Results of the October 14 and 20, 2014 Compliance Tests on the EU-Dryer Exhaust Stack and EU-Raw Material Baghouse at Michigan Renewable Carbon Located in Gwinn, Michigan

EU-Dryer
EU-Raw Material

SV-Exhaust
SV-BH 666

Permit to Install No. 24-12A
Barr Project 22521140.12

Prepared for
Michigan Renewable Carbon
Gwinn, Michigan

December 2014

Report Certification

Certification of Sampling Procedures:

I certify that the sampling procedures were performed in accordance with the approved test plan and that the data presented in this test report are, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below

12/10/14

Thomas Leier
Air Quality Technician
Barr Engineering Company

Date

Certification of Analytical Procedures:

I certify that the analytical procedures were performed in accordance with the requirements of the test methods and that the data presented for use in the test report were, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below

12/10/14

Matt Morrison
Air Quality Technician
Barr Engineering Company

Date

Certification of Test Report by Testing Company:

I certify that this test report and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the test information submitted. Based on my inquiry of the person or persons who performed sampling and analysis relating to the performance test, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.

12/10/2014

Tom Kuchinski
Sr. Air Quality Technician
Barr Engineering Company

Date

Certification of Test Report by Owner or Operator of Emission Facility:

I certify that the information submitted in this test report accurately reflects the operating conditions at the emission facility during this performance test and describes the date and nature of all operational and maintenance activities that were performed on the process and control equipment during the month prior to the performance test. Based on my inquiry of the person or persons who performed the operational and maintenance activities, the information submitted in this test report is, to the best of my knowledge and belief, true, accurate, and complete. All exceptions are listed and explained below.

Dan Hendrickson
Plant Manager
Michigan Renewable Carbon

12-17-14
Date

Executive Summary

Barr Engineering Co. performed emissions tests on the EU-Dryer exhaust stack (SV-EXHAUST) and EU-Raw Material baghouse (SV-BH 666) at Michigan Renewable Carbon located in Gwinn, Michigan. On October 14, 2014 testing was performed on the EU-Raw Material baghouse (SV-BH 666) for the determination of particulate matter (PM). Testing was performed on October 20, 2014 on the EU-Dryer exhaust stack (SV-EXHAUST) for the determination of particulate matter (PM), particulate matter less than 10 microns (PM_{10}), nitrogen oxides (NO_X), carbon monoxide (CO), volatile organic compounds (VOC), hydrogen chloride (HCl) and methanol (MeOH) emissions. An opacity determination was made at each source by a certified visible observer. This testing was performed to demonstrate compliance with the permitted emission limits listed in Permit to Install 24-12A.

Table ES-1 on the following page summarizes the test results and provides applicable emission limits (Permit to Install 24-12A)

Table ES-1 Executive Summary Table

TEST PARAMETER EPA Methods 1-4, 5/202, 7E, 9, 10, 25A, 26 and 308	EU – Raw Material	EU – Dryer
Stack Vent ID	**SV-BH 666**	**SV-EXHAUST**
Test Date	**10/14/14**	**10/20/14**
Volumetric Airflow Rate		
ACFM	36,300	46,500
SCFM	35,100	30,100
DSCFM	34,600	20,100
Particulate Matter		
PM Emission Rate (Filterable), lb/hr	0.39	9.9
PM Emission Rate (Filterable), lb/1000 lb gas	0.0025	0.082
PM_{10} Emission Rate (Dry Catch + Organic + Inorganic), lb/hr	--	10.0
PM Emission Limit, lb/hr	*4.22*	*11.45*
PM Emission Limit, lb/1000 lb exhaust gas	*0.017*	*0.09*
PM_{10} Emission Limit, lb/hr(1)	*4.22*	*20.5*
Nitrogen Oxides (NO_X)		
Concentration, ppm (dry basis)	--	28.7
Emission Rate, lb/hr	--	4.1
Nitrogen Oxides (NO_X) Emission Limit, lb/hr	--	*46.2*
Carbon Monoxide (CO)		
Concentration, ppm (dry basis)	--	22.8
Emission Rate, lb/hr	--	2.0
Carbon Monoxide (CO) Emission Limit, lb/hr	--	*23.1*
Volatile Organic Compounds (VOC)		
Concentration (as Carbon), ppm (wet basis)	--	22.2
Emission Rate (as Carbon), lb/hr(2)	--	1.3
Non-Methane Organic Compounds (NMOC) Limit, lb/hr	--	*23.1*
Hydrogen Chloride (HCl)		
Emission Rate, lb/hr	--	0.008 J
Hydrogen Chloride Emission Limit, lb/hr	--	*2.1*
Methanol		
Emission Rate, lb/hr	--	0.047 J
Visible Emissions		
% Opacity	0	0
Opacity Limit, % Highest 6 minute average	*10*	*20*

(1) All filterable PM is assumed to be less than or equal to 10 microns (PM_{10})

(2) Methane was not removed from the total VOC concentration to demonstrate compliance with the NMOC limit

Note:

"J" indicates that the value is between the Minimum Detection Limit (MDL) and the Limit of Quantification (LOQ)

1.0 Introduction

Barr Engineering Co. performed emissions tests on the EU-Dryer exhaust stack (SV-EXHAUST) and EU-Raw Material baghouse (SV-BH 666) at the Michigan Renewable Carbon facility located in Gwinn, Michigan on October 14 and 20, 2014. The tests were performed to comply with the facility Permit to Install 24-12A.

A test plan was submitted to the Michigan Department of Environmental Quality (MDEQ) on August 19, 2014. An approval of the original testing protocol for testing on October 14-16, 2014 was given on September 24, 2014. Testing on the EU-Dryer exhaust stack (SV-EXHAUST) was completed on October 20, 2014 due to process malfunction on the original test date. Email communication related to the test rescheduling, copies of the stack testing protocol and the testing protocol approval letter are located in Appendix I.

Thomas Leier of Barr Engineering lead the test team. Dan Hendrickson of Michigan Renewable Carbon provided the coordination of the Barr test team with facility operations. Joe Scanlon and Jeremy Howe of the MDEQ were on site to witness testing activities. A list of project participants is provided in Appendix J.

The testing at the EU-Raw Material baghouse (SV-BH 666) consisted of three one-hour runs for the determination of filterable particulate matter. The testing at the EU-Dryer exhaust stack (SV-EXHAUST) consisted of three one-hour runs for the determination of particulate matter (PM), particulate matter less than 10 microns (PM10), nitrogen oxides (NOX), carbon monoxide (CO), volatile organic compounds (VOC), hydrogen chloride (HCl) and methanol (MeOH) emissions. PM_{10} emissions were determined using EPA Method 5 and EPA Method 202 with the assumption that all filterable particulate matter is less than or equal to 10 microns (PM_{10}). A one hour opacity test was performed during the first particulate matter test run at each location.

Test results are presented in the following section. Field data and laboratory data along with supporting documentation are located in the appendices.

Table 1 Emission Source Information

Name of source group				
Source/Emissions Unit (Plant or process descriptor)	**Control Equipment**	**Stack Vent**	**Process Rates**	**Applicable Rule**
EU-Raw Material	CE-BH 666	SV-BH 666	48 green tons/hr	Permit to Install 24-12A
EU-Dryer	Multiclones and Thermal Oxidizer	SV-Exhaust	24 dry tons/hr 25 MMBTU/hr (Natural Gas) 44 MMBTU/hr (wood dust)	Permit to Install 24-12A

2.0 Results

Pollutant emission rate results are reported in pound per hour (lb/hr). PM is also reported in pound per 1000 lb exhaust gas (lb/1000 lb exhaust gas). Emission rates are provided in the Executive Summary and in the tables. Applicable emission limits are provided in the Executive Summary table.

2.1 EU-Raw Material baghouse (SV-BH 666)

Testing on the EU-Raw Material baghouse (SV-BH 666) was performed on October 14, 2014 and results are summarized in Table 1. EPA Method 202 was not performed to determine condensable particulate matter (CPM) because the stack gas temperature was below 85 degrees Fahrenheit. During port change on run one the cyclone bypass broke and was replaced. The train was leak checked and sampling continued. The broken cyclone bypass was recovered and included in the sample. The particulate matter test emission results are in compliance with permit limits.

2.2 EU-Dryer exhaust stack (SV-EXHAUST)

Results of the October 20, 2014 testing on the EU-Dryer exhaust stack (SV-EXHAUST) are provided in Tables 2-5. Table 2 summarizes the test results for filterable PM and PM_{10} emission rates and opacity. Table 3 summarizes the NO_X, CO and VOC concentrations and emission rates. VOC is reported as propane and as carbon. The parameter for VOC concentration in Permit to Install 24-12A is listed as Non-Methane Organic Compounds (NMOC). Methane concentration was not determined, thus an NMOC value was not determined by subtraction from the VOC results. The VOC emission rate as carbon in lb/hr was used as a conservative comparison to the NMOC limit. Table 4 summarizes the hydrogen chloride emissions and Table 5 summarizes the methanol emissions.

Emissions testing on the EU-Dryer exhaust stack (SV-EXHAUST) that began on October 15, 2014 was aborted during the first run due to plant process upsets. EU-Dryer malfunctioned during sampling and then was shut down to determine the cause of the malfunction. The Michigan Department of Environmental Quality AQD requires all aborted, failed or repeated runs to be submitted. Email communication related to the test rescheduling is included in Appendix I. Field data sheets from the aborted run are provided in Appendix B.

3.0 Process Description

The drum dryer system used during normal drying operations may burn softwood or hardwood chips, corn stover, switch grass, sawdust (raw material) and/or natural gas. The burner is fired with natural gas during start-up, and can also continue with natural gas during normal operation. Emissions from the dryer are controlled by a multiclone and thermal oxidation system and gases are vented to the atmosphere through the EU-Dryer exhaust stack (SV-EXHAUST). Emissions from the EU-Raw Material process equipment are controlled by baghouse (CE-BH 666). The gas stream is then exhausted through the EU-Raw Material baghouse stack (SV-BH 666).

Process operating data can be found in Appendix H.

4.0 Stack Testing Procedures and Methods

Testing at the EU-Dryer exhaust stack (SV-EXHAUST) and EU-Raw Material baghouse (SV-BH 666) was performed from two ports meeting EPA Method 1 (40 CFR Part 60, Appendix A) criteria. The determination of volumetric airflow and collection of particulate matter samples were performed using 24 sampling points at each source. A cyclonic check indicated that the average yaw angle is below twenty degrees at both stacks. Sample port locations and traverse point detail are provided in Figures 1 through Figure 4.

Volumetric airflow determinations were performed in accordance with EPA Method 2 (40 CFR Part 60, Appendix A) using an S-type pitot tube and an oil manometer.

The stack gas compositions and molecular weights were determined by EPA Method 3A (40 CFR Part 60, Appendix A) with a Servomex 1440 O_2/CO_2 analyzer.

Stack gas moisture contents were determined by the performance of EPA Method 4 in conjunction with the EPA Method 5 tests (40 CFR Part 60, Appendix A). Stack gas conditions at the EU-Raw Material baghouse (SV-BH 666) were assumed to be ambient and verified using a portable oxygen analyzer.

Particulate matter concentrations and emission rates were determined in accordance with EPA Method 5 (40CFR Part 60, Appendix A). At the request of the MDEQ, the probe temperature during sampling at the EU-Raw Material baghouse (SV-BH 666) was kept near the stack temperature. Particulate concentrations at the EU-Dryer exhaust stack (SV-EXHAUST) include condensable particulate matter collected in the back half of the sample train. Condensable particulate matter was determined using EPA Method 202 (40 CFR Part 51, Appendix M).

Determination of opacity of visual emissions was performed in accordance with EPA Method 9 (40 CFR Part 60, Appendix A). One 60-minute observation was performed at each source concurrent with run 1 of each particulate matter test. The visible emissions observer's certification is provided in Appendix G.

Hydrogen chloride (HCl) emissions were determined by EPA Method 26 (40 CFR Part 60, Appendix A). Three samples were collected in midget impingers loaded with 0.1N H_2SO_4 solution. Enthalpy Analytical, Inc. of North Carolina analyzed the samples. A blank correction was performed using the starting volume of H_2SO_4 in the impingers and the concentration of the H_2SO_4 blank. These two values were multiplied and the result was subtracted from the lab reported HCl catch weight. The blank corrected HCl catch weight was used to determine HCl emissions.

Total hydrocarbon concentrations were determined by EPA Method 25A (40CFR Part 60, Appendix A) with a Ratfisch RS55CA flame ionization detector analyzer calibrated with propane. The parameter for VOC concentration in Permit to Install 24-12A is listed as Non-Methane Organic Compounds (NMOC). Methane concentration was not determined, thus an NMOC value was not determined by subtraction from the VOC emission rate results because VOCs were present in very low concentrations.

Carbon monoxide concentrations were determined by EPA Method 10 (40 CFR Part 60, Appendix A) with a Thermo Environmental Model 10i gas filter correlation analyzer.

Nitrogen oxide concentrations were determined by EPA Method 7E (40CFR Part 60, Appendix A) using an API 200EH analyzer. Filtered stack gas was delivered through a heated sample line to a sample chiller and directed to the analyzers. The analyzers were calibrated with EPA Protocol 1 gases. Data was recorded on an electronic data acquisition system. Instrument output data and calibration gas certifications are located in Appendix D and F, respectively.

Methanol determinations were performed by EPA Method 308. (40 CFR Part 60, Appendix A). Three 1-hour samples were collected in midget impingers filled with water followed by silica gel tubes. Samples were collected in sealed 42 milliliter vials. Deionized water was used to fill vials to zero head space. No blank correction was performed because the blank lab result was non-detect (ND). Enthalpy Analytical, Inc. of North Carolina analyzed the samples

Table 2 Method 1 Criteria

Location	Distance to Upstream Disturbances (Diameters)	Distance to Downstream Disturbances (Diameters)	Number of Ports	Number of Points	Average Absolute Yaw Angle
EU-Raw Material	3	17	2	24	°11
EU-Dryer	2	14	2	24	°12

Tables

Michigan Renewable Carbon
Gwinn, Michigan

Barr Engineering Co.
December 9, 2014

TABLE 1

PARTICULATE MATTER TEST RESULTS

EU-Raw Material
Test 1

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/14/2014	10/14/2014	10/14/2014	---
Test Period	949 - 1101	1132 - 1234	1335 - 1437	---
Test Duration, min	60	60	60	60
Average Stack Temperature, °F	62	62	63	62
Average Moisture Content, %V/V	0.9	1.5	1.5	1.3
Particulate Loading, g				
PM - Filterable	0.00630	0.00198	0.00192	0.00340
Air Flow Rate				
acfm	36,800	36,100	36,100	36,300
scfm	35,600	34,900	34,800	35,100
dscfm	35,200	34,300	34,300	34,600
lb/hr	158,600	155,100	154,900	156,200
Sample Volume				
acf	40.63	40.49	40.47	40.53
dscf	40.72	40.33	40.22	40.42
Isokinetic Variation, %	101.9	103.6	103.4	103.0
Particulate Concentration, gr/dscf				
PM - Filterable	0.0024	0.00076	0.00074	0.0013
Particulate Emission Rate				
PM - Filterable, lb/hr	0.72	0.22	0.22	0.39
PM - Filterable, lb/1000 lb gas	0.0045	0.0014	0.0014	0.0025
Visible Emissions, % Opacity	0	--	--	0

TABLE 2

PARTICULATE MATTER TEST RESULTS

EU-Dryer
Test 2

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/20/2014	10/20/2014	10/20/2014	---
Test Period	916 - 1019	1127 - 1235	1332 - 1436	---
Test Duration, min	60	60	60	60
Average Stack Temperature, °F	330	315	313	320
Average Moisture Content, %V/V	35.5	32.0	32.6	33.4
Particulate Loading, g				
PM - Filterable	0.07987	0.11343	0.13658	0.10996
CPM - Organics plus inorganics	0.0020	0.0020	0.0016	0.0019
Air Flow Rate				
acfm	46,000	47,900	45,600	46,500
scfm	29,400	31,200	29,800	30,100
dscfm	18,900	21,200	20,100	20,100
lb/hr	116,300	125,100	119,400	120,300
Sample Volume				
acf	26.63	33.88	33.82	31.44
dscf	24.68	31.84	31.67	29.40
Isokinetic Variation, %	103.8	95.4	100.1	99.8
Particulate Concentration, gr/dscf				
PM - Filterable	0.050	0.055	0.067	0.057
Primary PM - All Fractions (PM_{10})	0.051	0.056	0.067	0.058
Particulate Emission Rate				
PM - Filterable, lb/hr	8.1	10.0	11.5	9.9
PM Filterable lb/1000 lb gas	0.070	0.080	0.096	0.082
Primary PM - All Fractions, lb/hr (PM_{10})	8.3	10.2	11.6	10.0
Visible Emissions, % Opacity	0	--	--	0

TABLE 3

GASEOUS POLLUTANT TEST RESULTS SUMMARY

EU-Dryer
Test 3

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/20/2014	10/20/2014	10/20/2014	--
Test Period	0916-1021	1127-1236	1332-1437	--
Air Flow Rate				
ACFM	46,000	47,900	45,600	46,500
SCFM	29,400	31,200	29,800	30,100
DSCFM	18,900	21,200	20,100	20,100
EPA Method 7E Results				
NO_X Concentration, ppm dry	28.2	27.5	30.3	28.7
NO_X Emission Rate, lb/hr	3.8	4.2	4.4	4.1
EPA Method 10 Results				
CO Concentration, ppm dry	21.3	32.5	14.6	22.8
CO Emission Rate, lb/hr	1.8	3.0	1.3	2.0
EPA Method 25A Results				
THC ppm, wet as Propane	6.6	7.7	8.0	7.4
THC ppm, wet as Carbon	19.8	23.0	23.9	22.2
THC Emission Rate as Propane, lb/hr	1.3	1.6	1.6	1.5
THC Emission Rate as Carbon, lb/hr	1.1	1.3	1.3	1.3

TABLE 4

HYDROGEN CHLORIDE TEST RESULTS SUMMARY

EU-Dryer
Test 4

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/20/2014	10/20/2014	10/20/2014	---
Test Period	916 - 1019	1127 - 1235	1332 - 1436	---
Test Duration, min.	60	60	60	---
Average Stack Temperature, °F (from Method 5 Test)	330	315	313	320
Average Moisture Content, %V/V (from Method 5 Test)	35.5	32.0	32.6	33.4
Hydrogen Chloride Lab Result, ug	16.9 J	11.7 J	6.0 J	11.5 J
Air Flow Rate (from Method 5 Test)				
acfm	46,000	47,900	45,600	46,500
scfm	29,400	31,200	29,800	30,100
dscfm	18,900	21,200	20,100	20,100
Sample Volume				
Liters - Actual	120.0	120.0	120.7	120.3
dscf	3.96	4.00	4.01	3.99
Emission Rate, lb/hr				
Hydrogen Chloride	0.011 J	0.008 J	0.004 J	0.008 J

"J" indicates that the value is between the Minimum Detection Limit (MDL) and the Limit of Quantification (LOQ)

TABLE 5

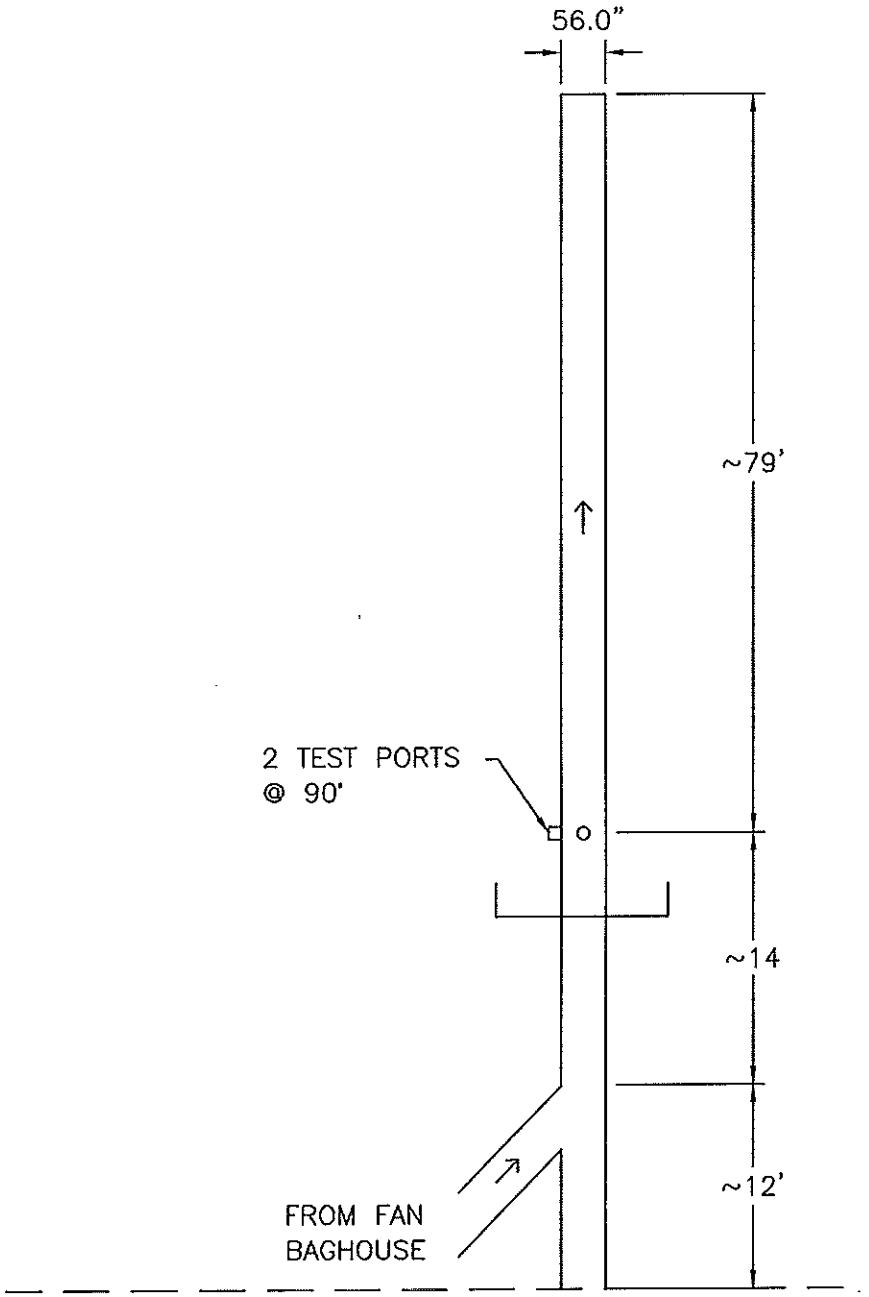
METHANOL TEST RESULTS SUMMARY

EU-Dryer
Test 5

Parameter	Run 1	Run 2	Run 3	Average
Test Date	10/20/2014	10/20/2014	10/20/2014	---
Test Period	916 - 1019	1127 - 1235	1332 - 1436	---
Test Duration, min.	60	60	60	---
Average Stack Temperature, °F (from Method 5 Test)	330	315	313	320
Average Moisture Content, %V/V (from Method 5 Test)	35.5	32.0	32.6	33.4
Methanol Lab Result, ug	37.9 J	30.0 J	39.6 J	35.8 J
Air Flow Rate (from Method 5 Test)				
acfm	46,000	47,900	45,600	46,500
scfm	29,400	31,200	29,800	30,100
dscfm	18,900	21,200	20,100	20,100
Sample Volume				
Liters - Actual	60.9	60.1	61.0	60.7
dscf	2.00	1.99	2.01	2.00
Emission Rate, lb/hr				
Methanol	0.048 J	0.042 J	0.052 J	0.047 J

"J" indicates that the value is between the Minimum Detection Limit (MDL) and the Limit of Quantification (LOQ)

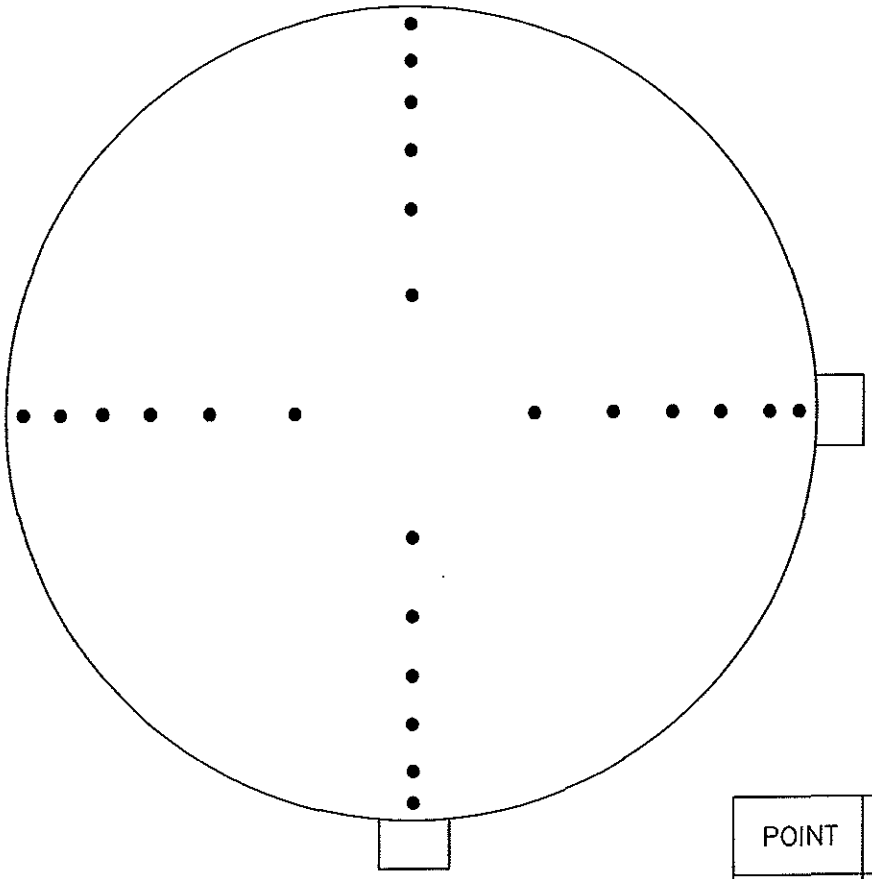
Figures



TEST PORT LOCATIONS
MICHIGAN RENEWABLE CARBON
GWINN, MICHIGAN
EU RAW MATERIAL STACK (SV-BH666)

NOT TO SCALE

FIGURE 1



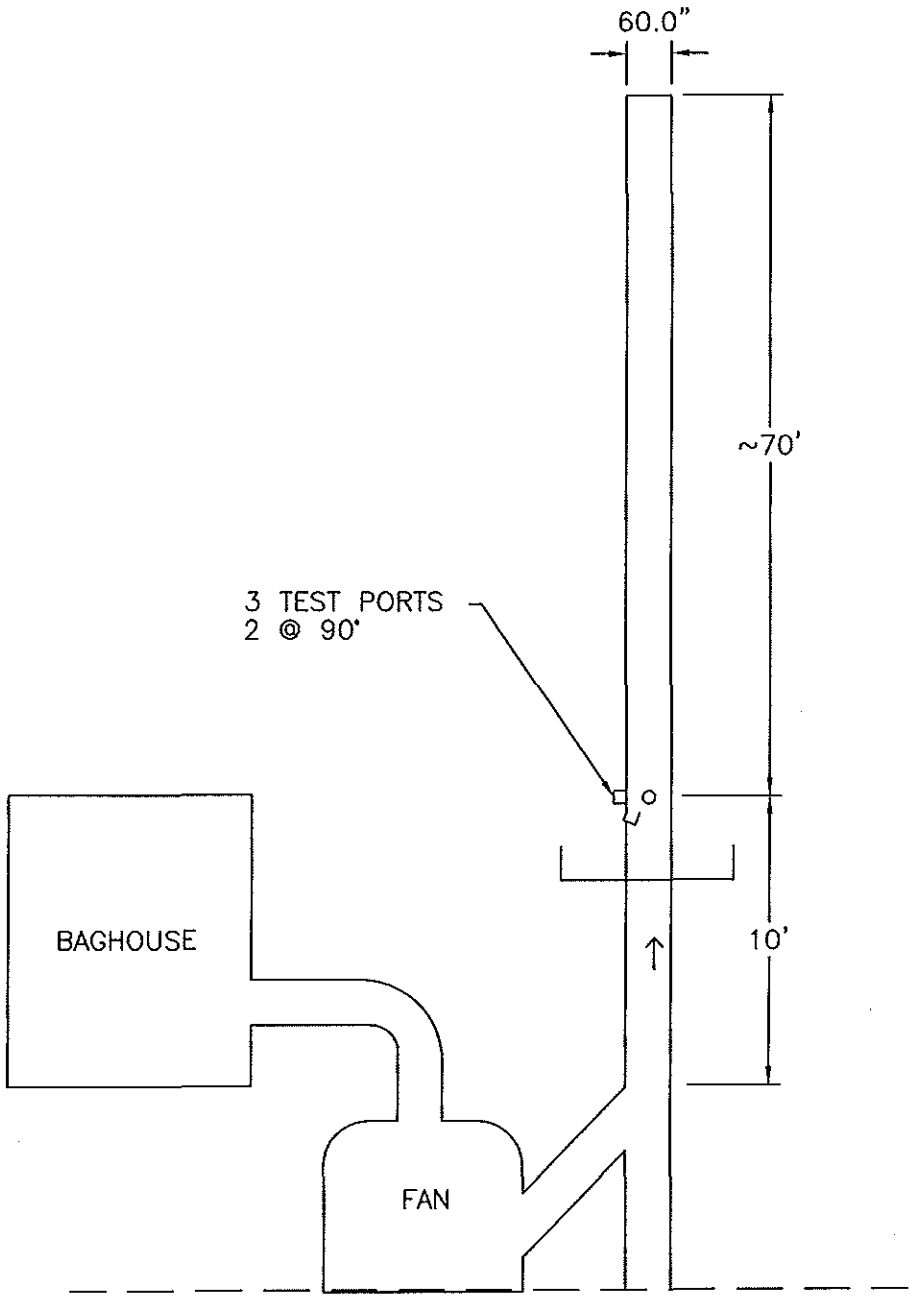
NO. OF TEST PORTS	2
PORT LENGTH	6.0"
PORT DIAMETER	6"
NO. OF TRAVERSE POINTS	24
DUCT DIAMETER	56.0"

POINT	INSERTION DEPTH IN "
1	1.19
2	3.75
3	6.61
4	9.93
5	14.00
6	19.92
7	36.08
8	42.00
9	46.07
10	49.39
11	52.25
12	54.81

TRAVERSE POINT LOCATIONS
MICHIGAN RENEWABLE CARBON
GWINN, MICHIGAN
EU RAW MATERIAL STACK (SV-BH666)

NOT TO SCALE

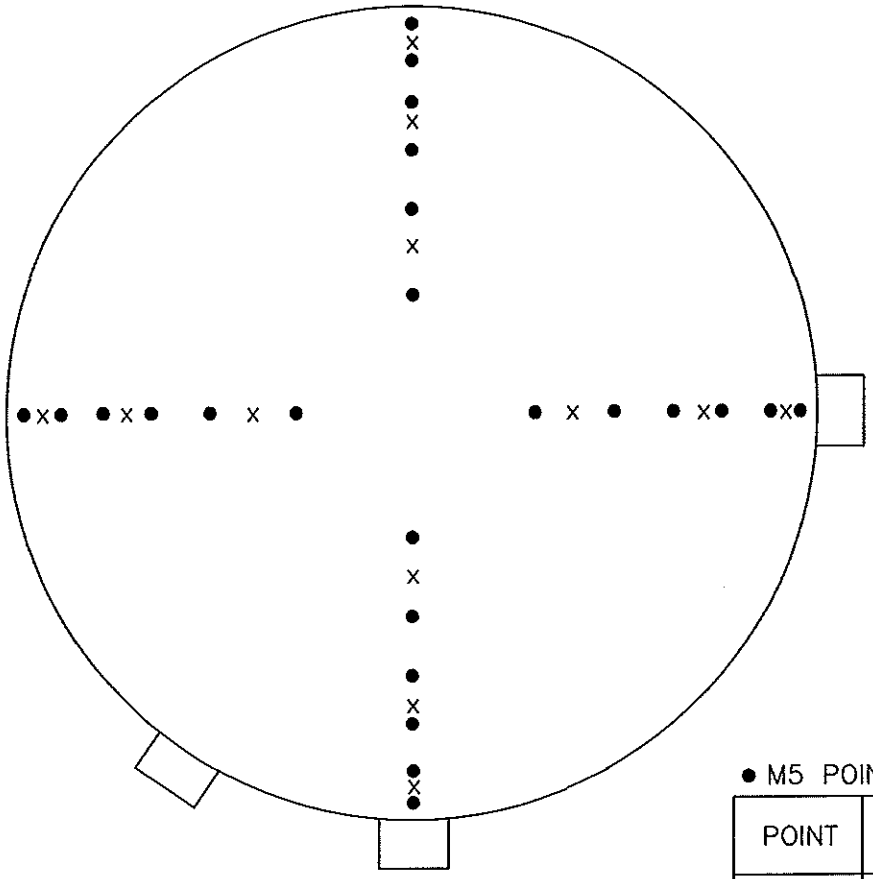
FIGURE 2



TEST PORT LOCATIONS
MICHIGAN RENEWABLE CARBON
GWINN, MICHIGAN
EU DRYER STACK (SVEXHAUST)

NOT TO SCALE

FIGURE 3



● M5 POINTS

POINT	INSERTION DEPTH IN "
1	1.28
2	4.02
3	7.09
4	10.64
5	15.00
6	21.34
7	38.66
8	45.00
9	49.36
10	52.91
11	55.98
12	58.72

x ANALYZER POINTS

POINT	INSERTION DEPTH IN "
1	2.61
2	8.79
3	17.75
4	42.25
5	51.21
6	57.39

NO. OF TEST PORTS	2
PORT LENGTH	6.0"
PORT DIAMETER	6"
NO. OF TRAVERSE POINTS	12/24
DUCT DIAMETER	60.0"

TRAVERSE POINT LOCATIONS
MICHIGAN RENEWABLE CARBON
GWINN, MICHIGAN
EU DRYER STACK (SVEXHAUST)

NOT TO SCALE

FIGURE 4