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REPORT FOR PARTICULATE MATTER AND PARTICULATE MATTER LESS THEN TEN MICRONS TESTING ON THE EXHAUST STACKS ASSOCIATED WITH THE FG-GRINDER/DRYER AND THE EU-BAGHOUSE AT THE KIRTLAND PRODUCTS FACILITY LOCATED IN BOYNE CITY, MICHIGAN

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STACK TEST GROUP, INC. PROJECT NO. 16-2867

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1.0 EXECUTIVE SUMMARY

On November 10, 2016 The Stack Test Group, Inc. performed PM/PM10 testing on the exhaust stacks associated with the FG-Grinder/Dryer and the EU-Baghouse at the Kirtland Products facility located in Boyne City, MI. Three one-hour tests were conducted on these sources to determine the emission rate and to prove compliance with the existing permit.

FG-Grinder/Dryer Results:

PM/PM10 Emission Rate:	7.80	lbs/hour
PM/PM10 Emission Rate:	0.060	lbs/1000 lbs.

EU-Baghouse Results:

PM10 Emission Rate:	0.04	lbs/hour
PM/PM10 Emission Rate:	0.004	lbs/1000 lbs.

INTRODUCTION

On November 10, 2016 The Stack Test Group, Inc. performed particulate (PM/PM10) emissions testing on the exhaust stacks associated with the FG-Grinder/Dryer and the EU-Baghouse at the Kirtland Products facility located in Boyne City, MI. Testing was performed to calculate the PM/PM10 emissions rate of these sources associated with this facility.

Testing was conducted while Kirtland Products personnel operated these sources as close to maximum rate as possible and at normal conditions.

Testing was supervised by Mr. Gary Kohnke of the Stack Test Group, Inc. Testing was coordinated by Mr. Mathew Kwiatkowski of ERM. Mr. Robert Dickman of the Department of Environmental Quality (DEQ) was present to witness the testing.

All testing followed the guidelines of U.S. EPA Reference Methods 1 through 5 and 202. 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 FG-Grinder/Dryer exhaust stack. The number of velocity traverse and sample measurement points for the stack was determined using EPA Method 1. The test ports were located approximately 252 inches (6.3 equivalent diameters) downstream and 192 inches (4.8 equivalent diameter) upstream of the nearest flow disturbance. The stack inside diameter measured 40 inches. Velocity and particulate measurements were taken at each of 24 points, 12 points across each of the 2 ports set horizontally to each other.

Testing was conducted on the EU-Baghouse exhaust. The number of velocity traverse and sample measurement points for the stack was determined using EPA Method 1. The test ports were located approximately 41 inches (2.0 equivalent diameters) downstream and at least 360 inches (17.6 equivalent diameters) upstream of the nearest flow disturbance. The stack inside diameter measured 20.5 inches. Velocity and particulate measurements were taken at each of 24 points, 12 points across each of the 2 ports set horizontally to each other.

3.1.2 Velocity Traverse

Velocity measurements were performed during each 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 test. Gas analysis was conducted using fyrite analyzer.

3.1.4 Moisture Content

The exhaust gas moisture content was determined using EPA Method 4 for all tests. Moisture content was determined by using the particulate train.

3.1.5 Particle Sizing Analysis (PM10/2.5)

Samples were prepared for analysis in accordance with MVA SOP 310. "Sample Preparation Methods for Total Particle Sizing Using Microscopical Techniques"

3.2 EMISSION RATE TESTING (METHOD 5/202)

3.2.1 Sample Collection

Method 5/202: Determination of Direct and Indirect Particulate Emissions from Stationary Sources.

Particulate 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 (Standard Type 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 Matter 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. Glass lined probe heated to 248 ± 25°F.
3. Heated glass fiber filter to 248 ± 25°F.
4. Condenser, Drop out Impinger, 2 Modified Greenburg-Smith Impingers, Teflon CPM Filter in a dual insulated ice water bath in the following sequence:
   A. Method 202 Vertical Condenser.
   B. Method 23 Knockout Impinger.
   C. Modified Greenburg-Smith Impinger Empty.
   D. Glass Filter Assembly Containing a Teflon Filter.
   E. Modified Greenburg-Smith Impinger with 100 mls of Water.
   F. Known Amount of Silica Gel.
5. Sampling gas measuring system.

The Method 5 sampling train consisted of the following components.

1. Appropriately sized nozzle.
2. Glass lined probe unheated.
3. Unheated glass fiber filter.
4. Four impingers in an insulated ice water bath in the following sequence:
   A. Modified Greenburg-Smith design containing 100 mls. of water.
   B. Greenburg-Smith design containing 100 mls. of water.
   C. Modified Greenburg-Smith design empty.
   D. Known amount of Silica Gel
5. Sampling gas measuring system.

3.2.2 Sample Duration and Frequency

The method 5 and 5/202 trains were collected in triplicate with each test lasting sixty minutes in duration.

3.2.3 Calibrations

All sampling equipment was calibrated according to the procedures outlined in EPA Reference Method 5 and 202. Copies of the calibrations are included in Appendix E.

3.2.4 Sample Recovery

Upon completion of each test the sampling train was removed from the stack. The probe, nozzle, and prefilter glassware were rinsed, brushed and placed into a labeled container. The filter was placed into a separate container. The impingers were weighed for moisture

gain and purged with nitrogen for 1 hour at 17 liters per minute. The contents of the impingers were placed into a separate container along with the DI rinses of the impingers. The impingers were then rinsed with acetone and hexane and placed into a separate container. The CPM filter was placed in a separate container.

3.2.5 Particle Sizing Duration and Frquency

Sample collection for the particle sizing was done for 5 minutes at a known average delta H. The train was set at a average point in the stack and collected on a poly carbon filter. The filter was then put in a labeled petri and sealed. The poly carbon filter were collected in triplicate with each test lasting five minutes in duration. The filter was then sent to MVA Scientific Consultants for analysis.

4.0 TEST RESULTS

Presented in this section are the results of this test series. Test results are reported in Tables 4.1 through 4.2. Table 4.1 reports the results for the FG-Grinder/Dryer exhaust testing 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 in pounds per hour (lbs./hr), pounds per 1000 pounds of stack gas and grains per DSCF.

Table 4.2 presents the results for the EU-Baghouse 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 field parameter sheets are presented in Appendix C. Copies of equipment calibrations are presented in Appendix D. Copies of the analytical results are presented in Appendix E.

Table 4.1

Particulate (PM/PM10) Results
Kirtland Products
Boyne City, MI
11/10/16

FG-Grinder/Dryer Exhaust

Test No:	T2	T3	T4	Avg.
Start Time:	10:46 AM	12:40 PM	02:18 PM	
Finish Time:	11:56 AM	01:47 PM	03:27 PM	
Stack Gas Temperature, degrees F:	113.00	110.75	111.29	111.7
% Carbon Dioxide:	0.0	0.0	0.0	0.0
% Oxygen:	20.0	20.0	20.0	20.0
% Moisture:	13.95	13.45	14.58	13.99
Molecular Weight dry, lb/lb-Mole:	28.80	28.80	28.80	28.80
Molecular Weight wet, lb/lb-Mole:	27.29	27.35	27.23	27.29
Velocity and Flow Results:				
Average Stack Gas Velocity FPS:	71.65	70.05	70.25	70.65
Stack Gas Flow Rate, ACFM:	37,530	36,692	36,797	37,006
Stack Gas Flow Rate, SCFM:	33,797	33,172	33,236	33,402
Stack Gas Flow Rate, DSCF/HR:	1,744,934	1,722,645	1,703,396	1,723,658
Stack Gas Flow Rate, DSCFM:	29,082	28,711	28,390	28,728
PM/PM10 Results:				
Grains Per DSCF:	0.0344	0.0339	0.0266	0.0316
LBS/DSCF:	4.91E-06	4.85E-06	3.80E-06	4.52E-06
LBS/HR:	8.57	8.36	6.47	7.80
LBS/1000 LBS of Gas:	0.065	0.065	0.051	0.060

Table 4.2

Particulate (PM/PM10) Results
Kirtland Products
Boyne City, MI
11/10/16

EU-Baghouse Exhaust

Test No:	T1	T2	T3	Avg.
Start Time:	08:30 AM	10:02 AM	11:25 AM	
Finish Time:	09:33 AM	11:05 AM	12:28 PM	
Stack Gas Temperature, degrees F:	73.17	78.38	80.46	77.3
% Carbon Dioxide:	0.0	0.0	0.0	0.0
% Oxygen:	21.0	21.0	21.0	21.0
% Moisture:	1.38	1.19	1.25	1.27
Molecular Weight dry, lb/lb-Mole:	28.84	28.84	28.84	28.84
Molecular Weight wet, lb/lb-Mole:	28.69	28.71	28.70	28.70
Velocity and Flow Results:				
Average Stack Gas Velocity FPS:	71.34	72.06	72.63	72.01
Stack Gas Flow Rate, ACFM:	9,802	9,901	9,979	9,894
Stack Gas Flow Rate, SCFM:	9,470	9,473	9,511	9,485
Stack Gas Flow Rate, DSCF/HR:	560,372	561,630	563,552	561,852
Stack Gas Flow Rate, DSCFM:	9,340	9,361	9,393	9,364
PM Results:				
Grains Per DSCF:	0.0022	0.0012	0.0021	0.0018
LBS/DSCF:	3.17E-07	1.67E-07	3.06E-07	2.63E-07
LBS/HR:	0.18	0.09	0.17	0.15
LBS/1000 LBS of Gas:	0.004	0.002	0.004	0.004
PM/10 Results:				
Percent of PM10:	14.9%	9.2%	52.4%	25.5%
LBS/HR:	0.03	0.008	0.09	0.04