supply gas directly into the analyzer, bypassing the gas dilution system. Repeat the procedure twice more, for a total of three mid-level supply gas injections.

Calculate the average analyzer output concentration for the mid-level supply gas. The difference between the certified concentration of the mid-level supply gas and the average instrument response shall be within  $\pm 2$  percent.

3.3 If the gas dilution system meets the criteria listed in Section 3.2, the gas dilution system may be used throughout that field test.

**Hollingsworth & Vose****4/26/2018****CFU 114****Daily Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 Cal | CO2 Cal |
|-----------|----------|--------|---------|--------|---------|
| 4/26/2018 | 14:50:31 | 0.21   | 0.07    |        |         |
| 4/26/2018 | 14:50:41 | 0.11   | 0.07    |        |         |
| 4/26/2018 | 14:50:51 | 0.07   | 0.06    |        |         |
| 4/26/2018 | 14:51:01 | 0.06   | 0.06    |        |         |
| 4/26/2018 | 14:51:11 | 0.05   | 0.06    |        |         |
| 4/26/2018 | 14:51:21 | 0.04   | 0.07    |        |         |
| 4/26/2018 | 14:51:31 | 0.05   | 0.07    | AZ     | AZ      |
| 4/26/2018 | 14:51:41 | 0.02   | 0.07    | 0.04   | 0.07    |
| 4/26/2018 | 14:51:51 | 0.01   | 0.07    |        |         |
| 4/26/2018 | 14:52:01 | 8.37   | 7.07    |        |         |
| 4/26/2018 | 14:52:11 | 14.99  | 15.79   |        |         |
| 4/26/2018 | 14:52:21 | 19.90  | 20.11   |        |         |
| 4/26/2018 | 14:52:31 | 20.05  | 20.09   |        |         |
| 4/26/2018 | 14:52:41 | 20.07  | 20.03   |        |         |
| 4/26/2018 | 14:52:51 | 20.06  | 20.04   | AS     |         |
| 4/26/2018 | 14:53:01 | 20.06  | 20.04   | 20.06  |         |
| 4/26/2018 | 14:53:11 | 6.06   | 13.05   |        |         |
| 4/26/2018 | 14:53:21 | 4.05   | 4.05    |        |         |
| 4/26/2018 | 14:53:31 | 4.03   | 4.06    |        | AS      |
| 4/26/2018 | 14:53:41 | 3.92   | 4.02    |        | 4.04    |
| 4/26/2018 | 14:53:51 | 2.17   | 16.60   |        |         |
| 4/26/2018 | 14:54:01 | 2.04   | 1.55    |        |         |
| 4/26/2018 | 14:54:11 | 2.04   | 2.11    |        |         |
| 4/26/2018 | 14:54:21 | 2.06   | 2.08    |        |         |
| 4/26/2018 | 14:54:31 | 2.02   | 2.07    |        | AM      |
| 4/26/2018 | 14:54:41 | 2.03   | 2.06    |        | 2.07    |
| 4/26/2018 | 14:54:51 | 0.23   | 0.85    |        |         |
| 4/26/2018 | 14:55:01 | -0.03  | 0.04    |        |         |
| 4/26/2018 | 14:55:11 | 9.99   | 10.04   |        |         |
| 4/26/2018 | 14:55:21 | 10.01  | 10.03   |        |         |
| 4/26/2018 | 14:55:31 | 10.02  | 10.03   |        |         |
| 4/26/2018 | 14:55:41 | 10.03  | 10.02   | AM     |         |
| 4/26/2018 | 14:55:51 | 10.03  | 10.02   | 10.03  |         |
| 4/26/2018 | 14:56:01 | 9.37   | 8.35    |        |         |
| 4/26/2018 | 14:56:11 | 19.99  | 19.89   |        |         |
| 4/26/2018 | 14:56:21 | 20.35  | 20.01   |        |         |
| 4/26/2018 | 14:56:31 | 20.37  | 20.04   |        |         |

System

**Hollingsworth & Vose****4/26/2018****CFU 114****Daily Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 Cal | CO2 Cal |
|-----------|----------|--------|---------|--------|---------|
| 4/26/2018 | 14:56:41 | 20.22  | 20.04   |        |         |
| 4/26/2018 | 14:56:51 | 20.06  | 20.02   |        |         |
| 4/26/2018 | 14:57:01 | 20.07  | 20.03   |        |         |
| 4/26/2018 | 14:57:11 | 20.07  | 20.04   |        |         |
| 4/26/2018 | 14:57:21 | 20.05  | 20.04   |        |         |
| 4/26/2018 | 14:57:31 | 20.04  | 20.05   |        |         |
| 4/26/2018 | 14:57:41 | 20.06  | 20.05   |        |         |
| 4/26/2018 | 14:57:51 | 20.05  | 20.05   |        |         |
| 4/26/2018 | 14:58:01 | 19.96  | 20.05   |        |         |
| 4/26/2018 | 14:58:11 | 19.96  | 20.05   |        |         |
| 4/26/2018 | 14:58:21 | 19.96  | 20.05   |        |         |
| 4/26/2018 | 14:58:31 | 18.71  | 19.24   |        |         |
| 4/26/2018 | 14:58:41 | 9.96   | 9.64    |        |         |
| 4/26/2018 | 14:58:51 | 10.08  | 10.04   |        |         |
| 4/26/2018 | 14:59:01 | 10.10  | 10.03   |        |         |
| 4/26/2018 | 14:59:11 | 10.09  | 10.04   |        |         |
| 4/26/2018 | 14:59:21 | 10.08  | 10.02   | SM     |         |
| 4/26/2018 | 14:59:31 | 10.07  | 10.02   | 10.08  |         |
| 4/26/2018 | 14:59:41 | 10.07  | 10.01   |        |         |
| 4/26/2018 | 14:59:51 | 10.07  | 10.01   |        |         |
| 4/26/2018 | 15:00:01 | 10.24  | 9.99    |        |         |
| 4/26/2018 | 15:00:11 | 3.40   | 2.12    |        |         |
| 4/26/2018 | 15:00:21 | 2.04   | 2.08    |        |         |
| 4/26/2018 | 15:00:31 | 2.02   | 2.02    |        |         |
| 4/26/2018 | 15:00:41 | 2.01   | 2.02    |        | SM      |
| 4/26/2018 | 15:00:51 | 2.03   | 2.01    |        | 2.02    |
| 4/26/2018 | 15:01:01 | 11.01  | 2.26    |        |         |
| 4/26/2018 | 15:01:11 | 19.48  | 0.85    |        |         |
| 4/26/2018 | 15:01:21 | 19.65  | 0.71    |        |         |
| 4/26/2018 | 15:01:31 | 19.64  | 0.69    |        |         |
| 4/26/2018 | 15:01:41 | 19.64  | 0.69    |        |         |
| 4/26/2018 | 15:01:51 | 19.65  | 0.69    |        |         |
| 4/26/2018 | 15:02:01 | 19.55  | 0.79    |        |         |
| 4/26/2018 | 15:02:11 | 13.65  | 6.71    |        |         |
| 4/26/2018 | 15:02:21 | 10.31  | 9.61    |        |         |
| 4/26/2018 | 15:02:31 | 10.00  | 9.91    |        |         |
| 4/26/2018 | 15:02:41 | 9.97   | 9.95    |        |         |
| 4/26/2018 | 15:02:51 | 9.96   | 9.96    |        |         |
| 4/26/2018 | 15:03:01 | 9.97   | 9.96    |        |         |
| 4/26/2018 | 15:03:11 | 9.98   | 9.96    |        |         |

**Hollingsworth & Vose****4/26/2018****CFU 114****Daily Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 Cal | CO2 Cal |
|-----------|----------|--------|---------|--------|---------|
| 4/26/2018 | 15:03:21 | 9.99   | 9.94    |        |         |
| 4/26/2018 | 15:03:31 | 10.00  | 9.94    |        |         |
| 4/26/2018 | 15:03:41 | 9.46   | 9.39    |        |         |
| 4/26/2018 | 15:03:51 | 2.73   | 2.41    |        |         |
| 4/26/2018 | 15:04:01 | 0.41   | 0.34    |        |         |
| 4/26/2018 | 15:04:11 | 0.39   | 0.17    |        |         |
| 4/26/2018 | 15:04:21 | 0.31   | 0.02    |        |         |
| 4/26/2018 | 15:04:31 | 0.31   | 0.02    |        |         |
| 4/26/2018 | 15:04:41 | 0.32   | 0.02    |        |         |
| 4/26/2018 | 15:04:51 | 0.33   | 0.03    |        |         |
| 4/26/2018 | 15:05:01 | 0.32   | 0.03    |        |         |
| 4/26/2018 | 15:05:11 | 0.31   | 0.02    |        |         |
| 4/26/2018 | 15:05:21 | 0.30   | 0.02    |        |         |
| 4/26/2018 | 15:05:31 | 0.30   | 0.02    |        |         |
| 4/26/2018 | 15:05:41 | 0.28   | 0.02    |        |         |
| 4/26/2018 | 15:05:51 | 0.27   | 0.02    |        |         |
| 4/26/2018 | 15:06:01 | 0.26   | 0.02    |        |         |
| 4/26/2018 | 15:06:11 | 0.26   | 0.02    |        |         |
| 4/26/2018 | 15:06:21 | 0.25   | 0.02    |        |         |
| 4/26/2018 | 15:06:31 | 0.24   | 0.01    |        |         |
| 4/26/2018 | 15:06:41 | 0.23   | 0.02    |        |         |
| 4/26/2018 | 15:06:51 | 0.23   | 0.02    |        |         |
| 4/26/2018 | 15:07:01 | 0.22   | 0.03    |        |         |
| 4/26/2018 | 15:07:11 | 0.21   | 0.02    |        |         |
| 4/26/2018 | 15:07:21 | 0.20   | 0.02    |        |         |
| 4/26/2018 | 15:07:31 | 0.19   | 0.02    |        |         |
| 4/26/2018 | 15:07:41 | 0.17   | 0.02    |        |         |
| 4/26/2018 | 15:07:51 | 0.16   | 0.02    |        |         |
| 4/26/2018 | 15:08:01 | 0.16   | 0.02    |        |         |
| 4/26/2018 | 15:08:11 | 0.11   | 0.02    |        |         |
| 4/26/2018 | 15:08:21 | 0.07   | 0.02    |        |         |
| 4/26/2018 | 15:08:31 | 0.06   | 0.02    |        |         |
| 4/26/2018 | 15:08:41 | 0.05   | 0.01    | SZ     | SZ      |
| 4/26/2018 | 15:08:51 | 0.04   | 0.02    | 0.05   | 0.02    |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #1**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/26/2018 | 15:18:05 | 19.34  | 0.68    |
| 4/26/2018 | 15:19:05 | 19.34  | 0.67    |
| 4/26/2018 | 15:20:05 | 19.36  | 0.66    |
| 4/26/2018 | 15:21:05 | 19.36  | 0.66    |
| 4/26/2018 | 15:22:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:23:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:24:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:25:05 | 19.39  | 0.66    |
| 4/26/2018 | 15:26:05 | 19.40  | 0.65    |
| 4/26/2018 | 15:27:05 | 19.41  | 0.64    |
| 4/26/2018 | 15:28:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:29:05 | 19.41  | 0.64    |
| 4/26/2018 | 15:30:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:31:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:32:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:33:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:34:05 | 19.41  | 0.65    |
| 4/26/2018 | 15:35:05 | 19.41  | 0.66    |
| 4/26/2018 | 15:36:05 | 19.41  | 0.66    |
| 4/26/2018 | 15:37:05 | 19.42  | 0.66    |
| 4/26/2018 | 15:38:05 | 19.41  | 0.67    |
| 4/26/2018 | 15:39:05 | 19.41  | 0.68    |
| 4/26/2018 | 15:40:05 | 19.41  | 0.67    |
| 4/26/2018 | 15:41:05 | 19.41  | 0.68    |
| 4/26/2018 | 15:42:05 | 19.41  | 0.68    |
| 4/26/2018 | 15:43:05 | 19.41  | 0.67    |
| 4/26/2018 | 15:44:05 | 19.41  | 0.68    |
| 4/26/2018 | 15:45:05 | 19.41  | 0.68    |
| 4/26/2018 | 15:46:05 | 19.41  | 0.67    |
| 4/26/2018 | 15:47:05 | 19.41  | 0.68    |
| 4/26/2018 | 15:48:05 | 19.42  | 0.67    |
| 4/26/2018 | 15:49:05 | 19.42  | 0.67    |
| 4/26/2018 | 15:50:05 | 19.43  | 0.67    |
| 4/26/2018 | 15:51:05 | 19.42  | 0.66    |
| 4/26/2018 | 15:52:05 | 19.43  | 0.66    |
| 4/26/2018 | 15:53:05 | 19.43  | 0.66    |
| 4/26/2018 | 15:54:05 | 19.43  | 0.66    |
| 4/26/2018 | 15:55:05 | 19.43  | 0.66    |
| 4/26/2018 | 15:56:05 | 19.43  | 0.67    |
| 4/26/2018 | 15:57:05 | 19.43  | 0.67    |

**Hollingsworth & Vose****CFU 114****4/26/2018****Run #1**

| Date          | Time     | O2 [%]       | CO2 [%]     |
|---------------|----------|--------------|-------------|
| 4/26/2018     | 15:58:05 | 19.43        | 0.67        |
| 4/26/2018     | 15:59:05 | 19.42        | 0.67        |
| 4/26/2018     | 16:00:05 | 19.43        | 0.67        |
| 4/26/2018     | 16:01:05 | 19.43        | 0.67        |
| 4/26/2018     | 16:02:05 | 19.43        | 0.67        |
| 4/26/2018     | 16:03:05 | 19.43        | 0.68        |
| 4/26/2018     | 16:04:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:05:05 | 19.43        | 0.68        |
| 4/26/2018     | 16:06:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:07:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:08:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:09:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:10:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:11:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:12:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:13:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:14:05 | 19.44        | 0.68        |
| 4/26/2018     | 16:15:05 | 19.44        | 0.67        |
| 4/26/2018     | 16:16:05 | 19.44        | 0.67        |
| 4/26/2018     | 16:17:05 | 19.44        | 0.67        |
| 4/26/2018     | 16:18:05 | 19.45        | 0.67        |
| 4/26/2018     | 16:19:05 | 19.44        | 0.67        |
| 4/26/2018     | 16:20:05 | 19.45        | 0.67        |
| 4/26/2018     | 16:21:05 | 19.45        | 0.67        |
| 4/26/2018     | 16:22:05 | 19.45        | 0.67        |
| 4/26/2018     | 16:23:05 | 19.45        | 0.67        |
| 4/26/2018     | 16:24:05 | 19.45        | 0.68        |
| 4/26/2018     | 16:25:05 | 19.45        | 0.68        |
| 4/26/2018     | 16:26:05 | 19.45        | 0.68        |
| 4/26/2018     | 16:27:05 | 19.46        | 0.68        |
| 4/26/2018     | 16:28:05 | 19.46        | 0.68        |
| Final Average |          | <b>19.42</b> | <b>0.67</b> |



**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #1 Post Cal Check**

| Date      | Time     | O2 [%] | CO2 [%] |      |      |
|-----------|----------|--------|---------|------|------|
| 4/26/2018 | 16:29:35 | 19.44  | 0.69    |      |      |
| 4/26/2018 | 16:29:45 | 18.38  | 0.65    |      |      |
| 4/26/2018 | 16:29:55 | 5.22   | 0.23    |      |      |
| 4/26/2018 | 16:30:05 | 0.6    | 0.06    |      |      |
| 4/26/2018 | 16:30:15 | 0.07   | 0.05    |      |      |
| 4/26/2018 | 16:30:25 | 0.01   | 0.05    |      |      |
| 4/26/2018 | 16:30:35 | 0.03   | 0.05    |      |      |
| 4/26/2018 | 16:30:45 | 0.09   | 0.05    |      |      |
| 4/26/2018 | 16:30:55 | 0.11   | 0.05    |      |      |
| 4/26/2018 | 16:31:05 | 0.11   | 0.04    | SZ   | SZ   |
| 4/26/2018 | 16:31:15 | 0.11   | 0.05    | 0.11 | 0.05 |
| 4/26/2018 | 16:31:25 | 0.11   | 0.04    |      |      |
| 4/26/2018 | 16:31:35 | 0.11   | 0.05    |      |      |
| 4/26/2018 | 16:31:45 | 0.36   | 0.05    |      |      |
| 4/26/2018 | 16:31:55 | 5.62   | 4.09    |      |      |
| 4/26/2018 | 16:32:05 | 9.61   | 9.49    |      |      |
| 4/26/2018 | 16:32:15 | 9.9    | 9.89    |      |      |
| 4/26/2018 | 16:32:25 | 9.92   | 9.94    |      |      |
| 4/26/2018 | 16:32:35 | 9.93   | 9.95    |      |      |
| 4/26/2018 | 16:32:45 | 9.94   | 9.95    |      |      |
| 4/26/2018 | 16:32:55 | 9.94   | 9.97    |      |      |
| 4/26/2018 | 16:33:05 | 9.94   | 9.96    | SM   |      |
| 4/26/2018 | 16:33:15 | 9.94   | 9.98    | 9.94 |      |
| 4/26/2018 | 16:33:25 | 9.95   | 9.98    |      |      |
| 4/26/2018 | 16:33:35 | 9.55   | 9.63    |      |      |
| 4/26/2018 | 16:33:45 | 3.43   | 3.07    |      |      |
| 4/26/2018 | 16:33:55 | 1.97   | 1.76    |      |      |
| 4/26/2018 | 16:34:05 | 2.07   | 1.95    |      |      |
| 4/26/2018 | 16:34:15 | 2.1    | 1.94    |      |      |
| 4/26/2018 | 16:34:25 | 2.09   | 1.93    |      |      |
| 4/26/2018 | 16:34:35 | 2.09   | 1.94    |      |      |
| 4/26/2018 | 16:34:45 | 2.09   | 1.93    |      |      |
| 4/26/2018 | 16:34:55 | 2.09   | 1.93    |      |      |
| 4/26/2018 | 16:35:05 | 2.09   | 1.93    | SM   |      |
| 4/26/2018 | 16:35:15 | 2.09   | 1.93    |      | 1.93 |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #2**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/26/2018 | 17:15:02 | 19.44  | 0.69    |
| 4/26/2018 | 17:16:02 | 19.44  | 0.69    |
| 4/26/2018 | 17:17:02 | 19.44  | 0.69    |
| 4/26/2018 | 17:18:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:19:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:20:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:21:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:22:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:23:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:24:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:25:02 | 19.44  | 0.70    |
| 4/26/2018 | 17:26:02 | 19.44  | 0.70    |
| 4/26/2018 | 17:27:02 | 19.44  | 0.69    |
| 4/26/2018 | 17:28:02 | 19.44  | 0.69    |
| 4/26/2018 | 17:29:02 | 19.44  | 0.69    |
| 4/26/2018 | 17:30:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:31:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:32:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:33:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:34:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:35:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:36:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:37:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:38:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:39:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:40:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:41:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:42:02 | 19.43  | 0.68    |
| 4/26/2018 | 17:43:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:44:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:45:02 | 19.43  | 0.69    |
| 4/26/2018 | 17:46:02 | 19.42  | 0.70    |
| 4/26/2018 | 17:47:02 | 19.42  | 0.70    |
| 4/26/2018 | 17:48:02 | 19.42  | 0.70    |
| 4/26/2018 | 17:49:02 | 19.43  | 0.70    |
| 4/26/2018 | 17:50:02 | 19.42  | 0.69    |
| 4/26/2018 | 17:51:02 | 19.42  | 0.70    |
| 4/26/2018 | 17:52:02 | 19.41  | 0.69    |
| 4/26/2018 | 17:53:02 | 19.42  | 0.69    |
| 4/26/2018 | 17:54:02 | 19.42  | 0.69    |
| 4/26/2018 | 17:55:02 | 19.42  | 0.69    |
| 4/26/2018 | 17:56:02 | 19.42  | 0.69    |
| 4/26/2018 | 17:57:02 | 19.42  | 0.69    |
| 4/26/2018 | 17:58:02 | 19.42  | 0.68    |

**Hollingsworth & Vose****CFU 114****4/26/2018****Run #2**

| Date          | Time     | O2 [%]       | CO2 [%]     |
|---------------|----------|--------------|-------------|
| 4/26/2018     | 17:59:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:00:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:01:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:02:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:03:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:04:02 | 19.42        | 0.68        |
| 4/26/2018     | 18:05:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:06:02 | 19.42        | 0.69        |
| 4/26/2018     | 18:07:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:08:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:09:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:10:02 | 19.44        | 0.69        |
| 4/26/2018     | 18:11:02 | 19.43        | 0.70        |
| 4/26/2018     | 18:12:02 | 19.43        | 0.70        |
| 4/26/2018     | 18:13:02 | 19.43        | 0.70        |
| 4/26/2018     | 18:14:02 | 19.42        | 0.70        |
| 4/26/2018     | 18:15:02 | 19.42        | 0.70        |
| 4/26/2018     | 18:16:02 | 19.41        | 0.70        |
| 4/26/2018     | 18:17:02 | 19.42        | 0.69        |
| 4/26/2018     | 18:18:02 | 19.42        | 0.69        |
| 4/26/2018     | 18:19:02 | 19.42        | 0.69        |
| 4/26/2018     | 18:20:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:21:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:22:02 | 19.43        | 0.69        |
| 4/26/2018     | 18:23:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:24:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:25:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:26:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:27:02 | 19.43        | 0.68        |
| 4/26/2018     | 18:28:02 | 19.44        | 0.68        |
| 4/26/2018     | 18:29:02 | 19.44        | 0.69        |
| 4/26/2018     | 18:30:02 | 19.44        | 0.68        |
| 4/26/2018     | 18:31:02 | 19.45        | 0.68        |
| 4/26/2018     | 18:32:02 | 19.44        | 0.69        |
| 4/26/2018     | 18:33:02 | 19.45        | 0.69        |
| 4/26/2018     | 18:34:02 | 19.45        | 0.69        |
| Final Average |          | <b>19.43</b> | <b>0.69</b> |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #2 Post Cal Check**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] cal | CO2 [%] cal |
|-----------|----------|--------|---------|------------|-------------|
| 4/26/2018 | 18:35:32 | 7.88   | 0.58    |            |             |
| 4/26/2018 | 18:35:42 | 1.37   | 0.44    |            |             |
| 4/26/2018 | 18:35:52 | 0.35   | 0.18    |            |             |
| 4/26/2018 | 18:36:02 | 0.15   | 0.07    |            |             |
| 4/26/2018 | 18:36:12 | 0.12   | 0.06    |            |             |
| 4/26/2018 | 18:36:22 | 0.12   | 0.06    |            |             |
| 4/26/2018 | 18:36:32 | 0.09   | 0.06    |            |             |
| 4/26/2018 | 18:36:42 | 0.03   | 0.05    |            |             |
| 4/26/2018 | 18:36:52 | 0.03   | 0.05    |            |             |
| 4/26/2018 | 18:37:02 | 0.03   | 0.05    |            |             |
| 4/26/2018 | 18:37:12 | 0.03   | 0.05    |            |             |
| 4/26/2018 | 18:37:22 | 0.02   | 0.06    |            |             |
| 4/26/2018 | 18:37:32 | 0.02   | 0.05    | 0.02       | 0.05        |
| 4/26/2018 | 18:37:42 | 0.02   | 0.05    |            |             |
| 4/26/2018 | 18:37:52 | 0.02   | 0.06    |            |             |
| 4/26/2018 | 18:38:02 | 0.68   | 0.09    |            |             |
| 4/26/2018 | 18:38:12 | 1.53   | 0.17    |            |             |
| 4/26/2018 | 18:38:22 | 1.88   | 1.54    |            |             |
| 4/26/2018 | 18:38:32 | 1.91   | 1.86    |            |             |
| 4/26/2018 | 18:38:42 | 1.89   | 1.89    |            |             |
| 4/26/2018 | 18:38:52 | 1.90   | 1.91    |            |             |
| 4/26/2018 | 18:39:02 | 1.90   | 1.92    |            |             |
| 4/26/2018 | 18:39:12 | 1.91   | 1.93    |            |             |
| 4/26/2018 | 18:39:22 | 1.91   | 1.92    |            |             |
| 4/26/2018 | 18:39:32 | 1.92   | 1.92    |            |             |
| 4/26/2018 | 18:39:42 | 1.92   | 1.93    |            |             |
| 4/26/2018 | 18:39:52 | 1.92   | 1.93    |            |             |
| 4/26/2018 | 18:40:02 | 1.92   | 1.93    |            | 1.93        |
| 4/26/2018 | 18:40:12 | 1.92   | 1.94    |            |             |
| 4/26/2018 | 18:40:22 | 4.90   | 5.04    |            |             |
| 4/26/2018 | 18:40:32 | 9.44   | 9.77    |            |             |
| 4/26/2018 | 18:40:42 | 9.94   | 9.96    |            |             |
| 4/26/2018 | 18:40:52 | 9.96   | 9.99    |            |             |
| 4/26/2018 | 18:41:02 | 9.97   | 10.00   |            |             |
| 4/26/2018 | 18:41:12 | 9.97   | 10.00   |            |             |
| 4/26/2018 | 18:41:22 | 9.94   | 10.01   |            |             |
| 4/26/2018 | 18:41:32 | 9.92   | 10.01   |            |             |
| 4/26/2018 | 18:41:42 | 9.92   | 10.01   |            |             |
| 4/26/2018 | 18:41:52 | 9.92   | 10.02   |            |             |
| 4/26/2018 | 18:42:02 | 9.92   | 10.03   |            |             |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #2 Post Cal Check**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] cal | CO2 [%] cal |
|-----------|----------|--------|---------|------------|-------------|
| 4/26/2018 | 18:42:12 | 9.92   | 10.02   |            |             |
| 4/26/2018 | 18:42:22 | 9.92   | 10.02   |            |             |
| 4/26/2018 | 18:42:32 | 9.93   | 10.03   |            |             |
| 4/26/2018 | 18:42:42 | 9.92   | 10.03   |            |             |
| 4/26/2018 | 18:42:52 | 9.93   | 10.03   |            |             |
| 4/26/2018 | 18:43:02 | 9.93   | 10.03   | 9.93       |             |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #3**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/26/2018 | 18:55:08 | 19.50  | 0.70    |
| 4/26/2018 | 18:56:08 | 19.50  | 0.70    |
| 4/26/2018 | 18:57:08 | 19.51  | 0.70    |
| 4/26/2018 | 18:58:08 | 19.50  | 0.70    |
| 4/26/2018 | 18:59:08 | 19.51  | 0.70    |
| 4/26/2018 | 19:00:08 | 19.51  | 0.70    |
| 4/26/2018 | 19:01:08 | 19.46  | 0.69    |
| 4/26/2018 | 19:02:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:03:08 | 19.42  | 0.69    |
| 4/26/2018 | 19:04:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:05:08 | 19.43  | 0.68    |
| 4/26/2018 | 19:06:08 | 19.43  | 0.68    |
| 4/26/2018 | 19:07:08 | 19.43  | 0.68    |
| 4/26/2018 | 19:08:08 | 19.44  | 0.69    |
| 4/26/2018 | 19:09:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:10:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:11:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:12:08 | 19.44  | 0.69    |
| 4/26/2018 | 19:13:08 | 19.44  | 0.69    |
| 4/26/2018 | 19:14:08 | 19.44  | 0.69    |
| 4/26/2018 | 19:15:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:16:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:17:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:18:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:19:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:20:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:21:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:22:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:23:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:24:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:25:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:26:08 | 19.43  | 0.70    |
| 4/26/2018 | 19:27:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:28:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:29:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:30:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:31:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:32:08 | 19.42  | 0.69    |
| 4/26/2018 | 19:33:08 | 19.43  | 0.69    |
| 4/26/2018 | 19:34:08 | 19.43  | 0.69    |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #3**

| Date          | Time     | O2 [%]       | CO2 [%]     |
|---------------|----------|--------------|-------------|
| 4/26/2018     | 19:35:08 | 19.43        | 0.69        |
| 4/26/2018     | 19:36:08 | 19.43        | 0.69        |
| 4/26/2018     | 19:37:08 | 19.43        | 0.69        |
| 4/26/2018     | 19:38:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:39:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:40:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:41:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:42:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:43:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:44:08 | 19.42        | 0.70        |
| 4/26/2018     | 19:45:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:46:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:47:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:48:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:49:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:50:08 | 19.41        | 0.70        |
| 4/26/2018     | 19:51:08 | 19.42        | 0.70        |
| 4/26/2018     | 19:52:08 | 19.42        | 0.70        |
| 4/26/2018     | 19:53:08 | 19.42        | 0.70        |
| 4/26/2018     | 19:54:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:55:08 | 19.42        | 0.69        |
| 4/26/2018     | 19:56:08 | 19.43        | 0.69        |
| 4/26/2018     | 19:57:08 | 19.43        | 0.68        |
| 4/26/2018     | 19:58:08 | 19.43        | 0.69        |
| 4/26/2018     | 19:59:08 | 19.43        | 0.69        |
| 4/26/2018     | 20:00:08 | 19.42        | 0.68        |
| 4/26/2018     | 20:01:08 | 19.44        | 0.69        |
| Final Average |          | <b>19.43</b> | <b>0.69</b> |

**Hollingsworth & Vose**  
**CFU 114**  
**4/26/2018**  
**Run #3 Post Cal Check**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] Cal | CO2 [%] Cal |
|-----------|----------|--------|---------|------------|-------------|
| 4/26/2018 | 20:02:38 | 19.32  | 0.92    |            |             |
| 4/26/2018 | 20:02:48 | 7.69   | 1.59    |            |             |
| 4/26/2018 | 20:02:58 | 0.81   | 0.24    |            |             |
| 4/26/2018 | 20:03:08 | 0.15   | 0.08    |            |             |
| 4/26/2018 | 20:03:18 | 0.07   | 0.06    |            |             |
| 4/26/2018 | 20:03:28 | 0.06   | 0.05    |            |             |
| 4/26/2018 | 20:03:38 | 0.05   | 0.05    |            |             |
| 4/26/2018 | 20:03:48 | 0.04   | 0.05    |            |             |
| 4/26/2018 | 20:03:58 | 0.04   | 0.05    | 0.04       | 0.05        |
| 4/26/2018 | 20:04:08 | 0.04   | 0.05    |            |             |
| 4/26/2018 | 20:04:18 | 0.04   | 0.05    |            |             |
| 4/26/2018 | 20:04:28 | 0.68   | 0.07    |            |             |
| 4/26/2018 | 20:04:38 | 1.72   | 0.12    |            |             |
| 4/26/2018 | 20:04:48 | 1.67   | 1.09    |            |             |
| 4/26/2018 | 20:04:58 | 1.93   | 1.82    |            |             |
| 4/26/2018 | 20:05:08 | 1.93   | 1.89    |            |             |
| 4/26/2018 | 20:05:18 | 1.93   | 1.90    |            |             |
| 4/26/2018 | 20:05:28 | 1.93   | 1.91    |            |             |
| 4/26/2018 | 20:05:38 | 1.94   | 1.92    |            |             |
| 4/26/2018 | 20:05:48 | 1.94   | 1.92    |            |             |
| 4/26/2018 | 20:05:58 | 1.94   | 1.92    |            |             |
| 4/26/2018 | 20:06:08 | 1.94   | 1.92    |            |             |
| 4/26/2018 | 20:06:18 | 1.95   | 1.92    |            | 1.92        |
| 4/26/2018 | 20:06:28 | 1.96   | 1.92    |            |             |
| 4/26/2018 | 20:06:38 | 1.96   | 1.93    |            |             |
| 4/26/2018 | 20:06:48 | 2.01   | 1.94    |            |             |
| 4/26/2018 | 20:06:58 | 7.65   | 7.77    |            |             |
| 4/26/2018 | 20:07:08 | 9.78   | 9.90    |            |             |
| 4/26/2018 | 20:07:18 | 9.86   | 9.96    |            |             |
| 4/26/2018 | 20:07:28 | 9.87   | 9.98    |            |             |
| 4/26/2018 | 20:07:38 | 9.87   | 9.99    |            |             |
| 4/26/2018 | 20:07:48 | 9.87   | 9.99    |            |             |
| 4/26/2018 | 20:07:58 | 9.87   | 10.00   |            |             |
| 4/26/2018 | 20:08:08 | 9.88   | 9.99    |            |             |
| 4/26/2018 | 20:08:18 | 9.88   | 10.00   |            |             |
| 4/26/2018 | 20:08:28 | 9.88   | 10.00   |            |             |
| 4/26/2018 | 20:08:38 | 9.88   | 10.01   | 9.88       |             |





|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 114              |
| DATE      | 04/27/18             |
| METHOD    | 5                    |
| POLLUTANT | PM                   |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** 5  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/Rainy, 50 degrees

**Run:** 1  
**Start Time:** 9:30  
**End Time:** 11:40  
**Date:** 4/27/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

|             |        |            |       |             |                 |
|-------------|--------|------------|-------|-------------|-----------------|
| Meterbox ID | 11     | Probe ID   | 4A    | Liner type  | Glass           |
| Y factor    | 0.9820 | Nozzle ID  | 0.255 | Nozzle size | 0.2550 inches   |
| ΔH@         | 1.8073 | Hot box ID | 1     | Nozzle area | 0.000355 sq.ft. |
|             |        | Pitot Cp   | 0.84  | Probe heat  | 250 F           |
|             |        |            |       | Filter heat | 250 F           |

**Source Information:**

|                        |                         |                 |              |
|------------------------|-------------------------|-----------------|--------------|
| Barometric Pressure    | 29.85 "Hg               | O <sub>2</sub>  | 19.90 %      |
| Static Pressure        | 0.56 "H <sub>2</sub> O  | CO <sub>2</sub> | 0.68 %       |
| Ave. ΔP                | 0.988 "H <sub>2</sub> O | Rec. Nz.        | 0.224 inches |
| Stack Temperature      | 260 F                   |                 |              |
| Assumed moisture       | 2 %                     |                 |              |
| Assumed meter temp.    | 55 F                    |                 |              |
| Total number of points | 24                      |                 |              |
| Time per point         | 5                       |                 |              |
| Total run time         | 120                     |                 |              |

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.010     |
| Leak check vacuum, "Hg | 15       | 5         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

|                         |                               |                     |                          |
|-------------------------|-------------------------------|---------------------|--------------------------|
| Sample volume           | 119.720 dcf                   | Ave. ΔP             | 1.003 "H <sub>2</sub> O  |
| Wet mol. weight         | 28.66 M <sub>s</sub> (actual) | Ave. √ΔP            | 1.0006 "H <sub>2</sub> O |
| Actual H <sub>2</sub> O | 2.17 %                        | Ave. ΔH             | 3.233 "H <sub>2</sub> O  |
| Std. meter vol.         | 120.926 dscf                  | Ave. T <sub>s</sub> | 264.6 °F                 |
| Isokinetic Average      | 100.6 %                       | Ave. T <sub>m</sub> | 56 °F                    |

**Moisture/Lab:**

| Filter        | Q1309 #           |       |      |
|---------------|-------------------|-------|------|
|               | Initial           | Final | Gain |
| Impingers, g  | 200.0             | 232   | 32.0 |
| Silica gel, g | 240.2             | 265.2 | 25.0 |
|               | Total water gain: |       | 57.0 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 5           | 473.502            | 0.83                            | 255              | 54               | 2.70     | 2.70   | 4            | 255             | 52                     |
| 2              | 10          | 482.860            | 0.92                            | 254              | 54               | 3.00     | 3.00   | 4            | 260             | 54                     |
| 3              | 15          | 487.820            | 0.99                            | 266              | 54               | 3.18     | 3.20   | 4            | 256             | 45                     |
| 4              | 20          | 492.730            | 1.00                            | 267              | 54               | 3.20     | 3.20   | 4            | 254             | 46                     |
| 5              | 25          | 497.950            | 1.10                            | 270              | 55               | 3.52     | 3.50   | 4            | 253             | 47                     |
| 6              | 30          | 503.120            | 1.10                            | 270              | 55               | 3.52     | 3.50   | 4            | 254             | 48                     |
| 7              | 35          | 508.310            | 1.10                            | 269              | 55               | 3.52     | 3.50   | 4            | 255             | 50                     |
| 8              | 40          | 513.780            | 1.20                            | 268              | 55               | 3.85     | 3.90   | 4            | 257             | 50                     |
| 9              | 45          | 518.980            | 1.10                            | 267              | 56               | 3.54     | 3.50   | 4            | 255             | 47                     |
| 10             | 50          | 524.200            | 1.10                            | 267              | 56               | 3.54     | 3.50   | 4            | 256             | 48                     |
| 11             | 55          | 529.460            | 1.10                            | 267              | 56               | 3.54     | 3.50   | 4            | 255             | 49                     |
| 12             | 60          | 534.440            | 1.00                            | 266              | 56               | 3.22     | 3.20   | 4            | 255             | 49                     |
| 13             | 65          | 539.190            | 0.91                            | 263              | 57               | 2.95     | 3.00   | 4            | 253             | 52                     |
| 14             | 70          | 543.990            | 0.91                            | 263              | 57               | 2.95     | 3.00   | 4            | 251             | 46                     |
| 15             | 75          | 548.930            | 0.96                            | 262              | 57               | 3.11     | 3.10   | 4            | 250             | 47                     |
| 16             | 80          | 553.780            | 0.97                            | 267              | 57               | 3.13     | 3.10   | 4            | 249             | 49                     |
| 17             | 85          | 558.770            | 1.00                            | 267              | 57               | 3.22     | 3.20   | 4            | 254             | 49                     |
| 18             | 90          | 563.770            | 1.00                            | 267              | 57               | 3.22     | 3.20   | 4            | 255             | 51                     |
| 19             | 95          | 569.040            | 1.10                            | 266              | 57               | 3.55     | 3.60   | 4            | 252             | 50                     |
| 20             | 100         | 574.000            | 1.00                            | 265              | 57               | 3.23     | 3.20   | 4            | 256             | 51                     |
| 21             | 105         | 578.950            | 0.99                            | 265              | 57               | 3.20     | 3.20   | 4            | 254             | 50                     |
| 22             | 110         | 583.830            | 0.97                            | 264              | 57               | 3.14     | 3.10   | 4            | 252             | 49                     |
| 23             | 115         | 588.660            | 0.91                            | 259              | 57               | 2.96     | 3.00   | 4            | 253             | 49                     |
| 24             | 120         | 593.222            | 0.82                            | 256              | 57               | 2.68     | 2.70   | 4            | 257             | 49                     |

**Isokinetic Field Data  
Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** 5  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
 Cloudy/Rainy, 50 degrees

**Run:** 2  
**Start Time:** 12:45  
**End Time:** 15:00  
**Date:** 4/27/2018

**Stack Dimensional Data:**

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 4A Liner type: Glass  
 Y factor 0.9820 Nozzle ID 0.255 Nozzle size: 0.2550 inches  
 ΔH@ 1.8073 Hot box ID 1 Nozzle area: 0.000355 sq.ft.  
 Pitot Cp 0.84 Probe heat: 250 F  
 Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.88 "Hg O<sub>2</sub> 19.92 %  
 Static Pressure 0.56 "H<sub>2</sub>O CO<sub>2</sub> 0.67 %  
 Ave. ΔP 0.988 "H<sub>2</sub>O Rec. Nz. 0.224 inches  
 Stack Temperature 260 F  
 Assumed moisture 2.17 %  
 Assumed meter temp. 56 F  
 Total number of points 24  
 Time per point 5  
 Total run time 120

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 12       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 121.335 dcf Ave. ΔP 1.027 "H<sub>2</sub>O  
 Wet mol. weight 28.65 M<sub>s</sub> (actual) Ave. √ΔP 1.0117 "H<sub>2</sub>O  
 Actual H<sub>2</sub>O 2.28 % Ave. ΔH 3.35 "H<sub>2</sub>O  
 Std. meter vol. 122.784 dscf Ave. T<sub>s</sub> 258.5 °F  
 Isokinetic Average 100.6 % Ave. T<sub>m</sub> 55.7 °F

**Moisture/Lab:**

| Filter        | Q1311 # | Initial           | Final | Gain |
|---------------|---------|-------------------|-------|------|
| Impingers, g  |         | 200.0             | 231   | 31.0 |
| Silica gel, g |         | 248.5             | 278.5 | 30.0 |
|               |         | Total water gain: |       | 61.0 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 5           | 593.526            | 0.78                            | 256              | 55               | 2.53     | 2.50   | 4            | 252             | 50                     |
| 2              | 10          | 597.900            | 0.84                            | 255              | 55               | 2.73     | 2.70   | 4            | 256             | 46                     |
| 3              | 15          | 607.360            | 0.96                            | 257              | 55               | 3.12     | 3.10   | 4            | 254             | 49                     |
| 4              | 20          | 612.380            | 1.00                            | 257              | 55               | 3.25     | 3.30   | 4            | 260             | 52                     |
| 5              | 25          | 617.640            | 1.10                            | 257              | 55               | 3.57     | 3.60   | 4            | 257             | 53                     |
| 6              | 30          | 622.910            | 1.10                            | 260              | 55               | 3.55     | 3.60   | 4            | 254             | 53                     |
| 7              | 35          | 628.140            | 1.10                            | 258              | 55               | 3.56     | 3.60   | 4            | 255             | 53                     |
| 8              | 40          | 633.180            | 1.00                            | 258              | 56               | 3.25     | 3.30   | 4            | 254             | 54                     |
| 9              | 45          | 638.240            | 1.00                            | 259              | 56               | 3.24     | 3.30   | 4            | 255             | 54                     |
| 10             | 50          | 643.130            | 0.97                            | 259              | 56               | 3.15     | 3.20   | 4            | 253             | 54                     |
| 11             | 55          | 647.900            | 0.92                            | 257              | 56               | 2.99     | 3.00   | 4            | 251             | 55                     |
| 12             | 60          | 652.345            | 0.77                            | 254              | 56               | 2.51     | 2.50   | 4            | 253             | 54                     |
| 13             | 65          | 657.580            | 1.10                            | 256              | 56               | 3.58     | 3.60   | 4            | 256             | 52                     |
| 14             | 70          | 662.530            | 1.00                            | 256              | 56               | 3.26     | 3.30   | 4            | 254             | 52                     |
| 15             | 75          | 667.780            | 1.10                            | 256              | 56               | 3.58     | 3.60   | 4            | 255             | 54                     |
| 16             | 80          | 673.080            | 1.10                            | 258              | 56               | 3.57     | 3.60   | 4            | 254             | 56                     |
| 17             | 85          | 678.550            | 1.20                            | 258              | 56               | 3.90     | 3.90   | 4            | 258             | 56                     |
| 18             | 90          | 683.980            | 1.20                            | 258              | 56               | 3.90     | 3.90   | 4            | 260             | 56                     |
| 19             | 95          | 689.270            | 1.10                            | 261              | 56               | 3.56     | 3.60   | 4            | 256             | 56                     |
| 20             | 100         | 694.450            | 1.10                            | 262              | 56               | 3.55     | 3.60   | 4            | 258             | 58                     |
| 21             | 105         | 699.710            | 1.10                            | 262              | 56               | 3.55     | 3.60   | 4            | 254             | 59                     |
| 22             | 110         | 705.010            | 1.10                            | 263              | 56               | 3.55     | 3.60   | 4            | 255             | 60                     |
| 23             | 115         | 709.920            | 1.00                            | 263              | 56               | 3.22     | 3.20   | 4            | 254             | 60                     |
| 24             | 120         | 714.861            | 1.00                            | 263              | 56               | 3.22     | 3.20   | 4            | 254             | 60                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** 5  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/Rainy, 50 degrees

**Run:** 3  
**Start Time:** 15:45  
**End Time:** 17:50  
**Date:** 4/27/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 4A Liner type: Glass  
Y factor 0.9820 Nozzle ID 0.255 Nozzle size: 0.2550 inches  
 $\Delta H@$  1.8073 Hot box ID 1 Nozzle area: 0.000355 sq.ft.  
Pitot Cp 0.84 Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.91 "Hg O<sub>2</sub> 19.96 %  
Static Pressure 0.56 "H<sub>2</sub>O CO<sub>2</sub> 0.68 %  
Ave.  $\Delta P$  0.988 "H<sub>2</sub>O Rec. Nz. 0.224 inches  
Stack Temperature 260 F  
Assumed moisture 2.28 %  
Assumed meter temp. 55.7 F  
Total number of points 24  
Time per point 5  
Total run time 120

**Leak Checks:** Pre-test Post-test  
Pitot: x x  
Train leak rate, dcf: 0.000 0.000  
Leak check vacuum, "Hg: 10 8

**Nozzle check for roundness:**

1 2 3  
0.255 0.255 0.255 inches  
Caliper ID# HLN1

**Post Test Calculations:**

Sample volume 121.299 dcf Ave.  $\Delta P$  1.038 "H<sub>2</sub>O  
Wet mol. weight 28.68 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.0175 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 2.08 % Ave.  $\Delta H$  3.325 "H<sub>2</sub>O  
Std. meter vol. 122.481 dscf Ave. T<sub>s</sub> 267 °F  
Isokinetic Average 100.2 % Ave. T<sub>m</sub> 57.3 °F

**Moisture/Lab:**

Filter Q1312 #  
Initial Final Gain  
Impingers, g 200.0 228 28.0  
Silica gel, g 240.1 267.3 27.2  
Total water gain: 55.2

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 5           | 715.246            | 0.99                                    | 263              | 56               | 3.19             | 3.20           | 4            | 254             | 44                     |
| 2              | 10          | 725.430            | 1.10                                    | 263              | 56               | 3.54             | 3.60           | 4            | 256             | 44                     |
| 3              | 15          | 730.610            | 1.10                                    | 266              | 56               | 3.53             | 3.50           | 4            | 255             | 49                     |
| 4              | 20          | 735.790            | 1.10                                    | 267              | 56               | 3.52             | 3.50           | 4            | 254             | 53                     |
| 5              | 25          | 741.250            | 1.20                                    | 267              | 56               | 3.84             | 3.90           | 4            | 256             | 56                     |
| 6              | 30          | 746.740            | 1.20                                    | 267              | 56               | 3.84             | 3.90           | 4            | 254             | 57                     |
| 7              | 35          | 751.880            | 1.10                                    | 268              | 57               | 3.52             | 3.50           | 4            | 254             | 59                     |
| 8              | 40          | 757.120            | 1.10                                    | 268              | 57               | 3.52             | 3.50           | 4            | 254             | 60                     |
| 9              | 45          | 762.330            | 1.10                                    | 268              | 57               | 3.52             | 3.50           | 4            | 254             | 60                     |
| 10             | 50          | 767.340            | 1.00                                    | 269              | 57               | 3.20             | 3.20           | 4            | 255             | 56                     |
| 11             | 55          | 772.280            | 1.00                                    | 268              | 57               | 3.20             | 3.20           | 4            | 254             | 52                     |
| 12             | 60          | 776.605            | 0.78                                    | 266              | 57               | 2.50             | 2.50           | 4            | 255             | 50                     |
| 13             | 65          | 781.580            | 1.00                                    | 264              | 58               | 3.23             | 3.20           | 4            | 253             | 44                     |
| 14             | 70          | 786.490            | 1.00                                    | 264              | 58               | 3.23             | 3.20           | 4            | 255             | 45                     |
| 15             | 75          | 791.500            | 1.00                                    | 265              | 58               | 3.22             | 3.20           | 4            | 256             | 45                     |
| 16             | 80          | 796.720            | 1.10                                    | 269              | 58               | 3.52             | 3.50           | 4            | 255             | 48                     |
| 17             | 85          | 801.900            | 1.10                                    | 269              | 58               | 3.52             | 3.50           | 4            | 255             | 50                     |
| 18             | 90          | 807.130            | 1.10                                    | 269              | 58               | 3.52             | 3.50           | 4            | 257             | 51                     |
| 19             | 95          | 812.100            | 1.00                                    | 269              | 58               | 3.20             | 3.20           | 4            | 256             | 52                     |
| 20             | 100         | 817.070            | 1.00                                    | 269              | 58               | 3.20             | 3.20           | 4            | 255             | 52                     |
| 21             | 105         | 822.240            | 1.10                                    | 269              | 58               | 3.52             | 3.50           | 4            | 256             | 52                     |
| 22             | 110         | 827.230            | 1.00                                    | 269              | 58               | 3.20             | 3.20           | 4            | 255             | 53                     |
| 23             | 115         | 832.050            | 0.94                                    | 268              | 58               | 3.02             | 3.00           | 4            | 255             | 52                     |
| 24             | 120         | 836.545            | 0.80                                    | 263              | 58               | 2.58             | 2.60           | 4            | 253             | 51                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Particulate Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** ODEQ 5

**Run:** 1  
**Start Time:** 9:30  
**End Time:** 11:40  
**Date:** 4/27/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 473.502                  |                                 |                            |                   |                         |                            |             |
| 5             | 478.050                  | 2.70                            | 54                         | 1                 | 0.83                    | 255                        | 0.9110      |
| 10            | 482.860                  | 3.00                            | 54                         | 2                 | 0.92                    | 254                        | 0.9592      |
| 15            | 487.820                  | 3.20                            | 54                         | 3                 | 0.99                    | 266                        | 0.9950      |
| 20            | 492.730                  | 3.20                            | 54                         | 4                 | 1.00                    | 267                        | 1.0000      |
| 25            | 497.950                  | 3.50                            | 55                         | 5                 | 1.10                    | 270                        | 1.0488      |
| 30            | 503.120                  | 3.50                            | 55                         | 6                 | 1.10                    | 270                        | 1.0488      |
| 35            | 508.310                  | 3.50                            | 55                         | 7                 | 1.10                    | 269                        | 1.0488      |
| 40            | 513.780                  | 3.90                            | 55                         | 8                 | 1.20                    | 268                        | 1.0954      |
| 45            | 518.980                  | 3.50                            | 56                         | 9                 | 1.10                    | 267                        | 1.0488      |
| 50            | 524.200                  | 3.50                            | 56                         | 10                | 1.10                    | 267                        | 1.0488      |
| 55            | 529.460                  | 3.50                            | 56                         | 11                | 1.10                    | 267                        | 1.0488      |
| 60            | 534.440                  | 3.20                            | 56                         | 12                | 1.00                    | 266                        | 1.0000      |
| 65            | 539.190                  | 3.00                            | 57                         | 13                | 0.91                    | 263                        | 0.9539      |
| 70            | 543.990                  | 3.00                            | 57                         | 14                | 0.91                    | 263                        | 0.9539      |
| 75            | 548.930                  | 3.10                            | 57                         | 15                | 0.96                    | 262                        | 0.9798      |
| 80            | 553.780                  | 3.10                            | 57                         | 16                | 0.97                    | 267                        | 0.9849      |
| 85            | 558.770                  | 3.20                            | 57                         | 17                | 1.00                    | 267                        | 1.0000      |
| 90            | 563.770                  | 3.20                            | 57                         | 18                | 1.00                    | 267                        | 1.0000      |
| 95            | 569.040                  | 3.60                            | 57                         | 19                | 1.10                    | 266                        | 1.0488      |
| 100           | 574.000                  | 3.20                            | 57                         | 20                | 1.00                    | 265                        | 1.0000      |
| 105           | 578.950                  | 3.20                            | 57                         | 21                | 0.99                    | 265                        | 0.9950      |
| 110           | 583.830                  | 3.10                            | 57                         | 22                | 0.97                    | 264                        | 0.9849      |
| 115           | 588.660                  | 3.00                            | 57                         | 23                | 0.91                    | 259                        | 0.9539      |
| 120           | 593.222                  | 2.70                            | 57                         | 24                | 0.82                    | 256                        | 0.9055      |

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 1  
Date: 04/27/18

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**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 120 min         |
| Sample Time Interval   | 5 min           |
| Meter Volume, $V_m$    | 119.720 dcf     |
| Water Volume           | 57.0 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2550 in.      |
| Nozzle Area            | 0.000355 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 36.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 7.069 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 29.85 "Hg              |
| Static Pressure            | 0.56 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.68 %vd  |
| O <sub>2</sub> Average  | 19.90 %vd |

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**Field Data Averages**Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 3.233 "H <sub>2</sub> O |
| Temperature, $T_m$    | 56.0 °F                 |
| Temperature, $T_m$    | 516.0 °A (°R)           |
| Pressure Meter, $P_m$ | 30.088 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.0006 "H <sub>2</sub> O |
| Temperature, $T_s$    | 264.6 °F                 |
| Temperature, $T_s$    | 724.6 °A (R)             |
| Pressure Stack, $P_s$ | 29.891 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 120.926 dscf |
|                                | 3.424 dscm   |
| Actual Volume, $V_{m(actual)}$ | 169.866 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 66.08 fps           |
| Volume (actual)   | 28,027.2 awcfm      |
|                   | 27,419.0 adcfm      |
| Volume (standard) | 1,224,179.1 wscf/hr |
|                   | 1,197,614.4 dscf/hr |
|                   | 19,960.2 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 2.682 scf |
| Moisture, $B_{ws}$           | 0.0217    |
| Moisture EPA M4              | 2.17 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.90 lb/lb-mole |
| Wet, $M_s$ | 28.66 lb/lb-mole |

|                    |         |
|--------------------|---------|
| Percent Isokinetic | 100.6 % |
|--------------------|---------|

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**Laboratory Results****EPA Method 5**

|               |               |
|---------------|---------------|
| Filterable PM | 0.00122 grams |
|---------------|---------------|

**Emissions:**

|                      |                  |
|----------------------|------------------|
| Concentration, $C_s$ | 1.56E-04 gr/dscf |
|                      | 357 µg/dscm      |
| Mass Emissions       | 2.67E-02 lb/hr   |

**Back Half:**

|                      |                  |
|----------------------|------------------|
| Inorganic CPM        | 1.94E-03 grams   |
| Inorganic CPM, $C_s$ | 2.48E-04 gr/dscf |
|                      | 567 µg/dscm      |
| Mass Emissions       | 4.24E-02 lb/hr   |

|                    |                  |
|--------------------|------------------|
| Organic CPM        | 4.76E-04 grams   |
| Organic CPM, $C_s$ | 6.08E-05 gr/dscf |
|                    | 139 µg/dscm      |
| Mass Emissions     | 1.04E-02 lb/hr   |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Particulate Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** ODEQ 5

**Run:** 2  
**Start Time:** 12:45  
**End Time:** 15:00  
**Date:** 04/27/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 593.526                  |                                 |                            |                   |                         |                            |             |
| 5             | 597.900                  | 2.50                            | 55                         | 1                 | 0.78                    | 256                        | 0.8832      |
| 10            | 602.480                  | 2.70                            | 55                         | 2                 | 0.84                    | 255                        | 0.9165      |
| 15            | 607.360                  | 3.10                            | 55                         | 3                 | 0.96                    | 257                        | 0.9798      |
| 20            | 612.380                  | 3.30                            | 55                         | 4                 | 1.00                    | 257                        | 1.0000      |
| 25            | 617.640                  | 3.60                            | 55                         | 5                 | 1.10                    | 257                        | 1.0488      |
| 30            | 622.910                  | 3.60                            | 55                         | 6                 | 1.10                    | 260                        | 1.0488      |
| 35            | 628.140                  | 3.60                            | 55                         | 7                 | 1.10                    | 258                        | 1.0488      |
| 40            | 633.180                  | 3.30                            | 56                         | 8                 | 1.00                    | 258                        | 1.0000      |
| 45            | 638.240                  | 3.30                            | 56                         | 9                 | 1.00                    | 259                        | 1.0000      |
| 50            | 643.130                  | 3.20                            | 56                         | 10                | 0.97                    | 259                        | 0.9849      |
| 55            | 647.900                  | 3.00                            | 56                         | 11                | 0.92                    | 257                        | 0.9592      |
| 60            | 652.345                  | 2.50                            | 56                         | 12                | 0.77                    | 254                        | 0.8775      |
| 65            | 657.580                  | 3.60                            | 56                         | 13                | 1.10                    | 256                        | 1.0488      |
| 70            | 662.530                  | 3.30                            | 56                         | 14                | 1.00                    | 256                        | 1.0000      |
| 75            | 667.780                  | 3.60                            | 56                         | 15                | 1.10                    | 256                        | 1.0488      |
| 80            | 673.080                  | 3.60                            | 56                         | 16                | 1.10                    | 258                        | 1.0488      |
| 85            | 678.550                  | 3.90                            | 56                         | 17                | 1.20                    | 258                        | 1.0954      |
| 90            | 683.980                  | 3.90                            | 56                         | 18                | 1.20                    | 258                        | 1.0954      |
| 95            | 689.270                  | 3.60                            | 56                         | 19                | 1.10                    | 261                        | 1.0488      |
| 100           | 694.450                  | 3.60                            | 56                         | 20                | 1.10                    | 262                        | 1.0488      |
| 105           | 699.710                  | 3.60                            | 56                         | 21                | 1.10                    | 262                        | 1.0488      |
| 110           | 705.010                  | 3.60                            | 56                         | 22                | 1.10                    | 263                        | 1.0488      |
| 115           | 709.920                  | 3.20                            | 56                         | 23                | 1.00                    | 263                        | 1.0000      |
| 120           | 714.861                  | 3.20                            | 56                         | 24                | 1.00                    | 263                        | 1.0000      |

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 2  
Date: 04/27/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 120 min  
Sample Time Interval 5 min  
Meter Volume,  $V_m$  121.335 dcf  
Water Volume 61.0 ml (g)  
Nozzle Diameter,  $N_z$  0.2550 in.  
Nozzle Area 0.000355 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  29.88 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.67 %vd  
O<sub>2</sub> Average 19.92 %vd

### Field Data Averages

#### Meter

$\Delta H$  3.350 "H<sub>2</sub>O  
Temperature,  $T_m$  55.7 °F  
Temperature,  $T_m$  515.7 °A (°R)  
Pressure Meter,  $P_m$  30.126 "Hg

#### Stack

$\sqrt{D_p}$  1.0117 "H<sub>2</sub>O  
Temperature,  $T_s$  258.5 °F  
Temperature,  $T_s$  718.5 °A (R)  
Pressure Stack,  $P_s$  29.921 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  122.784 dscf  
3.477 dscm  
Actual Volume,  $V_{m(actual)}$  171.045 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  66.51 fps  
Volume (actual) 28,209.6 awcfm  
27,566.4 adcfm  
Volume (standard) 1,243,853.1 wscf/hr  
1,215,493.2 dscf/hr  
20,258.2 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  2.871 scf  
Moisture,  $B_{ws}$  0.0228  
Moisture EPA M4 2.28 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
Wet,  $M_s$  28.65 lb/lb-mole

Percent Isokinetic 100.6 %

### Laboratory Results

#### Front Half:

Filterable PM 0.00279 grams

#### Emissions:

Concentration,  $C_s$  3.51E-04 gr/dscf  
802 µg/dscm  
Mass Emissions 6.09E-02 lb/hr

#### Back Half:

Inorganic CPM 1.94E-03 grams  
Inorganic CPM,  $C_s$  2.44E-04 gr/dscf  
558 µg/dscm  
Mass Emissions 4.23E-02 lb/hr

Organic CPM 2.21E-04 grams  
Organic CPM,  $C_s$  2.78E-05 gr/dscf  
64 µg/dscm  
Mass Emissions 4.82E-03 lb/hr



**Isokinetic Field Data**  
**Field Data and Calculations**  
**Particulate Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** ODEQ 5

**Run:** 3  
**Start Time:** 15:45  
**End Time:** 17:50  
**Date:** 04/27/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 715.246                  |                                 |                            |                   |                         |                            |             |
| 5             | 720.190                  | 3.20                            | 56                         | 1                 | 0.99                    | 263                        | 0.9950      |
| 10            | 725.430                  | 3.60                            | 56                         | 2                 | 1.10                    | 263                        | 1.0488      |
| 15            | 730.610                  | 3.50                            | 56                         | 3                 | 1.10                    | 266                        | 1.0488      |
| 20            | 735.790                  | 3.50                            | 56                         | 4                 | 1.10                    | 267                        | 1.0488      |
| 25            | 741.250                  | 3.90                            | 56                         | 5                 | 1.20                    | 267                        | 1.0954      |
| 30            | 746.740                  | 3.90                            | 56                         | 6                 | 1.20                    | 267                        | 1.0954      |
| 35            | 751.880                  | 3.50                            | 57                         | 7                 | 1.10                    | 268                        | 1.0488      |
| 40            | 757.120                  | 3.50                            | 57                         | 8                 | 1.10                    | 268                        | 1.0488      |
| 45            | 762.330                  | 3.50                            | 57                         | 9                 | 1.10                    | 268                        | 1.0488      |
| 50            | 767.340                  | 3.20                            | 57                         | 10                | 1.00                    | 269                        | 1.0000      |
| 55            | 772.280                  | 3.20                            | 57                         | 11                | 1.00                    | 268                        | 1.0000      |
| 60            | 776.605                  | 2.50                            | 57                         | 12                | 0.78                    | 266                        | 0.8832      |
| 65            | 781.580                  | 3.20                            | 58                         | 13                | 1.00                    | 264                        | 1.0000      |
| 70            | 786.490                  | 3.20                            | 58                         | 14                | 1.00                    | 264                        | 1.0000      |
| 75            | 791.500                  | 3.20                            | 58                         | 15                | 1.00                    | 265                        | 1.0000      |
| 80            | 796.720                  | 3.50                            | 58                         | 16                | 1.10                    | 269                        | 1.0488      |
| 85            | 801.900                  | 3.50                            | 58                         | 17                | 1.10                    | 269                        | 1.0488      |
| 90            | 807.130                  | 3.50                            | 58                         | 18                | 1.10                    | 269                        | 1.0488      |
| 95            | 812.100                  | 3.20                            | 58                         | 19                | 1.00                    | 269                        | 1.0000      |
| 100           | 817.070                  | 3.20                            | 58                         | 20                | 1.00                    | 269                        | 1.0000      |
| 105           | 822.240                  | 3.50                            | 58                         | 21                | 1.10                    | 269                        | 1.0488      |
| 110           | 827.230                  | 3.20                            | 58                         | 22                | 1.00                    | 269                        | 1.0000      |
| 115           | 832.050                  | 3.00                            | 58                         | 23                | 0.94                    | 268                        | 0.9695      |
| 120           | 836.545                  | 2.60                            | 58                         | 24                | 0.80                    | 263                        | 0.8944      |

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 3  
Date: 04/27/18

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**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 120 min         |
| Sample Time Interval   | 5 min           |
| Meter Volume, $V_m$    | 121.299 dcf     |
| Water Volume           | 55.2 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2550 in.      |
| Nozzle Area            | 0.000355 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 36.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 7.069 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 29.91 "Hg              |
| Static Pressure            | 0.56 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.68 %vd  |
| O <sub>2</sub> Average  | 19.96 %vd |

---

**Field Data Averages**Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 3.325 "H <sub>2</sub> O |
| Temperature, $T_m$    | 57.3 °F                 |
| Temperature, $T_m$    | 517.3 °A (°R)           |
| Pressure Meter, $P_m$ | 30.154 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.0175 "H <sub>2</sub> O |
| Temperature, $T_s$    | 267.0 °F                 |
| Temperature, $T_s$    | 727.0 °A (°R)            |
| Pressure Stack, $P_s$ | 29.951 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 122.481 dscf |
|                                | 3.468 dscm   |
| Actual Volume, $V_{m(actual)}$ | 172.117 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 67.22 fps           |
| Volume (actual)   | 28,510.7 awcfm      |
|                   | 27,917.7 adcfm      |
| Volume (standard) | 1,243,678.8 wscf/hr |
|                   | 1,217,810.3 dscf/hr |
|                   | 20,296.8 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 2.598 scf |
| Moisture, $B_{ws}$           | 0.0208    |
| Moisture EPA M4              | 2.08 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.91 lb/lb-mole |
| Wet, $M_s$ | 28.68 lb/lb-mole |

|                    |         |
|--------------------|---------|
| Percent Isokinetic | 100.2 % |
|--------------------|---------|

---

**Laboratory Results****Front Half:**

|               |               |
|---------------|---------------|
| Filterable PM | 0.00188 grams |
|---------------|---------------|

**Emissions:**

|                      |                  |
|----------------------|------------------|
| Concentration, $C_s$ | 2.37E-04 gr/dscf |
|                      | 543 µg/dscm      |
| Mass Emissions       | 4.13E-02 lb/hr   |

**Back Half:**

|                      |                  |                    |                  |
|----------------------|------------------|--------------------|------------------|
| Inorganic CPM        | 2.01E-03 grams   | Organic CPM        | 4.55E-04 grams   |
| Inorganic CPM, $C_s$ | 2.53E-04 gr/dscf | Organic CPM, $C_s$ | 5.74E-05 gr/dscf |
|                      | 579 µg/dscm      |                    | 131.28 µg/dscm   |
| Mass Emissions       | 4.40E-02 lb/hr   | Mass Emissions     | 9.98E-03 lb/hr   |

**Oregon Method 5**  
**Filterable and Condensable Particulate**  
**Laboratory Gravimetric Data**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114

| Run | Sample Description                  | g, #  | Initial<br>(grams) | Final<br>(grams) | Net Gain | Blank<br>Correction       | Corrected<br>Gain (grams) |
|-----|-------------------------------------|-------|--------------------|------------------|----------|---------------------------|---------------------------|
| 1   | CPM Organics (Acetone BH)           | 165   | 44.54045           | 44.54110         | 0.00065  | 1.74E-04                  | <b>0.00048</b>            |
|     | Probe Rinse (Acetone FH)            | 75    | 44.81190           | 44.81320         | 0.00130  | 7.89E-05                  | <b>0.00122</b>            |
|     | Filter                              | Q1309 | 0.38840            | 0.38815          | 0.00000  |                           | <b>0.00000</b>            |
|     | CPM Inorganics (Water)              | 393   | 46.52055           | 46.52290         | 0.00235  | 4.09E-04                  | <b>0.00194</b>            |
|     | CPM Organics (Hexane BH)            | 85    | 41.79590           | 41.79590         | 0.00000  | 2.13E-04                  | <b>0.00000</b>            |
|     | Impinger H <sub>2</sub> O Gain, mls |       | 200                | 232              | 32.0     |                           |                           |
|     |                                     |       |                    |                  |          | <b>Filterable PM (mg)</b> | <b>1.22</b>               |
|     |                                     |       |                    |                  |          | <b>Total PM (mg)</b>      | <b>3.64 ND</b>            |
| 2   | CPM Organics (Acetone BH)           | 170   | 47.03680           | 47.03720         | 0.00040  | 1.79E-04                  | <b>0.00022</b>            |
|     | Probe Rinse (Acetone FH)            | 105   | 43.66670           | 43.66960         | 0.00290  | 1.11E-04                  | <b>0.00279</b>            |
|     | Filter                              | Q1311 | 0.39885            | 0.39840          | 0.00000  |                           | <b>0.00000</b>            |
|     | CPM Inorganics (Water)              | 394   | 43.65795           | 43.66030         | 0.00235  | 4.10E-04                  | <b>0.00194</b>            |
|     | CPM Organics (Hexane BH)            | 85    | 44.78310           | 44.78330         | 0.00020  | 2.13E-04                  | <b>0.00000</b>            |
|     | Impinger H <sub>2</sub> O Gain, mls |       | 200                | 231              | 31.0     |                           |                           |
|     |                                     |       |                    |                  |          | <b>Filterable PM (mg)</b> | <b>2.79</b>               |
|     |                                     |       |                    |                  |          | <b>Total PM (mg)</b>      | <b>4.95 ND</b>            |
| 3   | CPM Organics (Acetone BH)           | 185   | 47.37905           | 47.37970         | 0.00065  | 1.95E-04                  | <b>0.00046</b>            |
|     | Probe Rinse (Acetone FH)            | 110   | 43.22280           | 43.22480         | 0.00200  | 1.16E-04                  | <b>0.00188</b>            |
|     | Filter                              | Q1312 | 0.39735            | 0.39710          | 0.00000  |                           | <b>0.00000</b>            |
|     | CPM Inorganics (Water)              | 377   | 40.48280           | 40.48520         | 0.00240  | 3.93E-04                  | <b>0.00201</b>            |
|     | CPM Organics (Hexane BH)            | 85    | 43.17855           | 43.17840         | 0.00000  | 2.13E-04                  | <b>0.00000</b>            |
|     | Impinger H <sub>2</sub> O Gain, mls |       | 200                | 228              | 28.0     |                           |                           |
|     |                                     |       |                    |                  |          | <b>Filterable PM (mg)</b> | <b>1.88</b>               |
|     |                                     |       |                    |                  |          | <b>Total PM (mg)</b>      | <b>4.35 ND</b>            |
|     | Acetone Blank                       | 190   | 46.37740           | 46.37760         | 0.00020  | 1.05E-06                  | g/g                       |
|     | Water Blank                         | 240   | 42.97395           | 42.97420         | 0.00025  | 1.04E-06                  | g/g                       |
|     | Hexane Blank                        | 100   | 47.15305           | 47.15330         | 0.00025  | 2.50E-06                  | g/g                       |

ND = Non-Detect. Values are below the method detection limit (7 mg).

**Oregon Methods 1-5**  
**Filterable and Condensable Particulate**  
**Results Summary**

**Client:** Hollingsworth & Vose  
**Source:** CFU 114  
**Location:** Corvallis, OR

| Run                                      |                               |             | 1           | 2           | 3           | Average            |
|------------------------------------------|-------------------------------|-------------|-------------|-------------|-------------|--------------------|
| Date                                     |                               |             | 4/27/2018   | 4/27/2018   | 4/27/2018   |                    |
| Run Start Time                           |                               |             | 9:30        | 12:45       | 15:45       |                    |
| Run End Time                             |                               |             | 11:40       | 15:00       | 17:50       |                    |
| Duration, min.                           |                               |             | 120         | 120         | 120         |                    |
| Barometric Pressure, "Hg                 |                               |             | 29.85       | 29.88       | 29.91       | <b>29.88</b>       |
| Nozzle Dia., in.                         |                               |             | 0.2550      | 0.2550      | 0.2550      | <b>0.2550</b>      |
| Isokinetic Average, %                    |                               |             | 100.6       | 100.6       | 100.2       | <b>100.5</b>       |
| Sample Volume, dscf                      |                               |             | 120.926     | 122.784     | 122.481     | <b>122.064</b>     |
| Sample Volume, dscm                      |                               |             | 3.424       | 3.477       | 3.468       | <b>3.456</b>       |
| Stack Diameter, in.                      |                               |             | 36.00       | 36.00       | 36.00       | <b>36.00</b>       |
| Stack Area, sq.ft.                       |                               |             | 7.069       | 7.069       | 7.069       | <b>7.069</b>       |
| CO <sub>2</sub> % vd                     |                               |             | 0.68        | 0.67        | 0.68        | <b>0.68</b>        |
| O <sub>2</sub> % vd                      |                               |             | 19.90       | 19.92       | 19.96       | <b>19.93</b>       |
| Static Press., "H <sub>2</sub> O         |                               |             | 0.56        | 0.56        | 0.56        | <b>0.56</b>        |
| H <sub>2</sub> O % v                     |                               |             | 2.17        | 2.28        | 2.08        | <b>2.18</b>        |
| Wet Molecular Weight, lb/lb-mole         |                               |             | 28.66       | 28.65       | 28.68       | <b>28.66</b>       |
| Velocity, FPS                            |                               |             | 66.08       | 66.51       | 67.22       | <b>66.60</b>       |
| ADCFM                                    |                               |             | 27,419.0    | 27,566.4    | 27,917.7    | <b>27,634.4</b>    |
| AWCFM                                    |                               |             | 28,027.2    | 28,209.6    | 28,510.7    | <b>28,249.2</b>    |
| DSCFM                                    |                               |             | 19,960.2    | 20,258.2    | 20,296.8    | <b>20,171.8</b>    |
| Stack Temperature, °F                    |                               |             | 264.6       | 258.5       | 267.0       | <b>263.4</b>       |
| Filterable Particulate                   | Concentration, C <sub>s</sub> | gr/dscf     | 1.56E-04    | 3.51E-04    | 2.37E-04    | <b>2.48E-04</b>    |
|                                          |                               | µg/dscm     | 357         | 802         | 543         | <b>567</b>         |
|                                          | Mass                          | lb/hr       | 2.67E-02    | 6.09E-02    | 4.13E-02    | <b>4.29E-02</b>    |
|                                          |                               | lb/lb glass | 4.37E-04    | 9.98E-04    | 6.77E-04    | <b>7.04E-04</b>    |
| Inorganic CPM                            | Concentration, C <sub>s</sub> | gr/dscf     | 2.48E-04    | 2.44E-04    | 2.53E-04    | <b>2.48E-04</b>    |
|                                          |                               | µg/dscm     | 567         | 558         | 579         | <b>568</b>         |
|                                          | Mass                          | lb/hr       | 4.24E-02    | 4.23E-02    | 4.40E-02    | <b>4.29E-02</b>    |
|                                          |                               | lb/lb glass | 6.95E-04    | 6.94E-04    | 7.21E-04    | <b>7.03E-04</b>    |
| Organic CPM                              | Concentration, C <sub>s</sub> | gr/dscf     | 6.08E-05    | 2.78E-05    | 5.74E-05    | <b>4.86E-05</b>    |
|                                          |                               | µg/dscm     | 139         | 64          | 131         | <b>111</b>         |
|                                          | Mass                          | lb/hr       | 1.04E-02    | 4.82E-03    | 9.98E-03    | <b>8.40E-03</b>    |
|                                          |                               | lb/lb glass | 1.70E-04    | 7.91E-05    | 1.64E-04    | <b>1.38E-04</b>    |
| Measured Total PM                        | Concentration, C <sub>s</sub> | gr/dscf     | ND 4.64E-04 | ND 6.22E-04 | ND 5.48E-04 | ND <b>5.45E-04</b> |
|                                          |                               | µg/dscm     | ND 1,062    | ND 1,424    | ND 1,253    | ND <b>1,247</b>    |
|                                          | Mass                          | lb/hr       | ND 7.94E-02 | ND 1.08E-01 | ND 9.53E-02 | ND <b>9.42E-02</b> |
|                                          |                               | lb/lb glass | ND 1.30E-03 | ND 1.77E-03 | ND 1.56E-03 | ND <b>1.54E-03</b> |
| Total PM @ Method Detection Limit (7 mg) | Mass                          | gr/dscf     | < 8.93E-04  | < 8.80E-04  | < 8.80E-04  | < <b>8.84E-04</b>  |
|                                          |                               | lb/hr       | < 1.53E-01  | < 1.53E-01  | < 1.53E-01  | < <b>1.53E-01</b>  |
|                                          |                               | lb/lb glass | < 2.51E-03  | < 2.50E-03  | < 2.51E-03  | < <b>2.51E-03</b>  |
| Production Data                          | Glass Production              | lbs/hr      | 61.0        | 61.0        | 61.0        | <b>61.0</b>        |

ND = Non-Detect. Values calculated with results below the method detection limit (7mg).

**Oregon Methods 1-5**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 114**  
**Method: ODEQ 5**

**Run: 1**  
**Start Time: 9:30**  
**End Time: 11:40**  
**Date: 4/27/2018**

**EPA Methods 1-4:**

$$1) P_m = P_b + (\Delta H/13.6) = 30.088 \text{ "Hg}$$

where  $P_b$ : 29.85 "Hg  
 $\Delta H$ : 3.233 "H<sub>2</sub>O

$$2) P_s = P_b + (\text{Static Press.}/13.6) = 29.891 \text{ "Hg}$$

where  $P_b$ : 29.85 "Hg  
Static Press.: 0.56 "H<sub>2</sub>O

$$3) V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 120.926 \text{ dscf}$$

where  $V_m$ : 119.720 dcf  
 $Y$ : 0.9820  
 $P_m$ : 30.088 "Hg  
 $T_m$ : 516.0 °A

$$4) V_w(\text{std}) = (0.04706)(H_2O) = 2.682 \text{ scf}$$

where  $H_2O$ : 57.00 g

$$5) Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0217$$

where  $Vw(\text{std})$ : 2.682 scf  
 $Vm(\text{std})$ : 120.926 dscf

$$6) \% H_2O = Bws \times 100 = 2.17 \%v$$

$$7) V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 169.866 \text{ awcf}$$

where  $Y$ : 0.9820  
 $V_m$ : 119.7200 dcf  
 $Bws$ : 0.0217  
 $T_s$ : 724.6 °A  
 $T_m$ : 516.0 °A  
 $P_m$ : 30.088 "Hg  
 $P_s$ : 29.891 "Hg

$$8) M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.90 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.68 %vd  
 $O_2$ : 19.90 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.42 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.66 \text{ lb/lb-mole}$$

where  $M_d$ : 28.90 lb/lb-mole  
 $Bws$ : 0.0217

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 7.069 \text{ sq. ft.}$$

where Stack ID: 36 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 66.08 \text{ fps}$$

where  $Cp$ : 0.84  
Ave. Sqrt  $\Delta P$ : 1.0006  
 $T_s$ : 724.6 °A  
 $P_s$ : 29.891 "Hg  
 $M_s$ : 28.66 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 28,027.2 \text{ AWCfm}$$

where  $V_s$ : 66.08 ft/sec  
Stack Area: 7.069 sq. ft

$$13) \text{ ADCfm} = (\text{AWCFM})(1-Bws) = 27,419.0 \text{ ADCfm}$$

where AWCfm: 28,027.2  
 $Bws$ : 0.0217

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,224,179.1 \text{ wscf/hr}$$

where  $V_s$ : 66.08 ft/sec  
Stack Area: 7.0690 sq. ft.  
 $T_s$ : 724.6 °A  
 $P_s$ : 29.891 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1-Bws) = 1,197,614.4 \text{ dscf/hr}$$

where wscf/hr: 1,224,179.1  
 $Bws$ : 0.0217

$$16) \text{ DSCFM} = (\text{dscf/hr})/60 \text{ mins/hr} = 19,960.2 \text{ DSCFM}$$

where dscf/hr: 1,197,614.4

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000355 \text{ sq. ft.}$$

where Nozzle Size: 0.2550 inches

$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(T_s)(V_m(\text{std}))}{P_s(V_s)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 100.6 \%$$

where Ts: 724.6 °A  
Vm(Std): 120.926 dscf  
Ps: 29.891 "Hg  
Vs: 66.08 ft/sec  
Nozzle Area: 0.000355 sq. ft.  
Sampling Time: 120 min.  
Bws: 0.0217

### ODEQ Method 5:

#### Front Half:

$$19) \text{ Filterable PM} = \text{filter gain} + \text{probe rinse gain} = 0.00122 \text{ grams}$$

where Filter Gain: 0.00000 grams  
Probe Rinse: 0.00122 grams

$$20) \text{ Cs} = (\text{Sample grams}/V_m(\text{Std})) (15.43 \text{ grains/gram}) = 1.56\text{E-}04 \text{ gr/dscf}$$

where Sample: 0.00122 grams  
Vm(std): 120.926 dscf

$$21) \text{ Cs} = (\text{Sample grams} * 1,000,000 \text{ }\mu\text{g/gram}) / V_m(\text{std}) = 356.6 \text{ }\mu\text{g/dscm}$$

where Sample: 0.00122 grams  
Vm(std): 3.424 dscm

$$22) \text{ Mass Emission Rate} = (\text{Cs})(\text{Stack flow})/7000 \text{ gr/lb} = 2.67\text{E-}02 \text{ lb/hr}$$

where Cs: 1.56E-04 gr/dscf  
Stack Flow: 1,197,614.4 dscf/hr

#### Back Half:

$$23) \text{ Inorganic CPM} = \text{water fraction} = 0.00194 \text{ grams}$$

$$\text{Organic CPM} = \text{acetone BH} + \text{hexane BH} = 0.00048 \text{ grams}$$

Back-half concentrations and mass rates are calculated as front-half examples.

$$24) \text{ lb/lb glass produced} = \text{PM fraction}/\text{Glass production} = 4.37\text{E-}04 \text{ lb/lb glass}$$

where glass produced: 61.0 lb/hr  
Filterable PM emissions: 2.67E-02 lb/hr



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 114              |
| DATE      | 04/27/18             |
| METHOD    | M316                 |
| POLLUTANT | Formaldehyde         |



**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M316  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/rainy, 50 degrees

**Run:** 1  
**Start Time:** 9:30  
**End Time:** 11:40  
**Date:** 4/27/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

|             |        |            |      |             |                 |
|-------------|--------|------------|------|-------------|-----------------|
| Meterbox ID | 13     | Probe ID   | 4D   | Liner type  | Glass           |
| Y factor    | 0.9966 | Nozzle ID  | 220  | Nozzle size | 0.2203 inches   |
| ΔH@         | 1.8316 | Hot box ID | 2    | Nozzle area | 0.000265 sq.ft. |
|             |        | Pitot Cp   | 0.84 | Probe heat  | 250 F           |
|             |        |            |      | Filter heat | 250 F           |

**Source Information:**

|                        |                         |                 |              |
|------------------------|-------------------------|-----------------|--------------|
| Barometric Pressure    | 29.85 "Hg               | O <sub>2</sub>  | 19.90 %      |
| Static Pressure        | 0.56 "H <sub>2</sub> O  | CO <sub>2</sub> | 0.68 %       |
| Ave. ΔP                | 0.988 "H <sub>2</sub> O | Rec. Nz.        | 0.224 inches |
| Stack Temperature      | 260 F                   |                 |              |
| Assumed moisture       | 2 %                     |                 |              |
| Assumed meter temp.    | 55 F                    |                 |              |
| Total number of points | 24                      |                 |              |
| Time per point         | 5                       |                 |              |
| Total run time         | 120                     |                 |              |

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 13       | 6         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.220       | 0.220 | 0.221 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

|                         |                               |                     |                          |
|-------------------------|-------------------------------|---------------------|--------------------------|
| Sample volume           | 91.867 dcf                    | Ave. ΔP             | 1.091 "H <sub>2</sub> O  |
| Wet mol. weight         | 28.63 M <sub>s</sub> (actual) | Ave. √ΔP            | 1.0434 "H <sub>2</sub> O |
| Actual H <sub>2</sub> O | 2.50 %                        | Ave. ΔH             | 1.988 "H <sub>2</sub> O  |
| Std. meter vol.         | 94.085 dscf                   | Ave. T <sub>s</sub> | 264.7 °F                 |
| Isokinetic Average      | 100.8 %                       | Ave. T <sub>m</sub> | 54.9 °F                  |

**Moisture/Lab:**

| Filter        | NA #              |       |      |
|---------------|-------------------|-------|------|
|               | Initial           | Final | Gain |
| Impingers, g  | 200.0             | 232   | 32.0 |
| Silica gel, g | 239.6             | 258.8 | 19.2 |
|               | Total water gain: |       | 51.2 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 5           | 3.980              | 1.20                            | 266              | 52               | 2.16     | 2.20   | 3            | 250             | 51                     |
| 2              | 10          | 7.780              | 1.10                            | 266              | 52               | 1.98     | 2.00   | 3            | 250             | 42                     |
| 3              | 15          | 11.590             | 1.10                            | 267              | 52               | 1.98     | 2.00   | 3            | 250             | 45                     |
| 4              | 20          | 15.400             | 1.10                            | 268              | 52               | 1.98     | 2.00   | 3            | 250             | 48                     |
| 5              | 25          | 19.410             | 1.20                            | 268              | 53               | 2.16     | 2.20   | 3            | 252             | 50                     |
| 6              | 30          | 23.250             | 1.10                            | 267              | 53               | 1.99     | 2.00   | 3            | 250             | 51                     |
| 7              | 35          | 26.900             | 1.00                            | 267              | 54               | 1.81     | 1.80   | 2            | 249             | 53                     |
| 8              | 40          | 30.750             | 1.10                            | 267              | 54               | 1.99     | 2.00   | 3            | 250             | 53                     |
| 9              | 45          | 34.430             | 1.00                            | 267              | 55               | 1.81     | 1.80   | 2            | 253             | 51                     |
| 10             | 50          | 38.080             | 0.99                            | 266              | 55               | 1.80     | 1.80   | 2            | 252             | 51                     |
| 11             | 55          | 41.640             | 0.95                            | 265              | 55               | 1.73     | 1.70   | 2            | 252             | 51                     |
| 12             | 60          | 45.014             | 0.84                            | 261              | 55               | 1.53     | 1.50   | 2            | 252             | 51                     |
| 13             | 65          | 49.010             | 1.20                            | 267              | 55               | 2.17     | 2.20   | 3            | 253             | 46                     |
| 14             | 70          | 52.890             | 1.10                            | 263              | 56               | 2.01     | 2.00   | 3            | 252             | 44                     |
| 15             | 75          | 56.910             | 1.20                            | 263              | 56               | 2.19     | 2.20   | 3            | 252             | 45                     |
| 16             | 80          | 60.930             | 1.20                            | 264              | 56               | 2.19     | 2.20   | 3            | 251             | 47                     |
| 17             | 85          | 64.800             | 1.10                            | 265              | 56               | 2.00     | 2.00   | 3            | 250             | 48                     |
| 18             | 90          | 68.650             | 1.10                            | 265              | 56               | 2.00     | 2.00   | 3            | 251             | 49                     |
| 19             | 95          | 72.670             | 1.20                            | 265              | 56               | 2.18     | 2.20   | 3            | 250             | 50                     |
| 20             | 100         | 76.540             | 1.10                            | 264              | 57               | 2.01     | 2.00   | 3            | 252             | 50                     |
| 21             | 105         | 80.590             | 1.20                            | 264              | 57               | 2.19     | 2.20   | 3            | 248             | 50                     |
| 22             | 110         | 84.440             | 1.10                            | 262              | 57               | 2.01     | 2.00   | 3            | 252             | 50                     |
| 23             | 115         | 88.120             | 1.00                            | 259              | 57               | 1.84     | 1.80   | 2            | 248             | 49                     |
| 24             | 120         | 91.867             | 1.00                            | 256              | 57               | 1.85     | 1.90   | 2            | 250             | 49                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M316  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/rainy, 50 degrees

**Run:** 2  
**Start Time:** 12:53  
**End Time:** 15:00  
**Date:** 4/27/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 13 Probe ID 4D Liner type: Glass  
Y factor 0.9966 Nozzle ID 220 Nozzle size: 0.2203 inches  
 $\Delta H@$  1.8316 Hot box ID 2 Nozzle area: 0.000265 sq.ft.  
Pitot Cp 0.84 Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.88 "Hg  $O_2$  19.92 %  
Static Pressure 0.56 "H<sub>2</sub>O  $CO_2$  0.67 %  
Ave.  $\Delta P$  0.988 "H<sub>2</sub>O Rec. Nz. 0.224 inches  
Stack Temperature 260 F  
Assumed moisture 2.5 %  
Assumed meter temp. 54.9 F  
Total number of points 24  
Time per point 5  
Total run time 120

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 10       | 9         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.220       | 0.220 | 0.221 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 90.364 dcf Ave.  $\Delta P$  1.051 "H<sub>2</sub>O  
Wet mol. weight 28.66 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.0237 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 2.17 % Ave.  $\Delta H$  1.917 "H<sub>2</sub>O  
Std. meter vol. 92.587 dscf Ave. T<sub>s</sub> 257.7 °F  
Isokinetic Average 100.3 % Ave. T<sub>m</sub> 55.1 °F

**Moisture/Lab:**

| Filter        | NA # | Initial           | Final | Gain |
|---------------|------|-------------------|-------|------|
| Impingers, g  |      | 200.0             | 223   | 23.0 |
| Silica gel, g |      | 242.7             | 263.4 | 20.7 |
|               |      | Total water gain: |       | 43.7 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 5           | 3.840              | 1.10                                    | 256              | 54               | 2.00             | 2.00           | 3            | 249             | 49                     |
| 2              | 10          | 7.690              | 1.10                                    | 255              | 54               | 2.01             | 2.00           | 3            | 252             | 48                     |
| 3              | 15          | 11.720             | 1.20                                    | 255              | 54               | 2.19             | 2.20           | 3            | 251             | 49                     |
| 4              | 20          | 15.770             | 1.20                                    | 256              | 54               | 2.19             | 2.20           | 3            | 251             | 51                     |
| 5              | 25          | 19.790             | 1.20                                    | 256              | 54               | 2.19             | 2.20           | 3            | 251             | 51                     |
| 6              | 30          | 23.660             | 1.10                                    | 256              | 54               | 2.00             | 2.00           | 3            | 249             | 51                     |
| 7              | 35          | 27.490             | 1.10                                    | 256              | 54               | 2.00             | 2.00           | 3            | 250             | 50                     |
| 8              | 40          | 31.510             | 1.20                                    | 258              | 54               | 2.18             | 2.20           | 3            | 250             | 50                     |
| 9              | 45          | 35.370             | 1.10                                    | 257              | 55               | 2.00             | 2.00           | 3            | 250             | 50                     |
| 10             | 50          | 39.230             | 1.10                                    | 257              | 55               | 2.00             | 2.00           | 3            | 250             | 51                     |
| 11             | 55          | 42.880             | 0.99                                    | 256              | 55               | 1.81             | 1.80           | 2            | 250             | 52                     |
| 12             | 60          | 46.435             | 0.94                                    | 254              | 55               | 1.72             | 1.70           | 2            | 250             | 53                     |
| 13             | 65          | 49.820             | 0.84                                    | 261              | 55               | 1.52             | 1.50           | 2            | 250             | 51                     |
| 14             | 70          | 53.410             | 0.95                                    | 256              | 56               | 1.74             | 1.80           | 3            | 250             | 51                     |
| 15             | 75          | 57.060             | 0.97                                    | 255              | 55               | 1.77             | 1.80           | 3            | 249             | 51                     |
| 16             | 80          | 60.710             | 0.99                                    | 256              | 56               | 1.81             | 1.80           | 3            | 250             | 52                     |
| 17             | 85          | 64.560             | 1.10                                    | 258              | 56               | 2.01             | 2.00           | 3            | 250             | 52                     |
| 18             | 90          | 68.410             | 1.10                                    | 259              | 56               | 2.00             | 2.00           | 3            | 250             | 53                     |
| 19             | 95          | 72.270             | 1.10                                    | 260              | 56               | 2.00             | 2.00           | 3            | 250             | 54                     |
| 20             | 100         | 75.980             | 1.00                                    | 261              | 56               | 1.82             | 1.80           | 3            | 251             | 55                     |
| 21             | 105         | 79.640             | 1.00                                    | 261              | 55               | 1.81             | 1.80           | 3            | 250             | 55                     |
| 22             | 110         | 83.500             | 1.10                                    | 263              | 57               | 2.00             | 2.00           | 3            | 250             | 56                     |
| 23             | 115         | 87.050             | 0.92                                    | 262              | 57               | 1.67             | 1.70           | 3            | 250             | 56                     |
| 24             | 120         | 90.364             | 0.82                                    | 261              | 56               | 1.49             | 1.50           | 2            | 251             | 57                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** M316  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/rainy, 50 degrees

**Run:** 3  
**Start Time:** 15:45  
**End Time:** 17:50  
**Date:** 4/27/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 13  
Y factor 0.9966  
ΔH@ 1.8316  
Probe ID 4D  
Nozzle ID 220  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.2203 inches  
Nozzle area: 0.000265 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.91 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Ave. ΔP 0.988 "H<sub>2</sub>O  
Stack Temperature 260 F  
Assumed moisture 2.17 %  
Assumed meter temp. 55.1 F  
Total number of points 24  
Time per point 5  
Total run time 120  
O<sub>2</sub> 19.96 %  
CO<sub>2</sub> 0.68 %  
Rec. Nz. 0.224 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 11       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.220       | 0.220 | 0.221 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 90.831 dcf  
Wet mol. weight 28.71 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.79 %  
Std. meter vol. 92.804 dscf  
Isokinetic Average 100.0 %  
Ave. ΔP 1.067 "H<sub>2</sub>O  
Ave. √ΔP 1.032 "H<sub>2</sub>O  
Ave. ΔH 1.942 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 267 °F  
Ave. T<sub>m</sub> 57.1 °F

**Moisture/Lab:**

|                   | Filter | NA #    |       | Gain |
|-------------------|--------|---------|-------|------|
|                   |        | Initial | Final |      |
| Impingers, g      | 200.0  | 212     | 12.0  |      |
| Silica gel, g     | 245.1  | 269     | 23.9  |      |
| Total water gain: |        |         | 35.9  |      |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 5           | 3.390              | 0.86                            | 266              | 55               | 1.56     | 1.60   | 2            | 249             | 48                     |
| 2              | 10          | 7.020              | 0.98                            | 266              | 56               | 1.78     | 1.80   | 2            | 250             | 46                     |
| 3              | 15          | 10.860             | 1.10                            | 265              | 55               | 1.99     | 2.00   | 3            | 250             | 47                     |
| 4              | 20          | 14.680             | 1.10                            | 268              | 55               | 1.99     | 2.00   | 3            | 250             | 50                     |
| 5              | 25          | 18.490             | 1.10                            | 267              | 55               | 1.99     | 2.00   | 3            | 251             | 52                     |
| 6              | 30          | 22.150             | 1.00                            | 268              | 56               | 1.81     | 1.80   | 3            | 250             | 54                     |
| 7              | 35          | 26.000             | 1.10                            | 267              | 56               | 1.99     | 2.00   | 3            | 250             | 56                     |
| 8              | 40          | 29.850             | 1.10                            | 267              | 57               | 2.00     | 2.00   | 3            | 250             | 60                     |
| 9              | 45          | 33.710             | 1.10                            | 268              | 57               | 1.99     | 2.00   | 3            | 251             | 62                     |
| 10             | 50          | 37.350             | 1.00                            | 267              | 57               | 1.81     | 1.80   | 3            | 250             | 61                     |
| 11             | 55          | 41.210             | 1.10                            | 267              | 58               | 2.00     | 2.00   | 3            | 250             | 61                     |
| 12             | 60          | 44.913             | 1.00                            | 265              | 58               | 1.82     | 1.80   | 2            | 250             | 60                     |
| 13             | 65          | 48.540             | 0.97                            | 266              | 57               | 1.76     | 1.80   | 2            | 251             | 55                     |
| 14             | 70          | 52.410             | 1.10                            | 268              | 58               | 2.00     | 2.00   | 3            | 249             | 56                     |
| 15             | 75          | 56.440             | 1.20                            | 268              | 58               | 2.18     | 2.20   | 3            | 250             | 56                     |
| 16             | 80          | 60.460             | 1.20                            | 268              | 58               | 2.18     | 2.20   | 3            | 249             | 56                     |
| 17             | 85          | 64.320             | 1.10                            | 268              | 58               | 2.00     | 2.00   | 3            | 250             | 56                     |
| 18             | 90          | 68.190             | 1.10                            | 268              | 58               | 2.00     | 2.00   | 3            | 250             | 58                     |
| 19             | 95          | 72.180             | 1.20                            | 268              | 58               | 2.18     | 2.20   | 3            | 251             | 58                     |
| 20             | 100         | 76.030             | 1.10                            | 267              | 58               | 2.00     | 2.00   | 3            | 250             | 59                     |
| 21             | 105         | 79.860             | 1.10                            | 267              | 58               | 2.00     | 2.00   | 3            | 250             | 58                     |
| 22             | 110         | 83.520             | 1.00                            | 267              | 58               | 1.82     | 1.80   | 3            | 251             | 58                     |
| 23             | 115         | 87.180             | 1.00                            | 267              | 58               | 1.82     | 1.80   | 3            | 252             | 56                     |
| 24             | 120         | 90.831             | 0.99                            | 266              | 58               | 1.80     | 1.80   | 3            | 251             | 57                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 316

**Run:** 1  
**Start Time:** 9:30  
**End Time:** 11:40  
**Date:** 4/27/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>°H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>°H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 5             | 3.980                    | 2.20                            | 52                         | 1                 | 1.20                    | 266                        | 1.0954      |
| 10            | 7.780                    | 2.00                            | 52                         | 2                 | 1.10                    | 266                        | 1.0488      |
| 15            | 11.590                   | 2.00                            | 52                         | 3                 | 1.10                    | 267                        | 1.0488      |
| 20            | 15.400                   | 2.00                            | 52                         | 4                 | 1.10                    | 268                        | 1.0488      |
| 25            | 19.410                   | 2.20                            | 53                         | 5                 | 1.20                    | 268                        | 1.0954      |
| 30            | 23.250                   | 2.00                            | 53                         | 6                 | 1.10                    | 267                        | 1.0488      |
| 35            | 26.900                   | 1.80                            | 54                         | 7                 | 1.00                    | 267                        | 1.0000      |
| 40            | 30.750                   | 2.00                            | 54                         | 8                 | 1.10                    | 267                        | 1.0488      |
| 45            | 34.430                   | 1.80                            | 55                         | 9                 | 1.00                    | 267                        | 1.0000      |
| 50            | 38.080                   | 1.80                            | 55                         | 10                | 0.99                    | 266                        | 0.9950      |
| 55            | 41.640                   | 1.70                            | 55                         | 11                | 0.95                    | 265                        | 0.9747      |
| 60            | 45.014                   | 1.50                            | 55                         | 12                | 0.84                    | 261                        | 0.9165      |
| 65            | 49.010                   | 2.20                            | 55                         | 13                | 1.20                    | 267                        | 1.0954      |
| 70            | 52.890                   | 2.00                            | 56                         | 14                | 1.10                    | 263                        | 1.0488      |
| 75            | 56.910                   | 2.20                            | 56                         | 15                | 1.20                    | 263                        | 1.0954      |
| 80            | 60.930                   | 2.20                            | 56                         | 16                | 1.20                    | 264                        | 1.0954      |
| 85            | 64.800                   | 2.00                            | 56                         | 17                | 1.10                    | 265                        | 1.0488      |
| 90            | 68.650                   | 2.00                            | 56                         | 18                | 1.10                    | 265                        | 1.0488      |
| 95            | 72.670                   | 2.20                            | 56                         | 19                | 1.20                    | 265                        | 1.0954      |
| 100           | 76.540                   | 2.00                            | 57                         | 20                | 1.10                    | 264                        | 1.0488      |
| 105           | 80.590                   | 2.20                            | 57                         | 21                | 1.20                    | 264                        | 1.0954      |
| 110           | 84.440                   | 2.00                            | 57                         | 22                | 1.10                    | 262                        | 1.0488      |
| 115           | 88.120                   | 1.80                            | 57                         | 23                | 1.00                    | 259                        | 1.0000      |
| 120           | 91.867                   | 1.90                            | 57                         | 24                | 1.00                    | 256                        | 1.0000      |

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 1  
Date: 04/27/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 120 min  
Sample Time Interval 5 min  
Meter Volume,  $V_m$  91.867 dcf  
Water Volume 51.2 ml (g)  
Nozzle Diameter,  $N_z$  0.2203 in.  
Nozzle Area 0.000265 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  29.85 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9966 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.68 %vd  
O<sub>2</sub> Average 19.90 %vd

### Field Data Averages

#### Meter

$\Delta H$  1.988 "H<sub>2</sub>O  
Temperature,  $T_m$  54.9 °F  
Temperature,  $T_m$  514.9 °A (°R)  
Pressure Meter,  $P_m$  29.996 "Hg

#### Stack

$\sqrt{D_p}$  1.0434 "H<sub>2</sub>O  
Temperature,  $T_s$  264.7 °F  
Temperature,  $T_s$  724.7 °A (R)  
Pressure Stack,  $P_s$  29.891 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  94.085 dscf  
2.664 dscm  
Actual Volume,  $V_{m(actual)}$  132.628 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  68.95 fps  
Volume (actual) 29,244.5 awcfm  
28,513.4 adcfm  
Volume (standard) 1,277,171.6 wscf/hr  
1,245,242.3 dscf/hr  
20,754.0 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  2.409 scf  
Moisture,  $B_{ws}$  0.0250  
Moisture EPA M4 2.50 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
Wet,  $M_s$  28.63 lb/lb-mole

Volume/Mole,  $V/M$  529.308

Percent Isokinetic 100.8 %

### Laboratory Results

|                   |          |           |                      |               |
|-------------------|----------|-----------|----------------------|---------------|
| CH <sub>2</sub> O | 455.0    | μg/sample |                      |               |
| CH <sub>2</sub> O | 4.55E-04 | grams     | MW CH <sub>2</sub> O | 30.031 g/mole |

#### Emissions:

|                      |          |         |
|----------------------|----------|---------|
| Concentration, $C_s$ | 7.46E-05 | gr/dscf |
|                      | 170.8    | μg/dscm |
|                      | 1.37E-01 | ppmvd   |
| Mass Emissions       | 1.33E-02 | lb/hr   |

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 316

**Run:** 2  
**Start Time:** 12:53  
**End Time:** 15:00  
**Date:** 04/27/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 5             | 3.840                    | 2.00                            | 54                         | 1                 | 1.10                    | 256                        | 1.0488      |
| 10            | 7.690                    | 2.00                            | 54                         | 2                 | 1.10                    | 255                        | 1.0488      |
| 15            | 11.720                   | 2.20                            | 54                         | 3                 | 1.20                    | 255                        | 1.0954      |
| 20            | 15.770                   | 2.20                            | 54                         | 4                 | 1.20                    | 256                        | 1.0954      |
| 25            | 19.790                   | 2.20                            | 54                         | 5                 | 1.20                    | 256                        | 1.0954      |
| 30            | 23.660                   | 2.00                            | 54                         | 6                 | 1.10                    | 256                        | 1.0488      |
| 35            | 27.490                   | 2.00                            | 54                         | 7                 | 1.10                    | 256                        | 1.0488      |
| 40            | 31.510                   | 2.20                            | 54                         | 8                 | 1.20                    | 258                        | 1.0954      |
| 45            | 35.370                   | 2.00                            | 55                         | 9                 | 1.10                    | 257                        | 1.0488      |
| 50            | 39.230                   | 2.00                            | 55                         | 10                | 1.10                    | 257                        | 1.0488      |
| 55            | 42.880                   | 1.80                            | 55                         | 11                | 0.99                    | 256                        | 0.9950      |
| 60            | 46.435                   | 1.70                            | 55                         | 12                | 0.94                    | 254                        | 0.9695      |
| 65            | 49.820                   | 1.50                            | 55                         | 13                | 0.84                    | 261                        | 0.9165      |
| 70            | 53.410                   | 1.80                            | 56                         | 14                | 0.95                    | 256                        | 0.9747      |
| 75            | 57.060                   | 1.80                            | 55                         | 15                | 0.97                    | 255                        | 0.9849      |
| 80            | 60.710                   | 1.80                            | 56                         | 16                | 0.99                    | 256                        | 0.9950      |
| 85            | 64.560                   | 2.00                            | 56                         | 17                | 1.10                    | 258                        | 1.0488      |
| 90            | 68.410                   | 2.00                            | 56                         | 18                | 1.10                    | 259                        | 1.0488      |
| 95            | 72.270                   | 2.00                            | 56                         | 19                | 1.10                    | 260                        | 1.0488      |
| 100           | 75.980                   | 1.80                            | 56                         | 20                | 1.00                    | 261                        | 1.0000      |
| 105           | 79.640                   | 1.80                            | 55                         | 21                | 1.00                    | 261                        | 1.0000      |
| 110           | 83.500                   | 2.00                            | 57                         | 22                | 1.10                    | 263                        | 1.0488      |
| 115           | 87.050                   | 1.70                            | 57                         | 23                | 0.92                    | 262                        | 0.9592      |
| 120           | 90.364                   | 1.50                            | 56                         | 24                | 0.82                    | 261                        | 0.9055      |

Client: Hollingsworth &amp; Vose

Run:

2

Source: CFU 114

Date: 04/27/18

**Field Data Input Continued**Moisture Data

Total Test Time 120 min  
 Sample Time Interval 5 min  
 Meter Volume,  $V_m$  90.364 dcf  
 Water Volume 43.7 ml (g)  
 Nozzle Diameter,  $N_z$  0.2203 in.  
 Nozzle Area 0.000265 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.88 "Hg  
 Static Pressure 0.56 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9966 Y

Molecular Weight:

CO<sub>2</sub> Average 0.67 %vd  
 O<sub>2</sub> Average 19.92 %vd

**Field Data Averages**Meter

$\Delta H$  1.917 "H<sub>2</sub>O  
 Temperature,  $T_m$  55.1 °F  
 Temperature,  $T_m$  515.1 °A (°R)  
 Pressure Meter,  $P_m$  30.021 "Hg

Stack

$\sqrt{D_p}$  1.0237 "H<sub>2</sub>O  
 Temperature,  $T_s$  257.7 °F  
 Temperature,  $T_s$  717.7 °A (R)  
 Pressure Stack,  $P_s$  29.921 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  92.587 dscf  
 2.622 dscm  
 Actual Volume,  $V_{m(actual)}$  128.690 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  67.25 fps  
 Volume (actual) 28,523.4 awcfm  
 27,904.4 adcfm  
 Volume (standard) 1,259,094.3 wscf/hr  
 1,231,772.0 dscf/hr  
 20,529.5 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  2.057 scf  
 Moisture,  $B_{ws}$  0.0217  
 Moisture EPA M4 2.17 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
 Wet,  $M_s$  28.66 lb/lb-mole

Volume/Mole,  $V/M$  523.67

Percent Isokinetic 100.3 %

**Laboratory Results**

CH<sub>2</sub>O 349.0 µg/sample  
 CH<sub>2</sub>O 3.49E-04 grams MW CH<sub>2</sub>O 30.031 g/mole

**Emissions:**

Concentration,  $C_s$  5.82E-05 gr/dscf  
 133.10 µg/dscm  
 1.07E-01 ppmvd  
 Mass Emissions 1.02E-02 lb/hr

"&lt;" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 316

**Run:** 3  
**Start Time:** 15:45  
**End Time:** 17:50  
**Date:** 04/27/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 5             | 3.390                    | 1.60                            | 55                         | 1                 | 0.86                    | 266                        | 0.9274      |
| 10            | 7.020                    | 1.80                            | 56                         | 2                 | 0.98                    | 266                        | 0.9899      |
| 15            | 10.860                   | 2.00                            | 55                         | 3                 | 1.10                    | 265                        | 1.0488      |
| 20            | 14.680                   | 2.00                            | 55                         | 4                 | 1.10                    | 268                        | 1.0488      |
| 25            | 18.490                   | 2.00                            | 55                         | 5                 | 1.10                    | 267                        | 1.0488      |
| 30            | 22.150                   | 1.80                            | 56                         | 6                 | 1.00                    | 268                        | 1.0000      |
| 35            | 26.000                   | 2.00                            | 56                         | 7                 | 1.10                    | 267                        | 1.0488      |
| 40            | 29.850                   | 2.00                            | 57                         | 8                 | 1.10                    | 267                        | 1.0488      |
| 45            | 33.710                   | 2.00                            | 57                         | 9                 | 1.10                    | 268                        | 1.0488      |
| 50            | 37.350                   | 1.80                            | 57                         | 10                | 1.00                    | 267                        | 1.0000      |
| 55            | 41.210                   | 2.00                            | 58                         | 11                | 1.10                    | 267                        | 1.0488      |
| 60            | 44.913                   | 1.80                            | 58                         | 12                | 1.00                    | 265                        | 1.0000      |
| 65            | 48.540                   | 1.80                            | 57                         | 13                | 0.97                    | 266                        | 0.9849      |
| 70            | 52.410                   | 2.00                            | 58                         | 14                | 1.10                    | 268                        | 1.0488      |
| 75            | 56.440                   | 2.20                            | 58                         | 15                | 1.20                    | 268                        | 1.0954      |
| 80            | 60.460                   | 2.20                            | 58                         | 16                | 1.20                    | 268                        | 1.0954      |
| 85            | 64.320                   | 2.00                            | 58                         | 17                | 1.10                    | 268                        | 1.0488      |
| 90            | 68.190                   | 2.00                            | 58                         | 18                | 1.10                    | 268                        | 1.0488      |
| 95            | 72.180                   | 2.20                            | 58                         | 19                | 1.20                    | 268                        | 1.0954      |
| 100           | 76.030                   | 2.00                            | 58                         | 20                | 1.10                    | 267                        | 1.0488      |
| 105           | 79.860                   | 2.00                            | 58                         | 21                | 1.10                    | 267                        | 1.0488      |
| 110           | 83.520                   | 1.80                            | 58                         | 22                | 1.00                    | 267                        | 1.0000      |
| 115           | 87.180                   | 1.80                            | 58                         | 23                | 1.00                    | 267                        | 1.0000      |
| 120           | 90.831                   | 1.80                            | 58                         | 24                | 0.99                    | 266                        | 0.9950      |



Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU 114

Date:

04/27/18

**Field Data Input Continued**Moisture Data

Total Test Time 120 min  
 Sample Time Interval 5 min  
 Meter Volume,  $V_m$  90.831 dcf  
 Water Volume 35.9 ml (g)  
 Nozzle Diameter,  $N_z$  0.2203 in.  
 Nozzle Area 0.000265 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 36.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 7.069 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.91 "Hg  
 Static Pressure 0.56 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9966 Y

Molecular Weight:

CO<sub>2</sub> Average 0.68 %vd  
 O<sub>2</sub> Average 19.96 %vd

**Field Data Averages**Meter

$\Delta H$  1.942 "H<sub>2</sub>O  
 Temperature,  $T_m$  57.1 °F  
 Temperature,  $T_m$  517.1 °A (°R)  
 Pressure Meter,  $P_m$  30.053 "Hg

Stack

$\sqrt{D_p}$  1.0320 "H<sub>2</sub>O  
 Temperature,  $T_s$  267.0 °F  
 Temperature,  $T_s$  727.0 °A (R)  
 Pressure Stack,  $P_s$  29.951 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  92.804 dscf  
 2.628 dscm  
 Actual Volume,  $V_{m(actual)}$  130.027 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  68.14 fps  
 Volume (actual) 28,900.9 awcfm  
 28,383.6 adcfm  
 Volume (standard) 1,260,700.3 wscf/hr  
 1,238,133.8 dscf/hr  
 20,635.6 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.689 scf  
 Moisture,  $B_{ws}$  0.0179  
 Moisture EPA M4 1.79 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.91 lb/lb-mole  
 Wet,  $M_s$  28.71 lb/lb-mole

Volume/Mole,  $V/M$  529.925

Percent Isokinetic 100.0 %

**Laboratory Results**

CH<sub>2</sub>O 416.0 µg/sample  
 CH<sub>2</sub>O 4.16E-04 grams MW CH<sub>2</sub>O 30.031 g/mole

**Emissions:**

Concentration,  $C_s$  6.92E-05 gr/dscf  
 158.30 µg/dscm  
 1.27E-01 ppmvd  
 Mass Emissions 1.22E-02 lb/hr

"&lt;" represents MDL value

**EPA Method 316**  
**Laboratory Results**  
**Formaldehyde**

**Client:** Hollingsworth & Vose

**Location:** Corvallis, OR

**Source:** CFU 114

**MDL** 0.0137 µg/mL

| Lab ID | Sample ID              | Sample Date | < | Result | MDL  | Sample Vol.<br>(mL) | Units     |
|--------|------------------------|-------------|---|--------|------|---------------------|-----------|
| 11     | Run 1                  | 4/27/2018   |   | 455    | 5.93 | 433.0               | µg/sample |
| 17     | Run 2                  | 4/27/2018   |   | 349    | 6.18 | 451.0               | µg/sample |
| 18     | Run 3                  | 4/27/2018   |   | 416    | 6.69 | 488.0               | µg/sample |
| 19     | H <sub>2</sub> O Blank |             | < | MDL    | 4.73 | 345.0               | µg/sample |
| 20     | Field Train Blank      |             | < | MDL    | 4.18 | 305.0               | µg/sample |

\*If sample results are below MDL, MDL value is shown. A "<" sign designates less than MDL.  
 If blank values are below MDL, no blank corrections are performed.

# EPA Method 316

## Results Summary

Client: Hollingsworth & Vose

Location: Corvallis, OR

Source: CFU 114

| Run                              |                               |             | 1         | 2         | 3         |          |
|----------------------------------|-------------------------------|-------------|-----------|-----------|-----------|----------|
| Date                             |                               |             | 4/27/2018 | 4/27/2018 | 4/27/2018 |          |
| Run Start Time                   |                               |             | 9:30      | 12:53     | 15:45     |          |
| Run End Time                     |                               |             | 11:40     | 15:00     | 17:50     |          |
| Duration, min.                   |                               |             | 120       | 120       | 120       | Average  |
| Barometric Pressure, "Hg         |                               |             | 29.85     | 29.88     | 29.91     | 29.88    |
| Nozzle Dia., in.                 |                               |             | 0.2203    | 0.2203    | 0.2203    | 0.2203   |
| Isokinetic Average, %            |                               |             | 100.8     | 100.3     | 100.0     | 100.4    |
| Sample Volume, dscf              |                               |             | 94.085    | 92.587    | 92.804    | 93.159   |
| Sample Volume, dscm              |                               |             | 2.664     | 2.622     | 2.628     | 2.638    |
| Stack Diameter, in.              |                               |             | 36.00     | 36.00     | 36.00     | 36.00    |
| Stack Area, sq.ft.               |                               |             | 7.069     | 7.069     | 7.069     | 7.069    |
| CO <sub>2</sub> %vd              |                               |             | 0.68      | 0.67      | 0.68      | 0.68     |
| O <sub>2</sub> %vd               |                               |             | 19.90     | 19.92     | 19.96     | 19.93    |
| Static Press., "H <sub>2</sub> O |                               |             | 0.56      | 0.56      | 0.56      | 0.56     |
| H <sub>2</sub> O %v              |                               |             | 2.50      | 2.17      | 1.79      | 2.15     |
| Wet Molecular Weight, lb/lb-mole |                               |             | 28.63     | 28.66     | 28.71     | 28.67    |
| Velocity, FPS                    |                               |             | 68.95     | 67.25     | 68.14     | 68.11    |
| ADCFM                            |                               |             | 28,513.4  | 27,904.4  | 28,383.6  | 28,267.1 |
| AWCFM                            |                               |             | 29,244.5  | 28,523.4  | 28,900.9  | 28,889.6 |
| DSCFM                            |                               |             | 20,754.0  | 20,529.5  | 20,635.6  | 20,639.7 |
| Stack Temperature, °F            |                               |             | 264.7     | 257.7     | 267.0     | 263.1    |
| Formaldehyde                     | Concentration, C <sub>s</sub> | gr/dscf     | 7.46E-05  | 5.82E-05  | 6.92E-05  | 6.73E-05 |
|                                  |                               | µg/dscm     | 170.8     | 133.1     | 158.3     | 154.1    |
|                                  |                               | ppmvd       | 1.37E-01  | 1.07E-01  | 1.27E-01  | 1.23E-01 |
|                                  | Mass                          | lb/hr       | 1.33E-02  | 1.02E-02  | 1.22E-02  | 1.19E-02 |
|                                  |                               | lb/lb glass | 2.18E-04  | 1.68E-04  | 2.01E-04  | 1.95E-04 |
| Production Data                  | Glass Production              | lbs/hr      | 61.0      | 61.0      | 61.0      | 61.0     |

"<" represents MDL value

**EPA Methods 1-4, 316**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 114**  
**Method: 316**

**Run: 1**  
**Start Time: 9:30**  
**End Time: 11:40**  
**Date: 4/27/2018**

**EPA Methods 1-4:**

$$1) \quad P_m = P_b + (\Delta H/13.6) = 29.996 \text{ "Hg}$$

where  $P_b$ : 29.85 "Hg  
 $\Delta H$ : 1.988 "H<sub>2</sub>O

$$2) \quad P_s = P_b + (\text{Static Press.}/13.6) = 29.891 \text{ "Hg}$$

where  $P_b$ : 29.85 "Hg  
Static Press.: 0.56 "H<sub>2</sub>O

$$3) \quad V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 94.085 \text{ dscf}$$

where  $V_m$ : 91.867 dcf  
 $Y$ : 0.9966  
 $P_m$ : 29.996 "Hg  
 $T_m$ : 514.9 °A

$$4) \quad V_w(\text{std}) = (0.04706)(H_2O) = 2.409 \text{ scf}$$

where  $H_2O$ : 51.20 g

$$5) \quad Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0250$$

where  $Vw(\text{std})$ : 2.409 scf  
 $Vm(\text{std})$ : 94.085 dscf

$$6) \quad \% H_2O = Bws \times 100 = 2.50 \%v$$

$$7) \quad V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 132.628 \text{ awcf}$$

where  $Y$ : 0.9966  
 $V_m$ : 91.8669 dcf  
 $Bws$ : 0.0250  
 $T_s$ : 724.7 °A  
 $T_m$ : 514.9 °A  
 $P_m$ : 29.996 "Hg  
 $P_s$ : 29.891 "Hg

$$8) \quad M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.90 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.68 %vd  
 $O_2$ : 19.90 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.42 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.63 \text{ lb/lb-mole}$$

where  $M_d$ : 28.90 lb/lb-mole  
 $Bws$ : 0.0250

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 7.069 \text{ sq. ft.}$$

where Stack ID: 36 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 68.95 \text{ fps}$$

where  $Cp$ : 0.84  
Ave. Sqrt  $\Delta P$ : 1.0434  
 $T_s$ : 724.7 °A  
 $P_s$ : 29.891 "Hg  
 $M_s$ : 28.63 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 29,244.5 \text{ AWCfm}$$

where  $V_s$ : 68.95 ft/sec  
Stack Area: 7.069 sq. ft

$$13) \text{ ADCfm} = (\text{AWCFM})(1-Bws) = 28,513.4 \text{ ADCfm}$$

where AWCfm: 29,244.5  
 $Bws$ : 0.0250

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,277,171.6 \text{ wscf/hr}$$

where  $V_s$ : 68.95 ft/sec  
Stack Area: 7.0690 sq. ft.  
 $T_s$ : 724.7 °A  
 $P_s$ : 29.891 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1-Bws) = 1,245,242.3 \text{ dscf/hr}$$

where wscf/hr: 1,277,171.6  
 $Bws$ : 0.0250

$$16) \text{ DSCFM} = (\text{dscf/hr})/60 \text{ mins/hr} = 20,754.0 \text{ DSCFM}$$

where dscf/hr: 1,245,242.3

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000265 \text{ sq. ft.}$$

where Nozzle Size: 0.2203 inches

$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(Ts)(Vm(std))}{Ps(Vs)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 100.8 \%$$

where Ts: 724.7 °A  
Vm(Std): 94.085 dscf  
Ps: 29.891 "Hg  
Vs: 68.95 ft/sec  
Nozzle Area: 0.000265 sq. ft.  
Sampling Time: 120 min.  
Bws: 0.0250

### EPA Method 316:

$$19) \text{ Formaldehyde laboratory results} = 455.0 \text{ } \mu\text{g/sample}$$

$$20) \text{ Formaldehyde} = (\mu\text{g/sample})/1,000,000 = 4.55\text{E-}04 \text{ grams/sample}$$

$$21) \text{ Cs} = (\text{Sample grams}/Vm(\text{Std})) (15.43 \text{ grains/gram}) = 7.46\text{E-}05 \text{ gr/dscf}$$

where Sample: 0.00046 grams  
Vm(std) 94.085 dscf

$$22) \text{ Cs} = (\text{Sample grams} * 1,000,000 \text{ } \mu\text{g/gram}) / Vm(\text{std}) = 170.8 \text{ } \mu\text{g/dscm}$$

where Sample: 0.00046 grams  
Vm(std) 2.664 dscm

$$23) \text{ Volume/Mole} = \left( \frac{359 \frac{ft^3}{lb-mol} @ STP (Ts) (29.92" Hg)}{492^\circ A (Ps)} \right) = 529.308 \text{ Vol./Mole}$$

where Ts: 724.7 °A  
Ps: 29.891 "Hg

$$24) \text{ ppmvd} = \left( \frac{\frac{lb}{hr} \times \frac{Vol.}{Mole}}{(MW \times 0.00006 \times ADCFM)} \right) = 1.37\text{E-}01 \text{ ppmvd}$$

where MW: 30.031 g/mol  
lb/hr: 0.01  
Vol./Mole: 529.308  
ADCFM: 28513.4

$$25) \text{ Mass Emission Rate} = (Cs)(\text{Stack flow})/7000 \text{ gr/lb} = 1.33\text{E-}02 \text{ lb/hr}$$

where Cs: 7.46E-05 gr/dscf  
Stack Flow: 1,245,242.3 dscf/hr

## BISON ENGINEERING GASEOUS SUMMARY SPREADSHEET

|          |                      |        |                |
|----------|----------------------|--------|----------------|
| Company  | Hollingsworth & Vose | Source | CFU 114        |
| Facility | Glass Plant 2        | Date   | April 27, 2018 |
| Location | Corvallis, OR        |        |                |

|          |                                     |         | Test date  | 4/27/2018   | 4/27/2018   | 4/27/2018   |
|----------|-------------------------------------|---------|------------|-------------|-------------|-------------|
|          |                                     |         | Start time | 9:30        | 12:45       | 15:45       |
|          |                                     |         | End time   | 11:40       | 15:00       | 17:50       |
|          |                                     |         | Test run   | 1           | 2           | 3           |
|          |                                     |         |            |             |             |             |
| Method 5 | Flow data from concurrent test runs | dscf/hr |            | 1,197,614.4 | 1,215,493.2 | 1,217,810.3 |
|          |                                     | wscf/hr |            | 1,224,179.1 | 1,243,853.1 | 1,243,678.8 |
|          |                                     | dscfm   |            | 19,960.2    | 20,258.2    | 20,296.8    |
|          |                                     | wscfm   |            | 20,403.0    | 20,730.9    | 20,728.0    |

| E M I S S I O N S |                                                 |                   |                  |          |          |          | Average  |
|-------------------|-------------------------------------------------|-------------------|------------------|----------|----------|----------|----------|
| Meth 3A           | Oxygen Concentration (O <sub>2</sub> )          | O <sub>2</sub>    | %                | 19.90    | 19.92    | 19.96    | 19.93    |
|                   | Carbon Dioxide Concentration (CO <sub>2</sub> ) | CO <sub>2</sub>   | %                | 0.68     | 0.67     | 0.68     | 0.68     |
| Meth 7E           | Nitrogen oxides (NOx) concentration             | NOx               | ppmvd            | 5.63     | 5.60     | 5.49     | 5.57     |
|                   | NOx mass rate                                   |                   | lbs/hr           | 8.05E-01 | 8.12E-01 | 7.98E-01 | 8.05E-01 |
|                   | NOx emission factor                             |                   | lbs/lb of glass  | 1.32E-02 | 1.33E-02 | 1.31E-02 | 1.32E-02 |
|                   | NOx emission factor                             |                   | lbs/Mscf nat gas | 1.52E-01 | 1.53E-01 | 1.50E-01 | 1.52E-01 |
| Meth 10           | Carbon monoxide (CO) concentration              | CO                | ppmvd            | 126.3    | 125.5    | 129.2    | 127.0    |
|                   | CO mass rate                                    |                   | lbs/hr           | 11.00    | 11.09    | 11.44    | 11.17    |
|                   | CO emission factor                              |                   | lbs/lb of glass  | 1.80E-01 | 1.82E-01 | 1.88E-01 | 1.83E-01 |
|                   | CO emission factor                              |                   | lbs/Mscf nat gas | 2.07     | 2.09     | 2.15     | 2.11     |
| Meth 25A          | Volatile Organics (NMVOC) concentration         | VOC               | ppmvw            | 5.50E-01 | 4.80E-01 | 6.10E-01 | 5.47E-01 |
|                   | NMVOC mass rate                                 |                   | lbs/hr           | 7.69E-02 | 6.82E-02 | 8.67E-02 | 7.73E-02 |
|                   | NMVOC emission factor                           |                   | lbs/lb of glass  | 1.26E-03 | 1.12E-03 | 1.42E-03 | 1.27E-03 |
|                   | NMVOC emission factor                           |                   | lbs/Mscf nat gas | 1.45E-02 | 1.29E-02 | 1.63E-02 | 1.46E-02 |
| Method 316        | Formaldehyde mass rate                          | CH <sub>2</sub> O | lb/hr            | 1.33E-02 | 1.02E-02 | 1.22E-02 | 1.19E-02 |
|                   | Formaldehyde emission factor                    |                   | lbs/lb of glass  | 2.18E-04 | 1.68E-04 | 2.01E-04 | 1.95E-04 |
|                   | Formaldehyde emission factor                    |                   | lb/Mscf nat. gas | 2.50E-03 | 1.93E-03 | 2.30E-03 | 2.24E-03 |
| Total VOCs        | Total VOC mass rate                             | Total VOC         | lb/hr            | 9.02E-02 | 7.84E-02 | 9.89E-02 | 8.92E-02 |
|                   | Total VOC emission factor                       |                   | lb/ton glass     | 1.48E-03 | 1.29E-03 | 1.62E-03 | 1.46E-03 |
|                   | Total VOC emission factor                       |                   | lb/Mscf nat. gas | 1.70E-02 | 1.48E-02 | 1.86E-02 | 1.68E-02 |

| P R O D U C T I O N R A T E S |  |         |         |         |         |
|-------------------------------|--|---------|---------|---------|---------|
| Glass Production              |  | lbs/hr  | 61.0    | 61.0    | 61.0    |
|                               |  | scf/hr  | 5,305.7 | 5,305.0 | 5,311.4 |
| Natural Gas Usage             |  | Mscf/hr | 5.3057  | 5.3050  | 5.3114  |
|                               |  |         |         |         | 5.3074  |

**Bison Engineering, Inc.**  
**Method 7E Nitrogen Oxides**  
*Calibration Error, System Bias and System Drift*  
 NOx molecular weight of 46

|           |                      |         |                |                      |                      |
|-----------|----------------------|---------|----------------|----------------------|----------------------|
| Company:  | Hollingsworth & Vose | Source: | CFU 114        | Instrument Make:     | Thermo Environmental |
| Facility: | Glass Plant 2        | Date:   | April 27, 2018 | Instrument Model:    | 42i                  |
| Location: | Corvallis, OR        |         |                | Instrument Serial #: | 729825194            |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.30                   | 0.10                | -2.00                               | pass      | 0.02                | -2.80                                | pass      | -0.80                  | pass      |               |                  |                    |                               |
|       | upscale | 5.11                   | 4.82                | -2.90                               | pass      | 4.86                | -2.50                                | pass      | 0.40                   | pass      | 10            | 5.44             | 5.63               | 5.0                           |
| Run 2 | zero    | 0.30                   | 0.02                | -2.80                               | pass      | 0.02                | -2.80                                | pass      | 0.00                   | pass      |               |                  |                    |                               |
|       | upscale | 5.11                   | 4.86                | -2.50                               | pass      | 4.83                | -2.80                                | pass      | -0.30                  | pass      | 10            | 5.42             | 5.60               | 5.0                           |
| Run 3 | zero    | 0.30                   | 0.02                | -2.80                               | pass      | 0.01                | -2.90                                | pass      | -0.10                  | pass      |               |                  |                    |                               |
|       | upscale | 5.11                   | 4.83                | -2.80                               | pass      | 5.09                | -0.20                                | pass      | 2.60                   | pass      | 10            | 5.44             | 5.49               | 5.0                           |
|       |         |                        |                     | < 5%*                               |           | < 5%*               |                                      | < 3%*     |                        |           |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid  | High  |
|----------------------------|------|------|-------|
| Calibration gas standards  | 0    | 5    | 10    |
| Cal gas analyzer response  | 0.3  | 5.11 | 9.84  |
| Analyzer Cal. Error        | 3.00 | 1.10 | -1.60 |
| Analyzer Error < 2%*       | pass | pass | pass  |

**NO2 CONVERTER TEST**

|                        |        |
|------------------------|--------|
| NO2 Tank Value (ppm)   | 51.910 |
| NO Check Value         | 48.06  |
| NO2 to NO Conversion % | 92.6%  |
| NO2 Conversion > 90% ? | pass   |

\*Or < 0.5 ppm absolute difference



**Bison Engineering, Inc.****Method 25A Total Hydrocarbons or Volatile Organic Compounds (VOC)****Calibration Error and Drift Checks**

VOC molecular weight of 44 as propane

|           |                                 |         |                       |                      |                             |
|-----------|---------------------------------|---------|-----------------------|----------------------|-----------------------------|
| Company:  | <b>Hollingsworth &amp; Vose</b> | Source: | <b>CFU 114</b>        | Instrument Make:     | <b>Thermo Environmental</b> |
| Facility: | <b>Glass Plant 2</b>            | Date:   | <b>April 27, 2018</b> | Instrument Model:    | <b>55i</b>                  |
| Location: | <b>Corvallis, OR</b>            |         |                       | Instrument Serial #: | <b>1018142851</b>           |

|       |         | System Cal. | Post-Run Cal. | Cal. to Post-Run System Drift |           | Analyzer | Avg Gas | Instrument Cal. |
|-------|---------|-------------|---------------|-------------------------------|-----------|----------|---------|-----------------|
|       |         | Response    | Response      | % of span                     | pass/fail | Span     | Conc    | Reference Gas   |
| Run 1 | zero    | 0.19        | 0.24          | 1.25                          | pass      |          |         |                 |
|       | upscale | 1.69        | 1.97          | 7.00                          | pass      | 5        | 0.55    | 2.5             |
| Run 2 | zero    | 0.19        | 0.05          | -3.50                         | pass      |          |         |                 |
|       | upscale | 1.69        | 1.82          | 3.25                          | pass      | 5        | 0.48    | 2.5             |
| Run 3 | zero    | 0.19        | 0.01          | -4.50                         | pass      |          |         |                 |
|       | upscale | 1.69        | 1.48          | -5.25                         | pass      | 5        | 0.61    | 2.5             |
|       |         |             |               | ≤ 3%*                         |           |          |         |                 |

| Instrument Response Time(s): |            |
|------------------------------|------------|
| Time 1                       | 300        |
| Time 2                       | 300        |
| Time 3                       | 300        |
| <b>Average:</b>              | <b>300</b> |

| <b>SYSTEM CAL. ERROR</b>  | <b>Zero</b> | <b>Low</b> | <b>Mid</b> | <b>High</b> |
|---------------------------|-------------|------------|------------|-------------|
| Calibration gas standards | 0           | 1.5        | 2.5        | 4           |
| Cal gas system response   | 0.19        | 1.69       | 2.66       | 4.16        |
| System Cal. Error         | 4.75        | 4.75       | 4.00       | 4.00        |
| System Cal. Error <5%*    | pass        | pass       | pass       | pass        |

\*Or &lt; 0.5 ppm absolute difference as per administrator approval

# Bison Engineering, Inc.

## Method 10 Carbon Monoxide

*Calibration Error, System Bias and System Drift*

CO molecular weight of 28

|                                          |                             |                                              |
|------------------------------------------|-----------------------------|----------------------------------------------|
| Company: <b>Hollingsworth &amp; Vose</b> | Source: <b>CFU 114</b>      | Instrument Make: <b>Thermo Environmental</b> |
| Facility: <b>Glass Plant 2</b>           | Date: <b>April 27, 2018</b> | Instrument Model: <b>48i HL</b>              |
| Location: <b>Corvallis, OR</b>           |                             | Instrument Serial #: <b>734025183</b>        |

|       |         | <i>Initial Values</i>        |                           |                                           |           | <i>Final Values</i>       |                                            |           |                           |           |                  | Raw Avg<br>Gas<br>Conc | Corrected<br>concentration<br>Conc | Instrument<br>Cal.<br>Reference<br>Gas |
|-------|---------|------------------------------|---------------------------|-------------------------------------------|-----------|---------------------------|--------------------------------------------|-----------|---------------------------|-----------|------------------|------------------------|------------------------------------|----------------------------------------|
|       |         | Analyzer<br>Cal.<br>Response | System<br>Cal<br>Response | Pre test<br>System Cal. Bias<br>% of span | pass/fail | System<br>Cal<br>Response | Post test<br>System Cal. Bias<br>% of span | pass/fail | System Drift<br>% of span | pass/fail | Analyzer<br>Span |                        |                                    |                                        |
| Run 1 | zero    | 0.74                         | -0.68                     | -0.71                                     | pass      | -3.21                     | -1.98                                      | pass      | -1.27                     | pass      |                  |                        |                                    |                                        |
|       | upscale | 100.66                       | 101.88                    | 0.61                                      | pass      | 101.12                    | 0.23                                       | pass      | -0.38                     | pass      | 200              | 128.68                 | 126.27                             | 100                                    |
| Run 2 | zero    | 0.74                         | -3.21                     | -1.98                                     | pass      | -1.85                     | -1.30                                      | pass      | 0.68                      | pass      |                  |                        |                                    |                                        |
|       | upscale | 100.66                       | 101.12                    | 0.23                                      | pass      | 100.43                    | -0.11                                      | pass      | -0.34                     | pass      | 200              | 127.07                 | 125.45                             | 100                                    |
| Run 3 | zero    | 0.74                         | -1.85                     | -1.30                                     | pass      | -0.12                     | -0.43                                      | pass      | 0.87                      | pass      |                  |                        |                                    |                                        |
|       | upscale | 100.66                       | 100.43                    | -0.11                                     | pass      | 98.14                     | -1.26                                      | pass      | -1.15                     | pass      | 200              | 128.58                 | 129.22                             | 100                                    |
|       |         |                              |                           | < 5%                                      |           | < 5%                      |                                            | < 3%      |                           |           |                  |                        |                                    |                                        |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid    | High   |
|----------------------------|------|--------|--------|
| Calibration gas standards  | 0    | 100    | 200    |
| Cal gas analyzer response  | 0.74 | 100.66 | 201.14 |
| Analyzer Cal. Error        | 0.37 | 0.33   | 0.57   |
| Analyzer Cal. Error < 2%   | pass | pass   | pass   |

**Bison Engineering, Inc.**  
**Method 3A Oxygen**  
*Calibration Error, System Bias and System Drift*

|           |                      |        |                |                      |              |
|-----------|----------------------|--------|----------------|----------------------|--------------|
| Company:  | Hollingsworth & Vose | Source | CFU 114        | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2        | Date   | April 27, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR        |        |                | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>        |                           |                                           |           | <i>Final Values</i>       |                                            |           |                           |           |                  | Raw Avg<br>Gas<br>Conc | Corrected<br>Gas<br>Conc | Instrument<br>Cal.<br>Reference<br>Gas |
|-------|---------|------------------------------|---------------------------|-------------------------------------------|-----------|---------------------------|--------------------------------------------|-----------|---------------------------|-----------|------------------|------------------------|--------------------------|----------------------------------------|
|       |         | Analyzer<br>Cal.<br>Response | System<br>Cal<br>Response | Pre test<br>System Cal. Bias<br>% of span | pass/fail | System<br>Cal<br>Response | Post test<br>System Cal. Bias<br>% of span | pass/fail | System Drift<br>% of span | pass/fail | Analyzer<br>Span |                        |                          |                                        |
| Run 1 | zero    | 0.02                         | 0.05                      | 0.15                                      | pass      | -0.01                     | -0.15                                      | pass      | -0.30                     | pass      |                  |                        |                          |                                        |
|       | upscale | 10.08                        | 9.93                      | -0.75                                     | pass      | 9.93                      | -0.75                                      | pass      | 0.00                      | pass      | 20               | 19.74                  | 19.90                    | 10                                     |
| Run 2 | zero    | 0.02                         | -0.01                     | -0.15                                     | pass      | 0.07                      | 0.25                                       | pass      | 0.40                      | pass      |                  |                        |                          |                                        |
|       | upscale | 10.08                        | 9.93                      | -0.75                                     | pass      | 9.94                      | -0.70                                      | pass      | 0.05                      | pass      | 20               | 19.76                  | 19.92                    | 10                                     |
| Run 3 | zero    | 0.02                         | 0.07                      | 0.25                                      | pass      | 0.05                      | 0.15                                       | pass      | -0.10                     | pass      |                  |                        |                          |                                        |
|       | upscale | 10.08                        | 9.94                      | -0.70                                     | pass      | 9.93                      | -0.75                                      | pass      | -0.05                     | pass      | 20               | 19.77                  | 19.96                    | 10                                     |
|       |         |                              |                           | < 5%*                                     |           |                           |                                            | < 5%*     |                           | < 3%*     |                  |                        |                          |                                        |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High  |
|----------------------------|------|-------|-------|
| Calibration gas standards  | 0    | 10    | 20    |
| Cal gas analyzer response  | 0.02 | 10.08 | 20.05 |
| Analyzer Cal. Error        | 0.10 | 0.40  | 0.25  |
| Analyzer Cal. Error <2%*   | pass | pass  | pass  |

\*Or <0.5% O<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 3A Carbon Dioxide**  
*Calibration Error, System Bias and System Drift*

|                                          |                            |                                          |
|------------------------------------------|----------------------------|------------------------------------------|
| Company: <b>Hollingsworth &amp; Vose</b> | Source <b>CFU 114</b>      | Instrument Make: <b>Servomex</b>         |
| Facility: <b>Glass Plant 2</b>           | Date <b>April 27, 2018</b> | Instrument Model: <b>1440</b>            |
| Location: <b>Corvallis, OR</b>           |                            | Instrument Serial #: <b>01440D1-5041</b> |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.04                   | 0.05                | 0.25                                | pass      | 0.05                | 0.25                                 | pass      | 0.00                   | pass      |               |                  |                    |                               |
|       | upscale | 2.01                   | 1.95                | -1.50                               | pass      | 1.97                | -1.00                                | pass      | 0.50                   | pass      | 4.0           | 0.70             | 0.68               | 2                             |
| Run 2 | zero    | 0.04                   | 0.05                | 0.25                                | pass      | 0.09                | 1.25                                 | pass      | 1.00                   | pass      |               |                  |                    |                               |
|       | upscale | 2.01                   | 1.97                | -1.00                               | pass      | 1.97                | -1.00                                | pass      | 0.00                   | pass      | 4.0           | 0.71             | 0.67               | 2                             |
| Run 3 | zero    | 0.04                   | 0.09                | 1.25                                | pass      | 0.08                | 1.00                                 | pass      | -0.25                  | pass      |               |                  |                    |                               |
|       | upscale | 2.01                   | 1.97                | -1.00                               | pass      | 1.95                | -1.50                                | pass      | -0.50                  | pass      | 4.0           | 0.72             | 0.68               | 2                             |
|       |         |                        |                     | < 5%*                               |           |                     |                                      | < 5%*     |                        | < 3%*     |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid  | High |
|----------------------------|------|------|------|
| Calibration gas standards  | 0    | 2    | 4.0  |
| Cal gas analyzer response  | 0.04 | 2.01 | 4.09 |
| Analyzer Cal. Error        | 1.00 | 0.25 | 2.25 |
| Analyzer Cal. Error < 2%*  | pass | pass | pass |

\*Or <0.5% CO<sub>2</sub> absolute difference

## Stratification Check

|                                      |                    |                         |                       |                  |        |
|--------------------------------------|--------------------|-------------------------|-----------------------|------------------|--------|
| <b>Facility</b> Hollingsworth & Vose |                    |                         |                       |                  |        |
| <b>Location</b> Glass Plant 2        |                    |                         | <b>Date</b> 4/27/2018 |                  |        |
| <b>Source</b> CFU 114                |                    | <b>Stack Dimensions</b> |                       | 36               | inches |
| <b>3 POINT METHOD</b>                |                    |                         |                       |                  |        |
| <u>% of diameter</u>                 | <u>Pt location</u> | <u>O2 %</u>             | <u>Diff (+/- 5%)</u>  | <u>Pass/Fail</u> |        |
| 16.7%                                | 1                  | 6.01                    | 19.71                 | -0.15%           | PASS   |
| 50.0%                                | 2                  | 18.00                   | 19.75                 | 0.05%            | PASS   |
| 83.3%                                | 3                  | 29.99                   | 19.76                 | 0.10%            | PASS   |
|                                      | AVERAGE %:         |                         | 19.74                 |                  |        |

**Bison Engineering, Inc.**  
**Method 205 Dilution System Check**

|           |                      |         |                |                      |            |
|-----------|----------------------|---------|----------------|----------------------|------------|
| Company:  | Hollingsworth & Vose | Source: | CFU 114        | Instrument Make:     | EnviroNics |
| Facility: | Glass Plant 2        | Date:   | April 27, 2018 | Instrument Model:    | 4040       |
| Location: | Corvallis, OR        |         |                | Instrument Serial #: | 3880       |

|                                                |                 | First | Second | Third | Average |
|------------------------------------------------|-----------------|-------|--------|-------|---------|
| High Level                                     | 10 % oxygen     | 9.99  | 10.02  | 10.02 | 10.01   |
| Percent diff from avg recorded value           | dilution system | -0.2% | 0.1%   | 0.1%  |         |
| Pass or Fail +/- 2%                            |                 | PASS  | PASS   | PASS  |         |
| Percent diff from target of 10% O <sub>2</sub> |                 | -0.1% | 0.2%   | 0.2%  | 0.1%    |
| Pass or Fail +/- 2% from target value          |                 |       |        |       | PASS    |

|                                               |                 |       |      |      |      |
|-----------------------------------------------|-----------------|-------|------|------|------|
| Mid Level                                     | 5 % oxygen      | 5.04  | 5.06 | 5.06 | 5.05 |
| Percent diff from avg recorded value          | dilution system | -0.3% | 0.1% | 0.1% |      |
| Pass or Fail +/- 2%                           |                 | PASS  | PASS | PASS |      |
| Percent diff from target of 5% O <sub>2</sub> |                 | 0.8%  | 1.2% | 1.2% | 1.1% |
| Pass or Fail +/- 2% from target value         |                 |       |      |      | PASS |

|                             |             |      |      |      |      |            |       |
|-----------------------------|-------------|------|------|------|------|------------|-------|
| Independent Mid Level Check | 5% oxygen   | 9.95 | 9.95 | 9.96 | 9.95 | Tank value | 9.893 |
|                             | independent |      |      |      |      | 0.61%      |       |
|                             | tank check  |      |      |      |      | PASS       |       |

**Summary - Method 205 - Verification of Gas Dilution Systems for Field Instrument Calibrations**

A gas dilution system can provide known values of calibration gases through controlled dilution of high-level calibration gases with an appropriate dilution gas. The calibration gases with an appropriate dilution gas. The instrumental test methods in 40 CFR part 60 - e.g., Methods 3A, 6C, 7E, 10, 15, 16, 20, 25A and 25B require on-site, multi-point point calibration using gases of known concentrations. A gas dilution system that produces known low level calibration gases from high-level calibration gases, with a degree of confidence similar to that for Protocol 1 gases, may be used for compliance tests in lieu of multiple calibration gases when the gas dilution system is demonstrated to meet the requirements of this method.

The gas dilution system shall be evaluated on one analyzer once during each field test. A precalibrated analyzer is chosen, at the discretion of the source owner or operator, to demonstrate that the gas dilution system produces predictable gas concentrations spanning a range of concentrations. After meeting the requirements of this method, the remaining analyzers may be calibrated with the dilution system in accordance to the requirements of the applicable method for the duration of the field test.

The gas dilution system shall produce calibration gases whose measured values are within  $\pm 2$  percent of the predicted values.

**Instructions from Method 205**

3.2.2 Calculate the predicted concentration for each of the dilutions based on the flow rates through the gas dilution system (or the dilution ratios) and the certified concentration of the high - level supply gas.

3.2.3 Introduce each of the dilutions from Section 3.2.1 into the analyzer or monitor one at a time and determine the instrument response for each of the dilutions.

3.2.4 Repeat the procedure in Section 3.2.3 two times, i.e., until three injections are made at dilution level. Calculate the average instrument response for each triplicate injection at each dilution level. No single injection shall differ by more than  $\pm 2$  percent from the average instrument response for that dilution.

3.2.5 For each level of dilution, calculate the difference between the average concentration output recorded by the analyzer and the predicted concentration calculated in Section 3.2.2. The average concentration output from the analyzer shall be within  $\pm 2$  percent of the predicted value.

3.2.6 Introduce the mid - level supply gas directly into the analyzer, bypassing the gas dilution system. Repeat the procedure twice more, for a total of three mid-level supply gas injections.

Calculate the average analyzer output concentration for the mid-level supply gas. The difference between the certified concentration of the mid-level supply gas and the average instrument response shall be within  $\pm 2$  percent.

3.3 If the gas dilution system meets the criteria listed in Section 3.2, the gas dilution system may be used throughout that field test.

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:26:35 | 0.70      | 1.65     | -0.36     | 20.80  | 0.11    |           |          |           |        |         |
| 4/27/2018 | 6:26:45 | 0.72      | 1.02     | -0.47     | 20.80  | 0.11    |           |          |           |        |         |
| 4/27/2018 | 6:26:55 | 0.71      | 0.23     | -0.42     | 18.97  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 6:27:05 | 0.71      | -0.23    | -0.33     | 18.50  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 6:27:15 | 0.70      | 0.14     | -0.44     | 6.83   | 4.98    |           |          |           |        |         |
| 4/27/2018 | 6:27:25 | 0.70      | 1.97     | -0.50     | 0.63   | 0.29    |           |          |           |        |         |
| 4/27/2018 | 6:27:35 | 0.74      | 4.09     | -0.33     | 0.06   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 6:27:45 | 1.01      | 3.93     | -0.36     | 0.03   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 6:27:55 | 1.30      | 2.55     | -0.34     | 0.01   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 6:28:05 | 1.25      | 1.11     | -0.42     | 0.01   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 6:28:15 | 0.71      | 0.22     | -0.42     | 0.00   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 6:28:25 | 0.72      | 0.20     | -0.39     | -0.01  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 6:28:35 | 0.73      | 0.13     | -0.47     | -0.01  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 6:28:45 | 0.73      | 0.35     | -0.34     | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:28:55 | 0.72      | 1.47     | -0.42     | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:29:05 | 0.73      | 2.48     | -0.45     | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:29:15 | 0.72      | 2.32     | -0.47     | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:29:25 | 1.22      | 1.69     | -0.45     | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:29:35 | 1.45      | 0.85     | -0.40     | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:29:45 | 1.01      | 0.09     | -0.31     | -0.03  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:29:55 | 0.00      | -0.12    | -0.34     | -0.04  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:30:05 | 0.00      | -0.24    | -0.45     | -0.04  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:30:15 | 0.03      | 0.76     | -0.36     | -0.03  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:30:25 | 0.00      | 1.95     | -0.36     | 0.02   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:30:35 | 0.01      | 2.44     | -0.42     | 0.02   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:30:45 | 0.00      | 1.97     | -0.36     | 0.02   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:30:55 | 0.01      | 1.43     | -0.47     | 0.02   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:31:05 | 0.01      | 0.85     | -0.45     | 0.01   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:31:15 | 0.00      | 0.22     | -0.40     | 0.02   | 0.04    |           |          |           | 0.02   | 0.04    |
| 4/27/2018 | 6:31:25 | 0.02      | -0.07    | -0.33     | 0.03   | 0.04    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:31:35 | 0.01      | 0.12     | -0.42     | 0.16   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:31:45 | -0.01     | 1.28     | -0.25     | 0.28   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:31:55 | 0.02      | 2.33     | -0.51     | 0.34   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:32:05 | -0.01     | 2.51     | -0.34     | 0.36   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:32:15 | 0.00      | 1.77     | -0.33     | 1.86   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:32:25 | -0.01     | 0.91     | -0.36     | 8.19   | 7.22    |           |          |           |        |         |
| 4/27/2018 | 6:32:35 | 0.15      | 0.56     | -0.45     | 3.50   | 3.08    |           |          |           |        |         |
| 4/27/2018 | 6:32:45 | 1.65      | 0.47     | -0.34     | 3.58   | 4.12    |           |          |           |        |         |
| 4/27/2018 | 6:32:55 | 2.93      | 0.08     | -0.33     | 3.64   | 4.15    |           |          |           |        |         |
| 4/27/2018 | 6:33:05 | 1.79      | 0.14     | -0.31     | 3.66   | 4.16    |           |          |           |        |         |
| 4/27/2018 | 6:33:15 | 0.59      | 1.27     | -0.31     | 3.66   | 4.16    |           |          |           |        |         |
| 4/27/2018 | 6:33:25 | 0.31      | 1.94     | -0.39     | 3.67   | 4.17    |           |          |           |        |         |
| 4/27/2018 | 6:33:35 | 0.28      | 1.31     | -0.54     | 3.67   | 4.18    |           |          |           |        |         |
| 4/27/2018 | 6:33:45 | 0.29      | 0.33     | -0.45     | 3.67   | 4.18    |           |          |           |        |         |
| 4/27/2018 | 6:33:55 | 0.28      | -0.32    | -0.37     | 3.68   | 4.18    |           |          |           |        |         |
| 4/27/2018 | 6:34:05 | 0.29      | -0.53    | -0.47     | 3.69   | 4.13    |           |          |           |        |         |
| 4/27/2018 | 6:34:15 | 0.31      | -0.88    | -0.40     | 3.81   | 4.09    |           |          |           |        |         |
| 4/27/2018 | 6:34:25 | 0.31      | -0.70    | -0.34     | 3.96   | 4.09    |           |          |           |        |         |
| 4/27/2018 | 6:34:35 | 0.30      | 0.46     | -0.39     | 3.97   | 4.08    |           |          |           |        | 4.09    |
| 4/27/2018 | 6:34:45 | 0.31      | 1.57     | -0.30     | 3.97   | 4.09    |           |          |           |        |         |
| 4/27/2018 | 6:34:55 | 0.30      | 1.55     | -0.30     | 9.14   | 9.67    |           |          |           |        |         |
| 4/27/2018 | 6:35:05 | 0.30      | 0.83     | -0.37     | 18.00  | 18.79   |           |          |           |        |         |
| 4/27/2018 | 6:35:15 | 0.31      | 0.29     | -0.44     | 19.91  | 19.54   |           |          |           |        |         |
| 4/27/2018 | 6:35:25 | 0.30      | 0.20     | -0.40     | 20.04  | 19.57   |           |          |           |        |         |
| 4/27/2018 | 6:35:35 | 0.31      | -0.40    | -0.36     | 20.05  | 19.59   |           |          |           |        |         |
| 4/27/2018 | 6:35:45 | 0.31      | -0.92    | -0.36     | 20.05  | 19.60   |           |          |           |        |         |
| 4/27/2018 | 6:35:55 | 0.00      | -0.59    | -0.44     | 20.06  | 19.60   |           |          |           | 20.05  |         |
| 4/27/2018 | 6:36:05 | 0.00      | 0.23     | -0.50     | 19.73  | 19.57   |           |          |           |        |         |
| 4/27/2018 | 6:36:15 | -0.01     | 0.56     | -0.42     | 16.73  | 14.81   |           |          |           |        |         |
| 4/27/2018 | 6:36:25 | -0.02     | 0.06     | -0.45     | 10.08  | 9.75    |           |          |           |        |         |



**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:36:35 | 0.00      | -0.29    | -0.54     | 10.09  | 9.89    |           |          |           |        |         |
| 4/27/2018 | 6:36:45 | 0.00      | -0.51    | -0.40     | 10.08  | 9.86    |           |          |           |        |         |
| 4/27/2018 | 6:36:55 | 0.01      | -1.12    | -0.45     | 10.08  | 9.85    |           |          |           | 10.08  |         |
| 4/27/2018 | 6:37:05 | 0.01      | -1.52    | -0.42     | 10.07  | 9.83    |           |          |           |        |         |
| 4/27/2018 | 6:37:15 | -0.01     | -0.72    | -0.42     | 9.97   | 9.48    |           |          |           |        |         |
| 4/27/2018 | 6:37:25 | 0.01      | 1.03     | -0.33     | 3.46   | 2.46    |           |          |           |        |         |
| 4/27/2018 | 6:37:35 | 0.00      | 2.14     | -0.36     | 2.08   | 1.92    |           |          |           |        |         |
| 4/27/2018 | 6:37:45 | 1.48      | 2.04     | -0.36     | 2.01   | 1.89    |           |          |           |        |         |
| 4/27/2018 | 6:37:55 | 3.06      | 1.57     | -0.39     | 2.00   | 1.87    |           |          |           |        |         |
| 4/27/2018 | 6:38:05 | 1.80      | 0.35     | -0.53     | 2.00   | 1.87    |           |          |           |        |         |
| 4/27/2018 | 6:38:15 | 0.60      | -0.30    | -0.48     | 2.00   | 1.87    |           |          |           |        |         |
| 4/27/2018 | 6:38:25 | 0.31      | -0.58    | -0.51     | 2.00   | 1.87    |           |          |           |        |         |
| 4/27/2018 | 6:38:35 | 0.31      | -0.13    | -0.42     | 2.06   | 1.86    |           |          |           |        |         |
| 4/27/2018 | 6:38:45 | 0.31      | 1.28     | -0.31     | 2.07   | 1.87    |           |          |           |        |         |
| 4/27/2018 | 6:38:55 | 0.30      | 1.72     | -0.44     | 2.07   | 1.88    |           |          |           |        |         |
| 4/27/2018 | 6:39:05 | 0.30      | 1.63     | -0.39     | 2.07   | 1.88    |           |          |           |        |         |
| 4/27/2018 | 6:39:15 | 0.31      | 0.92     | -0.36     | 2.07   | 1.93    |           |          |           |        |         |
| 4/27/2018 | 6:39:25 | 0.29      | 0.10     | -0.45     | 2.07   | 2.01    |           |          |           |        |         |
| 4/27/2018 | 6:39:35 | 0.30      | -0.63    | -0.45     | 2.07   | 2.01    |           |          |           |        |         |
| 4/27/2018 | 6:39:45 | 0.31      | -1.01    | -0.44     | 2.07   | 2.01    |           |          |           |        |         |
| 4/27/2018 | 6:39:55 | 0.30      | -0.29    | -0.40     | 2.07   | 2.01    |           |          |           |        |         |
| 4/27/2018 | 6:40:05 | 0.31      | 1.01     | -0.28     | 2.07   | 2.00    |           |          |           |        |         |
| 4/27/2018 | 6:40:15 | 0.30      | 1.50     | -0.44     | 1.85   | 2.01    | 0.30      | 0.74     |           |        | 2.01    |
| 4/27/2018 | 6:40:25 | 0.30      | 1.44     | -0.37     | 2.35   | 2.03    |           |          |           |        |         |
| 4/27/2018 | 6:40:35 | 0.33      | 2.53     | -0.37     | 1.23   | 0.93    |           |          |           |        |         |
| 4/27/2018 | 6:40:45 | 0.30      | 37.20    | -0.44     | 0.10   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 6:40:55 | -0.32     | 117.24   | -0.45     | 0.01   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 6:41:05 | 175.09    | 186.63   | -0.47     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:41:15 | 302.66    | 205.08   | -0.44     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:41:25 | 221.28    | 188.70   | -0.28     | -0.01  | 0.05    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:41:35 | 154.29    | 171.07   | -0.40     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:41:45 | 156.74    | 164.19   | -0.40     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:41:55 | 161.19    | 162.18   | -0.50     | 0.00   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:42:05 | 164.73    | 161.12   | -0.40     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:42:15 | 167.14    | 160.54   | -0.42     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:42:25 | 177.94    | 160.56   | -0.40     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:42:35 | 188.20    | 160.83   | -0.39     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:42:45 | 188.48    | 162.39   | -0.31     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:42:55 | 190.89    | 201.31   | -0.37     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:43:05 | 190.88    | 201.57   | -0.40     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:43:15 | 191.10    | 200.53   | -0.42     | -0.01  | 0.03    |           | 201.14   |           |        |         |
| 4/27/2018 | 6:43:25 | 190.58    | 199.02   | -0.39     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:43:35 | 190.01    | 197.99   | -0.39     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:43:45 | 189.70    | 195.86   | -0.40     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:43:55 | 189.40    | 179.52   | -0.40     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:44:05 | 125.57    | 150.07   | -0.42     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:44:15 | 70.77     | 124.14   | -0.39     | -0.02  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:44:25 | 86.24     | 109.93   | -0.50     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:44:35 | 92.38     | 105.06   | -0.37     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:44:45 | 91.79     | 102.84   | -0.39     | -0.02  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:44:55 | 91.51     | 101.12   | -0.34     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:45:05 | 91.50     | 100.29   | -0.47     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:45:15 | 91.50     | 100.24   | -0.50     | -0.02  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:45:25 | 91.51     | 100.63   | -0.36     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:45:35 | 91.49     | 101.99   | -0.44     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:45:45 | 91.48     | 103.41   | -0.40     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:45:55 | 91.50     | 103.55   | -0.45     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:46:05 | 91.48     | 102.30   | -0.40     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:46:15 | 91.48     | 101.10   | -0.34     | -0.02  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:46:25 | 91.49     | 100.66   | -0.31     | -0.01  | 0.03    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:46:35 | 91.77     | 99.98    | -0.33     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:46:45 | 91.79     | 100.13   | -0.44     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:46:55 | 91.79     | 101.86   | -0.31     | -0.01  | 0.02    |           | 100.66   |           |        |         |
| 4/27/2018 | 6:47:05 | 91.79     | 103.44   | -0.37     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:47:15 | 91.76     | 103.33   | -0.44     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:47:25 | 91.77     | 102.10   | -0.37     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:47:35 | 92.07     | 101.20   | -0.36     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:47:45 | 92.09     | 100.67   | -0.33     | 0.01   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:47:55 | 92.06     | 94.24    | -0.33     | 0.03   | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:48:05 | 92.07     | 75.57    | -0.42     | 0.07   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:48:15 | 92.08     | 51.25    | -0.42     | 0.09   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:48:25 | 92.08     | 31.44    | -0.45     | 0.10   | 0.03    |           |          |           |        |         |
| 4/27/2018 | 6:48:35 | 92.34     | 19.56    | -0.39     | 0.10   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:48:45 | 92.07     | 13.37    | -0.36     | 0.10   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 6:48:55 | 92.09     | 8.98     | -0.33     | 0.18   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 6:49:05 | 92.06     | 6.30     | -0.37     | 0.43   | 0.10    |           |          |           |        |         |
| 4/27/2018 | 6:49:15 | 92.08     | 4.70     | -0.37     | 0.83   | 0.12    |           |          |           |        |         |
| 4/27/2018 | 6:49:25 | 91.80     | 4.24     | -0.37     | 4.45   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 6:49:35 | 91.50     | 6.81     | -0.44     | 0.11   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:49:45 | 59.51     | 9.58     | -0.42     | 0.76   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 6:49:55 | 35.61     | 63.00    | -0.40     | 0.22   | 0.13    |           |          |           |        |         |
| 4/27/2018 | 6:50:05 | 43.07     | 276.66   | -0.28     | 0.13   | 0.14    |           |          |           |        |         |
| 4/27/2018 | 6:50:15 | -54.05    | 550.55   | -0.42     | 0.17   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 6:50:25 | 408.42    | 626.92   | -0.37     | 0.15   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 6:50:35 | 999.28    | 467.01   | -0.36     | 0.23   | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:50:45 | 591.84    | 250.67   | -0.45     | 0.01   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:50:55 | 30.19     | 121.08   | -0.28     | 0.00   | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:51:05 | 45.99     | 77.72    | -0.47     | -0.01  | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:51:15 | 63.94     | 64.78    | -0.33     | 0.00   | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:51:25 | 38.86     | 48.87    | -0.28     | 0.00   | 0.01    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:51:35 | 20.69     | 30.80    | -0.36     | -0.01  | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:51:45 | 22.12     | 18.42    | -0.39     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:51:55 | 17.86     | 12.81    | -0.34     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:52:05 | 17.25     | 11.24    | -0.47     | 0.00   | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:52:15 | 16.10     | 10.84    | -0.48     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:52:25 | 15.77     | 12.04    | -0.34     | -0.01  | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:52:35 | 15.19     | 13.39    | -0.37     | 0.00   | 0.02    |           |          |           |        |         |
| 4/27/2018 | 6:52:45 | 14.90     | 13.15    | -0.39     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:52:55 | 14.58     | 12.63    | -0.31     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:53:05 | 14.29     | 11.53    | -0.40     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:53:15 | 14.00     | 10.75    | -0.34     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:53:25 | 13.70     | 10.44    | -0.36     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:53:35 | 13.38     | 10.34    | -0.39     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:53:45 | 13.39     | 11.49    | -0.36     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:53:55 | 13.09     | 13.07    | -0.39     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:54:05 | 13.10     | 13.43    | -0.34     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:54:15 | 12.80     | 12.82    | -0.36     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:54:25 | 12.79     | 11.66    | -0.30     | 0.00   | 0.01    |           |          |           |        |         |
| 4/27/2018 | 6:54:35 | 12.52     | 11.09    | -0.34     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:54:45 | 12.50     | 10.57    | -0.28     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:54:55 | 12.50     | 10.03    | -0.27     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:55:05 | 12.20     | 11.02    | -0.33     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:55:15 | 12.19     | 12.57    | -0.33     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:55:25 | 12.20     | 13.39    | -0.27     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:55:35 | 11.90     | 13.04    | -0.25     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:55:45 | 11.71     | 11.81    | -0.34     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:55:55 | 10.79     | 11.20    | -0.36     | 0.01   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:56:05 | 10.42     | 10.51    | -0.33     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:56:15 | 10.41     | 10.01    | -0.31     | 0.01   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:56:25 | 10.14     | 10.89    | -0.39     | 0.00   | 0.00    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 6:56:35 | 10.11     | 12.43    | -0.40     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:56:45 | 10.12     | 13.45    | -0.40     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:56:55 | 10.12     | 13.16    | -0.31     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:57:05 | 10.14     | 12.00    | -0.36     | 0.01   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:57:15 | 9.84      | 11.09    | -0.36     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:57:25 | 9.85      | 10.48    | -0.30     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:57:35 | 9.84      | 9.39     | -0.33     | 0.00   | -0.01   | 9.84      |          |           |        |         |
| 4/27/2018 | 6:57:45 | 8.70      | 8.83     | -0.39     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:57:55 | 7.80      | 8.61     | -0.44     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:58:05 | 6.62      | 8.75     | -0.40     | 0.01   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:58:15 | 5.12      | 8.31     | -0.28     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:58:25 | 5.12      | 6.80     | -0.39     | 0.01   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:58:35 | 5.11      | 5.95     | -0.44     | 0.00   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:58:45 | 5.12      | 5.33     | -0.34     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:58:55 | 5.10      | 4.71     | -0.34     | 0.00   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:59:05 | 5.12      | 5.29     | -0.34     | 0.01   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:59:15 | 5.12      | 6.41     | -0.34     | 2.81   | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:59:25 | 5.10      | 6.66     | -0.25     | 8.94   | -0.01   |           |          |           |        |         |
| 4/27/2018 | 6:59:35 | 5.12      | 5.70     | -0.37     | 19.12  | 0.00    | 5.11      |          |           |        |         |
| 4/27/2018 | 6:59:45 | 2.49      | 3.41     | -0.40     | 22.46  | 0.00    |           |          |           |        |         |
| 4/27/2018 | 6:59:55 | 0.29      | 1.39     | -0.30     | 22.52  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:00:05 | 22.75     | 0.41     | -0.40     | 22.52  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:00:15 | 44.83     | -0.18    | -0.31     | 22.52  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:00:25 | 46.31     | -0.24    | -0.39     | 22.52  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:00:35 | 47.79     | 1.09     | -0.37     | 22.53  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:00:45 | 47.76     | 2.48     | -0.34     | 22.53  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:00:55 | 47.76     | 2.57     | -0.34     | 22.53  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:01:05 | 47.79     | 2.00     | -0.37     | 22.53  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:01:15 | 48.06     | 1.37     | -0.34     | 22.53  | -0.01   |           |          |           |        |         |
| 4/27/2018 | 7:01:25 | 48.06     | 0.37     | -0.21     | 22.53  | -0.01   |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM]           | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|---------------------|----------|-----------|--------|---------|
| 4/27/2018 | 7:01:35 | 48.06     | -0.42    | -0.42     | 22.53  | -0.01   |                     |          |           |        |         |
| 4/27/2018 | 7:01:45 | 48.06     | -0.62    | -0.47     | 22.54  | -0.01   |                     |          |           |        |         |
| 4/27/2018 | 7:01:55 | 48.07     | 0.33     | -0.39     | 22.53  | -0.01   | Nox converter check |          |           |        |         |
| 4/27/2018 | 7:02:05 | 48.06     | 2.21     | -0.36     | 20.35  | -0.01   | 48.06               |          |           |        |         |
| 4/27/2018 | 7:02:15 | 48.07     | 4.85     | -0.40     | 22.02  | 0.29    |                     |          |           |        |         |
| 4/27/2018 | 7:02:25 | 47.16     | 21.34    | -0.33     | 21.25  | 0.68    |                     |          |           |        |         |
| 4/27/2018 | 7:02:35 | 46.29     | 57.34    | -0.36     | 21.25  | 0.69    |                     |          |           |        |         |
| 4/27/2018 | 7:02:45 | 26.65     | 97.62    | -0.42     | 17.39  | 1.38    |                     |          |           |        |         |

## System Calibrations

|           |         |      |        |       |       |      |
|-----------|---------|------|--------|-------|-------|------|
| 4/27/2018 | 7:02:55 | 7.52 | 119.70 | -0.37 | 12.28 | 0.63 |
| 4/27/2018 | 7:03:05 | 5.68 | 118.41 | -0.42 | 18.81 | 0.65 |
| 4/27/2018 | 7:03:15 | 4.25 | 113.08 | -0.40 | 21.05 | 0.70 |
| 4/27/2018 | 7:03:25 | 4.49 | 118.93 | -0.39 | 21.28 | 0.70 |
| 4/27/2018 | 7:03:35 | 4.49 | 132.16 | -0.42 | 21.30 | 0.69 |
| 4/27/2018 | 7:03:45 | 4.50 | 142.38 | -0.39 | 21.29 | 0.70 |
| 4/27/2018 | 7:03:55 | 4.25 | 146.81 | -0.39 | 21.29 | 0.70 |
| 4/27/2018 | 7:04:05 | 4.26 | 148.06 | -0.40 | 21.30 | 0.71 |
| 4/27/2018 | 7:04:15 | 4.25 | 148.09 | -0.31 | 19.88 | 0.66 |
| 4/27/2018 | 7:04:25 | 4.25 | 145.01 | -0.44 | 5.47  | 0.21 |
| 4/27/2018 | 7:04:35 | 4.25 | 126.88 | -0.39 | 0.71  | 0.06 |
| 4/27/2018 | 7:04:45 | 3.35 | 92.94  | -0.36 | 0.23  | 0.04 |
| 4/27/2018 | 7:04:55 | 2.77 | 56.83  | -0.37 | 0.20  | 0.04 |
| 4/27/2018 | 7:05:05 | 3.35 | 30.28  | -0.40 | 0.23  | 0.04 |
| 4/27/2018 | 7:05:15 | 4.24 | 16.57  | -0.37 | 0.24  | 0.04 |
| 4/27/2018 | 7:05:25 | 4.51 | 10.80  | -0.30 | 0.23  | 0.04 |
| 4/27/2018 | 7:05:35 | 4.50 | 8.45   | -0.33 | 0.11  | 0.04 |
| 4/27/2018 | 7:05:45 | 4.50 | 7.29   | -0.30 | 0.09  | 0.04 |
| 4/27/2018 | 7:05:55 | 4.51 | 7.49   | -0.33 | 0.07  | 0.05 |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:06:05 | 4.82      | 8.48     | -0.40     | 0.06   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:06:15 | 4.82      | 9.26     | -0.42     | 0.05   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:06:25 | 4.80      | 8.82     | -0.42     | 0.05   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:06:35 | 4.82      | 7.68     | -0.37     | 0.05   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:06:45 | 4.80      | 6.85     | -0.39     | 0.05   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:06:55 | 4.82      | 6.09     | -0.45     | 0.05   | 0.05    |           |          |           | 0.05   | 0.05    |
| 4/27/2018 | 7:07:05 | 4.82      | 5.88     | -0.34     | 0.30   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:07:15 | 4.82      | 7.71     | -0.42     | 13.05  | 0.48    |           |          |           |        |         |
| 4/27/2018 | 7:07:25 | 4.84      | 22.43    | -0.40     | 20.17  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 7:07:35 | 4.83      | 55.55    | -0.28     | 21.05  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 7:07:45 | 4.51      | 92.11    | -0.39     | 21.14  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:07:55 | 4.27      | 119.49   | -0.37     | 21.15  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:08:05 | 4.27      | 133.65   | -0.36     | 21.16  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:08:15 | 4.27      | 139.53   | -0.28     | 21.19  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:08:25 | 4.27      | 141.49   | -0.40     | 10.54  | 0.39    |           |          |           |        |         |
| 4/27/2018 | 7:08:35 | 4.26      | 134.25   | -0.28     | 1.27   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 7:08:45 | 8.38      | 116.12   | -0.30     | 0.21   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:08:55 | 8.99      | 94.43    | -0.40     | 0.09   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:09:05 | 22.46     | 77.11    | -0.40     | 0.54   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:09:15 | 40.08     | 68.41    | -0.39     | 13.85  | 0.52    |           |          |           |        |         |
| 4/27/2018 | 7:09:25 | 40.09     | 72.86    | -0.30     | 20.27  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 7:09:35 | 43.06     | 90.89    | -0.44     | 21.04  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:09:45 | 25.75     | 113.29   | -0.34     | 21.12  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:09:55 | 6.62      | 131.69   | -0.39     | 21.14  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:10:05 | 6.00      | 142.97   | -0.39     | 21.14  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:10:15 | 4.50      | 147.71   | -0.42     | 21.15  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:10:25 | 4.26      | 148.13   | -0.36     | 21.15  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:10:35 | 4.26      | 147.71   | -0.36     | 21.15  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:10:45 | 4.26      | 147.35   | -0.42     | 21.14  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:10:55 | 4.27      | 147.25   | -0.36     | 21.14  | 0.74    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:11:05 | 4.28      | 147.37   | -0.42     | 21.15  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:11:15 | 4.27      | 148.77   | -0.45     | 21.17  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:11:25 | 4.29      | 150.68   | -0.34     | 21.16  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:11:35 | 4.28      | 151.36   | -0.40     | 21.17  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:11:45 | 4.28      | 150.43   | -0.31     | 20.07  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 7:11:55 | 4.27      | 147.02   | -0.44     | 6.06   | 0.26    |           |          |           |        |         |
| 4/27/2018 | 7:12:05 | 4.51      | 131.62   | -0.34     | 13.26  | 0.50    |           |          |           |        |         |
| 4/27/2018 | 7:12:15 | 4.51      | 110.29   | -0.44     | 20.18  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 7:12:25 | 4.81      | 104.22   | -0.37     | 21.05  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:12:35 | 5.40      | 116.04   | -0.44     | 21.14  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:12:45 | 5.12      | 133.43   | -0.42     | 21.20  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:12:55 | 4.25      | 143.88   | -0.33     | 11.24  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:13:05 | 4.26      | 135.93   | -0.33     | 1.91   | 0.12    |           |          |           |        |         |
| 4/27/2018 | 7:13:15 | 4.25      | 107.62   | -0.36     | 0.84   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 7:13:25 | 5.11      | 76.28    | -0.37     | 1.22   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 7:13:35 | 2.79      | 59.48    | -0.36     | 10.32  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:13:45 | 17.56     | 62.42    | -0.22     | 12.57  | 0.48    |           |          |           |        |         |
| 4/27/2018 | 7:13:55 | 37.96     | 81.98    | -0.33     | 3.20   | 0.15    |           |          |           |        |         |
| 4/27/2018 | 7:14:05 | 22.14     | 190.50   | -0.37     | 5.58   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 7:14:15 | -57.60    | 401.96   | -0.34     | 18.43  | 0.66    |           |          |           |        |         |
| 4/27/2018 | 7:14:25 | 265.50    | 540.69   | -0.28     | 16.98  | 0.60    |           |          |           |        |         |
| 4/27/2018 | 7:14:35 | 708.86    | 516.19   | -0.37     | 10.87  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:14:45 | 458.20    | 402.80   | -0.33     | 10.53  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:14:55 | 148.52    | 291.58   | -0.31     | 10.51  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:15:05 | 96.25     | 217.25   | -0.30     | 10.51  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:15:15 | 48.07     | 172.74   | -0.28     | 10.50  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:15:25 | 45.43     | 151.54   | -0.34     | 10.50  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:15:35 | 39.74     | 142.06   | -0.37     | 10.50  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:15:45 | 39.74     | 137.33   | -0.34     | 10.49  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:15:55 | 39.45     | 133.75   | -0.40     | 10.49  | 0.41    |           |          |           |        |         |



**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:16:05 | 39.47     | 132.00   | -0.40     | 10.49  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:16:15 | 39.19     | 131.14   | -0.34     | 10.49  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:16:25 | 39.16     | 130.97   | -0.34     | 10.49  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:16:35 | 39.17     | 131.84   | -0.30     | 10.48  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:16:45 | 39.16     | 133.74   | 88.60     | 10.74  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:16:55 | 39.15     | 132.71   | 98.47     | 2.99   | 0.14    |           |          |           |        |         |
| 4/27/2018 | 7:17:05 | 37.41     | 127.16   | 98.50     | 0.35   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:17:15 | 32.93     | 121.29   | 98.46     | 0.06   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:17:25 | 53.46     | 117.58   | 98.50     | 0.02   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:17:35 | 75.83     | 116.16   | 98.46     | 0.02   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:17:45 | 75.83     | 116.04   | 98.49     | 0.01   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:17:55 | 76.72     | 117.16   | 63.62     | 0.02   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:18:05 | 77.03     | 118.39   | 40.37     | 0.01   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:18:15 | 77.33     | 118.05   | 40.37     | 0.01   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:18:25 | 77.33     | 117.27   | 40.37     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:18:35 | 77.65     | 116.15   | 40.46     | 0.01   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:18:45 | 77.65     | 115.23   | 40.40     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:18:55 | 77.66     | 114.65   | 40.40     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:19:05 | 77.66     | 114.83   | 49.55     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:19:15 | 77.66     | 116.41   | 71.11     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:19:25 | 77.65     | 118.15   | 71.11     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:19:35 | 77.66     | 117.99   | 71.11     | 0.00   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:19:45 | 77.65     | 116.83   | 71.22     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:19:55 | 77.64     | 115.89   | 71.16     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:20:05 | 77.65     | 115.39   | 71.10     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:20:15 | 77.64     | 115.06   | 71.08     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:20:25 | 77.93     | 115.25   | 82.97     | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:20:35 | 78.22     | 116.88   | 82.97     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:20:45 | 77.94     | 118.30   | 82.99     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:20:55 | 77.92     | 118.18   | 82.96     | -0.02  | 0.03    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:21:05 | 77.94     | 116.94   | 82.86     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:21:15 | 77.94     | 116.04   | 83.02     | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:21:25 | 77.93     | 115.28   | 82.89     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:21:35 | 77.94     | 114.54   | 72.08     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:21:45 | 77.93     | 114.85   | 67.27     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:21:55 | 77.93     | 116.39   | 67.25     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:22:05 | 77.93     | 118.02   | 67.31     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:22:15 | 78.23     | 118.32   | 67.28     | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:22:25 | 78.23     | 117.24   | 67.24     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:22:35 | 78.22     | 116.26   | 67.28     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:22:45 | 77.93     | 115.19   | 65.73     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:22:55 | 77.92     | 114.77   | 62.14     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:23:05 | 77.93     | 114.88   | 61.91     | -0.02  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:23:15 | 77.93     | 115.90   | 61.97     | -0.01  | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:23:25 | 78.22     | 116.99   | 62.05     | 0.03   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:23:35 | 78.51     | 116.19   | 62.07     | 0.04   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:23:45 | 76.73     | 113.86   | 62.04     | 0.04   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:23:55 | 80.22     | 111.62   | 61.29     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:24:05 | 80.58     | 110.30   | 55.67     | 0.04   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:24:15 | 80.60     | 105.09   | 55.61     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:24:25 | 80.96     | 100.62   | 55.75     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:24:35 | 81.79     | 101.69   | 55.72     | 0.03   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:24:45 | 81.80     | 103.06   | 55.73     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:24:55 | 81.79     | 103.64   | 55.69     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:25:05 | 82.09     | 102.91   | 55.64     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:25:15 | 82.08     | 101.73   | 53.69     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:25:25 | 82.08     | 101.26   | 53.15     | 0.03   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:25:35 | 82.08     | 100.99   | 53.09     | 0.02   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:25:45 | 82.43     | 101.04   | 53.15     | 0.02   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:25:55 | 82.42     | 102.46   | 53.12     | 0.03   | 0.05    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:26:05 | 82.42     | 103.84   | 53.09     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:26:15 | 82.41     | 103.99   | 53.11     | 0.03   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:26:25 | 82.42     | 103.30   | 48.73     | 0.05   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:26:35 | 82.41     | 102.26   | 44.24     | 0.08   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:26:45 | 82.42     | 101.42   | 44.29     | 0.11   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:26:55 | 82.09     | 101.51   | 44.18     | 0.10   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:27:05 | 82.10     | 101.57   | 44.18     | 2.58   | 0.11    |           |          |           |        |         |
| 4/27/2018 | 7:27:15 | 82.10     | 104.14   | 44.17     | 16.86  | 0.60    |           |          |           |        |         |
| 4/27/2018 | 7:27:25 | 79.15     | 111.45   | 44.21     | 15.52  | 0.54    |           |          |           |        |         |
| 4/27/2018 | 7:27:35 | 82.43     | 122.44   | 44.96     | 14.27  | 0.51    |           |          |           |        |         |
| 4/27/2018 | 7:27:45 | 69.28     | 137.49   | 47.83     | 10.89  | 0.41    |           |          |           |        |         |
| 4/27/2018 | 7:27:55 | 44.26     | 152.81   | 47.95     | 17.03  | 0.60    |           |          |           |        |         |
| 4/27/2018 | 7:28:05 | 62.78     | 160.04   | 47.83     | 20.87  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 7:28:15 | 92.39     | 156.04   | 47.83     | 21.34  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:28:25 | 52.60     | 146.72   | 47.77     | 21.39  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 7:28:35 | 10.14     | 141.06   | 47.81     | 21.40  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:28:45 | 8.36      | 139.20   | 47.80     | 21.41  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:28:55 | 5.11      | 138.18   | 54.86     | 21.42  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:29:05 | 4.83      | 137.18   | 55.72     | 21.42  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:29:15 | 4.82      | 136.18   | 55.69     | 21.42  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:29:25 | 4.85      | 135.87   | 55.67     | 21.42  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:29:35 | 4.83      | 135.74   | 55.66     | 21.42  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:29:45 | 4.83      | 135.95   | 55.72     | 21.42  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 7:29:55 | 4.83      | 137.89   | 55.73     | 21.42  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:30:05 | 4.82      | 139.15   | 48.85     | 21.44  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 7:30:15 | 4.82      | 138.94   | 44.20     | 20.33  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 7:30:25 | 4.82      | 140.13   | 44.23     | 12.08  | 0.46    | 4.82      |          |           |        |         |
| 4/27/2018 | 7:30:35 | 3.36      | 147.00   | 44.30     | 10.82  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:30:45 | 46.31     | 158.48   | 44.21     | 10.93  | 0.42    |           |          |           |        |         |
| 4/27/2018 | 7:30:55 | 84.73     | 167.67   | 44.27     | 8.74   | 0.34    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:31:05 | 79.73     | 174.29   | 44.17     | 1.23   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 7:31:15 | 77.04     | 184.64   | 45.63     | 0.18   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:31:25 | 123.44    | 197.83   | 49.20     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:31:35 | 168.04    | 205.56   | 49.16     | 0.04   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:31:45 | 168.34    | 193.78   | 49.17     | 0.04   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:31:55 | 181.40    | 163.69   | 49.14     | 0.07   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:32:05 | 139.11    | 133.32   | 49.06     | 0.10   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:32:15 | 91.18     | 114.76   | 49.05     | 0.11   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:32:25 | 89.38     | 109.33   | 49.08     | 0.11   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:32:35 | 86.81     | 109.30   | 45.74     | 0.11   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:32:45 | 86.80     | 107.90   | 45.69     | 0.12   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:32:55 | 87.10     | 100.61   | 45.68     | 0.11   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:33:05 | 92.47     | 99.50    | 45.65     | 0.11   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:33:15 | 96.23     | 98.79    | 45.83     | 0.11   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:33:25 | 98.07     | 98.52    | 45.66     | 0.11   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:33:35 | 99.92     | 98.72    | 45.71     | 0.11   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:33:45 | 99.92     | 102.58   | 42.93     | 0.10   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:33:55 | 99.92     | 103.94   | 41.65     | 0.10   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:34:05 | 99.92     | 103.81   | 41.71     | 0.10   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:34:15 | 100.19    | 102.88   | 41.63     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:34:25 | 99.91     | 101.99   | 41.68     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:34:35 | 99.91     | 101.36   | 41.62     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:34:45 | 99.91     | 100.65   | 41.65     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:34:55 | 99.92     | 100.45   | 42.44     | 0.10   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:35:05 | 99.90     | 101.77   | 44.23     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:35:15 | 100.23    | 103.07   | 44.26     | 0.08   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:35:25 | 100.22    | 103.53   | 44.21     | 0.09   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:35:35 | 99.93     | 102.75   | 44.21     | 0.09   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:35:45 | 99.92     | 101.81   | 44.24     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:35:55 | 99.91     | 101.08   | 44.21     | 4.19   | 0.19    |           | 101.88   |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:36:05 | 99.92     | 102.45   | 44.15     | 18.12  | 0.65    |           |          |           |        |         |
| 4/27/2018 | 7:36:15 | 102.16    | 107.28   | 42.92     | 18.43  | 0.77    |           |          |           |        |         |
| 4/27/2018 | 7:36:25 | 58.15     | 116.13   | 43.02     | 11.95  | 7.03    |           |          |           |        |         |
| 4/27/2018 | 7:36:35 | 14.58     | 112.92   | 43.07     | 10.95  | 10.20   |           |          |           |        |         |
| 4/27/2018 | 7:36:45 | 30.18     | 85.61    | 42.98     | 10.82  | 10.48   |           |          |           |        |         |
| 4/27/2018 | 7:36:55 | 45.70     | 49.34    | 42.99     | 10.82  | 10.53   |           |          |           |        |         |
| 4/27/2018 | 7:37:05 | 25.16     | 20.53    | 42.93     | 10.82  | 10.55   |           |          |           |        |         |
| 4/27/2018 | 7:37:15 | 2.47      | 5.25     | 42.98     | 10.82  | 10.55   |           |          |           |        |         |
| 4/27/2018 | 7:37:25 | 1.78      | -0.01    | 41.88     | 10.82  | 10.55   |           |          |           |        |         |
| 4/27/2018 | 7:37:35 | 1.19      | -0.95    | 41.69     | 10.71  | 10.56   |           |          |           |        |         |
| 4/27/2018 | 7:37:45 | 0.84      | 0.18     | 41.68     | 10.67  | 10.55   |           |          |           |        |         |
| 4/27/2018 | 7:37:55 | 0.86      | 1.08     | 41.66     | 10.68  | 10.56   |           |          |           |        |         |
| 4/27/2018 | 7:38:05 | 0.59      | 0.63     | 41.60     | 8.78   | 8.63    |           |          |           |        |         |
| 4/27/2018 | 7:38:15 | 0.58      | 0.24     | 41.66     | 1.68   | 1.54    |           |          |           |        |         |
| 4/27/2018 | 7:38:25 | 0.60      | -0.12    | 41.66     | 0.21   | 0.30    |           |          |           |        |         |
| 4/27/2018 | 7:38:35 | 0.58      | 0.23     | 42.34     | 0.06   | 0.15    |           |          |           |        |         |
| 4/27/2018 | 7:38:45 | 0.31      | 0.29     | 42.92     | 0.03   | 0.12    |           |          |           |        |         |
| 4/27/2018 | 7:38:55 | 0.30      | 0.49     | 42.88     | 0.02   | 0.11    |           |          |           |        |         |
| 4/27/2018 | 7:39:05 | 0.30      | 2.20     | 42.98     | 3.49   | 2.19    |           |          |           |        |         |
| 4/27/2018 | 7:39:15 | 0.29      | 4.37     | 42.90     | 9.83   | 9.65    |           |          |           |        |         |
| 4/27/2018 | 7:39:25 | 0.88      | 5.71     | 42.96     | 10.61  | 10.45   |           |          |           |        |         |
| 4/27/2018 | 7:39:35 | 1.78      | 5.05     | 42.96     | 10.66  | 10.52   |           |          |           |        |         |
| 4/27/2018 | 7:39:45 | 1.20      | 2.76     | 41.36     | 10.72  | 10.55   |           |          |           |        |         |
| 4/27/2018 | 7:39:55 | 0.59      | 0.34     | 34.97     | 10.76  | 10.55   |           |          |           |        |         |
| 4/27/2018 | 7:40:05 | 0.28      | -0.81    | 35.00     | 10.76  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:40:15 | 0.30      | -1.12    | 34.98     | 10.77  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:40:25 | 0.28      | 0.17     | 35.00     | 10.77  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:40:35 | 0.31      | 1.07     | 34.97     | 10.76  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:40:45 | 0.31      | 0.75     | 35.01     | 11.88  | 9.70    |           |          |           |        |         |
| 4/27/2018 | 7:40:55 | 0.31      | 5.15     | 35.09     | 19.09  | 2.72    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:41:05 | 0.58      | 28.37    | 39.82     | 21.04  | 1.01    |           |          |           |        |         |
| 4/27/2018 | 7:41:15 | 0.29      | 67.15    | 40.37     | 21.32  | 0.83    |           |          |           |        |         |
| 4/27/2018 | 7:41:25 | 2.47      | 100.26   | 40.37     | 18.18  | 3.49    |           |          |           |        |         |
| 4/27/2018 | 7:41:35 | 5.11      | 110.36   | 40.32     | 12.07  | 9.78    |           |          |           |        |         |
| 4/27/2018 | 7:41:45 | 4.50      | 90.39    | 40.40     | 10.94  | 10.50   |           |          |           |        |         |
| 4/27/2018 | 7:41:55 | 4.50      | 54.91    | 40.41     | 10.81  | 10.56   |           |          |           |        |         |
| 4/27/2018 | 7:42:05 | 2.77      | 25.02    | 40.40     | 10.77  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:42:15 | 0.32      | 7.79     | 41.85     | 10.71  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:42:25 | 0.31      | 0.48     | 42.79     | 10.71  | 10.57   |           |          |           |        |         |
| 4/27/2018 | 7:42:35 | 0.31      | -1.29    | 43.07     | 10.71  | 10.58   |           |          |           |        |         |
| 4/27/2018 | 7:42:45 | 0.32      | -1.60    | 42.96     | 10.70  | 10.58   |           |          |           |        |         |
| 4/27/2018 | 7:42:55 | 0.31      | -1.14    | 42.98     | 10.80  | 10.53   |           |          |           |        |         |
| 4/27/2018 | 7:43:05 | 0.31      | 2.48     | 42.93     | 14.73  | 6.68    |           |          |           |        |         |
| 4/27/2018 | 7:43:15 | 0.32      | 12.53    | 43.01     | 11.26  | 9.73    |           |          |           |        |         |
| 4/27/2018 | 7:43:25 | 1.52      | 21.12    | 43.34     | 10.77  | 10.56   |           |          |           |        |         |
| 4/27/2018 | 7:43:35 | 3.08      | 19.11    | 44.18     | 10.75  | 10.61   |           |          |           |        |         |
| 4/27/2018 | 7:43:45 | 1.49      | 10.40    | 44.24     | 10.48  | 10.45   |           |          |           |        |         |
| 4/27/2018 | 7:43:55 | 0.31      | 2.82     | 44.29     | 10.27  | 10.07   |           |          |           |        |         |
| 4/27/2018 | 7:44:05 | 0.31      | -0.77    | 44.26     | 13.88  | 13.37   |           |          |           |        |         |
| 4/27/2018 | 7:44:15 | 0.30      | -0.67    | 44.26     | 20.17  | 20.04   |           |          |           |        |         |
| 4/27/2018 | 7:44:25 | 0.31      | 0.88     | 44.17     | 19.97  | 20.09   |           |          |           |        |         |
| 4/27/2018 | 7:44:35 | 0.31      | 1.51     | 44.23     | 20.00  | 19.97   |           |          |           |        |         |
| 4/27/2018 | 7:44:45 | 0.30      | 0.80     | 41.60     | 20.05  | 19.99   |           |          |           |        |         |
| 4/27/2018 | 7:44:55 | 0.29      | -0.66    | 41.65     | 19.55  | 19.96   |           |          |           |        |         |
| 4/27/2018 | 7:45:05 | 0.29      | -1.46    | 41.69     | 16.08  | 15.43   |           |          |           |        |         |
| 4/27/2018 | 7:45:15 | 0.30      | -0.51    | 41.71     | 9.81   | 9.83    |           |          |           |        |         |
| 4/27/2018 | 7:45:25 | 0.33      | 1.21     | 41.66     | 9.97   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 7:45:35 | 0.31      | 1.82     | 41.68     | 9.95   | 10.02   |           |          |           |        |         |
| 4/27/2018 | 7:45:45 | 0.29      | 1.75     | 41.66     | 9.94   | 10.01   |           |          |           |        |         |
| 4/27/2018 | 7:45:55 | 0.01      | 1.06     | 36.99     | 9.93   | 10.01   |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:46:05 | 0.01      | 0.01     | 35.09     | 9.93   | 9.99    | 0.10      |          |           | 9.93   |         |
| 4/27/2018 | 7:46:15 | 0.02      | -0.78    | 34.98     | 8.28   | 8.00    |           |          |           |        |         |
| 4/27/2018 | 7:46:25 | -0.01     | -1.27    | 35.09     | 3.35   | 3.48    |           | -0.68    |           |        |         |
| 4/27/2018 | 7:46:35 | 0.00      | -1.44    | 35.09     | 3.90   | 4.23    |           |          |           |        |         |
| 4/27/2018 | 7:46:45 | 0.01      | -0.96    | 35.18     | 3.91   | 4.22    |           |          |           |        |         |
| 4/27/2018 | 7:46:55 | 0.00      | -0.50    | 35.13     | 3.91   | 4.21    |           |          |           |        |         |
| 4/27/2018 | 7:47:05 | 0.01      | 0.63     | 38.87     | 3.91   | 4.21    |           |          |           |        |         |
| 4/27/2018 | 7:47:15 | 0.01      | 1.36     | 47.95     | 3.90   | 4.19    |           |          |           |        |         |
| 4/27/2018 | 7:47:25 | 0.00      | 0.75     | 47.94     | 3.91   | 4.18    |           |          |           |        |         |
| 4/27/2018 | 7:47:35 | 0.00      | 0.10     | 47.83     | 3.91   | 4.18    |           |          |           |        |         |
| 4/27/2018 | 7:47:45 | -0.01     | 0.30     | 47.83     | 2.39   | 2.39    |           |          |           |        |         |
| 4/27/2018 | 7:47:55 | 0.00      | 9.41     | 47.86     | 1.94   | 1.95    |           |          |           |        |         |
| 4/27/2018 | 7:48:05 | 28.09     | 17.97    | 47.89     | 1.91   | 1.90    |           |          |           |        |         |
| 4/27/2018 | 7:48:15 | 56.10     | 16.11    | 47.36     | 1.91   | 1.90    |           |          |           |        |         |
| 4/27/2018 | 7:48:25 | 29.90     | 9.65     | 42.98     | 1.91   | 1.91    |           |          |           |        |         |
| 4/27/2018 | 7:48:35 | 4.49      | 4.03     | 42.96     | 1.92   | 1.92    |           |          |           |        |         |
| 4/27/2018 | 7:48:45 | 3.69      | 1.73     | 42.92     | 1.78   | 1.91    |           |          |           |        |         |
| 4/27/2018 | 7:48:55 | 2.48      | 5.58     | 43.05     | 1.80   | 1.92    |           |          |           |        |         |
| 4/27/2018 | 7:49:05 | 2.16      | 23.40    | 42.93     | 1.64   | 1.62    |           |          |           |        |         |
| 4/27/2018 | 7:49:15 | 1.78      | 53.17    | 42.96     | 0.08   | 0.14    |           |          |           |        |         |
| 4/27/2018 | 7:49:25 | 14.30     | 95.43    | 42.93     | -0.01  | 0.08    |           |          |           |        |         |
| 4/27/2018 | 7:49:35 | 16.10     | 142.73   | 47.91     | -0.03  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:49:45 | 76.76     | 178.31   | 49.10     | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:49:55 | 142.42    | 196.14   | 49.08     | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:50:05 | 166.87    | 200.68   | 49.03     | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:50:15 | 196.80    | 200.57   | 49.05     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:50:25 | 199.70    | 199.92   | 49.08     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:50:35 | 202.34    | 199.24   | 49.06     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:50:45 | 203.53    | 199.05   | 48.44     | 0.00   | 0.04    |           |          |           |        |         |
| 4/27/2018 | 7:50:55 | 205.27    | 197.21   | 47.80     | -0.01  | 0.03    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:51:05 | 205.59    | 179.44   | 47.87     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 7:51:15 | 217.14    | 147.66   | 47.77     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 7:51:25 | 168.57    | 120.16   | 47.91     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 7:51:35 | 107.81    | 105.85   | 47.89     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 7:51:45 | 103.07    | 102.00   | 47.84     | -0.01  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 7:51:55 | 100.51    | 100.93   | 45.48     | -0.01  | 0.02    |           |          |           |        |         |
| 4/27/2018 | 7:52:05 | 100.22    | 100.83   | 36.25     | -0.02  | 0.03    |           |          |           |        |         |
| 4/27/2018 | 7:52:15 | 99.91     | 101.47   | 36.23     | 16.26  | 0.75    |           |          |           |        |         |
| 4/27/2018 | 7:52:25 | 99.91     | 105.48   | 36.25     | 14.80  | 1.98    |           |          |           |        |         |
| 4/27/2018 | 7:52:35 | 107.52    | 110.41   | 36.22     | 8.19   | 0.54    |           |          |           |        |         |
| 4/27/2018 | 7:52:45 | 71.64     | 110.95   | 36.14     | 1.21   | 0.11    |           |          |           |        |         |
| 4/27/2018 | 7:52:55 | 23.96     | 108.08   | 36.20     | 0.16   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:53:05 | 60.10     | 104.71   | 36.31     | 0.05   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:53:15 | 97.51     | 102.28   | 39.53     | 0.15   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:53:25 | 96.82     | 100.67   | 40.31     | 0.21   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:53:35 | 99.28     | 100.51   | 40.37     | 0.21   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:53:45 | 99.61     | 101.93   | 40.34     | 0.21   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:53:55 | 99.59     | 103.30   | 40.37     | 0.22   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:54:05 | 99.61     | 103.48   | 40.49     | 0.23   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:54:15 | 99.93     | 102.65   | 40.40     | 0.23   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:54:25 | 99.61     | 101.79   | 41.10     | 0.23   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:54:35 | 99.60     | 101.05   | 41.68     | 0.23   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:54:45 | 99.28     | 100.55   | 41.60     | 0.23   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:54:55 | 99.28     | 100.48   | 41.69     | 0.19   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:55:05 | 99.27     | 101.56   | 41.62     | 0.14   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:55:15 | 99.60     | 103.03   | 41.57     | 0.14   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:55:25 | 99.60     | 103.40   | 41.51     | 0.13   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:55:35 | 99.60     | 102.49   | 40.81     | 0.13   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:55:45 | 99.92     | 101.81   | 37.48     | 0.14   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:55:55 | 99.91     | 101.08   | 37.73     | 0.13   | 0.07    |           |          |           |        |         |



**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 7:56:05 | 99.92     | 100.18   | 37.68     | 0.14   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:56:15 | 99.91     | 100.54   | 37.71     | 0.14   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:56:25 | 99.91     | 101.08   | 37.68     | 0.13   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:56:35 | 99.92     | 102.54   | 37.64     | 0.12   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:56:45 | 99.92     | 103.30   | 37.65     | 0.08   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:56:55 | 99.92     | 102.50   | 39.13     | 0.07   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:57:05 | 99.93     | 101.81   | 38.98     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:57:15 | 100.24    | 101.10   | 39.09     | 0.07   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:57:25 | 100.22    | 100.53   | 38.99     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:57:35 | 100.22    | 100.19   | 39.07     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:57:45 | 100.23    | 100.67   | 39.09     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:57:55 | 99.93     | 102.03   | 39.07     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:58:05 | 99.92     | 103.18   | 34.32     | 0.06   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:58:15 | 99.93     | 103.03   | 32.17     | 0.06   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:58:25 | 100.23    | 101.98   | 32.22     | 0.07   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:58:35 | 100.23    | 101.21   | 32.25     | 0.08   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:58:45 | 100.22    | 100.32   | 32.17     | 0.09   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:58:55 | 100.21    | 99.87    | 32.17     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:59:05 | 100.21    | 101.00   | 32.25     | 0.09   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 7:59:15 | 100.23    | 102.27   | 33.93     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:59:25 | 99.92     | 103.15   | 37.73     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:59:35 | 99.92     | 102.85   | 37.71     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 7:59:45 | 99.90     | 101.70   | 37.67     | 0.09   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 7:59:55 | 99.92     | 101.10   | 37.61     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 8:00:05 | 99.92     | 100.69   | 37.64     | 0.08   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 8:00:15 | 99.92     | 99.99    | 37.59     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 8:00:25 | 99.93     | 100.74   | 37.83     | 0.08   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 8:00:35 | 99.91     | 101.97   | 39.07     | 0.08   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 8:00:45 | 99.93     | 103.10   | 38.99     | 0.09   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 8:00:55 | 99.91     | 102.77   | 39.09     | 0.09   | 0.06    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 8:01:05 | 99.90     | 101.67   | 39.25     | 0.10   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 8:01:15 | 99.91     | 101.40   | 39.04     | 10.25  | 0.38    |           |          |           |        |         |
| 4/27/2018 | 8:01:25 | 99.91     | 103.72   | 38.92     | 18.77  | 0.67    |           |          |           |        |         |
| 4/27/2018 | 8:01:35 | 105.47    | 110.38   | 39.05     | 19.85  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 8:01:45 | 60.39     | 118.94   | 36.83     | 19.97  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 8:01:55 | 12.52     | 125.86   | 36.19     | 20.02  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 8:02:05 | 10.43     | 129.86   | 36.20     | 15.13  | 1.78    |           |          |           |        |         |
| 4/27/2018 | 8:02:15 | 6.01      | 128.80   | 36.29     | 13.64  | 3.50    |           |          |           |        |         |
| 4/27/2018 | 8:02:25 | 28.10     | 121.98   | 36.26     | 18.27  | 1.04    |           |          |           |        |         |
| 4/27/2018 | 8:02:35 | 48.37     | 117.51   | 36.26     | 19.80  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 8:02:45 | 28.71     | 119.17   | 36.22     | 19.98  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 8:02:55 | 13.99     | 123.62   | 29.72     | 20.00  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 8:03:05 | 11.00     | 127.65   | 23.08     | 20.00  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 8:03:15 | 5.69      | 129.94   | 23.17     | 19.93  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 8:03:25 | 5.68      | 130.73   | 23.22     | 16.42  | 1.54    |           |          |           |        |         |
| 4/27/2018 | 8:03:35 | 5.42      | 126.61   | 23.12     | 18.37  | 1.76    |           |          |           |        |         |
| 4/27/2018 | 8:03:45 | 9.00      | 116.24   | 23.12     | 12.24  | 8.09    |           |          |           |        |         |
| 4/27/2018 | 8:03:55 | 12.20     | 94.12    | 23.12     | 10.41  | 9.82    |           |          |           |        |         |
| 4/27/2018 | 8:04:05 | 7.51      | 60.73    | 25.46     | 10.18  | 9.95    |           |          |           |        |         |
| 4/27/2018 | 8:04:15 | 2.77      | 29.63    | 35.00     | 10.18  | 9.98    |           |          |           |        |         |
| 4/27/2018 | 8:04:25 | 2.16      | 9.92     | 34.92     | 10.16  | 9.98    |           |          |           |        |         |
| 4/27/2018 | 8:04:35 | 0.85      | 2.39     | 34.97     | 10.15  | 9.98    |           |          |           |        |         |
| 4/27/2018 | 8:04:45 | 0.58      | 1.11     | 34.98     | 10.14  | 9.98    |           |          |           |        |         |
| 4/27/2018 | 8:04:55 | 0.59      | 0.55     | 34.98     | 10.15  | 9.99    |           |          |           |        |         |
| 4/27/2018 | 8:05:05 | 0.59      | -0.03    | 34.97     | 10.14  | 9.98    |           |          |           |        |         |
| 4/27/2018 | 8:05:15 | 0.59      | -1.03    | 35.00     | 10.12  | 9.98    |           |          |           |        |         |
| 4/27/2018 | 8:05:25 | 0.60      | -1.63    | 37.33     | 10.09  | 10.00   |           |          |           |        |         |
| 4/27/2018 | 8:05:35 | 0.32      | -1.73    | 37.65     | 10.10  | 10.00   |           |          |           |        |         |
| 4/27/2018 | 8:05:45 | 0.30      | -1.75    | 37.62     | 7.65   | 7.54    |           |          |           |        |         |
| 4/27/2018 | 8:05:55 | 0.29      | -0.51    | 37.61     | 2.26   | 1.84    |           |          |           |        |         |

**Hollingsworth & Vose****4/27/2018****CFU 114****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 8:06:05 | 0.30      | 1.58     | 37.64     | 2.07   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 8:06:15 | 0.31      | 2.48     | 37.70     | 2.04   | 1.98    |           |          |           |        |         |
| 4/27/2018 | 8:06:25 | 0.31      | 1.74     | 37.68     | 2.03   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 8:06:35 | 0.31      | 0.52     | 34.98     | 2.02   | 1.95    |           |          |           |        |         |
| 4/27/2018 | 8:06:45 | 0.31      | -0.69    | 32.20     | 2.03   | 1.94    |           |          |           |        | 1.95    |
| 4/27/2018 | 8:06:55 | 0.31      | -0.96    | 32.28     | 2.02   | 1.94    |           |          |           |        |         |
| 4/27/2018 | 8:07:05 | 0.30      | -0.99    | 32.23     | 2.65   | 1.92    |           |          |           |        |         |
| 4/27/2018 | 8:07:15 | 0.30      | 2.57     | 32.25     | 14.38  | 1.13    |           |          |           |        |         |
| 4/27/2018 | 8:07:25 | 0.30      | 23.07    | 32.20     | 19.23  | 0.74    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 8:29:52 AM | 6.53      |
| 4/27/2018 | 8:30:02 AM | 6.53      |
| 4/27/2018 | 8:30:12 AM | 6.53      |
| 4/27/2018 | 8:30:22 AM | 6.53      |
| 4/27/2018 | 8:30:32 AM | 6.53      |
| 4/27/2018 | 8:30:42 AM | 6.53      |
| 4/27/2018 | 8:30:52 AM | 6.35      |
| 4/27/2018 | 8:31:02 AM | 5.93      |
| 4/27/2018 | 8:31:12 AM | 5.93      |
| 4/27/2018 | 8:31:22 AM | 5.93      |
| 4/27/2018 | 8:31:32 AM | 5.93      |
| 4/27/2018 | 8:31:42 AM | 5.93      |
| 4/27/2018 | 8:31:52 AM | 5.93      |
| 4/27/2018 | 8:32:02 AM | 5.93      |
| 4/27/2018 | 8:32:12 AM | 4.90      |
| 4/27/2018 | 8:32:22 AM | 4.90      |
| 4/27/2018 | 8:32:32 AM | 4.90      |
| 4/27/2018 | 8:32:42 AM | 4.90      |
| 4/27/2018 | 8:32:52 AM | 4.90      |
| 4/27/2018 | 8:33:02 AM | 4.90      |
| 4/27/2018 | 8:33:12 AM | 4.90      |
| 4/27/2018 | 8:33:22 AM | 4.68      |
| 4/27/2018 | 8:33:32 AM | 4.58      |
| 4/27/2018 | 8:33:42 AM | 4.58      |
| 4/27/2018 | 8:33:52 AM | 4.58      |
| 4/27/2018 | 8:34:02 AM | 4.58      |
| 4/27/2018 | 8:34:12 AM | 4.58      |
| 4/27/2018 | 8:34:22 AM | 4.58      |
| 4/27/2018 | 8:34:32 AM | 4.53      |
| 4/27/2018 | 8:34:42 AM | 4.46      |
| 4/27/2018 | 8:34:52 AM | 4.46      |
| 4/27/2018 | 8:35:02 AM | 4.46      |
| 4/27/2018 | 8:35:12 AM | 4.46      |
| 4/27/2018 | 8:35:22 AM | 4.46      |
| 4/27/2018 | 8:35:32 AM | 4.46      |
| 4/27/2018 | 8:35:42 AM | 4.46      |
| 4/27/2018 | 8:35:52 AM | 4.40      |
| 4/27/2018 | 8:36:02 AM | 4.40      |
| 4/27/2018 | 8:36:12 AM | 4.40      |
| 4/27/2018 | 8:36:22 AM | 4.40      |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 8:36:32 AM | 4.40      |
| 4/27/2018 | 8:36:42 AM | 4.40      |
| 4/27/2018 | 8:36:52 AM | 4.40      |
| 4/27/2018 | 8:37:02 AM | 4.33      |
| 4/27/2018 | 8:37:12 AM | 4.31      |
| 4/27/2018 | 8:37:22 AM | 4.31      |
| 4/27/2018 | 8:37:32 AM | 4.31      |
| 4/27/2018 | 8:37:42 AM | 4.31      |
| 4/27/2018 | 8:37:52 AM | 4.31      |
| 4/27/2018 | 8:38:02 AM | 4.31      |
| 4/27/2018 | 8:38:12 AM | 4.30      |
| 4/27/2018 | 8:38:22 AM | 4.28      |
| 4/27/2018 | 8:38:32 AM | 4.28      |
| 4/27/2018 | 8:38:42 AM | 4.28      |
| 4/27/2018 | 8:38:52 AM | 4.28      |
| 4/27/2018 | 8:39:02 AM | 4.28      |
| 4/27/2018 | 8:39:12 AM | 4.28      |
| 4/27/2018 | 8:39:22 AM | 4.28      |
| 4/27/2018 | 8:39:32 AM | 4.26      |
| 4/27/2018 | 8:39:42 AM | 4.26      |
| 4/27/2018 | 8:39:52 AM | 4.26      |
| 4/27/2018 | 8:40:02 AM | 4.26      |
| 4/27/2018 | 8:40:12 AM | 4.26      |
| 4/27/2018 | 8:40:22 AM | 4.26      |
| 4/27/2018 | 8:40:32 AM | 4.26      |
| 4/27/2018 | 8:40:42 AM | 4.18      |
| 4/27/2018 | 8:40:52 AM | 4.18      |
| 4/27/2018 | 8:41:02 AM | 4.18      |
| 4/27/2018 | 8:41:12 AM | 4.18      |
| 4/27/2018 | 8:41:22 AM | 4.18      |
| 4/27/2018 | 8:41:32 AM | 4.18      |
| 4/27/2018 | 8:41:42 AM | 4.18      |
| 4/27/2018 | 8:41:52 AM | 4.18      |
| 4/27/2018 | 8:42:02 AM | 4.18      |
| 4/27/2018 | 8:42:12 AM | 4.18      |
| 4/27/2018 | 8:42:22 AM | 4.18      |
| 4/27/2018 | 8:42:32 AM | 4.18      |
| 4/27/2018 | 8:42:42 AM | 4.18      |
| 4/27/2018 | 8:42:52 AM | 4.18      |
| 4/27/2018 | 8:43:02 AM | 4.17      |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |      |
|-----------|------------|-----------|------|
| 4/27/2018 | 8:43:12 AM | 4.16      |      |
| 4/27/2018 | 8:43:22 AM | 4.16      |      |
| 4/27/2018 | 8:43:32 AM | 4.16      | 4.16 |
| 4/27/2018 | 8:43:42 AM | 4.16      |      |
| 4/27/2018 | 8:43:52 AM | 4.16      |      |
| 4/27/2018 | 8:44:02 AM | 4.16      |      |
| 4/27/2018 | 8:44:12 AM | 4.16      |      |
| 4/27/2018 | 8:44:22 AM | 4.19      |      |
| 4/27/2018 | 8:44:32 AM | 4.19      |      |
| 4/27/2018 | 8:44:42 AM | 4.19      |      |
| 4/27/2018 | 8:44:52 AM | 4.19      |      |
| 4/27/2018 | 8:45:02 AM | 4.19      |      |
| 4/27/2018 | 8:45:12 AM | 4.19      |      |
| 4/27/2018 | 8:45:22 AM | 4.19      |      |
| 4/27/2018 | 8:45:32 AM | 4.14      |      |
| 4/27/2018 | 8:45:42 AM | 4.11      |      |
| 4/27/2018 | 8:45:52 AM | 4.11      |      |
| 4/27/2018 | 8:46:02 AM | 4.11      |      |
| 4/27/2018 | 8:46:12 AM | 4.11      |      |
| 4/27/2018 | 8:46:22 AM | 4.12      |      |
| 4/27/2018 | 8:46:32 AM | 4.12      |      |
| 4/27/2018 | 8:46:42 AM | 3.63      |      |
| 4/27/2018 | 8:46:52 AM | 2.89      |      |
| 4/27/2018 | 8:47:02 AM | 2.89      |      |
| 4/27/2018 | 8:47:12 AM | 2.89      |      |
| 4/27/2018 | 8:47:22 AM | 2.89      |      |
| 4/27/2018 | 8:47:32 AM | 2.89      |      |
| 4/27/2018 | 8:47:42 AM | 2.89      |      |
| 4/27/2018 | 8:47:52 AM | 2.88      |      |
| 4/27/2018 | 8:48:02 AM | 2.70      |      |
| 4/27/2018 | 8:48:12 AM | 2.70      |      |
| 4/27/2018 | 8:48:22 AM | 2.70      |      |
| 4/27/2018 | 8:48:32 AM | 2.70      |      |
| 4/27/2018 | 8:48:42 AM | 2.70      |      |
| 4/27/2018 | 8:48:52 AM | 2.70      |      |
| 4/27/2018 | 8:49:02 AM | 2.70      |      |
| 4/27/2018 | 8:49:12 AM | 2.67      |      |
| 4/27/2018 | 8:49:22 AM | 2.66      |      |
| 4/27/2018 | 8:49:32 AM | 2.66      |      |
| 4/27/2018 | 8:49:42 AM | 2.66      | 2.66 |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 8:49:52 AM | 2.66      |
| 4/27/2018 | 8:50:02 AM | 2.66      |
| 4/27/2018 | 8:50:12 AM | 2.66      |
| 4/27/2018 | 8:50:22 AM | 2.65      |
| 4/27/2018 | 8:50:32 AM | 2.65      |
| 4/27/2018 | 8:50:42 AM | 2.65      |
| 4/27/2018 | 8:50:52 AM | 2.65      |
| 4/27/2018 | 8:51:02 AM | 2.65      |
| 4/27/2018 | 8:51:12 AM | 2.65      |
| 4/27/2018 | 8:51:22 AM | 2.65      |
| 4/27/2018 | 8:51:32 AM | 2.64      |
| 4/27/2018 | 8:51:42 AM | 2.63      |
| 4/27/2018 | 8:51:52 AM | 2.63      |
| 4/27/2018 | 8:52:02 AM | 2.63      |
| 4/27/2018 | 8:52:12 AM | 2.63      |
| 4/27/2018 | 8:52:22 AM | 2.63      |
| 4/27/2018 | 8:52:32 AM | 2.63      |
| 4/27/2018 | 8:52:42 AM | 2.63      |
| 4/27/2018 | 8:52:52 AM | 2.66      |
| 4/27/2018 | 8:53:02 AM | 2.66      |
| 4/27/2018 | 8:53:12 AM | 2.66      |
| 4/27/2018 | 8:53:22 AM | 2.66      |
| 4/27/2018 | 8:53:32 AM | 2.66      |
| 4/27/2018 | 8:53:42 AM | 2.66      |
| 4/27/2018 | 8:53:52 AM | 2.66      |
| 4/27/2018 | 8:54:02 AM | 2.68      |
| 4/27/2018 | 8:54:12 AM | 2.69      |
| 4/27/2018 | 8:54:22 AM | 2.69      |
| 4/27/2018 | 8:54:32 AM | 2.69      |
| 4/27/2018 | 8:54:42 AM | 2.69      |
| 4/27/2018 | 8:54:52 AM | 2.69      |
| 4/27/2018 | 8:55:02 AM | 2.69      |
| 4/27/2018 | 8:55:12 AM | 2.67      |
| 4/27/2018 | 8:55:22 AM | 2.63      |
| 4/27/2018 | 8:55:32 AM | 2.63      |
| 4/27/2018 | 8:55:42 AM | 2.63      |
| 4/27/2018 | 8:55:52 AM | 2.63      |
| 4/27/2018 | 8:56:02 AM | 2.63      |
| 4/27/2018 | 8:56:12 AM | 2.63      |
| 4/27/2018 | 8:56:22 AM | 2.63      |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 8:56:32 AM | 2.73      |
| 4/27/2018 | 8:56:42 AM | 2.73      |
| 4/27/2018 | 8:56:52 AM | 2.73      |
| 4/27/2018 | 8:57:02 AM | 2.73      |
| 4/27/2018 | 8:57:12 AM | 2.73      |
| 4/27/2018 | 8:57:22 AM | 2.73      |
| 4/27/2018 | 8:57:32 AM | 2.73      |
| 4/27/2018 | 8:57:42 AM | 2.69      |
| 4/27/2018 | 8:57:52 AM | 2.67      |
| 4/27/2018 | 8:58:02 AM | 2.67      |
| 4/27/2018 | 8:58:12 AM | 2.67      |
| 4/27/2018 | 8:58:22 AM | 2.67      |
| 4/27/2018 | 8:58:32 AM | 2.67      |
| 4/27/2018 | 8:58:42 AM | 2.67      |
| 4/27/2018 | 8:58:52 AM | 2.31      |
| 4/27/2018 | 8:59:02 AM | 1.76      |
| 4/27/2018 | 8:59:12 AM | 1.76      |
| 4/27/2018 | 8:59:22 AM | 1.76      |
| 4/27/2018 | 8:59:32 AM | 1.76      |
| 4/27/2018 | 8:59:42 AM | 1.76      |
| 4/27/2018 | 8:59:52 AM | 1.76      |
| 4/27/2018 | 9:00:02 AM | 1.75      |
| 4/27/2018 | 9:00:12 AM | 1.69      |
| 4/27/2018 | 9:00:22 AM | 1.69      |
| 4/27/2018 | 9:00:32 AM | 1.69      |
| 4/27/2018 | 9:00:42 AM | 1.69      |
| 4/27/2018 | 9:00:52 AM | 1.69      |
| 4/27/2018 | 9:01:02 AM | 1.69      |
| 4/27/2018 | 9:01:12 AM | 1.69      |
| 4/27/2018 | 9:01:22 AM | 1.68      |
| 4/27/2018 | 9:01:32 AM | 1.68      |
| 4/27/2018 | 9:01:42 AM | 1.68      |
| 4/27/2018 | 9:01:52 AM | 1.68      |
| 4/27/2018 | 9:02:02 AM | 1.68      |
| 4/27/2018 | 9:02:12 AM | 1.68      |
| 4/27/2018 | 9:02:22 AM | 1.68      |
| 4/27/2018 | 9:02:32 AM | 1.73      |
| 4/27/2018 | 9:02:42 AM | 1.78      |
| 4/27/2018 | 9:02:52 AM | 1.78      |
| 4/27/2018 | 9:03:02 AM | 1.78      |



**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 9:03:12 AM | 1.79      |
| 4/27/2018 | 9:03:22 AM | 1.78      |
| 4/27/2018 | 9:03:32 AM | 1.78      |
| 4/27/2018 | 9:03:42 AM | 1.77      |
| 4/27/2018 | 9:03:52 AM | 1.73      |
| 4/27/2018 | 9:04:02 AM | 1.73      |
| 4/27/2018 | 9:04:12 AM | 1.73      |
| 4/27/2018 | 9:04:22 AM | 1.73      |
| 4/27/2018 | 9:04:32 AM | 1.73      |
| 4/27/2018 | 9:04:42 AM | 1.73      |
| 4/27/2018 | 9:04:52 AM | 1.73      |
| 4/27/2018 | 9:05:02 AM | 1.71      |
| 4/27/2018 | 9:05:12 AM | 1.70      |
| 4/27/2018 | 9:05:22 AM | 1.71      |
| 4/27/2018 | 9:05:32 AM | 1.71      |
| 4/27/2018 | 9:05:42 AM | 1.71      |
| 4/27/2018 | 9:05:52 AM | 1.71      |
| 4/27/2018 | 9:06:02 AM | 1.71      |
| 4/27/2018 | 9:06:12 AM | 1.72      |
| 4/27/2018 | 9:06:22 AM | 1.73      |
| 4/27/2018 | 9:06:32 AM | 1.73      |
| 4/27/2018 | 9:06:42 AM | 1.73      |
| 4/27/2018 | 9:06:52 AM | 1.73      |
| 4/27/2018 | 9:07:02 AM | 1.73      |
| 4/27/2018 | 9:07:12 AM | 1.73      |
| 4/27/2018 | 9:07:22 AM | 1.72      |
| 4/27/2018 | 9:07:32 AM | 1.69      |
| 4/27/2018 | 9:07:42 AM | 1.69      |
| 4/27/2018 | 9:07:52 AM | 1.69      |
| 4/27/2018 | 9:08:02 AM | 1.69      |
| 4/27/2018 | 9:08:12 AM | 1.69      |
| 4/27/2018 | 9:08:22 AM | 1.69      |
| 4/27/2018 | 9:08:32 AM | 1.69      |
| 4/27/2018 | 9:08:42 AM | 1.69      |
| 4/27/2018 | 9:08:52 AM | 1.69      |
| 4/27/2018 | 9:09:02 AM | 1.69      |
| 4/27/2018 | 9:09:12 AM | 1.69      |
| 4/27/2018 | 9:09:22 AM | 1.69      |
| 4/27/2018 | 9:09:32 AM | 1.69      |
| 4/27/2018 | 9:09:42 AM | 1.69      |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 9:09:52 AM | 1.79      |
| 4/27/2018 | 9:10:02 AM | 1.84      |
| 4/27/2018 | 9:10:12 AM | 1.84      |
| 4/27/2018 | 9:10:22 AM | 1.84      |
| 4/27/2018 | 9:10:32 AM | 1.84      |
| 4/27/2018 | 9:10:42 AM | 1.83      |
| 4/27/2018 | 9:10:52 AM | 1.83      |
| 4/27/2018 | 9:11:02 AM | 1.76      |
| 4/27/2018 | 9:11:12 AM | 1.65      |
| 4/27/2018 | 9:11:22 AM | 1.65      |
| 4/27/2018 | 9:11:32 AM | 1.65      |
| 4/27/2018 | 9:11:42 AM | 1.65      |
| 4/27/2018 | 9:11:52 AM | 1.65      |
| 4/27/2018 | 9:12:02 AM | 1.65      |
| 4/27/2018 | 9:12:12 AM | 1.67      |
| 4/27/2018 | 9:12:22 AM | 1.77      |
| 4/27/2018 | 9:12:32 AM | 1.77      |
| 4/27/2018 | 9:12:42 AM | 1.77      |
| 4/27/2018 | 9:12:52 AM | 1.77      |
| 4/27/2018 | 9:13:02 AM | 1.77      |
| 4/27/2018 | 9:13:12 AM | 1.77      |
| 4/27/2018 | 9:13:22 AM | 1.77      |
| 4/27/2018 | 9:13:32 AM | 1.73      |
| 4/27/2018 | 9:13:42 AM | 1.72      |
| 4/27/2018 | 9:13:52 AM | 1.72      |
| 4/27/2018 | 9:14:02 AM | 1.72      |
| 4/27/2018 | 9:14:12 AM | 1.72      |
| 4/27/2018 | 9:14:22 AM | 1.72      |
| 4/27/2018 | 9:14:32 AM | 1.72      |
| 4/27/2018 | 9:14:42 AM | 1.71      |
| 4/27/2018 | 9:14:52 AM | 1.71      |
| 4/27/2018 | 9:15:02 AM | 1.71      |
| 4/27/2018 | 9:15:12 AM | 1.71      |
| 4/27/2018 | 9:15:22 AM | 1.71      |
| 4/27/2018 | 9:15:32 AM | 1.71      |
| 4/27/2018 | 9:15:42 AM | 1.71      |
| 4/27/2018 | 9:15:52 AM | 1.71      |
| 4/27/2018 | 9:16:02 AM | 1.71      |
| 4/27/2018 | 9:16:12 AM | 1.71      |
| 4/27/2018 | 9:16:22 AM | 1.71      |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 9:16:32 AM | 1.71      |
| 4/27/2018 | 9:16:42 AM | 1.71      |
| 4/27/2018 | 9:16:52 AM | 1.71      |
| 4/27/2018 | 9:17:02 AM | 1.71      |
| 4/27/2018 | 9:17:12 AM | 1.69      |
| 4/27/2018 | 9:17:22 AM | 1.69      |
| 4/27/2018 | 9:17:32 AM | 1.69      |
| 4/27/2018 | 9:17:42 AM | 1.69      |
| 4/27/2018 | 9:17:52 AM | 1.69      |
| 4/27/2018 | 9:18:02 AM | 1.69      |
| 4/27/2018 | 9:18:12 AM | 1.69      |
| 4/27/2018 | 9:18:22 AM | 1.74      |
| 4/27/2018 | 9:18:32 AM | 1.77      |
| 4/27/2018 | 9:18:42 AM | 1.77      |
| 4/27/2018 | 9:18:52 AM | 1.77      |
| 4/27/2018 | 9:19:02 AM | 1.77      |
| 4/27/2018 | 9:19:12 AM | 1.77      |
| 4/27/2018 | 9:19:22 AM | 1.77      |
| 4/27/2018 | 9:19:32 AM | 1.78      |
| 4/27/2018 | 9:19:42 AM | 1.81      |
| 4/27/2018 | 9:19:52 AM | 1.81      |
| 4/27/2018 | 9:20:02 AM | 1.81      |
| 4/27/2018 | 9:20:12 AM | 1.81      |
| 4/27/2018 | 9:20:22 AM | 1.81      |
| 4/27/2018 | 9:20:32 AM | 1.81      |
| 4/27/2018 | 9:20:42 AM | 1.81      |
| 4/27/2018 | 9:20:52 AM | 0.67      |
| 4/27/2018 | 9:21:02 AM | 0.67      |
| 4/27/2018 | 9:21:12 AM | 0.67      |
| 4/27/2018 | 9:21:22 AM | 0.67      |
| 4/27/2018 | 9:21:32 AM | 0.67      |
| 4/27/2018 | 9:21:42 AM | 0.67      |
| 4/27/2018 | 9:21:52 AM | 0.67      |
| 4/27/2018 | 9:22:02 AM | 0.45      |
| 4/27/2018 | 9:22:12 AM | 0.16      |
| 4/27/2018 | 9:22:22 AM | 0.16      |
| 4/27/2018 | 9:22:32 AM | 0.16      |
| 4/27/2018 | 9:22:42 AM | 0.16      |
| 4/27/2018 | 9:22:52 AM | 0.16      |
| 4/27/2018 | 9:23:02 AM | 0.16      |

**Hollingsworth & Vose**  
**4/27/2018**  
**CFU 114**  
**VOC Daily Calibrations**

| Date      | Time       | VOC [PPM] |
|-----------|------------|-----------|
| 4/27/2018 | 9:23:12 AM | 0.17      |
| 4/27/2018 | 9:23:22 AM | 0.19      |
| 4/27/2018 | 9:23:32 AM | 0.19      |
| 4/27/2018 | 9:23:42 AM | 0.19      |
| 4/27/2018 | 9:23:52 AM | 0.19      |
| 4/27/2018 | 9:24:02 AM | 0.19      |
| 4/27/2018 | 9:24:12 AM | 0.19      |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #1**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 9:30:16  | 5.42      | 129.88   | 0.29      | 19.69  | 0.70    |
| 4/27/2018 | 9:31:16  | 5.42      | 130.28   | 0.31      | 19.69  | 0.70    |
| 4/27/2018 | 9:32:16  | 5.42      | 129.22   | 0.30      | 19.69  | 0.70    |
| 4/27/2018 | 9:33:16  | 5.42      | 130.61   | 0.27      | 19.70  | 0.70    |
| 4/27/2018 | 9:34:16  | 5.42      | 129.80   | 0.29      | 19.69  | 0.70    |
| 4/27/2018 | 9:35:16  | 5.41      | 128.97   | 0.27      | 19.69  | 0.70    |
| 4/27/2018 | 9:36:16  | 5.43      | 129.54   | 0.28      | 19.69  | 0.70    |
| 4/27/2018 | 9:37:16  | 5.43      | 130.01   | 0.28      | 19.70  | 0.71    |
| 4/27/2018 | 9:38:16  | 5.42      | 129.71   | 0.27      | 19.70  | 0.71    |
| 4/27/2018 | 9:39:16  | 5.42      | 129.46   | 0.32      | 19.70  | 0.71    |
| 4/27/2018 | 9:40:16  | 5.43      | 130.25   | 0.33      | 19.70  | 0.71    |
| 4/27/2018 | 9:41:16  | 5.42      | 129.44   | 0.31      | 19.70  | 0.71    |
| 4/27/2018 | 9:42:16  | 5.43      | 129.08   | 0.27      | 19.70  | 0.71    |
| 4/27/2018 | 9:43:16  | 5.43      | 130.23   | 0.25      | 19.70  | 0.71    |
| 4/27/2018 | 9:44:16  | 5.43      | 128.99   | 0.27      | 19.70  | 0.71    |
| 4/27/2018 | 9:45:16  | 5.44      | 129.27   | 0.24      | 19.70  | 0.70    |
| 4/27/2018 | 9:46:16  | 5.43      | 129.58   | 0.28      | 19.71  | 0.70    |
| 4/27/2018 | 9:47:16  | 5.43      | 128.79   | 0.29      | 19.71  | 0.70    |
| 4/27/2018 | 9:48:16  | 5.42      | 129.88   | 0.29      | 19.71  | 0.70    |
| 4/27/2018 | 9:49:16  | 5.42      | 130.00   | 0.31      | 19.71  | 0.70    |
| 4/27/2018 | 9:50:16  | 5.42      | 128.80   | 0.41      | 19.71  | 0.69    |
| 4/27/2018 | 9:51:16  | 5.47      | 129.62   | 0.47      | 19.71  | 0.69    |
| 4/27/2018 | 9:52:16  | 5.42      | 130.27   | 0.58      | 19.70  | 0.69    |
| 4/27/2018 | 9:53:16  | 5.42      | 130.21   | 0.63      | 19.71  | 0.69    |
| 4/27/2018 | 9:54:16  | 5.43      | 130.07   | 0.65      | 19.72  | 0.69    |
| 4/27/2018 | 9:55:16  | 5.43      | 129.46   | 0.66      | 19.72  | 0.69    |
| 4/27/2018 | 9:56:16  | 5.41      | 128.13   | 0.69      | 19.72  | 0.69    |
| 4/27/2018 | 9:57:16  | 5.43      | 128.96   | 0.68      | 19.72  | 0.69    |
| 4/27/2018 | 9:58:16  | 5.43      | 129.39   | 0.70      | 19.74  | 0.69    |
| 4/27/2018 | 9:59:16  | 5.28      | 123.41   | 0.70      | 19.75  | 0.68    |
| 4/27/2018 | 10:00:16 | 5.42      | 129.21   | 0.68      | 19.72  | 0.70    |
| 4/27/2018 | 10:01:16 | 5.43      | 128.63   | 0.66      | 19.72  | 0.71    |
| 4/27/2018 | 10:02:16 | 5.43      | 127.91   | 0.72      | 19.73  | 0.71    |
| 4/27/2018 | 10:03:16 | 5.42      | 129.37   | 0.75      | 19.72  | 0.71    |
| 4/27/2018 | 10:04:16 | 5.42      | 128.23   | 0.76      | 19.72  | 0.71    |
| 4/27/2018 | 10:05:16 | 5.41      | 127.47   | 0.73      | 19.73  | 0.71    |
| 4/27/2018 | 10:06:16 | 5.43      | 128.53   | 0.69      | 19.73  | 0.71    |
| 4/27/2018 | 10:07:16 | 5.42      | 128.61   | 0.72      | 19.72  | 0.70    |
| 4/27/2018 | 10:08:16 | 5.42      | 128.55   | 0.67      | 19.73  | 0.70    |
| 4/27/2018 | 10:09:16 | 5.42      | 129.77   | 0.70      | 19.73  | 0.70    |
| 4/27/2018 | 10:10:16 | 5.42      | 129.88   | 0.69      | 19.73  | 0.70    |
| 4/27/2018 | 10:11:16 | 5.42      | 128.48   | 0.67      | 19.73  | 0.70    |
| 4/27/2018 | 10:12:16 | 5.43      | 129.69   | 0.66      | 19.73  | 0.70    |
| 4/27/2018 | 10:13:16 | 5.43      | 129.22   | 0.66      | 19.73  | 0.69    |
| 4/27/2018 | 10:14:16 | 5.42      | 128.30   | 0.64      | 19.73  | 0.69    |
| 4/27/2018 | 10:15:16 | 5.42      | 129.37   | 0.69      | 19.73  | 0.69    |
| 4/27/2018 | 10:16:16 | 5.73      | 128.95   | 0.70      | 19.74  | 0.69    |

Stratification Check:

19.71 S1

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #1**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 10:17:16 | 5.74      | 128.60   | 0.69      | 19.74  | 0.69    |
| 4/27/2018 | 10:18:16 | 5.72      | 130.41   | 0.69      | 19.74  | 0.70    |
| 4/27/2018 | 10:19:16 | 5.72      | 129.60   | 0.66      | 19.74  | 0.69    |
| 4/27/2018 | 10:20:16 | 5.52      | 128.42   | 0.69      | 19.74  | 0.70    |
| 4/27/2018 | 10:21:16 | 5.42      | 128.76   | 0.72      | 19.75  | 0.70    |
| 4/27/2018 | 10:22:16 | 5.43      | 128.91   | 0.72      | 19.74  | 0.70    |
| 4/27/2018 | 10:23:16 | 5.41      | 128.84   | 0.69      | 19.75  | 0.70    |
| 4/27/2018 | 10:24:16 | 5.47      | 128.56   | 0.66      | 19.75  | 0.71    |
| 4/27/2018 | 10:25:16 | 5.47      | 129.15   | 0.67      | 19.75  | 0.71    |
| 4/27/2018 | 10:26:16 | 5.42      | 128.61   | 0.65      | 19.75  | 0.71    |
| 4/27/2018 | 10:27:16 | 5.42      | 128.04   | 0.63      | 19.74  | 0.71    |
| 4/27/2018 | 10:28:16 | 5.45      | 129.38   | 0.63      | 19.75  | 0.71    |
| 4/27/2018 | 10:29:16 | 5.46      | 129.46   | 0.67      | 19.75  | 0.71    |
| 4/27/2018 | 10:30:16 | 5.41      | 128.41   | 0.66      | 19.75  | 0.71    |
| 4/27/2018 | 10:31:16 | 5.41      | 129.07   | 0.59      | 19.76  | 0.70    |
| 4/27/2018 | 10:32:16 | 5.41      | 128.99   | 0.66      | 19.76  | 0.70    |
| 4/27/2018 | 10:33:16 | 5.41      | 128.13   | 0.68      | 19.76  | 0.70    |
| 4/27/2018 | 10:34:16 | 5.41      | 128.58   | 0.62      | 19.76  | 0.70    |
| 4/27/2018 | 10:35:16 | 5.41      | 129.30   | 0.58      | 19.75  | 0.70    |
| 4/27/2018 | 10:36:16 | 5.42      | 128.31   | 0.65      | 19.76  | 0.70    |
| 4/27/2018 | 10:37:16 | 5.42      | 128.03   | 0.66      | 19.75  | 0.69    |
| 4/27/2018 | 10:38:16 | 5.41      | 128.96   | 0.60      | 19.75  | 0.69    |
| 4/27/2018 | 10:39:16 | 5.41      | 127.65   | 0.59      | 19.75  | 0.69    |
| 4/27/2018 | 10:40:16 | 5.41      | 127.33   | 0.67      | 19.75  | 0.69    |
| 4/27/2018 | 10:41:16 | 5.42      | 128.56   | 0.66      | 19.75  | 0.69    |
| 4/27/2018 | 10:42:16 | 5.41      | 128.04   | 0.59      | 19.75  | 0.69    |
| 4/27/2018 | 10:43:16 | 5.41      | 128.05   | 0.60      | 19.75  | 0.70    |
| 4/27/2018 | 10:44:16 | 5.41      | 129.73   | 0.58      | 19.75  | 0.70    |
| 4/27/2018 | 10:45:16 | 5.41      | 128.65   | 0.54      | 19.76  | 0.70    |
| 4/27/2018 | 10:46:16 | 5.41      | 128.20   | 0.51      | 19.75  | 0.70    |
| 4/27/2018 | 10:47:16 | 5.62      | 129.88   | 0.58      | 19.75  | 0.71    |
| 4/27/2018 | 10:48:16 | 5.46      | 129.35   | 0.63      | 19.75  | 0.71    |
| 4/27/2018 | 10:49:16 | 5.67      | 129.25   | 0.55      | 19.75  | 0.71    |
| 4/27/2018 | 10:50:16 | 5.51      | 130.32   | 0.50      | 19.76  | 0.71    |
| 4/27/2018 | 10:51:16 | 5.40      | 128.84   | 0.55      | 19.75  | 0.71    |
| 4/27/2018 | 10:52:16 | 5.41      | 128.89   | 0.59      | 19.76  | 0.71    |
| 4/27/2018 | 10:53:16 | 5.46      | 130.10   | 0.56      | 19.76  | 0.71    |
| 4/27/2018 | 10:54:16 | 5.60      | 128.78   | 0.54      | 19.75  | 0.71    |
| 4/27/2018 | 10:55:16 | 5.47      | 128.94   | 0.50      | 19.76  | 0.71    |
| 4/27/2018 | 10:56:16 | 5.45      | 129.73   | 0.49      | 19.76  | 0.71    |
| 4/27/2018 | 10:57:16 | 5.41      | 128.74   | 0.51      | 19.76  | 0.70    |
| 4/27/2018 | 10:58:16 | 5.41      | 128.89   | 0.64      | 19.76  | 0.70    |
| 4/27/2018 | 10:59:16 | 5.41      | 129.16   | 0.55      | 19.76  | 0.70    |
| 4/27/2018 | 11:00:16 | 5.42      | 127.53   | 0.48      | 19.76  | 0.69    |
| 4/27/2018 | 11:01:16 | 5.41      | 128.67   | 0.50      | 19.76  | 0.69    |
| 4/27/2018 | 11:02:16 | 5.43      | 128.98   | 0.57      | 19.76  | 0.69    |
| 4/27/2018 | 11:03:16 | 5.42      | 128.42   | 0.58      | 19.76  | 0.69    |

19.75 S2

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #1**

| Date          | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|---------------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018     | 11:04:16 | 5.41      | 129.01   | 0.52      | 19.76  | 0.69    |
| 4/27/2018     | 11:05:16 | 5.42      | 128.67   | 0.59      | 19.76  | 0.70    |
| 4/27/2018     | 11:06:16 | 5.41      | 127.58   | 0.60      | 19.76  | 0.70    |
| 4/27/2018     | 11:07:16 | 5.42      | 129.06   | 0.58      | 19.76  | 0.70    |
| 4/27/2018     | 11:08:16 | 5.42      | 128.94   | 0.59      | 19.76  | 0.70    |
| 4/27/2018     | 11:09:16 | 5.41      | 127.72   | 0.60      | 19.76  | 0.70    |
| 4/27/2018     | 11:10:16 | 5.41      | 127.98   | 0.47      | 19.76  | 0.70    |
| 4/27/2018     | 11:11:16 | 5.43      | 127.15   | 0.45      | 19.76  | 0.70    |
| 4/27/2018     | 11:12:16 | 5.42      | 126.27   | 0.47      | 19.75  | 0.71    |
| 4/27/2018     | 11:13:16 | 5.42      | 127.85   | 0.51      | 19.75  | 0.71    |
| 4/27/2018     | 11:14:16 | 5.41      | 127.03   | 0.52      | 19.75  | 0.71    |
| 4/27/2018     | 11:15:16 | 5.41      | 127.01   | 0.37      | 19.75  | 0.71    |
| 4/27/2018     | 11:16:16 | 5.42      | 128.48   | 0.55      | 19.76  | 0.71    |
| 4/27/2018     | 11:17:16 | 5.42      | 128.15   | 0.56      | 19.76  | 0.71    |
| 4/27/2018     | 11:18:16 | 5.43      | 127.73   | 0.50      | 19.76  | 0.71    |
| 4/27/2018     | 11:19:16 | 5.42      | 128.88   | 0.43      | 19.76  | 0.70    |
| 4/27/2018     | 11:20:16 | 5.43      | 127.40   | 0.44      | 19.76  | 0.71    |
| 4/27/2018     | 11:21:16 | 5.42      | 127.05   | 0.55      | 19.76  | 0.70    |
| 4/27/2018     | 11:22:16 | 5.43      | 127.70   | 0.54      | 19.75  | 0.70    |
| 4/27/2018     | 11:23:16 | 5.42      | 127.06   | 0.54      | 19.76  | 0.70    |
| 4/27/2018     | 11:24:16 | 5.42      | 127.98   | 0.55      | 19.76  | 0.69    |
| 4/27/2018     | 11:25:16 | 5.43      | 128.29   | 0.55      | 19.75  | 0.69    |
| 4/27/2018     | 11:26:16 | 5.42      | 126.99   | 0.33      | 19.76  | 0.69    |
| 4/27/2018     | 11:27:16 | 5.42      | 129.63   | 0.48      | 19.76  | 0.70    |
| 4/27/2018     | 11:28:16 | 5.47      | 129.25   | 0.53      | 19.76  | 0.69    |
| 4/27/2018     | 11:29:16 | 5.42      | 127.99   | 0.54      | 19.76  | 0.70    |
| 4/27/2018     | 11:30:16 | 5.42      | 128.76   | 0.55      | 19.76  | 0.70    |
| 4/27/2018     | 11:31:16 | 5.42      | 127.46   | 0.66      | 19.76  | 0.70    |
| 4/27/2018     | 11:32:16 | 5.42      | 127.50   | 0.57      | 19.76  | 0.70    |
| 4/27/2018     | 11:33:16 | 5.42      | 128.40   | 0.59      | 19.76  | 0.70    |
| 4/27/2018     | 11:34:16 | 5.43      | 127.50   | 0.59      | 19.76  | 0.70    |
| 4/27/2018     | 11:35:16 | 5.44      | 126.73   | 0.59      | 19.77  | 0.71    |
| 4/27/2018     | 11:36:16 | 5.43      | 127.47   | 0.56      | 19.76  | 0.71    |
| 4/27/2018     | 11:37:16 | 5.43      | 126.77   | 0.45      | 19.77  | 0.71    |
| 4/27/2018     | 11:38:16 | 5.43      | 127.84   | 0.49      | 19.77  | 0.71    |
| 4/27/2018     | 11:39:16 | 5.44      | 128.01   | 0.43      | 19.77  | 0.71    |
| 4/27/2018     | 11:40:16 | 5.44      | 126.63   | 0.46      | 19.77  | 0.71    |
| 4/27/2018     | 11:41:16 | 5.44      | 128.54   | 0.52      | 19.77  | 0.71    |
| Final average |          | 5.44      | 128.68   | 0.55      | 19.74  | 0.70    |

19.76 S3

**Hollingsworth & Vose**  
**CFU 114**  
**4/27/2018**  
**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 11:42:46 | 5.45      | 114.73   | 0.48      | 14.94  | 5.36    |           |          |           |        |         |
| 4/27/2018 | 11:42:56 | 5.33      | 95.98    | 0.48      | 14.83  | 5.45    |           |          |           |        |         |
| 4/27/2018 | 11:43:06 | 4.13      | 78.66    | 0.49      | 14.81  | 5.47    |           |          |           |        |         |
| 4/27/2018 | 11:43:16 | 3.1       | 68.38    | 0.54      | 14.81  | 5.47    |           |          |           |        |         |
| 4/27/2018 | 11:43:26 | 3.08      | 63.7     | 0.54      | 14.81  | 5.48    |           |          |           |        |         |
| 4/27/2018 | 11:43:36 | 2.81      | 62.52    | 0.54      | 14.81  | 5.49    |           |          |           |        |         |
| 4/27/2018 | 11:43:46 | 2.81      | 62.22    | 0.54      | 15.21  | 5.08    |           |          |           |        |         |
| 4/27/2018 | 11:43:56 | 2.82      | 62.08    | 0.54      | 12.06  | 8.08    |           |          |           |        |         |
| 4/27/2018 | 11:44:06 | 2.84      | 55.48    | 0.54      | 13.64  | 6.62    |           |          |           |        |         |
| 4/27/2018 | 11:44:16 | 3.05      | 49.28    | 0.54      | 6.71   | 2.42    |           |          |           |        |         |
| 4/27/2018 | 11:44:26 | 2.75      | 51.33    | 0.08      | 0.84   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 11:44:36 | 3.68      | 64.04    | 0.03      | 0.13   | 0.14    |           |          |           |        |         |
| 4/27/2018 | 11:44:46 | 17.67     | 79.32    | 0.03      | 0.05   | 0.1     |           |          |           |        |         |
| 4/27/2018 | 11:44:56 | 29.05     | 89.98    | 0.03      | 0.03   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 11:45:06 | 55.8      | 94.95    | 0.03      | 0.02   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 11:45:16 | 82.21     | 96.87    | 0.03      | 0.01   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 11:45:26 | 86.19     | 97.53    | 0.03      | 0.01   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 11:45:36 | 91.17     | 98.77    | 0.21      | 0.02   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 11:45:46 | 93.56     | 100.57   | 0.33      | 8.86   | 0.37    |           |          |           |        |         |
| 4/27/2018 | 11:45:56 | 93.59     | 104.3    | 0.33      | 10.4   | 0.43    |           |          |           |        |         |
| 4/27/2018 | 11:46:06 | 69.62     | 115.74   | 0.33      | 9.77   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 11:46:16 | 49.98     | 126.99   | 0.33      | 9.75   | 0.4     |           |          |           |        |         |
| 4/27/2018 | 11:46:26 | 62.83     | 128.28   | 0.33      | 9.74   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 11:46:36 | 75.37     | 122      | 0.33      | 9.74   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 11:46:46 | 63.68     | 115.24   | 0.33      | 9.74   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 11:46:56 | 50.21     | 112.23   | 0.32      | 9.74   | 0.39    |           |          |           |        |         |
| 4/27/2018 | 11:47:06 | 50.19     | 112.83   | 0.32      | 9.58   | 0.39    |           |          |           |        |         |



**Hollingsworth & Vose**  
**CFU 114**  
**4/27/2018**  
**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 11:47:16 | 50        | 113.24   | 0.32      | 2.21   | 0.13    |           |          |           |        |         |
| 4/27/2018 | 11:47:26 | 47.58     | 111.08   | 0.32      | 0.23   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 11:47:36 | 45.4      | 106.99   | 0.32      | 0.03   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:47:46 | 71.61     | 103.45   | 0.32      | 0.01   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:47:56 | 97.65     | 100.86   | 0.32      | 0      | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:48:06 | 98.88     | 99.36    | 0.07      | 0      | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:48:16 | 100.26    | 98.89    | 0.07      | 0      | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:48:26 | 100.25    | 98.8     | 0.07      | 0      | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:48:36 | 100.24    | 98.52    | 0.07      | 0      | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:48:46 | 100.27    | 99.78    | 0.07      | 0      | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:48:56 | 100.26    | 101.46   | 0.07      | 0      | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:49:06 | 100.24    | 101.84   | 0.07      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:49:16 | 99.97     | 101.01   | 0.22      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:49:26 | 100.02    | 100.51   | 0.28      | -0.01  | 0.04    |           | 101.12   |           | -0.01  | 0.05    |
| 4/27/2018 | 11:49:36 | 100.23    | 99.41    | 0.28      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:49:46 | 99.97     | 99.02    | 0.28      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:49:56 | 99.97     | 98.84    | 0.28      | 1.29   | 0.1     |           |          |           |        |         |
| 4/27/2018 | 11:50:06 | 100.37    | 91.3     | 0.28      | 2.34   | 0.13    |           |          |           |        |         |
| 4/27/2018 | 11:50:16 | 99.28     | 71.24    | 0.28      | 4.76   | 0.2     |           |          |           |        |         |
| 4/27/2018 | 11:50:26 | 51.95     | 51.09    | 0.18      | 5.67   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 11:50:36 | 8.85      | 38.85    | 0.03      | 0.9    | 0.08    |           |          |           |        |         |
| 4/27/2018 | 11:50:46 | 7.36      | 29.32    | 0.03      | 0.84   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 11:50:56 | 2.98      | 18.93    | 0.03      | 0.86   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 11:51:06 | 1.78      | 10.07    | 0.03      | 0.86   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 11:51:16 | 0.63      | 5.79     | 0.03      | 1.76   | 0.1     |           |          |           |        |         |
| 4/27/2018 | 11:51:26 | 0.59      | 7.9      | 0.03      | 14.3   | 0.53    |           |          |           |        |         |
| 4/27/2018 | 11:51:36 | 0.54      | 27.8     | 0.07      | 19.08  | 0.68    |           |          |           |        |         |

**Hollingsworth & Vose**  
**CFU 114**  
**4/27/2018**  
**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 11:51:46 | 2.69      | 63.19    | 0.4       | 19.63  | 0.69    |           |          |           |        |         |
| 4/27/2018 | 11:51:56 | 4.29      | 97.52    | 0.4       | 19.7   | 0.69    |           |          |           |        |         |
| 4/27/2018 | 11:52:06 | 4.93      | 118.29   | 0.4       | 12.35  | 0.45    |           |          |           |        |         |
| 4/27/2018 | 11:52:16 | 5.67      | 113.4    | 0.4       | 2.25   | 0.11    |           |          |           |        |         |
| 4/27/2018 | 11:52:26 | 4.81      | 84.46    | 0.4       | 1.84   | 0.12    |           |          |           |        |         |
| 4/27/2018 | 11:52:36 | 4.08      | 49.42    | 0.4       | 0.96   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 11:52:46 | 2.61      | 23.66    | 0.4       | 0.14   | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:52:56 | 1.38      | 9.68     | 0.34      | 0.05   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:53:06 | 5.84      | 4.02     | 0.32      | 0.01   | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:53:16 | 9.58      | 2.72     | 0.32      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:53:26 | 9.61      | 3.75     | 0.32      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:53:36 | 9.86      | 5.46     | 0.32      | -0.01  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:53:46 | 9.86      | 6.02     | 0.32      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:53:56 | 9.84      | 6.02     | 0.32      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:54:06 | 9.55      | 5.09     | 0.33      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:54:16 | 9.2       | 4.34     | 0.35      | -0.01  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:54:26 | 8.94      | 3.91     | 0.35      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:54:36 | 8.69      | 3.64     | 0.35      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:54:46 | 8.41      | 3.33     | 0.35      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:54:56 | 8.11      | 4.04     | 0.35      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:55:06 | 8.06      | 5.58     | 0.35      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:55:16 | 7.8       | 6.05     | 0.35      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:55:26 | 7.81      | 5.73     | 0.33      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:55:36 | 7.53      | 4.97     | 0.33      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:55:46 | 7.5       | 4.45     | 0.33      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:55:56 | 7.24      | 4.01     | 0.33      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:56:06 | 7.21      | 3.64     | 0.33      | -0.02  | 0.06    |           |          |           |        |         |

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**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 11:56:16 | 6.91      | 3.41     | 0.33      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:56:26 | 6.91      | 4.38     | 0.33      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:56:36 | 6.87      | 5.47     | 0.04      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:56:46 | 6.61      | 6        | 0.01      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:56:56 | 6.63      | 5.62     | 0.01      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:57:06 | 6.61      | 5.26     | 0.01      | -0.03  | 0.07    |           |          |           |        |         |
| 4/27/2018 | 11:57:16 | 6.61      | 4.41     | 0.01      | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:57:26 | 6.59      | 3.81     | 0.01      | -0.03  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:57:36 | 6.35      | 3.67     | 0.01      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:57:46 | 6.34      | 3.74     | 0.21      | -0.02  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:57:56 | 6.34      | 4.33     | 0.35      | -0.02  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:58:06 | 6.33      | 5.48     | 0.35      | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:58:16 | 6.29      | 5.7      | 0.35      | -0.03  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:58:26 | 5.7       | 5.1      | 0.35      | -0.03  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:58:36 | 5.12      | 3.8      | 0.35      | -0.03  | 0.05    |           |          |           |        |         |
| 4/27/2018 | 11:58:46 | 4.86      | 3.16     | 0.35      | -0.03  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:58:56 | 4.86      | 2.94     | 0.26      | -0.03  | 0.06    |           |          |           |        |         |
| 4/27/2018 | 11:59:06 | 4.86      | 2.55     | 0.05      | -0.03  | 0.07    |           |          |           |        |         |
| 4/27/2018 | 11:59:16 | 4.86      | 2.48     | 0.05      | -0.03  | 0.06    | 4.86      |          |           |        |         |
| 4/27/2018 | 11:59:26 | 4.85      | 3.31     | 0.05      | 2.77   | 0.15    |           |          |           |        |         |
| 4/27/2018 | 11:59:36 | 4.84      | 10.09    | 0.05      | 13.92  | 0.66    |           |          |           |        |         |
| 4/27/2018 | 11:59:46 | 4.85      | 30.89    | 0.05      | 14.24  | 4.43    |           |          |           |        |         |
| 4/27/2018 | 11:59:56 | 4.87      | 52.71    | 0.05      | 14.69  | 5.29    |           |          |           |        |         |
| 4/27/2018 | 12:00:06 | 5.2       | 63.76    | 0.05      | 14.77  | 5.41    |           |          |           |        |         |
| 4/27/2018 | 12:00:16 | 5.64      | 64.97    | 0.29      | 14.78  | 5.43    |           |          |           |        |         |
| 4/27/2018 | 12:00:26 | 4.44      | 63.4     | 0.29      | 14.78  | 5.44    |           |          |           |        |         |
| 4/27/2018 | 12:00:36 | 3.37      | 61.53    | 0.29      | 15.56  | 4.7     |           |          |           |        |         |

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**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 12:00:46 | 3.08      | 62.04    | 0.29      | 12.64  | 7.53    |           |          |           |        |         |
| 4/27/2018 | 12:00:56 | 2.99      | 57.06    | 0.29      | 10.3   | 9.83    |           |          |           |        |         |
| 4/27/2018 | 12:01:06 | 2.18      | 42.08    | 0.29      | 9.96   | 9.99    |           |          |           |        |         |
| 4/27/2018 | 12:01:16 | 1.79      | 23.17    | 0.29      | 9.93   | 10.01   |           |          |           |        |         |
| 4/27/2018 | 12:01:26 | 0.82      | 8.58     | 0.26      | 9.93   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 12:01:36 | 0.03      | 1.21     | 0.24      | 9.92   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 12:01:46 | 0.03      | -1.92    | 0.24      | 9.93   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 12:01:56 | 0.03      | -2.83    | 0.24      | 9.93   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 12:02:06 | 0.02      | -3.2     | 0.24      | 9.93   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 12:02:16 | 0.02      | -3.37    | 0.24      | 9.93   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 12:02:26 | 0.01      | -3.06    | 0.24      | 9.93   | 10.04   | 0.02      | -3.21    | 0.24      | 9.93   |         |
| 4/27/2018 | 12:02:36 | 0         | -2.08    | 0.26      | 9.93   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 12:02:46 | 0.01      | -0.92    | 0.29      | 8.35   | 8.42    |           |          |           |        |         |
| 4/27/2018 | 12:02:56 | 0.03      | -0.61    | 0.29      | 2.61   | 1.9     |           |          |           |        |         |
| 4/27/2018 | 12:03:06 | 0.04      | 0.38     | 0.29      | 2.01   | 1.94    |           |          |           |        |         |
| 4/27/2018 | 12:03:16 | 0.03      | 0.99     | 0.29      | 1.97   | 2       |           |          |           |        |         |
| 4/27/2018 | 12:03:26 | 0.03      | 0.07     | 0.29      | 1.95   | 1.99    |           |          |           |        |         |
| 4/27/2018 | 12:03:36 | 0.03      | -1.05    | 0.29      | 1.94   | 1.99    |           |          |           |        |         |
| 4/27/2018 | 12:03:46 | 0.03      | -1.99    | 0.29      | 1.94   | 1.98    |           |          |           |        |         |
| 4/27/2018 | 12:03:56 | 0.02      | -2.41    | 0.25      | 1.94   | 1.97    |           |          |           |        |         |
| 4/27/2018 | 12:04:06 | 0.03      | -1.46    | 0.25      | 1.94   | 1.97    |           |          |           |        |         |
| 4/27/2018 | 12:04:16 | 0.03      | -0.1     | 0.25      | 1.94   | 1.97    |           |          |           |        | 1.97    |
| 4/27/2018 | 12:04:26 | 0.03      | 0.19     | 0.25      | 1.94   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 12:04:36 | 0.03      | -0.57    | 0.25      | 1.94   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 12:04:46 | 0.02      | -0.62    | 0.25      | 8.05   | 1.58    |           |          |           |        |         |
| 4/27/2018 | 12:04:56 | 0.08      | 10.31    | 0.25      | 17.93  | 0.85    |           |          |           |        |         |
| 4/27/2018 | 12:05:06 | 0.65      | 39.42    | 0.33      | 9.31   | 0.78    |           |          |           |        |         |

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**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 12:05:16 | 1.25      | 60.8     | 0.35      | 13.69  | 0.36    |           |          |           |        |         |
| 4/27/2018 | 12:05:26 | 1.64      | 55.34    | 0.35      | 20.69  | 0.27    |           |          |           |        |         |
| 4/27/2018 | 12:05:36 | 2.66      | 33.59    | 0.35      | 20.81  | 0.26    |           |          |           |        |         |
| 4/27/2018 | 12:05:46 | 1.33      | 14.29    | 0.35      | 20.79  | 0.26    |           |          |           |        |         |
| 4/27/2018 | 12:05:56 | -0.26     | 4.53     | 0.35      | 20.81  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:06:06 | -0.27     | 1.4      | 0.35      | 20.81  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:06:16 | -0.27     | 0.13     | 0.34      | 20.81  | 0.26    |           |          |           |        |         |
| 4/27/2018 | 12:06:26 | -0.27     | -0.93    | 0.33      | 20.81  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:06:36 | -0.26     | -1.41    | 0.33      | 20.81  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:06:46 | -0.28     | -1.56    | 0.33      | 20.81  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:06:56 | -0.27     | -1.6     | 0.33      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:07:06 | -0.26     | -0.96    | 0.33      | 20.81  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:07:16 | -0.27     | 0.68     | 0.33      | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:07:26 | -0.27     | 0.9      | 0.4       | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:07:36 | -0.27     | 0.42     | 0.67      | 20.8   | 0.26    |           |          |           |        |         |
| 4/27/2018 | 12:07:46 | -0.26     | -0.29    | 0.67      | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:07:56 | -0.26     | -1.03    | 0.67      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:08:06 | -0.26     | -1.25    | 0.67      | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:08:16 | -0.27     | -1.45    | 0.67      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:08:26 | -0.24     | -1.67    | 0.67      | 20.79  | 0.26    |           |          |           |        |         |
| 4/27/2018 | 12:08:36 | -0.27     | -0.93    | 0.67      | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:08:46 | -0.27     | 0.31     | 1.9       | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:08:56 | -0.27     | 0.89     | 2.04      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:09:06 | -0.27     | 0.42     | 2.04      | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:09:16 | -0.26     | -0.18    | 2.04      | 20.81  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:09:26 | -0.26     | -0.6     | 2.04      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:09:36 | -0.27     | -1.18    | 2.04      | 20.8   | 0.24    |           |          |           |        |         |

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**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 12:09:46 | -0.26     | -1.53    | 2.04      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:09:56 | -0.26     | -1.56    | 2.01      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:10:06 | -0.25     | -1.34    | 1.99      | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:10:16 | -0.26     | -0.29    | 1.99      | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:10:26 | -0.27     | 0.98     | 1.99      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:10:36 | -0.28     | 0.87     | 1.99      | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:10:46 | -0.27     | 0.1      | 1.99      | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:10:56 | -0.28     | -0.76    | 1.99      | 20.8   | 0.22    |           |          |           |        |         |
| 4/27/2018 | 12:11:06 | -0.26     | -1.09    | 1.99      | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:11:16 | -0.27     | -1.54    | 2         | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:11:26 | -0.27     | -1.65    | 2         | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:11:36 | -0.27     | -1.57    | 2         | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:11:46 | -0.26     | -0.08    | 2         | 20.8   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:11:56 | -0.26     | 0.91     | 2         | 20.8   | 0.22    |           |          |           |        |         |
| 4/27/2018 | 12:12:06 | -0.27     | 0.83     | 2         | 20.8   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:12:16 | -0.27     | 0.05     | 2         | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:12:26 | -0.26     | -0.45    | 2.01      | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:12:36 | -0.25     | -1.11    | 2.01      | 20.8   | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:12:46 | -0.28     | -1.43    | 2.01      | 20.8   | 0.22    |           |          |           |        |         |
| 4/27/2018 | 12:12:56 | -0.27     | -1.63    | 2.01      | 20.79  | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:13:06 | -0.26     | -1.25    | 2.01      | 20.79  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:13:16 | -0.27     | -0.32    | 2.01      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:13:26 | -0.26     | 0.79     | 2.01      | 20.79  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:13:36 | -0.25     | 0.94     | 2.04      | 20.79  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:13:46 | -0.27     | 0.2      | 2.05      | 20.79  | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:13:56 | -0.27     | -0.68    | 2.05      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:14:06 | -0.26     | -1.09    | 2.05      | 20.79  | 0.23    |           |          |           |        |         |

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**Run #1 Post Cal Check**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 12:14:16 | -0.26     | -1.35    | 2.05      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:14:26 | -0.27     | -1.61    | 2.05      | 20.79  | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:14:36 | -0.25     | -1.84    | 2.05      | 20.78  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:14:46 | -0.26     | -0.45    | 2.04      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:14:56 | -0.26     | 0.73     | 2.04      | 20.79  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:15:06 | -0.26     | 0.93     | 2.04      | 20.78  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:15:16 | -0.26     | 0.35     | 2.04      | 20.78  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:15:26 | -0.27     | -0.39    | 2.04      | 20.78  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:15:36 | -0.26     | -1.13    | 2.04      | 20.79  | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:15:46 | -0.29     | -1.46    | 2.04      | 20.79  | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:15:56 | -0.26     | -1.63    | 2.03      | 20.8   | 0.22    |           |          |           |        |         |
| 4/27/2018 | 12:16:06 | -0.26     | -1.76    | 1.97      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:16:16 | -0.28     | -0.78    | 1.97      | 20.79  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:16:26 | -0.28     | 0.52     | 1.97      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:16:36 | -0.29     | 1.1      | 1.97      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:16:46 | -0.26     | 0.39     | 1.97      | 20.79  | 0.23    |           |          |           |        |         |
| 4/27/2018 | 12:16:56 | -0.26     | -0.09    | 1.97      | 20.78  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:17:06 | -0.25     | -0.95    | 1.97      | 20.78  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:17:16 | -0.27     | -1.36    | 1.97      | 20.79  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:17:26 | -0.26     | -1.64    | 1.97      | 20.78  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:17:36 | -0.27     | -1.53    | 1.97      | 20.77  | 0.26    |           |          |           |        |         |
| 4/27/2018 | 12:17:46 | -0.26     | -1.23    | 1.97      | 20.78  | 0.24    |           |          |           |        |         |
| 4/27/2018 | 12:17:56 | -0.27     | 0.17     | 1.97      | 20.78  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:18:06 | -0.26     | 1.07     | 1.97      | 20.77  | 0.23    |           |          | 1.97      |        |         |
| 4/27/2018 | 12:18:16 | -0.26     | 0.53     | 1.97      | 20.78  | 0.25    |           |          |           |        |         |
| 4/27/2018 | 12:18:26 | -0.26     | 0.02     | 2.01      | 20.78  | 0.23    |           |          |           |        |         |

**Hollingsworth & Vose**  
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**4/27/2018**  
**Run #2**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 12:53:15 | 5.44      | 126.49   | 0.54      | 19.74  | 0.70    |
| 4/27/2018 | 12:54:15 | 5.42      | 126.63   | 0.56      | 19.74  | 0.70    |
| 4/27/2018 | 12:55:15 | 5.44      | 125.66   | 0.57      | 19.74  | 0.70    |
| 4/27/2018 | 12:56:15 | 5.42      | 127.18   | 0.59      | 19.74  | 0.70    |
| 4/27/2018 | 12:57:15 | 5.43      | 126.46   | 0.55      | 19.74  | 0.71    |
| 4/27/2018 | 12:58:15 | 5.43      | 125.83   | 0.56      | 19.75  | 0.71    |
| 4/27/2018 | 12:59:15 | 5.43      | 126.26   | 0.56      | 19.75  | 0.72    |
| 4/27/2018 | 13:00:15 | 5.43      | 125.93   | 0.56      | 19.75  | 0.72    |
| 4/27/2018 | 13:01:15 | 5.43      | 125.96   | 0.59      | 19.75  | 0.71    |
| 4/27/2018 | 13:02:15 | 5.42      | 127.03   | 0.51      | 19.75  | 0.71    |
| 4/27/2018 | 13:03:15 | 5.43      | 127.54   | 0.56      | 19.74  | 0.71    |
| 4/27/2018 | 13:04:15 | 5.43      | 127.73   | 0.52      | 19.74  | 0.71    |
| 4/27/2018 | 13:05:15 | 5.42      | 128.01   | 0.49      | 19.75  | 0.71    |
| 4/27/2018 | 13:06:15 | 5.43      | 126.92   | 0.52      | 19.74  | 0.71    |
| 4/27/2018 | 13:07:15 | 5.43      | 127.00   | 0.48      | 19.75  | 0.71    |
| 4/27/2018 | 13:08:15 | 5.43      | 128.27   | 0.51      | 19.75  | 0.70    |
| 4/27/2018 | 13:09:15 | 5.43      | 126.86   | 0.49      | 19.74  | 0.70    |
| 4/27/2018 | 13:10:15 | 5.43      | 127.60   | 0.51      | 19.74  | 0.70    |
| 4/27/2018 | 13:11:15 | 5.42      | 127.16   | 0.54      | 19.74  | 0.70    |
| 4/27/2018 | 13:12:15 | 5.42      | 126.31   | 0.53      | 19.75  | 0.70    |
| 4/27/2018 | 13:13:15 | 5.42      | 126.62   | 0.50      | 19.75  | 0.70    |
| 4/27/2018 | 13:14:15 | 5.42      | 126.30   | 0.57      | 19.75  | 0.70    |
| 4/27/2018 | 13:15:15 | 5.43      | 125.34   | 0.46      | 19.75  | 0.70    |
| 4/27/2018 | 13:16:15 | 5.42      | 126.79   | 0.42      | 19.75  | 0.70    |
| 4/27/2018 | 13:17:15 | 5.42      | 126.47   | 0.52      | 19.75  | 0.70    |
| 4/27/2018 | 13:18:15 | 5.42      | 125.41   | 0.48      | 19.75  | 0.70    |
| 4/27/2018 | 13:19:15 | 5.42      | 127.02   | 0.45      | 19.75  | 0.70    |
| 4/27/2018 | 13:20:15 | 5.41      | 126.31   | 0.43      | 19.75  | 0.71    |
| 4/27/2018 | 13:21:15 | 5.41      | 126.02   | 0.42      | 19.75  | 0.71    |
| 4/27/2018 | 13:22:15 | 5.42      | 126.93   | 0.41      | 19.75  | 0.72    |
| 4/27/2018 | 13:23:15 | 5.42      | 126.10   | 0.39      | 19.75  | 0.72    |
| 4/27/2018 | 13:24:15 | 5.42      | 125.40   | 0.47      | 19.75  | 0.71    |
| 4/27/2018 | 13:25:15 | 5.42      | 126.55   | 0.52      | 19.75  | 0.72    |
| 4/27/2018 | 13:26:15 | 5.42      | 124.99   | 0.52      | 19.75  | 0.71    |
| 4/27/2018 | 13:27:15 | 5.42      | 125.22   | 0.52      | 19.75  | 0.71    |
| 4/27/2018 | 13:28:15 | 5.42      | 126.43   | 0.52      | 19.75  | 0.71    |
| 4/27/2018 | 13:29:15 | 5.41      | 127.57   | 0.49      | 19.75  | 0.71    |
| 4/27/2018 | 13:30:15 | 5.42      | 126.12   | 0.58      | 19.75  | 0.71    |
| 4/27/2018 | 13:31:15 | 5.43      | 126.38   | 0.60      | 19.75  | 0.71    |
| 4/27/2018 | 13:32:15 | 5.42      | 124.82   | 0.58      | 19.75  | 0.70    |



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**Run #2**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 13:33:15 | 5.41      | 124.18   | 0.58      | 19.75  | 0.70    |
| 4/27/2018 | 13:34:15 | 5.42      | 125.22   | 0.59      | 19.75  | 0.70    |
| 4/27/2018 | 13:35:15 | 5.41      | 125.64   | 0.60      | 19.75  | 0.70    |
| 4/27/2018 | 13:36:15 | 5.43      | 125.79   | 0.57      | 19.75  | 0.70    |
| 4/27/2018 | 13:37:15 | 5.43      | 127.32   | 0.62      | 19.76  | 0.70    |
| 4/27/2018 | 13:38:15 | 5.42      | 128.17   | 0.60      | 19.76  | 0.70    |
| 4/27/2018 | 13:39:15 | 5.41      | 128.76   | 0.54      | 19.76  | 0.70    |
| 4/27/2018 | 13:40:15 | 5.41      | 129.95   | 0.54      | 19.76  | 0.70    |
| 4/27/2018 | 13:41:15 | 5.42      | 128.92   | 0.58      | 19.76  | 0.70    |
| 4/27/2018 | 13:42:15 | 5.41      | 126.55   | 0.55      | 19.76  | 0.71    |
| 4/27/2018 | 13:43:15 | 5.42      | 126.60   | 0.50      | 19.76  | 0.71    |
| 4/27/2018 | 13:44:15 | 5.41      | 125.26   | 0.49      | 19.77  | 0.71    |
| 4/27/2018 | 13:45:15 | 5.42      | 123.72   | 0.52      | 19.77  | 0.72    |
| 4/27/2018 | 13:46:15 | 5.41      | 124.23   | 0.47      | 19.77  | 0.72    |
| 4/27/2018 | 13:47:15 | 5.41      | 124.43   | 0.50      | 19.77  | 0.72    |
| 4/27/2018 | 13:48:15 | 5.41      | 124.86   | 0.40      | 19.77  | 0.72    |
| 4/27/2018 | 13:49:15 | 5.41      | 124.61   | 0.45      | 19.77  | 0.72    |
| 4/27/2018 | 13:50:15 | 5.42      | 125.54   | 0.55      | 19.77  | 0.72    |
| 4/27/2018 | 13:51:15 | 5.40      | 125.47   | 0.58      | 19.77  | 0.71    |
| 4/27/2018 | 13:52:15 | 5.40      | 124.28   | 0.53      | 19.77  | 0.71    |
| 4/27/2018 | 13:53:15 | 5.41      | 124.58   | 0.46      | 19.77  | 0.71    |
| 4/27/2018 | 13:54:15 | 5.40      | 126.18   | 0.44      | 19.76  | 0.71    |
| 4/27/2018 | 13:55:15 | 5.39      | 127.00   | 0.45      | 19.76  | 0.71    |
| 4/27/2018 | 13:56:15 | 5.40      | 126.29   | 0.45      | 19.77  | 0.71    |
| 4/27/2018 | 13:57:15 | 5.40      | 126.44   | 0.35      | 19.76  | 0.70    |
| 4/27/2018 | 13:58:15 | 5.39      | 127.50   | 0.46      | 19.77  | 0.70    |
| 4/27/2018 | 13:59:15 | 5.40      | 127.00   | 0.48      | 19.77  | 0.70    |
| 4/27/2018 | 14:00:15 | 5.39      | 125.34   | 0.48      | 19.77  | 0.70    |
| 4/27/2018 | 14:01:15 | 5.39      | 125.20   | 0.44      | 19.77  | 0.70    |
| 4/27/2018 | 14:02:15 | 5.39      | 125.20   | 0.41      | 19.77  | 0.71    |
| 4/27/2018 | 14:03:15 | 5.40      | 125.23   | 0.47      | 19.77  | 0.71    |
| 4/27/2018 | 14:04:15 | 5.39      | 126.66   | 0.49      | 19.77  | 0.71    |
| 4/27/2018 | 14:05:15 | 5.39      | 127.28   | 0.52      | 19.77  | 0.71    |
| 4/27/2018 | 14:06:15 | 5.40      | 126.70   | 0.45      | 19.76  | 0.71    |
| 4/27/2018 | 14:07:15 | 5.41      | 126.91   | 0.39      | 19.76  | 0.71    |
| 4/27/2018 | 14:08:15 | 5.41      | 128.09   | 0.53      | 19.76  | 0.72    |
| 4/27/2018 | 14:09:15 | 5.40      | 128.08   | 0.54      | 19.76  | 0.72    |
| 4/27/2018 | 14:10:15 | 5.40      | 127.03   | 0.44      | 19.77  | 0.72    |
| 4/27/2018 | 14:11:15 | 5.40      | 128.30   | 0.42      | 19.76  | 0.72    |
| 4/27/2018 | 14:12:15 | 5.40      | 128.64   | 0.45      | 19.77  | 0.72    |

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**Run #2**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 14:13:15 | 5.40      | 128.12   | 0.48      | 19.77  | 0.72    |
| 4/27/2018 | 14:14:15 | 5.41      | 127.45   | 0.45      | 19.77  | 0.72    |
| 4/27/2018 | 14:15:15 | 5.40      | 128.14   | 0.48      | 19.77  | 0.72    |
| 4/27/2018 | 14:16:15 | 5.40      | 127.95   | 0.35      | 19.78  | 0.72    |
| 4/27/2018 | 14:17:15 | 5.39      | 127.14   | 0.37      | 19.77  | 0.71    |
| 4/27/2018 | 14:18:15 | 5.41      | 127.20   | 0.44      | 19.78  | 0.72    |
| 4/27/2018 | 14:19:15 | 5.55      | 128.63   | 0.45      | 19.78  | 0.72    |
| 4/27/2018 | 14:20:15 | 5.69      | 129.09   | 0.44      | 19.78  | 0.71    |
| 4/27/2018 | 14:21:15 | 5.70      | 128.47   | 0.49      | 19.78  | 0.71    |
| 4/27/2018 | 14:22:15 | 5.45      | 127.01   | 0.49      | 19.78  | 0.71    |
| 4/27/2018 | 14:23:15 | 5.41      | 125.89   | 0.45      | 19.78  | 0.71    |
| 4/27/2018 | 14:24:15 | 5.40      | 124.82   | 0.40      | 19.78  | 0.71    |
| 4/27/2018 | 14:25:15 | 5.41      | 124.60   | 0.36      | 19.78  | 0.71    |
| 4/27/2018 | 14:26:15 | 5.41      | 128.09   | 0.53      | 19.78  | 0.71    |
| 4/27/2018 | 14:27:15 | 5.41      | 128.55   | 0.39      | 19.78  | 0.71    |
| 4/27/2018 | 14:28:15 | 5.41      | 128.16   | 0.42      | 19.78  | 0.71    |
| 4/27/2018 | 14:29:15 | 5.41      | 127.80   | 0.49      | 19.78  | 0.71    |
| 4/27/2018 | 14:30:15 | 5.41      | 128.50   | 0.49      | 19.78  | 0.71    |
| 4/27/2018 | 14:31:15 | 5.41      | 128.01   | 0.45      | 19.78  | 0.72    |
| 4/27/2018 | 14:32:15 | 5.42      | 126.65   | 0.39      | 19.78  | 0.72    |
| 4/27/2018 | 14:33:15 | 5.41      | 127.78   | 0.44      | 19.78  | 0.73    |
| 4/27/2018 | 14:34:15 | 5.41      | 127.59   | 0.43      | 19.78  | 0.72    |
| 4/27/2018 | 14:35:15 | 5.41      | 126.52   | 0.39      | 19.78  | 0.73    |
| 4/27/2018 | 14:36:15 | 5.41      | 127.37   | 0.39      | 19.78  | 0.72    |
| 4/27/2018 | 14:37:15 | 5.42      | 130.00   | 0.29      | 19.78  | 0.72    |
| 4/27/2018 | 14:38:15 | 5.42      | 130.33   | 0.49      | 19.78  | 0.73    |
| 4/27/2018 | 14:39:15 | 5.41      | 128.43   | 0.39      | 19.78  | 0.73    |
| 4/27/2018 | 14:40:15 | 5.41      | 128.51   | 0.35      | 19.78  | 0.72    |
| 4/27/2018 | 14:41:15 | 5.42      | 128.25   | 0.42      | 19.78  | 0.72    |
| 4/27/2018 | 14:42:15 | 5.40      | 127.87   | 0.37      | 19.78  | 0.72    |
| 4/27/2018 | 14:43:15 | 5.41      | 126.86   | 0.48      | 19.79  | 0.71    |
| 4/27/2018 | 14:44:15 | 5.41      | 128.19   | 0.52      | 19.78  | 0.71    |
| 4/27/2018 | 14:45:15 | 5.41      | 129.05   | 0.43      | 19.78  | 0.71    |
| 4/27/2018 | 14:46:15 | 5.50      | 128.84   | 0.35      | 19.78  | 0.71    |
| 4/27/2018 | 14:47:15 | 5.40      | 129.51   | 0.39      | 19.78  | 0.71    |
| 4/27/2018 | 14:48:15 | 5.40      | 130.87   | 0.44      | 19.78  | 0.71    |
| 4/27/2018 | 14:49:15 | 5.40      | 128.58   | 0.55      | 19.78  | 0.71    |
| 4/27/2018 | 14:50:15 | 5.41      | 127.11   | 0.54      | 19.78  | 0.71    |
| 4/27/2018 | 14:51:15 | 5.40      | 127.88   | 0.49      | 19.78  | 0.72    |
| 4/27/2018 | 14:52:15 | 5.39      | 128.02   | 0.45      | 19.78  | 0.71    |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #2**

| Date          | Time     | NOx [PPM]   | CO [PPM]      | VOC [PPM]   | O2 [%]       | CO2 [%]     |
|---------------|----------|-------------|---------------|-------------|--------------|-------------|
| 4/27/2018     | 14:53:15 | 5.39        | 127.65        | 0.44        | 19.78        | 0.72        |
| 4/27/2018     | 14:54:15 | 5.40        | 129.44        | 0.49        | 19.77        | 0.72        |
| 4/27/2018     | 14:55:15 | 5.41        | 129.39        | 0.54        | 19.77        | 0.72        |
| 4/27/2018     | 14:56:15 | 5.40        | 129.46        | 0.53        | 19.78        | 0.72        |
| 4/27/2018     | 14:57:15 | 5.40        | 128.32        | 0.51        | 19.77        | 0.73        |
| 4/27/2018     | 14:58:15 | 5.40        | 128.97        | 0.51        | 19.77        | 0.73        |
| 4/27/2018     | 14:59:15 | 5.40        | 129.79        | 0.48        | 19.77        | 0.73        |
| 4/27/2018     | 15:00:15 | 5.40        | 129.36        | 0.51        | 19.77        | 0.73        |
| 4/27/2018     | 15:01:15 | 5.41        | 128.59        | 0.50        | 19.77        | 0.73        |
| Run averages: |          | <b>5.42</b> | <b>127.07</b> | <b>0.48</b> | <b>19.76</b> | <b>0.71</b> |

**Hollingsworth & Vose**  
**CFU 114**  
**4/27/2018**  
**Run #2 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 15:05:55 | 2.77      | 69.32    | 0.51      | 14.85  | 5.45    |           |          |           |        |         |
| 4/27/2018 | 15:06:05 | 2.78      | 66.8     | 0.51      | 14.84  | 5.45    |           |          |           |        |         |
| 4/27/2018 | 15:06:15 | 2.79      | 65.64    | 0.53      | 17.02  | 3.29    |           |          |           |        |         |
| 4/27/2018 | 15:06:25 | 2.78      | 69.26    | 0.64      | 13.59  | 6.56    |           |          |           |        |         |
| 4/27/2018 | 15:06:35 | 2.77      | 68.45    | 0.64      | 10.48  | 9.82    |           |          |           |        |         |
| 4/27/2018 | 15:06:45 | 2.19      | 52.23    | 0.64      | 10     | 9.99    |           |          |           |        |         |
| 4/27/2018 | 15:06:55 | 1.87      | 29.39    | 0.64      | 9.96   | 10.02   |           |          |           |        |         |
| 4/27/2018 | 15:07:05 | 1.21      | 11.39    | 0.64      | 9.95   | 10.02   |           |          |           |        |         |
| 4/27/2018 | 15:07:15 | 0.01      | 2.76     | 0.64      | 9.95   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 15:07:25 | 0.02      | -0.05    | 0.64      | 9.94   | 10.02   |           |          |           |        |         |
| 4/27/2018 | 15:07:35 | 0.02      | -1.56    | 0.41      | 9.94   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 15:07:45 | 0.02      | -2.51    | 0.35      | 9.94   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 15:07:55 | 0.01      | -2.95    | 0.35      | 9.94   | 10.03   |           |          |           |        |         |
| 4/27/2018 | 15:08:05 | 0.02      | -3.44    | 0.35      | 9.94   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 15:08:15 | 0         | -2.81    | 0.35      | 9.94   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 15:08:25 | 0.01      | -1.31    | 0.35      | 9.93   | 10.04   |           |          |           | 9.94   |         |
| 4/27/2018 | 15:08:35 | 0.02      | -0.79    | 0.35      | 9.95   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 15:08:45 | 0.02      | -1.24    | 0.21      | 9.96   | 10.05   |           |          |           |        |         |
| 4/27/2018 | 15:08:55 | 0.02      | -2.23    | 0.07      | 9.96   | 10.04   |           |          |           |        |         |
| 4/27/2018 | 15:09:05 | 0.01      | -2.79    | 0.07      | 9.96   | 10.05   |           |          |           |        |         |
| 4/27/2018 | 15:09:15 | 0.01      | -3.11    | 0.07      | 9.96   | 10.05   |           |          |           |        |         |
| 4/27/2018 | 15:09:25 | 0.02      | -3.02    | 0.07      | 7.96   | 7.83    |           |          |           |        |         |
| 4/27/2018 | 15:09:35 | 0.01      | -1.97    | 0.07      | 2.48   | 1.65    |           |          |           |        |         |
| 4/27/2018 | 15:09:45 | 0.01      | 0.89     | 0.07      | 2.02   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 15:09:55 | 0         | 2.91     | 0.07      | 1.97   | 2.01    |           |          |           |        |         |
| 4/27/2018 | 15:10:05 | 0.02      | 1.87     | 0.05      | 1.95   | 1.99    |           |          |           |        |         |
| 4/27/2018 | 15:10:15 | 0         | 0.2      | 0.05      | 1.95   | 1.98    |           |          |           |        |         |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #2 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 15:10:25 | 0.01      | -1.2     | 0.05      | 1.95   | 1.98    |           |          |           |        |         |
| 4/27/2018 | 15:10:35 | 0.01      | -2.1     | 0.05      | 1.95   | 1.97    |           |          |           |        |         |
| 4/27/2018 | 15:10:45 | 0.03      | -2.25    | 0.05      | 1.95   | 1.97    | 0.02      | -1.85    | 0.05      |        | 1.97    |
| 4/27/2018 | 15:10:55 | 0.03      | -1.29    | 0.05      | 1.95   | 1.97    |           |          |           |        |         |
| 4/27/2018 | 15:11:05 | 0.01      | 0.11     | 0.05      | 1.95   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 15:11:15 | 0.01      | 0.38     | 0.2       | 3.02   | 1.91    |           |          |           |        |         |
| 4/27/2018 | 15:11:25 | 0.01      | 3.66     | 0.22      | 15.15  | 1.06    |           |          |           |        |         |
| 4/27/2018 | 15:11:35 | -0.28     | 23.41    | 0.22      | 19.26  | 0.75    |           |          |           |        |         |
| 4/27/2018 | 15:11:45 | 2.2       | 59.69    | 0.21      | 18.31  | 0.81    |           |          |           |        |         |
| 4/27/2018 | 15:11:55 | 4.24      | 88.92    | 0.21      | 5.14   | 0.67    |           |          |           |        |         |
| 4/27/2018 | 15:12:05 | 4.22      | 87.79    | 0.22      | 0.66   | 0.25    |           |          |           |        |         |
| 4/27/2018 | 15:12:15 | 5.41      | 61.13    | 0.21      | 0.1    | 0.12    |           |          |           |        |         |
| 4/27/2018 | 15:12:25 | 7.8       | 33.17    | 0.25      | 0.03   | 0.1     |           |          |           |        |         |
| 4/27/2018 | 15:12:35 | 9.83      | 15.67    | 0.27      | 0.08   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:12:45 | 7.8       | 7.97     | 0.27      | 0.09   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:12:55 | 6.04      | 5.54     | 0.27      | 0.09   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:13:05 | 5.74      | 4.82     | 0.27      | 0.08   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:13:15 | 5.4       | 4.29     | 0.27      | 0.09   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:13:25 | 5.42      | 4.26     | 0.27      | 0.08   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:13:35 | 4.81      | 5.29     | 0.25      | 0.07   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:13:45 | 4.85      | 6.74     | 0.23      | 0.07   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:13:55 | 4.82      | 6.84     | 0.23      | 0.07   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:14:05 | 4.83      | 6.14     | 0.23      | 0.07   | 0.08    | 4.83      |          |           | 0.07   | 0.09    |
| 4/27/2018 | 15:14:15 | 5.1       | 5.51     | 0.23      | 0.06   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:14:25 | 5.11      | 4.61     | 0.23      | 0.07   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:14:35 | 5.4       | 4.3      | 0.23      | 6.75   | 0.29    |           |          |           |        |         |
| 4/27/2018 | 15:14:45 | 5.41      | 14.63    | 0.23      | 17.89  | 0.67    |           |          |           |        |         |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #2 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 15:14:55 | 5.41      | 44.35    | 0.23      | 19.54  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:15:05 | 5.4       | 81.21    | 0.23      | 19.69  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 15:15:15 | 5.41      | 108.67   | 0.23      | 19.72  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 15:15:25 | 5.4       | 121.44   | 0.23      | 19.72  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:15:35 | 5.4       | 124.6    | 0.23      | 19.73  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 15:15:45 | 5.41      | 124.92   | 0.23      | 18.91  | 0.69    |           |          |           |        |         |
| 4/27/2018 | 15:15:55 | 5.4       | 123.1    | 0.23      | 12.06  | 0.49    |           |          |           |        |         |
| 4/27/2018 | 15:16:05 | 5.4       | 114.68   | 0.13      | 2.18   | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:16:15 | 5.41      | 108.67   | 0.09      | 0.22   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:16:25 | 60.1      | 108.22   | 0.09      | 0.07   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:16:35 | 108.1     | 106.1    | 0.09      | 0.13   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 15:16:45 | 94.14     | 102.86   | 0.09      | 0.13   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:16:55 | 86.82     | 99.86    | 0.08      | 0.12   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:17:05 | 90.61     | 98.75    | 0.09      | 0.11   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:17:15 | 94.44     | 98.37    | 0.08      | 0.1    | 0.09    |           |          |           |        |         |
| 4/27/2018 | 15:17:25 | 96.26     | 99.26    | 0.07      | 0.1    | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:17:35 | 98.4      | 100.67   | 0.07      | 0.1    | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:17:45 | 98.99     | 101.2    | 0.07      | 0.1    | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:17:55 | 99.3      | 100.82   | 0.07      | 0.1    | 0.08    |           |          |           |        |         |
| 4/27/2018 | 15:18:05 | 99.31     | 100.09   | 0.07      | 2.11   | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:18:15 | 99.62     | 100.39   | 0.07      | 15.58  | 0.6     |           | 100.43   |           |        |         |
| 4/27/2018 | 15:18:25 | 95.94     | 104.96   | 0.08      | 14.52  | 0.53    |           |          |           |        |         |
| 4/27/2018 | 15:18:35 | 99.92     | 107.45   | 0.11      | 19.05  | 0.17    |           |          |           |        |         |
| 4/27/2018 | 15:18:45 | 68.42     | 90.85    | 0.11      | 20.97  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 15:18:55 | 31.41     | 57.36    | 0.11      | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:19:05 | 16.95     | 25.69    | 0.11      | 21.01  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:19:15 | 1.49      | 7.22     | 0.11      | 21.01  | 0.13    |           |          |           |        |         |

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**Run #2 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 15:19:25 | 0.92      | 0.98     | 0.11      | 21.01  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 15:19:35 | 0.01      | -0.57    | 0.11      | 21.01  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:19:45 | 0         | -1.37    | 0.11      | 21.01  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:19:55 | 0.01      | -1.28    | 0.11      | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:20:05 | 0.01      | -0.2     | 0.11      | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:20:15 | -0.28     | 0.99     | 0.11      | 21.01  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:20:25 | -0.27     | 0.76     | 0.11      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:20:35 | -0.27     | 0.16     | 0.11      | 21.01  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:20:45 | -0.3      | -0.54    | 0.11      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:20:55 | -0.29     | -1.2     | 0.9       | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:21:05 | -0.29     | -1.61    | 1.69      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:21:15 | -0.31     | -0.78    | 1.69      | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:21:25 | -0.3      | 0.5      | 1.69      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:21:35 | -0.3      | 0.84     | 1.69      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:21:45 | -0.3      | 0.49     | 1.69      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:21:55 | -0.27     | -0.23    | 1.69      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:22:05 | -0.28     | -0.87    | 1.79      | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:22:15 | -0.29     | -1.49    | 1.79      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:22:25 | -0.29     | -1.02    | 1.79      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:22:35 | -0.3      | 0.08     | 1.79      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:22:45 | -0.3      | 1.07     | 1.79      | 21.02  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:22:55 | -0.28     | 1.1      | 1.79      | 21.03  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:23:05 | -0.28     | 0.42     | 1.79      | 21.03  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:23:15 | -0.3      | -0.44    | 1.79      | 21.03  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:23:25 | -0.29     | -1.25    | 1.82      | 21.02  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 15:23:35 | -0.3      | -1.32    | 1.82      | 20.49  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 15:23:45 | -0.3      | -0.01    | 1.82      | 12.57  | 0.17    |           |          |           |        |         |

**Hollingsworth & Vose**  
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**4/27/2018**  
**Run #2 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 15:23:55 | -0.3      | 8.07     | 1.82      | 14.83  | 0.57    |           |          |           |        |         |
| 4/27/2018 | 15:24:05 | 8.93      | 31.83    | 1.82      | 19.2   | 0.71    |           |          |           |        |         |
| 4/27/2018 | 15:24:15 | 17.87     | 67.75    | 1.82      | 19.69  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:24:25 | 11.6      | 99.68    | 1.82      | 19.74  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:24:35 | 6.01      | 117.52   | 1.78      | 19.75  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:24:45 | 5.71      | 124.16   | 1.76      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:24:55 | 5.4       | 126.29   | 1.76      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:25:05 | 5.39      | 127.42   | 1.76      | 19.76  | 0.74    |           |          |           |        |         |
| 4/27/2018 | 15:25:15 | 5.4       | 129.2    | 1.76      | 19.77  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:25:25 | 5.39      | 129.54   | 1.76      | 19.77  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:25:35 | 5.39      | 128.05   | 1.76      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:25:45 | 5.39      | 127.32   | 1.78      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:25:55 | 5.4       | 126.92   | 1.82      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:26:05 | 5.4       | 126.53   | 1.82      | 19.76  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:26:15 | 5.41      | 126.95   | 1.82      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:26:25 | 5.39      | 128.44   | 1.82      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:26:35 | 5.38      | 129.1    | 1.82      | 19.76  | 0.72    |           |          |           |        |         |
| 4/27/2018 | 15:26:45 | 5.4       | 128.35   | 1.82      | 19.76  | 0.73    |           |          |           |        |         |
| 4/27/2018 | 15:26:55 | 5.41      | 127.62   | 1.82      | 19.76  | 0.73    |           |          | 1.82      |        |         |
| 4/27/2018 | 15:27:05 | 5.39      | 126.72   | 1.76      | 19.76  | 0.72    |           |          |           |        |         |



**Hollingsworth & Vose**  
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**4/27/2018**  
**Run #3**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 15:45:10 | 5.40      | 128.33   | 0.67      | 19.79  | 0.73    |
| 4/27/2018 | 15:46:10 | 5.40      | 127.55   | 0.68      | 19.79  | 0.73    |
| 4/27/2018 | 15:47:10 | 5.59      | 129.38   | 0.67      | 19.79  | 0.73    |
| 4/27/2018 | 15:48:10 | 5.70      | 131.31   | 0.66      | 19.79  | 0.73    |
| 4/27/2018 | 15:49:10 | 5.69      | 131.09   | 0.67      | 19.79  | 0.73    |
| 4/27/2018 | 15:50:10 | 5.69      | 129.91   | 0.69      | 19.79  | 0.72    |
| 4/27/2018 | 15:51:10 | 5.69      | 129.02   | 0.73      | 19.79  | 0.72    |
| 4/27/2018 | 15:52:10 | 5.56      | 128.60   | 0.71      | 19.79  | 0.72    |
| 4/27/2018 | 15:53:10 | 5.43      | 128.41   | 0.69      | 19.79  | 0.72    |
| 4/27/2018 | 15:54:10 | 5.40      | 127.36   | 0.71      | 19.79  | 0.72    |
| 4/27/2018 | 15:55:10 | 5.39      | 126.76   | 0.66      | 19.79  | 0.72    |
| 4/27/2018 | 15:56:10 | 5.39      | 126.29   | 0.69      | 19.79  | 0.71    |
| 4/27/2018 | 15:57:10 | 5.43      | 127.37   | 0.69      | 19.79  | 0.71    |
| 4/27/2018 | 15:58:10 | 5.39      | 128.10   | 0.65      | 19.79  | 0.71    |
| 4/27/2018 | 15:59:10 | 5.39      | 127.79   | 0.61      | 19.79  | 0.71    |
| 4/27/2018 | 16:00:10 | 5.38      | 126.99   | 0.68      | 19.79  | 0.71    |
| 4/27/2018 | 16:01:10 | 5.39      | 128.15   | 0.71      | 19.78  | 0.71    |
| 4/27/2018 | 16:02:10 | 5.39      | 129.66   | 0.72      | 19.78  | 0.71    |
| 4/27/2018 | 16:03:10 | 5.39      | 129.35   | 0.72      | 19.78  | 0.71    |
| 4/27/2018 | 16:04:10 | 5.44      | 128.54   | 0.69      | 19.79  | 0.72    |
| 4/27/2018 | 16:05:10 | 5.45      | 128.66   | 0.65      | 19.78  | 0.72    |
| 4/27/2018 | 16:06:10 | 5.39      | 128.43   | 0.68      | 19.79  | 0.72    |
| 4/27/2018 | 16:07:10 | 5.39      | 126.27   | 0.68      | 19.79  | 0.72    |
| 4/27/2018 | 16:08:10 | 5.38      | 125.95   | 0.66      | 19.78  | 0.72    |
| 4/27/2018 | 16:09:10 | 5.38      | 127.22   | 0.61      | 19.78  | 0.73    |
| 4/27/2018 | 16:10:10 | 5.39      | 127.81   | 0.56      | 19.78  | 0.73    |
| 4/27/2018 | 16:11:10 | 5.38      | 127.39   | 0.57      | 19.78  | 0.72    |
| 4/27/2018 | 16:12:10 | 5.39      | 126.79   | 0.61      | 19.78  | 0.72    |
| 4/27/2018 | 16:13:10 | 5.39      | 127.79   | 0.54      | 19.78  | 0.73    |
| 4/27/2018 | 16:14:10 | 5.40      | 129.65   | 0.49      | 19.78  | 0.72    |
| 4/27/2018 | 16:15:10 | 5.40      | 131.30   | 0.53      | 19.78  | 0.72    |
| 4/27/2018 | 16:16:10 | 5.40      | 130.78   | 0.60      | 19.78  | 0.72    |
| 4/27/2018 | 16:17:10 | 5.53      | 133.28   | 0.55      | 19.78  | 0.72    |
| 4/27/2018 | 16:18:10 | 5.66      | 137.92   | 0.64      | 19.78  | 0.72    |
| 4/27/2018 | 16:19:10 | 5.67      | 135.57   | 0.61      | 19.78  | 0.71    |
| 4/27/2018 | 16:20:10 | 5.40      | 129.75   | 0.57      | 19.78  | 0.71    |
| 4/27/2018 | 16:21:10 | 5.41      | 128.35   | 0.51      | 19.78  | 0.71    |
| 4/27/2018 | 16:22:10 | 5.41      | 127.40   | 0.46      | 19.78  | 0.71    |
| 4/27/2018 | 16:23:10 | 5.41      | 126.37   | 0.62      | 19.78  | 0.71    |
| 4/27/2018 | 16:24:10 | 5.42      | 126.83   | 0.56      | 19.78  | 0.71    |

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**4/27/2018**  
**Run #3**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 16:25:10 | 5.41      | 128.06   | 0.47      | 19.78  | 0.71    |
| 4/27/2018 | 16:26:10 | 5.42      | 127.94   | 0.51      | 19.78  | 0.71    |
| 4/27/2018 | 16:27:10 | 5.41      | 126.47   | 0.59      | 19.78  | 0.71    |
| 4/27/2018 | 16:28:10 | 5.41      | 128.52   | 0.54      | 19.78  | 0.71    |
| 4/27/2018 | 16:29:10 | 5.41      | 130.62   | 0.51      | 19.78  | 0.71    |
| 4/27/2018 | 16:30:10 | 5.41      | 133.11   | 0.57      | 19.78  | 0.72    |
| 4/27/2018 | 16:31:10 | 5.40      | 132.68   | 0.55      | 19.78  | 0.72    |
| 4/27/2018 | 16:32:10 | 5.41      | 135.54   | 0.47      | 19.78  | 0.72    |
| 4/27/2018 | 16:33:10 | 5.42      | 135.36   | 0.40      | 19.78  | 0.73    |
| 4/27/2018 | 16:34:10 | 5.64      | 136.80   | 0.49      | 19.77  | 0.72    |
| 4/27/2018 | 16:35:10 | 5.73      | 138.35   | 0.48      | 19.77  | 0.73    |
| 4/27/2018 | 16:36:10 | 5.64      | 139.16   | 0.47      | 19.77  | 0.73    |
| 4/27/2018 | 16:37:10 | 5.42      | 137.35   | 0.49      | 19.77  | 0.72    |
| 4/27/2018 | 16:38:10 | 5.41      | 136.86   | 0.49      | 19.77  | 0.72    |
| 4/27/2018 | 16:39:10 | 5.42      | 137.63   | 0.43      | 19.78  | 0.72    |
| 4/27/2018 | 16:40:10 | 5.66      | 136.26   | 0.37      | 19.78  | 0.72    |
| 4/27/2018 | 16:41:10 | 5.58      | 133.05   | 0.47      | 19.78  | 0.72    |
| 4/27/2018 | 16:42:10 | 5.42      | 129.50   | 0.62      | 19.78  | 0.72    |
| 4/27/2018 | 16:43:10 | 5.42      | 128.57   | 0.67      | 19.78  | 0.71    |
| 4/27/2018 | 16:44:10 | 5.42      | 128.00   | 0.68      | 19.78  | 0.71    |
| 4/27/2018 | 16:45:10 | 5.42      | 128.43   | 0.80      | 19.78  | 0.71    |
| 4/27/2018 | 16:46:10 | 5.41      | 128.05   | 0.76      | 19.77  | 0.71    |
| 4/27/2018 | 16:47:10 | 5.42      | 126.84   | 0.62      | 19.77  | 0.71    |
| 4/27/2018 | 16:48:10 | 5.43      | 127.51   | 0.55      | 19.77  | 0.71    |
| 4/27/2018 | 16:49:10 | 5.42      | 128.65   | 0.54      | 19.77  | 0.71    |
| 4/27/2018 | 16:50:10 | 5.42      | 130.21   | 0.56      | 19.77  | 0.71    |
| 4/27/2018 | 16:51:10 | 5.42      | 132.44   | 0.53      | 19.77  | 0.71    |
| 4/27/2018 | 16:52:10 | 5.42      | 132.51   | 0.59      | 19.77  | 0.71    |
| 4/27/2018 | 16:53:10 | 5.42      | 129.75   | 0.56      | 19.77  | 0.71    |
| 4/27/2018 | 16:54:10 | 5.42      | 127.82   | 0.56      | 19.77  | 0.71    |
| 4/27/2018 | 16:55:10 | 5.43      | 128.40   | 0.59      | 19.77  | 0.71    |
| 4/27/2018 | 16:56:10 | 5.42      | 127.38   | 0.61      | 19.78  | 0.72    |
| 4/27/2018 | 16:57:10 | 5.42      | 126.65   | 0.67      | 19.78  | 0.72    |
| 4/27/2018 | 16:58:10 | 5.42      | 128.05   | 0.81      | 19.78  | 0.72    |
| 4/27/2018 | 16:59:10 | 5.42      | 128.58   | 0.76      | 19.78  | 0.72    |
| 4/27/2018 | 17:00:10 | 5.43      | 127.43   | 0.76      | 19.78  | 0.72    |
| 4/27/2018 | 17:01:10 | 5.42      | 129.89   | 0.85      | 19.77  | 0.72    |
| 4/27/2018 | 17:02:10 | 5.66      | 132.44   | 0.92      | 19.77  | 0.72    |
| 4/27/2018 | 17:03:10 | 5.51      | 129.15   | 0.78      | 19.77  | 0.72    |
| 4/27/2018 | 17:04:10 | 5.49      | 128.35   | 0.88      | 19.77  | 0.72    |

**Hollingsworth & Vose**  
**CFU 114**  
**4/27/2018**  
**Run #3**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 17:05:10 | 5.43      | 128.04   | 0.88      | 19.77  | 0.72    |
| 4/27/2018 | 17:06:10 | 5.42      | 126.32   | 0.85      | 19.77  | 0.71    |
| 4/27/2018 | 17:07:10 | 5.42      | 126.12   | 0.83      | 19.76  | 0.71    |
| 4/27/2018 | 17:08:10 | 5.43      | 127.77   | 0.66      | 19.76  | 0.71    |
| 4/27/2018 | 17:09:10 | 5.42      | 126.36   | 0.55      | 19.77  | 0.70    |
| 4/27/2018 | 17:10:10 | 5.42      | 126.45   | 0.57      | 19.77  | 0.71    |
| 4/27/2018 | 17:11:10 | 5.41      | 126.86   | 0.56      | 19.77  | 0.70    |
| 4/27/2018 | 17:12:10 | 5.41      | 126.45   | 0.50      | 19.77  | 0.71    |
| 4/27/2018 | 17:13:10 | 5.42      | 125.98   | 0.43      | 19.77  | 0.71    |
| 4/27/2018 | 17:14:10 | 5.42      | 127.80   | 0.44      | 19.77  | 0.70    |
| 4/27/2018 | 17:15:10 | 5.42      | 128.18   | 0.58      | 19.76  | 0.71    |
| 4/27/2018 | 17:16:10 | 5.41      | 127.85   | 0.55      | 19.76  | 0.71    |
| 4/27/2018 | 17:17:10 | 5.43      | 129.29   | 0.60      | 19.76  | 0.71    |
| 4/27/2018 | 17:18:10 | 5.50      | 129.20   | 0.76      | 19.76  | 0.71    |
| 4/27/2018 | 17:19:10 | 5.47      | 128.42   | 0.73      | 19.76  | 0.71    |
| 4/27/2018 | 17:20:10 | 5.41      | 128.01   | 0.71      | 19.76  | 0.72    |
| 4/27/2018 | 17:21:10 | 5.41      | 128.67   | 0.72      | 19.76  | 0.72    |
| 4/27/2018 | 17:22:10 | 5.41      | 128.11   | 0.68      | 19.76  | 0.72    |
| 4/27/2018 | 17:23:10 | 5.42      | 127.11   | 0.63      | 19.77  | 0.72    |
| 4/27/2018 | 17:24:10 | 5.42      | 127.59   | 0.63      | 19.77  | 0.72    |
| 4/27/2018 | 17:25:10 | 5.40      | 127.07   | 0.68      | 19.77  | 0.72    |
| 4/27/2018 | 17:26:10 | 5.41      | 125.25   | 0.63      | 19.77  | 0.72    |
| 4/27/2018 | 17:27:10 | 5.40      | 124.43   | 0.61      | 19.76  | 0.72    |
| 4/27/2018 | 17:28:10 | 5.40      | 124.36   | 0.61      | 19.76  | 0.72    |
| 4/27/2018 | 17:29:10 | 5.41      | 124.57   | 0.64      | 19.77  | 0.71    |
| 4/27/2018 | 17:30:10 | 5.41      | 123.09   | 0.72      | 19.77  | 0.71    |
| 4/27/2018 | 17:31:10 | 5.41      | 123.26   | 0.67      | 19.76  | 0.71    |
| 4/27/2018 | 17:32:10 | 5.41      | 125.68   | 0.65      | 19.76  | 0.71    |
| 4/27/2018 | 17:33:10 | 5.41      | 122.13   | 0.58      | 19.77  | 0.71    |
| 4/27/2018 | 17:34:10 | 5.41      | 123.55   | 0.55      | 19.76  | 0.70    |
| 4/27/2018 | 17:35:10 | 5.41      | 123.77   | 0.60      | 19.77  | 0.70    |
| 4/27/2018 | 17:36:10 | 5.40      | 123.76   | 0.54      | 19.76  | 0.70    |
| 4/27/2018 | 17:37:10 | 5.40      | 126.48   | 0.47      | 19.76  | 0.71    |
| 4/27/2018 | 17:38:10 | 5.40      | 125.45   | 0.57      | 19.76  | 0.71    |
| 4/27/2018 | 17:39:10 | 5.40      | 125.81   | 0.60      | 19.77  | 0.71    |
| 4/27/2018 | 17:40:10 | 5.40      | 125.04   | 0.57      | 19.77  | 0.71    |
| 4/27/2018 | 17:41:10 | 5.41      | 124.75   | 0.54      | 19.76  | 0.71    |
| 4/27/2018 | 17:42:10 | 5.41      | 126.07   | 0.60      | 19.76  | 0.71    |
| 4/27/2018 | 17:43:10 | 5.40      | 127.64   | 0.56      | 19.76  | 0.72    |
| 4/27/2018 | 17:44:10 | 5.40      | 129.25   | 0.50      | 19.76  | 0.72    |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #3**

| Date      | Time     | NOx [PPM]   | CO [PPM]      | VOC [PPM]   | O2 [%]       | CO2 [%]     |
|-----------|----------|-------------|---------------|-------------|--------------|-------------|
| 4/27/2018 | 17:45:10 | 5.40        | 128.77        | 0.46        | 19.76        | 0.73        |
| 4/27/2018 | 17:46:10 | 5.40        | 127.16        | 0.45        | 19.76        | 0.72        |
| 4/27/2018 | 17:47:10 | 5.40        | 126.39        | 0.51        | 19.76        | 0.73        |
| 4/27/2018 | 17:48:10 | 5.40        | 125.89        | 0.50        | 19.76        | 0.72        |
| 4/27/2018 | 17:49:10 | 5.40        | 125.90        | 0.53        | 19.77        | 0.72        |
| 4/27/2018 | 17:50:10 | 5.41        | 126.11        | 0.55        | 19.76        | 0.72        |
| 4/27/2018 | 17:51:10 | 5.40        | 126.63        | 0.53        | 19.77        | 0.72        |
| 4/27/2018 | 17:52:10 | 5.40        | 127.76        | 0.45        | 19.76        | 0.72        |
|           |          | <b>5.44</b> | <b>128.58</b> | <b>0.61</b> | <b>19.77</b> | <b>0.72</b> |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #3 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 17:53:30 | 5.40      | 120.55   | 0.54      | 10.89  | 9.29    |           |          |           |        |         |
| 4/27/2018 | 17:53:40 | 4.40      | 90.70    | 0.54      | 10.01  | 9.92    |           |          |           |        |         |
| 4/27/2018 | 17:53:50 | 2.45      | 50.62    | 0.54      | 9.95   | 9.98    |           |          |           |        |         |
| 4/27/2018 | 17:54:00 | 1.20      | 20.21    | 0.54      | 9.94   | 9.99    |           |          |           |        |         |
| 4/27/2018 | 17:54:10 | 0.46      | 4.02     | 0.55      | 9.94   | 10.00   |           |          |           |        |         |
| 4/27/2018 | 17:54:20 | 0.02      | -1.64    | 0.58      | 9.94   | 10.00   |           |          |           |        |         |
| 4/27/2018 | 17:54:30 | 0.02      | -3.11    | 0.58      | 9.93   | 10.00   |           |          |           |        |         |
| 4/27/2018 | 17:54:40 | 0.01      | -3.67    | 0.58      | 9.93   | 10.00   |           |          |           |        |         |
| 4/27/2018 | 17:54:50 | -0.01     | -2.22    | 0.58      | 9.93   | 10.00   |           |          |           | 9.93   |         |
| 4/27/2018 | 17:55:00 | 0.00      | -0.68    | 0.58      | 9.93   | 10.01   |           |          |           |        |         |
| 4/27/2018 | 17:55:10 | 0.02      | -1.15    | 0.58      | 9.93   | 10.01   |           |          |           |        |         |
| 4/27/2018 | 17:55:20 | 0.00      | -1.25    | 0.58      | 9.88   | 10.00   |           |          |           |        |         |
| 4/27/2018 | 17:55:30 | 0.00      | -2.54    | 0.16      | 4.71   | 4.21    |           |          |           |        |         |
| 4/27/2018 | 17:55:40 | 0.03      | -2.48    | 0.11      | 1.95   | 1.54    |           |          |           |        |         |
| 4/27/2018 | 17:55:50 | 0.03      | -0.38    | 0.11      | 1.99   | 1.99    |           |          |           |        |         |
| 4/27/2018 | 17:56:00 | 0.01      | 0.35     | 0.11      | 1.95   | 1.97    |           |          |           |        |         |
| 4/27/2018 | 17:56:10 | 0.02      | 1.31     | 0.11      | 1.95   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 17:56:20 | 0.01      | 0.58     | 0.11      | 1.94   | 1.96    |           |          |           |        |         |
| 4/27/2018 | 17:56:30 | 0.00      | 0.01     | 0.11      | 1.94   | 1.95    |           |          |           |        |         |
| 4/27/2018 | 17:56:40 | 0.01      | -0.95    | 0.06      | 1.94   | 1.95    | 0.01      | -0.12    |           |        | 1.95    |
| 4/27/2018 | 17:56:50 | 0.01      | -0.76    | 0.02      | 1.94   | 1.94    |           |          |           |        |         |
| 4/27/2018 | 17:57:00 | 0.01      | -0.08    | 0.02      | 1.94   | 1.94    |           |          |           |        |         |
| 4/27/2018 | 17:57:10 | 0.01      | -0.59    | 0.02      | 1.93   | 1.95    |           |          |           |        |         |
| 4/27/2018 | 17:57:20 | 0.02      | -0.40    | 0.02      | 10.06  | 1.43    |           |          |           |        |         |
| 4/27/2018 | 17:57:30 | -0.12     | 9.84     | 0.02      | 16.88  | 0.94    |           |          |           |        |         |
| 4/27/2018 | 17:57:40 | 1.10      | 44.59    | 0.02      | 6.83   | 0.74    |           |          |           |        |         |
| 4/27/2018 | 17:57:50 | 3.51      | 71.82    | 0.01      | 0.72   | 0.18    |           |          |           |        |         |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #3 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 17:58:00 | 14.10     | 90.86    | 0.01      | 0.09   | 0.10    |           |          |           |        |         |
| 4/27/2018 | 17:58:10 | 32.01     | 94.59    | 0.01      | 0.01   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 17:58:20 | 47.19     | 96.46    | 0.01      | 0.00   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 17:58:30 | 61.51     | 96.84    | 0.01      | -0.01  | 0.09    |           |          |           |        |         |
| 4/27/2018 | 17:58:40 | 73.01     | 98.60    | 0.01      | 0.00   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 17:58:50 | 81.33     | 100.78   | 0.01      | 0.02   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 17:59:00 | 87.96     | 100.15   | 0.01      | 0.04   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 17:59:10 | 92.53     | 100.00   | 0.01      | 0.03   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 17:59:20 | 96.12     | 98.90    | 0.01      | 0.03   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 17:59:30 | 99.17     | 97.84    | 0.01      | 0.04   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 17:59:40 | 100.97    | 98.28    | 0.01      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 17:59:50 | 101.67    | 98.31    | 0.01      | 0.05   | 0.08    |           | 98.14    |           | 0.05   | 0.08    |
| 4/27/2018 | 18:00:00 | 102.05    | 100.73   | 0.01      | 9.36   | 0.38    |           |          |           |        |         |
| 4/27/2018 | 18:00:10 | 102.64    | 102.70   | 0.01      | 18.19  | 0.67    |           |          |           |        |         |
| 4/27/2018 | 18:00:20 | 81.29     | 109.82   | 0.03      | 17.10  | 0.63    |           |          |           |        |         |
| 4/27/2018 | 18:00:30 | 38.77     | 115.67   | 0.03      | 19.37  | 0.70    |           |          |           |        |         |
| 4/27/2018 | 18:00:40 | 16.91     | 119.99   | 0.03      | 19.67  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:00:50 | 12.35     | 121.82   | 0.03      | 19.71  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:01:00 | 8.64      | 122.86   | 0.03      | 19.71  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:01:10 | 7.06      | 124.61   | 0.03      | 19.72  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:01:20 | 6.03      | 126.10   | 0.03      | 19.72  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:01:30 | 5.88      | 127.51   | 0.02      | 19.72  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:01:40 | 5.72      | 126.52   | 0.01      | 19.72  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:01:50 | 5.72      | 126.47   | 0.01      | 19.73  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:02:00 | 5.70      | 125.61   | 0.01      | 19.73  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:02:10 | 5.71      | 125.84   | 0.01      | 19.75  | 0.71    |           |          |           |        |         |
| 4/27/2018 | 18:02:20 | 5.72      | 125.43   | 0.01      | 11.79  | 0.46    |           |          |           |        |         |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #3 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 18:02:30 | 5.25      | 123.91   | 0.01      | 1.38   | 0.12    |           |          |           |        |         |
| 4/27/2018 | 18:02:40 | 20.98     | 112.69   | 0.01      | 0.16   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:02:50 | 53.18     | 82.05    | 0.02      | 0.03   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:03:00 | 58.54     | 46.66    | 0.02      | 0.07   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:03:10 | 38.25     | 19.63    | 0.02      | 0.10   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:03:20 | 26.04     | 8.45     | 0.02      | 0.09   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:03:30 | 20.18     | 5.51     | 0.02      | 0.08   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:03:40 | 16.22     | 4.51     | 0.02      | 0.07   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:03:50 | 14.58     | 5.69     | 0.02      | 0.07   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:04:00 | 13.25     | 7.15     | 0.19      | 0.06   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:04:10 | 12.20     | 6.98     | 0.23      | 0.06   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:04:20 | 11.31     | 5.82     | 0.23      | 0.06   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:04:30 | 10.72     | 5.51     | 0.23      | 0.06   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:04:40 | 10.29     | 4.25     | 0.23      | 0.06   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:04:50 | 9.99      | 4.00     | 0.23      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:05:00 | 9.53      | 4.21     | 0.23      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:05:10 | 9.08      | 6.00     | 0.12      | 0.04   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:05:20 | 8.94      | 6.84     | 0.01      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:05:30 | 8.83      | 6.66     | 0.01      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:05:40 | 8.56      | 5.53     | 0.01      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:05:50 | 8.27      | 5.04     | 0.01      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:06:00 | 8.10      | 4.07     | 0.01      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:06:10 | 7.96      | 4.21     | 0.01      | 0.04   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:06:20 | 7.80      | 4.87     | 0.06      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:06:30 | 7.64      | 6.68     | 0.25      | 0.04   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:06:40 | 7.51      | 6.53     | 0.26      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:06:50 | 7.50      | 5.91     | 0.26      | 0.05   | 0.08    |           |          |           |        |         |

**Hollingsworth & Vose****CFU 114****4/27/2018****Run #3 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 18:07:00 | 7.37      | 5.25     | 0.25      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:07:10 | 7.22      | 4.31     | 0.25      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:07:20 | 7.22      | 4.11     | 0.25      | 0.06   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:07:30 | 7.22      | 4.01     | 0.25      | 0.05   | 0.07    |           |          |           |        |         |
| 4/27/2018 | 18:07:40 | 6.77      | 5.82     | 0.03      | 0.04   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:07:50 | 6.00      | 5.78     | 0.01      | 0.04   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:08:00 | 5.69      | 5.83     | 0.01      | 0.04   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:08:10 | 5.70      | 4.33     | 0.01      | 0.04   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:08:20 | 5.55      | 3.99     | 0.01      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:08:30 | 5.40      | 3.18     | 0.01      | 0.05   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:08:40 | 5.40      | 2.73     | 0.01      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:08:50 | 5.38      | 3.80     | 0.06      | 0.04   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:09:00 | 5.39      | 5.11     | 0.10      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:09:10 | 5.39      | 6.38     | 0.10      | 0.05   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:09:20 | 5.24      | 5.11     | 0.10      | 0.06   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:09:30 | 5.12      | 4.47     | 0.10      | 9.82   | 0.41    |           |          |           |        |         |
| 4/27/2018 | 18:09:40 | 5.11      | 14.98    | 0.10      | 17.69  | 0.68    |           |          |           |        |         |
| 4/27/2018 | 18:09:50 | 5.10      | 49.31    | 0.10      | 5.28   | 0.24    |           |          |           |        |         |
| 4/27/2018 | 18:10:00 | 5.09      | 66.03    | 0.08      | 0.88   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:10:10 | 5.09      | 52.65    | 0.03      | 0.59   | 0.09    | 5.09      |          |           |        |         |
| 4/27/2018 | 18:10:20 | 4.38      | 27.93    | 0.03      | 0.56   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:10:30 | 2.91      | 8.89     | 0.03      | 0.63   | 0.08    |           |          |           |        |         |
| 4/27/2018 | 18:10:40 | 2.18      | 2.20     | 0.03      | 0.67   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:10:50 | 2.01      | -0.14    | 0.03      | 0.67   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:11:00 | 1.87      | -0.34    | 0.03      | 0.63   | 0.09    |           |          |           |        |         |
| 4/27/2018 | 18:11:10 | 1.86      | -0.89    | 0.03      | 7.41   | 0.10    |           |          |           |        |         |
| 4/27/2018 | 18:11:20 | 1.85      | -0.91    | 0.01      | 20.20  | 0.13    |           |          |           |        |         |



**Hollingsworth & Vose****CFU 114****4/27/2018****Run #3 Post Cal**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/27/2018 | 18:11:30 | 1.86      | 0.08     | 0.01      | 19.78  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 18:11:40 | 1.37      | 1.36     | 0.01      | 20.59  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 18:11:50 | 0.29      | 0.63     | 0.01      | 20.66  | 0.14    |           |          |           |        |         |
| 4/27/2018 | 18:12:00 | -0.29     | -0.14    | 0.01      | 20.24  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:12:10 | -0.30     | -0.63    | 0.01      | 14.31  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 18:12:20 | -0.30     | -1.74    | 0.01      | 13.45  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:12:30 | -0.31     | -0.63    | 0.01      | 20.32  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 18:12:40 | -0.32     | -0.09    | 0.01      | 20.67  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:12:50 | -0.31     | 1.21     | 0.01      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:13:00 | -0.32     | 1.65     | 0.01      | 20.73  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:13:10 | -0.31     | 0.63     | 0.01      | 20.73  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:13:20 | -0.30     | -0.25    | 0.01      | 20.73  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:13:30 | -0.32     | -1.24    | 0.01      | 20.74  | 0.13    |           |          | 0.01      |        |         |
| 4/27/2018 | 18:13:40 | -0.30     | -1.73    | 0.07      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:13:50 | -0.30     | -1.69    | 0.18      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:14:00 | -0.31     | -0.90    | 0.18      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:14:10 | -0.31     | 0.87     | 0.18      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:14:20 | -0.30     | 1.09     | 0.18      | 20.74  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 18:14:30 | -0.31     | -0.22    | 0.18      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:14:40 | -0.30     | -0.75    | 0.18      | 20.75  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:14:50 | -0.30     | -1.11    | 0.21      | 20.75  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:15:00 | -0.30     | -1.72    | 1.48      | 20.75  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:15:10 | -0.30     | -1.47    | 1.48      | 20.75  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:15:20 | -0.30     | 0.53     | 1.48      | 20.75  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:15:30 | -0.30     | 1.13     | 1.48      | 20.74  | 0.12    |           |          |           |        |         |
| 4/27/2018 | 18:15:40 | -0.30     | 0.60     | 1.48      | 20.74  | 0.13    |           |          |           |        |         |
| 4/27/2018 | 18:15:50 | -0.29     | -0.12    | 1.48      | 20.74  | 0.13    |           |          | 1.48      |        |         |

## EPA Method 7E

### Example calculation

Company: Hollingsworth + Vose

Run 1

Location: Corvallis, OR

4/27/18

Source: CFU 114

\* flows are from concurrent Method 5 run

1) Raw NO<sub>x</sub> concentration from analyzer = 5.44 ppmvd

Corrected concentration =

$$\text{Raw NO}_x \text{ ppmvd} - \left( \frac{\text{system initial zero} + \text{system zero final}}{2} \right) \times \text{Instrument reference gas conc.}$$

$$\frac{\left( \frac{\text{upscale system initial} + \text{upscale system final}}{2} \right) - \left( \frac{\text{zero system initial} + \text{zero system final}}{2} \right)}{1}$$

$$= \frac{\left( 5.44 - \left( \frac{0.10 + 0.02}{2} \right) \right) \times 5.0}{\left( \left( \frac{4.82 + 4.86}{2} \right) - \left( \frac{0.10 + 0.02}{2} \right) \right)} = 5.63 \text{ ppmvd}$$

$$\begin{aligned} 2) \text{ NO}_x \frac{\text{lb}}{\text{hr}} &= \text{ppmvd} \times 1.558 \times 10^{-7} \times \text{MW}_{\text{NO}_x} \times \text{dsrfm (Method 5)} \\ &= 5.63 \times 1.558 \times 10^{-7} \times 46 \text{ g/mol} \times 19,960.2 \text{ dsrfm} \\ &= 8.05 \times 10^{-1} \text{ lb/hr} \end{aligned}$$

$$3) \text{ NO}_x \frac{\text{lb}}{\text{lb glass}} = \frac{\text{lb/hr}}{\text{lb glass/hr}} = \frac{8.05 \times 10^{-1}}{61.0} = 1.32 \times 10^{-2}$$

$$4) \text{ NO}_x \frac{\text{lb}}{\text{Mscf natural gas}} = \frac{\text{lb/hr}}{\text{Mscf/hr n.g.}} = \frac{8.05 \times 10^{-1}}{5.3057} = 1.52 \times 10^{-1}$$

EPA Method 10  
Example Calculation

Company: Hollingsworth + Vose

Location: Corvallis, OR

Source: CFU 114

Run 1

4/27/18

\* flows are from concurrent Method 5 run

1) Raw CO concentration from analyzer = 128.68 ppmvd

Corrected concentration =

$$\text{Raw CO ppmvd} - \left( \frac{\text{system initial zero} + \text{system zero final}}{2} \right) \times \text{Instrument reference gas conc.}$$

$$\left( \left( \frac{\text{upscale system initial} + \text{upscale system final}}{2} \right) - \left( \frac{\text{zero system initial} + \text{zero system final}}{2} \right) \right)$$

$$= 128.68 - \left( \frac{(-0.68 + -3.21)}{2} \right) \times 100$$
$$\left( \left( \frac{101.88 + 101.12}{2} \right) - \left( \frac{-0.68 + -3.21}{2} \right) \right) = 126.27 \text{ ppmvd}$$

$$2) \text{ CO } \frac{\text{lb}}{\text{hr}} = \text{ppmvd} \times 1.558 \times 10^{-7} \times \text{MW}_{\text{CO}} \times \text{dscf Method 5}$$
$$= 126.27 \times 1.558 \times 10^{-7} \times 28 \text{ g/mol} \times 19,960.2 \text{ dscf}$$
$$= 11.00 \text{ lb/hr}$$

$$3) \text{ CO } \frac{\text{lb}}{\text{lb glass}} = \frac{\text{CO lb/hr}}{\text{lb glass/hr}} = \frac{11.00}{61.0} = 1.80 \times 10^{-1}$$

$$4) \text{ CO } \frac{\text{lb}}{\text{Mscf natural gas}} = \frac{\text{CO lb/hr}}{\text{Mscf gas/hr}} = \frac{11.00}{5.3057} = 2.07$$

# EPA Method 25A

## Example Calculation

Company : Hollingsworth + Vose

Location : Corvallis, OR

Source : CFU 114

Run 1

4/27/18

\* flows measured during concurrent Method 5 run

Raw concentration from analyzer = 0.55 ppmvw

$$\begin{aligned} 1) \text{ VOC } \frac{\text{lb}}{\text{hr}} &= \text{ppmvw} \times 1.558 \times 10^{-7} \times \text{MW}_{\text{propane}} \times \text{flow}_{\text{wsfm}} \\ &= 0.55 \times 1.558 \times 10^{-7} \times 44.1 \text{ lb/mol} \times 20,403.0 \\ &= \cancel{6.25 \times 10^{-2}} \text{ lb/hr} \\ &= 7.69 \times 10^{-2} \end{aligned}$$

$$2) \text{ VOCs } \frac{\text{lb}}{\text{lb glass}} = \frac{\text{VOCs lb/hr}}{\text{lb glass/hr}} = \frac{7.69 \times 10^{-2}}{61.0} = 1.26 \times 10^{-3} \text{ lb/lb glass}$$

$$3) \text{ VOCs } \frac{\text{lb}}{\text{Mscf natural gas}} = \frac{\text{VOC lb/hr}}{\text{Mscf n.g./hr}} = \frac{7.69 \times 10^{-2}}{5.3057} = 1.45 \times 10^{-2} \text{ lb/Mscf n.g.}$$

(continued)

04/26 - Leak check @ 7:00

Cal targets

NO<sub>x</sub> - 0/5/10 A S

CO - 0/100/200 A S

O<sub>2</sub> - 0/10/20 A S

CO<sub>2</sub> - 0/2/4 A S

VOL - 0/1.5/2.5/4 A S

NO<sub>2</sub> - 51.91 ✓

Air 106 CH<sub>4</sub> - 100

NG

Void Test

07:40 - move from 117 to 118 -

08:31 - move to Flame blown (CFU-114)

Down for power hook-up

Calibrate O<sub>2</sub>/CO<sub>2</sub>

CFU-114 start R-1 @ 15:18  
end " "

start R-2 @ 17:05  
↓  
17:15  
18:33

R-3 18:55  
20:01

end of day

04/27/18 CFU 114

Leak check @ 6:22

begin calibrations @ 6:25

| A                               | S           |
|---------------------------------|-------------|
| NOR 0/5/10                      | 0/5 ± 1 2   |
| CO 0/100/200                    | 0/100 ± 1 2 |
| O <sub>2</sub> 0/10/20          | 0/10 ± 1 2  |
| CO <sub>2</sub> 0/2/4           | 0/2 ± 1 2   |
| VOC 0/1.5/2.5/4                 | 0/1.5 ± 1   |
| NO <sub>2</sub> 0/90% > (st.91) |             |

★ stat checks

★ CH<sub>4</sub> 100 ppm ✓ Pass

★ start R-1 @ 09:30  
end @ 11:40

★ start R-2 @ 12:53  
end @ 15:00

★ start R-3 @ 15:45  
17:50

calibrate and leak check @ Flow "pass"  
prep for metals day

~~04/28/18~~



M-29 / O<sub>2</sub>/CO<sub>2</sub> L1 - 114

04/28

Leak check

⊗ flow "pass"

cal O<sub>2</sub>/CO<sub>2</sub>

O<sub>2</sub> - 0/10/20 0/10

CO<sub>2</sub> - 0/2/4 0/2

R-1 9:18

12:28

R-2 13:09

16:17

R-3 16:45

19:53

Leak check ⊗ flow pass

04/29

perform leak check

⊗ Flow "Pass"

M-205 and Calibrate

M-29/M-30B O<sub>2</sub>/CO<sub>2</sub>

R-1 8:42 - 11:50

R-2 12:36 - 15:46

R-3 16:02 -

perform leak check ⊗ flow  
"Pass"



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 114              |
| DATE      | 04/28/18             |
| METHOD    | 29                   |
| POLLUTANT | Metals               |



**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** 29  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/Rainy, 50 degrees

**Run:** 1  
**Start Time:** 9:18  
**End Time:** 12:28  
**Date:** 4/28/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
ΔH@ 1.8073  
Probe ID 4A  
Nozzle ID 0.255  
Hot box ID 1  
Pitot Cp 0.84  
Liner type Glass  
Nozzle size 0.2550 inches  
Nozzle area 0.000355 sq.ft.  
Probe heat 250 F  
Filter heat 250 F

**Source Information:**

Barometric Pressure 29.85 "Hg  
Static Pressure 0.56 "H<sub>2</sub>O  
Ave. ΔP 1 "H<sub>2</sub>O  
Stack Temperature 260 F  
Assumed moisture 2 %  
Assumed meter temp. 55 F  
Total number of points 24  
Time per point 7.5  
Total run time 180  
O<sub>2</sub> 19.78 %  
CO<sub>2</sub> 0.67 %  
Rec. Nz. 0.223 inches

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 11       | 9         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 182.080 dcf  
Wet mol. weight 28.7 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.84 %  
Std. meter vol. 183.453 dscf  
Isokinetic Average 100.3 %  
Ave. ΔP 1.026 "H<sub>2</sub>O  
Ave. √ΔP 1.012 "H<sub>2</sub>O  
Ave. ΔH 3.313 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 263.8 °F  
Ave. T<sub>m</sub> 57.4 °F

**Moisture/Lab:**

|                   | Filter | N/A # | Initial | Final | Gain |
|-------------------|--------|-------|---------|-------|------|
| Impingers, g      |        |       | 200.0   | 235   | 35.0 |
| Silica gel, g     |        |       | 244.2   | 282.2 | 38.0 |
| Total water gain: |        |       |         |       | 73.0 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 7.5         | 837.394            | 1.10                            | 262              | 51               | 3.53     | 3.50   | 4            | 255             | 49                     |
| 2              | 15          | 852.960            | 1.10                            | 263              | 52               | 3.53     | 3.50   | 4            | 256             | 48                     |
| 3              | 22.5        | 860.380            | 1.00                            | 261              | 52               | 3.22     | 3.20   | 4            | 256             | 50                     |
| 4              | 30          | 867.810            | 1.00                            | 264              | 53               | 3.21     | 3.20   | 4            | 256             | 51                     |
| 5              | 37.5        | 875.600            | 1.10                            | 264              | 54               | 3.54     | 3.50   | 4            | 254             | 51                     |
| 6              | 45          | 883.460            | 1.10                            | 265              | 55               | 3.54     | 3.50   | 4            | 255             | 53                     |
| 7              | 52.5        | 890.870            | 1.00                            | 265              | 56               | 3.22     | 3.20   | 4            | 253             | 55                     |
| 8              | 60          | 898.350            | 1.00                            | 264              | 56               | 3.23     | 3.20   | 4            | 255             | 55                     |
| 9              | 67.5        | 905.820            | 1.00                            | 265              | 57               | 3.23     | 3.20   | 4            | 251             | 51                     |
| 10             | 75          | 913.180            | 0.97                            | 264              | 57               | 3.14     | 3.10   | 4            | 253             | 49                     |
| 11             | 82.5        | 920.380            | 0.92                            | 261              | 58               | 2.99     | 3.00   | 4            | 253             | 49                     |
| 12             | 90          | 926.879            | 0.74                            | 256              | 58               | 2.43     | 2.40   | 4            | 254             | 50                     |
| 13             | 97.5        | 934.480            | 1.00                            | 259              | 59               | 3.27     | 3.20   | 4            | 255             | 53                     |
| 14             | 105         | 942.400            | 1.10                            | 259              | 59               | 3.60     | 3.60   | 4            | 254             | 48                     |
| 15             | 112.5       | 949.830            | 0.99                            | 258              | 59               | 3.24     | 3.20   | 4            | 256             | 48                     |
| 16             | 120         | 957.260            | 1.00                            | 265              | 59               | 3.24     | 3.20   | 4            | 256             | 50                     |
| 17             | 127.5       | 965.200            | 1.10                            | 267              | 60               | 3.56     | 3.60   | 4            | 256             | 52                     |
| 18             | 135         | 973.120            | 1.10                            | 267              | 60               | 3.56     | 3.60   | 4            | 257             | 53                     |
| 19             | 142.5       | 981.010            | 1.10                            | 267              | 60               | 3.56     | 3.60   | 4            | 255             | 53                     |
| 20             | 150         | 988.880            | 1.10                            | 267              | 60               | 3.56     | 3.60   | 4            | 254             | 53                     |
| 21             | 157.5       | 996.790            | 1.10                            | 267              | 60               | 3.56     | 3.60   | 4            | 256             | 51                     |
| 22             | 165         | 1004.280           | 1.00                            | 267              | 60               | 3.24     | 3.20   | 4            | 256             | 49                     |
| 23             | 172.5       | 1011.870           | 1.00                            | 267              | 61               | 3.25     | 3.30   | 4            | 256             | 49                     |
| 24             | 180         | 1019.474           | 1.00                            | 266              | 61               | 3.25     | 3.30   | 4            | 254             | 48                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** 29  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/Rainy, 50 degrees

**Run:** 2  
**Start Time:** 13:09  
**End Time:** 16:16  
**Date:** 4/28/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 4A Liner type: Glass  
Y factor 0.9820 Nozzle ID 0.255 Nozzle size: 0.2550 inches  
 $\Delta H@$  1.8073 Hot box ID 1 Nozzle area: 0.000355 sq.ft.  
Pitot Cp 0.84 Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.83 "Hg  $O_2$  19.96 %  
Static Pressure 0.56 "H<sub>2</sub>O  $CO_2$  0.64 %  
Ave.  $\Delta P$  1 "H<sub>2</sub>O Rec. Nz. 0.222 inches  
Stack Temperature 260 F  
Assumed moisture 1.84 %  
Assumed meter temp. 57.4 F  
Total number of points 24  
Time per point 7.5  
Total run time 180

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 10       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 183.915 dcf Ave.  $\Delta P$  1.036 "H<sub>2</sub>O  
Wet mol. weight 28.7 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.0172 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 1.82 % Ave.  $\Delta H$  3.388 "H<sub>2</sub>O  
Std. meter vol. 184.461 dscf Ave. T<sub>s</sub> 262.2 °F  
Isokinetic Average 100.2 % Ave. T<sub>m</sub> 59.5 °F

**Moisture/Lab:**

| Filter        | N/A #             |       |      |
|---------------|-------------------|-------|------|
|               | Initial           | Final | Gain |
| Impingers, g  | 200.0             | 230   | 30.0 |
| Silica gel, g | 242.0             | 284.8 | 42.8 |
|               | Total water gain: |       | 72.8 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 7.5         | 19.680             | 1.10                                    | 258              | 58               | 3.60             | 3.60           | 4            | 252             | 46                     |
| 2              | 15          | 27.530             | 1.10                                    | 262              | 58               | 3.58             | 3.60           | 4            | 255             | 43                     |
| 3              | 22.5        | 35.460             | 1.10                                    | 262              | 57               | 3.58             | 3.60           | 4            | 255             | 48                     |
| 4              | 30          | 43.370             | 1.00                                    | 263              | 57               | 3.25             | 3.20           | 4            | 253             | 48                     |
| 5              | 37.5        | 50.850             | 1.00                                    | 263              | 57               | 3.25             | 3.20           | 4            | 258             | 52                     |
| 6              | 45          | 58.250             | 1.10                                    | 264              | 57               | 3.57             | 3.60           | 4            | 257             | 52                     |
| 7              | 52.5        | 66.150             | 1.00                                    | 265              | 57               | 3.24             | 3.20           | 4            | 254             | 56                     |
| 8              | 60          | 73.600             | 1.00                                    | 265              | 58               | 3.25             | 3.20           | 4            | 255             | 56                     |
| 9              | 67.5        | 81.070             | 1.10                                    | 266              | 58               | 3.56             | 3.60           | 4            | 258             | 55                     |
| 10             | 75          | 88.940             | 1.10                                    | 266              | 58               | 3.56             | 3.60           | 4            | 256             | 56                     |
| 11             | 82.5        | 96.860             | 1.10                                    | 266              | 58               | 3.56             | 3.60           | 4            | 256             | 56                     |
| 12             | 90          | 104.190            | 0.94                                    | 265              | 59               | 3.06             | 3.10           | 4            | 256             | 56                     |
| 13             | 97.5        | 110.850            | 0.79                                    | 261              | 60               | 2.59             | 2.60           | 4            | 254             | 58                     |
| 14             | 105         | 118.360            | 1.00                                    | 259              | 61               | 3.29             | 3.30           | 4            | 253             | 60                     |
| 15             | 112.5       | 125.810            | 0.95                                    | 255              | 61               | 3.14             | 3.10           | 4            | 255             | 53                     |
| 16             | 120         | 133.260            | 0.99                                    | 257              | 61               | 3.27             | 3.30           | 4            | 252             | 54                     |
| 17             | 127.5       | 141.200            | 1.10                                    | 258              | 61               | 3.63             | 3.60           | 4            | 256             | 54                     |
| 18             | 135         | 149.120            | 1.10                                    | 264              | 61               | 3.60             | 3.60           | 4            | 261             | 55                     |
| 19             | 142.5       | 157.060            | 1.10                                    | 263              | 62               | 3.61             | 3.60           | 4            | 255             | 56                     |
| 20             | 150         | 164.990            | 1.10                                    | 264              | 62               | 3.60             | 3.60           | 4            | 253             | 57                     |
| 21             | 157.5       | 172.590            | 1.00                                    | 263              | 62               | 3.28             | 3.30           | 4            | 253             | 56                     |
| 22             | 165         | 180.190            | 1.00                                    | 263              | 61               | 3.27             | 3.30           | 4            | 257             | 55                     |
| 23             | 172.5       | 188.050            | 1.10                                    | 262              | 61               | 3.61             | 3.60           | 4            | 253             | 54                     |
| 24             | 180         | 195.990            | 1.10                                    | 263              | 61               | 3.60             | 3.60           | 4            | 256             | 56                     |
|                |             | 203.595            | 1.00                                    | 262              | 60               | 3.27             | 3.30           | 4            | 258             | 57                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**EPA Method:** 29  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy/Rainy, 50 degrees

**Run:** 3  
**Start Time:** 16:45  
**End Time:** 19:53  
**Date:** 4/28/2018

**Stack Dimensional Data:**

Circular  
Diameter 36.000 in  
Rectangular  
Width in  
Length in  
Stack Area 7.069 sq.ft.

**Equipment:**

|             |        |            |       |              |                 |
|-------------|--------|------------|-------|--------------|-----------------|
| Meterbox ID | 11     | Probe ID   | 4A    | Liner type:  | Glass           |
| Y factor    | 0.9820 | Nozzle ID  | 0.255 | Nozzle size: | 0.2550 inches   |
| ΔH@         | 1.8073 | Hot box ID | 1     | Nozzle area: | 0.000355 sq.ft. |
|             |        | Pitot Cp   | 0.84  | Probe heat:  | 250 F           |
|             |        |            |       | Filter heat: | 250 F           |

**Source Information:**

|                        |                        |                 |              |
|------------------------|------------------------|-----------------|--------------|
| Barometric Pressure    | 29.8 "Hg               | O <sub>2</sub>  | 19.97 %      |
| Static Pressure        | 0.56 "H <sub>2</sub> O | CO <sub>2</sub> | 0.66 %       |
| Ave. ΔP                | 1 "H <sub>2</sub> O    | Rec. Nz.        | 0.222 inches |
| Stack Temperature      | 260 F                  |                 |              |
| Assumed moisture       | 1.82 %                 |                 |              |
| Assumed meter temp.    | 59.5 F                 |                 |              |
| Total number of points | 24                     |                 |              |
| Time per point         | 7.5                    |                 |              |
| Total run time         | 180                    |                 |              |

|                         |          |           |
|-------------------------|----------|-----------|
| <b>Leak Checks:</b>     | Pre-test | Post-test |
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 11       | 9         |

**Nozzle check for roundness:**

|             |       |              |
|-------------|-------|--------------|
| 1           | 2     | 3            |
| 0.255       | 0.255 | 0.255 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

|                         |                               |                     |                          |
|-------------------------|-------------------------------|---------------------|--------------------------|
| Sample volume           | 185.195 dcf                   | Ave. ΔP             | 1.053 "H <sub>2</sub> O  |
| Wet mol. weight         | 28.67 M <sub>s</sub> (actual) | Ave. √ΔP            | 1.0253 "H <sub>2</sub> O |
| Actual H <sub>2</sub> O | 2.07 %                        | Ave. ΔH             | 3.446 "H <sub>2</sub> O  |
| Std. meter vol.         | 186.158 dscf                  | Ave. T <sub>s</sub> | 262.3 °F                 |
| Isokinetic Average      | 100.6 %                       | Ave. T <sub>m</sub> | 57.9 °F                  |

**Moisture/Lab:**

|               |                   |       |      |
|---------------|-------------------|-------|------|
| Filter        | N/A #             |       |      |
|               | Initial           | Final | Gain |
| Impingers, g  | 200.0             | 240   | 40.0 |
| Silica gel, g | 255.0             | 298.5 | 43.5 |
|               | Total water gain: |       | 83.5 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 7.5         | 203.810            | 1.10                            | 257              | 58               | 3.61     | 3.60   | 4            | 250             | 56                     |
| 2              | 15          | 211.620            | 1.10                            | 261              | 58               | 3.59     | 3.60   | 4            | 252             | 43                     |
| 3              | 22.5        | 219.550            | 1.10                            | 264              | 57               | 3.57     | 3.60   | 4            | 258             | 43                     |
| 4              | 30          | 227.430            | 1.00                            | 264              | 57               | 3.24     | 3.20   | 4            | 259             | 46                     |
| 5              | 37.5        | 234.870            | 1.10                            | 263              | 57               | 3.57     | 3.60   | 4            | 261             | 47                     |
| 6              | 45          | 242.780            | 1.10                            | 263              | 58               | 3.58     | 3.60   | 4            | 261             | 50                     |
| 7              | 52.5        | 250.690            | 1.00                            | 264              | 58               | 3.25     | 3.30   | 4            | 255             | 51                     |
| 8              | 60          | 258.270            | 1.00                            | 264              | 58               | 3.25     | 3.30   | 4            | 253             | 55                     |
| 9              | 67.5        | 265.780            | 1.10                            | 263              | 58               | 3.58     | 3.60   | 4            | 255             | 55                     |
| 10             | 75          | 273.730            | 1.10                            | 263              | 58               | 3.58     | 3.60   | 4            | 252             | 56                     |
| 11             | 82.5        | 281.500            | 0.96                            | 263              | 58               | 3.13     | 3.10   | 4            | 251             | 55                     |
| 12             | 90          | 288.930            | 0.81                            | 260              | 58               | 2.65     | 2.70   | 4            | 253             | 54                     |
| 13             | 97.5        | 295.700            | 1.00                            | 254              | 58               | 3.30     | 3.30   | 4            | 253             | 54                     |
| 14             | 105         | 303.280            | 1.10                            | 252              | 58               | 3.64     | 3.60   | 4            | 254             | 47                     |
| 15             | 112.5       | 311.170            | 1.10                            | 263              | 58               | 3.58     | 3.60   | 4            | 257             | 50                     |
| 16             | 120         | 319.060            | 1.10                            | 262              | 58               | 3.59     | 3.60   | 4            | 253             | 52                     |
| 17             | 127.5       | 326.950            | 1.10                            | 264              | 58               | 3.58     | 3.60   | 4            | 257             | 53                     |
| 18             | 135         | 334.850            | 1.10                            | 264              | 58               | 3.58     | 3.60   | 4            | 255             | 54                     |
| 19             | 142.5       | 342.750            | 1.00                            | 264              | 58               | 3.25     | 3.30   | 4            | 254             | 53                     |
| 20             | 150         | 350.330            | 1.00                            | 264              | 58               | 3.25     | 3.30   | 4            | 255             | 53                     |
| 21             | 157.5       | 357.820            | 1.10                            | 265              | 58               | 3.57     | 3.60   | 4            | 261             | 52                     |
| 22             | 165         | 365.730            | 1.10                            | 264              | 58               | 3.58     | 3.60   | 4            | 258             | 51                     |
| 23             | 172.5       | 373.640            | 1.10                            | 264              | 58               | 3.58     | 3.60   | 4            | 254             | 51                     |
| 24             | 180         | 381.500            | 0.99                            | 264              | 58               | 3.22     | 3.20   | 4            | 256             | 51                     |
|                |             | 389.005            |                                 |                  |                  |          |        |              |                 |                        |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 29

**Run:** 1  
**Start Time:** 9:18  
**End Time:** 12:28  
**Date:** 4/28/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 837.394                  |                                 |                            |                   |                         |                            |             |
| 7.5           | 845.240                  | 3.50                            | 51                         | 1                 | 1.10                    | 262                        | 1.0488      |
| 15.0          | 852.960                  | 3.50                            | 52                         | 2                 | 1.10                    | 263                        | 1.0488      |
| 22.5          | 860.380                  | 3.20                            | 52                         | 3                 | 1.00                    | 261                        | 1.0000      |
| 30.0          | 867.810                  | 3.20                            | 53                         | 4                 | 1.00                    | 264                        | 1.0000      |
| 37.5          | 875.600                  | 3.50                            | 54                         | 5                 | 1.10                    | 264                        | 1.0488      |
| 45.0          | 883.460                  | 3.50                            | 55                         | 6                 | 1.10                    | 265                        | 1.0488      |
| 52.5          | 890.870                  | 3.20                            | 56                         | 7                 | 1.00                    | 265                        | 1.0000      |
| 60.0          | 898.350                  | 3.20                            | 56                         | 8                 | 1.00                    | 264                        | 1.0000      |
| 67.5          | 905.820                  | 3.20                            | 57                         | 9                 | 1.00                    | 265                        | 1.0000      |
| 75.0          | 913.180                  | 3.10                            | 57                         | 10                | 0.97                    | 264                        | 0.9849      |
| 82.5          | 920.380                  | 3.00                            | 58                         | 11                | 0.92                    | 261                        | 0.9592      |
| 90.0          | 926.879                  | 2.40                            | 58                         | 12                | 0.74                    | 256                        | 0.8602      |
| 97.5          | 934.480                  | 3.20                            | 59                         | 13                | 1.00                    | 259                        | 1.0000      |
| 105.0         | 942.400                  | 3.60                            | 59                         | 14                | 1.10                    | 259                        | 1.0488      |
| 112.5         | 949.830                  | 3.20                            | 59                         | 15                | 0.99                    | 258                        | 0.9950      |
| 120.0         | 957.260                  | 3.20                            | 59                         | 16                | 1.00                    | 265                        | 1.0000      |
| 127.5         | 965.200                  | 3.60                            | 60                         | 17                | 1.10                    | 267                        | 1.0488      |
| 135.0         | 973.120                  | 3.60                            | 60                         | 18                | 1.10                    | 267                        | 1.0488      |
| 142.5         | 981.010                  | 3.60                            | 60                         | 19                | 1.10                    | 267                        | 1.0488      |
| 150.0         | 988.880                  | 3.60                            | 60                         | 20                | 1.10                    | 267                        | 1.0488      |
| 157.5         | 996.790                  | 3.60                            | 60                         | 21                | 1.10                    | 267                        | 1.0488      |
| 165.0         | 1004.280                 | 3.20                            | 60                         | 22                | 1.00                    | 267                        | 1.0000      |
| 172.5         | 1011.870                 | 3.30                            | 61                         | 23                | 1.00                    | 267                        | 1.0000      |
| 180.0         | 1019.474                 | 3.30                            | 61                         | 24                | 1.00                    | 266                        | 1.0000      |

**Client: Hollingsworth & Vose****Run: 1****Source: CFU 114****Date: 04/28/18**

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**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 180 min         |
| Sample Time Interval   | 7.5 min         |
| Meter Volume, $V_m$    | 182.080 dcf     |
| Water Volume           | 73.0 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2550 in.      |
| Nozzle Area            | 0.000355 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 36.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 7.069 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 29.85 "Hg              |
| Static Pressure            | 0.56 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.67 %vd  |
| O <sub>2</sub> Average  | 19.78 %vd |

**Field Data Averages**

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Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 3.313 "H <sub>2</sub> O |
| Temperature, $T_m$    | 57.4 °F                 |
| Temperature, $T_m$    | 517.4 °A (°R)           |
| Pressure Meter, $P_m$ | 30.094 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.0120 "H <sub>2</sub> O |
| Temperature, $T_s$    | 263.8 °F                 |
| Temperature, $T_s$    | 723.8 °A (°R)            |
| Pressure Stack, $P_s$ | 29.891 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 183.453 dscf |
|                                | 5.195 dscm   |
| Actual Volume, $V_{m(actual)}$ | 256.549 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 66.75 fps           |
| Volume (actual)   | 28,311.3 awcfm      |
|                   | 27,790.4 adcfm      |
| Volume (standard) | 1,237,958.1 wscf/hr |
|                   | 1,215,179.7 dscf/hr |
|                   | 20,253.0 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 3.435 scf |
| Moisture, $B_{ws}$           | 0.0184    |
| Moisture EPA M4              | 1.84 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.90 lb/lb-mole |
| Wet, $M_s$ | 28.70 lb/lb-mole |

|                    |         |
|--------------------|---------|
| Percent Isokinetic | 100.3 % |
|--------------------|---------|

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 29

**Run:** 2  
**Start Time:** 13:09  
**End Time:** 16:16  
**Date:** 04/28/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 19.680                   |                                 |                            |                   |                         |                            |             |
| 7.5           | 27.530                   | 3.60                            | 58                         | 1                 | 1.10                    | 258                        | 1.0488      |
| 15.0          | 35.460                   | 3.60                            | 58                         | 2                 | 1.10                    | 262                        | 1.0488      |
| 22.5          | 43.370                   | 3.60                            | 57                         | 3                 | 1.10                    | 262                        | 1.0488      |
| 30.0          | 50.850                   | 3.20                            | 57                         | 4                 | 1.00                    | 263                        | 1.0000      |
| 37.5          | 58.250                   | 3.20                            | 57                         | 5                 | 1.00                    | 263                        | 1.0000      |
| 45.0          | 66.150                   | 3.60                            | 57                         | 6                 | 1.10                    | 264                        | 1.0488      |
| 52.5          | 73.600                   | 3.20                            | 57                         | 7                 | 1.00                    | 265                        | 1.0000      |
| 60.0          | 81.070                   | 3.20                            | 58                         | 8                 | 1.00                    | 265                        | 1.0000      |
| 67.5          | 88.940                   | 3.60                            | 58                         | 9                 | 1.10                    | 266                        | 1.0488      |
| 75.0          | 96.860                   | 3.60                            | 58                         | 10                | 1.10                    | 266                        | 1.0488      |
| 82.5          | 104.190                  | 3.10                            | 59                         | 11                | 0.94                    | 265                        | 0.9695      |
| 90.0          | 110.850                  | 2.60                            | 60                         | 12                | 0.79                    | 261                        | 0.8888      |
| 97.5          | 118.360                  | 3.30                            | 61                         | 13                | 1.00                    | 259                        | 1.0000      |
| 105.0         | 125.810                  | 3.10                            | 61                         | 14                | 0.95                    | 255                        | 0.9747      |
| 112.5         | 133.260                  | 3.30                            | 61                         | 15                | 0.99                    | 257                        | 0.9950      |
| 120.0         | 141.200                  | 3.60                            | 61                         | 16                | 1.10                    | 258                        | 1.0488      |
| 127.5         | 149.120                  | 3.60                            | 61                         | 17                | 1.10                    | 264                        | 1.0488      |
| 135.0         | 157.060                  | 3.60                            | 62                         | 18                | 1.10                    | 263                        | 1.0488      |
| 142.5         | 164.990                  | 3.60                            | 62                         | 19                | 1.10                    | 264                        | 1.0488      |
| 150.0         | 172.590                  | 3.30                            | 62                         | 20                | 1.00                    | 263                        | 1.0000      |
| 157.5         | 180.190                  | 3.30                            | 61                         | 21                | 1.00                    | 263                        | 1.0000      |
| 165.0         | 188.050                  | 3.60                            | 61                         | 22                | 1.10                    | 262                        | 1.0488      |
| 172.5         | 195.990                  | 3.60                            | 61                         | 23                | 1.10                    | 263                        | 1.0488      |
| 180.0         | 203.595                  | 3.30                            | 60                         | 24                | 1.00                    | 262                        | 1.0000      |

**Client: Hollingsworth & Vose****Run: 2****Source: CFU 114****Date: 04/28/18**

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**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 180 min         |
| Sample Time Interval   | 7.5 min         |
| Meter Volume, $V_m$    | 183.915 dcf     |
| Water Volume           | 72.8 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2550 in.      |
| Nozzle Area            | 0.000355 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 36.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 7.069 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 29.83 "Hg              |
| Static Pressure            | 0.56 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.64 %vd  |
| O <sub>2</sub> Average  | 19.96 %vd |

**Field Data Averages**

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Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 3.388 "H <sub>2</sub> O |
| Temperature, $T_m$    | 59.5 °F                 |
| Temperature, $T_m$    | 519.5 °A (°R)           |
| Pressure Meter, $P_m$ | 30.079 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.0172 "H <sub>2</sub> O |
| Temperature, $T_s$    | 262.2 °F                 |
| Temperature, $T_s$    | 722.2 °A (°R)            |
| Pressure Stack, $P_s$ | 29.871 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 184.461 dscf |
|                                | 5.223 dscm   |
| Actual Volume, $V_{m(actual)}$ | 257.508 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 67.04 fps           |
| Volume (actual)   | 28,434.3 awcfm      |
|                   | 27,916.8 adcfm      |
| Volume (standard) | 1,245,257.3 wscf/hr |
|                   | 1,222,593.6 dscf/hr |
|                   | 20,376.6 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 3.426 scf |
| Moisture, $B_{ws}$           | 0.0182    |
| Moisture EPA M4              | 1.82 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.90 lb/lb-mole |
| Wet, $M_s$ | 28.70 lb/lb-mole |

|                    |         |
|--------------------|---------|
| Percent Isokinetic | 100.2 % |
|--------------------|---------|

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Method:** 29

**Run:** 3  
**Start Time:** 16:45  
**End Time:** 19:53  
**Date:** 04/28/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 203.810                  |                                 |                            |                   |                         |                            |             |
| 7.5           | 211.620                  | 3.60                            | 58                         | 1                 | 1.10                    | 257                        | 1.0488      |
| 15.0          | 219.550                  | 3.60                            | 58                         | 2                 | 1.10                    | 261                        | 1.0488      |
| 22.5          | 227.430                  | 3.60                            | 57                         | 3                 | 1.10                    | 264                        | 1.0488      |
| 30.0          | 234.870                  | 3.20                            | 57                         | 4                 | 1.00                    | 264                        | 1.0000      |
| 37.5          | 242.780                  | 3.60                            | 57                         | 5                 | 1.10                    | 263                        | 1.0488      |
| 45.0          | 250.690                  | 3.60                            | 58                         | 6                 | 1.10                    | 264                        | 1.0488      |
| 52.5          | 258.270                  | 3.30                            | 58                         | 7                 | 1.00                    | 264                        | 1.0000      |
| 60.0          | 265.780                  | 3.30                            | 58                         | 8                 | 1.00                    | 264                        | 1.0000      |
| 67.5          | 273.730                  | 3.60                            | 58                         | 9                 | 1.10                    | 263                        | 1.0488      |
| 75.0          | 281.500                  | 3.60                            | 58                         | 10                | 1.10                    | 263                        | 1.0488      |
| 82.5          | 288.930                  | 3.10                            | 58                         | 11                | 0.96                    | 263                        | 0.9798      |
| 90.0          | 295.700                  | 2.70                            | 58                         | 12                | 0.81                    | 260                        | 0.9000      |
| 97.5          | 303.280                  | 3.30                            | 58                         | 13                | 1.00                    | 254                        | 1.0000      |
| 105.0         | 311.170                  | 3.60                            | 58                         | 14                | 1.10                    | 252                        | 1.0488      |
| 112.5         | 319.060                  | 3.60                            | 58                         | 15                | 1.10                    | 263                        | 1.0488      |
| 120.0         | 326.950                  | 3.60                            | 58                         | 16                | 1.10                    | 262                        | 1.0488      |
| 127.5         | 334.850                  | 3.60                            | 58                         | 17                | 1.10                    | 264                        | 1.0488      |
| 135.0         | 342.750                  | 3.60                            | 58                         | 18                | 1.10                    | 264                        | 1.0488      |
| 142.5         | 350.330                  | 3.30                            | 58                         | 19                | 1.00                    | 264                        | 1.0000      |
| 150.0         | 357.820                  | 3.30                            | 58                         | 20                | 1.00                    | 264                        | 1.0000      |
| 157.5         | 365.730                  | 3.60                            | 58                         | 21                | 1.10                    | 265                        | 1.0488      |
| 165.0         | 373.640                  | 3.60                            | 58                         | 22                | 1.10                    | 264                        | 1.0488      |
| 172.5         | 381.500                  | 3.60                            | 58                         | 23                | 1.10                    | 264                        | 1.0488      |
| 180.0         | 389.005                  | 3.20                            | 58                         | 24                | 0.99                    | 264                        | 0.9950      |



Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU 114

Date:

04/28/18

**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 180 min         |
| Sample Time Interval   | 7.5 min         |
| Meter Volume, $V_m$    | 185.195 dcf     |
| Water Volume           | 83.5 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2550 in.      |
| Nozzle Area            | 0.000355 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 36.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 7.069 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 29.80 "Hg              |
| Static Pressure            | 0.56 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.66 %vd  |
| O <sub>2</sub> Average  | 19.97 %vd |

**Field Data Averages**Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 3.446 "H <sub>2</sub> O |
| Temperature, $T_m$    | 57.9 °F                 |
| Temperature, $T_m$    | 517.9 °A (°R)           |
| Pressure Meter, $P_m$ | 30.053 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.0253 "H <sub>2</sub> O |
| Temperature, $T_s$    | 262.3 °F                 |
| Temperature, $T_s$    | 722.3 °A (°R)            |
| Pressure Stack, $P_s$ | 29.841 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 186.158 dscf |
|                                | 5.271 dscm   |
| Actual Volume, $V_{m(actual)}$ | 260.838 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 67.65 fps           |
| Volume (actual)   | 28,693.1 awcfm      |
|                   | 28,099.2 adcfm      |
| Volume (standard) | 1,255,152.2 wscf/hr |
|                   | 1,229,170.5 dscf/hr |
|                   | 20,486.2 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 3.930 scf |
| Moisture, $B_{ws}$           | 0.0207    |
| Moisture EPA M4              | 2.07 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.90 lb/lb-mole |
| Wet, $M_s$ | 28.67 lb/lb-mole |

|                    |         |
|--------------------|---------|
| Percent Isokinetic | 100.6 % |
|--------------------|---------|

|             |            |        |           |        |              |          |           |
|-------------|------------|--------|-----------|--------|--------------|----------|-----------|
| Source:     | CFU 114    |        |           |        | Sample Date: | 04/28/18 |           |
| Run:        | 1          |        |           |        |              |          |           |
|             | Filter +   |        |           |        |              |          |           |
| Client ID:  | Front Half |        | Back Half |        |              |          |           |
| Analyte     | <          | Result | <         | Result | FH MDL       | BH MDL   | Units     |
| Antimony    | <          | MDL    | <         | MDL    | 1.250        | 0.500    | µg/sample |
| Arsenic     | <          | MDL    | <         | MDL    | 1.750        | 0.700    | µg/sample |
| Barium      |            | 4.030  |           | 0.547  | 0.125        | 0.050    | µg/sample |
| Beryllium   | <          | MDL    | <         | MDL    | 0.050        | 0.020    | µg/sample |
| Cadmium     |            | 0.492  | <         | MDL    | 0.100        | 0.040    | µg/sample |
| Chromium    |            | 1.630  |           | 0.176  | 0.200        | 0.080    | µg/sample |
| Cobalt      | <          | MDL    | <         | MDL    | 0.125        | 0.050    | µg/sample |
| Copper      | <          | MDL    |           | 2.330  | 1.250        | 0.500    | µg/sample |
| Lead        | <          | MDL    | <         | MDL    | 1.250        | 0.500    | µg/sample |
| Manganese   |            | 1.260  |           | 0.414  | 0.075        | 0.030    | µg/sample |
| Nickel      |            | 2.690  | <         | MDL    | 0.750        | 0.300    | µg/sample |
| Phosphorus  |            | 11.700 |           | 2.540  | 5.000        | 2.000    | µg/sample |
| Selenium    | <          | MDL    | <         | MDL    | 3.750        | 1.500    | µg/sample |
| Zinc        |            | 8.600  |           | 9.370  | 0.750        | 0.300    | µg/sample |
| Lab ID:     | 18-S668    |        | 18-S669   |        |              |          |           |
| Sample Vol: | 250        |        | 100       |        | mL           |          |           |

|             |            |        |           |        |                       |        |           |
|-------------|------------|--------|-----------|--------|-----------------------|--------|-----------|
| Source:     | CFU 114    |        |           |        | Sample Date: 04/28/18 |        |           |
| Run:        | 2          |        |           |        |                       |        |           |
|             | Filter +   |        |           |        |                       |        |           |
| Client ID:  | Front Half |        | Back Half |        |                       |        |           |
| Analyte     | <          | Result | <         | Result | FH MDL                | BH MDL | Units     |
| Antimony    | <          | MDL    | <         | MDL    | 1.250                 | 0.500  | µg/sample |
| Arsenic     | <          | MDL    | <         | MDL    | 1.750                 | 0.700  | µg/sample |
| Barium      |            | 3.610  |           | 0.575  | 0.125                 | 0.050  | µg/sample |
| Beryllium   | <          | MDL    | <         | MDL    | 0.050                 | 0.020  | µg/sample |
| Cadmium     | <          | MDL    | <         | MDL    | 0.100                 | 0.040  | µg/sample |
| Chromium    |            | 1.360  |           | 0.194  | 0.200                 | 0.080  | µg/sample |
| Cobalt      | <          | MDL    | <         | MDL    | 0.125                 | 0.050  | µg/sample |
| Copper      | <          | MDL    |           | 1.670  | 1.250                 | 0.500  | µg/sample |
| Lead        | <          | MDL    | <         | MDL    | 1.250                 | 0.500  | µg/sample |
| Manganese   |            | 1.060  |           | 0.451  | 0.075                 | 0.030  | µg/sample |
| Nickel      |            | 2.540  | <         | MDL    | 0.750                 | 0.300  | µg/sample |
| Phosphorus  |            | 9.690  | <         | MDL    | 5.000                 | 2.000  | µg/sample |
| Selenium    | <          | MDL    | <         | MDL    | 3.750                 | 1.500  | µg/sample |
| Zinc        |            | 6.480  |           | 18.700 | 0.750                 | 0.300  | µg/sample |
| Lab ID:     | 18-S670    |        | 18-S671   |        |                       |        |           |
| Sample Vol: | 250        |        | 100       |        | mL                    |        |           |

Source: CFU 114 Sample Date: 04/28/18

Run: 3

Filter +

| Client ID:     | Front Half |               | Back Half |               |               |               |              |
|----------------|------------|---------------|-----------|---------------|---------------|---------------|--------------|
| <u>Analyte</u> | <          | <u>Result</u> | <         | <u>Result</u> | <u>FH MDL</u> | <u>BH MDL</u> | <u>Units</u> |
| Antimony       | <          | MDL           | <         | MDL           | 1.250         | 0.500         | µg/sample    |
| Arsenic        | <          | MDL           | <         | MDL           | 1.750         | 0.700         | µg/sample    |
| Barium         |            | 3.920         |           | 0.450         | 0.125         | 0.050         | µg/sample    |
| Beryllium      | <          | MDL           | <         | MDL           | 0.050         | 0.020         | µg/sample    |
| Cadmium        | <          | MDL           | <         | MDL           | 0.100         | 0.040         | µg/sample    |
| Chromium       |            | 1.350         |           | 0.164         | 0.200         | 0.080         | µg/sample    |
| Cobalt         | <          | MDL           | <         | MDL           | 0.125         | 0.050         | µg/sample    |
| Copper         | <          | MDL           |           | 2.000         | 1.250         | 0.500         | µg/sample    |
| Lead           | <          | MDL           | <         | MDL           | 1.250         | 0.500         | µg/sample    |
| Manganese      |            | 1.180         |           | 0.370         | 0.075         | 0.030         | µg/sample    |
| Nickel         |            | 4.270         | <         | MDL           | 0.750         | 0.300         | µg/sample    |
| Phosphorus     |            | 9.880         | <         | MDL           | 5.000         | 2.000         | µg/sample    |
| Selenium       | <          | MDL           | <         | MDL           | 3.750         | 1.500         | µg/sample    |
| Zinc           |            | 6.620         |           | 6.980         | 0.750         | 0.300         | µg/sample    |
| Lab ID:        |            | 18-S672       |           | 18-S673       |               |               |              |
| Sample Vol:    |            | 250           |           | 100           |               |               | mL           |

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**Source: CFU 114**  
**Blank Values**

| Client ID:      |   | Filter           | MDL                                   | BH Capture Soln.                                           |         | MDL                                                            | FH/BH Rinse            |                  | MDL                           |                  |
|-----------------|---|------------------|---------------------------------------|------------------------------------------------------------|---------|----------------------------------------------------------------|------------------------|------------------|-------------------------------|------------------|
|                 |   |                  |                                       | 5% HNO <sub>3</sub> /<br>10% H <sub>2</sub> O <sub>2</sub> |         | 5% HNO <sub>3</sub> / 10%<br>H <sub>2</sub> O <sub>2</sub> MDL | 0.1 N HNO <sub>3</sub> |                  | 0.1 N HNO <sub>3</sub><br>MDL |                  |
| <u>Analyte</u>  | < | <u>ug/sample</u> | <u>Filter MDL</u><br><u>ug/sample</u> | <u>ug/sample</u>                                           | <       | <u>ug/sample</u>                                               | <                      | <u>ug/sample</u> | <                             | <u>ug/sample</u> |
| Antimony        | < | MDL              | 1.250                                 | <                                                          | MDL     | 0.500                                                          | <                      | MDL              |                               | 1.250            |
| Arsenic         | < | MDL              | 1.750                                 | <                                                          | MDL     | 0.700                                                          | <                      | MDL              |                               | 1.750            |
| Barium          |   | 3.300            | 0.125                                 |                                                            | 0.362   | 0.050                                                          |                        | 0.221            |                               | 0.125            |
| Beryllium       | < | MDL              | 0.050                                 | <                                                          | MDL     | 0.020                                                          | <                      | MDL              |                               | 0.050            |
| Cadmium         | < | MDL              | 0.100                                 | <                                                          | MDL     | 0.040                                                          | <                      | MDL              |                               | 0.100            |
| Chromium        |   | 1.330            | 0.200                                 |                                                            | 0.098   | 0.080                                                          | <                      | MDL              |                               | 0.200            |
| Cobalt          | < | MDL              | 0.125                                 | <                                                          | MDL     | 0.050                                                          | <                      | MDL              |                               | 0.125            |
| Copper          | < | MDL              | 1.250                                 |                                                            | 1.520   | 0.500                                                          | <                      | MDL              |                               | 1.250            |
| Lead            | < | MDL              | 1.250                                 | <                                                          | MDL     | 0.500                                                          | <                      | MDL              |                               | 1.250            |
| Manganese       |   | 0.565            | 0.075                                 |                                                            | 0.295   | 0.030                                                          |                        | 0.176            |                               | 0.075            |
| Nickel          |   | 2.370            | 0.750                                 | <                                                          | MDL     | 0.300                                                          | <                      | MDL              |                               | 0.750            |
| Phosphorus      |   | 7.900            | 5.000                                 | <                                                          | MDL     | 2.000                                                          | <                      | MDL              |                               | 5.000            |
| Selenium        | < | MDL              | 3.750                                 | <                                                          | MDL     | 1.500                                                          | <                      | MDL              |                               | 3.750            |
| Zinc            |   | 2.200            | 0.750                                 |                                                            | 0.556   | 0.300                                                          | <                      | MDL              |                               | 0.750            |
| Lab ID:         |   | 18-S675          |                                       |                                                            | 18-S676 |                                                                |                        | 18-S674          |                               |                  |
| Sample Vol, ml: |   | 250              |                                       |                                                            | 100     |                                                                |                        | 250              |                               |                  |

Hollingsworth & Vose  
CFU 114

Method 29 Metals Blank Calculations

Run: 1

1 of 3

| 04/28/18    | I                                 | II                   | III                  | IV                                                                 | V                                | VI                               | VII                  | VIII      |                   |
|-------------|-----------------------------------|----------------------|----------------------|--------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------|-----------|-------------------|
|             | Sample*                           | Blank*               | Blank*               | Sample*                                                            | Blank*                           | BH Blank*                        | BH Blank*            | Allowable |                   |
|             | FH                                | FH                   | FH                   | BH                                                                 | BH                               | Corrected                        | Corrected            | BH        |                   |
| Species     | Wash+Filter                       | Wash, µg             | Filter, µg           | Cap.Sol.                                                           | Cap.Sol.                         | Cap.Sol.                         | Wash, µg             | Blank, µg | Species           |
| Volume(ml)  | 100                               | 100                  | N/A                  | 100                                                                | µg/mL                            | 200                              | 100                  |           |                   |
| <b>Sb</b> < | 1.250 <                           | 0.5000 <             | 1.250 <              | 0.500 <                                                            | 0.0050 <                         | 1.000 <                          | 0.5000               | 0.000     | <b>Antimony</b>   |
| <b>As</b> < | 1.750 <                           | 0.7000 <             | 1.750 <              | 0.700 <                                                            | 0.0070 <                         | 1.400 <                          | 0.7000               | 0.000     | <b>Arsenic</b>    |
| <b>Ba</b>   | 4.030                             | 0.0884               | 3.300                | 0.547                                                              | 0.0036                           | 0.724                            | 0.0884               | 0.812     | <b>Barium</b>     |
| <b>Be</b> < | 0.050 <                           | 0.0200 <             | 0.050 <              | 0.020 <                                                            | 0.0002 <                         | 0.040 <                          | 0.0200               | 0.000     | <b>Beryllium</b>  |
| <b>Cd</b>   | 0.492 <                           | 0.0400 <             | 0.100 <              | 0.040 <                                                            | 0.0004 <                         | 0.080 <                          | 0.0400               | 0.000     | <b>Cadmium</b>    |
| <b>Cr</b>   | 1.630 <                           | 0.0800               | 1.330                | 0.176                                                              | 0.0010                           | 0.196 <                          | 0.0800               | 0.196     | <b>Chromium</b>   |
| <b>Co</b> < | 0.125 <                           | 0.0500 <             | 0.125 <              | 0.050 <                                                            | 0.0005 <                         | 0.100 <                          | 0.0500               | 0.000     | <b>Cobalt</b>     |
| <b>Cu</b> < | 1.250 <                           | 0.5000 <             | 1.250                | 2.330                                                              | 0.0152                           | 3.040 <                          | 0.5000               | 3.040     | <b>Copper</b>     |
| <b>Pb</b> < | 1.250 <                           | 0.5000 <             | 1.250 <              | 0.500 <                                                            | 0.0050 <                         | 1.000 <                          | 0.5000               | 0.000     | <b>Lead</b>       |
| <b>Mn</b>   | 1.260                             | 0.0704               | 0.565                | 0.414                                                              | 0.0030                           | 0.590                            | 0.0704               | 0.660     | <b>Manganese</b>  |
| <b>Ni</b>   | 2.690 <                           | 0.3000               | 2.370 <              | 0.300 <                                                            | 0.0030 <                         | 0.600 <                          | 0.3000               | 0.000     | <b>Nickel</b>     |
| <b>P</b>    | 11.700 <                          | 2.0000               | 7.900                | 2.540 <                                                            | 0.0200 <                         | 4.000 <                          | 2.0000               | 0.000     | <b>Phosphorus</b> |
| <b>Se</b> < | 3.750 <                           | 1.5000 <             | 3.750 <              | 1.500 <                                                            | 0.0150 <                         | 3.000 <                          | 1.5000               | 0.000     | <b>Selenium</b>   |
| <b>Zn</b>   | 8.600 <                           | 0.3000               | 2.200                | 9.370                                                              | 0.0056                           | 1.112 <                          | 0.3000               | 1.112     | <b>Zinc</b>       |
| <b>Lab:</b> | <b>18-S668</b>                    | <b>18-S674</b>       | <b>18-S675</b>       | <b>18-S669</b>                                                     | <b>18-S676</b>                   |                                  |                      |           |                   |
| Content:    | 0.1NHNO <sub>3</sub>              | 0.1NHNO <sub>3</sub> | 0.1NHNO <sub>3</sub> | 5%HNO <sub>3</sub> /                                               | 5%HNO <sub>3</sub> /             | 5%HNO <sub>3</sub> /             | 0.1NHNO <sub>3</sub> |           |                   |
|             | FH Filter & Probe Rinse           |                      |                      | 10%H <sub>2</sub> O <sub>2</sub>                                   | 10%H <sub>2</sub> O <sub>2</sub> | 10%H <sub>2</sub> O <sub>2</sub> |                      |           |                   |
|             | 100ml 0.1N HNO <sub>3</sub> rinse |                      |                      | BH Imps 1&2                                                        |                                  |                                  |                      |           |                   |
|             |                                   | Same as BH           |                      | 100ml .1N HNO <sub>3</sub> rinse                                   |                                  |                                  | Same as FH           |           |                   |
|             |                                   | Blank Wash           |                      | 200ml 5%HNO <sub>3</sub> /10%H <sub>2</sub> O <sub>2</sub> reagent |                                  |                                  | Blank Wash           |           |                   |

Blanks are prorated to reflect 100ml for HNO<sub>3</sub> and 200ml for HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

\* Blank Rules:

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

CFU 114  
4/28/18

Method 29 Metals Blank Calculations

Run: 1

2 of 3

|           | X              | XI        | XII             | XIII      | XIV        | XV              |                   |
|-----------|----------------|-----------|-----------------|-----------|------------|-----------------|-------------------|
|           | Allowable      | FH Blank  | 5% of FH        | Lessor of | Greater of | FH              |                   |
| Species   | FH             | Corrected | Sample, $\mu g$ | XI or XII | A or XIII  | Net             | Species           |
|           | Blank, $\mu g$ | $\mu g$   |                 |           |            | Sample, $\mu g$ |                   |
| <b>Sb</b> | 0.000          | 0.000 <   | 0.063           | 0.000     | 11.63 <    | 1.250           | <b>Antimony</b>   |
| <b>As</b> | 0.000          | 0.000 <   | 0.088           | 0.000     | 11.63 <    | 1.750           | <b>Arsenic</b>    |
| <b>Ba</b> | 3.388          | 3.388     | 0.202           | 0.202     | 11.63      | 0.642           | <b>Barium</b>     |
| <b>Be</b> | 0.000          | 0.000 <   | 0.003           | 0.000     | 11.63 <    | 0.050           | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000          | 0.000     | 0.025           | 0.000     | 11.63      | 0.492           | <b>Cadmium</b>    |
| <b>Cr</b> | 1.330          | 1.330     | 0.082           | 0.082     | 11.63      | 0.300           | <b>Chromium</b>   |
| <b>Co</b> | 0.000          | 0.000 <   | 0.006           | 0.000     | 11.63 <    | 0.125           | <b>Cobalt</b>     |
| <b>Cu</b> | 0.000          | 0.000 <   | 0.063           | 0.000     | 11.63 <    | 1.250           | <b>Copper</b>     |
| <b>Pb</b> | 0.000          | 0.000 <   | 0.063           | 0.000     | 11.63 <    | 1.250           | <b>Lead</b>       |
| <b>Mn</b> | 0.635          | 0.635     | 0.063           | 0.063     | 11.63      | 0.625           | <b>Manganese</b>  |
| <b>Ni</b> | 2.370          | 2.370     | 0.135           | 0.135     | 11.63      | 0.320           | <b>Nickel</b>     |
| <b>P</b>  | 7.900          | 7.900     | 0.585           | 0.585     | 11.63      | 3.800           | <b>Phosphorus</b> |
| <b>Se</b> | 0.000          | 0.000 <   | 0.188           | 0.000     | 11.63 <    | 3.750           | <b>Selenium</b>   |
| <b>Zn</b> | 2.200          | 2.200     | 0.430           | 0.430     | 11.63      | 6.400           | <b>Zinc</b>       |

Allowable FH Blank Calculation:

$A = (\text{area of filter, sq. in.}) \times (1.4 \mu g/\text{sq.in.}) = \mu g$

$A = 11.63 \mu g$

if  $A > \text{blank} > 0$ , use blank derived

if blank > A, use greater of A or 5% of sample  $\mu g$  or FH blank whichever is lessor.

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

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Method 29 Metals Blank Calculations

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|           | XVI            | XVII     | XVIII           | XIX           | XX               | XXI             | XXII            | XXIII           |                   |
|-----------|----------------|----------|-----------------|---------------|------------------|-----------------|-----------------|-----------------|-------------------|
|           | Allowable      | Blank BH | 5% of BH        | Lessor of     | Greater of       | BH              | FH              | FH+BH           |                   |
|           | BH             | Total    | sample, $\mu g$ | XVII or XVIII | 1 $\mu g$ or XIX | Net             | Net             | Total Net       |                   |
| Species   | Blank, $\mu g$ |          |                 |               |                  | Sample, $\mu g$ | Sample, $\mu g$ | Sample, $\mu g$ | Species           |
| <b>Sb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500</b> <  | <b>1.250</b> <  | <b>1.750</b>    | <b>Antimony</b>   |
| <b>As</b> | 0.000          | 0.000 <  | 0.035           | 0.000         | 1.000 <          | <b>0.700</b> <  | <b>1.750</b> <  | <b>2.450</b>    | <b>Arsenic</b>    |
| <b>Ba</b> | 0.812          | 0.812    | 0.027           | 0.027         | 1.000            | <b>0.000</b>    | <b>0.642</b>    | <b>0.642</b>    | <b>Barium</b>     |
| <b>Be</b> | 0.000          | 0.000 <  | 0.001           | 0.000         | 1.000 <          | <b>0.020</b> <  | <b>0.050</b> <  | <b>0.070</b>    | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000          | 0.000 <  | 0.002           | 0.000         | 1.000 <          | <b>0.040</b>    | <b>0.492</b> <  | <b>0.532</b>    | <b>Cadmium</b>    |
| <b>Cr</b> | 0.196          | 0.196    | 0.009           | 0.009         | 1.000            | <b>0.000</b>    | <b>0.300</b>    | <b>0.300</b>    | <b>Chromium</b>   |
| <b>Co</b> | 0.000          | 0.000 <  | 0.003           | 0.000         | 1.000 <          | <b>0.050</b> <  | <b>0.125</b> <  | <b>0.175</b>    | <b>Cobalt</b>     |
| <b>Cu</b> | 1.000          | 3.040    | 0.117           | 0.117         | 1.000            | <b>1.330</b> <  | <b>1.250</b> <  | <b>2.580</b>    | <b>Copper</b>     |
| <b>Pb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500</b> <  | <b>1.250</b> <  | <b>1.750</b>    | <b>Lead</b>       |
| <b>Mn</b> | 0.660          | 0.660    | 0.021           | 0.021         | 1.000            | <b>0.000</b>    | <b>0.625</b>    | <b>0.625</b>    | <b>Manganese</b>  |
| <b>Ni</b> | 0.000          | 0.000 <  | 0.015           | 0.000         | 1.000 <          | <b>0.300</b>    | <b>0.320</b> <  | <b>0.620</b>    | <b>Nickel</b>     |
| <b>P</b>  | 0.000          | 0.000    | 0.127           | 0.000         | 1.000            | <b>2.540</b>    | <b>3.800</b>    | <b>6.340</b>    | <b>Phosphorus</b> |
| <b>Se</b> | 0.000          | 0.000 <  | 0.075           | 0.000         | 1.000 <          | <b>1.500</b> <  | <b>3.750</b> <  | <b>5.250</b>    | <b>Selenium</b>   |
| <b>Zn</b> | 1.000          | 1.112    | 0.469           | 0.469         | 1.000            | <b>8.370</b>    | <b>6.400</b>    | <b>14.770</b>   | <b>Zinc</b>       |

Allowable BH Blank Calculation:

if 1.00 $\mu g$  > blank > 0, use blank derived

if blank > 1.00 $\mu g$ , use greater of 1.00 or 5% of sample ug or BH blank whichever is lessor

**\* Blank Rules:**

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Hollingsworth &amp; Vose

## Method 29 Metals Blank Calculations

Run: 2

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|             | I                                 |   | II                   |   | III                  |   | IV                                                                 |   | V                                |   | VI                               |   | VII                  |  | VIII      |                   |
|-------------|-----------------------------------|---|----------------------|---|----------------------|---|--------------------------------------------------------------------|---|----------------------------------|---|----------------------------------|---|----------------------|--|-----------|-------------------|
|             | Sample*                           |   | Blank*               |   | Blank*               |   | Sample*                                                            |   | Blank*                           |   | BH Blank*                        |   | BH Blank*            |  | Allowable |                   |
|             | FH                                |   | FH                   |   | FH                   |   | BH                                                                 |   | BH                               |   | Corrected                        |   | Corrected            |  | BH        |                   |
| Species     | Wash+Filter                       |   | Wash, µg             |   | Filter, µg           |   | Cap.Sol.                                                           |   | Cap.Sol.                         |   | Cap.Sol.                         |   | Wash, µg             |  | Blank, µg |                   |
| Volume(ml)  | 100                               |   | 100                  |   | N/A                  |   | 100                                                                |   | µg/mL                            |   | 200                              |   | 100                  |  | Species   |                   |
| <b>Sb</b> < | 1.250                             | < | 0.5000               | < | 1.250                | < | 0.500                                                              | < | 0.0050                           | < | 1.000                            | < | 0.5000               |  | 0.000     | <b>Antimony</b>   |
| <b>As</b> < | 1.750                             | < | 0.7000               | < | 1.750                | < | 0.700                                                              | < | 0.0070                           | < | 1.400                            | < | 0.7000               |  | 0.000     | <b>Arsenic</b>    |
| <b>Ba</b>   | 3.610                             |   | 0.0884               |   | 3.300                |   | 0.575                                                              |   | 0.0036                           |   | 0.724                            |   | 0.0884               |  | 0.812     | <b>Barium</b>     |
| <b>Be</b> < | 0.050                             | < | 0.0200               | < | 0.050                | < | 0.020                                                              | < | 0.0002                           | < | 0.040                            | < | 0.0200               |  | 0.000     | <b>Beryllium</b>  |
| <b>Cd</b> < | 0.100                             | < | 0.0400               | < | 0.100                | < | 0.040                                                              | < | 0.0004                           | < | 0.080                            | < | 0.0400               |  | 0.000     | <b>Cadmium</b>    |
| <b>Cr</b>   | 1.360                             | < | 0.0800               |   | 1.330                |   | 0.194                                                              |   | 0.0010                           |   | 0.196                            | < | 0.0800               |  | 0.196     | <b>Chromium</b>   |
| <b>Co</b> < | 0.125                             | < | 0.0500               | < | 0.125                | < | 0.050                                                              | < | 0.0005                           | < | 0.100                            | < | 0.0500               |  | 0.000     | <b>Cobalt</b>     |
| <b>Cu</b> < | 1.250                             | < | 0.5000               | < | 1.250                |   | 1.670                                                              |   | 0.0152                           |   | 3.040                            | < | 0.5000               |  | 3.040     | <b>Copper</b>     |
| <b>Pb</b> < | 1.250                             | < | 0.5000               | < | 1.250                | < | 0.500                                                              | < | 0.0050                           | < | 1.000                            | < | 0.5000               |  | 0.000     | <b>Lead</b>       |
| <b>Mn</b>   | 1.060                             |   | 0.0704               |   | 0.565                |   | 0.451                                                              |   | 0.0030                           |   | 0.590                            |   | 0.0704               |  | 0.660     | <b>Manganese</b>  |
| <b>Ni</b>   | 2.540                             | < | 0.3000               |   | 2.370                | < | 0.300                                                              | < | 0.0030                           | < | 0.600                            | < | 0.3000               |  | 0.000     | <b>Nickel</b>     |
| <b>P</b>    | 9.690                             | < | 2.0000               |   | 7.900                | < | 2.000                                                              | < | 0.0200                           | < | 4.000                            | < | 2.0000               |  | 0.000     | <b>Phosphorus</b> |
| <b>Se</b> < | 3.750                             | < | 1.5000               | < | 3.750                | < | 1.500                                                              | < | 0.0150                           | < | 3.000                            | < | 1.5000               |  | 0.000     | <b>Selenium</b>   |
| <b>Zn</b>   | 6.480                             | < | 0.3000               |   | 2.200                |   | 18.700                                                             |   | 0.0056                           |   | 1.112                            | < | 0.3000               |  | 1.112     | <b>Zinc</b>       |
| <b>Lab:</b> | <b>18-S670</b>                    |   | <b>18-S674</b>       |   | <b>18-S675</b>       |   | <b>18-S671</b>                                                     |   | <b>18-S676</b>                   |   |                                  |   |                      |  |           |                   |
| Content:    | 0.1NHNO <sub>3</sub>              |   | 0.1NHNO <sub>3</sub> |   | 0.1NHNO <sub>3</sub> |   | 5%HNO <sub>3</sub> /                                               |   | 5%HNO <sub>3</sub> /             |   | 5%HNO <sub>3</sub> /             |   | 0.1NHNO <sub>3</sub> |  |           |                   |
|             | FH Filter & Probe Rinse           |   |                      |   |                      |   | 10%H <sub>2</sub> O <sub>2</sub>                                   |   | 10%H <sub>2</sub> O <sub>2</sub> |   | 10%H <sub>2</sub> O <sub>2</sub> |   |                      |  |           |                   |
|             | 100ml 0.1N HNO <sub>3</sub> rinse |   |                      |   |                      |   | BH Imps 1&2                                                        |   |                                  |   |                                  |   |                      |  |           |                   |
|             |                                   |   | Same as BH           |   |                      |   | 100ml .1N HNO <sub>3</sub> rinse                                   |   |                                  |   |                                  |   | Same as FH           |  |           |                   |
|             |                                   |   | Blank Wash           |   |                      |   | 200ml 5%HNO <sub>3</sub> /10%H <sub>2</sub> O <sub>2</sub> reagent |   |                                  |   |                                  |   | Blank Wash           |  |           |                   |

Blanks are prorated to reflect 100ml for HNO<sub>3</sub> and 200ml for HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

## \* Blank Rules:

"&lt;" indicates value is below the minimum detection limit (MDL)

If Blank is a "&lt;" value it is treated as zero.

If Sample is a "&lt;" it used for emission rate calculations but the final answer contains a "&lt;" to demonstrate the value is unknown



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Method 29 Metals Blank Calculations

Run: 2

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| Species   | X<br>Allowable<br>FH<br>Blank, $\mu g$ | XI<br>FH Blank<br>Corrected<br>$\mu g$ | XII<br>5% of FH<br>Sample, $\mu g$ | XIII<br>Lessor of<br>XI or XII | XIV<br>Greater of<br>A or XIII | XV<br>FH<br>Net<br>Sample, $\mu g$ | Species           |
|-----------|----------------------------------------|----------------------------------------|------------------------------------|--------------------------------|--------------------------------|------------------------------------|-------------------|
| <b>Sb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Antimony</b>   |
| <b>As</b> | 0.000                                  | 0.000 <                                | 0.088                              | 0.000                          | 11.63 <                        | 1.750                              | <b>Arsenic</b>    |
| <b>Ba</b> | 3.388                                  | 3.388                                  | 0.181                              | 0.181                          | 11.63                          | 0.222                              | <b>Barium</b>     |
| <b>Be</b> | 0.000                                  | 0.000 <                                | 0.003                              | 0.000                          | 11.63 <                        | 0.050                              | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000                                  | 0.000 <                                | 0.005                              | 0.000                          | 11.63 <                        | 0.100                              | <b>Cadmium</b>    |
| <b>Cr</b> | 1.330                                  | 1.330                                  | 0.068                              | 0.068                          | 11.63                          | 0.030                              | <b>Chromium</b>   |
| <b>Co</b> | 0.000                                  | 0.000 <                                | 0.006                              | 0.000                          | 11.63 <                        | 0.125                              | <b>Cobalt</b>     |
| <b>Cu</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Copper</b>     |
| <b>Pb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Lead</b>       |
| <b>Mn</b> | 0.635                                  | 0.635                                  | 0.053                              | 0.053                          | 11.63                          | 0.425                              | <b>Manganese</b>  |
| <b>Ni</b> | 2.370                                  | 2.370                                  | 0.127                              | 0.127                          | 11.63                          | 0.170                              | <b>Nickel</b>     |
| <b>P</b>  | 7.900                                  | 7.900                                  | 0.485                              | 0.485                          | 11.63                          | 1.790                              | <b>Phosphorus</b> |
| <b>Se</b> | 0.000                                  | 0.000 <                                | 0.188                              | 0.000                          | 11.63 <                        | 3.750                              | <b>Selenium</b>   |
| <b>Zn</b> | 2.200                                  | 2.200                                  | 0.324                              | 0.324                          | 11.63                          | 4.280                              | <b>Zinc</b>       |

Allowable FH Blank Calculation:

$A = (\text{area of filter, sq. in.}) \times (1.4 \mu g/\text{sq. in.}) = \mu g$

$A = 11.63 \mu g$

if  $A > \text{blank} > 0$ , use blank derived

if blank > A, use greater of A or 5% of sample  $\mu g$  or FH blank whichever is lessor.

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Method 29 Metals Blank Calculations

Run: 2

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|           | XVI            | XVII     | XVIII           | XIX           | XX               | XXI               | XXII              | XXIII           |                   |
|-----------|----------------|----------|-----------------|---------------|------------------|-------------------|-------------------|-----------------|-------------------|
|           | Allowable      | Blank BH | 5% of BH        | Lessor of     | Greater of       | BH                | FH                | FH+BH           |                   |
|           | BH             | Total    | sample, $\mu g$ | XVII or XVIII | 1 $\mu g$ or XIX | Net               | Net               | Total Net       |                   |
| Species   | Blank, $\mu g$ |          |                 |               |                  | Sample, $\mu g$   | Sample, $\mu g$   | Sample, $\mu g$ | Species           |
| <b>Sb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Antimony</b>   |
| <b>As</b> | 0.000          | 0.000 <  | 0.035           | 0.000         | 1.000 <          | <b>0.700 &lt;</b> | <b>1.750 &lt;</b> | <b>2.450</b>    | <b>Arsenic</b>    |
| <b>Ba</b> | 0.812          | 0.812    | 0.029           | 0.029         | 1.000            | <b>0.000</b>      | <b>0.222</b>      | <b>0.222</b>    | <b>Barium</b>     |
| <b>Be</b> | 0.000          | 0.000 <  | 0.001           | 0.000         | 1.000 <          | <b>0.020 &lt;</b> | <b>0.050 &lt;</b> | <b>0.070</b>    | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000          | 0.000 <  | 0.002           | 0.000         | 1.000 <          | <b>0.040 &lt;</b> | <b>0.100 &lt;</b> | <b>0.140</b>    | <b>Cadmium</b>    |
| <b>Cr</b> | 0.196          | 0.196    | 0.010           | 0.010         | 1.000            | <b>0.000</b>      | <b>0.030</b>      | <b>0.030</b>    | <b>Chromium</b>   |
| <b>Co</b> | 0.000          | 0.000 <  | 0.003           | 0.000         | 1.000 <          | <b>0.050 &lt;</b> | <b>0.125 &lt;</b> | <b>0.175</b>    | <b>Cobalt</b>     |
| <b>Cu</b> | 1.000          | 3.040    | 0.084           | 0.084         | 1.000            | <b>0.670 &lt;</b> | <b>1.250 &lt;</b> | <b>1.920</b>    | <b>Copper</b>     |
| <b>Pb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Lead</b>       |
| <b>Mn</b> | 0.660          | 0.660    | 0.023           | 0.023         | 1.000            | <b>0.000</b>      | <b>0.425</b>      | <b>0.425</b>    | <b>Manganese</b>  |
| <b>Ni</b> | 0.000          | 0.000 <  | 0.015           | 0.000         | 1.000 <          | <b>0.300</b>      | <b>0.170 &lt;</b> | <b>0.470</b>    | <b>Nickel</b>     |
| <b>P</b>  | 0.000          | 0.000 <  | 0.100           | 0.000         | 1.000 <          | <b>2.000</b>      | <b>1.790 &lt;</b> | <b>3.790</b>    | <b>Phosphorus</b> |
| <b>Se</b> | 0.000          | 0.000 <  | 0.075           | 0.000         | 1.000 <          | <b>1.500 &lt;</b> | <b>3.750 &lt;</b> | <b>5.250</b>    | <b>Selenium</b>   |
| <b>Zn</b> | 1.000          | 1.112    | 0.935           | 0.935         | 1.000            | <b>17.700</b>     | <b>4.280</b>      | <b>21.980</b>   | <b>Zinc</b>       |

Allowable BH Blank Calculation:

if  $1.00\mu g > \text{blank} > 0$ , use blank derived

if blank  $> 1.00\mu g$ , use greater of 1.00 or 5% of sample ug or BH blank whichever is lessor

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Method 29 Metals Blank Calculations

Run: 3

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| Species     |   | I                                 | II                   | III                  | IV                                                                 | V                                | VI                               | VII                  | VIII      | Species           |
|-------------|---|-----------------------------------|----------------------|----------------------|--------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------|-----------|-------------------|
|             |   | Sample*                           | Blank*               | Blank*               | Sample*                                                            | Blank*                           | BH Blank*                        | BH Blank*            | Allowable |                   |
| Volume(ml)  |   | FH                                | FH                   | FH                   | BH                                                                 | BH                               | Corrected                        | Corrected            | BH        |                   |
|             |   | Wash+Filter                       | Wash, µg             | Filter, µg           | Cap.Sol.                                                           | Cap.Sol.                         | Cap.Sol.                         | Wash, µg             | Blank, µg |                   |
|             |   | 100                               | 100                  | N/A                  | 100                                                                | µg/mL                            | 200                              | 100                  |           |                   |
| <b>Sb</b>   | < | 1.250                             | <                    | 1.250                | <                                                                  | 0.0050                           | <                                | 0.5000               | 0.000     | <b>Antimony</b>   |
| <b>As</b>   | < | 1.750                             | <                    | 1.750                | <                                                                  | 0.0070                           | <                                | 0.7000               | 0.000     | <b>Arsenic</b>    |
| <b>Ba</b>   |   | 3.920                             | 0.0884               | 3.300                | 0.450                                                              | 0.0036                           | 0.724                            | 0.0884               | 0.812     | <b>Barium</b>     |
| <b>Be</b>   | < | 0.050                             | <                    | 0.050                | <                                                                  | 0.0002                           | <                                | 0.0200               | 0.000     | <b>Beryllium</b>  |
| <b>Cd</b>   | < | 0.100                             | <                    | 0.100                | <                                                                  | 0.0004                           | <                                | 0.0400               | 0.000     | <b>Cadmium</b>    |
| <b>Cr</b>   |   | 1.350                             | <                    | 1.330                | 0.164                                                              | 0.0010                           | 0.196                            | 0.0800               | 0.196     | <b>Chromium</b>   |
| <b>Co</b>   | < | 0.125                             | <                    | 0.125                | <                                                                  | 0.0005                           | <                                | 0.0500               | 0.000     | <b>Cobalt</b>     |
| <b>Cu</b>   | < | 1.250                             | <                    | 1.250                | 2.000                                                              | 0.0152                           | 3.040                            | 0.5000               | 3.040     | <b>Copper</b>     |
| <b>Pb</b>   | < | 1.250                             | <                    | 1.250                | <                                                                  | 0.0050                           | <                                | 0.5000               | 0.000     | <b>Lead</b>       |
| <b>Mn</b>   |   | 1.180                             | 0.0704               | 0.565                | 0.370                                                              | 0.0030                           | 0.590                            | 0.0704               | 0.660     | <b>Manganese</b>  |
| <b>Ni</b>   |   | 4.270                             | <                    | 2.370                | <                                                                  | 0.0030                           | <                                | 0.3000               | 0.000     | <b>Nickel</b>     |
| <b>P</b>    |   | 9.880                             | <                    | 7.900                | <                                                                  | 0.0200                           | <                                | 2.0000               | 0.000     | <b>Phosphorus</b> |
| <b>Se</b>   | < | 3.750                             | <                    | 3.750                | <                                                                  | 0.0150                           | <                                | 1.5000               | 0.000     | <b>Selenium</b>   |
| <b>Zn</b>   |   | 6.620                             | <                    | 2.200                | 6.980                                                              | 0.0056                           | 1.112                            | 0.3000               | 1.112     | <b>Zinc</b>       |
| <b>Lab:</b> |   | <b>18-S672</b>                    | <b>18-S674</b>       | <b>18-S675</b>       | <b>18-S673</b>                                                     | <b>18-S676</b>                   |                                  |                      |           |                   |
| Content:    |   | 0.1NHNO <sub>3</sub>              | 0.1NHNO <sub>3</sub> | 0.1NHNO <sub>3</sub> | 5%HNO <sub>3</sub> /                                               | 5%HNO <sub>3</sub> /             | 5%HNO <sub>3</sub> /             | 0.1NHNO <sub>3</sub> |           |                   |
|             |   | FH Filter & Probe Rinse           |                      |                      | 10%H <sub>2</sub> O <sub>2</sub>                                   | 10%H <sub>2</sub> O <sub>2</sub> | 10%H <sub>2</sub> O <sub>2</sub> |                      |           |                   |
|             |   | 100ml 0.1N HNO <sub>3</sub> rinse |                      |                      | BH Imps 1&2                                                        |                                  |                                  |                      |           |                   |
|             |   |                                   | Same as BH           |                      | 100ml .1N HNO <sub>3</sub> rinse                                   |                                  |                                  | Same as FH           |           |                   |
|             |   |                                   | Blank Wash           |                      | 200ml 5%HNO <sub>3</sub> /10%H <sub>2</sub> O <sub>2</sub> reagent |                                  |                                  | Blank Wash           |           |                   |

Blanks are prorated to reflect 100ml for HNO<sub>3</sub> and 200ml for HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

\* Blank Rules:

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

| Species   | X<br>Allowable<br>FH<br>Blank, $\mu g$ | XI<br>FH Blank<br>Corrected<br>$\mu g$ | XII<br>5% of FH<br>Sample, $\mu g$ | XIII<br>Lessor of<br>XI or XII | XIV<br>Greater of<br>A or XIII | XV<br>FH<br>Net<br>Sample, $\mu g$ | Species           |
|-----------|----------------------------------------|----------------------------------------|------------------------------------|--------------------------------|--------------------------------|------------------------------------|-------------------|
| <b>Sb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Antimony</b>   |
| <b>As</b> | 0.000                                  | 0.000 <                                | 0.088                              | 0.000                          | 11.63 <                        | 1.750                              | <b>Arsenic</b>    |
| <b>Ba</b> | 3.388                                  | 3.388                                  | 0.196                              | 0.196                          | 11.63                          | 0.532                              | <b>Barium</b>     |
| <b>Be</b> | 0.000                                  | 0.000 <                                | 0.003                              | 0.000                          | 11.63 <                        | 0.050                              | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000                                  | 0.000 <                                | 0.005                              | 0.000                          | 11.63 <                        | 0.100                              | <b>Cadmium</b>    |
| <b>Cr</b> | 1.330                                  | 1.330                                  | 0.068                              | 0.068                          | 11.63                          | 0.020                              | <b>Chromium</b>   |
| <b>Co</b> | 0.000                                  | 0.000 <                                | 0.006                              | 0.000                          | 11.63 <                        | 0.125                              | <b>Cobalt</b>     |
| <b>Cu</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Copper</b>     |
| <b>Pb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Lead</b>       |
| <b>Mn</b> | 0.635                                  | 0.635                                  | 0.059                              | 0.059                          | 11.63                          | 0.545                              | <b>Manganese</b>  |
| <b>Ni</b> | 2.370                                  | 2.370                                  | 0.214                              | 0.214                          | 11.63                          | 1.900                              | <b>Nickel</b>     |
| <b>P</b>  | 7.900                                  | 7.900                                  | 0.494                              | 0.494                          | 11.63                          | 1.980                              | <b>Phosphorus</b> |
| <b>Se</b> | 0.000                                  | 0.000 <                                | 0.188                              | 0.000                          | 11.63 <                        | 3.750                              | <b>Selenium</b>   |
| <b>Zn</b> | 2.200                                  | 2.200                                  | 0.331                              | 0.331                          | 11.63                          | 4.420                              | <b>Zinc</b>       |

Allowable FH Blank Calculation:

$A = (\text{area of filter, sq. in.}) \times (1.4 \mu g/\text{sq. in.}) = \mu g$

A= 11.63  $\mu g$

if  $A > \text{blank} > 0$ , use blank derived

if blank > A, use greater of A or 5% of sample  $\mu g$  or FH blank whichever is lessor.

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

CFU 114  
4/28/18

Method 29 Metals Blank Calculations

Run: 3

3 of 3

|         | XVI            | XVII     | XVIII           | XIX           | XX               | XXI             | XXII            | XXIII           |            |
|---------|----------------|----------|-----------------|---------------|------------------|-----------------|-----------------|-----------------|------------|
|         | Allowable      | Blank BH | 5% of BH        | Lessor of     | Greater of       | BH              | FH              | FH+BH           |            |
|         | BH             | Total    | sample, $\mu g$ | XVII or XVIII | 1 $\mu g$ or XIX | Net             | Net             | Total Net       |            |
| Species | Blank, $\mu g$ |          |                 |               |                  | Sample, $\mu g$ | Sample, $\mu g$ | Sample, $\mu g$ | Species    |
| Sb      | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | 0.500 <         | 1.250 <         | 1.750           | Antimony   |
| As      | 0.000          | 0.000 <  | 0.035           | 0.000         | 1.000 <          | 0.700 <         | 1.750 <         | 2.450           | Arsenic    |
| Ba      | 0.812          | 0.812    | 0.023           | 0.023         | 1.000            | 0.000           | 0.532           | 0.532           | Barium     |
| Be      | 0.000          | 0.000 <  | 0.001           | 0.000         | 1.000 <          | 0.020 <         | 0.050 <         | 0.070           | Beryllium  |
| Cd      | 0.000          | 0.000 <  | 0.002           | 0.000         | 1.000 <          | 0.040 <         | 0.100 <         | 0.140           | Cadmium    |
| Cr      | 0.196          | 0.196    | 0.008           | 0.008         | 1.000            | 0.000           | 0.020           | 0.020           | Chromium   |
| Co      | 0.000          | 0.000 <  | 0.003           | 0.000         | 1.000 <          | 0.050 <         | 0.125 <         | 0.175           | Cobalt     |
| Cu      | 1.000          | 3.040    | 0.100           | 0.100         | 1.000            | 1.000 <         | 1.250 <         | 2.250           | Copper     |
| Pb      | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | 0.500 <         | 1.250 <         | 1.750           | Lead       |
| Mn      | 0.660          | 0.660    | 0.019           | 0.019         | 1.000            | 0.000           | 0.545           | 0.545           | Manganese  |
| Ni      | 0.000          | 0.000 <  | 0.015           | 0.000         | 1.000 <          | 0.300           | 1.900 <         | 2.200           | Nickel     |
| P       | 0.000          | 0.000 <  | 0.100           | 0.000         | 1.000 <          | 2.000           | 1.980 <         | 3.980           | Phosphorus |
| Se      | 0.000          | 0.000 <  | 0.075           | 0.000         | 1.000 <          | 1.500 <         | 3.750 <         | 5.250           | Selenium   |
| Zn      | 1.000          | 1.112    | 0.349           | 0.349         | 1.000            | 5.980           | 4.420           | 10.400          | Zinc       |

Allowable BH Blank Calculation:

if  $1.00\mu g > \text{blank} > 0$ , use blank derived

if  $\text{blank} > 1.00\mu g$ , use greater of 1.00 or 5% of sample  $\mu g$  or BH blank whichever is lessor

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

**EPA Method 29**  
**Gas Stream Characteristics**  
**Test Summary**

**Client:** Hollingsworth & Vose  
**Source:** CFU 114  
**Location:** Corvallis, OR

| Run                              | 1                | 2         | 3         |                 |
|----------------------------------|------------------|-----------|-----------|-----------------|
| Date                             | 4/28/2018        | 4/28/2018 | 4/28/2018 |                 |
| Run Start Time                   | 9:18             | 13:09     | 16:45     |                 |
| Run End Time                     | 12:28            | 16:16     | 19:53     |                 |
| Duration, min.                   | 180              | 180       | 180       | <b>Average</b>  |
| Barometric Pressure, "Hg         | 29.85            | 29.83     | 29.80     | <b>29.83</b>    |
| Nozzle Dia., in.                 | 0.2550           | 0.2550    | 0.2550    | <b>0.2550</b>   |
| Isokinetic Average, %            | 100.3            | 100.2     | 100.6     | <b>100.4</b>    |
| Sample Volume, dscf              | 183.453          | 184.461   | 186.158   | <b>184.691</b>  |
| Sample Volume, dscm              | 5.195            | 5.223     | 5.271     | <b>5.230</b>    |
| Stack Diameter, in.              | 36.00            | 36.00     | 36.00     | <b>36.00</b>    |
| Stack Area, sq.ft.               | 7.069            | 7.069     | 7.069     | <b>7.069</b>    |
| CO <sub>2</sub> %vd              | 0.67             | 0.64      | 0.66      | <b>0.66</b>     |
| O <sub>2</sub> %vd               | 19.78            | 19.96     | 19.97     | <b>19.90</b>    |
| Static Press., "H <sub>2</sub> O | 0.56             | 0.56      | 0.56      | <b>0.56</b>     |
| H <sub>2</sub> O %v              | 1.84             | 1.82      | 2.07      | <b>1.91</b>     |
| Wet Molecular Weight, lb/lb-mole | 28.70            | 28.70     | 28.67     | <b>28.69</b>    |
| Velocity, FPS                    | 66.75            | 67.04     | 67.65     | <b>67.15</b>    |
| ADCFM                            | 27,790.4         | 27,916.8  | 28,099.2  | <b>27,935.5</b> |
| AWCFM                            | 28,311.3         | 28,434.3  | 28,693.1  | <b>28,479.6</b> |
| DSCFM                            | 20,253.0         | 20,376.6  | 20,486.2  | <b>20,371.9</b> |
| Stack Temperature, °F            | 263.8            | 262.2     | 262.3     | <b>262.8</b>    |
| Production Data                  | Glass Production | lbs/hr    |           |                 |
|                                  |                  | 61.0      | 61.0      | 61.0            |

Hollingsworth & Vose  
CFU 114  
Metals Results Summary

Test: M29

| Run 1      |         |         |            |             |         |         |            |             |         |         |            |             |    |
|------------|---------|---------|------------|-------------|---------|---------|------------|-------------|---------|---------|------------|-------------|----|
| Total      |         |         |            |             | FH Net  |         |            |             | BH Net  |         |            |             |    |
| Species    | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony   | < 1.750 | < 0.337 | < 2.56E-05 | < 4.19E-07  | < 1.250 | < 0.241 | < 1.83E-05 | < 2.99E-07  | < 0.500 | < 0.096 | < 7.30E-06 | < 1.20E-07  | Sb |
| Arsenic    | < 2.450 | < 0.472 | < 3.58E-05 | < 5.87E-07  | < 1.750 | < 0.337 | < 2.56E-05 | < 4.19E-07  | < 0.700 | < 0.135 | < 1.02E-05 | < 1.68E-07  | As |
| Barium     | 0.642   | 0.124   | 9.37E-06   | 1.54E-07    | 0.642   | 0.124   | 9.37E-06   | 1.54E-07    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium  | < 0.070 | < 0.013 | < 1.02E-06 | < 1.68E-08  | < 0.050 | < 0.010 | < 7.30E-07 | < 1.20E-08  | < 0.020 | < 0.004 | < 2.92E-07 | < 4.79E-09  | Be |
| Cadmium    | < 0.532 | < 0.102 | < 7.77E-06 | < 1.27E-07  | 0.492   | 0.095   | 7.19E-06   | 1.18E-07    | < 0.040 | < 0.008 | < 5.84E-07 | < 9.57E-09  | Cd |
| Chromium   | 0.300   | 0.058   | 4.38E-06   | 7.18E-08    | 0.300   | 0.058   | 4.38E-06   | 7.18E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Cr |
| Cobalt     | < 0.175 | < 0.034 | < 2.56E-06 | < 4.19E-08  | < 0.125 | < 0.024 | < 1.83E-06 | < 2.99E-08  | < 0.050 | < 0.010 | < 7.30E-07 | < 1.20E-08  | Co |
| Copper     | < 2.580 | < 0.497 | < 3.77E-05 | < 6.18E-07  | < 1.250 | < 0.241 | < 1.83E-05 | < 2.99E-07  | 1.330   | 0.256   | 1.94E-05   | 3.18E-07    | Cu |
| Lead       | < 1.750 | < 0.337 | < 2.56E-05 | < 4.19E-07  | < 1.250 | < 0.241 | < 1.83E-05 | < 2.99E-07  | < 0.500 | < 0.096 | < 7.30E-06 | < 1.20E-07  | Pb |
| Manganese  | 0.625   | 0.120   | 9.12E-06   | 1.50E-07    | 0.625   | 0.120   | 9.12E-06   | 1.50E-07    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel     | < 0.620 | < 0.119 | < 9.05E-06 | < 1.48E-07  | 0.320   | 0.062   | 4.67E-06   | 7.66E-08    | < 0.300 | < 0.058 | < 4.38E-06 | < 7.18E-08  | Ni |
| Phosphorus | 6.340   | 1.220   | 9.26E-05   | 1.52E-06    | 3.800   | 0.731   | 5.55E-05   | 9.10E-07    | 2.540   | 0.489   | 3.71E-05   | 6.08E-07    | P  |
| Selenium   | < 5.250 | < 1.011 | < 7.67E-05 | < 1.26E-06  | < 3.750 | < 0.722 | < 5.48E-05 | < 8.98E-07  | < 1.500 | < 0.289 | < 2.19E-05 | < 3.591E-07 | Se |
| Zinc       | 14.770  | 2.843   | 2.16E-04   | 3.54E-06    | 6.400   | 1.232   | 9.35E-05   | 1.53E-06    | 8.370   | 1.611   | 1.22E-04   | 2.004E-06   | Zn |

| Run 2      |         |         |            |             |         |         |            |             |         |         |            |             |    |
|------------|---------|---------|------------|-------------|---------|---------|------------|-------------|---------|---------|------------|-------------|----|
| Total      |         |         |            |             | FH Net  |         |            |             | BH Net  |         |            |             |    |
| Species    | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony   | < 1.750 | < 0.335 | < 2.56E-05 | < 4.19E-07  | < 1.250 | < 0.239 | < 1.83E-05 | < 2.99E-07  | < 0.500 | < 0.096 | < 7.31E-06 | < 1.20E-07  | Sb |
| Arsenic    | < 2.450 | < 0.469 | < 3.58E-05 | < 5.87E-07  | < 1.750 | < 0.335 | < 2.56E-05 | < 4.19E-07  | < 0.700 | < 0.134 | < 1.02E-05 | < 1.68E-07  | As |
| Barium     | 0.222   | 0.042   | 3.24E-06   | 5.31E-08    | 0.222   | 0.042   | 3.24E-06   | 5.31E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium  | < 0.070 | < 0.013 | < 1.02E-06 | < 1.68E-08  | < 0.050 | < 0.010 | < 7.31E-07 | < 1.20E-08  | < 0.020 | < 0.004 | < 2.92E-07 | < 4.79E-09  | Be |
| Cadmium    | < 0.140 | < 0.027 | < 2.05E-06 | < 3.35E-08  | < 0.100 | < 0.019 | < 1.46E-06 | < 2.40E-08  | < 0.040 | < 0.008 | < 5.85E-07 | < 9.59E-09  | Cd |
| Chromium   | 0.030   | 0.006   | 4.38E-07   | 7.18E-09    | 0.030   | 0.006   | 4.38E-07   | 7.18E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Cr |
| Cobalt     | < 0.175 | < 0.034 | < 2.56E-06 | < 4.19E-08  | < 0.125 | < 0.024 | < 1.83E-06 | < 3.00E-08  | < 0.050 | < 0.010 | < 7.31E-07 | < 1.20E-08  | Co |
| Copper     | < 1.920 | < 0.368 | < 2.81E-05 | < 4.60E-07  | < 1.250 | < 0.239 | < 1.83E-05 | < 2.99E-07  | 0.670   | 0.128   | 9.79E-06   | 1.61E-07    | Cu |
| Lead       | < 1.750 | < 0.335 | < 2.56E-05 | < 4.19E-07  | < 1.250 | < 0.239 | < 1.83E-05 | < 2.99E-07  | < 0.500 | < 0.096 | < 7.31E-06 | < 1.20E-07  | Pb |
| Manganese  | 0.425   | 0.081   | 6.21E-06   | 1.02E-07    | 0.425   | 0.081   | 6.21E-06   | 1.02E-07    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel     | < 0.470 | < 0.090 | < 6.87E-06 | < 1.13E-07  | 0.170   | 0.033   | 2.48E-06   | 4.07E-08    | < 0.300 | < 0.057 | < 4.38E-06 | < 7.19E-08  | Ni |
| Phosphorus | < 3.790 | < 0.726 | < 5.54E-05 | < 9.08E-07  | 1.790   | 0.343   | 2.62E-05   | 4.29E-07    | < 2.000 | < 0.383 | < 2.92E-05 | < 4.79E-07  | P  |
| Selenium   | < 5.250 | < 1.005 | < 7.67E-05 | < 1.26E-06  | < 3.750 | < 0.718 | < 5.48E-05 | < 8.98E-07  | < 1.500 | < 0.287 | < 2.19E-05 | < 3.59E-07  | Se |
| Zinc       | 21.980  | 4.208   | 3.21E-04   | 5.27E-06    | 4.280   | 0.819   | 6.25E-05   | 1.03E-06    | 17.700  | 3.389   | 2.59E-04   | 4.24E-06    | Zn |

Hollingsworth & Vose  
CFU 114  
Metals Results Summary

Test: M29

| Run 3      |         |         |            |             |         |         |            |             |         |         |            |             |    |
|------------|---------|---------|------------|-------------|---------|---------|------------|-------------|---------|---------|------------|-------------|----|
|            | Total   |         |            |             | FH Net  |         |            |             | BH Net  |         |            |             |    |
| Species    | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony   | < 1.750 | < 0.332 | < 2.55E-05 | < 4.18E-07  | < 1.250 | < 0.237 | < 1.82E-05 | < 2.98E-07  | < 0.500 | < 0.095 | < 7.28E-06 | < 1.19E-07  | Sb |
| Arsenic    | < 2.450 | < 0.465 | < 3.57E-05 | < 5.85E-07  | < 1.750 | < 0.332 | < 2.55E-05 | < 4.18E-07  | < 0.700 | < 0.133 | < 1.02E-05 | < 1.67E-07  | As |
| Barium     | 0.532   | 0.101   | 7.74E-06   | 1.27E-07    | 0.532   | 0.101   | 7.74E-06   | 1.27E-07    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium  | < 0.070 | < 0.013 | < 1.02E-06 | < 1.67E-08  | < 0.050 | < 0.009 | < 7.28E-07 | < 1.19E-08  | < 0.020 | < 0.004 | < 2.91E-07 | < 4.77E-09  | Be |
| Cadmium    | < 0.140 | < 0.027 | < 2.04E-06 | < 3.34E-08  | < 0.100 | < 0.019 | < 1.46E-06 | < 2.39E-08  | < 0.040 | < 0.008 | < 5.82E-07 | < 9.54E-09  | Cd |
| Chromium   | 0.020   | 0.004   | 2.91E-07   | 4.77E-09    | 0.020   | 0.004   | 2.91E-07   | 4.77E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Cr |
| Cobalt     | < 0.175 | < 0.033 | < 2.55E-06 | < 4.18E-08  | < 0.125 | < 0.024 | < 1.82E-06 | < 2.98E-08  | < 0.050 | < 0.009 | < 7.28E-07 | < 1.19E-08  | Co |
| Copper     | < 2.250 | < 0.427 | < 3.28E-05 | < 5.37E-07  | < 1.250 | < 0.237 | < 1.82E-05 | < 2.98E-07  | 1.000   | 0.190   | 1.46E-05   | 2.39E-07    | Cu |
| Lead       | < 1.750 | < 0.332 | < 2.55E-05 | < 4.18E-07  | < 1.250 | < 0.237 | < 1.82E-05 | < 2.98E-07  | < 0.500 | < 0.095 | < 7.28E-06 | < 1.19E-07  | Pb |
| Manganese  | 0.545   | 0.103   | 7.93E-06   | 1.30E-07    | 0.545   | 0.103   | 7.93E-06   | 1.30E-07    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel     | < 2.200 | < 0.417 | < 3.20E-05 | < 5.25E-07  | 1.900   | 0.360   | 2.77E-05   | 4.53E-07    | < 0.300 | < 0.057 | < 4.37E-06 | < 7.16E-08  | Ni |
| Phosphorus | < 3.980 | < 0.755 | < 5.79E-05 | < 9.50E-07  | 1.980   | 0.376   | 2.88E-05   | 4.73E-07    | < 2.000 | < 0.379 | < 2.91E-05 | < 4.77E-07  | P  |
| Selenium   | < 5.250 | < 0.996 | < 7.64E-05 | < 1.25E-06  | < 3.750 | < 0.711 | < 5.46E-05 | < 8.95E-07  | < 1.500 | < 0.285 | < 2.18E-05 | < 3.58E-07  | Se |
| Zinc       | 10.400  | 1.973   | 1.51E-04   | 2.48E-06    | 4.420   | 0.839   | 6.43E-05   | 1.05E-06    | 5.980   | 1.135   | 8.71E-05   | 1.427E-06   | Zn |

| Mean Runs 1-3 |          |         |            |             |          |         |            |             |          |         |            |             |    |  |
|---------------|----------|---------|------------|-------------|----------|---------|------------|-------------|----------|---------|------------|-------------|----|--|
| Total         |          |         |            |             | FH Net   |         |            |             | BH Net   |         |            |             |    |  |
| Species       | µg       | µg/dscm | lb/hr      | lb/lb glass | µg       | µg/dscm | lb/hr      | lb/lb glass | µg       | µg/dscm | lb/hr      | lb/lb glass |    |  |
| Antimony      | < 1.750  | < 0.335 | < 2.55E-05 | < 4.19E-07  | < 1.250  | < 0.239 | < 1.82E-05 | < 2.99E-07  | < 0.500  | < 0.096 | < 7.30E-06 | < 1.20E-07  | Sb |  |
| Arsenic       | < 2.450  | < 0.468 | < 3.57E-05 | < 5.86E-07  | < 1.750  | < 0.335 | < 2.55E-05 | < 4.19E-07  | < 0.700  | < 0.134 | < 1.02E-05 | < 1.67E-07  | As |  |
| Barium        | 0.465    | 0.089   | 6.78E-06   | 1.11E-07    | 0.465    | 0.089   | 6.78E-06   | 1.11E-07    | 0.000    | 0.000   | 0.00E+00   | 0.00E+00    | Ba |  |
| Beryllium     | < 0.070  | < 0.013 | < 1.02E-06 | < 1.67E-08  | < 0.050  | < 0.010 | < 7.30E-07 | < 1.20E-08  | < 0.020  | < 0.004 | < 2.92E-07 | < 4.78E-09  | Be |  |
| Cadmium       | < 0.271  | < 0.052 | < 3.95E-06 | < 6.48E-08  | < 0.231  | < 0.044 | < 3.37E-06 | < 5.52E-08  | < 0.040  | < 0.008 | < 5.84E-07 | < 9.57E-09  | Cd |  |
| Chromium      | 0.117    | 0.022   | 1.70E-06   | 2.79E-08    | 0.117    | 0.022   | 1.70E-06   | 2.79E-08    | 0.000    | 0.000   | 0.00E+00   | 0.00E+00    | Cr |  |
| Cobalt        | < 0.175  | < 0.033 | < 2.55E-06 | < 4.19E-08  | < 0.125  | < 0.024 | < 1.82E-06 | < 2.99E-08  | < 0.050  | < 0.010 | < 7.30E-07 | < 1.20E-08  | Co |  |
| Copper        | < 2.250  | < 0.430 | < 3.28E-05 | < 5.38E-07  | < 1.250  | < 0.239 | < 1.82E-05 | < 2.99E-07  | 1.000    | 0.191   | 1.46E-05   | 2.39E-07    | Cu |  |
| Lead          | < 1.750  | < 0.335 | < 2.55E-05 | < 4.19E-07  | < 1.250  | < 0.239 | < 1.82E-05 | < 2.99E-07  | < 0.500  | < 0.096 | < 7.30E-06 | < 1.20E-07  | Pb |  |
| Manganese     | 0.531    | 0.102   | 7.75E-06   | 1.27E-07    | 0.531    | 0.102   | 7.75E-06   | 1.27E-07    | 0.000    | 0.000   | 0.00E+00   | 0.00E+00    | Mn |  |
| Nickel        | < 1.097  | < 0.209 | < 1.60E-05 | < 2.62E-07  | 0.797    | 0.152   | 1.16E-05   | 1.90E-07    | < 0.300  | < 0.057 | < 4.38E-06 | < 7.18E-08  | Ni |  |
| Phosphorus    | < 4.703  | < 0.900 | < 6.86E-05 | < 1.13E-06  | 2.523    | 0.483   | 3.68E-05   | 6.04E-07    | < 2.180  | < 0.417 | < 3.18E-05 | < 5.21E-07  | P  |  |
| Selenium      | < 5.250  | < 1.004 | < 7.66E-05 | < 1.26E-06  | < 3.750  | < 0.717 | < 5.47E-05 | < 8.97E-07  | < 1.500  | < 0.287 | < 2.19E-05 | < 3.588E-07 | Se |  |
| Zinc          | 15.717   | 3.008   | 2.29E-04   | 3.76E-06    | 5.033    | 0.963   | 7.34E-05   | 1.20E-06    | 10.683   | 2.045   | 1.56E-04   | 2.557E-06   | Zn |  |
| Total:        | < 36.595 | < 7.001 | < 5.34E-04 | < 8.76E-06  | < 19.122 | < 3.658 | < 2.79E-04 | < 4.57E-06  | < 17.473 | < 3.344 | < 2.55E-04 | < 4.18E-06  |    |  |

'<' denotes results calculated using the minimum detection limit for front half or back half results that were non-detect.



**EPA Methods 1-4, 29**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 114**  
**Method: 29**

**Run: 1**  
**Start Time: 9:18**  
**End Time: 12:28**  
**Date: 4/28/2018**

**EPA Methods 1-4:**

$$1) P_m = P_b + (\Delta H/13.6) = 30.094 \text{ "Hg}$$

where  $P_b$ : 29.85 "Hg  
 $\Delta H$ : 3.313 "H<sub>2</sub>O

$$2) P_s = P_b + (\text{Static Press.}/13.6) = 29.891 \text{ "Hg}$$

where  $P_b$ : 29.85 "Hg  
Static Press.: 0.56 "H<sub>2</sub>O

$$3) V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 183.453 \text{ dscf}$$

where  $V_m$ : 182.080 dcf  
 $Y$ : 0.9820  
 $P_m$ : 30.094 "Hg  
 $T_m$ : 517.4 °A

$$4) V_w(\text{std}) = (0.04706)(H_2O) = 3.435 \text{ scf}$$

where  $H_2O$ : 73.00 g

$$5) Bws = \left( \frac{V_w(\text{std})}{V_w(\text{std}) + V_m(\text{std})} \right) = 0.0184$$

where  $V_w(\text{std})$ : 3.435 scf  
 $V_m(\text{std})$ : 183.453 dscf

$$6) \% H_2O = Bws \times 100 = 1.84 \%v$$

$$7) V_m(\text{actual}) = \left( \frac{Y \times V_m}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 256.549 \text{ awcf}$$

where  $Y$ : 0.9820  
 $V_m$ : 182.0800 dcf  
 $Bws$ : 0.0184  
 $T_s$ : 723.8 °A  
 $T_m$ : 517.4 °A  
 $P_m$ : 30.094 "Hg  
 $P_s$ : 29.891 "Hg

$$8) M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.90 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.67 %vd  
 $O_2$ : 19.78 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.55 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.70 \text{ lb/lb-mole}$$

where  $M_d$ : 28.90 lb/lb-mole  
 $Bws$ : 0.0184

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 7.069 \text{ sq. ft.}$$

where Stack ID: 36 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
 Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(C_p)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 66.75 \text{ fps}$$

where  $C_p$ : 0.84  
 Ave. Sqrt  $\Delta P$ : 1.0120  
 $T_s$ : 723.8 °A  
 $P_s$ : 29.891 "Hg  
 $M_s$ : 28.70 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 28,311.3 \text{ AWCfm}$$

where  $V_s$ : 66.75 ft/sec  
 Stack Area: 7.069 sq. ft

$$13) \text{ ADCfm} = (\text{AWCfm})(1 - Bws) = 27,790.4 \text{ ADCfm}$$

where AWCfm: 28,311.3  
 $Bws$ : 0.0184

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,237,958.1 \text{ wscf/hr}$$

where  $V_s$ : 66.75 ft/sec  
 Stack Area: 7.0690 sq. ft.  
 $T_s$ : 723.8 °A  
 $P_s$ : 29.891 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1 - Bws) = 1,215,179.7 \text{ dscf/hr}$$

where wscf/hr: 1,237,958.1  
 $Bws$ : 0.0184

$$16) \text{ DSCfm} = (\text{dscf/hr})/60 \text{ mins/hr} = 20,253.0 \text{ DSCfm}$$

where dscf/hr: 1,215,179.7

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000355 \text{ sq. ft.}$$

where Nozzle Size: 0.2550 inches

Client: Hollingsworth & Vose  
Source: CFU 114

Run: 1  
Date: 4/28/2018

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$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(T_s)(V_m(\text{std}))}{P_s(V_s)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 100.3 \%$$

where Ts: 723.8 °A  
Vm(Std): 183.453 dscf  
Ps: 29.891 "Hg  
Vs: 66.75 ft/sec  
Nozzle Area: 0.000355 sq. ft.  
Sampling Time: 180 min.  
Bws: 0.0184

**EPA Method 29:  
Chromium**

19) Cr Laboratory Results (blank corrected)

Front half (FH): 0.300 µg/sample  
Back half (BH): 0.000 µg/sample  
Total (FH + BH): 0.300 µg/sample

$$20) C_s = \mu\text{g}/V_m(\text{std}) = 0.058 \mu\text{g}/\text{dscm}$$

where Run 1 Total: 0.300 µg/sample  
Vm(std): 5.195 dscm

$$21) \text{ Emission Rate} = (C_s) \left( \frac{2.83168 \text{ m}^3}{\text{ft}^3} \right) (\text{stack flow}) \left( \frac{2.2046 \text{ E-}9 \text{ lb}}{\mu\text{g}} \right) = 4.38\text{E-}06 \text{ lb/hr}$$

where Cs: 0.058 µg/dscm  
Stack Flow: 1,215,179.7 dscf/hr



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 114              |
| DATE(S)   | 04/28/18             |
| METHOD    | 30B                  |
| POLLUTANT | Mercury              |



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 Solon, OH 44139  
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## Sorbent Trap Spike Level Worksheet

|                   |                                  |       |                      |                                                        |
|-------------------|----------------------------------|-------|----------------------|--------------------------------------------------------|
| C                 | Expected mercury concentration   | 0.008 | µg/dscm              |                                                        |
| q                 | Expected average sample rate     | 2000  | cm <sup>3</sup> /min | cc/min                                                 |
| Ø                 | Expected sample duration         | 3     | hours                |                                                        |
| V <sub>m</sub>    | Total sample volume expected     | 0.36  | dscm                 | $V_m = q \times \text{Ø} \times 60 \times 1\text{e-}6$ |
| M                 | Expected mass HG on sorbent trap | 2.88  | ng                   | $m = C \times V_m \times 1,000$                        |
| S <sub>low</sub>  | Low range of spike               | 1.44  | ng                   | $S_{\text{low}} = m \times 0.5$                        |
| S <sub>mid</sub>  | Mid range of spike               | 2.88  | ng                   | $S_{\text{mid}} = m \times 1$                          |
| S <sub>high</sub> | High range of spike              | 4.32  | ng                   | $S_{\text{high}} = m \times 1.5$                       |

Method 30B Field Data  
Field Data Entry

Client: Hollingsworth & Vose  
Location: Corvallis, OR  
Source: CFU 114  
EPA Method: 30B  
Box Operator: KLS  
Technician(s): CW

Run: 1  
Start Time: 9:18  
End Time: 12:28  
Start Date: 4/28/2018  
End Date: 4/28/2018

Pre-Test Information:

Barometric Pressure: 29.85 "Hg  
Test duration: 180 min

Equipment:

Probe ID: HG1  
Probe heat: 270 F  
Side A Side B  
Meterbox ID: 2 2  
Y factor: 1.0420 1.0460  
Desired sampling rate: 2 2 lpm  
Trap ID#: OL462380 OL469598  
Spiked @: 5 0 ng  
Orifice # (if used):

Leak Checks:

|                        | Pre-test |        | Post-test |        |
|------------------------|----------|--------|-----------|--------|
|                        | Side A   | Side B | Side A    | Side B |
| Leak check vacuum, "Hg | 17       | 18     | 16        | 17     |
| Train leak rate, lpm   | 0.000    | 0.000  | 0.000     | 0.000  |

Test Summary:

|                  | Side A  | Side B    |
|------------------|---------|-----------|
| Sample Volume:   | 360.122 | 360.128 L |
| Ave. Meter Temp: | 61.9    | 64.8 °F   |

| Time (min.) | Meter Volume (L) |          | Stack Temp. (°F) |          | Meter Temp. (°F) |          | Vacuum ("Hg) |          | Trap Temperature (°F) |          | Sampling Rate (Lpm) |          |
|-------------|------------------|----------|------------------|----------|------------------|----------|--------------|----------|-----------------------|----------|---------------------|----------|
|             | Side A           | Sample B | Sample A         | Sample B | Sample A         | Sample B | Sample A     | Sample B | Sample A              | Sample B | Sample A            | Sample B |
| 0           | 0.000            | 0.000    | 263              | 263      | 49               | 50       | 0            | 0        | 270                   | 270      | 2.000               | 2.000    |
| 5           | 10.010           | 10.010   | 263              | 263      | 51               | 52       | 10           | 11       | 269                   | 271      | 2.002               | 2.002    |
| 10          | 19.990           | 20.020   | 265              | 265      | 52               | 53       | 10           | 12       | 271                   | 270      | 1.996               | 2.002    |
| 15          | 30.030           | 30.010   | 266              | 266      | 53               | 55       | 10           | 11       | 271                   | 270      | 2.008               | 1.998    |
| 20          | 40.020           | 40.030   | 264              | 264      | 54               | 56       | 10           | 11       | 271                   | 271      | 1.998               | 2.004    |
| 25          | 50.040           | 50.010   | 264              | 264      | 56               | 59       | 10           | 11       | 270                   | 270      | 2.004               | 1.996    |
| 30          | 60.030           | 60.040   | 265              | 265      | 57               | 59       | 10           | 11       | 272                   | 271      | 1.998               | 2.006    |
| 35          | 70.050           | 70.020   | 264              | 264      | 59               | 62       | 10           | 11       | 271                   | 270      | 2.004               | 1.996    |
| 40          | 80.050           | 80.040   | 265              | 265      | 60               | 63       | 10           | 11       | 270                   | 272      | 2.000               | 2.004    |
| 45          | 90.030           | 90.050   | 265              | 265      | 61               | 64       | 10           | 12       | 271                   | 272      | 1.996               | 2.002    |
| 50          | 100.040          | 100.060  | 264              | 264      | 61               | 64       | 10           | 11       | 270                   | 271      | 2.002               | 2.002    |
| 55          | 110.060          | 110.040  | 265              | 265      | 62               | 66       | 10           | 11       | 271                   | 270      | 2.004               | 1.996    |
| 60          | 120.030          | 120.050  | 264              | 264      | 63               | 66       | 10           | 10       | 270                   | 271      | 1.994               | 2.002    |
| 65          | 130.010          | 130.060  | 264              | 264      | 63               | 66       | 10           | 11       | 271                   | 272      | 1.996               | 2.002    |
| 70          | 140.040          | 140.100  | 265              | 265      | 64               | 67       | 10           | 11       | 271                   | 270      | 2.006               | 2.008    |
| 75          | 150.010          | 150.060  | 264              | 264      | 64               | 67       | 10           | 11       | 270                   | 271      | 1.994               | 1.992    |
| 80          | 160.050          | 160.090  | 264              | 264      | 64               | 67       | 11           | 10       | 271                   | 272      | 2.008               | 2.006    |
| 85          | 170.030          | 170.080  | 265              | 265      | 64               | 67       | 11           | 11       | 270                   | 271      | 1.996               | 1.998    |
| 90          | 180.050          | 180.070  | 264              | 264      | 65               | 67       | 9            | 10       | 271                   | 270      | 2.004               | 1.998    |
| 95          | 190.080          | 190.090  | 265              | 265      | 64               | 67       | 9            | 9        | 270                   | 270      | 2.006               | 2.004    |
| 100         | 200.080          | 200.090  | 265              | 265      | 64               | 67       | 9            | 9        | 271                   | 272      | 2.000               | 2.000    |
| 105         | 210.090          | 210.100  | 264              | 264      | 64               | 68       | 10           | 10       | 272                   | 271      | 2.002               | 2.002    |
| 110         | 220.110          | 220.090  | 265              | 265      | 64               | 68       | 10           | 9        | 273                   | 270      | 2.004               | 1.998    |
| 115         | 230.080          | 230.050  | 265              | 265      | 65               | 68       | 10           | 10       | 271                   | 271      | 1.994               | 1.992    |
| 120         | 240.120          | 240.080  | 263              | 263      | 65               | 68       | 9            | 10       | 270                   | 271      | 2.008               | 2.006    |
| 125         | 250.090          | 250.070  | 263              | 263      | 65               | 68       | 10           | 10       | 271                   | 270      | 1.994               | 1.998    |
| 130         | 260.110          | 260.100  | 264              | 264      | 66               | 69       | 10           | 9        | 270                   | 272      | 2.004               | 2.006    |
| 135         | 270.080          | 270.110  | 265              | 265      | 66               | 69       | 10           | 9        | 271                   | 272      | 1.994               | 2.002    |
| 140         | 280.120          | 280.160  | 264              | 264      | 65               | 68       | 10           | 11       | 270                   | 271      | 2.008               | 2.010    |
| 145         | 290.150          | 290.180  | 263              | 263      | 66               | 68       | 11           | 11       | 271                   | 270      | 2.006               | 2.004    |
| 150         | 300.130          | 300.200  | 265              | 265      | 65               | 68       | 11           | 10       | 270                   | 271      | 1.996               | 2.004    |
| 155         | 310.160          | 310.160  | 266              | 266      | 65               | 68       | 11           | 9        | 269                   | 270      | 2.006               | 1.992    |
| 160         | 320.110          | 320.130  | 265              | 265      | 65               | 69       | 10           | 10       | 270                   | 271      | 1.990               | 1.994    |
| 165         | 330.090          | 330.110  | 264              | 264      | 65               | 68       | 10           | 9        | 271                   | 270      | 1.996               | 1.996    |
| 170         | 340.110          | 340.140  | 265              | 265      | 65               | 68       | 9            | 10       | 270                   | 272      | 2.004               | 2.006    |
| 175         | 350.100          | 350.160  | 265              | 265      | 66               | 70       | 10           | 11       | 272                   | 271      | 1.998               | 2.004    |
| 180         | 360.122          | 360.128  | 264              | 264      | 65               | 68       | 10           | 10       | 271                   | 270      | 2.004               | 1.994    |

Method 30B Field Data  
Field Data Entry

Client: Hollingsworth & Vose  
Location: Corvallis, OR  
Source: CFU 114  
EPA Method: 30B  
Box Operator: KLS  
Technician(s): CW

Run: 2  
Start Time: 13:09  
End Time: 16:16  
Start Date: 4/28/2018  
End Date: 4/28/2018

Pre-Test Information:

Barometric Pressure: 29.83 "Hg  
Test duration: 180 min

Equipment:

Probe ID: HG1  
Probe heat: 270 F  
Side A Side B  
Meterbox ID: 2 2  
Y factor: 1.0420 1.0460  
Desired sampling rate: 2 2 lpm  
Trap ID#: OL462401 OL469610  
Spiked @: 5 0 ng  
Orifice # (if used):

Leak Checks:

|                        | Pre-test |        | Post-test |        |
|------------------------|----------|--------|-----------|--------|
|                        | Side A   | Side B | Side A    | Side B |
| Leak check vacuum, "Hg | 17       | 18     | 17        | 17     |
| Train leak rate, lpm   | 0.000    | 0.000  | 0.000     | 0.000  |

Test Summary:

|                  | Side A  | Side B    |
|------------------|---------|-----------|
| Sample Volume:   | 360.116 | 360.099 L |
| Ave. Meter Temp: | 66.8    | 69.7 °F   |

| Time (min.) | Meter Volume (L) |          | Stack Temp. (°F) |          | Meter Temp. (°F) |          | Vacuum ("Hg) |          | Trap Temperature (°F) |          | Sampling Rate (Lpm) |          |
|-------------|------------------|----------|------------------|----------|------------------|----------|--------------|----------|-----------------------|----------|---------------------|----------|
|             | Side A           | Sample B | Sample A         | Sample B | Sample A         | Sample B | Sample A     | Sample B | Sample A              | Sample B | Sample A            | Sample B |
| 0           | 0.000            | 0.000    | 258              | 258      | 63               | 66       | 0            | 0        | 268                   | 269      | 2.000               | 2.000    |
| 5           | 10.020           | 10.040   | 262              | 262      | 64               | 66       | 8            | 10       | 270                   | 271      | 2.004               | 2.008    |
| 10          | 20.060           | 20.050   | 263              | 263      | 65               | 67       | 8            | 10       | 271                   | 270      | 2.008               | 2.002    |
| 15          | 30.090           | 30.080   | 265              | 265      | 64               | 67       | 9            | 10       | 270                   | 269      | 2.006               | 2.006    |
| 20          | 40.110           | 40.090   | 263              | 263      | 64               | 67       | 10           | 8        | 272                   | 273      | 2.004               | 2.002    |
| 25          | 50.120           | 50.080   | 263              | 263      | 64               | 67       | 9            | 9        | 271                   | 272      | 2.002               | 1.998    |
| 30          | 60.070           | 60.090   | 264              | 264      | 64               | 67       | 10           | 9        | 271                   | 270      | 1.990               | 2.002    |
| 35          | 70.080           | 70.060   | 265              | 265      | 65               | 68       | 10           | 10       | 270                   | 272      | 2.002               | 1.994    |
| 40          | 80.110           | 80.090   | 265              | 265      | 65               | 68       | 9            | 10       | 271                   | 271      | 2.006               | 2.006    |
| 45          | 90.140           | 90.120   | 265              | 265      | 65               | 68       | 10           | 9        | 270                   | 272      | 2.006               | 2.006    |
| 50          | 100.090          | 100.100  | 266              | 266      | 66               | 69       | 9            | 9        | 271                   | 271      | 1.990               | 1.996    |
| 55          | 110.140          | 110.130  | 265              | 265      | 66               | 69       | 10           | 9        | 272                   | 271      | 2.010               | 2.006    |
| 60          | 120.110          | 120.160  | 266              | 266      | 66               | 69       | 10           | 10       | 270                   | 272      | 1.994               | 2.006    |
| 65          | 130.120          | 130.140  | 265              | 265      | 67               | 70       | 11           | 10       | 272                   | 271      | 2.002               | 1.996    |
| 70          | 140.190          | 140.120  | 265              | 265      | 67               | 70       | 11           | 10       | 271                   | 273      | 2.014               | 1.996    |
| 75          | 150.210          | 150.160  | 264              | 264      | 67               | 70       | 10           | 10       | 270                   | 271      | 2.004               | 2.008    |
| 80          | 160.180          | 160.130  | 265              | 265      | 68               | 71       | 9            | 10       | 272                   | 271      | 1.994               | 1.994    |
| 85          | 170.150          | 170.100  | 264              | 264      | 68               | 71       | 10           | 10       | 273                   | 272      | 1.994               | 1.994    |
| 90          | 180.160          | 180.130  | 263              | 263      | 68               | 71       | 9            | 11       | 272                   | 273      | 2.002               | 2.006    |
| 95          | 190.110          | 190.160  | 263              | 263      | 68               | 72       | 10           | 11       | 273                   | 271      | 1.990               | 2.006    |
| 100         | 200.090          | 200.150  | 264              | 264      | 69               | 72       | 10           | 10       | 270                   | 272      | 1.996               | 1.998    |
| 105         | 210.110          | 210.130  | 264              | 264      | 69               | 73       | 11           | 10       | 271                   | 271      | 2.004               | 1.996    |
| 110         | 220.120          | 220.160  | 265              | 265      | 69               | 72       | 10           | 10       | 270                   | 272      | 2.002               | 2.006    |
| 115         | 230.090          | 230.130  | 265              | 265      | 69               | 72       | 10           | 11       | 270                   | 271      | 1.994               | 1.994    |
| 120         | 240.110          | 240.140  | 265              | 265      | 69               | 72       | 11           | 11       | 269                   | 270      | 2.004               | 2.002    |
| 125         | 250.120          | 250.110  | 265              | 265      | 69               | 72       | 10           | 10       | 270                   | 271      | 2.002               | 1.994    |
| 130         | 260.150          | 260.090  | 264              | 264      | 69               | 72       | 10           | 10       | 271                   | 272      | 2.006               | 1.996    |
| 135         | 270.190          | 270.080  | 265              | 265      | 69               | 71       | 10           | 11       | 270                   | 271      | 2.008               | 1.998    |
| 140         | 280.160          | 280.090  | 265              | 265      | 68               | 71       | 10           | 10       | 271                   | 272      | 1.994               | 2.002    |
| 145         | 290.140          | 290.110  | 264              | 264      | 68               | 70       | 11           | 10       | 272                   | 270      | 1.996               | 2.004    |
| 150         | 300.120          | 300.080  | 265              | 265      | 68               | 71       | 10           | 10       | 271                   | 272      | 1.996               | 1.994    |
| 155         | 310.090          | 310.060  | 266              | 266      | 68               | 70       | 10           | 11       | 270                   | 271      | 1.994               | 1.996    |
| 160         | 320.110          | 320.080  | 265              | 265      | 67               | 70       | 9            | 10       | 271                   | 272      | 2.004               | 2.004    |
| 165         | 330.100          | 330.070  | 264              | 264      | 67               | 70       | 10           | 10       | 272                   | 270      | 1.998               | 1.998    |
| 170         | 340.090          | 340.060  | 264              | 264      | 67               | 69       | 10           | 11       | 270                   | 271      | 1.998               | 1.998    |
| 175         | 350.070          | 350.080  | 264              | 264      | 67               | 69       | 10           | 10       | 272                   | 271      | 1.996               | 2.004    |
| 180         | 360.116          | 360.099  | 264              | 264      | 66               | 69       | 10           | 10       | 273                   | 271      | 2.009               | 2.004    |

Method 30B Field Data  
Field Data Entry

Client: Hollingsworth & Vose  
Location: Corvallis, OR  
Source: CFU 114  
EPA Method: 30B  
Box Operator: KLS  
Technician(s): CW

Run: 3  
Start Time: 16:45  
End Time: 19:53  
Start Date: 4/28/2018  
End Date: 4/28/2018

Pre-Test Information:

Barometric Pressure: 29.80 "Hg  
Test duration: 180 min

Equipment:

Probe ID: HG1  
Probe heat: 270 F  
Side A Side B  
Meterbox ID: 2.00 2.00  
Y factor: 1.0420 1.0460  
Desired sampling rate: 2 2 lpm  
Trap ID#: OL464776 OL469566  
Spiked @: 5 0 ng  
Orifice # (if used):

Leak Checks:

|                        | Pre-test |        | Post-test |        |
|------------------------|----------|--------|-----------|--------|
|                        | Side A   | Side B | Side A    | Side B |
| Leak check vacuum, "Hg | 20       | 19     | 18        | 18     |
| Train leak rate, lpm   | 0.000    | 0.000  | 0.000     | 0.000  |

Test Summary:

|                  | Side A  | Side B    |
|------------------|---------|-----------|
| Sample Volume:   | 360.120 | 360.180 L |
| Ave. Meter Temp: | 63.8    | 66.2 °F   |

| Time (min.) | Meter Volume (L) |          | Stack Temp. (°F) |          | Meter Temp. (°F) |          | Vacuum ("Hg) |          | Trap Temperature (°F) |          | Sampling Rate (Lpm) |          |
|-------------|------------------|----------|------------------|----------|------------------|----------|--------------|----------|-----------------------|----------|---------------------|----------|
|             | Side A           | Sample B | Sample A         | Sample B | Sample A         | Sample B | Sample A     | Sample B | Sample A              | Sample B | Sample A            | Sample B |
| 0           | 0.000            | 0.000    | 260              | 260      | 62               | 63       | 0            | 0        | 268                   | 269      | 2.000               | 2.000    |
| 5           | 10.020           | 10.040   | 262              | 262      | 61               | 63       | 10           | 10       | 270                   | 271      | 2.004               | 2.008    |
| 10          | 20.030           | 20.010   | 263              | 263      | 61               | 63       | 10           | 9        | 271                   | 272      | 2.002               | 1.994    |
| 15          | 30.050           | 30.040   | 264              | 264      | 61               | 63       | 9            | 10       | 270                   | 272      | 2.004               | 2.006    |
| 20          | 40.080           | 40.020   | 264              | 264      | 62               | 64       | 9            | 10       | 271                   | 272      | 2.006               | 1.996    |
| 25          | 50.110           | 50.060   | 264              | 264      | 62               | 65       | 10           | 10       | 270                   | 271      | 2.006               | 2.008    |
| 30          | 60.140           | 60.090   | 264              | 264      | 62               | 65       | 10           | 11       | 271                   | 272      | 2.006               | 2.006    |
| 35          | 70.120           | 70.140   | 265              | 265      | 63               | 66       | 10           | 10       | 271                   | 273      | 1.996               | 2.010    |
| 40          | 80.100           | 80.150   | 265              | 265      | 63               | 66       | 10           | 11       | 271                   | 273      | 1.996               | 2.002    |
| 45          | 90.090           | 90.120   | 265              | 265      | 63               | 66       | 10           | 10       | 270                   | 272      | 1.998               | 1.994    |
| 50          | 100.130          | 100.150  | 264              | 264      | 64               | 66       | 10           | 11       | 271                   | 270      | 2.008               | 2.006    |
| 55          | 110.150          | 110.180  | 264              | 264      | 64               | 66       | 10           | 10       | 270                   | 273      | 2.004               | 2.006    |
| 60          | 120.180          | 120.200  | 264              | 264      | 64               | 66       | 9            | 10       | 272                   | 271      | 2.006               | 2.004    |
| 65          | 130.160          | 130.190  | 265              | 265      | 64               | 67       | 10           | 10       | 273                   | 273      | 1.996               | 1.998    |
| 70          | 140.180          | 140.210  | 264              | 264      | 64               | 67       | 10           | 11       | 272                   | 271      | 2.004               | 2.004    |
| 75          | 150.210          | 150.240  | 264              | 264      | 64               | 67       | 10           | 11       | 271                   | 272      | 2.006               | 2.006    |
| 80          | 160.190          | 160.260  | 265              | 265      | 64               | 67       | 10           | 10       | 272                   | 271      | 1.996               | 2.004    |
| 85          | 170.160          | 170.220  | 264              | 264      | 64               | 67       | 10           | 11       | 271                   | 273      | 1.994               | 1.992    |
| 90          | 180.150          | 180.180  | 264              | 264      | 64               | 67       | 10           | 10       | 272                   | 271      | 1.998               | 1.992    |
| 95          | 190.130          | 190.150  | 263              | 263      | 64               | 67       | 9            | 10       | 273                   | 272      | 1.996               | 1.994    |
| 100         | 200.110          | 200.130  | 264              | 264      | 64               | 67       | 10           | 11       | 273                   | 272      | 1.996               | 1.996    |
| 105         | 210.090          | 210.120  | 264              | 264      | 64               | 67       | 10           | 11       | 271                   | 272      | 1.996               | 1.998    |
| 110         | 220.110          | 220.110  | 263              | 263      | 64               | 67       | 11           | 10       | 272                   | 270      | 2.004               | 1.998    |
| 115         | 230.120          | 230.150  | 263              | 263      | 64               | 67       | 10           | 10       | 270                   | 271      | 2.002               | 2.008    |
| 120         | 240.140          | 240.160  | 263              | 263      | 65               | 67       | 10           | 10       | 272                   | 273      | 2.004               | 2.002    |
| 125         | 250.110          | 250.170  | 263              | 263      | 65               | 67       | 11           | 10       | 271                   | 272      | 1.994               | 2.002    |
| 130         | 260.080          | 260.130  | 264              | 264      | 65               | 67       | 10           | 10       | 270                   | 273      | 1.994               | 1.992    |
| 135         | 270.090          | 270.140  | 264              | 264      | 65               | 67       | 10           | 10       | 271                   | 272      | 2.002               | 2.002    |
| 140         | 280.100          | 280.120  | 264              | 264      | 65               | 67       | 10           | 11       | 270                   | 270      | 2.002               | 1.996    |
| 145         | 290.120          | 290.150  | 264              | 264      | 65               | 67       | 11           | 11       | 272                   | 271      | 2.004               | 2.006    |
| 150         | 300.130          | 300.130  | 264              | 264      | 65               | 67       | 10           | 11       | 272                   | 273      | 2.002               | 1.996    |
| 155         | 310.160          | 310.120  | 264              | 264      | 65               | 67       | 10           | 10       | 271                   | 272      | 2.006               | 1.998    |
| 160         | 320.180          | 320.150  | 265              | 265      | 65               | 67       | 10           | 9        | 270                   | 271      | 2.004               | 2.006    |
| 165         | 330.150          | 330.160  | 265              | 265      | 65               | 67       | 10           | 10       | 269                   | 270      | 1.994               | 2.002    |
| 170         | 340.170          | 340.190  | 264              | 264      | 65               | 67       | 11           | 10       | 271                   | 272      | 2.004               | 2.006    |
| 175         | 350.180          | 350.210  | 264              | 264      | 65               | 67       | 10           | 10       | 271                   | 271      | 2.002               | 2.004    |
| 180         | 360.120          | 360.180  | 264              | 264      | 65               | 67       | 11           | 11       | 270                   | 273      | 1.988               | 1.994    |



**Method 30B**  
**Mercury Concentration**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Test date:** 4/28/2018

**Meterbox Y:**  
**Side A** 1.0420  
**Side B** 1.0460

| Run | Sample | Sample Date | Trap ID  | Spiked @<br>ng | Section 1<br>ng | Section 2<br>ng | Total Hg<br>ng | Total Hg<br>µg | DGM<br>reading<br>L | Sample volume<br>(corrected for Y)<br>L | Bp<br>"Hg | Meter<br>Temp.<br>°F | Sample<br>Vol.<br>dscm | Hg Conc.<br>µg/dscm | Ave. Pair<br>Hg Conc.<br>µg/dscm |
|-----|--------|-------------|----------|----------------|-----------------|-----------------|----------------|----------------|---------------------|-----------------------------------------|-----------|----------------------|------------------------|---------------------|----------------------------------|
| 1   | A      | 4/28/2018   | OL462380 | 5.0            | NA              | NA              | -              | -              | 360.122             | 375.247                                 | 29.85     | 61.9                 | 0.379                  | -                   | -                                |
|     | B      |             | OL469598 | 0.0            | 1.4             | 2.5             | 3.9            | 3.90E-03       | 360.128             | 376.694                                 |           | 64.8                 | 0.378                  | 1.03E-02            | -                                |
| 2   | A      | 4/28/2018   | OL462401 | 5.0            | 6.5             | 0.3             | 1.8            | 1.80E-03       | 360.116             | 375.241                                 | 29.83     | 66.8                 | 0.375                  | 4.80E-03            | 4.67E-03                         |
|     | B      |             | OL469610 | 0.0            | 1.4             | 0.3             | 1.7            | 1.70E-03       | 360.099             | 376.664                                 |           | 69.7                 | 0.374                  | 4.54E-03            | 4.67E-03                         |
| 3   | A      | 4/28/2018   | OL464776 | 5.0            | 6.2             | 0.2             | 1.4            | 1.40E-03       | 360.120             | 375.245                                 | 29.80     | 63.8                 | 0.377                  | 3.72E-03            | 3.85E-03                         |
|     | B      |             | OL469566 | 0.0            | 1.3             | 0.2             | 1.5            | 1.50E-03       | 360.180             | 376.748                                 |           | 66.2                 | 0.377                  | 3.98E-03            | 3.85E-03                         |

**Trap Concentrations Example Calculations:**  
**Run 2, Side A**

Average: 4.26E-03

- Total Hg  
 where Section 1: 6.5 ng  
 Section 2: 0.3 ng  
 Spike: 5.0 ng  
 Total Hg = Section 1 + Section 2 - Spike = 1.8 ng
- Conversion to µg  
 where Total Hg ng: 1.8 ng  
 Total Hg ng/1000 = 1.80E-03 µg
- Corrected sample volume = DGM reading x Meterbox Y factor = 375.241 L  
 where DGM reading: 360.116 L  
 Y: 1.042
- Standard Volume (DSCM) = Sample Vol. (L) x  $\left(\frac{528^\circ\text{A}}{T_m + 460}\right)$  x Bp/29.92 "Hg /1000 = 0.375 DSCM  
 where Sample vol.: 375.241 L  
 T<sub>m</sub>: 66.8 °F  
 B<sub>p</sub>: 29.83 "Hg
- Hg concentration µg/dscm = Total Hg µg / Volume DSCM = 4.80E-03 µg/dscm  
 where Total Hg: 1.80E-03 µg  
 DSCM: 0.375
- Average Pair Concentration = (Side A Conc. + Side B Conc.)/2 = 4.67E-03 µg/dscm  
 where Side A: 4.80E-03 µg/dscm  
 Side B: 4.54E-03 µg/dscm

Red = Run 1, Side A, trap was broken during analysis at Ohio Lumex. See report notes for more details.

**Method 30B**  
**Results QA/QC**

**Client:** Hollingsworth & Vose

**Location:** Corvallis, OR

**Source:** CFU 114

**Test date:** 4/28/2018

**Test type:** C [C for compliance; R for RATA]

| Run | Sample | Sample Date | Trap ID  | Spiked @<br>ng | Section 1<br>ng | Section 2<br>ng | Total Hg<br>ng | Hg Conc.<br>µg/dscm | Breakthr.<br>% | Breakthr. Results<br>PASS/FAIL | C <sub>rec.</sub> Spiked<br>Compound<br>µg/dscm | Spiked Hg<br>Recovery R<br>Value<br>% | Field<br>Recovery<br>PASS/FAIL | RD Paired<br>Traps<br>% | Paired<br>Trap<br>Agree.<br>PASS/FAIL |
|-----|--------|-------------|----------|----------------|-----------------|-----------------|----------------|---------------------|----------------|--------------------------------|-------------------------------------------------|---------------------------------------|--------------------------------|-------------------------|---------------------------------------|
| 1   | A      | 4/28/2018   | OL462380 | 5              | NA              | NA              | -              | -                   | -              | -                              | -                                               | -                                     | -                              | -                       | -                                     |
|     | B      |             | OL469598 | 0              | 1.4             | 2.5             | 3.9            | 1.03E-02            | 178.6          | Hg <0.1 µg/dscm                | -                                               | -                                     | -                              | -                       | -                                     |
| 2   | A      | 4/28/2018   | OL462401 | 5              | 6.5             | 0.3             | 1.8            | 4.80E-03            | 4.62           | PASS                           | 1.36E-02                                        | 101.9                                 | PASS                           | 2.77                    | PASS                                  |
|     | B      |             | OL469610 | 0              | 1.4             | 0.3             | 1.7            | 4.54E-03            | 21.43          | Hg <0.1 µg/dscm                | 1.36E-02                                        | 101.9                                 | PASS                           | 2.77                    | PASS                                  |
| 3   | A      | 4/28/2018   | OL464776 | 5              | 6.2             | 0.2             | 1.4            | 3.72E-03            | 3.23           | PASS                           | 1.30E-02                                        | 98.0                                  | PASS                           | 3.48                    | PASS                                  |
|     | B      |             | OL469566 | 0              | 1.3             | 0.2             | 1.5            | 3.98E-03            | 15.38          | PASS                           | 1.30E-02                                        | 98.0                                  | PASS                           | 3.48                    | PASS                                  |

**1. Breakthrough Criteria**

Every sample must meet the following criteria for breakthrough % from Section 1 to Section 2.

$$\text{Breakthrough \%} = \frac{\text{Section 2 ng}}{\text{Section 1 ng}} \times 100 \quad \text{Eq. 30B-2}$$

| Allowable Breakthrough % | Compliance Testing (µg/dscm)    | RATA (µg/dscm) |
|--------------------------|---------------------------------|----------------|
| 10                       | > 1                             | > 1            |
| 20                       | ≤1                              | ≤1; >0.5       |
| 50                       | Hg conc. ≤30% of emission limit | ≤0.5; >0.1     |

RM average: 4.26E-03 µg/dscm

**2. Field Recovery Test**

Determines the fraction of spiked Hg recovered (R). Perform for at least three runs per field test. Average of three runs must be between 85 and 115%

$$C_{rec} = \frac{\text{mass spiked } (\mu\text{g})}{\text{Volume spiked } (\text{dscm})} - \frac{\text{mass unspiked } (\mu\text{g})}{\text{Volume unspiked } (\text{dscm})} \quad \text{Eq. 30B-6}$$

$$R = \frac{C_{rec} \left( \frac{\mu\text{g}}{\text{dscm}} \right) \times \text{vol. spiked } (\text{dscm})}{\text{mass spiked } (\mu\text{g})} \times 100 \quad \text{Eq. 30B-7}$$

**3. Paired trap agreement**

$$RD = \frac{|\text{Conc. Trap A} - \text{Conc. Trap B}|}{\text{Conc. Trap A} + \text{Conc. Trap B}} \times 100 \quad \text{Eq. 30B-5}$$

If paired trains meet the relative deviation (RD) and other QA requirements, the average of the two Hg concs. may be used as an emissions test run value or as the reference method value for a RATA run.

| Allowable Relative Dev. %                        | For Hg conc. (µg/dscm) |
|--------------------------------------------------|------------------------|
| 10                                               | > 1                    |
| 20                                               | ≤1                     |
| or ≤0.2 ug/dscm absolute difference in Hg concs. | ≤1                     |

M30B Table 9-1

**Method 30B**  
**Emission Calculations**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 114  
**Test date:** 4/28/2018

| Run                 | Ave. Pair<br>Hg Conc. | Hg Conc. | Stack Flow* | Glass<br>Production | Stack Emissions |                      |
|---------------------|-----------------------|----------|-------------|---------------------|-----------------|----------------------|
|                     | µg/dscm               | lb/dscf  | dscf/hr     | lbs/hr              | lb/hr           | lb/lb glass produced |
| 1                   | -                     | -        | 1,215,179.7 | 61.0                |                 |                      |
| 2                   | 4.67E-03              | 2.92E-13 | 1,222,593.6 | 61.0                | 3.57E-07        | 5.84E-09             |
| 3                   | 3.85E-03              | 2.40E-13 | 1,229,170.5 | 61.0                | 2.95E-07        | 4.84E-09             |
| Average<br>Results: | 4.26E-03              | 2.66E-13 | 1,222,314.6 | 61.0                | 3.26E-07        | 5.34E-09             |

\*From direct stack measurements made during concurrent M29 runs

## **APPENDIX C: CFU 117 (ROTARY FINE) TEST DATA**



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 117              |
| DATE      | 04/29/18             |
| METHOD    | M29                  |
| POLLUTANT | Metals               |

**EPA Method 1**  
**Stack Parameters and Traverse Points**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Facility:** GP2

Type of Testing: P (P for Particulate; V for Velocity/Nonparticulate)  
Type of Duct: C (C for circular; R for rectangular)

Number of ports available: 2  
Number of ports to be used: 2  
Port diameter: 5 inches

Circular ID (Rectangular Depth): 30.00 inches  
Port depth and/or wall thickness: 4.00 inches  
Stack width (Rectangular only): inches

Equivalent Diameter  
If rectangular =  $\frac{2 * \text{Depth} * \text{Width}}{\text{Depth} + \text{Width}} =$  30.00 inches (If circular = duct ID)

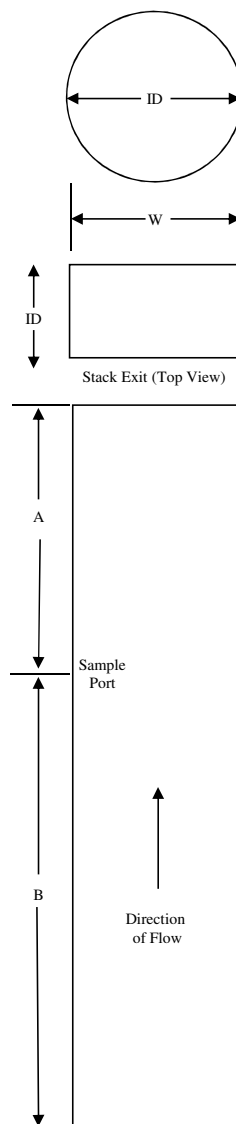
Stack/duct area = 4.909 sq.feet 706.9 sq.inches

|                       |                                                            |                                                         |
|-----------------------|------------------------------------------------------------|---------------------------------------------------------|
| Sample Port Location: | Downstream from<br>flow disturbance<br><u>from process</u> | Upstream from<br>flow disturbance<br><u>toward exit</u> |
|                       | B                                                          | A                                                       |
| Number of Inches:     | 152.00                                                     | 42.00                                                   |
| Number of Diameters:  | 5.07                                                       | 1.40                                                    |

Minimum Number of Traverse Points: 20

| Points | % of<br>diameter | Distance from<br>inside wall (in.) | Distance including<br>port (in.) |
|--------|------------------|------------------------------------|----------------------------------|
| 1      | 2.6              | 0.78                               | 4 3/4                            |
| 2      | 8.2              | 2.46                               | 6 1/2                            |
| 3      | 14.6             | 4.38                               | 8 3/8                            |
| 4      | 22.6             | 6.78                               | 10 3/4                           |
| 5      | 34.2             | 10.26                              | 14 1/4                           |
| 6      | 65.8             | 19.74                              | 23 3/4                           |
| 7      | 77.4             | 23.22                              | 27 1/4                           |
| 8      | 85.4             | 25.62                              | 29 5/8                           |
| 9      | 91.8             | 27.54                              | 31 1/2                           |
| 10     | 97.4             | 29.22                              | 33 1/4                           |

**Reference Diagram**



Drawing NOT to scale and  
NOT an accurate representation of stack.

## Pre Traverse Flow Information

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117

**Stack Temp:** 248

| Traverse Point | Velocity<br>$\Delta P$ ("H <sub>2</sub> O) | Null<br>Angle |
|----------------|--------------------------------------------|---------------|
| 1              | 1.60                                       | 0.0           |
| 2              | 1.70                                       | 5.0           |
| 3              | 1.70                                       | 8.0           |
| 4              | 1.70                                       | 8.0           |
| 5              | 1.80                                       | 10.0          |
| 6              | 1.80                                       | 5.0           |
| 7              | 1.80                                       | 5.0           |
| 8              | 1.70                                       | 0.0           |
| 9              | 1.60                                       | 0.0           |
| 10             | 1.40                                       | 5.0           |
| 11             | 1.50                                       | 5.0           |
| 12             | 1.60                                       | 7.0           |
| 13             | 1.70                                       | 5.0           |
| 14             | 1.80                                       | 5.0           |
| 15             | 1.90                                       | 0.0           |
| 16             | 1.90                                       | 0.0           |
| 17             | 1.80                                       | 5.0           |
| 18             | 1.70                                       | 5.0           |
| 19             | 1.60                                       | 5.0           |
| 20             | 1.50                                       | 0.0           |
| 21             |                                            |               |
| 22             |                                            |               |
| 23             |                                            |               |
| 24             |                                            |               |
| 25             |                                            |               |
| 26             |                                            |               |
| 27             |                                            |               |
| 28             |                                            |               |
| 29             |                                            |               |
| 30             |                                            |               |

Average: 1.69 4.2

Flow is found to be (indicate with 'x' below):

Non-cyclonic x

Cyclonic

**Isokinetic Field Data**
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M29  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
 Cloud/Rainy, 50 degrees

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 11:50  
**Date:** 4/29/2018

**Stack Dimensional Data:**

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
 Y factor 0.9820  
 ΔH@ 1.8073  
 Probe ID 3C  
 Nozzle ID 0.214  
 Hot box ID 2  
 Pitot Cp 0.84  
 Liner type Glass  
 Nozzle size 0.2140 inches  
 Nozzle area 0.00025 sq.ft.  
 Probe heat 250 F  
 Filter heat 250 F

**Source Information:**

Barometric Pressure 29.94 "Hg  
 Static Pressure 0.6 "H<sub>2</sub>O  
 Ave. ΔP 1.6 "H<sub>2</sub>O  
 Stack Temperature 248 F  
 Assumed moisture 2 %  
 Assumed meter temp. 55 F  
 Total number of points 20  
 Time per point 9  
 Total run time 180  
 O<sub>2</sub> 19.80 %  
 CO<sub>2</sub> 0.64 %  
 Rec. Nz. 0.197 inches

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 10       | 12        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 161.510 dcf  
 Wet mol. weight 28.67 M<sub>s</sub> (actual)  
 Actual H<sub>2</sub>O 1.99 %  
 Std. meter vol. 162.939 dscf  
 Isokinetic Average 100.2 %  
 Ave. ΔP 1.6 "H<sub>2</sub>O  
 Ave. √ΔP 1.2644 "H<sub>2</sub>O  
 Ave. ΔH 2.625 "H<sub>2</sub>O  
 Ave. T<sub>s</sub> 250.5 °F  
 Ave. T<sub>m</sub> 57.4 °F

**Moisture/Lab:**

| Filter            | N/A #   |       |      |
|-------------------|---------|-------|------|
|                   | Initial | Final | Gain |
| Impingers, g      | 200.0   | 235   | 35.0 |
| Silica gel, g     | 238.4   | 273.8 | 35.4 |
| Total water gain: |         |       | 70.4 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1              | 9           | 389.214            | 1.60                            | 249              | 50               | 2.59     | 2.60   | 4            | 257             | 41                     |
| 2              | 18          | 397.240            | 1.40                            | 245              | 50               | 2.28     | 2.30   | 4            | 255             | 45                     |
| 3              | 27          | 404.680            | 1.50                            | 257              | 50               | 2.40     | 2.40   | 4            | 256             | 48                     |
| 4              | 36          | 412.390            | 1.60                            | 252              | 53               | 2.59     | 2.60   | 4            | 255             | 52                     |
| 5              | 45          | 420.390            | 1.70                            | 252              | 54               | 2.76     | 2.80   | 4            | 252             | 54                     |
| 6              | 54          | 428.700            | 1.70                            | 252              | 55               | 2.76     | 2.80   | 4            | 255             | 50                     |
| 7              | 63          | 437.030            | 1.70                            | 253              | 55               | 2.76     | 2.80   | 4            | 251             | 49                     |
| 8              | 72          | 445.300            | 1.60                            | 255              | 55               | 2.59     | 2.60   | 4            | 255             | 49                     |
| 9              | 81          | 453.310            | 1.60                            | 250              | 57               | 2.62     | 2.60   | 4            | 253             | 47                     |
| 10             | 90          | 461.350            | 1.50                            | 248              | 57               | 2.46     | 2.50   | 4            | 256             | 47                     |
| 11             | 99          | 469.206            | 1.60                            | 247              | 58               | 2.63     | 2.60   | 4            | 258             | 55                     |
| 12             | 108         | 477.290            | 1.60                            | 247              | 58               | 2.62     | 2.60   | 4            | 255             | 48                     |
| 13             | 117         | 485.310            | 1.60                            | 248              | 58               | 2.63     | 2.60   | 4            | 258             | 50                     |
| 14             | 126         | 493.310            | 1.70                            | 251              | 61               | 2.80     | 2.80   | 4            | 254             | 51                     |
| 15             | 135         | 501.830            | 1.70                            | 252              | 62               | 2.80     | 2.80   | 4            | 256             | 52                     |
| 16             | 144         | 510.110            | 1.70                            | 252              | 62               | 2.80     | 2.80   | 4            | 255             | 52                     |
| 17             | 153         | 518.560            | 1.60                            | 252              | 63               | 2.64     | 2.60   | 4            | 254             | 50                     |
| 18             | 162         | 526.640            | 1.60                            | 248              | 63               | 2.66     | 2.70   | 4            | 256             | 48                     |
| 19             | 171         | 534.870            | 1.50                            | 249              | 63               | 2.49     | 2.50   | 4            | 258             | 48                     |
| 20             | 180         | 542.820            | 1.50                            | 248              | 63               | 2.49     | 2.50   | 4            | 257             | 49                     |
|                |             | 550.724            | 1.50                            | 248              | 63               | 2.49     | 2.50   | 4            | 257             | 49                     |



**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M29  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloud/Rainy, 50 degrees

**Run:** 2  
**Start Time:** 12:36  
**End Time:** 15:46  
**Date:** 4/29/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
 $\Delta H@$  1.8073  
Probe ID 3C  
Nozzle ID 0.214  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.2140 inches  
Nozzle area: 0.00025 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.91 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.6 "H<sub>2</sub>O  
Stack Temperature 248 F  
Assumed moisture 1.99 %  
Assumed meter temp. 57.4 F  
Total number of points 20  
Time per point 9  
Total run time 180

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 12       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 168.169 dcf  
Wet mol. weight 28.69 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 2.06 %  
Std. meter vol. 168.207 dscf  
Isokinetic Average 100.2 %

**Moisture/Lab:**

| Filter            | N/A # | Initial | Final | Gain |
|-------------------|-------|---------|-------|------|
| Impingers, g      | 200.0 | 240     | 40.0  |      |
| Silica gel, g     | 240.7 | 276     | 35.3  |      |
| Total water gain: |       |         |       | 75.3 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 9           | 551.062            | 1.70                                    | 248              | 62               | 2.82             | 2.80           | 4            | 255             | 40                     |
| 2              | 18          | 567.850            | 1.70                                    | 239              | 59               | 2.84             | 2.80           | 4            | 253             | 40                     |
| 3              | 27          | 576.170            | 1.70                                    | 242              | 59               | 2.83             | 2.80           | 4            | 260             | 43                     |
| 4              | 36          | 584.650            | 1.80                                    | 249              | 58               | 2.96             | 3.00           | 4            | 258             | 45                     |
| 5              | 45          | 593.190            | 1.80                                    | 252              | 59               | 2.95             | 3.00           | 4            | 251             | 47                     |
| 6              | 54          | 601.730            | 1.80                                    | 251              | 60               | 2.96             | 3.00           | 4            | 255             | 48                     |
| 7              | 63          | 610.450            | 1.80                                    | 252              | 61               | 2.96             | 3.00           | 4            | 252             | 49                     |
| 8              | 72          | 618.820            | 1.70                                    | 253              | 62               | 2.80             | 2.80           | 4            | 257             | 50                     |
| 9              | 81          | 626.860            | 1.60                                    | 255              | 62               | 2.63             | 2.60           | 4            | 256             | 51                     |
| 10             | 90          | 634.481            | 1.40                                    | 252              | 63               | 2.31             | 2.30           | 4            | 255             | 50                     |
| 11             | 99          | 642.450            | 1.50                                    | 254              | 63               | 2.47             | 2.50           | 4            | 252             | 50                     |
| 12             | 108         | 650.530            | 1.60                                    | 249              | 61               | 2.64             | 2.60           | 4            | 257             | 48                     |
| 13             | 117         | 659.300            | 1.80                                    | 243              | 61               | 3.00             | 3.00           | 4            | 250             | 50                     |
| 14             | 126         | 668.002            | 1.80                                    | 246              | 61               | 2.99             | 3.00           | 4            | 254             | 51                     |
| 15             | 135         | 676.950            | 1.90                                    | 247              | 61               | 3.15             | 3.20           | 4            | 255             | 53                     |
| 16             | 144         | 685.670            | 1.80                                    | 246              | 62               | 2.99             | 3.00           | 4            | 258             | 52                     |
| 17             | 153         | 694.370            | 1.80                                    | 244              | 64               | 3.01             | 3.00           | 4            | 253             | 53                     |
| 18             | 162         | 702.790            | 1.70                                    | 245              | 64               | 2.84             | 2.80           | 4            | 256             | 55                     |
| 19             | 171         | 711.000            | 1.60                                    | 242              | 65               | 2.69             | 2.70           | 4            | 253             | 54                     |
| 20             | 180         | 719.231            | 1.60                                    | 240              | 65               | 2.70             | 2.70           | 4            | 251             | 54                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M29  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloud/Rainy, 50 degrees

**Run:** 3  
**Start Time:** 16:02  
**End Time:** 19:06  
**Date:** 4/29/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
 $\Delta H$ @ 1.8073  
Probe ID 3C  
Nozzle ID 0.214  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.2140 inches  
Nozzle area: 0.00025 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.91 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.6 "H<sub>2</sub>O  
Stack Temperature 248 F  
Assumed moisture 2.06 %  
Assumed meter temp. 61.6 F  
Total number of points 20  
Time per point 9  
Total run time 180  
O<sub>2</sub> 19.92 %  
CO<sub>2</sub> 0.65 %  
Rec. Nz. 0.196 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 11       | 9         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 168.210 dcf  
Wet mol. weight 28.7 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.83 %  
Std. meter vol. 168.254 dscf  
Isokinetic Average 100.0 %  
Ave.  $\Delta P$  1.7 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.3031 "H<sub>2</sub>O  
Ave.  $\Delta H$  2.84 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 244.7 °F  
Ave. T<sub>m</sub> 61.6 °F

**Moisture/Lab:**

|                   | N/A #   |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 236   | 36.0 |
| Silica gel, g     | 240.8   | 271.4 | 30.6 |
| Total water gain: |         |       | 66.6 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 9           | 719.347            | 1.70                                    | 245              | 65               | 2.84             | 2.90           | 4            | 254             | 48                     |
| 2              | 18          | 727.840            | 1.70                                    | 244              | 65               | 2.85             | 2.90           | 4            | 259             | 46                     |
| 3              | 27          | 744.650            | 1.60                                    | 241              | 65               | 2.69             | 2.70           | 4            | 261             | 47                     |
| 4              | 36          | 753.330            | 1.80                                    | 242              | 65               | 3.02             | 3.00           | 4            | 252             | 47                     |
| 5              | 45          | 761.700            | 1.70                                    | 241              | 64               | 2.85             | 2.90           | 4            | 254             | 48                     |
| 6              | 54          | 770.520            | 1.80                                    | 244              | 63               | 3.00             | 3.00           | 4            | 257             | 48                     |
| 7              | 63          | 779.310            | 1.80                                    | 244              | 63               | 3.00             | 3.00           | 4            | 263             | 48                     |
| 8              | 72          | 787.400            | 1.60                                    | 242              | 63               | 2.68             | 2.70           | 4            | 254             | 47                     |
| 9              | 81          | 795.630            | 1.60                                    | 245              | 63               | 2.66             | 2.70           | 4            | 260             | 48                     |
| 10             | 90          | 803.528            | 1.50                                    | 245              | 62               | 2.49             | 2.50           | 4            | 251             | 48                     |
| 11             | 99          | 811.370            | 1.50                                    | 243              | 61               | 2.50             | 2.50           | 4            | 260             | 47                     |
| 12             | 108         | 819.560            | 1.60                                    | 246              | 60               | 2.65             | 2.70           | 4            | 255             | 46                     |
| 13             | 117         | 828.150            | 1.80                                    | 245              | 60               | 2.98             | 3.00           | 4            | 254             | 47                     |
| 14             | 126         | 836.830            | 1.80                                    | 248              | 60               | 2.97             | 3.00           | 4            | 261             | 49                     |
| 15             | 135         | 845.500            | 1.90                                    | 247              | 60               | 3.14             | 3.10           | 4            | 260             | 48                     |
| 16             | 144         | 854.190            | 1.80                                    | 248              | 59               | 2.96             | 3.00           | 4            | 262             | 48                     |
| 17             | 153         | 862.730            | 1.80                                    | 246              | 59               | 2.97             | 3.00           | 4            | 257             | 48                     |
| 18             | 162         | 871.140            | 1.70                                    | 246              | 59               | 2.81             | 2.80           | 4            | 259             | 48                     |
| 19             | 171         | 879.510            | 1.70                                    | 246              | 58               | 2.80             | 2.80           | 4            | 256             | 49                     |
| 20             | 180         | 887.557            | 1.60                                    | 246              | 58               | 2.64             | 2.60           | 4            | 258             | 49                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 29

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 11:50  
**Date:** 4/29/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 389.214                  |                                 |                            |                   |                         |                            |             |
| 9.0           | 397.240                  | 2.60                            | 50                         | 1                 | 1.60                    | 249                        | 1.2649      |
| 18.0          | 404.680                  | 2.30                            | 50                         | 2                 | 1.40                    | 245                        | 1.1832      |
| 27.0          | 412.390                  | 2.40                            | 50                         | 3                 | 1.50                    | 257                        | 1.2247      |
| 36.0          | 420.390                  | 2.60                            | 53                         | 4                 | 1.60                    | 252                        | 1.2649      |
| 45.0          | 428.700                  | 2.80                            | 54                         | 5                 | 1.70                    | 252                        | 1.3038      |
| 54.0          | 437.030                  | 2.80                            | 55                         | 6                 | 1.70                    | 252                        | 1.3038      |
| 63.0          | 445.300                  | 2.80                            | 55                         | 7                 | 1.70                    | 253                        | 1.3038      |
| 72.0          | 453.310                  | 2.60                            | 55                         | 8                 | 1.60                    | 255                        | 1.2649      |
| 81.0          | 461.350                  | 2.60                            | 57                         | 9                 | 1.60                    | 250                        | 1.2649      |
| 90.0          | 469.206                  | 2.50                            | 57                         | 10                | 1.50                    | 248                        | 1.2247      |
| 99.0          | 477.290                  | 2.60                            | 58                         | 11                | 1.60                    | 247                        | 1.2649      |
| 108.0         | 485.310                  | 2.60                            | 58                         | 12                | 1.60                    | 250                        | 1.2649      |
| 117.0         | 493.310                  | 2.60                            | 58                         | 13                | 1.60                    | 248                        | 1.2649      |
| 126.0         | 501.830                  | 2.80                            | 61                         | 14                | 1.70                    | 251                        | 1.3038      |
| 135.0         | 510.110                  | 2.80                            | 62                         | 15                | 1.70                    | 252                        | 1.3038      |
| 144.0         | 518.560                  | 2.80                            | 62                         | 16                | 1.70                    | 252                        | 1.3038      |
| 153.0         | 526.640                  | 2.60                            | 63                         | 17                | 1.60                    | 252                        | 1.2649      |
| 162.0         | 534.870                  | 2.70                            | 63                         | 18                | 1.60                    | 248                        | 1.2649      |
| 171.0         | 542.820                  | 2.50                            | 63                         | 19                | 1.50                    | 249                        | 1.2247      |
| 180.0         | 550.724                  | 2.50                            | 63                         | 20                | 1.50                    | 248                        | 1.2247      |

**Client: Hollingsworth & Vose****Run: 1****Source: CFU 117****Date: 04/29/18**

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**Field Data Input Continued**Moisture Data

Total Test Time 180 min  
Sample Time Interval 9.0 min  
Meter Volume,  $V_m$  161.510 dcf  
Water Volume 70.4 ml (g)  
Nozzle Diameter,  $N_z$  0.2140 in.  
Nozzle Area 0.000250 sq.ft.

Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.94 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.64 %vd  
O<sub>2</sub> Average 19.80 %vd

**Field Data Averages**

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Meter

$\Delta H$  2.625 "H<sub>2</sub>O  
Temperature,  $T_m$  57.4 °F  
Temperature,  $T_m$  517.4 °A (°R)  
Pressure Meter,  $P_m$  30.133 "Hg

Stack

$\sqrt{D_p}$  1.2644 "H<sub>2</sub>O  
Temperature,  $T_s$  250.5 °F  
Temperature,  $T_s$  710.5 °A (°R)  
Pressure Stack,  $P_s$  29.984 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  162.939 dscf  
4.614 dscm  
Actual Volume,  $V_{m(actual)}$  223.322 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  82.55 fps  
Volume (actual) 24,314.3 awcfm  
23,830.4 adcfm  
Volume (standard) 1,086,451.7 wscf/hr  
1,064,831.3 dscf/hr  
17,747.2 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  3.313 scf  
Moisture,  $B_{ws}$  0.0199  
Moisture EPA M4 1.99 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.89 lb/lb-mole  
Wet,  $M_s$  28.67 lb/lb-mole

Percent Isokinetic 100.2 %

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 29

**Run:** 2  
**Start Time:** 12:36  
**End Time:** 15:46  
**Date:** 04/29/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 551.062                  |                                 |                            |                   |                         |                            |             |
| 9.0           | 559.550                  | 2.80                            | 62                         | 1                 | 1.70                    | 248                        | 1.3038      |
| 18.0          | 567.850                  | 2.80                            | 59                         | 2                 | 1.70                    | 239                        | 1.3038      |
| 27.0          | 576.170                  | 2.80                            | 59                         | 3                 | 1.70                    | 242                        | 1.3038      |
| 36.0          | 584.650                  | 3.00                            | 58                         | 4                 | 1.80                    | 249                        | 1.3416      |
| 45.0          | 593.190                  | 3.00                            | 59                         | 5                 | 1.80                    | 252                        | 1.3416      |
| 54.0          | 601.730                  | 3.00                            | 60                         | 6                 | 1.80                    | 251                        | 1.3416      |
| 63.0          | 610.450                  | 3.00                            | 61                         | 7                 | 1.80                    | 252                        | 1.3416      |
| 72.0          | 618.820                  | 2.80                            | 62                         | 8                 | 1.70                    | 253                        | 1.3038      |
| 81.0          | 626.860                  | 2.60                            | 62                         | 9                 | 1.60                    | 255                        | 1.2649      |
| 90.0          | 634.481                  | 2.30                            | 63                         | 10                | 1.40                    | 252                        | 1.1832      |
| 99.0          | 642.450                  | 2.50                            | 63                         | 11                | 1.50                    | 254                        | 1.2247      |
| 108.0         | 650.530                  | 2.60                            | 61                         | 12                | 1.60                    | 249                        | 1.2649      |
| 117.0         | 659.300                  | 3.00                            | 61                         | 13                | 1.80                    | 243                        | 1.3416      |
| 126.0         | 668.002                  | 3.00                            | 61                         | 14                | 1.80                    | 246                        | 1.3416      |
| 135.0         | 676.950                  | 3.20                            | 61                         | 15                | 1.90                    | 247                        | 1.3784      |
| 144.0         | 685.670                  | 3.00                            | 62                         | 16                | 1.80                    | 246                        | 1.3416      |
| 153.0         | 694.370                  | 3.00                            | 64                         | 17                | 1.80                    | 244                        | 1.3416      |
| 162.0         | 702.790                  | 2.80                            | 64                         | 18                | 1.70                    | 245                        | 1.3038      |
| 171.0         | 711.000                  | 2.70                            | 65                         | 19                | 1.60                    | 242                        | 1.2649      |
| 180.0         | 719.231                  | 2.70                            | 65                         | 20                | 1.60                    | 240                        | 1.2649      |

**Client: Hollingsworth & Vose****Run: 2****Source: CFU 117****Date: 04/29/18**

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**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 180 min         |
| Sample Time Interval   | 9.0 min         |
| Meter Volume, $V_m$    | 168.169 dcf     |
| Water Volume           | 75.3 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2140 in.      |
| Nozzle Area            | 0.000250 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 30.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 4.909 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 29.91 "Hg              |
| Static Pressure            | 0.60 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.76 %vd  |
| O <sub>2</sub> Average  | 19.59 %vd |

**Field Data Averages**

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Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 2.830 "H <sub>2</sub> O |
| Temperature, $T_m$    | 61.6 °F                 |
| Temperature, $T_m$    | 521.6 °A (°R)           |
| Pressure Meter, $P_m$ | 30.118 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.3049 "H <sub>2</sub> O |
| Temperature, $T_s$    | 247.5 °F                 |
| Temperature, $T_s$    | 707.5 °A (°R)            |
| Pressure Stack, $P_s$ | 29.954 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 168.207 dscf |
|                                | 4.763 dscm   |
| Actual Volume, $V_{m(actual)}$ | 229.963 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 85.02 fps           |
| Volume (actual)   | 25,041.8 awcfm      |
|                   | 24,525.9 adcfm      |
| Volume (standard) | 1,122,580.1 wscf/hr |
|                   | 1,099,454.9 dscf/hr |
|                   | 18,324.2 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 3.544 scf |
| Moisture, $B_{ws}$           | 0.0206    |
| Moisture EPA M4              | 2.06 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.91 lb/lb-mole |
| Wet, $M_s$ | 28.69 lb/lb-mole |

|                    |         |
|--------------------|---------|
| Percent Isokinetic | 100.2 % |
|--------------------|---------|

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 29

**Run:** 3  
**Start Time:** 16:02  
**End Time:** 19:06  
**Date:** 04/29/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 719.347                  |                                 |                            |                   |                         |                            |             |
| 9.0           | 727.840                  | 2.90                            | 65                         | 1                 | 1.70                    | 245                        | 1.3038      |
| 18.0          | 736.400                  | 2.90                            | 65                         | 2                 | 1.70                    | 244                        | 1.3038      |
| 27.0          | 744.650                  | 2.70                            | 65                         | 3                 | 1.60                    | 241                        | 1.2649      |
| 36.0          | 753.330                  | 3.00                            | 65                         | 4                 | 1.80                    | 242                        | 1.3416      |
| 45.0          | 761.700                  | 2.90                            | 64                         | 5                 | 1.70                    | 241                        | 1.3038      |
| 54.0          | 770.520                  | 3.00                            | 63                         | 6                 | 1.80                    | 244                        | 1.3416      |
| 63.0          | 779.310                  | 3.00                            | 63                         | 7                 | 1.80                    | 244                        | 1.3416      |
| 72.0          | 787.400                  | 2.70                            | 63                         | 8                 | 1.60                    | 242                        | 1.2649      |
| 81.0          | 795.630                  | 2.70                            | 63                         | 9                 | 1.60                    | 245                        | 1.2649      |
| 90.0          | 803.528                  | 2.50                            | 62                         | 10                | 1.50                    | 245                        | 1.2247      |
| 99.0          | 811.370                  | 2.50                            | 61                         | 11                | 1.50                    | 243                        | 1.2247      |
| 108.0         | 819.560                  | 2.70                            | 60                         | 12                | 1.60                    | 246                        | 1.2649      |
| 117.0         | 828.150                  | 3.00                            | 60                         | 13                | 1.80                    | 245                        | 1.3416      |
| 126.0         | 836.830                  | 3.00                            | 60                         | 14                | 1.80                    | 248                        | 1.3416      |
| 135.0         | 845.500                  | 3.10                            | 60                         | 15                | 1.90                    | 247                        | 1.3784      |
| 144.0         | 854.190                  | 3.00                            | 59                         | 16                | 1.80                    | 248                        | 1.3416      |
| 153.0         | 862.730                  | 3.00                            | 59                         | 17                | 1.80                    | 246                        | 1.3416      |
| 162.0         | 871.140                  | 2.80                            | 59                         | 18                | 1.70                    | 246                        | 1.3038      |
| 171.0         | 879.510                  | 2.80                            | 58                         | 19                | 1.70                    | 246                        | 1.3038      |
| 180.0         | 887.557                  | 2.60                            | 58                         | 20                | 1.60                    | 246                        | 1.2649      |

**Client: Hollingsworth & Vose****Run: 3****Source: CFU 117****Date: 04/29/18**

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**Field Data Input Continued**Moisture Data

Total Test Time 180 min  
Sample Time Interval 9.0 min  
Meter Volume,  $V_m$  168.210 dcf  
Water Volume 66.6 ml (g)  
Nozzle Diameter,  $N_z$  0.2140 in.  
Nozzle Area 0.000250 sq.ft.

Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.91 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.65 %vd  
O<sub>2</sub> Average 19.92 %vd

**Field Data Averages**

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Meter

$\Delta H$  2.840 "H<sub>2</sub>O  
Temperature,  $T_m$  61.6 °F  
Temperature,  $T_m$  521.6 °A (°R)  
Pressure Meter,  $P_m$  30.119 "Hg

Stack

$\sqrt{D_p}$  1.3031 "H<sub>2</sub>O  
Temperature,  $T_s$  244.7 °F  
Temperature,  $T_s$  704.7 °A (°R)  
Pressure Stack,  $P_s$  29.954 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  168.254 dscf  
4.764 dscm  
Actual Volume,  $V_{m(actual)}$  228.579 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  84.72 fps  
Volume (actual) 24,953.4 awcfm  
24,496.8 adcfm  
Volume (standard) 1,123,063.6 wscf/hr  
1,102,511.5 dscf/hr  
18,375.2 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  3.134 scf  
Moisture,  $B_{ws}$  0.0183  
Moisture EPA M4 1.83 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
Wet,  $M_s$  28.70 lb/lb-mole

Percent Isokinetic 100.0 %



|             |            |        |           |        |              |          |           |
|-------------|------------|--------|-----------|--------|--------------|----------|-----------|
| Source:     | CFU 117    |        |           |        | Sample Date: | 04/29/18 |           |
| Run:        | 1          |        |           |        |              |          |           |
|             | Filter +   |        |           |        |              |          |           |
| Client ID:  | Front Half |        | Back Half |        |              |          |           |
| Analyte     | <          | Result | <         | Result | FH MDL       | BH MDL   | Units     |
| Antimony    | <          | MDL    | <         | MDL    | 1.250        | 0.500    | µg/sample |
| Arsenic     | <          | MDL    | <         | MDL    | 1.750        | 0.700    | µg/sample |
| Barium      |            | 3.410  |           | 0.452  | 0.125        | 0.050    | µg/sample |
| Beryllium   | <          | MDL    | <         | MDL    | 0.050        | 0.020    | µg/sample |
| Cadmium     | <          | MDL    | <         | MDL    | 0.100        | 0.040    | µg/sample |
| Chromium    |            | 1.290  |           | 0.210  | 0.200        | 0.080    | µg/sample |
| Cobalt      | <          | MDL    | <         | MDL    | 0.125        | 0.050    | µg/sample |
| Copper      | <          | MDL    |           | 2.500  | 1.250        | 0.500    | µg/sample |
| Lead        | <          | MDL    | <         | MDL    | 1.250        | 0.500    | µg/sample |
| Manganese   |            | 0.938  |           | 0.384  | 0.075        | 0.030    | µg/sample |
| Nickel      |            | 2.640  | <         | MDL    | 0.750        | 0.300    | µg/sample |
| Phosphorus  |            | 14.800 | <         | MDL    | 5.000        | 2.000    | µg/sample |
| Selenium    | <          | MDL    | <         | MDL    | 3.750        | 1.500    | µg/sample |
| Zinc        |            | 3.070  |           | 7.110  | 0.750        | 0.300    | µg/sample |
| Lab ID:     | 18-S677    |        | 18-S678   |        |              |          |           |
| Sample Vol: | 250        |        | 100       |        | mL           |          |           |

|             |            |        |           |        |                       |        |           |
|-------------|------------|--------|-----------|--------|-----------------------|--------|-----------|
| Source:     | CFU 117    |        |           |        | Sample Date: 04/29/18 |        |           |
| Run:        | 2          |        |           |        |                       |        |           |
|             | Filter +   |        |           |        |                       |        |           |
| Client ID:  | Front Half |        | Back Half |        |                       |        |           |
| Analyte     | <          | Result | <         | Result | FH MDL                | BH MDL | Units     |
| Antimony    | <          | MDL    | <         | MDL    | 1.250                 | 0.500  | µg/sample |
| Arsenic     | <          | MDL    | <         | MDL    | 1.750                 | 0.700  | µg/sample |
| Barium      |            | 3.490  |           | 0.479  | 0.125                 | 0.050  | µg/sample |
| Beryllium   | <          | MDL    | <         | MDL    | 0.050                 | 0.020  | µg/sample |
| Cadmium     | <          | MDL    | <         | MDL    | 0.100                 | 0.040  | µg/sample |
| Chromium    |            | 1.400  |           | 0.184  | 0.200                 | 0.080  | µg/sample |
| Cobalt      | <          | MDL    | <         | MDL    | 0.125                 | 0.050  | µg/sample |
| Copper      | <          | MDL    |           | 1.500  | 1.250                 | 0.500  | µg/sample |
| Lead        | <          | MDL    | <         | MDL    | 1.250                 | 0.500  | µg/sample |
| Manganese   |            | 0.986  |           | 0.344  | 0.075                 | 0.030  | µg/sample |
| Nickel      |            | 2.330  | <         | MDL    | 0.750                 | 0.300  | µg/sample |
| Phosphorus  |            | 8.820  | <         | MDL    | 5.000                 | 2.000  | µg/sample |
| Selenium    | <          | MDL    | <         | MDL    | 3.750                 | 1.500  | µg/sample |
| Zinc        |            | 3.400  |           | 3.030  | 0.750                 | 0.300  | µg/sample |
| Lab ID:     | 18-S679    |        | 18-S680   |        |                       |        |           |
| Sample Vol: | 250        |        | 100       |        | mL                    |        |           |

Source: CFU 117 Sample Date: 04/29/18

Run: 3

Filter +

| Client ID:  | Front Half |         | Back Half |         |        |        |           |
|-------------|------------|---------|-----------|---------|--------|--------|-----------|
| Analyte     | <          | Result  | <         | Result  | FH MDL | BH MDL | Units     |
| Antimony    | <          | MDL     | <         | MDL     | 1.250  | 0.500  | µg/sample |
| Arsenic     | <          | MDL     | <         | MDL     | 1.750  | 0.700  | µg/sample |
| Barium      |            | 3.400   |           | 0.408   | 0.125  | 0.050  | µg/sample |
| Beryllium   | <          | MDL     | <         | MDL     | 0.050  | 0.020  | µg/sample |
| Cadmium     | <          | MDL     | <         | MDL     | 0.100  | 0.040  | µg/sample |
| Chromium    |            | 1.360   |           | 0.132   | 0.200  | 0.080  | µg/sample |
| Cobalt      | <          | MDL     | <         | MDL     | 0.125  | 0.050  | µg/sample |
| Copper      | <          | MDL     | <         | MDL     | 1.250  | 0.500  | µg/sample |
| Lead        | <          | MDL     | <         | MDL     | 1.250  | 0.500  | µg/sample |
| Manganese   |            | 0.896   |           | 0.349   | 0.075  | 0.030  | µg/sample |
| Nickel      |            | 2.480   | <         | MDL     | 0.750  | 0.300  | µg/sample |
| Phosphorus  |            | 9.510   | <         | MDL     | 5.000  | 2.000  | µg/sample |
| Selenium    | <          | MDL     | <         | MDL     | 3.750  | 1.500  | µg/sample |
| Zinc        |            | 2.850   |           | 3.150   | 0.750  | 0.300  | µg/sample |
| Lab ID:     |            | 18-S681 |           | 18-S682 |        |        |           |
| Sample Vol: |            | 250     |           | 100     |        |        | mL        |

**Source: CFU 117**  
**Blank Values**

| Client ID:      |   | Filter           | MDL              | BH Capture Soln.                                           |         | MDL                                                            | FH/BH Rinse            |                  | MDL                           |                  |
|-----------------|---|------------------|------------------|------------------------------------------------------------|---------|----------------------------------------------------------------|------------------------|------------------|-------------------------------|------------------|
|                 |   |                  |                  | 5% HNO <sub>3</sub> /<br>10% H <sub>2</sub> O <sub>2</sub> |         | 5% HNO <sub>3</sub> / 10%<br>H <sub>2</sub> O <sub>2</sub> MDL | 0.1 N HNO <sub>3</sub> |                  | 0.1 N HNO <sub>3</sub><br>MDL |                  |
|                 |   |                  | Filter MDL       |                                                            |         |                                                                |                        |                  |                               |                  |
| <u>Analyte</u>  | < | <u>ug/sample</u> | <u>ug/sample</u> | <u>ug/sample</u>                                           | <       | <u>ug/sample</u>                                               | <                      | <u>ug/sample</u> | <                             | <u>ug/sample</u> |
| Antimony        | < | MDL              | 1.250            | <                                                          | MDL     | 0.500                                                          | <                      | MDL              | <                             | 1.250            |
| Arsenic         | < | MDL              | 1.750            | <                                                          | MDL     | 0.700                                                          | <                      | MDL              | <                             | 1.750            |
| Barium          |   | 3.300            | 0.125            |                                                            | 0.362   | 0.050                                                          |                        | 0.221            |                               | 0.125            |
| Beryllium       | < | MDL              | 0.050            | <                                                          | MDL     | 0.020                                                          | <                      | MDL              | <                             | 0.050            |
| Cadmium         | < | MDL              | 0.100            | <                                                          | MDL     | 0.040                                                          | <                      | MDL              | <                             | 0.100            |
| Chromium        |   | 1.330            | 0.200            |                                                            | 0.098   | 0.080                                                          | <                      | MDL              |                               | 0.200            |
| Cobalt          | < | MDL              | 0.125            | <                                                          | MDL     | 0.050                                                          | <                      | MDL              | <                             | 0.125            |
| Copper          | < | MDL              | 1.250            |                                                            | 1.520   | 0.500                                                          | <                      | MDL              |                               | 1.250            |
| Lead            | < | MDL              | 1.250            | <                                                          | MDL     | 0.500                                                          | <                      | MDL              | <                             | 1.250            |
| Manganese       |   | 0.565            | 0.075            |                                                            | 0.295   | 0.030                                                          |                        | 0.176            |                               | 0.075            |
| Nickel          |   | 2.370            | 0.750            | <                                                          | MDL     | 0.300                                                          | <                      | MDL              |                               | 0.750            |
| Phosphorus      |   | 7.900            | 5.000            | <                                                          | MDL     | 2.000                                                          | <                      | MDL              |                               | 5.000            |
| Selenium        | < | MDL              | 3.750            | <                                                          | MDL     | 1.500                                                          | <                      | MDL              | <                             | 3.750            |
| Zinc            |   | 2.200            | 0.750            |                                                            | 0.556   | 0.300                                                          | <                      | MDL              |                               | 0.750            |
| Lab ID:         |   | 18-S675          |                  |                                                            | 18-S676 |                                                                |                        | 18-S674          |                               |                  |
| Sample Vol, ml: |   | 250              |                  |                                                            | 100     |                                                                |                        | 250              |                               |                  |

Hollingsworth &amp; Vose

CFU 117

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## Method 29 Metals Blank Calculations

Run: 1

1 of 3

|             | I                                 | II                   | III                  | IV                                                                 | V                                | VI                               | VII                  | VIII      |                   |
|-------------|-----------------------------------|----------------------|----------------------|--------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------|-----------|-------------------|
|             | Sample*                           | Blank*               | Blank*               | Sample*                                                            | Blank*                           | BH Blank*                        | BH Blank*            | Allowable |                   |
|             | FH                                | FH                   | FH                   | BH                                                                 | BH                               | Corrected                        | Corrected            | BH        |                   |
| Species     | Wash+Filter                       | Wash, µg             | Filter, µg           | Cap.Sol.                                                           | Cap.Sol.                         | Cap.Sol.                         | Wash, µg             | Blank, µg | Species           |
| Volume(ml)  | 100                               | 100                  | N/A                  | 100                                                                | µg/mL                            | 200                              | 100                  |           |                   |
| <b>Sb</b> < | 1.250 <                           | 0.5000 <             | 1.250 <              | 0.500 <                                                            | 0.0050 <                         | 1.000 <                          | 0.5000               | 0.000     | <b>Antimony</b>   |
| <b>As</b> < | 1.750 <                           | 0.7000 <             | 1.750 <              | 0.700 <                                                            | 0.0070 <                         | 1.400 <                          | 0.7000               | 0.000     | <b>Arsenic</b>    |
| <b>Ba</b>   | 3.410                             | 0.0884               | 3.300                | 0.452                                                              | 0.0036                           | 0.724                            | 0.0884               | 0.812     | <b>Barium</b>     |
| <b>Be</b> < | 0.050 <                           | 0.0200 <             | 0.050 <              | 0.020 <                                                            | 0.0002 <                         | 0.040 <                          | 0.0200               | 0.000     | <b>Beryllium</b>  |
| <b>Cd</b> < | 0.100 <                           | 0.0400 <             | 0.100 <              | 0.040 <                                                            | 0.0004 <                         | 0.080 <                          | 0.0400               | 0.000     | <b>Cadmium</b>    |
| <b>Cr</b>   | 1.290 <                           | 0.0800               | 1.330                | 0.210                                                              | 0.0010                           | 0.196 <                          | 0.0800               | 0.196     | <b>Chromium</b>   |
| <b>Co</b> < | 0.125 <                           | 0.0500 <             | 0.125 <              | 0.050 <                                                            | 0.0005 <                         | 0.100 <                          | 0.0500               | 0.000     | <b>Cobalt</b>     |
| <b>Cu</b> < | 1.250 <                           | 0.5000 <             | 1.250                | 2.500                                                              | 0.0152                           | 3.040 <                          | 0.5000               | 3.040     | <b>Copper</b>     |
| <b>Pb</b> < | 1.250 <                           | 0.5000 <             | 1.250 <              | 0.500 <                                                            | 0.0050 <                         | 1.000 <                          | 0.5000               | 0.000     | <b>Lead</b>       |
| <b>Mn</b>   | 0.938                             | 0.0704               | 0.565                | 0.384                                                              | 0.0030                           | 0.590                            | 0.0704               | 0.660     | <b>Manganese</b>  |
| <b>Ni</b>   | 2.640 <                           | 0.3000               | 2.370 <              | 0.300 <                                                            | 0.0030 <                         | 0.600 <                          | 0.3000               | 0.000     | <b>Nickel</b>     |
| <b>P</b>    | 14.800 <                          | 2.0000               | 7.900 <              | 2.000 <                                                            | 0.0200 <                         | 4.000 <                          | 2.0000               | 0.000     | <b>Phosphorus</b> |
| <b>Se</b> < | 3.750 <                           | 1.5000 <             | 3.750 <              | 1.500 <                                                            | 0.0150 <                         | 3.000 <                          | 1.5000               | 0.000     | <b>Selenium</b>   |
| <b>Zn</b>   | 3.070 <                           | 0.3000               | 2.200                | 7.110                                                              | 0.0056                           | 1.112 <                          | 0.3000               | 1.112     | <b>Zinc</b>       |
| <b>Lab:</b> | <b>18-S677</b>                    | <b>18-S674</b>       | <b>18-S675</b>       | <b>18-S678</b>                                                     | <b>18-S676</b>                   |                                  |                      |           |                   |
| Content:    | 0.1NHNO <sub>3</sub>              | 0.1NHNO <sub>3</sub> | 0.1NHNO <sub>3</sub> | 5%HNO <sub>3</sub> /                                               | 5%HNO <sub>3</sub> /             | 5%HNO <sub>3</sub> /             | 0.1NHNO <sub>3</sub> |           |                   |
|             | FH Filter & Probe Rinse           |                      |                      | 10%H <sub>2</sub> O <sub>2</sub>                                   | 10%H <sub>2</sub> O <sub>2</sub> | 10%H <sub>2</sub> O <sub>2</sub> |                      |           |                   |
|             | 100ml 0.1N HNO <sub>3</sub> rinse |                      |                      | BH Imps 1&2                                                        |                                  |                                  |                      |           |                   |
|             |                                   | Same as BH           |                      | 100ml .1N HNO <sub>3</sub> rinse                                   |                                  |                                  | Same as FH           |           |                   |
|             |                                   | Blank Wash           |                      | 200ml 5%HNO <sub>3</sub> /10%H <sub>2</sub> O <sub>2</sub> reagent |                                  |                                  | Blank Wash           |           |                   |

Blanks are prorated to reflect 100ml for HNO<sub>3</sub> and 200ml for HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

## \* Blank Rules:

"&lt;" indicates value is below the minimum detection limit (MDL)

If Blank is a "&lt;" value it is treated as zero.

If Sample is a "&lt;" it used for emission rate calculations but the final answer contains a "&lt;" to demonstrate the value is unknown

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Method 29 Metals Blank Calculations

Run: 1

2 of 3

| Species   | X<br>Allowable<br>FH<br>Blank, $\mu g$ | XI<br>FH Blank<br>Corrected<br>$\mu g$ | XII<br>5% of FH<br>Sample, $\mu g$ | XIII<br>Lessor of<br>XI or XII | XIV<br>Greater of<br>A or XIII | XV<br>FH<br>Net<br>Sample, $\mu g$ | Species           |
|-----------|----------------------------------------|----------------------------------------|------------------------------------|--------------------------------|--------------------------------|------------------------------------|-------------------|
| <b>Sb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Antimony</b>   |
| <b>As</b> | 0.000                                  | 0.000 <                                | 0.088                              | 0.000                          | 11.63 <                        | 1.750                              | <b>Arsenic</b>    |
| <b>Ba</b> | 3.388                                  | 3.388                                  | 0.171                              | 0.171                          | 11.63                          | 0.022                              | <b>Barium</b>     |
| <b>Be</b> | 0.000                                  | 0.000 <                                | 0.003                              | 0.000                          | 11.63 <                        | 0.050                              | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000                                  | 0.000 <                                | 0.005                              | 0.000                          | 11.63 <                        | 0.100                              | <b>Cadmium</b>    |
| <b>Cr</b> | 1.330                                  | 1.330                                  | 0.065                              | 0.065                          | 11.63                          | -0.040                             | <b>Chromium</b>   |
| <b>Co</b> | 0.000                                  | 0.000 <                                | 0.006                              | 0.000                          | 11.63 <                        | 0.125                              | <b>Cobalt</b>     |
| <b>Cu</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Copper</b>     |
| <b>Pb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Lead</b>       |
| <b>Mn</b> | 0.635                                  | 0.635                                  | 0.047                              | 0.047                          | 11.63                          | 0.303                              | <b>Manganese</b>  |
| <b>Ni</b> | 2.370                                  | 2.370                                  | 0.132                              | 0.132                          | 11.63                          | 0.270                              | <b>Nickel</b>     |
| <b>P</b>  | 7.900                                  | 7.900                                  | 0.740                              | 0.740                          | 11.63                          | 6.900                              | <b>Phosphorus</b> |
| <b>Se</b> | 0.000                                  | 0.000 <                                | 0.188                              | 0.000                          | 11.63 <                        | 3.750                              | <b>Selenium</b>   |
| <b>Zn</b> | 2.200                                  | 2.200                                  | 0.154                              | 0.154                          | 11.63                          | 0.870                              | <b>Zinc</b>       |

Allowable FH Blank Calculation:

A = (area of filter, sq. in.)\*(1.4  $\mu g/sq.in.$ )=  $\mu g$

A= 11.63  $\mu g$

if A>blank>0, use blank derived

if blank > A, use greater of A or 5% of sample  $\mu g$  or FH blank whichever is lessor.

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

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Method 29 Metals Blank Calculations

Run: 1

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|           | XVI            | XVII     | XVIII           | XIX           | XX               | XXI             | XXII            | XXIII           |                   |
|-----------|----------------|----------|-----------------|---------------|------------------|-----------------|-----------------|-----------------|-------------------|
|           | Allowable      | Blank BH | 5% of BH        | Lessor of     | Greater of       | BH              | FH              | FH+BH           |                   |
|           | BH             | Total    | sample, $\mu g$ | XVII or XVIII | 1 $\mu g$ or XIX | Net             | Net             | Total Net       |                   |
| Species   | Blank, $\mu g$ |          |                 |               |                  | Sample, $\mu g$ | Sample, $\mu g$ | Sample, $\mu g$ | Species           |
| <b>Sb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500</b> <  | <b>1.250</b> <  | <b>1.750</b>    | <b>Antimony</b>   |
| <b>As</b> | 0.000          | 0.000 <  | 0.035           | 0.000         | 1.000 <          | <b>0.700</b> <  | <b>1.750</b> <  | <b>2.450</b>    | <b>Arsenic</b>    |
| <b>Ba</b> | 0.812          | 0.812    | 0.023           | 0.023         | 1.000            | <b>0.000</b>    | <b>0.022</b>    | <b>0.022</b>    | <b>Barium</b>     |
| <b>Be</b> | 0.000          | 0.000 <  | 0.001           | 0.000         | 1.000 <          | <b>0.020</b> <  | <b>0.050</b> <  | <b>0.070</b>    | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000          | 0.000 <  | 0.002           | 0.000         | 1.000 <          | <b>0.040</b> <  | <b>0.100</b> <  | <b>0.140</b>    | <b>Cadmium</b>    |
| <b>Cr</b> | 0.196          | 0.196    | 0.011           | 0.011         | 1.000            | <b>0.014</b>    | <b>0.000</b>    | <b>0.014</b>    | <b>Chromium</b>   |
| <b>Co</b> | 0.000          | 0.000 <  | 0.003           | 0.000         | 1.000 <          | <b>0.050</b> <  | <b>0.125</b> <  | <b>0.175</b>    | <b>Cobalt</b>     |
| <b>Cu</b> | 1.000          | 3.040    | 0.125           | 0.125         | 1.000            | <b>1.500</b> <  | <b>1.250</b> <  | <b>2.750</b>    | <b>Copper</b>     |
| <b>Pb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500</b> <  | <b>1.250</b> <  | <b>1.750</b>    | <b>Lead</b>       |
| <b>Mn</b> | 0.660          | 0.660    | 0.019           | 0.019         | 1.000            | <b>0.000</b>    | <b>0.303</b>    | <b>0.303</b>    | <b>Manganese</b>  |
| <b>Ni</b> | 0.000          | 0.000 <  | 0.015           | 0.000         | 1.000 <          | <b>0.300</b>    | <b>0.270</b> <  | <b>0.570</b>    | <b>Nickel</b>     |
| <b>P</b>  | 0.000          | 0.000 <  | 0.100           | 0.000         | 1.000 <          | <b>2.000</b>    | <b>6.900</b> <  | <b>8.900</b>    | <b>Phosphorus</b> |
| <b>Se</b> | 0.000          | 0.000 <  | 0.075           | 0.000         | 1.000 <          | <b>1.500</b> <  | <b>3.750</b> <  | <b>5.250</b>    | <b>Selenium</b>   |
| <b>Zn</b> | 1.000          | 1.112    | 0.356           | 0.356         | 1.000            | <b>6.110</b>    | <b>0.870</b>    | <b>6.980</b>    | <b>Zinc</b>       |

Allowable BH Blank Calculation:

if  $1.00\mu g > \text{blank} > 0$ , use blank derived

if blank  $> 1.00\mu g$ , use greater of 1.00 or 5% of sample ug or BH blank whichever is lessor

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

Hollingsworth &amp; Vose

## Method 29 Metals Blank Calculations

Run: 2

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|             | I                                 | II                   | III                  | IV                                                                 | V                                | VI                               | VII                  | VIII      |                   |
|-------------|-----------------------------------|----------------------|----------------------|--------------------------------------------------------------------|----------------------------------|----------------------------------|----------------------|-----------|-------------------|
|             | Sample*                           | Blank*               | Blank*               | Sample*                                                            | Blank*                           | BH Blank*                        | BH Blank*            | Allowable |                   |
|             | FH                                | FH                   | FH                   | BH                                                                 | BH                               | Corrected                        | Corrected            | BH        |                   |
| Species     | Wash+Filter                       | Wash, µg             | Filter, µg           | Cap.Sol.                                                           | Cap.Sol.                         | Cap.Sol.                         | Wash, µg             | Blank, µg | Species           |
| Volume(ml)  | 100                               | 100                  | N/A                  | 100                                                                | µg/mL                            | 200                              | 100                  |           |                   |
| <b>Sb</b> < | 1.250 <                           | 0.5000 <             | 1.250 <              | 0.500 <                                                            | 0.0050 <                         | 1.000 <                          | 0.5000               | 0.000     | <b>Antimony</b>   |
| <b>As</b> < | 1.750 <                           | 0.7000 <             | 1.750 <              | 0.700 <                                                            | 0.0070 <                         | 1.400 <                          | 0.7000               | 0.000     | <b>Arsenic</b>    |
| <b>Ba</b>   | 3.490                             | 0.0884               | 3.300                | 0.479                                                              | 0.0036                           | 0.724                            | 0.0884               | 0.812     | <b>Barium</b>     |
| <b>Be</b> < | 0.050 <                           | 0.0200 <             | 0.050 <              | 0.020 <                                                            | 0.0002 <                         | 0.040 <                          | 0.0200               | 0.000     | <b>Beryllium</b>  |
| <b>Cd</b> < | 0.100 <                           | 0.0400 <             | 0.100 <              | 0.040 <                                                            | 0.0004 <                         | 0.080 <                          | 0.0400               | 0.000     | <b>Cadmium</b>    |
| <b>Cr</b>   | 1.400 <                           | 0.0800               | 1.330                | 0.184                                                              | 0.0010                           | 0.196 <                          | 0.0800               | 0.196     | <b>Chromium</b>   |
| <b>Co</b> < | 0.125 <                           | 0.0500 <             | 0.125 <              | 0.050 <                                                            | 0.0005 <                         | 0.100 <                          | 0.0500               | 0.000     | <b>Cobalt</b>     |
| <b>Cu</b> < | 1.250 <                           | 0.5000 <             | 1.250                | 1.500                                                              | 0.0152                           | 3.040 <                          | 0.5000               | 3.040     | <b>Copper</b>     |
| <b>Pb</b> < | 1.250 <                           | 0.5000 <             | 1.250 <              | 0.500 <                                                            | 0.0050 <                         | 1.000 <                          | 0.5000               | 0.000     | <b>Lead</b>       |
| <b>Mn</b>   | 0.986                             | 0.0704               | 0.565                | 0.344                                                              | 0.0030                           | 0.590                            | 0.0704               | 0.660     | <b>Manganese</b>  |
| <b>Ni</b>   | 2.330 <                           | 0.3000               | 2.370 <              | 0.300 <                                                            | 0.0030 <                         | 0.600 <                          | 0.3000               | 0.000     | <b>Nickel</b>     |
| <b>P</b>    | 8.820 <                           | 2.0000               | 7.900 <              | 2.000 <                                                            | 0.0200 <                         | 4.000 <                          | 2.0000               | 0.000     | <b>Phosphorus</b> |
| <b>Se</b> < | 3.750 <                           | 1.5000 <             | 3.750 <              | 1.500 <                                                            | 0.0150 <                         | 3.000 <                          | 1.5000               | 0.000     | <b>Selenium</b>   |
| <b>Zn</b>   | 3.400 <                           | 0.3000               | 2.200                | 3.030                                                              | 0.0056                           | 1.112 <                          | 0.3000               | 1.112     | <b>Zinc</b>       |
| <b>Lab:</b> | <b>18-S679</b>                    | <b>18-S674</b>       | <b>18-S675</b>       | <b>18-S680</b>                                                     | <b>18-S676</b>                   |                                  |                      |           |                   |
| Content:    | 0.1NHNO <sub>3</sub>              | 0.1NHNO <sub>3</sub> | 0.1NHNO <sub>3</sub> | 5%HNO <sub>3</sub> /                                               | 5%HNO <sub>3</sub> /             | 5%HNO <sub>3</sub> /             | 0.1NHNO <sub>3</sub> |           |                   |
|             | FH Filter & Probe Rinse           |                      |                      | 10%H <sub>2</sub> O <sub>2</sub>                                   | 10%H <sub>2</sub> O <sub>2</sub> | 10%H <sub>2</sub> O <sub>2</sub> |                      |           |                   |
|             | 100ml 0.1N HNO <sub>3</sub> rinse |                      |                      | BH Imps 1&2                                                        |                                  |                                  |                      |           |                   |
|             |                                   | Same as BH           |                      | 100ml .1N HNO <sub>3</sub> rinse                                   |                                  |                                  | Same as FH           |           |                   |
|             |                                   | Blank Wash           |                      | 200ml 5%HNO <sub>3</sub> /10%H <sub>2</sub> O <sub>2</sub> reagent |                                  |                                  | Blank Wash           |           |                   |

Blanks are prorated to reflect 100ml for HNO<sub>3</sub> and 200ml for HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

## \* Blank Rules:

"&lt;" indicates value is below the minimum detection limit (MDL)

If Blank is a "&lt;" value it is treated as zero.

If Sample is a "&lt;" it used for emission rate calculations but the final answer contains a "&lt;" to demonstrate the value is unknown

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Method 29 Metals Blank Calculations

Run: 2

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| Species   | X<br>Allowable<br>FH<br>Blank, $\mu g$ | XI<br>FH Blank<br>Corrected<br>$\mu g$ | XII<br>5% of FH<br>Sample, $\mu g$ | XIII<br>Lessor of<br>XI or XII | XIV<br>Greater of<br>A or XIII | XV<br>FH<br>Net<br>Sample, $\mu g$ | Species           |
|-----------|----------------------------------------|----------------------------------------|------------------------------------|--------------------------------|--------------------------------|------------------------------------|-------------------|
| <b>Sb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Antimony</b>   |
| <b>As</b> | 0.000                                  | 0.000 <                                | 0.088                              | 0.000                          | 11.63 <                        | 1.750                              | <b>Arsenic</b>    |
| <b>Ba</b> | 3.388                                  | 3.388                                  | 0.175                              | 0.175                          | 11.63                          | 0.102                              | <b>Barium</b>     |
| <b>Be</b> | 0.000                                  | 0.000 <                                | 0.003                              | 0.000                          | 11.63 <                        | 0.050                              | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000                                  | 0.000 <                                | 0.005                              | 0.000                          | 11.63 <                        | 0.100                              | <b>Cadmium</b>    |
| <b>Cr</b> | 1.330                                  | 1.330                                  | 0.070                              | 0.070                          | 11.63                          | 0.070                              | <b>Chromium</b>   |
| <b>Co</b> | 0.000                                  | 0.000 <                                | 0.006                              | 0.000                          | 11.63 <                        | 0.125                              | <b>Cobalt</b>     |
| <b>Cu</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Copper</b>     |
| <b>Pb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Lead</b>       |
| <b>Mn</b> | 0.635                                  | 0.635                                  | 0.049                              | 0.049                          | 11.63                          | 0.351                              | <b>Manganese</b>  |
| <b>Ni</b> | 2.370                                  | 2.370                                  | 0.117                              | 0.117                          | 11.63                          | -0.040                             | <b>Nickel</b>     |
| <b>P</b>  | 7.900                                  | 7.900                                  | 0.441                              | 0.441                          | 11.63                          | 0.920                              | <b>Phosphorus</b> |
| <b>Se</b> | 0.000                                  | 0.000 <                                | 0.188                              | 0.000                          | 11.63 <                        | 3.750                              | <b>Selenium</b>   |
| <b>Zn</b> | 2.200                                  | 2.200                                  | 0.170                              | 0.170                          | 11.63                          | 1.200                              | <b>Zinc</b>       |

Allowable FH Blank Calculation:

$A = (\text{area of filter, sq. in.}) \times (1.4 \mu g/\text{sq. in.}) = \mu g$

$A = 11.63 \mu g$

if  $A > \text{blank} > 0$ , use blank derived

if blank > A, use greater of A or 5% of sample  $\mu g$  or FH blank whichever is lessor.

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Method 29 Metals Blank Calculations

Run: 2

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|           | XVI            | XVII     | XVIII           | XIX           | XX               | XXI               | XXII              | XXIII           |                   |
|-----------|----------------|----------|-----------------|---------------|------------------|-------------------|-------------------|-----------------|-------------------|
|           | Allowable      | Blank BH | 5% of BH        | Lessor of     | Greater of       | BH                | FH                | FH+BH           |                   |
|           | BH             | Total    | sample, $\mu g$ | XVII or XVIII | 1 $\mu g$ or XIX | Net               | Net               | Total Net       |                   |
| Species   | Blank, $\mu g$ |          |                 |               |                  | Sample, $\mu g$   | Sample, $\mu g$   | Sample, $\mu g$ | Species           |
| <b>Sb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Antimony</b>   |
| <b>As</b> | 0.000          | 0.000 <  | 0.035           | 0.000         | 1.000 <          | <b>0.700 &lt;</b> | <b>1.750 &lt;</b> | <b>2.450</b>    | <b>Arsenic</b>    |
| <b>Ba</b> | 0.812          | 0.812    | 0.024           | 0.024         | 1.000            | <b>0.000</b>      | <b>0.102</b>      | <b>0.102</b>    | <b>Barium</b>     |
| <b>Be</b> | 0.000          | 0.000 <  | 0.001           | 0.000         | 1.000 <          | <b>0.020 &lt;</b> | <b>0.050 &lt;</b> | <b>0.070</b>    | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000          | 0.000 <  | 0.002           | 0.000         | 1.000 <          | <b>0.040 &lt;</b> | <b>0.100 &lt;</b> | <b>0.140</b>    | <b>Cadmium</b>    |
| <b>Cr</b> | 0.196          | 0.196    | 0.009           | 0.009         | 1.000            | <b>0.000</b>      | <b>0.070</b>      | <b>0.070</b>    | <b>Chromium</b>   |
| <b>Co</b> | 0.000          | 0.000 <  | 0.003           | 0.000         | 1.000 <          | <b>0.050 &lt;</b> | <b>0.125 &lt;</b> | <b>0.175</b>    | <b>Cobalt</b>     |
| <b>Cu</b> | 1.000          | 3.040    | 0.075           | 0.075         | 1.000            | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Copper</b>     |
| <b>Pb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Lead</b>       |
| <b>Mn</b> | 0.660          | 0.660    | 0.017           | 0.017         | 1.000            | <b>0.000</b>      | <b>0.351</b>      | <b>0.351</b>    | <b>Manganese</b>  |
| <b>Ni</b> | 0.000          | 0.000 <  | 0.015           | 0.000         | 1.000 <          | <b>0.300</b>      | <b>0.000 &lt;</b> | <b>0.300</b>    | <b>Nickel</b>     |
| <b>P</b>  | 0.000          | 0.000 <  | 0.100           | 0.000         | 1.000 <          | <b>2.000</b>      | <b>0.920 &lt;</b> | <b>2.920</b>    | <b>Phosphorus</b> |
| <b>Se</b> | 0.000          | 0.000 <  | 0.075           | 0.000         | 1.000 <          | <b>1.500 &lt;</b> | <b>3.750 &lt;</b> | <b>5.250</b>    | <b>Selenium</b>   |
| <b>Zn</b> | 1.000          | 1.112    | 0.152           | 0.152         | 1.000            | <b>2.030</b>      | <b>1.200</b>      | <b>3.230</b>    | <b>Zinc</b>       |

Allowable BH Blank Calculation:

if  $1.00\mu g > \text{blank} > 0$ , use blank derived

if blank  $> 1.00\mu g$ , use greater of 1.00 or 5% of sample ug or BH blank whichever is lessor

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| Species<br>Volume(ml) | I                                 |   | II                   |   | III                  |   | IV                                                                 |   | V                                |   | VI                               |   | VII                  |  | VIII      |                   |
|-----------------------|-----------------------------------|---|----------------------|---|----------------------|---|--------------------------------------------------------------------|---|----------------------------------|---|----------------------------------|---|----------------------|--|-----------|-------------------|
|                       | Sample*                           |   | Blank*               |   | Blank*               |   | Sample*                                                            |   | Blank*                           |   | BH Blank*                        |   | BH Blank*            |  | Allowable |                   |
|                       | FH                                |   | FH                   |   | FH                   |   | BH                                                                 |   | BH                               |   | Corrected                        |   | Corrected            |  | BH        |                   |
|                       | Wash+Filter                       |   | Wash, µg             |   | Filter, µg           |   | Cap.Sol.                                                           |   | Cap.Sol.                         |   | Cap.Sol.                         |   | Wash, µg             |  | Blank, µg | Species           |
|                       | 100                               |   | 100                  |   | N/A                  |   | 100                                                                |   | µg/mL                            |   | 200                              |   | 100                  |  |           |                   |
| <b>Sb</b> <           | 1.250                             | < | 0.5000               | < | 1.250                | < | 0.500                                                              | < | 0.0050                           | < | 1.000                            | < | 0.5000               |  | 0.000     | <b>Antimony</b>   |
| <b>As</b> <           | 1.750                             | < | 0.7000               | < | 1.750                | < | 0.700                                                              | < | 0.0070                           | < | 1.400                            | < | 0.7000               |  | 0.000     | <b>Arsenic</b>    |
| <b>Ba</b>             | 3.400                             |   | 0.0884               |   | 3.300                |   | 0.408                                                              |   | 0.0036                           |   | 0.724                            |   | 0.0884               |  | 0.812     | <b>Barium</b>     |
| <b>Be</b> <           | 0.050                             | < | 0.0200               | < | 0.050                | < | 0.020                                                              | < | 0.0002                           | < | 0.040                            | < | 0.0200               |  | 0.000     | <b>Beryllium</b>  |
| <b>Cd</b> <           | 0.100                             | < | 0.0400               | < | 0.100                | < | 0.040                                                              | < | 0.0004                           | < | 0.080                            | < | 0.0400               |  | 0.000     | <b>Cadmium</b>    |
| <b>Cr</b>             | 1.360                             | < | 0.0800               |   | 1.330                |   | 0.132                                                              |   | 0.0010                           |   | 0.196                            | < | 0.0800               |  | 0.196     | <b>Chromium</b>   |
| <b>Co</b> <           | 0.125                             | < | 0.0500               | < | 0.125                | < | 0.050                                                              | < | 0.0005                           | < | 0.100                            | < | 0.0500               |  | 0.000     | <b>Cobalt</b>     |
| <b>Cu</b> <           | 1.250                             | < | 0.5000               | < | 1.250                | < | 0.500                                                              |   | 0.0152                           |   | 3.040                            | < | 0.5000               |  | 3.040     | <b>Copper</b>     |
| <b>Pb</b> <           | 1.250                             | < | 0.5000               | < | 1.250                | < | 0.500                                                              | < | 0.0050                           | < | 1.000                            | < | 0.5000               |  | 0.000     | <b>Lead</b>       |
| <b>Mn</b>             | 0.896                             |   | 0.0704               |   | 0.565                |   | 0.349                                                              |   | 0.0030                           |   | 0.590                            |   | 0.0704               |  | 0.660     | <b>Manganese</b>  |
| <b>Ni</b>             | 2.480                             | < | 0.3000               |   | 2.370                | < | 0.300                                                              | < | 0.0030                           | < | 0.600                            | < | 0.3000               |  | 0.000     | <b>Nickel</b>     |
| <b>P</b>              | 9.510                             | < | 2.0000               |   | 7.900                | < | 2.000                                                              | < | 0.0200                           | < | 4.000                            | < | 2.0000               |  | 0.000     | <b>Phosphorus</b> |
| <b>Se</b> <           | 3.750                             | < | 1.5000               | < | 3.750                | < | 1.500                                                              | < | 0.0150                           | < | 3.000                            | < | 1.5000               |  | 0.000     | <b>Selenium</b>   |
| <b>Zn</b>             | 2.850                             | < | 0.3000               |   | 2.200                |   | 3.150                                                              |   | 0.0056                           |   | 1.112                            | < | 0.3000               |  | 1.112     | <b>Zinc</b>       |
| <b>Lab:</b>           | <b>18-S681</b>                    |   | <b>18-S674</b>       |   | <b>18-S675</b>       |   | <b>18-S682</b>                                                     |   | <b>18-S676</b>                   |   |                                  |   |                      |  |           |                   |
| Content:              | 0.1NHNO <sub>3</sub>              |   | 0.1NHNO <sub>3</sub> |   | 0.1NHNO <sub>3</sub> |   | 5%HNO <sub>3</sub> /                                               |   | 5%HNO <sub>3</sub> /             |   | 5%HNO <sub>3</sub> /             |   | 0.1NHNO <sub>3</sub> |  |           |                   |
|                       | FH Filter & Probe Rinse           |   |                      |   |                      |   | 10%H <sub>2</sub> O <sub>2</sub>                                   |   | 10%H <sub>2</sub> O <sub>2</sub> |   | 10%H <sub>2</sub> O <sub>2</sub> |   |                      |  |           |                   |
|                       | 100ml 0.1N HNO <sub>3</sub> rinse |   |                      |   |                      |   | BH Imps 1&2                                                        |   |                                  |   |                                  |   |                      |  |           |                   |
|                       |                                   |   | Same as BH           |   |                      |   | 100ml .1N HNO <sub>3</sub> rinse                                   |   |                                  |   |                                  |   | Same as FH           |  |           |                   |
|                       |                                   |   | Blank Wash           |   |                      |   | 200ml 5%HNO <sub>3</sub> /10%H <sub>2</sub> O <sub>2</sub> reagent |   |                                  |   |                                  |   | Blank Wash           |  |           |                   |

Blanks are prorated to reflect 100ml for HNO<sub>3</sub> and 200ml for HNO<sub>3</sub>/H<sub>2</sub>O<sub>2</sub>

## \* Blank Rules:

"&lt;" indicates value is below the minimum detection limit (MDL)

If Blank is a "&lt;" value it is treated as zero.

If Sample is a "&lt;" it used for emission rate calculations but the final answer contains a "&lt;" to demonstrate the value is unknown

| Species   | X<br>Allowable<br>FH<br>Blank, $\mu g$ | XI<br>FH Blank<br>Corrected<br>$\mu g$ | XII<br>5% of FH<br>Sample, $\mu g$ | XIII<br>Lessor of<br>XI or XII | XIV<br>Greater of<br>A or XIII | XV<br>FH<br>Net<br>Sample, $\mu g$ | Species           |
|-----------|----------------------------------------|----------------------------------------|------------------------------------|--------------------------------|--------------------------------|------------------------------------|-------------------|
| <b>Sb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Antimony</b>   |
| <b>As</b> | 0.000                                  | 0.000 <                                | 0.088                              | 0.000                          | 11.63 <                        | 1.750                              | <b>Arsenic</b>    |
| <b>Ba</b> | 3.388                                  | 3.388                                  | 0.170                              | 0.170                          | 11.63                          | 0.012                              | <b>Barium</b>     |
| <b>Be</b> | 0.000                                  | 0.000 <                                | 0.003                              | 0.000                          | 11.63 <                        | 0.050                              | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000                                  | 0.000 <                                | 0.005                              | 0.000                          | 11.63 <                        | 0.100                              | <b>Cadmium</b>    |
| <b>Cr</b> | 1.330                                  | 1.330                                  | 0.068                              | 0.068                          | 11.63                          | 0.030                              | <b>Chromium</b>   |
| <b>Co</b> | 0.000                                  | 0.000 <                                | 0.006                              | 0.000                          | 11.63 <                        | 0.125                              | <b>Cobalt</b>     |
| <b>Cu</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Copper</b>     |
| <b>Pb</b> | 0.000                                  | 0.000 <                                | 0.063                              | 0.000                          | 11.63 <                        | 1.250                              | <b>Lead</b>       |
| <b>Mn</b> | 0.635                                  | 0.635                                  | 0.045                              | 0.045                          | 11.63                          | 0.261                              | <b>Manganese</b>  |
| <b>Ni</b> | 2.370                                  | 2.370                                  | 0.124                              | 0.124                          | 11.63                          | 0.110                              | <b>Nickel</b>     |
| <b>P</b>  | 7.900                                  | 7.900                                  | 0.476                              | 0.476                          | 11.63                          | 1.610                              | <b>Phosphorus</b> |
| <b>Se</b> | 0.000                                  | 0.000 <                                | 0.188                              | 0.000                          | 11.63 <                        | 3.750                              | <b>Selenium</b>   |
| <b>Zn</b> | 2.200                                  | 2.200                                  | 0.143                              | 0.143                          | 11.63                          | 0.650                              | <b>Zinc</b>       |

Allowable FH Blank Calculation:

$A = (\text{area of filter, sq. in.}) \times (1.4 \mu g/\text{sq. in.}) = \mu g$

A= 11.63  $\mu g$

if  $A > \text{blank} > 0$ , use blank derived

if blank > A, use greater of A or 5% of sample  $\mu g$  or FH blank whichever is lessor.

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

CFU 117  
4/29/18

Method 29 Metals Blank Calculations

Run: 3

3 of 3

|           | XVI            | XVII     | XVIII           | XIX           | XX               | XXI               | XXII              | XXIII           |                   |
|-----------|----------------|----------|-----------------|---------------|------------------|-------------------|-------------------|-----------------|-------------------|
|           | Allowable      | Blank BH | 5% of BH        | Lessor of     | Greater of       | BH                | FH                | FH+BH           |                   |
|           | BH             | Total    | sample, $\mu g$ | XVII or XVIII | 1 $\mu g$ or XIX | Net               | Net               | Total Net       |                   |
| Species   | Blank, $\mu g$ |          |                 |               |                  | Sample, $\mu g$   | Sample, $\mu g$   | Sample, $\mu g$ | Species           |
| <b>Sb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Antimony</b>   |
| <b>As</b> | 0.000          | 0.000 <  | 0.035           | 0.000         | 1.000 <          | <b>0.700 &lt;</b> | <b>1.750 &lt;</b> | <b>2.450</b>    | <b>Arsenic</b>    |
| <b>Ba</b> | 0.812          | 0.812    | 0.020           | 0.020         | 1.000            | <b>0.000</b>      | <b>0.012</b>      | <b>0.012</b>    | <b>Barium</b>     |
| <b>Be</b> | 0.000          | 0.000 <  | 0.001           | 0.000         | 1.000 <          | <b>0.020 &lt;</b> | <b>0.050 &lt;</b> | <b>0.070</b>    | <b>Beryllium</b>  |
| <b>Cd</b> | 0.000          | 0.000 <  | 0.002           | 0.000         | 1.000 <          | <b>0.040 &lt;</b> | <b>0.100 &lt;</b> | <b>0.140</b>    | <b>Cadmium</b>    |
| <b>Cr</b> | 0.196          | 0.196    | 0.007           | 0.007         | 1.000            | <b>0.000</b>      | <b>0.030</b>      | <b>0.030</b>    | <b>Chromium</b>   |
| <b>Co</b> | 0.000          | 0.000 <  | 0.003           | 0.000         | 1.000 <          | <b>0.050 &lt;</b> | <b>0.125 &lt;</b> | <b>0.175</b>    | <b>Cobalt</b>     |
| <b>Cu</b> | 1.000          | 3.040 <  | 0.025 <         | 0.025         | 1.000            | <b>0.000 &lt;</b> | <b>1.250 &lt;</b> | <b>1.250</b>    | <b>Copper</b>     |
| <b>Pb</b> | 0.000          | 0.000 <  | 0.025           | 0.000         | 1.000 <          | <b>0.500 &lt;</b> | <b>1.250 &lt;</b> | <b>1.750</b>    | <b>Lead</b>       |
| <b>Mn</b> | 0.660          | 0.660    | 0.017           | 0.017         | 1.000            | <b>0.000</b>      | <b>0.261</b>      | <b>0.261</b>    | <b>Manganese</b>  |
| <b>Ni</b> | 0.000          | 0.000 <  | 0.015           | 0.000         | 1.000 <          | <b>0.300</b>      | <b>0.110 &lt;</b> | <b>0.410</b>    | <b>Nickel</b>     |
| <b>P</b>  | 0.000          | 0.000 <  | 0.100           | 0.000         | 1.000 <          | <b>2.000</b>      | <b>1.610 &lt;</b> | <b>3.610</b>    | <b>Phosphorus</b> |
| <b>Se</b> | 0.000          | 0.000 <  | 0.075           | 0.000         | 1.000 <          | <b>1.500 &lt;</b> | <b>3.750 &lt;</b> | <b>5.250</b>    | <b>Selenium</b>   |
| <b>Zn</b> | 1.000          | 1.112    | 0.158           | 0.158         | 1.000            | <b>2.150</b>      | <b>0.650</b>      | <b>2.800</b>    | <b>Zinc</b>       |

Allowable BH Blank Calculation:

if  $1.00\mu g > \text{blank} > 0$ , use blank derived

if  $\text{blank} > 1.00\mu g$ , use greater of 1.00 or 5% of sample ug or BH blank whichever is lessor

**\* Blank Rules:**

"<" indicates value is below the minimum detection limit (MDL)

If Blank is a "<" value it is treated as zero.

If Sample is a "<" it used for emission rate calculations but the final answer contains a "<" to demonstrate the value is unknown

**EPA Method 29**  
**Gas Stream Characteristics**  
**Test Summary**

**Client:** Hollingsworth & Vose  
**Source:** CFU 117  
**Location:** Corvallis, OR

| Run                              | 1                | 2         | 3         |                 |
|----------------------------------|------------------|-----------|-----------|-----------------|
| Date                             | 4/29/2018        | 4/29/2018 | 4/29/2018 |                 |
| Run Start Time                   | 8:42             | 12:36     | 16:02     |                 |
| Run End Time                     | 11:50            | 15:46     | 19:06     |                 |
| Duration, min.                   | 180              | 180       | 180       | <b>Average</b>  |
| Barometric Pressure, "Hg         | 29.94            | 29.91     | 29.91     | <b>29.92</b>    |
| Nozzle Dia., in.                 | 0.2140           | 0.2140    | 0.2140    | <b>0.2140</b>   |
| Isokinetic Average, %            | 100.2            | 100.2     | 100.0     | <b>100.1</b>    |
| Sample Volume, dscf              | 162.939          | 168.207   | 168.254   | <b>166.467</b>  |
| Sample Volume, dscm              | 4.614            | 4.763     | 4.764     | <b>4.714</b>    |
| Stack Diameter, in.              | 30.00            | 30.00     | 30.00     | <b>30.00</b>    |
| Stack Area, sq.ft.               | 4.909            | 4.909     | 4.909     | <b>4.909</b>    |
| CO <sub>2</sub> %vd              | 0.64             | 0.76      | 0.65      | <b>0.68</b>     |
| O <sub>2</sub> %vd               | 19.80            | 19.59     | 19.92     | <b>19.77</b>    |
| Static Press., "H <sub>2</sub> O | 0.60             | 0.60      | 0.60      | <b>0.60</b>     |
| H <sub>2</sub> O %v              | 1.99             | 2.06      | 1.83      | <b>1.96</b>     |
| Wet Molecular Weight, lb/lb-mole | 28.67            | 28.69     | 28.70     | <b>28.69</b>    |
| Velocity, FPS                    | 82.55            | 85.02     | 84.72     | <b>84.10</b>    |
| ADCFM                            | 23,830.4         | 24,525.9  | 24,496.8  | <b>24,284.4</b> |
| AWCFM                            | 24,314.3         | 25,041.8  | 24,953.4  | <b>24,769.8</b> |
| DSCFM                            | 17,747.2         | 18,324.2  | 18,375.2  | <b>18,148.9</b> |
| Stack Temperature, °F            | 250.5            | 247.5     | 244.7     | <b>247.6</b>    |
| Production Data                  | Glass Production | lbs/hr    |           |                 |
|                                  |                  | 109.5     | 111.1     | 114.3           |
|                                  |                  |           |           | <b>111.6</b>    |

Hollingsworth & Vose  
CFU 117  
Metals Results Summary

Test: M29

| Run 1      |         |         |            |             |         |         |            |             |         |         |            |             |    |
|------------|---------|---------|------------|-------------|---------|---------|------------|-------------|---------|---------|------------|-------------|----|
| Total      |         |         |            |             | FH Net  |         |            |             | BH Net  |         |            |             |    |
| Species    | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony   | < 1.750 | < 0.379 | < 2.52E-05 | < 2.30E-07  | < 1.250 | < 0.271 | < 1.80E-05 | < 1.64E-07  | < 0.500 | < 0.108 | < 7.20E-06 | < 6.58E-08  | Sb |
| Arsenic    | < 2.450 | < 0.531 | < 3.53E-05 | < 3.22E-07  | < 1.750 | < 0.379 | < 2.52E-05 | < 2.30E-07  | < 0.700 | < 0.152 | < 1.01E-05 | < 9.21E-08  | As |
| Barium     | 0.022   | 0.005   | 3.11E-07   | 2.84E-09    | 0.022   | 0.005   | 3.11E-07   | 2.84E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium  | < 0.070 | < 0.015 | < 1.01E-06 | < 9.21E-09  | < 0.050 | < 0.011 | < 7.20E-07 | < 6.58E-09  | < 0.020 | < 0.004 | < 2.88E-07 | < 2.63E-09  | Be |
| Cadmium    | < 0.140 | < 0.030 | < 2.02E-06 | < 1.84E-08  | < 0.100 | < 0.022 | < 1.44E-06 | < 1.32E-08  | < 0.040 | < 0.009 | < 5.76E-07 | < 5.26E-09  | Cd |
| Chromium   | 0.014   | 0.003   | 2.02E-07   | 1.84E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | 0.014   | 0.003   | 2.02E-07   | 1.84E-09    | Cr |
| Cobalt     | < 0.175 | < 0.038 | < 2.52E-06 | < 2.30E-08  | < 0.125 | < 0.027 | < 1.80E-06 | < 1.64E-08  | < 0.050 | < 0.011 | < 7.20E-07 | < 6.58E-09  | Co |
| Copper     | < 2.750 | < 0.596 | < 3.96E-05 | < 3.62E-07  | < 1.250 | < 0.271 | < 1.80E-05 | < 1.64E-07  | 1.500   | 0.325   | 2.16E-05   | 1.97E-07    | Cu |
| Lead       | < 1.750 | < 0.379 | < 2.52E-05 | < 2.30E-07  | < 1.250 | < 0.271 | < 1.80E-05 | < 1.64E-07  | < 0.500 | < 0.108 | < 7.20E-06 | < 6.58E-08  | Pb |
| Manganese  | 0.303   | 0.066   | 4.36E-06   | 3.98E-08    | 0.303   | 0.066   | 4.36E-06   | 3.98E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel     | < 0.570 | < 0.124 | < 8.21E-06 | < 7.50E-08  | 0.270   | 0.059   | 3.89E-06   | 3.55E-08    | < 0.300 | < 0.065 | < 4.32E-06 | < 3.95E-08  | Ni |
| Phosphorus | < 8.900 | < 1.929 | < 1.28E-04 | < 1.17E-06  | 6.900   | 1.495   | 9.94E-05   | 9.08E-07    | < 2.000 | < 0.433 | < 2.88E-05 | < 2.63E-07  | P  |
| Selenium   | < 5.250 | < 1.138 | < 7.56E-05 | < 6.91E-07  | < 3.750 | < 0.813 | < 5.40E-05 | < 4.93E-07  | < 1.500 | < 0.325 | < 2.16E-05 | < 1.97E-07  | Se |
| Zinc       | 6.980   | 1.513   | 1.01E-04   | 9.18E-07    | 0.870   | 0.189   | 1.25E-05   | 1.14E-07    | 6.110   | 1.324   | 8.80E-05   | 8.04E-07    | Zn |

| Run 2      |         |         |            |             |         |         |            |             |         |         |            |             |    |
|------------|---------|---------|------------|-------------|---------|---------|------------|-------------|---------|---------|------------|-------------|----|
| Total      |         |         |            |             | FH Net  |         |            |             | BH Net  |         |            |             |    |
| Species    | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony   | < 1.750 | < 0.367 | < 2.52E-05 | < 2.27E-07  | < 1.250 | < 0.262 | < 1.80E-05 | < 1.62E-07  | < 0.500 | < 0.105 | < 7.21E-06 | < 6.49E-08  | Sb |
| Arsenic    | < 2.450 | < 0.514 | < 3.53E-05 | < 3.18E-07  | < 1.750 | < 0.367 | < 2.52E-05 | < 2.27E-07  | < 0.700 | < 0.147 | < 1.01E-05 | < 9.08E-08  | As |
| Barium     | 0.102   | 0.021   | 1.46E-06   | 1.32E-08    | 0.102   | 0.021   | 1.46E-06   | 1.32E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium  | < 0.070 | < 0.015 | < 1.01E-06 | < 9.08E-09  | < 0.050 | < 0.010 | < 7.21E-07 | < 6.49E-09  | < 0.020 | < 0.004 | < 2.88E-07 | < 2.59E-09  | Be |
| Cadmium    | < 0.140 | < 0.029 | < 2.02E-06 | < 1.82E-08  | < 0.100 | < 0.021 | < 1.44E-06 | < 1.30E-08  | < 0.040 | < 0.008 | < 5.76E-07 | < 5.18E-09  | Cd |
| Chromium   | 0.070   | 0.015   | 1.01E-06   | 9.08E-09    | 0.070   | 0.015   | 1.01E-06   | 9.08E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Cr |
| Cobalt     | < 0.175 | < 0.037 | < 2.52E-06 | < 2.27E-08  | < 0.125 | < 0.026 | < 1.80E-06 | < 1.62E-08  | < 0.050 | < 0.010 | < 7.21E-07 | < 6.49E-09  | Co |
| Copper     | < 1.750 | < 0.367 | < 2.52E-05 | < 2.27E-07  | < 1.250 | < 0.262 | < 1.80E-05 | < 1.62E-07  | 0.500   | 0.105   | 7.21E-06   | 6.49E-08    | Cu |
| Lead       | < 1.750 | < 0.367 | < 2.52E-05 | < 2.27E-07  | < 1.250 | < 0.262 | < 1.80E-05 | < 1.62E-07  | < 0.500 | < 0.105 | < 7.21E-06 | < 6.49E-08  | Pb |
| Manganese  | 0.351   | 0.074   | 5.05E-06   | 4.55E-08    | 0.351   | 0.074   | 5.05E-06   | 4.55E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel     | < 0.300 | < 0.063 | < 4.32E-06 | < 3.89E-08  | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | < 0.300 | < 0.063 | < 4.32E-06 | < 3.89E-08  | Ni |
| Phosphorus | < 2.920 | < 0.613 | < 4.21E-05 | < 3.79E-07  | 0.920   | 0.193   | 1.33E-05   | 1.19E-07    | < 2.000 | < 0.420 | < 2.88E-05 | < 2.59E-07  | P  |
| Selenium   | < 5.250 | < 1.102 | < 7.57E-05 | < 6.81E-07  | < 3.750 | < 0.787 | < 5.40E-05 | < 4.86E-07  | < 1.500 | < 0.315 | < 2.16E-05 | < 1.95E-07  | Se |
| Zinc       | 3.230   | 0.678   | 4.65E-05   | 4.19E-07    | 1.200   | 0.252   | 1.73E-05   | 1.56E-07    | 2.030   | 0.426   | 2.93E-05   | 2.63E-07    | Zn |

Hollingsworth & Vose  
CFU 117  
Metals Results Summary

Test: M29

| Run 3      |         |         |            |             |         |         |            |             |         |         |            |             |    |
|------------|---------|---------|------------|-------------|---------|---------|------------|-------------|---------|---------|------------|-------------|----|
| Species    | Total   |         |            |             | FH Net  |         |            |             | BH Net  |         |            |             |    |
|            | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony   | < 1.750 | < 0.367 | < 2.53E-05 | < 2.21E-07  | < 1.250 | < 0.262 | < 1.81E-05 | < 1.58E-07  | < 0.500 | < 0.105 | < 7.22E-06 | < 6.32E-08  | Sb |
| Arsenic    | < 2.450 | < 0.514 | < 3.54E-05 | < 3.10E-07  | < 1.750 | < 0.367 | < 2.53E-05 | < 2.21E-07  | < 0.700 | < 0.147 | < 1.01E-05 | < 8.85E-08  | As |
| Barium     | 0.012   | 0.002   | 1.68E-07   | 1.47E-09    | 0.012   | 0.002   | 1.68E-07   | 1.47E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium  | < 0.070 | < 0.015 | < 1.01E-06 | < 8.85E-09  | < 0.050 | < 0.010 | < 7.22E-07 | < 6.32E-09  | < 0.020 | < 0.004 | < 2.89E-07 | < 2.53E-09  | Be |
| Cadmium    | < 0.140 | < 0.029 | < 2.02E-06 | < 1.77E-08  | < 0.100 | < 0.021 | < 1.45E-06 | < 1.26E-08  | < 0.040 | < 0.008 | < 5.78E-07 | < 5.06E-09  | Cd |
| Chromium   | 0.030   | 0.006   | 4.33E-07   | 3.79E-09    | 0.030   | 0.006   | 4.33E-07   | 3.79E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Cr |
| Cobalt     | < 0.175 | < 0.037 | < 2.53E-06 | < 2.21E-08  | < 0.125 | < 0.026 | < 1.81E-06 | < 1.58E-08  | < 0.050 | < 0.010 | < 7.22E-07 | < 6.32E-09  | Co |
| Copper     | < 1.250 | < 0.262 | < 1.81E-05 | < 1.58E-07  | < 1.250 | < 0.262 | < 1.81E-05 | < 1.58E-07  | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Cu |
| Lead       | < 1.750 | < 0.367 | < 2.53E-05 | < 2.21E-07  | < 1.250 | < 0.262 | < 1.81E-05 | < 1.58E-07  | < 0.500 | < 0.105 | < 7.22E-06 | < 6.32E-08  | Pb |
| Manganese  | 0.261   | 0.055   | 3.77E-06   | 3.29E-08    | 0.261   | 0.055   | 3.77E-06   | 3.29E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel     | < 0.410 | < 0.086 | < 5.92E-06 | < 5.18E-08  | 0.110   | 0.023   | 1.59E-06   | 1.39E-08    | < 0.300 | < 0.063 | < 4.33E-06 | < 3.79E-08  | Ni |
| Phosphorus | < 3.610 | < 0.758 | < 5.22E-05 | < 4.56E-07  | 1.610   | 0.338   | 2.33E-05   | 2.03E-07    | < 2.000 | < 0.420 | < 2.89E-05 | < 2.53E-07  | P  |
| Selenium   | < 5.250 | < 1.102 | < 7.58E-05 | < 6.64E-07  | < 3.750 | < 0.787 | < 5.42E-05 | < 4.74E-07  | < 1.500 | < 0.315 | < 2.17E-05 | < 1.9E-07   | Se |
| Zinc       | 2.800   | 0.588   | 4.05E-05   | 3.54E-07    | 0.650   | 0.136   | 9.39E-06   | 8.22E-08    | 2.150   | 0.451   | 3.11E-05   | 2.72E-07    | Zn |

| Mean Runs 1-3 |          |         |            |             |          |         |            |             |         |         |            |             |    |
|---------------|----------|---------|------------|-------------|----------|---------|------------|-------------|---------|---------|------------|-------------|----|
| Species       | Total    |         |            |             | FH Net   |         |            |             | BH Net  |         |            |             |    |
|               | µg       | µg/dscm | lb/hr      | lb/lb glass | µg       | µg/dscm | lb/hr      | lb/lb glass | µg      | µg/dscm | lb/hr      | lb/lb glass |    |
| Antimony      | < 1.750  | < 0.371 | < 2.52E-05 | < 2.26E-07  | < 1.250  | < 0.265 | < 1.80E-05 | < 1.62E-07  | < 0.500 | < 0.106 | < 7.21E-06 | < 6.46E-08  | Sb |
| Arsenic       | < 2.450  | < 0.520 | < 3.53E-05 | < 3.17E-07  | < 1.750  | < 0.371 | < 2.52E-05 | < 2.26E-07  | < 0.700 | < 0.149 | < 1.01E-05 | < 9.05E-08  | As |
| Barium        | 0.045    | 0.009   | 6.48E-07   | 5.83E-09    | 0.045    | 0.009   | 6.48E-07   | 5.83E-09    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Ba |
| Beryllium     | < 0.070  | < 0.015 | < 1.01E-06 | < 9.05E-09  | < 0.050  | < 0.011 | < 7.21E-07 | < 6.46E-09  | < 0.020 | < 0.004 | < 2.88E-07 | < 2.58E-09  | Be |
| Cadmium       | < 0.140  | < 0.030 | < 2.02E-06 | < 1.81E-08  | < 0.100  | < 0.021 | < 1.44E-06 | < 1.29E-08  | < 0.040 | < 0.008 | < 5.77E-07 | < 5.17E-09  | Cd |
| Chromium      | 0.038    | 0.008   | 5.48E-07   | 4.90E-09    | 0.033    | 0.007   | 4.81E-07   | 4.29E-09    | 0.005   | 0.001   | 6.73E-08   | 6.15E-10    | Cr |
| Cobalt        | < 0.175  | < 0.037 | < 2.52E-06 | < 2.26E-08  | < 0.125  | < 0.027 | < 1.80E-06 | < 1.62E-08  | < 0.050 | < 0.011 | < 7.21E-07 | < 6.46E-09  | Co |
| Copper        | < 1.917  | < 0.409 | < 2.76E-05 | < 2.49E-07  | < 1.250  | < 0.265 | < 1.80E-05 | < 1.62E-07  | 0.667   | 0.143   | 9.61E-06   | 8.74E-08    | Cu |
| Lead          | < 1.750  | < 0.371 | < 2.52E-05 | < 2.26E-07  | < 1.250  | < 0.265 | < 1.80E-05 | < 1.62E-07  | < 0.500 | < 0.106 | < 7.21E-06 | < 6.46E-08  | Pb |
| Manganese     | 0.305    | 0.065   | 4.39E-06   | 3.94E-08    | 0.305    | 0.065   | 4.39E-06   | 3.94E-08    | 0.000   | 0.000   | 0.00E+00   | 0.00E+00    | Mn |
| Nickel        | < 0.427  | < 0.091 | < 6.15E-06 | < 5.52E-08  | 0.127    | 0.027   | 1.83E-06   | 1.65E-08    | < 0.300 | < 0.064 | < 4.33E-06 | < 3.88E-08  | Ni |
| Phosphorus    | < 5.143  | < 1.100 | < 7.42E-05 | < 6.69E-07  | 3.143    | 0.676   | 4.53E-05   | 4.10E-07    | < 2.000 | < 0.424 | < 2.88E-05 | < 2.58E-07  | P  |
| Selenium      | < 5.250  | < 1.114 | < 7.57E-05 | < 6.78E-07  | < 3.750  | < 0.796 | < 5.41E-05 | < 4.85E-07  | < 1.500 | < 0.318 | < 2.16E-05 | < 1.94E-07  | Se |
| Zinc          | 4.337    | 0.926   | 6.25E-05   | 5.64E-07    | 0.907    | 0.192   | 1.31E-05   | 1.17E-07    | 3.430   | 0.734   | 4.94E-05   | 4.46E-07    | Zn |
| Total:        | < 23.796 | < 5.066 | < 3.43E-04 | < 3.08E-06  | < 14.085 | < 2.997 | < 2.03E-04 | < 1.82E-06  | < 9.711 | < 2.069 | < 1.40E-04 | < 1.26E-06  |    |

'<' denotes results which were calculated using the minimum detection limit for front half or back half results that were non-detect.

**EPA Methods 1-4, 29**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 117**  
**Method: 29**

**Run: 1**  
**Start Time: 8:42**  
**End Time: 11:50**  
**Date: 4/29/2018**

**EPA Methods 1-4:**

$$1) P_m = P_b + (\Delta H/13.6) = 30.133 \text{ "Hg}$$

where  $P_b$ : 29.94 "Hg  
 $\Delta H$ : 2.625 "H<sub>2</sub>O

$$2) P_s = P_b + (\text{Static Press.}/13.6) = 29.984 \text{ "Hg}$$

where  $P_b$ : 29.94 "Hg  
Static Press.: 0.60 "H<sub>2</sub>O

$$3) V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 162.939 \text{ dscf}$$

where  $V_m$ : 161.510 dcf  
 $Y$ : 0.9820  
 $P_m$ : 30.133 "Hg  
 $T_m$ : 517.4 °A

$$4) V_w(\text{std}) = (0.04706)(H_2O) = 3.313 \text{ scf}$$

where  $H_2O$ : 70.40 g

$$5) Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0199$$

where  $Vw(\text{std})$ : 3.313 scf  
 $Vm(\text{std})$ : 162.939 dscf

$$6) \% H_2O = Bws \times 100 = 1.99 \%v$$

$$7) V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 223.322 \text{ awcf}$$

where  $Y$ : 0.9820  
 $Vm$ : 161.5100 dcf  
 $Bws$ : 0.0199  
 $T_s$ : 710.5 °A  
 $T_m$ : 517.4 °A  
 $P_m$ : 30.133 "Hg  
 $P_s$ : 29.984 "Hg

$$8) M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.89 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.64 %vd  
 $O_2$ : 19.80 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.56 %vd



$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.67 \text{ lb/lb-mole}$$

where  $M_d$ : 28.89 lb/lb-mole  
 $Bws$ : 0.0199

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 4.909 \text{ sq. ft.}$$

where Stack ID: 30 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
 Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(C_p)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 82.55 \text{ fps}$$

where  $C_p$ : 0.84  
 Ave. Sqrt  $\Delta P$ : 1.2644  
 $T_s$ : 710.5 °A  
 $P_s$ : 29.984 "Hg  
 $M_s$ : 28.67 lb/lb-mole

$$12) \text{ AWC FM} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 24,314.3 \text{ AWC FM}$$

where  $V_s$ : 82.55 ft/sec  
 Stack Area: 4.909 sq. ft

$$13) \text{ ADC FM} = (\text{AWC FM})(1 - Bws) = 23,830.4 \text{ ADC FM}$$

where AWC FM: 24,314.3  
 $Bws$ : 0.0199

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ \text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,086,451.7 \text{ wscf/hr}$$

where  $V_s$ : 82.55 ft/sec  
 Stack Area: 4.9090 sq. ft.  
 $T_s$ : 710.5 °A  
 $P_s$ : 29.984 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1 - Bws) = 1,064,831.3 \text{ dscf/hr}$$

where wscf/hr: 1,086,451.7  
 $Bws$ : 0.0199

$$16) \text{ DSC FM} = (\text{dscf/hr})/60 \text{ mins/hr} = 17,747.2 \text{ DSC FM}$$

where dscf/hr: 1,064,831.3

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000250 \text{ sq. ft.}$$

where Nozzle Size: 0.2140 inches

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 1  
Date: 4/29/2018

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$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(T_s)(V_m(\text{std}))}{P_s(V_s)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 100.2 \%$$

where Ts: 710.5 °A  
Vm(Std): 162.939 dscf  
Ps: 29.984 "Hg  
Vs: 82.55 ft/sec  
Nozzle Area: 0.000250 sq. ft.  
Sampling Time: 180 min.  
Bws: 0.0199

**EPA Method 29:  
Chromium**

19) Cr Laboratory Results (blank corrected)

Front half (FH): 0.000 µg/sample  
Back half (BH): 0.014 µg/sample  
Total (FH + BH): 0.014 µg/sample

$$20) C_s = \mu\text{g}/V_m(\text{std}) = 0.003 \mu\text{g}/\text{dscm}$$

where Run 1 Total: 0.014 µg/sample  
Vm(std): 4.614 dscm

$$21) \text{ Emission Rate} = (C_s) \left( \frac{2.83168 \text{ m}^3}{\text{ft}^3} \right) (\text{stack flow}) \left( \frac{2.2046 \text{E}-9 \text{ lb}}{\mu\text{g}} \right) = 2.02\text{E}-07 \text{ lb/hr}$$

where Cs: 0.003 µg/dscm  
Stack Flow: 1,064,831.3 dscf/hr



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 117              |
| DATE(S)   | 04/29/18             |
| METHOD    | 30B                  |
| POLLUTANT | Mercury              |



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 30350 Bruce Industrial Parkway  
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 Phone: (440)264-2500  
[www.ohiolumex.com](http://www.ohiolumex.com)

## Sorbent Trap Spike Level Worksheet

|                   |                                  |       |                      |                                                |
|-------------------|----------------------------------|-------|----------------------|------------------------------------------------|
| C                 | Expected mercury concentration   | 0.008 | µg/dscm              |                                                |
| q                 | Expected average sample rate     | 2000  | cm <sup>3</sup> /min | cc/min                                         |
| Ø                 | Expected sample duration         | 3     | hours                |                                                |
| Vm                | Total sample volume expected     | 0.36  | dscm                 | $Vm = q \times \text{Ø} \times 60 \times 1e-6$ |
| M                 | Expected mass HG on sorbent trap | 2.88  | ng                   | $m = C \times Vm \times 1,000$                 |
| S <sub>low</sub>  | Low range of spike               | 1.44  | ng                   | $S_{low} = m \times 0.5$                       |
| S <sub>mid</sub>  | Mid range of spike               | 2.88  | ng                   | $S_{mid} = m \times 1$                         |
| S <sub>high</sub> | High range of spike              | 4.32  | ng                   | $S_{high} = m \times 1.5$                      |

Method 30B Field Data  
Field Data Entry

Client: Hollingsworth & Vose  
Location: Corvallis, OR  
Source: CFU 117  
EPA Method: 30B  
Box Operator: KLS  
Technician(s): CW

Run: 1  
Start Time: 8:42  
End Time: 11:50  
Start Date: 4/29/2018  
End Date: 4/29/2018

Pre-Test Information:

Barometric Pressure: 29.94 "Hg  
Test duration: 180 min

Equipment:

Probe ID: HG1  
Probe heat: 270 F  
Side A Side B  
Meterbox ID: 2 2  
Y factor: 1.0420 1.0460  
Desired sampling rate: 2 2 lpm  
Trap ID#: OL464795 OL469559  
Spiked @: 5 0 ng  
Orifice # (if used):

Leak Checks:

|                        | Pre-test |        | Post-test |        |
|------------------------|----------|--------|-----------|--------|
|                        | Side A   | Side B | Side A    | Side B |
| Leak check vacuum, "Hg | 16       | 15     | 18        | 16     |
| Train leak rate, lpm   | 0.000    | 0.000  | 0.000     | 0.000  |

Test Summary:

|                  | Side A  | Side B    |
|------------------|---------|-----------|
| Sample Volume:   | 360.179 | 360.193 L |
| Ave. Meter Temp: | 63.4    | 65.2 °F   |

| Time (min.) | Meter Volume (L) |          | Stack Temp. (°F) |          | Meter Temp. (°F) |          | Vacuum ("Hg) |          | Trap Temperature (°F) |          | Sampling Rate (Lpm) |          |
|-------------|------------------|----------|------------------|----------|------------------|----------|--------------|----------|-----------------------|----------|---------------------|----------|
|             | Side A           | Sample B | Sample A         | Sample B | Sample A         | Sample B | Sample A     | Sample B | Sample A              | Sample B | Sample A            | Sample B |
| 0           | 0.000            | 0.000    | 252              | 252      | 48               | 48       | 0            | 0        | 269                   | 271      | 2.000               | 2.000    |
| 5           | 10.020           | 10.030   | 251              | 251      | 50               | 51       | 10           | 10       | 270                   | 271      | 2.004               | 2.006    |
| 10          | 20.060           | 20.010   | 252              | 252      | 51               | 52       | 9            | 10       | 271                   | 272      | 2.008               | 1.996    |
| 15          | 30.090           | 30.040   | 252              | 252      | 53               | 53       | 10           | 10       | 272                   | 273      | 2.006               | 2.006    |
| 20          | 40.110           | 40.060   | 252              | 252      | 55               | 56       | 10           | 11       | 273                   | 270      | 2.004               | 2.004    |
| 25          | 50.110           | 50.080   | 252              | 252      | 55               | 57       | 10           | 11       | 272                   | 271      | 2.000               | 2.004    |
| 30          | 60.070           | 60.100   | 252              | 252      | 56               | 58       | 10           | 11       | 271                   | 273      | 1.992               | 2.004    |
| 35          | 70.080           | 70.120   | 252              | 252      | 57               | 60       | 10           | 10       | 270                   | 272      | 2.002               | 2.004    |
| 40          | 80.090           | 80.130   | 252              | 252      | 59               | 61       | 10           | 11       | 271                   | 270      | 2.002               | 2.002    |
| 45          | 90.120           | 90.110   | 252              | 252      | 61               | 62       | 9            | 10       | 270                   | 270      | 2.006               | 1.996    |
| 50          | 100.100          | 100.120  | 251              | 251      | 61               | 62       | 10           | 10       | 272                   | 273      | 1.996               | 2.002    |
| 55          | 110.070          | 110.130  | 252              | 252      | 61               | 64       | 9            | 9        | 273                   | 270      | 1.994               | 2.002    |
| 60          | 120.110          | 120.160  | 251              | 251      | 62               | 65       | 10           | 10       | 273                   | 272      | 2.008               | 2.006    |
| 65          | 130.120          | 130.170  | 252              | 252      | 62               | 65       | 10           | 11       | 271                   | 272      | 2.002               | 2.002    |
| 70          | 140.130          | 140.150  | 250              | 250      | 63               | 65       | 10           | 10       | 270                   | 271      | 2.002               | 1.996    |
| 75          | 150.150          | 150.110  | 251              | 251      | 64               | 66       | 11           | 10       | 271                   | 272      | 2.004               | 1.992    |
| 80          | 160.180          | 160.150  | 252              | 252      | 65               | 67       | 10           | 11       | 272                   | 271      | 2.006               | 2.008    |
| 85          | 170.160          | 170.130  | 251              | 251      | 66               | 68       | 10           | 10       | 271                   | 273      | 1.996               | 1.996    |
| 90          | 180.140          | 180.160  | 250              | 250      | 66               | 68       | 10           | 11       | 273                   | 273      | 1.996               | 2.006    |
| 95          | 190.160          | 190.150  | 252              | 252      | 66               | 68       | 10           | 11       | 270                   | 272      | 2.004               | 1.998    |
| 100         | 200.180          | 200.130  | 251              | 251      | 66               | 68       | 11           | 10       | 270                   | 271      | 2.004               | 1.996    |
| 105         | 210.130          | 210.160  | 250              | 250      | 67               | 69       | 10           | 11       | 271                   | 272      | 1.990               | 2.006    |
| 110         | 220.100          | 220.150  | 250              | 250      | 67               | 69       | 10           | 10       | 273                   | 272      | 1.994               | 1.998    |
| 115         | 230.120          | 230.180  | 251              | 251      | 68               | 70       | 11           | 11       | 273                   | 273      | 2.004               | 2.006    |
| 120         | 240.100          | 240.170  | 250              | 250      | 68               | 70       | 10           | 11       | 271                   | 272      | 1.996               | 1.998    |
| 125         | 250.130          | 250.160  | 251              | 251      | 68               | 70       | 11           | 11       | 270                   | 271      | 2.006               | 1.998    |
| 130         | 260.150          | 260.190  | 250              | 250      | 69               | 71       | 10           | 10       | 272                   | 273      | 2.004               | 2.006    |
| 135         | 270.170          | 270.150  | 252              | 252      | 69               | 71       | 10           | 11       | 271                   | 271      | 2.004               | 1.992    |
| 140         | 280.190          | 280.120  | 252              | 252      | 69               | 71       | 11           | 10       | 272                   | 273      | 2.004               | 1.994    |
| 145         | 290.210          | 290.160  | 252              | 252      | 69               | 71       | 10           | 11       | 273                   | 272      | 2.004               | 2.008    |
| 150         | 300.180          | 300.140  | 252              | 252      | 69               | 71       | 10           | 10       | 271                   | 273      | 1.994               | 1.996    |
| 155         | 310.200          | 310.160  | 252              | 252      | 69               | 71       | 11           | 10       | 272                   | 271      | 2.004               | 2.004    |
| 160         | 320.210          | 320.190  | 252              | 252      | 69               | 71       | 10           | 10       | 271                   | 270      | 2.002               | 2.006    |
| 165         | 330.230          | 330.170  | 252              | 252      | 69               | 71       | 10           | 10       | 271                   | 272      | 2.004               | 1.996    |
| 170         | 340.250          | 340.210  | 251              | 251      | 69               | 71       | 11           | 11       | 272                   | 273      | 2.004               | 2.008    |
| 175         | 350.210          | 350.160  | 252              | 252      | 69               | 71       | 10           | 11       | 273                   | 271      | 1.992               | 1.990    |
| 180         | 360.179          | 360.193  | 252              | 252      | 69               | 71       | 10           | 10       | 272                   | 270      | 1.994               | 2.007    |

Method 30B Field Data  
Field Data Entry

Client: Hollingsworth & Vose  
Location: Corvallis, OR  
Source: CFU 117  
EPA Method: 30B  
Box Operator: KLS  
Technician(s): CW

Run: 2  
Start Time: 12:36  
End Time: 15:46  
Start Date: 4/29/2018  
End Date: 4/29/2018

Pre-Test Information:

Barometric Pressure: 29.91 "Hg  
Test duration: 180 min

Equipment:

Probe ID: HG1  
Probe heat: 270 F  
Side A Side B  
Meterbox ID: 2 2  
Y factor: 1.0420 1.0460  
Desired sampling rate: 2 2 lpm  
Trap ID#: OL464761 OL469520  
Spiked @: 5 0 ng  
Orifice # (if used):

Leak Checks:

|                        | Pre-test |        | Post-test |        |
|------------------------|----------|--------|-----------|--------|
|                        | Side A   | Side B | Side A    | Side B |
| Leak check vacuum, "Hg | 20       | 18     | 16        | 15     |
| Train leak rate, lpm   | 0.000    | 0.000  | 0.000     | 0.000  |

Test Summary:

|                  | Side A  | Side B    |
|------------------|---------|-----------|
| Sample Volume:   | 360.144 | 360.219 L |
| Ave. Meter Temp: | 67.1    | 69.1 °F   |

| Time (min.) | Meter Volume (L) |          | Stack Temp. (°F) |          | Meter Temp. (°F) |          | Vacuum ("Hg) |          | Trap Temperature (°F) |          | Sampling Rate (Lpm) |          |
|-------------|------------------|----------|------------------|----------|------------------|----------|--------------|----------|-----------------------|----------|---------------------|----------|
|             | Side A           | Sample B | Sample A         | Sample B | Sample A         | Sample B | Sample A     | Sample B | Sample A              | Sample B | Sample A            | Sample B |
| 0           | 0.000            | 0.000    | 249              | 249      | 63               | 64       | 0            | 0        | 269                   | 270      | 2.000               | 2.000    |
| 5           | 10.030           | 10.050   | 248              | 248      | 61               | 62       | 9            | 9        | 270                   | 271      | 2.006               | 2.010    |
| 10          | 20.060           | 20.020   | 248              | 248      | 61               | 63       | 10           | 11       | 269                   | 270      | 2.006               | 1.994    |
| 15          | 30.080           | 30.060   | 249              | 249      | 62               | 64       | 10           | 10       | 270                   | 271      | 2.004               | 2.008    |
| 20          | 40.110           | 40.050   | 250              | 250      | 63               | 65       | 11           | 10       | 269                   | 272      | 2.006               | 1.998    |
| 25          | 50.150           | 50.080   | 251              | 251      | 64               | 66       | 10           | 10       | 270                   | 273      | 2.008               | 2.006    |
| 30          | 60.120           | 60.110   | 251              | 251      | 64               | 66       | 11           | 10       | 272                   | 272      | 1.994               | 2.006    |
| 35          | 70.150           | 70.100   | 250              | 250      | 65               | 67       | 10           | 10       | 271                   | 273      | 2.006               | 1.998    |
| 40          | 80.120           | 80.130   | 250              | 250      | 65               | 68       | 9            | 10       | 270                   | 271      | 1.994               | 2.006    |
| 45          | 90.160           | 90.140   | 252              | 252      | 66               | 68       | 10           | 10       | 272                   | 271      | 2.008               | 2.002    |
| 50          | 100.190          | 100.160  | 252              | 252      | 66               | 68       | 10           | 11       | 271                   | 272      | 2.006               | 2.004    |
| 55          | 110.210          | 110.170  | 252              | 252      | 67               | 69       | 10           | 10       | 270                   | 271      | 2.004               | 2.002    |
| 60          | 120.180          | 120.150  | 252              | 252      | 68               | 70       | 11           | 10       | 271                   | 273      | 1.994               | 1.996    |
| 65          | 130.170          | 130.180  | 251              | 251      | 68               | 70       | 10           | 10       | 272                   | 272      | 1.998               | 2.006    |
| 70          | 140.200          | 140.160  | 252              | 252      | 68               | 71       | 11           | 9        | 270                   | 271      | 2.006               | 1.996    |
| 75          | 150.190          | 150.130  | 252              | 252      | 69               | 71       | 10           | 9        | 271                   | 272      | 1.998               | 1.994    |
| 80          | 160.150          | 160.170  | 251              | 251      | 70               | 72       | 10           | 10       | 270                   | 271      | 1.992               | 2.008    |
| 85          | 170.130          | 170.170  | 252              | 252      | 69               | 72       | 10           | 11       | 272                   | 272      | 1.996               | 2.000    |
| 90          | 180.160          | 180.120  | 252              | 252      | 69               | 71       | 11           | 11       | 273                   | 270      | 2.006               | 1.990    |
| 95          | 190.180          | 190.150  | 252              | 252      | 69               | 71       | 10           | 11       | 272                   | 271      | 2.004               | 2.006    |
| 100         | 200.200          | 200.170  | 251              | 251      | 68               | 70       | 11           | 10       | 271                   | 273      | 2.004               | 2.004    |
| 105         | 210.190          | 210.150  | 252              | 252      | 68               | 70       | 10           | 10       | 273                   | 272      | 1.998               | 1.996    |
| 110         | 220.160          | 220.140  | 252              | 252      | 68               | 70       | 11           | 10       | 272                   | 272      | 1.994               | 1.998    |
| 115         | 230.150          | 230.170  | 252              | 252      | 67               | 70       | 10           | 11       | 271                   | 270      | 1.998               | 2.006    |
| 120         | 240.110          | 240.190  | 251              | 251      | 67               | 69       | 11           | 11       | 272                   | 271      | 1.992               | 2.004    |
| 125         | 250.120          | 250.210  | 252              | 252      | 67               | 70       | 10           | 10       | 273                   | 271      | 2.002               | 2.004    |
| 130         | 260.130          | 260.200  | 251              | 251      | 67               | 70       | 11           | 10       | 271                   | 270      | 2.002               | 1.998    |
| 135         | 270.090          | 270.180  | 253              | 253      | 68               | 69       | 10           | 10       | 270                   | 272      | 1.992               | 1.996    |
| 140         | 280.110          | 280.190  | 252              | 252      | 69               | 71       | 10           | 11       | 271                   | 271      | 2.004               | 2.002    |
| 145         | 290.140          | 290.220  | 252              | 252      | 69               | 71       | 11           | 11       | 270                   | 272      | 2.006               | 2.006    |
| 150         | 300.150          | 300.190  | 250              | 250      | 69               | 71       | 10           | 11       | 269                   | 271      | 2.002               | 1.994    |
| 155         | 310.130          | 310.210  | 249              | 249      | 69               | 71       | 11           | 10       | 270                   | 271      | 1.996               | 2.004    |
| 160         | 320.160          | 320.220  | 250              | 250      | 69               | 71       | 10           | 10       | 272                   | 273      | 2.006               | 2.002    |
| 165         | 330.170          | 330.190  | 249              | 249      | 69               | 71       | 11           | 10       | 271                   | 272      | 2.002               | 1.994    |
| 170         | 340.200          | 340.210  | 250              | 250      | 70               | 72       | 10           | 10       | 270                   | 271      | 2.006               | 2.004    |
| 175         | 350.160          | 350.230  | 249              | 249      | 70               | 72       | 10           | 11       | 269                   | 271      | 1.992               | 2.004    |
| 180         | 360.144          | 360.219  | 249              | 249      | 70               | 72       | 11           | 11       | 270                   | 270      | 1.997               | 1.998    |

Method 30B Field Data  
Field Data Entry

Client: Hollingsworth & Vose  
Location: Corvallis, OR  
Source: CFU 117  
EPA Method: 30B  
Box Operator: KLS  
Technician(s): CW

Run: 3  
Start Time: 16:02  
End Time: 19:06  
Start Date: 4/29/2018  
End Date: 4/29/2018

Pre-Test Information:

Barometric Pressure: 29.91 "Hg  
Test duration: 180 min

Equipment:

Probe ID: HG1  
Probe heat: 270 F  
Side A Side B  
Meterbox ID: 2 2  
Y factor: 1.0420 1.0460  
Desired sampling rate: 2 2 lpm  
Trap ID#: OL464778 OL469519  
Spiked @: 5 0 ng  
Orifice # (if used):

Leak Checks:

|                        | Pre-test |        | Post-test |        |
|------------------------|----------|--------|-----------|--------|
|                        | Side A   | Side B | Side A    | Side B |
| Leak check vacuum, "Hg | 19       | 17     | 16        | 17     |
| Train leak rate, lpm   | 0.000    | 0.000  | 0.000     | 0.000  |

Test Summary:

|                  | Side A  | Side B    |
|------------------|---------|-----------|
| Sample Volume:   | 360.211 | 360.238 L |
| Ave. Meter Temp: | 66.5    | 68.4 °F   |

| Time (min.) | Meter Volume (L) |          | Stack Temp. (°F) |          | Meter Temp. (°F) |          | Vacuum ("Hg) |          | Trap Temperature (°F) |          | Sampling Rate (Lpm) |          |
|-------------|------------------|----------|------------------|----------|------------------|----------|--------------|----------|-----------------------|----------|---------------------|----------|
|             | Side A           | Sample B | Sample A         | Sample B | Sample A         | Sample B | Sample A     | Sample B | Sample A              | Sample B | Sample A            | Sample B |
| 0           | 0.000            | 0.000    | 249              | 249      | 68               | 68       | 0            | 0        | 270                   | 272      | 2.000               | 2.000    |
| 5           | 10.030           | 10.050   | 250              | 250      | 67               | 68       | 9            | 9        | 270                   | 271      | 2.006               | 2.010    |
| 10          | 20.060           | 20.030   | 250              | 250      | 66               | 68       | 10           | 9        | 271                   | 272      | 2.006               | 1.996    |
| 15          | 30.090           | 30.060   | 248              | 248      | 67               | 68       | 10           | 10       | 270                   | 273      | 2.006               | 2.006    |
| 20          | 40.060           | 40.080   | 247              | 247      | 66               | 68       | 9            | 10       | 272                   | 272      | 1.994               | 2.004    |
| 25          | 50.080           | 50.120   | 247              | 247      | 66               | 68       | 10           | 10       | 271                   | 273      | 2.004               | 2.008    |
| 30          | 60.050           | 60.140   | 245              | 245      | 67               | 68       | 9            | 10       | 272                   | 271      | 1.994               | 2.004    |
| 35          | 70.090           | 70.170   | 244              | 244      | 67               | 68       | 10           | 9        | 273                   | 272      | 2.008               | 2.006    |
| 40          | 80.110           | 80.180   | 244              | 244      | 66               | 68       | 10           | 10       | 270                   | 271      | 2.004               | 2.002    |
| 45          | 90.140           | 90.220   | 245              | 245      | 66               | 68       | 10           | 9        | 271                   | 273      | 2.006               | 2.008    |
| 50          | 100.120          | 100.210  | 244              | 244      | 67               | 68       | 9            | 9        | 270                   | 272      | 1.996               | 1.998    |
| 55          | 110.150          | 110.190  | 244              | 244      | 67               | 69       | 10           | 9        | 271                   | 271      | 2.006               | 1.996    |
| 60          | 120.160          | 120.200  | 244              | 244      | 67               | 69       | 10           | 10       | 271                   | 270      | 2.002               | 2.002    |
| 65          | 130.140          | 130.170  | 244              | 244      | 67               | 69       | 10           | 11       | 270                   | 271      | 1.996               | 1.994    |
| 70          | 140.110          | 140.200  | 245              | 245      | 67               | 69       | 10           | 10       | 270                   | 272      | 1.994               | 2.006    |
| 75          | 150.150          | 150.210  | 245              | 245      | 67               | 69       | 9            | 10       | 272                   | 271      | 2.008               | 2.002    |
| 80          | 160.120          | 160.220  | 244              | 244      | 67               | 69       | 10           | 11       | 270                   | 271      | 1.994               | 2.002    |
| 85          | 170.110          | 170.230  | 246              | 246      | 67               | 69       | 11           | 11       | 272                   | 273      | 1.998               | 2.002    |
| 90          | 180.130          | 180.190  | 248              | 248      | 67               | 69       | 10           | 11       | 271                   | 272      | 2.004               | 1.992    |
| 95          | 190.160          | 190.220  | 248              | 248      | 66               | 68       | 10           | 10       | 272                   | 270      | 2.006               | 2.006    |
| 100         | 200.150          | 200.240  | 246              | 246      | 66               | 68       | 10           | 11       | 271                   | 270      | 1.998               | 2.004    |
| 105         | 210.180          | 210.260  | 245              | 245      | 66               | 68       | 10           | 11       | 272                   | 272      | 2.006               | 2.004    |
| 110         | 220.190          | 220.230  | 244              | 244      | 66               | 68       | 10           | 11       | 271                   | 273      | 2.002               | 1.994    |
| 115         | 230.170          | 230.220  | 245              | 245      | 66               | 68       | 10           | 10       | 270                   | 271      | 1.996               | 1.998    |
| 120         | 240.150          | 240.250  | 245              | 245      | 66               | 68       | 11           | 10       | 271                   | 272      | 1.996               | 2.006    |
| 125         | 250.110          | 250.270  | 246              | 246      | 66               | 68       | 10           | 11       | 272                   | 271      | 1.992               | 2.004    |
| 130         | 260.120          | 260.240  | 247              | 247      | 66               | 68       | 11           | 10       | 270                   | 272      | 2.002               | 1.994    |
| 135         | 270.130          | 270.230  | 248              | 248      | 66               | 68       | 10           | 10       | 271                   | 273      | 2.002               | 1.998    |
| 140         | 280.110          | 280.250  | 248              | 248      | 66               | 68       | 10           | 11       | 272                   | 271      | 1.996               | 2.004    |
| 145         | 290.140          | 290.260  | 247              | 247      | 67               | 69       | 11           | 10       | 270                   | 271      | 2.006               | 2.002    |
| 150         | 300.160          | 300.270  | 248              | 248      | 67               | 69       | 10           | 10       | 272                   | 273      | 2.004               | 2.002    |
| 155         | 310.190          | 300.240  | 248              | 248      | 67               | 69       | 11           | 10       | 271                   | 272      | 2.006               | -0.006   |
| 160         | 320.210          | 320.260  | 248              | 248      | 67               | 69       | 10           | 11       | 270                   | 271      | 2.004               | 4.004    |
| 165         | 330.200          | 330.230  | 247              | 247      | 67               | 69       | 10           | 10       | 272                   | 273      | 1.998               | 1.994    |
| 170         | 340.180          | 340.210  | 248              | 248      | 66               | 68       | 10           | 11       | 271                   | 273      | 1.996               | 1.996    |
| 175         | 350.170          | 350.220  | 248              | 248      | 66               | 68       | 10           | 10       | 273                   | 272      | 1.998               | 2.002    |
| 180         | 360.211          | 360.238  | 248              | 248      | 66               | 68       | 10           | 11       | 272                   | 273      | 2.008               | 2.004    |

**Method 30B**  
**Mercury Concentration**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Test date:** 4/29/2018

**Meterbox Y:**  
**Side A** 1.0420  
**Side B** 1.0460

| Run | Sample | Sample Date | Trap ID  | Spiked @<br>ng | Section 1<br>ng | Section 2<br>ng | Total Hg<br>ng | Total Hg<br>µg | DGM<br>reading<br>L | Sample volume<br>(corrected for Y)<br>L | Bp<br>"Hg | Meter<br>Temp.<br>°F | Sample<br>Vol.<br>dscm | Hg Conc.<br>µg/dscm | Ave. Pair<br>Hg Conc.<br>µg/dscm |
|-----|--------|-------------|----------|----------------|-----------------|-----------------|----------------|----------------|---------------------|-----------------------------------------|-----------|----------------------|------------------------|---------------------|----------------------------------|
| 1   | A      | 4/29/2018   | OL464795 | 5.0            | 6.1             | 0.2             | 1.3            | 1.30E-03       | 360.179             | 375.307                                 | 29.94     | 63.4                 | 0.379                  | 3.43E-03            | 3.69E-03                         |
|     | B      |             | OL469559 | 0.0            | 1.2             | 0.3             | 1.5            | 1.50E-03       | 360.193             | 376.762                                 |           |                      | 0.379                  | 3.96E-03            |                                  |
| 2   | A      | 4/29/2018   | OL464761 | 5.0            | 5.9             | 0.2             | 1.1            | 1.10E-03       | 360.144             | 375.270                                 | 29.91     | 67.1                 | 0.376                  | 2.93E-03            | 3.19E-03                         |
|     | B      |             | OL469520 | 0.0            | 1.1             | 0.2             | 1.3            | 1.30E-03       | 360.219             | 376.789                                 |           |                      | 0.376                  | 3.46E-03            |                                  |
| 3   | A      | 4/29/2018   | OL464778 | 5.0            | 6.0             | 0.2             | 1.2            | 1.20E-03       | 360.211             | 375.340                                 | 29.91     | 66.5                 | 0.376                  | 3.19E-03            | 3.19E-03                         |
|     | B      |             | OL469519 | 0.0            | 1.0             | 0.2             | 1.2            | 1.20E-03       | 360.238             | 376.809                                 |           |                      | 0.376                  | 3.19E-03            |                                  |

**Trap Concentrations Example Calculations:**  
**Run 1, Side A**

Average: 3.36E-03

1. Total Hg                      Total Hg = Section 1 + Section 2 - Spike =              1.3 ng  
     where Section 1:              6.1 ng  
     Section 2:                      0.2 ng  
     Spike:                          5.0 ng

4. Standard Volume (DSCM) = Sample Vol. (L)  $\times \left( \frac{528^\circ\text{A}}{T_m + 460} \right) \times B_p / 29.92$  "Hg / 1000 =              0.379 DSCM  
     where Sample vol.:              375.307 L  
     T<sub>m</sub>:                              63.4 °F  
     B<sub>p</sub>:                              29.94 "Hg

2. Conversion to µg                      Total Hg ng/1000 =              1.30E-03 µg  
     where Total Hg ng:              1.3 ng

5. Hg concentration µg/dscm = Total Hg µg / Volume DSCM =              3.43E-03 µg/dscm  
     where Total Hg:              1.30E-03 µg  
     DSCM:                          0.379

3. Corrected sample volume = DGM reading x Meterbox Y factor =              375.307 L  
     where DGM reading:              360.179 L  
     Y:                                  1.042

6. Average Pair Concentration = (Side A Conc. + Side B Conc.) / 2 =              3.69E-03 µg/dscm  
     where Side A:              3.43E-03 µg/dscm  
     Side B:                          3.96E-03 µg/dscm



**Method 30B**  
**Results QA/QC**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Test date:** 4/29/2018  
**Test type:** C [C for compliance; R for RATA]

| Run | Sample | Sample Date | Trap ID  | Spiked @<br>ng | Section 1<br>ng | Section 2<br>ng | Total Hg<br>ng | Hg Conc.<br>µg/dscm | Breakthr.<br>% | Breakthr. Results<br>PASS/FAIL | C <sub>rec</sub> : Spiked Compound<br>µg/dscm | Spiked Hg Recovery R<br>Value % | Field Recovery<br>PASS/FAIL | RD Paired Traps<br>% | Paired Trap Agree.<br>PASS/FAIL |
|-----|--------|-------------|----------|----------------|-----------------|-----------------|----------------|---------------------|----------------|--------------------------------|-----------------------------------------------|---------------------------------|-----------------------------|----------------------|---------------------------------|
| 1   | A      | 4/29/2018   | OL464795 | 5              | 6.1             | 0.2             | 1.3            | 3.43E-03            | 3.3            | PASS                           | 1.27E-02                                      | 96.0                            | PASS                        | 7.1                  | PASS                            |
|     | B      |             | OL469559 | 0              | 1.2             | 0.3             | 1.5            | 3.96E-03            | 25.0           | Hg <0.1 µg/dscm                |                                               |                                 |                             |                      |                                 |
| 2   | A      | 4/29/2018   | OL464761 | 5              | 5.9             | 0.2             | 1.1            | 2.93E-03            | 3.4            | PASS                           | 1.28E-02                                      | 96.0                            | PASS                        | 8.3                  | PASS                            |
|     | B      |             | OL469520 | 0              | 1.1             | 0.2             | 1.3            | 3.46E-03            | 18.2           | PASS                           |                                               |                                 |                             |                      |                                 |
| 3   | A      | 4/29/2018   | OL464778 | 5              | 6.0             | 0.2             | 1.2            | 3.19E-03            | 3.3            | PASS                           | 1.33E-02                                      | 100.0                           | PASS                        | 0.0                  | PASS                            |
|     | B      |             | OL469519 | 0              | 1.0             | 0.2             | 1.2            | 3.19E-03            | 20.0           | Hg <0.1 µg/dscm                |                                               |                                 |                             |                      |                                 |

1. Breakthrough Criteria

Every sample must meet the following criteria for breakthrough % from Section 1 to Section 2.

$$\text{Breakthrough \%} = \frac{\text{Section 2 ng}}{\text{Section 1 ng}} \times 100 \quad \text{Eq. 30B-2}$$

| Allowable Breakthrough % | Compliance Testing (µg/dscm)    | RATA (µg/dscm) |
|--------------------------|---------------------------------|----------------|
| 10                       | > 1                             | > 1            |
| 20                       | ≤1                              | ≤1; >0.5       |
| 50                       | Hg conc. ≤30% of emission limit | ≤0.5; >0.1     |

RM average: 3.36E-03 µg/dscm

2. Field Recovery Test

Determines the fraction of spiked Hg recovered (R). Perform for at least three runs per field test. Average of three runs must be between 85 and 115%

$$C_{rec} = \frac{\text{mass spiked } (\mu\text{g})}{\text{Volume spiked } (\text{dscm})} - \frac{\text{mass unspiked } (\mu\text{g})}{\text{Volume unspiked } (\text{dscm})} \quad \text{Eq. 30B-6}$$

$$R = \frac{C_{rec} \left( \frac{\mu\text{g}}{\text{dscm}} \right) \times \text{vol. spiked } (\text{dscm})}{\text{mass spiked } (\mu\text{g})} \times 100 \quad \text{Eq. 30B-7}$$

3. Paired trap agreement

$$RD = \frac{|\text{Conc. Trap A} - \text{Conc. Trap B}|}{\text{Conc. Trap A} + \text{Conc. Trap B}} \times 100 \quad \text{Eq. 30B-5}$$

If paired trains meet the relative deviation (RD) and other QA requirements, the average of the two Hg concs. may be used as an emissions test run value or as the reference method value for a RATA run.

| Allowable Relative Dev. %                        | For Hg conc. (µg/dscm) |
|--------------------------------------------------|------------------------|
| 10                                               | > 1                    |
| 20                                               | ≤1                     |
| or ≤0.2 ug/dscm absolute difference in Hg concs. | ≤1                     |

M30B Table 9-1

**Method 30B****Emission Calculations****Client:** Hollingsworth & Vose**Location:** Corvallis, OR**Source:** CFU 117**Test date:** 4/29/2018

| Run | Ave. Pair<br>Hg Conc. | Hg Conc. | Stack Flow* | Glass<br>Production | Stack Emissions |                      |
|-----|-----------------------|----------|-------------|---------------------|-----------------|----------------------|
|     | µg/dscm               | lb/dscf  | dscf/hr     | lb/hr               | lb/hr           | lb/lb glass produced |
| 1   | 3.69E-03              | 2.31E-13 | 1,064,831.3 | 110.3               | 2.46E-07        | 2.23E-09             |
| 2   | 3.19E-03              | 1.99E-13 | 1,099,454.9 | 110.3               | 2.19E-07        | 1.99E-09             |
| 3   | 3.19E-03              | 1.99E-13 | 1,102,511.5 | 112.7               | 2.19E-07        | 1.95E-09             |

Average  
Results:

3.36E-03

2.10E-13

1,088,933

111.1

2.28E-07

2.05E-09

\*From direct stack measurements made during concurrent M29 runs

## BISON ENGINEERING GASEOUS SUMMARY SPREADSHEET

|          |                      |        |                |
|----------|----------------------|--------|----------------|
| Company  | Hollingsworth & Vose | Source | CFU 117        |
| Facility | Glass Plant 2        | Date   | April 29, 2018 |
| Location | Corvallis, OR        |        |                |

|            |           |           |           |
|------------|-----------|-----------|-----------|
| Test date  | 4/29/2018 | 4/29/2018 | 4/29/2018 |
| Start time | 8:42      | 12:36     | 16:02     |
| End time   | 11:50     | 15:46     | 19:06     |
| Test run   | 1         | 2         | 3         |

| E M I S S I O N S |                                                 |                 |   |       |       |       | Average |
|-------------------|-------------------------------------------------|-----------------|---|-------|-------|-------|---------|
| Meth 3A           | Oxygen Concentration (O <sub>2</sub> )          | O <sub>2</sub>  | % | 19.80 | 19.59 | 19.92 | 19.77   |
|                   | Carbon Dioxide Concentration (CO <sub>2</sub> ) | CO <sub>2</sub> | % | 0.64  | 0.76  | 0.65  | 0.68    |

**Bison Engineering, Inc.**  
**Method 3A Oxygen**  
*Calibration Error, System Bias and System Drift*

|           |                      |        |                |                      |              |
|-----------|----------------------|--------|----------------|----------------------|--------------|
| Company:  | Hollingsworth & Vose | Source | CFU 117        | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2        | Date   | April 29, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR        |        |                | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>        |                           |                                           |           | <i>Final Values</i>       |                                            |           |                           |           |                  | Raw Avg<br>Gas<br>Conc | Corrected<br>Gas<br>Conc | Instrument<br>Cal.<br>Reference<br>Gas |
|-------|---------|------------------------------|---------------------------|-------------------------------------------|-----------|---------------------------|--------------------------------------------|-----------|---------------------------|-----------|------------------|------------------------|--------------------------|----------------------------------------|
|       |         | Analyzer<br>Cal.<br>Response | System<br>Cal<br>Response | Pre test<br>System Cal. Bias<br>% of span | pass/fail | System<br>Cal<br>Response | Post test<br>System Cal. Bias<br>% of span | pass/fail | System Drift<br>% of span | pass/fail | Analyzer<br>Span |                        |                          |                                        |
| Run 1 | zero    | 0.03                         | 0.02                      | -0.05                                     | pass      | 0.09                      | 0.30                                       | pass      | 0.35                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.97                         | 10.01                     | 0.20                                      | pass      | 9.95                      | -0.10                                      | pass      | -0.30                     | pass      | 20               | 19.71                  | 19.80                    | 10                                     |
| Run 2 | zero    | 0.03                         | 0.09                      | 0.30                                      | pass      | 0.10                      | 0.35                                       | pass      | 0.05                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.97                         | 9.95                      | -0.10                                     | pass      | 9.97                      | 0.00                                       | pass      | 0.10                      | pass      | 20               | 19.42                  | 19.59                    | 10                                     |
| Run 3 | zero    | 0.03                         | 0.10                      | 0.35                                      | pass      | 0.12                      | 0.45                                       | pass      | 0.10                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.97                         | 9.97                      | 0.00                                      | pass      | 10.00                     | 0.15                                       | pass      | 0.15                      | pass      | 20               | 19.78                  | 19.92                    | 10                                     |
|       |         |                              |                           | < 5%*                                     |           |                           |                                            | < 5%*     |                           | < 3%*     |                  |                        |                          |                                        |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High  |
|----------------------------|------|-------|-------|
| Calibration gas standards  | 0    | 10    | 20    |
| Cal gas analyzer response  | 0.03 | 9.97  | 20.04 |
| Analyzer Cal. Error        | 0.15 | -0.15 | 0.20  |
| Analyzer Cal. Error <2%*   | pass | pass  | pass  |

\*Or <0.5% O<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 3A Carbon Dioxide**  
*Calibration Error, System Bias and System Drift*

|                                          |                            |                                          |
|------------------------------------------|----------------------------|------------------------------------------|
| Company: <b>Hollingsworth &amp; Vose</b> | Source <b>CFU 117</b>      | Instrument Make: <b>Servomex</b>         |
| Facility: <b>Glass Plant 2</b>           | Date <b>April 29, 2018</b> | Instrument Model: <b>1440</b>            |
| Location: <b>Corvallis, OR</b>           |                            | Instrument Serial #: <b>01440D1-5041</b> |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.07                   | 0.08                | 0.25                                | pass      | 0.08                | 0.25                                 | pass      | 0.00                   | pass      |               |                  |                    |                               |
|       | upscale | 1.92                   | 1.93                | 0.25                                | pass      | 1.93                | 0.25                                 | pass      | 0.00                   | pass      | 4.0           | 0.67             | 0.64               | 2                             |
| Run 2 | zero    | 0.07                   | 0.08                | 0.25                                | pass      | 0.09                | 0.50                                 | pass      | 0.25                   | pass      |               |                  |                    |                               |
|       | upscale | 1.92                   | 1.93                | 0.25                                | pass      | 1.89                | -0.75                                | pass      | -1.00                  | pass      | 4.0           | 0.78             | 0.76               | 2                             |
| Run 3 | zero    | 0.07                   | 0.09                | 0.50                                | pass      | 0.11                | 1.00                                 | pass      | 0.50                   | pass      |               |                  |                    |                               |
|       | upscale | 1.92                   | 1.89                | -0.75                               | pass      | 1.94                | 0.50                                 | pass      | 1.25                   | pass      | 4.0           | 0.69             | 0.65               | 2                             |
|       |         |                        |                     | < 5%*                               |           | < 5%*               |                                      | < 3%*     |                        |           |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High |
|----------------------------|------|-------|------|
| Calibration gas standards  | 0    | 2     | 4.0  |
| Cal gas analyzer response  | 0.07 | 1.92  | 4.09 |
| Analyzer Cal. Error        | 1.75 | -2.00 | 2.25 |
| Analyzer Cal. Error < 2%*  | pass | pass  | pass |

\*Or <0.5% CO<sub>2</sub> absolute difference

## Stratification Check

|                               |                    |                  |                |                      |                  |
|-------------------------------|--------------------|------------------|----------------|----------------------|------------------|
| Facility Hollingsworth & Vose |                    |                  |                |                      |                  |
| Location Glass Plant 2        |                    |                  | Date 4/24/2018 |                      |                  |
| Source CFU 117                |                    | Stack Dimensions |                | 30                   | inches           |
| 3 POINT METHOD                |                    |                  |                |                      |                  |
| <u>% of diameter</u>          | <u>Pt location</u> |                  | <u>O2 %</u>    | <u>Diff (+/- 5%)</u> | <u>Pass/Fail</u> |
| 16.7%                         | 1                  | 5.01             | 19.72          | 0.07%                | PASS             |
| 50.0%                         | 2                  | 15.00            | 19.70          | -0.03%               | PASS             |
| 83.3%                         | 3                  | 24.99            | 19.70          | -0.03%               | PASS             |
|                               | AVERAGE:           |                  | 19.71          |                      |                  |

**Hollingsworth & Vose****4/24/2018****CFU 117****Stratification Check**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%]   |
|-----------|----------|--------|---------|----------|
| 4/24/2018 | 12:38:04 | 19.81  | 0.62    |          |
| 4/24/2018 | 12:38:14 | 19.81  | 0.62    |          |
| 4/24/2018 | 12:38:24 | 19.79  | 0.62    |          |
| 4/24/2018 | 12:38:34 | 19.72  | 0.63    |          |
| 4/24/2018 | 12:38:44 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:38:54 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:39:04 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:39:14 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:39:24 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:39:34 | 19.72  | 0.62    |          |
| 4/24/2018 | 12:39:44 | 19.72  | 0.62    |          |
| 4/24/2018 | 12:39:54 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:40:04 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:40:14 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:40:24 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:40:34 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:40:44 | 19.72  | 0.62    |          |
| 4/24/2018 | 12:40:54 | 19.72  | 0.63    |          |
| 4/24/2018 | 12:41:04 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:41:14 | 19.70  | 0.61    | 19.72 S1 |
| 4/24/2018 | 12:41:24 | 19.70  | 0.63    |          |
| 4/24/2018 | 12:41:34 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:41:44 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:41:54 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:42:04 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:42:14 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:42:24 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:42:34 | 19.69  | 0.61    |          |
| 4/24/2018 | 12:42:44 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:42:54 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:43:04 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:43:14 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:43:24 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:43:34 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:43:44 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:43:54 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:44:04 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:44:14 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:44:24 | 19.70  | 0.62    | 19.70 S2 |
| 4/24/2018 | 12:44:34 | 19.69  | 0.62    |          |

**Hollingsworth & Vose****4/24/2018****CFU 117****Stratification Check**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%]   |
|-----------|----------|--------|---------|----------|
| 4/24/2018 | 12:44:44 | 19.69  | 0.61    |          |
| 4/24/2018 | 12:44:54 | 19.69  | 0.62    |          |
| 4/24/2018 | 12:45:04 | 19.70  | 0.61    |          |
| 4/24/2018 | 12:45:14 | 19.70  | 0.62    |          |
| 4/24/2018 | 12:45:24 | 19.71  | 0.62    |          |
| 4/24/2018 | 12:45:34 | 19.70  | 0.61    |          |
| 4/24/2018 | 12:45:44 | 19.69  | 0.61    |          |
| 4/24/2018 | 12:45:54 | 19.69  | 0.61    |          |
| 4/24/2018 | 12:46:04 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:46:14 | 19.70  | 0.61    |          |
| 4/24/2018 | 12:46:24 | 19.70  | 0.61    |          |
| 4/24/2018 | 12:46:34 | 19.70  | 0.61    |          |
| 4/24/2018 | 12:46:44 | 19.71  | 0.60    |          |
| 4/24/2018 | 12:46:54 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:47:04 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:47:14 | 19.71  | 0.61    |          |
| 4/24/2018 | 12:47:24 | 19.71  | 0.61    | 19.70 S3 |



**Hollingsworth & Vose****Alt 106 Methane column check****Blended 1000/4000 ppm C3H8 and CH4 tank**

| Date      | Time     | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|----------|-----------|-----------|-----------|-----------|
| 4/24/2018 | 10:02:44 | 1.92      | 2.54      |           |           |
| 4/24/2018 | 10:02:54 | 1.92      | 2.54      |           |           |
| 4/24/2018 | 10:03:04 | 1.93      | 2.54      |           |           |
| 4/24/2018 | 10:03:14 | 1.92      | 2.54      |           |           |
| 4/24/2018 | 10:03:24 | 1.92      | 2.54      |           |           |
| 4/24/2018 | 10:03:34 | 1.89      | 3.09      |           |           |
| 4/24/2018 | 10:03:44 | 1.59      | 8.12      |           |           |
| 4/24/2018 | 10:03:54 | 1.59      | 8.13      |           |           |
| 4/24/2018 | 10:04:04 | 1.59      | 8.13      |           |           |
| 4/24/2018 | 10:04:14 | 1.59      | 8.13      |           |           |
| 4/24/2018 | 10:04:24 | 1.59      | 8.13      |           |           |
| 4/24/2018 | 10:04:34 | 1.59      | 8.13      |           |           |
| 4/24/2018 | 10:04:44 | 1.59      | 8.13      |           |           |
| 4/24/2018 | 10:04:54 | 40.32     | 401.63    |           |           |
| 4/24/2018 | 10:05:04 | 50.00     | 500.00    |           |           |
| 4/24/2018 | 10:05:14 | 50.00     | 500.00    |           |           |
| 4/24/2018 | 10:05:24 | 50.00     | 500.00    |           |           |
| 4/24/2018 | 10:05:34 | 50.00     | 500.00    |           |           |
| 4/24/2018 | 10:05:44 | 50.00     | 500.00    |           |           |
| 4/24/2018 | 10:05:54 | 50.00     | 500.00    |           |           |
| 4/24/2018 | 10:06:04 | 40.11     | 309.01    |           |           |
| 4/24/2018 | 10:06:14 | 30.21     | 118.03    |           |           |
| 4/24/2018 | 10:06:24 | 30.21     | 118.02    |           |           |
| 4/24/2018 | 10:06:34 | 30.21     | 118.01    |           |           |
| 4/24/2018 | 10:06:44 | 30.21     | 118.02    |           |           |
| 4/24/2018 | 10:06:54 | 30.21     | 118.02    |           |           |
| 4/24/2018 | 10:07:04 | 30.21     | 118.03    |           |           |
| 4/24/2018 | 10:07:14 | 30.18     | 118.13    |           |           |
| 4/24/2018 | 10:07:24 | 30.06     | 118.58    |           |           |
| 4/24/2018 | 10:07:34 | 30.06     | 118.58    |           |           |
| 4/24/2018 | 10:07:44 | 30.06     | 118.57    |           |           |
| 4/24/2018 | 10:07:54 | 30.06     | 118.58    |           |           |
| 4/24/2018 | 10:08:04 | 30.06     | 118.58    |           |           |
| 4/24/2018 | 10:08:14 | 30.06     | 118.58    |           |           |
| 4/24/2018 | 10:08:24 | 30.06     | 118.57    |           |           |
| 4/24/2018 | 10:08:34 | 30.07     | 119.05    |           |           |
| 4/24/2018 | 10:08:44 | 30.07     | 119.11    |           |           |
| 4/24/2018 | 10:08:54 | 30.07     | 119.11    |           |           |
| 4/24/2018 | 10:09:04 | 30.07     | 119.11    |           |           |
| 4/24/2018 | 10:09:14 | 30.07     | 119.11    |           |           |
| 4/24/2018 | 10:09:24 | 30.07     | 119.10    |           |           |
| 4/24/2018 | 10:09:34 | 30.07     | 119.11    |           |           |

## Hollingsworth & Vose

### Alt 106 Methane column check

### Blended 1000/4000 ppm C3H8 and CH4 tank

| Date               | Time     | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|--------------------|----------|-----------|-----------|-----------|-----------|
| 4/24/2018          | 10:09:44 | 30.08     | 119.21    |           |           |
| 4/24/2018          | 10:09:54 | 30.10     | 119.37    |           |           |
| 4/24/2018          | 10:10:04 | 30.10     | 119.37    |           |           |
| 4/24/2018          | 10:10:14 | 30.10     | 119.37    |           |           |
| 4/24/2018          | 10:10:24 | 30.10     | 119.37    |           |           |
| 4/24/2018          | 10:10:34 | 30.10     | 119.37    |           |           |
| 4/24/2018          | 10:10:44 | 30.10     | 119.36    |           |           |
| 4/24/2018          | 10:10:54 | 30.10     | 119.37    |           |           |
| 4/24/2018          | 10:11:04 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:11:14 | 30.16     | 119.63    |           |           |
| 4/24/2018          | 10:11:24 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:11:34 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:11:44 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:11:54 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:12:04 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:12:14 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:12:24 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:12:34 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:12:44 | 30.16     | 119.63    |           |           |
| 4/24/2018          | 10:12:54 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:13:04 | 30.16     | 119.63    |           |           |
| 4/24/2018          | 10:13:14 | 30.16     | 119.63    |           |           |
| 4/24/2018          | 10:13:24 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:13:34 | 30.16     | 119.62    |           |           |
| 4/24/2018          | 10:13:44 | 25.51     | 99.86     |           |           |
| 4/24/2018          | 10:13:54 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:14:04 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:14:14 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:14:24 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:14:34 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:14:44 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:14:54 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:15:04 | 25.00     | 99.87     |           |           |
| 4/24/2018          | 10:15:14 | 25.00     | 99.86     |           |           |
| 4/24/2018          | 10:15:24 | 25.02     | 99.78     |           |           |
| 4/24/2018          | 10:15:34 | 25.04     | 99.73     |           |           |
| 4/24/2018          | 10:15:44 | 25.04     | 99.73     |           |           |
| 4/24/2018          | 10:15:54 | 25.04     | 99.73     |           |           |
| 4/24/2018          | 10:16:04 | 25.04     | 99.74     | 25.04     | 99.73     |
| Tank values (ppm): |          |           |           | 982.70    | 3992.00   |
|                    |          |           |           |           | 24.62%    |
|                    |          |           |           | Ratio:    | 25.11%    |

**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|---------|--------|---------|--------|---------|
| 4/29/2018 | 7:32:16 | 21.06  | 0.12    |        |         |
| 4/29/2018 | 7:32:26 | 21.07  | 0.12    |        |         |
| 4/29/2018 | 7:32:36 | 21.07  | 0.12    |        |         |
| 4/29/2018 | 7:32:46 | 21.03  | 0.12    |        |         |
| 4/29/2018 | 7:32:56 | 18.34  | 0.12    |        |         |
| 4/29/2018 | 7:33:06 | 17.79  | 2.64    |        |         |
| 4/29/2018 | 7:33:16 | 3.99   | 2.14    |        |         |
| 4/29/2018 | 7:33:26 | -0.10  | 0.12    |        |         |
| 4/29/2018 | 7:33:36 | -0.30  | 0.07    |        |         |
| 4/29/2018 | 7:33:46 | -0.08  | 0.07    |        |         |
| 4/29/2018 | 7:33:56 | -0.07  | 0.07    |        |         |
| 4/29/2018 | 7:34:06 | -0.07  | 0.08    |        |         |
| 4/29/2018 | 7:34:16 | -0.08  | 0.07    |        |         |
| 4/29/2018 | 7:34:26 | -0.08  | 0.07    |        |         |
| 4/29/2018 | 7:34:36 | -0.09  | 0.06    |        |         |
| 4/29/2018 | 7:34:46 | -0.09  | 0.06    |        |         |
| 4/29/2018 | 7:34:56 | 0.00   | 0.06    |        |         |
| 4/29/2018 | 7:35:06 | 0.03   | 0.05    |        |         |
| 4/29/2018 | 7:35:16 | 0.03   | 0.06    |        |         |
| 4/29/2018 | 7:35:26 | 0.02   | 0.06    | 0.03   |         |
| 4/29/2018 | 7:35:36 | 0.05   | 0.07    |        |         |
| 4/29/2018 | 7:35:46 | 11.06  | 9.51    |        |         |
| 4/29/2018 | 7:35:56 | 19.85  | 20.20   |        |         |
| 4/29/2018 | 7:36:06 | 20.13  | 20.18   |        |         |
| 4/29/2018 | 7:36:16 | 20.14  | 20.01   |        |         |
| 4/29/2018 | 7:36:26 | 20.06  | 20.01   |        |         |
| 4/29/2018 | 7:36:36 | 20.03  | 20.02   |        |         |
| 4/29/2018 | 7:36:46 | 20.03  | 20.02   | 20.04  |         |
| 4/29/2018 | 7:36:56 | 18.82  | 19.90   |        |         |
| 4/29/2018 | 7:37:06 | 17.79  | 19.64   |        |         |
| 4/29/2018 | 7:37:16 | 13.47  | 9.24    |        |         |
| 4/29/2018 | 7:37:26 | 6.67   | 7.26    |        |         |
| 4/29/2018 | 7:37:36 | 10.05  | 10.06   |        |         |
| 4/29/2018 | 7:37:46 | 10.15  | 10.06   |        |         |
| 4/29/2018 | 7:37:56 | 10.08  | 10.00   |        |         |
| 4/29/2018 | 7:38:06 | 10.06  | 9.99    |        |         |
| 4/29/2018 | 7:38:16 | 10.06  | 9.99    |        |         |
| 4/29/2018 | 7:38:26 | 10.06  | 9.98    |        |         |
| 4/29/2018 | 7:38:36 | 10.06  | 9.98    |        |         |
| 4/29/2018 | 7:38:46 | 10.06  | 9.98    |        |         |

**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%]     | CO2 [%] |
|-----------|---------|--------|---------|------------|---------|
| 4/29/2018 | 7:38:56 | 10.06  | 9.98    |            |         |
| 4/29/2018 | 7:39:06 | 9.75   | 9.97    |            |         |
| 4/29/2018 | 7:39:16 | 9.83   | 9.36    |            |         |
| 4/29/2018 | 7:39:26 | 10.28  | 0.49    |            |         |
| 4/29/2018 | 7:39:36 | 10.01  | 0.11    |            |         |
| 4/29/2018 | 7:39:46 | 10.00  | 0.09    |            |         |
| 4/29/2018 | 7:39:56 | 10.00  | 0.09    |            |         |
| 4/29/2018 | 7:40:06 | 9.98   | 0.08    |            |         |
| 4/29/2018 | 7:40:16 | 9.97   | 0.08    |            |         |
| 4/29/2018 | 7:40:26 | 9.96   | 0.07    | 9.97       |         |
| 4/29/2018 | 7:40:36 | 9.62   | 0.07    |            |         |
| 4/29/2018 | 7:40:46 | 8.70   | 0.11    |            |         |
| 4/29/2018 | 7:40:56 | 9.50   | 0.40    |            |         |
| 4/29/2018 | 7:41:06 | 5.30   | 3.84    |            |         |
| 4/29/2018 | 7:41:16 | 0.22   | 0.13    |            |         |
| 4/29/2018 | 7:41:26 | 0.07   | 0.09    |            |         |
| 4/29/2018 | 7:41:36 | 0.05   | 0.08    |            |         |
| 4/29/2018 | 7:41:46 | 0.05   | 0.08    |            |         |
| 4/29/2018 | 7:41:56 | 0.05   | 0.07    |            |         |
| 4/29/2018 | 7:42:06 | 0.05   | 0.07    |            |         |
| 4/29/2018 | 7:42:16 | 0.05   | 0.06    |            |         |
| 4/29/2018 | 7:42:26 | 0.05   | 0.07    |            |         |
| 4/29/2018 | 7:42:36 | 0.05   | 0.07    |            |         |
| 4/29/2018 | 7:42:46 | 0.04   | 0.07    |            |         |
| 4/29/2018 | 7:42:56 | 0.04   | 0.06    |            | 0.07    |
| 4/29/2018 | 7:43:06 | 0.06   | 0.06    |            |         |
| 4/29/2018 | 7:43:16 | 5.78   | 6.15    |            |         |
| 4/29/2018 | 7:43:26 | 10.23  | 10.28   |            |         |
| 4/29/2018 | 7:43:36 | 10.10  | 10.04   |            |         |
| 4/29/2018 | 7:43:46 | 10.06  | 10.00   |            |         |
| 4/29/2018 | 7:43:56 | 10.04  | 9.99    |            |         |
| 4/29/2018 | 7:44:06 | 10.03  | 9.98    | Start M205 |         |
| 4/29/2018 | 7:44:16 | 10.02  | 9.98    | 10.03      |         |
| 4/29/2018 | 7:44:26 | 5.68   | 4.85    |            |         |
| 4/29/2018 | 7:44:36 | 0.21   | 0.16    |            |         |
| 4/29/2018 | 7:44:46 | 0.22   | 0.26    |            |         |
| 4/29/2018 | 7:44:56 | 3.50   | 3.78    |            |         |
| 4/29/2018 | 7:45:06 | 5.07   | 5.23    |            |         |
| 4/29/2018 | 7:45:16 | 4.99   | 5.15    |            |         |
| 4/29/2018 | 7:45:26 | 4.99   | 5.15    |            |         |

**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%]                | CO2 [%] |
|-----------|---------|--------|---------|-----------------------|---------|
| 4/29/2018 | 7:45:36 | 5.01   | 5.16    |                       |         |
| 4/29/2018 | 7:45:46 | 5.01   | 5.16    | 5.00                  |         |
| 4/29/2018 | 7:45:56 | 9.83   | 10.08   |                       |         |
| 4/29/2018 | 7:46:06 | 10.19  | 10.09   |                       |         |
| 4/29/2018 | 7:46:16 | 10.10  | 10.02   |                       |         |
| 4/29/2018 | 7:46:26 | 10.07  | 10.00   |                       |         |
| 4/29/2018 | 7:46:36 | 10.07  | 10.00   | 10.08                 |         |
| 4/29/2018 | 7:46:46 | 10.06  | 10.00   |                       |         |
| 4/29/2018 | 7:46:56 | 5.19   | 4.75    |                       |         |
| 4/29/2018 | 7:47:06 | 4.90   | 5.09    |                       |         |
| 4/29/2018 | 7:47:16 | 5.00   | 5.16    |                       |         |
| 4/29/2018 | 7:47:26 | 5.02   | 5.17    |                       |         |
| 4/29/2018 | 7:47:36 | 5.03   | 5.17    | 5.02                  |         |
| 4/29/2018 | 7:47:46 | 5.83   | 5.77    |                       |         |
| 4/29/2018 | 7:47:56 | 10.66  | 11.01   |                       |         |
| 4/29/2018 | 7:48:06 | 10.15  | 10.05   |                       |         |
| 4/29/2018 | 7:48:16 | 10.10  | 10.01   |                       |         |
| 4/29/2018 | 7:48:26 | 10.08  | 10.01   |                       |         |
| 4/29/2018 | 7:48:36 | 10.08  | 10.00   |                       |         |
| 4/29/2018 | 7:48:46 | 10.07  | 9.99    |                       |         |
| 4/29/2018 | 7:48:56 | 10.07  | 9.99    | 10.07                 |         |
| 4/29/2018 | 7:49:06 | 10.08  | 9.99    |                       |         |
| 4/29/2018 | 7:49:16 | 5.89   | 5.42    |                       |         |
| 4/29/2018 | 7:49:26 | 4.88   | 5.08    |                       |         |
| 4/29/2018 | 7:49:36 | 5.01   | 5.16    |                       |         |
| 4/29/2018 | 7:49:46 | 5.04   | 5.17    |                       |         |
| 4/29/2018 | 7:49:56 | 5.05   | 5.17    | 5.03                  |         |
| 4/29/2018 | 7:50:06 | 5.06   | 5.18    |                       |         |
| 4/29/2018 | 7:50:16 | 3.12   | 2.85    |                       |         |
| 4/29/2018 | 7:50:26 | 0.19   | 0.13    |                       |         |
| 4/29/2018 | 7:50:36 | 0.10   | 0.10    |                       |         |
| 4/29/2018 | 7:50:46 | 0.09   | 0.09    |                       |         |
| 4/29/2018 | 7:50:56 | 0.00   | 0.08    |                       |         |
| 4/29/2018 | 7:51:06 | 0.00   | 0.09    |                       |         |
| 4/29/2018 | 7:51:16 | 0.00   | 0.08    | <b>Cylinder Audit</b> |         |
| 4/29/2018 | 7:51:26 | 0.00   | 0.07    | 0.00                  |         |
| 4/29/2018 | 7:51:36 | 0.00   | 0.07    |                       |         |
| 4/29/2018 | 7:51:46 | 0.01   | 0.08    |                       |         |
| 4/29/2018 | 7:51:56 | 4.81   | 0.18    |                       |         |
| 4/29/2018 | 7:52:06 | 9.74   | 0.06    |                       |         |

**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|---------|--------|---------|--------|---------|
| 4/29/2018 | 7:52:16 | 9.90   | 0.07    |        |         |
| 4/29/2018 | 7:52:26 | 9.91   | 0.06    |        |         |
| 4/29/2018 | 7:52:36 | 9.91   | 0.06    |        |         |
| 4/29/2018 | 7:52:46 | 9.91   | 0.06    | 9.91   |         |
| 4/29/2018 | 7:52:56 | 9.43   | 0.06    |        |         |
| 4/29/2018 | 7:53:06 | 7.25   | 0.11    |        |         |
| 4/29/2018 | 7:53:16 | 0.26   | 0.08    |        |         |
| 4/29/2018 | 7:53:26 | 0.02   | 0.06    |        |         |
| 4/29/2018 | 7:53:36 | 0.01   | 0.08    |        |         |
| 4/29/2018 | 7:53:46 | 0.01   | 0.07    |        |         |
| 4/29/2018 | 7:53:56 | 0.01   | 0.06    | 0.01   |         |
| 4/29/2018 | 7:54:06 | 3.86   | 0.08    |        |         |
| 4/29/2018 | 7:54:16 | 9.70   | 0.06    |        |         |
| 4/29/2018 | 7:54:26 | 9.91   | 0.06    |        |         |
| 4/29/2018 | 7:54:36 | 9.92   | 0.05    |        |         |
| 4/29/2018 | 7:54:46 | 9.92   | 0.06    |        |         |
| 4/29/2018 | 7:54:56 | 9.93   | 0.05    | 9.92   |         |
| 4/29/2018 | 7:55:06 | 9.57   | 0.08    |        |         |
| 4/29/2018 | 7:55:16 | 4.55   | 0.16    |        |         |
| 4/29/2018 | 7:55:26 | 0.10   | 0.05    |        |         |
| 4/29/2018 | 7:55:36 | 0.03   | 0.05    |        |         |
| 4/29/2018 | 7:55:46 | 0.02   | 0.06    |        |         |
| 4/29/2018 | 7:55:56 | 0.02   | 0.05    |        |         |
| 4/29/2018 | 7:56:06 | 0.02   | 0.06    |        |         |
| 4/29/2018 | 7:56:16 | 0.02   | 0.05    | 0.02   |         |
| 4/29/2018 | 7:56:26 | 4.51   | 0.07    |        |         |
| 4/29/2018 | 7:56:36 | 9.76   | 0.05    |        |         |
| 4/29/2018 | 7:56:46 | 9.92   | 0.04    |        |         |
| 4/29/2018 | 7:56:56 | 9.92   | 0.05    |        |         |
| 4/29/2018 | 7:57:06 | 9.93   | 0.05    |        |         |
| 4/29/2018 | 7:57:16 | 9.93   | 0.05    | 9.93   |         |
| 4/29/2018 | 7:57:26 | 9.59   | 0.05    |        |         |
| 4/29/2018 | 7:57:36 | 9.17   | 0.05    |        |         |
| 4/29/2018 | 7:57:46 | 2.07   | 0.07    |        |         |
| 4/29/2018 | 7:57:56 | 0.12   | 0.06    |        |         |
| 4/29/2018 | 7:58:06 | 1.48   | 1.48    |        |         |
| 4/29/2018 | 7:58:16 | 4.04   | 4.29    |        |         |
| 4/29/2018 | 7:58:26 | 3.94   | 4.12    |        |         |
| 4/29/2018 | 7:58:36 | 3.94   | 4.10    |        |         |
| 4/29/2018 | 7:58:46 | 3.95   | 4.11    |        |         |

**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|---------|--------|---------|--------|---------|
| 4/29/2018 | 7:58:56 | 3.96   | 4.10    |        |         |
| 4/29/2018 | 7:59:06 | 3.96   | 4.08    |        |         |
| 4/29/2018 | 7:59:16 | 3.96   | 4.09    |        | 4.09    |
| 4/29/2018 | 7:59:26 | 3.97   | 4.10    |        |         |
| 4/29/2018 | 7:59:36 | 3.54   | 3.50    |        |         |
| 4/29/2018 | 7:59:46 | 2.35   | 2.27    |        |         |
| 4/29/2018 | 7:59:56 | 2.07   | 1.94    |        |         |
| 4/29/2018 | 8:00:06 | 2.03   | 1.92    |        |         |
| 4/29/2018 | 8:00:16 | 2.02   | 1.92    |        |         |
| 4/29/2018 | 8:00:26 | 2.02   | 1.92    |        |         |
| 4/29/2018 | 8:00:36 | 2.01   | 1.91    |        | 1.92    |
| 4/29/2018 | 8:00:46 | 2.01   | 1.90    |        |         |
| 4/29/2018 | 8:00:56 | 2.01   | 1.90    |        |         |
| 4/29/2018 | 8:01:06 | 2.01   | 1.91    |        |         |
| 4/29/2018 | 8:01:16 | 2.01   | 1.90    |        |         |
| 4/29/2018 | 8:01:26 | 2.23   | 1.90    |        |         |
| 4/29/2018 | 8:01:36 | 17.98  | 0.50    |        |         |
| 4/29/2018 | 8:01:46 | 15.73  | 1.54    |        |         |
| 4/29/2018 | 8:01:56 | 14.55  | 0.89    |        |         |

## System

|           |         |       |      |
|-----------|---------|-------|------|
| 4/29/2018 | 8:02:06 | 19.83 | 0.22 |
| 4/29/2018 | 8:02:16 | 20.78 | 0.11 |
| 4/29/2018 | 8:02:26 | 20.87 | 0.10 |
| 4/29/2018 | 8:02:36 | 20.87 | 0.11 |
| 4/29/2018 | 8:02:46 | 20.87 | 0.11 |
| 4/29/2018 | 8:02:56 | 19.71 | 0.30 |
| 4/29/2018 | 8:03:06 | 15.27 | 3.20 |
| 4/29/2018 | 8:03:16 | 11.06 | 8.38 |
| 4/29/2018 | 8:03:26 | 4.25  | 3.02 |
| 4/29/2018 | 8:03:36 | 2.28  | 1.36 |
| 4/29/2018 | 8:03:46 | 2.46  | 1.86 |
| 4/29/2018 | 8:03:56 | 2.51  | 1.87 |
| 4/29/2018 | 8:04:06 | 2.54  | 1.87 |
| 4/29/2018 | 8:04:16 | 2.56  | 1.81 |
| 4/29/2018 | 8:04:26 | 2.56  | 1.87 |
| 4/29/2018 | 8:04:36 | 2.07  | 1.54 |
| 4/29/2018 | 8:04:46 | 0.85  | 0.34 |
| 4/29/2018 | 8:04:56 | 0.75  | 0.11 |

**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|---------|--------|---------|--------|---------|
| 4/29/2018 | 8:05:06 | 0.75   | 0.10    |        |         |
| 4/29/2018 | 8:05:16 | 0.78   | 0.09    |        |         |
| 4/29/2018 | 8:05:26 | 0.78   | 0.09    |        |         |
| 4/29/2018 | 8:05:36 | 0.73   | 0.09    |        |         |
| 4/29/2018 | 8:05:46 | 0.69   | 0.09    |        |         |
| 4/29/2018 | 8:05:56 | 0.73   | 0.08    |        |         |
| 4/29/2018 | 8:06:06 | 0.69   | 0.09    |        |         |
| 4/29/2018 | 8:06:16 | 0.66   | 0.08    |        |         |
| 4/29/2018 | 8:06:26 | 0.68   | 0.08    |        |         |
| 4/29/2018 | 8:06:36 | 0.70   | 0.10    |        |         |
| 4/29/2018 | 8:06:46 | 0.70   | 0.09    |        |         |
| 4/29/2018 | 8:06:56 | 0.67   | 0.10    |        |         |
| 4/29/2018 | 8:07:06 | 0.67   | 0.10    |        |         |
| 4/29/2018 | 8:07:16 | 0.66   | 0.10    |        |         |
| 4/29/2018 | 8:07:26 | 0.66   | 0.10    |        |         |
| 4/29/2018 | 8:07:36 | 0.66   | 0.10    |        |         |
| 4/29/2018 | 8:07:46 | 0.64   | 0.09    |        |         |
| 4/29/2018 | 8:07:56 | 0.60   | 0.09    |        |         |
| 4/29/2018 | 8:08:06 | 0.57   | 0.09    |        |         |
| 4/29/2018 | 8:08:16 | 0.64   | 0.09    |        |         |
| 4/29/2018 | 8:08:26 | 0.65   | 0.09    |        |         |
| 4/29/2018 | 8:08:36 | 0.65   | 0.10    |        |         |
| 4/29/2018 | 8:08:46 | 0.64   | 0.10    |        |         |
| 4/29/2018 | 8:08:56 | 0.64   | 0.10    |        |         |
| 4/29/2018 | 8:09:06 | 0.83   | 0.10    |        |         |
| 4/29/2018 | 8:09:16 | 10.17  | 0.40    |        |         |
| 4/29/2018 | 8:09:26 | 3.22   | 0.18    |        |         |
| 4/29/2018 | 8:09:36 | 0.77   | 0.10    |        |         |
| 4/29/2018 | 8:09:46 | 0.16   | 0.08    |        |         |
| 4/29/2018 | 8:09:56 | 0.06   | 0.07    |        |         |
| 4/29/2018 | 8:10:06 | 0.02   | 0.08    |        |         |
| 4/29/2018 | 8:10:16 | 0.02   | 0.08    |        |         |
| 4/29/2018 | 8:10:26 | 0.01   | 0.07    | 0.02   | 0.08    |
| 4/29/2018 | 8:10:36 | 1.12   | 1.20    |        |         |
| 4/29/2018 | 8:10:46 | 2.10   | 2.03    |        |         |
| 4/29/2018 | 8:10:56 | 2.00   | 1.93    |        |         |
| 4/29/2018 | 8:11:06 | 1.98   | 1.94    |        |         |
| 4/29/2018 | 8:11:16 | 1.97   | 1.93    |        |         |
| 4/29/2018 | 8:11:26 | 1.92   | 1.93    |        | 1.93    |
| 4/29/2018 | 8:11:36 | 5.79   | 5.70    |        |         |



**Hollingsworth & Vose****4/29/2018****CFU 117****Daily Calibrations and Method 205**

| Date      | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|---------|--------|---------|--------|---------|
| 4/29/2018 | 8:11:46 | 10.34  | 10.26   |        |         |
| 4/29/2018 | 8:11:56 | 10.08  | 9.89    |        |         |
| 4/29/2018 | 8:12:06 | 10.04  | 9.86    |        |         |
| 4/29/2018 | 8:12:16 | 10.02  | 9.85    |        |         |
| 4/29/2018 | 8:12:26 | 10.02  | 9.85    |        |         |
| 4/29/2018 | 8:12:36 | 10.01  | 9.85    |        |         |
| 4/29/2018 | 8:12:46 | 10.01  | 9.84    | 10.01  |         |
| 4/29/2018 | 8:12:56 | 10.00  | 9.84    |        |         |
| 4/29/2018 | 8:13:06 | 10.00  | 9.83    |        |         |
| 4/29/2018 | 8:13:16 | 10.00  | 9.83    |        |         |
| 4/29/2018 | 8:13:26 | 9.99   | 9.83    |        |         |
| 4/29/2018 | 8:13:36 | 9.37   | 9.79    |        |         |
| 4/29/2018 | 8:13:46 | 9.33   | 9.92    |        |         |
| 4/29/2018 | 8:13:56 | 19.57  | 2.42    |        |         |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #1**

| Date      | Time    | O2 [%] | CO2 [%] |
|-----------|---------|--------|---------|
| 4/29/2018 | 8:43:40 | 19.73  | 0.63    |
| 4/29/2018 | 8:44:40 | 19.74  | 0.64    |
| 4/29/2018 | 8:45:40 | 19.74  | 0.63    |
| 4/29/2018 | 8:46:40 | 19.74  | 0.64    |
| 4/29/2018 | 8:47:40 | 19.74  | 0.64    |
| 4/29/2018 | 8:48:40 | 19.75  | 0.65    |
| 4/29/2018 | 8:49:40 | 19.74  | 0.64    |
| 4/29/2018 | 8:50:40 | 19.74  | 0.64    |
| 4/29/2018 | 8:51:40 | 19.73  | 0.64    |
| 4/29/2018 | 8:52:40 | 19.73  | 0.64    |
| 4/29/2018 | 8:53:40 | 19.73  | 0.64    |
| 4/29/2018 | 8:54:40 | 19.73  | 0.64    |
| 4/29/2018 | 8:55:40 | 19.72  | 0.63    |
| 4/29/2018 | 8:56:40 | 19.73  | 0.63    |
| 4/29/2018 | 8:57:40 | 19.73  | 0.63    |
| 4/29/2018 | 8:58:40 | 19.74  | 0.64    |
| 4/29/2018 | 8:59:40 | 19.74  | 0.63    |
| 4/29/2018 | 9:00:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:01:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:02:40 | 19.73  | 0.62    |
| 4/29/2018 | 9:03:40 | 19.74  | 0.63    |
| 4/29/2018 | 9:04:40 | 19.74  | 0.63    |
| 4/29/2018 | 9:05:40 | 19.74  | 0.63    |
| 4/29/2018 | 9:06:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:07:40 | 19.73  | 0.62    |
| 4/29/2018 | 9:08:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:09:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:10:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:11:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:12:40 | 19.73  | 0.63    |
| 4/29/2018 | 9:13:40 | 19.73  | 0.64    |
| 4/29/2018 | 9:14:40 | 19.72  | 0.64    |
| 4/29/2018 | 9:15:40 | 19.72  | 0.64    |
| 4/29/2018 | 9:16:40 | 19.72  | 0.64    |
| 4/29/2018 | 9:17:40 | 19.72  | 0.64    |
| 4/29/2018 | 9:18:40 | 19.72  | 0.64    |
| 4/29/2018 | 9:19:40 | 19.72  | 0.68    |
| 4/29/2018 | 9:20:40 | 19.72  | 0.69    |
| 4/29/2018 | 9:21:40 | 19.72  | 0.69    |
| 4/29/2018 | 9:22:40 | 19.72  | 0.68    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #1**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 9:23:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:24:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:25:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:26:40  | 19.72  | 0.67    |
| 4/29/2018 | 9:27:40  | 19.72  | 0.67    |
| 4/29/2018 | 9:28:40  | 19.71  | 0.67    |
| 4/29/2018 | 9:29:40  | 19.71  | 0.67    |
| 4/29/2018 | 9:30:40  | 19.71  | 0.67    |
| 4/29/2018 | 9:31:40  | 19.71  | 0.67    |
| 4/29/2018 | 9:32:40  | 19.71  | 0.67    |
| 4/29/2018 | 9:33:40  | 19.72  | 0.67    |
| 4/29/2018 | 9:34:40  | 19.71  | 0.67    |
| 4/29/2018 | 9:35:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:36:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:37:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:38:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:39:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:40:40  | 19.71  | 0.69    |
| 4/29/2018 | 9:41:40  | 19.71  | 0.69    |
| 4/29/2018 | 9:42:40  | 19.71  | 0.69    |
| 4/29/2018 | 9:43:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:44:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:45:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:46:40  | 19.71  | 0.68    |
| 4/29/2018 | 9:47:40  | 19.70  | 0.68    |
| 4/29/2018 | 9:48:40  | 19.70  | 0.68    |
| 4/29/2018 | 9:49:40  | 19.70  | 0.68    |
| 4/29/2018 | 9:50:40  | 19.70  | 0.68    |
| 4/29/2018 | 9:51:40  | 19.70  | 0.68    |
| 4/29/2018 | 9:52:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:53:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:54:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:55:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:56:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:57:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:58:40  | 19.70  | 0.67    |
| 4/29/2018 | 9:59:40  | 19.70  | 0.67    |
| 4/29/2018 | 10:00:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:01:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:02:40 | 19.70  | 0.67    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #1**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 10:03:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:04:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:05:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:06:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:07:40 | 19.70  | 0.69    |
| 4/29/2018 | 10:08:40 | 19.70  | 0.69    |
| 4/29/2018 | 10:09:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:10:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:11:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:12:40 | 19.69  | 0.68    |
| 4/29/2018 | 10:13:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:14:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:15:40 | 19.69  | 0.68    |
| 4/29/2018 | 10:16:40 | 19.69  | 0.68    |
| 4/29/2018 | 10:17:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:18:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:19:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:20:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:21:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:22:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:23:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:24:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:25:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:26:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:27:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:28:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:29:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:30:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:31:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:32:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:33:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:34:40 | 19.69  | 0.69    |
| 4/29/2018 | 10:35:40 | 19.69  | 0.68    |
| 4/29/2018 | 10:36:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:37:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:38:40 | 19.70  | 0.68    |
| 4/29/2018 | 10:39:40 | 19.69  | 0.68    |
| 4/29/2018 | 10:40:40 | 19.70  | 0.67    |
| 4/29/2018 | 10:41:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:42:40 | 19.69  | 0.67    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #1**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 10:43:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:44:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:45:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:46:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:47:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:48:40 | 19.68  | 0.67    |
| 4/29/2018 | 10:49:40 | 19.68  | 0.67    |
| 4/29/2018 | 10:50:40 | 19.69  | 0.67    |
| 4/29/2018 | 10:51:40 | 19.68  | 0.67    |
| 4/29/2018 | 10:52:40 | 19.68  | 0.67    |
| 4/29/2018 | 10:53:40 | 19.68  | 0.67    |
| 4/29/2018 | 10:54:40 | 19.68  | 0.68    |
| 4/29/2018 | 10:55:40 | 19.68  | 0.68    |
| 4/29/2018 | 10:56:40 | 19.68  | 0.68    |
| 4/29/2018 | 10:57:40 | 19.68  | 0.68    |
| 4/29/2018 | 10:58:40 | 19.69  | 0.68    |
| 4/29/2018 | 10:59:40 | 19.69  | 0.68    |
| 4/29/2018 | 11:00:40 | 19.69  | 0.68    |
| 4/29/2018 | 11:01:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:02:40 | 19.69  | 0.68    |
| 4/29/2018 | 11:03:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:04:40 | 19.68  | 0.67    |
| 4/29/2018 | 11:05:40 | 19.68  | 0.67    |
| 4/29/2018 | 11:06:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:07:40 | 19.69  | 0.66    |
| 4/29/2018 | 11:08:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:09:40 | 19.69  | 0.66    |
| 4/29/2018 | 11:10:40 | 19.69  | 0.66    |
| 4/29/2018 | 11:11:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:12:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:13:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:14:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:15:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:16:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:17:40 | 19.69  | 0.67    |
| 4/29/2018 | 11:18:40 | 19.70  | 0.67    |
| 4/29/2018 | 11:19:40 | 19.70  | 0.68    |
| 4/29/2018 | 11:20:40 | 19.70  | 0.68    |
| 4/29/2018 | 11:21:40 | 19.70  | 0.68    |
| 4/29/2018 | 11:22:40 | 19.70  | 0.68    |

**Hollingsworth & Vose****CFU-117****4/29/2018****Run #1**

| Date           | Time     | O2 [%]       | CO2 [%]     |
|----------------|----------|--------------|-------------|
| 4/29/2018      | 11:23:40 | 19.70        | 0.68        |
| 4/29/2018      | 11:24:40 | 19.70        | 0.68        |
| 4/29/2018      | 11:25:40 | 19.71        | 0.68        |
| 4/29/2018      | 11:26:40 | 19.71        | 0.68        |
| 4/29/2018      | 11:27:40 | 19.72        | 0.68        |
| 4/29/2018      | 11:28:40 | 19.71        | 0.67        |
| 4/29/2018      | 11:29:40 | 19.71        | 0.67        |
| 4/29/2018      | 11:30:40 | 19.71        | 0.67        |
| 4/29/2018      | 11:31:40 | 19.71        | 0.67        |
| 4/29/2018      | 11:32:40 | 19.71        | 0.67        |
| 4/29/2018      | 11:33:40 | 19.72        | 0.67        |
| 4/29/2018      | 11:34:40 | 19.72        | 0.67        |
| 4/29/2018      | 11:35:40 | 19.72        | 0.67        |
| 4/29/2018      | 11:36:40 | 19.72        | 0.67        |
| 4/29/2018      | 11:37:40 | 19.72        | 0.67        |
| 4/29/2018      | 11:38:40 | 19.72        | 0.67        |
| 4/29/2018      | 11:39:40 | 19.73        | 0.67        |
| 4/29/2018      | 11:40:40 | 19.72        | 0.68        |
| 4/29/2018      | 11:41:40 | 19.72        | 0.68        |
| 4/29/2018      | 11:42:40 | 19.72        | 0.68        |
| 4/29/2018      | 11:43:40 | 19.72        | 0.69        |
| 4/29/2018      | 11:44:40 | 19.72        | 0.69        |
| 4/29/2018      | 11:45:40 | 19.72        | 0.68        |
| 4/29/2018      | 11:46:40 | 19.72        | 0.69        |
| 4/29/2018      | 11:47:40 | 19.73        | 0.69        |
| 4/29/2018      | 11:48:40 | 19.73        | 0.69        |
| 4/29/2018      | 11:49:40 | 19.72        | 0.68        |
| 4/29/2018      | 11:50:40 | 19.72        | 0.68        |
| Final Averages |          | <b>19.71</b> | <b>0.67</b> |

**Holingsworth & Vose****CFU-117****4/29/2018****Run 1****Post calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|--------|---------|
| 4/29/2018 | 11:54:30 | 0.33   | 0.08    |        |         |
| 4/29/2018 | 11:54:40 | 0.25   | 0.08    |        |         |
| 4/29/2018 | 11:54:50 | 0.11   | 0.08    |        |         |
| 4/29/2018 | 11:55:00 | 0.09   | 0.08    |        |         |
| 4/29/2018 | 11:55:10 | 0.09   | 0.09    |        |         |
| 4/29/2018 | 11:55:20 | 0.09   | 0.08    | 0.09   | 0.08    |
| 4/29/2018 | 11:55:30 | 0.08   | 0.08    |        |         |
| 4/29/2018 | 11:55:40 | 0.09   | 0.09    |        |         |
| 4/29/2018 | 11:55:50 | 0.09   | 0.08    |        |         |
| 4/29/2018 | 11:56:00 | 0.09   | 0.08    |        |         |
| 4/29/2018 | 11:56:10 | 4      | 0.19    |        |         |
| 4/29/2018 | 11:56:20 | 8.03   | 0.35    |        |         |
| 4/29/2018 | 11:56:30 | 6.76   | 5.08    |        |         |
| 4/29/2018 | 11:56:40 | 10.02  | 9.24    |        |         |
| 4/29/2018 | 11:56:50 | 11.87  | 7.65    |        |         |
| 4/29/2018 | 11:57:00 | 10.13  | 9.56    |        |         |
| 4/29/2018 | 11:57:10 | 9.9    | 9.76    |        |         |
| 4/29/2018 | 11:57:20 | 9.89   | 9.78    |        |         |
| 4/29/2018 | 11:57:30 | 9.9    | 9.79    |        |         |
| 4/29/2018 | 11:57:40 | 9.95   | 9.79    |        |         |
| 4/29/2018 | 11:57:50 | 9.95   | 9.8     |        |         |
| 4/29/2018 | 11:58:00 | 9.95   | 9.8     |        |         |
| 4/29/2018 | 11:58:10 | 9.95   | 9.8     | 9.95   |         |
| 4/29/2018 | 11:58:20 | 9.95   | 9.81    |        |         |
| 4/29/2018 | 11:58:30 | 8.76   | 8.67    |        |         |
| 4/29/2018 | 11:58:40 | 2.19   | 1.95    |        |         |
| 4/29/2018 | 11:58:50 | 1.9    | 1.83    |        |         |
| 4/29/2018 | 11:59:00 | 2.02   | 1.93    |        |         |
| 4/29/2018 | 11:59:10 | 2.02   | 1.93    |        |         |
| 4/29/2018 | 11:59:20 | 2.03   | 1.93    |        |         |
| 4/29/2018 | 11:59:30 | 2.03   | 1.93    |        |         |
| 4/29/2018 | 11:59:40 | 2.03   | 1.92    |        |         |
| 4/29/2018 | 11:59:50 | 2.03   | 1.93    |        | 1.93    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 12:36:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:37:09 | 19.81  | 0.70    |
| 4/29/2018 | 12:38:09 | 19.81  | 0.70    |
| 4/29/2018 | 12:39:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:40:09 | 19.82  | 0.69    |
| 4/29/2018 | 12:41:09 | 19.81  | 0.70    |
| 4/29/2018 | 12:42:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:43:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:44:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:45:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:46:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:47:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:48:09 | 19.81  | 0.69    |
| 4/29/2018 | 12:49:09 | 19.81  | 0.68    |
| 4/29/2018 | 12:50:09 | 19.81  | 0.68    |
| 4/29/2018 | 12:51:09 | 19.80  | 0.68    |
| 4/29/2018 | 12:52:09 | 19.80  | 0.68    |
| 4/29/2018 | 12:53:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:54:09 | 19.80  | 0.68    |
| 4/29/2018 | 12:55:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:56:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:57:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:58:09 | 19.80  | 0.69    |
| 4/29/2018 | 12:59:09 | 19.80  | 0.69    |
| 4/29/2018 | 13:00:09 | 19.80  | 0.69    |
| 4/29/2018 | 13:01:09 | 19.80  | 0.70    |
| 4/29/2018 | 13:02:09 | 19.79  | 0.70    |
| 4/29/2018 | 13:03:09 | 19.80  | 0.70    |
| 4/29/2018 | 13:04:09 | 19.79  | 0.70    |
| 4/29/2018 | 13:05:09 | 19.79  | 0.70    |
| 4/29/2018 | 13:06:09 | 19.79  | 0.70    |
| 4/29/2018 | 13:07:09 | 19.79  | 0.69    |
| 4/29/2018 | 13:08:09 | 19.79  | 0.69    |
| 4/29/2018 | 13:09:09 | 19.79  | 0.69    |
| 4/29/2018 | 13:10:09 | 19.78  | 0.69    |
| 4/29/2018 | 13:11:09 | 19.78  | 0.69    |
| 4/29/2018 | 13:12:09 | 19.78  | 0.69    |
| 4/29/2018 | 13:13:09 | 19.78  | 0.69    |
| 4/29/2018 | 13:14:09 | 19.78  | 0.68    |
| 4/29/2018 | 13:15:09 | 19.78  | 0.68    |



**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 13:16:09 | 19.78  | 0.68    |
| 4/29/2018 | 13:17:09 | 19.78  | 0.68    |
| 4/29/2018 | 13:18:09 | 19.78  | 0.68    |
| 4/29/2018 | 13:19:09 | 19.78  | 0.68    |
| 4/29/2018 | 13:20:09 | 19.78  | 0.68    |
| 4/29/2018 | 13:21:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:22:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:23:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:24:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:25:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:26:09 | 19.77  | 0.70    |
| 4/29/2018 | 13:27:09 | 19.77  | 0.70    |
| 4/29/2018 | 13:28:09 | 19.77  | 0.70    |
| 4/29/2018 | 13:29:09 | 19.77  | 0.70    |
| 4/29/2018 | 13:30:09 | 19.77  | 0.70    |
| 4/29/2018 | 13:31:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:32:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:33:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:34:09 | 19.76  | 0.69    |
| 4/29/2018 | 13:35:09 | 19.77  | 0.69    |
| 4/29/2018 | 13:36:09 | 19.76  | 0.69    |
| 4/29/2018 | 13:37:09 | 19.76  | 0.69    |
| 4/29/2018 | 13:38:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:39:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:40:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:41:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:42:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:43:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:44:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:45:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:46:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:47:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:48:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:49:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:50:09 | 19.76  | 0.68    |
| 4/29/2018 | 13:51:09 | 19.75  | 0.69    |
| 4/29/2018 | 13:52:09 | 19.75  | 0.69    |
| 4/29/2018 | 13:53:09 | 19.75  | 0.70    |
| 4/29/2018 | 13:54:09 | 19.75  | 0.69    |
| 4/29/2018 | 13:55:09 | 19.75  | 0.69    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 13:56:09 | 19.75  | 0.69    |
| 4/29/2018 | 13:57:09 | 19.75  | 0.69    |
| 4/29/2018 | 13:58:09 | 19.75  | 0.69    |
| 4/29/2018 | 13:59:09 | 19.75  | 0.69    |
| 4/29/2018 | 14:00:09 | 19.75  | 0.69    |
| 4/29/2018 | 14:01:09 | 19.75  | 0.69    |
| 4/29/2018 | 14:02:09 | 19.76  | 0.68    |
| 4/29/2018 | 14:03:09 | 19.76  | 0.68    |
| 4/29/2018 | 14:04:09 | 19.76  | 0.68    |
| 4/29/2018 | 14:05:09 | 19.76  | 0.68    |
| 4/29/2018 | 14:06:09 | 19.76  | 0.67    |
| 4/29/2018 | 14:07:09 | 19.77  | 0.68    |
| 4/29/2018 | 14:08:09 | 19.76  | 0.67    |
| 4/29/2018 | 14:09:09 | 19.76  | 0.68    |
| 4/29/2018 | 14:10:09 | 19.77  | 0.68    |
| 4/29/2018 | 14:11:09 | 19.76  | 0.68    |
| 4/29/2018 | 14:12:09 | 19.77  | 0.68    |
| 4/29/2018 | 14:13:09 | 19.77  | 0.68    |
| 4/29/2018 | 14:14:09 | 19.77  | 0.68    |
| 4/29/2018 | 14:15:09 | 19.77  | 0.69    |
| 4/29/2018 | 14:16:09 | 19.77  | 0.69    |
| 4/29/2018 | 14:17:09 | 19.77  | 0.70    |
| 4/29/2018 | 14:18:09 | 19.77  | 0.69    |
| 4/29/2018 | 14:19:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:20:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:21:09 | 19.77  | 0.69    |
| 4/29/2018 | 14:22:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:23:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:24:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:25:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:26:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:27:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:28:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:29:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:30:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:31:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:32:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:33:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:34:09 | 19.79  | 0.68    |
| 4/29/2018 | 14:35:09 | 19.79  | 0.68    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 14:36:09 | 19.79  | 0.68    |
| 4/29/2018 | 14:37:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:38:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:39:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:40:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:41:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:42:09 | 19.79  | 0.70    |
| 4/29/2018 | 14:43:09 | 19.79  | 0.70    |
| 4/29/2018 | 14:44:09 | 19.78  | 0.70    |
| 4/29/2018 | 14:45:09 | 19.79  | 0.70    |
| 4/29/2018 | 14:46:09 | 19.79  | 0.70    |
| 4/29/2018 | 14:47:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:48:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:49:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:50:09 | 19.79  | 0.69    |
| 4/29/2018 | 14:51:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:52:09 | 19.78  | 0.69    |
| 4/29/2018 | 14:53:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:54:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:55:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:56:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:57:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:58:09 | 19.78  | 0.68    |
| 4/29/2018 | 14:59:09 | 19.78  | 0.68    |
| 4/29/2018 | 15:00:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:01:09 | 19.78  | 0.68    |
| 4/29/2018 | 15:02:09 | 19.78  | 0.68    |
| 4/29/2018 | 15:03:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:04:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:05:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:06:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:07:09 | 19.78  | 0.70    |
| 4/29/2018 | 15:08:09 | 19.78  | 0.70    |
| 4/29/2018 | 15:09:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:10:09 | 19.78  | 0.70    |
| 4/29/2018 | 15:11:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:12:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:13:09 | 19.78  | 0.69    |
| 4/29/2018 | 15:14:09 | 19.77  | 0.69    |
| 4/29/2018 | 15:15:09 | 19.78  | 0.69    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2**

| Date           | Time     | O2 [%]       | CO2 [%]     |
|----------------|----------|--------------|-------------|
| 4/29/2018      | 15:16:09 | 19.78        | 0.69        |
| 4/29/2018      | 15:17:09 | 19.78        | 0.68        |
| 4/29/2018      | 15:18:09 | 19.78        | 0.69        |
| 4/29/2018      | 15:19:09 | 19.78        | 0.68        |
| 4/29/2018      | 15:20:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:21:09 | 19.78        | 0.68        |
| 4/29/2018      | 15:22:09 | 19.78        | 0.68        |
| 4/29/2018      | 15:23:09 | 19.78        | 0.68        |
| 4/29/2018      | 15:24:09 | 19.78        | 0.68        |
| 4/29/2018      | 15:25:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:26:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:27:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:28:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:29:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:30:09 | 19.78        | 0.69        |
| 4/29/2018      | 15:31:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:32:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:33:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:34:09 | 19.77        | 0.70        |
| 4/29/2018      | 15:35:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:36:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:37:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:38:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:39:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:40:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:41:09 | 19.77        | 0.69        |
| 4/29/2018      | 15:42:09 | 19.76        | 0.69        |
| 4/29/2018      | 15:43:09 | 19.76        | 0.68        |
| 4/29/2018      | 15:44:09 | 19.77        | 0.68        |
| 4/29/2018      | 15:45:09 | 19.76        | 0.68        |
| 4/29/2018      | 15:46:09 | 19.76        | 0.68        |
| 4/29/2018      | 15:47:09 | 17.21        | 0.70        |
| 4/29/2018      | 15:48:09 | 2.10         | 1.83        |
| 4/29/2018      | 15:49:09 | 7.81         | 7.66        |
| 4/29/2018      | 15:50:09 | 9.96         | 9.82        |
| 4/29/2018      | 15:51:09 | 14.98        | 2.18        |
| 4/29/2018      | 15:52:09 | 0.17         | 0.12        |
| Final Averages |          | <b>19.42</b> | <b>0.78</b> |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2 Post Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|--------|---------|
| 4/29/2018 | 15:46:19 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:46:29 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:46:39 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:46:49 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:46:59 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:47:09 | 19.76  | 0.69    |        |         |
| 4/29/2018 | 15:47:19 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:47:29 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:47:39 | 19.76  | 0.68    |        |         |
| 4/29/2018 | 15:47:49 | 18.60  | 0.73    |        |         |
| 4/29/2018 | 15:47:59 | 5.63   | 0.74    |        |         |
| 4/29/2018 | 15:48:09 | 2.34   | 1.62    |        |         |
| 4/29/2018 | 15:48:19 | 2.08   | 1.85    |        |         |
| 4/29/2018 | 15:48:29 | 2.05   | 1.88    |        |         |
| 4/29/2018 | 15:48:39 | 2.04   | 1.89    |        |         |
| 4/29/2018 | 15:48:49 | 2.04   | 1.89    |        |         |
| 4/29/2018 | 15:48:59 | 2.05   | 1.89    |        |         |
| 4/29/2018 | 15:49:09 | 2.05   | 1.90    |        | 1.89    |
| 4/29/2018 | 15:49:19 | 5.26   | 5.09    |        |         |
| 4/29/2018 | 15:49:29 | 9.68   | 9.62    |        |         |
| 4/29/2018 | 15:49:39 | 9.94   | 9.77    |        |         |
| 4/29/2018 | 15:49:49 | 9.95   | 9.79    |        |         |
| 4/29/2018 | 15:49:59 | 9.96   | 9.80    |        |         |
| 4/29/2018 | 15:50:09 | 9.96   | 9.81    |        |         |
| 4/29/2018 | 15:50:19 | 9.96   | 9.80    |        |         |
| 4/29/2018 | 15:50:29 | 9.96   | 9.81    |        |         |
| 4/29/2018 | 15:50:39 | 9.97   | 9.82    |        |         |
| 4/29/2018 | 15:50:49 | 9.97   | 9.83    | 9.97   |         |
| 4/29/2018 | 15:50:59 | 9.96   | 9.83    |        |         |
| 4/29/2018 | 15:51:09 | 12.70  | 7.55    |        |         |
| 4/29/2018 | 15:51:19 | 18.71  | 1.57    |        |         |
| 4/29/2018 | 15:51:29 | 19.62  | 0.82    |        |         |
| 4/29/2018 | 15:51:39 | 19.73  | 0.74    |        |         |
| 4/29/2018 | 15:51:49 | 16.22  | 1.67    |        |         |
| 4/29/2018 | 15:51:59 | 2.90   | 0.71    |        |         |
| 4/29/2018 | 15:52:09 | 0.38   | 0.18    |        |         |
| 4/29/2018 | 15:52:19 | 0.16   | 0.12    |        |         |
| 4/29/2018 | 15:52:29 | 0.13   | 0.12    |        |         |
| 4/29/2018 | 15:52:39 | 0.12   | 0.11    |        |         |
| 4/29/2018 | 15:52:49 | 0.12   | 0.11    |        |         |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #2 Post Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|--------|---------|
| 4/29/2018 | 15:52:59 | 0.12   | 0.11    |        |         |
| 4/29/2018 | 15:53:09 | 0.11   | 0.10    |        |         |
| 4/29/2018 | 15:53:19 | 0.11   | 0.10    |        |         |
| 4/29/2018 | 15:53:29 | 0.11   | 0.09    |        |         |
| 4/29/2018 | 15:53:39 | 0.10   | 0.10    |        |         |
| 4/29/2018 | 15:53:49 | 0.10   | 0.09    | 0.10   | 0.09    |

**Hollingsworth & Vose**  
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**4/29/2018**  
**Run #3**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 16:02:08 | 19.75  | 0.67    |
| 4/29/2018 | 16:03:08 | 19.76  | 0.68    |
| 4/29/2018 | 16:04:08 | 19.76  | 0.68    |
| 4/29/2018 | 16:05:08 | 19.76  | 0.68    |
| 4/29/2018 | 16:06:08 | 19.76  | 0.68    |
| 4/29/2018 | 16:07:08 | 19.76  | 0.68    |
| 4/29/2018 | 16:08:08 | 19.76  | 0.68    |
| 4/29/2018 | 16:09:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:10:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:11:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:12:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:13:08 | 19.76  | 0.70    |
| 4/29/2018 | 16:14:08 | 19.76  | 0.70    |
| 4/29/2018 | 16:15:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:16:08 | 19.76  | 0.69    |
| 4/29/2018 | 16:17:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:18:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:19:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:20:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:21:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:22:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:23:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:24:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:25:08 | 19.77  | 0.67    |
| 4/29/2018 | 16:26:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:27:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:28:08 | 19.77  | 0.67    |
| 4/29/2018 | 16:29:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:30:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:31:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:32:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:33:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:34:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:35:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:36:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:37:08 | 19.78  | 0.69    |
| 4/29/2018 | 16:38:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:39:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:40:08 | 19.78  | 0.69    |
| 4/29/2018 | 16:41:08 | 19.77  | 0.69    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #3**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 16:42:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:43:08 | 19.77  | 0.69    |
| 4/29/2018 | 16:44:08 | 19.78  | 0.69    |
| 4/29/2018 | 16:45:08 | 19.78  | 0.69    |
| 4/29/2018 | 16:46:08 | 19.78  | 0.68    |
| 4/29/2018 | 16:47:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:48:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:49:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:50:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:51:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:52:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:53:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:54:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:55:08 | 19.77  | 0.67    |
| 4/29/2018 | 16:56:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:57:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:58:08 | 19.77  | 0.68    |
| 4/29/2018 | 16:59:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:00:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:01:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:02:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:03:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:04:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:05:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:06:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:07:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:08:08 | 19.78  | 0.69    |
| 4/29/2018 | 17:09:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:10:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:11:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:12:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:13:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:14:08 | 19.78  | 0.67    |
| 4/29/2018 | 17:15:08 | 19.78  | 0.67    |
| 4/29/2018 | 17:16:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:17:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:18:08 | 19.78  | 0.67    |
| 4/29/2018 | 17:19:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:20:08 | 19.78  | 0.67    |
| 4/29/2018 | 17:21:08 | 19.78  | 0.68    |



**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #3**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 17:22:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:23:08 | 19.78  | 0.68    |
| 4/29/2018 | 17:24:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:25:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:26:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:27:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:28:08 | 19.78  | 0.69    |
| 4/29/2018 | 17:29:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:30:08 | 19.77  | 0.70    |
| 4/29/2018 | 17:31:08 | 19.77  | 0.70    |
| 4/29/2018 | 17:32:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:33:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:34:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:35:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:36:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:37:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:38:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:39:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:40:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:41:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:42:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:43:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:44:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:45:08 | 19.77  | 0.68    |
| 4/29/2018 | 17:46:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:47:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:48:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:49:08 | 19.77  | 0.69    |
| 4/29/2018 | 17:50:08 | 19.78  | 0.69    |
| 4/29/2018 | 17:51:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:52:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:53:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:54:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:55:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:56:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:57:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:58:08 | 19.78  | 0.70    |
| 4/29/2018 | 17:59:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:00:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:01:08 | 19.78  | 0.69    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #3**

| Date      | Time     | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|
| 4/29/2018 | 18:02:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:03:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:04:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:05:08 | 19.78  | 0.68    |
| 4/29/2018 | 18:06:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:07:08 | 19.79  | 0.68    |
| 4/29/2018 | 18:08:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:09:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:10:08 | 19.78  | 0.69    |
| 4/29/2018 | 18:11:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:12:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:13:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:14:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:15:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:16:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:17:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:18:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:19:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:20:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:21:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:22:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:23:08 | 19.79  | 0.70    |
| 4/29/2018 | 18:24:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:25:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:26:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:27:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:28:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:29:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:30:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:31:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:32:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:33:08 | 19.79  | 0.69    |
| 4/29/2018 | 18:34:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:35:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:36:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:37:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:38:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:39:08 | 19.80  | 0.70    |
| 4/29/2018 | 18:40:08 | 19.80  | 0.69    |
| 4/29/2018 | 18:41:08 | 19.80  | 0.70    |

**Hollingsworth & Vose****CFU-117****4/29/2018****Run #3**

| Date          | Time     | O2 [%] | CO2 [%] |
|---------------|----------|--------|---------|
| 4/29/2018     | 18:42:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:43:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:44:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:45:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:46:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:47:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:48:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:49:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:50:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:51:08 | 19.80  | 0.69    |
| 4/29/2018     | 18:52:08 | 19.80  | 0.70    |
| 4/29/2018     | 18:53:08 | 19.80  | 0.69    |
| 4/29/2018     | 18:54:08 | 19.80  | 0.69    |
| 4/29/2018     | 18:55:08 | 19.80  | 0.69    |
| 4/29/2018     | 18:56:08 | 19.80  | 0.68    |
| 4/29/2018     | 18:57:08 | 19.80  | 0.69    |
| 4/29/2018     | 18:58:08 | 19.81  | 0.69    |
| 4/29/2018     | 18:59:08 | 19.81  | 0.69    |
| 4/29/2018     | 19:00:08 | 19.85  | 0.69    |
| 4/29/2018     | 19:01:08 | 19.82  | 0.69    |
| 4/29/2018     | 19:02:08 | 19.82  | 0.69    |
| 4/29/2018     | 19:03:08 | 19.82  | 0.69    |
| 4/29/2018     | 19:04:08 | 19.82  | 0.70    |
| 4/29/2018     | 19:05:08 | 19.82  | 0.70    |
| 4/29/2018     | 19:06:08 | 19.83  | 0.70    |
| Run averages: |          | 19.78  | 0.69    |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #3 Post Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|--------|---------|
| 4/29/2018 | 19:06:18 | 19.83  | 0.70    |        |         |
| 4/29/2018 | 19:06:28 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:06:38 | 19.83  | 0.72    |        |         |
| 4/29/2018 | 19:06:48 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:06:58 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:07:08 | 19.82  | 0.71    |        |         |
| 4/29/2018 | 19:07:18 | 19.83  | 0.70    |        |         |
| 4/29/2018 | 19:07:28 | 19.82  | 0.71    |        |         |
| 4/29/2018 | 19:07:38 | 19.82  | 0.71    |        |         |
| 4/29/2018 | 19:07:48 | 19.82  | 0.71    |        |         |
| 4/29/2018 | 19:07:58 | 19.82  | 0.71    |        |         |
| 4/29/2018 | 19:08:08 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:08:18 | 19.83  | 0.71    |        |         |
| 4/29/2018 | 19:08:28 | 19.82  | 0.72    |        |         |
| 4/29/2018 | 19:08:38 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:08:48 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:08:58 | 19.82  | 0.70    |        |         |
| 4/29/2018 | 19:09:55 | 20.76  | 0.14    |        |         |
| 4/29/2018 | 19:10:05 | 20.77  | 0.14    |        |         |
| 4/29/2018 | 19:10:15 | 20.76  | 0.14    |        |         |
| 4/29/2018 | 19:10:25 | 20.77  | 0.13    |        |         |
| 4/29/2018 | 19:10:35 | 20.76  | 0.14    |        |         |
| 4/29/2018 | 19:10:45 | 20.76  | 0.15    |        |         |
| 4/29/2018 | 19:10:55 | 20.77  | 0.14    |        |         |
| 4/29/2018 | 19:11:05 | 20.77  | 0.13    |        |         |
| 4/29/2018 | 19:11:15 | 20.77  | 0.14    |        |         |
| 4/29/2018 | 19:11:25 | 18.23  | 0.46    |        |         |
| 4/29/2018 | 19:11:35 | 10.72  | 7.26    |        |         |
| 4/29/2018 | 19:11:45 | 10.14  | 9.63    |        |         |
| 4/29/2018 | 19:11:55 | 10.04  | 9.77    |        |         |
| 4/29/2018 | 19:12:05 | 10.02  | 9.79    |        |         |
| 4/29/2018 | 19:12:15 | 10.02  | 9.81    |        |         |
| 4/29/2018 | 19:12:25 | 10.01  | 9.81    |        |         |
| 4/29/2018 | 19:12:35 | 10.01  | 9.82    |        |         |
| 4/29/2018 | 19:12:45 | 10.01  | 9.82    |        |         |
| 4/29/2018 | 19:12:55 | 10.01  | 9.82    |        |         |
| 4/29/2018 | 19:13:05 | 9.99   | 9.82    | 10.00  |         |
| 4/29/2018 | 19:13:15 | 4.63   | 4.39    |        |         |
| 4/29/2018 | 19:13:25 | 1.76   | 1.57    |        |         |
| 4/29/2018 | 19:13:35 | 2.10   | 1.97    |        |         |

**Hollingsworth & Vose**  
**CFU-117**  
**4/29/2018**  
**Run #3 Post Calibrations**

| Date      | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|-----------|----------|--------|---------|--------|---------|
| 4/29/2018 | 19:13:45 | 2.09   | 1.97    |        |         |
| 4/29/2018 | 19:13:55 | 2.08   | 1.95    |        |         |
| 4/29/2018 | 19:14:05 | 2.07   | 1.94    |        |         |
| 4/29/2018 | 19:14:15 | 2.07   | 1.94    |        |         |
| 4/29/2018 | 19:14:25 | 2.08   | 1.94    |        | 1.94    |
| 4/29/2018 | 19:14:35 | 3.05   | 1.89    |        |         |
| 4/29/2018 | 19:14:45 | 3.83   | 0.92    |        |         |
| 4/29/2018 | 19:14:55 | 0.51   | 0.21    |        |         |
| 4/29/2018 | 19:15:05 | 0.17   | 0.13    |        |         |
| 4/29/2018 | 19:15:15 | 0.13   | 0.13    |        |         |
| 4/29/2018 | 19:15:25 | 0.13   | 0.12    |        |         |
| 4/29/2018 | 19:15:35 | 0.12   | 0.12    |        |         |
| 4/29/2018 | 19:15:45 | 0.13   | 0.12    |        |         |
| 4/29/2018 | 19:15:55 | 0.12   | 0.11    |        |         |
| 4/29/2018 | 19:16:05 | 0.12   | 0.11    |        |         |
| 4/29/2018 | 19:16:15 | 0.12   | 0.11    | 0.12   | 0.11    |

04/24/18 - Day 1 Log

CFU - 117 RF #1

NO<sub>x</sub>, CO, VOC, O<sub>2</sub>, CO<sub>2</sub>

gaseous sampling

07:45 \* - leak check & flow plugged (see video)  
- calibration targets

AS - NO<sub>x</sub> - <sup>DSB</sup> 0/100/200 0/5/10

- AS - CO - 0/100/200

VOC - 0/15/<sup>225</sup>25/4

- AS - O<sub>2</sub> - 0/10/20 <sup>DSB</sup>

- AS - CO<sub>2</sub> - 0/2/4

+ - NO<sub>2</sub> - 51.91 ~ 57.8 response

✓ - M-205 w/o,

10/5/10/5/10/5 - <sup>PSD</sup> <sup>DSB</sup> ~~from direct~~ 0/10/10/10/5

Direct tank 0/9.898/0/9.898/0/9.898

Stratification check points

16.7%, 50% and 83.3%

30" TD 5.01", 15", and 25"

09:00 \* Alt 106 meth. check 100 ppm  
Pass

\* Time off 65 1-hour

~ 09:00 \* Start 205 @ 9:00 - end 205

\* Clock fixed @ 09:51

\* 0.5 ppm marker ~~at~~ diff to be utilized

\* ~~NO<sub>2</sub>~~ @ 57.8 Response (51.91)

\* Calibration complete @ 12:27

\* begin stat check @ 12:35

Test on CFU-117

R-1 @ 13:00 - ~~14:30~~ <sup>25B</sup> 14:30  
Process down

cal @ 14:35

~~R-2~~

VOL Failed post cal

Re-Run 1 within Run 2

04/25/14

VOL - 0/1.5/2.5/4.0 - 5 ppm range

CFU 118

4/26 leak check @ 6:40 - Flow "Pass"  
begin gals @ 6:50

PSD

M-29 / O<sub>2</sub>/CO<sub>2</sub> L1 - 114

04/28

Leak check

⊗ flow "pass"

cal O<sub>2</sub>/CO<sub>2</sub>

O<sub>2</sub> - 0/10/20 0/10

CO<sub>2</sub> - 0/2/4 0/2

R-1 9:18

12:28

R-2 13:09

16:17

R-3 16:45

19:53

Leak check ⊗ flow pass

04/29

perform leak check

⊗ Flow "Pass"

M-205 and Calibrate

M-29/M-30B O<sub>2</sub>/CO<sub>2</sub>

R-1 8:42 - 11:50

R-2 12:36 - 15:46

R-3 16:02 -

perform leak check ⊗ flow  
"Pass"



04/30

ALL gasses  
Leak Check & Flow Pass  
calibrate analyzers

DEB

~~pass~~

| A                                             | S                                                      |
|-----------------------------------------------|--------------------------------------------------------|
| O <sub>2</sub> - <del>0/10/20</del> 0/10/20 ✓ | 0/10 ✓                                                 |
| CO <sub>2</sub> - 0/2/4 ✓                     | 0/2 ✓                                                  |
| NO <sub>x</sub> - 0/5/10 ✓                    | 0/5 ✓                                                  |
| CO - 0/100/200 ✓                              | 0/100 ✓                                                |
| VOC - 0/1.5/2.5/4 (5 span)                    | 0/2.5                                                  |
| M-106 CH <sub>4</sub> @ 10 and 100            | 20 C <sub>3</sub> H <sub>8</sub><br>80 CH <sub>4</sub> |
| NO <sub>2</sub> - (51.91) 90% ✓               |                                                        |

R-1 8:42

10:47

R-2 11:35 <sup>DSB</sup>

13:34 ~~4~~

R-2 14:29

16:34

POST check

Leak check "pass" & Flow

05/01

Leak check & Flow "Pass"

O<sub>2</sub> - ~~0/10/20~~ <sup>DSB</sup> 0/10/20

CO<sub>2</sub> - ~~0/2/4~~ 0/2/4

over →

05/01 - continue

65 H3/HR

Start R-1 8:40  
9:44

R-2 9:57  
R-2 11:01

R-3 11:10  
12:14

change over to 118 -  
calibrate CO

prep for RATA

DAS 1-hour behind!!!

R-1 13:30 - 13:51

R-2 13:52 - 14:13

C1 R-3 14:17 - 14:38

R-4 14:55 - 15:16

R-5 15:18 - 15:39

C2 R-6 15:44 void

R-7

R-8

C3 R-9

R-10

R-11

C4 R-12

Process down

CEM OFF 64

Factor of 5

SOLAR testing with



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 117              |
| DATE      | 04/30/18             |
| METHOD    | M5                   |
| POLLUTANT | PM                   |

**Isokinetic Field Data**
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M5  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
 Cloudy, 50 degrees

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 10:47  
**Date:** 4/30/2018

**Stack Dimensional Data:**

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
 Y factor 0.9820  
 ΔH@ 1.8073  
 Probe ID 3C  
 Nozzle ID 0.214  
 Hot box ID 1  
 Pitot Cp 0.84  
 Liner type Glass  
 Nozzle size 0.2140 inches  
 Nozzle area 0.00025 sq.ft.  
 Probe heat 250 F  
 Filter heat 250 F

**Source Information:**

Barometric Pressure 30.06 "Hg  
 Static Pressure 0.6 "H<sub>2</sub>O  
 Ave. ΔP 1.6 "H<sub>2</sub>O  
 Stack Temperature 250 F  
 Assumed moisture 2 %  
 Assumed meter temp. 55 F  
 Total number of points 20  
 Time per point 6  
 Total run time 120  
 O<sub>2</sub> 20.14 %  
 CO<sub>2</sub> 0.64 %  
 Rec. Nz. 0.198 inches

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 11       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 105.650 dcf  
 Wet mol. weight 28.73 M<sub>s</sub> (actual)  
 Actual H<sub>2</sub>O 1.66 %  
 Std. meter vol. 107.445 dscf  
 Isokinetic Average 99.7 %  
 Ave. ΔP 1.555 "H<sub>2</sub>O  
 Ave. √ΔP 1.2458 "H<sub>2</sub>O  
 Ave. ΔH 2.545 "H<sub>2</sub>O  
 Ave. T<sub>s</sub> 244 °F  
 Ave. T<sub>m</sub> 55.2 °F

**Moisture/Lab:**

| Filter            | Q1313 # | Initial | Final | Gain |
|-------------------|---------|---------|-------|------|
| Impingers, g      | 200.0   | 216     | 16.0  |      |
| Silica gel, g     | 261.2   | 283.8   | 22.6  |      |
| Total water gain: |         |         |       | 38.6 |

| Traversal Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|-----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1               | 6           | 887.745            | 1.30                            | 237              | 45               | 2.12     | 2.00   | 4            | 253             | 47                     |
| 2               | 12          | 892.460            | 1.60                            | 238              | 51               | 2.63     | 2.60   | 4            | 256             | 45                     |
| 3               | 18          | 897.750            | 1.60                            | 239              | 52               | 2.63     | 2.60   | 4            | 254             | 46                     |
| 4               | 24          | 903.100            | 1.70                            | 242              | 52               | 2.79     | 2.80   | 4            | 255             | 46                     |
| 5               | 30          | 908.590            | 1.80                            | 243              | 53               | 2.95     | 3.00   | 4            | 253             | 46                     |
| 6               | 36          | 914.300            | 1.60                            | 244              | 53               | 2.62     | 2.60   | 4            | 258             | 47                     |
| 7               | 42          | 919.660            | 1.60                            | 244              | 54               | 2.63     | 2.60   | 4            | 254             | 47                     |
| 8               | 48          | 924.990            | 1.60                            | 244              | 54               | 2.63     | 2.60   | 4            | 256             | 47                     |
| 9               | 54          | 930.350            | 1.40                            | 244              | 55               | 2.30     | 2.30   | 4            | 257             | 47                     |
| 10              | 60          | 935.430            | 1.50                            | 242              | 55               | 2.47     | 2.50   | 4            | 254             | 47                     |
| 11              | 66          | 940.592            | 1.40                            | 241              | 56               | 2.32     | 2.30   | 4            | 259             | 49                     |
| 12              | 72          | 945.590            | 1.50                            | 241              | 57               | 2.49     | 2.50   | 4            | 255             | 45                     |
| 13              | 78          | 950.840            | 1.50                            | 245              | 57               | 2.47     | 2.50   | 4            | 256             | 46                     |
| 14              | 84          | 956.090            | 1.60                            | 248              | 57               | 2.63     | 2.60   | 4            | 255             | 47                     |
| 15              | 90          | 961.460            | 1.70                            | 248              | 58               | 2.80     | 2.80   | 4            | 255             | 48                     |
| 16              | 96          | 967.000            | 1.70                            | 248              | 58               | 2.80     | 2.80   | 4            | 255             | 47                     |
| 17              | 102         | 972.560            | 1.70                            | 249              | 59               | 2.80     | 2.80   | 4            | 253             | 48                     |
| 18              | 108         | 978.110            | 1.60                            | 247              | 59               | 2.64     | 2.60   | 4            | 256             | 48                     |
| 19              | 114         | 983.490            | 1.40                            | 247              | 59               | 2.31     | 2.30   | 4            | 252             | 48                     |
| 20              | 120         | 988.540            | 1.30                            | 248              | 59               | 2.14     | 2.10   | 4            | 253             | 48                     |
|                 |             | 993.395            |                                 |                  |                  |          |        |              |                 |                        |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M5  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy, 50 degrees

**Run:** 2  
**Start Time:** 11:35  
**End Time:** 13:39  
**Date:** 4/30/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 3C Liner type: Glass  
Y factor 0.9820 Nozzle ID 0.214 Nozzle size: 0.2140 inches  
 $\Delta H@$  1.8073 Hot box ID 1 Nozzle area: 0.00025 sq.ft.  
Pitot Cp 0.84 Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 30.03 "Hg O<sub>2</sub> 20.19 %  
Static Pressure 0.6 "H<sub>2</sub>O CO<sub>2</sub> 0.65 %  
Ave.  $\Delta P$  1.6 "H<sub>2</sub>O Rec. Nz. 0.198 inches  
Stack Temperature 250 F  
Assumed moisture 1.66 %  
Assumed meter temp. 55.2 F  
Total number of points 20  
Time per point 6  
Total run time 120

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 12       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 110.958 dcf Ave.  $\Delta P$  1.695 "H<sub>2</sub>O  
Wet mol. weight 28.72 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.3002 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 1.7 % Ave.  $\Delta H$  2.785 "H<sub>2</sub>O  
Std. meter vol. 111.564 dscf Ave. T<sub>s</sub> 252.9 °F  
Isokinetic Average 99.9 % Ave. T<sub>m</sub> 60.9 °F

**Moisture/Lab:**

| Filter            | Q1314 # |       |      |  |
|-------------------|---------|-------|------|--|
|                   | Initial | Final | Gain |  |
| Impingers, g      | 200.0   | 218   | 18.0 |  |
| Silica gel, g     | 238.0   | 261   | 23.0 |  |
| Total water gain: |         |       | 41.0 |  |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 6           | 993.548            | 1.40                                    | 248              | 60               | 2.32             | 2.30           | 4            | 255             | 43                     |
| 2              | 12          | 998.570            | 1.60                                    | 249              | 59               | 2.65             | 2.60           | 4            | 257             | 41                     |
| 3              | 18          | 1003.920           | 1.80                                    | 247              | 59               | 2.99             | 3.00           | 4            | 252             | 43                     |
| 4              | 24          | 1009.690           | 1.90                                    | 250              | 59               | 3.14             | 3.10           | 4            | 255             | 45                     |
| 5              | 30          | 1015.600           | 1.80                                    | 253              | 58               | 2.96             | 2.90           | 4            | 260             | 46                     |
| 6              | 36          | 1021.210           | 1.80                                    | 254              | 59               | 2.96             | 2.90           | 4            | 254             | 48                     |
| 7              | 42          | 1026.910           | 1.80                                    | 254              | 59               | 2.96             | 2.90           | 4            | 256             | 49                     |
| 8              | 48          | 1032.610           | 1.60                                    | 255              | 60               | 2.63             | 2.60           | 4            | 254             | 49                     |
| 9              | 54          | 1037.980           | 1.50                                    | 255              | 61               | 2.47             | 2.50           | 4            | 255             | 49                     |
| 10             | 60          | 1043.250           | 1.30                                    | 255              | 61               | 2.14             | 2.10           | 4            | 255             | 49                     |
| 11             | 66          | 1048.080           | 1.40                                    | 250              | 62               | 2.33             | 2.30           | 4            | 254             | 54                     |
| 12             | 72          | 1053.200           | 1.80                                    | 253              | 62               | 2.98             | 3.00           | 4            | 255             | 46                     |
| 13             | 78          | 1058.870           | 1.80                                    | 254              | 62               | 2.97             | 3.00           | 4            | 255             | 49                     |
| 14             | 84          | 1064.620           | 1.90                                    | 254              | 62               | 3.14             | 3.10           | 4            | 252             | 49                     |
| 15             | 90          | 1070.480           | 1.80                                    | 254              | 62               | 2.97             | 3.00           | 4            | 258             | 49                     |
| 16             | 96          | 1076.280           | 1.80                                    | 254              | 62               | 2.97             | 3.00           | 4            | 257             | 50                     |
| 17             | 102         | 1082.020           | 1.70                                    | 255              | 62               | 2.80             | 2.80           | 4            | 255             | 52                     |
| 18             | 108         | 1087.600           | 1.70                                    | 255              | 62               | 2.80             | 2.80           | 4            | 255             | 54                     |
| 19             | 114         | 1093.170           | 1.70                                    | 255              | 63               | 2.81             | 2.80           | 4            | 254             | 56                     |
| 20             | 120         | 1098.740           | 1.80                                    | 254              | 63               | 2.98             | 3.00           | 4            | 255             | 55                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M5  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy, 50 degrees

**Run:** 3  
**Start Time:** 14:29  
**End Time:** 16:34  
**Date:** 4/30/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
 $\Delta H$ @ 1.8073  
Probe ID 3C  
Nozzle ID 0.214  
Hot box ID 1  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.2140 inches  
Nozzle area: 0.00025 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 30.03 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.6 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 1.7 %  
Assumed meter temp. 60.9 F  
Total number of points 20  
Time per point 6  
Total run time 120  
O<sub>2</sub> 20.24 %  
CO<sub>2</sub> 0.55 %  
Rec. Nz. 0.196 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 10       | 13        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 111.722 dcf  
Wet mol. weight 28.72 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.66 %  
Std. meter vol. 111.569 dscf  
Isokinetic Average 100.0 %  
Ave.  $\Delta P$  1.7 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.302 "H<sub>2</sub>O  
Ave.  $\Delta H$  2.81 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 256 °F  
Ave. T<sub>m</sub> 64.5 °F

**Moisture/Lab:**

|                   | Q1315 # |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 218   | 18.0 |
| Silica gel, g     | 238.3   | 260.3 | 22.0 |
| Total water gain: |         |       | 40.0 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 6           | 104.629            | 1.30                                    | 250              | 63               | 2.16             | 2.20           | 4            | 256             | 52                     |
| 2              | 12          | 114.820            | 1.50                                    | 256              | 63               | 2.47             | 2.50           | 4            | 256             | 51                     |
| 3              | 18          | 120.420            | 1.70                                    | 257              | 63               | 2.80             | 2.80           | 4            | 256             | 50                     |
| 4              | 24          | 126.230            | 1.80                                    | 255              | 63               | 2.97             | 3.00           | 4            | 255             | 47                     |
| 5              | 30          | 132.100            | 1.90                                    | 259              | 63               | 3.12             | 3.10           | 4            | 253             | 44                     |
| 6              | 36          | 137.940            | 1.90                                    | 257              | 64               | 3.14             | 3.10           | 4            | 259             | 44                     |
| 7              | 42          | 143.730            | 1.80                                    | 256              | 64               | 2.98             | 3.00           | 4            | 255             | 45                     |
| 8              | 48          | 149.460            | 1.80                                    | 257              | 64               | 2.97             | 3.00           | 4            | 256             | 46                     |
| 9              | 54          | 155.150            | 1.80                                    | 257              | 64               | 2.97             | 3.00           | 4            | 257             | 47                     |
| 10             | 60          | 160.790            | 1.70                                    | 258              | 64               | 2.80             | 2.80           | 4            | 258             | 48                     |
| 11             | 66          | 166.380            | 1.70                                    | 255              | 65               | 2.82             | 2.80           | 4            | 255             | 55                     |
| 12             | 72          | 172.000            | 1.70                                    | 255              | 65               | 2.82             | 2.80           | 4            | 256             | 49                     |
| 13             | 78          | 177.910            | 1.90                                    | 257              | 66               | 3.15             | 3.10           | 4            | 260             | 49                     |
| 14             | 84          | 183.730            | 1.80                                    | 257              | 66               | 2.98             | 3.00           | 4            | 257             | 49                     |
| 15             | 90          | 189.510            | 1.80                                    | 256              | 66               | 2.99             | 3.00           | 4            | 255             | 49                     |
| 16             | 96          | 195.230            | 1.80                                    | 256              | 66               | 2.99             | 3.00           | 4            | 262             | 49                     |
| 17             | 102         | 200.770            | 1.70                                    | 256              | 66               | 2.82             | 2.80           | 4            | 256             | 47                     |
| 18             | 108         | 206.230            | 1.60                                    | 255              | 65               | 2.65             | 2.60           | 4            | 251             | 46                     |
| 19             | 114         | 211.530            | 1.50                                    | 256              | 65               | 2.48             | 2.50           | 4            | 255             | 46                     |
| 20             | 120         | 216.351            | 1.30                                    | 255              | 64               | 2.15             | 2.10           | 4            | 261             | 46                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Particulate Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** ODEQ 5

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 10:47  
**Date:** 4/30/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 887.745                  |                                 |                            |                   |                         |                            |             |
| 6             | 892.460                  | 2.00                            | 45                         | 1                 | 1.30                    | 237                        | 1.1402      |
| 12            | 897.750                  | 2.60                            | 51                         | 2                 | 1.60                    | 238                        | 1.2649      |
| 18            | 903.100                  | 2.60                            | 52                         | 3                 | 1.60                    | 239                        | 1.2649      |
| 24            | 908.590                  | 2.80                            | 52                         | 4                 | 1.70                    | 242                        | 1.3038      |
| 30            | 914.300                  | 3.00                            | 53                         | 5                 | 1.80                    | 243                        | 1.3416      |
| 36            | 919.660                  | 2.60                            | 53                         | 6                 | 1.60                    | 244                        | 1.2649      |
| 42            | 924.990                  | 2.60                            | 54                         | 7                 | 1.60                    | 244                        | 1.2649      |
| 48            | 930.350                  | 2.60                            | 54                         | 8                 | 1.60                    | 244                        | 1.2649      |
| 54            | 935.430                  | 2.30                            | 55                         | 9                 | 1.40                    | 244                        | 1.1832      |
| 60            | 940.592                  | 2.50                            | 55                         | 10                | 1.50                    | 242                        | 1.2247      |
| 66            | 945.590                  | 2.30                            | 56                         | 11                | 1.40                    | 241                        | 1.1832      |
| 72            | 950.840                  | 2.50                            | 57                         | 12                | 1.50                    | 241                        | 1.2247      |
| 78            | 956.090                  | 2.50                            | 57                         | 13                | 1.50                    | 245                        | 1.2247      |
| 84            | 961.460                  | 2.60                            | 57                         | 14                | 1.60                    | 248                        | 1.2649      |
| 90            | 967.000                  | 2.80                            | 58                         | 15                | 1.70                    | 248                        | 1.3038      |
| 96            | 972.560                  | 2.80                            | 58                         | 16                | 1.70                    | 248                        | 1.3038      |
| 102           | 978.110                  | 2.80                            | 59                         | 17                | 1.70                    | 249                        | 1.3038      |
| 108           | 983.490                  | 2.60                            | 59                         | 18                | 1.60                    | 247                        | 1.2649      |
| 114           | 988.540                  | 2.30                            | 59                         | 19                | 1.40                    | 247                        | 1.1832      |
| 120           | 993.395                  | 2.10                            | 59                         | 20                | 1.30                    | 248                        | 1.1402      |

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 1  
Date: 04/30/18

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**Field Data Input Continued**Moisture Data

|                        |                 |
|------------------------|-----------------|
| Total Test Time        | 120 min         |
| Sample Time Interval   | 6 min           |
| Meter Volume, $V_m$    | 105.650 dcf     |
| Water Volume           | 38.6 ml (g)     |
| Nozzle Diameter, $N_z$ | 0.2140 in.      |
| Nozzle Area            | 0.000250 sq.ft. |

Stack Dimensional Data:

|             |              |
|-------------|--------------|
| Circular    |              |
| Diameter    | 30.000 in    |
| Rectangular |              |
| Width       | in           |
| Length      | in           |
| Stack Area  | 4.909 sq.ft. |

Traverse Data

|                            |                        |
|----------------------------|------------------------|
| Barometric Pressure, $P_b$ | 30.06 "Hg              |
| Static Pressure            | 0.60 "H <sub>2</sub> O |
| Pitot Factor, cp           | 0.84                   |
| Meter Cal Factor           | 0.9820 Y               |

Molecular Weight:

|                         |           |
|-------------------------|-----------|
| CO <sub>2</sub> Average | 0.64 %vd  |
| O <sub>2</sub> Average  | 20.14 %vd |

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**Field Data Averages**Meter

|                       |                         |
|-----------------------|-------------------------|
| $\Delta H$            | 2.545 "H <sub>2</sub> O |
| Temperature, $T_m$    | 55.2 °F                 |
| Temperature, $T_m$    | 515.2 °A (°R)           |
| Pressure Meter, $P_m$ | 30.247 "Hg              |

Stack

|                       |                          |
|-----------------------|--------------------------|
| $\sqrt{D_p}$          | 1.2458 "H <sub>2</sub> O |
| Temperature, $T_s$    | 244.0 °F                 |
| Temperature, $T_s$    | 704.0 °A (°R)            |
| Pressure Stack, $P_s$ | 30.104 "Hg               |

**Field Data Calculations**Meter Box Capture

|                                |              |
|--------------------------------|--------------|
| Standard Volume, $V_{m(std)}$  | 107.445 dscf |
|                                | 3.042 dscm   |
| Actual Volume, $V_{m(actual)}$ | 144.846 awcf |

EPA Method 2 Stack Gas Flowrate:

|                   |                     |
|-------------------|---------------------|
| Velocity, $V_s$   | 80.71 fps           |
| Volume (actual)   | 23,772.3 awcfm      |
|                   | 23,377.7 adcfm      |
| Volume (standard) | 1,076,333.3 wscf/hr |
|                   | 1,058,466.2 dscf/hr |
|                   | 17,641.1 dscf/min   |

Gas Stream Moisture

|                              |           |
|------------------------------|-----------|
| Moisture Vapor, $V_{w(std)}$ | 1.817 scf |
| Moisture, $B_{ws}$           | 0.0166    |
| Moisture EPA M4              | 1.66 %v   |

EPA Method 3 Gas Density

|            |                  |
|------------|------------------|
| Dry, $M_d$ | 28.91 lb/lb-mole |
| Wet, $M_s$ | 28.73 lb/lb-mole |

|                    |        |
|--------------------|--------|
| Percent Isokinetic | 99.7 % |
|--------------------|--------|

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**Laboratory Results****EPA Method 5**

|               |               |
|---------------|---------------|
| Filterable PM | 0.00223 grams |
|---------------|---------------|

**Emissions:**

|                      |                  |
|----------------------|------------------|
| Concentration, $C_s$ | 3.20E-04 gr/dscf |
|                      | 733 µg/dscm      |
| Mass Emissions       | 4.84E-02 lb/hr   |

**Back Half:**

|                      |                  |
|----------------------|------------------|
| Inorganic CPM        | 1.78E-03 grams   |
| Inorganic CPM, $C_s$ | 2.55E-04 gr/dscf |
|                      | 584 µg/dscm      |
| Mass Emissions       | 3.86E-02 lb/hr   |

|                    |                  |
|--------------------|------------------|
| Organic CPM        | 1.24E-03 grams   |
| Organic CPM, $C_s$ | 1.78E-04 gr/dscf |
|                    | 409 µg/dscm      |
| Mass Emissions     | 2.70E-02 lb/hr   |



**Isokinetic Field Data**  
**Field Data and Calculations**  
**Particulate Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** ODEQ 5

**Run:** 2  
**Start Time:** 11:35  
**End Time:** 13:39  
**Date:** 04/30/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 993.548                  |                                 |                            |                   |                         |                            |             |
| 6             | 998.570                  | 2.30                            | 60                         | 1                 | 1.40                    | 248                        | 1.1832      |
| 12            | 1003.920                 | 2.60                            | 59                         | 2                 | 1.60                    | 249                        | 1.2649      |
| 18            | 1009.690                 | 3.00                            | 59                         | 3                 | 1.80                    | 247                        | 1.3416      |
| 24            | 1015.600                 | 3.10                            | 59                         | 4                 | 1.90                    | 250                        | 1.3784      |
| 30            | 1021.210                 | 2.90                            | 58                         | 5                 | 1.80                    | 253                        | 1.3416      |
| 36            | 1026.910                 | 2.90                            | 59                         | 6                 | 1.80                    | 254                        | 1.3416      |
| 42            | 1032.610                 | 2.90                            | 59                         | 7                 | 1.80                    | 254                        | 1.3416      |
| 48            | 1037.980                 | 2.60                            | 60                         | 8                 | 1.60                    | 255                        | 1.2649      |
| 54            | 1043.250                 | 2.50                            | 61                         | 9                 | 1.50                    | 255                        | 1.2247      |
| 60            | 1048.080                 | 2.10                            | 61                         | 10                | 1.30                    | 255                        | 1.1402      |
| 66            | 1053.200                 | 2.30                            | 62                         | 11                | 1.40                    | 250                        | 1.1832      |
| 72            | 1058.870                 | 3.00                            | 62                         | 12                | 1.80                    | 253                        | 1.3416      |
| 78            | 1064.620                 | 3.00                            | 62                         | 13                | 1.80                    | 254                        | 1.3416      |
| 84            | 1070.480                 | 3.10                            | 62                         | 14                | 1.90                    | 254                        | 1.3784      |
| 90            | 1076.280                 | 3.00                            | 62                         | 15                | 1.80                    | 254                        | 1.3416      |
| 96            | 1082.020                 | 3.00                            | 62                         | 16                | 1.80                    | 254                        | 1.3416      |
| 102           | 1087.600                 | 2.80                            | 62                         | 17                | 1.70                    | 255                        | 1.3038      |
| 108           | 1093.170                 | 2.80                            | 62                         | 18                | 1.70                    | 255                        | 1.3038      |
| 114           | 1098.740                 | 2.80                            | 63                         | 19                | 1.70                    | 255                        | 1.3038      |
| 120           | 1104.506                 | 3.00                            | 63                         | 20                | 1.80                    | 254                        | 1.3416      |

**Client:** Hollingsworth & Vose  
**Source:** CFU 117

**Run:** 2  
**Date:** 04/30/18

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**Field Data Input Continued**Moisture Data

Total Test Time 120 min  
Sample Time Interval 6 min  
Meter Volume,  $V_m$  110.958 dcf  
Water Volume 41.0 ml (g)  
Nozzle Diameter,  $N_z$  0.2140 in.  
Nozzle Area 0.000250 sq.ft.

Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  30.03 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.65 %vd  
O<sub>2</sub> Average 20.19 %vd

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**Field Data Averages**Meter

$\Delta H$  2.785 "H<sub>2</sub>O  
Temperature,  $T_m$  60.9 °F  
Temperature,  $T_m$  520.9 °A (°R)  
Pressure Meter,  $P_m$  30.235 "Hg

Stack

$\sqrt{D_p}$  1.3002 "H<sub>2</sub>O  
Temperature,  $T_s$  252.9 °F  
Temperature,  $T_s$  712.9 °A (R)  
Pressure Stack,  $P_s$  30.074 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  111.564 dscf  
3.159 dscm  
Actual Volume,  $V_{m(actual)}$  152.514 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  84.83 fps  
Volume (actual) 24,985.8 awcfm  
24,561.0 adcfm  
Volume (standard) 1,116,040.4 wscf/hr  
1,097,067.7 dscf/hr  
18,284.5 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.929 scf  
Moisture,  $B_{ws}$  0.0170  
Moisture EPA M4 1.70 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.91 lb/lb-mole  
Wet,  $M_s$  28.72 lb/lb-mole

Percent Isokinetic 99.9 %

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**Laboratory Results****Front Half:**

Filterable PM 0.00154 grams

**Emissions:**

Concentration,  $C_s$  2.13E-04 gr/dscf  
488 µg/dscm  
Mass Emissions 3.34E-02 lb/hr

**Back Half:**

Inorganic CPM 1.65E-03 grams  
Inorganic CPM,  $C_s$  2.28E-04 gr/dscf  
522 µg/dscm  
Mass Emissions 3.58E-02 lb/hr

Organic CPM 1.07E-03 grams  
Organic CPM,  $C_s$  1.48E-04 gr/dscf  
339 µg/dscm  
Mass Emissions 2.32E-02 lb/hr

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Particulate Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** ODEQ 5

**Run:** 3  
**Start Time:** 14:29  
**End Time:** 16:34  
**Date:** 04/30/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 104.629                  |                                 |                            |                   |                         |                            |             |
| 6             | 109.580                  | 2.20                            | 63                         | 1                 | 1.30                    | 250                        | 1.1402      |
| 12            | 114.820                  | 2.50                            | 63                         | 2                 | 1.50                    | 256                        | 1.2247      |
| 18            | 120.420                  | 2.80                            | 63                         | 3                 | 1.70                    | 257                        | 1.3038      |
| 24            | 126.230                  | 3.00                            | 63                         | 4                 | 1.80                    | 255                        | 1.3416      |
| 30            | 132.100                  | 3.10                            | 63                         | 5                 | 1.90                    | 259                        | 1.3784      |
| 36            | 137.940                  | 3.10                            | 64                         | 6                 | 1.90                    | 257                        | 1.3784      |
| 42            | 143.730                  | 3.00                            | 64                         | 7                 | 1.80                    | 256                        | 1.3416      |
| 48            | 149.460                  | 3.00                            | 64                         | 8                 | 1.80                    | 257                        | 1.3416      |
| 54            | 155.150                  | 3.00                            | 64                         | 9                 | 1.80                    | 257                        | 1.3416      |
| 60            | 160.790                  | 2.80                            | 64                         | 10                | 1.70                    | 258                        | 1.3038      |
| 66            | 166.380                  | 2.80                            | 65                         | 11                | 1.70                    | 255                        | 1.3038      |
| 72            | 172.000                  | 2.80                            | 65                         | 12                | 1.70                    | 255                        | 1.3038      |
| 78            | 177.910                  | 3.10                            | 66                         | 13                | 1.90                    | 257                        | 1.3784      |
| 84            | 183.730                  | 3.00                            | 66                         | 14                | 1.80                    | 257                        | 1.3416      |
| 90            | 189.510                  | 3.00                            | 66                         | 15                | 1.80                    | 256                        | 1.3416      |
| 96            | 195.230                  | 3.00                            | 66                         | 16                | 1.80                    | 256                        | 1.3416      |
| 102           | 200.770                  | 2.80                            | 66                         | 17                | 1.70                    | 256                        | 1.3038      |
| 108           | 206.230                  | 2.60                            | 65                         | 18                | 1.60                    | 255                        | 1.2649      |
| 114           | 211.530                  | 2.50                            | 65                         | 19                | 1.50                    | 256                        | 1.2247      |
| 120           | 216.351                  | 2.10                            | 64                         | 20                | 1.30                    | 255                        | 1.1402      |

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 3  
Date: 04/30/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 120 min  
Sample Time Interval 6 min  
Meter Volume,  $V_m$  111.722 dcf  
Water Volume 40.0 ml (g)  
Nozzle Diameter,  $N_z$  0.2140 in.  
Nozzle Area 0.000250 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  30.03 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.55 %vd  
O<sub>2</sub> Average 20.24 %vd

### Field Data Averages

#### Meter

$\Delta H$  2.810 "H<sub>2</sub>O  
Temperature,  $T_m$  64.5 °F  
Temperature,  $T_m$  524.5 °A (°R)  
Pressure Meter,  $P_m$  30.237 "Hg

#### Stack

$\sqrt{D_p}$  1.3020 "H<sub>2</sub>O  
Temperature,  $T_s$  256.0 °F  
Temperature,  $T_s$  716.0 °A (R)  
Pressure Stack,  $P_s$  30.074 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  111.569 dscf  
3.159 dscm  
Actual Volume,  $V_{m(actual)}$  153.121 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  85.13 fps  
Volume (actual) 25,074.2 awcfm  
24,658.0 adcfm  
Volume (standard) 1,115,138.1 wscf/hr  
1,096,626.8 dscf/hr  
18,277.1 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.882 scf  
Moisture,  $B_{ws}$  0.0166  
Moisture EPA M4 1.66 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
Wet,  $M_s$  28.72 lb/lb-mole

Percent Isokinetic 100.0 %

### Laboratory Results

#### Front Half:

Filterable PM 0.00076 grams

#### Emissions:

Concentration,  $C_s$  1.04E-04 gr/dscf  
239 µg/dscm  
Mass Emissions 1.64E-02 lb/hr

#### Back Half:

|                      |                  |                    |                  |
|----------------------|------------------|--------------------|------------------|
| Inorganic CPM        | 1.30E-03 grams   | Organic CPM        | 8.70E-04 grams   |
| Inorganic CPM, $C_s$ | 1.79E-04 gr/dscf | Organic CPM, $C_s$ | 1.20E-04 gr/dscf |
|                      | 411 µg/dscm      |                    | 275 µg/dscm      |
| Mass Emissions       | 2.81E-02 lb/hr   | Mass Emissions     | 1.88E-02 lb/hr   |

**Oregon Method 5**  
**Filterable and Condensable Particulate**  
**Laboratory Gravimetric Data**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117

| Run | Sample Description                  | g, #  | Initial<br>(grams) | Final<br>(grams) | Net Gain | Blank<br>Correction       | Corrected<br>Gain (grams) |
|-----|-------------------------------------|-------|--------------------|------------------|----------|---------------------------|---------------------------|
| 1   | CPM Organics (Acetone BH)           | 185   | 44.39665           | 44.39800         | 0.00135  | 1.95E-04                  | <b>0.00116</b>            |
|     | Probe Rinse (Acetone FH)            | 115   | 42.04745           | 42.04980         | 0.00235  | 1.21E-04                  | <b>0.00223</b>            |
|     | Filter                              | Q1313 | 0.39700            | 0.39685          | 0.00000  |                           | <b>0.00000</b>            |
|     | CPM Inorganics (Water)              | 359   | 43.50715           | 43.50930         | 0.00215  | 3.74E-04                  | <b>0.00178</b>            |
|     | CPM Organics (Hexane BH)            | 85    | 45.93500           | 45.93530         | 0.00030  | 2.13E-04                  | <b>0.00009</b>            |
|     | Impinger H <sub>2</sub> O Gain, mls |       | 200                | 216              | 16.0     |                           |                           |
|     |                                     |       |                    |                  |          | <b>Filterable PM (mg)</b> | <b>2.23</b>               |
|     |                                     |       |                    |                  |          | <b>Total PM (mg)</b>      | <b>5.25 ND</b>            |
| 2   | CPM Organics (Acetone BH)           | 205   | 44.20980           | 44.21100         | 0.00120  | 2.16E-04                  | <b>0.00098</b>            |
|     | Probe Rinse (Acetone FH)            | 55    | 48.30230           | 48.30390         | 0.00160  | 5.79E-05                  | <b>0.00154</b>            |
|     | Filter                              | Q1314 | 0.39760            | 0.39730          | 0.00000  |                           | <b>0.00000</b>            |
|     | CPM Inorganics (Water)              | 432   | 47.95910           | 47.96120         | 0.00210  | 4.50E-04                  | <b>0.00165</b>            |
|     | CPM Organics (Hexane BH)            | 85    | 45.21260           | 45.21290         | 0.00030  | 2.13E-04                  | <b>0.00009</b>            |
|     | Impinger H <sub>2</sub> O Gain, mls |       | 200                | 218              | 18.0     |                           |                           |
|     |                                     |       |                    |                  |          | <b>Filterable PM (mg)</b> | <b>1.54</b>               |
|     |                                     |       |                    |                  |          | <b>Total PM (mg)</b>      | <b>4.26 ND</b>            |
| 3   | CPM Organics (Acetone BH)           | 195   | 43.69395           | 43.69490         | 0.00095  | 2.05E-04                  | <b>0.00074</b>            |
|     | Probe Rinse (Acetone FH)            | 90    | 43.05145           | 43.05230         | 0.00085  | 9.47E-05                  | <b>0.00076</b>            |
|     | Filter                              | Q1315 | 0.39430            | 0.39410          | 0.00000  |                           | <b>0.00000</b>            |
|     | CPM Inorganics (Water)              | 387   | 44.32010           | 44.32180         | 0.00170  | 4.03E-04                  | <b>0.00130</b>            |
|     | CPM Organics (Hexane BH)            | 90    | 47.19905           | 47.19940         | 0.00035  | 2.25E-04                  | <b>0.00012</b>            |
|     | Impinger H <sub>2</sub> O Gain, mls |       | 200                | 218              | 18.0     |                           |                           |
|     |                                     |       |                    |                  |          | <b>Filterable PM (mg)</b> | <b>0.76</b>               |
|     |                                     |       |                    |                  |          | <b>Total PM (mg)</b>      | <b>2.92 ND</b>            |
|     | Acetone Blank                       | 190   | 46.37740           | 46.37760         | 0.00020  | 1.05E-06                  | g/g                       |
|     | Water Blank                         | 240   | 42.97395           | 42.97420         | 0.00025  | 1.04E-06                  | g/g                       |
|     | Hexane Blank                        | 100   | 47.15305           | 47.15330         | 0.00025  | 2.50E-06                  | g/g                       |

ND = Non-Detect. Values are below the method detection limit (7 mg).

**Oregon Methods 1-5**  
**Filterable and Condensable Particulate**  
**Results Summary**

**Client:** Hollingsworth & Vose  
**Source:** CFU 117  
**Location:** Corvallis, OR

| Run                                      |                               |             | 1           | 2           | 3           | Average     |
|------------------------------------------|-------------------------------|-------------|-------------|-------------|-------------|-------------|
| Date                                     |                               |             | 4/30/2018   | 4/30/2018   | 4/30/2018   |             |
| Run Start Time                           |                               |             | 8:42        | 11:35       | 14:29       |             |
| Run End Time                             |                               |             | 10:47       | 13:39       | 16:34       |             |
| Duration, min.                           |                               |             | 120         | 120         | 120         |             |
| Barometric Pressure, "Hg                 |                               |             | 30.06       | 30.03       | 30.03       | 30.04       |
| Nozzle Dia., in.                         |                               |             | 0.2140      | 0.2140      | 0.2140      | 0.2140      |
| Isokinetic Average, %                    |                               |             | 99.7        | 99.9        | 100.0       | 99.9        |
| Sample Volume, dscf                      |                               |             | 107.445     | 111.564     | 111.569     | 110.193     |
| Sample Volume, dscm                      |                               |             | 3.042       | 3.159       | 3.159       | 3.120       |
| Stack Diameter, in.                      |                               |             | 30.00       | 30.00       | 30.00       | 30.00       |
| Stack Area, sq.ft.                       |                               |             | 4.909       | 4.909       | 4.909       | 4.909       |
| CO <sub>2</sub> % vd                     |                               |             | 0.64        | 0.65        | 0.55        | 0.61        |
| O <sub>2</sub> % vd                      |                               |             | 20.14       | 20.19       | 20.24       | 20.19       |
| Static Press., "H <sub>2</sub> O         |                               |             | 0.60        | 0.60        | 0.60        | 0.60        |
| H <sub>2</sub> O % v                     |                               |             | 1.66        | 1.70        | 1.66        | 1.67        |
| Wet Molecular Weight, lb/lb-mole         |                               |             | 28.73       | 28.72       | 28.72       | 28.72       |
| Velocity, FPS                            |                               |             | 80.71       | 84.83       | 85.13       | 83.56       |
| ADCFM                                    |                               |             | 23,377.7    | 24,561.0    | 24,658.0    | 24,198.9    |
| AWCFM                                    |                               |             | 23,772.3    | 24,985.8    | 25,074.2    | 24,610.8    |
| DSCFM                                    |                               |             | 17,641.1    | 18,284.5    | 18,277.1    | 18,067.6    |
| Stack Temperature, °F                    |                               |             | 244.0       | 252.9       | 256.0       | 251.0       |
| Filterable Particulate                   | Concentration, C <sub>s</sub> | gr/dscf     | 3.20E-04    | 2.13E-04    | 1.04E-04    | 2.13E-04    |
|                                          |                               | µg/dscm     | 733         | 488         | 239         | 487         |
|                                          | Mass                          | lb/hr       | 4.84E-02    | 3.34E-02    | 1.64E-02    | 3.27E-02    |
|                                          |                               | lb/lb glass | 4.18E-04    | 3.05E-04    | 1.49E-04    | 2.91E-04    |
| Inorganic CPM                            | Concentration, C <sub>s</sub> | gr/dscf     | 2.55E-04    | 2.28E-04    | 1.79E-04    | 2.21E-04    |
|                                          |                               | µg/dscm     | 584         | 522         | 411         | 506         |
|                                          | Mass                          | lb/hr       | 3.86E-02    | 3.58E-02    | 2.81E-02    | 3.41E-02    |
|                                          |                               | lb/lb glass | 3.33E-04    | 3.27E-04    | 2.57E-04    | 3.05E-04    |
| Organic CPM                              | Concentration, C <sub>s</sub> | gr/dscf     | 1.78E-04    | 1.48E-04    | 1.20E-04    | 1.49E-04    |
|                                          |                               | µg/dscm     | 409         | 339         | 275         | 341         |
|                                          | Mass                          | lb/hr       | 2.70E-02    | 2.32E-02    | 1.88E-02    | 2.30E-02    |
|                                          |                               | lb/lb glass | 2.33E-04    | 2.12E-04    | 1.72E-04    | 2.06E-04    |
| Measured Total PM                        | Concentration, C <sub>s</sub> | gr/dscf     | ND 7.54E-04 | ND 5.90E-04 | ND 4.04E-04 | ND 5.82E-04 |
|                                          |                               | µg/dscm     | ND 1,725    | ND 1,350    | ND 925      | ND 1,333    |
|                                          | Mass                          | lb/hr       | ND 1.14E-01 | ND 9.24E-02 | ND 6.33E-02 | ND 8.99E-02 |
|                                          |                               | lb/lb glass | ND 9.83E-04 | ND 8.44E-04 | ND 5.78E-04 | ND 8.02E-04 |
| Total PM @ Method Detection Limit (7 mg) | Mass                          | gr/dscf     | < 1.01E-03  | < 9.68E-04  | < 9.68E-04  | < 9.81E-04  |
|                                          |                               | lb/hr       | < 1.52E-01  | < 1.52E-01  | < 1.52E-01  | < 1.52E-01  |
|                                          |                               | lb/lb glass | < 1.31E-03  | < 1.39E-03  | < 1.39E-03  | < 1.36E-03  |
| Production Data                          | Glass Production              | lbs/hr      | 115.9       | 109.5       | 109.5       | 111.6       |

ND = Non-Detect. Values calculated with results below the method detection limit (7mg).

**Oregon Methods 1-5**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 117**  
**Method: ODEQ 5**

**Run: 1**  
**Start Time: 8:42**  
**End Time: 10:47**  
**Date: 4/30/2018**

**EPA Methods 1-4:**

$$1) P_m = P_b + (\Delta H/13.6) = 30.247 \text{ "Hg}$$

where  $P_b$ : 30.06 "Hg  
 $\Delta H$ : 2.545 "H<sub>2</sub>O

$$2) P_s = P_b + (\text{Static Press.}/13.6) = 30.104 \text{ "Hg}$$

where  $P_b$ : 30.06 "Hg  
Static Press.: 0.60 "H<sub>2</sub>O

$$3) V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 107.445 \text{ dscf}$$

where  $V_m$ : 105.650 dcf  
 $Y$ : 0.9820  
 $P_m$ : 30.247 "Hg  
 $T_m$ : 515.2 °A

$$4) V_w(\text{std}) = (0.04706)(H_2O) = 1.817 \text{ scf}$$

where  $H_2O$ : 38.60 g

$$5) Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0166$$

where  $Vw(\text{std})$ : 1.817 scf  
 $Vm(\text{std})$ : 107.445 dscf

$$6) \% H_2O = Bws \times 100 = 1.66 \%v$$

$$7) V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 144.846 \text{ awcf}$$

where  $Y$ : 0.9820  
 $Vm$ : 105.6500 dcf  
 $Bws$ : 0.0166  
 $T_s$ : 704.0 °A  
 $T_m$ : 515.2 °A  
 $P_m$ : 30.247 "Hg  
 $P_s$ : 30.104 "Hg

$$8) M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.91 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.64 %vd  
 $O_2$ : 20.14 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.22 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.73 \text{ lb/lb-mole}$$

where  $M_d$ : 28.91 lb/lb-mole  
Bws: 0.0166

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 4.909 \text{ sq. ft.}$$

where Stack ID: 30 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 80.71 \text{ fps}$$

where Cp: 0.84  
Ave. Sqrt  $\Delta P$ : 1.2458  
Ts: 704.0 °A  
Ps: 30.104 "Hg  
Ms: 28.73 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 23,772.3 \text{ AWCfm}$$

where  $V_s$ : 80.71 ft/sec  
Stack Area: 4.909 sq. ft

$$13) \text{ ADCfm} = (\text{AWCfm})(1-Bws) = 23,377.7 \text{ ADCfm}$$

where AWCfm: 23,772.3  
Bws: 0.0166

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,076,333.3 \text{ wscf/hr}$$

where  $V_s$ : 80.71 ft/sec  
Stack Area: 4.9090 sq. ft.  
Ts: 704.0 °A  
Ps: 30.104 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1-Bws) = 1,058,466.2 \text{ dscf/hr}$$

where wscf/hr: 1,076,333.3  
Bws: 0.0166

$$16) \text{ DSCfm} = (\text{dscf/hr})/60 \text{ mins/hr} = 17,641.1 \text{ DSCfm}$$

where dscf/hr: 1,058,466.2

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000250 \text{ sq. ft.}$$

where Nozzle Size: 0.2140 inches



$$18) \text{ Isokinetic \%} = \left( \frac{0.0945(T_s)(V_m(\text{std}))}{P_s(V_s)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 99.7 \%$$

where Ts: 704.0 °A  
Vm(Std): 107.445 dscf  
Ps: 30.104 "Hg  
Vs: 80.71 ft/sec  
Nozzle Area: 0.000250 sq. ft.  
Sampling Time: 120 min.  
Bws: 0.0166

#### ODEQ Method 5:

##### Front Half:

$$19) \text{ Filterable PM} = \text{filter gain} + \text{probe rinse gain} = 0.00223 \text{ grams}$$

where Filter Gain: 0.00000 grams  
Probe Rinse: 0.00223 grams

$$20) \text{ Cs} = (\text{Sample grams}/V_m(\text{Std})) (15.43 \text{ grains/gram}) = 3.20\text{E-}04 \text{ gr/dscf}$$

where Sample: 0.00223 grams  
Vm(std) 107.445 dscf

$$21) \text{ Cs} = (\text{Sample grams} * 1,000,000 \text{ }\mu\text{g/gram}) / V_m(\text{std}) = 733 \text{ }\mu\text{g/dscm}$$

where Sample: 0.00223 grams  
Vm(std) 3.042 dscm

$$22) \text{ Mass Emission Rate} = (\text{Cs})(\text{Stack flow})/7000 \text{ gr/lb} = 4.84\text{E-}02 \text{ lb/hr}$$

where Cs: 3.20E-04 gr/dscf  
Stack Flow: 1,058,466.2 dscf/hr

##### Back Half:

$$23) \text{ Inorganic CPM} = \text{water fraction} = 0.00178 \text{ grams}$$

$$\text{Organic CPM} = \text{acetone BH} + \text{hexane BH} = 0.00124 \text{ grams}$$

Back-half concentrations and mass rates are calculated as front-half examples.

$$24) \text{ lb/lb glass produced} = \text{PM fraction}/\text{Glass production} = 4.18\text{E-}04 \text{ lb/lb glass}$$

where glass produced: 115.9 lb/hr  
Filterable PM emissions: 4.84E-02 lb/hr



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU117               |
| DATE      | 04/30/18             |
| METHOD    | 316                  |
| POLLUTANT | Formaldehyde         |

**Isokinetic Field Data**
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**EPA Method:** 316  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
 cloudy/rainy, 50 degrees

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 10:47  
**Date:** 4/30/2018

**Stack Dimensional Data:**

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 13  
 Y factor 0.9966  
 ΔH@ 1.8316  
 Probe ID 1307999  
 Nozzle ID 192  
 Hot box ID 2  
 Pitot Cp 0.84  
 Liner type Glass  
 Nozzle size 0.1927 inches  
 Nozzle area 0.000203 sq.ft.  
 Probe heat 250 F  
 Filter heat 250 F

**Source Information:**

Barometric Pressure 30.06 "Hg  
 Static Pressure 0.6 "H<sub>2</sub>O  
 Ave. ΔP 1.6 "H<sub>2</sub>O  
 Stack Temperature 250 F  
 Assumed moisture 2 %  
 Assumed meter temp. 52 F  
 Total number of points 20  
 Time per point 6  
 Total run time 120  
 O<sub>2</sub> 20.14 %  
 CO<sub>2</sub> 0.64 %  
 Rec. Nz. 0.198 inches

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 12       | 15        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.193       | 0.192 | 0.193 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 89.028 dcf  
 Wet mol. weight 28.76 M<sub>s</sub> (actual)  
 Actual H<sub>2</sub>O 1.34 %  
 Std. meter vol. 91.848 dscf  
 Isokinetic Average 99.9 %  
 Ave. ΔP 1.705 "H<sub>2</sub>O  
 Ave. √ΔP 1.3039 "H<sub>2</sub>O  
 Ave. ΔH 1.89 "H<sub>2</sub>O  
 Ave. T<sub>s</sub> 241.8 °F  
 Ave. T<sub>m</sub> 54.6 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 210   | 10.0 |
| Silica gel, g     | 264.7   | 281.2 | 16.5 |
| Total water gain: |         |       | 26.5 |

| Traversal Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|-----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1               | 6           | 4.620              | 1.90                            | 240              | 49               | 2.07     | 2.10   | 2            | 248             | 48                     |
| 2               | 12          | 9.260              | 1.90                            | 238              | 48               | 2.07     | 2.10   | 2            | 250             | 45                     |
| 3               | 18          | 13.780             | 1.80                            | 237              | 49               | 1.97     | 2.00   | 2            | 252             | 43                     |
| 4               | 24          | 18.340             | 1.80                            | 237              | 50               | 1.97     | 2.00   | 2            | 249             | 43                     |
| 5               | 30          | 23.050             | 1.90                            | 238              | 51               | 2.08     | 2.10   | 2            | 250             | 43                     |
| 6               | 36          | 27.630             | 1.80                            | 240              | 52               | 1.97     | 2.00   | 2            | 252             | 44                     |
| 7               | 42          | 32.090             | 1.70                            | 242              | 53               | 1.86     | 1.90   | 2            | 249             | 44                     |
| 8               | 48          | 36.530             | 1.70                            | 242              | 53               | 1.86     | 1.90   | 2            | 248             | 45                     |
| 9               | 54          | 40.860             | 1.60                            | 242              | 54               | 1.75     | 1.80   | 2            | 251             | 45                     |
| 10              | 60          | 44.814             | 1.30                            | 238              | 55               | 1.44     | 1.40   | 2            | 250             | 45                     |
| 11              | 66          | 48.830             | 1.40                            | 240              | 55               | 1.54     | 1.50   | 2            | 248             | 49                     |
| 12              | 72          | 53.140             | 1.60                            | 241              | 56               | 1.76     | 1.80   | 2            | 250             | 44                     |
| 13              | 78          | 57.460             | 1.60                            | 244              | 57               | 1.76     | 1.80   | 3            | 251             | 45                     |
| 14              | 84          | 61.930             | 1.70                            | 246              | 57               | 1.86     | 1.90   | 3            | 252             | 47                     |
| 15              | 90          | 66.640             | 1.90                            | 246              | 58               | 2.09     | 2.10   | 3            | 251             | 48                     |
| 16              | 96          | 71.250             | 1.80                            | 245              | 58               | 1.98     | 2.00   | 3            | 250             | 47                     |
| 17              | 102         | 75.990             | 1.90                            | 245              | 59               | 2.09     | 2.10   | 3            | 251             | 48                     |
| 18              | 108         | 80.490             | 1.70                            | 244              | 59               | 1.88     | 1.90   | 3            | 251             | 47                     |
| 19              | 114         | 84.980             | 1.70                            | 245              | 59               | 1.87     | 1.90   | 2            | 252             | 48                     |
| 20              | 120         | 89.028             | 1.40                            | 245              | 59               | 1.54     | 1.50   | 2            | 252             | 47                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**EPA Method:** 316  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
cloudy/rainy, 50 degrees

**Run:** 2  
**Start Time:** 11:35  
**End Time:** 13:39  
**Date:** 4/30/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 13  
Y factor 0.9966  
 $\Delta H@$  1.8316  
Probe ID 1307999  
Nozzle ID 192  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.1927 inches  
Nozzle area: 0.000202 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 30.03 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.6 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 1.34 %  
Assumed meter temp. 54.6 F  
Total number of points 20  
Time per point 6  
Total run time 120  
O<sub>2</sub> 20.19 %  
CO<sub>2</sub> 0.65 %  
Rec. Nz. 0.197 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 13       | 10        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.193       | 0.192 | 0.193 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 90.946 dcf  
Wet mol. weight 28.77 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.25 %  
Std. meter vol. 92.829 dscf  
Isokinetic Average 100.2 %  
Ave.  $\Delta P$  1.765 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.3275 "H<sub>2</sub>O  
Ave.  $\Delta H$  1.96 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 250 °F  
Ave. T<sub>m</sub> 59.7 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 206   | 6.0  |
| Silica gel, g     | 255.9   | 274.9 | 19.0 |
| Total water gain: |         |       | 25.0 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (<68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 6           | 4.570              | 1.80                                    | 244              | 57               | 2.00             | 2.00           | 2            | 251             | 47                     |
| 2              | 12          | 9.260              | 1.90                                    | 245              | 58               | 2.11             | 2.10           | 3            | 250             | 40                     |
| 3              | 18          | 13.860             | 1.80                                    | 245              | 57               | 2.00             | 2.00           | 3            | 251             | 43                     |
| 4              | 24          | 18.550             | 1.90                                    | 246              | 57               | 2.10             | 2.10           | 3            | 248             | 44                     |
| 5              | 30          | 23.140             | 1.80                                    | 249              | 57               | 1.99             | 2.00           | 3            | 251             | 46                     |
| 6              | 36          | 27.850             | 1.90                                    | 250              | 58               | 2.10             | 2.10           | 2            | 252             | 49                     |
| 7              | 42          | 32.440             | 1.80                                    | 251              | 58               | 1.98             | 2.00           | 2            | 250             | 48                     |
| 8              | 48          | 37.170             | 1.90                                    | 251              | 59               | 2.10             | 2.10           | 2            | 251             | 48                     |
| 9              | 54          | 41.740             | 1.80                                    | 252              | 60               | 1.99             | 2.00           | 2            | 250             | 49                     |
| 10             | 60          | 46.371             | 1.80                                    | 252              | 60               | 1.99             | 2.00           | 3            | 249             | 48                     |
| 11             | 66          | 50.850             | 1.70                                    | 250              | 60               | 1.88             | 1.90           | 3            | 250             | 49                     |
| 12             | 72          | 55.440             | 1.80                                    | 249              | 61               | 2.00             | 2.00           | 3            | 250             | 46                     |
| 13             | 78          | 60.030             | 1.80                                    | 250              | 61               | 2.00             | 2.00           | 3            | 250             | 48                     |
| 14             | 84          | 64.650             | 1.80                                    | 250              | 61               | 2.00             | 2.00           | 3            | 251             | 48                     |
| 15             | 90          | 69.140             | 1.70                                    | 251              | 61               | 1.88             | 1.90           | 3            | 250             | 48                     |
| 16             | 96          | 73.710             | 1.80                                    | 251              | 61               | 2.00             | 2.00           | 3            | 251             | 49                     |
| 17             | 102         | 78.190             | 1.70                                    | 253              | 61               | 1.88             | 1.90           | 3            | 249             | 50                     |
| 18             | 108         | 82.670             | 1.70                                    | 254              | 61               | 1.88             | 1.90           | 3            | 249             | 50                     |
| 19             | 114         | 87.030             | 1.60                                    | 254              | 62               | 1.77             | 1.80           | 3            | 251             | 52                     |
| 20             | 120         | 90.946             | 1.30                                    | 252              | 63               | 1.44             | 1.40           | 3            | 250             | 52                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**EPA Method:** 316  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
cloudy/rainy, 50 degrees

**Run:** 3  
**Start Time:** 14:29  
**End Time:** 16:34  
**Date:** 4/30/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 13  
Y factor 0.9966  
 $\Delta H$ @ 1.8316  
Probe ID 1307999  
Nozzle ID 192  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.1927 inches  
Nozzle area: 0.000202 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 30.03 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.6 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 1.25 %  
Assumed meter temp. 59.7 F  
Total number of points 20  
Time per point 6  
Total run time 120  
O<sub>2</sub> 20.24 %  
CO<sub>2</sub> 0.55 %  
Rec. Nz. 0.196 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 12       | 10        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.193       | 0.192 | 0.193 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 88.976 dcf  
Wet mol. weight 28.77 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.19 %  
Std. meter vol. 90.331 dscf  
Isokinetic Average 100.1 %  
Ave.  $\Delta P$  1.685 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.2961 "H<sub>2</sub>O  
Ave.  $\Delta H$  1.87 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 254.2 °F  
Ave. T<sub>m</sub> 62.4 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 206   | 6.0  |
| Silica gel, g     | 237.4   | 254.6 | 17.2 |
| Total water gain: |         |       | 23.2 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
|                |             | 0.000              |                                         |                  |                  |                  |                |              |                 |                        |
| 1              | 6           | 4.620              | 1.80                                    | 250              | 60               | 2.00             | 2.00           | 3            | 251             | 53                     |
| 2              | 12          | 9.090              | 1.70                                    | 251              | 60               | 1.88             | 1.90           | 3            | 250             | 52                     |
| 3              | 18          | 13.650             | 1.80                                    | 254              | 60               | 1.99             | 2.00           | 3            | 250             | 51                     |
| 4              | 24          | 18.250             | 1.80                                    | 254              | 61               | 1.99             | 2.00           | 3            | 252             | 49                     |
| 5              | 30          | 22.960             | 1.90                                    | 254              | 61               | 2.10             | 2.10           | 3            | 250             | 46                     |
| 6              | 36          | 27.550             | 1.80                                    | 254              | 62               | 1.99             | 2.00           | 3            | 249             | 44                     |
| 7              | 42          | 32.040             | 1.70                                    | 254              | 62               | 1.88             | 1.90           | 3            | 250             | 44                     |
| 8              | 48          | 36.660             | 1.80                                    | 255              | 62               | 1.99             | 2.00           | 3            | 250             | 45                     |
| 9              | 54          | 40.970             | 1.60                                    | 256              | 62               | 1.77             | 1.80           | 3            | 251             | 46                     |
| 10             | 60          | 45.039             | 1.40                                    | 256              | 63               | 1.55             | 1.50           | 2            | 250             | 47                     |
| 11             | 66          | 48.930             | 1.30                                    | 256              | 62               | 1.44             | 1.40           | 2            | 252             | 48                     |
| 12             | 72          | 53.370             | 1.70                                    | 257              | 63               | 1.88             | 1.90           | 3            | 250             | 45                     |
| 13             | 78          | 57.950             | 1.80                                    | 257              | 63               | 1.99             | 2.00           | 3            | 249             | 46                     |
| 14             | 84          | 62.550             | 1.80                                    | 256              | 64               | 2.00             | 2.00           | 3            | 250             | 46                     |
| 15             | 90          | 67.300             | 1.90                                    | 255              | 64               | 2.11             | 2.10           | 3            | 251             | 46                     |
| 16             | 96          | 71.960             | 1.80                                    | 255              | 64               | 2.00             | 2.00           | 3            | 251             | 46                     |
| 17             | 102         | 76.450             | 1.70                                    | 254              | 64               | 1.89             | 1.90           | 3            | 250             | 45                     |
| 18             | 108         | 80.820             | 1.60                                    | 253              | 64               | 1.78             | 1.80           | 3            | 249             | 44                     |
| 19             | 114         | 85.050             | 1.50                                    | 253              | 63               | 1.67             | 1.70           | 2            | 249             | 45                     |
| 20             | 120         | 88.976             | 1.30                                    | 250              | 63               | 1.45             | 1.40           | 2            | 250             | 45                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**Method:** 316

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 10:47  
**Date:** 4/30/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 6             | 4.620                    | 2.10                            | 49                         | 1                 | 1.90                    | 240                        | 1.3784      |
| 12            | 9.260                    | 2.10                            | 48                         | 2                 | 1.90                    | 238                        | 1.3784      |
| 18            | 13.780                   | 2.00                            | 49                         | 3                 | 1.80                    | 237                        | 1.3416      |
| 24            | 18.340                   | 2.00                            | 50                         | 4                 | 1.80                    | 237                        | 1.3416      |
| 30            | 23.050                   | 2.10                            | 51                         | 5                 | 1.90                    | 238                        | 1.3784      |
| 36            | 27.630                   | 2.00                            | 52                         | 6                 | 1.80                    | 240                        | 1.3416      |
| 42            | 32.090                   | 1.90                            | 53                         | 7                 | 1.70                    | 242                        | 1.3038      |
| 48            | 36.530                   | 1.90                            | 53                         | 8                 | 1.70                    | 242                        | 1.3038      |
| 54            | 40.860                   | 1.80                            | 54                         | 9                 | 1.60                    | 242                        | 1.2649      |
| 60            | 44.814                   | 1.40                            | 55                         | 10                | 1.30                    | 238                        | 1.1402      |
| 66            | 48.830                   | 1.50                            | 55                         | 11                | 1.40                    | 240                        | 1.1832      |
| 72            | 53.140                   | 1.80                            | 56                         | 12                | 1.60                    | 241                        | 1.2649      |
| 78            | 57.460                   | 1.80                            | 57                         | 13                | 1.60                    | 244                        | 1.2649      |
| 84            | 61.930                   | 1.90                            | 57                         | 14                | 1.70                    | 246                        | 1.3038      |
| 90            | 66.640                   | 2.10                            | 58                         | 15                | 1.90                    | 246                        | 1.3784      |
| 96            | 71.250                   | 2.00                            | 58                         | 16                | 1.80                    | 245                        | 1.3416      |
| 102           | 75.990                   | 2.10                            | 59                         | 17                | 1.90                    | 245                        | 1.3784      |
| 108           | 80.490                   | 1.90                            | 59                         | 18                | 1.70                    | 244                        | 1.3038      |
| 114           | 84.980                   | 1.90                            | 59                         | 19                | 1.70                    | 245                        | 1.3038      |
| 120           | 89.028                   | 1.50                            | 59                         | 20                | 1.40                    | 245                        | 1.1832      |

Client: Hollingsworth & Vose  
Source: CFU117

Run: 1  
Date: 04/30/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 120 min  
Sample Time Interval 6 min  
Meter Volume,  $V_m$  89.028 dcf  
Water Volume 26.5 ml (g)  
Nozzle Diameter,  $N_z$  0.1927 in.  
Nozzle Area 0.000203 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  30.06 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9966 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.64 %vd  
O<sub>2</sub> Average 20.14 %vd

### Field Data Averages

#### Meter

$\Delta H$  1.890 "H<sub>2</sub>O  
Temperature,  $T_m$  54.6 °F  
Temperature,  $T_m$  514.6 °A (°R)  
Pressure Meter,  $P_m$  30.199 "Hg

#### Stack

$\sqrt{Dp}$  1.3039 "H<sub>2</sub>O  
Temperature,  $T_s$  241.8 °F  
Temperature,  $T_s$  701.8 °A (R)  
Pressure Stack,  $P_s$  30.104 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  91.848 dscf  
2.601 dscm  
Actual Volume,  $V_{m(actual)}$  123.032 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  84.30 fps  
Volume (actual) 24,829.7 awcfm  
24,497.0 adcfm  
Volume (standard) 1,127,733.0 wscf/hr  
1,112,621.4 dscf/hr  
18,543.7 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.247 scf  
Moisture,  $B_{ws}$  0.0134  
Moisture EPA M4 1.34 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.91 lb/lb-mole  
Wet,  $M_s$  28.76 lb/lb-mole

Volume/Mole,  $V/M$  508.956

Percent Isokinetic 99.9 %

### Laboratory Results

|                   |          |           |                      |               |
|-------------------|----------|-----------|----------------------|---------------|
| CH <sub>2</sub> O | 1580.0   | μg/sample |                      |               |
| CH <sub>2</sub> O | 1.58E-03 | grams     | MW CH <sub>2</sub> O | 30.031 g/mole |

#### Emissions:

|                      |          |         |
|----------------------|----------|---------|
| Concentration, $C_s$ | 2.65E-04 | gr/dscf |
|                      | 607.46   | μg/dscm |
|                      | 4.86E-01 | ppmvd   |
| Mass Emissions       | 4.22E-02 | lb/hr   |

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**Method:** 316

**Run:** 2  
**Start Time:** 11:35  
**End Time:** 13:39  
**Date:** 04/30/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 6             | 4.570                    | 2.00                            | 57                         | 1                 | 1.80                    | 244                        | 1.3416      |
| 12            | 9.260                    | 2.10                            | 58                         | 2                 | 1.90                    | 245                        | 1.3784      |
| 18            | 13.860                   | 2.00                            | 57                         | 3                 | 1.80                    | 245                        | 1.3416      |
| 24            | 18.550                   | 2.10                            | 57                         | 4                 | 1.90                    | 246                        | 1.3784      |
| 30            | 23.140                   | 2.00                            | 57                         | 5                 | 1.80                    | 249                        | 1.3416      |
| 36            | 27.850                   | 2.10                            | 58                         | 6                 | 1.90                    | 250                        | 1.3784      |
| 42            | 32.440                   | 2.00                            | 58                         | 7                 | 1.80                    | 251                        | 1.3416      |
| 48            | 37.170                   | 2.10                            | 59                         | 8                 | 1.90                    | 251                        | 1.3784      |
| 54            | 41.740                   | 2.00                            | 60                         | 9                 | 1.80                    | 252                        | 1.3416      |
| 60            | 46.371                   | 2.00                            | 60                         | 10                | 1.80                    | 252                        | 1.3416      |
| 66            | 50.850                   | 1.90                            | 60                         | 11                | 1.70                    | 250                        | 1.3038      |
| 72            | 55.440                   | 2.00                            | 61                         | 12                | 1.80                    | 249                        | 1.3416      |
| 78            | 60.030                   | 2.00                            | 61                         | 13                | 1.80                    | 250                        | 1.3416      |
| 84            | 64.650                   | 2.00                            | 61                         | 14                | 1.80                    | 250                        | 1.3416      |
| 90            | 69.140                   | 1.90                            | 61                         | 15                | 1.70                    | 251                        | 1.3038      |
| 96            | 73.710                   | 2.00                            | 61                         | 16                | 1.80                    | 251                        | 1.3416      |
| 102           | 78.190                   | 1.90                            | 61                         | 17                | 1.70                    | 253                        | 1.3038      |
| 108           | 82.670                   | 1.90                            | 61                         | 18                | 1.70                    | 254                        | 1.3038      |
| 114           | 87.030                   | 1.80                            | 62                         | 19                | 1.60                    | 254                        | 1.2649      |
| 120           | 90.946                   | 1.40                            | 63                         | 20                | 1.30                    | 252                        | 1.1402      |



Client: Hollingsworth & Vose  
Source: CFU117

Run: 2  
Date: 04/30/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 120 min  
Sample Time Interval 6 min  
Meter Volume,  $V_m$  90.946 dcf  
Water Volume 25.0 ml (g)  
Nozzle Diameter,  $N_z$  0.1927 in.  
Nozzle Area 0.000202 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  30.03 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9966 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.65 %vd  
O<sub>2</sub> Average 20.19 %vd

### Field Data Averages

#### Meter

$\Delta H$  1.960 "H<sub>2</sub>O  
Temperature,  $T_m$  59.7 °F  
Temperature,  $T_m$  519.7 °A (°R)  
Pressure Meter,  $P_m$  30.174 "Hg

#### Stack

$\sqrt{D_p}$  1.3275 "H<sub>2</sub>O  
Temperature,  $T_s$  250.0 °F  
Temperature,  $T_s$  710.0 °A (R)  
Pressure Stack,  $P_s$  30.074 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  92.829 dscf  
2.629 dscm  
Actual Volume,  $V_{m(actual)}$  125.810 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  86.36 fps  
Volume (actual) 25,436.5 awcfm  
25,118.5 adcfm  
Volume (standard) 1,140,810.1 wscf/hr  
1,126,550.0 dscf/hr  
18,775.8 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.177 scf  
Moisture,  $B_{ws}$  0.0125  
Moisture EPA M4 1.25 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.91 lb/lb-mole  
Wet,  $M_s$  28.77 lb/lb-mole

Volume/Mole,  $V/M$  515.416

Percent Isokinetic 100.2 %

### Laboratory Results

|                   |          |           |                      |               |
|-------------------|----------|-----------|----------------------|---------------|
| CH <sub>2</sub> O | 1650.0   | μg/sample |                      |               |
| CH <sub>2</sub> O | 1.65E-03 | grams     | MW CH <sub>2</sub> O | 30.031 g/mole |

#### Emissions:

Concentration,  $C_s$  2.74E-04 gr/dscf  
627.62 μg/dscm  
5.03E-01 ppmvd  
Mass Emissions 4.41E-02 lb/hr

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**Method:** 316

**Run:** 3  
**Start Time:** 14:29  
**End Time:** 16:34  
**Date:** 04/30/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 6             | 4.620                    | 2.00                            | 60                         | 1                 | 1.80                    | 250                        | 1.3416      |
| 12            | 9.090                    | 1.90                            | 60                         | 2                 | 1.70                    | 251                        | 1.3038      |
| 18            | 13.650                   | 2.00                            | 60                         | 3                 | 1.80                    | 254                        | 1.3416      |
| 24            | 18.250                   | 2.00                            | 61                         | 4                 | 1.80                    | 254                        | 1.3416      |
| 30            | 22.960                   | 2.10                            | 61                         | 5                 | 1.90                    | 254                        | 1.3784      |
| 36            | 27.550                   | 2.00                            | 62                         | 6                 | 1.80                    | 254                        | 1.3416      |
| 42            | 32.040                   | 1.90                            | 62                         | 7                 | 1.70                    | 254                        | 1.3038      |
| 48            | 36.660                   | 2.00                            | 62                         | 8                 | 1.80                    | 255                        | 1.3416      |
| 54            | 40.970                   | 1.80                            | 62                         | 9                 | 1.60                    | 256                        | 1.2649      |
| 60            | 45.039                   | 1.50                            | 63                         | 10                | 1.40                    | 256                        | 1.1832      |
| 66            | 48.930                   | 1.40                            | 62                         | 11                | 1.30                    | 256                        | 1.1402      |
| 72            | 53.370                   | 1.90                            | 63                         | 12                | 1.70                    | 257                        | 1.3038      |
| 78            | 57.950                   | 2.00                            | 63                         | 13                | 1.80                    | 257                        | 1.3416      |
| 84            | 62.550                   | 2.00                            | 64                         | 14                | 1.80                    | 256                        | 1.3416      |
| 90            | 67.300                   | 2.10                            | 64                         | 15                | 1.90                    | 255                        | 1.3784      |
| 96            | 71.960                   | 2.00                            | 64                         | 16                | 1.80                    | 255                        | 1.3416      |
| 102           | 76.450                   | 1.90                            | 64                         | 17                | 1.70                    | 254                        | 1.3038      |
| 108           | 80.820                   | 1.80                            | 64                         | 18                | 1.60                    | 253                        | 1.2649      |
| 114           | 85.050                   | 1.70                            | 63                         | 19                | 1.50                    | 253                        | 1.2247      |
| 120           | 88.976                   | 1.40                            | 63                         | 20                | 1.30                    | 250                        | 1.1402      |

Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU117

Date:

04/30/18

**Field Data Input Continued**Moisture Data

Total Test Time 120 min  
 Sample Time Interval 6 min  
 Meter Volume,  $V_m$  88.976 dcf  
 Water Volume 23.2 ml (g)  
 Nozzle Diameter,  $N_z$  0.1927 in.  
 Nozzle Area 0.000202 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  30.03 "Hg  
 Static Pressure 0.60 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9966 Y

Molecular Weight:

CO<sub>2</sub> Average 0.55 %vd  
 O<sub>2</sub> Average 20.24 %vd

**Field Data Averages**Meter

$\Delta H$  1.870 "H<sub>2</sub>O  
 Temperature,  $T_m$  62.4 °F  
 Temperature,  $T_m$  522.4 °A (°R)  
 Pressure Meter,  $P_m$  30.168 "Hg

Stack

$\sqrt{D_p}$  1.2961 "H<sub>2</sub>O  
 Temperature,  $T_s$  254.2 °F  
 Temperature,  $T_s$  714.2 °A (R)  
 Pressure Stack,  $P_s$  30.074 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  90.331 dscf  
 2.558 dscm  
 Actual Volume,  $V_{m(actual)}$  123.073 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  84.56 fps  
 Volume (actual) 24,906.3 awcfm  
 24,609.9 adcfm  
 Volume (standard) 1,110,463.2 wscf/hr  
 1,097,248.7 dscf/hr  
 18,287.5 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.092 scf  
 Moisture,  $B_{ws}$  0.0119  
 Moisture EPA M4 1.19 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
 Wet,  $M_s$  28.77 lb/lb-mole

Volume/Mole,  $V/M$  518.465

Percent Isokinetic 100.1 %

**Laboratory Results**

CH<sub>2</sub>O 1652.0 µg/sample  
 CH<sub>2</sub>O 1.65E-03 grams MW CH<sub>2</sub>O 30.031 g/mole

**Emissions:**

Concentration,  $C_s$  2.82E-04 gr/dscf  
 645.82 µg/dscm  
 5.17E-01 ppmvd  
 Mass Emissions 4.42E-02 lb/hr

"&lt;" represents MDL value

**EPA Method 316**  
**Laboratory Results**  
**Formaldehyde**

**Client:** Hollingsworth & Vose

**Location:** Corvallis, OR

**Source:** CFU117

**MDL** 0.0137 µg/mL

| Lab ID | Sample ID              | Sample Date | < | Result | MDL  | Sample Vol.<br>(mL) | Units     |
|--------|------------------------|-------------|---|--------|------|---------------------|-----------|
| 4      | Run 1                  | 4/30/2018   |   | 1580   | 7.80 | 569.0               | µg/sample |
| 4      | Run 2                  | 4/30/2018   |   | 1650   | 6.67 | 487.0               | µg/sample |
| 9      | Run 3                  | 4/30/2018   |   | 1652   | 7.33 | 535.0               | µg/sample |
| 10     | H <sub>2</sub> O Blank | 4/30/2018   | < | MDL    | 4.11 | 300.0               | µg/sample |
| 20     | Field Train Blank      |             | < | MDL    | 4.18 | 305.0               | µg/sample |

\*If sample results are below MDL, MDL value is shown. A "<" sign designates less than MDL.  
 If blank values are below MDL, no blank corrections are performed.

# EPA Method 316

## Results Summary

Client: Hollingsworth & Vose

Location: Corvallis, OR

Source: CFU117

| Run                              |                               |             | 1         | 2         | 3         | Average  |
|----------------------------------|-------------------------------|-------------|-----------|-----------|-----------|----------|
| Date                             |                               |             | 4/30/2018 | 4/30/2018 | 4/30/2018 |          |
| Run Start Time                   |                               |             | 8:42      | 11:35     | 14:29     |          |
| Run End Time                     |                               |             | 10:47     | 13:39     | 16:34     |          |
| Duration, min.                   |                               |             | 120       | 120       | 120       |          |
| Barometric Pressure, "Hg         |                               |             | 30.06     | 30.03     | 30.03     | 30.04    |
| Nozzle Dia., in.                 |                               |             | 0.1927    | 0.1927    | 0.1927    | 0.1927   |
| Isokinetic Average, %            |                               |             | 99.9      | 100.2     | 100.1     | 100.1    |
| Sample Volume, dscf              |                               |             | 91.848    | 92.829    | 90.331    | 91.669   |
| Sample Volume, dscm              |                               |             | 2.601     | 2.629     | 2.558     | 2.596    |
| Stack Diameter, in.              |                               |             | 30.00     | 30.00     | 30.00     | 30.00    |
| Stack Area, sq.ft.               |                               |             | 4.909     | 4.909     | 4.909     | 4.909    |
| CO <sub>2</sub> %vd              |                               |             | 0.64      | 0.65      | 0.55      | 0.61     |
| O <sub>2</sub> %vd               |                               |             | 20.14     | 20.19     | 20.24     | 20.19    |
| Static Press., "H <sub>2</sub> O |                               |             | 0.60      | 0.60      | 0.60      | 0.60     |
| H <sub>2</sub> O %v              |                               |             | 1.34      | 1.25      | 1.19      | 1.26     |
| Wet Molecular Weight, lb/lb-mole |                               |             | 28.76     | 28.77     | 28.77     | 28.77    |
| Velocity, FPS                    |                               |             | 84.30     | 86.36     | 84.56     | 85.07    |
| ADCFM                            |                               |             | 24,497.0  | 25,118.5  | 24,609.9  | 24,741.8 |
| AWCFM                            |                               |             | 24,829.7  | 25,436.5  | 24,906.3  | 25,057.5 |
| DSCFM                            |                               |             | 18,543.7  | 18,775.8  | 18,287.5  | 18,535.7 |
| Stack Temperature, °F            |                               |             | 241.8     | 250.0     | 254.2     | 248.7    |
| Formaldehyde                     | Concentration, C <sub>s</sub> | gr/dscf     | 2.65E-04  | 2.74E-04  | 2.82E-04  | 2.74E-04 |
|                                  |                               | µg/dscm     | 607.5     | 627.6     | 645.8     | 627.0    |
|                                  |                               | ppmvd       | 4.86E-01  | 5.03E-01  | 5.17E-01  | 5.02E-01 |
|                                  | Mass                          | lb/hr       | 4.22E-02  | 4.41E-02  | 4.42E-02  | 4.35E-02 |
|                                  |                               | lb/lb glass | 3.64E-04  | 4.03E-04  | 4.04E-04  | 3.90E-04 |
| Production Data                  | Glass Production              | lbs/hr      | 115.9     | 109.5     | 109.5     | 111.6    |

"<" represents MDL value

**EPA Methods 1-4, 316**  
**Example Calculations**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU117  
**Method:** 316

**Run:** 1  
**Start Time:** 8:42  
**End Time:** 10:47  
**Date:** 4/30/2018

**EPA Methods 1-4:**

$$1) \quad P_m = P_b + (\Delta H/13.6) = 30.199 \text{ "Hg}$$

where  $P_b$ : 30.06 "Hg  
 $\Delta H$ : 1.890 "H<sub>2</sub>O

$$2) \quad P_s = P_b + (\text{Static Press.}/13.6) = 30.104 \text{ "Hg}$$

where  $P_b$ : 30.06 "Hg  
 Static Press.: 0.60 "H<sub>2</sub>O

$$3) \quad V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 91.848 \text{ dscf}$$

where  $V_m$ : 89.028 dcf  
 $Y$ : 0.9966  
 $P_m$ : 30.199 "Hg  
 $T_m$ : 514.6 °A

$$4) \quad V_w(\text{std}) = (0.04706)(H_2O) = 1.247 \text{ scf}$$

where  $H_2O$ : 26.50 g

$$5) \quad Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0134$$

where  $Vw(\text{std})$ : 1.247 scf  
 $Vm(\text{std})$ : 91.848 dscf

$$6) \quad \% H_2O = Bws \times 100 = 1.34 \%v$$

$$7) \quad V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 123.032 \text{ awcf}$$

where  $Y$ : 0.9966  
 $V_m$ : 89.0279 dcf  
 $Bws$ : 0.0134  
 $T_s$ : 701.8 °A  
 $T_m$ : 514.6 °A  
 $P_m$ : 30.199 "Hg  
 $P_s$ : 30.104 "Hg

$$8) \quad M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.91 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.64 %vd  
 $O_2$ : 20.14 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.22 %vd

$$9) M_s = M_d(1 - Bws) + (18 \times Bws) = 28.76 \text{ lb/lb-mole}$$

where  $M_d$ : 28.91 lb/lb-mole  
Bws: 0.0134

$$10) \text{ Stack Area(cir.)} = 3.1416 (\text{stack diameter}/24)^2 = 4.909 \text{ sq. ft.}$$

where Stack ID: 30 inches

$$\text{Stack Area(rect.)} = \text{stack width}/12 \times \text{stack length}/12 = \text{NA sq. ft.}$$

where Stack Width: 0.000 inches  
Stack Length: 0.000 inches

$$11) \text{ Velocity, } V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) = 84.30 \text{ fps}$$

where Cp: 0.84  
Ave. Sqrt  $\Delta P$ : 1.3039  
Ts: 701.8 °A  
Ps: 30.104 "Hg  
Ms: 28.76 lb/lb-mole

$$12) \text{ AWCfm} = (V_s)(\text{stack area})(60 \text{ sec/min}) = 24,829.7 \text{ AWCfm}$$

where  $V_s$ : 84.30 ft/sec  
Stack Area: 4.909 sq. ft

$$13) \text{ ADCfm} = (\text{AWCfm})(1-Bws) = 24,497.0 \text{ ADCfm}$$

where AWCfm: 24,829.7  
Bws: 0.0134

$$14) Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ\text{A}}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) = 1,127,733.0 \text{ wscf/hr}$$

where  $V_s$ : 84.30 ft/sec  
Stack Area: 4.9090 sq. ft.  
Ts: 701.8 °A  
Ps: 30.104 "Hg

$$15) Q_{sd} = (\text{wscf/hr})(1-Bws) = 1,112,621.4 \text{ dscf/hr}$$

where wscf/hr: 1,127,733.0  
Bws: 0.0134

$$16) \text{ DSCfm} = (\text{dscf/hr})/60 \text{ mins/hr} = 18,543.7 \text{ DSCfm}$$

where dscf/hr: 1,112,621.4

$$17) \text{ Nozzle Area} = 3.1416 (\text{Nozzle Size}/24)^2 = 0.000203 \text{ sq. ft.}$$

where Nozzle Size: 0.1927 inches

Client: Hollingsworth & Vose  
Source: CFU117

Run: 1  
Date: 4/30/2018

$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(T_s)(V_m(\text{std}))}{P_s(V_s)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 99.9 \%$$

where Ts: 701.8 °A  
Vm(Std): 91.848 dscf  
Ps: 30.104 "Hg  
Vs: 84.30 ft/sec  
Nozzle Area: 0.000203 sq. ft.  
Sampling Time: 120 min.  
Bws: 0.0134

### EPA Method 316:

$$19) \text{ Formaldehyde laboratory results} = 1580.00000 \text{ } \mu\text{g/sample}$$

$$20) \text{ Formaldehyde} = (\mu\text{g/sample})/1,000,000 = 1.58\text{E-}03 \text{ grams/sample}$$

$$21) \text{ Cs} = (\text{Sample grams}/V_m(\text{Std}))(15.43\text{grains/gram}) = 2.65\text{E-}04 \text{ gr/dscf}$$

where Sample: 0.00158 grams  
Vm(std) 91.848 dscf

$$22) \text{ Cs} = (\text{Sample grams} \times 1,000,000 \text{ } \mu\text{g/gram})/V_m(\text{std}) = 607.5 \text{ } \mu\text{g/dscm}$$

where Sample: 0.00158 grams  
Vm(std) 2.601 dscm

$$23) \text{ Volume/Mole} = \left( \frac{359 \frac{\text{ft}^3}{\text{lb-mol}} @ \text{STP } (T_s) (29.92" \text{Hg})}{492^\circ \text{A } (P_s)} \right) = 508.956 \text{ Vol./Mole}$$

where Ts: 701.8 °A  
Ps: 30.104 "Hg

$$24) \text{ ppmvd} = \left( \frac{\frac{\text{lb}}{\text{hr}} \times \frac{\text{Vol.}}{\text{Mole}}}{(MW \times 0.00006 \times \text{ADCFM})} \right) = 4.86\text{E-}01 \text{ ppmvd}$$

where MW: 30.031 g/mol  
lb/hr: 0.04  
Vol./Mole: 508.956  
ADCFM: 24497.0

$$25) \text{ Mass Emission Rate} = (\text{Cs})(\text{Stack flow})/7000\text{gr/lb} = 4.22\text{E-}02 \text{ lb/hr}$$

where Cs: 2.65E-04 gr/dscf  
Stack Flow: 1,112,621.4 dscf/hr



## BISON ENGINEERING GASEOUS SUMMARY SPREADSHEET

|          |                        |        |                |
|----------|------------------------|--------|----------------|
| Company  | Hollingsworth and Vose | Source | CFU 117        |
| Facility | Glass Plant 2          | Date   | April 30, 2018 |
| Location | Corvallis, OR          |        |                |

|          |                                     | Test date  | 4/30/2018   | 4/30/2018   | 4/30/2018   |
|----------|-------------------------------------|------------|-------------|-------------|-------------|
|          |                                     | Start time | 8:42        | 11:35       | 14:29       |
|          |                                     | End time   | 10:47       | 13:39       | 16:34       |
|          |                                     | Test run   | 1           | 2           | 3           |
| Method 5 | Flow data from concurrent test runs | dscf/hr    | 1,058,466.2 | 1,097,067.7 | 1,096,626.8 |
|          |                                     | wscf/hr    | 1,076,333.3 | 1,116,040.4 | 1,115,138.1 |
|          |                                     | dscfm      | 17,641.1    | 18,284.5    | 18,277.1    |
|          |                                     | wscfm      | 17,938.9    | 18,600.7    | 18,585.6    |

| E M I S S I O N S |                                                 |                   |                  |          |          |          | Average  |
|-------------------|-------------------------------------------------|-------------------|------------------|----------|----------|----------|----------|
| Meth 3A           | Oxygen Concentration (O <sub>2</sub> )          | O <sub>2</sub>    | %                | 20.14    | 20.19    | 20.24    | 20.19    |
|                   | Carbon Dioxide Concentration (CO <sub>2</sub> ) | CO <sub>2</sub>   | %                | 0.64     | 0.65     | 0.55     | 0.61     |
| Meth 7E           | Nitrogen oxides (NOx) concentration             | NOx               | ppmvd            | 3.62     | 3.62     | 3.42     | 3.55     |
|                   | NOx mass rate                                   |                   | lbs/hr           | 4.57E-01 | 4.74E-01 | 4.47E-01 | 4.60E-01 |
|                   | NOx emission factor                             |                   | lbs/lb of glass  | 4.06E-03 | 4.24E-03 | 4.09E-03 | 4.13E-03 |
|                   | NOx emission factor                             |                   | lbs/Mscf nat gas | 8.48E-02 | 8.72E-02 | 8.12E-02 | 8.44E-02 |
| Meth 10           | Carbon monoxide (CO) concentration              | CO                | ppmvd            | 159.7    | 164.6    | 165.8    | 163.4    |
|                   | CO mass rate                                    |                   | lbs/hr           | 12.29    | 13.13    | 13.22    | 12.88    |
|                   | CO emission factor                              |                   | lbs/lb of glass  | 1.09E-01 | 1.17E-01 | 1.21E-01 | 1.16E-01 |
|                   | CO emission factor                              |                   | lbs/Mscf nat gas | 2.28     | 2.42     | 2.40     | 2.36     |
| Meth 25A          | Volatile Organics (NMVOC) concentration         | VOC               | ppmvw            | 2.29     | 1.94     | 1.34     | 1.86     |
|                   | NMVOC mass rate                                 |                   | lbs/hr           | 2.82E-01 | 2.47E-01 | 1.71E-01 | 2.33E-01 |
|                   | NMVOC emission factor                           |                   | lbs/lb of glass  | 2.50E-03 | 2.21E-03 | 1.56E-03 | 2.09E-03 |
|                   | NMVOC emission factor                           |                   | lbs/Mscf nat gas | 5.22E-02 | 4.55E-02 | 3.10E-02 | 4.29E-02 |
| Method 316        | Formaldehyde mass rate                          | CH <sub>2</sub> O | lb/hr            | 4.22E-02 | 4.41E-02 | 4.42E-02 | 4.35E-02 |
|                   | Formaldehyde emission factor                    |                   | lbs/lb of glass  | 3.74E-04 | 3.94E-04 | 4.04E-04 | 3.91E-04 |
|                   | Formaldehyde emission factor                    |                   | lb/Mscf nat. gas | 7.82E-03 | 8.12E-03 | 8.03E-03 | 7.99E-03 |
| Total VOCs        | Total VOC mass rate                             | Total VOC         | lb/hr            | 3.24E-01 | 2.92E-01 | 2.15E-01 | 2.77E-01 |
|                   | Total VOC emission factor                       |                   | lbs/lb of glass  | 2.87E-03 | 2.61E-03 | 1.96E-03 | 2.48E-03 |
|                   | Total VOC emission factor                       |                   | lb/Mscf nat. gas | 6.00E-02 | 5.36E-02 | 3.90E-02 | 5.09E-02 |

| P R O D U C T I O N R A T E S |  |         |         |         |         |
|-------------------------------|--|---------|---------|---------|---------|
| Glass Production              |  | lbs/hr  | 112.7   | 111.9   | 109.5   |
|                               |  | scf/hr  | 5,395.3 | 5,435.0 | 5,508.5 |
| Natural Gas Usage             |  | Mscf/hr | 5.3953  | 5.4350  | 5.5085  |
|                               |  |         |         |         | 5.4463  |

**Bison Engineering, Inc.**  
**Method 7E Nitrogen Oxides**  
*Calibration Error, System Bias and System Drift*  
 NOx molecular weight of 46

|           |                        |         |                |                      |                      |
|-----------|------------------------|---------|----------------|----------------------|----------------------|
| Company:  | Hollingsworth and Vose | Source: | CFU 117        | Instrument Make:     | Thermo Environmental |
| Facility: | Glass Plant 2          | Date:   | April 30, 2018 | Instrument Model:    | 42i                  |
| Location: | Corvallis, OR          |         |                | Instrument Serial #: | 729825194            |

|       |                        | <i>Initial Values</i> |                                     |           |                     | <i>Final Values</i>                  |           |                        |           |               |    | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|------------------------|-----------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|----|------------------|--------------------|-------------------------------|
|       | Analyzer Cal. Response | System Cal Response   | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |    |                  |                    |                               |
| Run 1 | zero                   | -0.10                 | -0.02                               | 0.80      | pass                | 0.03                                 | 1.30      | pass                   | 0.50      | pass          |    |                  |                    |                               |
|       | upscale                | 4.84                  | 5.16                                | 3.20      | pass                | 5.09                                 | 2.50      | pass                   | -0.70     | pass          | 10 | 3.71             | 3.62               | 5.0                           |
| Run 2 | zero                   | -0.10                 | 0.03                                | 1.30      | pass                | 0.03                                 | 1.30      | pass                   | 0.00      | pass          |    |                  |                    |                               |
|       | upscale                | 4.84                  | 5.09                                | 2.50      | pass                | 5.28                                 | 4.40      | pass                   | 1.90      | pass          | 10 | 3.76             | 3.62               | 5.0                           |
| Run 3 | zero                   | -0.10                 | 0.03                                | 1.30      | pass                | 0.03                                 | 1.30      | pass                   | 0.00      | pass          |    |                  |                    |                               |
|       | upscale                | 4.84                  | 5.28                                | 4.40      | pass                | 5.29                                 | 4.50      | pass                   | 0.10      | pass          | 10 | 3.62             | 3.42               | 5.0                           |
|       |                        | < 5%*                 |                                     |           |                     | < 5%*                                |           |                        |           | < 3%*         |    |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero  | Mid   | High  |
|----------------------------|-------|-------|-------|
| Calibration gas standards  | 0     | 5     | 10    |
| Cal gas analyzer response  | -0.1  | 4.84  | 9.9   |
| Analyzer Cal. Error        | -1.00 | -1.60 | -1.00 |
| Analyzer Error < 2%*       | pass  | pass  | pass  |

| <i>NO2 CONVERTER TEST</i> |        |
|---------------------------|--------|
| NO2 Tank Value (ppm)**    | 51.910 |
| NO Check Value            | 51.82  |
| NO2 to NO Conversion %    | 99.8%  |
| NO2 Conversion > 90% ?    | pass   |

\*Or < 0.5 ppm absolute difference

**Bison Engineering, Inc.**  
**Method 10 Carbon Monoxide**  
*Calibration Error, System Bias and System Drift*  
CO molecular weight of 28

|                                        |                             |                                              |
|----------------------------------------|-----------------------------|----------------------------------------------|
| Company: <b>Hollingsworth and Vose</b> | Source: <b>CFU 117</b>      | Instrument Make: <b>Thermo Environmental</b> |
| Facility: <b>Glass Plant 2</b>         | Date: <b>April 30, 2018</b> | Instrument Model: <b>48i HL</b>              |
| Location: <b>Corvallis, OR</b>         |                             | Instrument Serial #: <b>734025183</b>        |

|       |         | <i>Initial Values</i>        |                           |                                           |           | <i>Final Values</i>       |                                            |           |                           |           |                  | Raw Avg<br>Gas<br>Conc | Corrected<br>concentration<br>Conc | Instrument<br>Cal.<br>Reference<br>Gas |
|-------|---------|------------------------------|---------------------------|-------------------------------------------|-----------|---------------------------|--------------------------------------------|-----------|---------------------------|-----------|------------------|------------------------|------------------------------------|----------------------------------------|
|       |         | Analyzer<br>Cal.<br>Response | System<br>Cal<br>Response | Pre test<br>System Cal. Bias<br>% of span | pass/fail | System<br>Cal<br>Response | Post test<br>System Cal. Bias<br>% of span | pass/fail | System Drift<br>% of span | pass/fail | Analyzer<br>Span |                        |                                    |                                        |
| Run 1 | zero    | 0.94                         | -0.20                     | -0.57                                     | pass      | -0.37                     | -0.66                                      | pass      | -0.09                     | pass      |                  |                        |                                    |                                        |
|       | upscale | 100.91                       | 100.81                    | -0.05                                     | pass      | 100.61                    | -0.15                                      | pass      | -0.10                     | pass      | 200              | 161.04                 | 159.74                             | 100                                    |
| Run 2 | zero    | 0.94                         | -0.37                     | -0.66                                     | pass      | 0.36                      | -0.29                                      | pass      | 0.37                      | pass      |                  |                        |                                    |                                        |
|       | upscale | 100.91                       | 100.61                    | -0.15                                     | pass      | 100.16                    | -0.38                                      | pass      | -0.23                     | pass      | 200              | 165.24                 | 164.60                             | 100                                    |
| Run 3 | zero    | 0.94                         | 0.36                      | -0.29                                     | pass      | 0.02                      | -0.46                                      | pass      | -0.17                     | pass      |                  |                        |                                    |                                        |
|       | upscale | 100.91                       | 100.16                    | -0.38                                     | pass      | 99.51                     | -0.70                                      | pass      | -0.32                     | pass      | 200              | 165.38                 | 165.78                             | 100                                    |
|       |         |                              |                           | < 5%                                      |           | < 5%                      |                                            | < 3%      |                           |           |                  |                        |                                    |                                        |

| <i><b>ANALYZER CAL. ERROR</b></i>  | <b>Zero</b> | <b>Mid</b> | <b>High</b> |
|------------------------------------|-------------|------------|-------------|
| <b>Calibration gas standards</b>   | 0           | 100        | 200         |
| <b>Cal gas analyzer response</b>   | 0.94        | 100.91     | 201.6       |
| <b>Analyzer Cal. Error</b>         | 0.47        | 0.45       | 0.80        |
| <b>Analyzer Cal. Error &lt; 2%</b> | pass        | pass       | pass        |

**Bison Engineering, Inc.**

**Method 25A Total Hydrocarbons or Volatile Organic Compounds (VOC)**

**Calibration Error and Drift Checks**

VOC molecular weight of 44 as propane

|                                        |                             |                                              |
|----------------------------------------|-----------------------------|----------------------------------------------|
| Company: <b>Hollingsworth and Vose</b> | Source: <b>CFU 117</b>      | Instrument Make: <b>Thermo Environmental</b> |
| Facility: <b>Glass Plant 2</b>         | Date: <b>April 30, 2018</b> | Instrument Model: <b>55i</b>                 |
| Location: <b>Corvallis, OR</b>         |                             | Instrument Serial #: <b>1018142851</b>       |

|       |         | System Cal. | Post-Run Cal. | Cal. to Post-Run System Drift |           | Analyzer | Avg Gas | Instrument Cal. |
|-------|---------|-------------|---------------|-------------------------------|-----------|----------|---------|-----------------|
|       |         | Response    | Response      | % of span                     | pass/fail | Span     | Conc    | Reference Gas   |
| Run 1 | zero    | 0.16        | 0.32          | 4.00                          | pass      |          |         |                 |
|       | upscale | 2.79        | 2.55          | -6.00                         | pass      | 4        | 2.29    | 2.5             |
| Run 2 | zero    | 0.16        | 0.47          | 7.75                          | pass      |          |         |                 |
|       | upscale | 2.79        | 2.91          | 3.00                          | pass      | 4        | 1.94    | 2.5             |
| Run 3 | zero    | 0.16        | 0.06          | -2.50                         | pass      |          |         |                 |
|       | upscale | 2.79        | 2.86          | 1.75                          | pass      | 4        | 1.34    | 2.5             |
|       |         |             |               | ≤ 3%*                         |           |          |         |                 |

| Instrument Response Time(s): |            |
|------------------------------|------------|
| Time 1                       | 300        |
| Time 2                       | 300        |
| Time 3                       | 300        |
| <b>Average:</b>              | <b>300</b> |

| SYSTEM CAL. ERROR         | Zero | Low   | Mid  | High  |
|---------------------------|------|-------|------|-------|
| Calibration gas standards | 0    | 1.5   | 2.5  | 4     |
| Cal gas system response   | 0.16 | 1.45  | 2.79 | 3.88  |
| System Cal. Error         | 4.00 | -1.25 | 7.25 | -3.00 |
| System Cal. Error <5%*    | pass | pass  | pass | pass  |

\*Or < 0.5 ppm absolute difference as per administrator approval

**Bison Engineering, Inc.**  
**Method 3A Oxygen**  
*Calibration Error, System Bias and System Drift*

|           |                        |        |                |                      |              |
|-----------|------------------------|--------|----------------|----------------------|--------------|
| Company:  | Hollingsworth and Vose | Source | CFU 117        | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2          | Date   | April 30, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR          |        |                | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>        |                           |                                           |           | <i>Final Values</i>       |                                            |           |                           |           |                  | Raw Avg<br>Gas<br>Conc | Corrected<br>Gas<br>Conc | Instrument<br>Cal.<br>Reference<br>Gas |
|-------|---------|------------------------------|---------------------------|-------------------------------------------|-----------|---------------------------|--------------------------------------------|-----------|---------------------------|-----------|------------------|------------------------|--------------------------|----------------------------------------|
|       |         | Analyzer<br>Cal.<br>Response | System<br>Cal<br>Response | Pre test<br>System Cal. Bias<br>% of span | pass/fail | System<br>Cal<br>Response | Post test<br>System Cal. Bias<br>% of span | pass/fail | System Drift<br>% of span | pass/fail | Analyzer<br>Span |                        |                          |                                        |
| Run 1 | zero    | 0.00                         | 0.01                      | 0.05                                      | pass      | 0.24                      | 1.20                                       | pass      | 1.15                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.93                         | 9.82                      | -0.55                                     | pass      | 9.90                      | -0.15                                      | pass      | 0.40                      | pass      | 20               | 19.73                  | 20.14                    | 10                                     |
| Run 2 | zero    | 0.00                         | 0.24                      | 1.20                                      | pass      | 0.23                      | 1.15                                       | pass      | -0.05                     | pass      |                  |                        |                          |                                        |
|       | upscale | 9.93                         | 9.90                      | -0.15                                     | pass      | 9.88                      | -0.25                                      | pass      | -0.10                     | pass      | 20               | 19.73                  | 20.19                    | 10                                     |
| Run 3 | zero    | 0.00                         | 0.23                      | 1.15                                      | pass      | 0.29                      | 1.45                                       | pass      | 0.30                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.93                         | 9.88                      | -0.25                                     | pass      | 9.93                      | 0.00                                       | pass      | 0.25                      | pass      | 20               | 19.78                  | 20.24                    | 10                                     |
|       |         |                              |                           | < 5%*                                     |           |                           |                                            | < 5%*     |                           | < 3%*     |                  |                        |                          |                                        |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High  |
|----------------------------|------|-------|-------|
| Calibration gas standards  | 0    | 10    | 20    |
| Cal gas analyzer response  | 0    | 9.93  | 20.05 |
| Analyzer Cal. Error        | 0.00 | -0.35 | 0.25  |
| Analyzer Cal. Error <2%*   | pass | pass  | pass  |

\*Or <0.5% O<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 3A Carbon Dioxide**  
*Calibration Error, System Bias and System Drift*

|           |                        |        |                |                      |              |
|-----------|------------------------|--------|----------------|----------------------|--------------|
| Company:  | Hollingsworth and Vose | Source | CFU 117        | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2          | Date   | April 30, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR          |        |                | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.08                   | 0.04                | -1.00                               | pass      | 0.09                | 0.25                                 | pass      | 1.25                   | pass      |               |                  |                    |                               |
|       | upscale | 1.85                   | 1.88                | 0.75                                | pass      | 1.93                | 2.00                                 | pass      | 1.25                   | pass      | 4.0           | 0.65             | 0.64               | 2                             |
| Run 2 | zero    | 0.08                   | 0.09                | 0.25                                | pass      | 0.08                | 0.00                                 | pass      | -0.25                  | pass      |               |                  |                    |                               |
|       | upscale | 1.85                   | 1.93                | 2.00                                | pass      | 1.86                | 0.25                                 | pass      | -1.75                  | pass      | 4.0           | 0.67             | 0.65               | 2                             |
| Run 3 | zero    | 0.08                   | 0.08                | 0.00                                | pass      | 0.38                | 7.50                                 | pass      | 7.50                   | pass      |               |                  |                    |                               |
|       | upscale | 1.85                   | 1.86                | 0.25                                | pass      | 1.90                | 1.25                                 | pass      | 1.00                   | pass      | 4.0           | 0.68             | 0.55               | 2                             |
|       |         |                        |                     | < 5%*                               |           | < 5%*               |                                      | < 3%*     |                        |           |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High |
|----------------------------|------|-------|------|
| Calibration gas standards  | 0    | 2     | 4.0  |
| Cal gas analyzer response  | 0.08 | 1.85  | 4.04 |
| Analyzer Cal. Error        | 2.00 | -3.75 | 1.00 |
| Analyzer Cal. Error < 2%*  | pass | pass  | pass |

\*Or <0.5% CO<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 205 Dilution System Check**

|           |                        |         |                |                      |            |
|-----------|------------------------|---------|----------------|----------------------|------------|
| Company:  | Hollingsworth and Vose | Source: | CFU 117        | Instrument Make:     | EnviroNics |
| Facility: | Glass Plant 2          | Date:   | April 30, 2018 | Instrument Model:    | 4040       |
| Location: | Corvallis, OR          |         |                | Instrument Serial #: | 3880       |

|                                                |                 | First | Second | Third | Average |
|------------------------------------------------|-----------------|-------|--------|-------|---------|
| High Level                                     | 10 % oxygen     | 10.03 | 10.08  | 10.07 | 10.06   |
| Percent diff from avg recorded value           | dilution system | -0.3% | 0.2%   | 0.1%  |         |
| Pass or Fail +/- 2%                            |                 | PASS  | PASS   | PASS  |         |
| Percent diff from target of 10% O <sub>2</sub> |                 | 0.3%  | 0.8%   | 0.7%  | 0.6%    |
| Pass or Fail +/- 2% from target value          |                 |       |        |       | PASS    |

|                                               |                 |       |      |      |      |
|-----------------------------------------------|-----------------|-------|------|------|------|
| Mid Level                                     | 5 % oxygen      | 5.00  | 5.02 | 5.03 | 5.02 |
| Percent diff from avg recorded value          | dilution system | -0.3% | 0.1% | 0.3% |      |
| Pass or Fail +/- 2%                           |                 | PASS  | PASS | PASS |      |
| Percent diff from target of 5% O <sub>2</sub> |                 | 0.0%  | 0.4% | 0.6% | 0.3% |
| Pass or Fail +/- 2% from target value         |                 |       |      |      | PASS |

|                             |             |                       |      |      |      |            |       |
|-----------------------------|-------------|-----------------------|------|------|------|------------|-------|
| Independent Mid Level Check | 5% oxygen   | 9.91                  | 9.92 | 9.93 | 9.92 | Tank value | 9.893 |
|                             | independent | Percent diff from avg |      |      |      | 0.27%      |       |
|                             | tank check  | Pass or Fail < 2%     |      |      |      | PASS       |       |

**Summary - Method 205 - Verification of Gas Dilution Systems for Field Instrument Calibrations**

A gas dilution system can provide known values of calibration gases through controlled dilution of high-level calibration gases with an appropriate dilution gas. The calibration gases with an appropriate dilution gas. The instrumental test methods in 40 CFR part 60 - e.g., Methods 3A, 6C, 7E, 10, 15, 16, 20, 25A and 25B require on-site, multi-point point calibration using gases of known concentrations. A gas dilution system that produces known low level calibration gases from high-level calibration gases, with a degree of confidence similar to that for Protocol 1 gases, may be used for compliance tests in lieu of multiple calibration gases when the gas dilution system is demonstrated to meet the requirements of this method.

The gas dilution system shall be evaluated on one analyzer once during each field test. A precalibrated analyzer is chosen, at the discretion of the source owner or operator, to demonstrate that the gas dilution system produces predictable gas concentrations spanning a range of concentrations. After meeting the requirements of this method, the remaining analyzers may be calibrated with the dilution system in accordance to the requirements of the applicable method for the duration of the field test.

The gas dilution system shall produce calibration gases whose measured values are within  $\pm 2$  percent of the predicted values.

**Instructions from Method 205**

3.2.2 Calculate the predicted concentration for each of the dilutions based on the flow rates through the gas dilution system (or the dilution ratios) and the certified concentration of the high - level supply gas.

3.2.3 Introduce each of the dilutions from Section 3.2.1 into the analyzer or monitor one at a time and determine the instrument response for each of the dilutions.

3.2.4 Repeat the procedure in Section 3.2.3 two times, i.e., until three injections are made at dilution level. Calculate the average instrument response for each triplicate injection at each dilution level. No single injection shall differ by more than  $\pm 2$  percent from the average instrument response for that dilution.

3.2.5 For each level of dilution, calculate the difference between the average concentration output recorded by the analyzer and the predicted concentration calculated in Section 3.2.2. The average concentration output from the analyzer shall be within  $\pm 2$  percent of the predicted value.

3.2.6 Introduce the mid - level supply gas directly into the analyzer, bypassing the gas dilution system. Repeat the procedure twice more, for a total of three mid-level supply gas injections.

Calculate the average analyzer output concentration for the mid-level supply gas. The difference between the certified concentration of the mid-level supply gas and the average instrument response shall be within  $\pm 2$  percent.

3.3 If the gas dilution system meets the criteria listed in Section 3.2, the gas dilution system may be used throughout that field test.

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 6:36:28 | -0.10     | 2.33     | 0.01   | 0.08    |           |          |        |         |
| 4/30/2018 | 6:36:38 | -0.09     | 1.46     | 0.01   | 0.08    |           |          |        |         |
| 4/30/2018 | 6:36:48 | -0.10     | 0.89     | 0.01   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:36:58 | -0.09     | 0.72     | 0.01   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:37:08 | -0.09     | 2.10     | 0.01   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:37:18 | -0.10     | 3.12     | 0.00   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:37:28 | -0.08     | 3.31     | 0.01   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:38:40 | -0.09     | 2.84     | 0.00   | 0.08    |           |          |        |         |
| 4/30/2018 | 6:38:50 | -0.10     | 1.96     | 0.00   | 0.08    |           |          |        |         |
| 4/30/2018 | 6:39:00 | -0.10     | 0.97     | 0.00   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:39:10 | -0.10     | 0.64     | 0.00   | 0.08    |           |          |        |         |
| 4/30/2018 | 6:39:20 | -0.09     | 1.22     | 0.00   | 0.08    | -0.10     | 0.94     | 0.00   | 0.08    |
| 4/30/2018 | 6:39:30 | -0.11     | 2.55     | -0.01  | 0.07    |           |          |        |         |
| 4/30/2018 | 6:39:40 | -0.10     | 3.00     | 0.00   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:39:50 | -0.11     | 2.50     | 0.03   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:40:00 | -0.10     | 1.57     | 0.00   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:40:10 | -0.11     | 0.67     | 0.00   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:40:20 | -0.10     | 0.42     | 0.00   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:40:30 | -0.09     | 1.31     | 2.56   | 0.11    |           |          |        |         |
| 4/30/2018 | 6:40:40 | -0.10     | 2.70     | 9.24   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:40:50 | -0.10     | 3.15     | 9.90   | 0.06    |           |          |        |         |
| 4/30/2018 | 6:41:00 | -0.09     | 2.87     | 9.93   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:41:10 | -0.10     | 1.97     | 9.93   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:41:20 | -0.11     | 0.85     | 9.93   | 0.07    |           |          | 9.93   |         |
| 4/30/2018 | 6:41:30 | -0.11     | 0.43     | 9.94   | 0.07    |           |          |        |         |
| 4/30/2018 | 6:41:40 | -0.10     | 1.19     | 9.93   | 0.06    |           |          |        |         |
| 4/30/2018 | 6:41:50 | -0.08     | 2.48     | 11.23  | 0.24    |           |          |        |         |
| 4/30/2018 | 6:42:00 | -0.10     | 3.19     | 19.74  | 17.92   |           |          |        |         |
| 4/30/2018 | 6:42:10 | -0.11     | 3.17     | 19.98  | 19.79   |           |          |        |         |
| 4/30/2018 | 6:42:20 | -0.09     | 3.27     | 20.04  | 19.85   |           |          |        |         |
| 4/30/2018 | 6:42:30 | -0.09     | 2.27     | 20.04  | 19.86   |           |          |        |         |
| 4/30/2018 | 6:42:40 | -0.09     | 0.50     | 20.06  | 19.88   |           |          |        |         |
| 4/30/2018 | 6:42:50 | -0.09     | -0.03    | 20.06  | 19.88   |           |          | 20.05  |         |
| 4/30/2018 | 6:43:00 | -0.09     | 0.51     | 20.06  | 19.88   |           |          |        |         |
| 4/30/2018 | 6:43:10 | -0.09     | 0.87     | 17.84  | 19.64   |           |          |        |         |
| 4/30/2018 | 6:43:20 | -0.09     | 0.38     | 13.81  | 10.94   |           |          |        |         |
| 4/30/2018 | 6:43:30 | 0.00      | 0.48     | 3.49   | 3.56    |           |          |        |         |
| 4/30/2018 | 6:43:40 | 0.67      | 1.17     | 3.93   | 4.17    |           |          |        |         |
| 4/30/2018 | 6:43:50 | 1.73      | 0.94     | 3.87   | 4.12    |           |          |        |         |
| 4/30/2018 | 6:44:00 | 0.78      | 0.55     | 3.89   | 4.13    |           |          |        |         |
| 4/30/2018 | 6:44:10 | -0.03     | 1.12     | 3.90   | 4.15    |           |          |        |         |
| 4/30/2018 | 6:44:20 | -0.02     | 2.04     | 3.90   | 4.14    |           |          |        |         |
| 4/30/2018 | 6:44:30 | -0.02     | 1.98     | 3.91   | 4.06    |           |          |        |         |
| 4/30/2018 | 6:44:40 | -0.01     | 1.09     | 3.92   | 4.03    |           |          |        |         |



**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 6:44:50 | -0.02     | 0.05     | 3.92   | 4.03    |           |          |        | 4.04    |
| 4/30/2018 | 6:45:00 | -0.02     | -0.51    | 3.93   | 4.02    |           |          |        |         |
| 4/30/2018 | 6:45:10 | -0.08     | -0.21    | 3.93   | 4.03    |           |          |        |         |
| 4/30/2018 | 6:45:20 | -0.33     | 0.81     | 3.25   | 3.21    |           |          |        |         |
| 4/30/2018 | 6:45:30 | -0.28     | 1.90     | 2.11   | 2.01    |           |          |        |         |
| 4/30/2018 | 6:45:40 | 0.31      | 2.17     | 1.96   | 1.86    |           |          |        |         |
| 4/30/2018 | 6:45:50 | 0.84      | 1.55     | 1.95   | 1.86    |           |          |        |         |
| 4/30/2018 | 6:46:00 | 0.85      | 0.68     | 1.95   | 1.85    |           |          |        |         |
| 4/30/2018 | 6:46:10 | 0.83      | 0.02     | 1.95   | 1.85    |           |          |        |         |
| 4/30/2018 | 6:46:20 | 0.50      | -0.02    | 1.95   | 1.85    |           |          |        |         |
| 4/30/2018 | 6:46:30 | 0.26      | 1.27     | 1.95   | 1.85    |           |          |        |         |
| 4/30/2018 | 6:46:40 | 0.25      | 2.39     | 1.96   | 1.85    |           |          |        | 1.85    |
| 4/30/2018 | 6:46:50 | 0.26      | 2.19     | 1.95   | 1.85    |           |          |        |         |
| 4/30/2018 | 6:47:00 | 0.26      | 1.06     | 1.86   | 1.84    |           |          |        |         |
| 4/30/2018 | 6:47:10 | 0.25      | 0.15     | 1.20   | 0.76    |           |          |        |         |
| 4/30/2018 | 6:47:20 | 0.22      | -0.10    | 1.58   | 1.21    |           |          |        |         |
| 4/30/2018 | 6:47:30 | 0.16      | 1.28     | 0.55   | 0.17    |           |          |        |         |
| 4/30/2018 | 6:47:40 | 2.00      | 6.26     | 0.13   | 0.10    |           |          |        |         |
| 4/30/2018 | 6:47:50 | 3.90      | 11.49    | 0.04   | 0.09    |           |          |        |         |
| 4/30/2018 | 6:48:00 | 6.53      | 13.25    | 0.02   | 0.08    |           |          |        |         |
| 4/30/2018 | 6:48:10 | 8.88      | 12.89    | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:48:20 | 8.85      | 11.72    | 0.02   | -0.03   |           |          |        |         |
| 4/30/2018 | 6:48:30 | 8.66      | 10.66    | 0.01   | -0.03   |           |          |        |         |
| 4/30/2018 | 6:48:40 | 8.71      | 10.58    | 0.01   | -0.03   |           |          |        |         |
| 4/30/2018 | 6:48:50 | 8.56      | 11.79    | 0.01   | -0.03   |           |          |        |         |
| 4/30/2018 | 6:49:00 | 8.60      | 13.25    | 0.01   | -0.03   |           |          |        |         |
| 4/30/2018 | 6:49:10 | 8.88      | 13.73    | 0.01   | -0.04   |           |          |        |         |
| 4/30/2018 | 6:49:20 | 9.27      | 12.95    | 0.01   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:49:30 | 9.91      | 11.48    | 0.01   | -0.04   |           |          |        |         |
| 4/30/2018 | 6:49:40 | 10.40     | 10.63    | 0.01   | -0.04   |           |          |        |         |
| 4/30/2018 | 6:49:50 | 10.72     | 10.65    | 0.01   | -0.04   |           |          |        |         |
| 4/30/2018 | 6:50:00 | 11.01     | 11.52    | 0.01   | -0.04   |           |          |        |         |
| 4/30/2018 | 6:50:10 | 11.54     | 12.97    | 0.01   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:50:20 | 11.61     | 13.32    | 0.01   | -0.04   |           |          |        |         |
| 4/30/2018 | 6:50:30 | 11.89     | 12.39    | 0.00   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:50:40 | 11.93     | 11.83    | 0.01   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:50:50 | 12.23     | 10.93    | 0.01   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:51:00 | 12.24     | 10.59    | 0.00   | -0.06   |           |          |        |         |
| 4/30/2018 | 6:51:10 | 12.25     | 11.35    | 0.01   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:51:20 | 12.52     | 12.74    | 0.00   | -0.06   |           |          |        |         |
| 4/30/2018 | 6:51:30 | 12.51     | 13.52    | 0.00   | -0.05   |           |          |        |         |
| 4/30/2018 | 6:51:40 | 12.51     | 13.04    | 0.01   | -0.06   |           |          |        |         |
| 4/30/2018 | 6:51:50 | 12.51     | 11.71    | 0.01   | -0.03   |           |          |        |         |
| 4/30/2018 | 6:52:00 | 12.51     | 10.89    | 0.01   | 0.00    |           |          |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 6:52:10 | 12.53     | 10.64    | 0.00   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:52:20 | 12.53     | 11.63    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:52:30 | 12.51     | 12.85    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:52:40 | 12.51     | 13.00    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:52:50 | 12.51     | 12.72    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:53:00 | 12.51     | 11.93    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:53:10 | 12.51     | 11.04    | 0.00   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:53:20 | 12.53     | 10.60    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:53:30 | 12.52     | 11.04    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:53:40 | 12.52     | 12.73    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:53:50 | 12.51     | 13.64    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:54:00 | 12.51     | 13.00    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:54:10 | 12.53     | 12.03    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:54:20 | 12.55     | 11.25    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:54:30 | 12.56     | 10.66    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:54:40 | 12.56     | 11.19    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:54:50 | 12.56     | 12.34    | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:55:00 | 12.56     | 13.22    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:55:10 | 12.55     | 13.07    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:55:20 | 12.56     | 12.03    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:55:30 | 12.56     | 11.19    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:55:40 | 11.08     | 10.42    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:55:50 | 11.05     | 11.05    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:56:00 | 10.79     | 12.21    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:56:10 | 10.87     | 13.15    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:56:20 | 10.90     | 13.19    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:56:30 | 10.91     | 12.58    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:56:40 | 19.91     | 11.57    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:56:50 | 16.91     | 10.55    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:57:00 | 0.92      | 10.59    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:57:10 | 0.91      | 11.74    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:57:20 | 5.90      | 12.68    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:57:30 | 5.92      | 13.13    | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:57:40 | 5.93      | 12.59    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:57:50 | 7.52      | 11.55    | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:58:00 | 7.92      | 10.75    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:58:10 | 7.91      | 10.82    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:58:20 | 8.91      | 11.44    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:58:30 | 9.89      | 12.96    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:58:40 | 9.62      | 13.23    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:58:50 | 9.62      | 12.48    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:59:00 | 9.60      | 11.73    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:59:10 | 9.67      | 10.65    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:59:20 | 10.20     | 10.53    | 0.01   | -0.01   |           |          |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 6:59:30 | 10.18     | 11.62    | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 6:59:40 | 9.91      | 12.88    | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 6:59:50 | 9.91      | 13.35    | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:00:00 | 9.90      | 12.95    | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:00:10 | 9.88      | 11.76    | 0.02   | 0.00    | 9.90      |          |        |         |
| 4/30/2018 | 7:00:20 | 9.89      | 11.03    | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:00:30 | 9.69      | 9.71     | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:00:40 | 7.62      | 8.37     | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:00:50 | 5.73      | 8.47     | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:01:00 | 5.62      | 8.07     | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:01:10 | 4.84      | 7.41     | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:01:20 | 4.85      | 6.62     | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:01:30 | 4.83      | 5.54     | 0.01   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:01:40 | 4.83      | 5.41     | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:01:50 | 4.83      | 6.02     | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:02:00 | 4.84      | 7.17     | 0.01   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:02:10 | 4.85      | 7.75     | 0.01   | -0.01   | 4.84      |          |        |         |
| 4/30/2018 | 7:02:20 | 4.84      | 7.56     | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:02:30 | 4.84      | 6.94     | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:02:40 | 4.87      | 5.70     | 0.17   | 0.01    |           |          |        |         |
| 4/30/2018 | 7:02:50 | 4.82      | 4.27     | 0.04   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:03:00 | 4.59      | 3.03     | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:03:10 | 4.89      | 3.36     | 1.05   | 0.06    |           |          |        |         |
| 4/30/2018 | 7:03:20 | 2.20      | 16.99    | 0.26   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:03:30 | 5.43      | 60.89    | 0.04   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:03:40 | 89.08     | 122.43   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:03:50 | 156.45    | 169.59   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:04:00 | 167.59    | 192.02   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:04:10 | 189.12    | 199.02   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:04:20 | 185.84    | 201.33   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:04:30 | 182.78    | 203.56   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:04:40 | 187.81    | 203.89   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:04:50 | 191.66    | 202.84   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:05:00 | 192.93    | 202.02   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:05:10 | 194.52    | 201.37   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:05:20 | 193.93    | 201.03   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:05:30 | 193.62    | 202.52   | 0.03   | 0.01    |           |          |        |         |
| 4/30/2018 | 7:05:40 | 193.36    | 204.52   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:05:50 | 193.33    | 204.57   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:06:00 | 193.02    | 203.31   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:06:10 | 192.74    | 202.25   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:06:20 | 192.70    | 201.67   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:06:30 | 192.42    | 201.14   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:06:40 | 192.12    | 201.99   | 0.03   | 0.00    |           | 201.60   |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 7:06:50 | 191.88    | 204.01   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:07:00 | 192.40    | 197.14   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:07:10 | 188.64    | 170.35   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:07:20 | 129.74    | 136.05   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:07:30 | 81.26     | 112.68   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:07:40 | 91.29     | 103.40   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:07:50 | 95.02     | 102.29   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:08:00 | 94.75     | 103.83   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:08:10 | 94.38     | 104.88   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:08:20 | 93.49     | 104.35   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:08:30 | 92.69     | 103.47   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:08:40 | 92.94     | 102.64   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:08:50 | 92.96     | 102.10   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:09:00 | 93.29     | 102.19   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:09:10 | 93.53     | 103.57   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:09:20 | 93.21     | 104.81   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:09:30 | 94.35     | 104.48   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:09:40 | 94.71     | 103.01   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:09:50 | 94.60     | 101.84   | 0.02   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:10:00 | 96.01     | 100.97   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:10:10 | 96.57     | 100.63   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:10:20 | 96.89     | 101.69   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:10:30 | 97.13     | 103.49   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:10:40 | 96.86     | 103.96   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:10:50 | 96.87     | 103.39   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:11:00 | 96.89     | 102.36   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:11:10 | 97.19     | 101.22   | 0.03   | 0.00    |           |          |        |         |
| 4/30/2018 | 7:11:20 | 97.44     | 100.59   | 0.02   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:11:30 | 97.18     | 100.91   | 0.02   | -0.01   |           | 100.91   |        |         |
| 4/30/2018 | 7:11:40 | 97.14     | 101.99   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:11:50 | 96.87     | 103.46   | 0.03   | -0.01   |           |          |        |         |
| 4/30/2018 | 7:12:00 | 96.91     | 99.36    | 13.91  | 0.11    |           |          |        |         |
| 4/30/2018 | 7:12:10 | 94.81     | 79.51    | 20.81  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:12:20 | 71.95     | 48.62    | 21.11  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:12:30 | 58.22     | 21.84    | 21.10  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:12:40 | 61.10     | 6.63     | 21.10  | -0.02   |           |          |        |         |
| 4/30/2018 | 7:12:50 | 56.67     | 2.14     | 21.11  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:13:00 | 56.94     | 2.30     | 21.11  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:13:10 | 56.94     | 2.37     | 21.13  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:13:20 | 56.92     | 2.09     | 21.13  | -0.02   |           |          |        |         |
| 4/30/2018 | 7:13:30 | 56.94     | 1.11     | 21.14  | -0.02   |           |          |        |         |
| 4/30/2018 | 7:13:40 | 56.94     | 0.49     | 21.13  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:13:50 | 56.94     | 0.13     | 21.14  | -0.01   |           |          |        |         |
| 4/30/2018 | 7:14:00 | 56.94     | 0.16     | 21.14  | -0.01   |           |          |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM]      | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|----------------|----------|--------|---------|
| 4/30/2018 | 7:14:10 | 56.91     | 1.45     | 21.15  | -0.01   |                |          |        |         |
| 4/30/2018 | 7:14:20 | 56.91     | 2.48     | 18.70  | -0.02   |                |          |        |         |
| 4/30/2018 | 7:14:30 | 56.80     | 2.44     | 18.29  | -0.01   |                |          |        |         |
| 4/30/2018 | 7:14:40 | 55.59     | 1.68     | 18.18  | -0.01   |                |          |        |         |
| 4/30/2018 | 7:14:50 | 54.19     | 1.10     | 18.07  | -0.02   |                |          |        |         |
| 4/30/2018 | 7:15:00 | 53.23     | 0.31     | 17.92  | -0.01   |                |          |        |         |
| 4/30/2018 | 7:15:10 | 52.17     | 0.12     | 17.76  | -0.02   |                |          |        |         |
| 4/30/2018 | 7:15:20 | 52.13     | 1.60     | 17.63  | -0.01   |                |          |        |         |
| 4/30/2018 | 7:15:30 | 51.81     | 2.62     | 17.57  | -0.02   | NO2 Conversion |          |        |         |
| 4/30/2018 | 7:15:40 | 51.52     | 2.70     | 20.42  | 0.01    | 51.82          |          |        |         |
| 4/30/2018 | 7:15:50 | 49.88     | 2.06     | 20.98  | 0.03    |                |          |        |         |
| 4/30/2018 | 7:16:00 | 36.36     | 1.39     | 21.00  | 0.03    |                |          |        |         |
| 4/30/2018 | 7:16:10 | 23.05     | 0.51     | 20.98  | 0.04    |                |          |        |         |
| 4/30/2018 | 7:16:20 | 11.74     | 0.26     | 20.96  | 0.04    |                |          |        |         |

**System Calibrations**

|           |         |       |        |       |      |
|-----------|---------|-------|--------|-------|------|
| 4/30/2018 | 7:16:30 | 1.43  | 1.27   | 20.94 | 0.05 |
| 4/30/2018 | 7:16:40 | 0.87  | 2.37   | 20.92 | 0.04 |
| 4/30/2018 | 7:16:50 | 0.57  | 2.68   | 20.92 | 0.04 |
| 4/30/2018 | 7:17:00 | 0.54  | 2.31   | 20.91 | 0.06 |
| 4/30/2018 | 7:17:10 | 0.27  | 1.52   | 19.38 | 0.07 |
| 4/30/2018 | 7:17:20 | 0.25  | 3.12   | 5.07  | 0.03 |
| 4/30/2018 | 7:17:30 | 3.15  | 19.57  | 0.85  | 0.01 |
| 4/30/2018 | 7:17:40 | 34.35 | 49.61  | 0.84  | 0.02 |
| 4/30/2018 | 7:17:50 | 58.88 | 76.95  | 0.82  | 0.01 |
| 4/30/2018 | 7:18:00 | 67.04 | 93.09  | 0.79  | 0.01 |
| 4/30/2018 | 7:18:10 | 79.08 | 98.21  | 0.77  | 0.01 |
| 4/30/2018 | 7:18:20 | 83.08 | 98.16  | 0.75  | 0.02 |
| 4/30/2018 | 7:18:30 | 87.96 | 97.79  | 0.73  | 0.02 |
| 4/30/2018 | 7:18:40 | 91.13 | 97.46  | 0.71  | 0.01 |
| 4/30/2018 | 7:18:50 | 93.38 | 97.77  | 0.70  | 0.02 |
| 4/30/2018 | 7:19:00 | 94.62 | 99.51  | 1.78  | 0.03 |
| 4/30/2018 | 7:19:10 | 95.65 | 99.41  | 1.03  | 0.02 |
| 4/30/2018 | 7:19:20 | 92.37 | 98.02  | 0.31  | 0.02 |
| 4/30/2018 | 7:19:30 | 90.01 | 97.83  | 0.52  | 0.01 |
| 4/30/2018 | 7:19:40 | 93.59 | 98.16  | 0.58  | 0.02 |
| 4/30/2018 | 7:19:50 | 96.47 | 98.33  | 0.65  | 0.02 |
| 4/30/2018 | 7:20:00 | 95.60 | 97.55  | 4.97  | 0.03 |
| 4/30/2018 | 7:20:10 | 93.30 | 94.46  | 1.04  | 0.02 |
| 4/30/2018 | 7:20:20 | 75.73 | 92.56  | 0.22  | 0.02 |
| 4/30/2018 | 7:20:30 | 61.82 | 94.71  | 0.14  | 0.02 |
| 4/30/2018 | 7:20:40 | 79.52 | 97.89  | 0.13  | 0.02 |
| 4/30/2018 | 7:20:50 | 95.37 | 100.06 | 0.13  | 0.03 |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 7:21:00 | 95.70     | 100.36   | 0.14   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:21:10 | 95.97     | 100.44   | 0.14   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:21:20 | 95.96     | 101.64   | 0.16   | 0.03    |           | 100.81   |        |         |
| 4/30/2018 | 7:21:30 | 95.97     | 102.29   | 2.78   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:21:40 | 96.16     | 99.95    | 0.58   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:21:50 | 98.03     | 97.01    | 0.17   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:22:00 | 99.77     | 97.26    | 0.14   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:22:10 | 97.98     | 99.44    | 0.14   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:22:20 | 96.61     | 101.04   | 0.14   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:22:30 | 97.18     | 102.17   | 0.13   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:22:40 | 97.18     | 103.78   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:22:50 | 97.19     | 104.65   | 0.05   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:23:00 | 97.22     | 104.41   | 0.05   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:23:10 | 97.49     | 103.40   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:23:20 | 97.51     | 102.43   | 0.06   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:23:30 | 97.83     | 102.03   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:23:40 | 97.79     | 102.28   | 0.05   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:23:50 | 97.47     | 103.83   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:24:00 | 97.50     | 104.74   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:24:10 | 97.78     | 104.17   | 0.06   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:24:20 | 97.49     | 103.26   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:24:30 | 97.47     | 102.31   | 0.05   | 0.02    |           |          |        |         |
| 4/30/2018 | 7:24:40 | 97.47     | 101.84   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:24:50 | 97.47     | 102.23   | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:25:00 | 97.44     | 103.43   | 3.06   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:25:10 | 96.03     | 101.22   | 0.87   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:25:20 | 84.42     | 98.25    | 0.12   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:25:30 | 75.03     | 98.18    | 6.87   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:25:40 | 87.40     | 92.42    | 17.43  | 0.07    |           |          |        |         |
| 4/30/2018 | 7:25:50 | 96.60     | 73.57    | 11.89  | 0.05    |           |          |        |         |
| 4/30/2018 | 7:26:00 | 50.53     | 49.44    | 19.44  | 0.07    |           |          |        |         |
| 4/30/2018 | 7:26:10 | 8.81      | 29.86    | 20.70  | 0.08    |           |          |        |         |
| 4/30/2018 | 7:26:20 | 6.59      | 16.50    | 18.71  | 0.07    |           |          |        |         |
| 4/30/2018 | 7:26:30 | 3.59      | 11.91    | 7.98   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:26:40 | 5.26      | 15.79    | 6.17   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:26:50 | 4.07      | 18.97    | 6.77   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:27:00 | 8.31      | 16.44    | 2.83   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:27:10 | 14.76     | 10.86    | 0.31   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:27:20 | 11.91     | 7.62     | 0.08   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:27:30 | 8.22      | 7.97     | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:27:40 | 8.83      | 8.54     | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:27:50 | 9.56      | 7.97     | 0.05   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:28:00 | 8.97      | 7.07     | 0.05   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:28:10 | 8.43      | 6.49     | 0.04   | 0.04    |           |          |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 7:28:20 | 8.13      | 5.72     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:28:30 | 7.82      | 6.04     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:28:40 | 7.57      | 7.30     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:28:50 | 7.53      | 8.10     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:29:00 | 7.28      | 7.98     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:29:10 | 7.23      | 7.32     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:29:20 | 6.93      | 6.27     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:29:30 | 6.92      | 5.82     | 0.04   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:29:40 | 6.64      | 5.87     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:29:50 | 6.63      | 6.73     | 0.03   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:30:00 | 6.61      | 8.09     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:30:10 | 6.36      | 8.32     | 0.03   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:30:20 | 6.36      | 7.18     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:30:30 | 6.36      | 6.69     | 0.03   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:30:40 | 6.34      | 5.80     | 0.03   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:30:50 | 6.08      | 5.21     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:31:00 | 6.08      | 5.90     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:31:10 | 6.08      | 7.38     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:31:20 | 6.04      | 8.11     | 0.03   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:31:30 | 5.75      | 7.87     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:31:40 | 5.74      | 7.10     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:31:50 | 5.74      | 5.95     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:32:00 | 5.73      | 5.51     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:32:10 | 5.75      | 5.56     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:32:20 | 5.70      | 6.65     | 0.02   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:32:30 | 5.43      | 7.85     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:32:40 | 5.43      | 8.26     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:32:50 | 5.43      | 7.43     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:33:00 | 5.44      | 6.44     | 0.01   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:33:10 | 5.44      | 5.83     | 0.01   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:33:20 | 5.43      | 5.37     | 0.02   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:33:30 | 5.44      | 5.77     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:33:40 | 5.45      | 7.55     | 0.02   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:33:50 | 5.42      | 8.36     | 0.01   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:34:00 | 5.17      | 7.94     | 0.01   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:34:10 | 5.16      | 6.97     | 0.01   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:34:20 | 5.14      | 6.29     | 0.01   | 0.04    | 5.16      |          | 0.01   | 0.04    |
| 4/30/2018 | 7:34:30 | 5.15      | 5.69     | 6.93   | 0.06    |           |          |        |         |
| 4/30/2018 | 7:34:40 | 5.19      | 4.93     | 10.23  | 0.05    |           |          |        |         |
| 4/30/2018 | 7:34:50 | 5.26      | 4.75     | 9.87   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:35:00 | 3.20      | 4.39     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:35:10 | 1.44      | 4.01     | 9.81   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:35:20 | 0.82      | 2.91     | 9.81   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:35:30 | 0.00      | 1.68     | 9.82   | 0.04    |           |          |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 7:35:40 | 0.00      | 0.82     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:35:50 | 0.00      | 0.55     | 9.82   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:36:00 | 0.01      | 0.48     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:36:10 | -0.03     | 1.64     | 9.82   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:36:20 | -0.30     | 2.82     | 9.82   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:36:30 | -0.30     | 2.80     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:36:40 | -0.29     | 2.06     | 9.82   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:36:50 | -0.30     | 1.04     | 9.82   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:37:00 | -0.30     | 0.59     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:37:10 | -0.31     | 0.52     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:37:20 | -0.29     | 0.84     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:37:30 | -0.29     | 2.19     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:37:40 | -0.10     | 2.90     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:37:50 | 0.00      | 2.57     | 9.82   | 0.05    |           |          | 9.82   |         |
| 4/30/2018 | 7:38:00 | 0.01      | 1.62     | 9.82   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:38:10 | 0.01      | 0.69     | 9.83   | 0.04    |           |          |        |         |
| 4/30/2018 | 7:38:20 | 0.01      | 0.13     | 9.82   | 0.03    |           |          |        |         |
| 4/30/2018 | 7:38:30 | 0.00      | 0.45     | 9.82   | 0.05    |           |          |        |         |
| 4/30/2018 | 7:38:40 | -0.01     | 1.61     | 10.02  | 0.04    |           |          |        |         |
| 4/30/2018 | 7:38:50 | -0.01     | 2.46     | 16.60  | 0.07    |           |          |        |         |
| 4/30/2018 | 7:39:00 | 0.01      | 2.60     | 14.29  | 1.11    |           |          |        |         |
| 4/30/2018 | 7:39:10 | 0.15      | 2.26     | 18.30  | 0.33    |           |          |        |         |
| 4/30/2018 | 7:39:20 | 1.67      | 2.14     | 20.51  | 0.10    |           |          |        |         |
| 4/30/2018 | 7:39:30 | 2.93      | 1.14     | 20.62  | 0.09    |           |          |        |         |
| 4/30/2018 | 7:39:40 | 1.37      | 0.40     | 17.00  | 1.02    |           |          |        |         |
| 4/30/2018 | 7:39:50 | 0.35      | 0.96     | 12.29  | 6.71    |           |          |        |         |
| 4/30/2018 | 7:40:00 | 0.96      | 2.22     | 3.96   | 2.28    |           |          |        |         |
| 4/30/2018 | 7:40:10 | 1.43      | 2.71     | 2.27   | 1.57    |           |          |        |         |
| 4/30/2018 | 7:40:20 | 0.84      | 2.27     | 2.28   | 1.77    |           |          |        |         |
| 4/30/2018 | 7:40:30 | 0.28      | 0.90     | 2.25   | 1.78    |           |          |        |         |
| 4/30/2018 | 7:40:40 | 0.30      | 0.10     | 2.23   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:40:50 | 0.28      | -0.38    | 2.22   | 1.78    |           |          |        |         |
| 4/30/2018 | 7:41:00 | 0.29      | -0.30    | 2.21   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:41:10 | 0.29      | 0.74     | 2.21   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:41:20 | 0.28      | 1.83     | 2.20   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:41:30 | 0.27      | 2.17     | 2.20   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:41:40 | 0.29      | 1.50     | 2.19   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:41:50 | 0.27      | 0.72     | 2.19   | 1.79    |           |          |        |         |
| 4/30/2018 | 7:42:00 | 0.30      | 0.20     | 5.34   | 1.38    |           |          |        |         |
| 4/30/2018 | 7:42:10 | 0.30      | -0.35    | 2.02   | 0.37    |           |          |        |         |
| 4/30/2018 | 7:42:20 | 0.29      | 0.24     | 1.47   | 0.79    |           |          |        |         |
| 4/30/2018 | 7:42:30 | 0.29      | 1.62     | 1.96   | 1.78    |           |          |        |         |
| 4/30/2018 | 7:42:40 | 0.25      | 2.35     | 1.96   | 1.80    |           |          |        |         |
| 4/30/2018 | 7:42:50 | 0.00      | 2.15     | 1.95   | 1.81    |           |          |        |         |



**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations**

| Date      | Time    | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|--------|---------|-----------|----------|--------|---------|
| 4/30/2018 | 7:43:00 | 0.00      | 1.22     | 1.96   | 1.81    |           |          |        |         |
| 4/30/2018 | 7:43:10 | -0.01     | 0.38     | 1.96   | 1.82    |           |          |        |         |
| 4/30/2018 | 7:43:20 | -0.01     | -0.03    | 1.96   | 1.82    |           |          |        |         |
| 4/30/2018 | 7:43:30 | 0.00      | -0.22    | 1.96   | 1.81    |           |          |        |         |
| 4/30/2018 | 7:43:40 | 0.00      | 0.47     | 1.96   | 1.82    |           |          |        |         |
| 4/30/2018 | 7:43:50 | -0.01     | 1.91     | 1.96   | 1.81    |           |          |        |         |
| 4/30/2018 | 7:44:00 | -0.01     | 2.14     | 1.96   | 1.82    |           |          |        |         |
| 4/30/2018 | 7:44:10 | 0.00      | 1.55     | 1.96   | 1.82    |           |          |        |         |
| 4/30/2018 | 7:44:20 | -0.01     | 0.49     | 1.96   | 1.88    |           |          |        |         |
| 4/30/2018 | 7:44:30 | 0.00      | -0.12    | 1.96   | 1.87    |           |          |        |         |
| 4/30/2018 | 7:44:40 | -0.01     | -0.33    | 1.96   | 1.87    |           |          |        |         |
| 4/30/2018 | 7:44:50 | 0.00      | 0.09     | 1.96   | 1.87    |           |          |        |         |
| 4/30/2018 | 7:45:00 | -0.01     | 1.32     | 1.96   | 1.88    |           |          |        |         |
| 4/30/2018 | 7:45:10 | -0.02     | 2.17     | 1.96   | 1.88    |           |          |        |         |
| 4/30/2018 | 7:45:20 | 0.00      | 1.66     | 1.96   | 1.88    |           |          |        |         |
| 4/30/2018 | 7:45:30 | 0.01      | 1.03     | 1.96   | 1.88    |           |          |        |         |
| 4/30/2018 | 7:45:40 | -0.01     | 0.19     | 1.96   | 1.87    |           |          |        |         |
| 4/30/2018 | 7:45:50 | -0.02     | -0.45    | 1.96   | 1.88    |           |          |        |         |
| 4/30/2018 | 7:46:00 | -0.02     | -0.34    | 1.96   | 1.88    | -0.02     | -0.20    |        | 1.88    |
| 4/30/2018 | 7:46:10 | -0.01     | 0.71     | 2.44   | 1.86    |           |          |        |         |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 7:37:10 | 5.95      | 2.28      |           |           |
| 4/30/2018 | 7:37:20 | 5.95      | 2.28      |           |           |
| 4/30/2018 | 7:37:30 | 5.95      | 2.28      |           |           |
| 4/30/2018 | 7:37:40 | 5.95      | 2.28      |           |           |
| 4/30/2018 | 7:37:50 | 5.94      | 2.28      |           |           |
| 4/30/2018 | 7:38:00 | 5.82      | 2.40      |           |           |
| 4/30/2018 | 7:38:10 | 5.79      | 2.40      |           |           |
| 4/30/2018 | 7:38:20 | 5.78      | 2.40      |           |           |
| 4/30/2018 | 7:38:30 | 5.79      | 2.41      |           |           |
| 4/30/2018 | 7:38:40 | 5.78      | 2.41      |           |           |
| 4/30/2018 | 7:38:50 | 5.78      | 2.42      |           |           |
| 4/30/2018 | 7:39:00 | 5.78      | 2.41      |           |           |
| 4/30/2018 | 7:39:10 | 5.78      | 2.48      |           |           |
| 4/30/2018 | 7:39:20 | 5.78      | 2.54      |           |           |
| 4/30/2018 | 7:39:30 | 5.78      | 2.54      |           |           |
| 4/30/2018 | 7:39:40 | 5.78      | 2.53      |           |           |
| 4/30/2018 | 7:39:50 | 5.78      | 2.53      |           |           |
| 4/30/2018 | 7:40:00 | 5.78      | 2.54      |           |           |
| 4/30/2018 | 7:40:10 | 5.78      | 2.54      |           |           |
| 4/30/2018 | 7:40:20 | 5.77      | 2.57      |           |           |
| 4/30/2018 | 7:40:30 | 5.73      | 2.67      |           |           |
| 4/30/2018 | 7:40:40 | 5.73      | 2.67      |           |           |
| 4/30/2018 | 7:40:50 | 5.73      | 2.66      |           |           |
| 4/30/2018 | 7:41:00 | 5.73      | 2.66      |           |           |
| 4/30/2018 | 7:41:10 | 5.73      | 2.66      |           |           |
| 4/30/2018 | 7:41:20 | 5.73      | 2.66      |           |           |
| 4/30/2018 | 7:41:30 | 5.73      | 2.66      |           |           |
| 4/30/2018 | 7:41:40 | 5.66      | 2.53      |           |           |
| 4/30/2018 | 7:41:50 | 5.66      | 2.53      |           |           |
| 4/30/2018 | 7:42:00 | 5.66      | 2.54      |           |           |
| 4/30/2018 | 7:42:10 | 5.66      | 2.54      |           |           |
| 4/30/2018 | 7:42:20 | 5.66      | 2.54      |           |           |
| 4/30/2018 | 7:42:30 | 5.66      | 2.54      |           |           |
| 4/30/2018 | 7:42:40 | 5.66      | 2.53      |           |           |
| 4/30/2018 | 7:42:50 | 5.57      | 2.63      |           |           |
| 4/30/2018 | 7:43:00 | 5.51      | 2.67      |           |           |
| 4/30/2018 | 7:43:10 | 5.51      | 2.66      |           |           |
| 4/30/2018 | 7:43:20 | 5.51      | 2.67      |           |           |
| 4/30/2018 | 7:43:30 | 5.51      | 2.67      |           |           |
| 4/30/2018 | 7:43:40 | 5.51      | 2.66      |           |           |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 7:43:50 | 5.51      | 2.66      |           |           |
| 4/30/2018 | 7:44:00 | 5.52      | 2.66      |           |           |
| 4/30/2018 | 7:44:10 | 5.52      | 2.66      |           |           |
| 4/30/2018 | 7:44:20 | 5.53      | 2.66      |           |           |
| 4/30/2018 | 7:44:30 | 5.52      | 2.66      |           |           |
| 4/30/2018 | 7:44:40 | 5.52      | 2.66      |           |           |
| 4/30/2018 | 7:44:50 | 5.52      | 2.66      |           |           |
| 4/30/2018 | 7:45:00 | 5.52      | 2.66      |           |           |
| 4/30/2018 | 7:45:10 | 5.53      | 2.61      |           |           |
| 4/30/2018 | 7:45:20 | 5.42      | 2.15      |           |           |
| 4/30/2018 | 7:45:30 | 5.42      | 2.15      |           |           |
| 4/30/2018 | 7:45:40 | 5.42      | 2.15      |           |           |
| 4/30/2018 | 7:45:50 | 5.42      | 2.15      |           |           |
| 4/30/2018 | 7:46:00 | 5.42      | 2.15      |           |           |
| 4/30/2018 | 7:46:10 | 5.42      | 2.16      |           |           |
| 4/30/2018 | 7:46:20 | 5.42      | 2.15      |           |           |
| 4/30/2018 | 7:46:30 | 5.43      | 2.26      |           |           |
| 4/30/2018 | 7:46:40 | 5.43      | 2.28      |           |           |
| 4/30/2018 | 7:46:50 | 5.43      | 2.29      |           |           |
| 4/30/2018 | 7:47:00 | 5.43      | 2.29      |           |           |
| 4/30/2018 | 7:47:10 | 5.43      | 2.28      |           |           |
| 4/30/2018 | 7:47:20 | 5.43      | 2.28      |           |           |
| 4/30/2018 | 7:47:30 | 5.43      | 2.28      |           |           |
| 4/30/2018 | 7:47:40 | 5.37      | 2.34      |           |           |
| 4/30/2018 | 7:47:50 | 5.28      | 2.40      |           |           |
| 4/30/2018 | 7:48:00 | 5.28      | 2.40      |           |           |
| 4/30/2018 | 7:48:10 | 5.28      | 2.41      |           |           |
| 4/30/2018 | 7:48:20 | 5.28      | 2.41      |           |           |
| 4/30/2018 | 7:48:30 | 5.28      | 2.41      |           |           |
| 4/30/2018 | 7:48:40 | 5.28      | 2.41      |           |           |
| 4/30/2018 | 7:48:50 | 5.28      | 2.44      |           |           |
| 4/30/2018 | 7:49:00 | 5.25      | 2.54      |           |           |
| 4/30/2018 | 7:49:10 | 5.25      | 2.53      |           |           |
| 4/30/2018 | 7:49:20 | 5.25      | 2.53      |           |           |
| 4/30/2018 | 7:49:30 | 5.25      | 2.53      |           |           |
| 4/30/2018 | 7:49:40 | 5.25      | 2.53      |           |           |
| 4/30/2018 | 7:49:50 | 5.25      | 2.54      |           |           |
| 4/30/2018 | 7:50:00 | 5.25      | 2.54      |           |           |
| 4/30/2018 | 7:50:10 | 5.04      | 1.13      |           |           |
| 4/30/2018 | 7:50:20 | 4.99      | 0.97      |           |           |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 7:50:30 | 4.99      | 0.98      |           |           |
| 4/30/2018 | 7:50:40 | 4.99      | 0.98      |           |           |
| 4/30/2018 | 7:50:50 | 4.99      | 0.97      |           |           |
| 4/30/2018 | 7:51:00 | 4.99      | 0.99      |           |           |
| 4/30/2018 | 7:51:10 | 4.99      | 0.98      |           |           |
| 4/30/2018 | 7:51:20 | 4.86      | 0.35      |           |           |
| 4/30/2018 | 7:51:30 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:51:40 | 4.73      | -0.07     |           |           |
| 4/30/2018 | 7:51:50 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:52:00 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:52:10 | 4.73      | -0.07     |           |           |
| 4/30/2018 | 7:52:20 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:52:30 | 4.73      | -0.07     |           |           |
| 4/30/2018 | 7:52:40 | 4.71      | -0.07     |           |           |
| 4/30/2018 | 7:52:50 | 4.71      | -0.08     |           |           |
| 4/30/2018 | 7:53:00 | 4.71      | -0.08     |           |           |
| 4/30/2018 | 7:53:10 | 4.71      | -0.08     |           |           |
| 4/30/2018 | 7:53:20 | 4.71      | -0.08     |           |           |
| 4/30/2018 | 7:53:30 | 4.71      | -0.08     |           |           |
| 4/30/2018 | 7:53:40 | 4.71      | -0.08     |           |           |
| 4/30/2018 | 7:53:50 | 4.73      | -0.07     |           |           |
| 4/30/2018 | 7:54:00 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:54:10 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:54:20 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:54:30 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:54:40 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:54:50 | 4.73      | -0.08     |           |           |
| 4/30/2018 | 7:55:00 | 4.69      | -0.07     |           |           |
| 4/30/2018 | 7:55:10 | 4.67      | -0.08     |           |           |
| 4/30/2018 | 7:55:20 | 4.67      | -0.07     |           |           |
| 4/30/2018 | 7:55:30 | 4.67      | -0.08     |           |           |
| 4/30/2018 | 7:55:40 | 4.67      | -0.08     |           |           |
| 4/30/2018 | 7:55:50 | 4.67      | -0.08     |           |           |
| 4/30/2018 | 7:56:00 | 4.67      | -0.08     |           |           |
| 4/30/2018 | 7:56:10 | 4.66      | -0.08     |           |           |
| 4/30/2018 | 7:56:20 | 4.64      | -0.08     |           |           |
| 4/30/2018 | 7:56:30 | 4.64      | -0.08     |           |           |
| 4/30/2018 | 7:56:40 | 4.64      | -0.07     |           |           |
| 4/30/2018 | 7:56:50 | 4.64      | -0.07     |           |           |
| 4/30/2018 | 7:57:00 | 4.64      | -0.07     |           |           |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 7:57:10 | 4.64      | -0.07     |           |           |
| 4/30/2018 | 7:57:20 | 4.64      | -0.07     |           |           |
| 4/30/2018 | 7:57:30 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:57:40 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:57:50 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:58:00 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:58:10 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:58:20 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:58:30 | 4.58      | -0.07     |           |           |
| 4/30/2018 | 7:58:40 | 4.55      | -0.07     |           |           |
| 4/30/2018 | 7:58:50 | 4.54      | -0.07     |           |           |
| 4/30/2018 | 7:59:00 | 4.54      | -0.07     |           |           |
| 4/30/2018 | 7:59:10 | 4.54      | -0.08     |           |           |
| 4/30/2018 | 7:59:20 | 4.54      | -0.07     |           |           |
| 4/30/2018 | 7:59:30 | 4.54      | -0.08     |           |           |
| 4/30/2018 | 7:59:40 | 4.54      | -0.07     |           |           |
| 4/30/2018 | 7:59:50 | 4.54      | -0.07     |           |           |
| 4/30/2018 | 8:00:00 | 4.53      | -0.08     |           |           |
| 4/30/2018 | 8:00:10 | 4.53      | -0.08     |           |           |
| 4/30/2018 | 8:00:20 | 4.53      | -0.08     |           |           |
| 4/30/2018 | 8:00:30 | 4.53      | -0.07     |           |           |
| 4/30/2018 | 8:00:40 | 4.53      | -0.08     |           |           |
| 4/30/2018 | 8:00:50 | 4.53      | -0.08     |           |           |
| 4/30/2018 | 8:01:00 | 4.54      | 0.05      |           |           |
| 4/30/2018 | 8:01:10 | 4.66      | 0.58      |           |           |
| 4/30/2018 | 8:01:20 | 4.66      | 0.58      |           |           |
| 4/30/2018 | 8:01:30 | 4.66      | 0.58      |           |           |
| 4/30/2018 | 8:01:40 | 4.66      | 0.58      |           |           |
| 4/30/2018 | 8:01:50 | 4.66      | 0.58      |           |           |
| 4/30/2018 | 8:02:00 | 4.66      | 0.58      |           |           |
| 4/30/2018 | 8:02:10 | 4.66      | 0.59      |           |           |
| 4/30/2018 | 8:02:20 | 40.93     | 356.53    |           |           |
| 4/30/2018 | 8:02:30 | 50.00     | 396.09    |           |           |
| 4/30/2018 | 8:02:40 | 50.00     | 396.09    |           |           |
| 4/30/2018 | 8:02:50 | 50.00     | 396.10    |           |           |
| 4/30/2018 | 8:03:00 | 50.00     | 396.09    |           |           |
| 4/30/2018 | 8:03:10 | 50.00     | 396.10    |           |           |
| 4/30/2018 | 8:03:20 | 50.00     | 396.08    |           |           |
| 4/30/2018 | 8:03:30 | 50.00     | 402.35    |           |           |
| 4/30/2018 | 8:03:40 | 50.00     | 406.52    |           |           |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM]   |
|-----------|---------|-----------|-----------|-----------|-------------|
| 4/30/2018 | 8:03:50 | 50.00     | 406.52    |           |             |
| 4/30/2018 | 8:04:00 | 50.00     | 406.52    |           |             |
| 4/30/2018 | 8:04:10 | 50.00     | 406.52    |           |             |
| 4/30/2018 | 8:04:20 | 50.00     | 406.53    |           |             |
| 4/30/2018 | 8:04:30 | 50.00     | 406.53    |           |             |
| 4/30/2018 | 8:04:40 | 43.83     | 306.03    |           |             |
| 4/30/2018 | 8:04:50 | 19.14     | 71.55     |           |             |
| 4/30/2018 | 8:05:00 | 19.14     | 71.56     |           |             |
| 4/30/2018 | 8:05:10 | 19.14     | 71.55     |           |             |
| 4/30/2018 | 8:05:20 | 19.14     | 71.55     |           |             |
| 4/30/2018 | 8:05:30 | 19.14     | 71.55     |           |             |
| 4/30/2018 | 8:05:40 | 19.14     | 71.56     |           |             |
| 4/30/2018 | 8:05:50 | 19.14     | 71.56     |           |             |
| 4/30/2018 | 8:06:00 | 21.12     | 81.99     |           |             |
| 4/30/2018 | 8:06:10 | 21.34     | 82.00     |           |             |
| 4/30/2018 | 8:06:20 | 21.34     | 82.00     |           |             |
| 4/30/2018 | 8:06:30 | 21.34     | 81.99     |           |             |
| 4/30/2018 | 8:06:40 | 21.34     | 81.99     |           |             |
| 4/30/2018 | 8:06:50 | 21.34     | 81.99     |           |             |
| 4/30/2018 | 8:07:00 | 21.34     | 81.00     |           |             |
| 4/30/2018 | 8:07:10 | 21.31     | 81.52     |           |             |
| 4/30/2018 | 8:07:20 | 21.29     | 81.75     |           |             |
| 4/30/2018 | 8:07:30 | 21.29     | 81.75     |           |             |
| 4/30/2018 | 8:07:40 | 21.29     | 81.75     | C3H8      | CH4 ALT 106 |
| 4/30/2018 | 8:07:50 | 21.28     | 81.74     | 21.29     | 81.75       |
| 4/30/2018 | 8:08:00 | 21.29     | 81.75     | Target 20 | Target 80   |
| 4/30/2018 | 8:08:10 | 21.29     | 81.75     |           |             |
| 4/30/2018 | 8:08:20 | 29.90     | 189.73    |           |             |
| 4/30/2018 | 8:08:30 | 50.00     | 350.21    |           |             |
| 4/30/2018 | 8:08:40 | 50.00     | 350.22    |           |             |
| 4/30/2018 | 8:08:50 | 50.00     | 350.23    |           |             |
| 4/30/2018 | 8:09:00 | 50.00     | 350.23    |           |             |
| 4/30/2018 | 8:09:10 | 50.00     | 350.22    |           |             |
| 4/30/2018 | 8:09:20 | 50.00     | 350.22    |           |             |
| 4/30/2018 | 8:09:30 | 50.00     | 348.19    |           |             |
| 4/30/2018 | 8:09:40 | 50.00     | 329.80    |           |             |
| 4/30/2018 | 8:09:50 | 50.00     | 329.80    |           |             |
| 4/30/2018 | 8:10:00 | 50.00     | 329.81    |           |             |
| 4/30/2018 | 8:10:10 | 50.00     | 329.81    |           |             |
| 4/30/2018 | 8:10:20 | 50.00     | 329.80    |           |             |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 8:10:30 | 50.00     | 329.80    |           |           |
| 4/30/2018 | 8:10:40 | 50.00     | 329.81    |           |           |
| 4/30/2018 | 8:10:50 | 18.89     | 67.89     |           |           |
| 4/30/2018 | 8:11:00 | 5.56      | 2.41      |           |           |
| 4/30/2018 | 8:11:10 | 5.56      | 2.41      |           |           |
| 4/30/2018 | 8:11:20 | 5.56      | 2.41      |           |           |
| 4/30/2018 | 8:11:30 | 5.56      | 2.41      |           |           |
| 4/30/2018 | 8:11:40 | 5.56      | 2.40      |           |           |
| 4/30/2018 | 8:11:50 | 5.56      | 2.41      |           |           |
| 4/30/2018 | 8:12:00 | 5.49      | 1.83      |           |           |
| 4/30/2018 | 8:12:10 | 5.38      | 1.24      |           |           |
| 4/30/2018 | 8:12:20 | 5.38      | 1.23      |           |           |
| 4/30/2018 | 8:12:30 | 5.38      | 1.23      |           |           |
| 4/30/2018 | 8:12:40 | 5.38      | 1.23      |           |           |
| 4/30/2018 | 8:12:50 | 5.38      | 1.24      |           |           |
| 4/30/2018 | 8:13:00 | 5.38      | 1.23      |           |           |
| 4/30/2018 | 8:13:10 | 5.38      | 1.16      |           |           |
| 4/30/2018 | 8:13:20 | 5.36      | 0.83      |           |           |
| 4/30/2018 | 8:13:30 | 5.36      | 0.84      |           |           |
| 4/30/2018 | 8:13:40 | 5.36      | 0.83      |           |           |
| 4/30/2018 | 8:13:50 | 5.36      | 0.83      |           |           |
| 4/30/2018 | 8:14:00 | 5.36      | 0.83      |           |           |
| 4/30/2018 | 8:14:10 | 5.36      | 0.84      |           |           |
| 4/30/2018 | 8:14:20 | 5.36      | 0.84      |           |           |
| 4/30/2018 | 8:14:30 | 5.30      | 0.73      |           |           |
| 4/30/2018 | 8:14:40 | 5.29      | 0.71      |           |           |
| 4/30/2018 | 8:14:50 | 5.29      | 0.71      |           |           |
| 4/30/2018 | 8:15:00 | 5.29      | 0.71      |           |           |
| 4/30/2018 | 8:15:10 | 5.29      | 0.71      |           |           |
| 4/30/2018 | 8:15:20 | 5.29      | 0.71      |           |           |
| 4/30/2018 | 8:15:30 | 5.29      | 0.71      |           |           |
| 4/30/2018 | 8:15:40 | 4.92      | 0.56      |           |           |
| 4/30/2018 | 8:15:50 | 4.55      | 0.46      |           |           |
| 4/30/2018 | 8:16:00 | 4.55      | 0.45      |           |           |
| 4/30/2018 | 8:16:10 | 4.55      | 0.45      |           |           |
| 4/30/2018 | 8:16:20 | 4.55      | 0.45      |           |           |
| 4/30/2018 | 8:16:30 | 4.55      | 0.45      |           |           |
| 4/30/2018 | 8:16:40 | 4.55      | 0.45      |           |           |
| 4/30/2018 | 8:16:50 | 4.44      | 0.46      |           |           |
| 4/30/2018 | 8:17:00 | 4.00      | 0.46      |           |           |

**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 8:17:10 | 3.99      | 0.45      |           |           |
| 4/30/2018 | 8:17:20 | 4.00      | 0.46      |           |           |
| 4/30/2018 | 8:17:30 | 4.00      | 0.46      |           |           |
| 4/30/2018 | 8:17:40 | 4.00      | 0.45      |           |           |
| 4/30/2018 | 8:17:50 | 4.00      | 0.46      |           |           |
| 4/30/2018 | 8:18:00 | 4.00      | 0.46      |           |           |
| 4/30/2018 | 8:18:10 | 3.89      | 0.46      |           |           |
| 4/30/2018 | 8:18:20 | 3.88      | 0.46      |           |           |
| 4/30/2018 | 8:18:30 | 3.88      | 0.46      |           |           |
| 4/30/2018 | 8:18:40 | 3.88      | 0.46      |           |           |
| 4/30/2018 | 8:18:50 | 3.87      | 0.46      | 3.88      |           |
| 4/30/2018 | 8:19:00 | 3.88      | 0.46      |           |           |
| 4/30/2018 | 8:19:10 | 3.88      | 0.47      |           |           |
| 4/30/2018 | 8:19:20 | 3.23      | 0.09      |           |           |
| 4/30/2018 | 8:19:30 | 2.81      | -0.07     |           |           |
| 4/30/2018 | 8:19:40 | 2.81      | -0.07     |           |           |
| 4/30/2018 | 8:19:50 | 2.81      | -0.08     |           |           |
| 4/30/2018 | 8:20:00 | 2.81      | -0.07     |           |           |
| 4/30/2018 | 8:20:10 | 2.81      | -0.07     |           |           |
| 4/30/2018 | 8:20:20 | 2.81      | -0.06     |           |           |
| 4/30/2018 | 8:20:30 | 2.80      | 0.09      |           |           |
| 4/30/2018 | 8:20:40 | 2.79      | 0.33      |           |           |
| 4/30/2018 | 8:20:50 | 2.79      | 0.32      |           |           |
| 4/30/2018 | 8:21:00 | 2.79      | 0.33      |           |           |
| 4/30/2018 | 8:21:10 | 2.79      | 0.33      |           |           |
| 4/30/2018 | 8:21:20 | 2.79      | 0.33      | 2.79      |           |
| 4/30/2018 | 8:21:30 | 2.79      | 0.33      |           |           |
| 4/30/2018 | 8:21:40 | 2.79      | 0.33      |           |           |
| 4/30/2018 | 8:21:50 | 2.31      | 0.33      |           |           |
| 4/30/2018 | 8:22:00 | 2.31      | 0.33      |           |           |
| 4/30/2018 | 8:22:10 | 2.31      | 0.32      |           |           |
| 4/30/2018 | 8:22:20 | 2.31      | 0.32      |           |           |
| 4/30/2018 | 8:22:30 | 2.31      | 0.32      |           |           |
| 4/30/2018 | 8:22:40 | 2.31      | 0.33      |           |           |
| 4/30/2018 | 8:22:50 | 2.31      | 0.32      |           |           |
| 4/30/2018 | 8:23:00 | 1.71      | 0.22      |           |           |
| 4/30/2018 | 8:23:10 | 1.46      | 0.19      |           |           |
| 4/30/2018 | 8:23:20 | 1.46      | 0.18      |           |           |
| 4/30/2018 | 8:23:30 | 1.46      | 0.18      |           |           |
| 4/30/2018 | 8:23:40 | 1.46      | 0.18      |           |           |



**Hollingsworth & Vose****4/30/2018****CFU 117****Daily Calibrations NMOC CH4**

| Date      | Time    | VOC [PPM] | CH4 [PPM] | VOC [PPM] | CH4 [PPM] |
|-----------|---------|-----------|-----------|-----------|-----------|
| 4/30/2018 | 8:23:50 | 1.46      | 0.18      |           |           |
| 4/30/2018 | 8:24:00 | 1.46      | 0.18      |           |           |
| 4/30/2018 | 8:24:10 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:24:20 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:24:30 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:24:40 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:24:50 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:25:00 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:25:10 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:25:20 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:25:30 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:25:40 | 1.45      | 0.19      |           |           |
| 4/30/2018 | 8:25:50 | 1.45      | 0.20      |           |           |
| 4/30/2018 | 8:26:00 | 1.45      | 0.19      |           |           |
| 4/30/2018 | 8:26:10 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:26:20 | 1.45      | 0.18      |           |           |
| 4/30/2018 | 8:26:30 | 1.45      | 0.18      | 1.45      |           |
| 4/30/2018 | 8:26:40 | 1.39      | 0.18      |           |           |
| 4/30/2018 | 8:26:50 | 1.37      | 0.18      |           |           |
| 4/30/2018 | 8:27:00 | 1.37      | 0.19      |           |           |
| 4/30/2018 | 8:27:10 | 1.37      | 0.18      |           |           |
| 4/30/2018 | 8:27:20 | 1.37      | 0.18      |           |           |
| 4/30/2018 | 8:27:30 | 1.37      | 0.18      |           |           |
| 4/30/2018 | 8:27:40 | 1.37      | 0.18      |           |           |
| 4/30/2018 | 8:27:50 | 1.40      | 0.35      |           |           |
| 4/30/2018 | 8:28:00 | 1.43      | 0.45      |           |           |
| 4/30/2018 | 8:28:10 | 1.43      | 0.45      |           |           |
| 4/30/2018 | 8:28:20 | 1.42      | 0.46      |           |           |
| 4/30/2018 | 8:28:30 | 1.42      | 0.46      |           |           |
| 4/30/2018 | 8:28:40 | 1.42      | 0.45      |           |           |
| 4/30/2018 | 8:28:50 | 1.43      | 0.45      |           |           |
| 4/30/2018 | 8:29:00 | 1.48      | 0.69      |           |           |
| 4/30/2018 | 8:29:10 | 0.16      | 1.23      |           |           |
| 4/30/2018 | 8:29:20 | 0.16      | 1.24      |           |           |
| 4/30/2018 | 8:29:30 | 0.16      | 1.24      |           |           |
| 4/30/2018 | 8:29:40 | 0.16      | 1.23      |           |           |
| 4/30/2018 | 8:29:50 | 0.16      | 1.24      |           |           |
| 4/30/2018 | 8:30:00 | 0.16      | 1.23      | 0.16      |           |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 1**

| Date      | Time    | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 8:42:05 | 3.43      | 150.65   | 2.23      | 19.83  | 0.63    |
| 4/30/2018 | 8:43:05 | 3.42      | 148.52   | 2.29      | 19.83  | 0.63    |
| 4/30/2018 | 8:44:05 | 3.43      | 155.35   | 2.34      | 19.83  | 0.63    |
| 4/30/2018 | 8:45:05 | 3.42      | 156.55   | 2.33      | 19.83  | 0.63    |
| 4/30/2018 | 8:46:05 | 3.43      | 151.85   | 2.34      | 19.83  | 0.63    |
| 4/30/2018 | 8:47:05 | 3.43      | 147.71   | 2.40      | 19.82  | 0.63    |
| 4/30/2018 | 8:48:05 | 3.71      | 154.56   | 2.45      | 19.82  | 0.63    |
| 4/30/2018 | 8:49:05 | 3.73      | 156.56   | 2.51      | 19.81  | 0.64    |
| 4/30/2018 | 8:50:05 | 3.73      | 156.53   | 2.56      | 19.81  | 0.64    |
| 4/30/2018 | 8:51:05 | 3.73      | 157.60   | 2.57      | 19.81  | 0.64    |
| 4/30/2018 | 8:52:05 | 3.74      | 153.59   | 2.59      | 19.81  | 0.64    |
| 4/30/2018 | 8:53:05 | 3.73      | 153.07   | 2.60      | 19.80  | 0.64    |
| 4/30/2018 | 8:54:05 | 3.72      | 155.88   | 2.61      | 19.80  | 0.64    |
| 4/30/2018 | 8:55:05 | 3.73      | 154.08   | 2.62      | 19.79  | 0.65    |
| 4/30/2018 | 8:56:05 | 3.74      | 156.81   | 2.64      | 19.78  | 0.65    |
| 4/30/2018 | 8:57:05 | 3.73      | 157.13   | 2.63      | 19.79  | 0.65    |
| 4/30/2018 | 8:58:05 | 3.74      | 151.84   | 2.58      | 19.79  | 0.65    |
| 4/30/2018 | 8:59:05 | 3.74      | 156.15   | 2.62      | 19.78  | 0.65    |
| 4/30/2018 | 9:00:05 | 3.73      | 160.52   | 2.62      | 19.78  | 0.65    |
| 4/30/2018 | 9:01:05 | 3.74      | 158.99   | 2.55      | 19.77  | 0.65    |
| 4/30/2018 | 9:02:05 | 3.73      | 158.69   | 2.58      | 19.77  | 0.65    |
| 4/30/2018 | 9:03:05 | 3.73      | 158.56   | 2.56      | 19.77  | 0.65    |
| 4/30/2018 | 9:04:05 | 3.51      | 151.97   | 2.58      | 19.77  | 0.64    |
| 4/30/2018 | 9:05:05 | 3.57      | 155.25   | 2.59      | 19.77  | 0.64    |
| 4/30/2018 | 9:06:05 | 3.73      | 158.62   | 2.58      | 19.76  | 0.64    |
| 4/30/2018 | 9:07:05 | 3.72      | 158.55   | 2.56      | 19.76  | 0.64    |
| 4/30/2018 | 9:08:05 | 3.73      | 159.34   | 2.61      | 19.76  | 0.64    |
| 4/30/2018 | 9:09:05 | 3.73      | 159.89   | 2.58      | 19.76  | 0.64    |
| 4/30/2018 | 9:10:05 | 3.74      | 158.91   | 2.61      | 19.75  | 0.64    |
| 4/30/2018 | 9:11:05 | 3.74      | 159.38   | 2.61      | 19.75  | 0.64    |
| 4/30/2018 | 9:12:05 | 3.74      | 159.28   | 2.56      | 19.75  | 0.64    |
| 4/30/2018 | 9:13:05 | 3.61      | 156.98   | 2.60      | 19.75  | 0.64    |
| 4/30/2018 | 9:14:05 | 3.60      | 159.15   | 2.62      | 19.75  | 0.64    |
| 4/30/2018 | 9:15:05 | 3.73      | 162.84   | 2.60      | 19.74  | 0.64    |
| 4/30/2018 | 9:16:05 | 3.74      | 162.59   | 2.61      | 19.73  | 0.65    |
| 4/30/2018 | 9:17:05 | 3.73      | 169.00   | 2.62      | 19.73  | 0.65    |
| 4/30/2018 | 9:18:05 | 3.73      | 166.46   | 2.61      | 19.73  | 0.65    |
| 4/30/2018 | 9:19:05 | 3.73      | 161.75   | 2.61      | 19.73  | 0.66    |
| 4/30/2018 | 9:20:05 | 3.74      | 161.40   | 2.60      | 19.73  | 0.65    |
| 4/30/2018 | 9:21:05 | 3.74      | 164.08   | 2.51      | 19.72  | 0.66    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 1**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 9:22:05  | 3.74      | 165.53   | 2.48      | 19.72  | 0.66    |
| 4/30/2018 | 9:23:05  | 3.74      | 166.89   | 2.51      | 19.72  | 0.66    |
| 4/30/2018 | 9:24:05  | 3.74      | 165.37   | 2.56      | 19.72  | 0.66    |
| 4/30/2018 | 9:25:05  | 3.74      | 165.42   | 2.49      | 19.72  | 0.66    |
| 4/30/2018 | 9:26:05  | 3.79      | 164.57   | 2.53      | 19.72  | 0.66    |
| 4/30/2018 | 9:27:05  | 3.74      | 164.85   | 2.53      | 19.72  | 0.65    |
| 4/30/2018 | 9:28:05  | 3.76      | 167.06   | 2.54      | 19.71  | 0.65    |
| 4/30/2018 | 9:29:05  | 3.74      | 165.82   | 2.56      | 19.71  | 0.65    |
| 4/30/2018 | 9:30:05  | 3.74      | 163.71   | 2.49      | 19.71  | 0.65    |
| 4/30/2018 | 9:31:05  | 3.75      | 160.66   | 2.57      | 19.72  | 0.64    |
| 4/30/2018 | 9:32:05  | 3.70      | 159.48   | 2.55      | 19.71  | 0.64    |
| 4/30/2018 | 9:33:05  | 3.74      | 162.42   | 2.50      | 19.71  | 0.64    |
| 4/30/2018 | 9:34:05  | 3.74      | 162.22   | 2.48      | 19.71  | 0.64    |
| 4/30/2018 | 9:35:05  | 3.75      | 162.62   | 2.55      | 19.70  | 0.65    |
| 4/30/2018 | 9:36:05  | 3.74      | 168.17   | 2.46      | 19.70  | 0.65    |
| 4/30/2018 | 9:37:05  | 3.89      | 170.84   | 2.44      | 19.70  | 0.65    |
| 4/30/2018 | 9:38:05  | 3.75      | 170.90   | 2.49      | 19.70  | 0.65    |
| 4/30/2018 | 9:39:05  | 3.74      | 172.22   | 2.49      | 19.70  | 0.65    |
| 4/30/2018 | 9:40:05  | 3.75      | 170.65   | 2.43      | 19.71  | 0.65    |
| 4/30/2018 | 9:41:05  | 3.76      | 166.62   | 2.46      | 19.71  | 0.65    |
| 4/30/2018 | 9:42:05  | 3.76      | 167.50   | 2.44      | 19.71  | 0.66    |
| 4/30/2018 | 9:43:05  | 3.76      | 167.77   | 2.48      | 19.71  | 0.66    |
| 4/30/2018 | 9:44:05  | 3.75      | 166.98   | 2.48      | 19.71  | 0.66    |
| 4/30/2018 | 9:45:05  | 3.75      | 168.76   | 2.45      | 19.71  | 0.66    |
| 4/30/2018 | 9:46:05  | 3.74      | 168.09   | 2.41      | 19.72  | 0.66    |
| 4/30/2018 | 9:47:05  | 3.73      | 167.45   | 2.30      | 19.72  | 0.65    |
| 4/30/2018 | 9:48:05  | 3.73      | 168.35   | 2.37      | 19.72  | 0.66    |
| 4/30/2018 | 9:49:05  | 3.73      | 168.22   | 2.29      | 19.71  | 0.66    |
| 4/30/2018 | 9:50:05  | 3.73      | 167.43   | 2.24      | 19.71  | 0.65    |
| 4/30/2018 | 9:51:05  | 3.73      | 167.13   | 2.23      | 19.72  | 0.65    |
| 4/30/2018 | 9:52:05  | 3.73      | 165.54   | 2.25      | 19.72  | 0.65    |
| 4/30/2018 | 9:53:05  | 3.73      | 165.50   | 2.23      | 19.72  | 0.65    |
| 4/30/2018 | 9:54:05  | 3.73      | 165.59   | 2.22      | 19.72  | 0.64    |
| 4/30/2018 | 9:55:05  | 3.73      | 164.12   | 2.25      | 19.72  | 0.64    |
| 4/30/2018 | 9:56:05  | 3.73      | 164.53   | 2.22      | 19.72  | 0.65    |
| 4/30/2018 | 9:57:05  | 3.73      | 165.14   | 2.15      | 19.72  | 0.64    |
| 4/30/2018 | 9:58:05  | 3.73      | 164.82   | 2.29      | 19.72  | 0.65    |
| 4/30/2018 | 9:59:05  | 3.72      | 165.06   | 2.19      | 19.72  | 0.64    |
| 4/30/2018 | 10:00:05 | 3.73      | 164.87   | 2.18      | 19.72  | 0.65    |
| 4/30/2018 | 10:01:05 | 3.73      | 166.23   | 2.16      | 19.72  | 0.65    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 1**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 10:02:05 | 3.73      | 164.65   | 2.15      | 19.72  | 0.65    |
| 4/30/2018 | 10:03:05 | 3.72      | 163.87   | 2.17      | 19.72  | 0.65    |
| 4/30/2018 | 10:04:05 | 3.71      | 162.20   | 2.23      | 19.72  | 0.66    |
| 4/30/2018 | 10:05:05 | 3.71      | 162.46   | 2.16      | 19.72  | 0.66    |
| 4/30/2018 | 10:06:05 | 3.72      | 163.40   | 2.09      | 19.73  | 0.66    |
| 4/30/2018 | 10:07:05 | 3.72      | 161.58   | 2.06      | 19.73  | 0.66    |
| 4/30/2018 | 10:08:05 | 3.71      | 162.06   | 2.06      | 19.73  | 0.66    |
| 4/30/2018 | 10:09:05 | 3.72      | 164.82   | 2.06      | 19.73  | 0.66    |
| 4/30/2018 | 10:10:05 | 3.73      | 164.16   | 2.04      | 19.73  | 0.67    |
| 4/30/2018 | 10:11:05 | 3.72      | 162.68   | 2.05      | 19.73  | 0.66    |
| 4/30/2018 | 10:12:05 | 3.72      | 159.50   | 2.04      | 19.73  | 0.66    |
| 4/30/2018 | 10:13:05 | 3.71      | 161.90   | 2.04      | 19.73  | 0.66    |
| 4/30/2018 | 10:14:05 | 3.72      | 160.73   | 2.03      | 19.73  | 0.65    |
| 4/30/2018 | 10:15:05 | 3.71      | 161.63   | 1.97      | 19.73  | 0.65    |
| 4/30/2018 | 10:16:05 | 3.71      | 160.89   | 2.02      | 19.73  | 0.65    |
| 4/30/2018 | 10:17:05 | 3.72      | 159.28   | 2.00      | 19.73  | 0.65    |
| 4/30/2018 | 10:18:05 | 3.72      | 160.00   | 1.94      | 19.73  | 0.65    |
| 4/30/2018 | 10:19:05 | 3.72      | 160.92   | 1.85      | 19.72  | 0.65    |
| 4/30/2018 | 10:20:05 | 3.72      | 161.25   | 1.80      | 19.72  | 0.65    |
| 4/30/2018 | 10:21:05 | 3.73      | 160.16   | 1.85      | 19.72  | 0.65    |
| 4/30/2018 | 10:22:05 | 3.72      | 161.41   | 1.95      | 19.72  | 0.65    |
| 4/30/2018 | 10:23:05 | 3.72      | 160.31   | 1.92      | 19.72  | 0.65    |
| 4/30/2018 | 10:24:05 | 3.73      | 159.03   | 1.90      | 19.72  | 0.65    |
| 4/30/2018 | 10:25:05 | 3.74      | 160.15   | 1.91      | 19.72  | 0.65    |
| 4/30/2018 | 10:26:05 | 3.73      | 158.92   | 1.91      | 19.72  | 0.66    |
| 4/30/2018 | 10:27:05 | 3.74      | 158.99   | 1.92      | 19.71  | 0.66    |
| 4/30/2018 | 10:28:05 | 3.74      | 159.04   | 1.90      | 19.71  | 0.66    |
| 4/30/2018 | 10:29:05 | 3.74      | 159.22   | 1.92      | 19.71  | 0.66    |
| 4/30/2018 | 10:30:05 | 3.74      | 158.93   | 1.95      | 19.71  | 0.66    |
| 4/30/2018 | 10:31:05 | 3.74      | 158.70   | 1.93      | 19.71  | 0.66    |
| 4/30/2018 | 10:32:05 | 3.74      | 160.31   | 1.88      | 19.70  | 0.66    |
| 4/30/2018 | 10:33:05 | 3.74      | 159.02   | 1.93      | 19.70  | 0.66    |
| 4/30/2018 | 10:34:05 | 3.73      | 158.67   | 1.92      | 19.71  | 0.66    |
| 4/30/2018 | 10:35:05 | 3.74      | 157.07   | 1.93      | 19.70  | 0.66    |
| 4/30/2018 | 10:36:05 | 3.74      | 156.47   | 1.95      | 19.70  | 0.65    |
| 4/30/2018 | 10:37:05 | 3.74      | 157.46   | 1.99      | 19.70  | 0.65    |
| 4/30/2018 | 10:38:05 | 3.73      | 158.55   | 1.87      | 19.70  | 0.66    |
| 4/30/2018 | 10:39:05 | 3.74      | 157.31   | 1.85      | 19.70  | 0.65    |
| 4/30/2018 | 10:40:05 | 3.74      | 157.29   | 1.86      | 19.69  | 0.65    |
| 4/30/2018 | 10:41:05 | 3.61      | 152.62   | 1.90      | 19.70  | 0.64    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 1**

| Date          | Time     | NOx [PPM]   | CO [PPM]      | VOC [PPM]   | O2 [%]       | CO2 [%]     |
|---------------|----------|-------------|---------------|-------------|--------------|-------------|
| 4/30/2018     | 10:42:05 | 3.66        | 155.03        | 1.94        | 19.69        | 0.65        |
| 4/30/2018     | 10:43:05 | 3.74        | 157.60        | 1.91        | 19.69        | 0.65        |
| 4/30/2018     | 10:44:05 | 3.76        | 157.21        | 1.92        | 19.70        | 0.64        |
| 4/30/2018     | 10:45:05 | 3.75        | 158.58        | 1.93        | 19.69        | 0.65        |
| 4/30/2018     | 10:46:05 | 3.73        | 157.54        | 1.95        | 19.70        | 0.65        |
| 4/30/2018     | 10:47:05 | 3.73        | 156.35        | 1.95        | 19.72        | 0.65        |
| Run Averages: |          | <b>3.71</b> | <b>161.04</b> | <b>2.29</b> | <b>19.73</b> | <b>0.65</b> |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 1 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 10:47:15 | 3.73      | 159.41   | 1.96      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:47:25 | 3.72      | 158.00   | 1.96      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:47:35 | 3.73      | 156.10   | 1.96      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:47:45 | 3.74      | 153.69   | 1.95      | 19.72  | 0.64    |           |          |           |        |         |
| 4/30/2018 | 10:47:55 | 3.76      | 150.99   | 1.94      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:48:05 | 3.59      | 148.15   | 1.94      | 19.73  | 0.64    |           |          |           |        |         |
| 4/30/2018 | 10:48:15 | 3.43      | 148.53   | 1.94      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:48:25 | 3.44      | 148.96   | 1.94      | 19.73  | 0.64    |           |          |           |        |         |
| 4/30/2018 | 10:48:35 | 3.44      | 150.83   | 1.94      | 19.73  | 0.64    |           |          |           |        |         |
| 4/30/2018 | 10:48:45 | 3.43      | 150.98   | 1.94      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:48:55 | 3.59      | 152.67   | 1.95      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:49:05 | 3.73      | 153.43   | 2.00      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:49:15 | 3.74      | 155.19   | 2.00      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:49:25 | 3.73      | 156.13   | 2.00      | 19.73  | 0.64    |           |          |           |        |         |
| 4/30/2018 | 10:49:35 | 3.73      | 158.36   | 2.00      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:49:45 | 3.73      | 160.13   | 2.00      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:49:55 | 3.74      | 160.22   | 2.00      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:50:05 | 3.74      | 159.33   | 2.00      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:50:15 | 3.74      | 158.21   | 1.91      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:50:25 | 3.74      | 157.63   | 1.90      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:50:35 | 3.74      | 157.14   | 1.90      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:50:45 | 3.75      | 157.03   | 1.90      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:50:55 | 3.74      | 157.67   | 1.90      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:51:05 | 3.74      | 159.34   | 1.90      | 19.72  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:51:15 | 3.73      | 160.02   | 1.90      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:51:25 | 3.74      | 159.08   | 1.86      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:51:35 | 3.74      | 158.19   | 1.84      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:51:45 | 3.75      | 157.50   | 1.84      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:51:55 | 3.76      | 157.83   | 1.84      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 10:52:05 | 3.75      | 157.52   | 1.83      | 19.73  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 10:52:15 | 3.73      | 157.69   | 1.83      | 17.16  | 3.43    |           |          |           |        |         |
| 4/30/2018 | 10:52:25 | 3.73      | 150.98   | 1.84      | 11.02  | 8.88    |           |          |           |        |         |
| 4/30/2018 | 10:52:35 | 2.99      | 114.00   | 1.88      | 10.00  | 9.51    |           |          |           |        |         |
| 4/30/2018 | 10:52:45 | 1.58      | 67.12    | 1.97      | 9.92   | 9.57    |           |          |           |        |         |
| 4/30/2018 | 10:52:55 | 0.76      | 28.41    | 1.97      | 9.91   | 9.59    |           |          |           |        |         |
| 4/30/2018 | 10:53:05 | 0.31      | 7.14     | 1.97      | 9.90   | 9.60    |           |          |           |        |         |
| 4/30/2018 | 10:53:15 | 0.04      | -0.71    | 1.97      | 9.90   | 9.60    |           |          |           |        |         |
| 4/30/2018 | 10:53:25 | 0.03      | -2.57    | 1.97      | 9.90   | 9.79    |           |          |           |        |         |
| 4/30/2018 | 10:53:35 | 0.03      | -1.78    | 1.97      | 9.90   | 9.83    |           |          |           |        |         |
| 4/30/2018 | 10:53:45 | 0.04      | -0.83    | 1.97      | 9.90   | 9.84    | 0.03      |          |           | 9.90   |         |
| 4/30/2018 | 10:53:55 | 0.03      | -0.04    | 2.01      | 7.67   | 7.39    |           |          |           |        |         |
| 4/30/2018 | 10:54:05 | 0.04      | -0.65    | 2.01      | 2.40   | 1.47    |           |          |           |        |         |
| 4/30/2018 | 10:54:15 | 0.03      | 1.10     | 2.01      | 2.13   | 1.93    |           |          |           |        |         |
| 4/30/2018 | 10:54:25 | 0.04      | 2.01     | 2.01      | 2.11   | 1.96    |           |          |           |        |         |
| 4/30/2018 | 10:54:35 | 0.03      | 0.99     | 2.01      | 2.09   | 1.95    |           |          |           |        |         |
| 4/30/2018 | 10:54:45 | 0.03      | 0.27     | 2.01      | 2.09   | 1.94    |           |          |           |        |         |
| 4/30/2018 | 10:54:55 | 0.03      | 0.41     | 2.01      | 2.09   | 1.94    |           |          |           |        |         |
| 4/30/2018 | 10:55:05 | 0.02      | 1.47     | 1.37      | 2.08   | 1.93    |           |          |           |        |         |
| 4/30/2018 | 10:55:15 | 0.04      | 2.16     | 1.10      | 2.09   | 1.93    |           |          |           |        | 1.93    |
| 4/30/2018 | 10:55:25 | 0.05      | 1.21     | 1.10      | 6.97   | 1.59    |           |          |           |        |         |
| 4/30/2018 | 10:55:35 | 0.03      | 7.83     | 1.10      | 13.59  | 1.03    |           |          |           |        |         |
| 4/30/2018 | 10:55:45 | 0.02      | 37.31    | 1.10      | 6.42   | 0.40    |           |          |           |        |         |
| 4/30/2018 | 10:55:55 | 0.48      | 58.26    | 1.10      | 1.12   | 0.36    |           |          |           |        |         |
| 4/30/2018 | 10:56:05 | 1.58      | 54.39    | 1.10      | 0.34   | 0.19    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 1 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 10:56:15 | 6.99      | 53.80    | 1.11      | 0.30   | 0.12    |           |          |           |        |         |
| 4/30/2018 | 10:56:25 | 16.33     | 65.99    | 1.12      | 0.28   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 10:56:35 | 27.39     | 83.27    | 1.12      | 0.26   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:56:45 | 38.98     | 94.40    | 1.12      | 0.25   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 10:56:55 | 47.71     | 96.82    | 1.12      | 0.25   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:57:05 | 56.13     | 98.02    | 1.12      | 0.24   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:57:15 | 65.04     | 98.08    | 1.12      | 0.24   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:57:25 | 72.09     | 98.41    | 1.11      | 0.24   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:57:35 | 77.96     | 99.99    | 1.01      | 0.24   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:57:45 | 83.84     | 100.88   | 1.01      | 0.24   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:57:55 | 87.95     | 100.65   | 1.01      | 0.24   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:58:05 | 90.76     | 100.31   | 1.01      | 0.24   | 0.09    |           | 100.61   |           | 0.24   | 0.09    |
| 4/30/2018 | 10:58:15 | 92.73     | 99.28    | 1.01      | 0.25   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:58:25 | 93.47     | 98.68    | 1.01      | 0.24   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:58:35 | 93.93     | 98.42    | 1.01      | 0.24   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 10:58:45 | 93.90     | 99.04    | 1.06      | 0.24   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:58:55 | 94.05     | 100.78   | 1.07      | 0.25   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:59:05 | 94.19     | 101.84   | 1.07      | 6.18   | 0.28    |           |          |           |        |         |
| 4/30/2018 | 10:59:15 | 93.76     | 103.82   | 1.07      | 5.67   | 0.25    |           |          |           |        |         |
| 4/30/2018 | 10:59:25 | 94.82     | 106.97   | 1.07      | 0.61   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:59:35 | 92.18     | 92.43    | 1.07      | 0.05   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 10:59:45 | 83.11     | 62.70    | 1.07      | 0.14   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 10:59:55 | 65.65     | 33.37    | 1.04      | 0.25   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:00:05 | 39.60     | 18.20    | 1.01      | 0.25   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:00:15 | 24.23     | 14.53    | 1.01      | 0.25   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:00:25 | 20.49     | 13.91    | 1.01      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:00:35 | 17.86     | 13.29    | 1.01      | 0.24   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:00:45 | 16.55     | 12.66    | 1.01      | 0.25   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:00:55 | 15.69     | 11.63    | 1.01      | 0.25   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:01:05 | 14.89     | 10.91    | 1.01      | 0.30   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:01:15 | 13.24     | 10.28    | 1.01      | 0.27   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:01:25 | 11.14     | 9.87     | 1.01      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:01:35 | 9.63      | 9.89     | 1.01      | 0.26   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:01:45 | 8.31      | 9.04     | 1.01      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:01:55 | 7.45      | 7.96     | 1.01      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:02:05 | 7.30      | 6.88     | 1.01      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:02:15 | 7.14      | 6.26     | 1.01      | 0.26   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:02:25 | 6.97      | 6.25     | 1.09      | 0.27   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:02:35 | 6.82      | 6.82     | 1.10      | 0.25   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:02:45 | 6.67      | 7.75     | 1.10      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:02:55 | 6.70      | 8.75     | 1.10      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:03:05 | 6.54      | 8.09     | 1.10      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:03:15 | 6.39      | 7.39     | 1.10      | 0.27   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:03:25 | 6.38      | 6.81     | 1.10      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:03:35 | 6.39      | 6.28     | 1.05      | 0.27   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:03:45 | 6.25      | 6.08     | 1.01      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:03:55 | 5.78      | 6.97     | 1.01      | 0.27   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:04:05 | 5.19      | 7.64     | 1.01      | 0.27   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:04:15 | 4.87      | 7.57     | 1.01      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:04:25 | 4.88      | 6.73     | 1.01      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:04:35 | 4.88      | 6.05     | 1.01      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:04:45 | 4.87      | 5.53     | 1.01      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:04:55 | 4.88      | 4.85     | 1.02      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:05:05 | 4.90      | 4.93     | 1.02      | 0.25   | 0.07    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 1 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 11:05:15 | 4.74      | 6.46     | 1.02      | 0.25   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:05:25 | 4.59      | 8.04     | 1.02      | 0.26   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:05:35 | 4.74      | 7.84     | 1.02      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:05:45 | 5.05      | 7.10     | 1.02      | 0.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:05:55 | 5.19      | 6.29     | 1.02      | 0.27   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:06:05 | 5.20      | 5.93     | 1.02      | 7.07   | 0.29    |           |          |           |        |         |
| 4/30/2018 | 11:06:15 | 5.04      | 15.00    | 1.02      | 17.98  | 0.62    |           |          |           |        |         |
| 4/30/2018 | 11:06:25 | 5.03      | 53.54    | 1.02      | 19.52  | 0.65    | 5.09      |          |           |        |         |
| 4/30/2018 | 11:06:35 | 4.88      | 99.03    | 1.02      | 12.64  | 0.43    |           |          |           |        |         |
| 4/30/2018 | 11:06:45 | 4.16      | 121.29   | 1.02      | 2.14   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 11:06:55 | 3.73      | 97.84    | 1.02      | 1.16   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:07:05 | 3.88      | 55.89    | 1.02      | 1.29   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:07:15 | 3.57      | 21.27    | 1.02      | 1.31   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:07:25 | 2.51      | 5.62     | 1.02      | 1.30   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:07:35 | 1.90      | 1.81     | 1.02      | 1.29   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:07:45 | 1.71      | 1.61     | 1.02      | 1.29   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:07:55 | 1.53      | 2.75     | 1.02      | 1.28   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:08:05 | 1.52      | 3.84     | 1.02      | 1.18   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 11:08:15 | 1.52      | 3.73     | 1.02      | 1.17   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:08:25 | 1.39      | 3.13     | 1.04      | 1.17   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:08:35 | 1.39      | 1.91     | 1.07      | 1.18   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 11:08:45 | 1.52      | 1.43     | 1.07      | 4.20   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 11:08:55 | 1.53      | 1.44     | 1.07      | 19.77  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:09:05 | 1.52      | 1.25     | 0.37      | 20.86  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:09:15 | 1.23      | 1.59     | 0.37      | 20.93  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:09:25 | 0.48      | 2.07     | 0.37      | 20.95  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:09:35 | 0.02      | 1.26     | 0.37      | 20.96  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:09:45 | 0.02      | 0.21     | 0.32      | 20.96  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:09:55 | 0.02      | -0.37    | 0.32      | 20.97  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:10:05 | -0.13     | -0.96    | 0.32      | 20.97  | 0.11    |           | -0.37    | 0.32      |        |         |
| 4/30/2018 | 11:10:15 | -0.28     | -1.39    | 0.32      | 20.97  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:10:25 | -0.29     | -0.48    | 0.32      | 20.97  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:10:35 | -0.28     | 1.04     | 0.32      | 20.97  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:10:45 | -0.27     | 1.56     | 0.32      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:10:55 | -0.28     | 0.95     | 2.00      | 20.97  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:11:05 | -0.12     | -0.08    | 2.42      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:11:15 | 0.04      | -0.63    | 2.42      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:11:25 | 0.02      | -1.16    | 2.42      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:11:35 | -0.12     | -1.48    | 2.42      | 20.97  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:11:45 | -0.28     | -0.24    | 2.42      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:11:55 | -0.29     | 1.06     | 2.42      | 20.98  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:12:05 | -0.29     | 1.36     | 2.39      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:12:15 | -0.28     | 0.97     | 2.35      | 20.98  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:12:25 | -0.28     | -0.01    | 2.35      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:12:35 | -0.27     | -0.75    | 2.35      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:12:45 | -0.27     | -1.12    | 2.35      | 20.99  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:12:55 | -0.30     | -0.97    | 2.35      | 20.98  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 11:13:05 | -0.28     | 0.38     | 2.35      | 20.99  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:13:15 | -0.28     | 1.47     | 2.39      | 20.99  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:13:25 | -0.29     | 1.46     | 2.55      | 20.99  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:13:35 | -0.30     | 0.39     | 2.55      | 20.99  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 11:13:45 | -0.28     | -0.34    | 2.55      | 20.99  | 0.12    |           |          | 2.55      |        |         |
| 4/30/2018 | 11:13:55 | -0.29     | -0.98    | 2.55      | 20.99  | 0.12    |           |          |           |        |         |



**Hollingsworth & Vose****4/30/2018****CFU 117****Run 2**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 11:34:58 | 4.01      | 174.22   | 2.54      | 19.75  | 0.68    |
| 4/30/2018 | 11:35:58 | 4.01      | 172.94   | 2.52      | 19.75  | 0.68    |
| 4/30/2018 | 11:36:58 | 4.01      | 171.56   | 2.52      | 19.75  | 0.68    |
| 4/30/2018 | 11:37:58 | 3.91      | 170.61   | 2.63      | 19.75  | 0.68    |
| 4/30/2018 | 11:38:58 | 3.83      | 171.48   | 2.78      | 19.75  | 0.68    |
| 4/30/2018 | 11:39:58 | 4.01      | 174.68   | 4.01      | 19.74  | 0.68    |
| 4/30/2018 | 11:40:58 | 4.01      | 174.72   | 4.29      | 19.75  | 0.68    |
| 4/30/2018 | 11:41:58 | 3.87      | 173.21   | 4.32      | 19.75  | 0.67    |
| 4/30/2018 | 11:42:58 | 4.01      | 174.67   | 4.35      | 19.75  | 0.67    |
| 4/30/2018 | 11:43:58 | 4.02      | 174.77   | 4.48      | 19.75  | 0.67    |
| 4/30/2018 | 11:44:58 | 4.02      | 173.62   | 4.46      | 19.74  | 0.67    |
| 4/30/2018 | 11:45:58 | 3.97      | 173.35   | 4.42      | 19.75  | 0.67    |
| 4/30/2018 | 11:46:58 | 3.73      | 171.56   | 4.41      | 19.75  | 0.67    |
| 4/30/2018 | 11:47:58 | 3.77      | 173.23   | 4.42      | 19.74  | 0.67    |
| 4/30/2018 | 11:48:58 | 3.92      | 173.82   | 4.16      | 19.74  | 0.67    |
| 4/30/2018 | 11:49:58 | 4.02      | 175.24   | 1.97      | 19.74  | 0.68    |
| 4/30/2018 | 11:50:58 | 3.88      | 174.71   | 1.74      | 19.74  | 0.68    |
| 4/30/2018 | 11:51:58 | 3.74      | 169.86   | 1.66      | 19.74  | 0.68    |
| 4/30/2018 | 11:52:58 | 3.79      | 171.87   | 1.69      | 19.74  | 0.68    |
| 4/30/2018 | 11:53:58 | 3.88      | 175.33   | 1.74      | 19.74  | 0.69    |
| 4/30/2018 | 11:54:58 | 3.79      | 174.93   | 1.70      | 19.74  | 0.69    |
| 4/30/2018 | 11:55:58 | 3.75      | 169.77   | 1.95      | 19.74  | 0.68    |
| 4/30/2018 | 11:56:58 | 3.74      | 168.88   | 1.86      | 19.74  | 0.69    |
| 4/30/2018 | 11:57:58 | 3.74      | 170.32   | 1.85      | 19.73  | 0.69    |
| 4/30/2018 | 11:58:58 | 3.74      | 172.34   | 1.85      | 19.73  | 0.69    |
| 4/30/2018 | 11:59:58 | 3.75      | 172.22   | 1.84      | 19.74  | 0.68    |
| 4/30/2018 | 12:00:58 | 3.75      | 169.19   | 1.85      | 19.74  | 0.68    |
| 4/30/2018 | 12:01:58 | 3.75      | 168.41   | 1.88      | 19.74  | 0.68    |
| 4/30/2018 | 12:02:58 | 3.75      | 170.29   | 1.86      | 19.74  | 0.68    |
| 4/30/2018 | 12:03:58 | 3.75      | 171.92   | 1.81      | 19.73  | 0.68    |
| 4/30/2018 | 12:04:58 | 3.76      | 170.40   | 1.79      | 19.73  | 0.67    |
| 4/30/2018 | 12:05:58 | 3.75      | 171.15   | 1.80      | 19.73  | 0.67    |
| 4/30/2018 | 12:06:58 | 3.74      | 171.24   | 1.69      | 19.73  | 0.66    |
| 4/30/2018 | 12:07:58 | 3.75      | 168.32   | 1.79      | 19.73  | 0.66    |
| 4/30/2018 | 12:08:58 | 3.75      | 169.01   | 1.82      | 19.73  | 0.66    |
| 4/30/2018 | 12:09:58 | 3.75      | 167.71   | 1.85      | 19.73  | 0.67    |
| 4/30/2018 | 12:10:58 | 3.75      | 166.56   | 1.88      | 19.73  | 0.66    |
| 4/30/2018 | 12:11:58 | 3.76      | 167.51   | 1.82      | 19.73  | 0.66    |
| 4/30/2018 | 12:12:58 | 3.75      | 167.49   | 1.94      | 19.73  | 0.67    |
| 4/30/2018 | 12:13:58 | 3.76      | 166.11   | 1.76      | 19.73  | 0.67    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 2**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 12:14:58 | 3.76      | 167.36   | 1.81      | 19.73  | 0.67    |
| 4/30/2018 | 12:15:58 | 3.75      | 167.12   | 1.90      | 19.73  | 0.67    |
| 4/30/2018 | 12:16:58 | 3.74      | 166.85   | 1.91      | 19.73  | 0.67    |
| 4/30/2018 | 12:17:58 | 3.76      | 165.01   | 1.92      | 19.73  | 0.68    |
| 4/30/2018 | 12:18:58 | 3.75      | 165.56   | 1.94      | 19.73  | 0.68    |
| 4/30/2018 | 12:19:58 | 3.74      | 165.84   | 1.95      | 19.73  | 0.68    |
| 4/30/2018 | 12:20:58 | 3.74      | 165.39   | 1.98      | 19.73  | 0.68    |
| 4/30/2018 | 12:21:58 | 3.74      | 164.01   | 1.98      | 19.73  | 0.68    |
| 4/30/2018 | 12:22:58 | 3.75      | 164.26   | 1.94      | 19.73  | 0.68    |
| 4/30/2018 | 12:23:58 | 3.75      | 163.03   | 1.93      | 19.73  | 0.67    |
| 4/30/2018 | 12:24:58 | 3.74      | 163.21   | 1.87      | 19.73  | 0.67    |
| 4/30/2018 | 12:25:58 | 3.74      | 163.06   | 1.83      | 19.73  | 0.67    |
| 4/30/2018 | 12:26:58 | 3.75      | 162.00   | 1.85      | 19.73  | 0.67    |
| 4/30/2018 | 12:27:58 | 3.74      | 161.29   | 1.93      | 19.73  | 0.66    |
| 4/30/2018 | 12:28:58 | 3.73      | 162.41   | 1.94      | 19.74  | 0.66    |
| 4/30/2018 | 12:29:58 | 3.72      | 161.73   | 1.74      | 19.74  | 0.66    |
| 4/30/2018 | 12:30:58 | 3.72      | 161.38   | 1.81      | 19.74  | 0.66    |
| 4/30/2018 | 12:31:58 | 3.72      | 162.80   | 1.83      | 19.74  | 0.66    |
| 4/30/2018 | 12:32:58 | 3.72      | 161.56   | 1.80      | 19.74  | 0.66    |
| 4/30/2018 | 12:33:58 | 3.73      | 159.23   | 1.74      | 19.73  | 0.66    |
| 4/30/2018 | 12:34:58 | 3.73      | 161.89   | 1.78      | 19.73  | 0.66    |
| 4/30/2018 | 12:35:58 | 3.72      | 161.60   | 1.82      | 19.73  | 0.66    |
| 4/30/2018 | 12:36:58 | 3.73      | 162.17   | 1.83      | 19.73  | 0.66    |
| 4/30/2018 | 12:37:58 | 3.72      | 162.88   | 1.78      | 19.73  | 0.67    |
| 4/30/2018 | 12:38:58 | 3.73      | 161.66   | 1.70      | 19.73  | 0.67    |
| 4/30/2018 | 12:39:58 | 3.72      | 161.24   | 1.69      | 19.73  | 0.67    |
| 4/30/2018 | 12:40:58 | 3.66      | 153.88   | 1.55      | 19.74  | 0.67    |
| 4/30/2018 | 12:41:58 | 3.52      | 152.74   | 1.53      | 19.73  | 0.68    |
| 4/30/2018 | 12:42:58 | 3.73      | 162.30   | 1.60      | 19.73  | 0.68    |
| 4/30/2018 | 12:43:58 | 3.73      | 162.80   | 1.65      | 19.73  | 0.68    |
| 4/30/2018 | 12:44:58 | 3.73      | 163.72   | 1.63      | 19.72  | 0.68    |
| 4/30/2018 | 12:45:58 | 3.73      | 161.88   | 1.55      | 19.73  | 0.67    |
| 4/30/2018 | 12:46:58 | 3.74      | 161.05   | 1.56      | 19.72  | 0.68    |
| 4/30/2018 | 12:47:58 | 3.73      | 161.54   | 1.62      | 19.72  | 0.67    |
| 4/30/2018 | 12:48:58 | 3.73      | 159.01   | 1.63      | 19.72  | 0.67    |
| 4/30/2018 | 12:49:58 | 3.73      | 160.52   | 1.63      | 19.72  | 0.67    |
| 4/30/2018 | 12:50:58 | 3.72      | 159.81   | 1.67      | 19.73  | 0.67    |
| 4/30/2018 | 12:51:58 | 3.73      | 160.03   | 1.68      | 19.73  | 0.66    |
| 4/30/2018 | 12:52:58 | 3.72      | 162.78   | 1.54      | 19.73  | 0.66    |
| 4/30/2018 | 12:53:58 | 3.73      | 162.76   | 1.54      | 19.73  | 0.66    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 2**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 12:54:58 | 3.72      | 162.78   | 1.60      | 19.73  | 0.66    |
| 4/30/2018 | 12:55:58 | 3.73      | 162.15   | 1.67      | 19.73  | 0.66    |
| 4/30/2018 | 12:56:58 | 3.72      | 160.71   | 1.69      | 19.74  | 0.66    |
| 4/30/2018 | 12:57:58 | 3.72      | 161.22   | 1.59      | 19.73  | 0.66    |
| 4/30/2018 | 12:58:58 | 3.72      | 163.68   | 1.59      | 19.74  | 0.67    |
| 4/30/2018 | 12:59:58 | 3.73      | 164.24   | 1.57      | 19.73  | 0.67    |
| 4/30/2018 | 13:00:58 | 3.73      | 163.58   | 1.55      | 19.73  | 0.67    |
| 4/30/2018 | 13:01:58 | 3.73      | 162.84   | 1.56      | 19.73  | 0.67    |
| 4/30/2018 | 13:02:58 | 3.73      | 155.98   | 1.63      | 19.74  | 0.67    |
| 4/30/2018 | 13:03:58 | 3.72      | 157.77   | 1.74      | 19.73  | 0.67    |
| 4/30/2018 | 13:04:58 | 3.73      | 164.24   | 1.74      | 19.73  | 0.68    |
| 4/30/2018 | 13:05:58 | 3.73      | 163.19   | 1.74      | 19.73  | 0.68    |
| 4/30/2018 | 13:06:58 | 3.73      | 162.86   | 1.73      | 19.73  | 0.68    |
| 4/30/2018 | 13:07:58 | 3.73      | 159.16   | 1.67      | 19.73  | 0.68    |
| 4/30/2018 | 13:08:58 | 3.74      | 158.92   | 1.65      | 19.73  | 0.68    |
| 4/30/2018 | 13:09:58 | 3.74      | 160.51   | 1.40      | 19.73  | 0.68    |
| 4/30/2018 | 13:10:58 | 3.75      | 163.02   | 1.45      | 19.73  | 0.68    |
| 4/30/2018 | 13:11:58 | 3.75      | 164.08   | 1.54      | 19.72  | 0.67    |
| 4/30/2018 | 13:12:58 | 3.74      | 163.22   | 1.54      | 19.73  | 0.67    |
| 4/30/2018 | 13:13:58 | 3.73      | 164.48   | 1.57      | 19.73  | 0.67    |
| 4/30/2018 | 13:14:58 | 3.73      | 163.89   | 1.59      | 19.73  | 0.67    |
| 4/30/2018 | 13:15:58 | 3.73      | 164.16   | 1.55      | 19.73  | 0.66    |
| 4/30/2018 | 13:16:58 | 3.73      | 164.26   | 1.51      | 19.73  | 0.67    |
| 4/30/2018 | 13:17:58 | 3.73      | 166.29   | 1.50      | 19.72  | 0.67    |
| 4/30/2018 | 13:18:58 | 3.73      | 162.79   | 1.54      | 19.73  | 0.66    |
| 4/30/2018 | 13:19:58 | 3.73      | 163.56   | 1.50      | 19.72  | 0.66    |
| 4/30/2018 | 13:20:58 | 3.73      | 164.24   | 1.60      | 19.72  | 0.66    |
| 4/30/2018 | 13:21:58 | 3.72      | 161.36   | 1.52      | 19.73  | 0.67    |
| 4/30/2018 | 13:22:58 | 3.72      | 161.76   | 1.55      | 19.72  | 0.67    |
| 4/30/2018 | 13:23:58 | 3.73      | 165.40   | 1.62      | 19.72  | 0.67    |
| 4/30/2018 | 13:24:58 | 3.73      | 163.84   | 1.49      | 19.72  | 0.67    |
| 4/30/2018 | 13:25:58 | 3.72      | 162.82   | 1.50      | 19.72  | 0.67    |
| 4/30/2018 | 13:26:58 | 3.73      | 163.03   | 1.49      | 19.72  | 0.68    |
| 4/30/2018 | 13:27:58 | 3.72      | 162.30   | 1.46      | 19.72  | 0.68    |
| 4/30/2018 | 13:28:58 | 3.73      | 163.58   | 1.48      | 19.72  | 0.68    |
| 4/30/2018 | 13:29:58 | 3.73      | 164.34   | 1.56      | 19.72  | 0.68    |
| 4/30/2018 | 13:30:58 | 3.73      | 163.56   | 1.64      | 19.72  | 0.68    |
| 4/30/2018 | 13:31:58 | 3.73      | 164.09   | 1.52      | 19.72  | 0.68    |
| 4/30/2018 | 13:32:58 | 3.73      | 164.14   | 1.63      | 19.72  | 0.68    |
| 4/30/2018 | 13:33:58 | 3.74      | 163.02   | 1.64      | 19.72  | 0.68    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 2**

| Date      | Time     | NOx [PPM]   | CO [PPM]      | VOC [PPM]   | O2 [%]       | CO2 [%]     |
|-----------|----------|-------------|---------------|-------------|--------------|-------------|
| 4/30/2018 | 13:34:58 | 3.74        | 163.82        | 1.56        | 19.72        | 0.68        |
| 4/30/2018 | 13:35:58 | 3.75        | 163.38        | 1.48        | 19.72        | 0.68        |
| 4/30/2018 | 13:36:58 | 3.70        | 154.84        | 1.66        | 19.73        | 0.67        |
| 4/30/2018 | 13:37:58 | 3.69        | 154.22        | 1.58        | 19.72        | 0.67        |
| 4/30/2018 | 13:38:58 | 3.73        | 162.24        | 1.48        | 19.72        | 0.67        |
| 4/30/2018 | 13:39:58 | 3.73        | 162.48        | 1.48        | 19.72        | 0.67        |
| Averages: |          | <b>3.76</b> | <b>165.24</b> | <b>1.94</b> | <b>19.73</b> | <b>0.67</b> |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 2 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 13:40:08 | 3.74      | 163.20   | 1.42      | 19.71  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:40:18 | 3.73      | 162.46   | 1.42      | 19.71  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:40:28 | 3.73      | 161.85   | 1.45      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:40:38 | 3.73      | 161.90   | 1.59      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:40:48 | 3.74      | 161.67   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:40:58 | 3.76      | 160.86   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:41:08 | 3.73      | 160.07   | 1.59      | 19.71  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:41:18 | 3.74      | 159.98   | 1.59      | 19.71  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:41:28 | 3.74      | 160.25   | 1.59      | 19.71  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:41:38 | 3.73      | 160.65   | 1.59      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:41:48 | 3.75      | 160.76   | 1.45      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:41:58 | 3.73      | 161.84   | 1.45      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:42:08 | 3.74      | 163.35   | 1.45      | 19.71  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:42:18 | 3.74      | 164.62   | 1.44      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:42:28 | 3.75      | 164.51   | 1.45      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:42:38 | 3.75      | 162.41   | 1.44      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:42:48 | 3.74      | 160.13   | 1.44      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:42:58 | 3.73      | 157.85   | 1.55      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:43:08 | 3.74      | 155.51   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:43:18 | 3.74      | 155.17   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:43:28 | 3.73      | 156.90   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:43:38 | 3.74      | 158.92   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:43:48 | 3.75      | 160.35   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:43:58 | 3.74      | 160.21   | 1.59      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:44:08 | 3.74      | 159.78   | 1.53      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:44:18 | 3.76      | 159.76   | 1.43      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:44:28 | 3.74      | 158.86   | 1.43      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:44:38 | 3.74      | 158.08   | 1.43      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:44:48 | 3.74      | 158.61   | 1.43      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:44:58 | 3.74      | 159.36   | 1.43      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:45:08 | 3.73      | 159.77   | 1.43      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:45:18 | 3.74      | 160.22   | 1.43      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:45:28 | 3.73      | 159.80   | 1.61      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:45:38 | 3.74      | 160.48   | 1.62      | 19.71  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:45:48 | 3.72      | 160.24   | 1.61      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:45:58 | 3.74      | 160.79   | 1.61      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:46:08 | 3.73      | 161.81   | 1.61      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:46:18 | 3.75      | 162.66   | 1.62      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:46:28 | 3.70      | 162.25   | 1.61      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:46:38 | 3.73      | 159.43   | 1.53      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:46:48 | 3.74      | 157.03   | 1.51      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:46:58 | 3.74      | 155.46   | 1.51      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:47:08 | 3.73      | 155.18   | 1.51      | 19.72  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:47:18 | 3.73      | 155.11   | 1.51      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:47:28 | 3.73      | 155.93   | 1.51      | 19.72  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:47:38 | 3.74      | 158.11   | 1.51      | 19.73  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:47:48 | 3.73      | 160.03   | 1.58      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:47:58 | 3.74      | 160.40   | 1.68      | 19.73  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:48:08 | 3.75      | 158.47   | 1.68      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:48:18 | 3.74      | 156.69   | 1.68      | 19.73  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:48:28 | 3.74      | 155.42   | 1.68      | 19.73  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:48:38 | 3.73      | 155.47   | 1.68      | 19.73  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:48:48 | 3.73      | 155.53   | 1.68      | 19.73  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:48:58 | 3.73      | 157.10   | 1.65      | 19.73  | 0.67    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 2 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 13:49:08 | 3.74      | 158.82   | 1.54      | 19.74  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:49:18 | 3.73      | 159.58   | 1.54      | 19.74  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:49:28 | 3.73      | 158.56   | 1.54      | 19.74  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:49:38 | 3.73      | 157.19   | 1.54      | 19.73  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:49:48 | 3.75      | 156.15   | 1.54      | 19.67  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:49:58 | 3.73      | 155.87   | 1.54      | 19.83  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:50:08 | 3.74      | 155.43   | 1.54      | 19.84  | 0.66    |           |          |           |        |         |
| 4/30/2018 | 13:50:18 | 3.73      | 154.74   | 1.51      | 19.84  | 0.67    |           |          |           |        |         |
| 4/30/2018 | 13:50:28 | 3.74      | 155.02   | 1.51      | 19.89  | 4.63    |           |          |           |        |         |
| 4/30/2018 | 13:50:38 | 3.73      | 148.60   | 1.51      | 19.98  | 16.35   |           |          |           |        |         |
| 4/30/2018 | 13:50:48 | 3.73      | 119.95   | 1.51      | 19.94  | 18.25   |           |          |           |        |         |
| 4/30/2018 | 13:50:58 | 2.39      | 79.28    | 1.51      | 19.93  | 18.45   |           |          |           |        |         |
| 4/30/2018 | 13:51:08 | 0.77      | 45.93    | 1.51      | 19.93  | 18.47   |           |          |           |        |         |
| 4/30/2018 | 13:51:18 | 0.36      | 24.03    | 1.51      | 19.93  | 18.50   |           |          |           |        |         |
| 4/30/2018 | 13:51:28 | 0.32      | 12.15    | 1.55      | 19.92  | 18.51   |           |          |           |        |         |
| 4/30/2018 | 13:51:38 | 0.32      | 7.19     | 1.59      | 19.92  | 18.53   |           |          |           |        |         |
| 4/30/2018 | 13:51:48 | 0.33      | 6.43     | 1.59      | 19.93  | 18.54   |           |          |           |        |         |
| 4/30/2018 | 13:51:58 | 0.33      | 7.45     | 1.59      | 19.93  | 18.55   |           |          |           |        |         |
| 4/30/2018 | 13:52:08 | 0.32      | 9.13     | 1.59      | 19.00  | 12.23   |           |          |           |        |         |
| 4/30/2018 | 13:52:18 | 0.33      | 14.72    | 1.59      | 11.86  | 2.28    |           |          |           |        |         |
| 4/30/2018 | 13:52:28 | 0.32      | 20.96    | 1.59      | 9.99   | 0.40    |           |          |           |        |         |
| 4/30/2018 | 13:52:38 | 0.06      | 18.19    | 1.39      | 9.84   | 0.23    |           |          |           |        |         |
| 4/30/2018 | 13:52:48 | 0.01      | 10.26    | 0.60      | 9.82   | 0.18    |           |          |           | 9.88   |         |
| 4/30/2018 | 13:52:58 | 0.03      | 3.34     | 0.60      | 9.81   | 0.16    |           |          |           |        |         |
| 4/30/2018 | 13:53:08 | 0.03      | -0.04    | 0.60      | 9.81   | 0.15    |           |          |           |        |         |
| 4/30/2018 | 13:53:18 | 0.04      | -0.16    | 0.60      | 9.81   | 0.13    |           |          |           |        |         |
| 4/30/2018 | 13:53:28 | 0.04      | 0.49     | 0.60      | 9.81   | 0.13    |           |          |           |        |         |
| 4/30/2018 | 13:53:38 | 0.03      | 0.34     | 0.61      | 9.80   | 0.13    |           |          |           |        |         |
| 4/30/2018 | 13:53:48 | 0.03      | -0.48    | 0.60      | 9.81   | 0.12    |           |          |           |        |         |
| 4/30/2018 | 13:53:58 | 0.04      | -1.13    | 0.71      | 9.80   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 13:54:08 | 0.03      | -1.83    | 0.71      | 9.80   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 13:54:18 | 0.02      | -1.81    | 0.71      | 9.81   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 13:54:28 | 0.01      | -1.50    | 0.71      | 9.80   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 13:54:38 | 0.00      | -0.38    | 0.71      | 9.80   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 13:54:48 | 0.02      | 0.63     | 0.71      | 9.80   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 13:54:58 | 0.02      | 0.31     | 0.71      | 9.80   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:55:08 | 0.03      | -0.48    | 0.57      | 9.80   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 13:55:18 | 0.02      | -1.26    | 0.48      | 9.80   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:55:28 | 0.02      | -1.50    | 0.48      | 9.80   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:55:38 | 0.01      | -1.67    | 0.48      | 9.80   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:55:48 | 0.01      | -1.22    | 0.48      | 9.63   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 13:55:58 | 0.03      | 0.09     | 0.48      | 3.43   | 0.14    |           |          |           |        |         |
| 4/30/2018 | 13:56:08 | 0.00      | 0.74     | 0.48      | 0.31   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:56:18 | 0.01      | 0.36     | 0.51      | 0.03   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:56:28 | 0.03      | -0.50    | 0.59      | 0.00   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:56:38 | 0.03      | -1.48    | 0.59      | 0.00   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:56:48 | 0.01      | -1.48    | 0.59      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:56:58 | 0.03      | -1.87    | 0.59      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:57:08 | 0.04      | -1.99    | 0.59      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:57:18 | 0.04      | -0.72    | 0.59      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 13:57:28 | 0.03      | 0.74     | 0.59      | -0.01  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:57:38 | 0.04      | 0.33     | 0.60      | -0.01  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:57:48 | 0.03      | -0.02    | 0.60      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:57:58 | 0.04      | -0.74    | 0.60      | -0.01  | 0.08    |           |          |           |        |         |

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**Run 2 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 13:58:08 | 0.05      | -1.58    | 0.60      | -0.01  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:58:18 | 0.03      | -1.75    | 0.60      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:58:28 | 0.04      | -1.42    | 0.60      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:58:38 | 0.04      | -0.34    | 0.60      | -0.02  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 13:58:48 | 0.04      | 0.93     | 0.61      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:58:58 | 0.04      | 0.59     | 0.62      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:59:08 | 0.04      | -0.27    | 0.62      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:59:18 | 0.05      | -0.91    | 0.62      | -0.02  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 13:59:28 | 0.05      | -1.75    | 0.62      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 13:59:38 | 0.03      | -1.76    | 0.62      | -0.02  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 13:59:48 | 0.03      | -1.53    | 0.62      | 0.01   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 13:59:58 | 0.03      | -0.16    | 0.62      | 0.34   | 0.20    |           |          |           |        |         |
| 4/30/2018 | 14:00:08 | 0.03      | 0.55     | 0.63      | 1.43   | 1.26    |           |          |           |        |         |
| 4/30/2018 | 14:00:18 | 0.55      | 0.85     | 0.63      | 1.88   | 1.83    |           |          |           |        |         |
| 4/30/2018 | 14:00:28 | 1.45      | 0.09     | 0.63      | 1.93   | 1.84    |           |          |           |        |         |
| 4/30/2018 | 14:00:38 | 1.00      | -1.07    | 0.63      | 2.04   | 1.86    |           |          |           |        |         |
| 4/30/2018 | 14:00:48 | 0.38      | -1.59    | 0.63      | 2.06   | 1.88    |           |          |           |        | 1.86    |
| 4/30/2018 | 14:00:58 | 0.32      | -1.57    | 0.63      | 2.06   | 1.88    |           |          |           |        |         |
| 4/30/2018 | 14:01:08 | 0.06      | -1.04    | 0.61      | 2.05   | 1.88    |           |          |           |        |         |
| 4/30/2018 | 14:01:18 | 0.03      | 0.09     | 0.54      | 2.05   | 1.88    |           |          |           |        |         |
| 4/30/2018 | 14:01:28 | 0.04      | 1.63     | 0.54      | 2.05   | 1.89    |           |          |           |        |         |
| 4/30/2018 | 14:01:38 | 0.03      | 1.32     | 0.54      | 2.06   | 1.89    |           |          |           |        |         |
| 4/30/2018 | 14:01:48 | 0.02      | 0.89     | 0.54      | 2.06   | 1.89    |           |          |           |        |         |
| 4/30/2018 | 14:01:58 | 0.04      | -0.26    | 0.54      | 2.06   | 1.89    |           |          |           |        |         |
| 4/30/2018 | 14:02:08 | 0.03      | -0.62    | 0.54      | 2.05   | 1.89    |           |          |           |        |         |
| 4/30/2018 | 14:02:18 | 0.04      | -1.09    | 0.54      | 4.60   | 1.74    |           |          |           |        |         |
| 4/30/2018 | 14:02:28 | 0.04      | 5.65     | 0.58      | 15.43  | 0.98    |           |          |           |        |         |
| 4/30/2018 | 14:02:38 | 0.29      | 32.42    | 0.58      | 13.68  | 0.79    |           |          |           |        |         |
| 4/30/2018 | 14:02:48 | 0.59      | 66.87    | 0.58      | 7.68   | 0.35    |           |          |           |        |         |
| 4/30/2018 | 14:02:58 | 1.43      | 83.54    | 0.58      | 0.91   | 0.25    |           |          |           |        |         |
| 4/30/2018 | 14:03:08 | 2.43      | 75.81    | 0.58      | 0.14   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 14:03:18 | 14.35     | 71.35    | 0.58      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:03:28 | 27.12     | 77.55    | 0.58      | 0.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:03:38 | 38.72     | 88.30    | 0.61      | 0.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:03:48 | 47.17     | 94.66    | 0.64      | 0.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:03:58 | 56.08     | 97.36    | 0.64      | 0.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:04:08 | 67.89     | 99.60    | 0.64      | 0.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:04:18 | 75.60     | 100.53   | 0.64      | 0.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:04:28 | 81.49     | 100.36   | 0.64      | 0.22   | 0.08    |           | 100.16   |           |        |         |
| 4/30/2018 | 14:04:38 | 85.51     | 99.43    | 0.64      | 0.27   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:04:48 | 90.17     | 99.64    | 0.67      | 8.91   | 0.36    |           |          |           |        |         |
| 4/30/2018 | 14:04:58 | 91.17     | 102.84   | 0.75      | 2.72   | 0.15    |           |          |           |        |         |
| 4/30/2018 | 14:05:08 | 96.09     | 101.09   | 0.75      | 0.24   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:05:18 | 86.44     | 80.21    | 0.75      | 0.12   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:05:28 | 74.74     | 49.54    | 0.75      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:05:38 | 49.99     | 24.59    | 0.75      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:05:48 | 21.95     | 12.13    | 0.75      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:05:58 | 16.82     | 8.08     | 0.75      | 0.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:06:08 | 13.58     | 6.67     | 0.80      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:06:18 | 12.45     | 5.77     | 0.80      | 0.21   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:06:28 | 11.27     | 5.32     | 0.80      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:06:38 | 10.60     | 5.40     | 0.80      | 0.21   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:06:48 | 9.74      | 6.19     | 0.80      | 0.21   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:06:58 | 9.36      | 7.56     | 0.80      | 0.21   | 0.07    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 2 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 14:07:08 | 9.08      | 8.06     | 0.80      | 0.21   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:07:18 | 8.84      | 7.22     | 0.75      | 0.21   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:07:28 | 8.58      | 6.70     | 0.72      | 0.21   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:07:38 | 8.23      | 5.54     | 0.72      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:07:48 | 7.87      | 5.36     | 0.72      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:07:58 | 7.37      | 5.13     | 0.72      | 0.22   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:08:08 | 7.30      | 6.18     | 0.72      | 0.21   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:08:18 | 6.99      | 7.19     | 0.72      | 0.21   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:08:28 | 6.97      | 7.79     | 0.70      | 0.21   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:08:38 | 6.71      | 7.84     | 0.66      | 3.56   | 0.19    |           |          |           |        |         |
| 4/30/2018 | 14:08:48 | 6.67      | 10.42    | 0.66      | 1.82   | 0.13    |           |          |           |        |         |
| 4/30/2018 | 14:08:58 | 6.16      | 16.72    | 0.66      | 0.12   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:09:08 | 5.53      | 15.72    | 0.66      | -0.02  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:09:18 | 5.75      | 11.29    | 0.66      | -0.03  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:09:28 | 6.08      | 6.63     | 0.66      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:09:38 | 6.11      | 5.99     | 0.66      | -0.03  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:09:48 | 6.12      | 6.02     | 0.70      | -0.03  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:09:58 | 6.12      | 5.58     | 0.69      | -0.04  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:10:08 | 6.12      | 4.54     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:10:18 | 5.82      | 3.95     | 0.69      | -0.04  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:10:28 | 5.80      | 3.20     | 0.69      | -0.03  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:10:38 | 5.80      | 3.34     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:10:48 | 5.81      | 3.69     | 0.69      | -0.03  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:10:58 | 5.79      | 4.86     | 0.69      | -0.04  | 0.06    |           |          |           |        |         |
| 4/30/2018 | 14:11:08 | 5.77      | 6.08     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:11:18 | 5.51      | 5.61     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:11:28 | 5.27      | 4.98     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:11:38 | 5.27      | 3.96     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:11:48 | 5.29      | 3.67     | 0.69      | -0.04  | 0.07    | 5.28      |          |           |        |         |
| 4/30/2018 | 14:11:58 | 5.28      | 3.23     | 0.69      | -0.04  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:12:08 | 5.27      | 3.02     | 0.67      | 0.05   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:12:18 | 5.29      | 7.31     | 0.63      | 11.79  | 0.45    |           |          |           |        |         |
| 4/30/2018 | 14:12:28 | 5.29      | 28.07    | 0.63      | 18.94  | 0.65    |           |          |           |        |         |
| 4/30/2018 | 14:12:38 | 4.68      | 72.43    | 0.63      | 11.73  | 0.41    |           |          |           |        |         |
| 4/30/2018 | 14:12:48 | 4.09      | 102.61   | 0.63      | 1.97   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 14:12:58 | 4.03      | 88.87    | 0.63      | 1.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:13:08 | 4.26      | 52.24    | 0.63      | 1.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:13:18 | 3.24      | 19.59    | 0.64      | 1.26   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:13:28 | 1.68      | 4.75     | 0.68      | 1.25   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:13:38 | 1.52      | 1.37     | 0.68      | 1.24   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:13:48 | 1.26      | 2.02     | 0.68      | 1.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:13:58 | 1.24      | 3.02     | 0.68      | 1.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:14:08 | 1.23      | 3.03     | 0.68      | 1.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:14:18 | 1.24      | 1.93     | 0.68      | 1.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:14:28 | 1.23      | 1.12     | 0.68      | 1.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:14:38 | 0.97      | 0.69     | 2.57      | 1.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:14:48 | 0.94      | 0.47     | 3.04      | 1.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:14:58 | 0.94      | 0.23     | 3.04      | 1.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:15:08 | 0.94      | 0.64     | 3.04      | 1.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:15:18 | 0.94      | 1.83     | 3.04      | 1.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:15:28 | 0.94      | 2.84     | 3.04      | 1.23   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:15:38 | 0.92      | 2.53     | 3.04      | 1.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:15:48 | 0.94      | 1.65     | 3.05      | 1.21   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:15:58 | 0.92      | 1.02     | 3.05      | 0.61   | 0.09    |           |          |           |        |         |



**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 2 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 14:16:08 | 0.93      | 0.15     | 3.05      | 0.25   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:16:18 | 0.62      | -0.42    | 3.05      | 0.23   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:16:28 | 0.37      | -0.16    | 3.05      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:16:38 | 0.05      | 1.06     | 3.05      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:16:48 | 0.04      | 2.73     | 3.05      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:16:58 | 0.04      | 2.44     | 3.03      | 0.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:17:08 | 0.04      | 1.88     | 2.91      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:17:18 | 0.04      | 1.15     | 2.91      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:17:28 | 0.03      | 0.54     | 2.91      | 0.21   | 0.09    |           |          | 2.91      |        |         |
| 4/30/2018 | 14:17:38 | 0.03      | 0.26     | 2.91      | 0.21   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:17:48 | 0.03      | -0.13    | 2.91      | 0.22   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:17:58 | 0.05      | 0.61     | 2.91      | 0.20   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:18:08 | 0.04      | 1.87     | 2.91      | 0.18   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:18:18 | 0.04      | 3.89     | 0.87      | 4.53   | 0.23    |           |          |           |        |         |
| 4/30/2018 | 14:18:28 | 0.04      | 9.56     | 0.64      | 1.04   | 0.12    |           |          |           |        |         |
| 4/30/2018 | 14:18:38 | 0.50      | 15.06    | 0.64      | 0.05   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 14:18:48 | 1.19      | 12.77    | 0.64      | 0.09   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:18:58 | 0.70      | 5.98     | 0.64      | 0.18   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:19:08 | 0.12      | 1.25     | 0.64      | 0.19   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:19:18 | 0.04      | -0.13    | 0.64      | 0.20   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:19:28 | 0.03      | 1.05     | 0.54      | 0.21   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:19:38 | 0.03      | 2.59     | 0.47      | 0.21   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:19:48 | 0.03      | 2.72     | 0.47      | 0.21   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:19:58 | 0.04      | 2.04     | 0.47      | 0.21   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:20:08 | 0.03      | 1.22     | 0.47      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:20:18 | 0.02      | 0.69     | 0.47      | 0.22   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 14:20:28 | 0.04      | 0.17     | 0.47      | 0.23   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 14:20:38 | 0.04      | 0.23     | 0.48      | 0.23   | 0.08    | 0.03      | 0.36     | 0.47      | 0.23   | 0.08    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 3**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 14:29:17 | 3.58      | 170.17   | 1.43      | 19.79  | 0.68    |
| 4/30/2018 | 14:30:17 | 3.73      | 171.00   | 1.34      | 19.79  | 0.68    |
| 4/30/2018 | 14:31:17 | 3.68      | 170.84   | 1.36      | 19.79  | 0.68    |
| 4/30/2018 | 14:32:17 | 3.73      | 170.94   | 1.35      | 19.79  | 0.68    |
| 4/30/2018 | 14:33:17 | 3.70      | 169.83   | 1.30      | 19.79  | 0.68    |
| 4/30/2018 | 14:34:17 | 3.73      | 169.73   | 1.35      | 19.79  | 0.68    |
| 4/30/2018 | 14:35:17 | 3.65      | 169.92   | 1.36      | 19.80  | 0.67    |
| 4/30/2018 | 14:36:17 | 3.62      | 168.80   | 1.36      | 19.79  | 0.67    |
| 4/30/2018 | 14:37:17 | 3.74      | 169.75   | 1.31      | 19.79  | 0.67    |
| 4/30/2018 | 14:38:17 | 3.74      | 170.93   | 1.30      | 19.79  | 0.67    |
| 4/30/2018 | 14:39:17 | 3.73      | 169.19   | 1.39      | 19.79  | 0.67    |
| 4/30/2018 | 14:40:17 | 3.74      | 170.60   | 1.40      | 19.79  | 0.67    |
| 4/30/2018 | 14:41:17 | 3.70      | 168.97   | 1.32      | 19.79  | 0.67    |
| 4/30/2018 | 14:42:17 | 3.68      | 168.41   | 1.33      | 19.78  | 0.68    |
| 4/30/2018 | 14:43:17 | 3.70      | 169.60   | 1.37      | 19.79  | 0.67    |
| 4/30/2018 | 14:44:17 | 3.43      | 167.34   | 1.40      | 19.79  | 0.68    |
| 4/30/2018 | 14:45:17 | 3.59      | 167.15   | 1.34      | 19.78  | 0.68    |
| 4/30/2018 | 14:46:17 | 3.75      | 170.56   | 1.30      | 19.78  | 0.69    |
| 4/30/2018 | 14:47:17 | 3.77      | 168.85   | 1.37      | 19.78  | 0.68    |
| 4/30/2018 | 14:48:17 | 3.76      | 167.97   | 1.35      | 19.78  | 0.69    |
| 4/30/2018 | 14:49:17 | 3.57      | 168.80   | 1.34      | 19.78  | 0.68    |
| 4/30/2018 | 14:50:17 | 3.56      | 167.04   | 1.39      | 19.78  | 0.69    |
| 4/30/2018 | 14:51:17 | 3.76      | 168.60   | 1.45      | 19.78  | 0.69    |
| 4/30/2018 | 14:52:17 | 3.73      | 168.24   | 1.40      | 19.78  | 0.68    |
| 4/30/2018 | 14:53:17 | 3.55      | 165.76   | 1.51      | 19.79  | 0.68    |
| 4/30/2018 | 14:54:17 | 3.75      | 169.30   | 1.45      | 19.79  | 0.68    |
| 4/30/2018 | 14:55:17 | 3.75      | 168.66   | 1.34      | 19.79  | 0.67    |
| 4/30/2018 | 14:56:17 | 3.75      | 167.30   | 1.37      | 19.79  | 0.68    |
| 4/30/2018 | 14:57:17 | 3.46      | 169.10   | 1.52      | 19.79  | 0.67    |
| 4/30/2018 | 14:58:17 | 3.66      | 165.70   | 1.41      | 19.79  | 0.67    |
| 4/30/2018 | 14:59:17 | 3.45      | 162.27   | 1.43      | 19.79  | 0.67    |
| 4/30/2018 | 15:00:17 | 3.49      | 166.68   | 1.42      | 19.79  | 0.67    |
| 4/30/2018 | 15:01:17 | 3.65      | 167.02   | 1.36      | 19.78  | 0.67    |
| 4/30/2018 | 15:02:17 | 3.52      | 165.79   | 1.32      | 19.79  | 0.67    |
| 4/30/2018 | 15:03:17 | 3.46      | 165.28   | 1.39      | 19.79  | 0.67    |
| 4/30/2018 | 15:04:17 | 3.56      | 166.39   | 1.43      | 19.79  | 0.67    |
| 4/30/2018 | 15:05:17 | 3.51      | 165.46   | 1.42      | 19.78  | 0.67    |
| 4/30/2018 | 15:06:17 | 3.44      | 166.38   | 1.40      | 19.79  | 0.67    |
| 4/30/2018 | 15:07:17 | 3.45      | 165.30   | 1.38      | 19.78  | 0.67    |
| 4/30/2018 | 15:08:17 | 3.45      | 164.94   | 1.26      | 19.79  | 0.68    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 3**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 15:09:17 | 3.45      | 164.27   | 1.34      | 19.79  | 0.68    |
| 4/30/2018 | 15:10:17 | 3.45      | 162.80   | 1.39      | 19.79  | 0.68    |
| 4/30/2018 | 15:11:17 | 3.45      | 163.34   | 1.35      | 19.78  | 0.68    |
| 4/30/2018 | 15:12:17 | 3.45      | 164.84   | 1.30      | 19.78  | 0.68    |
| 4/30/2018 | 15:13:17 | 3.44      | 164.79   | 1.34      | 19.78  | 0.68    |
| 4/30/2018 | 15:14:17 | 3.59      | 165.13   | 1.38      | 19.78  | 0.69    |
| 4/30/2018 | 15:15:17 | 3.53      | 166.23   | 1.31      | 19.78  | 0.68    |
| 4/30/2018 | 15:16:17 | 3.65      | 165.26   | 1.33      | 19.78  | 0.68    |
| 4/30/2018 | 15:17:17 | 3.44      | 162.31   | 1.34      | 19.78  | 0.68    |
| 4/30/2018 | 15:18:17 | 3.43      | 159.57   | 1.33      | 19.78  | 0.68    |
| 4/30/2018 | 15:19:17 | 3.44      | 162.17   | 1.38      | 19.78  | 0.67    |
| 4/30/2018 | 15:20:17 | 3.44      | 162.14   | 1.27      | 19.78  | 0.67    |
| 4/30/2018 | 15:21:17 | 3.45      | 165.29   | 1.35      | 19.78  | 0.67    |
| 4/30/2018 | 15:22:17 | 3.49      | 164.71   | 1.35      | 19.78  | 0.67    |
| 4/30/2018 | 15:23:17 | 3.48      | 163.32   | 1.32      | 19.78  | 0.67    |
| 4/30/2018 | 15:24:17 | 3.69      | 164.37   | 1.32      | 19.78  | 0.67    |
| 4/30/2018 | 15:25:17 | 3.56      | 164.47   | 1.32      | 19.78  | 0.67    |
| 4/30/2018 | 15:26:17 | 3.44      | 163.04   | 1.28      | 19.78  | 0.67    |
| 4/30/2018 | 15:27:17 | 3.49      | 163.16   | 1.32      | 19.78  | 0.67    |
| 4/30/2018 | 15:28:17 | 3.44      | 164.43   | 1.34      | 19.78  | 0.67    |
| 4/30/2018 | 15:29:17 | 3.43      | 162.83   | 1.32      | 19.78  | 0.67    |
| 4/30/2018 | 15:30:17 | 3.43      | 159.81   | 1.25      | 19.79  | 0.67    |
| 4/30/2018 | 15:31:17 | 3.57      | 163.89   | 1.30      | 19.79  | 0.68    |
| 4/30/2018 | 15:32:17 | 3.65      | 163.77   | 1.34      | 19.78  | 0.67    |
| 4/30/2018 | 15:33:17 | 3.47      | 162.09   | 1.31      | 19.78  | 0.68    |
| 4/30/2018 | 15:34:17 | 3.65      | 163.82   | 1.31      | 19.78  | 0.69    |
| 4/30/2018 | 15:35:17 | 3.43      | 162.24   | 1.37      | 19.78  | 0.68    |
| 4/30/2018 | 15:36:17 | 3.53      | 164.00   | 1.26      | 19.78  | 0.69    |
| 4/30/2018 | 15:37:17 | 3.74      | 165.30   | 1.45      | 19.78  | 0.68    |
| 4/30/2018 | 15:38:17 | 3.59      | 164.22   | 1.34      | 19.78  | 0.68    |
| 4/30/2018 | 15:39:17 | 3.48      | 163.39   | 1.27      | 19.78  | 0.68    |
| 4/30/2018 | 15:40:17 | 3.65      | 163.88   | 1.24      | 19.78  | 0.68    |
| 4/30/2018 | 15:41:17 | 3.66      | 164.08   | 1.23      | 19.78  | 0.68    |
| 4/30/2018 | 15:42:17 | 3.70      | 165.97   | 1.34      | 19.78  | 0.67    |
| 4/30/2018 | 15:43:17 | 3.43      | 162.76   | 1.35      | 19.78  | 0.68    |
| 4/30/2018 | 15:44:17 | 3.43      | 156.03   | 1.33      | 19.78  | 0.67    |
| 4/30/2018 | 15:45:17 | 3.43      | 160.73   | 1.31      | 19.78  | 0.67    |
| 4/30/2018 | 15:46:17 | 3.44      | 157.47   | 1.30      | 19.79  | 0.66    |
| 4/30/2018 | 15:47:17 | 3.43      | 159.37   | 1.38      | 19.78  | 0.67    |
| 4/30/2018 | 15:48:17 | 3.67      | 163.75   | 1.32      | 19.78  | 0.67    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 3**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 15:49:17 | 3.74      | 165.50   | 1.38      | 19.79  | 0.67    |
| 4/30/2018 | 15:50:17 | 3.75      | 164.92   | 1.39      | 19.78  | 0.67    |
| 4/30/2018 | 15:51:17 | 3.61      | 162.71   | 1.37      | 19.79  | 0.67    |
| 4/30/2018 | 15:52:17 | 3.52      | 163.48   | 1.38      | 19.79  | 0.67    |
| 4/30/2018 | 15:53:17 | 3.73      | 164.27   | 1.32      | 19.78  | 0.67    |
| 4/30/2018 | 15:54:17 | 3.73      | 164.31   | 1.22      | 19.79  | 0.67    |
| 4/30/2018 | 15:55:17 | 3.73      | 163.97   | 1.20      | 19.78  | 0.68    |
| 4/30/2018 | 15:56:17 | 3.73      | 165.03   | 1.23      | 19.79  | 0.68    |
| 4/30/2018 | 15:57:17 | 3.73      | 164.07   | 1.29      | 19.78  | 0.69    |
| 4/30/2018 | 15:58:17 | 3.74      | 164.20   | 1.39      | 19.78  | 0.69    |
| 4/30/2018 | 15:59:17 | 3.73      | 164.46   | 1.33      | 19.79  | 0.68    |
| 4/30/2018 | 16:00:17 | 3.73      | 164.59   | 1.30      | 19.79  | 0.68    |
| 4/30/2018 | 16:01:17 | 3.69      | 163.22   | 1.33      | 19.78  | 0.68    |
| 4/30/2018 | 16:02:17 | 3.72      | 162.65   | 1.35      | 19.79  | 0.68    |
| 4/30/2018 | 16:03:17 | 3.72      | 162.71   | 1.32      | 19.79  | 0.68    |
| 4/30/2018 | 16:04:17 | 3.73      | 162.63   | 1.41      | 19.79  | 0.68    |
| 4/30/2018 | 16:05:17 | 3.72      | 163.78   | 1.32      | 19.78  | 0.68    |
| 4/30/2018 | 16:06:17 | 3.73      | 164.02   | 1.29      | 19.79  | 0.68    |
| 4/30/2018 | 16:07:17 | 3.73      | 164.17   | 1.33      | 19.79  | 0.68    |
| 4/30/2018 | 16:08:17 | 3.72      | 164.51   | 1.38      | 19.79  | 0.67    |
| 4/30/2018 | 16:09:17 | 3.72      | 163.25   | 1.34      | 19.79  | 0.67    |
| 4/30/2018 | 16:10:17 | 3.73      | 163.02   | 1.22      | 19.80  | 0.67    |
| 4/30/2018 | 16:11:17 | 3.73      | 163.79   | 1.28      | 19.80  | 0.67    |
| 4/30/2018 | 16:12:17 | 3.71      | 162.43   | 1.38      | 19.80  | 0.66    |
| 4/30/2018 | 16:13:17 | 3.71      | 162.63   | 1.37      | 19.80  | 0.67    |
| 4/30/2018 | 16:14:17 | 3.72      | 164.22   | 1.25      | 19.80  | 0.67    |
| 4/30/2018 | 16:15:17 | 3.73      | 164.44   | 1.29      | 19.79  | 0.68    |
| 4/30/2018 | 16:16:17 | 3.61      | 161.56   | 1.31      | 19.79  | 0.67    |
| 4/30/2018 | 16:17:17 | 3.72      | 164.05   | 1.45      | 19.79  | 0.68    |
| 4/30/2018 | 16:18:17 | 3.73      | 164.89   | 1.48      | 19.79  | 0.68    |
| 4/30/2018 | 16:19:17 | 3.73      | 165.20   | 1.42      | 19.79  | 0.68    |
| 4/30/2018 | 16:20:17 | 3.73      | 163.49   | 1.33      | 19.79  | 0.68    |
| 4/30/2018 | 16:21:17 | 3.56      | 160.91   | 1.35      | 19.79  | 0.69    |
| 4/30/2018 | 16:22:17 | 3.66      | 164.08   | 1.19      | 19.78  | 0.69    |
| 4/30/2018 | 16:23:17 | 3.73      | 166.06   | 1.25      | 19.78  | 0.69    |
| 4/30/2018 | 16:24:17 | 3.73      | 166.90   | 1.30      | 19.78  | 0.69    |
| 4/30/2018 | 16:25:17 | 3.73      | 166.57   | 1.29      | 19.78  | 0.69    |
| 4/30/2018 | 16:26:17 | 3.73      | 168.55   | 1.30      | 19.77  | 0.69    |
| 4/30/2018 | 16:27:17 | 3.73      | 168.79   | 1.24      | 19.77  | 0.69    |
| 4/30/2018 | 16:28:17 | 3.73      | 167.10   | 1.33      | 19.77  | 0.69    |

**Hollingsworth & Vose****4/30/2018****CFU 117****Run 3**

| Date      | Time     | NOx [PPM]   | CO [PPM]      | VOC [PPM]   | O2 [%]       | CO2 [%]     |
|-----------|----------|-------------|---------------|-------------|--------------|-------------|
| 4/30/2018 | 16:29:17 | 3.73        | 168.09        | 1.33        | 19.77        | 0.69        |
| 4/30/2018 | 16:30:17 | 3.72        | 171.71        | 1.32        | 19.76        | 0.69        |
| 4/30/2018 | 16:31:17 | 3.72        | 171.39        | 1.32        | 19.76        | 0.69        |
| 4/30/2018 | 16:32:17 | 3.72        | 168.33        | 1.26        | 19.76        | 0.68        |
| 4/30/2018 | 16:33:17 | 3.73        | 167.72        | 1.26        | 19.76        | 0.68        |
| 4/30/2018 | 16:34:17 | 3.73        | 169.55        | 1.30        | 19.76        | 0.68        |
| Averages: |          | <b>3.62</b> | <b>165.38</b> | <b>1.34</b> | <b>19.78</b> | <b>0.68</b> |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 3 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 16:34:27 | 3.74      | 169.05   | 1.27      | 19.77  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:34:37 | 3.73      | 170.46   | 1.32      | 19.76  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:34:47 | 3.73      | 170.68   | 1.32      | 19.76  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:34:57 | 3.73      | 170.17   | 1.32      | 19.75  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:35:07 | 3.73      | 169.63   | 1.31      | 19.76  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:35:17 | 3.74      | 168.98   | 1.32      | 19.76  | 0.69    |           |          |           |        |         |
| 4/30/2018 | 16:35:27 | 3.73      | 168.60   | 1.32      | 19.75  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:35:37 | 3.75      | 168.49   | 1.32      | 19.76  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:35:47 | 3.73      | 170.31   | 1.14      | 19.76  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:35:57 | 3.73      | 172.62   | 1.10      | 19.76  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:36:07 | 3.74      | 172.54   | 1.10      | 19.75  | 0.69    |           |          |           |        |         |
| 4/30/2018 | 16:36:17 | 3.75      | 171.80   | 1.10      | 19.75  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:36:27 | 3.75      | 170.89   | 1.10      | 19.75  | 0.69    |           |          |           |        |         |
| 4/30/2018 | 16:36:37 | 3.74      | 169.95   | 1.10      | 19.77  | 0.69    |           |          |           |        |         |
| 4/30/2018 | 16:36:47 | 3.75      | 167.76   | 1.10      | 14.20  | 0.39    |           |          |           |        |         |
| 4/30/2018 | 16:36:57 | 3.74      | 150.16   | 1.20      | 10.14  | 0.10    |           |          |           |        |         |
| 4/30/2018 | 16:37:07 | 3.94      | 104.56   | 1.29      | 9.84   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:37:17 | 2.78      | 54.82    | 1.29      | 9.81   | 0.07    |           |          |           | 9.93   |         |
| 4/30/2018 | 16:37:27 | 0.90      | 19.24    | 1.29      | 9.81   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:37:37 | 0.33      | 4.25     | 1.29      | 9.80   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:37:47 | 0.14      | -0.10    | 1.29      | 9.80   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:37:57 | 0.01      | -1.16    | 1.29      | 9.80   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:38:07 | 0.04      | -2.05    | 1.23      | 9.80   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:38:17 | 0.02      | -2.29    | 0.97      | 9.79   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:38:27 | 0.04      | -2.31    | 0.97      | 9.80   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:38:37 | 0.03      | -1.03    | 0.97      | 11.40  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:38:47 | 0.04      | 0.31     | 0.97      | 16.81  | 0.25    |           |          |           |        |         |
| 4/30/2018 | 16:38:57 | 0.04      | 0.39     | 0.97      | 16.29  | 1.96    |           |          |           |        |         |
| 4/30/2018 | 16:39:07 | 0.02      | 0.06     | 0.97      | 11.93  | 3.52    |           |          |           |        |         |
| 4/30/2018 | 16:39:17 | 0.88      | -1.07    | 0.97      | 2.55   | 1.27    |           |          |           |        |         |
| 4/30/2018 | 16:39:27 | 2.34      | -1.22    | 0.54      | 1.15   | 0.67    |           |          |           |        |         |
| 4/30/2018 | 16:39:37 | 1.93      | -2.70    | 0.49      | 1.20   | 0.60    |           |          |           |        |         |
| 4/30/2018 | 16:39:47 | 0.70      | -2.66    | 0.49      | 1.18   | 0.58    |           |          |           |        |         |
| 4/30/2018 | 16:39:57 | 0.33      | -2.11    | 0.49      | 1.16   | 0.56    |           |          |           |        |         |
| 4/30/2018 | 16:40:07 | 0.30      | -0.74    | 0.49      | 1.16   | 0.56    |           |          |           |        |         |
| 4/30/2018 | 16:40:17 | 0.34      | 0.16     | 0.49      | 1.15   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:40:27 | 0.32      | -0.74    | 0.49      | 1.14   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:40:37 | 0.33      | -1.10    | 0.54      | 1.14   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:40:47 | 0.32      | -1.98    | 0.58      | 1.14   | 0.56    |           |          |           |        |         |
| 4/30/2018 | 16:40:57 | 0.33      | -2.40    | 0.58      | 1.14   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:41:07 | 0.31      | -2.66    | 0.58      | 1.14   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:41:17 | 0.32      | -2.48    | 0.58      | 1.13   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:41:27 | 0.33      | -1.34    | 0.58      | 1.13   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:41:37 | 0.33      | -0.13    | 0.58      | 1.13   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:41:47 | 0.33      | 0.13     | 0.53      | 1.13   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:41:57 | 0.33      | -1.05    | 0.40      | 1.13   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:42:07 | 0.11      | -1.41    | 0.40      | 1.13   | 0.56    |           |          |           |        |         |
| 4/30/2018 | 16:42:17 | 0.03      | -2.06    | 0.40      | 1.13   | 0.56    |           |          |           |        |         |
| 4/30/2018 | 16:42:27 | 0.03      | -2.55    | 0.40      | 1.12   | 0.55    |           |          |           |        |         |
| 4/30/2018 | 16:42:37 | 0.04      | -2.41    | 0.40      | 1.01   | 0.90    |           |          |           |        |         |
| 4/30/2018 | 16:42:47 | 0.03      | -1.94    | 0.40      | 1.31   | 1.37    |           |          |           |        |         |
| 4/30/2018 | 16:42:57 | 0.23      | -0.28    | 0.40      | 2.28   | 2.36    |           |          |           |        |         |
| 4/30/2018 | 16:43:07 | 0.33      | -0.52    | 0.47      | 1.90   | 1.86    |           |          |           |        |         |
| 4/30/2018 | 16:43:17 | 0.11      | -0.86    | 0.47      | 1.94   | 1.92    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 3 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 16:43:27 | 0.04      | -1.92    | 0.47      | 1.94   | 1.92    |           |          |           |        | 1.90    |
| 4/30/2018 | 16:43:37 | 0.03      | -2.38    | 0.47      | 1.94   | 1.93    |           |          |           |        |         |
| 4/30/2018 | 16:43:47 | 0.04      | -3.02    | 0.47      | 1.94   | 1.93    |           |          |           |        |         |
| 4/30/2018 | 16:43:57 | 0.03      | -3.15    | 0.47      | 1.94   | 1.92    |           |          |           |        |         |
| 4/30/2018 | 16:44:07 | 0.03      | -2.96    | 0.47      | 8.54   | 1.33    |           |          |           |        |         |
| 4/30/2018 | 16:44:17 | 0.04      | -1.17    | 0.50      | 14.77  | 0.68    |           |          |           |        |         |
| 4/30/2018 | 16:44:27 | 0.03      | -0.03    | 0.51      | 7.69   | 0.30    |           |          |           |        |         |
| 4/30/2018 | 16:44:37 | 0.04      | 1.14     | 0.51      | 1.05   | 0.31    |           |          |           |        |         |
| 4/30/2018 | 16:44:47 | 0.03      | 13.05    | 0.51      | 0.11   | 0.12    |           |          |           |        |         |
| 4/30/2018 | 16:44:57 | 13.00     | 40.77    | 0.52      | 0.01   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 16:45:07 | 30.55     | 69.38    | 0.51      | 0.00   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:45:17 | 45.77     | 87.66    | 0.51      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:45:27 | 59.42     | 94.65    | 0.49      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:45:37 | 66.98     | 96.82    | 0.45      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:45:47 | 73.33     | 99.05    | 0.45      | -0.02  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:45:57 | 79.05     | 99.97    | 0.45      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:46:07 | 83.68     | 99.52    | 0.45      | -0.02  | 0.08    |           | 99.51    |           |        |         |
| 4/30/2018 | 16:46:17 | 86.68     | 98.43    | 0.45      | -0.02  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:46:27 | 89.43     | 98.07    | 0.45      | -0.01  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:46:37 | 90.74     | 97.20    | 0.46      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:46:47 | 91.57     | 97.33    | 0.48      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:46:57 | 91.85     | 97.24    | 0.48      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:47:07 | 92.05     | 98.46    | 0.48      | -0.02  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:47:17 | 92.14     | 100.21   | 0.48      | 2.02   | 0.09    |           |          |           |        |         |
| 4/30/2018 | 16:47:27 | 91.92     | 96.63    | 0.48      | 15.68  | 0.12    |           |          |           |        |         |
| 4/30/2018 | 16:47:37 | 81.62     | 80.29    | 0.48      | 5.66   | 0.11    |           |          |           |        |         |
| 4/30/2018 | 16:47:47 | 70.93     | 59.77    | 0.48      | 0.50   | 0.10    |           |          |           |        |         |
| 4/30/2018 | 16:47:57 | 68.21     | 44.73    | 0.49      | 0.03   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:48:07 | 65.29     | 29.69    | 0.49      | -0.01  | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:48:17 | 48.21     | 17.10    | 0.49      | 0.00   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:48:27 | 25.08     | 8.53     | 0.49      | 0.08   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:48:37 | 15.97     | 6.72     | 0.49      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:48:47 | 13.18     | 6.01     | 0.49      | 0.11   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:48:57 | 11.53     | 5.80     | 0.49      | 0.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:49:07 | 10.53     | 4.65     | 0.46      | 0.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:49:17 | 9.86      | 3.83     | 0.44      | 0.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:49:27 | 9.25      | 3.43     | 0.44      | 0.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:49:37 | 8.88      | 2.78     | 0.44      | 0.11   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:49:47 | 8.62      | 3.17     | 0.44      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:49:57 | 8.30      | 3.42     | 0.44      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:50:07 | 8.00      | 4.96     | 0.44      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:50:17 | 7.70      | 5.68     | 0.43      | 0.11   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:50:27 | 7.62      | 4.90     | 0.41      | 0.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:50:37 | 7.39      | 4.40     | 0.41      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:50:47 | 7.31      | 3.40     | 0.41      | 0.11   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:50:57 | 7.09      | 2.94     | 0.41      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:51:07 | 6.80      | 2.98     | 0.41      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:51:17 | 6.71      | 2.76     | 0.41      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:51:27 | 6.72      | 4.18     | 0.42      | 0.09   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:51:37 | 6.49      | 4.80     | 0.39      | 0.09   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:51:47 | 6.41      | 5.42     | 0.39      | 0.09   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:51:57 | 6.42      | 4.21     | 0.39      | 0.09   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:52:07 | 6.20      | 4.03     | 0.39      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:52:17 | 6.12      | 3.23     | 0.39      | 0.10   | 0.08    |           |          |           |        |         |

**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 3 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 16:52:27 | 6.12      | 3.08     | 0.39      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:52:37 | 6.12      | 2.81     | 0.39      | 0.11   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:52:47 | 6.10      | 3.38     | 0.47      | 0.11   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:52:57 | 5.88      | 4.91     | 0.53      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:53:07 | 5.80      | 5.36     | 0.53      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:53:17 | 5.83      | 4.74     | 0.53      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:53:27 | 5.78      | 4.26     | 0.53      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:53:37 | 5.81      | 3.27     | 0.53      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:53:47 | 5.79      | 3.10     | 0.53      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:53:57 | 5.57      | 2.36     | 0.51      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:54:07 | 5.49      | 2.66     | 0.45      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:54:17 | 5.48      | 3.74     | 0.45      | 0.10   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 16:54:27 | 5.50      | 4.87     | 0.45      | 0.09   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:54:37 | 5.49      | 5.50     | 0.45      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:54:47 | 5.48      | 4.48     | 0.45      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:54:57 | 5.48      | 4.28     | 0.45      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:55:07 | 5.49      | 3.35     | 0.45      | 0.10   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:55:17 | 5.49      | 2.94     | 0.41      | 0.12   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:55:27 | 5.28      | 2.66     | 0.41      | 11.15  | 0.10    |           |          |           |        |         |
| 4/30/2018 | 16:55:37 | 5.20      | 2.06     | 0.41      | 17.32  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 16:55:47 | 5.40      | 2.35     | 0.41      | 6.98   | 0.08    | 5.29      |          |           |        |         |
| 4/30/2018 | 16:55:57 | 4.27      | 1.89     | 0.41      | 3.12   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:56:07 | 2.18      | 1.46     | 0.41      | 0.25   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:56:17 | 1.12      | -0.33    | 0.41      | 0.00   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:56:27 | 0.31      | -1.14    | 0.40      | -0.02  | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:56:37 | 0.03      | -1.94    | 0.39      | 0.05   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:56:47 | 0.02      | -2.19    | 0.39      | 0.11   | 0.05    |           |          |           |        |         |
| 4/30/2018 | 16:56:57 | 0.04      | -2.58    | 0.39      | 0.11   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:57:07 | 0.03      | -2.28    | 0.39      | 0.11   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:57:17 | 0.03      | -0.84    | 0.39      | 0.10   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:57:27 | 0.03      | 0.09     | 0.39      | 0.11   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:57:37 | 0.04      | 0.21     | 0.39      | 0.10   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:57:47 | 0.02      | -0.71    | 0.39      | 0.10   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:57:57 | 0.01      | -1.44    | 0.39      | 0.11   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:58:07 | 0.02      | -1.79    | 0.39      | 0.10   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:58:17 | 0.04      | -2.17    | 0.39      | 0.10   | 0.05    |           |          |           |        |         |
| 4/30/2018 | 16:58:27 | 0.03      | -2.74    | 0.39      | 0.10   | 0.05    |           |          |           |        |         |
| 4/30/2018 | 16:58:37 | 0.03      | -1.75    | 0.39      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:58:47 | 0.02      | -0.62    | 0.39      | 0.10   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:58:57 | 0.04      | 0.74     | 0.37      | 0.11   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:59:07 | 0.03      | -0.06    | 0.37      | 0.67   | 0.06    | 0.03      | 0.02     | 0.38      | 0.29   | 0.06    |
| 4/30/2018 | 16:59:17 | 0.02      | -0.76    | 0.37      | 1.17   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 16:59:27 | 0.03      | -1.55    | 0.37      | 1.27   | 0.31    |           |          |           |        |         |
| 4/30/2018 | 16:59:37 | 0.03      | -1.93    | 0.37      | 1.85   | 0.12    |           |          |           |        |         |
| 4/30/2018 | 16:59:47 | 0.03      | -2.27    | 0.37      | 1.95   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 16:59:57 | 0.46      | -2.10    | 0.37      | 1.98   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:00:07 | 1.06      | -1.33    | 0.37      | 1.98   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:00:17 | 1.24      | 0.32     | 0.37      | 1.99   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:00:27 | 1.02      | 0.22     | 0.37      | 2.00   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:00:37 | 0.93      | -0.67    | 0.37      | 2.00   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:00:47 | 0.95      | -1.15    | 0.37      | 2.00   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 17:00:57 | 0.71      | -2.17    | 0.37      | 2.00   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:01:07 | 0.62      | -2.49    | 0.37      | 2.01   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 17:01:17 | 0.62      | -2.43    | 2.74      | 2.01   | 0.07    |           |          |           |        |         |



**Hollingsworth & Vose**  
**4/30/2018**  
**CFU 117**  
**Run 3 Post Calibrations**

| Date      | Time     | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] | NOx [PPM] | CO [PPM] | VOC [PPM] | O2 [%] | CO2 [%] |
|-----------|----------|-----------|----------|-----------|--------|---------|-----------|----------|-----------|--------|---------|
| 4/30/2018 | 17:01:27 | 0.62      | -2.55    | 5.11      | 2.00   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:01:37 | 0.62      | -0.92    | 5.11      | 2.01   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:01:47 | 0.61      | 0.27     | 5.11      | 2.01   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:01:57 | 0.41      | -0.08    | 5.11      | 2.01   | 0.06    |           |          |           |        |         |
| 4/30/2018 | 17:02:07 | 0.34      | -0.71    | 5.11      | 1.51   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 17:02:17 | 0.33      | -1.26    | 5.11      | 0.99   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 17:02:27 | 0.34      | -1.82    | 5.13      | 9.44   | 0.08    |           |          |           |        |         |
| 4/30/2018 | 17:02:37 | 0.53      | -1.62    | 5.21      | 19.36  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:02:47 | 1.07      | -2.46    | 5.21      | 20.56  | 0.10    |           |          |           |        |         |
| 4/30/2018 | 17:02:57 | 0.81      | -2.10    | 5.21      | 20.66  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:03:07 | 0.22      | -0.88    | 5.21      | 20.67  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:03:17 | 0.05      | 0.37     | 5.21      | 20.68  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:03:27 | 0.04      | 0.17     | 5.21      | 20.68  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:03:37 | 0.02      | -1.01    | 5.21      | 20.68  | 0.10    |           |          |           |        |         |
| 4/30/2018 | 17:03:47 | 0.03      | -1.45    | 3.09      | 20.69  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:03:57 | 0.04      | -2.20    | 2.86      | 19.22  | 0.11    |           |          |           |        |         |
| 4/30/2018 | 17:04:07 | 0.04      | -2.29    | 2.86      | 5.20   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 17:04:17 | 0.03      | -2.37    | 2.86      | 1.18   | 0.07    |           |          |           |        |         |
| 4/30/2018 | 17:04:27 | 0.24      | -1.76    | 2.86      | 10.57  | 0.09    |           |          |           |        |         |
| 4/30/2018 | 17:04:37 | 0.54      | -0.56    | 2.86      | 19.58  | 0.11    |           |          | 2.86      |        |         |



|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 117              |
| DATE      | 05/01/18             |
| METHOD    | 13B                  |
| POLLUTANT | Fluorides            |

**Isokinetic Field Data**
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** 13B  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
 cloudy/rainy, 53 degrees

**Run:** 1  
**Start Time:** 8:40  
**End Time:** 9:44  
**Date:** 5/1/2018

**Stack Dimensional Data:**

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 13  
 Y factor 0.9960  
 ΔH@ 1.8316  
 Probe ID 1307999  
 Nozzle ID 186  
 Hot box ID 2  
 Pitot Cp 0.84  
 Liner type Glass  
 Nozzle size 0.1863 inches  
 Nozzle area 0.000189 sq.ft.  
 Probe heat 250 F  
 Filter heat 250 F

**Source Information:**

Barometric Pressure 30.00 "Hg  
 Static Pressure 0.6 "H<sub>2</sub>O  
 Ave. ΔP 1.7 "H<sub>2</sub>O  
 Stack Temperature 250 F  
 Assumed moisture 2 %  
 Assumed meter temp. 52 F  
 Total number of points 20  
 Time per point 3  
 Total run time 60  
 O<sub>2</sub> 19.89 %  
 CO<sub>2</sub> 0.67 %  
 Rec. Nz. 0.195 inches

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 10       | 12        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.186       | 0.186 | 0.187 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 41.573 dcf  
 Wet mol. weight 28.74 M<sub>s</sub> (actual)  
 Actual H<sub>2</sub>O 1.47 %  
 Std. meter vol. 43.005 dscf  
 Isokinetic Average 100.0 %  
 Ave. ΔP 1.76 "H<sub>2</sub>O  
 Ave. √ΔP 1.3257 "H<sub>2</sub>O  
 Ave. ΔH 1.655 "H<sub>2</sub>O  
 Ave. T<sub>s</sub> 256.6 °F  
 Ave. T<sub>m</sub> 51.6 °F

**Moisture/Lab:**

|                   | Filter | NA #    |       | Gain |
|-------------------|--------|---------|-------|------|
|                   |        | Initial | Final |      |
| Impingers, g      | 200.0  | 204     | 4.0   |      |
| Silica gel, g     | 264.1  | 273.7   | 9.6   |      |
| Total water gain: |        |         | 13.6  |      |

| Traversal Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|-----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1               | 3           | 1.910              | 1.50                            | 248              | 48               | 1.41     | 1.40   | 2            | 252             | 49                     |
| 2               | 6           | 3.860              | 1.60                            | 258              | 47               | 1.48     | 1.50   | 3            | 252             | 45                     |
| 3               | 9           | 5.940              | 1.80                            | 258              | 47               | 1.66     | 1.70   | 3            | 251             | 43                     |
| 4               | 12          | 8.090              | 1.90                            | 258              | 48               | 1.76     | 1.80   | 3            | 251             | 43                     |
| 5               | 15          | 10.340             | 2.10                            | 258              | 48               | 1.94     | 1.90   | 3            | 251             | 45                     |
| 6               | 18          | 12.460             | 1.90                            | 257              | 49               | 1.76     | 1.80   | 3            | 250             | 45                     |
| 7               | 21          | 14.550             | 1.80                            | 256              | 49               | 1.67     | 1.70   | 3            | 250             | 45                     |
| 8               | 24          | 16.660             | 1.80                            | 256              | 50               | 1.68     | 1.70   | 3            | 249             | 46                     |
| 9               | 27          | 18.740             | 1.70                            | 256              | 56               | 1.60     | 1.60   | 3            | 251             | 47                     |
| 10              | 30          | 20.792             | 1.70                            | 256              | 51               | 1.59     | 1.60   | 3            | 251             | 47                     |
| 11              | 33          | 22.760             | 1.60                            | 254              | 51               | 1.50     | 1.50   | 3            | 251             | 46                     |
| 12              | 36          | 24.790             | 1.70                            | 256              | 52               | 1.59     | 1.60   | 3            | 250             | 48                     |
| 13              | 39          | 26.850             | 1.70                            | 254              | 53               | 1.60     | 1.60   | 3            | 250             | 48                     |
| 14              | 42          | 28.960             | 1.80                            | 257              | 54               | 1.69     | 1.70   | 3            | 251             | 48                     |
| 15              | 45          | 31.080             | 1.80                            | 257              | 54               | 1.69     | 1.70   | 3            | 251             | 48                     |
| 16              | 48          | 33.260             | 1.90                            | 258              | 54               | 1.78     | 1.80   | 3            | 250             | 49                     |
| 17              | 51          | 35.380             | 1.80                            | 258              | 54               | 1.69     | 1.70   | 3            | 249             | 50                     |
| 18              | 54          | 37.510             | 1.80                            | 259              | 55               | 1.69     | 1.70   | 3            | 251             | 50                     |
| 19              | 57          | 39.560             | 1.70                            | 259              | 55               | 1.59     | 1.60   | 3            | 249             | 51                     |
| 20              | 60          | 41.573             | 1.60                            | 259              | 56               | 1.50     | 1.50   | 3            | 250             | 52                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** 13B  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
cloudy/rainy, 53 degrees

**Run:** 2  
**Start Time:** 9:57  
**End Time:** 11:01  
**Date:** 5/1/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 13  
Y factor 0.9960  
 $\Delta H@$  1.8316  
Probe ID 1307999  
Nozzle ID 186  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.1863 inches  
Nozzle area: 0.000189 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 30.00 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.7 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 1.47 %  
Assumed meter temp. 51.6 F  
Total number of points 20  
Time per point 3  
Total run time 60  
O<sub>2</sub> 19.85 %  
CO<sub>2</sub> 0.67 %  
Rec. Nz. 0.195 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 16       | 13        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.186       | 0.186 | 0.187 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 41.663 dcf  
Wet mol. weight 28.74 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.5 %  
Std. meter vol. 42.423 dscf  
Isokinetic Average 100.0 %  
Ave.  $\Delta P$  1.725 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.312 "H<sub>2</sub>O  
Ave.  $\Delta H$  1.625 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 259.9 °F  
Ave. T<sub>m</sub> 59.7 °F

**Moisture/Lab:**

| Filter            | NA #  | Initial | Final | Gain |
|-------------------|-------|---------|-------|------|
| Impingers, g      | 200.0 | 204     |       | 4.0  |
| Silica gel, g     | 256.3 | 266     |       | 9.7  |
| Total water gain: |       |         |       | 13.7 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 3           | 2.110              | 1.80                                    | 256              | 57               | 1.72             | 1.70           | 3            | 252             | 58                     |
| 2              | 6           | 4.180              | 1.70                                    | 258              | 57               | 1.62             | 1.60           | 2            | 252             | 55                     |
| 3              | 9           | 6.240              | 1.70                                    | 259              | 57               | 1.61             | 1.60           | 2            | 250             | 51                     |
| 4              | 12          | 8.350              | 1.80                                    | 259              | 58               | 1.71             | 1.70           | 3            | 251             | 52                     |
| 5              | 15          | 10.480             | 1.80                                    | 260              | 58               | 1.71             | 1.70           | 3            | 250             | 51                     |
| 6              | 18          | 12.660             | 1.90                                    | 260              | 58               | 1.81             | 1.80           | 3            | 249             | 51                     |
| 7              | 21          | 14.860             | 1.90                                    | 260              | 59               | 1.81             | 1.80           | 3            | 250             | 50                     |
| 8              | 24          | 16.970             | 1.80                                    | 261              | 59               | 1.71             | 1.70           | 3            | 249             | 49                     |
| 9              | 27          | 19.060             | 1.70                                    | 260              | 59               | 1.62             | 1.60           | 3            | 250             | 50                     |
| 10             | 30          | 20.893             | 1.30                                    | 259              | 60               | 1.24             | 1.20           | 3            | 251             | 52                     |
| 11             | 33          | 22.760             | 1.40                                    | 260              | 60               | 1.34             | 1.30           | 3            | 250             | 55                     |
| 12             | 36          | 24.770             | 1.60                                    | 260              | 60               | 1.53             | 1.50           | 3            | 252             | 54                     |
| 13             | 39          | 26.890             | 1.80                                    | 262              | 60               | 1.71             | 1.70           | 3            | 250             | 51                     |
| 14             | 42          | 29.050             | 1.80                                    | 262              | 61               | 1.72             | 1.70           | 3            | 252             | 51                     |
| 15             | 45          | 31.220             | 1.90                                    | 262              | 61               | 1.81             | 1.80           | 3            | 250             | 52                     |
| 16             | 48          | 33.340             | 1.80                                    | 261              | 61               | 1.72             | 1.70           | 3            | 251             | 52                     |
| 17             | 51          | 35.490             | 1.80                                    | 260              | 61               | 1.72             | 1.70           | 3            | 250             | 51                     |
| 18             | 54          | 37.570             | 1.70                                    | 260              | 62               | 1.63             | 1.60           | 3            | 250             | 52                     |
| 19             | 57          | 39.640             | 1.70                                    | 260              | 62               | 1.63             | 1.60           | 3            | 251             | 52                     |
| 20             | 60          | 41.663             | 1.60                                    | 258              | 63               | 1.54             | 1.50           | 3            | 250             | 52                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** 13B  
**Box Operator:** KLS  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
cloudy/rainy, 53 degrees

**Run:** 3  
**Start Time:** 11:10  
**End Time:** 12:14  
**Date:** 5/1/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 13  
Y factor 0.9960  
 $\Delta H$ @ 1.8316  
Probe ID 1307999  
Nozzle ID 186  
Hot box ID 2  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.1863 inches  
Nozzle area: 0.000189 sq.ft.  
Probe heat: 250 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.97 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.7 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 1.5 %  
Assumed meter temp. 59.7 F  
Total number of points 20  
Time per point 3  
Total run time 60  
O<sub>2</sub> 19.90 %  
CO<sub>2</sub> 0.69 %  
Rec. Nz. 0.193 inches

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 11       | 15        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.186       | 0.186 | 0.187 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 41.712 dcf  
Wet mol. weight 28.77 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.24 %  
Std. meter vol. 42.366 dscf  
Isokinetic Average 99.6 %  
Ave.  $\Delta P$  1.73 "H<sub>2</sub>O  
Ave.  $\sqrt{\Delta P}$  1.3134 "H<sub>2</sub>O  
Ave.  $\Delta H$  1.63 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 260.1 °F  
Ave. T<sub>m</sub> 60.5 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 202   | 2.0  |
| Silica gel, g     | 237.9   | 247.2 | 9.3  |
| Total water gain: |         |       | 11.3 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 3           | 2.140              | 1.80                                    | 255              | 61               | 1.73             | 1.70           | 3            | 248             | 52                     |
| 2              | 6           | 4.270              | 1.80                                    | 258              | 61               | 1.72             | 1.70           | 3            | 252             | 48                     |
| 3              | 9           | 6.340              | 1.70                                    | 258              | 61               | 1.63             | 1.60           | 3            | 252             | 46                     |
| 4              | 12          | 8.460              | 1.80                                    | 259              | 61               | 1.72             | 1.70           | 3            | 251             | 46                     |
| 5              | 15          | 10.590             | 1.80                                    | 259              | 60               | 1.72             | 1.70           | 3            | 250             | 47                     |
| 6              | 18          | 12.780             | 1.90                                    | 261              | 61               | 1.81             | 1.80           | 3            | 250             | 47                     |
| 7              | 21          | 14.920             | 1.80                                    | 262              | 60               | 1.71             | 1.70           | 3            | 251             | 47                     |
| 8              | 24          | 17.060             | 1.80                                    | 263              | 60               | 1.71             | 1.70           | 3            | 250             | 48                     |
| 9              | 27          | 19.120             | 1.70                                    | 263              | 60               | 1.61             | 1.60           | 3            | 252             | 49                     |
| 10             | 30          | 20.957             | 1.30                                    | 260              | 61               | 1.24             | 1.20           | 2            | 251             | 49                     |
| 11             | 33          | 22.830             | 1.40                                    | 258              | 60               | 1.34             | 1.30           | 2            | 251             | 51                     |
| 12             | 36          | 24.820             | 1.60                                    | 258              | 60               | 1.53             | 1.50           | 3            | 249             | 48                     |
| 13             | 39          | 26.950             | 1.80                                    | 261              | 60               | 1.71             | 1.70           | 3            | 250             | 47                     |
| 14             | 42          | 29.120             | 1.90                                    | 262              | 60               | 1.81             | 1.80           | 3            | 251             | 47                     |
| 15             | 45          | 31.300             | 1.90                                    | 261              | 60               | 1.81             | 1.80           | 3            | 248             | 48                     |
| 16             | 48          | 33.430             | 1.80                                    | 261              | 61               | 1.72             | 1.70           | 3            | 250             | 49                     |
| 17             | 51          | 35.620             | 1.90                                    | 261              | 61               | 1.81             | 1.80           | 3            | 251             | 50                     |
| 18             | 54          | 37.800             | 1.90                                    | 260              | 60               | 1.81             | 1.80           | 3            | 249             | 49                     |
| 19             | 57          | 39.810             | 1.60                                    | 261              | 61               | 1.53             | 1.50           | 3            | 252             | 50                     |
| 20             | 60          | 41.712             | 1.40                                    | 261              | 61               | 1.34             | 1.30           | 2            | 251             | 50                     |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 13B

**Run:** 1  
**Start Time:** 8:40  
**End Time:** 9:44  
**Date:** 5/1/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 3             | 1.910                    | 1.40                            | 48                         | 1                 | 1.50                    | 248                        | 1.2247      |
| 6             | 3.860                    | 1.50                            | 47                         | 2                 | 1.60                    | 258                        | 1.2649      |
| 9             | 5.940                    | 1.70                            | 47                         | 3                 | 1.80                    | 258                        | 1.3416      |
| 12            | 8.090                    | 1.80                            | 48                         | 4                 | 1.90                    | 258                        | 1.3784      |
| 15            | 10.340                   | 1.90                            | 48                         | 5                 | 2.10                    | 258                        | 1.4491      |
| 18            | 12.460                   | 1.80                            | 49                         | 6                 | 1.90                    | 257                        | 1.3784      |
| 21            | 14.550                   | 1.70                            | 49                         | 7                 | 1.80                    | 256                        | 1.3416      |
| 24            | 16.660                   | 1.70                            | 50                         | 8                 | 1.80                    | 256                        | 1.3416      |
| 27            | 18.740                   | 1.60                            | 56                         | 9                 | 1.70                    | 256                        | 1.3038      |
| 30            | 20.792                   | 1.60                            | 51                         | 10                | 1.70                    | 256                        | 1.3038      |
| 33            | 22.760                   | 1.50                            | 51                         | 11                | 1.60                    | 254                        | 1.2649      |
| 36            | 24.790                   | 1.60                            | 52                         | 12                | 1.70                    | 256                        | 1.3038      |
| 39            | 26.850                   | 1.60                            | 53                         | 13                | 1.70                    | 254                        | 1.3038      |
| 42            | 28.960                   | 1.70                            | 54                         | 14                | 1.80                    | 257                        | 1.3416      |
| 45            | 31.080                   | 1.70                            | 54                         | 15                | 1.80                    | 257                        | 1.3416      |
| 48            | 33.260                   | 1.80                            | 54                         | 16                | 1.90                    | 258                        | 1.3784      |
| 51            | 35.380                   | 1.70                            | 54                         | 17                | 1.80                    | 258                        | 1.3416      |
| 54            | 37.510                   | 1.70                            | 55                         | 18                | 1.80                    | 259                        | 1.3416      |
| 57            | 39.560                   | 1.60                            | 55                         | 19                | 1.70                    | 259                        | 1.3038      |
| 60            | 41.573                   | 1.50                            | 56                         | 20                | 1.60                    | 259                        | 1.2649      |

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 1  
Date: 05/01/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 60 min  
Sample Time Interval 3 min  
Meter Volume,  $V_m$  41.573 dcf  
Water Volume 13.6 ml (g)  
Nozzle Diameter,  $N_z$  0.1863 in.  
Nozzle Area 0.000189 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  30.00 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9960 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.67 %vd  
O<sub>2</sub> Average 19.89 %vd

### Field Data Averages

#### Meter

$\Delta H$  1.655 "H<sub>2</sub>O  
Temperature,  $T_m$  51.6 °F  
Temperature,  $T_m$  511.6 °A (°R)  
Pressure Meter,  $P_m$  30.122 "Hg

#### Stack

$\sqrt{Dp}$  1.3257 "H<sub>2</sub>O  
Temperature,  $T_s$  256.6 °F  
Temperature,  $T_s$  716.6 °A (R)  
Pressure Stack,  $P_s$  30.044 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  43.005 dscf  
1.218 dscm  
Actual Volume,  $V_{m(actual)}$  59.017 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  86.73 fps  
Volume (actual) 25,545.5 awcfm  
25,170.0 adcfm  
Volume (standard) 1,134,013.3 wscf/hr  
1,117,343.3 dscf/hr  
18,622.4 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.640 scf  
Moisture,  $B_{ws}$  0.0147  
Moisture EPA M4 1.47 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
Wet,  $M_s$  28.74 lb/lb-mole

Volume/Mole,  $V/M$  520.727

Percent Isokinetic 100.0 %

### Laboratory Results

|          |            |           |      |             |
|----------|------------|-----------|------|-------------|
| Fluoride | < 30.0     | μg/sample |      |             |
| Fluoride | < 3.00E-05 | grams     | MW F | 19.0 g/mole |

#### Emissions:

|                      |            |         |
|----------------------|------------|---------|
| Concentration, $C_s$ | < 1.08E-05 | gr/dscf |
|                      | < 24.6     | μg/dscm |
|                      | < 3.12E-02 | ppmv    |
| Mass Emissions       | < 1.72E-03 | lb/hr   |

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 13B

**Run:** 2  
**Start Time:** 9:57  
**End Time:** 11:01  
**Date:** 05/01/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 3             | 2.110                    | 1.70                            | 57                         | 1                 | 1.80                    | 256                        | 1.3416      |
| 6             | 4.180                    | 1.60                            | 57                         | 2                 | 1.70                    | 258                        | 1.3038      |
| 9             | 6.240                    | 1.60                            | 57                         | 3                 | 1.70                    | 259                        | 1.3038      |
| 12            | 8.350                    | 1.70                            | 58                         | 4                 | 1.80                    | 259                        | 1.3416      |
| 15            | 10.480                   | 1.70                            | 58                         | 5                 | 1.80                    | 260                        | 1.3416      |
| 18            | 12.660                   | 1.80                            | 58                         | 6                 | 1.90                    | 260                        | 1.3784      |
| 21            | 14.860                   | 1.80                            | 59                         | 7                 | 1.90                    | 260                        | 1.3784      |
| 24            | 16.970                   | 1.70                            | 59                         | 8                 | 1.80                    | 261                        | 1.3416      |
| 27            | 19.060                   | 1.60                            | 59                         | 9                 | 1.70                    | 260                        | 1.3038      |
| 30            | 20.893                   | 1.20                            | 60                         | 10                | 1.30                    | 259                        | 1.1402      |
| 33            | 22.760                   | 1.30                            | 60                         | 11                | 1.40                    | 260                        | 1.1832      |
| 36            | 24.770                   | 1.50                            | 60                         | 12                | 1.60                    | 260                        | 1.2649      |
| 39            | 26.890                   | 1.70                            | 60                         | 13                | 1.80                    | 262                        | 1.3416      |
| 42            | 29.050                   | 1.70                            | 61                         | 14                | 1.80                    | 262                        | 1.3416      |
| 45            | 31.220                   | 1.80                            | 61                         | 15                | 1.90                    | 262                        | 1.3784      |
| 48            | 33.340                   | 1.70                            | 61                         | 16                | 1.80                    | 261                        | 1.3416      |
| 51            | 35.490                   | 1.70                            | 61                         | 17                | 1.80                    | 260                        | 1.3416      |
| 54            | 37.570                   | 1.60                            | 62                         | 18                | 1.70                    | 260                        | 1.3038      |
| 57            | 39.640                   | 1.60                            | 62                         | 19                | 1.70                    | 260                        | 1.3038      |
| 60            | 41.663                   | 1.50                            | 63                         | 20                | 1.60                    | 258                        | 1.2649      |



Client: Hollingsworth &amp; Vose

Run: 2

Source: CFU 117

Date: 05/01/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 3 min  
 Meter Volume,  $V_m$  41.663 dcf  
 Water Volume 13.7 ml (g)  
 Nozzle Diameter,  $N_z$  0.1863 in.  
 Nozzle Area 0.000189 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  30.00 "Hg  
 Static Pressure 0.60 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9960 Y

Molecular Weight:

CO<sub>2</sub> Average 0.67 %vd  
 O<sub>2</sub> Average 19.85 %vd

**Field Data Averages**Meter

$\Delta H$  1.625 "H<sub>2</sub>O  
 Temperature,  $T_m$  59.7 °F  
 Temperature,  $T_m$  519.7 °A (°R)  
 Pressure Meter,  $P_m$  30.119 "Hg

Stack

$\sqrt{D_p}$  1.3120 "H<sub>2</sub>O  
 Temperature,  $T_s$  259.9 °F  
 Temperature,  $T_s$  719.9 °A (R)  
 Pressure Stack,  $P_s$  30.044 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  42.422 dscf  
 1.201 dscm  
 Actual Volume,  $V_{m(actual)}$  58.503 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  86.03 fps  
 Volume (actual) 25,339.3 awcfm  
 24,959.2 adcfm  
 Volume (standard) 1,119,704.4 wscf/hr  
 1,102,908.8 dscf/hr  
 18,381.8 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.645 scf  
 Moisture,  $B_{ws}$  0.0150  
 Moisture EPA M4 1.50 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
 Wet,  $M_s$  28.74 lb/lb-mole

Volume/Mole,  $V/M$  523.125

Percent Isokinetic 100.0 %

**Laboratory Results**

|          |            |           |      |             |
|----------|------------|-----------|------|-------------|
| Fluoride | < 30.0     | μg/sample |      |             |
| Fluoride | < 3.00E-05 | grams     | MW F | 19.0 g/mole |

**Emissions:**

Concentration,  $C_s$  < 1.09E-05 gr/dscf  
 < 25.0 μg/dscm  
 < 3.16E-02 ppmvd  
 Mass Emissions < 1.72E-03 lb/hr

&lt;" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 13B

**Run:** 3  
**Start Time:** 11:10  
**End Time:** 12:14  
**Date:** 05/01/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 0.000                    |                                 |                            |                   |                         |                            |             |
| 3             | 2.140                    | 1.70                            | 61                         | 1                 | 1.80                    | 255                        | 1.3416      |
| 6             | 4.270                    | 1.70                            | 61                         | 2                 | 1.80                    | 258                        | 1.3416      |
| 9             | 6.340                    | 1.60                            | 61                         | 3                 | 1.70                    | 258                        | 1.3038      |
| 12            | 8.460                    | 1.70                            | 61                         | 4                 | 1.80                    | 259                        | 1.3416      |
| 15            | 10.590                   | 1.70                            | 60                         | 5                 | 1.80                    | 259                        | 1.3416      |
| 18            | 12.780                   | 1.80                            | 61                         | 6                 | 1.90                    | 261                        | 1.3784      |
| 21            | 14.920                   | 1.70                            | 60                         | 7                 | 1.80                    | 262                        | 1.3416      |
| 24            | 17.060                   | 1.70                            | 60                         | 8                 | 1.80                    | 263                        | 1.3416      |
| 27            | 19.120                   | 1.60                            | 60                         | 9                 | 1.70                    | 263                        | 1.3038      |
| 30            | 20.957                   | 1.20                            | 61                         | 10                | 1.30                    | 260                        | 1.1402      |
| 33            | 22.830                   | 1.30                            | 60                         | 11                | 1.40                    | 258                        | 1.1832      |
| 36            | 24.820                   | 1.50                            | 60                         | 12                | 1.60                    | 258                        | 1.2649      |
| 39            | 26.950                   | 1.70                            | 60                         | 13                | 1.80                    | 261                        | 1.3416      |
| 42            | 29.120                   | 1.80                            | 60                         | 14                | 1.90                    | 262                        | 1.3784      |
| 45            | 31.300                   | 1.80                            | 60                         | 15                | 1.90                    | 261                        | 1.3784      |
| 48            | 33.430                   | 1.70                            | 61                         | 16                | 1.80                    | 261                        | 1.3416      |
| 51            | 35.620                   | 1.80                            | 61                         | 17                | 1.90                    | 261                        | 1.3784      |
| 54            | 37.800                   | 1.80                            | 60                         | 18                | 1.90                    | 260                        | 1.3784      |
| 57            | 39.810                   | 1.50                            | 61                         | 19                | 1.60                    | 261                        | 1.2649      |
| 60            | 41.712                   | 1.30                            | 61                         | 20                | 1.40                    | 261                        | 1.1832      |

Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU 117

Date:

05/01/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 3 min  
 Meter Volume,  $V_m$  41.712 dcf  
 Water Volume 11.3 ml (g)  
 Nozzle Diameter,  $N_z$  0.1863 in.  
 Nozzle Area 0.000189 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.97 "Hg  
 Static Pressure 0.60 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9960 Y

Molecular Weight:

CO<sub>2</sub> Average 0.69 %vd  
 O<sub>2</sub> Average 19.90 %vd

**Field Data Averages**Meter

$\Delta H$  1.630 "H<sub>2</sub>O  
 Temperature,  $T_m$  60.5 °F  
 Temperature,  $T_m$  520.5 °A (°R)  
 Pressure Meter,  $P_m$  30.090 "Hg

Stack

$\sqrt{D_p}$  1.3134 "H<sub>2</sub>O  
 Temperature,  $T_s$  260.1 °F  
 Temperature,  $T_s$  720.1 °A (R)  
 Pressure Stack,  $P_s$  30.014 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  42.366 dscf  
 1.200 dscm  
 Actual Volume,  $V_{m(actual)}$  58.346 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  86.13 fps  
 Volume (actual) 25,368.7 awcfm  
 25,054.1 adcfm  
 Volume (standard) 1,119,575.5 wscf/hr  
 1,105,692.8 dscf/hr  
 18,428.2 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.532 scf  
 Moisture,  $B_{ws}$  0.0124  
 Moisture EPA M4 1.24 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.91 lb/lb-mole  
 Wet,  $M_s$  28.77 lb/lb-mole

Volume/Mole,  $V/M$  523.793

Percent Isokinetic 99.6 %

**Laboratory Results**

|          |            |           |      |             |
|----------|------------|-----------|------|-------------|
| Fluoride | < 30.0     | μg/sample |      |             |
| Fluoride | < 3.00E-05 | grams     | MW F | 19.0 g/mole |

**Emissions:**

|                      |            |         |
|----------------------|------------|---------|
| Concentration, $C_s$ | < 1.09E-05 | gr/dscf |
|                      | < 25.0     | μg/dscm |
|                      | < 3.17E-02 | ppmv    |
| Mass Emissions       | < 1.73E-03 | lb/hr   |

&lt;" represents MDL value

**EPA Method 13B  
Laboratory Results  
Total Fluoride**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117

| Lab ID  | Sample ID          | Sample Date |   | Result | MDL  | Units     |
|---------|--------------------|-------------|---|--------|------|-----------|
| 18-S662 | M13B Cont. 1 Run 1 | 5/1/2018    | < | MDL    | 30.0 | µg/sample |
| 18-S663 | M13B Cont. 1 Run 2 | 5/1/2018    | < | MDL    | 30.0 | µg/sample |
| 18-S664 | M13B Cont. 1 Run 3 | 5/1/2018    | < | MDL    | 30.0 | µg/sample |
| 18-S665 | H2O + Filter Blank | 5/1/2018    | < | MDL    | 30.0 | µg/sample |

\*If sample results are below MDL, MDL value is shown. A "<" sign designates less than MDL.  
If blank values are below MDL, no blank corrections are performed.

**EPA Method 13B**

**Results Summary**

**Client:** Hollingsworth & Vose

**Location:** Corvallis, OR

**Source:** CFU 117

| Run                              |                               |             | 1          | 2          | 3          | Average           |
|----------------------------------|-------------------------------|-------------|------------|------------|------------|-------------------|
| Date                             |                               |             | 5/1/2018   | 5/1/2018   | 5/1/2018   |                   |
| Run Start Time                   |                               |             | 8:40       | 9:57       | 11:10      |                   |
| Run End Time                     |                               |             | 9:44       | 11:01      | 12:14      |                   |
| Duration, min.                   |                               |             | 60         | 60         | 60         |                   |
| Barometric Pressure, "Hg         |                               |             | 30.00      | 30.00      | 29.97      | <b>29.99</b>      |
| Nozzle Dia., in.                 |                               |             | 0.1863     | 0.1863     | 0.1863     | <b>0.1863</b>     |
| Isokinetic Average, %            |                               |             | 100.0      | 100.0      | 99.6       | <b>99.9</b>       |
| Sample Volume, dscf              |                               |             | 43.005     | 42.422     | 42.366     | <b>42.598</b>     |
| Sample Volume, dscm              |                               |             | 1.218      | 1.201      | 1.200      | <b>1.206</b>      |
| Stack Diameter, in.              |                               |             | 30.00      | 30.00      | 30.00      | <b>30.00</b>      |
| Stack Area, sq.ft.               |                               |             | 4.909      | 4.909      | 4.909      | <b>4.909</b>      |
| CO <sub>2</sub> %vd              |                               |             | 0.67       | 0.67       | 0.69       | <b>0.68</b>       |
| O <sub>2</sub> %vd               |                               |             | 19.89      | 19.85      | 19.90      | <b>19.88</b>      |
| Static Press., "H <sub>2</sub> O |                               |             | 0.60       | 0.60       | 0.60       | <b>0.60</b>       |
| H <sub>2</sub> O %v              |                               |             | 1.47       | 1.50       | 1.24       | <b>1.40</b>       |
| Wet Molecular Weight, lb/lb-mole |                               |             | 28.74      | 28.74      | 28.77      | <b>28.75</b>      |
| Velocity, FPS                    |                               |             | 86.73      | 86.03      | 86.13      | <b>86.30</b>      |
| ADCFM                            |                               |             | 25,170.0   | 24,959.2   | 25,054.1   | <b>25,061.1</b>   |
| AWCFM                            |                               |             | 25,545.5   | 25,339.3   | 25,368.7   | <b>25,417.8</b>   |
| DSCFM                            |                               |             | 18,622.4   | 18,381.8   | 18,428.2   | <b>18,477.5</b>   |
| Stack Temperature, °F            |                               |             | 256.6      | 259.9      | 260.1      | <b>258.9</b>      |
| Fluoride                         | Concentration, C <sub>s</sub> | gr/dscf     | < 1.08E-05 | < 1.09E-05 | < 1.09E-05 | < <b>1.09E-05</b> |
|                                  |                               | µg/dscm     | < 24.6     | < 25.0     | < 25.0     | < <b>24.9</b>     |
|                                  |                               | ppmvd       | < 3.12E-02 | < 3.16E-02 | < 3.17E-02 | < <b>3.15E-02</b> |
|                                  | Mass                          | lb/hr       | < 1.72E-03 | < 1.72E-03 | < 1.73E-03 | < <b>1.72E-03</b> |
|                                  |                               | lb/lb glass | < 1.55E-05 | < 1.55E-05 | < 1.55E-05 | < <b>1.55E-05</b> |
| Production Data                  | Glass Production              | lbs/hr      | 111.1      | 111.1      | 111.1      | <b>111.1</b>      |

"<" represents MDL value

**EPA Methods 1-4, 13B**  
**Example Calculations**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 13B

**Run:** 1  
**Start Time:** 8:40  
**End Time:** 9:44  
**Date:** 5/1/2018

**EPA Methods 1-4:**

$$1) \quad P_m = P_b + (\Delta H/13.6) = 30.122 \text{ "Hg}$$

where  $P_b$ : 30.00 "Hg  
 $\Delta H$ : 1.655 "H<sub>2</sub>O

$$2) \quad P_s = P_b + (\text{Static Press.}/13.6) = 30.044 \text{ "Hg}$$

where  $P_b$ : 30.00 "Hg  
 Static Press.: 0.60 "H<sub>2</sub>O

$$3) \quad V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 43.005 \text{ dscf}$$

where  $V_m$ : 41.573 dcf  
 $Y$ : 0.9960  
 $P_m$ : 30.122 "Hg  
 $T_m$ : 511.6 °A

$$4) \quad V_w(\text{std}) = (0.04706)(H_2O) = 0.640 \text{ scf}$$

where  $H_2O$ : 13.60 g

$$5) \quad Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0147$$

where  $Vw(\text{std})$ : 0.640 scf  
 $Vm(\text{std})$ : 43.005 dscf

$$6) \quad \% H_2O = Bws \times 100 = 1.47 \%v$$

$$7) \quad V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 59.017 \text{ awcf}$$

where  $Y$ : 0.9960  
 $Vm$ : 41.5729 dcf  
 $Bws$ : 0.0147  
 $T_s$ : 716.6 °A  
 $T_m$ : 511.6 °A  
 $P_m$ : 30.122 "Hg  
 $P_s$ : 30.044 "Hg

$$8) \quad M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.90 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.67 %vd  
 $O_2$ : 19.89 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.44 %vd

9)  $M_s = M_d(1 - Bws) + (18 \times Bws) =$  28.74 lb/lb-mole  
       where  $M_d$ : 28.90 lb/lb-mole  
       Bws: 0.0147

10) Stack Area(cir.) =  $3.1416 (\text{stack diameter}/24)^2 =$  4.909 sq. ft.  
       where Stack ID: 30 inches

Stack Area(rect.) = stack width/12 x stack length/12 = NA sq. ft.  
       where Stack Width: 0.000 inches  
       Stack Length: 0.000 inches

11) Velocity,  $V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) =$  86.73 fps  
       where Cp: 0.84  
       Ave. Sqrt  $\Delta P$ : 1.3257  
       Ts: 716.6 °A  
       Ps: 30.044 "Hg  
       Ms: 28.74 lb/lb-mole

12) AWCfm =  $(V_s)(\text{stack area})(60 \text{ sec/min}) =$  25,545.5 AWCfm  
       where  $V_s$ : 86.73 ft/sec  
       Stack Area: 4.909 sq. ft

13) ADCfm =  $(\text{AWCFM})(1-Bws) =$  25,170.0 ADCfm  
       where AWCfm: 25,545.5  
       Bws: 0.0147

14)  $Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ A}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) =$  1,134,013.3 wscf/hr  
       where  $V_s$ : 86.73 ft/sec  
       Stack Area: 4.9090 sq. ft.  
       Ts: 716.6 °A  
       Ps: 30.044 "Hg

15)  $Q_{sd} = (\text{wscf/hr})(1-Bws) =$  1,117,343.3 dscf/hr  
       where wscf/hr: 1,134,013.3  
       Bws: 0.0147

16) DSCFM =  $(\text{dscf/hr})/60 \text{ mins/hr} =$  18,622.4 DSCFM  
       where dscf/hr: 1,117,343.3

17) Nozzle Area =  $3.1416 (\text{Nozzle Size}/24)^2 =$  0.000189 sq. ft.  
       where Nozzle Size: 0.1863 inches

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 1  
Date: 5/1/2018

$$18) \text{ Isokinetic \%} = \left( \frac{0.0945(Ts)(Vm(std))}{Ps(Vs)(nozzle\ area)(sampling\ time)(1-Bws)} \right) = 100.0 \%$$

where Ts: 716.6 °A  
Vm(Std): 43.005 dscf  
Ps: 30.044 "Hg  
Vs: 86.73 ft/sec  
Nozzle Area: 0.000189 sq. ft.  
Sampling Time: 60 min.  
Bws: 0.0147

#### EPA Method 13B:

$$19) \text{ Fluoride laboratory results} < 30.0 \text{ }\mu\text{g/sample}$$

$$20) \text{ Fluoride} = (\mu\text{g/sample})/1,000,000 = < 3.00\text{E-}05 \text{ grams/sample}$$

$$21) \text{ Cs} = (\text{Sample grams}/Vm(\text{Std}))(15.43\text{grains/gram}) = < 1.08\text{E-}05 \text{ gr/dscf}$$

where Sample: 0.00003 grams  
Vm(std) 43.005 dscf

$$22) \text{ Cs} = (\text{Sample grams} \times 1,000,000 \text{ }\mu\text{g/gram})/Vm(\text{std}) = < 24.6 \text{ }\mu\text{g/dscm}$$

where Sample: 0.00003 grams  
Vm(std) 1.218 dscm

$$23) \text{ Volume/Mole} = \left( \frac{359(Ts)(29.92"Hg)}{492(Ps)} \right) = 520.727 \text{ Vol./Mole}$$

where Ts: 716.6 °A  
Ps: 30.044 "Hg

$$24) \text{ ppmvd} = \left( \frac{\frac{lb}{hr} \times \frac{Vol.}{Mole}}{(MW \times 0.00006 \times ADCFM)} \right) = < 3.12\text{E-}02 \text{ ppmvd}$$

where MW: 19.0 g/mol  
lb/hr: 0.00  
Vol./Mole: 520.727  
ADCFM: 25170.0

$$25) \text{ Mass Emission Rate} = (Cs)(\text{Stack flow})/7000\text{gr/lb} = < 1.72\text{E-}03 \text{ lb/hr}$$

where Cs: 1.08E-05 gr/dscf  
Stack Flow: 1,117,343.3 dscf/hr





|           |                      |
|-----------|----------------------|
| COMPANY   | Hollingsworth & Vose |
| FACILITY  | GP2                  |
| LOCATION  | Corvallis, OR        |
| SOURCE    | CFU 117              |
| DATE      | 05/01/18             |
| METHOD    | M26A                 |
| POLLUTANT | HF                   |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M26A  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy, 50 degrees

**Run:** 1  
**Start Time:** 8:40  
**End Time:** 9:44  
**Date:** 5/1/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
ΔH@ 1.8073  
Probe ID 3C  
Nozzle ID 0.214  
Hot box ID 1  
Pitot Cp 0.84  
Liner type Glass  
Nozzle size 0.2140 inches  
Nozzle area 0.00025 sq.ft.  
Probe heat 260 F  
Filter heat 250 F

**Source Information:**

Barometric Pressure 30 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave. ΔP 1.7 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 2 %  
Assumed meter temp. 55 F  
Total number of points 20  
Time per point 3  
Total run time 60  
O<sub>2</sub> 19.89 %  
CO<sub>2</sub> 0.67 %  
Rec. Nz. 0.195 inches

**Leak Checks:**

|                        | Pre-test | Post-test |
|------------------------|----------|-----------|
| Pitot                  | x        | x         |
| Train leak rate, dcf   | 0.000    | 0.000     |
| Leak check vacuum, "Hg | 11       | 10        |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 56.572 dcf  
Wet mol. weight 28.75 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.37 %  
Std. meter vol. 57.663 dscf  
Isokinetic Average 99.8 %  
Ave. ΔP 1.82 "H<sub>2</sub>O  
Ave. √ΔP 1.3483 "H<sub>2</sub>O  
Ave. ΔH 2.925 "H<sub>2</sub>O  
Ave. T<sub>s</sub> 259.8 °F  
Ave. T<sub>m</sub> 53.5 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 203   | 3.0  |
| Silica gel, g     | 250.2   | 264.2 | 14.0 |
| Total water gain: |         |       | 17.0 |

| Traversal Point | Time (min.) | Meter Volume (dcf) | Velocity ΔP ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. ΔH | Run ΔH | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|-----------------|-------------|--------------------|---------------------------------|------------------|------------------|----------|--------|--------------|-----------------|------------------------|
| 1               | 3           | 217.041            | 1.90                            | 259              | 50               | 3.03     | 3.00   | 4            | 259             | 47                     |
| 2               | 6           | 222.730            | 1.90                            | 260              | 50               | 3.02     | 3.00   | 4            | 257             | 41                     |
| 3               | 9           | 225.560            | 1.80                            | 260              | 51               | 2.87     | 2.90   | 4            | 256             | 40                     |
| 4               | 12          | 228.460            | 1.90                            | 260              | 51               | 3.03     | 3.00   | 4            | 256             | 41                     |
| 5               | 15          | 231.370            | 2.00                            | 260              | 51               | 3.19     | 3.20   | 4            | 258             | 43                     |
| 6               | 18          | 234.320            | 2.00                            | 260              | 52               | 3.20     | 3.20   | 4            | 257             | 44                     |
| 7               | 21          | 237.210            | 1.90                            | 260              | 52               | 3.04     | 3.00   | 4            | 254             | 45                     |
| 8               | 24          | 240.030            | 1.80                            | 260              | 52               | 2.88     | 2.90   | 4            | 255             | 46                     |
| 9               | 27          | 242.720            | 1.60                            | 260              | 53               | 2.56     | 2.60   | 4            | 256             | 47                     |
| 10              | 30          | 245.454            | 1.70                            | 257              | 53               | 2.73     | 2.70   | 4            | 255             | 48                     |
| 11              | 33          | 248.250            | 1.80                            | 259              | 54               | 2.89     | 2.90   | 4            | 256             | 51                     |
| 12              | 36          | 250.900            | 1.60                            | 260              | 54               | 2.57     | 2.60   | 4            | 254             | 47                     |
| 13              | 39          | 253.540            | 1.60                            | 258              | 55               | 2.58     | 2.60   | 4            | 257             | 46                     |
| 14              | 42          | 256.380            | 1.80                            | 259              | 55               | 2.90     | 2.90   | 4            | 256             | 47                     |
| 15              | 45          | 259.130            | 1.70                            | 261              | 55               | 2.73     | 2.70   | 4            | 259             | 48                     |
| 16              | 48          | 262.020            | 1.90                            | 261              | 56               | 3.06     | 3.10   | 4            | 456             | 48                     |
| 17              | 51          | 264.900            | 1.90                            | 260              | 56               | 3.06     | 3.10   | 4            | 253             | 49                     |
| 18              | 54          | 267.840            | 1.90                            | 261              | 56               | 3.06     | 3.10   | 4            | 256             | 50                     |
| 19              | 57          | 270.760            | 1.90                            | 261              | 57               | 3.06     | 3.10   | 4            | 257             | 51                     |
| 20              | 60          | 273.613            | 1.80                            | 259              | 57               | 2.91     | 2.90   | 4            | 255             | 51                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M26A  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy, 50 degrees

**Run:** 2  
**Start Time:** 9:57  
**End Time:** 11:01  
**Date:** 5/1/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11  
Y factor 0.9820  
 $\Delta H@$  1.8073  
Probe ID 3C  
Nozzle ID 0.214  
Hot box ID 1  
Pitot Cp 0.84  
Liner type: Glass  
Nozzle size: 0.2140 inches  
Nozzle area: 0.00025 sq.ft.  
Probe heat: 260 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 30 "Hg  
Static Pressure 0.6 "H<sub>2</sub>O  
Ave.  $\Delta P$  1.7 "H<sub>2</sub>O  
Stack Temperature 250 F  
Assumed moisture 1.37 %  
Assumed meter temp. 53.5 F  
Total number of points 20  
Time per point 3  
Total run time 60

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 10       | 9         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# | HLN1  |              |

**Post Test Calculations:**

Sample volume 56.298 dcf  
Wet mol. weight 28.77 M<sub>s</sub> (actual)  
Actual H<sub>2</sub>O 1.19 %  
Std. meter vol. 56.517 dscf  
Isokinetic Average 99.4 %

**Moisture/Lab:**

|                   | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 200   | 0.0  |
| Silica gel, g     | 247.5   | 262   | 14.5 |
| Total water gain: |         |       | 14.5 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 3           | 273.721            | 1.40                                    | 254              | 59               | 2.31             | 2.30           | 4            | 253             | 55                     |
| 2              | 6           | 278.830            | 1.50                                    | 259              | 59               | 2.46             | 2.40           | 4            | 257             | 50                     |
| 3              | 9           | 281.640            | 1.70                                    | 256              | 59               | 2.80             | 2.80           | 4            | 255             | 48                     |
| 4              | 12          | 284.440            | 1.80                                    | 263              | 60               | 2.94             | 2.90           | 4            | 252             | 50                     |
| 5              | 15          | 287.270            | 1.80                                    | 263              | 60               | 2.94             | 2.90           | 4            | 253             | 50                     |
| 6              | 18          | 290.220            | 1.90                                    | 263              | 60               | 3.10             | 3.10           | 4            | 253             | 50                     |
| 7              | 21          | 293.130            | 1.90                                    | 262              | 60               | 3.11             | 3.10           | 4            | 254             | 49                     |
| 8              | 24          | 296.060            | 1.90                                    | 263              | 61               | 3.11             | 3.10           | 4            | 253             | 49                     |
| 9              | 27          | 298.980            | 1.90                                    | 263              | 61               | 3.11             | 3.10           | 4            | 249             | 50                     |
| 10             | 30          | 301.842            | 1.80                                    | 262              | 61               | 2.95             | 2.90           | 4            | 259             | 51                     |
| 11             | 33          | 304.650            | 1.80                                    | 261              | 61               | 2.95             | 2.90           | 4            | 255             | 55                     |
| 12             | 36          | 307.530            | 1.80                                    | 261              | 62               | 2.96             | 2.90           | 4            | 258             | 53                     |
| 13             | 39          | 310.330            | 1.80                                    | 262              | 62               | 2.96             | 2.90           | 4            | 255             | 52                     |
| 14             | 42          | 313.230            | 1.90                                    | 261              | 62               | 3.12             | 3.10           | 4            | 257             | 52                     |
| 15             | 45          | 316.130            | 1.90                                    | 263              | 63               | 3.12             | 3.10           | 4            | 249             | 51                     |
| 16             | 48          | 319.020            | 1.90                                    | 263              | 63               | 3.12             | 3.10           | 4            | 257             | 52                     |
| 17             | 51          | 322.060            | 2.00                                    | 263              | 63               | 3.29             | 3.30           | 4            | 249             | 53                     |
| 18             | 54          | 324.930            | 1.80                                    | 264              | 63               | 2.95             | 2.90           | 4            | 255             | 54                     |
| 19             | 57          | 327.570            | 1.50                                    | 264              | 63               | 2.46             | 2.40           | 4            | 252             | 53                     |
| 20             | 60          | 330.019            | 1.30                                    | 259              | 63               | 2.15             | 2.10           | 4            | 255             | 51                     |

**Isokinetic Field Data**  
**Field Data Entry**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**EPA Method:** M26A  
**Box Operator:** RR  
**Technician(s):** CW

**Environmental Conditions/Test Notes:**  
Cloudy, 50 degrees

**Run:** 3  
**Start Time:** 11:10  
**End Time:** 12:14  
**Date:** 5/1/2018

**Stack Dimensional Data:**

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

**Equipment:**

Meterbox ID 11 Probe ID 3C Liner type: Glass  
Y factor 0.9820 Nozzle ID 0.214 Nozzle size: 0.2140 inches  
 $\Delta H$ @ 1.8073 Hot box ID 1 Nozzle area: 0.00025 sq.ft.  
Pitot Cp 0.84 Probe heat: 260 F  
Filter heat: 250 F

**Source Information:**

Barometric Pressure 29.97 "Hg O<sub>2</sub> 19.90 %  
Static Pressure 0.6 "H<sub>2</sub>O CO<sub>2</sub> 0.69 %  
Ave.  $\Delta P$  1.7 "H<sub>2</sub>O Rec. Nz. 0.193 inches  
Stack Temperature 250 F  
Assumed moisture 1.19 %  
Assumed meter temp. 61.3 F  
Total number of points 20  
Time per point 3  
Total run time 60

**Leak Checks:**

|                         | Pre-test | Post-test |
|-------------------------|----------|-----------|
| Pitot:                  | x        | x         |
| Train leak rate, dcf:   | 0.000    | 0.000     |
| Leak check vacuum, "Hg: | 12       | 8         |

**Nozzle check for roundness:**

| 1           | 2     | 3            |
|-------------|-------|--------------|
| 0.214       | 0.214 | 0.214 inches |
| Caliper ID# |       | HLN1         |

**Post Test Calculations:**

Sample volume 56.686 dcf Ave.  $\Delta P$  1.78 "H<sub>2</sub>O  
Wet mol. weight 28.69 M<sub>s</sub> (actual) Ave.  $\sqrt{\Delta P}$  1.3326 "H<sub>2</sub>O  
Actual H<sub>2</sub>O 2.02 % Ave.  $\Delta H$  2.9 "H<sub>2</sub>O  
Std. meter vol. 56.778 dscf Ave. T<sub>s</sub> 261.1 °F  
Isokinetic Average 100.2 % Ave. T<sub>m</sub> 62 °F

**Moisture/Lab:**

| Filter            | NA #    |       | Gain |
|-------------------|---------|-------|------|
|                   | Initial | Final |      |
| Impingers, g      | 200.0   | 210   | 10.0 |
| Silica gel, g     | 242.2   | 257.1 | 14.9 |
| Total water gain: |         |       | 24.9 |

| Traverse Point | Time (min.) | Meter Volume (dcf) | Velocity $\Delta P$ ("H <sub>2</sub> O) | Stack Temp. (°F) | Meter Temp. (°F) | Calc. $\Delta H$ | Run $\Delta H$ | Vacuum ("Hg) | Filter Box (°F) | Condenser Temp (≤68°F) |
|----------------|-------------|--------------------|-----------------------------------------|------------------|------------------|------------------|----------------|--------------|-----------------|------------------------|
| 1              | 3           | 330.134            | 1.30                                    | 249              | 62               | 2.18             | 2.20           | 4            | 253             | 53                     |
| 2              | 6           | 332.550            | 1.40                                    | 255              | 62               | 2.33             | 2.30           | 4            | 249             | 51                     |
| 3              | 9           | 335.100            | 1.60                                    | 260              | 62               | 2.64             | 2.60           | 4            | 251             | 49                     |
| 4              | 12          | 337.840            | 1.70                                    | 263              | 62               | 2.80             | 2.80           | 4            | 257             | 49                     |
| 5              | 15          | 340.580            | 1.90                                    | 264              | 62               | 3.12             | 3.10           | 4            | 261             | 50                     |
| 6              | 18          | 343.480            | 1.90                                    | 264              | 62               | 3.12             | 3.10           | 4            | 262             | 51                     |
| 7              | 21          | 346.390            | 1.90                                    | 264              | 61               | 3.11             | 3.10           | 4            | 256             | 53                     |
| 8              | 24          | 349.360            | 1.80                                    | 264              | 62               | 2.96             | 2.90           | 4            | 255             | 55                     |
| 9              | 27          | 352.190            | 1.90                                    | 264              | 62               | 3.12             | 3.10           | 4            | 253             | 55                     |
| 10             | 30          | 355.110            | 1.80                                    | 264              | 62               | 2.96             | 2.90           | 4            | 258             | 55                     |
| 11             | 33          | 357.975            | 1.80                                    | 263              | 62               | 2.97             | 2.90           | 4            | 255             | 56                     |
| 12             | 36          | 360.820            | 1.90                                    | 257              | 62               | 3.15             | 3.10           | 4            | 252             | 52                     |
| 13             | 39          | 363.760            | 1.90                                    | 261              | 62               | 3.13             | 3.10           | 4            | 258             | 52                     |
| 14             | 42          | 366.700            | 1.90                                    | 262              | 62               | 3.13             | 3.10           | 4            | 253             | 52                     |
| 15             | 45          | 369.640            | 1.90                                    | 262              | 62               | 3.13             | 3.10           | 4            | 256             | 53                     |
| 16             | 48          | 372.570            | 1.90                                    | 262              | 62               | 3.13             | 3.10           | 4            | 257             | 54                     |
| 17             | 51          | 375.500            | 1.80                                    | 263              | 62               | 2.96             | 2.90           | 4            | 254             | 54                     |
| 18             | 54          | 378.360            | 1.80                                    | 261              | 62               | 2.97             | 2.90           | 4            | 255             | 53                     |
| 19             | 57          | 381.230            | 1.80                                    | 261              | 62               | 2.97             | 2.90           | 4            | 250             | 54                     |
| 20             | 60          | 384.080            | 1.70                                    | 262              | 62               | 2.80             | 2.80           | 4            | 253             | 54                     |
|                |             | 386.820            |                                         |                  |                  |                  |                |              |                 |                        |

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 26A

**Run:** 1  
**Start Time:** 8:40  
**End Time:** 9:44  
**Date:** 5/1/2018

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 217.041                  |                                 |                            |                   |                         |                            |             |
| 3             | 219.860                  | 3.00                            | 50                         | 1                 | 1.90                    | 259                        | 1.3784      |
| 6             | 222.730                  | 3.00                            | 50                         | 2                 | 1.90                    | 260                        | 1.3784      |
| 9             | 225.560                  | 2.90                            | 51                         | 3                 | 1.80                    | 260                        | 1.3416      |
| 12            | 228.460                  | 3.00                            | 51                         | 4                 | 1.90                    | 260                        | 1.3784      |
| 15            | 231.370                  | 3.20                            | 51                         | 5                 | 2.00                    | 260                        | 1.4142      |
| 18            | 234.320                  | 3.20                            | 52                         | 6                 | 2.00                    | 260                        | 1.4142      |
| 21            | 237.210                  | 3.00                            | 52                         | 7                 | 1.90                    | 260                        | 1.3784      |
| 24            | 240.030                  | 2.90                            | 52                         | 8                 | 1.80                    | 260                        | 1.3416      |
| 27            | 242.720                  | 2.60                            | 53                         | 9                 | 1.60                    | 260                        | 1.2649      |
| 30            | 245.454                  | 2.70                            | 53                         | 10                | 1.70                    | 257                        | 1.3038      |
| 33            | 248.250                  | 2.90                            | 54                         | 11                | 1.80                    | 259                        | 1.3416      |
| 36            | 250.900                  | 2.60                            | 54                         | 12                | 1.60                    | 260                        | 1.2649      |
| 39            | 253.540                  | 2.60                            | 55                         | 13                | 1.60                    | 258                        | 1.2649      |
| 42            | 256.380                  | 2.90                            | 55                         | 14                | 1.80                    | 259                        | 1.3416      |
| 45            | 259.130                  | 2.70                            | 55                         | 15                | 1.70                    | 261                        | 1.3038      |
| 48            | 262.020                  | 3.10                            | 56                         | 16                | 1.90                    | 261                        | 1.3784      |
| 51            | 264.900                  | 3.10                            | 56                         | 17                | 1.90                    | 260                        | 1.3784      |
| 54            | 267.840                  | 3.10                            | 56                         | 18                | 1.90                    | 261                        | 1.3784      |
| 57            | 270.760                  | 3.10                            | 57                         | 19                | 1.90                    | 261                        | 1.3784      |
| 60            | 273.613                  | 2.90                            | 57                         | 20                | 1.80                    | 259                        | 1.3416      |

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 1  
Date: 05/01/18

### Field Data Input Continued

#### Moisture Data

Total Test Time 60 min  
Sample Time Interval 3 min  
Meter Volume,  $V_m$  56.572 dcf  
Water Volume 17.0 ml (g)  
Nozzle Diameter,  $N_z$  0.2140 in.  
Nozzle Area 0.000250 sq.ft.

#### Stack Dimensional Data:

Circular  
Diameter 30.000 in  
Rectangular  
Width in  
Length in  
Stack Area 4.909 sq.ft.

#### Traverse Data

Barometric Pressure,  $P_b$  30.00 "Hg  
Static Pressure 0.60 "H<sub>2</sub>O  
Pitot Factor, cp 0.84  
Meter Cal Factor 0.9820 Y

#### Molecular Weight:

CO<sub>2</sub> Average 0.67 %vd  
O<sub>2</sub> Average 19.89 %vd

### Field Data Averages

#### Meter

$\Delta H$  2.925 "H<sub>2</sub>O  
Temperature,  $T_m$  53.5 °F  
Temperature,  $T_m$  513.5 °A (°R)  
Pressure Meter,  $P_m$  30.215 "Hg

#### Stack

$\sqrt{D_p}$  1.3483 "H<sub>2</sub>O  
Temperature,  $T_s$  259.8 °F  
Temperature,  $T_s$  719.8 °A (R)  
Pressure Stack,  $P_s$  30.044 "Hg

### Field Data Calculations

#### Meter Box Capture

Standard Volume,  $V_{m(std)}$  57.663 dscf  
1.633 dscm  
Actual Volume,  $V_{m(actual)}$  79.404 awcf

#### EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  88.39 fps  
Volume (actual) 26,034.4 awcfm  
25,677.7 adcfm  
Volume (standard) 1,150,580.2 wscf/hr  
1,134,817.3 dscf/hr  
18,913.6 dscf/min

#### Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.800 scf  
Moisture,  $B_{ws}$  0.0137  
Moisture EPA M4 1.37 %v

#### EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
Wet,  $M_s$  28.75 lb/lb-mole

Volume/Mole,  $V/M$  523.052

Percent Isokinetic 99.8 %

### Laboratory Results

|    |          |           |       |              |
|----|----------|-----------|-------|--------------|
| HF | 85.3     | μg/sample |       |              |
| HF | 8.53E-05 | grams     | MW HF | 20.01 g/mole |

#### Emissions:

|                         |          |         |
|-------------------------|----------|---------|
| Concentration HF, $C_s$ | 2.28E-05 | gr/dscf |
|                         | 52.2     | μg/dscm |
|                         | 6.28E-02 | ppmvd   |
| Mass Emissions HF       | 3.70E-03 | lb/hr   |

"<" represents MDL value

**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 26A

**Run:** 2  
**Start Time:** 9:57  
**End Time:** 11:01  
**Date:** 05/01/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 273.721                  |                                 |                            |                   |                         |                            |             |
| 3             | 276.230                  | 2.30                            | 59                         | 1                 | 1.40                    | 254                        | 1.1832      |
| 6             | 278.830                  | 2.40                            | 59                         | 2                 | 1.50                    | 259                        | 1.2247      |
| 9             | 281.640                  | 2.80                            | 59                         | 3                 | 1.70                    | 256                        | 1.3038      |
| 12            | 284.440                  | 2.90                            | 60                         | 4                 | 1.80                    | 263                        | 1.3416      |
| 15            | 287.270                  | 2.90                            | 60                         | 5                 | 1.80                    | 263                        | 1.3416      |
| 18            | 290.220                  | 3.10                            | 60                         | 6                 | 1.90                    | 263                        | 1.3784      |
| 21            | 293.130                  | 3.10                            | 60                         | 7                 | 1.90                    | 262                        | 1.3784      |
| 24            | 296.060                  | 3.10                            | 61                         | 8                 | 1.90                    | 263                        | 1.3784      |
| 27            | 298.980                  | 3.10                            | 61                         | 9                 | 1.90                    | 263                        | 1.3784      |
| 30            | 301.842                  | 2.90                            | 61                         | 10                | 1.80                    | 262                        | 1.3416      |
| 33            | 304.650                  | 2.90                            | 61                         | 11                | 1.80                    | 261                        | 1.3416      |
| 36            | 307.530                  | 2.90                            | 62                         | 12                | 1.80                    | 261                        | 1.3416      |
| 39            | 310.330                  | 2.90                            | 62                         | 13                | 1.80                    | 262                        | 1.3416      |
| 42            | 313.230                  | 3.10                            | 62                         | 14                | 1.90                    | 261                        | 1.3784      |
| 45            | 316.130                  | 3.10                            | 63                         | 15                | 1.90                    | 263                        | 1.3784      |
| 48            | 319.020                  | 3.10                            | 63                         | 16                | 1.90                    | 263                        | 1.3784      |
| 51            | 322.060                  | 3.30                            | 63                         | 17                | 2.00                    | 263                        | 1.4142      |
| 54            | 324.930                  | 2.90                            | 63                         | 18                | 1.80                    | 264                        | 1.3416      |
| 57            | 327.570                  | 2.40                            | 63                         | 19                | 1.50                    | 264                        | 1.2247      |
| 60            | 330.019                  | 2.10                            | 63                         | 20                | 1.30                    | 259                        | 1.1402      |

Client: Hollingsworth &amp; Vose

Run: 2

Source: CFU 117

Date: 05/01/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 3 min  
 Meter Volume,  $V_m$  56.298 dcf  
 Water Volume 14.5 ml (g)  
 Nozzle Diameter,  $N_z$  0.2140 in.  
 Nozzle Area 0.000250 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  30.00 "Hg  
 Static Pressure 0.60 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.67 %vd  
 O<sub>2</sub> Average 19.85 %vd

**Field Data Averages**Meter

$\Delta H$  2.865 "H<sub>2</sub>O  
 Temperature,  $T_m$  61.3 °F  
 Temperature,  $T_m$  521.3 °A (°R)  
 Pressure Meter,  $P_m$  30.211 "Hg

Stack

$\sqrt{D_p}$  1.3265 "H<sub>2</sub>O  
 Temperature,  $T_s$  261.5 °F  
 Temperature,  $T_s$  721.5 °A (R)  
 Pressure Stack,  $P_s$  30.044 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  56.517 dscf  
 1.600 dscm  
 Actual Volume,  $V_{m(actual)}$  77.868 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  87.03 fps  
 Volume (actual) 25,633.8 awcfm  
 25,328.8 adcfm  
 Volume (standard) 1,130,207.7 wscf/hr  
 1,116,758.2 dscf/hr  
 18,612.6 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  0.682 scf  
 Moisture,  $B_{ws}$  0.0119  
 Moisture EPA M4 1.19 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.90 lb/lb-mole  
 Wet,  $M_s$  28.77 lb/lb-mole

Volume/Mole,  $V/M$  524.288

Percent Isokinetic 99.4 %

**Laboratory Results**

|    |          |           |       |              |
|----|----------|-----------|-------|--------------|
| HF | 68.0     | μg/sample |       |              |
| HF | 6.80E-05 | grams     | MW HF | 20.01 g/mole |

**Emissions:**

Concentration HF,  $C_s$  1.86E-05 gr/dscf  
 42.5 μg/dscm  
 5.11E-02 ppmvd  
 Mass Emissions HF 2.96E-03 lb/hr

"&lt;" represents MDL value



**Isokinetic Field Data**  
**Field Data and Calculations**  
**Emissions and Gas Stream Characteristics**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117  
**Method:** 26A

**Run:** 3  
**Start Time:** 11:10  
**End Time:** 12:14  
**Date:** 05/01/18

| Sampling Data |                          |                                 |                            | Traverse Data     |                         |                            |             |
|---------------|--------------------------|---------------------------------|----------------------------|-------------------|-------------------------|----------------------------|-------------|
| Time<br>min.  | Meter<br>ft <sup>3</sup> | $\Delta H$<br>"H <sub>2</sub> O | Meter<br>T <sub>m</sub> °F | Traverse<br>Point | Dp<br>"H <sub>2</sub> O | Stack<br>T <sub>s</sub> °F | $\sqrt{Dp}$ |
|               | 330.134                  |                                 |                            |                   |                         |                            |             |
| 3             | 332.550                  | 2.20                            | 62                         | 1                 | 1.30                    | 249                        | 1.1402      |
| 6             | 335.100                  | 2.30                            | 62                         | 2                 | 1.40                    | 255                        | 1.1832      |
| 9             | 337.840                  | 2.60                            | 62                         | 3                 | 1.60                    | 260                        | 1.2649      |
| 12            | 340.580                  | 2.80                            | 62                         | 4                 | 1.70                    | 263                        | 1.3038      |
| 15            | 343.480                  | 3.10                            | 62                         | 5                 | 1.90                    | 264                        | 1.3784      |
| 18            | 346.390                  | 3.10                            | 62                         | 6                 | 1.90                    | 264                        | 1.3784      |
| 21            | 349.360                  | 3.10                            | 61                         | 7                 | 1.90                    | 264                        | 1.3784      |
| 24            | 352.190                  | 2.90                            | 62                         | 8                 | 1.80                    | 264                        | 1.3416      |
| 27            | 355.110                  | 3.10                            | 62                         | 9                 | 1.90                    | 264                        | 1.3784      |
| 30            | 357.975                  | 2.90                            | 62                         | 10                | 1.80                    | 263                        | 1.3416      |
| 33            | 360.820                  | 2.90                            | 62                         | 11                | 1.80                    | 260                        | 1.3416      |
| 36            | 363.760                  | 3.10                            | 62                         | 12                | 1.90                    | 257                        | 1.3784      |
| 39            | 366.700                  | 3.10                            | 62                         | 13                | 1.90                    | 261                        | 1.3784      |
| 42            | 369.640                  | 3.10                            | 62                         | 14                | 1.90                    | 262                        | 1.3784      |
| 45            | 372.570                  | 3.10                            | 62                         | 15                | 1.90                    | 262                        | 1.3784      |
| 48            | 375.500                  | 3.10                            | 62                         | 16                | 1.90                    | 262                        | 1.3784      |
| 51            | 378.360                  | 2.90                            | 62                         | 17                | 1.80                    | 263                        | 1.3416      |
| 54            | 381.230                  | 2.90                            | 62                         | 18                | 1.80                    | 261                        | 1.3416      |
| 57            | 384.080                  | 2.90                            | 62                         | 19                | 1.80                    | 261                        | 1.3416      |
| 60            | 386.820                  | 2.80                            | 62                         | 20                | 1.70                    | 262                        | 1.3038      |

Client: Hollingsworth &amp; Vose

Run:

3

Source: CFU 117

Date:

05/01/18

**Field Data Input Continued**Moisture Data

Total Test Time 60 min  
 Sample Time Interval 3 min  
 Meter Volume,  $V_m$  56.686 dcf  
 Water Volume 24.9 ml (g)  
 Nozzle Diameter,  $N_z$  0.2140 in.  
 Nozzle Area 0.000250 sq.ft.

Stack Dimensional Data:

Circular  
 Diameter 30.000 in  
 Rectangular  
 Width in  
 Length in  
 Stack Area 4.909 sq.ft.

Traverse Data

Barometric Pressure,  $P_b$  29.97 "Hg  
 Static Pressure 0.60 "H<sub>2</sub>O  
 Pitot Factor, cp 0.84  
 Meter Cal Factor 0.9820 Y

Molecular Weight:

CO<sub>2</sub> Average 0.69 %vd  
 O<sub>2</sub> Average 19.90 %vd

**Field Data Averages**Meter

$\Delta H$  2.900 "H<sub>2</sub>O  
 Temperature,  $T_m$  62.0 °F  
 Temperature,  $T_m$  522.0 °A (°R)  
 Pressure Meter,  $P_m$  30.183 "Hg

Stack

$\sqrt{D_p}$  1.3326 "H<sub>2</sub>O  
 Temperature,  $T_s$  261.1 °F  
 Temperature,  $T_s$  721.1 °A (R)  
 Pressure Stack,  $P_s$  30.014 "Hg

**Field Data Calculations**Meter Box Capture

Standard Volume,  $V_{m(std)}$  56.778 dscf  
 1.608 dscm  
 Actual Volume,  $V_{m(actual)}$  78.925 awcf

EPA Method 2 Stack Gas Flowrate:

Velocity,  $V_s$  87.57 fps  
 Volume (actual) 25,792.9 awcfm  
 25,271.9 adcfm  
 Volume (standard) 1,136,715.0 wscf/hr  
 1,113,753.4 dscf/hr  
 18,562.6 dscf/min

Gas Stream Moisture

Moisture Vapor,  $V_{w(std)}$  1.172 scf  
 Moisture,  $B_{ws}$  0.0202  
 Moisture EPA M4 2.02 %v

EPA Method 3 Gas Density

Dry,  $M_d$  28.91 lb/lb-mole  
 Wet,  $M_s$  28.69 lb/lb-mole

Volume/Mole,  $V/M$  524.521

Percent Isokinetic 100.2 %

**Laboratory Results**

|    |          |           |       |              |
|----|----------|-----------|-------|--------------|
| HF | 77.3     | μg/sample |       |              |
| HF | 7.73E-05 | grams     | MW HF | 20.01 g/mole |

**Emissions:**

|                         |          |         |
|-------------------------|----------|---------|
| Concentration HF, $C_s$ | 2.10E-05 | gr/dscf |
|                         | 48.1     | μg/dscm |
|                         | 5.78E-02 | ppmvd   |
| Mass Emissions HF       | 3.34E-03 | lb/hr   |

&lt;" represents MDL value

**EPA Method 26A**  
**Laboratory Results**  
**HF**

**Client:** Hollingsworth & Vose  
**Location:** Corvallis, OR  
**Source:** CFU 117

| Lab ID  | Sample ID        | Sample Date | Result | MDL  | Sample Vol.<br>(ml) | Units     |
|---------|------------------|-------------|--------|------|---------------------|-----------|
| 18-S690 | M26A Cont. 3 R-1 | 5/1/2018    | 85.3   | 3.64 | 346.0               | µg/sample |
| 18-S691 | M26A Cont. 3 R-2 | 5/1/2018    | 68.0   | 3.35 | 318.0               | µg/sample |
| 18-S692 | M26A Cont. 3 R-3 | 5/1/2018    | 77.3   | 3.79 | 360.0               | µg/sample |
| 18-S694 | H2O Blank        | 5/1/2018    | < MDL  | 2.08 | 198.0               | µg/sample |
| 18-S693 | 0.1N H2SO4 Blank | 5/1/2018    | < MDL  | 3.39 | 322.0               | µg/sample |

\*If sample results are below MDL, MDL value is shown. A "<" sign designates less than MDL.  
 If blank values are below MDL, no blank corrections are performed.

**EPA Method 26A**

**Results Summary**

**Client:** Hollingsworth & Vose

**Location:** Corvallis, OR

**Source:** CFU 117

| Run                              |                               |             | 1        | 2        | 3        | Average  |
|----------------------------------|-------------------------------|-------------|----------|----------|----------|----------|
| Date                             |                               |             | 5/1/2018 | 5/1/2018 | 5/1/2018 |          |
| Run Start Time                   |                               |             | 8:40     | 9:57     | 11:10    |          |
| Run End Time                     |                               |             | 9:44     | 11:01    | 12:14    |          |
| Duration, min.                   |                               |             | 60       | 60       | 60       |          |
| Barometric Pressure, "Hg         |                               |             | 30.00    | 30.00    | 29.97    | 29.99    |
| Nozzle Dia., in.                 |                               |             | 0.2140   | 0.2140   | 0.2140   | 0.2140   |
| Isokinetic Average, %            |                               |             | 99.8     | 99.4     | 100.2    | 99.8     |
| Sample Volume, dscf              |                               |             | 57.663   | 56.517   | 56.778   | 56.986   |
| Sample Volume, dscm              |                               |             | 1.633    | 1.600    | 1.608    | 1.614    |
| Stack Diameter, in.              |                               |             | 30.00    | 30.00    | 30.00    | 30.00    |
| Stack Area, sq.ft.               |                               |             | 4.909    | 4.909    | 4.909    | 4.909    |
| CO <sub>2</sub> %vd              |                               |             | 0.67     | 0.67     | 0.69     | 0.68     |
| O <sub>2</sub> %vd               |                               |             | 19.89    | 19.85    | 19.90    | 19.88    |
| Static Press., "H <sub>2</sub> O |                               |             | 0.60     | 0.60     | 0.60     | 0.60     |
| H <sub>2</sub> O %v              |                               |             | 1.37     | 1.19     | 2.02     | 1.53     |
| Wet Molecular Weight, lb/lb-mole |                               |             | 28.75    | 28.77    | 28.69    | 28.74    |
| Velocity, FPS                    |                               |             | 88.39    | 87.03    | 87.57    | 87.66    |
| ADCFM                            |                               |             | 25,677.7 | 25,328.8 | 25,271.9 | 25,426.1 |
| AWCFM                            |                               |             | 26,034.4 | 25,633.8 | 25,792.9 | 25,820.4 |
| DSCFM                            |                               |             | 18,913.6 | 18,612.6 | 18,562.6 | 18,696.3 |
| Stack Temperature, °F            |                               |             | 259.8    | 261.5    | 261.1    | 260.8    |
| HF                               | Concentration, C <sub>s</sub> | gr/dscf     | 2.28E-05 | 1.86E-05 | 2.10E-05 | 2.08E-05 |
|                                  |                               | µg/dscm     | 52.2     | 42.5     | 48.1     | 47.6     |
|                                  |                               | ppmvd       | 6.28E-02 | 5.11E-02 | 5.78E-02 | 5.72E-02 |
|                                  | Mass                          | lb/hr       | 3.70E-03 | 2.96E-03 | 3.34E-03 | 3.33E-03 |
|                                  |                               | lb/lb glass | 3.33E-05 | 2.67E-05 | 3.01E-05 | 3.00E-05 |
| Production Data                  | Glass Production              | lbs/hr      | 111.1    | 111.1    | 111.1    | 111.1    |

"<" represents MDL value

**EPA Methods 1-4, 26A**  
**Example Calculations**

**Client: Hollingsworth & Vose**  
**Location: Corvallis, OR**  
**Source: CFU 117**  
**Method: 26A**

**Run: 1**  
**Start Time: 8:40**  
**End Time: 9:44**  
**Date: 5/1/2018**

**EPA Methods 1-4:**

$$1) \quad P_m = P_b + (\Delta H/13.6) = 30.215 \text{ "Hg}$$

where  $P_b$ : 30.00 "Hg  
 $\Delta H$ : 2.925 "H<sub>2</sub>O

$$2) \quad P_s = P_b + (\text{Static Press.}/13.6) = 30.044 \text{ "Hg}$$

where  $P_b$ : 30.00 "Hg  
 Static Press.: 0.60 "H<sub>2</sub>O

$$3) \quad V_m(\text{std}) = V_m(17.64)(Y)\left(\frac{P_m}{T_m}\right) = 57.663 \text{ dscf}$$

where  $V_m$ : 56.572 dcf  
 $Y$ : 0.9820  
 $P_m$ : 30.215 "Hg  
 $T_m$ : 513.5 °A

$$4) \quad V_w(\text{std}) = (0.04706)(H_2O) = 0.800 \text{ scf}$$

where  $H_2O$ : 17.00 g

$$5) \quad Bws = \left( \frac{Vw(\text{std})}{Vw(\text{std}) + Vm(\text{std})} \right) = 0.0137$$

where  $Vw(\text{std})$ : 0.800 scf  
 $Vm(\text{std})$ : 57.663 dscf

$$6) \quad \% H_2O = Bws \times 100 = 1.37 \%v$$

$$7) \quad V_m(\text{actual}) = \left( \frac{Y \times Vm}{(1 - Bws)} \right) \left( \frac{T_s}{T_m} \right) \left( \frac{P_m}{P_s} \right) = 79.404 \text{ awcf}$$

where  $Y$ : 0.9820  
 $Vm$ : 56.5720 dcf  
 $Bws$ : 0.0137  
 $T_s$ : 719.8 °A  
 $T_m$ : 513.5 °A  
 $P_m$ : 30.215 "Hg  
 $P_s$ : 30.044 "Hg

$$8) \quad M_d = 0.44(CO_2) + 0.32(O_2) + 0.28(N_2 + CO) = 28.90 \text{ lb/lb-mole}$$

where  $CO_2$ : 0.67 %vd  
 $O_2$ : 19.89 %vd  
 $N_2 + CO = (100 - (O_2 + CO_2))$ : 79.44 %vd

9)  $M_s = M_d(1 - Bws) + (18 \times Bws) =$  28.75 lb/lb-mole  
       where  $M_d$ : 28.90 lb/lb-mole  
       Bws: 0.0137

10) Stack Area(cir.) =  $3.1416 (\text{stack diameter}/24)^2 =$  4.909 sq. ft.  
       where Stack ID: 30 inches

Stack Area(rect.) = stack width/12 x stack length/12 = NA sq. ft.  
       where Stack Width: 0.000 inches  
       Stack Length: 0.000 inches

11) Velocity,  $V_s = 85.49(Cp)(\text{Ave. Sqrt } \Delta P) \left( \sqrt{\frac{T_s}{(P_s \times M_s)}} \right) =$  88.39 fps  
       where Cp: 0.84  
       Ave. Sqrt  $\Delta P$ : 1.3483  
       Ts: 719.8 °A  
       Ps: 30.044 "Hg  
       Ms: 28.75 lb/lb-mole

12) AWCfm =  $(V_s)(\text{stack area})(60 \text{ sec/min}) =$  26,034.4 AWCfm  
       where  $V_s$ : 88.39 ft/sec  
       Stack Area: 4.909 sq. ft

13) ADCfm =  $(\text{AWCFM})(1-Bws) =$  25,677.7 ADCfm  
       where AWCfm: 26,034.4  
       Bws: 0.0137

14)  $Q_{sw} = 3600(V_s)(\text{stack area}) \left( \frac{528^\circ A}{T_s} \right) \left( \frac{P_s}{29.92 \text{ "Hg}} \right) =$  1,150,580.2 wscf/hr  
       where  $V_s$ : 88.39 ft/sec  
       Stack Area: 4.9090 sq. ft.  
       Ts: 719.8 °A  
       Ps: 30.044 "Hg

15)  $Q_{sd} = (\text{wscf/hr})(1-Bws) =$  1,134,817.3 dscf/hr  
       where wscf/hr: 1,150,580.2  
       Bws: 0.0137

16) DSCFM =  $(\text{dscf/hr})/60 \text{ mins/hr} =$  18,913.6 DSCFM  
       where dscf/hr: 1,134,817.3

17) Nozzle Area =  $3.1416 (\text{Nozzle Size}/24)^2 =$  0.000250 sq. ft.  
       where Nozzle Size: 0.2140 inches

Client: Hollingsworth & Vose  
Source: CFU 117

Run: 1  
Date: 5/1/2018

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$$18) \text{ Isokinetic } \% = \left( \frac{0.0945(Ts)(Vm(std))}{Ps(Vs)(\text{nozzle area})(\text{sampling time})(1-Bws)} \right) = 99.8 \%$$

where Ts: 719.8 °A  
Vm(Std): 57.663 dscf  
Ps: 30.044 "Hg  
Vs: 88.39 ft/sec  
Nozzle Area: 0.000250 sq. ft.  
Sampling Time: 60 min.  
Bws: 0.0137

#### EPA Method 26A:

$$19) \text{ HF laboratory results} = 85.3 \text{ } \mu\text{g/sample}$$

$$20) \text{ HF} = (\mu\text{g/sample})/1,000,000 = 8.53\text{E-}05 \text{ grams/sample}$$

$$21) \text{ Cs} = (\text{Sample grams}/Vm(\text{Std}))(\text{15.43 grains/gram}) = 2.28\text{E-}05 \text{ gr/dscf}$$

where Sample: 0.00009 grams  
Vm(std) 57.663 dscf

$$22) \text{ Cs} = (\text{Sample grams} \times 1,000,000 \text{ } \mu\text{g/gram})/Vm(\text{std}) = 52.2 \text{ } \mu\text{g/dscm}$$

where Sample: 0.00009 grams  
Vm(std) 1.633 dscm

$$23) \text{ Volume/Mole} = \left( \frac{359(Ts)(29.92"Hg)}{492(Ps)} \right) = 523.052 \text{ Vol./Mole}$$

where Ts: 719.8 °A  
Ps: 30.044 "Hg

$$24) \text{ ppmvd} = \left( \frac{\frac{\text{lb}}{\text{hr}} \times \frac{\text{Vol.}}{\text{Mole}}}{(MW \times 0.00006 \times \text{ADCFM})} \right) = 6.28\text{E-}02 \text{ ppmvd}$$

where MW: 20.01 g/mol  
lb/hr: 0.00  
Vol./Mole: 523.052  
ADCFM: 25677.7

$$25) \text{ Mass Emission Rate} = (\text{Cs})(\text{Stack flow})/7000\text{gr/lb} = 3.70\text{E-}03 \text{ lb/hr}$$

where Cs: 2.28E-05 gr/dscf  
Stack Flow: 1,134,817.3 dscf/hr

### BISON ENGINEERING GASEOUS SUMMARY SPREADSHEET

|          |                        |        |             |
|----------|------------------------|--------|-------------|
| Company  | Hollingsworth and Vose | Source | CFU 117     |
| Facility | Glass Plant 2          | Date   | May 1, 2018 |
| Location | Corvallis, OR          |        |             |

|            |          |          |          |
|------------|----------|----------|----------|
| Test date  | 5/1/2018 | 5/1/2018 | 5/1/2018 |
| Start time | 8:40     | 9:57     | 11:10    |
| End time   | 9:44     | 11:01    | 12:14    |
| Test run   | 1        | 2        | 3        |

| E M I S S I O N S |                                                 |                 |   |       |       |       | Average |
|-------------------|-------------------------------------------------|-----------------|---|-------|-------|-------|---------|
| Meth 3A           | Oxygen Concentration (O <sub>2</sub> )          | O <sub>2</sub>  | % | 19.89 | 19.85 | 19.90 | 19.88   |
|                   | Carbon Dioxide Concentration (CO <sub>2</sub> ) | CO <sub>2</sub> | % | 0.67  | 0.67  | 0.69  | 0.68    |



**Bison Engineering, Inc.**  
**Method 3A Oxygen**  
*Calibration Error, System Bias and System Drift*

|           |                        |        |             |                      |              |
|-----------|------------------------|--------|-------------|----------------------|--------------|
| Company:  | Hollingsworth and Vose | Source | CFU 117     | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2          | Date   | May 1, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR          |        |             | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>        |                           |                                           |           | <i>Final Values</i>       |                                            |           |                           |           |                  | Raw Avg<br>Gas<br>Conc | Corrected<br>Gas<br>Conc | Instrument<br>Cal.<br>Reference<br>Gas |
|-------|---------|------------------------------|---------------------------|-------------------------------------------|-----------|---------------------------|--------------------------------------------|-----------|---------------------------|-----------|------------------|------------------------|--------------------------|----------------------------------------|
|       |         | Analyzer<br>Cal.<br>Response | System<br>Cal<br>Response | Pre test<br>System Cal. Bias<br>% of span | pass/fail | System<br>Cal<br>Response | Post test<br>System Cal. Bias<br>% of span | pass/fail | System Drift<br>% of span | pass/fail | Analyzer<br>Span |                        |                          |                                        |
| Run 1 | zero    | 0.01                         | 0.01                      | 0.00                                      | pass      | 0.04                      | 0.15                                       | pass      | 0.15                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.97                         | 9.92                      | -0.25                                     | pass      | 9.91                      | -0.30                                      | pass      | -0.05                     | pass      | 20               | 19.70                  | 19.89                    | 10                                     |
| Run 2 | zero    | 0.01                         | 0.04                      | 0.15                                      | pass      | 0.06                      | 0.25                                       | pass      | 0.10                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.97                         | 9.91                      | -0.30                                     | pass      | 9.86                      | -0.55                                      | pass      | -0.25                     | pass      | 20               | 19.57                  | 19.85                    | 10                                     |
| Run 3 | zero    | 0.01                         | 0.06                      | 0.25                                      | pass      | 0.06                      | 0.25                                       | pass      | 0.00                      | pass      |                  |                        |                          |                                        |
|       | upscale | 9.97                         | 9.86                      | -0.55                                     | pass      | 9.87                      | -0.50                                      | pass      | 0.05                      | pass      | 20               | 19.57                  | 19.90                    | 10                                     |
|       |         |                              |                           | < 5%*                                     |           | < 5%*                     |                                            | < 3%*     |                           |           |                  |                        |                          |                                        |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High  |
|----------------------------|------|-------|-------|
| Calibration gas standards  | 0    | 10    | 20    |
| Cal gas analyzer response  | 0.01 | 9.97  | 20.05 |
| Analyzer Cal. Error        | 0.05 | -0.15 | 0.25  |
| Analyzer Cal. Error <2%*   | pass | pass  | pass  |

\*Or <0.5% O<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 3A Carbon Dioxide**  
*Calibration Error, System Bias and System Drift*

|           |                        |        |             |                      |              |
|-----------|------------------------|--------|-------------|----------------------|--------------|
| Company:  | Hollingsworth and Vose | Source | CFU 117     | Instrument Make:     | Servomex     |
| Facility: | Glass Plant 2          | Date   | May 1, 2018 | Instrument Model:    | 1440         |
| Location: | Corvallis, OR          |        |             | Instrument Serial #: | 01440D1-5041 |

|       |         | <i>Initial Values</i>  |                     |                                     |           | <i>Final Values</i> |                                      |           |                        |           |               | Raw Avg Gas Conc | Corrected Gas Conc | Instrument Cal. Reference Gas |
|-------|---------|------------------------|---------------------|-------------------------------------|-----------|---------------------|--------------------------------------|-----------|------------------------|-----------|---------------|------------------|--------------------|-------------------------------|
|       |         | Analyzer Cal. Response | System Cal Response | Pre test System Cal. Bias % of span | pass/fail | System Cal Response | Post test System Cal. Bias % of span | pass/fail | System Drift % of span | pass/fail | Analyzer Span |                  |                    |                               |
| Run 1 | zero    | 0.05                   | 0.08                | 0.75                                | pass      | 0.06                | 0.25                                 | pass      | -0.50                  | pass      |               |                  |                    |                               |
|       | upscale | 1.90                   | 1.95                | 1.25                                | pass      | 1.95                | 1.25                                 | pass      | 0.00                   | pass      | 4.0           | 0.70             | 0.67               | 2                             |
| Run 2 | zero    | 0.05                   | 0.06                | 0.25                                | pass      | 0.05                | 0.00                                 | pass      | -0.25                  | pass      |               |                  |                    |                               |
|       | upscale | 1.90                   | 1.95                | 1.25                                | pass      | 1.94                | 1.00                                 | pass      | -0.25                  | pass      | 4.0           | 0.69             | 0.67               | 2                             |
| Run 3 | zero    | 0.05                   | 0.05                | 0.00                                | pass      | 0.05                | 0.00                                 | pass      | 0.00                   | pass      |               |                  |                    |                               |
|       | upscale | 1.90                   | 1.94                | 1.00                                | pass      | 1.91                | 0.25                                 | pass      | -0.75                  | pass      | 4.0           | 0.70             | 0.69               | 2                             |
|       |         |                        |                     | < 5%*                               |           | < 5%*               |                                      | < 3%*     |                        |           |               |                  |                    |                               |

| <i>ANALYZER CAL. ERROR</i> | Zero | Mid   | High |
|----------------------------|------|-------|------|
| Calibration gas standards  | 0    | 2     | 4.0  |
| Cal gas analyzer response  | 0.05 | 1.9   | 4.05 |
| Analyzer Cal. Error        | 1.25 | -2.50 | 1.25 |
| Analyzer Cal. Error < 2%*  | pass | pass  | pass |

\*Or <0.5% CO<sub>2</sub> absolute difference

**Bison Engineering, Inc.**  
**Method 205 Dilution System Check**

|           |                        |         |             |                      |            |
|-----------|------------------------|---------|-------------|----------------------|------------|
| Company:  | Hollingsworth and Vose | Source: | CFU 117     | Instrument Make:     | EnviroNics |
| Facility: | Glass Plant 2          | Date:   | May 1, 2018 | Instrument Model:    | 4040       |
| Location: | Corvallis, OR          |         |             | Instrument Serial #: | 3880       |

|                                                |                 | First | Second | Third | Average |
|------------------------------------------------|-----------------|-------|--------|-------|---------|
| High Level                                     | 10 % oxygen     | 10.03 | 10.08  | 10.07 | 10.06   |
| Percent diff from avg recorded value           | dilution system | -0.3% | 0.2%   | 0.1%  |         |
| Pass or Fail +/- 2%                            |                 | PASS  | PASS   | PASS  |         |
| Percent diff from target of 10% O <sub>2</sub> |                 | 0.3%  | 0.8%   | 0.7%  | 0.6%    |
| Pass or Fail +/- 2% from target value          |                 |       |        |       | PASS    |

|                                               |                 |       |      |      |      |
|-----------------------------------------------|-----------------|-------|------|------|------|
| Mid Level                                     | 5 % oxygen      | 5.00  | 5.02 | 5.03 | 5.02 |
| Percent diff from avg recorded value          | dilution system | -0.3% | 0.1% | 0.3% |      |
| Pass or Fail +/- 2%                           |                 | PASS  | PASS | PASS |      |
| Percent diff from target of 5% O <sub>2</sub> |                 | 0.0%  | 0.4% | 0.6% | 0.3% |
| Pass or Fail +/- 2% from target value         |                 |       |      |      | PASS |

|                             |             |      |      |      |      |            |       |
|-----------------------------|-------------|------|------|------|------|------------|-------|
| Independent Mid Level Check | 5% oxygen   | 9.91 | 9.92 | 9.93 | 9.92 | Tank value | 9.893 |
|                             | independent |      |      |      |      | 0.27%      |       |
|                             | tank check  |      |      |      |      | PASS       |       |

**Summary - Method 205 - Verification of Gas Dilution Systems for Field Instrument Calibrations**

A gas dilution system can provide known values of calibration gases through controlled dilution of high-level calibration gases with an appropriate dilution gas. The calibration gases with an appropriate dilution gas. The instrumental test methods in 40 CFR part 60 - e.g., Methods 3A, 6C, 7E, 10, 15, 16, 20, 25A and 25B require on-site, multi-point point calibration using gases of known concentrations. A gas dilution system that produces known low level calibration gases from high-level calibration gases, with a degree of confidence similar to that for Protocol 1 gases, may be used for compliance tests in lieu of multiple calibration gases when the gas dilution system is demonstrated to meet the requirements of this method.

The gas dilution system shall be evaluated on one analyzer once during each field test. A precalibrated analyzer is chosen, at the discretion of the source owner or operator, to demonstrate that the gas dilution system produces predictable gas concentrations spanning a range of concentrations. After meeting the requirements of this method, the remaining analyzers may be calibrated with the dilution system in accordance to the requirements of the applicable method for the duration of the field test.

The gas dilution system shall produce calibration gases whose measured values are within  $\pm 2$  percent of the predicted values.

**Instructions from Method 205**

3.2.2 Calculate the predicted concentration for each of the dilutions based on the flow rates through the gas dilution system (or the dilution ratios) and the certified concentration of the high - level supply gas.

3.2.3 Introduce each of the dilutions from Section 3.2.1 into the analyzer or monitor one at a time and determine the instrument response for each of the dilutions.

3.2.4 Repeat the procedure in Section 3.2.3 two times, i.e., until three injections are made at dilution level. Calculate the average instrument response for each triplicate injection at each dilution level. No single injection shall differ by more than  $\pm 2$  percent from the average instrument response for that dilution.

3.2.5 For each level of dilution, calculate the difference between the average concentration output recorded by the analyzer and the predicted concentration calculated in Section 3.2.2. The average concentration output from the analyzer shall be within  $\pm 2$  percent of the predicted value.

3.2.6 Introduce the mid - level supply gas directly into the analyzer, bypassing the gas dilution system. Repeat the procedure twice more, for a total of three mid-level supply gas injections.

Calculate the average analyzer output concentration for the mid-level supply gas. The difference between the certified concentration of the mid-level supply gas and the average instrument response shall be within  $\pm 2$  percent.

3.3 If the gas dilution system meets the criteria listed in Section 3.2, the gas dilution system may be used throughout that field test.

**Hollingsworth & Vose****5/1/2018****CFU 117****Daily Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 7:54:03 | 20.35  | 0.11    |        |         |
| 5/1/2018 | 7:54:13 | 20.36  | 0.11    |        |         |
| 5/1/2018 | 7:54:23 | 20.34  | 0.11    |        |         |
| 5/1/2018 | 7:54:33 | 20.27  | 0.11    |        |         |
| 5/1/2018 | 7:54:43 | 20.27  | 0.11    |        |         |
| 5/1/2018 | 7:54:53 | 20.02  | 0.11    |        |         |
| 5/1/2018 | 7:55:03 | 3.93   | 0.05    |        |         |
| 5/1/2018 | 7:55:13 | -0.65  | 0.05    |        |         |
| 5/1/2018 | 7:55:23 | -0.71  | 0.04    |        |         |
| 5/1/2018 | 7:55:33 | -0.37  | 0.04    |        |         |
| 5/1/2018 | 7:55:43 | 0.02   | 0.05    |        |         |
| 5/1/2018 | 7:55:53 | 0.09   | 0.05    |        |         |
| 5/1/2018 | 7:56:03 | 0.08   | 0.05    |        |         |
| 5/1/2018 | 7:56:13 | 0.05   | 0.05    |        |         |
| 5/1/2018 | 7:56:23 | 0.05   | 0.05    |        |         |
| 5/1/2018 | 7:56:33 | 0.09   | 0.04    |        |         |
| 5/1/2018 | 7:56:43 | 0.05   | 0.05    |        |         |
| 5/1/2018 | 7:56:53 | 0.01   | 0.05    |        |         |
| 5/1/2018 | 7:57:03 | 0.02   | 0.05    |        |         |
| 5/1/2018 | 7:57:13 | 0.01   | 0.05    |        |         |
| 5/1/2018 | 7:57:23 | 0.01   | 0.05    | 0.01   | 0.05    |
| 5/1/2018 | 7:57:33 | 15.87  | 12.16   |        |         |
| 5/1/2018 | 7:57:43 | 21.15  | 19.36   |        |         |
| 5/1/2018 | 7:57:53 | 20.32  | 19.37   |        |         |
| 5/1/2018 | 7:58:03 | 20.10  | 19.45   |        |         |
| 5/1/2018 | 7:58:13 | 20.05  | 19.48   |        |         |
| 5/1/2018 | 7:58:23 | 20.06  | 19.46   |        |         |
| 5/1/2018 | 7:58:33 | 20.05  | 19.48   |        |         |
| 5/1/2018 | 7:58:43 | 20.03  | 19.51   | 20.05  |         |
| 5/1/2018 | 7:58:53 | 17.37  | 12.38   |        |         |
| 5/1/2018 | 7:59:03 | 10.19  | 0.29    |        |         |
| 5/1/2018 | 7:59:13 | 9.91   | 0.11    |        |         |
| 5/1/2018 | 7:59:23 | 9.92   | 0.11    |        |         |
| 5/1/2018 | 7:59:33 | 9.95   | 0.07    |        |         |
| 5/1/2018 | 7:59:43 | 9.98   | 0.07    |        |         |
| 5/1/2018 | 7:59:53 | 9.98   | 0.07    | 9.97   |         |
| 5/1/2018 | 8:00:03 | 8.93   | 0.08    |        |         |
| 5/1/2018 | 8:00:13 | 9.67   | 4.40    |        |         |
| 5/1/2018 | 8:00:23 | 4.82   | 3.27    |        |         |
| 5/1/2018 | 8:00:33 | 3.70   | 3.95    |        |         |

**Hollingsworth & Vose****5/1/2018****CFU 117****Daily Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 8:00:43 | 3.79   | 4.01    |        |         |
| 5/1/2018 | 8:00:53 | 3.82   | 4.04    |        |         |
| 5/1/2018 | 8:01:03 | 3.85   | 4.06    |        |         |
| 5/1/2018 | 8:01:13 | 3.86   | 4.05    |        |         |
| 5/1/2018 | 8:01:23 | 3.87   | 4.04    |        | 4.05    |
| 5/1/2018 | 8:01:33 | 3.82   | 3.78    |        |         |
| 5/1/2018 | 8:01:43 | 2.54   | 1.82    |        |         |
| 5/1/2018 | 8:01:53 | 2.17   | 1.91    |        |         |
| 5/1/2018 | 8:02:03 | 2.14   | 1.90    |        |         |
| 5/1/2018 | 8:02:13 | 2.14   | 1.90    |        |         |
| 5/1/2018 | 8:02:23 | 2.13   | 1.90    |        |         |
| 5/1/2018 | 8:02:33 | 2.14   | 1.91    |        |         |
| 5/1/2018 | 8:02:43 | 2.17   | 1.90    |        | 1.90    |
| 5/1/2018 | 8:02:53 | 22.29  | 0.53    |        |         |
| 5/1/2018 | 8:03:03 | 17.97  | 0.54    |        |         |
| 5/1/2018 | 8:03:13 | 15.07  | 0.61    |        |         |
| 5/1/2018 | 8:03:23 | 8.56   | 0.15    |        |         |
| 5/1/2018 | 8:03:33 | 4.15   | 0.09    |        |         |

**System**

|          |         |      |      |
|----------|---------|------|------|
| 5/1/2018 | 8:03:43 | 3.91 | 0.08 |
| 5/1/2018 | 8:03:53 | 3.90 | 0.09 |
| 5/1/2018 | 8:04:03 | 4.42 | 0.09 |
| 5/1/2018 | 8:04:13 | 6.76 | 0.09 |
| 5/1/2018 | 8:04:23 | 1.15 | 0.08 |
| 5/1/2018 | 8:04:33 | 0.24 | 0.08 |
| 5/1/2018 | 8:04:43 | 0.17 | 0.08 |
| 5/1/2018 | 8:04:53 | 0.16 | 0.08 |
| 5/1/2018 | 8:05:03 | 0.16 | 0.08 |
| 5/1/2018 | 8:05:13 | 0.16 | 0.08 |
| 5/1/2018 | 8:05:23 | 0.16 | 0.08 |
| 5/1/2018 | 8:05:33 | 0.15 | 0.08 |
| 5/1/2018 | 8:05:43 | 0.02 | 0.08 |
| 5/1/2018 | 8:05:53 | 0.02 | 0.08 |
| 5/1/2018 | 8:06:03 | 0.02 | 0.08 |
| 5/1/2018 | 8:06:13 | 0.02 | 0.09 |
| 5/1/2018 | 8:06:23 | 0.02 | 0.08 |
| 5/1/2018 | 8:06:33 | 0.01 | 0.08 |
| 5/1/2018 | 8:06:43 | 0.01 | 0.08 |

**Hollingsworth & Vose****5/1/2018****CFU 117****Daily Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 8:06:53 | 0.01   | 0.09    | 0.01   | 0.08    |
| 5/1/2018 | 8:07:03 | 0.01   | 0.09    |        |         |
| 5/1/2018 | 8:07:13 | 4.91   | 0.11    |        |         |
| 5/1/2018 | 8:07:23 | 2.00   | 0.10    |        |         |
| 5/1/2018 | 8:07:33 | 2.00   | 0.09    |        |         |
| 5/1/2018 | 8:07:43 | 2.51   | 0.67    |        |         |
| 5/1/2018 | 8:07:53 | 2.58   | 1.39    |        |         |
| 5/1/2018 | 8:08:03 | 2.60   | 1.54    |        |         |
| 5/1/2018 | 8:08:13 | 2.78   | 2.21    |        |         |
| 5/1/2018 | 8:08:23 | 2.22   | 1.79    |        |         |
| 5/1/2018 | 8:08:33 | 2.48   | 1.85    |        |         |
| 5/1/2018 | 8:08:43 | 2.21   | 1.86    |        |         |
| 5/1/2018 | 8:08:53 | 2.17   | 1.86    |        |         |
| 5/1/2018 | 8:09:03 | 2.14   | 1.86    |        |         |
| 5/1/2018 | 8:09:13 | 2.13   | 1.86    |        |         |
| 5/1/2018 | 8:09:23 | 2.12   | 1.86    |        |         |
| 5/1/2018 | 8:09:33 | 2.13   | 1.86    |        |         |
| 5/1/2018 | 8:09:43 | 2.13   | 1.87    |        |         |
| 5/1/2018 | 8:09:53 | 2.13   | 1.88    |        |         |
| 5/1/2018 | 8:10:03 | 2.13   | 1.96    |        |         |
| 5/1/2018 | 8:10:13 | 2.12   | 1.95    |        |         |
| 5/1/2018 | 8:10:23 | 2.07   | 1.95    |        |         |
| 5/1/2018 | 8:10:33 | 2.08   | 1.96    |        |         |
| 5/1/2018 | 8:10:43 | 2.08   | 1.95    |        |         |
| 5/1/2018 | 8:10:53 | 2.08   | 1.95    |        |         |
| 5/1/2018 | 8:11:03 | 2.08   | 1.96    |        |         |
| 5/1/2018 | 8:11:13 | 2.09   | 1.95    |        |         |
| 5/1/2018 | 8:11:23 | 2.08   | 1.95    |        |         |
| 5/1/2018 | 8:11:33 | 2.09   | 1.95    |        |         |
| 5/1/2018 | 8:11:43 | 2.08   | 1.95    |        | 1.95    |
| 5/1/2018 | 8:11:53 | 2.93   | 2.80    |        |         |
| 5/1/2018 | 8:12:03 | 9.06   | 9.34    |        |         |
| 5/1/2018 | 8:12:13 | 9.79   | 9.70    |        |         |
| 5/1/2018 | 8:12:23 | 9.76   | 9.68    |        |         |
| 5/1/2018 | 8:12:33 | 9.74   | 9.69    |        |         |
| 5/1/2018 | 8:12:43 | 9.74   | 9.68    |        |         |
| 5/1/2018 | 8:12:53 | 9.77   | 9.69    |        |         |
| 5/1/2018 | 8:13:03 | 9.69   | 9.69    |        |         |
| 5/1/2018 | 8:13:13 | 9.68   | 9.69    |        |         |
| 5/1/2018 | 8:13:23 | 9.69   | 9.68    |        |         |

**Hollingsworth & Vose****5/1/2018****CFU 117****Daily Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 8:13:33 | 9.71   | 9.69    |        |         |
| 5/1/2018 | 8:13:43 | 9.72   | 9.69    |        |         |
| 5/1/2018 | 8:13:53 | 9.71   | 9.69    |        |         |
| 5/1/2018 | 8:14:03 | 9.71   | 9.69    |        |         |
| 5/1/2018 | 8:14:13 | 9.70   | 9.69    |        |         |
| 5/1/2018 | 8:14:23 | 9.70   | 9.69    |        |         |
| 5/1/2018 | 8:14:33 | 9.70   | 9.70    |        |         |
| 5/1/2018 | 8:14:43 | 9.71   | 9.70    |        |         |
| 5/1/2018 | 8:14:53 | 9.71   | 9.70    |        |         |
| 5/1/2018 | 8:15:03 | 9.70   | 9.70    |        |         |
| 5/1/2018 | 8:15:13 | 9.69   | 9.70    |        |         |
| 5/1/2018 | 8:15:23 | 9.74   | 9.71    |        |         |
| 5/1/2018 | 8:15:33 | 9.76   | 9.71    |        |         |
| 5/1/2018 | 8:15:43 | 9.76   | 9.73    |        |         |
| 5/1/2018 | 8:15:53 | 9.75   | 9.73    |        |         |
| 5/1/2018 | 8:16:03 | 9.75   | 9.72    |        |         |
| 5/1/2018 | 8:16:13 | 9.75   | 9.73    |        |         |
| 5/1/2018 | 8:16:23 | 9.75   | 9.73    |        |         |
| 5/1/2018 | 8:16:33 | 9.75   | 9.74    |        |         |
| 5/1/2018 | 8:16:43 | 9.74   | 9.73    |        |         |
| 5/1/2018 | 8:16:53 | 9.74   | 9.73    |        |         |
| 5/1/2018 | 8:17:03 | 9.74   | 9.74    |        |         |
| 5/1/2018 | 8:17:13 | 9.74   | 9.73    |        |         |
| 5/1/2018 | 8:17:23 | 13.30  | 6.61    |        |         |
| 5/1/2018 | 8:17:33 | 10.93  | 8.79    |        |         |
| 5/1/2018 | 8:17:43 | 9.59   | 9.82    |        |         |
| 5/1/2018 | 8:17:53 | 9.52   | 9.90    |        |         |
| 5/1/2018 | 8:18:03 | 9.51   | 9.91    |        |         |
| 5/1/2018 | 8:18:13 | 9.52   | 9.91    |        |         |
| 5/1/2018 | 8:18:23 | 9.45   | 9.91    |        |         |
| 5/1/2018 | 8:18:33 | 9.75   | 9.92    |        |         |
| 5/1/2018 | 8:18:43 | 9.97   | 9.91    |        |         |
| 5/1/2018 | 8:18:53 | 9.97   | 9.91    |        |         |
| 5/1/2018 | 8:19:03 | 9.97   | 9.91    |        |         |
| 5/1/2018 | 8:19:13 | 9.97   | 9.92    |        |         |
| 5/1/2018 | 8:19:23 | 9.97   | 9.91    |        |         |
| 5/1/2018 | 8:19:33 | 9.93   | 9.91    |        |         |
| 5/1/2018 | 8:19:43 | 9.92   | 9.92    |        |         |
| 5/1/2018 | 8:19:53 | 9.92   | 9.91    |        |         |
| 5/1/2018 | 8:20:03 | 9.92   | 9.92    |        |         |

**Hollingsworth & Vose****5/1/2018****CFU 117****Daily Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 8:20:13 | 9.92   | 9.91    |        |         |
| 5/1/2018 | 8:20:23 | 9.92   | 9.91    |        |         |
| 5/1/2018 | 8:20:33 | 9.92   | 9.91    |        |         |
| 5/1/2018 | 8:20:43 | 9.92   | 9.92    |        |         |
| 5/1/2018 | 8:20:53 | 9.92   | 9.92    | 9.92   |         |



**Hollingsworth & Vose****5/1/2018****CFU 117****Run 1**

| Date     | Time    | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|
| 5/1/2018 | 8:40:47 | 19.85  | 0.71    |
| 5/1/2018 | 8:41:47 | 19.83  | 0.71    |
| 5/1/2018 | 8:42:47 | 19.82  | 0.71    |
| 5/1/2018 | 8:43:47 | 19.81  | 0.71    |
| 5/1/2018 | 8:44:47 | 19.80  | 0.70    |
| 5/1/2018 | 8:45:47 | 19.78  | 0.70    |
| 5/1/2018 | 8:46:47 | 19.78  | 0.70    |
| 5/1/2018 | 8:47:47 | 19.77  | 0.70    |
| 5/1/2018 | 8:48:47 | 19.75  | 0.70    |
| 5/1/2018 | 8:49:47 | 19.75  | 0.70    |
| 5/1/2018 | 8:50:47 | 19.74  | 0.69    |
| 5/1/2018 | 8:51:47 | 19.74  | 0.69    |
| 5/1/2018 | 8:52:47 | 19.74  | 0.69    |
| 5/1/2018 | 8:53:47 | 19.74  | 0.69    |
| 5/1/2018 | 8:54:47 | 19.74  | 0.69    |
| 5/1/2018 | 8:55:47 | 19.73  | 0.69    |
| 5/1/2018 | 8:56:47 | 19.73  | 0.69    |
| 5/1/2018 | 8:57:47 | 19.72  | 0.70    |
| 5/1/2018 | 8:58:47 | 19.72  | 0.71    |
| 5/1/2018 | 8:59:47 | 19.72  | 0.71    |
| 5/1/2018 | 9:00:47 | 19.71  | 0.71    |
| 5/1/2018 | 9:01:47 | 19.71  | 0.71    |
| 5/1/2018 | 9:02:47 | 19.71  | 0.71    |
| 5/1/2018 | 9:03:47 | 19.70  | 0.71    |
| 5/1/2018 | 9:04:47 | 19.71  | 0.71    |
| 5/1/2018 | 9:05:47 | 19.71  | 0.72    |
| 5/1/2018 | 9:06:47 | 19.70  | 0.72    |
| 5/1/2018 | 9:07:47 | 19.70  | 0.72    |
| 5/1/2018 | 9:08:47 | 19.70  | 0.72    |
| 5/1/2018 | 9:09:47 | 19.69  | 0.72    |
| 5/1/2018 | 9:10:47 | 19.69  | 0.72    |
| 5/1/2018 | 9:11:47 | 19.69  | 0.72    |
| 5/1/2018 | 9:12:47 | 19.69  | 0.72    |
| 5/1/2018 | 9:13:47 | 19.69  | 0.71    |
| 5/1/2018 | 9:14:47 | 19.69  | 0.71    |
| 5/1/2018 | 9:15:47 | 19.69  | 0.71    |
| 5/1/2018 | 9:16:47 | 19.69  | 0.71    |
| 5/1/2018 | 9:17:47 | 19.68  | 0.70    |
| 5/1/2018 | 9:18:47 | 19.68  | 0.70    |
| 5/1/2018 | 9:19:47 | 19.68  | 0.70    |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 1**

| Date      | Time    | O2 [%]       | CO2 [%]     |
|-----------|---------|--------------|-------------|
| 5/1/2018  | 9:20:47 | 19.67        | 0.70        |
| 5/1/2018  | 9:21:47 | 19.67        | 0.69        |
| 5/1/2018  | 9:22:47 | 19.67        | 0.69        |
| 5/1/2018  | 9:23:47 | 19.67        | 0.69        |
| 5/1/2018  | 9:24:47 | 19.67        | 0.69        |
| 5/1/2018  | 9:25:47 | 19.66        | 0.69        |
| 5/1/2018  | 9:26:47 | 19.66        | 0.69        |
| 5/1/2018  | 9:27:47 | 19.66        | 0.69        |
| 5/1/2018  | 9:28:47 | 19.66        | 0.69        |
| 5/1/2018  | 9:29:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:30:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:31:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:32:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:33:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:34:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:35:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:36:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:37:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:38:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:39:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:40:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:41:47 | 19.66        | 0.70        |
| 5/1/2018  | 9:42:47 | 19.65        | 0.70        |
| Averages: |         | <b>19.70</b> | <b>0.70</b> |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 1 Post Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 9:42:57 | 19.66  | 0.70    |        |         |
| 5/1/2018 | 9:43:07 | 19.65  | 0.69    |        |         |
| 5/1/2018 | 9:43:17 | 19.65  | 0.70    |        |         |
| 5/1/2018 | 9:43:27 | 19.65  | 0.69    |        |         |
| 5/1/2018 | 9:43:37 | 19.65  | 0.70    |        |         |
| 5/1/2018 | 9:43:47 | 19.65  | 0.69    |        |         |
| 5/1/2018 | 9:43:57 | 19.65  | 0.70    |        |         |
| 5/1/2018 | 9:44:07 | 19.66  | 0.70    |        |         |
| 5/1/2018 | 9:44:17 | 19.66  | 0.70    |        |         |
| 5/1/2018 | 9:44:27 | 19.53  | 0.83    |        |         |
| 5/1/2018 | 9:44:37 | 14.59  | 6.33    |        |         |
| 5/1/2018 | 9:44:47 | 10.70  | 9.94    |        |         |
| 5/1/2018 | 9:44:57 | 10.00  | 9.94    |        |         |
| 5/1/2018 | 9:45:07 | 9.92   | 9.95    |        |         |
| 5/1/2018 | 9:45:17 | 9.92   | 9.97    |        |         |
| 5/1/2018 | 9:45:27 | 9.91   | 9.97    |        |         |
| 5/1/2018 | 9:45:37 | 9.91   | 9.98    |        |         |
| 5/1/2018 | 9:45:47 | 9.91   | 9.98    |        |         |
| 5/1/2018 | 9:45:57 | 9.91   | 9.98    |        |         |
| 5/1/2018 | 9:46:07 | 9.91   | 9.98    |        |         |
| 5/1/2018 | 9:46:17 | 9.91   | 9.98    |        |         |
| 5/1/2018 | 9:46:27 | 9.91   | 9.99    |        |         |
| 5/1/2018 | 9:46:37 | 9.91   | 9.98    |        |         |
| 5/1/2018 | 9:46:47 | 9.91   | 9.99    | 9.91   |         |
| 5/1/2018 | 9:46:57 | 5.80   | 5.31    |        |         |
| 5/1/2018 | 9:47:07 | 1.62   | 1.49    |        |         |
| 5/1/2018 | 9:47:17 | 1.99   | 1.95    |        |         |
| 5/1/2018 | 9:47:27 | 2.00   | 1.95    |        |         |
| 5/1/2018 | 9:47:37 | 2.00   | 1.94    |        | 1.95    |
| 5/1/2018 | 9:47:47 | 1.99   | 1.94    |        |         |
| 5/1/2018 | 9:47:57 | 1.99   | 1.93    |        |         |
| 5/1/2018 | 9:48:07 | 1.99   | 1.93    |        |         |
| 5/1/2018 | 9:48:17 | 1.99   | 1.94    |        |         |
| 5/1/2018 | 9:48:27 | 2.68   | 1.89    |        |         |
| 5/1/2018 | 9:48:37 | 8.59   | 1.21    |        |         |
| 5/1/2018 | 9:48:47 | 1.47   | 0.29    |        |         |
| 5/1/2018 | 9:48:57 | 0.18   | 0.10    |        |         |
| 5/1/2018 | 9:49:07 | 0.06   | 0.07    |        |         |
| 5/1/2018 | 9:49:17 | 0.05   | 0.07    |        |         |
| 5/1/2018 | 9:49:27 | 0.05   | 0.07    |        |         |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 1 Post Calibrations**

| Date     | Time    | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|---------|--------|---------|--------|---------|
| 5/1/2018 | 9:49:37 | 0.05   | 0.07    |        |         |
| 5/1/2018 | 9:49:47 | 0.05   | 0.07    |        |         |
| 5/1/2018 | 9:49:57 | 0.04   | 0.07    |        |         |
| 5/1/2018 | 9:50:07 | 0.04   | 0.06    |        |         |
| 5/1/2018 | 9:50:17 | 0.04   | 0.06    |        |         |
| 5/1/2018 | 9:50:27 | 0.04   | 0.06    | 0.04   | 0.06    |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 2**

| Date     | Time     | O2 [%] | CO2 [%] |
|----------|----------|--------|---------|
| 5/1/2018 | 9:57:02  | 19.57  | 0.71    |
| 5/1/2018 | 9:58:02  | 19.57  | 0.70    |
| 5/1/2018 | 9:59:02  | 19.57  | 0.70    |
| 5/1/2018 | 10:00:02 | 19.57  | 0.70    |
| 5/1/2018 | 10:01:02 | 19.57  | 0.70    |
| 5/1/2018 | 10:02:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:03:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:04:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:05:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:06:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:07:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:08:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:09:02 | 19.58  | 0.68    |
| 5/1/2018 | 10:10:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:11:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:12:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:13:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:14:02 | 19.58  | 0.69    |
| 5/1/2018 | 10:15:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:16:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:17:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:18:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:19:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:20:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:21:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:22:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:23:02 | 19.58  | 0.70    |
| 5/1/2018 | 10:24:02 | 19.57  | 0.70    |
| 5/1/2018 | 10:25:02 | 19.57  | 0.70    |
| 5/1/2018 | 10:26:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:27:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:28:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:29:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:30:02 | 19.57  | 0.68    |
| 5/1/2018 | 10:31:02 | 19.57  | 0.68    |
| 5/1/2018 | 10:32:02 | 19.57  | 0.68    |
| 5/1/2018 | 10:33:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:34:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:35:02 | 19.57  | 0.69    |
| 5/1/2018 | 10:36:02 | 19.57  | 0.69    |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 2**

| Date      | Time     | O2 [%]       | CO2 [%]     |
|-----------|----------|--------------|-------------|
| 5/1/2018  | 10:37:02 | 19.57        | 0.69        |
| 5/1/2018  | 10:38:02 | 19.57        | 0.69        |
| 5/1/2018  | 10:39:02 | 19.57        | 0.69        |
| 5/1/2018  | 10:40:02 | 19.56        | 0.69        |
| 5/1/2018  | 10:41:02 | 19.57        | 0.69        |
| 5/1/2018  | 10:42:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:43:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:44:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:45:02 | 19.57        | 0.70        |
| 5/1/2018  | 10:46:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:47:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:48:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:49:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:50:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:51:02 | 19.56        | 0.70        |
| 5/1/2018  | 10:52:02 | 19.56        | 0.69        |
| 5/1/2018  | 10:53:02 | 19.56        | 0.69        |
| 5/1/2018  | 10:54:02 | 19.56        | 0.69        |
| 5/1/2018  | 10:55:02 | 19.56        | 0.68        |
| 5/1/2018  | 10:56:02 | 19.56        | 0.68        |
| 5/1/2018  | 10:57:02 | 19.56        | 0.68        |
| 5/1/2018  | 10:58:02 | 19.56        | 0.69        |
| 5/1/2018  | 10:59:02 | 19.56        | 0.69        |
| 5/1/2018  | 11:00:02 | 19.56        | 0.69        |
| 5/1/2018  | 11:01:02 | 19.57        | 0.69        |
| Averages: |          | <b>19.57</b> | <b>0.69</b> |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 2 Post Calibrations**

| Date     | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|----------|--------|---------|--------|---------|
| 5/1/2018 | 11:01:12 | 19.57  | 0.68    |        |         |
| 5/1/2018 | 11:01:22 | 19.56  | 0.69    |        |         |
| 5/1/2018 | 11:01:32 | 19.57  | 0.69    |        |         |
| 5/1/2018 | 11:01:42 | 19.57  | 0.69    |        |         |
| 5/1/2018 | 11:01:52 | 19.57  | 0.69    |        |         |
| 5/1/2018 | 11:02:02 | 19.56  | 0.68    |        |         |
| 5/1/2018 | 11:02:12 | 19.57  | 0.69    |        |         |
| 5/1/2018 | 11:02:22 | 19.57  | 0.68    |        |         |
| 5/1/2018 | 11:02:32 | 18.39  | 0.68    |        |         |
| 5/1/2018 | 11:02:42 | 4.89   | 0.27    |        |         |
| 5/1/2018 | 11:02:52 | 0.50   | 0.07    |        |         |
| 5/1/2018 | 11:03:02 | 0.14   | 0.05    |        |         |
| 5/1/2018 | 11:03:12 | 0.10   | 0.05    |        |         |
| 5/1/2018 | 11:03:22 | 0.08   | 0.06    |        |         |
| 5/1/2018 | 11:03:32 | 0.08   | 0.04    |        |         |
| 5/1/2018 | 11:03:42 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 11:03:52 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 11:04:02 | 0.07   | 0.06    |        |         |
| 5/1/2018 | 11:04:12 | 0.07   | 0.04    |        |         |
| 5/1/2018 | 11:04:22 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 11:04:32 | 0.06   | 0.05    |        |         |
| 5/1/2018 | 11:04:42 | 0.06   | 0.05    | 0.06   | 0.05    |
| 5/1/2018 | 11:04:52 | 0.28   | 0.28    |        |         |
| 5/1/2018 | 11:05:02 | 6.58   | 6.89    |        |         |
| 5/1/2018 | 11:05:12 | 9.65   | 9.79    |        |         |
| 5/1/2018 | 11:05:22 | 9.85   | 9.92    |        |         |
| 5/1/2018 | 11:05:32 | 9.86   | 9.94    |        |         |
| 5/1/2018 | 11:05:42 | 9.86   | 9.95    |        |         |
| 5/1/2018 | 11:05:52 | 9.86   | 9.96    |        |         |
| 5/1/2018 | 11:06:02 | 9.86   | 9.97    | 9.86   |         |
| 5/1/2018 | 11:06:12 | 9.86   | 9.96    |        |         |
| 5/1/2018 | 11:06:22 | 9.87   | 9.98    |        |         |
| 5/1/2018 | 11:06:32 | 7.88   | 7.77    |        |         |
| 5/1/2018 | 11:06:42 | 2.39   | 1.52    |        |         |
| 5/1/2018 | 11:06:52 | 2.17   | 1.93    |        |         |
| 5/1/2018 | 11:07:02 | 2.16   | 1.95    |        |         |
| 5/1/2018 | 11:07:12 | 2.15   | 1.94    |        |         |
| 5/1/2018 | 11:07:22 | 2.14   | 1.93    |        | 1.94    |
| 5/1/2018 | 11:07:32 | 2.14   | 1.93    |        |         |
| 5/1/2018 | 11:07:42 | 2.14   | 1.93    |        |         |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 3**

| Date     | Time     | O2 [%] | CO2 [%] |
|----------|----------|--------|---------|
| 5/1/2018 | 11:10:11 | 19.56  | 0.70    |
| 5/1/2018 | 11:11:11 | 19.56  | 0.70    |
| 5/1/2018 | 11:12:11 | 19.56  | 0.70    |
| 5/1/2018 | 11:13:11 | 19.56  | 0.71    |
| 5/1/2018 | 11:14:11 | 19.56  | 0.70    |
| 5/1/2018 | 11:15:11 | 19.56  | 0.70    |
| 5/1/2018 | 11:16:11 | 19.57  | 0.70    |
| 5/1/2018 | 11:17:11 | 19.57  | 0.70    |
| 5/1/2018 | 11:18:11 | 19.57  | 0.70    |
| 5/1/2018 | 11:19:11 | 19.57  | 0.70    |
| 5/1/2018 | 11:20:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:21:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:22:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:23:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:24:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:25:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:26:11 | 19.59  | 0.69    |
| 5/1/2018 | 11:27:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:28:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:29:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:30:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:31:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:32:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:33:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:34:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:35:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:36:11 | 19.58  | 0.69    |
| 5/1/2018 | 11:37:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:38:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:39:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:40:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:41:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:42:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:43:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:44:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:45:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:46:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:47:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:48:11 | 19.58  | 0.70    |
| 5/1/2018 | 11:49:11 | 19.58  | 0.70    |



**Hollingsworth & Vose****5/1/2018****CFU 117****Run 3**

| Date     | Time     | O2 [%]       | CO2 [%]     |
|----------|----------|--------------|-------------|
| 5/1/2018 | 11:50:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:51:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:52:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:53:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:54:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:55:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:56:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:57:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:58:11 | 19.58        | 0.69        |
| 5/1/2018 | 11:59:11 | 19.57        | 0.70        |
| 5/1/2018 | 12:00:11 | 19.57        | 0.69        |
| 5/1/2018 | 12:01:11 | 19.57        | 0.70        |
| 5/1/2018 | 12:02:11 | 19.57        | 0.70        |
| 5/1/2018 | 12:03:11 | 19.57        | 0.70        |
| 5/1/2018 | 12:04:11 | 19.57        | 0.71        |
| 5/1/2018 | 12:05:11 | 19.57        | 0.70        |
| 5/1/2018 | 12:06:11 | 19.57        | 0.70        |
| 5/1/2018 | 12:07:11 | 19.56        | 0.71        |
| 5/1/2018 | 12:08:11 | 19.55        | 0.71        |
| 5/1/2018 | 12:09:11 | 19.55        | 0.71        |
| 5/1/2018 | 12:10:11 | 19.55        | 0.71        |
| 5/1/2018 | 12:11:11 | 19.55        | 0.71        |
| 5/1/2018 | 12:12:11 | 19.55        | 0.71        |
| 5/1/2018 | 12:13:11 | 19.55        | 0.71        |
| 5/1/2018 | 12:14:11 | 19.55        | 0.71        |
| Average: |          | <b>19.57</b> | <b>0.70</b> |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 3 Post Calibrations**

| Date     | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|----------|--------|---------|--------|---------|
| 5/1/2018 | 12:14:21 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:14:31 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:14:41 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:14:51 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:15:01 | 19.56  | 0.70    |        |         |
| 5/1/2018 | 12:15:11 | 19.55  | 0.72    |        |         |
| 5/1/2018 | 12:15:21 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:15:31 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:15:41 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:15:51 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:16:01 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:16:11 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:16:21 | 19.54  | 0.70    |        |         |
| 5/1/2018 | 12:16:31 | 19.55  | 0.69    |        |         |
| 5/1/2018 | 12:16:41 | 19.56  | 0.69    |        |         |
| 5/1/2018 | 12:16:51 | 19.56  | 0.70    |        |         |
| 5/1/2018 | 12:17:01 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:17:11 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:17:21 | 19.55  | 0.71    |        |         |
| 5/1/2018 | 12:17:31 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:17:41 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:17:51 | 19.55  | 0.70    |        |         |
| 5/1/2018 | 12:18:01 | 18.79  | 0.75    |        |         |
| 5/1/2018 | 12:18:11 | 6.01   | 0.45    |        |         |
| 5/1/2018 | 12:18:21 | 0.58   | 0.07    |        |         |
| 5/1/2018 | 12:18:31 | 0.15   | 0.05    |        |         |
| 5/1/2018 | 12:18:41 | 0.11   | 0.05    |        |         |
| 5/1/2018 | 12:18:51 | 0.10   | 0.05    |        |         |
| 5/1/2018 | 12:19:01 | 0.09   | 0.05    |        |         |
| 5/1/2018 | 12:19:11 | 0.08   | 0.05    |        |         |
| 5/1/2018 | 12:19:21 | 0.08   | 0.04    |        |         |
| 5/1/2018 | 12:19:31 | 0.08   | 0.04    |        |         |
| 5/1/2018 | 12:19:41 | 0.08   | 0.04    |        |         |
| 5/1/2018 | 12:19:51 | 0.08   | 0.05    |        |         |
| 5/1/2018 | 12:20:01 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 12:20:11 | 0.08   | 0.05    |        |         |
| 5/1/2018 | 12:20:21 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 12:20:31 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 12:20:41 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 12:20:51 | 0.07   | 0.05    |        |         |

**Hollingsworth & Vose****5/1/2018****CFU 117****Run 3 Post Calibrations**

| Date     | Time     | O2 [%] | CO2 [%] | O2 [%] | CO2 [%] |
|----------|----------|--------|---------|--------|---------|
| 5/1/2018 | 12:21:01 | 0.06   | 0.04    |        |         |
| 5/1/2018 | 12:21:11 | 0.06   | 0.05    | 0.06   | 0.05    |
| 5/1/2018 | 12:21:21 | 0.06   | 0.05    |        |         |
| 5/1/2018 | 12:21:31 | 0.07   | 0.05    |        |         |
| 5/1/2018 | 12:21:41 | 3.20   | 0.18    |        |         |
| 5/1/2018 | 12:21:51 | 2.37   | 0.19    |        |         |
| 5/1/2018 | 12:22:01 | 1.83   | 0.55    |        |         |
| 5/1/2018 | 12:22:11 | 2.17   | 1.75    |        |         |
| 5/1/2018 | 12:22:21 | 2.17   | 1.85    |        |         |
| 5/1/2018 | 12:22:31 | 2.16   | 1.87    |        |         |
| 5/1/2018 | 12:22:41 | 2.15   | 1.88    |        |         |
| 5/1/2018 | 12:22:51 | 2.14   | 1.88    |        |         |
| 5/1/2018 | 12:23:01 | 2.13   | 1.88    |        |         |
| 5/1/2018 | 12:23:11 | 2.14   | 1.90    |        |         |
| 5/1/2018 | 12:23:21 | 2.13   | 1.90    |        |         |
| 5/1/2018 | 12:23:31 | 2.13   | 1.90    |        |         |
| 5/1/2018 | 12:23:41 | 2.12   | 1.91    |        |         |
| 5/1/2018 | 12:23:51 | 2.19   | 1.93    |        | 1.91    |
| 5/1/2018 | 12:24:01 | 8.02   | 8.26    |        |         |
| 5/1/2018 | 12:24:11 | 9.83   | 9.92    |        |         |
| 5/1/2018 | 12:24:21 | 9.86   | 9.94    |        |         |
| 5/1/2018 | 12:24:31 | 9.86   | 9.94    |        |         |
| 5/1/2018 | 12:24:41 | 9.86   | 9.96    |        |         |
| 5/1/2018 | 12:24:51 | 9.87   | 9.97    |        |         |
| 5/1/2018 | 12:25:01 | 9.87   | 9.97    | 9.87   |         |
| 5/1/2018 | 12:25:11 | 13.13  | 6.97    |        |         |
| 5/1/2018 | 12:25:21 | 10.98  | 9.06    |        |         |

## **APPENDIX D: PROCESS DATA**

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**Table 1**  
**Production Data Summary - April 2018 Source Test Campaign - Method 5**  
**Hollingsworth & Vose Fiber Company - Corvallis, OR**

| Source Test                     | Product Type | Source Test ID | Source Test Time             | Total Hourly Fiber Pull Rate (lbs/hr) |                     |       |                     |                     |       |
|---------------------------------|--------------|----------------|------------------------------|---------------------------------------|---------------------|-------|---------------------|---------------------|-------|
|                                 |              |                |                              | L4F1                                  | L4F2                | Total | L4R6                | L4R7                | Total |
| 04/27/2018<br>CFU-114<br>Outlet | FB           | Run 1          | 09:30 - 11:40 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Run 2          | 12:45 - 15:00 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Run 3          | 15:45 - 17:50 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Average        |                              | 30.5                                  | 30.5                | 61.0  | --                  | --                  | --    |
| 04/30/2018<br>CFU-117<br>Outlet | RF           | Run 1          | 08:42 - 10:47 <sup>(1)</sup> | --                                    | --                  | --    | 57.1 <sup>(3)</sup> | 58.7 <sup>(3)</sup> | 115.9 |
|                                 |              | Run 2          | 11:35 - 13:39 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(4)</sup> | 54.0 <sup>(3)</sup> | 109.5 |
|                                 |              | Run 3          | 14:29 - 16:34 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(4)</sup> | 54.0 <sup>(3)</sup> | 109.5 |
|                                 |              | Average        |                              | --                                    | --                  | --    | 56.1                | 55.5                | 111.6 |

FB = Flameblown

RF = Rotary Fine

**References:**

- (1) Information provided by Bison Engineering via correspondence dated May 15, 2018.
- (2) Information provided by Hollingsworth & Vose Fiber Company. Assumes constant flameblown production rate from previous data monitoring.
- (3) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate measured over the source test time.
- (4) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate of the nearest before and after source test time pull rates measured.

**Table 2**

**Production Data Summary - April 2018 Source Test Campaign - Method 13B and 26A**  
**Hollingsworth & Vose Fiber Company - Corvallis, OR**

| Source Test                     | Product Type | Source Test ID | Source Test Time             | Total Hourly Fiber Pull Rate (lbs/hr) |                     |       |                     |                     |       |
|---------------------------------|--------------|----------------|------------------------------|---------------------------------------|---------------------|-------|---------------------|---------------------|-------|
|                                 |              |                |                              | L4F1                                  | L4F2                | Total | L4R6                | L4R7                | Total |
| 04/26/2018<br>CFU-114<br>Outlet | FB           | Run 1          | 15:18 - 16:27 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Run 2          | 17:15 - 18:33 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Run 3          | 18:55 - 20:01 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Average        |                              | 30.5                                  | 30.5                | 61.0  | --                  | --                  | --    |
| 05/01/2018<br>CFU-117<br>Outlet | RF           | Run 1          | 08:40 - 09:44 <sup>(1)</sup> | --                                    | --                  | --    | 55.6 <sup>(3)</sup> | 55.5 <sup>(3)</sup> | 111.1 |
|                                 |              | Run 2          | 09:57 - 11:01 <sup>(1)</sup> | --                                    | --                  | --    | 55.6 <sup>(4)</sup> | 55.5 <sup>(4)</sup> | 111.1 |
|                                 |              | Run 3          | 11:10 - 12:14 <sup>(1)</sup> | --                                    | --                  | --    | 55.6 <sup>(4)</sup> | 55.5 <sup>(4)</sup> | 111.1 |
|                                 |              | Average        |                              | --                                    | --                  | --    | 55.6                | 55.5                | 111.1 |

FB = Flameblown

RF = Rotary Fine

**References:**

- (1) Information provided by Bison Engineering via correspondence dated May 15, 2018.
- (2) Information provided by Hollingsworth & Vose Fiber Company. Assumes constant flameblown production rate from previous data monitoring.
- (3) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate measured over the source test time.
- (4) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate of the nearest before and after source test time pull rates measured.

**Table 3**  
**Production Data Summary - April 2018 Source Test Campaign - Method 316**  
**Hollingsworth & Vose Fiber Company - Corvallis, OR**

| Source Test                     | Product Type | Source Test ID | Source Test Time             | Total Hourly Fiber Pull Rate (lbs/hr) |                     |       |                     |                     |       | Total Hourly Natural Gas Usage (scf/hr) |                        |         |                        |                        |         |
|---------------------------------|--------------|----------------|------------------------------|---------------------------------------|---------------------|-------|---------------------|---------------------|-------|-----------------------------------------|------------------------|---------|------------------------|------------------------|---------|
|                                 |              |                |                              | L4F1                                  | L4F2                | Total | L4R6                | L4R7                | Total | L4F1                                    | L4F2                   | Total   | L4R6                   | L4R7                   | Total   |
| 04/27/2018<br>CFU-114<br>Outlet | FB           | Run 1          | 09:30 - 11:40 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    | 2,569.0 <sup>(3)</sup>                  | 2,736.7 <sup>(3)</sup> | 5,305.7 | --                     | --                     | --      |
|                                 |              | Run 2          | 12:53 - 15:00 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    | 2,569.7 <sup>(3)</sup>                  | 2,735.3 <sup>(3)</sup> | 5,305.0 | --                     | --                     | --      |
|                                 |              | Run 3          | 15:45 - 17:50 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    | 2,572.3 <sup>(3)</sup>                  | 2,739.1 <sup>(3)</sup> | 5,311.4 | --                     | --                     | --      |
|                                 |              | Average        |                              | 30.5                                  | 30.5                | 61.0  | --                  | --                  | --    | 2,570.3                                 | 2,737.0                | 5,307.4 | --                     | --                     | --      |
| 04/30/2018<br>CFU-117<br>Outlet | RF           | Run 1          | 08:42 - 10:47 <sup>(1)</sup> | --                                    | --                  | --    | 57.1 <sup>(4)</sup> | 58.7 <sup>(4)</sup> | 115.9 | --                                      | --                     | --      | 2,671.8 <sup>(3)</sup> | 2,723.5 <sup>(3)</sup> | 5,395.3 |
|                                 |              | Run 2          | 11:35 - 13:39 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(4)</sup> | 54.0 <sup>(4)</sup> | 109.5 | --                                      | --                     | --      | 2,719.1 <sup>(3)</sup> | 2,715.9 <sup>(3)</sup> | 5,435.0 |
|                                 |              | Run 3          | 14:29 - 16:34 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(5)</sup> | 54.0 <sup>(4)</sup> | 109.5 | --                                      | --                     | --      | 2,791.7 <sup>(3)</sup> | 2,716.8 <sup>(3)</sup> | 5,508.5 |
|                                 |              | Average        |                              | --                                    | --                  | --    | 56.1                | 55.5                | 111.6 | --                                      | --                     | --      | 2,727.5                | 2,718.7                | 5,446.3 |

FB = Flameblown

RF = Rotary Fine

**References:**

- (1) Information provided by Bison Engineering via correspondence dated May 15, 2018.
- (2) Information provided by Hollingsworth & Vose Fiber Company. Assumes constant flameblown production rate from previous data monitoring.
- (3) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated June 14, 2018. Value represents the average natural gas usage rate measured over the source test time.
- (4) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate measured over the source test time.
- (5) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate of the nearest before and after source test time pull rates measured.

**Table 4**

**Production Data Summary - April 2018 Source Test Campaign - Method 29 and 30B**  
**Hollingsworth & Vose Fiber Company - Corvallis, OR**

| Source Test                     | Product Type | Source Test ID | Source Test Time             | Total Hourly Fiber Pull Rate (lbs/hr) |                     |       |                     |                     |       |
|---------------------------------|--------------|----------------|------------------------------|---------------------------------------|---------------------|-------|---------------------|---------------------|-------|
|                                 |              |                |                              | L4F1                                  | L4F2                | Total | L4R6                | L4R7                | Total |
| 04/28/2018<br>CFU-114<br>Outlet | FB           | Run 1          | 09:18 - 12:28 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Run 2          | 13:09 - 16:16 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Run 3          | 16:45 - 19:53 <sup>(1)</sup> | 30.5 <sup>(2)</sup>                   | 30.5 <sup>(2)</sup> | 61.0  | --                  | --                  | --    |
|                                 |              | Average        |                              | 30.5                                  | 30.5                | 61.0  | --                  | --                  | --    |
| 04/29/2018<br>CFU-117<br>Outlet | RF           | Run 1          | 08:42 - 11:50 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(3)</sup> | 54.0 <sup>(3)</sup> | 109.5 |
|                                 |              | Run 2          | 12:36 - 15:46 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(3)</sup> | 55.5 <sup>(3)</sup> | 111.1 |
|                                 |              | Run 3          | 16:02 - 19:06 <sup>(1)</sup> | --                                    | --                  | --    | 55.5 <sup>(3)</sup> | 58.7 <sup>(3)</sup> | 114.3 |
|                                 |              | Average        |                              | --                                    | --                  | --    | 55.5                | 56.1                | 111.6 |

FB = Flameblown

RF = Rotary Fine

**References:**

- (1) Information provided by Bison Engineering via correspondence dated May 15, 2018.
- (2) Information provided by Hollingsworth & Vose Fiber Company. Assumes constant flameblown production rate from previous data monitoring.
- (3) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2018. Value represents the average pull rate measured over the source test time.





## MEMORANDUM

To: Ms. Kelly Dorsi, PhD Date: June 20, 2018

From: Chad Darby Project No.: 1421.01.01

RE: Production data for April 2018 MAO Testing- Hollingsworth & Vose Fiber Company  
Corvallis, Oregon

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On April 26 through May 1, 2018, emission testing was conducted at Hollingsworth & Vose Fiber Company (H&V) in Corvallis, Oregon. The purpose of the testing was to verify emission factors per Mutual Agreement and Order No. AQ/V-WR-15-132 Addendum 2 for the new ceramic filtration units (CFUs). On April 17, 2018, the Oregon Department of Environmental Quality (DEQ) provided approval of the source test protocol to Ms. Anita Ragan (H&V) and Mr. Chris Hiltunen (Bison Engineering). The letter of approval required assessment, measurement and/or reporting of a number of production parameters including the following:

1. Glass production rate, tons/hr
2. Product type
3. Natural gas usage where applicable (cf/hr)
4. CFU pressure drop
5. Dry bulking agent injection rate in lbs/hr (if possible)
6. Bulking agent composition

This memorandum discusses production parameters 4 through 6.

### **CFU Differential Pressure Drop (dP)**

The attached table provides the pressure drop across the appropriate CFUs measured during each of the seven emission test periods.

### **Dry Bulking Agent Injection Rate**

The dry bulking agent is a powder injected into the CFUs with the fiberizer exhaust to increase the mass of particulate in the exhaust so that it can be removed from the filters during the cleaning cycle. The bulking agent delivery system uses weigh bins to meter the amount added. Each weigh bin serves two or more CFUs. The bulking agent is pneumatically delivered to the CFUs from the weigh bin. En route to the CFUs, the pneumatic stream passes through a splitter (a branch in the delivery piping)

which directs part of the bulking agent to each CFU inlet. There is no means to measure the mass of the bulking agent at the inlet to each CFU. As specified in the DEQ approval letter, H&V has evaluated this system and determined it is not possible to provide an accurate measure of the bulking agent to each tested CFU.

To reiterate, the bulking agent is not a critical item in the filtration and emission control of the CFUs. It serves merely to ensure that 1) the cleaning cycle of the CFUs functions properly, 2) particulate in the CFUs does not form unclearable cobwebbing between the individual ceramic filters, and 3) particulate falls at a sufficient rate into the collection hopper during the cleaning cycle. If the amount of bulking agent is inadequate, the pressure drop will increase as the CFUs will be less efficient in cleaning the filter surface. Because it is not critical to particulate collection, the delivery system is not designed to precisely measure the rate to each unit. The appropriate parameter for monitoring proper operation of the CFUs is differential pressure.

#### **Bulking Agent Composition**

Currently, the facility is using hydrated lime as the bulking agent. The bulking agent is selected based on properties of particle agglomeration and cost. As a result, the current bulking agent may change in the future.

**Table 1**  
**Source Test Pressure Differential**  
**Hollingsworth & Vose Fiber Company - Corvallis, OR**

| Source Test          | Product Type | Source Test Method | Source Test ID | Source Test Time <sup>(1)</sup> | Pressure Drop <sup>(2)</sup> (" w.c.) |
|----------------------|--------------|--------------------|----------------|---------------------------------|---------------------------------------|
| 4/26/2018<br>CFU-114 | FB           | M13B & M26A        | Run 1          | 15:18 - 16:27                   | 2.88                                  |
|                      |              |                    | Run 2          | 17:15 - 18:33                   | 2.86                                  |
|                      |              |                    | Run 3          | 18:55 - 20:01                   | 2.83                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>2.85</b>                           |
| 4/27/2018<br>CFU-114 | FB           | M5                 | Run 1          | 09:30 - 11:40                   | 2.86                                  |
|                      |              |                    | Run 2          | 12:45 - 15:00                   | 2.84                                  |
|                      |              |                    | Run 3          | 15:45 - 17:50                   | 2.88                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>2.86</b>                           |
| 4/27/2018<br>CFU-114 | FB           | M316               | Run 1          | 09:30 - 11:40                   | 2.86                                  |
|                      |              |                    | Run 2          | 12:53 - 15:00                   | 2.84                                  |
|                      |              |                    | Run 3          | 15:45 - 17:50                   | 2.88                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>2.86</b>                           |
| 4/28/2018<br>CFU-114 | FB           | M29 & M30B         | Run 1          | 09:18 - 12:28                   | 2.87                                  |
|                      |              |                    | Run 2          | 13:09 - 16:16                   | 2.88                                  |
|                      |              |                    | Run 3          | 16:45 - 19:53                   | 2.87                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>2.87</b>                           |
| 4/29/2018<br>CFU-117 | RF           | M29 & M30B         | Run 1          | 08:42 - 11:50                   | 4.06                                  |
|                      |              |                    | Run 2          | 12:36 - 15:46                   | 4.04                                  |
|                      |              |                    | Run 3          | 16:02 - 19:06                   | 4.04                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>4.05</b>                           |
| 4/30/2018<br>CFU-117 | RF           | M5 & M316          | Run 1          | 08:42 - 10:47                   | 4.07                                  |
|                      |              |                    | Run 2          | 11:35 - 13:39                   | 4.11                                  |
|                      |              |                    | Run 3          | 14:29 - 16:34                   | 4.08                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>4.09</b>                           |
| 5/1/2018<br>CFU-117  | RF           | M13B & M26A        | Run 1          | 08:40 - 09:44                   | 4.06                                  |
|                      |              |                    | Run 2          | 09:57 - 11:01                   | 4.06                                  |
|                      |              |                    | Run 3          | 11:10 - 12:14                   | 4.08                                  |
|                      |              |                    | <b>Average</b> |                                 | <b>4.07</b>                           |

**References:**

- (1) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated May 15, 2016.  
(2) Information provided by Hollingsworth & Vose Fiber Company via correspondence dated June 15, 2016.

## **APPENDIX E: LABORATORY REPORTS**

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## Field Moisture Log:

Client: H&V Location: CFU 114 (Flameblown)  
 Source: CFU 114 Date(s): 4/26-

| Method | Run # | Impingers (g)                    |                            | Filter # | Silica gel (g)         |                              |
|--------|-------|----------------------------------|----------------------------|----------|------------------------|------------------------------|
| 13B    | 1     | Initial: 200<br>Rinse vol: 239   | Final: 203<br>Gain: 3ml    | n/9      | Initial: 242.3<br>#: 1 | Final: 257.0<br>Gain: 14.7   |
| 26A    | 1     | Initial: 200<br>Rinse vol: 100   | Final: 208<br>Gain: 8ml    |          | Initial: 257.4<br>#: 2 | Final: 277.9<br>Gain: 20.5   |
| 13B    | 2     | Initial: 200<br>Rinse vol: 240ml | Final: 210<br>Gain: 10ml   |          | Initial: 261.5<br>#: 3 | Final: 272.3<br>Gain: 10.8   |
| 26A    | 2     | Initial: 200<br>Rinse vol: 72ml  | Final: 206<br>Gain: 6ml    |          | Initial: 262.0<br>#: 4 | Final: 277.1<br>Gain: 15.1g. |
| 13B    | 3     | Initial: 200<br>Rinse vol: 240ml | Final: 204<br>Gain: 4ml    |          | Initial: 257.7<br>#: 5 | Final: 268.3<br>Gain: 10.6   |
| 26A    | 3     | Initial: 200<br>Rinse vol: 75    | Final: 204<br>Gain: + 4ml. | ✓        | Initial: 257.5<br>#: 6 | Final: 273.2<br>Gain: 15.7   |

# Field Moisture Log:

Client: H&V Location: Corvallis, OR  
Source: CF4 114 Date(s): 4/27-

| Method | Run # | Impingers (g)                  |                                                                            | Filter # | Silica gel (g)          |                               |
|--------|-------|--------------------------------|----------------------------------------------------------------------------|----------|-------------------------|-------------------------------|
| 5      | 1     | Initial: 200<br>Rinse vol:     | Final: 232<br>Gain: 32 ml                                                  | Q1309    | Initial: 240.2<br>#: 7  | Final: 265.2<br>Gain: 25      |
| 316    | 1     | Initial: 200<br>Rinse vol: 190 | Final: 232<br>Gain: 32 ml                                                  | n/a      | Initial: 239.6<br>#: 8  | Final: 258.8<br>Gain: 19.2    |
| 5      | 2     | Initial: 200<br>Rinse vol:     | Final: 231<br>Gain: 31 ml                                                  | Q1311    | Initial: 248.5<br>#: 9  | Final: 278.5<br>Gain: 30      |
| 316    | 2     | Initial: 200<br>Rinse vol: 214 | Final: 223<br>Gain: 23 ml                                                  | n/a      | Initial: 242.7<br>#: 10 | Final: 263.4<br>Gain: 20.7    |
| 5      | 3     | Initial: 200<br>Rinse vol:     | Final: 228<br>Gain: + 28 ml.                                               | Q1312    | Initial: 240.1<br>#: 11 | Final: 267.3<br>Gain: 27.2 g. |
| 316    | 3     | Initial: 200<br>Rinse vol: 262 | Final: <del>261</del> 212<br>Gain: <del>64 g.</del> + 12 ml<br>ARB<br>4/27 | n/a      | Initial: 245.1<br>#: 12 | Final: 269<br>Gain: 23.9      |

## Field Moisture Log:

Client: H&V Location: Corvallis  
 Source: CFU 114 Date(s): 4/28/18

| Method | Run # | Impingers (g)                  |                                                             | Filter # | Silica gel (g)                                            |                            |
|--------|-------|--------------------------------|-------------------------------------------------------------|----------|-----------------------------------------------------------|----------------------------|
| 29     | 1     | Initial: 200<br>Rinse vol: 100 | Final: 235<br>Gain: 35 ml                                   | n/a      | Initial: 244.2<br>#: 13                                   | Final: 282.2<br>Gain: 38   |
| 29     | 2     | Initial: 200<br>Rinse vol: 100 | Final: <del>244.8</del> <sup>DB</sup><br>230<br>Gain: 30 ml | n/a      | Initial: 242<br>#: 14                                     | Final: 284.8<br>Gain: 42.8 |
| 29     | 3     | Initial: 200<br>Rinse vol: 100 | Final: 240<br>Gain: 40 ml                                   | n/a      | Initial: <del>255.0</del> <sup>AB</sup><br>255.0<br>#: 15 | Final: 298.5<br>Gain: 43.5 |
|        |       | Initial:<br>Rinse vol:         | Final:<br>Gain:                                             |          | Initial:<br>#:                                            | Final:<br>Gain:            |
|        |       | Initial:<br>Rinse vol:         | Final:<br>Gain:                                             |          | Initial:<br>#:                                            | Final:<br>Gain:            |
|        |       | Initial:<br>Rinse vol:         | Final:<br>Gain:                                             |          | Initial:<br>#:                                            | Final:<br>Gain:            |

## Field Moisture Log:

Client: H&V Location: Corvallis, OR  
 Source: CFU ~~117~~ Date(s): 4/29/18

| Method | Run # | Impingers (g)                  |                          | Filter # | Silica gel (g)          |                            |
|--------|-------|--------------------------------|--------------------------|----------|-------------------------|----------------------------|
| 29     | 1     | Initial: 200<br>Rinse vol: 100 | Final: 235<br>Gain: 35ml | n/a      | Initial: 238.4<br>#: 16 | Final: 273.8<br>Gain: 35.4 |
| 29     | 2     | Initial: 200<br>Rinse vol: 100 | Final: 240<br>Gain: 40ml | n/a      | Initial: 240.7<br>#: 17 | Final: 276.0<br>Gain: 35.3 |
| 29     | 3     | Initial: 200<br>Rinse vol: 100 | Final: 236<br>Gain: 36ml | n/a      | Initial: 240.8<br>#: 18 | Final: 271.4<br>Gain: 30.6 |
|        |       | Initial:<br>Rinse vol:         | Final:<br>Gain:          |          | Initial:<br>#:          | Final:<br>Gain:            |
|        |       | Initial:<br>Rinse vol:         | Final:<br>Gain:          |          | Initial:<br>#:          | Final:<br>Gain:            |
|        |       | Initial:<br>Rinse vol:         | Final:<br>Gain:          |          | Initial:<br>#:          | Final:<br>Gain:            |



## Field Moisture Log:

Client: H&V Location: Corvallis, OR  
 Source: CFU 117 Date(s): 4/30/18

| Method | Run # | Impingers (g)                  |                            | Filter # | Silica gel (g)          |                                                |
|--------|-------|--------------------------------|----------------------------|----------|-------------------------|------------------------------------------------|
| 5      | 1     | Initial: 200<br>Rinse vol:     | Final: 216<br>Gain: 16 ml  | Q1313    | Initial: 261.2<br>#: 19 | Final: 283.8<br>Gain: 22.6                     |
| 316    | 1     | Initial: 200<br>Rinse vol: 340 | Final: 210<br>Gain: 10 ml  |          | Initial: 264.7<br>#: 20 | Final: 281.2<br>Gain: 16.5                     |
| 5      | 2     | Initial: 200<br>Rinse vol:     | Final: 218<br>Gain: 18 ml  | Q1314    | Initial: 238.0<br>#: 21 | Final: 261.0<br>Gain: 23                       |
| 316    | 2     | Initial: 200<br>Rinse vol: 270 | Final: 206<br>Gain: 6 ml   |          | Initial: 255.9<br>#: 22 | Final: 274.9<br>Gain: 19.9 <sup>ARB</sup> 4/30 |
| 5      | 3     | Initial: 200<br>Rinse vol:     | Final: 218<br>Gain: +18 ml | Q1315    | Initial: 238.3<br>#: 23 | Final: 260.3<br>Gain: 22g                      |
| 316    | 3     | Initial: 200<br>Rinse vol: 313 | Final: 206<br>Gain: +6 ml  |          | Initial: 237.4<br>#: 24 | Final: 254.6<br>Gain: +17.2                    |

## Field Moisture Log:

Page 1 of 1Client: HIVLocation: Corvallis, ORSource: CFV-117Date(s): 09/01/18

| Method | Run # | Impingers (g)                    |                        | Filter # | Silica gel (g)          |                                       |
|--------|-------|----------------------------------|------------------------|----------|-------------------------|---------------------------------------|
| 13B    | 1     | Initial: 200<br>Rinse vol: 275   | Final: 204<br>Gain: 4  | N/A      | Initial: 264.1<br>#: 25 | Final: 273.7<br>Gain: 9.6             |
| 26A    | 1     | Initial: 200<br>Rinse vol: 142   | Final: 203<br>Gain: 3  | n/a      | Initial: 250.2<br>#: 26 | Final: 264.2<br>Gain: 14              |
| 13B    | 2     | Initial: 200<br>Rinse vol: 240   | Final: 204<br>Gain: 4  | n/a      | Initial: 256.3<br>#: 27 | Final: 266.0<br>Gain: 9.7             |
| 26A    | 2     | Initial: 200<br>Rinse vol: 120   | Final: 200<br>Gain: 0  | n/a      | Initial: 247.5<br>#: 28 | Final: 262.0<br>Gain: <del>15.5</del> |
| 13B    | 3     | Initial: 200<br>Rinse vol: 290   | Final: 202<br>Gain: 2  | n/a      | Initial: 237.9<br>#: 29 | Final: 247.2<br>Gain: 9.3             |
| 26A    | 3     | Initial: 200<br>Rinse vol: 160ml | Final: 210<br>Gain: 10 | n/a      | Initial: 242.2<br>#: 30 | Final: 257.1<br>Gain: 14.9            |

## Gravimetric Information

Client: Hollingsworth & Vose

Location: Corvallis, OR

Job number: HAV218610

Dates: 4/26/2018 - 5/1/2018

### Filters:

| Sample Identification  | Filter # | Date      | Tare 1 (g) | Date      | Tare 2 (g) | CHECK   | Average | Filter # | Date     | Final 1 (g) | Date     | Final 2 (g) | CHECK   | Average | Gain     |
|------------------------|----------|-----------|------------|-----------|------------|---------|---------|----------|----------|-------------|----------|-------------|---------|---------|----------|
| HAV218610 CFU114 Run 1 | Q1309    | 4/17/2018 | 0.3885     | 4/18/2018 | 0.3883     | -0.0002 | 0.38840 | Q1309    | 5/7/2018 | 0.3881      | 5/8/2018 | 0.3882      | 0.0001  | 0.38815 | -0.00025 |
| HAV218610 CFU114 Run 2 | Q1311    | 4/17/2018 | 0.3988     | 4/18/2018 | 0.3989     | 0.0001  | 0.39885 | Q1311    | 5/7/2018 | 0.3983      | 5/8/2018 | 0.3985      | 0.0002  | 0.39840 | -0.00045 |
| HAV218610 CFU114 Run 3 | Q1312    | 4/17/2018 | 0.3974     | 4/18/2018 | 0.3973     | -0.0001 | 0.39735 | Q1312    | 5/7/2018 | 0.3970      | 5/8/2018 | 0.3972      | 0.0002  | 0.39710 | -0.00025 |
| HAV218610 CFU117 Run 1 | Q1313    | 4/17/2018 | 0.3970     | 4/18/2018 | 0.3970     | 0.0000  | 0.39700 | Q1313    | 5/7/2018 | 0.3969      | 5/8/2018 | 0.3968      | -0.0001 | 0.39685 | -0.00015 |
| HAV218610 CFU117 Run 2 | Q1314    | 4/17/2018 | 0.3976     | 4/18/2018 | 0.3976     | 0.0000  | 0.39760 | Q1314    | 5/7/2018 | 0.3973      | 5/8/2018 | 0.3973      | 0.0000  | 0.39730 | -0.00030 |
| HAV218610 CFU117 Run 3 | Q1315    | 4/17/2018 | 0.3942     | 4/18/2018 | 0.3944     | 0.0002  | 0.39430 | Q1315    | 5/7/2018 | 0.3941      | 5/8/2018 | 0.3941      | 0.0000  | 0.39410 | -0.00020 |

### Liquid Fractions:

| Wt (g) | Sample Identification                                    | Dish # | Date      | Tare 1 (g) | Date      | Tare 2 (g) | CHECK   | Average  | Dish # | Date      | Final 1 (g) | Date      | Final 2 (g) | CHECK   | Average  | Gain     |
|--------|----------------------------------------------------------|--------|-----------|------------|-----------|------------|---------|----------|--------|-----------|-------------|-----------|-------------|---------|----------|----------|
| 165    | HAV218610 M5 CFU 114 Cont #5 Acetone Rinse Run 1         | 59     | 5/8/2018  | 44.5405    | 5/9/2018  | 44.5404    | 0.0001  | 44.54045 | 59     | 5/18/2018 | 44.5409     | 5/22/2018 | 44.5413     | -0.0004 | 44.54110 | 0.00065  |
| 170    | HAV218610 M5 CFU 114 Cont #5 Acetone Rinse Run 2         | 60     | 5/8/2018  | 47.0368    | 5/9/2018  | 47.0368    | 0.0000  | 47.03680 | 60     | 5/18/2018 | 47.0371     | 5/22/2018 | 47.0373     | -0.0002 | 47.03720 | 0.00040  |
| 185    | HAV218610 M5 CFU 114 Cont #5 Acetone Rinse Run 3         | 61     | 5/8/2018  | 47.3789    | 5/9/2018  | 47.3792    | -0.0003 | 47.37905 | 61     | 5/18/2018 | 47.3797     | 5/22/2018 | 47.3796     | 0.0001  | 47.37970 | 0.00065  |
| 85     | HAV218610 M5 CFU 114 Cont #6 Organic Run 1               | 62     | 5/8/2018  | 41.7959    | 5/9/2018  | 41.7959    | 0.0000  | 41.79590 | 62     | 5/18/2018 | 41.7957     | 5/22/2018 | 41.7960     | -0.0003 | 41.79590 | 0.00000  |
| 85     | HAV218610 M5 CFU 114 Cont #6 Organic Run 2               | 63     | 5/8/2018  | 44.7832    | 5/9/2018  | 44.7830    | 0.0002  | 44.78310 | 63     | 5/18/2018 | 44.7832     | 5/22/2018 | 44.7833     | -0.0001 | 44.78330 | 0.00020  |
| 85     | HAV218610 M5 CFU 114 Cont #6 Organic Run 3               | 64     | 5/8/2018  | 43.1785    | 5/9/2018  | 43.1786    | -0.0001 | 43.17855 | 64     | 5/18/2018 | 43.1782     | 5/22/2018 | 43.1785     | -0.0003 | 43.17840 | -0.00015 |
| 75     | HAV218610 M5 CFU 114 Probe Rinse Run 1                   | 65     | 5/8/2018  | 44.8118    | 5/9/2018  | 44.8120    | -0.0002 | 44.81190 | 65     | 5/18/2018 | 44.8132     | 5/22/2018 | 44.8132     | 0.0000  | 44.81320 | 0.00130  |
| 105    | HAV218610 M5 CFU 114 Probe Rinse Run 2                   | 66     | 5/14/2018 | 43.6667    | 5/15/2018 | 43.6667    | 0.0000  | 43.66670 | 66     | 5/18/2018 | 43.6695     | 5/22/2018 | 43.6697     | -0.0002 | 43.66960 | 0.00290  |
| 110    | HAV218610 M5 CFU 114 Probe Rinse Run 3                   | 67     | 5/14/2018 | 43.2228    | 5/15/2018 | 43.2228    | 0.0000  | 43.22280 | 67     | 5/18/2018 | 43.2247     | 5/22/2018 | 43.2248     | -0.0001 | 43.22480 | 0.00200  |
| 185    | HAV218610 M5 CFU 117 Cont #5 Acetone Rinse Run 1         | 68     | 5/14/2018 | 44.3967    | 5/15/2018 | 44.3966    | 0.0001  | 44.39665 | 68     | 5/18/2018 | 44.3979     | 5/22/2018 | 44.3980     | -0.0001 | 44.39800 | 0.00135  |
| 205    | HAV218610 M5 CFU 117 Cont #5 Acetone Rinse Run 2         | 69     | 5/14/2018 | 44.2097    | 5/15/2018 | 44.2099    | -0.0002 | 44.20980 | 69     | 5/18/2018 | 44.2108     | 5/22/2018 | 44.2111     | -0.0003 | 44.21100 | 0.00120  |
| 195    | HAV218610 M5 CFU 117 Cont #5 Acetone Rinse Run 3         | 70     | 5/14/2018 | 43.6939    | 5/15/2018 | 43.6940    | -0.0001 | 43.69395 | 70     | 5/18/2018 | 43.6947     | 5/22/2018 | 43.6950     | -0.0003 | 43.69490 | 0.00095  |
| 85     | HAV218610 M5 CFU 117 Cont #6 Organic Run 1               | 71     | 5/14/2018 | 45.9350    | 5/15/2018 | 45.9350    | 0.0000  | 45.93500 | 71     | 5/18/2018 | 45.9352     | 5/22/2018 | 45.9354     | -0.0002 | 45.93530 | 0.00030  |
| 85     | HAV218610 M5 CFU 117 Cont #6 Organic Run 2               | 72     | 5/14/2018 | 45.2127    | 5/15/2018 | 45.2125    | 0.0002  | 45.21260 | 72     | 5/18/2018 | 45.2127     | 5/22/2018 | 45.2130     | -0.0003 | 45.21290 | 0.00030  |
| 90     | HAV218610 M5 CFU 117 Cont #6 Organic Run 3               | 73     | 5/14/2018 | 47.1989    | 5/15/2018 | 47.1992    | -0.0003 | 47.19905 | 73     | 5/18/2018 | 47.1993     | 5/22/2018 | 47.1994     | -0.0001 | 47.19940 | 0.00035  |
| 115    | HAV218610 M5 CFU 117 Probe Rinse Run 1                   | 74     | 5/14/2018 | 42.0474    | 5/15/2018 | 42.0475    | -0.0001 | 42.04745 | 74     | 5/18/2018 | 42.0496     | 5/22/2018 | 42.0499     | -0.0003 | 42.04980 | 0.00235  |
| 55     | HAV218610 M5 CFU 117 Probe Rinse Run 2                   | 75     | 5/14/2018 | 48.3023    | 5/15/2018 | 48.3023    | 0.0000  | 48.30230 | 75     | 5/18/2018 | 48.3038     | 5/22/2018 | 48.3039     | -0.0001 | 48.30390 | 0.00160  |
| 90     | HAV218610 M5 CFU 117 Probe Rinse Run 3                   | 76     | 5/14/2018 | 43.0513    | 5/15/2018 | 43.0516    | -0.0003 | 43.05145 | 76     | 5/18/2018 | 43.0522     | 5/22/2018 | 43.0524     | -0.0002 | 43.05230 | 0.00085  |
| 100    | HAV218610 M5 Hexane Blank                                | 77     | 5/14/2018 | 47.1529    | 5/15/2018 | 47.1532    | -0.0003 | 47.15305 | 77     | 5/18/2018 | 47.1532     | 5/22/2018 | 47.1534     | -0.0002 | 47.15330 | 0.00025  |
| 190    | HAV218610 M5 Acetone Blank                               | 78     | 5/14/2018 | 46.3773    | 5/15/2018 | 46.3775    | -0.0002 | 46.37740 | 78     | 5/18/2018 | 46.3774     | 5/22/2018 | 46.3777     | -0.0003 | 46.37760 | 0.00020  |
| 425    | HAV218610 M5 CFU114 Cont #4 H2O Rinse Run 1              | 79     | 5/14/2018 | 46.5204    | 5/15/2018 | 46.5207    | -0.0003 | 46.52055 | 79     | 5/22/2018 | 46.5231     | 5/23/2018 | 46.5227     | 0.0004  | 46.52290 | 0.00235  |
| 425    | HAV218610 M5 CFU114 Cont #4 H2O Rinse Run 2              | 80     | 5/14/2018 | 43.6578    | 5/15/2018 | 43.6581    | -0.0003 | 43.65795 | 80     | 5/22/2018 | 43.6604     | 5/23/2018 | 43.6601     | 0.0003  | 43.66030 | 0.00235  |
| 405    | HAV218610 M5 CFU114 Cont #4 H2O Rinse Run 3              | 81     | 5/14/2018 | 40.4827    | 5/15/2018 | 40.4829    | -0.0002 | 40.48280 | 81     | 5/22/2018 | 40.4853     | 5/23/2018 | 40.4850     | 0.0003  | 40.48520 | 0.00240  |
| 375    | HAV218610 M5 CFU117 Cont #4 Impinger and H2O Rinse Run 1 | 82     | 5/17/2018 | 43.5072    | 5/18/2018 | 43.5071    | 0.0001  | 43.50715 | 82     | 5/22/2018 | 43.5095     | 5/23/2018 | 43.5091     | 0.0004  | 43.50930 | 0.00215  |
| 450    | HAV218610 M5 CFU117 Cont #4 Impinger and H2O Rinse Run 2 | 83     | 5/17/2018 | 47.9592    | 5/18/2018 | 47.9590    | 0.0002  | 47.95910 | 83     | 5/22/2018 | 47.9612     | 5/23/2018 | 47.9612     | 0.0000  | 47.96120 | 0.00210  |
| 405    | HAV218610 M5 CFU117 Cont #4 Impinger and H2O Rinse Run 3 | 84     | 5/17/2018 | 44.3203    | 5/18/2018 | 44.3199    | 0.0004  | 44.32010 | 84     | 5/22/2018 | 44.3219     | 5/23/2018 | 44.3217     | 0.0002  | 44.32180 | 0.00170  |
| 240    | HAV218610 M5 DI HPLC Blank                               | 85     | 5/17/2018 | 42.9739    | 5/18/2018 | 42.9740    | -0.0001 | 42.97395 | 85     | 5/22/2018 | 42.9741     | 5/23/2018 | 42.9742     | -0.0001 | 42.97420 | 0.00025  |

BISON ENGINEERING

PROJECT: HAV218610

CLIENT # B020

REPORT # 18-180

SUBMITTED BY:

***CHESTER LabNet***

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## Case Narrative

Date: May 15, 2018

## General Information

Client: Bison Engineering  
Client Number: B020  
Report Number: 18-180  
Sample Description: Impinger Trains  
Sample Numbers: 18-S658 – 18-S695

## Analysis

Analytes: F, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, P, Se, Zn, HF  
Analytical Protocols: EPA Method 13B, EPA Method 29, EPA Method 26A  
Analytical Notes: Aliquots of the method 26A samples were removed before the client submitted the samples for analysis. The total sample volumes used to calculate the per sample concentrations were determined by adding the aliquot amounts to the volumes measured by the lab. No problems were encountered during the analyses. Results have not been blank corrected.  
QA/QC Review: All of the data have been reviewed by the analysts performing the analyses and the project manager. All of the quality control and sample-specific information in this package is complete and meets or exceeds the minimum requirements for acceptability.  
Comments: If you have any questions or concerns regarding this analysis, please feel free to contact the project manager.  
Disclaimer: This report shall not be reproduced, except in full, without the written approval of the laboratory. The results only represent that of the samples as received into the laboratory.

 5/15/18  
Project Manager Date  
Paul Duda

Lab ID: 18-S658  
Client ID: M13B Cont.1 Run 1  
Source: CFU 114  
Sample Date: 4/26/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | 49.0   | 30.0 | µg/sample |

---

Lab ID: 18-S659  
Client ID: M13B Cont.1 Run 2  
Source: CFU 114  
Sample Date: 4/26/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S660  
Client ID: M13B Cont.1 Run 3  
Source: CFU 114  
Sample Date: 4/26/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S661  
Client ID: M13B Cont.2 Blank  
Source: CFU 114  
Sample Date: 4/26/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S662  
Client ID: M13B Cont.1 Run 1  
Source: CFU 117  
Sample Date: 5/ 1/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S663  
Client ID: M13B Cont.1 Run 2  
Source: CFU 117  
Sample Date: 5/ 1/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Client: B020 - Bison Engineering  
Report Number: 18-180

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Lab ID: 18-S664  
Client ID: M13B Cont.1 Run 3  
Source: CFU 117  
Sample Date: 5/ 1/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S665  
Client ID: M13B DI Blank  
Source: CFU 117  
Sample Date: 5/ 1/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S666  
Client ID: M13B Filter Blank  
Source: CFU 117  
Sample Date: 5/ 1/18

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | < DL   | 30.0 | µg/sample |

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Lab ID: 18-S667  
Client ID: M13B Audit SSAS318

| Analyte      | Result | DL   | Units     |
|--------------|--------|------|-----------|
| Fluoride, IC | 39,700 | 30.0 | µg/sample |

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Lab ID: 18-S668  
Client ID: M29 Cont. 1&3 R-1  
Source: CFU 114  
Sample Date: 4/28/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 4.03   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | 0.492  | 0.100 | µg/sample |
| Chromium, ICP   | 1.63   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 1.26   | 0.075 | µg/sample |
| Nickel, ICP     | 2.69   | 0.750 | µg/sample |
| Phosphorus, ICP | 11.7   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 8.60   | 0.750 | µg/sample |

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Lab ID: 18-S669  
Client ID: M29 Cont. 4 R-1  
Source: CFU 114  
Sample Date: 4/28/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.547  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.176  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 2.33   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.414  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | 2.54   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 9.37   | 0.300 | µg/sample |

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Lab ID: 18-S670  
Client ID: M29 Cont. 1&3 R-2  
Source: CFU 114  
Sample Date: 4/28/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 3.61   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | 1.36   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 1.06   | 0.075 | µg/sample |
| Nickel, ICP     | 2.54   | 0.750 | µg/sample |
| Phosphorus, ICP | 9.69   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 6.48   | 0.750 | µg/sample |

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Lab ID: 18-S671  
Client ID: M29 Cont. 4 R-2  
Source: CFU 114  
Sample Date: 4/28/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.575  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.194  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 1.67   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.451  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | < DL   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 18.7   | 0.300 | µg/sample |

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Lab ID: 18-S672  
Client ID: M29 Cont. 1&3 R-3  
Source: CFU 114  
Sample Date: 4/28/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 3.92   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | 1.35   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 1.18   | 0.075 | µg/sample |
| Nickel, ICP     | 4.27   | 0.750 | µg/sample |
| Phosphorus, ICP | 9.88   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 6.62   | 0.750 | µg/sample |

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Lab ID: 18-S673  
Client ID: M29 Cont. 4 R-3  
Source: CFU 114  
Sample Date: 4/28/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.450  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.164  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 2.00   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.370  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | < DL   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 6.98   | 0.300 | µg/sample |

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Lab ID: 18-S674  
Client ID: Blank 0.1N HNO3

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 0.221  | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | < DL   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 0.176  | 0.075 | µg/sample |
| Nickel, ICP     | < DL   | 0.750 | µg/sample |
| Phosphorus, ICP | < DL   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | < DL   | 0.750 | µg/sample |

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Lab ID: 18-S675  
Client ID: Blank Filter

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 3.30   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | 1.33   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 0.565  | 0.075 | µg/sample |
| Nickel, ICP     | 2.37   | 0.750 | µg/sample |
| Phosphorus, ICP | 7.90   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 2.20   | 0.750 | µg/sample |

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Lab ID: 18-S676  
Client ID: Blank 5% HNO3/10% H2O2

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.362  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.098  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 1.52   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.295  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | < DL   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 0.556  | 0.300 | µg/sample |

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Lab ID: 18-S677  
Client ID: M29 Cont. 1&3 R-1  
Source: CFU 117  
Sample Date: 4/29/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 3.41   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | 1.29   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 0.938  | 0.075 | µg/sample |
| Nickel, ICP     | 2.64   | 0.750 | µg/sample |
| Phosphorus, ICP | 14.8   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 3.07   | 0.750 | µg/sample |

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Lab ID: 18-S678  
Client ID: M29 Cont. 4 R-1  
Source: CFU 117  
Sample Date: 4/29/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.452  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.210  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 2.50   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.384  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | < DL   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 7.11   | 0.300 | µg/sample |

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Lab ID: 18-S679  
Client ID: M29 Cont. 1&3 R-2  
Source: CFU 117  
Sample Date: 4/29/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 3.49   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | 1.40   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 0.986  | 0.075 | µg/sample |
| Nickel, ICP     | 2.33   | 0.750 | µg/sample |
| Phosphorus, ICP | 8.82   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 3.40   | 0.750 | µg/sample |

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Lab ID: 18-S680  
Client ID: M29 Cont. 4 R-2  
Source: CFU 117  
Sample Date: 4/29/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.479  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.184  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 1.50   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.344  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | < DL   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 3.03   | 0.300 | µg/sample |

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Lab ID: 18-S681  
Client ID: M29 Cont. 1&3 R-3  
Source: CFU 117  
Sample Date: 4/29/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 1.25  | µg/sample |
| Arsenic, ICP    | < DL   | 1.75  | µg/sample |
| Barium, ICP     | 3.40   | 0.125 | µg/sample |
| Beryllium, ICP  | < DL   | 0.050 | µg/sample |
| Cadmium, ICP    | < DL   | 0.100 | µg/sample |
| Chromium, ICP   | 1.36   | 0.200 | µg/sample |
| Cobalt, ICP     | < DL   | 0.125 | µg/sample |
| Copper, ICP     | < DL   | 1.25  | µg/sample |
| Lead, ICP       | < DL   | 1.25  | µg/sample |
| Manganese, ICP  | 0.896  | 0.075 | µg/sample |
| Nickel, ICP     | 2.48   | 0.750 | µg/sample |
| Phosphorus, ICP | 9.51   | 5.00  | µg/sample |
| Selenium, ICP   | < DL   | 3.75  | µg/sample |
| Zinc, ICP       | 2.85   | 0.750 | µg/sample |

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Lab ID: 18-S682  
Client ID: M29 Cont. 4 R-3  
Source: CFU 117  
Sample Date: 4/29/18

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | < DL   | 0.500 | µg/sample |
| Arsenic, ICP    | < DL   | 0.700 | µg/sample |
| Barium, ICP     | 0.408  | 0.050 | µg/sample |
| Beryllium, ICP  | < DL   | 0.020 | µg/sample |
| Cadmium, ICP    | < DL   | 0.040 | µg/sample |
| Chromium, ICP   | 0.132  | 0.080 | µg/sample |
| Cobalt, ICP     | < DL   | 0.050 | µg/sample |
| Copper, ICP     | 1.43   | 0.500 | µg/sample |
| Lead, ICP       | < DL   | 0.500 | µg/sample |
| Manganese, ICP  | 0.349  | 0.030 | µg/sample |
| Nickel, ICP     | < DL   | 0.300 | µg/sample |
| Phosphorus, ICP | < DL   | 2.00  | µg/sample |
| Selenium, ICP   | < DL   | 1.50  | µg/sample |
| Zinc, ICP       | 3.15   | 0.300 | µg/sample |

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Lab ID: 18-S683  
Client ID: M29 Filter Audit SSAS318

| Analyte         | Result | DL    | Units     |
|-----------------|--------|-------|-----------|
| Antimony, ICP   | 27.8   | 1.25  | µg/sample |
| Arsenic, ICP    | 16.7   | 1.75  | µg/sample |
| Barium, ICP     | 23.1   | 0.125 | µg/sample |
| Beryllium, ICP  | 12.7   | 0.050 | µg/sample |
| Cadmium, ICP    | 13.3   | 0.100 | µg/sample |
| Chromium, ICP   | 18.5   | 0.200 | µg/sample |
| Cobalt, ICP     | 12.5   | 0.125 | µg/sample |
| Copper, ICP     | 11.9   | 1.25  | µg/sample |
| Lead, ICP       | 21.3   | 1.25  | µg/sample |
| Manganese, ICP  | 13.4   | 0.075 | µg/sample |
| Nickel, ICP     | 23.0   | 0.750 | µg/sample |
| Phosphorus, ICP | 56.8   | 5.00  | µg/sample |
| Selenium, ICP   | 22.7   | 3.75  | µg/sample |
| Zinc, ICP       | 24.8   | 0.750 | µg/sample |

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Lab ID: 18-S684  
Client ID: M29 Impinger Audit SSAS318

| Analyte         | Result | DL      | Units |
|-----------------|--------|---------|-------|
| Antimony, ICP   | 0.681  | 0.00200 | µg/mL |
| Arsenic, ICP    | 0.478  | 0.00280 | µg/mL |
| Barium, ICP     | 2.27   | 0.00020 | µg/mL |
| Beryllium, ICP  | 0.728  | 0.00008 | µg/mL |
| Cadmium, ICP    | 0.359  | 0.00016 | µg/mL |
| Chromium, ICP   | 1.25   | 0.00032 | µg/mL |
| Cobalt, ICP     | 2.98   | 0.00020 | µg/mL |
| Copper, ICP     | 1.01   | 0.00200 | µg/mL |
| Lead, ICP       | 3.26   | 0.00200 | µg/mL |
| Manganese, ICP  | 0.405  | 0.00012 | µg/mL |
| Nickel, ICP     | 2.48   | 0.00120 | µg/mL |
| Phosphorus, ICP | < DL   | 0.00800 | µg/mL |
| Selenium, ICP   | 0.883  | 0.00600 | µg/mL |
| Zinc, ICP       | 0.800  | 0.00120 | µg/mL |

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Client: B020 - Bison Engineering  
Report Number: 18-180

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Lab ID: 18-S685  
Client ID: M26A Cont. 3 Run 1  
Source: CFU 114  
Sample Date: 4/26/18  
Sample Volume: 294. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.216 | 0.011 | 63.5      | 3.10 |

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Lab ID: 18-S686  
Client ID: M26A Cont. 3 Run 2  
Source: CFU 114  
Sample Date: 4/26/18  
Sample Volume: 350. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.180 | 0.011 | 63.0      | 3.69 |

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Lab ID: 18-S687  
Client ID: M26A Cont. 3 Run 3  
Source: CFU 114  
Sample Date: 4/26/18  
Sample Volume: 345. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.186 | 0.011 | 64.3      | 3.63 |

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Lab ID: 18-S688  
Client ID: 0.1N H2SO4 Blank  
Source: CFU 114  
Sample Date: 4/26/18  
Sample Volume: 196. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | < DL  | 0.011 | < DL      | 2.06 |

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Lab ID: 18-S689  
Client ID: DI H2O Blank  
Source: CFU 114  
Sample Date: 4/26/18  
Sample Volume: 244. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.023 | 0.011 | 5.65      | 2.57 |

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Client: B020 - Bison Engineering  
Report Number: 18-180

Lab ID: 18-S690  
Client ID: M26A Cont. 3 R-1  
Source: CFU 117  
Sample Date: 5/ 1/18  
Sample Volume: 346. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.246 | 0.011 | 85.3      | 3.64 |

Lab ID: 18-S691  
Client ID: M26A Cont. 3 R-2  
Source: CFU 117  
Sample Date: 5/ 1/18  
Sample Volume: 318. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.214 | 0.011 | 68.0      | 3.35 |

Lab ID: 18-S692  
Client ID: M26A Cont. 3 R-3  
Source: CFU 117  
Sample Date: 5/ 1/18  
Sample Volume: 360. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | 0.215 | 0.011 | 77.3      | 3.79 |

Lab ID: 18-S693  
Client ID: H2SO4 Blank  
Source: CFU 117  
Sample Date: 5/ 1/18  
Sample Volume: 322. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | < DL  | 0.011 | < DL      | 3.39 |

Lab ID: 18-S694  
Client ID: DI H2O Blank  
Source: CFU 117  
Sample Date: 5/ 1/18  
Sample Volume: 198. mL

| Analyte | mg/L  |       | µg/sample |      |
|---------|-------|-------|-----------|------|
|         | Conc. | DL    | Conc.     | DL   |
| HF      | < DL  | 0.011 | < DL      | 2.08 |

Lab ID: 18-S695  
Client ID: M26 Audit SSAS318

| Analyte | mg/L  |       |
|---------|-------|-------|
|         | Conc. | DL    |
| HF      | 22.0  | 0.011 |

## QA/QC Report

Client Name: Bison Engineering  
Project Number: B020  
Analytical Technique: Ion Chromatography  
Sample Description: EPA Method 13B  
Report Number: 18-180  
=====

### Blank Data

| Analyte | Sample ID | Measured Conc. mg/L | DL Conc. mg/L |
|---------|-----------|---------------------|---------------|
| F       | ICB       | < DL                | 0.030         |
| F       | Meth_Blkc | < DL                | 0.030         |
| F       | CCB       | < DL                | 0.030         |
| F       | CCB       | < DL                | 0.030         |

ICB: Initial Calibration Blank CCB: Continuing Calibration Blank

### Calibration QC

| Analyte | Sample ID | Standard Conc. mg/L | Measured Conc. mg/L | Percent Recovery |
|---------|-----------|---------------------|---------------------|------------------|
| F       | ICV       | 1.00                | 1.02                | 101.5            |
| F       | CCV       | 1.00                | 1.02                | 101.9            |
| F       | CCV       | 1.00                | 1.03                | 103.0            |

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification  
Calibration Verification Limits: 90% - 110% Recovery

### Duplicate Data

| Analyte | Sample ID | Sample Conc. mg/L | Duplicate Conc. mg/L | RPD    |
|---------|-----------|-------------------|----------------------|--------|
| F       | 18-S658   | 0.049             | 0.040                | 20.2 # |

$RPD = \{ (sample - duplicate) / [(sample + duplicate) / 2] \} \times 100$

N/C: RPD is not calculated when sample or duplicate is below detection limit

Duplicate Limit: 20% RPD

#: per EPA CLP protocol, control limits do not apply if sample and/or duplicate concentration is less than 5x the detection limit

### Matrix Spike Analysis

| Analyte | Sample ID | Sample Conc. mg/L | Spike Conc. mg/L | Spike Amount mg/L | Percent Recovery |
|---------|-----------|-------------------|------------------|-------------------|------------------|
| F       | LCS       | < 0.03            | 0.970            | 1.00              | 97.0             |
| F       | LCS       | < 0.03            | 1.03             | 1.00              | 103.             |
| F       | 18-S659   | < 0.03            | 1.02             | 1.00              | 102.             |

Spike Limit: 75% - 125% Recovery

\*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

### Laboratory Control Sample Duplicate Data

| Analyte | Sample ID | Spike Conc. µg/L | Duplicate Conc. µg/L | RPD  |
|---------|-----------|------------------|----------------------|------|
| F       | LCS-DUP   | 0.970            | 1.03                 | 5.61 |

$RPD = \{ (sample - duplicate) / [(sample + duplicate) / 2] \} \times 100$

Duplicate Limit: 20% RPD

LCS Limit: 80% - 120% Recovery

# QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180

## Blank Data

| Analyte | Sample ID | Measured Conc. µg/L | DL Conc. µg/L |
|---------|-----------|---------------------|---------------|
| As      | ICB       | < DL                | 7.00          |
| As      | Meth_Blkc | < DL                | 7.00          |
| As      | CCB       | < DL                | 7.00          |
| As      | CCB       | < DL                | 7.00          |
| Ba      | ICB       | < DL                | 0.500         |
| Ba      | Meth_Blkc | < DL                | 0.500         |
| Ba      | CCB       | < DL                | 0.500         |
| Ba      | CCB       | < DL                | 0.500         |
| Be      | ICB       | < DL                | 0.200         |
| Be      | Meth_Blkc | < DL                | 0.200         |
| Be      | CCB       | < DL                | 0.200         |
| Be      | CCB       | < DL                | 0.200         |
| Cd      | ICB       | < DL                | 0.400         |
| Cd      | Meth_Blkc | < DL                | 0.400         |
| Cd      | CCB       | < DL                | 0.400         |
| Cd      | CCB       | < DL                | 0.400         |
| Co      | ICB       | < DL                | 0.500         |
| Co      | Meth_Blkc | < DL                | 0.500         |
| Co      | CCB       | < DL                | 0.500         |
| Co      | CCB       | < DL                | 0.500         |
| Cr      | ICB       | < DL                | 0.800         |
| Cr      | Meth_Blkc | < DL                | 0.800         |
| Cr      | CCB       | < DL                | 0.800         |
| Cr      | CCB       | < DL                | 0.800         |
| Cu      | ICB       | < DL                | 5.00          |
| Cu      | Meth_Blkc | < DL                | 5.00          |
| Cu      | CCB       | < DL                | 5.00          |
| Cu      | CCB       | < DL                | 5.00          |
| Mn      | ICB       | < DL                | 0.300         |
| Mn      | Meth_Blkc | < DL                | 0.300         |
| Mn      | CCB       | < DL                | 0.300         |
| Mn      | CCB       | < DL                | 0.300         |
| Ni      | ICB       | < DL                | 3.00          |
| Ni      | Meth_Blkc | < DL                | 3.00          |
| Ni      | CCB       | < DL                | 3.00          |
| Ni      | CCB       | < DL                | 3.00          |
| P       | ICB       | < DL                | 20.0          |
| P       | Meth_Blkc | < DL                | 20.0          |
| P       | CCB       | < DL                | 20.0          |
| P       | CCB       | < DL                | 20.0          |
| Pb      | ICB       | < DL                | 5.00          |
| Pb      | Meth_Blkc | < DL                | 5.00          |
| Pb      | CCB       | < DL                | 5.00          |
| Pb      | CCB       | < DL                | 5.00          |
| Sb      | ICB       | < DL                | 5.00          |
| Sb      | Meth_Blkc | < DL                | 5.00          |
| Sb      | CCB       | < DL                | 5.00          |
| Sb      | CCB       | < DL                | 5.00          |
| Se      | ICB       | < DL                | 15.0          |
| Se      | Meth_Blkc | < DL                | 15.0          |
| Se      | CCB       | < DL                | 15.0          |
| Se      | CCB       | < DL                | 15.0          |
| Zn      | ICB       | < DL                | 3.00          |
| Zn      | Meth_Blkc | < DL                | 3.00          |
| Zn      | CCB       | < DL                | 3.00          |
| Zn      | CCB       | < DL                | 3.00          |

\*: Sample Media Blank (SM\_Blkc) concentration in µg/filter  
 ICB: Initial Calibration Blank CCB: Continuing Calibration Blank

## QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180  
 =====

### Calibration QC

| Analyte | Sample ID | Standard Conc. µg/L | Measured Conc. µg/L | Percent Recovery |
|---------|-----------|---------------------|---------------------|------------------|
| As      | ICV       | 2500                | 2480                | 99.2             |
| As      | LL-CCV    | 35.0                | 33.2                | 95.0             |
| As      | CCV       | 2500                | 2500                | 99.8             |
| As      | CCV       | 2500                | 2470                | 98.8             |
| Ba      | ICV       | 2500                | 2460                | 98.6             |
| Ba      | LL-CCV    | 2.50                | 2.66                | 106.2            |
| Ba      | CCV       | 2500                | 2430                | 97.4             |
| Ba      | CCV       | 2500                | 2490                | 99.6             |
| Be      | ICV       | 2500                | 2550                | 101.9            |
| Be      | CCV       | 2500                | 2510                | 100.4            |
| Be      | CCV       | 2500                | 2510                | 100.5            |
| Cd      | ICV       | 2500                | 2540                | 101.8            |
| Cd      | LL-CCV    | 2.00                | 2.46                | 122.8            |
| Cd      | CCV       | 2500                | 2430                | 97.2             |
| Cd      | CCV       | 2500                | 2490                | 99.7             |
| Co      | ICV       | 2500                | 2490                | 99.6             |
| Co      | LL-CCV    | 2.50                | 2.44                | 97.6             |
| Co      | CCV       | 2500                | 2510                | 100.5            |
| Co      | CCV       | 2500                | 2500                | 99.9             |
| Cr      | ICV       | 2500                | 2460                | 98.6             |
| Cr      | LL-CCV    | 4.00                | 4.30                | 107.6            |
| Cr      | CCV       | 2500                | 2490                | 99.7             |
| Cr      | CCV       | 2500                | 2470                | 98.9             |
| Cu      | ICV       | 2500                | 2500                | 100.0            |
| Cu      | LL-CCV    | 25.0                | 25.6                | 102.3            |
| Cu      | CCV       | 2500                | 2410                | 96.5             |
| Cu      | CCV       | 2500                | 2480                | 99.2             |
| Mn      | ICV       | 2500                | 2620                | 104.8            |
| Mn      | LL-CCV    | 1.50                | 1.70                | 113.3            |
| Mn      | CCV       | 2500                | 2500                | 100.2            |
| Mn      | CCV       | 2500                | 2570                | 102.7            |
| Ni      | ICV       | 2500                | 2490                | 99.6             |
| Ni      | LL-CCV    | 15.0                | 15.2                | 101.3            |
| Ni      | CCV       | 2500                | 2520                | 100.6            |
| Ni      | CCV       | 2500                | 2500                | 100.0            |
| P       | ICV       | 2500                | 2520                | 100.6            |
| P       | LL-CCV    | 100.                | 111.                | 111.3            |
| P       | CCV       | 2500                | 2510                | 100.5            |
| P       | CCV       | 2500                | 2490                | 99.6             |
| Pb      | ICV       | 2500                | 2480                | 99.4             |
| Pb      | LL-CCV    | 25.0                | 24.9                | 99.6             |
| Pb      | CCV       | 2500                | 2480                | 99.3             |
| Pb      | CCV       | 2500                | 2450                | 98.1             |
| Sb      | ICV       | 2500                | 2470                | 98.7             |
| Sb      | LL-CCV    | 25.0                | 26.5                | 106.1            |
| Sb      | CCV       | 2500                | 2480                | 99.0             |
| Sb      | CCV       | 2500                | 2440                | 97.8             |
| Se      | ICV       | 2500                | 2540                | 101.5            |
| Se      | LL-CCV    | 75.0                | 68.6                | 91.5             |
| Se      | CCV       | 2500                | 2560                | 102.2            |
| Se      | CCV       | 2500                | 2520                | 100.8            |
| Zn      | ICV       | 2500                | 2540                | 101.6            |
| Zn      | LL-CCV    | 15.0                | 15.9                | 105.7            |
| Zn      | CCV       | 2500                | 2560                | 102.6            |
| Zn      | CCV       | 2500                | 2550                | 102.0            |

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification  
 Calibration Verification Limits: 90% - 110% Recovery  
 LL-CCV: Low Level CCV  
 LL-CCV Limits: 70% - 130% Recovery

## QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180  
 =====

### Duplicate Data

| Analyte | Sample ID | Sample Conc. µg/L | Replicate Conc. µg/L | RPD    |
|---------|-----------|-------------------|----------------------|--------|
| As      | 18-S668   | < 7               | < 7                  | N/C #  |
| Ba      | 18-S668   | 16.11             | 15.80                | 1.94   |
| Be      | 18-S668   | < 0.2             | < 0.2                | N/C #  |
| Cd      | 18-S668   | 1.967             | 1.826                | 7.43 # |
| Co      | 18-S668   | < 0.5             | < 0.5                | N/C #  |
| Cr      | 18-S668   | 6.501             | 6.457                | 0.68   |
| Cu      | 18-S668   | < 5               | < 5                  | N/C #  |
| Mn      | 18-S668   | 5.044             | 5.367                | 6.20   |
| Ni      | 18-S668   | 10.77             | 10.46                | 2.92 # |
| P       | 18-S668   | 46.97             | 44.61                | 5.15 # |
| Pb      | 18-S668   | < 5               | < 5                  | N/C #  |
| Sb      | 18-S668   | < 5               | < 5                  | N/C #  |
| Se      | 18-S668   | < 15              | < 15                 | N/C #  |
| Zn      | 18-S668   | 34.38             | 35.09                | 2.04   |

RPD = {(sample-replicate)/[(sample+replicate)/2]}x100

N/C: RPD is not calculated when sample or replicate is below detection limit

Replicate Limit: 20% RPD

#: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

### Laboratory Control Sample/Post Digestion Spike Analysis

| Analyte | Sample ID | Sample Conc. µg/L | Spike Conc. µg/L | Spike Amount µg/L | Percent Recovery |
|---------|-----------|-------------------|------------------|-------------------|------------------|
| As      | LCS       | < 7               | 2592.            | 2500.             | 104.             |
| As      | LCS       | < 7               | 2586.            | 2500.             | 103.             |
| As      | 18-S670   | < 7               | 2480.            | 2500.             | 99.2             |
| Ba      | LCS       | < 0.5             | 2433.            | 2500.             | 97.3             |
| Ba      | LCS       | < 0.5             | 2464.            | 2500.             | 98.6             |
| Ba      | 18-S670   | 14.44             | 2335.            | 2500.             | 92.8             |
| Be      | LCS       | < 0.2             | 2604.            | 2500.             | 104.             |
| Be      | LCS       | < 0.2             | 2643.            | 2500.             | 106.             |
| Be      | 18-S670   | < 0.2             | 2469.            | 2500.             | 98.8             |
| Cd      | LCS       | < 0.4             | 2642.            | 2500.             | 106.             |
| Cd      | LCS       | < 0.4             | 2645.            | 2500.             | 106.             |
| Cd      | 18-S670   | < 0.4             | 2383.            | 2500.             | 95.3             |
| Co      | LCS       | < 0.5             | 2542.            | 2500.             | 102.             |
| Co      | LCS       | < 0.5             | 2591.            | 2500.             | 104.             |
| Co      | 18-S670   | < 0.5             | 2455.            | 2500.             | 98.2             |
| Cr      | LCS       | < 0.8             | 2479.            | 2500.             | 99.2             |
| Cr      | LCS       | < 0.8             | 2533.            | 2500.             | 101.             |
| Cr      | 18-S670   | 5.433             | 2471.            | 2500.             | 98.6             |
| Cu      | LCS       | < 5               | 2594.            | 2500.             | 104.             |
| Cu      | LCS       | < 5               | 2593.            | 2500.             | 104.             |
| Cu      | 18-S670   | < 5               | 2598.            | 2500.             | 104.             |
| Mn      | LCS       | < 0.3             | 2633.            | 2500.             | 105.             |
| Mn      | LCS       | < 0.3             | 2637.            | 2500.             | 105.             |
| Mn      | 18-S670   | 4.235             | 2470.            | 2500.             | 98.6             |
| Ni      | LCS       | < 3               | 2565.            | 2500.             | 103.             |
| Ni      | LCS       | < 3               | 2694.            | 2500.             | 108.             |
| Ni      | 18-S670   | 10.14             | 2476.            | 2500.             | 98.6             |
| P       | LCS       | < 20              | 2622.            | 2500.             | 105.             |
| P       | LCS       | < 20              | 2595.            | 2500.             | 104.             |
| P       | 18-S670   | 38.75             | 2532.            | 2500.             | 99.7             |
| Pb      | LCS       | < 5               | 2570.            | 2500.             | 103.             |

LCS Limit: 80% - 120% Recovery Spike Limit: 75% - 125% Recovery

\*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

## QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180  
 =====

### Laboratory Control Sample/Post Digestion Spike Analysis

| Analyte | Sample ID | Sample Conc. µg/L | Spike Conc. µg/L | Spike Amount µg/L | Percent Recovery |
|---------|-----------|-------------------|------------------|-------------------|------------------|
| Pb      | LCS       | < 5               | 2550.            | 2500.             | 102.             |
| Pb      | 18-S670   | < 5               | 2339.            | 2500.             | 93.6             |
| Sb      | LCS       | < 5               | 2527.            | 2500.             | 101.             |
| Sb      | LCS       | < 5               | 2527.            | 2500.             | 101.             |
| Sb      | 18-S670   | < 5               | 2400.            | 2500.             | 96.0             |
| Se      | LCS       | < 15              | 2697.            | 2500.             | 108.             |
| Se      | LCS       | < 15              | 2683.            | 2500.             | 107.             |
| Se      | 18-S670   | < 15              | 2493.            | 2500.             | 99.7             |
| Zn      | LCS       | < 3               | 2666.            | 2500.             | 107.             |
| Zn      | LCS       | < 3               | 2717.            | 2500.             | 109.             |
| Zn      | 18-S670   | 25.91             | 2573.            | 2500.             | 102.             |

LCS Limit: 80% - 120% Recovery Spike Limit: 75% - 125% Recovery

\*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

### Laboratory Control Sample Duplicate Data

| Analyte | Sample ID | Spike Conc. µg/L | Duplicate Conc. µg/L | RPD  |
|---------|-----------|------------------|----------------------|------|
| As      | LCS-DUP   | 2590             | 2590                 | 0.23 |
| Ba      | LCS-DUP   | 2430             | 2460                 | 1.27 |
| Be      | LCS-DUP   | 2600             | 2640                 | 1.49 |
| Cd      | LCS-DUP   | 2640             | 2640                 | 0.11 |
| Co      | LCS-DUP   | 2540             | 2590                 | 1.91 |
| Cr      | LCS-DUP   | 2480             | 2530                 | 2.15 |
| Cu      | LCS-DUP   | 2590             | 2590                 | 0.04 |
| Mn      | LCS-DUP   | 2630             | 2640                 | 0.15 |
| Ni      | LCS-DUP   | 2560             | 2690                 | 4.91 |
| P       | LCS-DUP   | 2620             | 2600                 | 1.04 |
| Pb      | LCS-DUP   | 2570             | 2550                 | 0.78 |
| Sb      | LCS-DUP   | 2530             | 2530                 | 0.00 |
| Se      | LCS-DUP   | 2700             | 2680                 | 0.52 |
| Zn      | LCS-DUP   | 2670             | 2720                 | 1.89 |

Duplicate Limit: 20% RPD

RPD =  $\{ (sample - duplicate) / [(sample + duplicate) / 2] \} \times 100$

# QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180

## Blank Data

| Analyte | Sample ID | Measured Conc. µg/L | DL Conc. µg/L |
|---------|-----------|---------------------|---------------|
| As      | ICB       | < DL                | 7.00          |
| As      | Meth_Blkc | < DL                | 7.00          |
| As      | CCB       | < DL                | 7.00          |
| As      | CCB       | < DL                | 7.00          |
| Ba      | ICB       | < DL                | 0.500         |
| Ba      | Meth_Blkc | < DL                | 0.500         |
| Ba      | CCB       | < DL                | 0.500         |
| Ba      | CCB       | < DL                | 0.500         |
| Ba      | ICB       | < DL                | 0.500         |
| Ba      | CCB       | < DL                | 0.500         |
| Be      | ICB       | < DL                | 0.200         |
| Be      | Meth_Blkc | < DL                | 0.200         |
| Be      | CCB       | < DL                | 0.200         |
| Be      | CCB       | < DL                | 0.200         |
| Cd      | ICB       | < DL                | 0.400         |
| Cd      | Meth_Blkc | < DL                | 0.400         |
| Cd      | CCB       | < DL                | 0.400         |
| Cd      | CCB       | < DL                | 0.400         |
| Co      | ICB       | < DL                | 0.500         |
| Co      | Meth_Blkc | < DL                | 0.500         |
| Co      | CCB       | < DL                | 0.500         |
| Co      | CCB       | < DL                | 0.500         |
| Cr      | ICB       | < DL                | 0.800         |
| Cr      | Meth_Blkc | < DL                | 0.800         |
| Cr      | CCB       | < DL                | 0.800         |
| Cr      | CCB       | < DL                | 0.800         |
| Cu      | ICB       | < DL                | 5.00          |
| Cu      | Meth_Blkc | < DL                | 5.00          |
| Cu      | CCB       | < DL                | 5.00          |
| Cu      | CCB       | < DL                | 5.00          |
| Mn      | ICB       | < DL                | 0.300         |
| Mn      | Meth_Blkc | < DL                | 0.300         |
| Mn      | CCB       | < DL                | 0.300         |
| Mn      | CCB       | < DL                | 0.300         |
| Ni      | ICB       | < DL                | 3.00          |
| Ni      | Meth_Blkc | < DL                | 3.00          |
| Ni      | CCB       | < DL                | 3.00          |
| Ni      | CCB       | < DL                | 3.00          |
| P       | ICB       | < DL                | 20.0          |
| P       | Meth_Blkc | < DL                | 20.0          |
| P       | CCB       | < DL                | 20.0          |
| P       | CCB       | < DL                | 20.0          |
| Pb      | ICB       | < DL                | 5.00          |
| Pb      | Meth_Blkc | < DL                | 5.00          |
| Pb      | CCB       | < DL                | 5.00          |
| Pb      | CCB       | < DL                | 5.00          |
| Sb      | ICB       | < DL                | 5.00          |
| Sb      | Meth_Blkc | < DL                | 5.00          |
| Sb      | CCB       | < DL                | 5.00          |
| Sb      | CCB       | < DL                | 5.00          |
| Se      | ICB       | < DL                | 15.0          |
| Se      | Meth_Blkc | < DL                | 15.0          |
| Se      | CCB       | < DL                | 15.0          |
| Se      | CCB       | < DL                | 15.0          |
| Zn      | ICB       | < DL                | 3.00          |
| Zn      | Meth_Blkc | < DL                | 3.00          |
| Zn      | CCB       | < DL                | 3.00          |
| Zn      | CCB       | < DL                | 3.00          |

\*: Sample Media Blank (SM\_Blkc) concentration in µg/filter  
 ICB: Initial Calibration Blank CCB: Continuing Calibration Blank

## QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180  
 =====

### Calibration QC

| Analyte | Sample ID | Standard Conc. µg/L | Measured Conc. µg/L | Percent Recovery |
|---------|-----------|---------------------|---------------------|------------------|
| As      | ICV       | 2500                | 2480                | 99.3             |
| As      | LL-CCV    | 35.0                | 33.4                | 95.5             |
| As      | CCV       | 2500                | 2540                | 101.4            |
| As      | CCV       | 2500                | 2470                | 98.7             |
| Ba      | ICV       | 2500                | 2490                | 99.5             |
| Ba      | LL-CCV    | 2.50                | 2.45                | 97.9             |
| Ba      | CCV       | 2500                | 2510                | 100.6            |
| Ba      | CCV       | 2500                | 2490                | 99.4             |
| Ba      | ICV       | 2500                | 2550                | 101.8            |
| Ba      | LL-CCV    | 2.50                | 2.42                | 96.9             |
| Ba      | CCV       | 2500                | 2520                | 100.8            |
| Be      | ICV       | 2500                | 2610                | 104.3            |
| Be      | LL-CCV    | 1.00                | 1.02                | 102.5            |
| Be      | CCV       | 2500                | 2640                | 105.5            |
| Be      | CCV       | 2500                | 2650                | 106.2            |
| Cd      | ICV       | 2500                | 2560                | 102.2            |
| Cd      | LL-CCV    | 2.00                | 2.06                | 103.0            |
| Cd      | CCV       | 2500                | 2530                | 101.1            |
| Cd      | CCV       | 2500                | 2540                | 101.4            |
| Co      | ICV       | 2500                | 2560                | 102.2            |
| Co      | LL-CCV    | 2.50                | 2.89                | 115.5            |
| Co      | CCV       | 2500                | 2550                | 102.0            |
| Co      | CCV       | 2500                | 2560                | 102.2            |
| Cr      | ICV       | 2500                | 2540                | 101.5            |
| Cr      | LL-CCV    | 4.00                | 4.36                | 109.1            |
| Cr      | CCV       | 2500                | 2530                | 101.1            |
| Cr      | CCV       | 2500                | 2530                | 101.2            |
| Cu      | ICV       | 2500                | 2510                | 100.6            |
| Cu      | LL-CCV    | 25.0                | 26.6                | 106.4            |
| Cu      | CCV       | 2500                | 2530                | 101.3            |
| Cu      | CCV       | 2500                | 2530                | 101.3            |
| Mn      | ICV       | 2500                | 2480                | 99.4             |
| Mn      | LL-CCV    | 1.50                | 1.93                | 128.4            |
| Mn      | CCV       | 2500                | 2540                | 101.6            |
| Mn      | CCV       | 2500                | 2560                | 102.3            |
| Ni      | ICV       | 2500                | 2560                | 102.4            |
| Ni      | LL-CCV    | 15.0                | 16.5                | 110.1            |
| Ni      | CCV       | 2500                | 2560                | 102.2            |
| Ni      | CCV       | 2500                | 2610                | 104.4            |
| P       | ICV       | 2500                | 2410                | 96.3             |
| P       | LL-CCV    | 100.                | 119.                | 119.4            |
| P       | CCV       | 2500                | 2500                | 100.0            |
| P       | CCV       | 2500                | 2490                | 99.5             |
| Pb      | ICV       | 2500                | 2480                | 99.3             |
| Pb      | LL-CCV    | 25.0                | 27.5                | 110.1            |
| Pb      | CCV       | 2500                | 2520                | 100.8            |
| Pb      | CCV       | 2500                | 2450                | 97.8             |
| Sb      | ICV       | 2500                | 2530                | 101.3            |
| Sb      | LL-CCV    | 25.0                | 27.7                | 110.7            |
| Sb      | CCV       | 2500                | 2590                | 103.6            |
| Sb      | CCV       | 2500                | 2520                | 100.8            |
| Se      | ICV       | 2500                | 2520                | 101.0            |
| Se      | LL-CCV    | 75.0                | 73.5                | 98.0             |
| Se      | CCV       | 2500                | 2590                | 103.6            |
| Se      | CCV       | 2500                | 2500                | 100.1            |
| Zn      | ICV       | 2500                | 2610                | 104.5            |
| Zn      | LL-CCV    | 15.0                | 17.5                | 116.8            |

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification  
 Calibration Verification Limits: 90% - 110% Recovery  
 LL-CCV: Low Level CCV  
 LL-CCV Limits: 70% - 130% Recovery



## QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180  
 =====

### Calibration QC

| Analyte | Sample ID | Standard Conc. µg/L | Measured Conc. µg/L | Percent Recovery |
|---------|-----------|---------------------|---------------------|------------------|
| Zn      | CCV       | 2500                | 2620                | 104.6            |
| Zn      | CCV       | 2500                | 2620                | 104.8            |

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification  
 Calibration Verification Limits: 90% - 110% Recovery  
 LL-CCV: Low Level CCV  
 LL-CCV Limits: 70% - 130% Recovery

### Duplicate Data

| Analyte | Sample ID | Sample Conc. µg/L | Replicate Conc. µg/L | RPD    |
|---------|-----------|-------------------|----------------------|--------|
| As      | 18-S669   | < 7               | < 7                  | N/C #  |
| Ba      | 18-S669   | 5.466             | 5.599                | 2.40   |
| Be      | 18-S669   | < 0.2             | < 0.2                | N/C #  |
| Cd      | 18-S669   | < 0.4             | < 0.4                | N/C #  |
| Co      | 18-S669   | < 0.5             | < 0.5                | N/C #  |
| Cr      | 18-S669   | 1.757             | 1.634                | 7.25 # |
| Cu      | 18-S669   | 23.32             | 19.30                | 18.9 # |
| Mn      | 18-S669   | 4.136             | 4.169                | 0.79   |
| Ni      | 18-S669   | < 3               | < 3                  | N/C #  |
| P       | 18-S669   | 25.43             | 22.16                | 13.7 # |
| Pb      | 18-S669   | < 5               | < 5                  | N/C #  |
| Sb      | 18-S669   | < 5               | < 5                  | N/C #  |
| Se      | 18-S669   | < 15              | < 15                 | N/C #  |
| Zn      | 18-S669   | 93.69             | 87.75                | 6.55   |

RPD = {(sample-replicate)/[(sample+replicate)/2]}x100  
 N/C: RPD is not calculated when sample or replicate is below detection limit  
 Replicate Limit: 20% RPD  
 #: per EPA CLP protocol, control limits do not apply if sample and/or replicate concentration is less than 5x the detection limit

### Laboratory Control Sample/Post Digestion Spike Analysis

| Analyte | Sample ID | Sample Conc. µg/L | Spike Conc. µg/L | Spike Amount µg/L | Percent Recovery |
|---------|-----------|-------------------|------------------|-------------------|------------------|
| As      | LCS       | < 7               | 2577.            | 2500.             | 103.             |
| As      | LCS       | < 7               | 2554.            | 2500.             | 102.             |
| As      | 18-S671   | < 7               | 2425.            | 2500.             | 97.0             |
| Ba      | LCS       | < 0.5             | 2539.            | 2500.             | 102.             |
| Ba      | LCS       | < 0.5             | 2541.            | 2500.             | 102.             |
| Ba      | 18-S671   | 5.747             | 2448.            | 2500.             | 97.7             |
| Be      | LCS       | < 0.2             | 2350.            | 2500.             | 94.0             |
| Be      | LCS       | < 0.2             | 2352.            | 2500.             | 94.1             |
| Be      | 18-S671   | < 0.2             | 2265.            | 2500.             | 90.6             |
| Cd      | LCS       | < 0.4             | 2622.            | 2500.             | 105.             |
| Cd      | LCS       | < 0.4             | 2602.            | 2500.             | 104.             |
| Cd      | 18-S671   | < 0.4             | 2478.            | 2500.             | 99.1             |
| Co      | LCS       | < 0.5             | 2665.            | 2500.             | 107.             |
| Co      | LCS       | < 0.5             | 2643.            | 2500.             | 106.             |
| Co      | 18-S671   | < 0.5             | 2531.            | 2500.             | 101.             |
| Cr      | LCS       | < 0.8             | 2653.            | 2500.             | 106.             |

LCS Limit: 80% - 120% Recovery Spike Limit: 75% - 125% Recovery  
 \*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

## QA/QC Report

Client Name: Bison Engineering B020  
 Project Number: B020  
 Analytical Technique: ICP - Optima 8300  
 Sample Description: EPA Method 29  
 Report Number: 18-180  
 =====

### Laboratory Control Sample/Post Digestion Spike Analysis

| Analyte | Sample ID | Sample Conc. µg/L | Spike Conc. µg/L | Spike Amount µg/L | Percent Recovery |
|---------|-----------|-------------------|------------------|-------------------|------------------|
| Cr      | LCS       | < 0.8             | 2648.            | 2500.             | 106.             |
| Cr      | 18-S671   | 1.941             | 2542.            | 2500.             | 102.             |
| Cu      | LCS       | < 5               | 2492.            | 2500.             | 99.7             |
| Cu      | LCS       | < 5               | 2502.            | 2500.             | 100.             |
| Cu      | 18-S671   | 16.74             | 2427.            | 2500.             | 96.4             |
| Mn      | LCS       | < 0.3             | 2647.            | 2500.             | 106.             |
| Mn      | LCS       | < 0.3             | 2694.            | 2500.             | 108.             |
| Mn      | 18-S671   | 4.507             | 2583.            | 2500.             | 103.             |
| Ni      | LCS       | < 3               | 2664.            | 2500.             | 107.             |
| Ni      | LCS       | < 3               | 2636.            | 2500.             | 105.             |
| Ni      | 18-S671   | < 3               | 2528.            | 2500.             | 101.             |
| P       | LCS       | < 20              | 2497.            | 2500.             | 99.9             |
| P       | LCS       | < 20              | 2445.            | 2500.             | 97.8             |
| P       | 18-S671   | < 20              | 2377.            | 2500.             | 95.1             |
| Pb      | LCS       | < 5               | 2594.            | 2500.             | 104.             |
| Pb      | LCS       | < 5               | 2572.            | 2500.             | 103.             |
| Pb      | 18-S671   | < 5               | 2435.            | 2500.             | 97.4             |
| Sb      | LCS       | < 5               | 2609.            | 2500.             | 104.             |
| Sb      | LCS       | < 5               | 2601.            | 2500.             | 104.             |
| Sb      | 18-S671   | < 5               | 2465.            | 2500.             | 98.6             |
| Se      | LCS       | < 15              | 2557.            | 2500.             | 102.             |
| Se      | LCS       | < 15              | 2538.            | 2500.             | 102.             |
| Se      | 18-S671   | < 15              | 2413.            | 2500.             | 96.5             |
| Zn      | LCS       | < 3               | 2682.            | 2500.             | 107.             |
| Zn      | LCS       | < 3               | 2658.            | 2500.             | 106.             |
| Zn      | 18-S671   | 186.9             | 2725.            | 2500.             | 102.             |

LCS Limit: 80% - 120% Recovery Spike Limit: 75% - 125% Recovery

\*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

### Laboratory Control Sample Duplicate Data

| Analyte | Sample ID | Spike Conc. µg/L | Duplicate Conc. µg/L | RPD  |
|---------|-----------|------------------|----------------------|------|
| As      | LCS-DUP   | 2580             | 2550                 | 0.90 |
| Ba      | LCS-DUP   | 2540             | 2540                 | 0.08 |
| Be      | LCS-DUP   | 2350             | 2350                 | 0.09 |
| Cd      | LCS-DUP   | 2620             | 2600                 | 0.77 |
| Co      | LCS-DUP   | 2660             | 2640                 | 0.83 |
| Cr      | LCS-DUP   | 2650             | 2650                 | 0.19 |
| Cu      | LCS-DUP   | 2490             | 2500                 | 0.40 |
| Mn      | LCS-DUP   | 2650             | 2690                 | 1.76 |
| Ni      | LCS-DUP   | 2660             | 2640                 | 1.06 |
| P       | LCS-DUP   | 2500             | 2440                 | 2.10 |
| Pb      | LCS-DUP   | 2590             | 2570                 | 0.85 |
| Sb      | LCS-DUP   | 2610             | 2600                 | 0.31 |
| Se      | LCS-DUP   | 2560             | 2540                 | 0.75 |
| Zn      | LCS-DUP   | 2680             | 2660                 | 0.90 |

Duplicate Limit: 20% RPD

RPD =  $\{ (sample - duplicate) / [(sample + duplicate) / 2] \} \times 100$

## QA/QC Report

Client Name: Bison Engineering  
Project Number: B020  
Analytical Technique: Ion Chromatography  
Sample Description: EPA Method 26A  
Report Number: 18-180  
=====

### Blank Data

| Analyte | Sample ID | Measured Conc. mg/L | DL Conc. mg/L |
|---------|-----------|---------------------|---------------|
| F       | ICB       | < DL                | 0.010         |
| F       | CCB       | < DL                | 0.010         |
| F       | CCB       | < DL                | 0.010         |
| F       | CCB       | < DL                | 0.010         |

ICB: Initial Calibration Blank CCB: Continuing Calibration Blank

### Calibration QC

| Analyte | Sample ID | Standard Conc. mg/L | Measured Conc. mg/L | Percent Recovery |
|---------|-----------|---------------------|---------------------|------------------|
| F       | ICV       | 1.00                | 1.03                | 102.6            |
| F       | CCV       | 1.00                | 1.03                | 103.2            |
| F       | CCV       | 1.00                | 1.03                | 103.1            |
| F       | CCV       | 1.00                | 1.03                | 103.4            |

ICV: Initial Calibration Verification CCV: Continuing Calibration Verification  
Calibration Verification Limits: 90% - 110% Recovery

### Duplicate Data

All samples analyzed in duplicate. The reported concentrations are the average of the two measurements.

### Matrix Spike Analysis

| Analyte | Sample ID | Sample Conc. mg/L | Spike Conc. mg/L | Spike Amount mg/L | Percent Recovery |
|---------|-----------|-------------------|------------------|-------------------|------------------|
| F       | 18-S685   | 0.205             | 1.14             | 1.00              | 94.0             |
| F       | 18-S690   | 0.234             | 1.14             | 1.00              | 90.4             |

Spike Limit: 75% - 125% Recovery

\*: per EPA CLP protocol, control limits do not apply if spike concentration is less than 25% of the sample concentration

LCS Limit: 80% - 120% Recovery

# CHESTER LABNET

## SOURCE SAMPLE RECEIPT CHECKLIST

Client Bison Engineering Date 5/1/18

# Runs 6 + blanks + Audits Report # 18-180

Custody Seals Inspected, If Present

Hand Delivered

Chain-of-Custody Form Inspected

**CoC present with samples?**

CoC indicate analytical methodology to be used? (eg M29 etc)

CoC indicate if compliance testing? (esp. M26)

M26 samples have Thiosulfate added in field?

M29 indicate FH/BH separate or combined?

Has Form Been Signed?

Have Date and Time Custody Released Been Noted on Form?

|          |    |
|----------|----|
| ✓        |    |
| ✓        | *  |
| ✓        | !! |
| Audits ✓ | !! |
| NA       | !! |
| Audits ✓ | !! |
| ✓        |    |
| ✓        |    |

All Sample Containers Inspected

Does Number of Samples Match Number on CoC Form?

Do All Sample ID Numbers Match Those on the CoC Form?

**Did client mark sample volumes prior to shipment?**

If required by method, did client vent samples prior to shipment?

Are the Sample Containers Intact?

**Are signs of leakage present?**

|    |    |
|----|----|
| ✓  |    |
| ✓  | !! |
| ✓  | !! |
| ✓  | *  |
| NA |    |
| ✓  | !! |
| NO | *  |

Chain-of-Custody Form Signed and Dated by CLN

|   |
|---|
| ✓ |
|---|

Corrective Actions

Client Contacted Due to Mismatching Sample ID Numbers

Client Contacted Due to Broken Sample Container(s)

Client Contacted Due to Leaking Sample Container(s)

Client contacted for verification of methodology?

Corrective Actions Documented?

Corrective Actions Accomplished?

|                   |
|-------------------|
| <del>5/1/18</del> |
| <del>5/1/18</del> |
| <del>5/1/18</del> |
| <del>5/1/18</del> |
| <del>5/1/18</del> |
| <del>5/1/18</del> |

Items marked !! shall be addressed prior to any analytical work being started.

Items marked \* shall be noted in case narrative upon reporting of results to client.

Signed Jim Ball

Notes M13B - all received and intact. M26 - audit not present  
will be sent. M2A - metals not listed on CoC - confirmed  
via phone metals request 5/1/18. H<sub>2</sub>O Blank sent but  
is not needed.  
M26 Audit received 5/4/18 @ 10:00

|                 |                            |                         |              |
|-----------------|----------------------------|-------------------------|--------------|
| Company Name    |                            | Bison Engineering, Inc. |              |
| Contact         | Kelly Dorsi                | Phone                   | 406-442-5768 |
| E-Mail Address  | kdorsi@bison-eng.com       | Fax                     |              |
| Report Address  | 1400 11 <sup>th</sup> Ave. |                         |              |
| City            | Helena                     | State                   | MT           |
|                 |                            | Zip                     | 59601        |
| Billing Address |                            |                         |              |
| City            |                            | State                   |              |
|                 |                            | Zip                     |              |
| PO #            |                            | Project                 | HAV218610    |

# CHAIN-OF-CUSTODY RECORD

[illegible]

12242 SW Garden Place  
Tigard, OR 97223  
(503) 624-2183  
Fax (503) 624-2653  
cln@chesterlab.net

## Page 1 of 1

|                                         |                       |                       |  |
|-----------------------------------------|-----------------------|-----------------------|--|
| Company Name<br>Bison Engineering, Inc. |                       | Phone<br>406-442-5768 |  |
| Contact<br>Kelly Doss                   |                       | Fax                   |  |
| E-Mail Address<br>kdoss@bison-eng.com   |                       |                       |  |
| Report Address<br>1400 11th Ave.        |                       |                       |  |
| City<br>Helena                          | State<br>MT           | Zip<br>59601          |  |
| Billing Address                         |                       |                       |  |
| City<br>( )                             | State<br>( )          | Zip<br>( )            |  |
| PO #                                    | Project<br>HAY 218610 |                       |  |

[illegible]

# CHESTER LabNet

12242 SW Garden Place  
Tigard, OR 97223  
(503) 624-2183  
Fax (503) 624-2653  
cln@chesterlab.net

## CHAIN-OF-CUSTODY RECORD

Page 1 of 1

|                                               |                             |                              |  |
|-----------------------------------------------|-----------------------------|------------------------------|--|
| Company Name<br><b>Bison Engineering</b>      |                             | Phone<br><b>406-442-5768</b> |  |
| Contact<br><b>Kelly Dorsi</b>                 | Fax<br><b>406-442-5768</b>  |                              |  |
| E-Mail Address<br><b>kdorsi@bison-eng.com</b> |                             |                              |  |
| Report Address<br><b>1400 11th Ave</b>        |                             |                              |  |
| City<br><b>Helena</b>                         | State<br><b>MT</b>          | Zip<br><b>59601</b>          |  |
| Billing Address<br><b>Same</b>                |                             |                              |  |
| City<br><b>Same</b>                           | State<br><b>MT</b>          | Zip<br><b>59601</b>          |  |
| PO #                                          | Project<br><b>HAU218610</b> |                              |  |

18-5675 Quetzal filter blank CFU114 4/28/18

| LabNet ID | Field Sample ID                                          | Site | Sample Date | Volume (m³) | Particle Size |
|-----------|----------------------------------------------------------|------|-------------|-------------|---------------|
| 18-5667   | Cont #4 R-1 CFU114                                       |      | 4/28/18     | 336         |               |
| 5669      | Cont #4 R-2 CFU114                                       |      | 4/28/18     | 360         |               |
| 5673      | Cont #4 R-3 CFU114                                       |      | 4/28/18     | 365         |               |
|           | PR Cont #3 R-1 CFU114                                    |      | 04/28/18    | 109         |               |
|           | PR Cont #3 R-2 CFU114                                    |      | 4/28/18     | 75          |               |
|           | PR Cont #3 R-3 CFU114                                    |      | 4/28/18     | 100         |               |
| 18-5676   | Blank 8% H <sub>2</sub> O <sub>2</sub>                   |      |             | 200         |               |
| 18-5674   | Blank 0.1M H <sub>2</sub> O <sub>2</sub>                 |      |             | 300         |               |
| 18-5666   | Cont #1 R-1 CFU114                                       |      | 4/28/18     | N/A         |               |
| 5670      | Cont #1 R-2 CFU114                                       |      | 4/28/18     | N/A         |               |
| 5672      | Cont #1 R-3 CFU114                                       |      | 4/28/18     | N/A         |               |
|           | HPLC D <sub>2</sub> H <sub>2</sub> O <sub>2</sub> CFU114 |      | 4/28/18     | 100         |               |

### Notes:

|                                                    |                          |                                                |                           |
|----------------------------------------------------|--------------------------|------------------------------------------------|---------------------------|
| Relinquished By: (Signature)<br><i>[Signature]</i> | Date/Time<br>4/30/18     | Received By: (Signature)<br><i>[Signature]</i> | Date/Time<br>5/1/18 3:20  |
| Relinquished By: (Signature)<br><i>[Signature]</i> | Date/Time<br>5/1/18 3:20 | Received By: (Signature)<br><i>[Signature]</i> | Date/Time<br>5/1/18 15:20 |

Turn Around Time  
☒ Standard  
☐ Rush Specify \_\_\_\_\_

Remarks

12242 SW Garden Place  
Tigard, OR 97223  
(503) 624-2183  
Fax (503) 624-2653  
cln@chesterlab.net

# CHAIN-OF-CUSTODY RECORD

Page 1 of 1

|                                         |                       |
|-----------------------------------------|-----------------------|
| Company Name<br>Bison Engineering, Inc. |                       |
| Contact<br>Kelly Dorsi                  | Phone<br>406-442-5768 |
| E-Mail Address<br>kdorsi@bison-eng.com  | Fax                   |
| Report Address<br>1400 11th Ave.        |                       |
| City<br>Helena                          | State<br>MT           |
| Zip<br>59601                            |                       |
| Billing Address                         |                       |
| City                                    | State                 |
| Zip                                     | Zip                   |
| PO #                                    | Project<br>HAYZ18610  |

[illegible]



12242 SW Garden Place  
Tigard, OR 97223  
(503) 624-2183  
Fax (503) 624-2653  
c1n@chesterlab.net

## Page 1 of 2

|                 |                           |                         |              |
|-----------------|---------------------------|-------------------------|--------------|
| Company Name    |                           | Bison Engineering, Inc. |              |
| Contact         | Kelly Dorsi               | Phone                   | 406-442-5768 |
| E-Mail Address  | Kdorsi@bison-eng.com      | Fax                     |              |
| Report Address  | 1400 11 <sup>th</sup> Ave |                         |              |
| City            | Helena                    | State                   | MT           |
|                 |                           | Zip                     | 59601        |
| Billing Address |                           |                         |              |
| City            |                           | State                   |              |
|                 |                           | Zip                     |              |
| PO #            | Project                   |                         |              |

[illegible]

12242 SW Garden Place  
Tigard, OR 97223  
(503) 624-2183  
Fax (503) 624-2653  
cln@chesterlab.net

## Page 1 of 1

|                                             |                       |              |  |
|---------------------------------------------|-----------------------|--------------|--|
| Company Name<br>Bison Engineering, Inc.     |                       |              |  |
| Contact<br>Kelli + Darsi                    | Phone<br>406-442-5768 |              |  |
| E-Mail Address<br>Kdarsi@bison-eng.com      | Fax                   |              |  |
| Report Address<br>1400 11 <sup>th</sup> Ave |                       |              |  |
| City<br>Helena                              | State<br>MT           | Zip<br>59601 |  |
| Billing Address                             |                       |              |  |
| City<br>"                                   | State<br>"            | Zip<br>"     |  |
| PO #                                        | Project<br>HAW218610  |              |  |

[illegible]

**RAW DATA**

Available upon request

# Bison Engineering

1400 11th Avenue  
Helena, MT 59601

CFU 114  
Corvallis, OR  
Project # HAV 218610

Analytical Report  
(0418-172R)

***EPA Method 316***  
Formaldehyde



**Enthalpy Analytical, LLC**

Phone: (919) 850 - 4392 / Fax: (919) 850 - 9012 / [www.enthalpy.com](http://www.enthalpy.com)  
800-1 Capitola Drive Durham, NC 27713-4385

I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF) and contains ??? pages.

Report Issued: xx/xx/xxxx

# Summary of Results

## Enthalpy Analytical

Company: Bison Engineering

Job No.: 0418-172 - EPA Method 316

Client No.: HAV 218610

| Compound     |                          | Sample ID / Catch Weight (µg) |                       |  |
|--------------|--------------------------|-------------------------------|-----------------------|--|
| Formaldehyde | <b><i>R1.Cond</i></b>    | <b><i>R2.Cond</i></b>         | <b><i>R3.Cond</i></b> |  |
|              | 455                      | 349                           | 416                   |  |
| Formaldehyde | <b><i>DiBlk.Cond</i></b> | <b><i>FTB.Cond</i></b>        |                       |  |
|              | 4.73 ND                  | 4.18 ND                       |                       |  |

# Results



# Enthalpy Analytical

Company: Bison Engineering

Job No.: 0418-172 - EPA Method 316

Client No.: HAV 218610

MDL 0.0137 (µg/mL)

Lower Curve Limit 0.274 (µg/mL)

LOQ 0.274 (µg/mL)

Upper Curve Limit 3.29 (µg/mL)

Compound Formaldehyde

| Sample ID         | Lab ID | Absorbance | Conc (µg/mL) | Dilution | Volume (mL) | Catch Weight (µg) | Qual |
|-------------------|--------|------------|--------------|----------|-------------|-------------------|------|
| <b>R1.Cond</b>    | 11     | 0.4697     | 1.0511       | 1        | 433         | 455               |      |
| <b>R2.Cond</b>    | 17     | 0.3456     | 0.7735       | 1        | 451         | 349               |      |
| <b>R3.Cond</b>    | 18     | 0.3815     | 0.8537       | 1        | 488         | 416               |      |
| <b>DiBlk.Cond</b> | 19     | 0.0020     | 0.0137       | 1        | 345         | 4.73              | ND   |
| <b>FTB.Cond</b>   | 20     | 0.0011     | 0.0137       | 1        | 305         | 4.18              | ND   |

|                              |    |        |        |   |      |        |    |
|------------------------------|----|--------|--------|---|------|--------|----|
| <b>Snowball II 2009 #MB</b>  | 10 | 0.0000 | 0.0137 | 1 | 1.00 | 0.0137 | ND |
| <b>Snowball II 2009 #MB1</b> | 3  | 0.0014 | 0.0137 | 1 | 1.00 | 0.0137 | ND |
| <b>Snowball II 2009 #MB2</b> | 14 | 0.0013 | 0.0137 | 1 | 1.00 | 0.0137 | ND |
| <b>Snowball II 2009 #MB3</b> | 3  | 0.0010 | 0.0137 | 1 | 1.00 | 0.0137 | ND |

|                          |    |        |        |   |     |      |  |
|--------------------------|----|--------|--------|---|-----|------|--|
| <b>Lab Dup / R1.Cond</b> | 19 | 0.4726 | 1.0576 | 1 | 433 | 458  |  |
| % Difference             |    |        |        |   |     | 0.6% |  |

|                          |    |        |        |   |     |      |  |
|--------------------------|----|--------|--------|---|-----|------|--|
| <b>Alt Dil / R1.Cond</b> | 20 | 0.2430 | 0.5438 | 2 | 433 | 471  |  |
| %Difference              |    |        |        |   |     | 3.4% |  |

|                     |    |        |        |   |      |      |  |
|---------------------|----|--------|--------|---|------|------|--|
| <b>MS / R1.Cond</b> | 20 | 0.8660 | 1.9378 | 1 | 2.50 | 4.84 |  |
| spike amount (ug)   |    |        |        |   |      | 2.19 |  |
| native amount (ug)  |    |        |        |   |      | 2.61 |  |
| Spike recovery      |    |        |        |   |      | 102% |  |

# Narrative Summary

## Enthalpy Analytical Narrative Summary

|                 |                           |
|-----------------|---------------------------|
| <b>Company</b>  | Bison Engineering, Inc.   |
| <b>Job #</b>    | 0418-133 – EPA Method 316 |
| <b>Client #</b> | HAV 218610                |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Custody</b>         | Matthew St. Lawrence of Enthalpy Analytical, LLC received the samples on 4/30/18 at 7.2 °C after being relinquished by Bison Engineering, Inc. The samples were received in good condition. Prior to, during, and after analysis, the samples were kept under lock with access only to authorized personnel by Enthalpy Analytical, LLC.                                                                                                                                                                                                                                                                                                           |
| <b>Analysis</b>        | <p>The samples were analyzed for formaldehyde using the analytical procedures in EPA Method 316, Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries (40 CFR Part 63, Appendix A).</p> <p>The Hewlett Packard Model 8453, Diode Array Spectrophotometer “Snowball II” (S/N US73000904) was operated at 570 nm.</p>                                                                                                                                                                                                                                                         |
| <b>Calibration</b>     | The calibration curve is located in the Raw Data section of this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>QC Notes</b>        | <p>The analyses of the field and laboratory blanks did not show formaldehyde at concentrations greater than the detection limit.</p> <p>A matrix spike was prepared using aliquots of sample <b>R1.Cond.</b> The matrix spike was analyzed in the same manner as the samples and exhibited a spike recovery of 102%.</p> <p>Laboratory duplicate (LD) and Alternate Dilution (AD) analyses were performed using aliquots of sample <b>R1.Cond.</b> The LD and AD analyses exhibited differences 0.6% and 3.4% from the original result, respectively.</p> <p>The samples were analyzed within the 14-day holding time specified by the method.</p> |
| <b>Reporting Notes</b> | Aliquots were received for each of the samples. The client provided the samples’ full volumes which have been used to determine the sample catch weights in this revised report. The volumes of the client’s blank samples are reported as measured by the laboratory.                                                                                                                                                                                                                                                                                                                                                                             |

## Enthalpy Analytical Narrative Summary

(continued)

### Reporting Notes (continued)

These analyses met the requirements of the TNI Standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

The results presented in this report are representative of the samples as provided to the laboratory.

## General Reporting Notes

The following are general reporting notes that are applicable to all Enthalpy Analytical, Inc. data reports, unless specifically noted otherwise.

- Any analysis which refers to the method as “**Type**” represents a planned deviation from the reference method. For instance a Hydrogen Sulfide assay from a Tedlar bag would be labeled as “EPA Method 16-Type” because Tedlar bags are not mentioned as one of the collection options in EPA Method 16.
- The acronym **MDL** represents the Minimum Detection Limit. Below this value the laboratory cannot determine the presence of the analyte of interest reliably.
- The acronym **LOQ** represents the Limit of Quantification. Below this value the laboratory cannot quantitate the analyte of interest within the criteria of the method.
- The acronym **ND** following a value indicates a non-detect or analytical result below the MDL.
- The letter **J** in the Qualifier or Flag column in the results indicates that the value is between the MDL and the LOQ. The laboratory can positively identify the analyte of interest as present, but the value should be considered an estimate.
- The letter **E** in the Qualifier or Flag column indicates an analytical result exceeding 100% of the highest calibration point. The associated value should be considered as an estimate.
- The acronym **DF** represents Dilution Factor. This number represents dilution of the sample during the preparation and/or analysis process. The analytical result taken from a laboratory instrument is multiplied by the DF to determine the final undiluted sample results.
- The addition of **MS** to the Sample ID represents a Matrix Spike. An aliquot of an actual sample is spiked with a known amount of analyte so that a percent recovery value can be determined. The MS analysis indicates what effect the sample matrix may have on the target analyte, i.e. whether or not anything in the sample matrix interferes with the analysis of the analyte(s).
- The addition of **MSD** to the Sample ID represents a Matrix Spike Duplicate. Prepared in the same manner as a MS, the use of duplicate matrix spikes allows further confirmation of laboratory quality by showing the consistency of results gained by performing the same steps multiple times.
- The addition of **LD** to the Sample ID represents a Laboratory Duplicate. The analyst prepares an additional aliquot of sample for testing and the results of the duplicate analysis are compared to the initial result. The result should have a difference value of within 10% of the initial result (if the results of the original analysis are greater than the LOQ).

# General Reporting Notes

(continued)

- The addition of **AD** to the Sample ID represents an Alternate Dilution. The analyst prepares an additional aliquot at a different dilution factor (usually double the initial factor). This analysis helps confirm that no additional compound is present and coeluting or sharing absorbance with the analyte of interest, as they would have a different response/absorbance than the analyte of interest.
- The Sample ID **LCS** represents a Laboratory Control Sample. Clean matrix, similar to the client sample matrix, prepared and analyzed by the laboratory using the same reagents, spiking standards and procedures used for the client samples. The LCS is used to assess the control of the laboratory's analytical system. Whenever spikes are prepared for our client projects, two spikes are retained as LCSs. The LCSs are labeled with the associated project number and kept in-house at the appropriate temperature conditions. When the project samples are received for analysis, the LCSs are analyzed to confirm that the analyte could be recovered from the media, separate from the samples which were used on the project and which may have been affected by source matrix, sample collection and/or sample transport.
- **Significant Figures:** Where the reported value is much greater than unity (1.00) in the units expressed, the number is rounded to a whole number of units, rather than to 3 significant figures. For example, a value of 10,456.45 ug catch is rounded to 10,456 ug. There are five significant digits displayed, but no confidence should be placed on more than two significant digits.
- **Manual Integration:** The data systems used for processing will flag manually integrated peaks with an "M". There are several reasons a peak may be manually integrated. These reasons will be identified by the following two letter designations on sample chromatograms, if provided in the report. The peak was **not integrated** by the software "**NI**", the peak was **integrated incorrectly** by the software "**II**" or the **wrong peak** was integrated by the software "**WP**". These codes will accompany the analyst's manual integration stamp placed next to the compound name on the chromatogram.

# Sample Custody





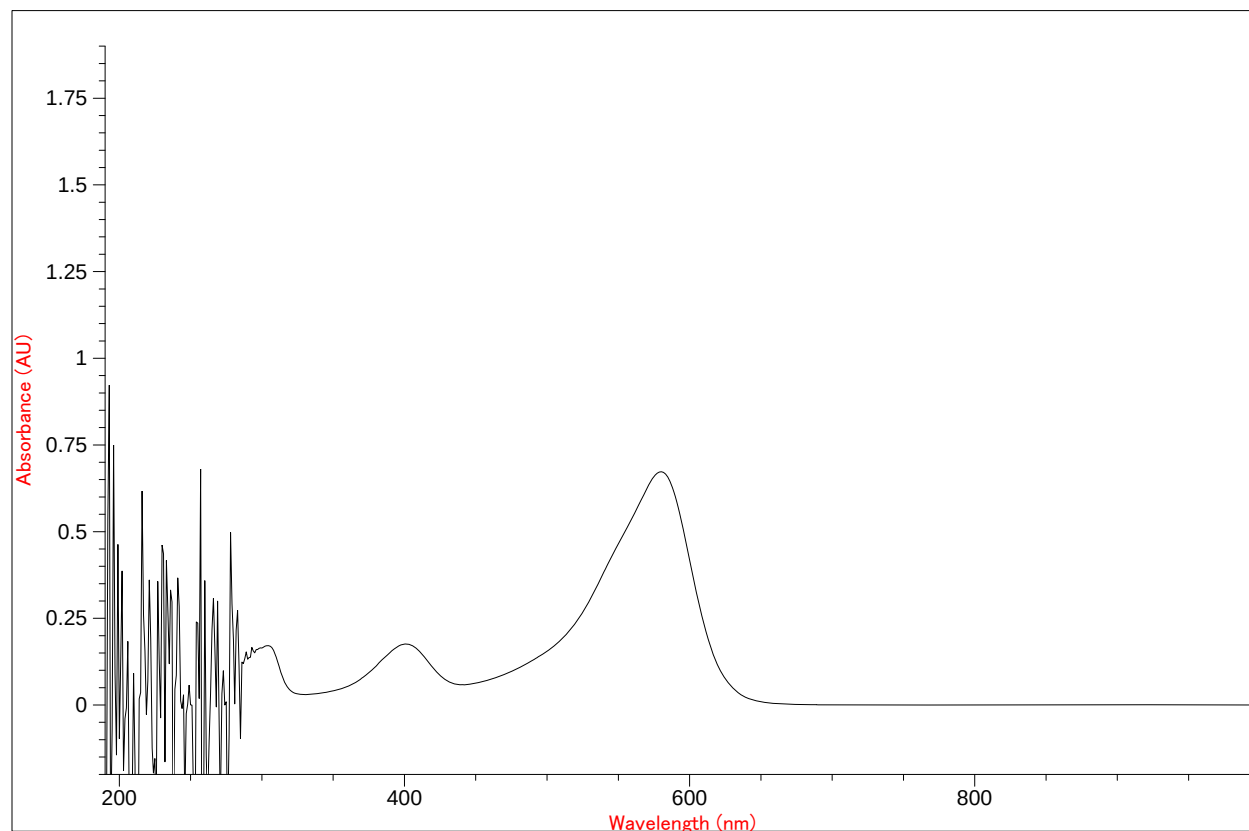


# Raw Data

## Sample 1

Sample Name Snowball II 2009 #SS1 (#8)  
Operator Patricia Mann  
Date 5/8/18  
Time 13:15:28  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



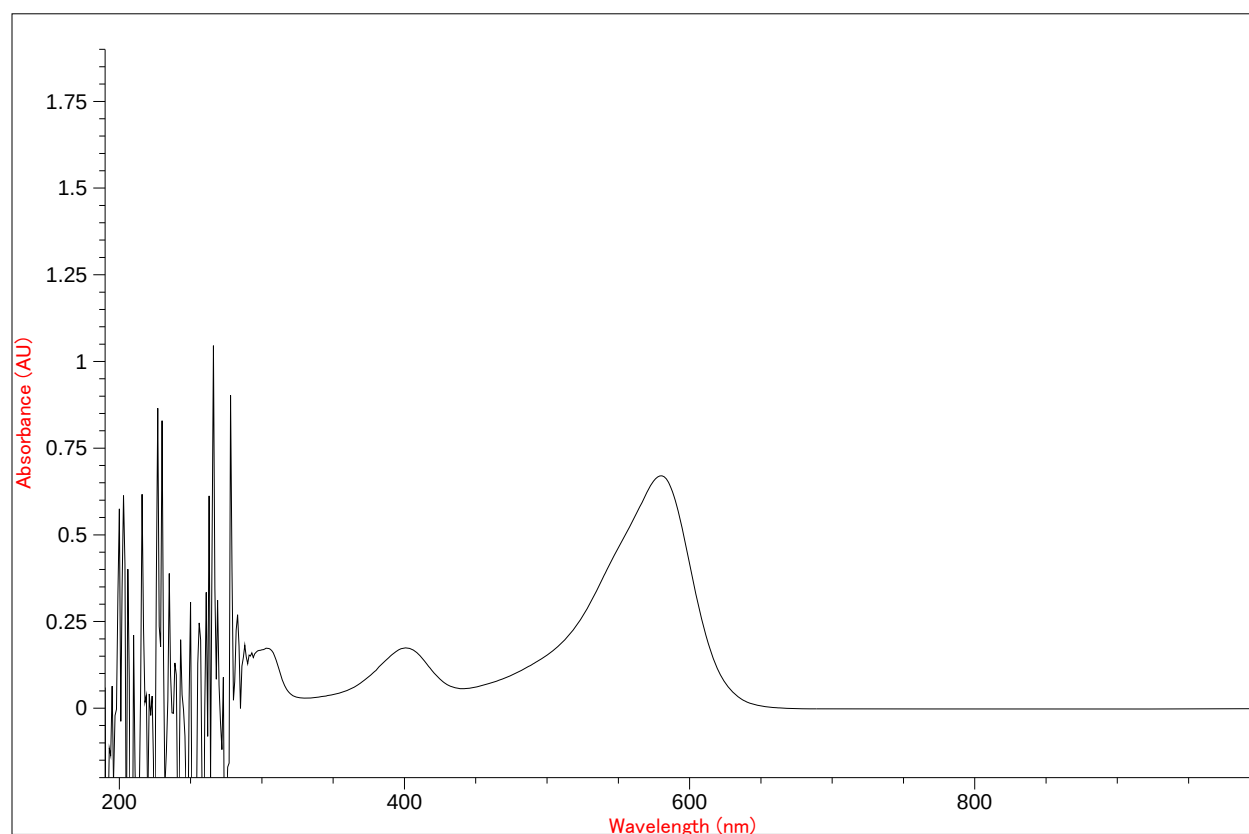
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.39746 | ug/mL | 0.01289   |

## Sample 2

Sample Name Snowball II 2009 #SS2 (#9)  
Operator Patricia Mann  
Date 5/8/18  
Time 13:15:44  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



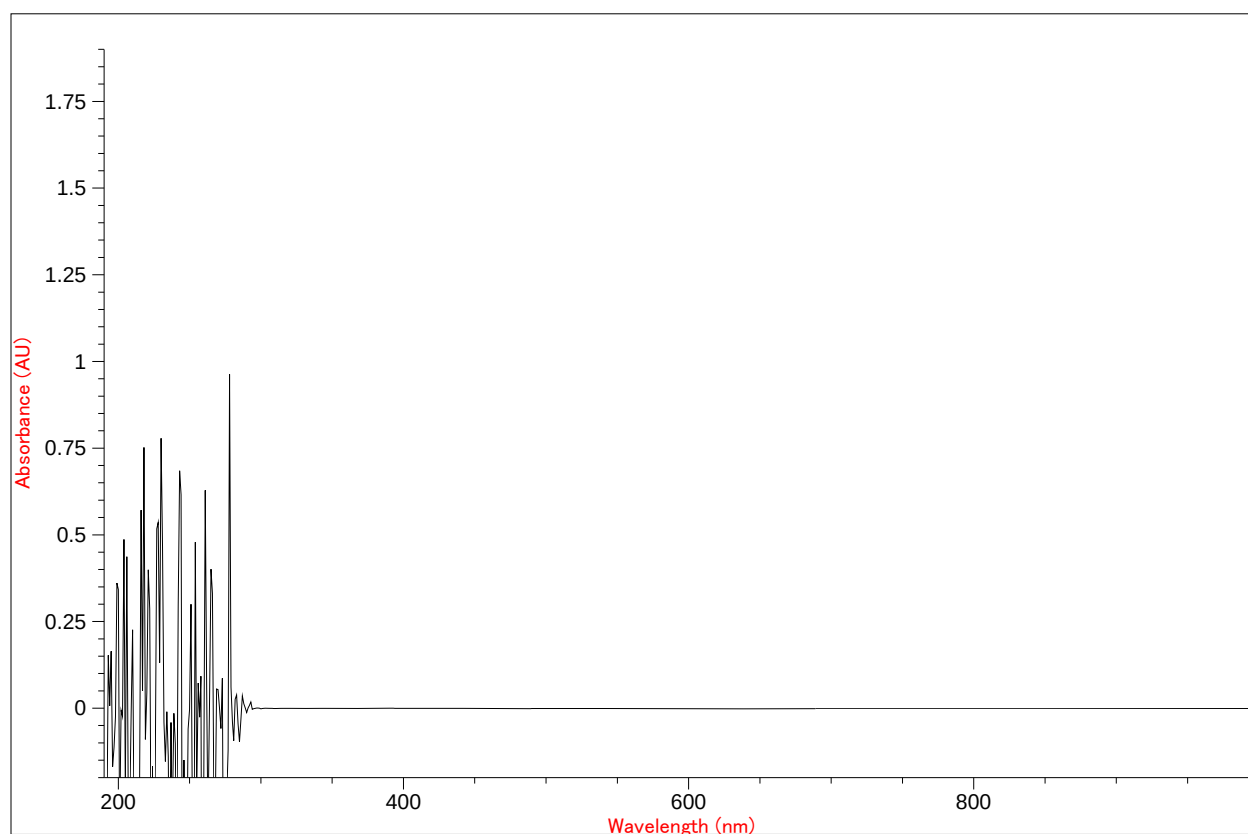
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.39190 | ug/mL | 0.01288   |

## Sample 3

Sample Name Snowball II 2009 #MB (#10)  
Operator Patricia Mann  
Date 5/8/18  
Time 13:16:00  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



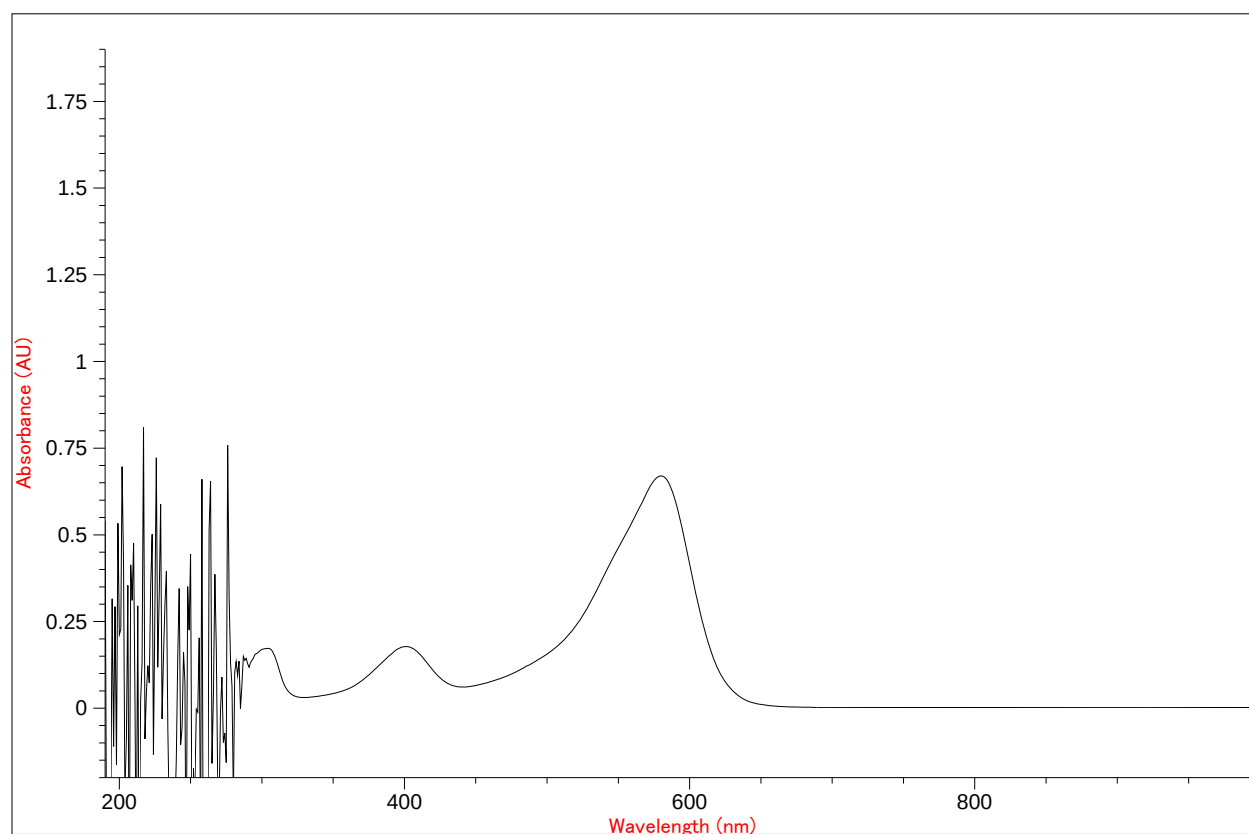
## Data Analysis Results

| # | Analyte Name | Value    | Unit  | Std. Dev. |
|---|--------------|----------|-------|-----------|
| 1 | Formaldehyde | -0.00183 | ug/mL | 0.01221   |

## Sample 4

Sample Name Snowball II 2009 #SSA (#2)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:46:07  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



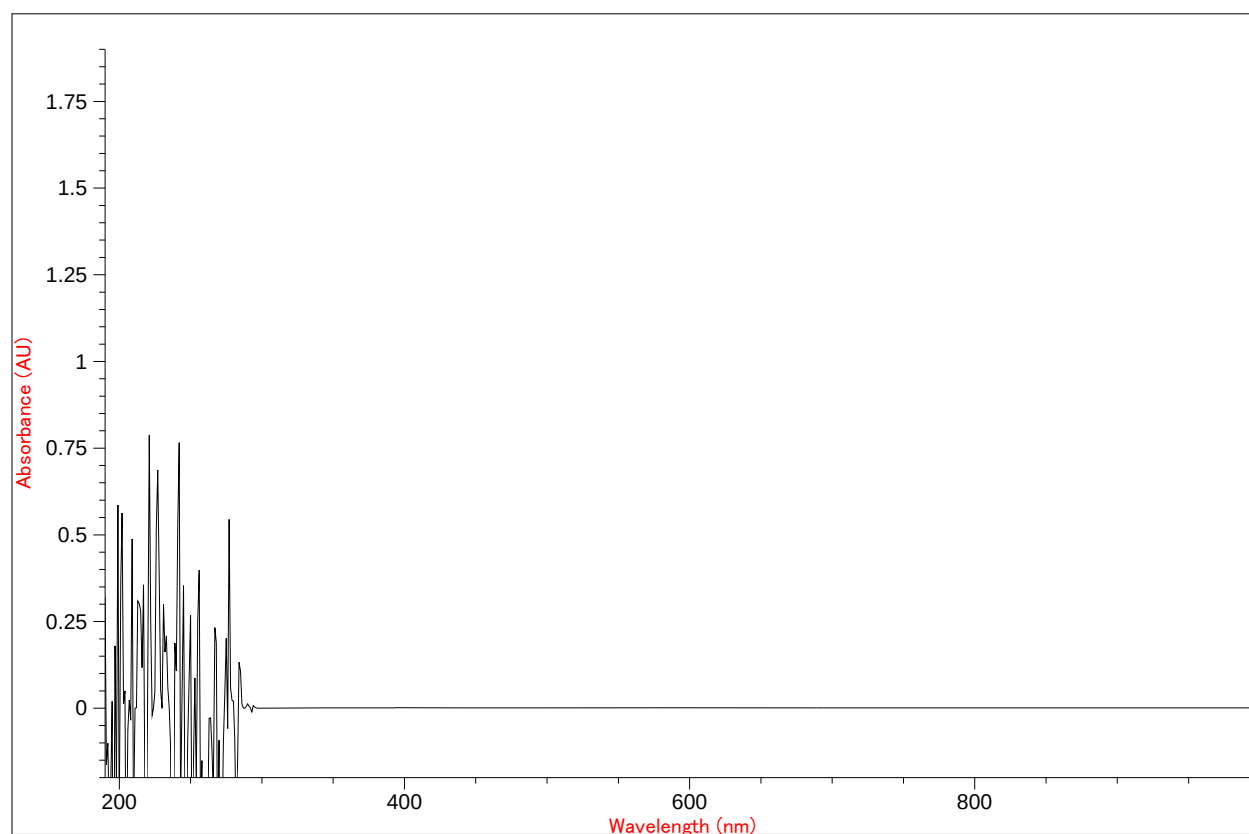
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.39191 | ug/mL | 0.01288   |

## Sample 5

Sample Name Snowball II 2009 #MB1 (#3)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:46:25  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



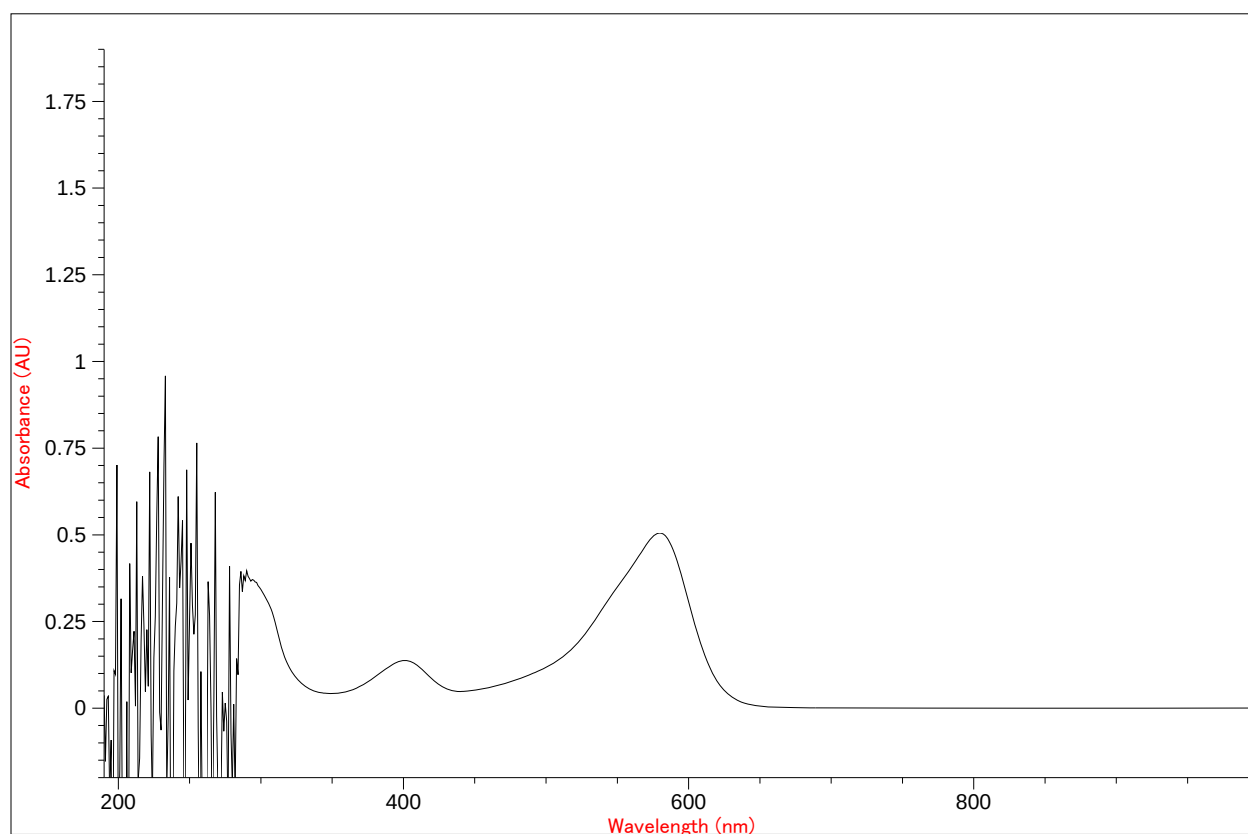
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00302 | ug/mL | 0.01221   |

## Sample 6

Sample Name 0418-172.R1.Cond (#11)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:50:33  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



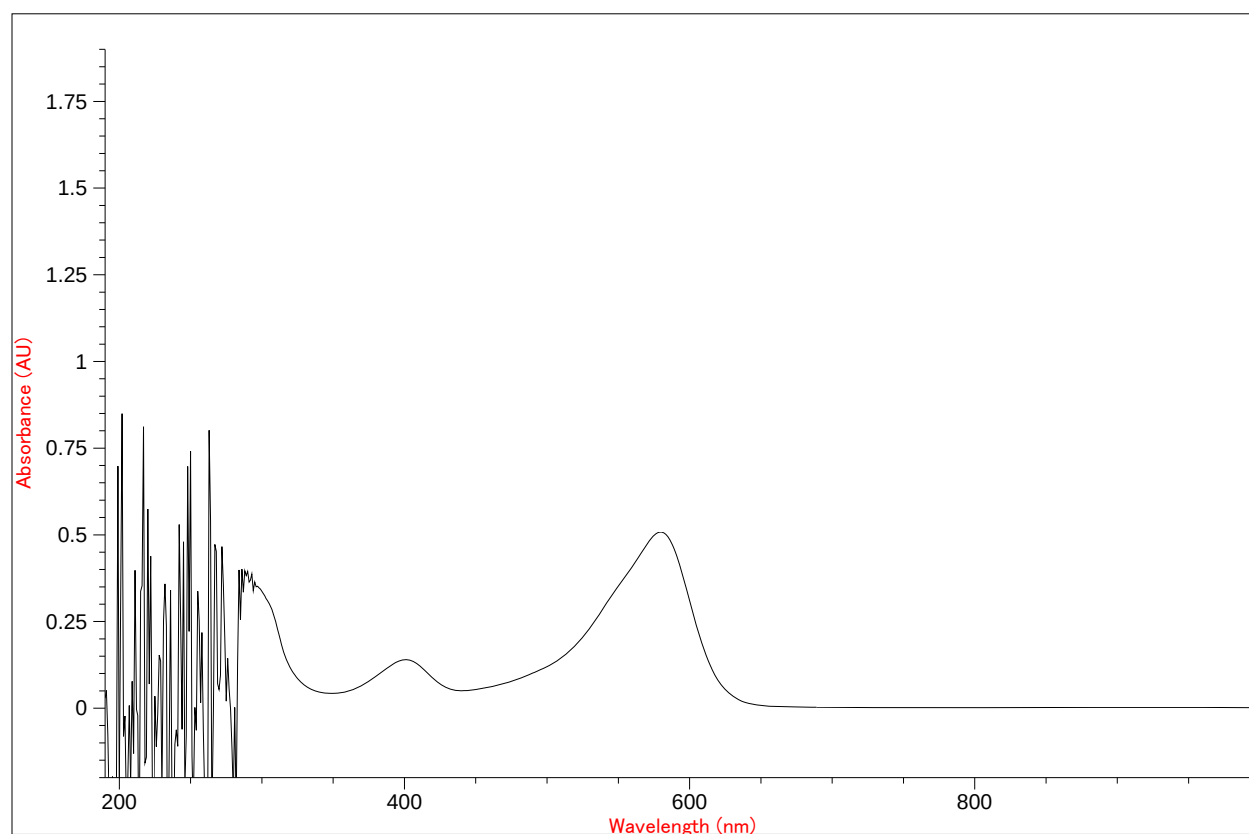
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.05114 | ug/mL | 0.01260   |

## Sample 7

Sample Name 0418-172.LD-R1.Cond (#12)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:51:19  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

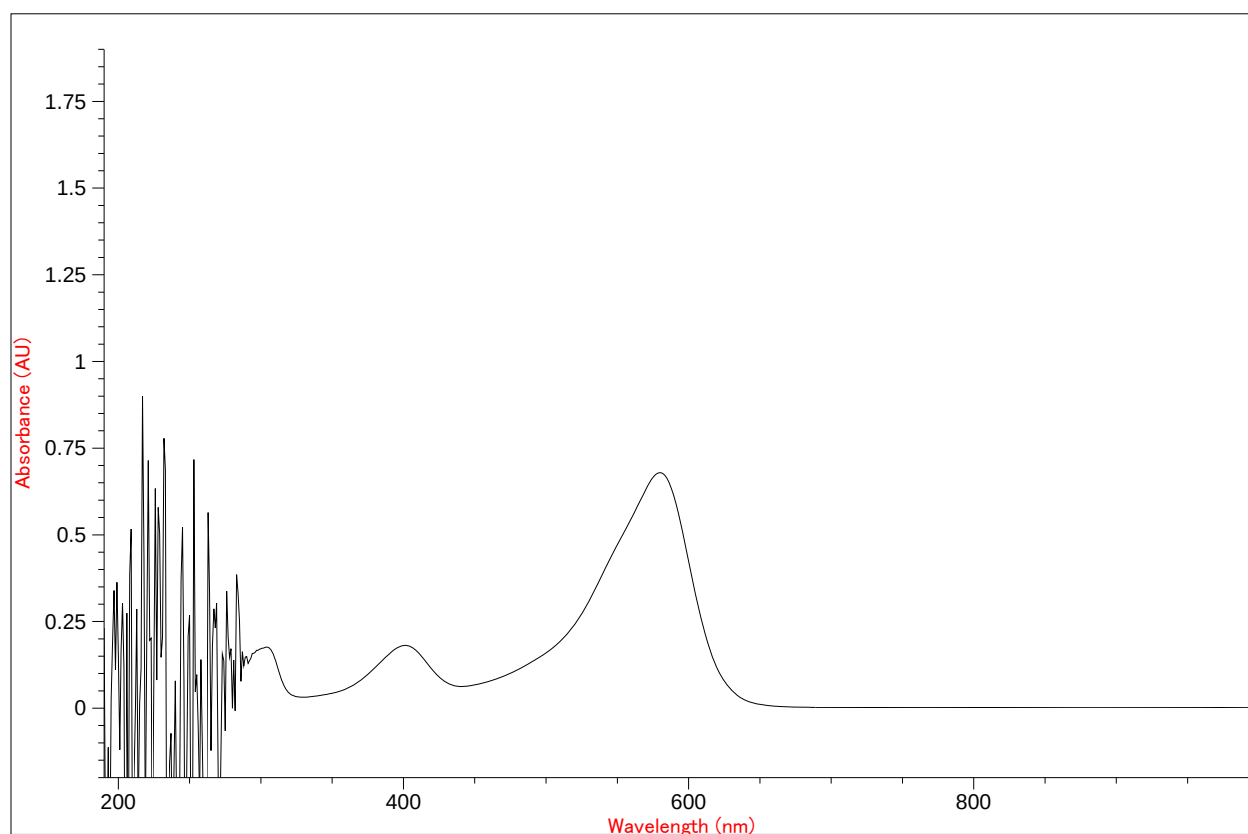
| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.05762 | ug/mL | 0.01260   |



## Sample 8

Sample Name Snowball II 2009 #SSB (#13)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:51:34  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



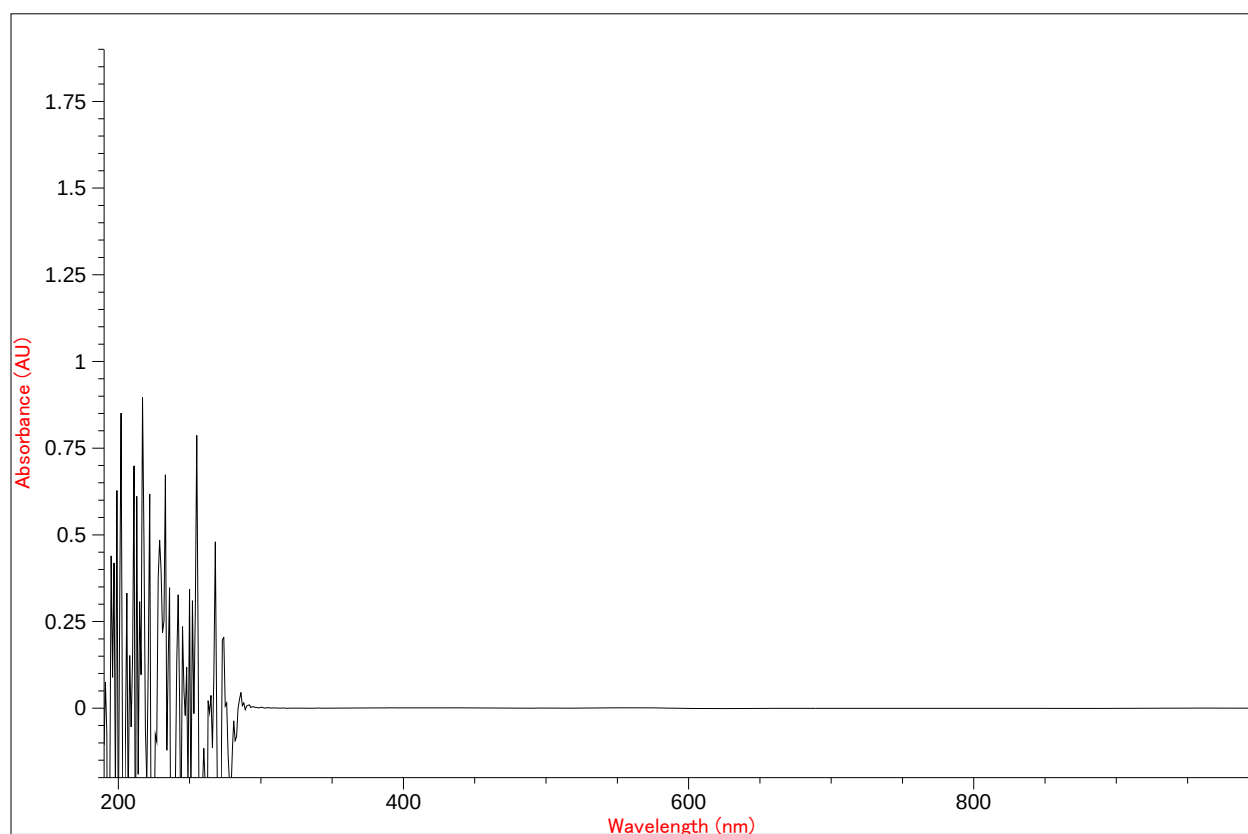
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.41296 | ug/mL | 0.01290   |

## Sample 9

Sample Name Snowball II 2009 #MB2 (#14)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:51:51  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



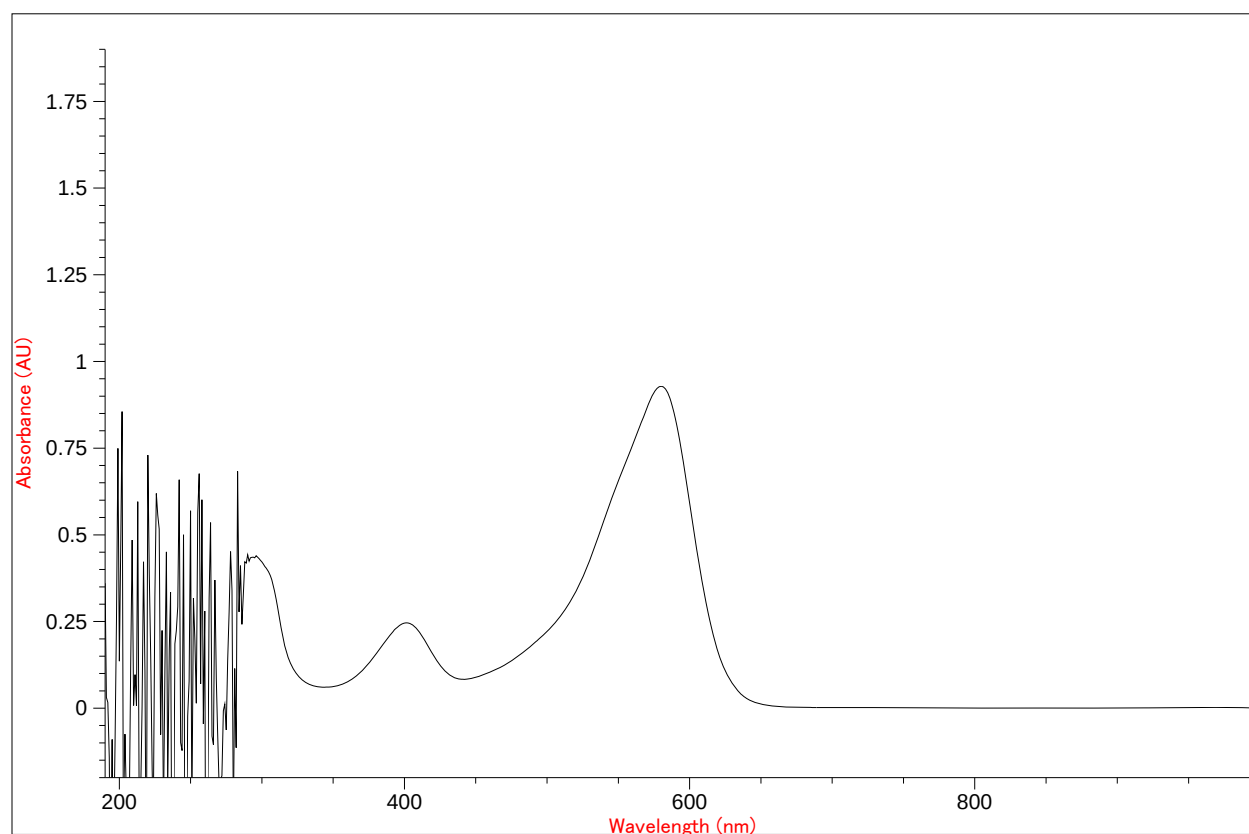
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00286 | ug/mL | 0.01221   |

## Sample 10

Sample Name 0418-172.MS-R1.Cond (#15)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:53:37  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



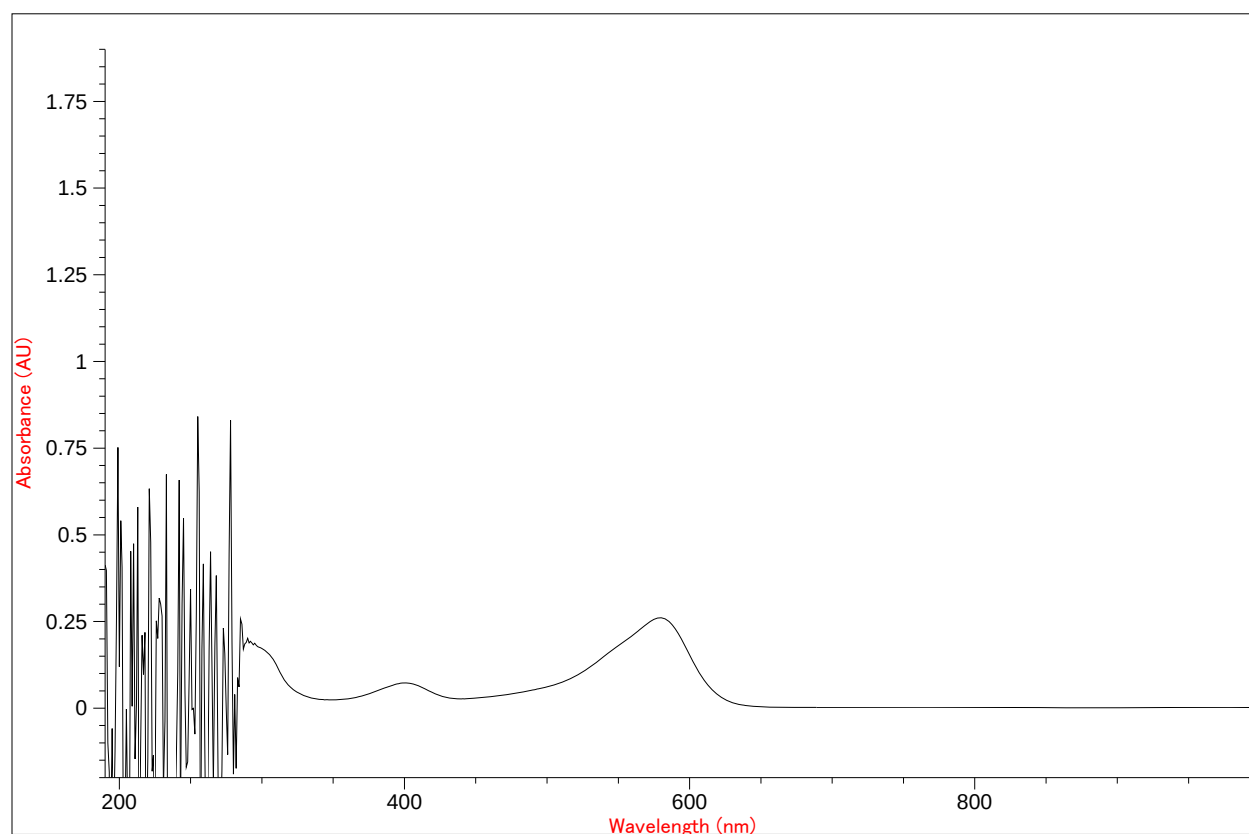
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.93784 | ug/mL | 0.01348   |

## Sample 11

Sample Name 0418-172.AD-R1.Cond (#16)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:53:57  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



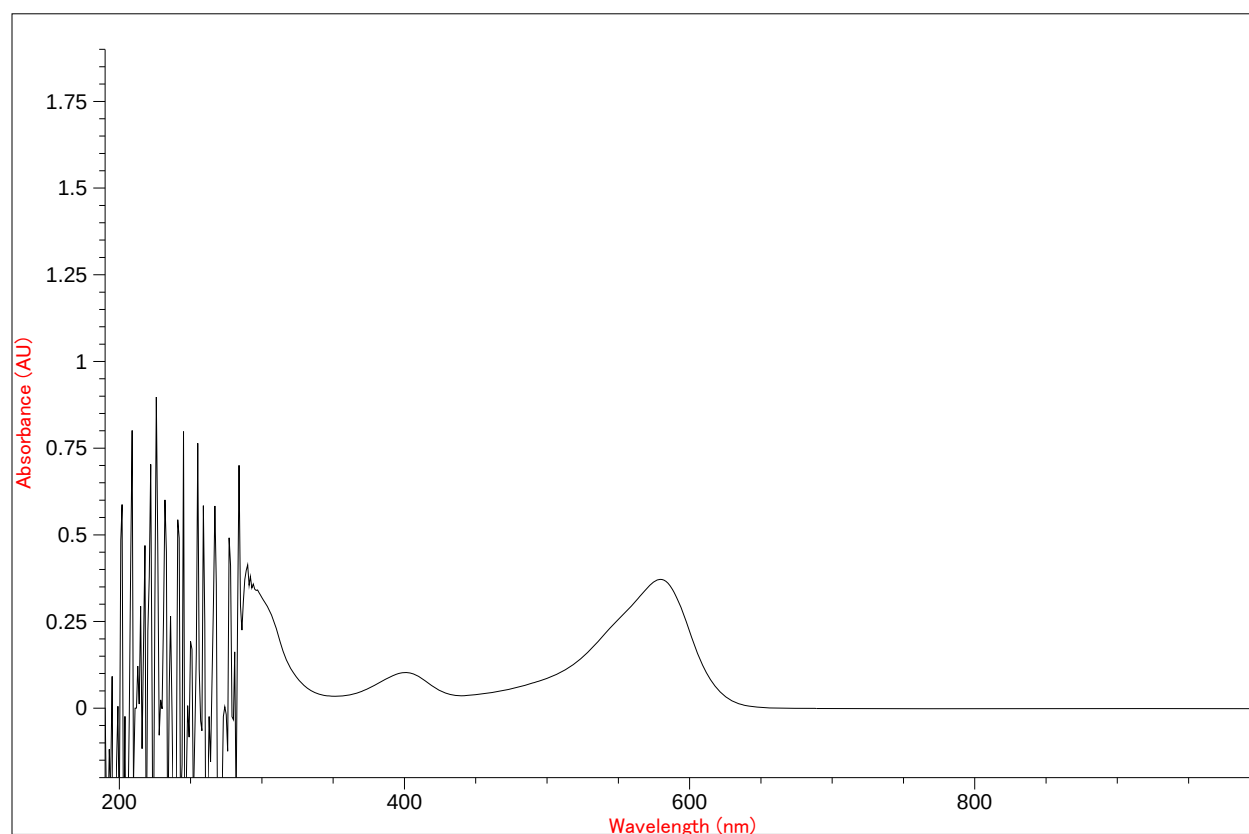
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.54380 | ug/mL | 0.01232   |

## Sample 12

Sample Name 0418-172.R2.Cond (#17)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:54:21  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



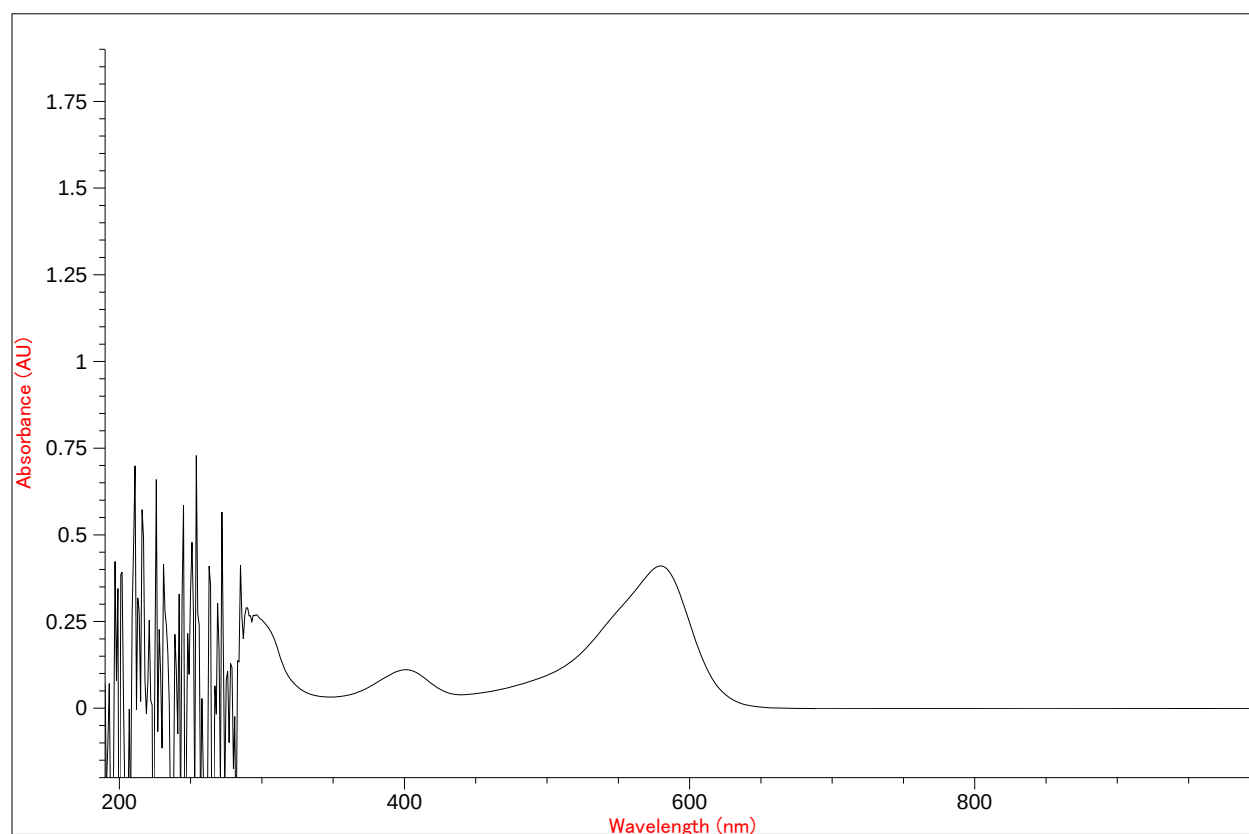
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.77345 | ug/mL | 0.01242   |

## Sample 13

Sample Name 0418-172.R3.Cond (#18)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:54:48  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



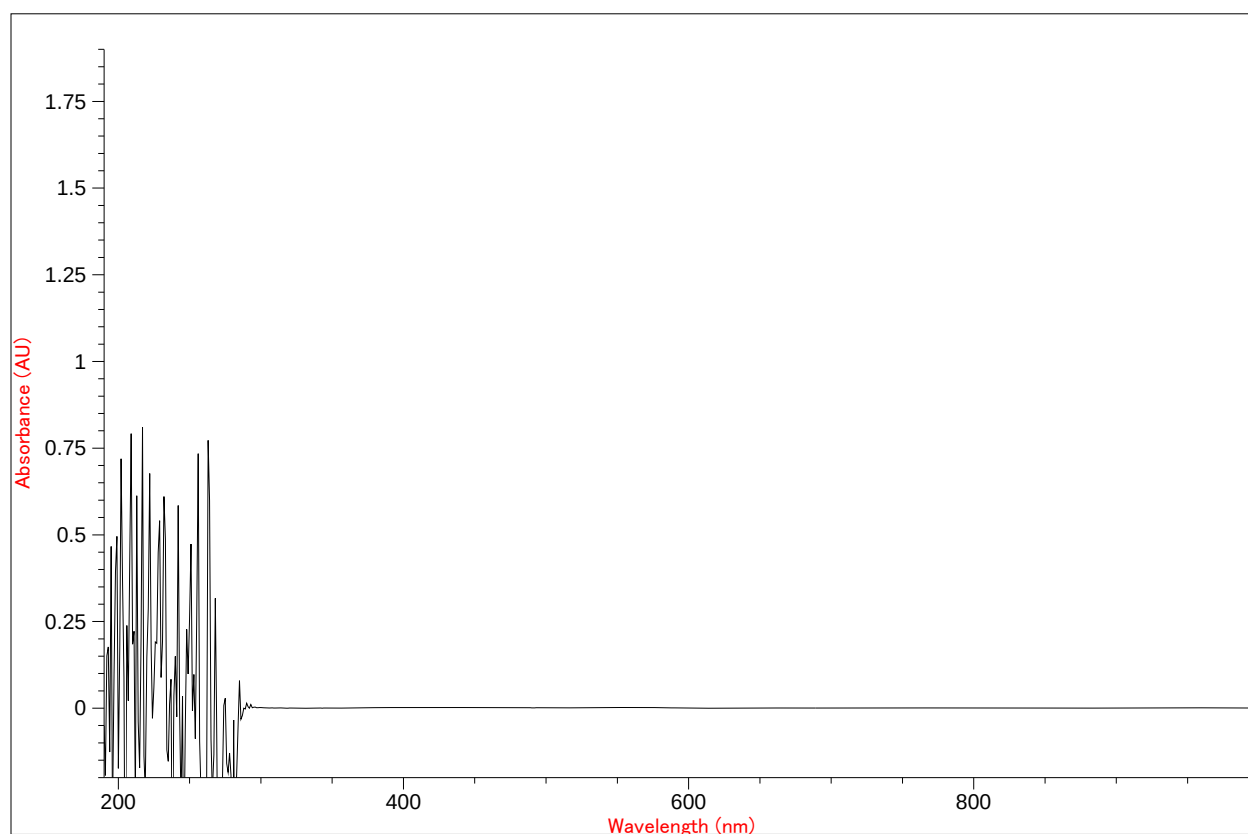
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.85374 | ug/mL | 0.01247   |

## Sample 14

Sample Name 0418-172.DiBlk.Cond (#19)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:55:10  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



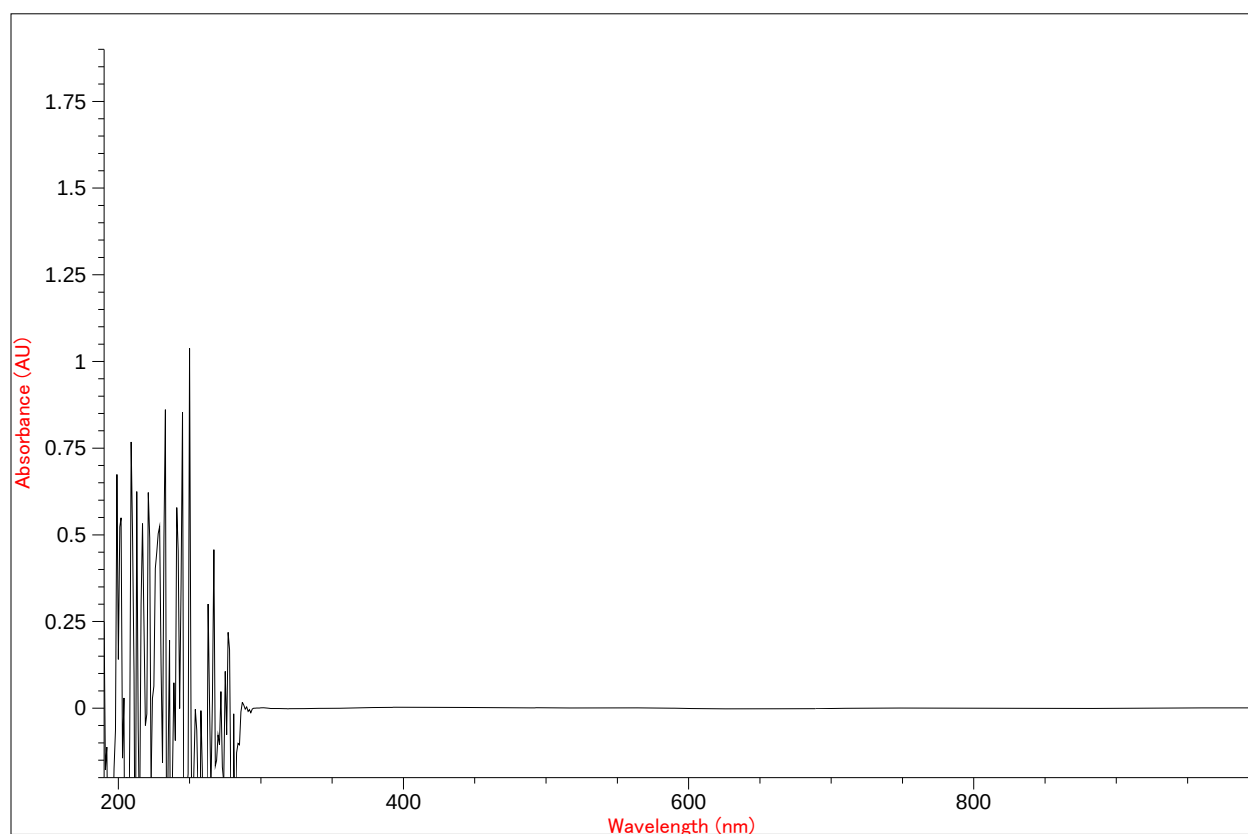
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00454 | ug/mL | 0.01221   |

## Sample 15

Sample Name 0418-172.FTB.Cond (#20)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:55:31  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

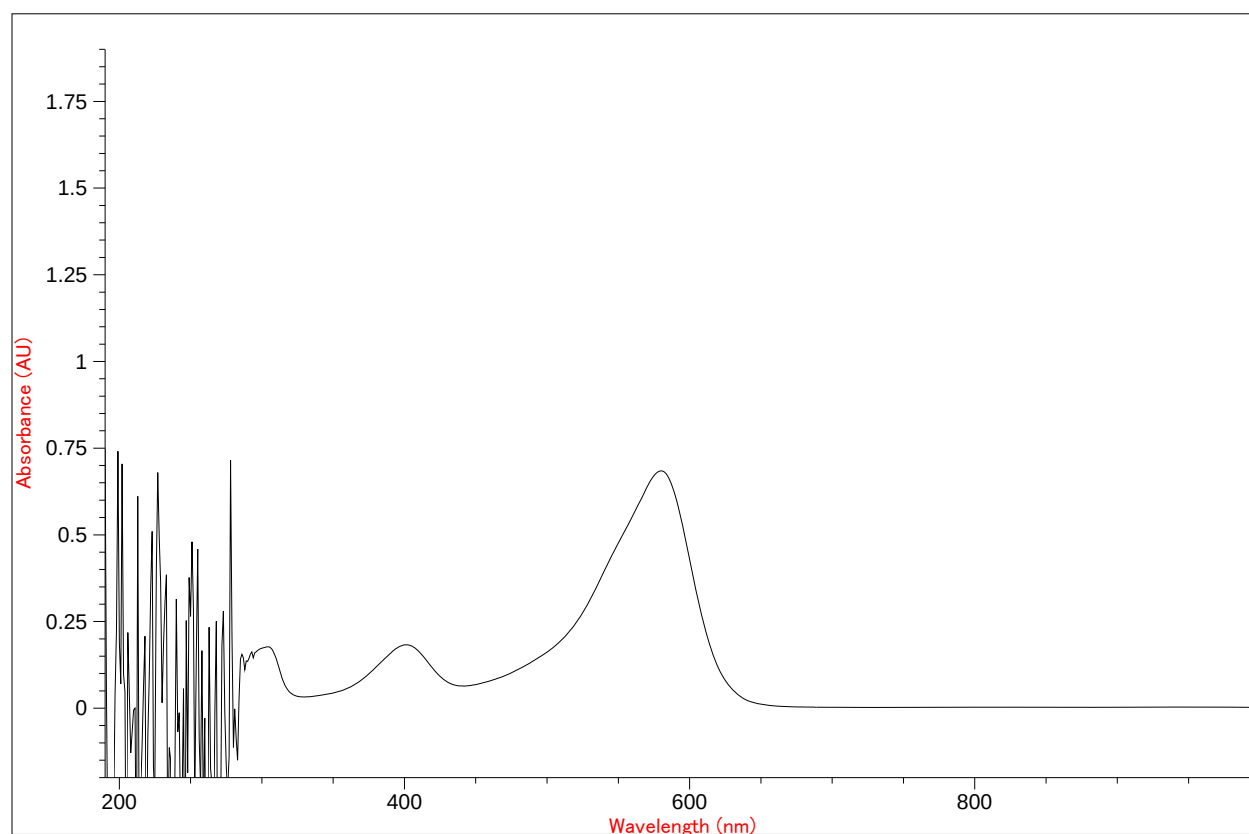
| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00237 | ug/mL | 0.01221   |



## Sample 16

Sample Name Snowball II 2009 #SSC (#21)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:55:48  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.42525 | ug/mL | 0.01291   |

## Results Summary

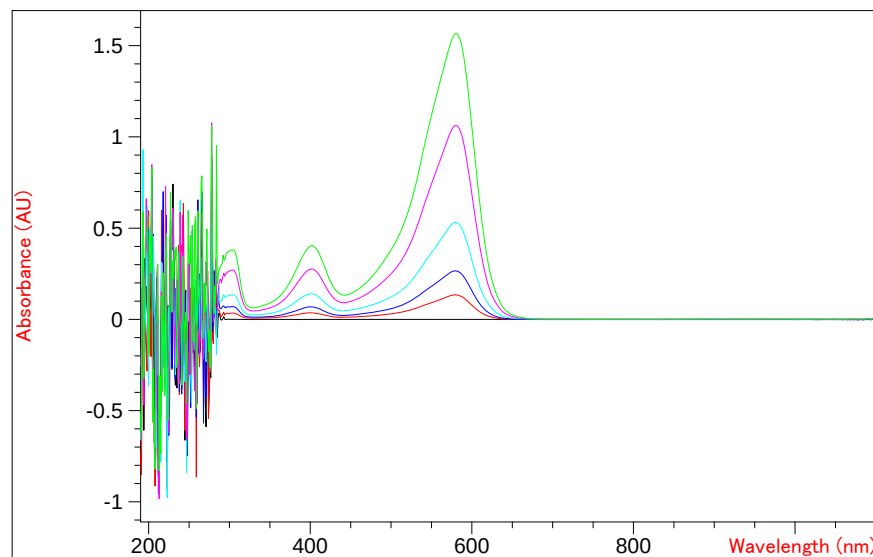
| Sample Name                 | Data Value | Result Value | Unit  | Std.Dev. |
|-----------------------------|------------|--------------|-------|----------|
| Snowball II 2009 #SS1 (#8)  | 0.62450    | 1.39746      | ug/mL | 0.01289  |
| Snowball II 2009 #SS2 (#9)  | 0.62202    | 1.39190      | ug/mL | 0.01288  |
| Snowball II 2009 #MB (#10)  | -0.00082   | -0.00183     | ug/mL | 0.01221  |
| Snowball II 2009 #SSA (#2)  | 0.62202    | 1.39191      | ug/mL | 0.01288  |
| Snowball II 2009 #MB1 (#3)  | 0.00135    | 0.00302      | ug/mL | 0.01221  |
| 0418-172.R1.Cond (#11)      | 0.46974    | 1.05114      | ug/mL | 0.01260  |
| 0418-172.LD-R1.Cond (#12)   | 0.47263    | 1.05762      | ug/mL | 0.01260  |
| Snowball II 2009 #SSB (#13) | 0.63143    | 1.41296      | ug/mL | 0.01290  |
| Snowball II 2009 #MB2 (#14) | 0.00128    | 0.00286      | ug/mL | 0.01221  |
| 0418-172.MS-R1.Cond (#15)   | 0.86599    | 1.93784      | ug/mL | 0.01348  |
| 0418-172.AD-R1.Cond (#16)   | 0.24302    | 0.54380      | ug/mL | 0.01232  |
| 0418-172.R2.Cond (#17)      | 0.34564    | 0.77345      | ug/mL | 0.01242  |
| 0418-172.R3.Cond (#18)      | 0.38152    | 0.85374      | ug/mL | 0.01247  |
| 0418-172.DiBlk.Cond (#19)   | 0.00203    | 0.00454      | ug/mL | 0.01221  |
| 0418-172.FTB.Cond (#20)     | 0.00106    | 0.00237      | ug/mL | 0.01221  |
| Snowball II 2009 #SSC (#21) | 0.63692    | 1.42525      | ug/mL | 0.01291  |

\*\*\* End Results Report \*\*\*

## \*\*\* Calibration Report \*\*\*

Number of Standards 6

## Standard Spectra



| # | Standard         | Path Length | Unit | Date   | Time     |
|---|------------------|-------------|------|--------|----------|
| 1 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:13:11 |
| 2 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:13:36 |
| 3 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:13:57 |
| 4 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:14:16 |
| 5 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:14:34 |
| 6 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:18:07 |

## Data Analysis:

## Spectral Processing:

Absorbance

Use Wavelength(s):

Single (nm): 570

Evaluation: SCA

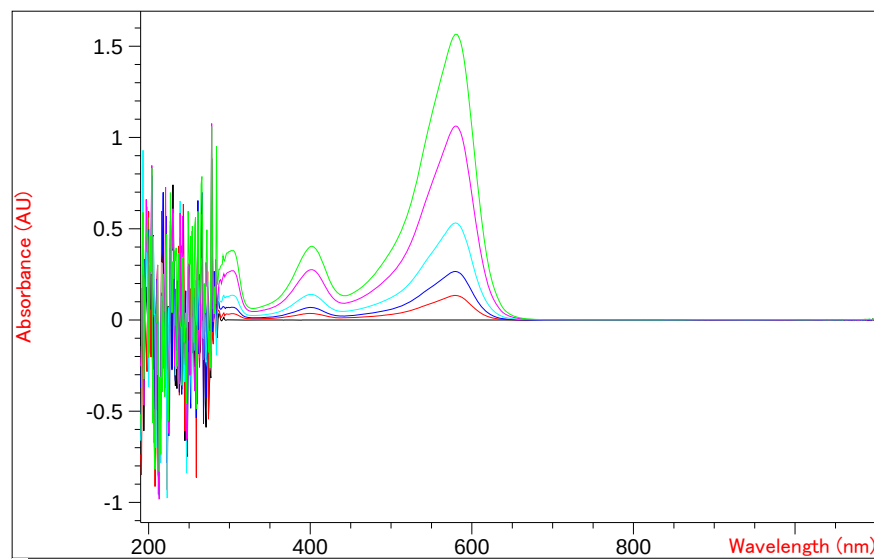
Calibrated at: Date 5/8/2018 Time 1:18:58 PM  
Operator: Patricia Mann

Weighting Method: Least squares  
Calibration Curve:  $C = k_1 * A$

Analyte Name Unit

Formaldehyde ug/mL

## Processed Standard Spectra



## Coefficients

| k# | Value   |
|----|---------|
| 1  | 2.23772 |

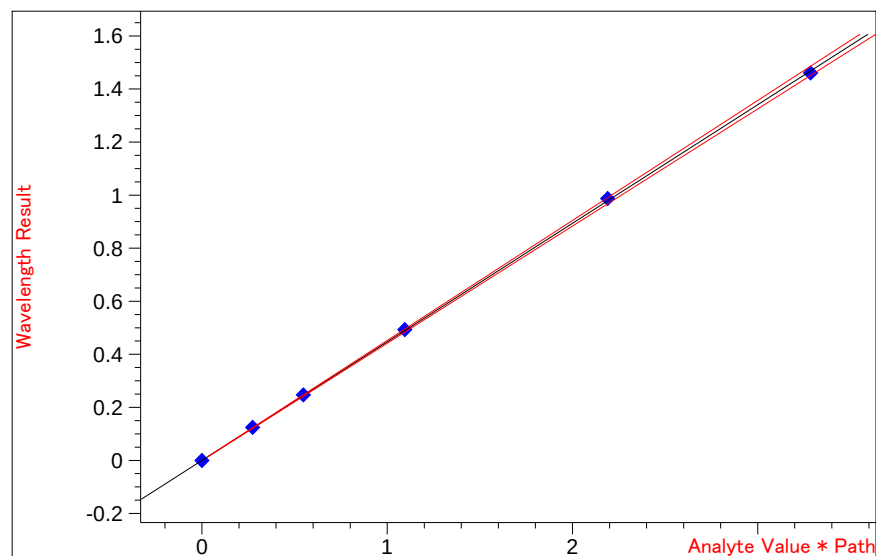
## Used Wavelength Results (Absorbance (AU))

| # | Value    | # | Value   | # | Value   |
|---|----------|---|---------|---|---------|
| 1 | -0.00027 | 3 | 0.24673 | 5 | 0.98694 |
| 2 | 0.12473  | 4 | 0.49322 | 6 | 1.46056 |

## Calibration Table of Formaldehyde (ug/mL)

| # | Standard Name    | Value   | Fitted Val. | Error (%) |
|---|------------------|---------|-------------|-----------|
| 1 | Snowball II 2009 | 0.00000 | -0.00061    | -100.0    |
| 2 | Snowball II 2009 | 0.27380 | 0.27911     | -1.9      |
| 3 | Snowball II 2009 | 0.54750 | 0.55211     | -0.8      |
| 4 | Snowball II 2009 | 1.09500 | 1.10369     | -0.8      |
| 5 | Snowball II 2009 | 2.19000 | 2.20850     | -0.8      |
| 6 | Snowball II 2009 | 3.28500 | 3.26833     | 0.5       |

## Calibration Curve (Data Analysis)



## SCA Summary

|                          |                 |
|--------------------------|-----------------|
| Analyte Name             | Formaldehyde    |
| Number of Standards      | 6               |
| Calculation Method       | LSQ             |
| Calibration Curve        | $C = k_1 * A$   |
| Coefficient $k_1$        | 2.23770 ug/mL   |
| Std.Dev. of $k_1$        | 6.5961E-3 ug/mL |
| Std.Dev. of Calibration  | 1.2211E-2 ug/mL |
| Correl. Coeff. ( $R^2$ ) | 0.99996         |
| Uncertainty              | 1.22 %          |

\*\*\* End Calibration Report \*\*\*

**This Is The Last Page  
Of This Report.**

# Bison Engineering

1400 11th Avenue  
Helena, MT 59601

CFU 117  
Corvallis, OR  
Project # HAV 218610

Analytical Report  
(0518-008R)

***EPA Method 316***  
Formaldehyde



**Enthalpy Analytical, LLC**

Phone: (919) 850 - 4392 / Fax: (919) 850 - 9012 / [www.enthalpy.com](http://www.enthalpy.com)  
800-1 Capitola Drive Durham, NC 27713-4385

I certify that to the best of my knowledge all analytical data presented in this report:

- Have been checked for completeness
- Are accurate, error-free, and legible
- Have been conducted in accordance with approved protocol, and that all deviations and analytical problems are summarized in the appropriate narrative(s)

This analytical report was prepared in Portable Document Format (.PDF) and contains ??? pages.

Report Issued: xx/xx/xxxx



# Summary of Results

## Enthalpy Analytical

Company: Bison Engineering

Job No.: 0518-008 - EPA Method 316

Client No.: HAV 218610

| Compound     |                          | Sample ID / Catch Weight (µg) |                       |  |
|--------------|--------------------------|-------------------------------|-----------------------|--|
| Formaldehyde | <b><i>R1.Cond</i></b>    | <b><i>R2.Cond</i></b>         | <b><i>R3.Cond</i></b> |  |
|              | 1,580                    | 1,650                         | 1,652                 |  |
| Formaldehyde | <b><i>DiBlk.Cond</i></b> |                               |                       |  |
|              | 4.11 ND                  |                               |                       |  |

# Results

# Enthalpy Analytical

Company: Bison Engineering

Job No.: 0518-008 - EPA Method 316

Client No.: HAV 218610

MDL 0.0137 (µg/mL)

Lower Curve Limit 0.274 (µg/mL)

LOQ 0.274 (µg/mL)

Upper Curve Limit 3.29 (µg/mL)

Compound Formaldehyde

| Sample ID         | Lab ID | Absorbance | Conc (µg/mL) | Dilution | Volume (mL) | Catch Weight (µg) | Qual |
|-------------------|--------|------------|--------------|----------|-------------|-------------------|------|
| <b>R1.Cond</b>    | 4      | 1.2399     | 2.7746       | 1        | 569         | 1,580             |      |
| <b>R2.Cond</b>    | 4      | 0.7566     | 1.6931       | 2        | 487         | 1,650             |      |
| <b>R3.Cond</b>    | 9      | 1.3804     | 3.0890       | 1        | 535         | 1,652             |      |
| <b>DiBlk.Cond</b> | 10     | 0.0021     | 0.0048       | 1        | 300         | 4.11              | ND   |

|                              |    |        |        |   |      |        |    |
|------------------------------|----|--------|--------|---|------|--------|----|
| <b>Snowball II 2009 #MB</b>  | 10 | 0.0000 | 0.0137 | 1 | 1.00 | 0.0137 | ND |
| <b>Snowball II 2009 #MB1</b> | 3  | 0.0014 | 0.0137 | 1 | 1.00 | 0.0137 | ND |
| <b>Snowball II 2009 #MB2</b> | 14 | 0.0013 | 0.0137 | 1 | 1.00 | 0.0137 | ND |
| <b>Snowball II 2009 #MB3</b> | 3  | 0.0010 | 0.0137 | 1 | 1.00 | 0.0137 | ND |

|                          |   |        |        |   |     |       |  |
|--------------------------|---|--------|--------|---|-----|-------|--|
| <b>Lab Dup / R1.Cond</b> | 5 | 1.2386 | 2.7717 | 1 | 569 | 1,578 |  |
| % Difference             |   |        |        |   |     | 0.1%  |  |

|                          |   |        |        |   |     |       |  |
|--------------------------|---|--------|--------|---|-----|-------|--|
| <b>Alt Dil / R1.Cond</b> | 7 | 0.6348 | 1.4204 | 2 | 569 | 1,618 |  |
| %Difference              |   |        |        |   |     | 2.4%  |  |

|                     |   |        |        |   |      |       |  |
|---------------------|---|--------|--------|---|------|-------|--|
| <b>MS / R1.Cond</b> | 6 | 1.6128 | 3.6090 | 1 | 2.50 | 9.02  |  |
| spike amount (ug)   |   |        |        |   |      | 2.19  |  |
| native amount (ug)  |   |        |        |   |      | 6.88  |  |
| Spike recovery      |   |        |        |   |      | 97.8% |  |

# Narrative Summary

## Enthalpy Analytical Narrative Summary

|                 |                           |
|-----------------|---------------------------|
| <b>Company</b>  | Bison Engineering, Inc    |
| <b>Job #</b>    | 0518-008 – EPA Method 316 |
| <b>Client #</b> | HAV 218610                |

|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Custody</b>     | Matthew St. Lawrence of Enthalpy Analytical, LLC received the samples on 5/2/18 at 4.4 °C after being relinquished by Bison Engineering, Inc. The samples were received in good condition. Prior to, during, and after analysis, the samples were kept under lock with access only to authorized personnel by Enthalpy Analytical, LLC.                                                                                                                                                                                                                                                                                                                           |
| <b>Analysis</b>    | <p>The samples were analyzed for formaldehyde using the analytical procedures in EPA Method 316, Sampling and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries (40 CFR Part 63, Appendix A).</p> <p>The client provided sample volumes on their chain of custody which were used to calculate total catch weight.</p> <p>The Hewlett Packard Model 8453, Diode Array Spectrophotometer “Snowball II” (S/N US73000904) was operated at 570 nm for these analyses.</p>                                                                                                                                |
| <b>Calibration</b> | The calibration curve is located in the Raw Data section of this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>QC Notes</b>    | <p>The analyses of the field and laboratory blanks did not show formaldehyde at concentrations greater than the detection limit.</p> <p>A Matrix Spike (MS) was prepared using an aliquot of sample <b>R1.Cond.</b> The matrix spike was analyzed in the same manner as the samples and exhibited a spike recovery of 97.8%.</p> <p>Laboratory Duplicate (LD) and Alternate Dilution (AD) analyses were performed using aliquots of sample <b>R1.Cond.</b> The LD and AD analyses exhibited differences of 0.1% and 2.4% from the original result, respectively.</p> <p>All sample preparation and analytical holding times specified in the method were met.</p> |

## Enthalpy Analytical Narrative Summary

(continued)

### Reporting Notes

Aliquots were received for each of the samples. The client provided the samples' full volumes which have been used to determine the sample catch weights in this revised report. The volume of the client's blank sample is reported as measured by the laboratory.

These analyses met the requirements of the TNI Standard. Any deviations from the requirements of the reference method or TNI Standard have been stated above.

The results presented in this report are representative of the samples as provided to the laboratory.

## General Reporting Notes

The following are general reporting notes that are applicable to all Enthalpy Analytical, Inc. data reports, unless specifically noted otherwise.

- Any analysis which refers to the method as “**Type**” represents a planned deviation from the reference method. For instance a Hydrogen Sulfide assay from a Tedlar bag would be labeled as “EPA Method 16-Type” because Tedlar bags are not mentioned as one of the collection options in EPA Method 16.
- The acronym **MDL** represents the Minimum Detection Limit. Below this value the laboratory cannot determine the presence of the analyte of interest reliably.
- The acronym **LOQ** represents the Limit of Quantification. Below this value the laboratory cannot quantitate the analyte of interest within the criteria of the method.
- The acronym **ND** following a value indicates a non-detect or analytical result below the MDL.
- The letter **J** in the Qualifier or Flag column in the results indicates that the value is between the MDL and the LOQ. The laboratory can positively identify the analyte of interest as present, but the value should be considered an estimate.
- The letter **E** in the Qualifier or Flag column indicates an analytical result exceeding 100% of the highest calibration point. The associated value should be considered as an estimate.
- The acronym **DF** represents Dilution Factor. This number represents dilution of the sample during the preparation and/or analysis process. The analytical result taken from a laboratory instrument is multiplied by the DF to determine the final undiluted sample results.
- The addition of **MS** to the Sample ID represents a Matrix Spike. An aliquot of an actual sample is spiked with a known amount of analyte so that a percent recovery value can be determined. The MS analysis indicates what effect the sample matrix may have on the target analyte, i.e. whether or not anything in the sample matrix interferes with the analysis of the analyte(s).
- The addition of **MSD** to the Sample ID represents a Matrix Spike Duplicate. Prepared in the same manner as a MS, the use of duplicate matrix spikes allows further confirmation of laboratory quality by showing the consistency of results gained by performing the same steps multiple times.
- The addition of **LD** to the Sample ID represents a Laboratory Duplicate. The analyst prepares an additional aliquot of sample for testing and the results of the duplicate analysis are compared to the initial result. The result should have a difference value of within 10% of the initial result (if the results of the original analysis are greater than the LOQ).



# General Reporting Notes

(continued)

- The addition of **AD** to the Sample ID represents an Alternate Dilution. The analyst prepares an additional aliquot at a different dilution factor (usually double the initial factor). This analysis helps confirm that no additional compound is present and coeluting or sharing absorbance with the analyte of interest, as they would have a different response/absorbance than the analyte of interest.
- The Sample ID **LCS** represents a Laboratory Control Sample. Clean matrix, similar to the client sample matrix, prepared and analyzed by the laboratory using the same reagents, spiking standards and procedures used for the client samples. The LCS is used to assess the control of the laboratory's analytical system. Whenever spikes are prepared for our client projects, two spikes are retained as LCSs. The LCSs are labeled with the associated project number and kept in-house at the appropriate temperature conditions. When the project samples are received for analysis, the LCSs are analyzed to confirm that the analyte could be recovered from the media, separate from the samples which were used on the project and which may have been affected by source matrix, sample collection and/or sample transport.
- **Significant Figures:** Where the reported value is much greater than unity (1.00) in the units expressed, the number is rounded to a whole number of units, rather than to 3 significant figures. For example, a value of 10,456.45 ug catch is rounded to 10,456 ug. There are five significant digits displayed, but no confidence should be placed on more than two significant digits.
- **Manual Integration:** The data systems used for processing will flag manually integrated peaks with an "M". There are several reasons a peak may be manually integrated. These reasons will be identified by the following two letter designations on sample chromatograms, if provided in the report. The peak was **not integrated** by the software "**NI**", the peak was **integrated incorrectly** by the software "**II**" or the **wrong peak** was integrated by the software "**WP**". These codes will accompany the analyst's manual integration stamp placed next to the compound name on the chromatogram.

# Sample Custody

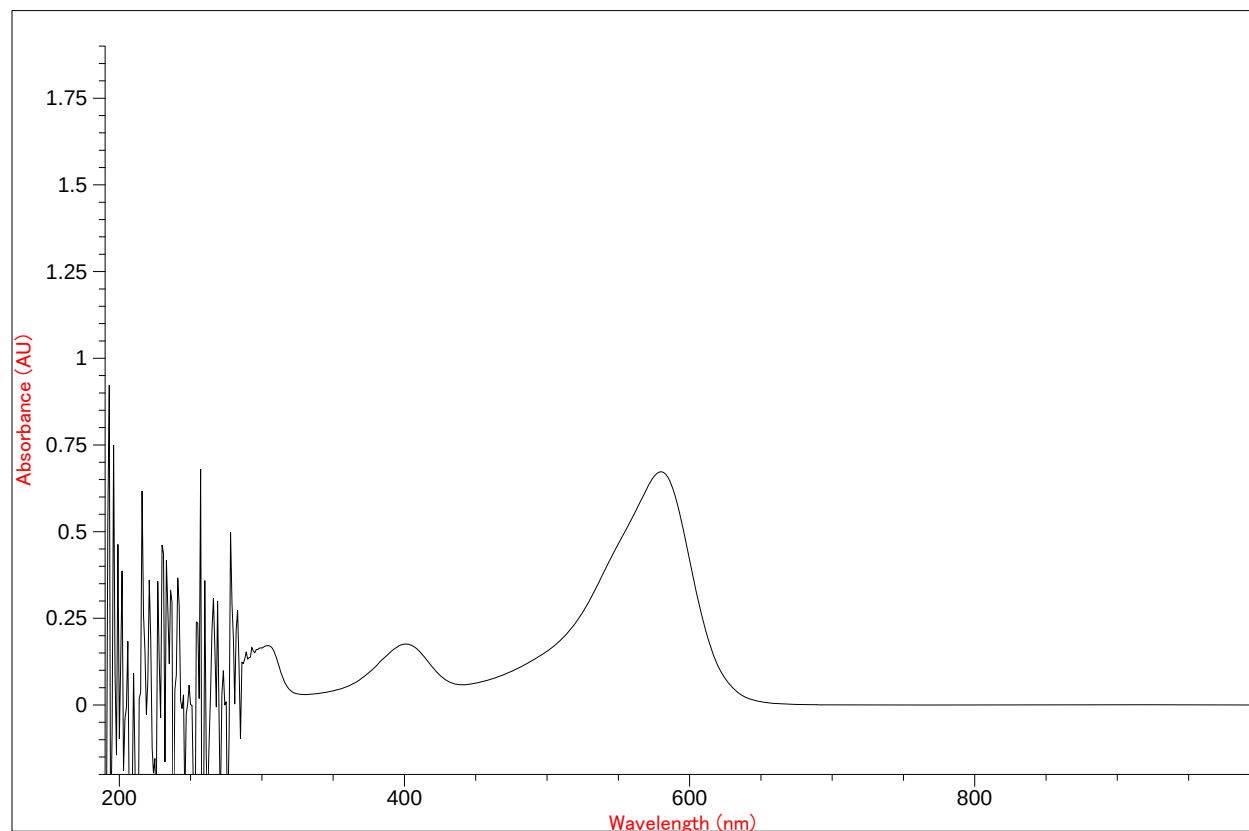


# Raw Data

## Sample 1

Sample Name Snowball II 2009 #SS1 (#8)  
Operator Patricia Mann  
Date 5/8/18  
Time 13:15:28  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

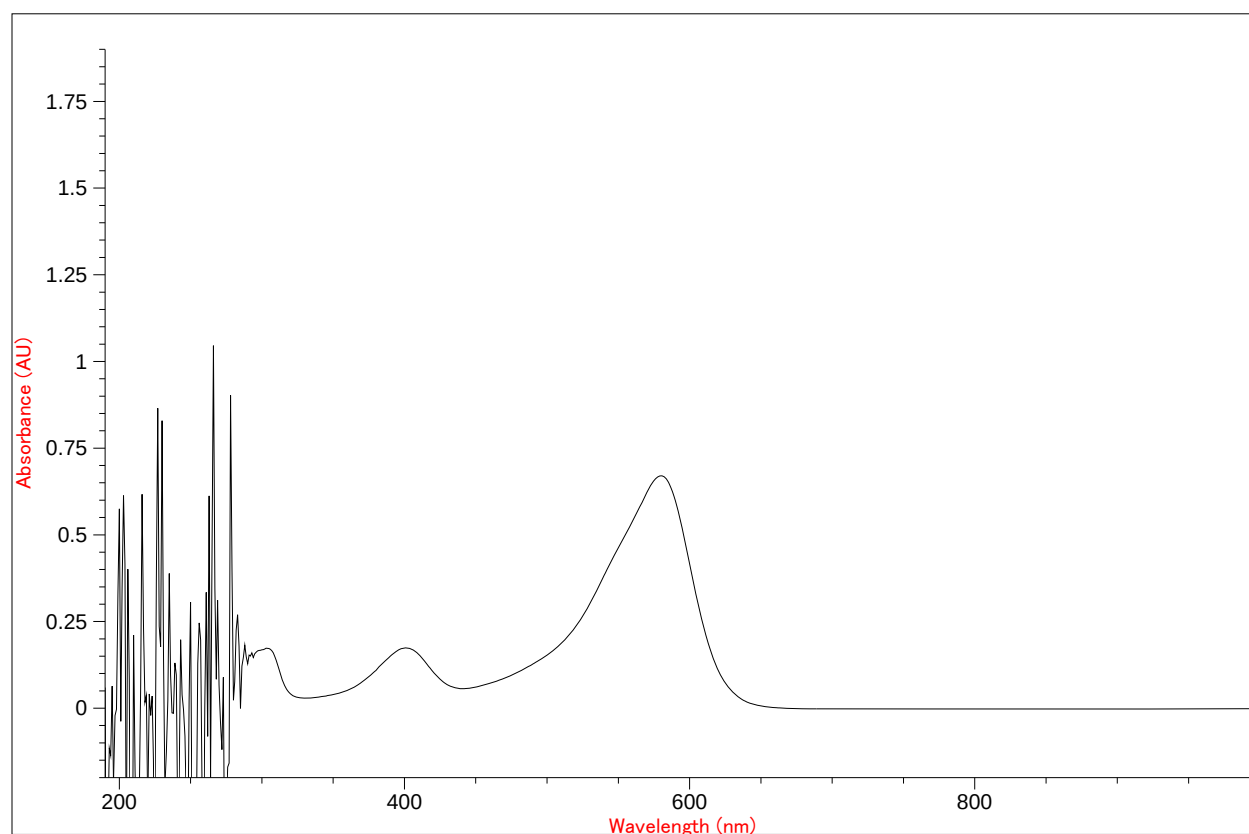
| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.39746 | ug/mL | 0.01289   |



## Sample 2

Sample Name Snowball II 2009 #SS2 (#9)  
Operator Patricia Mann  
Date 5/8/18  
Time 13:15:44  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



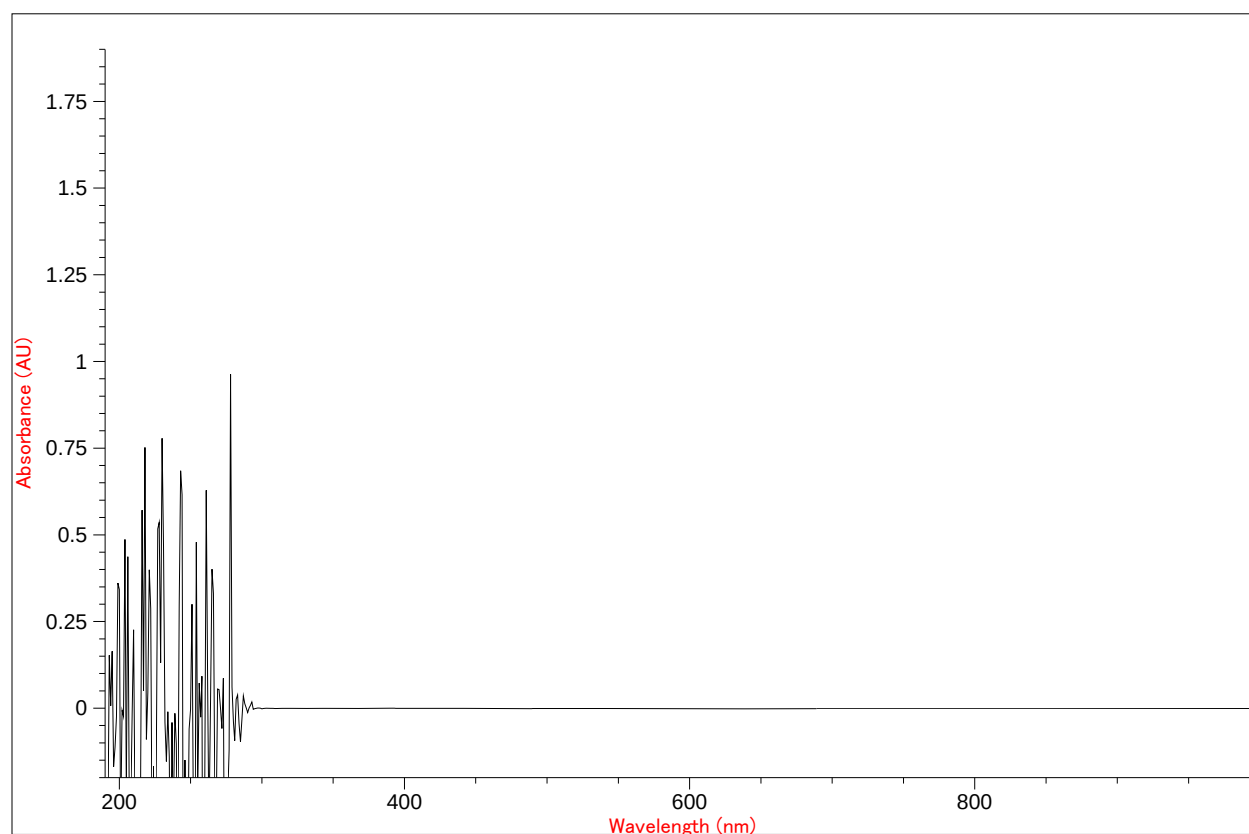
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.39190 | ug/mL | 0.01288   |

## Sample 3

|                  |                            |
|------------------|----------------------------|
| Sample Name      | Snowball II 2009 #MB (#10) |
| Operator         | Patricia Mann              |
| Date             | 5/8/18                     |
| Time             | 13:16:00                   |
| Path Length      | 1                          |
| Path Length Unit | cm                         |

## Sample Spectrum



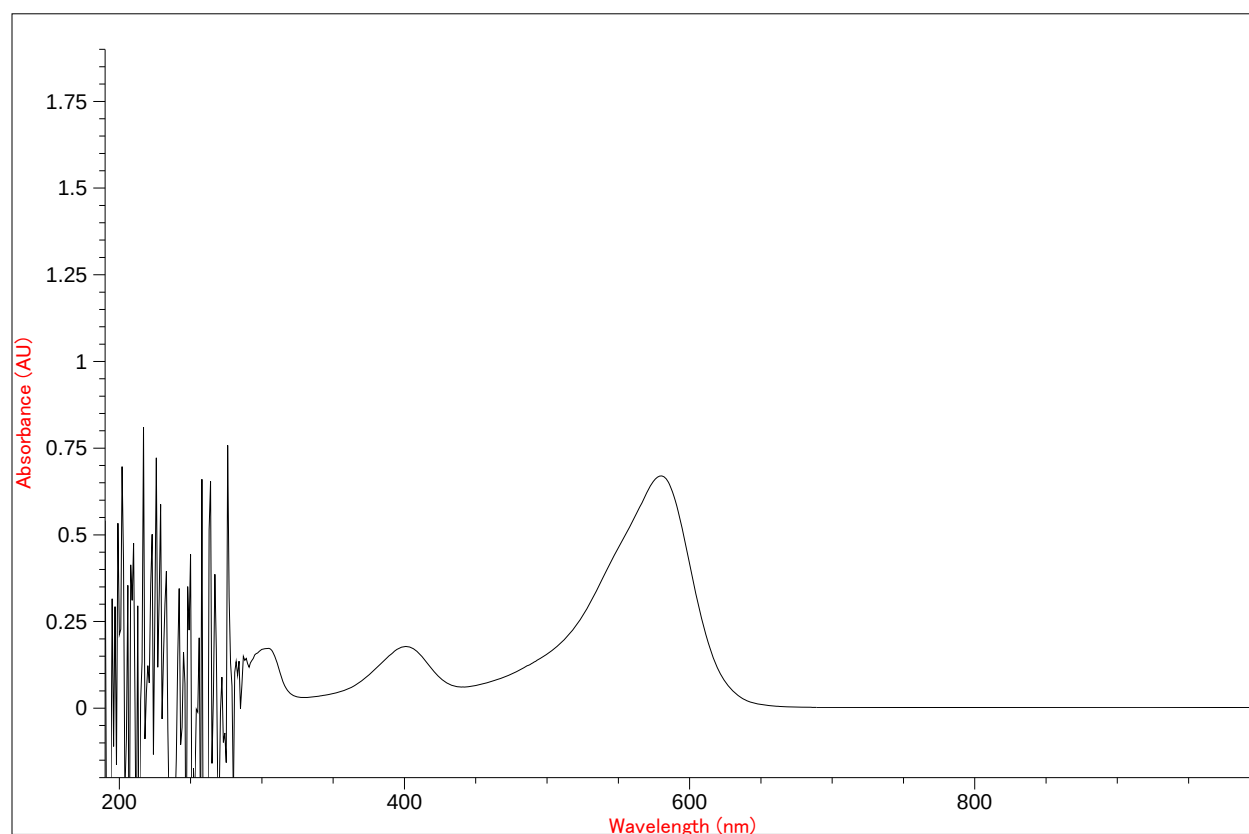
## Data Analysis Results

| # | Analyte Name | Value    | Unit  | Std. Dev. |
|---|--------------|----------|-------|-----------|
| 1 | Formaldehyde | -0.00183 | ug/mL | 0.01221   |

## Sample 4

Sample Name Snowball II 2009 #SSA (#2)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:46:07  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

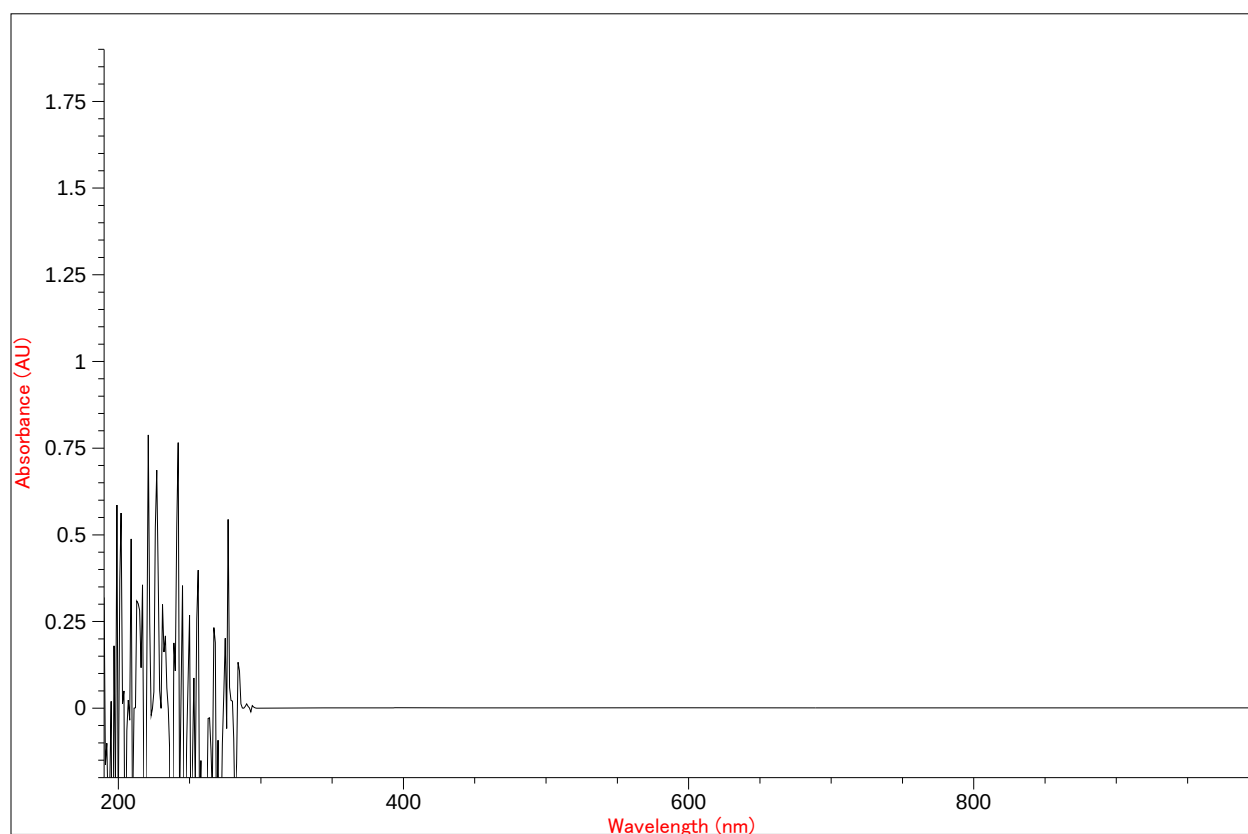
| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.39191 | ug/mL | 0.01288   |



## Sample 5

Sample Name Snowball II 2009 #MB1 (#3)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:46:25  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



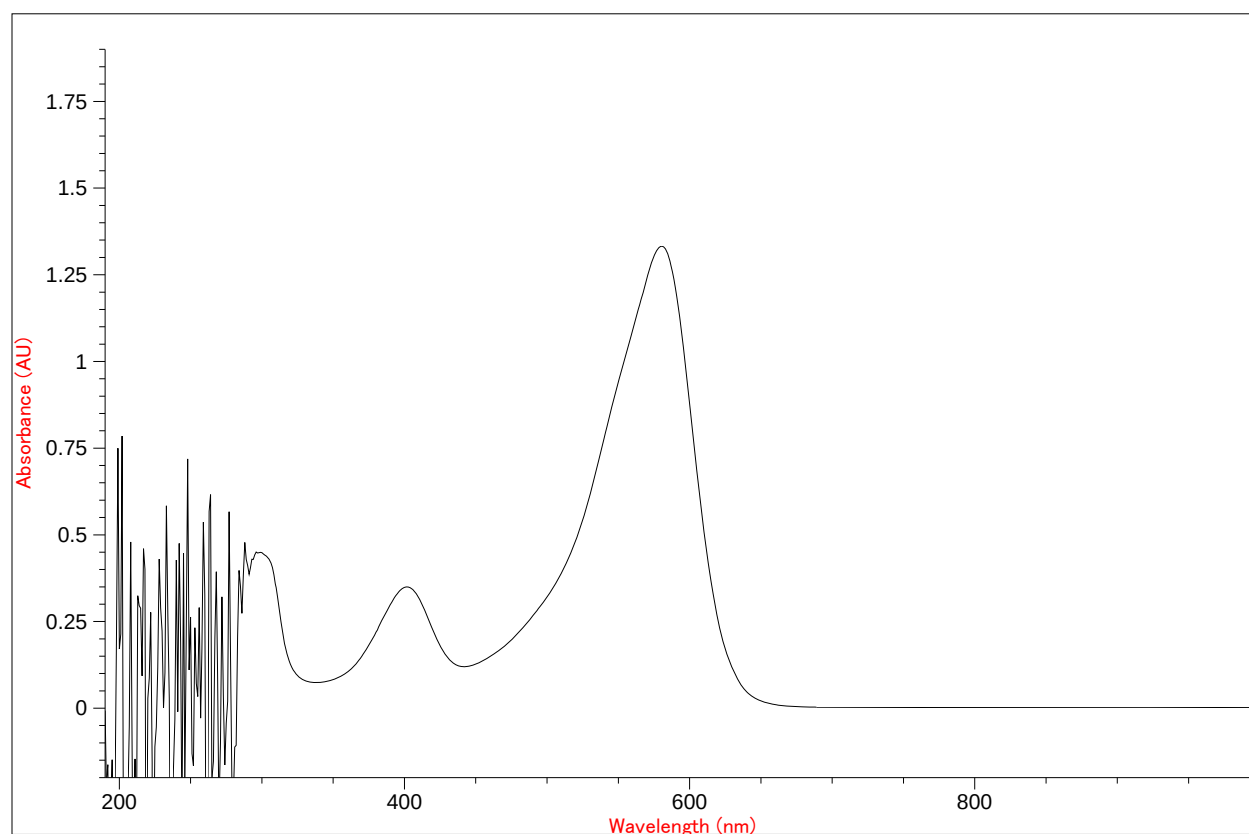
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00302 | ug/mL | 0.01221   |

## Sample 6

Sample Name 0518-008.R1.Cond (#4)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:47:08  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



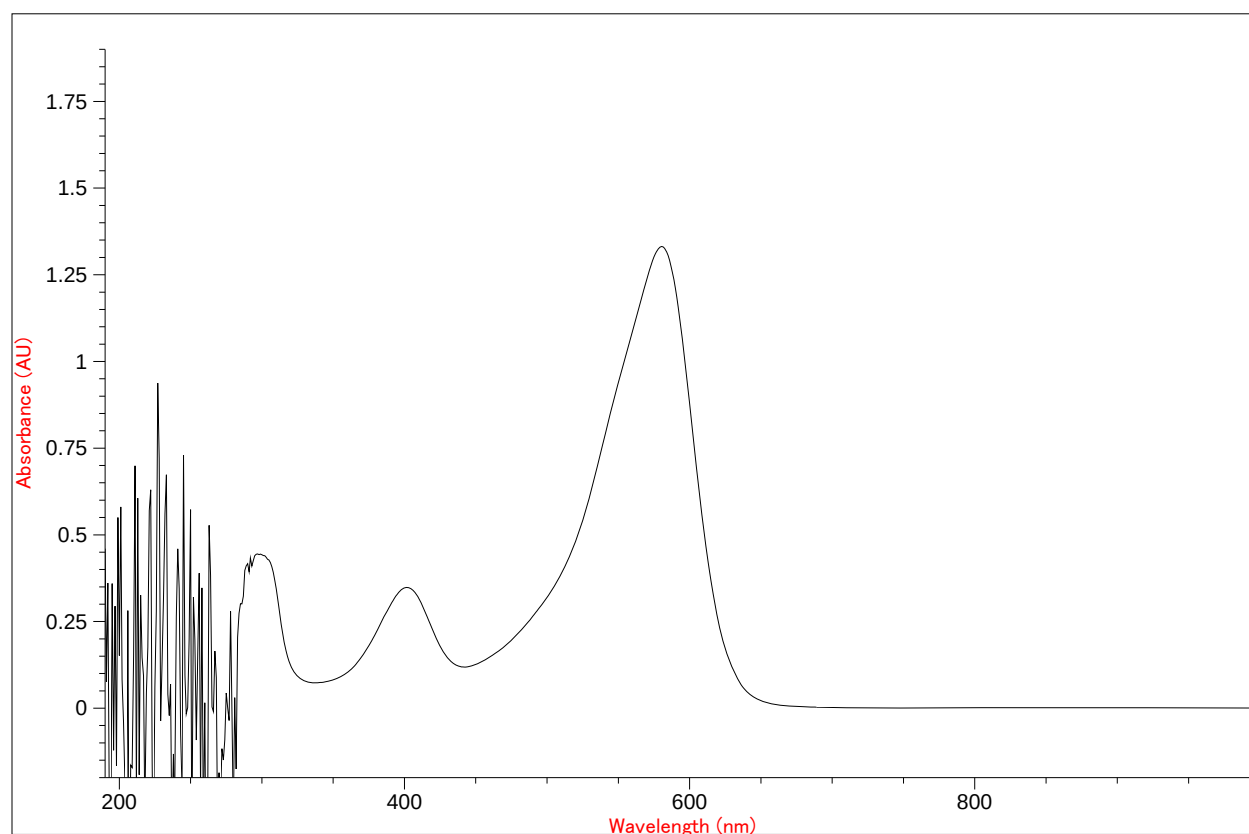
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 2.77457 | ug/mL | 0.01470   |

## Sample 7

Sample Name 0518-008.LD-R1.Cond (#5)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:47:35  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



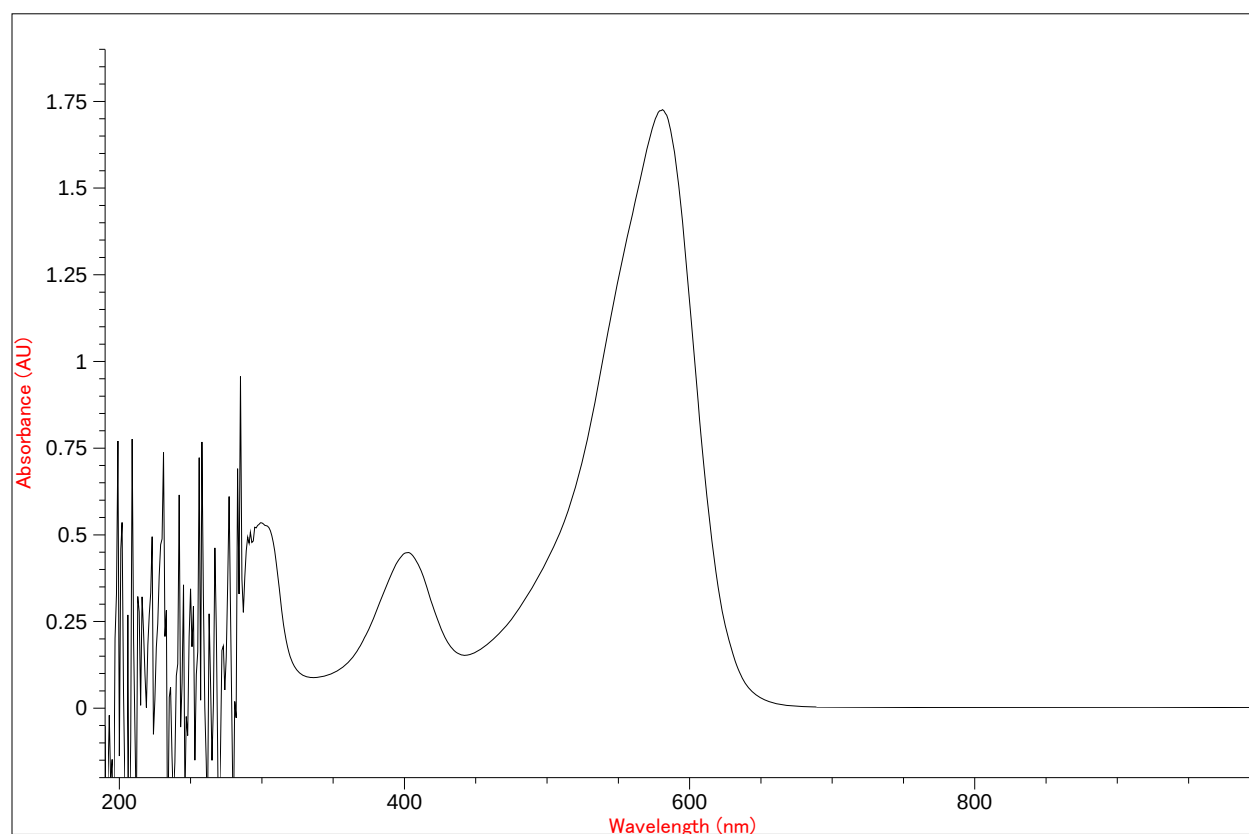
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 2.77167 | ug/mL | 0.01469   |

## Sample 8

Sample Name 0518-008.MS-R1.Cond (#6)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:48:07  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



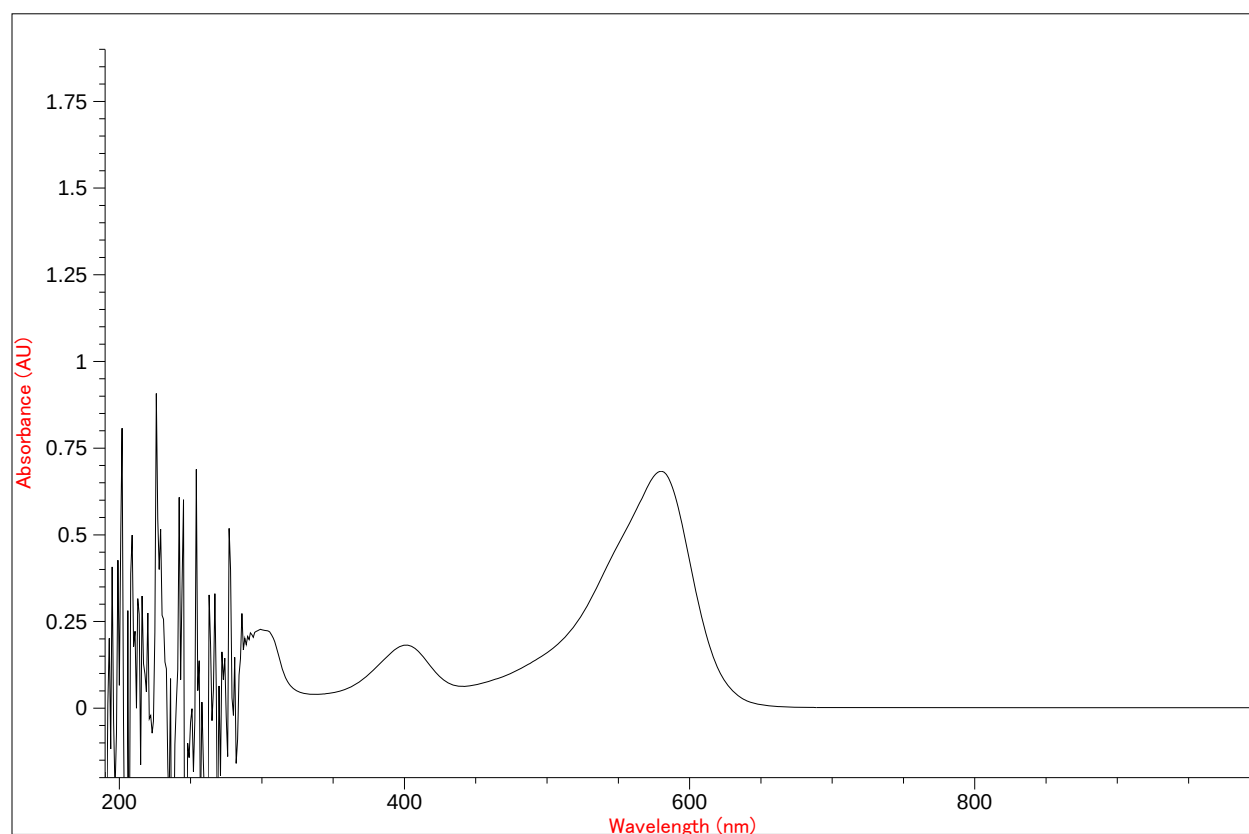
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 3.60901 | ug/mL | 0.01619   |

## Sample 9

Sample Name 0518-008.AD-R1.Cond (#7)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:48:38  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



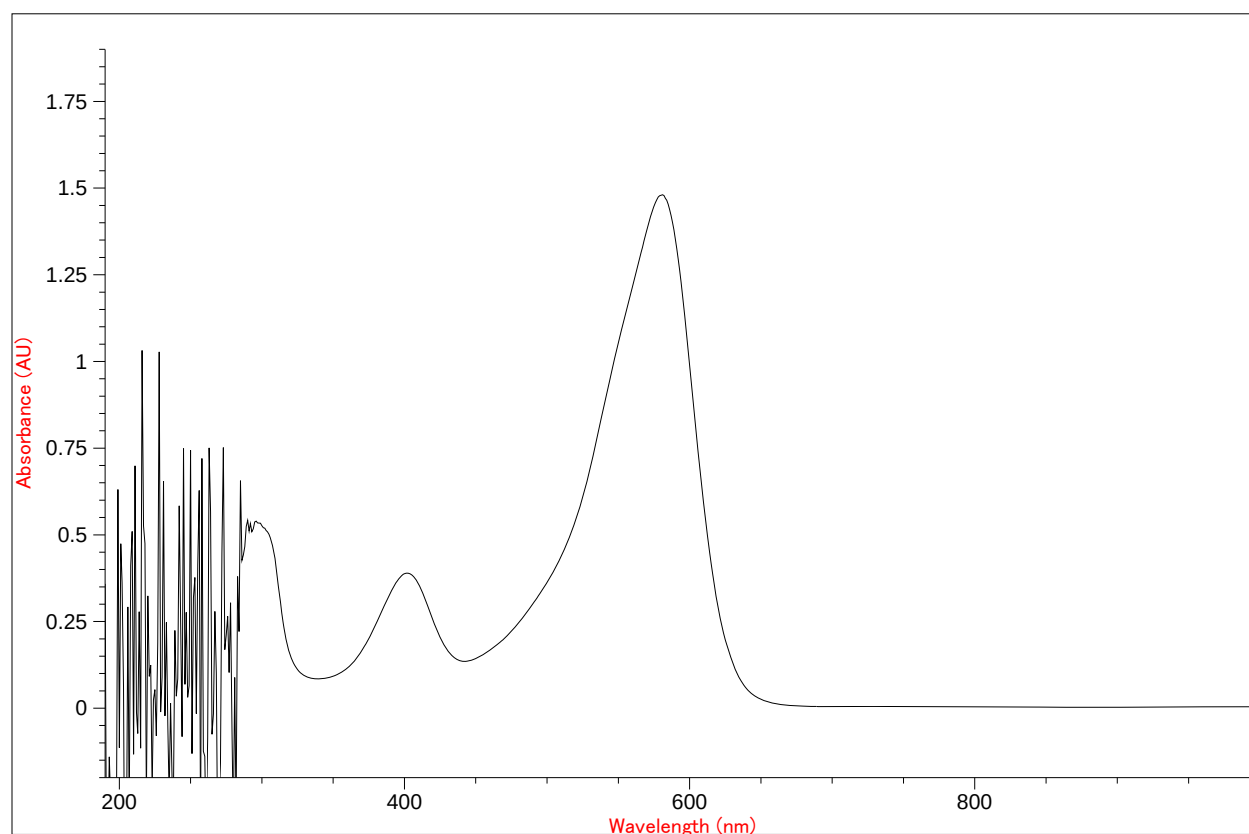
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.42044 | ug/mL | 0.01291   |

## Sample 10

Sample Name 0518-008.R3.Cond (#9)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:49:33  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



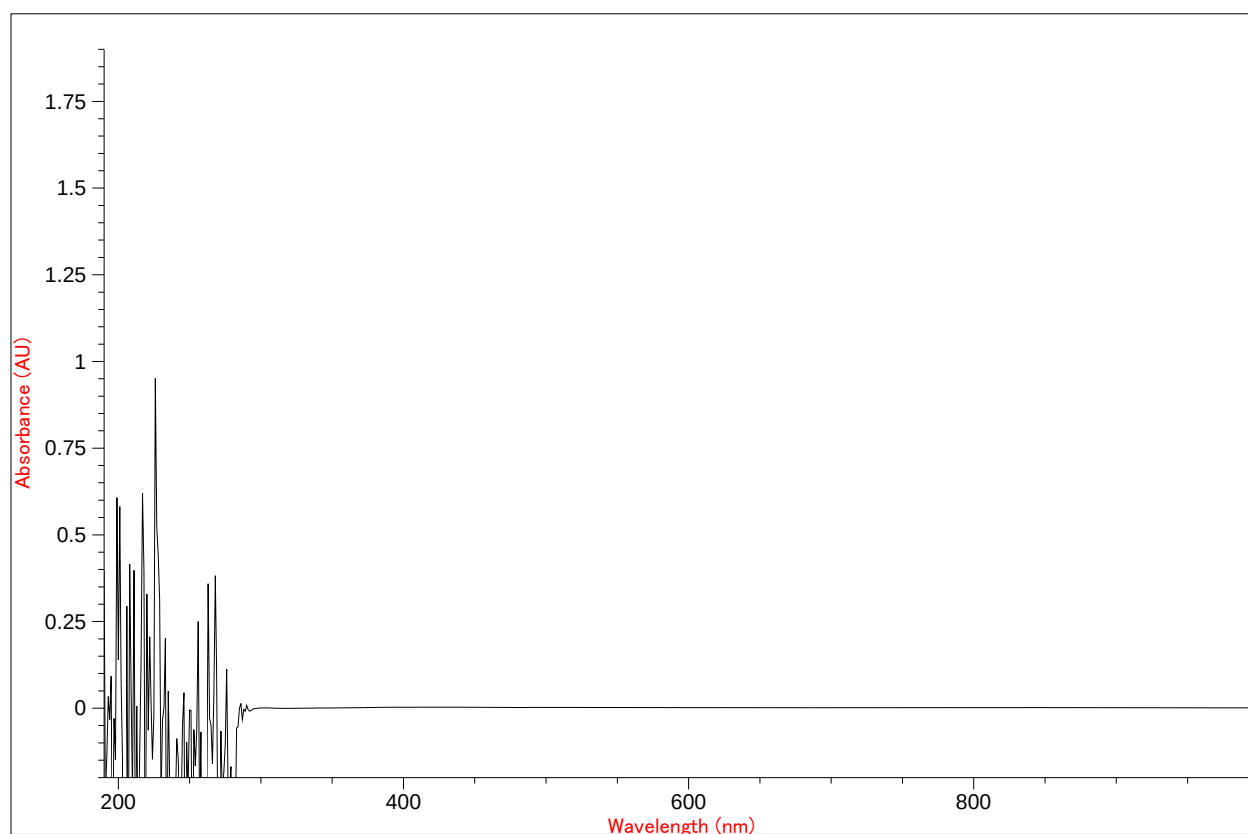
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 3.08899 | ug/mL | 0.01523   |

## Sample 11

Sample Name 0518-008.DiBlk.Cond (#10)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:50:07  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



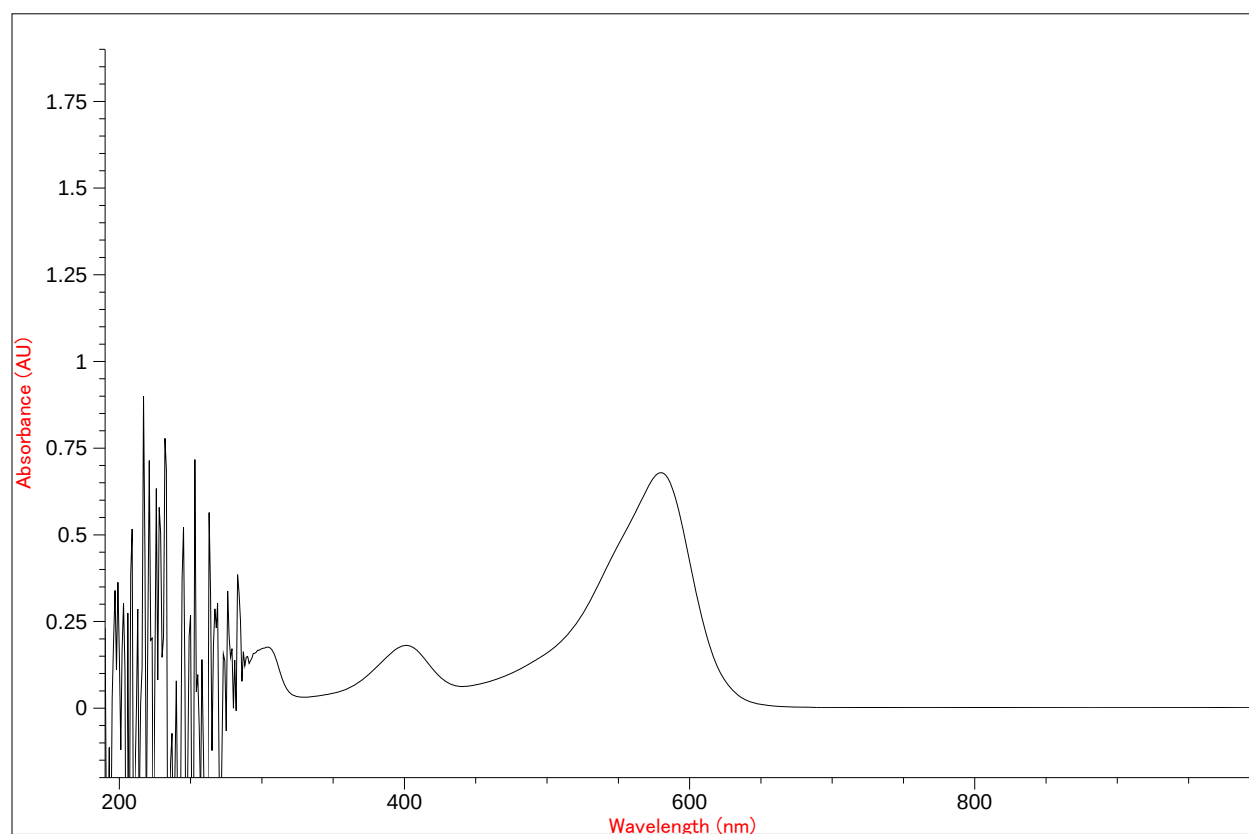
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00475 | ug/mL | 0.01221   |

## Sample 12

Sample Name Snowball II 2009 #SSB (#13)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:51:34  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

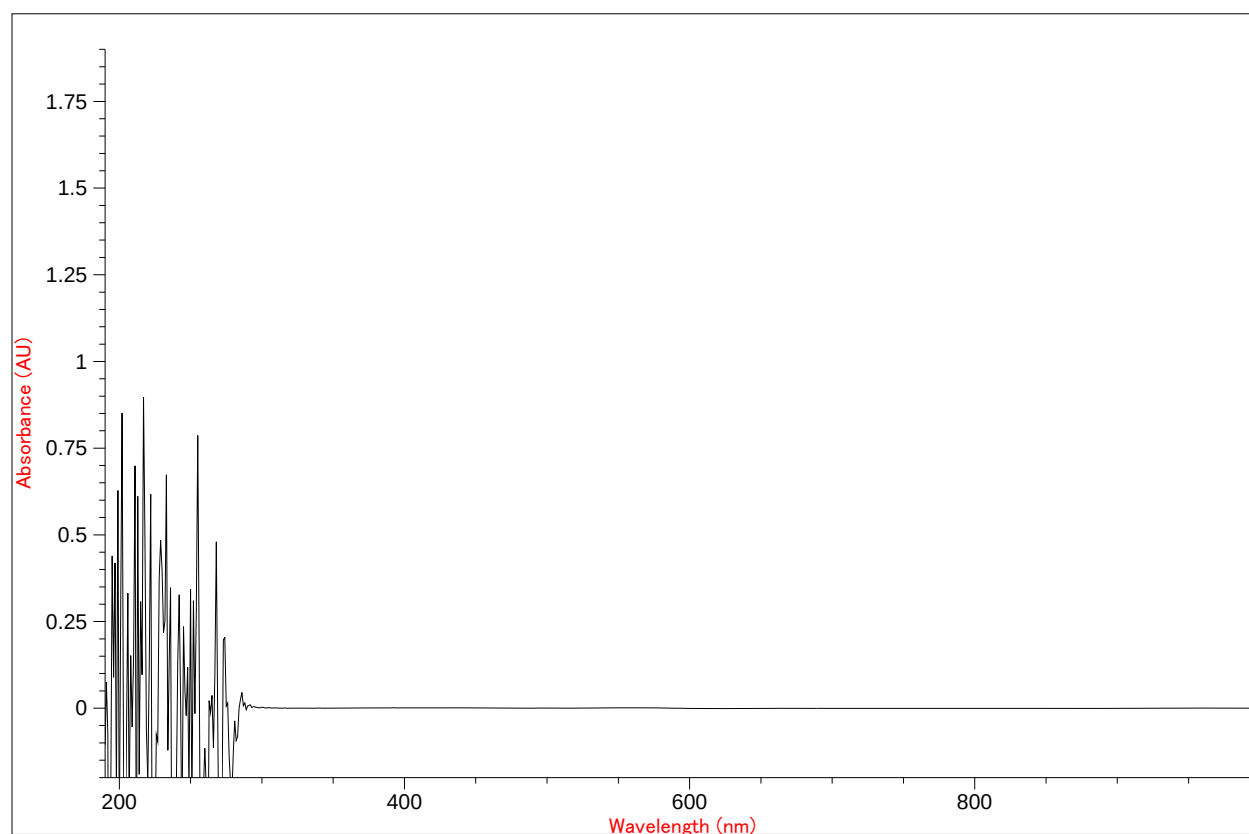
| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.41296 | ug/mL | 0.01290   |



## Sample 13

Sample Name Snowball II 2009 #MB2 (#14)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:51:51  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



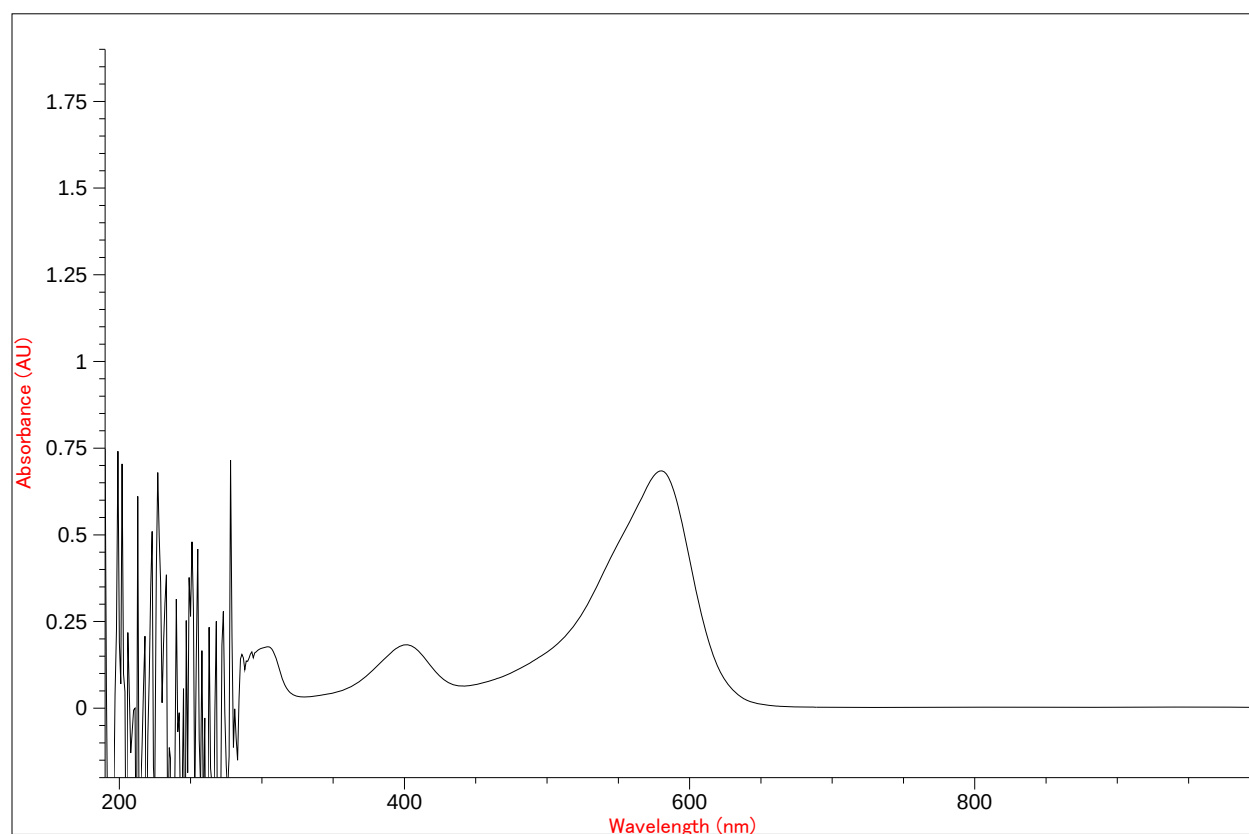
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00286 | ug/mL | 0.01221   |

## Sample 15

Sample Name Snowball II 2009 #SSC (#21)  
Operator Patricia Mann  
Date 5/8/18  
Time 14:55:48  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



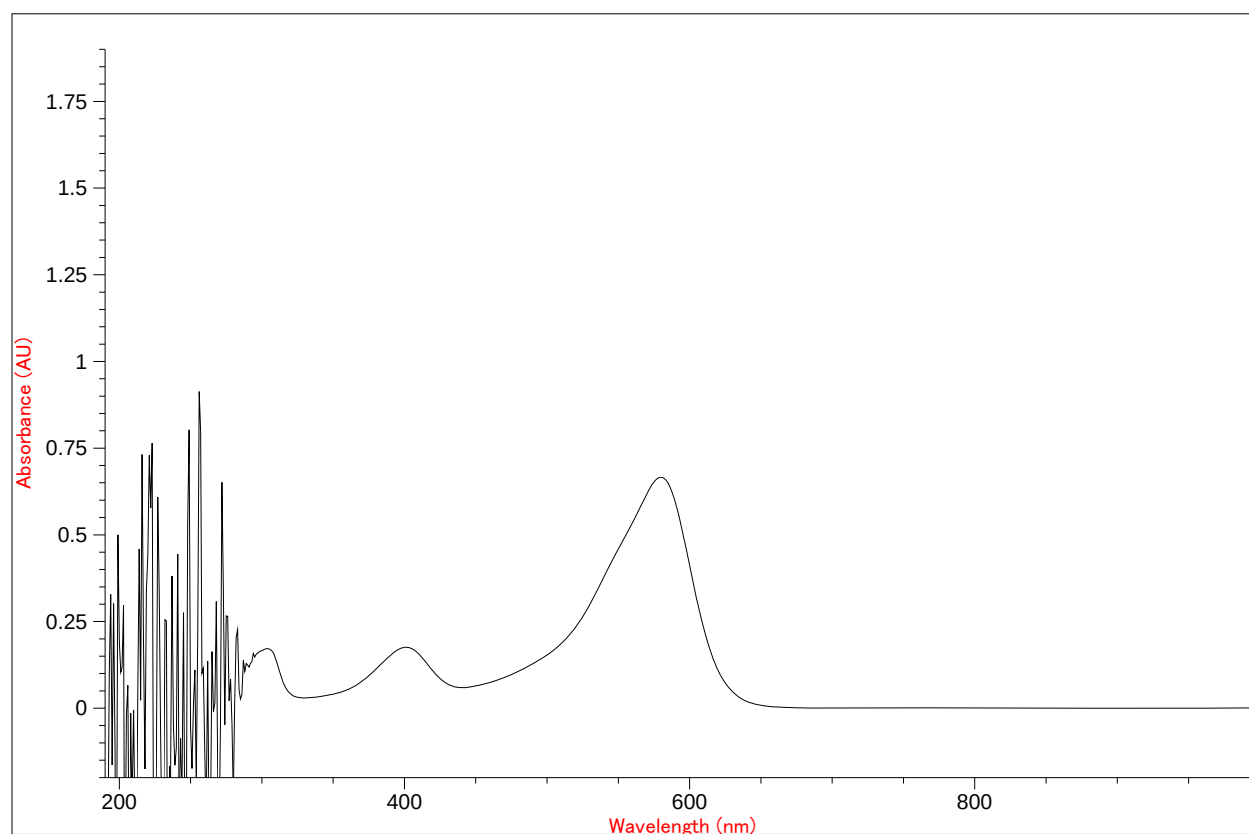
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.42525 | ug/mL | 0.01291   |

## Sample 16

Sample Name Snowball II 2009 #SSD (#2)  
Operator Patricia Mann  
Date 5/8/18  
Time 16:14:42  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



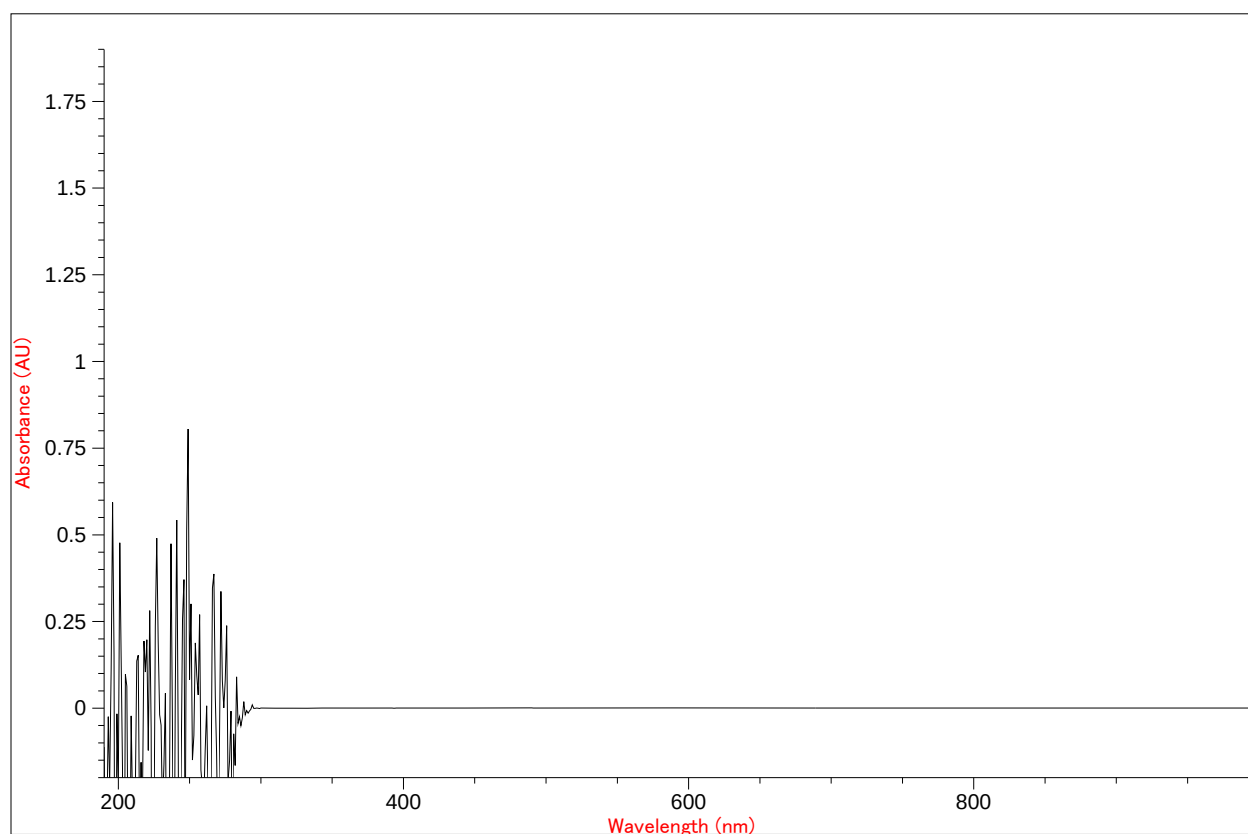
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.38361 | ug/mL | 0.01287   |

## Sample 17

|                  |                            |
|------------------|----------------------------|
| Sample Name      | Snowball II 2009 #MB3 (#3) |
| Operator         | Patricia Mann              |
| Date             | 5/8/18                     |
| Time             | 16:14:57                   |
| Path Length      | 1                          |
| Path Length Unit | cm                         |

## Sample Spectrum



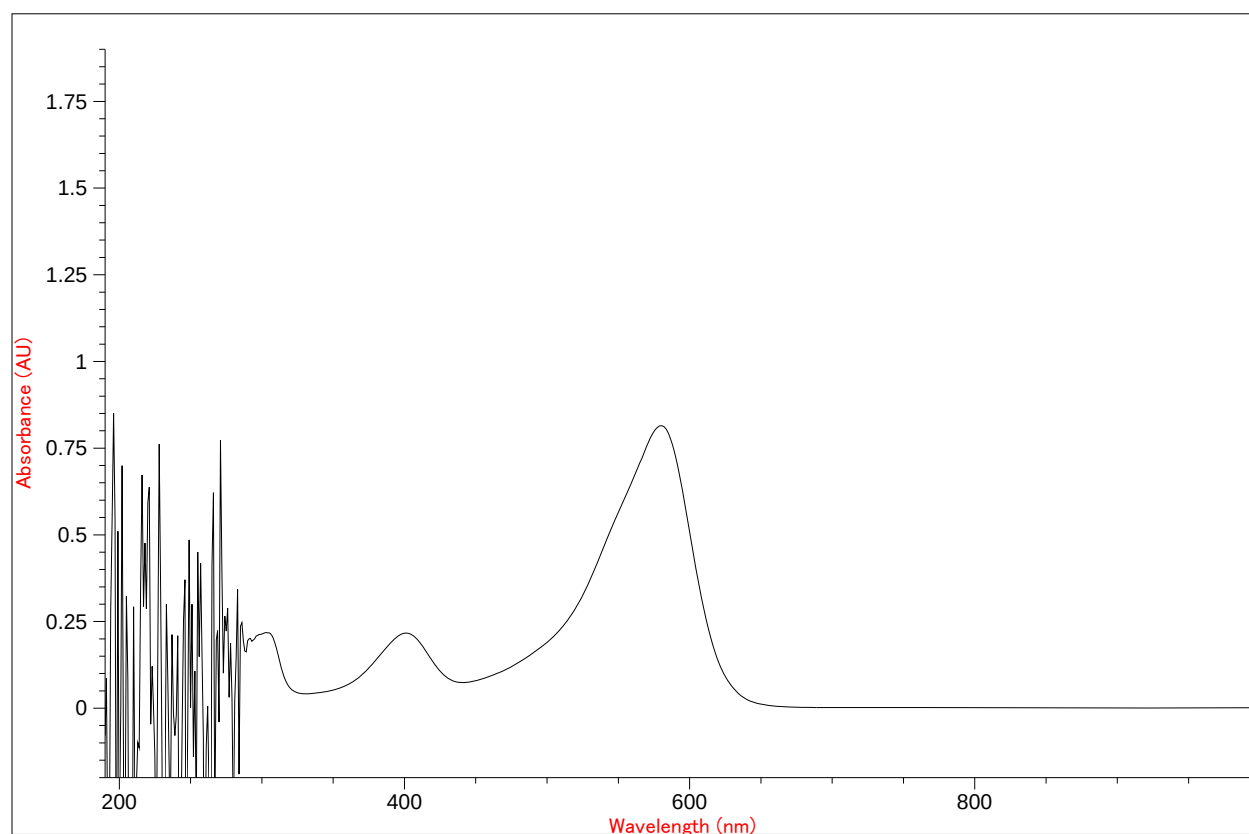
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 0.00218 | ug/mL | 0.01221   |

## Sample 18

Sample Name 0518-008.R2\*2.Cond (#4)  
Operator Patricia Mann  
Date 5/8/18  
Time 16:15:13  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



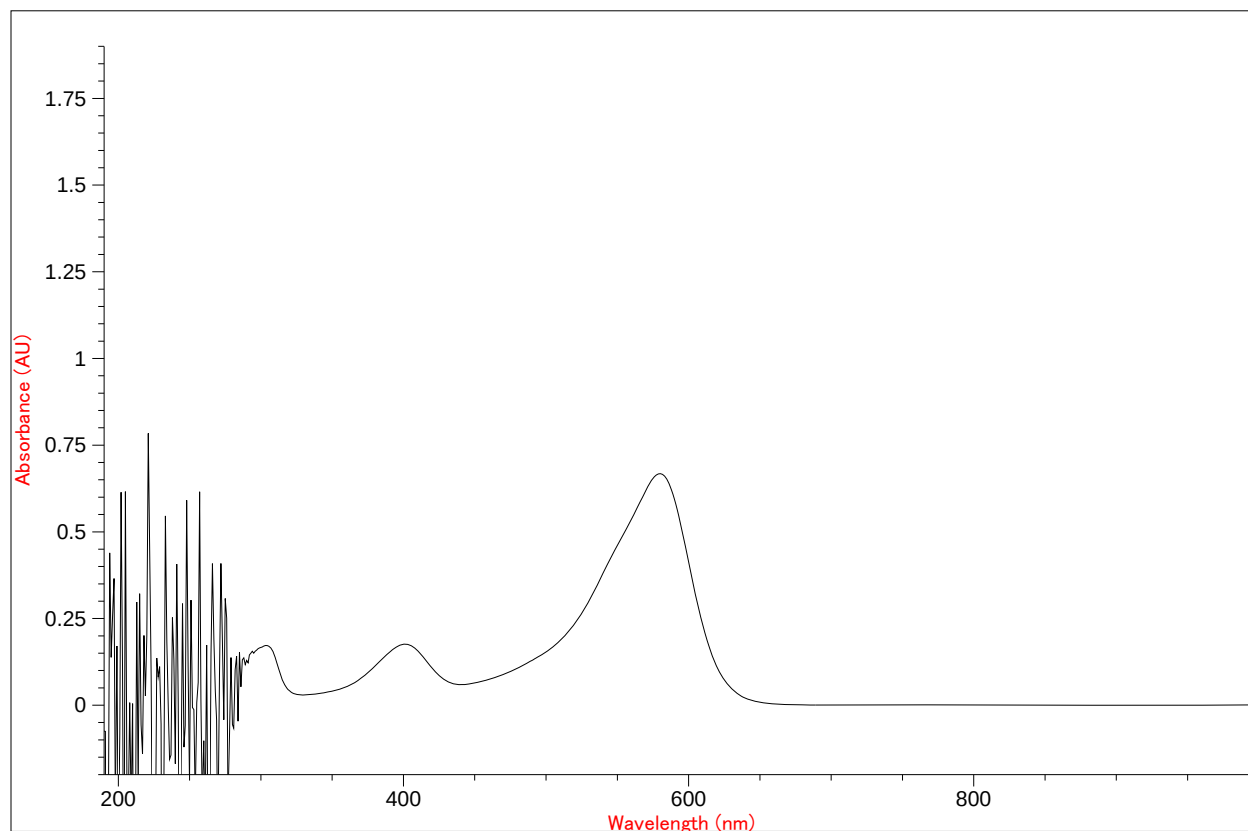
## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.69315 | ug/mL | 0.01319   |

## Sample 19

Sample Name Snowball II 2009 #SSE (#5)  
Operator Patricia Mann  
Date 5/8/18  
Time 16:15:28  
Path Length 1  
Path Length Unit cm

## Sample Spectrum



## Data Analysis Results

| # | Analyte Name | Value   | Unit  | Std. Dev. |
|---|--------------|---------|-------|-----------|
| 1 | Formaldehyde | 1.38717 | ug/mL | 0.01288   |

## Results Summary

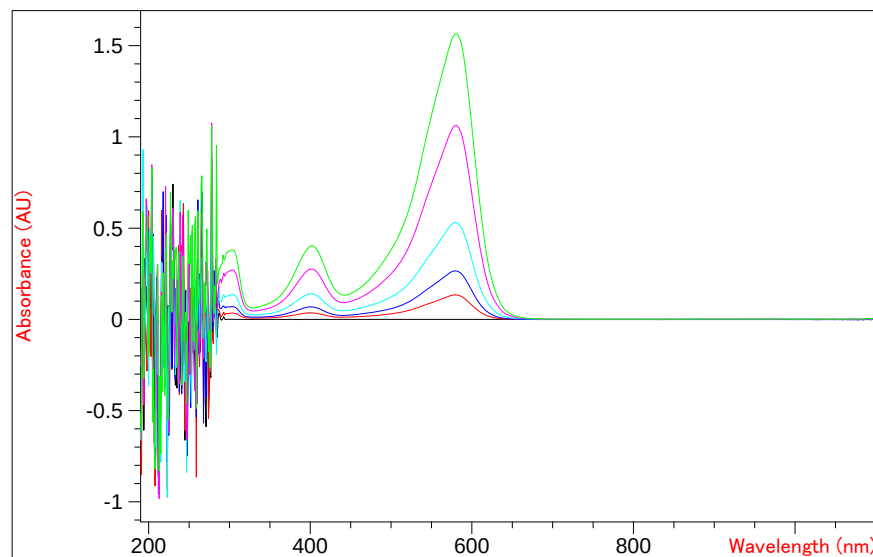
| Sample Name                          | Data Value         | Result Value       | Unit             | Std.Dev.           |
|--------------------------------------|--------------------|--------------------|------------------|--------------------|
| Snowball II 2009 #SS1 (#8)           | 0.62450            | 1.39746            | ug/mL            | 0.01289            |
| Snowball II 2009 #SS2 (#9)           | 0.62202            | 1.39190            | ug/mL            | 0.01288            |
| Snowball II 2009 #MB (#10)           | -0.00082           | -0.00183           | ug/mL            | 0.01221            |
| Snowball II 2009 #SSA (#2)           | 0.62202            | 1.39191            | ug/mL            | 0.01288            |
| Snowball II 2009 #MB1 (#3)           | 0.00135            | 0.00302            | ug/mL            | 0.01221            |
| 0518-008.R1.Cond (#4)                | 1.23991            | 2.77457            | ug/mL            | 0.01470            |
| 0518-008.LD-R1.Cond (#5)             | 1.23861            | 2.77167            | ug/mL            | 0.01469            |
| 0518-008.MS-R1.Cond (#6)             | 1.61280            | 3.60901            | ug/mL            | 0.01619            |
| 0518-008.AD-R1.Cond (#7)             | 0.63477            | 1.42044            | ug/mL            | 0.01291            |
| 0518-008.R3.Cond (#9)                | 1.38042            | 3.08899            | ug/mL            | 0.01523            |
| 0518-008.DiBlk.Cond (#10)            | 0.00212            | 0.00475            | ug/mL            | 0.01221            |
| Snowball II 2009 #SSB (#13)          | 0.63143            | 1.41296            | ug/mL            | 0.01290            |
| Snowball II 2009 #MB2 (#14)          | 0.00128            | 0.00286            | ug/mL            | 0.01221            |
| <del>0418-172.MS-R1.Cond (#15)</del> | <del>0.86599</del> | <del>1.93784</del> | <del>ug/mL</del> | <del>0.01348</del> |
| Snowball II 2009 #SSC (#21)          | 0.63692            | 1.42525            | ug/mL            | 0.01291            |
| Snowball II 2009 #SSD (#2)           | 0.61831            | 1.38361            | ug/mL            | 0.01287            |
| Snowball II 2009 #MB3 (#3)           | 0.00098            | 0.00218            | ug/mL            | 0.01221            |
| 0518-008.R2*2.Cond (#4)              | 0.75664            | 1.69315            | ug/mL            | 0.01319            |
| Snowball II 2009 #SSE (#5)           | 0.61990            | 1.38717            | ug/mL            | 0.01288            |

\*\*\* End Results Report \*\*\*

## \*\*\* Calibration Report \*\*\*

Number of Standards 6

## Standard Spectra



| # | Standard         | Path Length | Unit | Date   | Time     |
|---|------------------|-------------|------|--------|----------|
| 1 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:13:11 |
| 2 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:13:36 |
| 3 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:13:57 |
| 4 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:14:16 |
| 5 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:14:34 |
| 6 | Snowball II 2009 | 1.000       | cm   | 5/8/18 | 13:18:07 |

## Data Analysis:

## Spectral Processing:

Absorbance

Use Wavelength(s):

Single (nm): 570

Evaluation: SCA

Calibrated at: Date 5/8/2018 Time 1:18:58 PM  
Operator: Patricia Mann

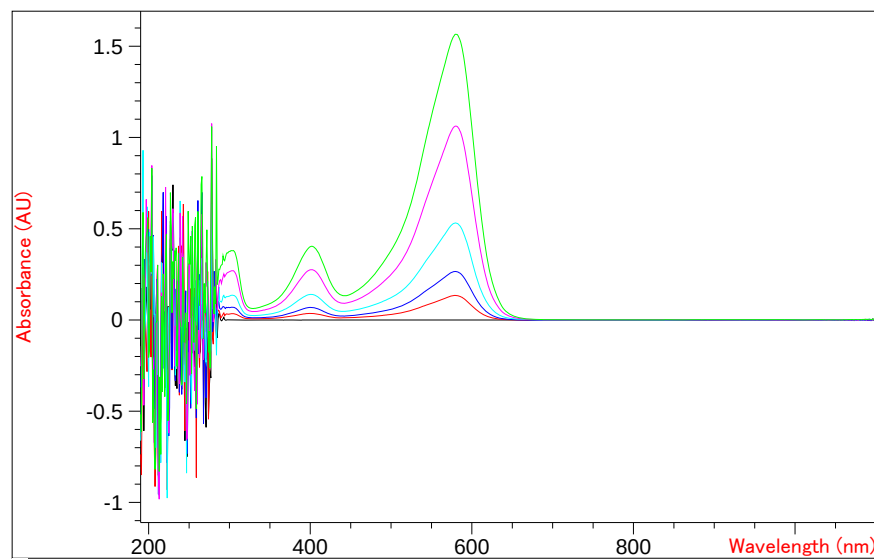
Weighting Method: Least squares  
Calibration Curve:  $C = k_1 * A$

Analyte Name Unit

Formaldehyde ug/mL



## Processed Standard Spectra



## Coefficients

| k# | Value   |
|----|---------|
| 1  | 2.23772 |

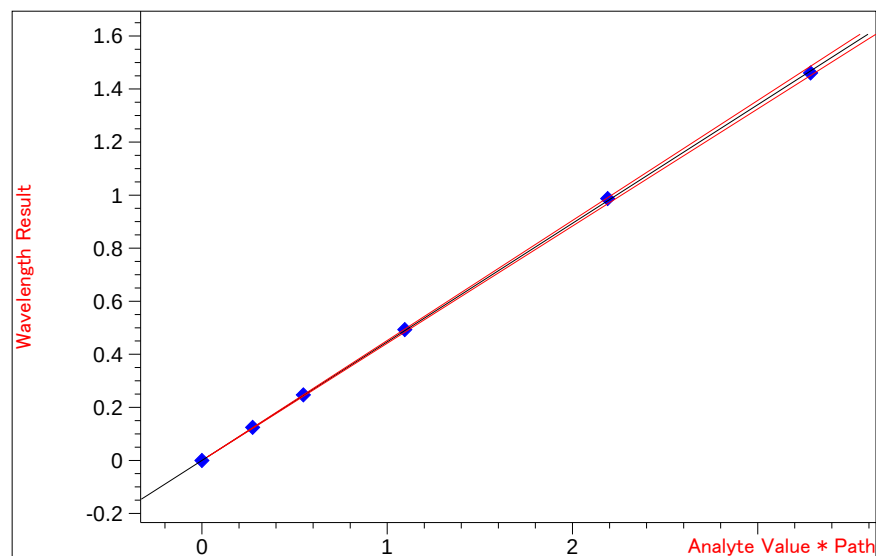
## Used Wavelength Results (Absorbance (AU))

| # | Value    | # | Value   | # | Value   |
|---|----------|---|---------|---|---------|
| 1 | -0.00027 | 3 | 0.24673 | 5 | 0.98694 |
| 2 | 0.12473  | 4 | 0.49322 | 6 | 1.46056 |

## Calibration Table of Formaldehyde (ug/mL)

| # | Standard Name    | Value   | Fitted Val. | Error (%) |
|---|------------------|---------|-------------|-----------|
| 1 | Snowball II 2009 | 0.00000 | -0.00061    | -100.0    |
| 2 | Snowball II 2009 | 0.27380 | 0.27911     | -1.9      |
| 3 | Snowball II 2009 | 0.54750 | 0.55211     | -0.8      |
| 4 | Snowball II 2009 | 1.09500 | 1.10369     | -0.8      |
| 5 | Snowball II 2009 | 2.19000 | 2.20850     | -0.8      |
| 6 | Snowball II 2009 | 3.28500 | 3.26833     | 0.5       |

## Calibration Curve (Data Analysis)



## SCA Summary

|                          |                 |
|--------------------------|-----------------|
| Analyte Name             | Formaldehyde    |
| Number of Standards      | 6               |
| Calculation Method       | LSQ             |
| Calibration Curve        | $C = k_1 * A$   |
| Coefficient $k_1$        | 2.23770 ug/mL   |
| Std.Dev. of $k_1$        | 6.5961E-3 ug/mL |
| Std.Dev. of Calibration  | 1.2211E-2 ug/mL |
| Correl. Coeff. ( $R^2$ ) | 0.99996         |
| Uncertainty              | 1.22 %          |

\*\*\* End Calibration Report \*\*\*

**This Is The Last Page  
Of This Report.**

# Sorbent Trap Analysis Report

|                         |                                    |                                    |
|-------------------------|------------------------------------|------------------------------------|
| Project Number: 2013868 | Plant: <u>Bison Engineering</u>    | Date: <u>5/9/2018</u>              |
|                         | Contact: <u>Kelly Dorsi</u>        | Analyst(s): <u>Alexandra Shuey</u> |
|                         | Phone: <u>406 442 57 68</u>        | Method: <u>EPA 7473</u>            |
| Turn-around: Standard   | Email: <u>kdorsi@bison-eng.com</u> | Method Uncertainty: <u>± 10%</u>   |

| Trap ID  | AGS Mass (ng) | Section 1 Mass (ng) | Section 2 Mass (ng) | Total Mass (ng) <sup>1</sup> | Section 3 Mass (ng) | Spike Level (ng) | Breakthrough (%) <sup>2</sup> | Spike Recovery (%) <sup>3</sup> | Source              | Notes                            |
|----------|---------------|---------------------|---------------------|------------------------------|---------------------|------------------|-------------------------------|---------------------------------|---------------------|----------------------------------|
| OL462380 |               | NA                  | NA                  | 0.0                          |                     | 5                | NA                            |                                 | HAV CF4114 FB Stack | Analyst Dropped and Broke Sample |
| OL469598 |               | 1.4                 | 2.5                 | 3.9                          |                     |                  | 178.57%                       |                                 | HAV CF4114 FB Stack |                                  |
| OL462401 |               | 6.5                 | 0.3                 | 6.8                          |                     | 5                | 4.62%                         |                                 | HAV CF4114 FB Stack |                                  |
| OL469610 |               | 1.4                 | 0.3                 | 1.7                          |                     |                  | 21.43%                        |                                 | HAV CF4114 FB Stack |                                  |
| OL464776 |               | 6.2                 | 0.2                 | 6.4                          |                     | 5                | 3.23%                         |                                 | HAV CF4114 FB Stack |                                  |
| OL469566 |               | 1.3                 | 0.2                 | 1.5                          |                     |                  | 15.38%                        |                                 | HAV CF4114 FB Stack |                                  |
| OL464795 |               | 6.1                 | 0.2                 | 6.3                          |                     | 5                | 3.28%                         |                                 | HAV CF4117 RF Stack |                                  |
| OL469559 |               | 1.2                 | 0.3                 | 1.5                          |                     |                  | 25.00%                        |                                 | HAV CF4117 RF Stack |                                  |
| OL464761 |               | 5.9                 | 0.2                 | 6.1                          |                     | 5                | 3.39%                         |                                 | HAV CF4117 RF Stack |                                  |
| OL469520 |               | 1.1                 | 0.2                 | 1.3                          |                     |                  | 18.18%                        |                                 | HAV CF4117 RF Stack |                                  |
| OL464778 |               | 6.0                 | 0.2                 | 6.2                          |                     | 5                | 3.33%                         |                                 | HAV CF4117 RF Stack |                                  |
| OL469519 |               | 1.0                 | 0.2                 | 1.2                          |                     |                  | 20.00%                        |                                 | HAV CF4117 RF Stack |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |
|          |               |                     |                     |                              |                     |                  |                               |                                 |                     |                                  |

|                                                                                                                                                                                                                       |            |                                         |                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------|---------------------------------------------------------------------------------------|
| MDL = 0.193 ng                                                                                                                                                                                                        | LOQ = 2 ng | Laboratory NELAP Accreditation #E871092 |  |
| <sup>1</sup> Total Mass = PF+AGS+S1+S2<br><sup>2</sup> Breakthrough = S2 / (PF+AGS+S1)<br><sup>3</sup> Spike Recovery = S3 / Spike Level<br><i>For PS-12B Only</i><br>R = Data invalidation qualifier. Refer to notes |            |                                         |                                                                                       |
|                                                                                                                                                                                                                       |            |                                         |                                                                                       |
|                                                                                                                                                                                                                       |            |                                         |                                                                                       |

## Bison Engineering

Date: May 9, 2018

Analyst: Alexandra Shuey

Temperature (°C): 680

File Name: 180509\_ANS\_Bison

Flow Rate (L/min): 1.00

Analyzer: 140

MDL (ng): 0.19

Cell type: Medium

SD: 1.8

|    | ID #     | PF Mass (ng) | AGS Mass (ng) | Section 1 Mass (ng) | Section 2 Mass (ng) | Section 3 Mass (ng) | Section 4 Mass (ng) | Spike Level (ng) | Source:             | Notes:                           |
|----|----------|--------------|---------------|---------------------|---------------------|---------------------|---------------------|------------------|---------------------|----------------------------------|
| 1  | OL462380 |              |               | NA                  | NA                  |                     |                     | 5                | HAV CF4114 FB Stack | Analyst Dropped and Broke Sample |
| 2  | OL469598 |              |               | 1.4                 | 2.5                 |                     |                     |                  | HAV CF4114 FB Stack |                                  |
| 3  | OL462401 |              |               | 6.5                 | 0.3                 |                     |                     | 5                | HAV CF4114 FB Stack |                                  |
| 4  | OL469610 |              |               | 1.4                 | 0.3                 |                     |                     |                  | HAV CF4114 FB Stack |                                  |
| 5  | OL464776 |              |               | 6.2                 | 0.2                 |                     |                     | 5                | HAV CF4114 FB Stack |                                  |
| 6  | OL469566 |              |               | 1.3                 | 0.2                 |                     |                     |                  | HAV CF4114 FB Stack |                                  |
| 7  | OL464795 |              |               | 6.1                 | 0.2                 |                     |                     | 5                | HAV CF4117 RF Stack |                                  |
| 8  | OL469559 |              |               | 1.2                 | 0.3                 |                     |                     |                  | HAV CF4117 RF Stack |                                  |
| 9  | OL464761 |              |               | 5.9                 | 0.2                 |                     |                     | 5                | HAV CF4117 RF Stack |                                  |
| 10 | OL469520 |              |               | 1.1                 | 0.2                 |                     |                     |                  | HAV CF4117 RF Stack |                                  |
| 11 | OL464778 |              |               | 6.0                 | 0.2                 |                     |                     | 5                | HAV CF4117 RF Stack |                                  |
| 12 | OL469519 |              |               | 1.0                 | 0.2                 |                     |                     |                  | HAV CF4117 RF Stack |                                  |
| 13 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 14 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 15 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 16 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 17 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 18 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 19 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |
| 20 |          |              |               |                     |                     |                     |                     |                  |                     |                                  |

Additional Notes:

| Daily Calibration* |           |                 |
|--------------------|-----------|-----------------|
| Lot # Std.         | Std. (ng) | Calculated (ng) |
| M2-MEB656771 B     | 2.0       | see cal. report |
| M2-MEB656771 B     | 5.0       | see cal. report |
| M2-MEB658995 B     | 50.0      | see cal. report |
| M2-MEB658995 B     | 100.0     | see cal. report |
| K2-HG650192 B      | 500.0     | see cal. report |
| K2-HG650192 B      | 1000.0    | see cal. report |
|                    |           | see cal. report |

| Independent Calibration Verification** |           |                 |
|----------------------------------------|-----------|-----------------|
| Lot # Std.                             | Std. (ng) | Calculated (ng) |
| M2-HG657626                            | 30.0      | 30.0            |

| Response Factor (Method 30B Only)***   |           |                   |
|----------------------------------------|-----------|-------------------|
| Lot # Std.                             | Std. (ng) | (area count/mass) |
| M2-MEB656771 B                         | 1.0       | 530               |
| RF Pipette ID (if different from cal): |           | R2-1              |

| Continuing Calibration Verifications**** |           |                 |
|------------------------------------------|-----------|-----------------|
| Lot # Std.                               | Std. (ng) | Calculated (ng) |
| OLC061880                                | 30.0      | 29.5            |
| M2-MEB656771 B                           | 5.0       | 5.2             |
| M2-MEB656771 B                           | 5.0       | 5.4             |
| M2-MEB656771 B                           | 5.0       | 5.1             |
| M2-MEB656771 B                           | 5.0       | 5.1             |
|                                          |           |                 |
|                                          |           |                 |
|                                          |           |                 |
|                                          |           |                 |

\*Performed daily prior to analysis of sorbent traps, Refer to SOP for Instrument Calibration for acceptance criteria

\*\*Performed immediately after calibration curve is verified, must come within 10% of expected value

\*\*\*Response factor value must fall between the LOQ and MDL

\*\*\*\*Performed between every 10 samples for method 30B and every analytical batch

\*\*\*\*\*Subject to change, for analyst convenience only

| Active Hg Standard Bank***** |                 |           |
|------------------------------|-----------------|-----------|
| Concentration (µg/mL)        | Lot #/Bottle ID | Exp. Date |
| 0.1                          | M2-MEB656771 B  | 6/23/2018 |
| 1                            | M2-MEB658995 B  | 12/4/2018 |
| 10                           | K2-HG650192 B   | 9/13/2018 |
| 100                          | M2-MEB662005 B  | 1/17/2019 |
| 1000                         | K2-HG653768     | 5/22/2018 |
| 0.1                          | M2-MEB656771 A  | 7/17/2018 |
| 1                            | M2-MEB658995 A  | 4/17/2019 |
| 10                           | M2-HG657392 A   | 12/4/2018 |
| 100                          | K2-MEB631040 A  | 6/9/2018  |
|                              |                 |           |
| 1 (Independent)              | M2-HG657626     | 4/12/2019 |
| 10 (Independent)             | M2-MEB659704    | 10/6/2018 |
| 100 (Independent)            | K2-MEB631050    | 4/17/2019 |

| Pipette Identification |  |
|------------------------|--|
| AB                     |  |

Immediately report any QA/QC failures or anything suspicious to the QA/QC Manager

Analyst Signature:

By signing this report I confirm that the above data are true to the best of my knowledge.

Date:

5/9/18

OHIO LUMEX



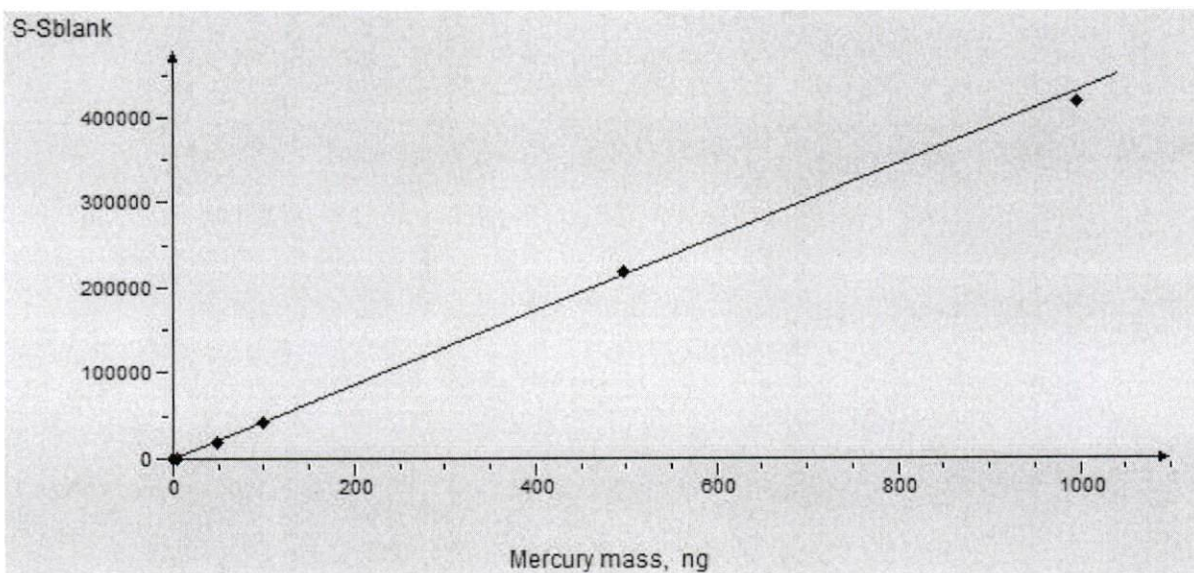
# REPORT

Report created 09.05.2018 09:54:09

Instrument RA915+ Serial number 140

Calibration created 09.05.2018 09:30:44

Calibration name 180509\_ANS\_2-1000



## Results

| N | Mercury mass, ng | S-Sblank | Ref.data, ng/g | Calculated, ng/g | d, % |
|---|------------------|----------|----------------|------------------|------|
| 1 | 1000.00          | 422100   | 1000.0         | 967.9            | -3.2 |
| 2 | 500.00           | 220500   | 500.0          | 505.6            | 1.1  |
| 3 | 100.00           | 43430    | 100.0          | 99.6             | -0.4 |
| 4 | 50.00            | 20990    | 50.0           | 48.1             | -3.7 |
| 5 | 5.00             | 2164     | 5.0            | 5.0              | -0.8 |
| 6 | 2.00             | 933      | 2.0            | 2.1              | 7.0  |

Calibration S - Sblank = a·m

Algorithm WLSM

Correlation coefficient 0.999808

Residual standard deviation 10.338071

Trap ID  
OL462380

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAV  
CFU 114  
Run 1  
4/28/18☐ Unspiked ☒ Spiked At: 5ngSpiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NIST

QA/QC Signature (Trap Maker)

QA/QC Signature (Spiker)

Production Lot: S-28D2 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: 4/5/2018 Spike Time: 1039

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAV/CFU 114 FB

PRE-Run Leak Check (circle one):

☒ PASS ☐ FAIL

Boiler ID: \_\_\_\_\_

Run START:

4/28/2018

9:18

Date

Time

Sampling Location: Stack  
(stack, FGD inlet, etc.)

Run Number (optional): 1

Run END:

4/28/2018

12:28

Date

Time

Sampling Train (circle one): ☒ A ☐ B

POST-Run Leak Check (circle one):

☒ PASS ☐ FAIL

Notes:

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 264

Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008

Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2400

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature | Date      | Time  | Security Seal                                                                           |
|-------------------------------|-----------|-----------|-------|-----------------------------------------------------------------------------------------|
| Trap inserted by              |           | 4/28/2018 | 9:00  | If Applicable Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    |           | 4/28/2018 | 12:35 |                                                                                         |
| Courier/Other (If Applicable) |           |           |       | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Courier/Other (If Applicable) |           |           |       | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap received by lab          |           | 5/2/18    | 1121  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap analyzed by              |           | 5/9/18    | 1042  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon - Refer to SDS

Best Before: April 2021

574





OL469598

## Sorbent Trap Chain of Custody Form

☒ Unspiked ☐ Spiked At: \_\_\_\_\_Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) [Signature]

QA/QC Signature (Spiker) \_\_\_\_\_

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm
Production Lot: U-B52 Carbon Lot: NC

Spike Date: \_\_\_\_\_ Spike Time: \_\_\_\_\_

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAV / CF4114 FB

PRE-Run Leak Check (circle one):

PASS FAIL

Boiler ID: \_\_\_\_\_

Run START: \_\_\_\_\_

Date

Time

Sampling Location: Stack  
(stack, FGD inlet, etc.)Run Number (optional): 1

Run END: \_\_\_\_\_

Date

Time

Sampling Train (circle one): A B

POST-Run Leak Check (circle one):

PASS FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 264Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 4000

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                           |
|-------------------------------|--------------------|----------------|--------------|-----------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/28/18</u> | <u>9:00</u>  | If Applicable Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/28/18</u> | <u>12:35</u> |                                                                                         |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>121</u>   | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>1047</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon – Refer to SDS

Best Before: February 2021



Trap ID  
OL462401

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAW  
CFU 114  
Run 2  
Trap A☐ Unspiked ☒ Spiked At: 5ngSpiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NIST

QA/QC Signature (Trap Maker)

QA/QC Signature (Spiker)

Production Lot: S-28D2 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: 4/5/2018 Spike Time: 1039

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAW / CFU 114 FB

PRE-Run Leak Check (circle one):

PASS FAIL

Boiler ID: \_\_\_\_\_

Run START:

4/28/2018

13:09

Date

Time

Sampling Location: Stack

(stack, FGD inlet, etc.)

Run Number (optional): 2

Run END:

4/28/18

16:16

Date

Time

Sampling Train (circle one): A B

POST-Run Leak Check (circle one):

PASS FAIL

Notes:

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 264

Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008

Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 7.00

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature | Date    | Time  | Security Seal                                                                        |
|-------------------------------|-----------|---------|-------|--------------------------------------------------------------------------------------|
| Trap inserted by              |           | 4/28/18 | 13:00 | If Applicable Place Chain of Custody seal here (See Security Seal Instruction Sheet) |
| Trap removed and sealed by    |           | 4/28/18 | 16:15 |                                                                                      |
| Courier/Other (If Applicable) |           |         |       | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Courier/Other (If Applicable) |           |         |       | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap received by lab          |           | 5/1/18  | 1121  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap analyzed by              |           | 5/9/18  | 1052  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon - Refer to SDS

Best Before: April 2021





OL469610

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAW  
CFU 114  
Run 2  
1m B☒ Unspiked ☐ Spiked At: \_\_\_\_\_Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker)              

QA/QC Signature (Spiker) \_\_\_\_\_

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mmProduction Lot: U-B52 Carbon Lot: NC

Spike Date: \_\_\_\_\_ Spike Time: \_\_\_\_\_

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAW / CFU 114 FB

PRE-Run Leak Check (circle one):

PASS

FAIL

Boiler ID: \_\_\_\_\_

Run START: 4/28/18

Date

13:09

Time

Sampling Location: Stack

(stack, FGD inlet, etc.)

Run Number (optional): 2Run END: 4/28/18

Date

16:16

Time

Sampling Train (circle one): A B

POST-Run Leak Check (circle one):

PASS

FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 264Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2.600

STARTUP

SHUTDOWN

Total Volume (L) 3600 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature     | Date           | Time         | Security Seal                                                                           |
|-------------------------------|---------------|----------------|--------------|-----------------------------------------------------------------------------------------|
| Trap inserted by              | <u>      </u> | <u>4/28/18</u> | <u>13:40</u> | If Applicable Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>      </u> | <u>4/28/18</u> | <u>16:14</u> |                                                                                         |
| Courier/Other (If Applicable) |               |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Courier/Other (If Applicable) |               |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap received by lab          | <u>AL</u>     | <u>5/2/18</u>  | <u>11:11</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap analyzed by              | <u>      </u> | <u>5/9/18</u>  | <u>10:58</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon – Refer to SDS

Best Before: February 2021





OL464776

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAV  
CFU 114  
Run 3  
Trap A☐ Unspiked ☒ Spiked At: 5ngSpiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) 7/11QA/QC Signature (Spiker) CP

Production Lot: S-28D2 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: 4/5/2018 Spike Time: 1039

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAV / CFU 114 PB PRE-Run Leak Check (circle one): PASS FAILBoiler ID: \_\_\_\_\_ Run START: 4/28/18 16:45  
Date TimeSampling Location: Stack  
(stack, FGD inlet, etc.)Run Number (optional): 3 Run END: 4/28/18 19:53  
Date TimeSampling Train (circle one): A B POST-Run Leak Check (circle one): PASS FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 264 Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008Ave Trap Temp (F°): 276 Circle Event if Occurred During Sampling: \_\_\_\_\_Ave Flow Rate (cc/min): 2,000 STARTUP SHUTDOWNTotal Volume (L) 360 or (dscm): \_\_\_\_\_ For CEMENT KILNS Only  
No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                        |
|-------------------------------|--------------------|----------------|--------------|--------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/28/18</u> | <u>16:40</u> | If Applicable Place Chain of Custody seal here (See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/28/18</u> | <u>20:00</u> |                                                                                      |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>11:21</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>11:06</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon - Refer to SDS

Best Before: April 2021

578





OL469566

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAW  
CFU 114  
Run 3  
for B☒ Unspiked ☐ Spiked At: \_\_\_\_\_Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) M B

QA/QC Signature (Spiker) \_\_\_\_\_

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mmProduction Lot: U-B52 Carbon Lot: NCSpike Date: \_\_\_\_\_ Spike Time: \_\_\_\_\_ Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAW / CFU 114 FBPRE-Run Leak Check (circle one): PASS FAIL

Boiler ID: \_\_\_\_\_

Run START: 4/28/18 16:45  
Date TimeSampling Location: Stack  
(stack, FGD inlet, etc.)Run Number (optional): 3Run END: 4/28/18 19:53  
Date TimeSampling Train (circle one): A BPOST-Run Leak Check (circle one): PASS FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 264Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2.00

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                           |
|-------------------------------|--------------------|----------------|--------------|-----------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/28/18</u> | <u>16:40</u> | If Applicable Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/28/18</u> | <u>20:00</u> |                                                                                         |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>421</u>   | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>1116</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool impregnated Activated Carbon – Refer to SDS

Best Before: February 2021





OL464795

## Sorbent Trap Chain of Custody Form

OHIO LUMEX

HAV  
CFU117  
Bul Trap A☐ Unspiked ☒ Spiked At: 5ngSpiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) YH LQA/QC Signature (Spiker) [Signature]

Production Lot: S-28D2 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: 4/5/2018 Spike Time: 1039

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAV / CFU117 RF

PRE-Run Leak Check (circle one):

PASS FAIL

Boiler ID: \_\_\_\_\_

Run START:

4/29/18  
Date8:42  
TimeSampling Location: Stack

(stack, FGD inlet, etc.)

Run Number (optional): 1

Run END:

4/29/18  
Date11:50  
TimeSampling Train (circle one): A B

POST-Run Leak Check (circle one):

PASS FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 250Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.08Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2,000

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                        |
|-------------------------------|--------------------|----------------|--------------|--------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/29/18</u> | <u>8:35</u>  | If Applicable Place Chain of Custody seal here (See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/29/18</u> | <u>12:00</u> |                                                                                      |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>11:21</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>11/4</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon - Refer to SDS

Best Before: April 2021



OL469559

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAW  
CPU 117  
Run 1  
Trap B☒ Unspiked ☐ Spiked At: \_\_\_\_\_Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) M B

QA/QC Signature (Spiker) \_\_\_\_\_

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mmProduction Lot: U-B52 Carbon Lot: NCSpike Date: \_\_\_\_\_ Spike Time: \_\_\_\_\_ Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAW / CPU 117 RF PRE-Run Leak Check (circle one): PASS **FAIL**

Boiler ID: \_\_\_\_\_ Run START: 4/29/18 8:42  
Date Time

Sampling Location: Stack  
(stack, FGD inlet, etc.)

Run Number (optional): 1 Run END: 4/29/18 11:50  
Date Time

Sampling Train (circle one): A (B) POST-Run Leak Check (circle one): PASS **FAIL**

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 250 Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008

Ave Trap Temp (F°): 270 Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2,000 **STARTUP** **SHUTDOWN**

Total Volume (L) 360 or (dscm): \_\_\_\_\_ **For CEMENT KILNS Only**

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                           |
|-------------------------------|--------------------|----------------|--------------|-----------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/29/18</u> | <u>8:35</u>  | If Applicable Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/29/18</u> | <u>12:05</u> |                                                                                         |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>1:20</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>11:21</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon - Refer to SDS

Best Before: February 2021





OL464761

## Sorbent Trap Chain of Custody Form

☐ Unspiked ☒ Spiked At: 5ng  
 Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
 Certified Accuracy  $\pm 10\%$ , Traceable to NIST

QA/QC Signature (Trap Maker) [Signature]QA/QC Signature (Spiker) [Signature]Production Lot: S-28D2 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: 4/5/2018 Spike Time: 1039Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAV/CP4117 RFPRE-Run Leak Check (circle one): PASS FAIL

Boiler ID: \_\_\_\_\_

Run START: 4/29/18 12:36  
Date TimeSampling Location: Stack  
(stack, FGD inlet, etc.)Run Number (optional): 2Run END: 4/29/18 15:46  
Date TimeSampling Train (circle one): A BPOST-Run Leak Check (circle one): PASS FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 250Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2,000

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                        |
|-------------------------------|--------------------|----------------|--------------|--------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/29/18</u> | <u>12:30</u> | If Applicable Place Chain of Custody seal here (See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/29/18</u> | <u>15:50</u> |                                                                                      |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>1121</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>1128</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon – Refer to SDS

Best Before: April 2021



OL469520

OHIO LUMEX

# Sorbent Trap Chain of Custody Form

HAV  
CEU 117 FB  
Run 2 Trap B

☒ **Unspiked** ☐ **Spiked At:** \_\_\_\_\_

Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NIST

QA/QC Signature (Trap Maker) [Signature]

QA/QC Signature (Spiker) \_\_\_\_\_

Production Lot: U-B52 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: \_\_\_\_\_ Spike Time: \_\_\_\_\_

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAV / CEU 117 FB

PRE-Run Leak Check (circle one):

PASS **FAIL**

Boiler ID: \_\_\_\_\_

Run START:

4/29/18

12:36

Date

Time

Sampling Location: Stack

(stack, FGD inlet, etc.)

Run Number (optional): 2

Run END:

4/29/18

15:46

Date

Time

Sampling Train (circle one): **A** **B**

POST-Run Leak Check (circle one):

PASS **FAIL**

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 250

Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008

Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2,000

**STARTUP**

**SHUTDOWN**

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.888

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                                  |
|-------------------------------|--------------------|----------------|--------------|------------------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/29/18</u> | <u>12:30</u> | <b>If Applicable</b> Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/29/18</u> | <u>15:55</u> |                                                                                                |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>            |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>            |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>11:21</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>            |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>11:31</u> | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>            |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon – Refer to SDS

Best Before: February 2021



Trap ID  
OL464778

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAW  
CFM 117  
Run 3 1 trap A☐ Unspiked ☒ Spiked At: 5ng  
Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) YH LQA/QC Signature (Spiker) [Signature]

Production Lot: S-28D2 Carbon Lot: NC

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm

Spike Date: 4/5/2018 Spike Time: 1039

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAW/CFM 117 RF PRE-Run Leak Check (circle one): PASS ~~FAIL~~

Boiler ID: \_\_\_\_\_ Run START: 4/29/18 16:02  
Date Time

Sampling Location: Stack  
(stack, FGD inlet, etc.)

Run Number (optional): 3 Run END: 4/29/18 19:06  
Date Time

Sampling Train (circle one): A B POST-Run Leak Check (circle one): PASS ~~FAIL~~

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 250 Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008

Ave Trap Temp (F°): 270 Circle Event if Occurred During Sampling: \_\_\_\_\_

Ave Flow Rate (cc/min): 2,000 STARTUP SHUTDOWN

Total Volume (L) 3600 or (dscm): \_\_\_\_\_ For CEMENT KILNS Only  
No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                        |
|-------------------------------|--------------------|----------------|--------------|--------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/29/18</u> | <u>15:55</u> | If Applicable Place Chain of Custody seal here (See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/29/18</u> | <u>19:10</u> |                                                                                      |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>1121</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>1135</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>  |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon – Refer to SDS

Best Before: April 2021





OL469519

OHIO LUMEX

## Sorbent Trap Chain of Custody Form

HAW  
CFU 117  
Run 3  
Trap B☒ Unspiked ☐ Spiked At: \_\_\_\_\_Spiking Method Cold Vapor Adsorption Via Impinger Sparging  
Certified Accuracy  $\pm 10\%$ , Traceable to NISTQA/QC Signature (Trap Maker) [Signature]

QA/QC Signature (Spiker) \_\_\_\_\_

☐ High Flow ☐ Coil Pre-filter ☐ 240 mm  
☐ Static Pre-filter ☐ AGS ☐ 300 mm  
☐ Fluffy Pre-filter ☒ 185 mm ☐ 450 mm
Production Lot: U-B52 Carbon Lot: NC

Spike Date: \_\_\_\_\_ Spike Time: \_\_\_\_\_

Type of Trap: 30B

## TO BE FILLED OUT BY SAMPLING TECHNICIAN

Plant/Source: HAW/CFU 117 RI

PRE-Run Leak Check (circle one):

PASS

FAIL

Boiler ID: \_\_\_\_\_

Run START:

4/29/18

Date

16:02

Time

Sampling Location: Stack

(stack, FGD inlet, etc.)

Run Number (optional): 3

Run END:

4/29/18

Date

19:06

Time

Sampling Train (circle one): A B

POST-Run Leak Check (circle one):

PASS

FAIL

Notes: \_\_\_\_\_

## SAMPLING CONDITIONS AND PARAMETERS

Ave Duct Temp (F°): 250Estimated Ave Hg Concentration ( $\mu\text{g}/\text{dscm}$ ): 0.008Ave Trap Temp (F°): 270

Circle Event if Occurred During Sampling:

Ave Flow Rate (cc/min): 2,000

STARTUP

SHUTDOWN

Total Volume (L) 360 or (dscm): \_\_\_\_\_

For CEMENT KILNS Only

No. of RAW MILL OFF Events During Sampling: \_\_\_\_\_

## REQUIRED IF RETURNING TO OHIO LUMEX FOR ANALYSIS

Estimated Hg Mass in Section 1 of Sorbent Trap (ng): 2.88

Note: Analyzer calibration range will be set based on this value. Leaving this blank may result in out-of-calibration analysis. Please contact us if you require assistance estimating this value.

## Chain Of Custody

Signatures along with Date/Time required for insertion, removal, lab receiving and lab analysis of trap.

|                               | Signature          | Date           | Time         | Security Seal                                                                           |
|-------------------------------|--------------------|----------------|--------------|-----------------------------------------------------------------------------------------|
| Trap inserted by              | <u>[Signature]</u> | <u>4/29/18</u> | <u>15:57</u> | If Applicable Place Chain of Custody seal here<br>(See Security Seal Instruction Sheet) |
| Trap removed and sealed by    | <u>[Signature]</u> | <u>4/29/18</u> | <u>19:11</u> |                                                                                         |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Courier/Other (If Applicable) |                    |                |              | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap received by lab          | <u>[Signature]</u> | <u>5/2/18</u>  | <u>121</u>   | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |
| Trap analyzed by              | <u>[Signature]</u> | <u>5/9/18</u>  | <u>1139</u>  | Seal intact as received<br>Yes <input type="checkbox"/> No <input type="checkbox"/>     |

Make sure all of your sampling conditions prevent moisture condensation in the trap media. Moisture condensation is a major cause of breakthrough and spike loss in sorbent traps and should be prevented at all costs.

Ohio Lumex Co., Inc. 30350 Bruce Industrial Pkwy. Solon, OH 44139 USA

Phone: 888-876-2611 mail@ohiolumex.com

Deactivated glass and glass wool Impregnated Activated Carbon - Refer to SDS

Best Before: February 2021





## Analysis Sample Return Form

|                                                            |                                        |
|------------------------------------------------------------|----------------------------------------|
| From:                                                      | Ship to:                               |
| Contact Name: Click here to enter text. <i>Kelly Dorsi</i> | Name: Ohio Lumex Analytical Laboratory |
| Company/Plant: <i>Bison Engineering / HAV</i>              | Company: Ohio Lumex Co., Inc.          |
| Date: <i>4/29/2018</i>                                     | Address: 30350 Bruce Industrial Pkwy   |
| Email: <i>kdorsi@bison-eng.com</i>                         | Solon, OH 44139 USA                    |
| Phone Number: <i>406-442-5768</i>                          | Phone: 1 440 264 2500                  |

Source Type: ☐ Coal Fired Power ☐ Cement Kiln ☐ Industrial Boiler ☒ Other: *CF4117*

| Sample Quantity | Sample IDs                                               | Sampling Method / Expected Capture Source Concentration / Notes |
|-----------------|----------------------------------------------------------|-----------------------------------------------------------------|
| 1               | Click here to enter text. <i>(Spillout 5ug) OL464795</i> | <i>M30B/CF4117/Run 1/Trap A/0.006 ug/dm</i>                     |
| 1               | <i>OL469559 (unspiked)</i>                               | <i>M30B/CF4117/Run 1/Trap B</i>                                 |
| 1               | <i>OL464761 (Spillout 5ug)</i>                           | <i>M30B/CF4117/Run 2/Trap A</i>                                 |
| 1               | <i>OL469520 (unspiked)</i>                               | <i>M30B/CF4117/Run 2/Trap B</i>                                 |
| 1               | <i>OL464778 (Spillout 5ug)</i>                           | <i>M30B/CF4117/Run 3/Trap A</i>                                 |
| 1               | <i>OL469519 (unspiked)</i>                               | <i>M30B/CF4117/Run 3/Trap B</i>                                 |

|                                                                                                                                                                                                                                                         |                                                                                                     |                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analysis Turnaround Time:                                                                                                                                                                                                                               | Report Type:                                                                                        | Payment Method:                                                                                                                                                                                                                                                                        |
| <input type="checkbox"/> Same Day Rush<br><input type="checkbox"/> Next Day Rush<br><input type="checkbox"/> Two Day Rush<br><input type="checkbox"/> *Expedited Compliance (1-2 Business Days)<br><input type="checkbox"/> Standard (3-5 Business Day) | <input checked="" type="checkbox"/> Standard<br><input type="checkbox"/> Extended (additional cost) | <input type="checkbox"/> Purchase Order PO #: <i>HAV218610</i><br>Please provide a hard or electronic copy when available<br><input type="checkbox"/> Credit Card<br>If paying by credit card, please provide a phone number so that we may contact for the co#<br>Phone Number: _____ |

Contacts to receive report:  
*Kelly Dorsi, Bison Engineering*  
*kdorsi@bison-eng.com*

Packaging Instructions: Please return traps packaged in their individual plastic tubes with caps on accompanied by their unique chain of custody. Place into a cardboard box or tube with enough packaging material that the traps cannot bounce or bend – similarly to how they were delivered.

Comments:  
*\* Use low level analyzer*

\*Long-term compliance contract required



## Analysis Sample Return Form

|                                                            |                                        |
|------------------------------------------------------------|----------------------------------------|
| From:                                                      | Ship to:                               |
| Contact Name: Click here to enter text. <i>Kelly Dorsi</i> | Name: Ohio Lumex Analytical Laboratory |
| Company/Plant: <i>Bison Engineering / HAV</i>              | Company: Ohio Lumex Co., Inc.          |
| Date: <i>4/28/2018</i>                                     | Address: 30350 Bruce Industrial Pkwy   |
| Email: <i>kdorsi@bison-eng.com</i>                         | Solon, OH 44139 USA                    |
| Phone Number: <i>406-442-5768</i>                          | Phone: 1 440 264 2500                  |

Source Type: ☐ Coal Fired Power ☐ Cement Kiln ☐ Industrial Boiler ☒ Other: *CFU114*

| Sample Quantity | Sample IDs                                            | Sampling Method / Expected Capture Source Concentration / Notes |
|-----------------|-------------------------------------------------------|-----------------------------------------------------------------|
| 1               | Click here to enter text. <i>spiked 5 ng OL462380</i> | <i>M30B / CFU114 Run 1 T-A / 0.008 ug/dscm</i>                  |
| 1               | <i>OL469598 (unspiked)</i>                            | <i>M30B / CFU114 Run 1 T-B</i>                                  |
| 1               | <i>OL462401 (spiked) 5ng</i>                          | <i>M30B / CFU114 Run 2 / Trap A</i>                             |
| 1               | <i>OL469610 (unspiked)</i>                            | <i>M30B / CFU114 Run 2 / Trap B</i>                             |
| 1               | <i>OL464776 (spiked 5ng)</i>                          | <i>M30B / CFU114 Run 3 / Trap A</i>                             |
| 1               | <i>OL469566 (unspiked)</i>                            | <i>M30B / CFU114 Run 3 / Trap B</i>                             |

|                                                                                                                                                                                                                                                                    |                                                                                                     |                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Analysis Turnaround Time:                                                                                                                                                                                                                                          | Report Type:                                                                                        | Payment Method:                                                                                                                                                                                                                                                                        |
| <input type="checkbox"/> Same Day Rush<br><input type="checkbox"/> Next Day Rush<br><input type="checkbox"/> Two Day Rush<br><input type="checkbox"/> *Expedited Compliance (1-2 Business Days)<br><input checked="" type="checkbox"/> Standard (3-5 Business Day) | <input checked="" type="checkbox"/> Standard<br><input type="checkbox"/> Extended (additional cost) | <input type="checkbox"/> Purchase Order PO #: <i>HAV218610</i><br>Please provide a hard or electronic copy when available<br><input type="checkbox"/> Credit Card<br>If paying by credit card, please provide a phone number so that we may contact for the cc#<br>Phone Number: _____ |

|                                                                                                     |                                                                                                                                                                                                                                                                                                  |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Contacts to receive report:<br><i>Kelly Dorsi, Bison Engineering</i><br><i>kdorsi@bison-eng.com</i> | Packaging Instructions: Please return traps packaged in their individual plastic tubes with caps on accompanied by their unique chain of custody. Place into a cardboard box or tube with enough packaging material that the traps cannot bounce or bend – similarly to how they were delivered. |
|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

|                                          |
|------------------------------------------|
| Comments:<br><i>* Low level analyzer</i> |
|------------------------------------------|

\*Long-term compliance contract required

Version 1.2  
ALR Issued 3/8/2016lab@ohiolumex.com  
www.ohiolumex.comToll Free 1 888 876 2611  
Fax 1 440 264 2501

## Kelly Dorsi

---

**From:** Anthony Schneider <anthony.schneider@ohiolumex.com>  
**Sent:** Thursday, May 10, 2018 7:26 AM  
**To:** Tanya Lopatkina; Kelly Dorsi  
**Cc:** Alexandra Sipershteyn; Jonathan Cross; Tanya Lopatkina  
**Subject:** RE: Sorbent Trap Analysis Results

Hi Kelly,

In case you haven't noticed yet, we accidentally dropped one of the sorbent traps and were not able to recover all of the carbon inside of it. We are very sorry that this happened and I hope that the test is not ruined because of this.

We take special measures to prevent breakage, but it is statistically inevitable to occur from time to time (this is the first one in a year or so).

We decided that we would not charge for any of the samples associated with that source which is 6 traps worth of analysis.

Feel free to get back to me if you want to talk about it.



**Anthony Schneider** | Dir. Of Laboratory Services and Analytical R&D  
e: anthony.schneider@ohiolumex.com | p: 1 440 264 2500 x307 | m: 1 330 888 2904  
Ohio Lumex Co., Inc. | www.ohiolumex.com  
30350 Bruce Industrial Parkway | Cleveland, OH 44139 USA

---

**From:** Tanya Lopatkina  
**Sent:** Wednesday, May 9, 2018 5:33 PM  
**To:** kdorsi@bison-eng.com  
**Cc:** Anthony Schneider; Ceylan Atesoglu; Shawn Wood  
**Subject:** Sorbent Trap Analysis Results

Dear Kelly,

Attached are the results of your analysis. If you have any questions, please do not hesitate to give us a call.

We sincerely appreciate your business and hope to work with you again in the near future. Whenever you need to purchase traps or would like additional analyses, please give us a call; we would be happy to assist you!

Have a great day,



**Tanya Lopatkina** | Laboratory Services Coordinator  
e: tanya.lopatkina@ohiolumex.com | p: 1 440 264 2500 x315  
Ohio Lumex Co., Inc. | www.ohiolumex.com  
30350 Bruce Industrial Parkway | Cleveland, OH 44139 USA

## **APPENDIX F: AUDIT SAMPLES**

---



## PERFORMANCE EVALUATION



Scheduled Study

**SSAS318**

23-Apr-2018 Through 18-May-2018

**50205534**

RTC Labcode

EPA Labcode

### Participating Laboratory:

Chester Labnet  
Paul Duda  
12242 SW Garden Place  
Tigard OR 97223 US

Thank you for participating in study SSAS318. Additional information about this study may be found online at [www.sigmaaldrich.com/pt](http://www.sigmaaldrich.com/pt).

Sigma-Aldrich RTC Inc.  
2931 Soldier Springs Road  
Laramie, WY 82070 USA  
1-307-742-5452  
[www.sigmaaldrich.com](http://www.sigmaaldrich.com)

This report shall not be reproduced except in full, without written approval of the laboratory. The data and results reported in this document are the property of the participating laboratory and are confidential. If you wish to appeal an evaluation listed in this report, please call our QA Supervisor at (307) 742-5452 or email [RTCreports@sial.com](mailto:RTCreports@sial.com)

Sincerely,

A handwritten signature in black ink, appearing to read "J. Duhon", with a long horizontal flourish extending to the right.

Jennifer Duhon  
Proficiency Testing Supervisor

## Accreditors

Evaluations of this dataset will be sent to the accreditor(s) listed below using your laboratory's labcode listed above each accrediting agency. If any of the information listed below is incorrect, please contact RTC immediately.

RTC is accredited to perform PT programs for the scope of accreditation to ISO/IEC 17043 under ANAB certificate AP-1469





## Miscellaneous Analytes

### Method:EPA 13B (2000) [10402105]

| Analyte                                                                   | Result Units | Assigned Value                                                | Accept. Window | Z                                             | Evaluation |
|---------------------------------------------------------------------------|--------------|---------------------------------------------------------------|----------------|-----------------------------------------------|------------|
| Fluoride <sup>1,2</sup>                                                   | 3.97 mg/dscm | 4                                                             | 3.4 to 4.6     | -0.1                                          | Acceptable |
| 1730 / PEA1940-20ML - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11 |              | Evaluation Criteria - 8<br><input type="checkbox"/> Voluntary |                | Evaluation Parameter - a:1, b:0, c:0.075, d:0 |            |

### Method:EPA Method 26A (2000) [10403200]

| Analyte                                                                   | Result Units | Assigned Value                                                | Accept. Window | Z                                            | Evaluation |
|---------------------------------------------------------------------------|--------------|---------------------------------------------------------------|----------------|----------------------------------------------|------------|
| Hydrogen fluoride <sup>1,2</sup>                                          | 22.0 mg/L    | 21.2                                                          | 19.1 to 23.3   | 0.75                                         | Acceptable |
| 1775 / PEA1941-20ML - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-07 |              | Evaluation Criteria - 8<br><input type="checkbox"/> Voluntary |                | Evaluation Parameter - a:1, b:0, c:0.05, d:0 |            |

### Method:EPA Method 29 (ICP) (2000) [10403608]

| Analyte                                                                  | Result Units   | Assigned Value                                                | Accept. Window | Z                                             | Evaluation |
|--------------------------------------------------------------------------|----------------|---------------------------------------------------------------|----------------|-----------------------------------------------|------------|
| Antimony, Sb <sup>1,2</sup>                                              | 0.681 ug/ml    | 0.64                                                          | 0.482 to 0.804 | 0.47                                          | Acceptable |
| 1005 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11 |                | Evaluation Criteria - 8<br><input type="checkbox"/> Voluntary |                | Evaluation Parameter - a:1, b:0, c:0.125, d:0 |            |
| Antimony, Sb <sup>1,2</sup>                                              | 27.8 ug/filter | 28.1                                                          | 21.1 to 35.1   | -0.09                                         | Acceptable |
| 1005 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15 |                | Evaluation Criteria - 8<br><input type="checkbox"/> Voluntary |                | Evaluation Parameter - a:1, b:0, c:0.125, d:0 |            |
| Arsenic, As <sup>1,2</sup>                                               | 16.7 ug/filter | 21.9                                                          | 16.4 to 27.4   | -1.9                                          | Acceptable |
| 1010 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15 |                | Evaluation Criteria - 8<br><input type="checkbox"/> Voluntary |                | Evaluation Parameter - a:1, b:0, c:0.125, d:0 |            |
| Arsenic, As <sup>1,2</sup>                                               | 0.478 ug/ml    | 0.46                                                          | 0.341 to 0.569 | 0.4                                           | Acceptable |
| 1010 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11 |                | Evaluation Criteria - 8<br><input type="checkbox"/> Voluntary |                | Evaluation Parameter - a:1, b:0, c:0.125, d:0 |            |

|                                                                                                          |                                                                                        |      |                |      |                                                                    |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|------|----------------|------|--------------------------------------------------------------------|
| Barium, Ba <sup>1,2</sup><br>1015 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11    | 2.27 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary     | 2.23 | 1.67 to 2.78   | 0.14 | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Barium, Ba <sup>1,2</sup><br>1015 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15    | 23.1 ug/filter<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary | 21.6 | 16.2 to 27     | 0.56 | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Beryllium, Be <sup>1,2</sup><br>1020 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15 | 12.7 ug/filter<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary | 12.3 | 9.2 to 15.3    | 0.26 | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Beryllium, Be <sup>1,2</sup><br>1020 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11 | 0.728 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary    | 0.73 | 0.508 to 0.944 | 0.02 | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.15, d:0</i>  |
| Cadmium, Cd <sup>1,2</sup><br>1030 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11   | 0.359 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary    | 0.35 | 0.279 to 0.419 | 0.29 | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.10, d:0</i>  |

**Method:EPA Method 29 (ICP) (2000) (Continued)**

| Analyte                                                                                                         | Result Units                                                                           | Assigned Value | Accept. Window | Z     | Evaluation                                                         |
|-----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|----------------|----------------|-------|--------------------------------------------------------------------|
| Cadmium, Cd <sup>1,2</sup><br>1030 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15          | 13.3 ug/filter<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary | 12.4           | 9.88 to 14.8   | 0.73  | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.10, d:0</i>  |
| Chromium, Cr (total) <sup>1,2</sup><br>1040 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15 | 18.5 ug/filter<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary | 17.1           | 13.7 to 20.6   | 0.82  | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.10, d:0</i>  |
| Chromium, Cr (total) <sup>1,2</sup><br>1040 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11 | 1.25 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary     | 1.17           | 0.934 to 1.4   | 0.68  | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.10, d:0</i>  |
| Cobalt, Co <sup>1,2</sup><br>1050 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11           | 2.98 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary     | 2.78           | 2.08 to 3.47   | 0.58  | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Cobalt, Co <sup>1,2</sup><br>1050 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15           | 12.5 ug/filter<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary | 11.9           | 8.94 to 14.9   | 0.4   | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Copper, Cu <sup>1,2</sup><br>1055 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15           | 11.9 ug/filter<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary | 12.5           | 9.38 to 15.6   | -0.38 | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Copper, Cu <sup>1,2</sup><br>1055 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11           | 1.01 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary     | 0.98           | 0.737 to 1.23  | 0.22  | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Lead, Pb <sup>1,2</sup><br>1075 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11             | 3.26 ug/ml<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary     | 3.2            | 2.4 to 4       | 0.15  | Acceptable<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Lead, Pb <sup>1,2</sup>                                                                                         | 21.3 ug/filter                                                                         | 21.8           | 17.4 to 26.1   | -0.23 | Acceptable                                                         |

1075 / PEA1945-1EA - Lot SSAS318  
/Analyst:/ Analysis Date: 2018-05-15

*Evaluation Criteria - 8*

☐ Voluntary

*Evaluation Parameter - a:1, b:0, c:0.10, d:0*

**Method:EPA Method 29 (ICP) (2000) (Continued)**

| Analyte                                                                                                  | Result Units   | Assigned Value | Accept. Window | Z    | Evaluation                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------|----------------|----------------|----------------|------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Manganese, Mn <sup>1,2</sup><br>1090 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15 | 13.4 ug/filter | 12.7           | 8.89 to 16.5   | 0.37 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.15, d:0</i>  |
| Manganese, Mn <sup>1,2</sup><br>1090 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11 | 0.405 ug/ml    | 0.38           | 0.287 to 0.479 | 0.46 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Nickel, Ni <sup>1,2</sup><br>1105 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11    | 2.48 ug/ml     | 2.36           | 1.89 to 2.83   | 0.51 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.10, d:0</i>  |
| Nickel, Ni <sup>1,2</sup><br>1105 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15    | 23.0 ug/filter | 21.5           | 15 to 27.9     | 0.47 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.15, d:0</i>  |
| Selenium, Se <sup>1,2</sup><br>1140 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15  | 22.7 ug/filter | 21.6           | 15.1 to 28.1   | 0.34 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.15, d:0</i>  |
| Selenium, Se <sup>1,2</sup><br>1140 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11  | 0.883 ug/ml    | 0.87           | 0.654 to 1.09  | 0.1  | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Zinc, Zn <sup>1,2</sup><br>1190 / PEA1948-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-11      | 0.800 ug/ml    | 0.74           | 0.557 to 0.928 | 0.63 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.125, d:0</i> |
| Zinc, Zn <sup>1,2</sup><br>1190 / PEA1945-1EA - Lot SSAS318<br>/Analyst:/ Analysis Date: 2018-05-15      | 24.8 ug/filter | 22.6           | 15.8 to 29.3   | 0.65 | Acceptable<br><i>Evaluation Criteria - 8</i><br><input type="checkbox"/> Voluntary<br><i>Evaluation Parameter - a:1, b:0, c:0.15, d:0</i>  |

Group Analysis Summary  
 Acceptable : 28 / 28

Score : 100% - (Acceptable)

## Sample Information

### FLUORIDE IN IMPINGER SOLUTION

PEA1940-20ML / Lot SSAS318

| Analytes                        | Units   | Gravimetric Value | Study Mean | Study Std. Dev. |
|---------------------------------|---------|-------------------|------------|-----------------|
| Fluoride <sup>1,2</sup><br>1730 | mg/dscm | 4.00±0.0204       | 0          | 0               |

## Hydrogen Halides/Halogens in Impinger Solution

PEA1941-20ML / Lot SSAS318

| Analytes                                 | Units | Gravimetric Value | Study Mean | Study Std. Dev. |
|------------------------------------------|-------|-------------------|------------|-----------------|
| Hydrogen chloride <sup>1,2</sup><br>1770 | mg/L  |                   | 0          | 0               |
| Hydrogen fluoride <sup>1,2</sup><br>1775 | mg/L  | 21.2±0.108        | 0          | 0               |



## Metals on Filter Paper

PEA1945-1EA / Lot SSAS318

| Analytes                                    | Units     | Gravimetric Value | Study Mean | Study Std. Dev. |
|---------------------------------------------|-----------|-------------------|------------|-----------------|
| Antimony, Sb <sup>1,2</sup><br>1005         | ug/filter | 28.074±0.14318    | 0          | 0               |
| Arsenic, As <sup>1,2</sup><br>1010          | ug/filter | 21.892±0.11165    | 0          | 0               |
| Barium, Ba <sup>1,2</sup><br>1015           | ug/filter | 21.589±0.11011    | 0          | 0               |
| Beryllium, Be <sup>1,2</sup><br>1020        | ug/filter | 12.272±0.06259    | 0          | 0               |
| Cadmium, Cd <sup>1,2</sup><br>1030          | ug/filter | 12.352±0.06299    | 0          | 0               |
| Chromium, Cr (total) <sup>1,2</sup><br>1040 | ug/filter | 17.126±0.08734    | 0          | 0               |
| Cobalt, Co <sup>1,2</sup><br>1050           | ug/filter | 11.920±0.06079    | 0          | 0               |
| Copper, Cu <sup>1,2</sup><br>1055           | ug/filter | 12.502±0.06376    | 0          | 0               |
| Lead, Pb <sup>1,2</sup><br>1075             | ug/filter | 21.757±0.11096    | 0          | 0               |
| Manganese, Mn <sup>1,2</sup><br>1090        | ug/filter | 12.706±0.06480    | 0          | 0               |
| Nickel, Ni <sup>1,2</sup><br>1105           | ug/filter | 21.487±0.10958    | 0          | 0               |
| Selenium, Se <sup>1,2</sup><br>1140         | ug/filter | 21.595±0.11013    | 0          | 0               |
| Silver, Ag <sup>1,2</sup><br>1150           | ug/filter | 32.718±0.16686    | 0          | 0               |
| Thallium, Tl <sup>1,2</sup><br>1165         | ug/filter | 32.324±0.16485    | 0          | 0               |
| Zinc, Zn <sup>1,2</sup><br>1190             | ug/filter | 22.550±0.11500    | 0          | 0               |

## Metals in Impinger Solution

PEA1948-1EA / Lot SSAS318

| Analytes                                    | Units | Gravimetric Value | Study Mean | Study Std. Dev. |
|---------------------------------------------|-------|-------------------|------------|-----------------|
| Antimony, Sb <sup>1,2</sup><br>1005         | ug/ml | 0.643±0.00328     | 0          | 0               |
| Arsenic, As <sup>1,2</sup><br>1010          | ug/ml | 0.455±0.00232     | 0          | 0               |
| Barium, Ba <sup>1,2</sup><br>1015           | ug/ml | 2.227±0.01136     | 0          | 0               |
| Beryllium, Be <sup>1,2</sup><br>1020        | ug/ml | 0.726±0.00370     | 0          | 0               |
| Cadmium, Cd <sup>1,2</sup><br>1030          | ug/ml | 0.349±0.00178     | 0          | 0               |
| Chromium, Cr (total) <sup>1,2</sup><br>1040 | ug/ml | 1.168±0.00596     | 0          | 0               |
| Cobalt, Co <sup>1,2</sup><br>1050           | ug/ml | 2.778±0.01417     | 0          | 0               |
| Copper, Cu <sup>1,2</sup><br>1055           | ug/ml | 0.983±0.00501     | 0          | 0               |
| Lead, Pb <sup>1,2</sup><br>1075             | ug/ml | 3.199±0.01632     | 0          | 0               |
| Manganese, Mn <sup>1,2</sup><br>1090        | ug/ml | 0.383±0.00195     | 0          | 0               |
| Nickel, Ni <sup>1,2</sup><br>1105           | ug/ml | 2.361±0.01204     | 0          | 0               |
| Selenium, Se <sup>1,2</sup><br>1140         | ug/ml | 0.872±0.00445     | 0          | 0               |
| Silver, Ag <sup>1,2</sup><br>1150           | ug/ml | 1.396±0.00712     | 0          | 0               |
| Thallium, Tl <sup>1,2</sup><br>1165         | ug/ml | 2.174±0.01109     | 0          | 0               |
| Zinc, Zn <sup>1,2</sup><br>1190             | ug/ml | 0.742±0.00378     | 0          | 0               |



## Definitions and Interpretation of Statistical Analysis:

**Assigned Value:** Value attributed to a particular quantity and accepted, sometimes by convention, as having an uncertainty appropriate for a given purpose. See ISO/IEC 17043 for additional information. In general the assigned value is the value used to assess proficiency and may or may not be the made to value (gravimetric value).

**Accept. Window:** The range of values that constitute acceptable performance for a laboratory participating in this PT study.

**Z:** A Z-Score tells how a single data point compares to normal data. A Z-Score says not only whether a point was above or below average, but how unusual the measurement is. Generally, a method result with a Z-Score less than |2| is considered to be in control, a Z-Score between |2| and |3| is considered 'Questionable', but still within control and a Z greater than |3| is considered not acceptable and the method is out of control. For WS studies, a z-score greater than |2| is unacceptable. Calculated as **Z = (Reported Value - Assigned Value) / Proficiency Std. Dev.**

**Proficiency Std. Dev.:** Standard deviation calculated based on **Evaluation Criteria**.

**Study Mean:** Statistical study mean calculated using a robust statistical model (RTC employs the 'Biweight Program'). Robust statistical techniques to minimize the influence that extreme results can have on estimates of the mean and standard deviation. NOTE - These techniques assign less weight to extreme results, rather than eliminate them from a data set.

**Study Std. Dev.:** Standard deviation calculated from study data using robust statisticals (Biweight).

**Gravimetric Value:** The 'prepared to' value, determined by gravimetric means. The uncertainty associated to this value is standard uncertainty and based on RTC's gravimetric tolerances.

## Evaluation Criteria:

**1 - Regression Equation** - Acceptance windows based on TNI adopted equation of proficiency value  $\pm 3$  proficiency standard deviations and check limits of proficiency value  $\pm 2$  proficiency standard deviations. Proficiency value and proficiency standard deviation are calculated from gravimetric variables a, b, c, & d as proficiency value =  $a * \text{gravimetric} + b$  and proficiency standard deviation =  $c * \text{gravimetric} + d$ .

**2 - Study Robust Mean and c,d regression** - Acceptance windows based on TNI adopted equation of proficiency value  $\pm 3$  proficiency standard deviations and check limits of proficiency value  $\pm 2$  proficiency standard deviations. Proficiency value and proficiency standard deviation calculated from robust study mean and variables c & d as proficiency value = robust mean and proficiency standard deviation =  $c * \text{proficiency value} + d$ .

**3 - Fixed Limits** - Acceptance windows based on span of gravimetric percentage from gravimetric as gravimetric  $\pm$  gravimetric \* percentage.

**4 - Adjustable Fixed Limits** - Acceptance windows base on a span of gravimetric percentage from gravimetric as gravimetric  $\pm$  gravimetric \* lowPercentage where gravimetric < break and gravimetric  $\pm$

gravimetric \* highPercentage where gravimetric >= break.

**5 - Study Statistics** - Acceptance windows based on a number of standard deviations span from the study mean as study mean +/- (deviations \* standard deviation).

**6 - Log Transform Statistics** - Acceptance windows based on lognormal distributed data. Acceptance windows = mean(lognormal) +/- span \* standard deviation(lognormal).

**7 - Reserved**

**8 - Regression Equation 2SD** - Acceptance windows based on EPA equation of proficiency value +/- 2 proficiency standard deviations. Proficiency value and proficiency standard deviation are calculated from gravimetric variables a, b, c, & d as proficiency value = a \* gravimetric + b and proficiency standard deviation = c \* gravimetric + d. Generally reserved for drinking water studies.

**Proficiency Test Item Preparation, Homogeneity and Stability Assessment** - RTC uses proprietary and published methods for the manufacture, homogeneity and stability testing of proficiency test items. RTC's proficiency test materials meet requirements of ISO Guide 34. For more information contact RTC. Additionally RTC complies with TNI Volume 3 'General Requirements for Environmental Proficiency Test Providers', EL-V3-2009, 2009 for all TNI Fields of Proficiency Testing analytes.

**Metrological Traceability** - All preparations are made using balances calibrated annually traceable to NIST standards. Where appropriate analytical measurements are traceable through an unbroken chain to NIST standards, or a Certified Reference Material manufactured under ISO Guide 34 in conjunction with ISO/IEC 17025.

**Statistical Analysis** - RTC uses robust statistics to calculate study means and standard deviations - Reference - Kafadar, K, A Biweight Approach to the One-Sample Problem, Journal of the American Statistical Association, Vol. 77, No. 378, June, 1982, pp. 416-424.

**Additional Information** - Go to [www.pt.sigmainformatics.com](http://www.pt.sigmainformatics.com) for additional information on summary statistics for specific methods, advice on the interpretation of the statistical analysis, and additional comments/recommendations. If you failed an analyte it may be required to perform a corrective action and/or retest. RTC recommends that you contact your accreditation body for specific instruction.

Program analyte accrediting footnotes

<sup>1</sup> NELAC Compliant, covered by RTC's ANAB Proficiency Testing Provider accreditation, Cert. AP-1469

<sup>2</sup> ISO 17043 Accredited, covered by RTC's ANAB Proficiency Testing Provider accreditation, Cert AP-1469

Authorizing Officer: \_\_\_\_\_



Date: 5/29/2018

Patrick Brumfield, ASQ CQA  
QA Manager

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**This section of the report is for informational purposes only. If you are unsure about specific accreditation requirements, please contact your state coordinator.**

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## **UNACCEPTABLE ANALYTES**

**PASS RATE**

|                             |      |
|-----------------------------|------|
| Number of Reported Results: | 28   |
| Number of Passing Results:  | 28   |
| Pass Rate:                  | 100% |

## **APPENDIX G: CALIBRATIONS & CERTIFICATIONS**





American Association for Laboratory Accreditation

## *Accredited Air Emission Testing Body*

A2LA has accredited

**Bison Engineering, Inc.**

In recognition of the successful completion of the joint A2LA and Stack Testing Accreditation Council (STAC) evaluation process, this laboratory is accredited to perform testing activities in compliance with ASTM D7036:2004 - Standard Practice for Competence of Air Emission Testing Bodies.



Presented this 26<sup>th</sup> day of February 2018.

A handwritten signature in black ink, appearing to be 'L. L. L.', written over a horizontal line.

President and CEO  
For the Accreditation Council  
Certificate Number 4675.01  
Valid to November 30, 2019

*This accreditation program is not included under the A2LA ILAC Mutual Recognition Arrangement.*

**APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION**  
**USING CALIBRATED CRITICAL ORIFICES**  
**5-POINT ENGLISH UNITS**

| Meter Console Information |          | Calibration Conditions                   |      |          |       |
|---------------------------|----------|------------------------------------------|------|----------|-------|
| Box Number                | 11       | Date                                     | Time | 8-Mar-18 | 14:20 |
| Console Serial Number     | 2029     | Barometric Pressure                      |      | 25.8     | in Hg |
| DGM Model Number          |          | Theoretical Critical Vacuum <sup>1</sup> |      | 12.2     | in Hg |
| DGM Serial Number         | 13966757 | Calibration Technician                   |      | CSW      |       |

| Factors/Conversions |        |          |
|---------------------|--------|----------|
| Std Temp            | 528    | °R       |
| Std Press           | 29.92  | in Hg    |
| K <sub>1</sub>      | 17.647 | oR/in Hg |

<sup>1</sup>For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

<sup>2</sup>The Critical Orifice Coefficient, K', must be entered in English units,  $(\text{ft}^3/\text{R}^{1/2})/(\text{in.Hg} \cdot \text{min})$ .

| Calibration Data |                     |                   |                   |                        |                      |                  |                        |                     |                     |                  |
|------------------|---------------------|-------------------|-------------------|------------------------|----------------------|------------------|------------------------|---------------------|---------------------|------------------|
| Run Time         |                     | Metering Console  |                   |                        |                      | Critical Orifice |                        |                     |                     |                  |
| Elapsed          | DGM Orifice<br>ΔH   | Volume<br>Initial | Volume<br>Final   | Outlet Temp<br>Initial | Outlet Temp<br>Final | Serial<br>Number | Coefficient            | Amb Temp<br>Initial | Amb Temp<br>Final   | Actual<br>Vacuum |
| (Θ)              | (P <sub>m</sub> )   | (V <sub>m</sub> ) | (V <sub>m</sub> ) | (t <sub>m</sub> )      | (t <sub>m</sub> )    |                  | K'                     | (t <sub>amb</sub> ) | (t <sub>amb</sub> ) |                  |
| min              | in H <sub>2</sub> O | cubic feet        | cubic feet        | °F                     | °F                   |                  | see above <sup>2</sup> | °F                  | °F                  | in Hg            |
| 10.0             | 0.25                | 170.155           | 173.135           | 64                     | 65                   | QM40             | 0.2300                 | 67                  | 67                  | 21               |
| 10.0             | 0.54                | 173.135           | 177.692           | 65                     | 67                   | QM48             | 0.3428                 | 67                  | 67                  | 20               |
| 10.0             | 0.92                | 177.692           | 183.557           | 67                     | 67                   | QM55             | 0.4425                 | 67                  | 67                  | 19               |
| 10.0             | 1.60                | 183.557           | 191.435           | 67                     | 68                   | QM63             | 0.5946                 | 67                  | 67                  | 17               |
| 10.0             | 2.90                | 191.435           | 201.814           | 68                     | 70                   | QM73             | 0.7845                 | 67                  | 67                  | 15               |

| Results                |                        |                         |                         |                    |           |                              |                     |             |
|------------------------|------------------------|-------------------------|-------------------------|--------------------|-----------|------------------------------|---------------------|-------------|
| Standardized Data      |                        |                         |                         | Dry Gas Meter      |           |                              |                     |             |
| Dry Gas Meter          |                        | Critical Orifice        |                         | Calibration Factor |           | Flowrate                     | ΔH @                |             |
| (V <sub>m(std)</sub> ) | (Q <sub>m(std)</sub> ) | (V <sub>cr(std)</sub> ) | (Q <sub>cr(std)</sub> ) | Value              | Variation | Std & Corr                   | 0.75 SCFM           | Variation   |
| (V <sub>m(std)</sub> ) | (Q <sub>m(std)</sub> ) | (V <sub>cr(std)</sub> ) | (Q <sub>cr(std)</sub> ) | (Y)                | (ΔY)      | (Q <sub>m(std)(corr)</sub> ) | (ΔH@)               | (ΔΔH@)      |
| cubic feet             | cfm                    | cubic feet              | cfm                     |                    |           | cfm                          | in H <sub>2</sub> O |             |
| 2.585                  | 0.258                  | 2.581                   | 0.258                   | 0.999              | 0.017     | 0.258                        | 1.834               | 0.027       |
| 3.944                  | 0.394                  | 3.847                   | 0.385                   | 0.975              | -0.007    | 0.385                        | 1.781               | -0.026      |
| 5.072                  | 0.507                  | 4.965                   | 0.497                   | 0.979              | -0.003    | 0.497                        | 1.821               | 0.014       |
| 6.820                  | 0.682                  | 6.672                   | 0.667                   | 0.978              | -0.004    | 0.667                        | 1.760               | -0.048      |
| 8.993                  | 0.899                  | 8.803                   | 0.880                   | 0.979              | -0.003    | 0.880                        | 1.840               | 0.033       |
|                        |                        |                         |                         | 0.982              | Y Average |                              | 1.807               | ΔH@ Average |

**AVERAGE Y= 0.9820**

**AVERAGE H= 1.8073**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.02$ .

Note: For Calibration Factor H, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.20$ .

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature

*[Handwritten Signature]*

Date

3/8/18

**APEX INSTRUMENTS METHOD 5 PRE-TEST CONSOLE CALIBRATION**  
**USING CALIBRATED CRITICAL ORIFICES**  
**5-POINT ENGLISH UNITS**

| Meter Console Information |         | Calibration Conditions                   |      |          |       |
|---------------------------|---------|------------------------------------------|------|----------|-------|
| Box Number                | 13      | Date                                     | Time | 8-Mar-18 | 9:12  |
| Console Serial Number     | 2200-D  | Barometric Pressure                      |      | 25.9     | in Hg |
| DGM Model Number          | I-Tron  | Theoretical Critical Vacuum <sup>1</sup> |      | 12.2     | in Hg |
| DGM Serial Number         | 3605481 | Calibration Technician                   |      | CSW      |       |

| Factors/Conversions |        |          |
|---------------------|--------|----------|
| Std Temp            | 528    | °R       |
| Std Press           | 29.92  | in Hg    |
| K <sub>1</sub>      | 17.647 | oR/in Hg |

<sup>1</sup>For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.

<sup>2</sup>The Critical Orifice Coefficient, K', must be entered in English units, (ft<sup>3</sup>R<sup>1/2</sup>)/(in.Hg\*min).

| Calibration Data |                     |                   |                   |                        |                      |                  |                        |                     |                     |                  |
|------------------|---------------------|-------------------|-------------------|------------------------|----------------------|------------------|------------------------|---------------------|---------------------|------------------|
| Run Time         |                     | Metering Console  |                   |                        |                      | Critical Orifice |                        |                     |                     |                  |
| Elapsed          | DGM Orifice<br>ΔH   | Volume<br>Initial | Volume<br>Final   | Outlet Temp<br>Initial | Outlet Temp<br>Final | Serial<br>Number | Coefficient            | Amb Temp<br>Initial | Amb Temp<br>Final   | Actual<br>Vacuum |
| (θ)              | (P <sub>m</sub> )   | (V <sub>m</sub> ) | (V <sub>m</sub> ) | (t <sub>m</sub> )      | (t <sub>m</sub> )    |                  | K'                     | (t <sub>amb</sub> ) | (t <sub>amb</sub> ) |                  |
| min              | in H <sub>2</sub> O | cubic feet        | cubic feet        | °F                     | °F                   |                  | see above <sup>2</sup> | °F                  | °F                  | in Hg            |
| 10.0             | 0.24                | 0.000             | 2.987             | 64                     | 64                   | QM40             | 0.2300                 | 68                  | 68                  | 21               |
| 10.0             | 0.55                | 2.987             | 7.432             | 64                     | 65                   | QM48             | 0.3428                 | 68                  | 68                  | 20               |
| 10.0             | 0.94                | 7.432             | 13.174            | 65                     | 66                   | QM55             | 0.4425                 | 68                  | 68                  | 19               |
| 10.0             | 1.70                | 13.174            | 20.865            | 66                     | 66                   | QM63             | 0.5946                 | 68                  | 68                  | 18               |
| 10.0             | 2.90                | 20.865            | 30.981            | 66                     | 67                   | QM73             | 0.7845                 | 68                  | 68                  | 16               |

| Results                |                        |                         |                         |                    |           |                              |                     |             |
|------------------------|------------------------|-------------------------|-------------------------|--------------------|-----------|------------------------------|---------------------|-------------|
| Standardized Data      |                        |                         |                         | Dry Gas Meter      |           |                              |                     |             |
| Dry Gas Meter          |                        | Critical Orifice        |                         | Calibration Factor |           | Flowrate                     | ΔH @                |             |
| (V <sub>m(Std)</sub> ) | (Q <sub>m(Std)</sub> ) | (V <sub>Cr(Std)</sub> ) | (Q <sub>Cr(Std)</sub> ) | Value              | Variation | Std & Corr                   | 0.75 SCFM           | Variation   |
| (V <sub>m(Std)</sub> ) | (Q <sub>m(Std)</sub> ) | (V <sub>Cr(Std)</sub> ) | (Q <sub>Cr(Std)</sub> ) | (Y)                | (ΔY)      | (Q <sub>m(Std)(Corr)</sub> ) | (ΔH@)               | (ΔΔH@)      |
| cubic feet             | cfm                    | cubic feet              | cfm                     |                    |           | cfm                          | in H <sub>2</sub> O |             |
| 2.602                  | 0.260                  | 2.587                   | 0.259                   | 0.994              | -0.002    | 0.259                        | 1.759               | -0.072      |
| 3.872                  | 0.387                  | 3.856                   | 0.386                   | 0.996              | -0.001    | 0.386                        | 1.816               | -0.015      |
| 4.998                  | 0.500                  | 4.978                   | 0.498                   | 0.996              | -0.001    | 0.498                        | 1.864               | 0.032       |
| 6.702                  | 0.670                  | 6.689                   | 0.669                   | 0.998              | 0.001     | 0.669                        | 1.873               | 0.041       |
| 8.837                  | 0.884                  | 8.825                   | 0.883                   | 0.999              | 0.002     | 0.883                        | 1.846               | 0.014       |
|                        |                        |                         |                         | 0.997              | Y Average |                              | 1.832               | ΔH@ Average |

**AVERAGE Y= 0.9966**

**AVERAGE H= 1.8316**

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.02$ .

Note: For Calibration Factor H, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is  $\pm 0.20$ .

I certify that the above Dry Gas Meter was calibrated in accordance with USEPA Methods, CFR Title 40, Part 60, Appendix A-3, Method 5, 16.2.3

Signature

*[Handwritten Signature]*

Date

*3/8/18*

| Standardized Factors/Conversions |        |         |
|----------------------------------|--------|---------|
| Temperature                      | 528    | R       |
| Pressure                         | 29.92  | in Hg   |
| $K_1$                            | 17.647 | R/in Hg |

| er                     |                      |
|------------------------|----------------------|
| Outlet Temp<br>Initial | Outlet Temp<br>Final |
| $t_{wi}$<br>°F         | $t_{wf}$<br>°F       |
| 71                     | 71                   |
| 71                     | 71                   |
| 71                     | 71                   |
|                        |                      |
|                        |                      |

|  |  |
|--|--|
|  |  |
|--|--|

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an Bell Prover # 157,

6/29/18

| Standardized Factors/Conversions |        |         |
|----------------------------------|--------|---------|
| Temperature                      | 528    | R       |
| Pressure                         | 29.92  | in Hg   |
| K <sub>1</sub>                   | 17.647 | R/in Hg |

10. *Journal of the American Medical Association*, 2000; 283: 2686-2692.

| er                     |                      |
|------------------------|----------------------|
| Outlet Temp<br>Initial | Outlet Temp<br>Final |
| $t_{wi}$<br>°F         | $t_{wf}$<br>°F       |
| 71                     | 71                   |
| 71                     | 72                   |
| 72                     | 72                   |
|                        |                      |
|                        |                      |

\_\_\_\_\_

[illegible]

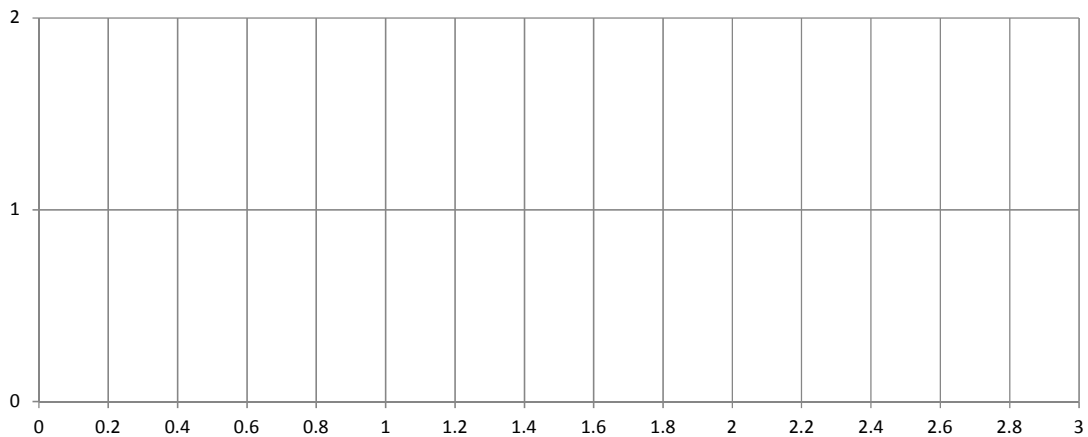
an Bell Prover # 157,

29-Jun-18

| Low Flow Console Calibration |                |                           |             |                                |                     |                                           |                |                         |                          |                         |                          |                         |       |                  |                   |                                |                                  |
|------------------------------|----------------|---------------------------|-------------|--------------------------------|---------------------|-------------------------------------------|----------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|-------|------------------|-------------------|--------------------------------|----------------------------------|
| Side A                       |                | Bison Dual Box 2 (Helena) |             |                                |                     | Apex Instruments Model XC-260 S/N 1608012 |                |                         |                          | April 17, 2018          |                          |                         |       | Temperature      |                   |                                |                                  |
| orifice<br>cnfguration       | Bubble<br>Tube | Average<br>Bubble<br>Tube | Run<br>Time | Minihelic<br>mm of W. (In. Hg) | Vaccume<br>(In. Hg) | DGM<br>Volume                             | Bubble<br>Tube | First<br>Bubble<br>Time | Second<br>Bubble<br>Time | Third<br>Bubble<br>Time | Fourth<br>Bubble<br>Time | Fifth<br>Bubble<br>Time |       | Bubble<br>Tube   | Of<br>The<br>Test | Test<br>Barometric<br>Pressure | Orifice<br>Indicated<br>Flowrate |
|                              | Volume         | Time                      | min.        |                                |                     | Rotameter<br>Liters                       | Volume         | Seconds                 | Seconds                  | Seconds                 | Seconds                  | Seconds                 | Yi    | Flow Rate<br>LPM | Degrees F         | In.Hg                          | LPM                              |
|                              | Cbc Cm         | Time                      |             |                                |                     |                                           |                |                         |                          |                         |                          |                         |       |                  |                   |                                |                                  |
|                              |                |                           |             |                                |                     |                                           |                |                         |                          |                         |                          |                         |       |                  |                   |                                |                                  |
|                              |                |                           |             |                                |                     |                                           |                |                         |                          |                         |                          |                         |       |                  |                   |                                |                                  |
|                              | 700            | 17.004                    | 4.866667    |                                | 0                   | 2.3                                       | 11.461         | 12.0207                 | 17                       | 17.03                   | 16.93                    | 17.06                   | 17    | 1.049            | 2.4700071         | 74                             | 26.51                            |
|                              | 700            | 21.888                    | 3.95        |                                | 0                   | 1.8                                       | 7.281          | 7.579496                | 21.91                    | 21.81                   | 22.06                    | 21.94                   | 21.72 | 1.041            | 1.9188596         |                                |                                  |
|                              | 600            | 34.244                    | 7.333333    |                                | 0                   | 1.2                                       | 7.361          | 7.70938                 | 34.22                    | 34.21                   | 34.26                    | 34.26                   | 34.27 | 1.047            | 1.0512791         |                                |                                  |
|                              | 100            | 7.976                     | 7.6         |                                | 0                   | 0.8                                       | 5.52           | 5.717151                | 7.97                     | 7.91                    | 8                        | 8                       | 8     | 1.036            | 0.7522568         |                                |                                  |
|                              | 100            | 11.424                    | 10.4        |                                | 0                   | 0.5                                       | 5.26           | 5.462185                | 11.41                    | 11.47                   | 11.37                    | 11.43                   | 11.44 | 1.038            | 0.5252101         |                                |                                  |

Minihelic  
Indication

Minihelic Relationship With Flow



Average Y 1.042 Durant Multiplier

Entries are made in Cells only.

Volume Correction at Calibration Conditions:

0.896003

Current Conditions:

Barometric Pressure In In. Hg 26.86

Temperature degrees F 73

Volume Correction at Current Conditions:

0.906302

Slope intercept Corr.COEF.

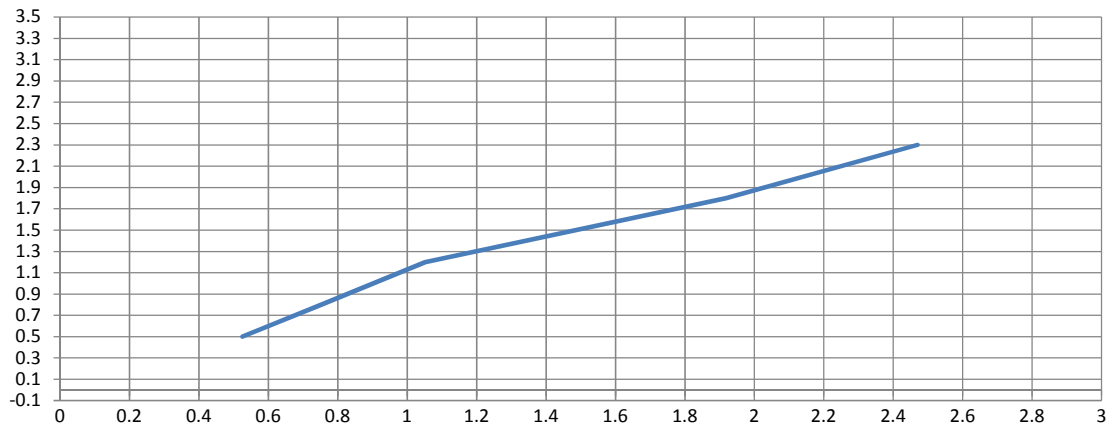
#DIV/0! #DIV/0! #DIV/0!

Desired flowrate (liters/minute) 0.73

Minihelic reading for flow #DIV/0!

Rotameter  
Indication

Rotameter Relationship With Flow



Flow in LPM (Actual)

897.7516 mb

Slope intercept Corr.COEF.

1.114367 -0.1274419 0.993099

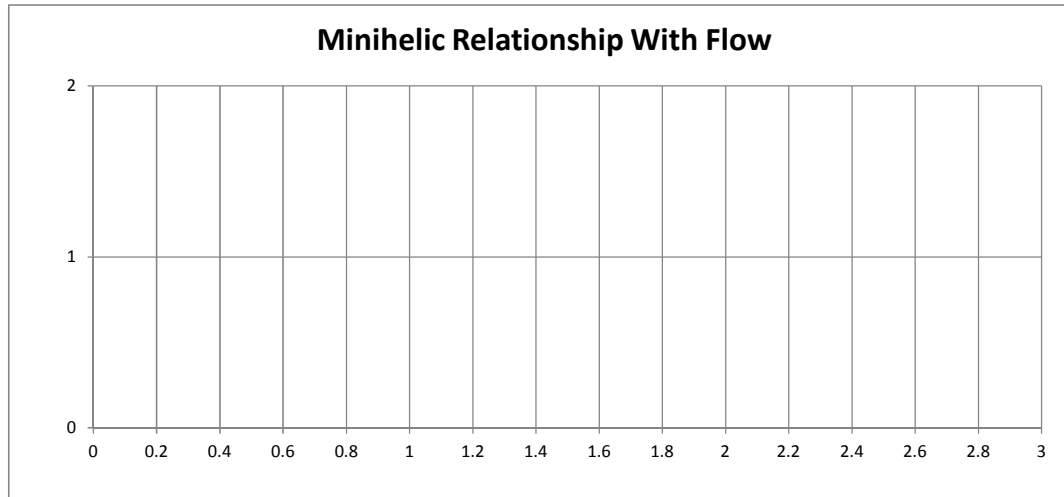
Desired flowrate (liters/minute) 0.73

Rotameter reading for flow 0.78

Flow in LPM (Actual)

| Side B                 | Low Flow Console Calibration |                |          |                  |           |                                           |             |              |               |              |                |              |       |             |           |                 |                   |
|------------------------|------------------------------|----------------|----------|------------------|-----------|-------------------------------------------|-------------|--------------|---------------|--------------|----------------|--------------|-------|-------------|-----------|-----------------|-------------------|
|                        | Bison Dual Box 2 (Helena)    |                |          |                  |           | Apex Instruments Model XC-260 S/N 1608012 |             |              |               |              | April 17, 2018 |              |       |             |           | Temperature     |                   |
|                        | Bubble Tube                  | Average Bubble | DGM Run  |                  |           |                                           | Bubble Tube | First Bubble | Second Bubble | Third Bubble | Fourth Bubble  | Fifth Bubble |       | Bubble Tube | Of The    | Test Barometric | Orifice Indicated |
|                        | Volume                       | Tube           | Time     | Minihelic        | Vacume    | Volume                                    | Tube        | Time         | Time          | Time         | Time           | Time         |       | Flow Rate   | Test      | Pressure        | Flowrate          |
|                        | Cbc Cm                       | Time           | min.     | mm of W. (In. Hg | Rotameter | Liters                                    | Volume      | Seconds      | Seconds       | Seconds      | Seconds        | Seconds      | Yi    | LPM         | Degrees F | In.Hg           | LPM               |
| orifice<br>cnfguration | 700                          | 13.684         | 2.666667 |                  | 0         | 3                                         | 7.827       | 8.184741     | 13.76         | 13.7         | 13.71          | 13.57        | 13.68 | 1.046       | 3.069278  | 74              | 26.51             |
|                        | 700                          | 17.1           | 4.233333 |                  | 0         | 2.2                                       | 9.982       | 10.39766     | 17.09         | 17.06        | 17.11          | 17.15        | 17.09 | 1.042       | 2.4561404 |                 |                   |
|                        | 500                          | 16.572         | 3.4      |                  | 0         | 1.7                                       | 5.87        | 6.15496      | 16.56         | 16.47        | 16.65          | 16.65        | 16.53 | 1.049       | 1.8102824 |                 |                   |
|                        | 100                          | 6.248          | 5.6      |                  | 0         | 1.1                                       | 5.14        | 5.377721     | 6.22          | 6.25         | 6.28           | 6.27         | 6.22  | 1.046       | 0.9603073 |                 |                   |
|                        | 100                          | 13.534         | 12.1     |                  | 0         | 0.4                                       | 5.118       | 5.364268     | 13.53         | 13.54        | 13.53          | 13.54        | 13.53 | 1.048       | 0.4433279 |                 |                   |

Minihelic  
Indication



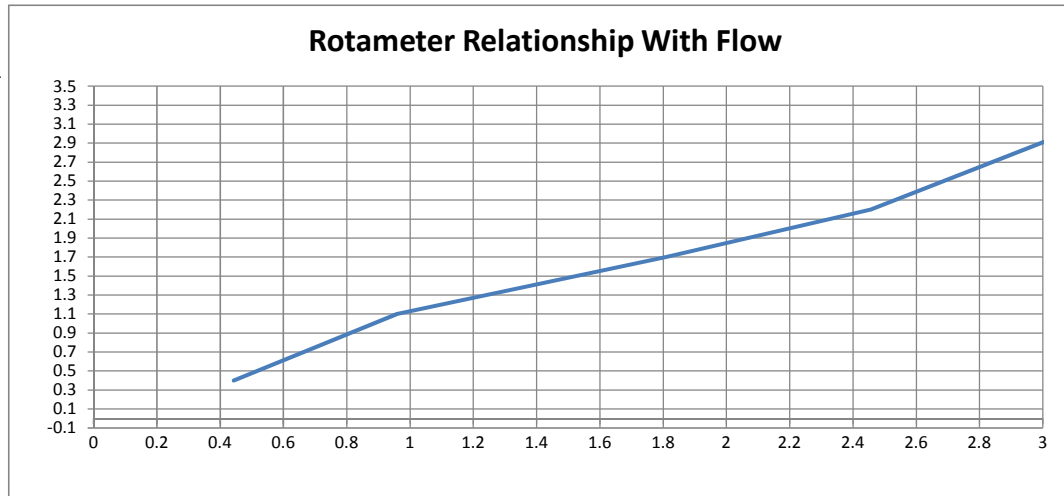
Average Y 1.046 Durant Multiplier

Entries are made in Cells only.  
 Volume Correction at Calibration Conditions:  
 0.896003  
 Current Conditions:  
 Current Barometric Pressure In In. Hg 26.86  
 Current Temperature degrees F 73  
 Volume Correction at Current Conditions:  
 0.906302

Slope intercept Corr.COEF.  
 #DIV/0! #DIV/0! #DIV/0!  
 Desired flowrate (liters/minute) 0.73  
 Minihelic reading for flow #DIV/0!

Flow in LPM (Actual)

Rotameter  
Indication



906.895

Slope intercept Corr.COEF.  
 1.063292 -0.038463 0.992874  
 Desired flowrate (liters/minute) 0.71  
 Rotameter reading for flow 0.71

Flow in LPM (Actual)

# Low Flow Console Calibration

## Bison Dual Box 2 (Helena) Side A

Apex Instruments Model XC-260 S/N 1608012

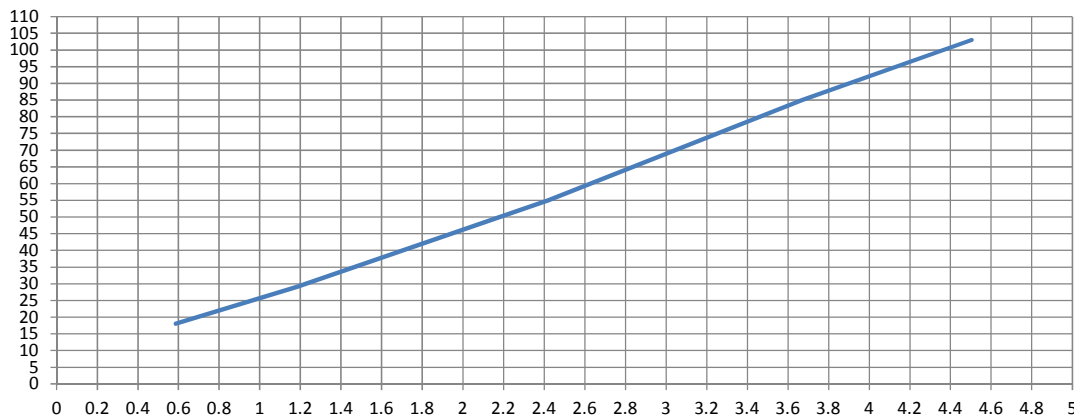
18-Jun-18

Temperature

| Bubble Tube   | Average Bubble | DGET Run | Minihelic Tube | Vacuum mm of W. G. | Rotameter Volume | DGM Volume | Bubble Tube | First Bubble | Second Bubble | Third Bubble | Fourth Bubble | Fifth Bubble | Yi    | Bubble Tube | Of The Flow Rate | Test Test | Barometric Pressure |
|---------------|----------------|----------|----------------|--------------------|------------------|------------|-------------|--------------|---------------|--------------|---------------|--------------|-------|-------------|------------------|-----------|---------------------|
| Volume Cbc Cm | Time           | min.     | mm of W. G.    | In. Hg             | Liters           | Liters     | Volume      | Time         | Time          | Time         | Time          | Time         |       | LPM         | Degrees F        | In.Hg     |                     |
| 700           | 9.326          | 2.600    | 103            | 0                  | 3.9              | 11.277     | 11.7092     | 9.3          | 9.34          | 9.36         | 9.32          | 9.31         | 1.038 | 4.5035385   | 74               | 26.56     |                     |
| 700           | 11.446         | 2.450    | 85             | 0                  | 3.1              | 8.785      | 8.99004     | 11.46        | 11.47         | 11.47        | 11.38         | 11.45        | 1.023 | 3.6694042   |                  |           |                     |
| 700           | 17.344         | 2.533    | 55             | 0                  | 2.1              | 5.95       | 6.134686    | 17.27        | 17.28         | 17.38        | 17.2          | 17.59        | 1.031 | 2.4215867   |                  |           |                     |
| 100           | 5.074          | 5.050    | 29             | 0                  | 1                | 5.749      | 5.97162     | 5.1          | 5             | 4.99         | 5.02          | 5.26         | 1.039 | 1.182499    |                  |           |                     |
| 100           | 10.240         | 9.450    | 18             | 0                  | 0.4              | 5.353      | 5.537109    | 10.2         | 10.25         | 10.28        | 10.17         | 10.3         | 1.034 | 0.5859375   |                  |           |                     |

Minihelic Indication

## Minihelic Relationship With Flow



Average Y 1.033

Durant Multiplier

Entries are made in Cells only.

Volume Correction at Calibration Conditions:

0.897693

Enter

Current

Conditions

Here V

Current Conditions:

Current Barometric Pressure In In. Hg

26.93

Current Temperature

degrees F

72

Volume Correction at Current Conditions:

0.906821

Slope intercept Corr.COEF.

0.045492 -0.165921 0.999356

Desired flowrate (liters/minute)

1.7

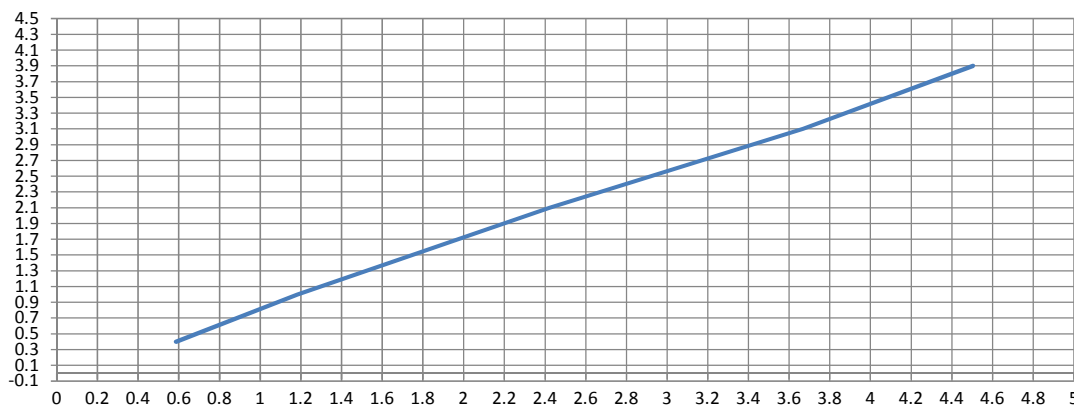
Minihelic reading for flow

41.43

Flow in LPM (Actual)

Rotameter Indication

## Rotameter Relationship With Flow



Slope intercept Corr.COEF.

1.136562 0.085812 0.999531

Desired flowrate (liters/minute)

1.7

Rotameter reading for flow

1.43

Flow in LPM (Actual)

Calibrator Signature:



# Low Flow Console Calibration

## Bison Dual Box 2 (Helena) Side B

Apex Instruments Model XC-260 S/N 1608012

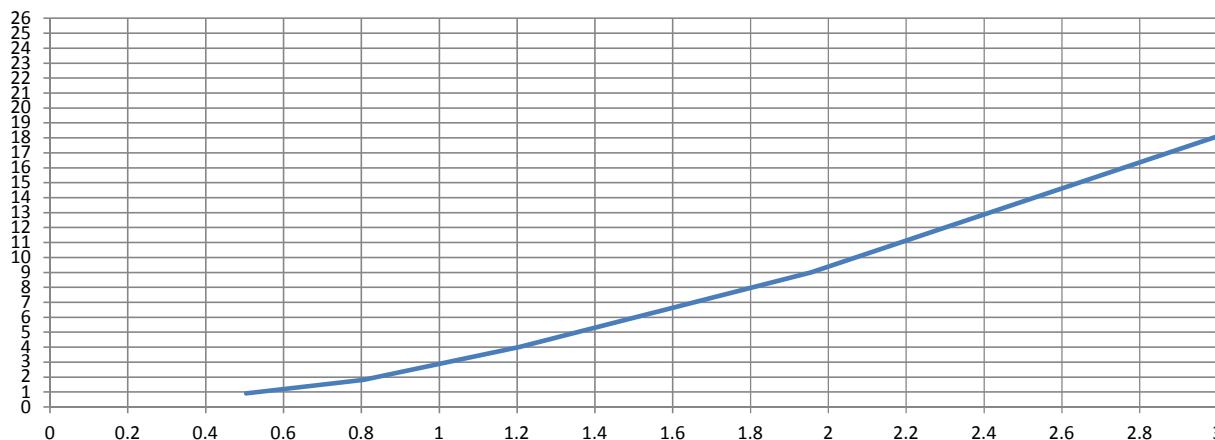
18-Jun-18

Temperature

| orifice<br>cnfguration | Bubble<br>Tube | Average<br>Bubble<br>Tube | DGM<br>Run<br>Time |                       |                  |           |               | Bubble<br>Tube | First<br>Bubble<br>Time | Second<br>Bubble<br>Time | Third<br>Bubble<br>Time | Fourth<br>Bubble<br>Time | Fifth<br>Bubble<br>Time |       | Bubble<br>Tube | Of<br>The<br>Test | Test<br>Barometric<br>Pressure |      |
|------------------------|----------------|---------------------------|--------------------|-----------------------|------------------|-----------|---------------|----------------|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|-------|----------------|-------------------|--------------------------------|------|
|                        | Volume         | Time                      | Time               | Minihelic<br>mm of W. | Vacuum<br>In. Hg | Rotameter | DGM<br>Volume | Run            | Time                    | Time                     | Time                    | Time                     | Time                    | Yi    | Flow Rate      | Test              | Pressure                       |      |
|                        | Cbc            | Cm                        | Time               |                       |                  |           | Liters        | Volume         | Seconds                 | Seconds                  | Seconds                 | Seconds                  | Seconds                 |       | LPM            | Degrees F         | In.Hg                          |      |
|                        |                |                           |                    |                       |                  |           |               |                |                         |                          |                         |                          |                         |       |                |                   |                                |      |
|                        | 700            | 11.422                    | 2.5833             | 24                    | 0                |           | 3.5           | 9.237          | 9.4992                  | 11.44                    | 11.44                   | 11.44                    | 11.38                   | 11.41 | 1.028          | 3.6771143         | 70                             | 26.4 |
|                        | 700            | 21.48                     | 5.1333             | 9                     | 0                |           | 1.8           | 9.6544         | 10.0372                 | 21.5                     | 21.43                   | 21.48                    | 21.56                   | 21.43 | 1.040          | 1.9553073         |                                |      |
|                        | 600            | 29.842                    | 5.7333             | 4                     | 0                |           | 1.2           | 6.8006         | 6.9164                  | 29.82                    | 29.93                   | 29.72                    | 29.96                   | 29.78 | 1.017          | 1.2063535         |                                |      |
|                        | 100            | 7.458                     | 6.6500             | 1.8                   | 0                |           | 0.8           | 5.0107         | 5.3500                  | 7.50                     | 7.50                    | 7.41                     | 7.44                    | 7.44  | 1.068          | 0.8045052         |                                |      |
|                        | 100            | 11.9                      | 10.6167            | 0.9                   | 0                |           | 0.5           | 5.2219         | 5.3529                  | 10                       | 12.41                   | 12.4                     | 12.41                   | 12.28 | 1.025          | 0.5042017         |                                |      |

MiniHelic  
Indication

## MiniHelic Relationship With Flow



Average Y

1.036

Durant Multiplier

Entries are made in   Cells only.

Volume Correction at Calibration Conditions:

0.885664

Enter  
Current  
Conditions  
Here V

Current

Current Conditions:

Barometric Pressure In In. Hg

26.93

Current

Temperature

degrees F

72

Volume Correction at Current Conditions:

0.906821

Slope intercept Corr.COEF.

0.13234 0.5787177 0.993146

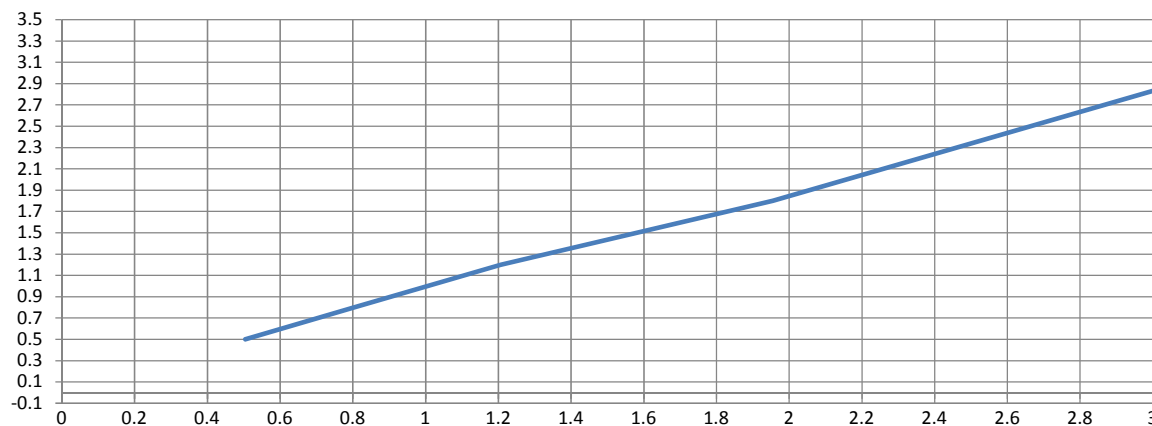
Desired flowrate (liters/minute)

MiniHelic reading for flow

Flow in LPM (Actual)

Rotameter  
Indication

## Rotameter Relationship With Flow



Slope intercept Corr.COEF.

1.065589 -0.0328229 0.999447

Desired flowrate (liters/minute)

Rotameter reading for flow

0.03

Flow in LPM (Actual)

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

|                  |                    |                     |                |
|------------------|--------------------|---------------------|----------------|
| Part Number:     | E03AI99E15A0PK1    | Reference Number:   | 54-124393905-1 |
| Cylinder Number: | CC273901           | Cylinder Volume:    | 146.4 CF       |
| Laboratory:      | ASG - Chicago - IL | Cylinder Pressure:  | 2015 PSIG      |
| PGVP Number:     | B12013             | Valve Outlet:       | 590            |
| Gas Code:        | CH4,PPN,BALA       | Certification Date: | Sep 09, 2013   |

**Expiration Date: Sep 09, 2021**

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

| ANALYTICAL RESULTS |                         |                      |                 |                            |             |
|--------------------|-------------------------|----------------------|-----------------|----------------------------|-------------|
| Component          | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates |
| PROPANE            | 1000 PPM                | 982.7 PPM            | G1              | +/- 1% NIST Traceable      | 09/09/2013  |
| METHANE            | 4000 PPM                | 3992 PPM             | G1              | +/- 0.6% NIST Traceable    | 09/09/2013  |
| AIR                | Balance                 |                      |                 |                            |             |

| CALIBRATION STANDARDS |          |             |                             |             |                 |
|-----------------------|----------|-------------|-----------------------------|-------------|-----------------|
| Type                  | Lot ID   | Cylinder No | Concentration               | Uncertainty | Expiration Date |
| NTRM/C3H8             | 11060916 | CC343415    | 1000.3 PPM PROPANE/NITROGEN | +/- 0.7%    | Mar 04, 2017    |
| CH4                   | 10061306 | CC282514    | 1.029 % METHANE/NITROGEN    | +/- 0.6%    | Jul 27, 2016    |

| ANALYTICAL EQUIPMENT    |                      |                             |
|-------------------------|----------------------|-----------------------------|
| Instrument/Make/Model   | Analytical Principle | Last Multipoint Calibration |
| Nicolet 6700 AHR0801332 | FTIR                 | Aug 22, 2013                |
| MKS Multigas 17707558   | FTIR                 | Aug 12, 2013                |

Triad Data Available Upon Request

Notes:

Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

#### Airgas Specialty Gases

11711 S. Alameda Street  
Los Angeles, CA 90059  
323-568-2208 Fax: 323-567-3686

Airgas.com

Part Number: E02AI99E15A1704  
Cylinder Number: CC503264  
Laboratory: ASG - Los Angeles - CA  
PGVP Number: B32015  
Gas Code: NO2,BALA

Reference Number: 48-124493966-1  
Cylinder Volume: 146.2 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 660  
Certification Date: May 29, 2015

**Expiration Date: May 29, 2018**

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

| Component        | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
|------------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| NITROGEN DIOXIDE | 50.00 PPM               | 51.91 PPM            | G1              | +/- 1.8% NIST Traceable    | 05/21/2015, 05/29/2015 |
| AIR              | Balance                 |                      |                 |                            |                        |

#### CALIBRATION STANDARDS

| Type | Lot ID   | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
|------|----------|-------------|-------------------------------------|-------------|-----------------|
| GMIS | 82120141 | CC502378    | 60.40 PPM NITROGEN DIOXIDE/NITROGEN | +/- 1.1%    | Aug 21, 2017    |
| PRM  | 12326    | APEX930720  | 100.3 PPM NITROGEN DIOXIDE/NITROGEN | +/- 1.0%    | Jan 06, 2015    |

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

#### ANALYTICAL EQUIPMENT

| Instrument/Make/Model       | Analytical Principle | Last Multipoint Calibration |
|-----------------------------|----------------------|-----------------------------|
| Nicolet 6700 AMP0900118 NO2 | FTIR                 | May 12, 2015                |

Triad Data Available Upon Request



Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

Part Number: E03NI60E15A0286  
 Cylinder Number: ALM-038559  
 Laboratory: 124 - Tooele - UT  
 PGVP Number: B72016  
 Gas Code: CO2,O2,BALN

Reference Number: 153-124595059-1  
 Cylinder Volume: 159.6 CF  
 Cylinder Pressure: 2015 PSIG  
 Valve Outlet: 590  
 Certification Date: Dec 27, 2016

**Expiration Date: Dec 27, 2024**

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

| Component      | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates |
|----------------|-------------------------|----------------------|-----------------|----------------------------|-------------|
| CARBON DIOXIDE | 20.00 %                 | 19.69 %              | G1              | +/- 0.7% NIST Traceable    | 12/27/2016  |
| OXYGEN         | 20.00 %                 | 20.00 %              | G1              | +/- 0.5% NIST Traceable    | 12/27/2016  |
| NITROGEN       | Balance                 |                      |                 |                            |             |

#### CALIBRATION STANDARDS

| Type | Lot ID   | Cylinder No | Concentration                   | Uncertainty | Expiration Date |
|------|----------|-------------|---------------------------------|-------------|-----------------|
| NTRM | 12061556 | CC354899    | 19.87 % CARBON DIOXIDE/NITROGEN | 0.6%        | Jan 27, 2018    |
| NTRM | 09061433 | CC282486    | 22.53 % OXYGEN/NITROGEN         | 0.4%        | Mar 08, 2019    |

#### ANALYTICAL EQUIPMENT

| Instrument/Make/Model       | Analytical Principle    | Last Multipoint Calibration |
|-----------------------------|-------------------------|-----------------------------|
| Horiba VIA-510 SV4MEUTJ CO2 | CO2 NDIR (Dixon)        | Dec 16, 2016                |
| Horiba MPA-510 X9A4UGL8 O2  | O2 Paramagnetic (Dixon) | Dec 22, 2016                |

Triad Data Available Upon Request



*[Signature]*  
 Approved for Release

## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

#### Airgas Specialty Gases

525 North Industrial Loop Road

Tooele, UT 84074

435-882-1412

Airgas.com

Part Number: E02NI90E15A0228  
Cylinder Number: CC464758  
Laboratory: ASG - Tooele - UT  
PGVP Number: B72015  
Gas Code: O2,BALN

Reference Number: 153-124493385-6  
Cylinder Volume: 145.2 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Certification Date: May 26, 2015

Expiration Date: May 26, 2023

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

### ANALYTICAL RESULTS

| Component | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates |
|-----------|-------------------------|----------------------|-----------------|----------------------------|-------------|
| OXYGEN    | 10.00 %                 | 9.893 %              | G1              | +/- 1.0% NIST Traceable    | 05/26/2015  |
| NITROGEN  | Balance                 |                      |                 |                            |             |

### CALIBRATION STANDARDS

| Type | Lot ID | Cylinder No | Concentration           | Uncertainty | Expiration Date |
|------|--------|-------------|-------------------------|-------------|-----------------|
| NTRM | 1      | CC195919    | 9.898 % OXYGEN/NITROGEN | 1%          | Jul 26, 2018    |

### ANALYTICAL EQUIPMENT

| Instrument/Make/Model      | Analytical Principle    | Last Multipoint Calibration |
|----------------------------|-------------------------|-----------------------------|
| Horiba MPA-510 W603MM58 O2 | O2 Paramagnetic (Mason) | May 03, 2015                |

Triad Data Available Upon Request



O<sub>2</sub> 9.893

CO<sub>2</sub> ~~2~~

*Kevin A. [Signature]*  
Signature on file

Approved for Release

## Airgas Specialty Gases

12722 South Wentworth Avenue  
Chicago, IL 60628  
(773) 785-3000 Fax: (773) 785-1928  
www.airgas.com

# CERTIFICATE OF ANALYSIS

## Grade of Product: EPA Protocol

Part Number: E03NI99E15A3797 Reference Number: 54-124409081-1  
Cylinder Number: CC112244@ Cylinder Volume: 144.4 CF  
Laboratory: ASG - Chicago - IL Cylinder Pressure: 2015 PSIG  
PGVP Number: B12013 Valve Outlet: 660  
Gas Code: CO,NO,BALN Certification Date: Dec 20, 2013

Expiration Date: Dec 20, 2021

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

| ANALYTICAL RESULTS |                         |                      |                 |                            |                        |
|--------------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| Component          | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
| NOX                | 2000 PPM                | 2018 PPM             | G1              | +/- 1.4% NIST Traceable    | 12/13/2013, 12/20/2013 |
| CARBON MONOXIDE    | 2000 PPM                | 2033 PPM             | G1              | +/- 1.1% NIST Traceable    | 12/13/2013             |
| NITRIC OXIDE       | 2000 PPM                | 2012 PPM             | G1              | +/- 1.4% NIST Traceable    | 12/13/2013, 12/20/2013 |
| NITROGEN           | Balance                 |                      |                 |                            |                        |

| CALIBRATION STANDARDS |              |             |                                     |             |                 |
|-----------------------|--------------|-------------|-------------------------------------|-------------|-----------------|
| Type                  | Lot ID       | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
| NTRM/CO               | 12060727     | CC356175    | 2498 PPM CARBON MONOXIDE/NITROGEN   | +/- 0.6%    | Dec 21, 2017    |
| ntrm/nor              | 06120501     | CC217507    | 1982 PPM NITRIC OXIDE/NITROGEN      | +/- 0.6%    | Aug 17, 2016    |
| NO2                   | 124206889130 | CC323209    | 4.824 PPM NITROGEN DIOXIDE/NITROGEN | +/- 2.0%    | Oct 25, 2015    |

| ANALYTICAL EQUIPMENT  |                      |                             |
|-----------------------|----------------------|-----------------------------|
| Instrument/Make/Model | Analytical Principle | Last Multipoint Calibration |
| Nexus 470 AEP0000428  | FTIR                 | Nov 21, 2013                |
| Nexus 470 AEP0000428  | FTIR                 | Nov 21, 2013                |
| Nexus 470 AEP0000428  | FTIR                 | Nov 21, 2013                |

Triad Data Available Upon Request

Notes:



Approved for Release



## CERTIFICATE OF ANALYSIS

### Grade of Product: EPA Protocol

#### Airgas Specialty Gases

525 North Industrial Loop Road

Tooele, UT 84074

435-241-5662 Fax: 435-241-5664

Airgas.com

Part Number: E03NI99E15A2038

Cylinder Number: CC85329

Laboratory: ASG - Tooele - UT

PGVP Number: B72016

Gas Code: CO,NO,NOX,BALN

Reference Number: 153-124542837-4A

Cylinder Volume: 144.3 CF

Cylinder Pressure: 2015 PSIG

Valve Outlet: 660

Certification Date: Mar 21, 2016

Expiration Date: Mar 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

#### ANALYTICAL RESULTS

| Component       | Requested Concentration | Actual Concentration | Protocol Method | Total Relative Uncertainty | Assay Dates            |
|-----------------|-------------------------|----------------------|-----------------|----------------------------|------------------------|
| NOX             | 100.0 PPM               | 101.9 PPM            | G1              | +/- 1.1% NIST Traceable    | 03/14/2016, 03/21/2016 |
| CARBON MONOXIDE | 100.0 PPM               | 99.93 PPM            | G1              | +/- 0.7% NIST Traceable    | 03/14/2016             |
| NITRIC OXIDE    | 100.0 PPM               | 101.8 PPM            | G1              | +/- 1.1% NIST Traceable    | 03/14/2016, 03/21/2016 |
| NITROGEN        | Balance                 |                      |                 |                            |                        |

#### CALIBRATION STANDARDS

| Type    | Lot ID   | Cylinder No | Concentration                       | Uncertainty | Expiration Date |
|---------|----------|-------------|-------------------------------------|-------------|-----------------|
| NTRM/CM | 12062209 | CC19582     | 97.56 PPM CARBON MONOXIDE/NITROGEN  | +/- 0.6%    | May 25, 2018    |
| PRM     | 12328    | 680179      | 10.01 PPM NITROGEN DIOXIDE/NITROGEN | +/- 2.0%    | Oct 15, 2014    |
| NTRM/NO | 13061215 | CC403892    | 49.40 PPM NITRIC OXIDE/NITROGEN     | +/- 0.8%    | Nov 19, 2019    |
| NTRM    | 1        | CC403906    | 49.40 PPM NITRIC OXIDE/NITROGEN     | 0.8%        | Nov 19, 2019    |
| GMIS    | 1        | CC500970    | 4.805 PPM NITROGEN DIOXIDE/NITROGEN | 2.0%        | Aug 12, 2017    |

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

#### ANALYTICAL EQUIPMENT

| Instrument/Make/Model                | Analytical Principle | Last Multipoint Calibration |
|--------------------------------------|----------------------|-----------------------------|
| Nicolet 6700 AMP0900119 CO MCO       | FTIR                 | Feb 26, 2016                |
| Nicolet 6700 AMP0900119 NO LNO       | FTIR                 | Mar 09, 2016                |
| Nicolet 6700 AMP0900119 NO2 impurity | FTIR NO2 impurity    | Mar 10, 2016                |

Triad Data Available Upon Request



Approved for Release

# CERTIFICATE OF ANALYSIS

## Grade of Product: EPA Protocol

Part Number: E02A199E15A0465  
Cylinder Number: EB0081576  
Laboratory: 124 - Tooele - UT  
PGVP Number: B72016  
Gas Code: PPN,BALA

Reference Number: 153-124573625-1  
Cylinder Volume: 146.2 CF  
Cylinder Pressure: 2015 PSIG  
Valve Outlet: 590  
Certification Date: Aug 29, 2016

Expiration Date: Aug 29, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

| ANALYTICAL RESULTS                 |                         |                      |                       |                             |                 |
|------------------------------------|-------------------------|----------------------|-----------------------|-----------------------------|-----------------|
| Component                          | Requested Concentration | Actual Concentration | Protocol Method       | Total Relative Uncertainty  | Assay Dates     |
| PROPANE                            | 100.0 PPM               | 99.03 PPM            | G1                    | +/- 0.5% NIST Traceable     | 08/29/2016      |
| AIR                                | Balance                 |                      |                       |                             |                 |
| CALIBRATION STANDARDS              |                         |                      |                       |                             |                 |
| Type                               | Lot ID                  | Cylinder No          | Concentration         | Uncertainty                 | Expiration Date |
| NTRM/C3H8                          | 08061008                | CC262362             | 49.62 PPM PROPANE/AIR | +/- 0.3%                    | May 14, 2018    |
| ANALYTICAL EQUIPMENT               |                         |                      |                       |                             |                 |
| Instrument/Make/Model              |                         | Analytical Principle |                       | Last Multipoint Calibration |                 |
| Nicolet 6700 AMP0900119 C3H8 MC3H8 |                         | FTIR                 |                       | Aug 17, 2016                |                 |

Triad Data Available Upon Request



Signature on file  
Approved for Release





**ENVIRONICS MODEL 4040 GAS DILUTION CALIBRATOR  
SERIAL NO. 3880  
MASS FLOW CONTROLLER CERTIFICATION**

**Flow measurement standards:**

Gilibrator Flow Cell S/N 1104013-H (2 - 30 lpm)

Certified NIST-Traceable by Sensidyne, LP on February 24, 2017

Gilibrator Flow Cell S/N 1104052-S (20 - 6,000 cc/min)

Certified NIST-Traceable by Sensidyne, LP on February 24, 2017

*Standard Conditions referenced to 0 °C and 29.92 inches Hg*

**MFC #1 / RANGE: 10,000 SCCM / SN 3463700001**

|      | <u>Flow Setting</u> | <u>Flow (Standard Conditions)</u> |
|------|---------------------|-----------------------------------|
| 100% | 10,000 sccm         | 10,207 sccm                       |
| 90%  | 9,000 sccm          | 9,196 sccm                        |
| 80%  | 8,000 sccm          | 8,179 sccm                        |
| 70%  | 7,000 sccm          | 7,248 sccm                        |
| 60%  | 6,000 sccm          | 6,271 sccm                        |
| 50%  | 5,000 sccm          | 5,307 sccm                        |
| 40%  | 4,000 sccm          | 4,333 sccm                        |
| 30%  | 3,000 sccm          | 3,382 sccm                        |
| 20%  | 2,000 sccm          | 2,381 sccm                        |
| 10%  | 1,000 sccm          | 1,384 sccm                        |
| 5%   | 500 sccm            | 881.0 sccm                        |

**MFC #2 / RANGE: 10,000 SCCM / SN 346370002**

|      | <u>Flow Setting</u> | <u>Flow (Standard Conditions)</u> |
|------|---------------------|-----------------------------------|
| 100% | 10,000 sccm         | 9,895 sccm                        |
| 90%  | 9,000 sccm          | 8,894 sccm                        |
| 80%  | 8,000 sccm          | 7,903 sccm                        |
| 70%  | 7,000 sccm          | 6,951 sccm                        |
| 60%  | 6,000 sccm          | 6,001 sccm                        |
| 50%  | 5,000 sccm          | 5,032 sccm                        |
| 40%  | 4,000 sccm          | 4,071 sccm                        |
| 30%  | 3,000 sccm          | 3,161 sccm                        |
| 20%  | 2,000 sccm          | 2,148 sccm                        |
| 10%  | 1,000 sccm          | 1,142 sccm                        |
| 5%   | 500 sccm            | 634.5 sccm                        |

**MFC #3 / RANGE: 1,000 SCCM / SN 3474100001**

|      | <u>Flow Setting</u> | <u>Flow (Standard Conditions)</u> |
|------|---------------------|-----------------------------------|
| 100% | 1,000 sccm          | 1,001 sccm                        |
| 90%  | 900 sccm            | 897.5 sccm                        |
| 80%  | 800 sccm            | 794.5 sccm                        |
| 70%  | 700 sccm            | 698.5 sccm                        |
| 60%  | 600 sccm            | 597.6 sccm                        |
| 50%  | 500 sccm            | 494.9 sccm                        |
| 40%  | 400 sccm            | 393.5 sccm                        |
| 30%  | 300 sccm            | 293.1 sccm                        |
| 20%  | 200 sccm            | 192.5 sccm                        |
| 10%  | 100 sccm            | 91.17 sccm                        |
| 5%   | 50 sccm             | 40.55 sccm                        |

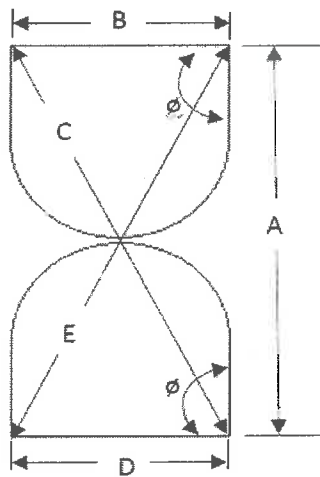
Performed By: Steven R. Arch

Date: 01-19-2018

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

3C



|   |       |
|---|-------|
| A | 0.917 |
| B | 0.375 |
| C | 0.98  |
| D | 0.375 |
| E | 0.985 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

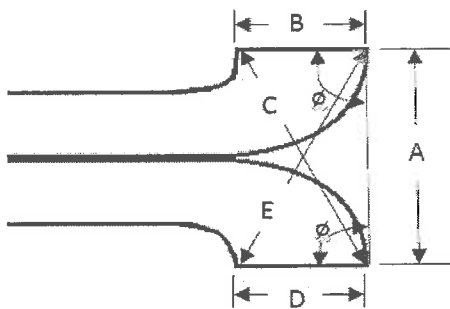
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta$$

|   |       |
|---|-------|
| ø | 88.24 |
|---|-------|

$$(80^\circ < \theta < 100^\circ)$$

|   |       |
|---|-------|
| ø | 89.06 |
|---|-------|

$$(80^\circ < \theta < 100^\circ)$$



|   |       |
|---|-------|
| A | 0.918 |
| B | 0.715 |
| C | 1.141 |
| D | 0.708 |
| E | 1.14  |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

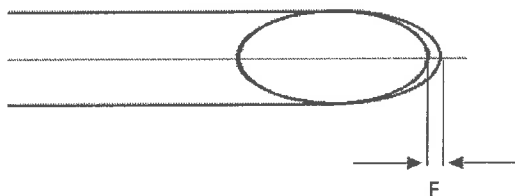
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta$$

|   |       |
|---|-------|
| ø | 87.73 |
|---|-------|

$$(85^\circ < \theta < 95^\circ)$$

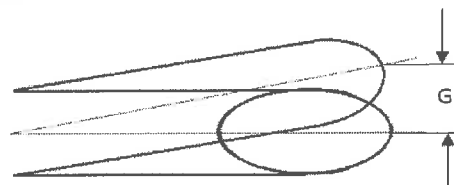
|   |       |
|---|-------|
| ø | 88.04 |
|---|-------|

$$(85^\circ < \theta < 95^\circ)$$



|    |      |
|----|------|
| F= | 6/79 |
|----|------|

$$(f < 1/8")$$



|    |   |
|----|---|
| G= | 0 |
|----|---|

$$(g < 1/32")$$

Technician Signature:

*Robert M. Bartley*

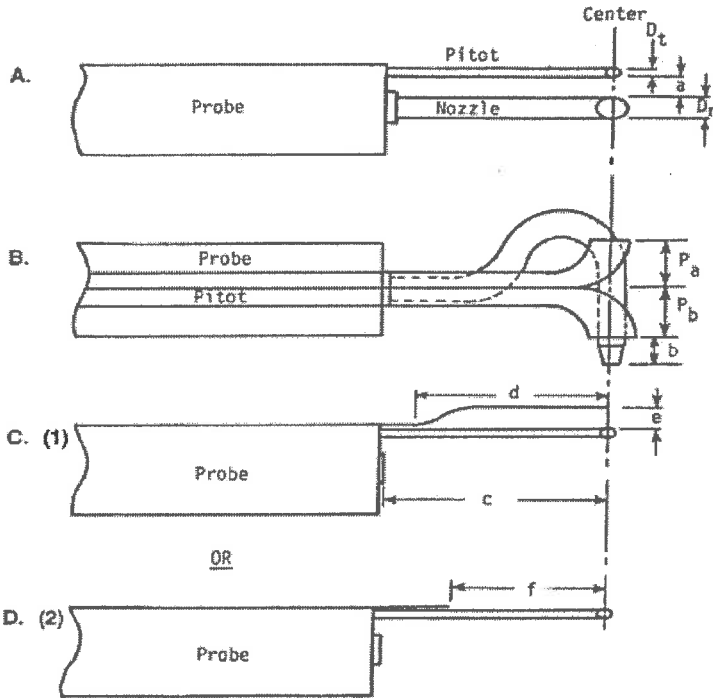
Date: 3/22/2018

## Probe Calibration

Probe Identification: 3C

Date: 3/22/2018

Calibration Technician: RMB



|     |       |
|-----|-------|
| Dt: | 3/8   |
| Dn: | 1/2   |
| a:  | 1 3/7 |

$$D_t = 3/16 \text{ to } 3/8$$

$$D_n = 1/2$$

$$a \approx 3/4$$

|     |       |
|-----|-------|
| Pa: | 3/7   |
| Pb: | 3/7   |
| b:  | 1 1/5 |

$$P_a = P_b$$

$$B \geq 0$$

|    |       |
|----|-------|
| c: | 4 5/7 |
| d: | 7 1/8 |
| e: | 1     |

$$c \approx 3"$$

$$d \approx 3"$$

$$e \approx 3/4"$$

or

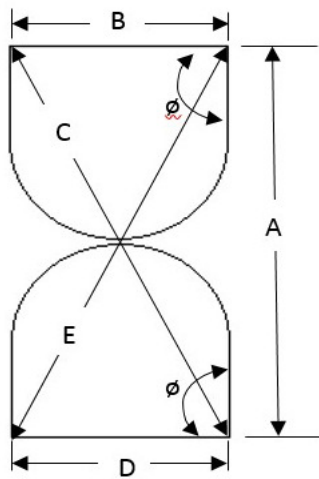
|    |  |
|----|--|
| f: |  |
|----|--|

$$f \geq 2"$$

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

3C



|   |       |
|---|-------|
| A | 0.925 |
| B | 0.378 |
| C | 0.995 |
| D | 0.377 |
| E | 0.995 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

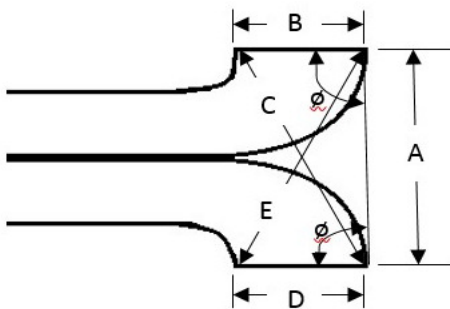
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 89.30 |
|--------|-------|

(80° <  $\phi$  < 100°)

|        |       |
|--------|-------|
| $\phi$ | 89.37 |
|--------|-------|

(80° <  $\phi$  < 100°)



|   |       |
|---|-------|
| A | 0.932 |
| B | 0.604 |
| C | 1.108 |
| D | 0.607 |
| E | 1.109 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

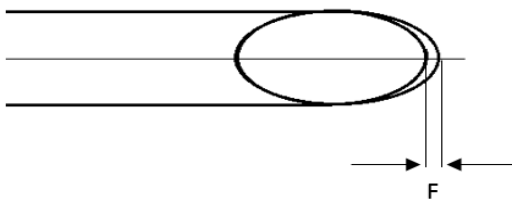
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 89.71 |
|--------|-------|

(85° <  $\phi$  < 95°)

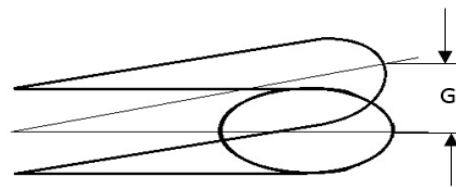
|        |       |
|--------|-------|
| $\phi$ | 89.64 |
|--------|-------|

(85° <  $\phi$  < 95°)



|    |      |
|----|------|
| F= | 0.08 |
|----|------|

( $f < 1/8$  ")



|    |      |
|----|------|
| G= | 0.01 |
|----|------|

( $g < 1/32$  ")

Technician Signature: Chris Whitten

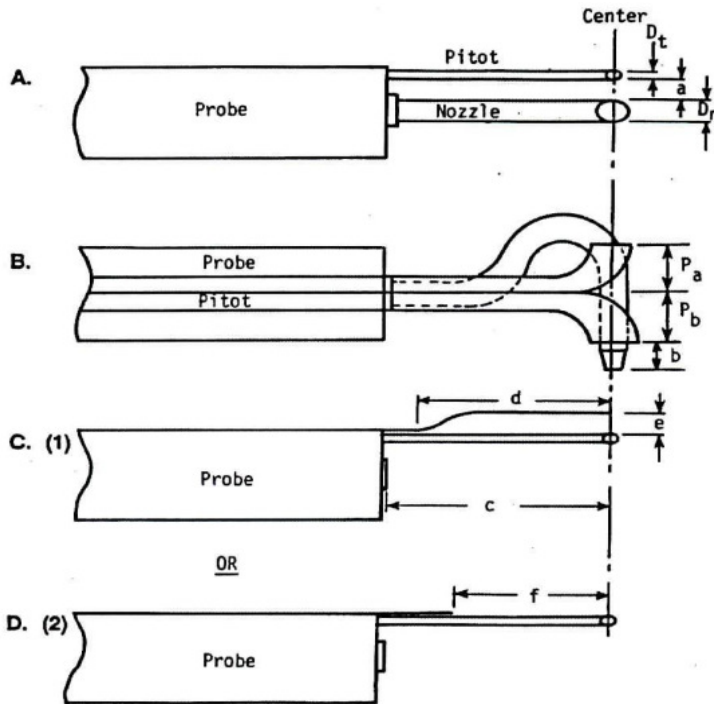
Date: 6/27/2018

## Probe Calibration

Probe Identification: 3C

Date: 6/27/2018

Calibration Technician: CSW



|     |      |
|-----|------|
| Dt: | 0.37 |
| Dn: | 0.43 |
| a:  | 0.86 |

$$D_t = 3/16 \text{ to } 3/8$$

$$D_n = 1/2 \text{ "}$$

$$a \geq 3/4 \text{ "}$$

|     |      |
|-----|------|
| Pa: | 0.43 |
| Pb: | 0.43 |
| b:  | 0.93 |

$$P_a = P_b$$

$$B \geq 0$$

|    |      |
|----|------|
| c: | 4.30 |
| d: | 3.80 |
| e: | 0.84 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq 3/4 \text{ "}$$

or

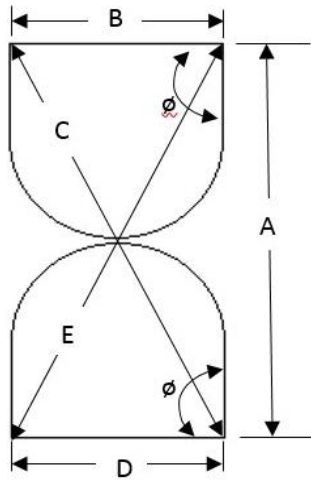
|    |  |
|----|--|
| f: |  |
|----|--|

$$f \geq 2 \text{ "}$$

## S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

4A



|   |       |
|---|-------|
| A | 1.005 |
| B | 0.372 |
| C | 1.073 |
| D | 0.379 |
| E | 1.055 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

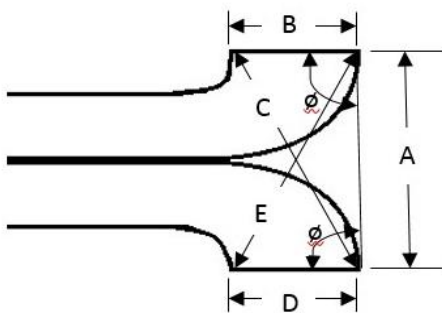
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta$$

|          |       |
|----------|-------|
| $\theta$ | 90.22 |
|----------|-------|

$$(80^\circ < \theta < 100^\circ)$$

|          |       |
|----------|-------|
| $\theta$ | 86.94 |
|----------|-------|

$$(80^\circ < \theta < 100^\circ)$$



|   |       |
|---|-------|
| A | 1.003 |
| B | 0.592 |
| C | 1.154 |
| D | 0.558 |
| E | 1.13  |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

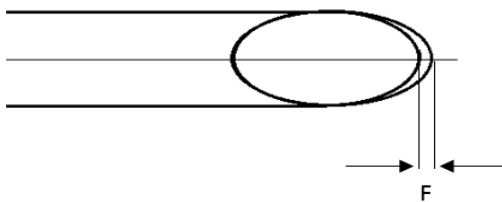
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta$$

|          |       |
|----------|-------|
| $\theta$ | 88.81 |
|----------|-------|

$$(85^\circ < \theta < 95^\circ)$$

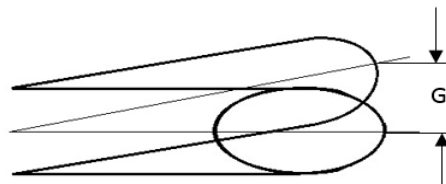
|          |       |
|----------|-------|
| $\theta$ | 87.93 |
|----------|-------|

$$(85^\circ < \theta < 95^\circ)$$



|    |   |
|----|---|
| F= | 0 |
|----|---|

$$(f < 1/8 \text{ "})$$



|    |   |
|----|---|
| G= | 0 |
|----|---|

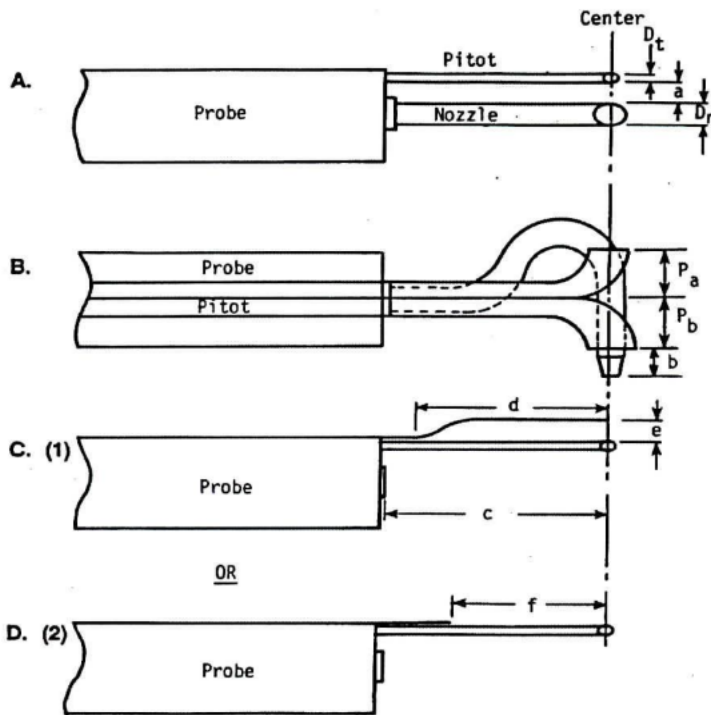
$$(g < 1/32 \text{ "})$$

Technician Signature: Zach Harding

Date: 1/26/2018

## Probe Calibration

Probe Identification: 4A  
 Date: 1/26/2018  
 Calibration Technician: Zach Harding



|     |       |
|-----|-------|
| Dt: | 3/8   |
| Dn: | 1/2   |
| a:  | 1 1/8 |

$$D_t = 3/16 \text{ to } 3/8$$

$$D_n = 1/2 \text{ "}$$

$$a \geq 3/4 \text{ "}$$

|     |       |
|-----|-------|
| Pa: | 1/2   |
| Pb: | 1/2   |
| b:  | 1 1/8 |

$$P_a = P_b$$

$$B \geq 0$$

|    |       |
|----|-------|
| c: | 4 1/2 |
| d: | 8     |
| e: | 1 1/2 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq 3/4 \text{ "}$$

or

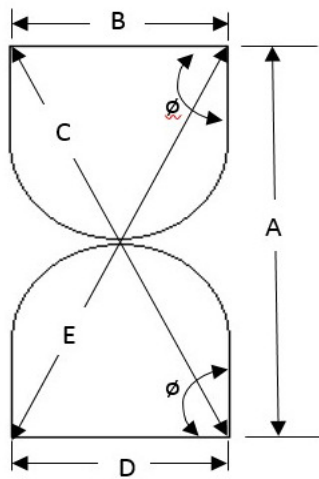
|    |  |
|----|--|
| f: |  |
|----|--|

$$f \geq 2 \text{ "}$$

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

4A



|   |       |
|---|-------|
| A | 1.007 |
| B | 0.374 |
| C | 1.079 |
| D | 0.374 |
| E | 1.069 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

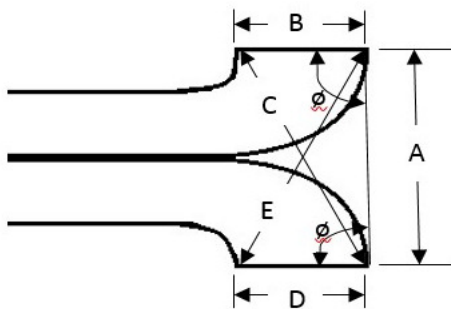
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 90.78 |
|--------|-------|

$$(80^\circ < \phi < 100^\circ)$$

|        |       |
|--------|-------|
| $\phi$ | 89.15 |
|--------|-------|

$$(80^\circ < \phi < 100^\circ)$$



|   |       |
|---|-------|
| A | 1.007 |
| B | 0.374 |
| C | 1.075 |
| D | 0.378 |
| E | 1.072 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

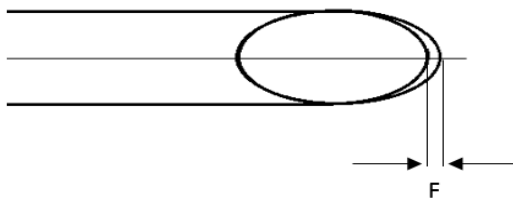
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 90.13 |
|--------|-------|

$$(85^\circ < \phi < 95^\circ)$$

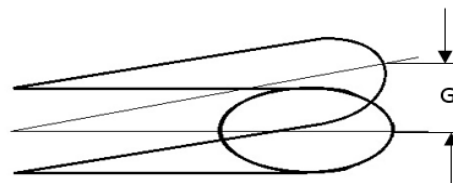
|        |       |
|--------|-------|
| $\phi$ | 89.42 |
|--------|-------|

$$(85^\circ < \phi < 95^\circ)$$



|    |      |
|----|------|
| F= | 0.07 |
|----|------|

$$(f < 1/8")$$



|    |      |
|----|------|
| G= | 0.00 |
|----|------|

$$(g < 1/32")$$

Technician Signature: CSW

Date: 6/27/2018

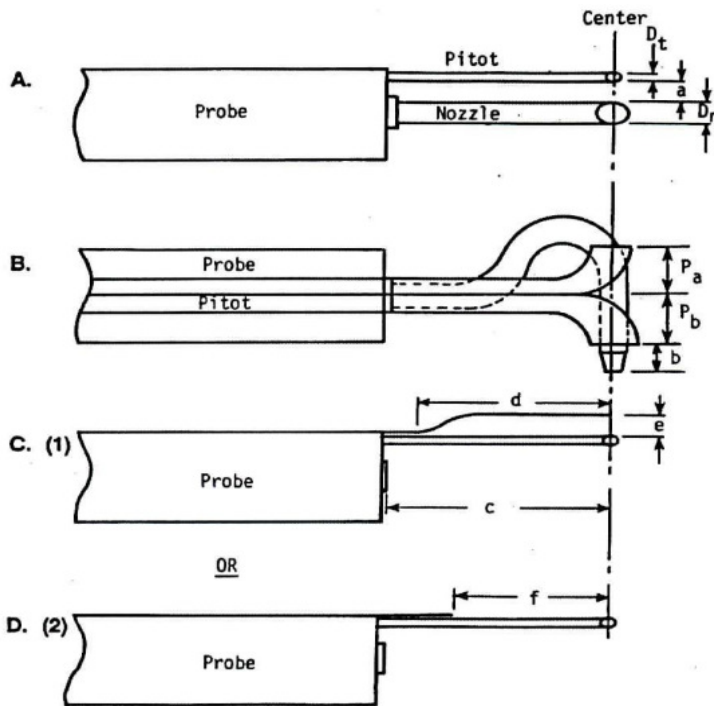


## Probe Calibration

Probe Identification: 4A

Date: 6/27/2018

Calibration Technician: CSW



|     |      |
|-----|------|
| Dt: | 0.37 |
| Dn: | 0.44 |
| a:  | 0.93 |

$$D_t = 3/16 \text{ to } 3/8$$

$$D_n = 1/2 \text{ "}$$

$$a \geq 3/4 \text{ "}$$

|     |      |
|-----|------|
| Pa: | 0.48 |
| Pb: | 0.48 |
| b:  | 1.07 |

$$P_a = P_b$$

$$B \geq 0$$

|    |      |
|----|------|
| c: | 4.38 |
| d: | 4.63 |
| e: | 0.81 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq 3/4 \text{ "}$$

or

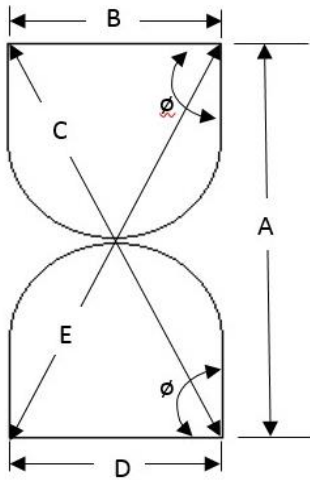
|    |     |
|----|-----|
| f: | N/A |
|----|-----|

$$f \geq 2 \text{ "}$$

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

4D



|   |       |
|---|-------|
| A | 1.028 |
| B | 0.376 |
| C | 1.078 |
| D | 0.377 |
| E | 1.077 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

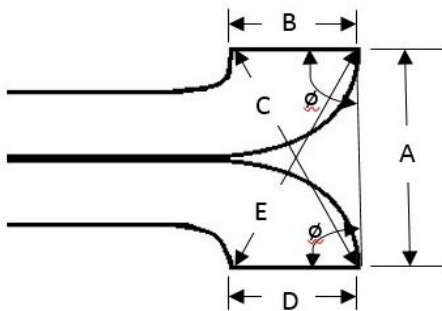
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta$$

|          |       |
|----------|-------|
| $\theta$ | 87.33 |
|----------|-------|

(80° <  $\theta$  < 100°)

|          |       |
|----------|-------|
| $\theta$ | 87.12 |
|----------|-------|

(80° <  $\theta$  < 100°)



|   |       |
|---|-------|
| A | 1.039 |
| B | 0.571 |
| C | 1.166 |
| D | 0.574 |
| E | 1.161 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \theta$$

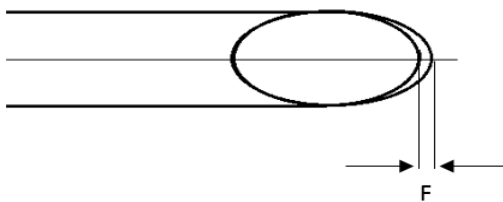
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \theta$$

|          |       |
|----------|-------|
| $\theta$ | 87.78 |
|----------|-------|

(85° <  $\theta$  < 95°)

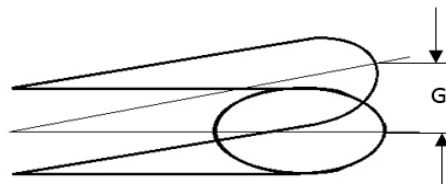
|          |       |
|----------|-------|
| $\theta$ | 87.06 |
|----------|-------|

(85° <  $\theta$  < 95°)



|    |   |
|----|---|
| F= | 0 |
|----|---|

(f < 1/8 ")



|    |   |
|----|---|
| G= | 0 |
|----|---|

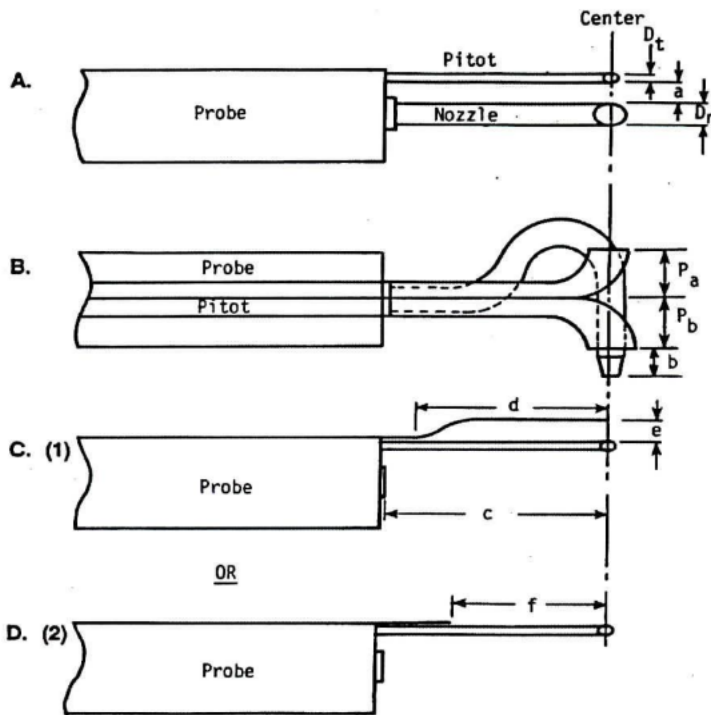
(g < 1/32 ")

Technician Signature: Zach Harding

Date: 1/26/2018

## Probe Calibration

Probe Identification: 4D  
 Date: 1/26/2018  
 Calibration Technician: Zach Harding



|     |       |
|-----|-------|
| Dt: | 3/8   |
| Dn: | 1/2   |
| a:  | 1 1/6 |

$$D_t = 3/16 \text{ to } 3/8$$

$$D_n = 1/2 \text{ "}$$

$$a \geq 3/4 \text{ "}$$

|     |     |
|-----|-----|
| Pa: | 1/2 |
| Pb: | 1/2 |
| b:  | 1   |

$$P_a = P_b$$

$$B \geq 0$$

|    |       |
|----|-------|
| c: | 4 1/2 |
| d: | 4 3/5 |
| e: | 1 4/5 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq 3/4 \text{ "}$$

or

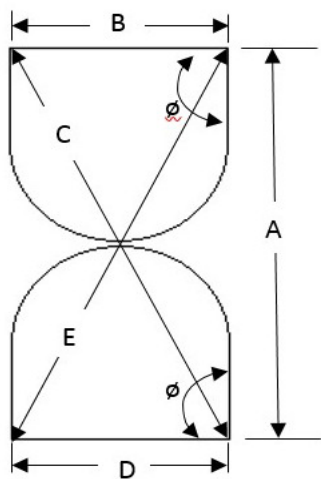
|    |  |
|----|--|
| f: |  |
|----|--|

$$f \geq 2 \text{ "}$$

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

4D



|   |       |
|---|-------|
| A | 0.933 |
| B | 0.39  |
| C | 1.025 |
| D | 0.389 |
| E | 1.022 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

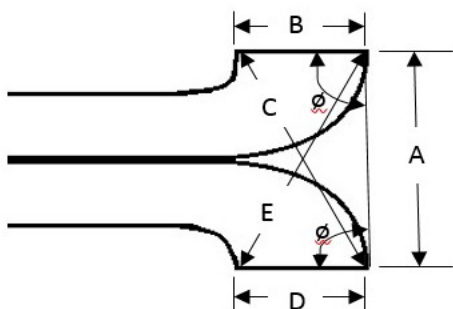
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 92.21 |
|--------|-------|

$$(80^\circ < \phi < 100^\circ)$$

|        |       |
|--------|-------|
| $\phi$ | 91.79 |
|--------|-------|

$$(80^\circ < \phi < 100^\circ)$$



|   |       |
|---|-------|
| A | 0.934 |
| B | 0.571 |
| C | 1.09  |
| D | 0.57  |
| E | 1.08  |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

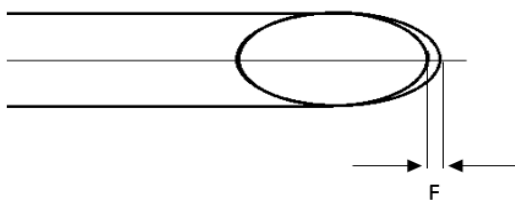
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 89.45 |
|--------|-------|

$$(85^\circ < \phi < 95^\circ)$$

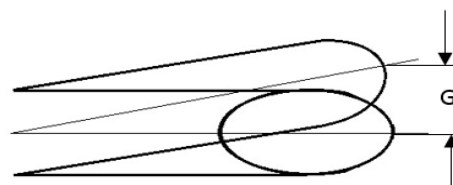
|        |       |
|--------|-------|
| $\phi$ | 88.34 |
|--------|-------|

$$(85^\circ < \phi < 95^\circ)$$



|    |      |
|----|------|
| F= | 0.07 |
|----|------|

$$(f < 1/8")$$



|    |   |
|----|---|
| G= | 0 |
|----|---|

$$(g < 1/32")$$

Technician Signature: CSW

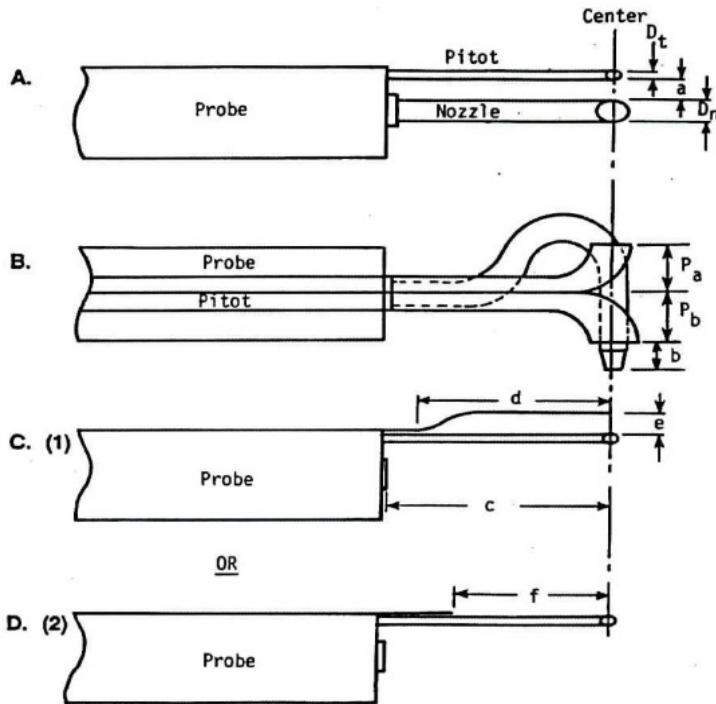
Date: 6/27/2018

## Probe Calibration

Probe Identification: 4D

Date: 6/27/2018

Calibration Technician CSW



|     |      |
|-----|------|
| Dt: | 0.36 |
| Dn: | 0.44 |
| a:  | 0.82 |

$$D_t = \frac{3}{16} \text{ to } \frac{3}{8}$$

$$D_n = \frac{1}{2} \text{ "}$$

$$a \geq \frac{3}{4} \text{ "}$$

|     |       |
|-----|-------|
| Pa: | 0.45  |
| Pb: | 0.45  |
| b:  | 1 1/2 |

$$P_a = P_b$$

$$B \geq 0$$

|    |      |
|----|------|
| c: | 4.75 |
| d: | 3.50 |
| e: | 1.06 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq \frac{3}{4} \text{ "}$$

or

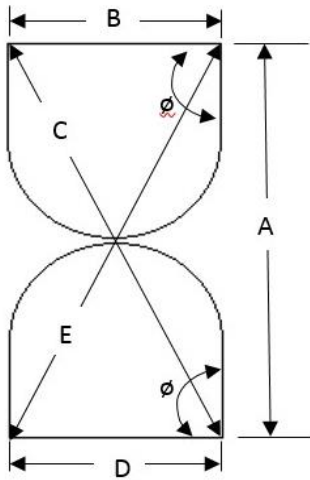
|    |     |
|----|-----|
| f: | N/A |
|----|-----|

$$f \geq 2 \text{ "}$$

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

1307999



|   |       |
|---|-------|
| A | 0.922 |
| B | 0.388 |
| C | 0.993 |
| D | 0.382 |
| E | 0.995 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

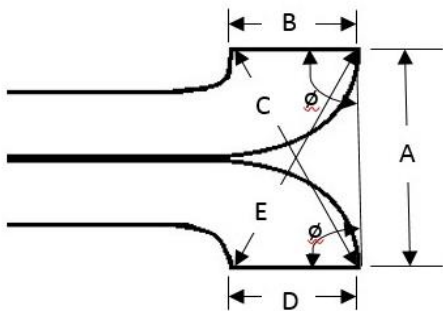
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|   |       |
|---|-------|
| φ | 88.83 |
|---|-------|

(80° < φ < 100°)

|   |       |
|---|-------|
| φ | 89.51 |
|---|-------|

(80° < φ < 100°)



|   |       |
|---|-------|
| A | 0.922 |
| B | 0.569 |
| C | 1.072 |
| D | 0.569 |
| E | 1.074 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

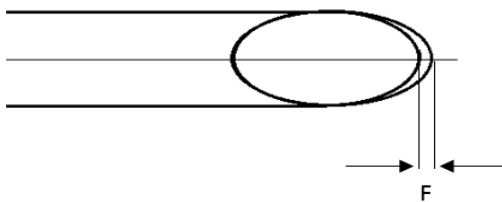
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|   |       |
|---|-------|
| φ | 88.65 |
|---|-------|

(85° < φ < 95°)

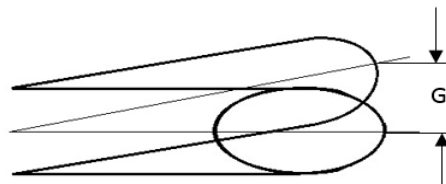
|   |       |
|---|-------|
| φ | 88.89 |
|---|-------|

(85° < φ < 95°)



|    |   |
|----|---|
| F= | 0 |
|----|---|

(f < 1/8 ")



|    |   |
|----|---|
| G= | 0 |
|----|---|

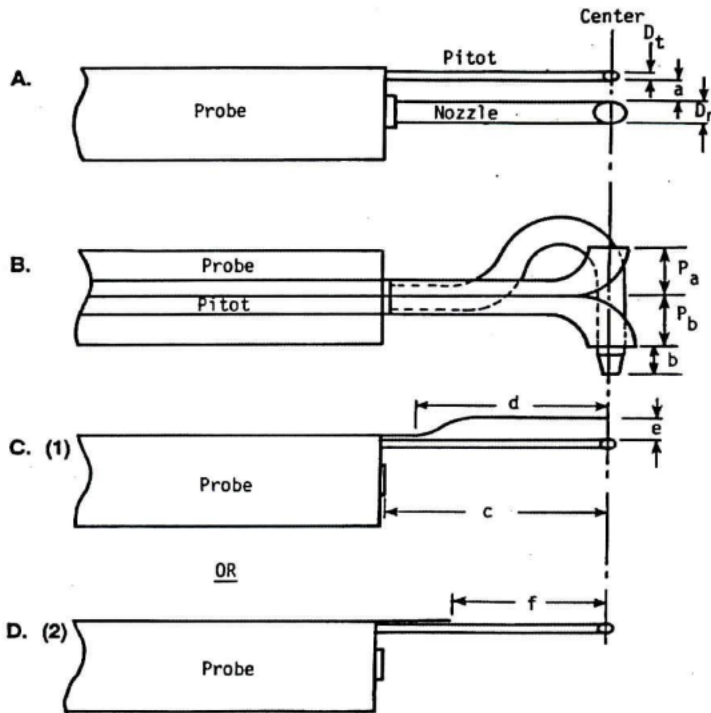
(g < 1/32 ")

Technician Signature: Zach Harding

Date: 1/26/2018

## Probe Calibration

Probe Identification: 1307999  
 Date: 1/26/2018  
 Calibration Technician: Zach Harding



|     |     |
|-----|-----|
| Dt: | 3/8 |
| Dn: | 1/2 |
| a:  | 4/5 |

$$D_t = 3/16 \text{ to } 3/8$$

$$D_n = 1/2 \text{ "}$$

$$a \geq 3/4 \text{ "}$$

|     |     |
|-----|-----|
| Pa: | 4/9 |
| Pb: | 4/9 |
| b:  | 2/3 |

$$P_a = P_b$$

$$B \geq 0$$

|    |       |
|----|-------|
| c: | 4 1/2 |
| d: | 7     |
| e: | 2 1/4 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq 3/4 \text{ "}$$

or

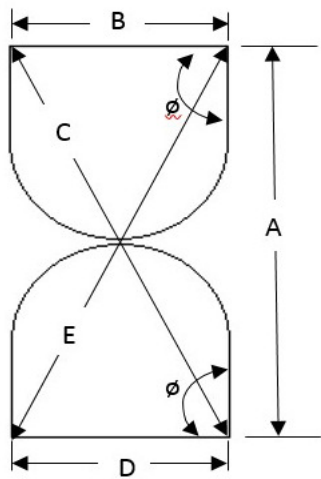
|    |  |
|----|--|
| f: |  |
|----|--|

$$f \geq 2 \text{ "}$$

# S-Type Pitot Tube Geometric Calibration

Pitot Tube Identification:

1307999



|   |       |
|---|-------|
| A | 0.940 |
| B | 0.383 |
| C | 0.971 |
| D | 0.385 |
| E | 0.971 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

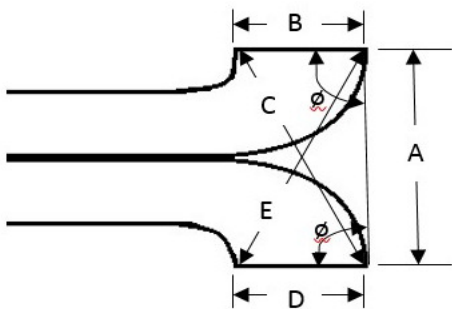
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 83.02 |
|--------|-------|

(80° <  $\phi$  < 100°)

|        |       |
|--------|-------|
| $\phi$ | 82.94 |
|--------|-------|

(80° <  $\phi$  < 100°)



|   |       |
|---|-------|
| A | 0.92  |
| B | 0.57  |
| C | 1.09  |
| D | 0.572 |
| E | 1.088 |

$$\frac{a^2 + b^2 - c^2}{2ab} = \cos \phi$$

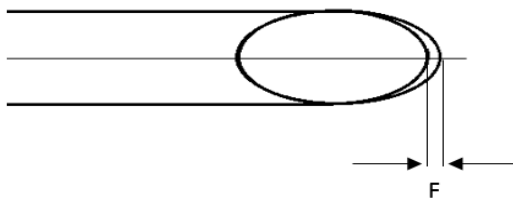
$$\frac{a^2 + d^2 - e^2}{2ad} = \cos \phi$$

|        |       |
|--------|-------|
| $\phi$ | 90.92 |
|--------|-------|

(85° <  $\phi$  < 95°)

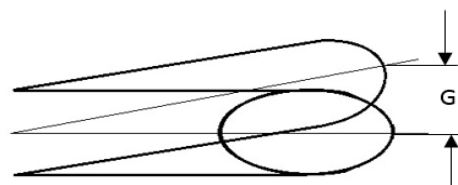
|        |       |
|--------|-------|
| $\phi$ | 90.55 |
|--------|-------|

(85° <  $\phi$  < 95°)



|    |       |
|----|-------|
| F= | 0.065 |
|----|-------|

( $f < 1/8$  ")



|    |   |
|----|---|
| G= | 0 |
|----|---|

( $g < 1/32$  ")

Technician Signature: Chris Whitten

Date: 6/27/2018

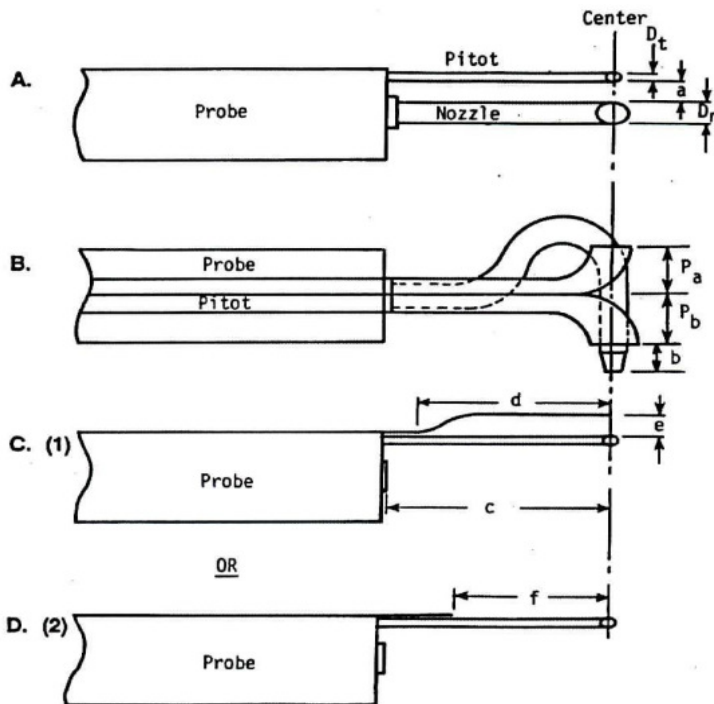


## Probe Calibration

Probe Identification: 1307999

Date: 6/29/2018

Calibration Technician: CSW



|     |      |
|-----|------|
| Dt: | 0.36 |
| Dn: | 0.44 |
| a:  | 0.97 |

$$D_t = \frac{3}{16} \text{ to } \frac{3}{8}$$

$$D_n = \frac{1}{2} \text{ "}$$

$$a \geq \frac{3}{4} \text{ "}$$

|     |      |
|-----|------|
| Pa: | 0.48 |
| Pb: | 0.48 |
| b:  | 1.28 |

$$P_a = P_b$$

$$B \geq 0$$

|    |      |
|----|------|
| c: | 4.32 |
| d: | 3.55 |
| e: | 1.50 |

$$c \geq 3 \text{ "}$$

$$d \geq 3 \text{ "}$$

$$e \geq \frac{3}{4} \text{ "}$$

or

|    |     |
|----|-----|
| f: | N/A |
|----|-----|

$$f \geq 2 \text{ "}$$

# BISON ENGINEERING

Method 2, section 10.1.3.1

Post Test Thermocouple calibrations



Client: H&V

Location: Corvallis, Oregon

Probe ID #: 3C

## Alt-011 6/21/94 Alternative Method 2 Thermocouple Calibration Procedure

Check at Ambient Temperature, or any temperature within the range specified by the manufacturer

| ASTM reference thermometer | Thermocouple reading | Difference | Limitation |
|----------------------------|----------------------|------------|------------|
| 70 °F                      | 71 °F                | 1          | +/- 2 °F   |

OR

### Method 2 Section 10.3.1

Avg source temp.: 459.7 °F  
459.7 °R

| + / - Calibration Ranges |        |   |        |
|--------------------------|--------|---|--------|
| + 10%                    | 46 °F  | = | 506 °R |
| - 10%                    | -42 °F | = | 418 °R |

| OR               | <table><tr><th colspan="3">Thermocouple</th></tr><tr><td><div></div> °C</td><td>=</td><td><div>273.15</div> °K</td></tr></table> | Thermocouple         |                      |          | <div></div> °C | = | <div>273.15</div> °K | <table><tr><th colspan="3">NIST Thermometer</th></tr><tr><td><div></div> °C</td><td>=</td><td><div>273.15</div> °K</td></tr></table> | NIST Thermometer |  |  | <div></div> °C | = | <div>273.15</div> °K | <table><tr><th>% Diff</th></tr><tr><td>0.00%</td></tr></table> | % Diff | 0.00% | Limitation |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------|----------------|---|----------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------|--|--|----------------|---|----------------------|----------------------------------------------------------------|--------|-------|------------|
|                  | Thermocouple                                                                                                                     |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  | <div></div> °C                                                                                                                   | =                    | <div>273.15</div> °K |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  | NIST Thermometer                                                                                                                 |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| <div></div> °C   | =                                                                                                                                | <div>273.15</div> °K |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| % Diff           |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| 0.00%            |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  |                                                                                                                                  |                      |                      | +/- 1.5% |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  | <table><tr><th colspan="3">Thermocouple</th></tr><tr><td><div></div> °F</td><td>=</td><td><div>460.67</div> °R</td></tr></table> | Thermocouple         |                      |          | <div></div> °F | = | <div>460.67</div> °R | <table><tr><th colspan="3">NIST Thermometer</th></tr><tr><td><div></div> °F</td><td>=</td><td><div>460.67</div> °R</td></tr></table> | NIST Thermometer |  |  | <div></div> °F | = | <div>460.67</div> °R | <table><tr><th>% Diff</th></tr><tr><td>0.00%</td></tr></table> | % Diff | 0.00% | +/- 1.5%   |
| Thermocouple     |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| <div></div> °F   | =                                                                                                                                | <div>460.67</div> °R |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| NIST Thermometer |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| <div></div> °F   | =                                                                                                                                | <div>460.67</div> °R |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| % Diff           |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| 0.00%            |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |

Temperatures are not corrected for Bp.

Calibration performed by: Chris Whitten

Date of Calibration: 6/27/2018

### EPA Reference Method 2. Section 10.0 Calibration and Standardization

10.3.1 After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other sensors at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405°C (761°F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference. Alternatively, either a reference thermocouple and potentiometer (calibrated against NIST standards) or thermometric fixed points (e.g., ice bath and boiling water, corrected for barometric pressure) may be used. For temperatures above 405°C (761°F), use a reference thermocouple-potentiometer system calibrated against NIST standards or an alternative reference, subject to the approval of the Administrator.

# BISON ENGINEERING

Method 2, section 10.1.3.1

Post Test Thermocouple calibrations



Client: H&V

Location: Corvallis, Oregon

Probe ID #: 4A

## Alt-011 6/21/94 Alternative Method 2 Thermocouple Calibration Procedure

Check at Ambient Temperature, or any temperature within the range specified by the manufacturer

| ASTM reference thermometer | Thermocouple reading | Difference | Limitation |
|----------------------------|----------------------|------------|------------|
| 71 °F                      | 70 °F                | -1         | +/- 2 °F   |

OR

### Method 2 Section 10.3.1

Avg source temp.: 459.7 °F  
459.7 °R

| + / - Calibration Ranges |        |   |        |
|--------------------------|--------|---|--------|
| + 10%                    | 46 °F  | = | 506 °R |
| - 10%                    | -42 °F | = | 418 °R |

|                |                  |        |            |
|----------------|------------------|--------|------------|
| Thermocouple   | NIST Thermometer | % Diff | Limitation |
| °C = 273.15 °K | °C = 273.15 °K   | 0.00%  | +/- 1.5%   |
| OR             |                  |        |            |
| Thermocouple   | NIST Thermometer | % Diff | Limitation |
| °F = 460.67 °R | °F = 460.67 °R   | 0.00%  | +/- 1.5%   |

Temperatures are not corrected for Bp.

Calibration performed by: Chris Whitten

Date of Calibration: 6/27/2018

### EPA Reference Method 2. Section 10.0 Calibration and Standardization

10.3.1 After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other sensors at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405°C (761°F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference. Alternatively, either a reference thermocouple and potentiometer (calibrated against NIST standards) or thermometric fixed points (e.g., ice bath and boiling water, corrected for barometric pressure) may be used. For temperatures above 405°C (761°F), use a reference thermocouple-potentiometer system calibrated against NIST standards or an alternative reference, subject to the approval of the Administrator.

# BISON ENGINEERING

Method 2, section 10.1.3.1

Post Test Thermocouple calibrations



Client: H&V

Location: Corvallis, Oregon

Probe ID #: 4D

## Alt-011 6/21/94 Alternative Method 2 Thermocouple Calibration Procedure

Check at Ambient Temperature, or any temperature within the range specified by the manufacturer

| ASTM reference thermometer | Thermocouple reading | Difference | Limitation |
|----------------------------|----------------------|------------|------------|
| 71 °F                      | 71 °F                | 0          | +/- 2 °F   |

OR

### Method 2 Section 10.3.1

Avg source temp.: 459.7 °F  
459.7 °R

| + / - Calibration Ranges |        |   |        |
|--------------------------|--------|---|--------|
| + 10%                    | 46 °F  | = | 506 °R |
| - 10%                    | -42 °F | = | 418 °R |

|              |                  |        |            |
|--------------|------------------|--------|------------|
| Thermocouple | NIST Thermometer | % Diff | Limitation |
| 273.15 °C    | 273.15 °C        | 0.00%  | +/- 1.5%   |
| OR           |                  |        |            |
| Thermocouple | NIST Thermometer | % Diff | Limitation |
| 460.67 °F    | 460.67 °F        | 0.00%  | +/- 1.5%   |

Temperatures are not corrected for Bp.

Calibration performed by: Chris Whitten

Date of Calibration: 6/27/2018

### EPA Reference Method 2. Section 10.0 Calibration and Standardization

10.3.1 After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other sensors at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405°C (761°F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference. Alternatively, either a reference thermocouple and potentiometer (calibrated against NIST standards) or thermometric fixed points (e.g., ice bath and boiling water, corrected for barometric pressure) may be used. For temperatures above 405°C (761°F), use a reference thermocouple-potentiometer system calibrated against NIST standards or an alternative reference, subject to the approval of the Administrator.

# BISON ENGINEERING

Method 2, section 10.1.3.1

Post Test Thermocouple calibrations



Client: H&V

Location: Corvallis, Oregon

Probe ID #: 1307999

## Alt-011 6/21/94 Alternative Method 2 Thermocouple Calibration Procedure

Check at Ambient Temperature, or any temperature within the range specified by the manufacturer

| ASTM reference thermometer | Thermocouple reading | Difference | Limitation |
|----------------------------|----------------------|------------|------------|
| 71 °F                      | 70 °F                | -1         | +/- 2 °F   |

OR

### Method 2 Section 10.3.1

Avg source temp.: 459.7 °F  
459.7 °R

| + / - Calibration Ranges |        |   |        |
|--------------------------|--------|---|--------|
| + 10%                    | 46 °F  | = | 506 °R |
| - 10%                    | -42 °F | = | 418 °R |

| OR               | <table><tr><th colspan="3">Thermocouple</th></tr><tr><td><div></div> °C</td><td>=</td><td><div>273.15</div> °K</td></tr></table> | Thermocouple         |                      |          | <div></div> °C | = | <div>273.15</div> °K | <table><tr><th colspan="3">NIST Thermometer</th></tr><tr><td><div></div> °C</td><td>=</td><td><div>273.15</div> °K</td></tr></table> | NIST Thermometer |  |  | <div></div> °C | = | <div>273.15</div> °K | <table><tr><th>% Diff</th></tr><tr><td>0.00%</td></tr></table> | % Diff | 0.00% | Limitation |
|------------------|----------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------------|----------|----------------|---|----------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------|--|--|----------------|---|----------------------|----------------------------------------------------------------|--------|-------|------------|
|                  | Thermocouple                                                                                                                     |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  | <div></div> °C                                                                                                                   | =                    | <div>273.15</div> °K |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  | NIST Thermometer                                                                                                                 |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| <div></div> °C   | =                                                                                                                                | <div>273.15</div> °K |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| % Diff           |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| 0.00%            |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  |                                                                                                                                  |                      |                      | +/- 1.5% |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
|                  | <table><tr><th colspan="3">Thermocouple</th></tr><tr><td><div></div> °F</td><td>=</td><td><div>460.67</div> °R</td></tr></table> | Thermocouple         |                      |          | <div></div> °F | = | <div>460.67</div> °R | <table><tr><th colspan="3">NIST Thermometer</th></tr><tr><td><div></div> °F</td><td>=</td><td><div>460.67</div> °R</td></tr></table> | NIST Thermometer |  |  | <div></div> °F | = | <div>460.67</div> °R | <table><tr><th>% Diff</th></tr><tr><td>0.00%</td></tr></table> | % Diff | 0.00% | +/- 1.5%   |
| Thermocouple     |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| <div></div> °F   | =                                                                                                                                | <div>460.67</div> °R |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| NIST Thermometer |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| <div></div> °F   | =                                                                                                                                | <div>460.67</div> °R |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| % Diff           |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |
| 0.00%            |                                                                                                                                  |                      |                      |          |                |   |                      |                                                                                                                                      |                  |  |  |                |   |                      |                                                                |        |       |            |

Temperatures are not corrected for Bp.

Calibration performed by: Chris Whitten

Date of Calibration: 6/27/2018

### EPA Reference Method 2. Section 10.0 Calibration and Standardization

10.3.1 After each field use, calibrate dial thermometers, liquid-filled bulb thermometers, thermocouple-potentiometer systems, and other sensors at a temperature within 10 percent of the average absolute stack temperature. For temperatures up to 405°C (761°F), use an ASTM mercury-in-glass reference thermometer, or equivalent, as a reference. Alternatively, either a reference thermocouple and potentiometer (calibrated against NIST standards) or thermometric fixed points (e.g., ice bath and boiling water, corrected for barometric pressure) may be used. For temperatures above 405°C (761°F), use a reference thermocouple-potentiometer system calibrated against NIST standards or an alternative reference, subject to the approval of the Administrator.



## Handheld Barometer Calibration Form

Branch Location: Helena, MT

### IN OFFICE PRE-TEST CHECKS

Date: 4/20/2018

Performed by: CSW

### NIST Reference Standard Barometer Used:

| Standard ID                 | Serial number | Calibrated on: | Calibration due: |
|-----------------------------|---------------|----------------|------------------|
| Helena mercury<br>Barometer | BIS01         | 3/12/2018      | NA               |

### Handheld Barometer Verification:

Barometer ID: SS160499022

| Reference Value (g) | Observed (g) | Correction* | Tolerance (+/-<br>0.10) |
|---------------------|--------------|-------------|-------------------------|
| 25.95               | 25.95        | 0.00        | PASS                    |

\*Correction is the difference between the observed and reference values



**Field Balance and Weights  
Calibration Form**

**Branch Location:** Helena

**Project #:** HAV218610

**IN OFFICE PRE-TEST CHECKS**

**Date:** 4/18/2018

**Performed by:** CSW

**Environmental conditions in the lab:**

| Temperature °F | Pressure "Hg | Humidity %RH |
|----------------|--------------|--------------|
| 70             | 26.2         | 30           |

**NIST Reference Standards Used:**

| Standard ID                                  | Serial number(s) | Calibrated on: | Calibration due: |
|----------------------------------------------|------------------|----------------|------------------|
| Helena Ref. Standard<br>Weights 200 and 500g | 10696            | 1/18/2018      | 1/18/2019        |

**Verification of Balance Against Reference Standards:**

**Balance ID:** Helena Scale #1

| Nominal Value (g) | Observed (g) | Correction* | Tolerance<br>(+/- 0.5g)** |
|-------------------|--------------|-------------|---------------------------|
| 200               | 200.0        | 0.0         | PASS                      |
| 500               | 500.1        | 0.1         | PASS                      |

**Verification of Field Standard Weights :**

**Weights ID:** HLN Field Weights 1

| Nominal Value (g) | Observed (g) | Correction* | Tolerance<br>(+/- 0.5g)** |
|-------------------|--------------|-------------|---------------------------|
| 200               | 200.0        | 0.0         | PASS                      |
| 500               | 500.3        | 0.3         | PASS                      |

\*Correction is the difference between the observed and nominal mass values

\*\*EPA Method 5, Section 6.3.4

**ONSITE BALANCE VERIFICATION**

**Date:** 4/26/2018

**Performed by:** CSW

**Environmental conditions onsite:**

| Temperature °F | Pressure "Hg |
|----------------|--------------|
| 70             | 29.83        |

**Field Balance Verification:**

**Balance ID:** Helena Scale #1

**Weights ID:** HLN Field weights 1

| Nominal Value (g) | Observed (g) | Correction* | PASS/FAIL<br>Tolerance<br>(+/- 0.5g) |
|-------------------|--------------|-------------|--------------------------------------|
| 500               | 500.1        | 0.1         | Pass                                 |
| 200               | 200.0        | 0.0         | Pass                                 |

\*Correction is the difference between the observed and nominal mass values

**Signed:** Chris Whitten

**Date:** 4/26/2018

**Version:** 1/20/2018

Y:\SOURCE\Calibrations\BLANK CALIBRATION FORMS\Working Balance Verification



## Report of Calibration

Firm: Bison Engineering  
Address: 1400 11th Avenue  
City/State/Zip: Helena, MT 59601

Test Completed: 01/18/18  
Purchase Order: RMB121517  
Traceable Number: 20180079

Test Item: 500 g and 200 g Weight Set  
Serial No.: 10696

Manufacturer: Rice Lake

### Laboratory Environment at time of test

| Temperature °C | Pressure mmHg | Humidity %RH |
|----------------|---------------|--------------|
| 21.943         | 758.09        | 49.46        |

### Conventional Mass Value

| Nominal Value | As Found Value (g) | As Found Correction (mg) | Uncertainty (mg) | Tolerance (mg) |
|---------------|--------------------|--------------------------|------------------|----------------|
| 500 g         | 500.0192           | 19.2                     | 1.0              | 50             |
| 200 g         | 200.0111           | 11.1                     | 1.0              | 20             |

\*Correction is the difference between the conventional mass value of a weight and its nominal value.

**Comments:** These weights were new from the manufacturer and were within ASTM Class 6 tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

**Quality Control Services, Inc.**  
**Metrology Laboratory Manager**  
E-mail [dthompson@qc-services.com](mailto:dthompson@qc-services.com)

Date: 01/18/18, Supplement 02/09/18

Signature David S. Thompson





## *Report of Calibration*

Firm: Bison Engineering  
Address: 1400 11th Avenue  
City/State/Zip: Helena, MT 59601

Test Completed: 01/18/18  
Purchase Order: RMB121517  
Traceable Number: 20180079

Test Item: 500 g and 200 g Weight Set  
Serial No.: 10696

Manufacturer: Rice Lake

| <u>Material</u> | <u>Assumed Density</u> | <u>Range</u>  | <u>Tolerance Class</u> |
|-----------------|------------------------|---------------|------------------------|
| Stainless Steel | 7.84 g/cm <sup>3</sup> | 500 g & 200 g | NIST HB 105-1 (F)      |

### **Method and Traceability**

The procedure used for this calibration is NIST IR 6969 SOP 7 Single Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

### **Standards Used:**

20 kg to 200 g Working Standards Were Calibrated: 02/21/17 Due: 02/28/18 Standards ID: 75388

Mass Comparators Used: MET-08

Tested by: D. Thompson

**Conventional Mass:** “The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). “Conventional Value of the Result of Weighing in Air” (Previously known as “Apparent Mass vs. 8.0 g/cm<sup>3</sup>).

**Uncertainty Statement:** The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor  $k=2$  for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

**Conventional Mass Values are listed on page 2 of this report.**

page 1 of 2

**Quality Control Services, Inc.**  
Metrology Laboratory Manager  
E-mail [dthompson@qc-services.com](mailto:dthompson@qc-services.com)

Date: 01/18/18

Signature  David S. Thompson



## *Report of Calibration*

Firm: Bison Engineering  
Address: 1400 11th Avenue  
City/State/Zip: Helena, MT 59601

Test Completed: 01/18/18  
Purchase Order: RMB121517  
Traceable Number: 20180079

Test Item: 500 g and 200 g Weight Set  
Serial No.: 10696

Manufacturer: Rice Lake

### Laboratory Environment at time of test

| Temperature °C | Pressure mmHg | Humidity %RH |
|----------------|---------------|--------------|
| 21.943         | 758.09        | 49.46        |

### Conventional Mass Value

| Nominal Value | As Found Value (g) | As Found Correction (mg) | Uncertainty (mg) | Tolerance (mg) |
|---------------|--------------------|--------------------------|------------------|----------------|
| 500 g         | 500.0192           | 19.2                     | 1.0              | 70             |
| 200 g         | 200.0111           | 11.1                     | 1.0              | 40             |

\*Correction is the difference between the conventional mass value of a weight and its nominal value.

**Comments:** These weights were new from the manufacturer and were within NIST Handbook 105-1 Class F tolerances As Found. No adjustments or changes were made so As Found values should be considered to be As Left values.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

**Quality Control Services, Inc.**  
Metrology Laboratory Manager  
E-mail [dthompson@qc-services.com](mailto:dthompson@qc-services.com)

Date: 01/18/18

  
Signature David S. Thompson



# QUALITY CONTROL SERVICES

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## Report of Calibration

Firm: Bison Engineering  
Address: 1400 11th Avenue  
City/State/Zip: Helena, MT 59601

Test Completed: 09/08/17  
Submitted by: Robyn Barkley  
Traceable Number: 20171650

Test Item: 100g to 1mg Weight Set  
Serial No.: 10482

Manufacturer: Troemner

| Material        | Assumed Density        | Range | Tolerance Class |
|-----------------|------------------------|-------|-----------------|
| Stainless Steel | 8.03 g/cm <sup>3</sup> | 100g  | ASTM Class 1    |
| Stainless Steel | 7.95 g/cm <sup>3</sup> | 10mg  | ASTM Class 1    |
| Stainless Steel | 2.7 g/cm <sup>3</sup>  | 1mg   | ASTM Class 1    |

### Method and Traceability

The procedure used for this calibration is NIST IR 6969 SOP 4 Double Substitution Weighing Design. Standards used for comparison are traceable to the National Institute of Standards and Technology (reports on file) and are part of a comprehensive measurement assurance program for ensuring continued accuracy and traceability within the level of uncertainty reported. The Traceable Number listed above is Traceable to National Standards through an unbroken chain of comparison each having stated uncertainties.

### Standards Used:

100g to 1mg Working Standards Were Calibrated: 03/03/17 Due: 03/31/18 Standards ID: 723318

Mass Comparators Used: MET-04, 05

Tested by: S. King

### Conventional Mass:

"The conventional value of the result of weighing a body in air is equal to the mass of a standard, of conventionally chosen density, at a conventionally chosen temperature, which balances this body at this reference temperature in air of conventionally chosen density. International Recommendation 33 (OIML IR 33 1973, 1979). "Conventional Value of the Result of Weighing in Air" (Previously known as "Apparent Mass vs. 8.0g/cm<sup>3</sup>).

**Uncertainty Statement:** The uncertainty conforms to the ISO Guide to the Expressions of Uncertainty in Measurement. Uncertainty as reported is based on a coverage factor k=2 for an approximate 95 percent level of uncertainty. Uncertainty components include the standard deviation of the process, the uncertainty of the standard used, an uncertainty component associated with the potential drift of the standard used, and the estimated uncertainty related to measuring and determining the air buoyancy effect.

Conventional Mass Values are listed on page 2 of this report.

page 1 of 2

Quality Control Services, Inc.  
Metrology Laboratory Manager  
E-mail [dtompson@qc-services.com](mailto:dtompson@qc-services.com)

Date: 09/08/17

  
\_\_\_\_\_  
Signature David S. Thompson

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(503) 236-2712 • FAX (503) 235-2535 • [www.qc-services.com](http://www.qc-services.com)



Calibration Services  
Certificate Number: 1550.01  
Laboratory code: 115953

## Report of Calibration

Firm: Bison Engineering  
Address: 1400 11th Avenue  
City/State/Zip: Helena, MT 59601

Test Completed: 09/08/17  
Submitted by: Robyn Barkley  
Traceable Number: 20171650

Test Item: 100g to 1mg Weight Set  
Serial No.: 10482

Manufacturer: Troemner

### Laboratory Environment at time of test

| Temperature °C | Pressure mmHg | Humidity %RH |
|----------------|---------------|--------------|
| 22.207         | 759.81        | 48.23        |

### Conventional Mass Value

| Nominal Value | As Found Value (g) | As Found Correction* (mg) | As Left Value (g) | As Left Correction* (mg) | Uncertainty (mg) | Tolerance (mg) |
|---------------|--------------------|---------------------------|-------------------|--------------------------|------------------|----------------|
| 100g          | 100.000079         | 0.079                     | 100.000079        | 0.079                    | 0.024            | 0.25           |
| 10mg          | 0.0100020          | 0.0020                    | 0.0100020         | 0.0020                   | 0.0020           | 0.01           |
| 1mg           | N/A                | N/A                       | 0.0010042         | 0.0042                   | 0.0014           | 0.01           |

\*Correction is the difference between the conventional mass value of a weight and its nominal value.

**Comments:** The 1mg weight was missing As Found and was replaced with a new 1mg Troemner weight and was within ASTM Class 1 tolerances As Left. All other weights listed above were received in good condition and were within ASTM Class 1 tolerances As Found.

Accredited by the American Association for Laboratory Accreditation (A2LA) under Calibration Laboratory Code 115953 and Certificate Number 1550.01. This laboratory meets the requirements of ISO/IEC 17025:2005 *General Requirements for the Competence of Testing and Calibration Laboratories*. This laboratory also meets the requirements of ANSI/NCSL Z540-1-1994 and any additional program requirements in the field of calibration.

page 2 of 2

Quality Control Services, Inc.  
Metrology Laboratory Manager  
E-mail [dtompson@qc-services.com](mailto:dtompson@qc-services.com)

Date: 09/08/17

  
Signature David S. Thompson



## QUALITY CONTROL SERVICES

LABORATORY EQUIPMENT • SALES • SERVICE • CALIBRATION • REPAIRS  
 2340 SE 11<sup>TH</sup> Ave. Portland, Oregon 97214 • Box 14831 Portland, Oregon 97293  
 (503) 236-2712 • FAX (503) 235-2535 • www.qc-services.com



Bison Engineering  
 1400 11th Avenue  
 Helena, MT 59601

Report Number: BISE0132350167170731

**A2LA ACCREDITED**  
**CERTIFICATE OF CALIBRATION WITH DATA**

## INSTRUMENT INFORMATION

| Item    | Make        | Model         | Serial Number | Customer ID   | Location     |
|---------|-------------|---------------|---------------|---------------|--------------|
| Balance | Sartorius   | Practum124-1S | 32350167      | N/A           | Lab          |
| Units   | Readability | SOP           | Cal Date      | Last Cal Date | Cal Due Date |
| g       | 0.0001      | QC012         | 7/31/17       | 7/22/16       | 7/2018       |

## FUNCTIONAL CHECKS

| ECCENTRICITY                              |                                | LINEARITY                                 |                                | STANDARD DEVIATION |           |               | ENVIRONMENTAL CONDITIONS |                                     |                          |
|-------------------------------------------|--------------------------------|-------------------------------------------|--------------------------------|--------------------|-----------|---------------|--------------------------|-------------------------------------|--------------------------|
| Test Wt:                                  | Tol:                           | Test Wt:                                  | Tol:                           | Test Wt:           | Tol:      |               | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| 100                                       | 0.0003                         | 25 x 4                                    | 0.0002                         | 20                 | 0.0001    |               | Good                     | Fair                                | Poor                     |
| As-Found:                                 |                                | As-Found:                                 |                                | 1.20.0000          | 5.20.0001 | 9.20.0001     | Temperature: 23.1°C      |                                     |                          |
| Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | 2.20.0000          | 6.20.0001 | 10.20.0000    |                          |                                     |                          |
| As-Left:                                  |                                | As-Left:                                  |                                | 3.20.0000          | 7.20.0001 | <u>Result</u> |                          |                                     |                          |
| Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | Pass: <input checked="" type="checkbox"/> | Fail: <input type="checkbox"/> | 4.20.0000          | 8.20.0000 | 0.00005       |                          |                                     |                          |

## A2LA ACCREDITED SECTION OF REPORT

| Standard | As-Found | As-Left  | Expanded Uncertainty |
|----------|----------|----------|----------------------|
| 100      | 99.9997  | 100.0000 | 0.00015              |
| 50       | 49.9999  | 50.0001  | 0.00015              |
| 20       | 19.9999  | 20.0000  | 0.00015              |
| 10       | 10.0000  | 10.0000  | 0.00015              |
| 1        | 1.0000   | 1.0000   | 0.00015              |
| 0.1      | 0.1000   | 0.1000   | 0.00015              |

## CALIBRATION STANDARDS

| Item       | Make            | Model    | Serial Number | Cal Date | Cal Due Date | NIST ID  |
|------------|-----------------|----------|---------------|----------|--------------|----------|
| Weight Set | R.Lake/Troemner | 1MG-25KG | 1265          | 11/22/16 | 11/2017      | 20162225 |

Permanent Information Concerning this Equipment:

Comments/Info Concerning this Calibration:

7/17 Adjusted Span

Report prepared/reviewed by: \_\_\_\_\_ Date: \_\_\_\_\_

Technician: G. Cahill

Report revised by: \_\_\_\_\_ Date: \_\_\_\_\_

Signature: G. Cahill

THIS CERTIFICATE SHALL NOT BE REPRODUCED WITHOUT THE APPROVAL OF QUALITY CONTROL SERVICES, INC.

The uncertainty is calculated according to the ISO Guide to the Expression of Uncertainty in Measurement and includes the uncertainty of standards used combined with the observed standard deviation and readability of the unit under test. The uncertainty is expanded with a k factor of 2 for an approximate 95% level of confidence. Instruments listed above were calibrated using standards traceable to the National Institute of Standards and Technology (NIST). Calibration data reflect results at the time and location of calibration. Calibration data should be reviewed to insure that the instrument is performing to its required accuracy. Calibrations comply with ISO/IEC 17025 and ANSI/Z540-1-1994 quality standards.

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Member: National Conference of Standards Laboratories and Weights &amp; Measures

PT ID: BISE01

To Whom It May Concern:

In an effort to assist our customers with meeting the requirements of the Instrumental Methods for testing, 3A, 6C, 7E, 10, and 20, we are providing a summary of interferences for certain Thermo Scientific analyzers.

The requirement for conducting analyzer interference checks for potential interfering gases is the responsibility of the testing organizations. The Methods do, however, allow the manufacturer of instruments to provide this data. Tests are required to be conducted on the same “make and model” as those being used for method testing.

The information contained in the accompanying tables pertains to the “make” of analyzers under the names of; Thermo Electron Corporation, Thermo Environmental Instruments and Thermo Scientific. The “model” are models; Model 42 for NO, NO<sub>2</sub>, NO<sub>x</sub>, Model 43 for SO<sub>2</sub>, and Model 410i for CO<sub>2</sub>. The specific pollutant detection and analytical technology for each of the above listed specific models have remained the same for the various series of analyzers manufactured over the past years. Therefore, the interference test results shown for iSeries analyzers would produce essentially the same results for C Series and earlier Series of these models.

The potential interference gases test results shown in the tables to follow indicate that none of the Thermo Scientific analyzers tested have a collective analytical detection interference that would sum more than 0.06% of analyzer span value. The acceptance criterion is; the sum of the interference responses must not be greater than 2.5% of analyzer span value.

If you have any questions regarding the information contained herein please do not hesitate to contact us.

Thermo Fisher Scientific



Frank Duckett  
Product Manager, Continuous Gas Analyzers  
Air Quality Instruments

## Thermo Scientific Model 42 NO-NO<sub>2</sub>-NO<sub>x</sub> Analyzer Potential Interference Gas Responses

| Potential Interferent        |               | Model 42iLS |                 |                 | Model 42iHL |                 |                 |
|------------------------------|---------------|-------------|-----------------|-----------------|-------------|-----------------|-----------------|
| Test Gas                     | Concentration | NO          | NO <sub>2</sub> | NO <sub>x</sub> | NO          | NO <sub>2</sub> | NO <sub>x</sub> |
| CO <sub>2</sub>              | 5.20%         | 0.001       | 0.004           | 0.004           | 0.001       | 0.003           | 0.004           |
| CO <sub>2</sub>              | 15.60%        | 0           | 0.003           | 0.003           | 0.001       | 0.004           | 0.005           |
| H <sub>2</sub> O             | 1.00%         | 0           | 0               | 0               | 0.003       | 0.001           | 0.004           |
| NO                           | 15 ppm        | 14.9        | 0.1             | 15              | 15          | -0.06           | 14.99           |
| NO <sub>2</sub>              | 15 ppm        | 1.1         | 14              | 15              | 0.4         | 14.6            | 15              |
| N <sub>2</sub> O             | 10 ppm        | 0           | 0               | 0               | 0           | 0               | 0               |
| CO                           | 50 ppm        | 0           | 0               | 0               | 0           | 0               | 0               |
| SO <sub>2</sub>              | 21 ppm        | -0.01       | 0               | -0.01           | 0.007       | 0               | 0.007           |
| CH <sub>4</sub>              | 50 ppm        | 0           | 0               | 0               | 0           | 0               | 0               |
| HCl                          | 10 ppm        | 0           | 0.006           | 0.006           | 0           | 0.004           | 0.004           |
| NH <sub>3</sub> <sup>1</sup> | 10 ppm        | 0           | 0               | 0               | 0.17        | 8.9             | 9.1             |
| Sum of Responses             |               | 0.011       | 0.01            | 0.02            | 0.011       | 0.009           | 0.02            |
| Span Value                   |               | 160         | 152             | 160             | 160         | 152             | 160             |
| % of Calibration Span        |               | 0.01%       | 0.01%           | 0.01%           | 0.01%       | 0.01%           | 0.01%           |

Acceptance Criteria found in Section 13.4 of Method 7E is the sum of responses must not be greater than 2.5% of the analyzer calibration span value.

<sup>1</sup>NH<sub>3</sub> interferent results shown for the Model 42iHL was not used in calculation of interference response check because it is a known interferent with an approximate 1 ppm to 1 ppm positive bias in analyzers using stainless steel NO<sub>2</sub> to NO converters. Thermo recommends that NO<sub>x</sub> analyzers with stainless steel NO<sub>2</sub> to NO converters must use a NH<sub>3</sub> scrubber when testing sources with potential NH<sub>3</sub> in the flue gas.

This document is subject to change without notice.

## Thermo Scientific Model 43 SO<sub>2</sub> and Model 410i CO<sub>2</sub> Analyzer Potential Interference Gas Responses

| <i>Potential Interferent</i> |                      | <i>Model<br/>43iLH</i> | <i>Model<br/>410iHL</i> |
|------------------------------|----------------------|------------------------|-------------------------|
| <i>Test<br/>Gas</i>          | <i>Concentration</i> | <i>SO<sub>2</sub></i>  | <i>CO<sub>2</sub></i>   |
| CO <sub>2</sub>              | 5.20%                | 0.03                   | 5.2                     |
| CO <sub>2</sub>              | 15.60%               | 0.14                   | 15.6                    |
| H <sub>2</sub> O             | 1.00%                | -0.05                  | 0                       |
| NO                           | 15 ppm               | 0.2                    | 0                       |
| NO <sub>2</sub>              | 15 ppm               | 0.06                   | 0                       |
| N <sub>2</sub> O             | 10 ppm               | 0                      | 0                       |
| CO                           | 50 ppm               | 0                      | 0                       |
| SO <sub>2</sub>              | 21 ppm               | 21                     | 0                       |
| CH <sub>4</sub>              | 50 ppm               | 0                      | 0                       |
| HCl                          | 10 ppm               | 0                      | 0                       |
| NH <sub>3</sub>              | 10 ppm               | 0                      | 0                       |
| <b>Sum of Responses</b>      |                      | <b>0.45</b>            | <b>0</b>                |
| <b>Span Value</b>            |                      | <b>800</b>             | <b>16</b>               |
| <b>% of Calibration Span</b> |                      | <b>0.06%</b>           | <b>0%</b>               |

*Acceptance Criteria found in Section 13.4 of Method 7E is the sum of responses must not be greater than 2.5% of the analyzer calibration span value.*

*This document is subject to change without notice.*





SOURCE  
EVALUATION  
SOCIETY

Name: **ADAM BENDER**  
SES ID: **DO NOT DISPLAY - 4431188**  
Test Name: **GROUP 1**  
Test Date: **6/5/2017**

On behalf of the Source Evaluation Society, we are pleased to inform you that you achieved a passing score on the Group 1 - EPA Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods examination. The tables below show your overall score and performance in each content area of the exam.

**Overall Test Results:**

|                   | Results   |
|-------------------|-----------|
| <b>Your Score</b> | <b>40</b> |
| Passing Score     | 40        |
| Possible Score    | 50        |

**Results By Domain:**

Your performance in each content area or domain is based on small subsets of test questions and should be considered a rough estimate of your knowledge within each area.

| Domain                                                                      | Percent Correct |
|-----------------------------------------------------------------------------|-----------------|
| Fundamentals, test planning, test site preparation                          | 100%            |
| Method applicability and specifications, pollutants measured, interferences | 84%             |
| Sampling equipment preparation, calibration, operating procedures           | 79%             |
| Isokinetic sampling, gas flow and emissions calculations                    | 60%             |

\* Percent Correct is the number of items answered correctly in a domain divided by the total number of scored items within that domain.

You are now eligible to apply for the SES QSTI/QSTO qualification approval(s). Please check the SES Website ([www.sesnews.org](http://www.sesnews.org)) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com).

**NOTE: (1) The ECMPs AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com). (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to retake your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your retest.**

Please contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com) with any questions about the exams. All information regarding the QSTI/QSTO application process may be sent by email (which is the preferred and faster method) to the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com), or mail your application to:

Source Evaluation Society  
P. O. Box 12124  
Research Triangle Park, NC 27709-2124



SOURCE  
EVALUATION  
SOCIETY

Name: ADAM BENDER  
SES ID: DO NOT DISPLAY - 4431188  
Test Name: GROUP 2  
Test Date: 7/26/2017

On behalf of the Source Evaluation Society, we are pleased to inform you that you achieved a passing score on the Group 2 - EPA Manual Gaseous Pollutants Source Sampling Methods examination. The tables below show your overall score and performance in each content area of the exam.

**Overall Test Results:**

|                | Results |
|----------------|---------|
| Your Score     | 42      |
| Passing Score  | 40      |
| Possible Score | 50      |

**Results By Domain:**

Your performance in each content area or domain is based on small subsets of test questions and should be considered a rough estimate of your knowledge within each area.

| Domain                                                                      | Percent Correct |
|-----------------------------------------------------------------------------|-----------------|
| Fundamentals, test planning, test site preparation                          | 100%            |
| Method applicability and specifications, pollutants measured, interferences | 88%             |
| Sampling equipment preparation, calibration, operating procedures           | 93%             |
| Isokinetic and proportional sampling, gas flow and emissions calculations   | 33%             |

\* Percent Correct is the number of items answered correctly in a domain divided by the total number of scored items within that domain.

You are now eligible to apply for the SES QSTI/QSTO qualification approval(s). Please check the SES Website ([www.sesnews.org](http://www.sesnews.org)) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com).

**NOTE: (1) The ECMPS AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com). (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to retake your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your retest.**

Please contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com) with any questions about the exams. All information regarding the QSTI/QSTO application process may be sent by email (which is the preferred and faster method) to the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com), or mail your application to:

Source Evaluation Society  
P. O. Box 12124  
Research Triangle Park, NC 27709-2124



SOURCE  
EVALUATION  
SOCIETY

Name: ADAM BENDER  
SES ID: DO NOT DISPLAY - 4431188  
Test Name: GROUP 4  
Test Date: 7/6/2017

On behalf of the Source Evaluation Society, we are pleased to inform you that you achieved a passing score on the Group 4 - EPA Hazardous Metals Measurement Methods examination. The tables below show your overall score and performance in each content area of the exam.

**Overall Test Results:**

|                | Results |
|----------------|---------|
| Your Score     | 45      |
| Passing Score  | 40      |
| Possible Score | 50      |

**Results By Domain:**

Your performance in each content area or domain is based on small subsets of test questions and should be considered a rough estimate of your knowledge within each area.

| Domain                                                                      | Percent Correct |
|-----------------------------------------------------------------------------|-----------------|
| Fundamentals, test planning, test site preparation                          | 100%            |
| Method applicability and specifications, pollutants measured, interferences | 73%             |
| Sampling equipment preparation, calibration, operating procedures           | 100%            |
| Isokinetic sampling, gas flow and emissions calculations                    | 80%             |

\* Percent Correct is the number of items answered correctly in a domain divided by the total number of scored items within that domain.

You are now eligible to apply for the SES QSTI/QSTO qualification approval(s). Please check the SES Website ([www.sesnews.org](http://www.sesnews.org)) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com).

**NOTE: (1) The ECMPs AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com). (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to retake your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your retest.**

Please contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com) with any questions about the exams. All information regarding the QSTI/QSTO application process may be sent by email (which is the preferred and faster method) to the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com), or mail your application to:

Source Evaluation Society  
P. O. Box 12124  
Research Triangle Park, NC 27709-2124

**From:** Theresa Lowe <tf\_lowe@yahoo.com>  
**Sent:** Monday, April 24, 2017 10:52 PM  
**To:** Dave Blankenship  
**Subject:** SES Exam Results - David S. Blankenship

**THIS EMAIL IS THE OFFICIAL NOTIFICATION OF YOUR SES QUALIFIED SOURCE TESTING INDIVIDUAL OR OBSERVER (QSTI/QSTO) EXAM(S) RESULTS (Please Print Out for Your Records)**

|                     |                             |
|---------------------|-----------------------------|
| <b>To:</b>          | <b>David S. Blankenship</b> |
| <b>Employed by:</b> | <b>BisonEngineering</b>     |
| <b>Phone:</b>       | <b>406-442-5768</b>         |
| <b>Email:</b>       | <b>daveb@bison-eng.com</b>  |

The Source Evaluation Society, through its contract with Eastern Technical Associates, has received the score of the exam(s) you completed on the date(s) as listed below. You are required to receive a score of 40 to pass an exam. As noted below, a "P" indicates you passed the exam, a "DNP" indicates that you did not pass the exam.

| <b>Group #</b> | <b>Exam</b>                                                                             | <b>Date of Exam</b> | <b>Exam #</b> | <b>Score</b> | <b>Status</b> |
|----------------|-----------------------------------------------------------------------------------------|---------------------|---------------|--------------|---------------|
| 1              | EPA Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods | 4/9/17              | 14113         | 44           | P             |
| 1A             | Stack Gas Flow Rate Measurements Sampling Methods                                       |                     |               |              |               |
| 2              | EPA Manual Gaseous Pollutants Source Sampling Methods                                   |                     |               |              |               |
| 3              | EPA Gaseous Pollutants Instrumental Methods                                             |                     |               |              |               |
| 4              | EPA Hazardous Metals Measurement Methods                                                | 4/9/17              | 14146         | 36           | DNP           |
| 5              | Part 75 CEMS RATA Testing                                                               |                     |               |              |               |

**NOTE: (1) The ECMPS AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: [gstiprogram@gmail.com](mailto:gstiprogram@gmail.com). (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to re-take your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your re-test.**

If you passed one or more exams, you are eligible to apply for your SES QSTI/QSTO qualification approval(s). To complete the qualification process, you will need to do the following: For New Applications / Additional Group Certificates / Renewals: Please check the SES Website ([www.sesnews.org](http://www.sesnews.org)) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact Theresa Lowe at [tf\\_lowe@yahoo.com](mailto:tf_lowe@yahoo.com).

Please contact Theresa Lowe of SES ([tf\\_lowe@yahoo.com](mailto:tf_lowe@yahoo.com)) with any questions about the exams. If you are interested in rescheduling the exam(s), please contact Kristy Radford or Janie Rose-Lofty of ETA ([gsti@smokeschool.com](mailto:gsti@smokeschool.com))

|                                                                                                       |
|-------------------------------------------------------------------------------------------------------|
| <b>All information regarding the QSTI/QSTO application process may be sent by email (which is the</b> |
|-------------------------------------------------------------------------------------------------------|

|                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p><i>preferred and faster method</i>) to <u>tf_lowe@yahoo.com</u>, or mail your application to:<br/>SES g P. O. Box 12124 g Research Triangle Park, NC g 27709-2124</p> |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Please let me know if you have any questions or if I can be of any assistance.

Theresa Lowe  
SES QSTI/QSTO Review Committee Administrator

**From:** Theresa Lowe <tf\_lowe@yahoo.com>  
**Sent:** Tuesday, April 05, 2016 9:23 PM  
**To:** Dave Blankenship  
**Cc:** Gail Westlin  
**Subject:** QSTI Score - David S. Blankenship

**THIS EMAIL IS THE OFFICIAL NOTIFICATION OF YOUR SES QUALIFIED SOURCE TESTING INDIVIDUAL OR OBSERVER (QSTI/QSTO) EXAM(S) RESULTS (Please Print Out for Your Records)**

|                     |                               |
|---------------------|-------------------------------|
| <b>To:</b>          | <b>David S. Blankenship</b>   |
| <b>Employed by:</b> | <b>Bison Engineering Inc.</b> |
| <b>Phone:</b>       | <b>406-442-5768</b>           |
| <b>Email:</b>       | <b>daveb@bison-eng.com</b>    |

The Source Evaluation Society, through its contract with Eastern Technical Associates, has received the score of the exam(s) you completed on the date(s) as listed below. You are required to receive a score of 40 to pass an exam. As noted below, a "P" indicates you passed the exam, a "DNP" indicates that you did not pass the exam.

| <b>Group #</b> | <b>Exam</b>                                                                             | <b>Date of Exam</b> | <b>Exam #</b> | <b>Score</b> | <b>Status</b> |
|----------------|-----------------------------------------------------------------------------------------|---------------------|---------------|--------------|---------------|
| 1              | EPA Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods | 3/21/16             | 12852         | 38           | DNP           |
| 1A             | Stack Gas Flow Rate Measurements Sampling Methods                                       |                     |               |              |               |
| 2              | EPA Manual Gaseous Pollutants Source Sampling Methods                                   | 3/21/16             | 12878         | 40           | P             |
| 3              | EPA Gaseous Pollutants Instrumental Methods                                             | 3/20/16             | 12904         | 43           | P             |
| 4              | EPA Hazardous Metals Measurement Methods                                                | 3/20/16             | 12926         | 34           | DNP           |
| 5              | Part 75 CEMS RATA Testing                                                               |                     |               |              |               |

**NOTE: (1) The ECMPS AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: [gstiprogram@gmail.com](mailto:gstiprogram@gmail.com). (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to re-take your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your re-test.**

**If you passed one or more exams, you are eligible to apply for your SES QSTI/QSTO qualification approval(s). To complete the qualification process, you will need to do the following: For New Applications / Additional Group Certificates / Renewals: Please check the SES Website ([www.sesnews.org](http://www.sesnews.org)) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact Theresa Lowe at [tf\\_lowe@yahoo.com](mailto:tf_lowe@yahoo.com).**

**If a QSTI/QSTO candidate receives notice that he or she did not pass a SES methods group exam(s), the QSTI/QSTO candidate ask the Committee for a review of their exam(s).** Any review request should be sent to [tf\\_lowe@yahoo.com](mailto:tf_lowe@yahoo.com). As part of the review, the Committee will provide references to methods for those questions missed.

**Please contact Theresa Lowe of SES ([tf\\_lowe@yahoo.com](mailto:tf_lowe@yahoo.com)) with any questions about the exams. If you are interested in rescheduling the exam(s), please contact Kristy Radford or Janie Rose-Lofty of ETA ([gsti@smokeschool.com](mailto:gsti@smokeschool.com))**

|                                                                                            |
|--------------------------------------------------------------------------------------------|
| All information regarding the QSTI/QSTO application process may be sent by email (which is |
|--------------------------------------------------------------------------------------------|

*the preferred and faster method*) to [tf\\_lowe@yahoo.com](mailto:tf_lowe@yahoo.com), or mail your application to:  
SES g P. O. Box 12124 g Research Triangle Park, NC g 27709-2124

**Please let me know if you have any questions or if I can be of any assistance.**

**Theresa Lowe**

**SES QSTI/QSTO Review Committee Administrator**



SOURCE  
EVALUATION  
SOCIETY

Name: **KELLEN L SULLIVAN**  
SES ID: **DO NOT DISPLAY - 2211446**  
Test Name: **GROUP 3**  
Test Date: **8/11/2017**

On behalf of the Source Evaluation Society, we are pleased to inform you that you achieved a passing score on the Group 3 - EPA Gaseous Pollutants Instrumental Methods and CEMS RATAs examination. The tables below show your overall score and performance in each content area of the exam.

**Overall Test Results:**

|                | Results |
|----------------|---------|
| Your Score     | 41      |
| Passing Score  | 40      |
| Possible Score | 50      |

**Results By Domain:**

Your performance in each content area or domain is based on small subsets of test questions and should be considered a rough estimate of your knowledge within each area.

| Domain                                                                      | Percent Correct |
|-----------------------------------------------------------------------------|-----------------|
| Fundamentals, test planning, test site preparation                          | 75%             |
| Method applicability and specifications, pollutants measured, interferences | 89%             |
| Sampling equipment and CEMS preparation, calibration, operating procedures  | 87%             |
| Gas flow, emissions, and RATA calculations                                  | 63%             |

\* Percent Correct is the number of items answered correctly in a domain divided by the total number of scored items within that domain.

You are now eligible to apply for the SES QSTI/QSTO qualification approval(s). Please check the SES Website ([www.sesnews.org](http://www.sesnews.org)) under the link for the "SES QSTI/QSTO Program" for directions on how to apply for your certificate or contact the SES QSTI Administrator at [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com).

**NOTE: (1) The ECMPs AETB reporting requirements include a provision for an email address to be noted for the exam provider. Your exam provider is the Source Evaluation Society. Please use the following email address: [qstiprogram@gmail.com](mailto:qstiprogram@gmail.com). (2) Your exam score(s), per ASTM D7036-04, will be applicable for five years. You will need to retake your exam(s) before expiration in order to maintain a current status. You are responsible for keeping track of scheduling for your retest.**

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