

## 1.0 EXECUTIVE SUMMARY

On February 7, 2020, The Stack Test Group, Inc. performed volatile organic compound (VOC), toluene and methanol emission testing on the north and south scrubber exhaust stacks at the American Chemical Solutions facility located in Muskegon, MI. Three one-hour tests were conducted on each source in order to determine the VOC, toluene and methanol emission rates. Presented below are the average results of these tests.

### **North Scrubber Exhaust Stack:**

|                      |             |
|----------------------|-------------|
| Toluene Emissions:   | 0.070 lb/hr |
| Methanol Emissions:  | 3.570 lb/hr |
| Total VOC Emissions: | 6.857 lb/hr |

### **South Scrubber Exhaust Stack:**

|                      |             |
|----------------------|-------------|
| Toluene Emissions:   | 0.003 lb/hr |
| Methanol Emissions:  | 4.956 lb/hr |
| Total VOC Emissions: | 6.071 lb/hr |

## 2.0 INTRODUCTION

On February 7, 2020, The Stack Test Group, Inc. performed VOC, toluene and methanol emission testing on the north and south scrubber exhaust stacks at the American Chemical Solutions facility located in Muskegon, MI. Testing was performed to determine the emission rates of the above mentioned compounds.

Testing was conducted while American Chemical Solutions personnel operated the process at normal rate and the scrubbers at normal conditions.

Testing was supervised by Mr. Bill J. Byczynski, Mr. Ryan Schueller and Mr. Gary Kohnke of the Stack Test Group, Inc. Testing was coordinated by Mr. Matthew Kwiatkowski of the ERM. Testing was witnessed by Mr. David Patterson from EGGLE.

Testing was halted during test 1 for approximately 2.5 hours due to process related issues. Testing was resumed once the process was operating under stable conditions.

All testing followed the guidelines of U.S. EPA Reference Methods 1 through 4, 18 and 25A. This report contains a summary of results for the above mentioned tests and all the supporting field, process, and computer generated data.

## 3.0 SAMPLING AND ANALYTICAL PROCEDURES

### **3.1 Exhaust Gas Parameters**

#### **3.1.1 *Traverse and Sampling Points***

Testing was conducted on the north and south scrubber exhaust stacks. The number of velocity traverse and sample measurement points for each stack was determined using EPA Method 1.

The two exhaust stack inside diameters measured 23 inches. The test ports were located approximately 20 feet (greater than 2.0 diameters) downstream and 15 feet (greater than 0.5 equivalent diameters) upstream of the nearest flow disturbances. Velocity measurements were taken at each of 16 points, 8 points in each of the two ports set at 90 degrees to each other.

### ***3.1.2 Velocity Traverse***

Velocity measurements were performed during each emission test in accordance with EPA Method 2. An "S" type Pitot Tube with an attached type "K" thermocouple was used to conduct the velocity traverse.

### ***3.1.3 Gas Composition***

Gas composition for oxygen, carbon dioxide, and nitrogen was determined employing EPA Method 3. An integrated gas sample was collected during each emission test. Gas analysis was conducted using a calibrated Servomex Model 1440C O<sub>2</sub>/CO<sub>2</sub> analyzer.

### ***3.1.4 Moisture Content***

The north and south scrubber exhaust gas moisture content was determined using the wet bulb/dry bulb technique. The temperatures for the wet bulb/dry bulb are included on the field data sheets.

## **3.2 TOLUENE & METHANOL EMISSION TESTING**

### ***3.2.1 Sample Collection***

Testing on the north and south scrubber exhaust stacks for toluene and methanol was performed using U.S. EPA Reference Method 18. This method is titled:

U.S. EPA Reference Method 18      Measurement of Gaseous Organic Compound Emissions from Stationary Sources

A sample was transported to a set of charcoal and silica gel tubes through a Teflon line from the exhaust stack. The dry gas meter was calibrated prior to the test series. The pump was set at 0.50 liters per minute. Immediately following the test, the sample tubes were removed from the stack, capped-off, placed on ice and sent overnighted to the laboratory for analysis.

Samples were collected in duplicate with one set of tubes pre-spiked with a known amount of toluene and methanol.

### ***3.2.2 Sample Duration and Frequency***

The Method 18 samples were collected in triplicate with each test lasting sixty minutes in duration. Testing on the north and south exhaust stacks were conducted simultaneously.

### ***3.2.3 Calibrations***

All sampling equipment was calibrated according to the procedures outlined in EPA Reference Method 18.

### **3.2.4 Analytical Procedures**

The method 18 samples were analyzed by Bureau Veritas labs located in Novi, MI. The samples were analyzed per the specifications of U.S. EPA Reference Method 18. A recovery study following the guidelines of U.S. EPA Reference Method 18 was performed on the samples. The results of this recovery study is included in the laboratory Appendix of the report.

## **3.3 VOLATILE ORGANIC COMPOUND (VOC) TESTING**

### **3.3.1 Sample Collection**

Testing for total VOC's on the north and south scrubber exhaust stacks was performed using U.S. EPA Reference Method 25A. A J.U.M. Model 3-300 Flame Ionization Detector (FID) was used to determine the emission concentrations at each location. A sample was transported through a heated Teflon line from the exhaust stack and inlet duct to the FIDs which analyzed the samples continuously. The output signal from the FIDs were then recorded at one minute averages throughout the test. Copies of this data may be found in Appendix E.

At the beginning of the test series, the analyzers were calibrated and then checked for calibration error by introducing zero, low-range, mid-range and high-range calibration gases to the back of the analyzers. Before and after each individual test run, a system bias was performed by introducing a zero and mid-range propane calibration gas to the outlet of the probes. Calibration gases used were U.S. EPA Protocol 1 certified.

### **3.3.2 Sample Duration and Frequency**

The Method 25A train samples were collected in triplicate with each test lasting sixty minutes in duration. Testing on the north and south scrubber exhaust stacks was conducted simultaneously.

### **3.3.3 Calibrations**

All sampling equipment was calibrated according to the procedures outlined in EPA Reference Method 25A. Copies of the FID calibrations are included in Appendix D.

## **4.0 TEST RESULTS**

Presented in this section are the results of this test series. Test results are reported in Tables 4.1 and 4.2. Table 4.1 reports the results for the north scrubber exhaust including stack gas temperature, percent carbon dioxide and oxygen, percent moisture, molecular weight of the stack gas dry and wet, and flow rate in actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm).

Tables 4.1 also presents the VOC, toluene and methanol results for the north scrubber exhaust stack. The toluene and methanol results are presented in terms of pounds per dry standard cubic feet (lb/DSCF) and pounds per hour (lb/hr). The total VOC results are presented in terms of ppm as propane, lb/DSCF and lb/hr.

Table 4.2 presents the results for the south scrubber exhaust stack in the same manner and format as Table 4.1.

Copies of the calculations used to determine these emission rates may be found in Appendix A. Copies of the field data sheets are presented in Appendix B. Copies of the laboratory report are presented in Appendix E.

**Table 4.1**

VOC, Toluene & Methanol Results  
American Chemical Solutions  
Muskegon, MI  
02/07/20  
North Scrubber Exhaust Stack

| Test No:                          | T1       | T2       | T3       | Avg.     |
|-----------------------------------|----------|----------|----------|----------|
| Start Time:                       | 10:20 AM | 03:15 PM | 04:25 PM |          |
| Finish Time:                      | 02:55 PM | 04:15 PM | 05:25 PM |          |
| Stack Gas Temperature, oF:        | 54.8     | 57.0     | 57.6     | 56.5     |
| % Carbon Dioxide:                 | 0.0      | 0.0      | 0.0      | 0.0      |
| % Oxygen:                         | 20.60    | 20.60    | 20.60    | 20.60    |
| % Moisture:                       | 2.60     | 2.60     | 2.70     | 2.63     |
| Molecular Weight dry, lb/lb-Mole: | 28.82    | 28.82    | 28.82    | 28.82    |
| Molecular Weight wet, lb/lb-Mole: | 28.54    | 28.54    | 28.53    | 28.54    |
| <b>Velocity and Flow Results:</b> |          |          |          |          |
| Average Stack Gas Velocity FPS:   | 7.26     | 9.66     | 10.46    | 9.13     |
| Stack Gas Flow Rate, ACFM:        | 1,259    | 1,675    | 1,814    | 1,583    |
| Stack Gas Flow Rate, SCFM:        | 1,257    | 1,665    | 1,801    | 1,574    |
| Stack Gas Flow Rate, DSCF/HR:     | 73,438   | 97,299   | 105,127  | 91,955   |
| Stack Gas Flow Rate, DSCFM:       | 1,224    | 1,622    | 1,752    | 1,533    |
| <b>VOC Results:</b>               |          |          |          |          |
| PPM as Propane:                   | 183.9    | 671.3    | 918.3    | 591.2    |
| LBS/DSCF:                         | 2.10E-05 | 7.67E-05 | 1.05E-04 | 6.75E-05 |
| LBS/HR:                           | 1.583    | 7.658    | 11.330   | 6.857    |
| <b>Toluene Results:</b>           |          |          |          |          |
| Grains Per DSCF:                  | 4.62E-03 | 6.36E-03 | 4.95E-03 | 5.31E-03 |
| LBS/DSCF:                         | 6.61E-07 | 9.09E-07 | 7.08E-07 | 7.59E-07 |
| LBS/HR:                           | 0.049    | 0.088    | 0.074    | 0.070    |
| <b>Methanol Results:</b>          |          |          |          |          |
| Grains Per DSCF:                  | 3.04E-01 | 2.23E-01 | 2.94E-01 | 2.74E-01 |
| LBS/DSCF:                         | 4.34E-05 | 3.19E-05 | 4.20E-05 | 3.91E-05 |
| LBS/HR:                           | 3.187    | 3.105    | 4.418    | 3.570    |

**Table 4.2**

VOC, Toluene & Methanol Results  
American Chemical Solutions  
Muskegon, MI  
02/07/20  
South Scrubber Exhaust Stack

| Test No:                          | <u>T1</u> | <u>T2</u> | <u>T3</u> | <u>Avg.</u> |
|-----------------------------------|-----------|-----------|-----------|-------------|
| Start Time:                       | 10:20 AM  | 03:15 PM  | 04:25 PM  |             |
| Finish Time:                      | 02:55 PM  | 04:15 PM  | 05:25 PM  |             |
| Stack Gas Temperature, oF:        | 50.1      | 53.9      | 58.3      | 54.1        |
| % Carbon Dioxide:                 | 0.0       | 0.0       | 0.0       | 0.0         |
| % Oxygen:                         | 20.60     | 20.60     | 20.60     | 20.60       |
| % Moisture:                       | 2.50      | 2.50      | 2.50      | 2.50        |
| Molecular Weight dry, lb/lb-Mole: | 28.82     | 28.82     | 28.82     | 28.82       |
| Molecular Weight wet, lb/lb-Mole: | 28.55     | 28.55     | 28.55     | 28.55       |
| <b>Velocity and Flow Results:</b> |           |           |           |             |
| Average Stack Gas Velocity FPS:   | 14.98     | 12.01     | 14.98     | 13.99       |
| Stack Gas Flow Rate, ACFM:        | 2,598     | 2,083     | 2,598     | 2,426       |
| Stack Gas Flow Rate, SCFM:        | 2,617     | 2,082     | 2,575     | 2,425       |
| Stack Gas Flow Rate, DSCF/HR:     | 153,082   | 121,824   | 150,660   | 141,856     |
| Stack Gas Flow Rate, DSCFM:       | 2,551     | 2,030     | 2,511     | 2,364       |
| <b>VOC Results:</b>               |           |           |           |             |
| PPM as Propane:                   | 145.9     | 446.6     | 522.7     | 371.7       |
| LBS/DSCF:                         | 1.67E-05  | 5.10E-05  | 5.97E-05  | 4.25E-05    |
| LBS/HR:                           | 2.616     | 6.372     | 9.224     | 6.071       |
| <b>Toluene Results:</b>           |           |           |           |             |
| Grains Per DSCF:                  | 1.50E-04  | 1.72E-04  | 1.12E-04  | 1.45E-04    |
| LBS/DSCF:                         | 2.14E-08  | 2.46E-08  | 1.60E-08  | 2.07E-08    |
| LBS/HR:                           | 0.0033    | 0.0030    | 0.0024    | 0.0029      |
| <b>Methanol Results:</b>          |           |           |           |             |
| Grains Per DSCF:                  | 1.78E-01  | 2.40E-01  | 3.16E-01  | 2.45E-01    |
| LBS/DSCF:                         | 2.55E-05  | 3.43E-05  | 4.51E-05  | 3.49E-05    |
| LBS/HR:                           | 3.899     | 4.177     | 6.794     | 4.956       |