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**COMPLIANCE EMISSION TEST REPORT FOR ETHYLENE OXIDE ON THE  
SCRUBBER EXHAUST STACK AT THE VIANT FACILITY LOCATED IN GRAND  
RAPIDS, MICHIGAN**

**Prepared for:**

ERM  
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HOLLAND, MI 49424

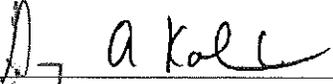
*NB796 TEST 00181206*

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DECEMBER 6, 2018  
STACK TEST GROUP PROJECT NO. 18-3116

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## 1.0 EXECUTIVE SUMMARY

On December 6, 2018, the Stack Test Group, Inc. performed ethylene oxide emissions testing at the Viant facility located in Grand Rapids, MI. Testing was conducted on the scrubber exhaust stack. Three tests were conducted on this unit under two different conditions. Three thirty minute test were performed in sterilization condition and three sixty minute tests were performed in aeration condition. Presented below are the average results of these tests.

### **Scrubber Exhaust Stack (Sterilization):**

Ethylene Oxide Emission Rate (Sterilization Stage): <0.006 lbs./hr.

### **Scrubber Exhaust Stack (Aeration):**

Ethylene Oxide Emission Rate (Aeration Stage): 0.3 ppm

## 2.0 INTRODUCTION

On December 6, 2018, the Stack Test Group, Inc. performed ethylene oxide emissions testing at the Viant facility located in Grand Rapids, MI.

The purpose of this testing was to determine the concentrations and emissions rates of the above mentioned parameters exhausting from the stack and to prove compliance with the operating permit serving this facility.

Testing was conducted while Viant personnel operated the process as close to maximum load as possible and at normal conditions.

Testing was supervised by Mr. Gary Kohnke of the Stack Test Group, Inc. and coordinated by Mr. Matthew Kwiatkowski of Environmental Resource Management (ERM). Mr. Tom Gasloli of the Michigan DNR was present to witness the testing.

All testing followed the guidelines of U.S. EPA Reference Methods 1 through 3 and 320. This report contains a summary of results for the above mentioned tests and all the supporting field, process, and computer generated data.

Testing was performed at: Viant  
520 Watson Street SW  
Grand Rapids, MI 49504

## 3.0 SAMPLING AND ANALYTICAL PROCEDURES

### **3.1 Exhaust Gas Parameters**

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

The number of velocity traverse and sample measurement points for each stack was determined using EPA Method 1.

**Scrubber Exhaust Stack:**

The stack (duct) inside diameter measured 18 inches. Velocity and sample measurements were taken at each of 12 points, 6 points across each of the two ports set at 90° to each other. The test ports were located approximately 150 inches (greater than 8.0 equivalent diameters) downstream and 40 inches (greater than 2.0 equivalent diameters) upstream of the nearest flow disturbances.

**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 and 320. An integrated gas sample was collected during each emission test. Gas analysis for carbon dioxide was determined using US EPA Method 320 while Oxygen was determined using a fyrite combustion analyzer.

**3.1.4 Moisture Content**

The exhaust gas moisture content was determined using EPA Method 320 for all tests.

**3.2 Ethylene Oxide****3.2.1 Sample Collection**

Ethylene Oxide emissions were determined using U.S. EPA Reference Methods 1, 2, 3, 4 and 320.

Method 1	Sample and Velocity Traverses for Stationary Sources.
Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate
Method 3	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight
Method 4	Determination of Moisture Content from Stationary Sources
Method 320	Vapor Phase Organic and Inorganic Emissions by Extractive FTIR

**3.2.2 Sample Duration and Frequency**

The samples were collected in triplicate with each test lasting thirty minutes in duration while in sterilization stage and sixty minutes in duration while in aeration stage.

**3.2.3 Calibration**

The sampling equipment was calibrated according to the procedures outlined in US EPA Method 320.

**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 stack gas conditions in purge stage for the scrubber exhaust stack including stack gas temperature, percent carbon dioxide and

oxygen, percent moisture, molecular weight of the stack gas dry and wet, velocity in feet per second (fps), and flow rate in actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm).

Table 4.1 also presents the ethylene oxide results in grains per dry standard cubic feet (grains/DSCF), pounds per dry standard cubic feet (lb/dscf) and pounds per hour (lb/hr).

Table 4.2 reports the stack gas conditions in aeration stage for the scrubber exhaust stack including stack gas temperature, percent carbon dioxide and oxygen, percent moisture, molecular weight of the stack gas dry and wet, velocity in feet per second (fps), and flow rate in actual cubic feet per minute (acfm), standard cubic feet per minute (scfm), and dry standard cubic feet per minute (dscfm).

Table 4.2 also presents the ethylene oxide results during aeration stage in ppm.

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 analytical results are presented in Appendix D. Copies of equipment calibrations are presented in Appendix E.

**Table 4.1**

Ethylene Oxide Results  
Viant  
Grand Rapids, MI  
12/06/18

Scrubber Outlet (Sterilization Vent Condition)

Test No:	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>Avg.</u>
Start Time:	08:07 AM	12:23 PM	04:17 PM	
Finish Time:	08:37 AM	12:53 PM	04:47 PM	
Stack Gas Temperature, degrees F:	65.17	70.67	71.75	69.2
% Carbon Dioxide:	0.1	0.1	0.1	0.1
% Oxygen:	21.0	21.0	21.0	21.0
% Moisture:	2.50	2.50	2.50	2.50
Molecular Weight dry, lb/lb-Mole:	28.86	28.86	28.86	28.86
Molecular Weight wet, lb/lb-Mole:	28.59	28.59	28.59	28.59
<b>Velocity and Flow Results:</b>				
Average Stack Gas Velocity FPS:	28.99	25.01	26.80	26.93
Stack Gas Flow Rate, ACFM:	3,079	2,656	2,846	2,860
Stack Gas Flow Rate, SCFM:	3,042	2,597	2,777	2,805
Stack Gas Flow Rate, DSCF/HR:	177,930	151,911	162,453	164,098
Stack Gas Flow Rate, DSCFM:	2,966	2,532	2,708	2,735
<b>Ethylene Oxide Results:</b>				
PPM as Ethylene:	<0.3	<0.3	<0.3	<0.3
LBS/DSCF	<3.43E-8	<3.43E-8	<3.43E-8	<3.43E-8
LBS/HR:	<0.006	<0.005	<0.006	<0.006

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**Table 4.2**

Ethylene Oxide Results  
 Vlant  
 Grand Rapids, MI  
 12/06/18

Scrubber Outlet (Aeration Cell Vent Condition)

Test No:	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>Avg.</u>
Start Time:	08:46 AM	01:05 PM	04:56 PM	
Finish Time:	09:46 AM	02:05 PM	05:56 PM	
Stack Gas Temperature, degrees F:	62.58	71.00	70.92	68.2
% Carbon Dioxide:	0.1	0.1	0.1	0.1
% Oxygen:	21.0	21.0	21.0	21.0
% Moisture:	2.50	2.50	2.50	2.50
Molecular Weight dry, lb/lb-Mole:	28.86	28.86	28.86	28.86
Molecular Weight wet, lb/lb-Mole:	28.59	28.59	28.59	28.59
<b>Velocity and Flow Results:</b>				
Average Stack Gas Velocity FPS:	19.04	30.14	28.63	25.94
Stack Gas Flow Rate, ACFM:	2,022	3,201	3,041	2,754
Stack Gas Flow Rate, SCFM:	2,007	3,126	2,971	2,701
Stack Gas Flow Rate, DSCF/HR:	117,400	182,895	173,817	158,037
Stack Gas Flow Rate, DSCFM:	1,957	3,048	2,897	2,634
<b>Ethylene Oxide Results:</b>				
PPM as Ethylene:	0.3	0.3	0.3	0.3