

**REPORT OF PARTICULATE & CARBON MONOXIDE EMISSION TESTING ON
THE EUDRYER EXHAUST STACK & PARTICULATAE/PM-10 TESTING ON THE
EU COOLING EXHAUST STACK AT MICHIGAN WOOD FUELS, LLC FACILITY
LOCATED IN HOLLAND, MI**

Prepared for:

ENVIRONMENTAL RESOURCES MANAGEMENT
3352 128th AVENUE
HOLLAND, MICHIGAN 49424

Prepared by:

STACK TEST GROUP, INC.
1500 BOYCE MEMORIAL DRIVE
OTTAWA, ILLINOIS 61350

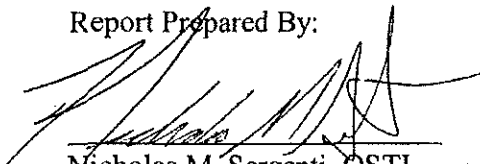
RECEIVED

NOV 17 2016

AIR QUALITY DIV.

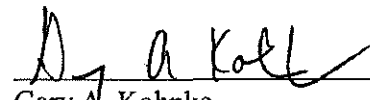
SEPTEMBER 13, 2016
STACK TEST GROUP, INC. PROJECT NO. 16-2858

Report Prepared By:



Nicholas M. Sergenti, QSTI
Project Manager

Report Reviewed By:



Gary A. Kohnke
Project Manager

RECEIVED

NOV 17 2016

AIR QUALITY DIV.

1.0 EXECUTIVE SUMMARY

On September 13, 2016, The Stack Test Group, Inc. performed particulate and carbon monoxide (CO) emission testing on the EUDRYER exhaust stack and particulate/PM-10 on the EUCOOLING exhaust stack. All testing was performed at the Michigan Wood Fuels, LLC facility in Holland, MI. Three tests were conducted on each exhaust stack for the above mentioned parameters. A fourth test for particulate was conducted on the EUDRYER stack due to a failed leak check on test run number 3. Only test runs 1, 2, and 4 are used in the average. Presented below are the average results of these tests.

EUDRYER Exhaust:

Particulate Concentration:	0.0496 Grains per Dry Standard Cubic Feet
Particulate Emission Rate:	20.170 Pounds per Hour
Particulate Concentration:	0.094 Pounds per 1000 Pounds of Exhaust Gas
Carbon Monoxide Concentration:	24.4 Parts per Million
Carbon Monoxide Emission Rate:	5.01 Pounds per Hour

Particulate Limit:	0.10 Pounds per 1000 Pounds of Exhaust Gas
Carbon Monoxide Limit:	19.13 Pounds per Hour

EUCOLING Exhaust:

Particulate Concentration:	0.0068 Grains per Dry Standard Cubic Feet
Particulate Emission Rate:	0.0552 Pounds per Hour
Total Particulate/PM-10 Concentration:	0.0088 Grains per Dry Standard Cubic Feet
Total Particulate/PM-10 Emission Rate:	0.719 Pounds per Hour

PM-10 Limit:	0.165 Pounds per Hour
--------------	-----------------------

2.0 INTRODUCTION

The Stack Test Group, Inc. conducted particulate and carbon monoxide emissions testing on the EUDRYER exhaust stack and particulate/PM-10 on the EUCOOLING exhaust stack. Testing was performed at the Michigan Wood Fuels, LLC facility located in Holland, MI. Testing was conducted on September 13, 2016. The purpose of this testing was to determine the concentrations and emissions rates of the above listed parameters exhausting from the stack and to prove compliance with the existing permit. The permit number of the facility is 354-06H

Testing was supervised:
Mr. Nicholas M. Sergenti, QSTI
Project Manager

Stack Test Group, Inc.
1500 Boyce Memorial Dr.
Ottawa, IL 61350
(815) 433-0545

Testing was coordinated by:
Mr. Matt Kwiatkowski
Environmental Resources Management
3352 128th Avenue
Holland, MI 49424
(616) 738-7535

All testing followed the guidelines of U.S. EPA Reference Methods 1 through 5, 10, and 202. This report contains a summary of results for the above mentioned tests and all the supporting field, process, and computer generated data.

Testing was conducted while Michigan Wood Fuels, LLC personnel operated the processes at normal conditions and as close to the maximum rate as possible. A copy of the the operating data is included in Appendix F.

3.0 SAMPLING AND ANALYTICAL PROCEDURES

3.1 **Exhaust Gas Parameters**

3.1.1 *Traverse and Sampling Points*

Testing was conducted on the exhaust stack of the EUDRYER. The number of velocity traverse and sample measurement points the stack were determined using EPA Method 1. Velocity and sample measurements were taken at each of 12 points, 6 points in each of the 2 ports set at 90 degrees to each other. The diameter of the stack is 48 inches. Test ports were located 50 feet (12.5 diameters) downstream and 20 feet (5 diameters upstream) the nearest flow disturbance.

Testing was conducted on the exhaust stack of the EUCOOLING. The number of velocity traverse and sample measurement points the stack were using EPA Method 1. Velocity and sample measurements were taken at each of 24 points, 12 points in each of the 2 ports set at 90 degrees to each other. The diameter of the stack is 24 inches. Test ports were located 126 inches (5.25 diameters) downstream and 18 inches (0.75 diameters upstream) the nearest flow disturbance.

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 3A. A continuous gas sample was collected during each EUDRYER emission test. Gas analysis was conducted using a calibrated Servomex O₂/CO₂ analyzer. An integrated gas sample was collected during each EUCCOOLING emissions test. Gas Analysis was conducted using a Fyrite.

3.1.4 Moisture Content

The exhaust gas moisture content was determined using EPA Method 4 for all tests. Moisture content was determined by drawing the gas sample through four impingers in the sample train. Volumetric analysis was used to measure the condensed moisture in the first three impingers while gravimetric analysis of silica gel was used to measure moisture collected in the fourth impinger.

3.2 Particulate and PM-10

3.2.1 Sample Collection

Particulate and PM-10 emissions were determined following the guidelines of USEPA Reference Methods 1,2,3,4,5 and 202. These Methods are titled:

Method 1	Sample and Velocity Traverses for Stationary Sources
Method 2	Determination of Stack Gas Velocity and Volumetric Flow Rate (Type "S" Pitot Tube)
Method 3	Gas Analysis for Carbon Dioxide, Oxygen, Excess Air and Dry Molecular Weight
Method 4	Determination of Moisture Content from Stationary Sources
Method 5	Determination of Particulate Emissions from Stationary Sources
Method 202	Determination of Condensable Particulate Emissions from Stationary Sources

These methods appear in detail in Title 40 of the Code of Federal Regulations (CFR), Part 60, Appendix A.

The Method 5/202 sampling train consisted of the following components.

1. Appropriately sized nozzle
2. Sample probe with heated glass liner
3. Heated glass fiber filter
4. Condenser Coil
5. Five impingers in an insulated ice water bath in the following sequence:
 - A. Modified Greenburg-Smith design empty.
 - B. Greenburg-Smith design empty.
Teflon Filter (Unheated)
 - C. Modified Greenburg-Smith design containing 100 ml DI H₂O.
 - D. Modified Greenburg-Smith design containing 100 ml DI H₂O.
 - E. Known amount of silica gel.

5. Sampling gas measuring system.

3.2.2 Sample Duration and Frequency

Three Method 5/202 train samples were collected with each test lasting 60 minutes in duration. A minimum sample size of 30 dry standard cubic feet (dscf) was collected for each test.

3.2.3 Sample Recovery

Upon completion of each test the sampling train was removed from the stack. The probe, nozzle, and prefilter glassware were rinsed and brushed with acetone and placed into a labeled container. The filter was placed into a separate container. The first two impingers were weighed for moisture gain. The impinger sampling train was then purged with nitrogen at a rate of 20 liters per minute for one hour. The contents of the first two impingers were put into a labeled sample container. The first two impingers were then rinsed with acetone and placed into a separate sample container. The first two impingers and all connecting glassware were then rinsed with hexane and placed into a separate sample container. The Teflon filter was placed into a separate sample container. The contents of impingers 3,4 and 5 were weighed for moisture gain.

Note that the EU-COOLING exhaust stack did not have any visible moisture therefore the purging step was skipped per Method 202.

3.2.4 Analytical Procedures

The total particulate mass was determined by adding the weight of the particulate from the prefilter wash with the particulate on the filter. This was added to the condensable particulate weight.

The acetone wash containing the particulate from the prefilter wash was placed into a tared beaker, evaporated to dryness, desiccated for 24 hours, then weighed in 6 hour intervals to a constant weight.

The tared glass fiber filter was desiccated for 24 hours, then weighed every six hours to constant weight.

3.2.5 Blanks

Blanks for the Method 5/202 train were prepared by recovering an acetone, water and a methylene chloride sample in the same manner listed above.

3.2.6 Calibrations

All sampling equipment was calibrated according to the procedures outlined in EPA Reference Method 5/202.

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 present the stack gas conditions 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 results of the particulate (PM) and carbon monoxide (CO). The particulate results are presented in grains per dry standard cubic feet (grains/DSCF), pounds per dry standard cubic feet (lbs/DSCF), pounds per hour (lbs/hr), and pounds per thousand pounds of exhaust gas (lbs/1000 lbs of exhaust gas).

Table 4.2 presents the results for the EU-COOLING exhaust stack. The auxiliary results are presented in the same manner and format as Table 4.1. The particulate/PM-10 results are presented in terms of grains per dry standard cubic feet (grains/DSCF), pounds per dry standard cubic feet (lbs/DSCF), and pounds per hour (lbs/hr) for both the filterable and total (filterable and condensable) portions of the sampling train.

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

Table 4.1

Particulate and CO Test Results
 Michigan Wood Fuels, LLC
 Holland, MI
 09/13/16

EUDRYER Exhaust

Test No:	T1	T2	T4	Avg.
Start Time:	09:00 AM	11:50 AM	03:55 PM	
Finish Time:	10:06 AM	12:54 PM	04:58 PM	
Stack Gas Temperature, degrees F:	139.83	140.83	141.58	140.75
% Carbon Dioxide:	1.0	1.0	1.0	1.0
% Oxygen:	20.0	19.9	19.7	19.9
% Moisture:	15.10	15.74	16.11	15.65
Molecular Weight dry, lb/lb-Mole:	28.96	28.96	28.95	28.95
Molecular Weight wet, lb/lb-Mole:	27.31	27.23	27.19	27.24
Velocity and Flow Results:				
Average Stack Gas Velocity FPS:	87.39	86.31	85.27	86.32
Stack Gas Flow Rate, ACFM:	65,910	65,095	64,311	65,105
Stack Gas Flow Rate, SCFM:	56,970	56,153	55,407	56,177
Stack Gas Flow Rate, DSCF/HR:	2,902,038	2,838,867	2,788,863	2,843,256
Stack Gas Flow Rate, DSCFM:	48,367	47,314	46,481	47,388
Filterable Particulate Results:				
Grains Per DSCF:	0.0558	0.0424	0.0507	0.0496
LBS/DSCF:	7.97E-06	6.06E-06	7.24E-06	7.09E-06
LBS/HR:	23.131	17.190	20.188	20.170
LBS/1000LBS of Exhaust Gas:	0.106	0.081	0.096	0.094
Total Particulate Results:				
Grains Per DSCF:	0.0584	0.0473	0.0535	0.0531
LBS/DSCF:	8.35E-06	6.76E-06	7.65E-06	7.59E-06
LBS/HR:	24.239	19.190	21.324	21.584
Carbon Monoxide Results:				
PPM dry:	10.7	19.5	43.1	24.4
LBS/DSCF:	7.78E-07	1.42E-06	3.13E-06	1.78E-06
LBS/HR:	2.26	4.02	8.74	5.01

Table 4.2

Particulate/PM-10 Test Results
Michigan Wood Fuels, LLC
Holland, MI
09/13/16

EUCOOLING Exhaust

Test No:	T1	T2	T3	Avg.
Start Time:	08:04 AM	11:35 AM	01:58 PM	
Finish Time:	09:08 AM	12:36 PM	02:59 PM	
Stack Gas Temperature, degrees F:	123.65	140.08	145.67	136.47
% Carbon Dioxide:	0.0	0.0	0.0	0.0
% Oxygen:	20.5	20.5	20.5	20.5
% Moisture:	1.97	2.28	2.26	2.17
Molecular Weight dry, lb/lb-Mole:	28.82	28.82	28.82	28.82
Molecular Weight wet, lb/lb-Mole:	28.61	28.57	28.58	28.59
Velocity and Flow Results:				
Average Stack Gas Velocity FPS:	57.61	60.82	58.72	59.05
Stack Gas Flow Rate, ACFM:	10,854	11,458	11,063	11,125
Stack Gas Flow Rate, SCFM:	9,655	9,914	9,483	9,684
Stack Gas Flow Rate, DSCF/HR:	567,873	581,257	556,121	568,417
Stack Gas Flow Rate, DSCFM:	9,465	9,688	9,269	9,474
Filterable Particulate Results:				
Grains Per DSCF:	0.0075	0.0073	0.0055	0.0068
LBS/DSCF:	1.07E-06	1.05E-06	7.84E-07	9.68E-07
LBS/HR:	0.608	0.610	0.436	0.552
Total Particulate/PM-10 Results:				
Grains Per DSCF:	0.0107	0.0082	0.0076	0.0088
LBS/DSCF:	1.54E-06	1.18E-06	1.08E-06	1.26E-06
LBS/HR:	0.872	0.685	0.600	0.719