BTEC Inc.

EU-PulverDryer-Pilot
Emissions Test Report

Prepared for:

City of Battle Creek

Battle Creek, Michigan

City of Battle Creek
150 Kendall Street
Battle Creek, Michigan 49037

Project No. 15-4685.00
June 22, 2015

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
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EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by the City of Battle Creek, Michigan to conduct a compliance emissions test program on the EU-PulverDryer-Pilot exhaust stack associated with a sludge drying system at the City of Battle Creek wastewater treatment plant in Battle Creek, Michigan. This emissions testing program included evaluation of total filterable particulate matter (PM), condensable particulate matter (CPM), and volatile organic compounds (VOC) concentrations and emission rates from a single sampling location associated with the EU-PulverDryer-Pilot exhaust. Testing consisted of duplicate 60-minute sampling runs for PM, CPM, and VOC under each of three operating conditions. The emissions test program was conducted on April 29, 2015.

The emissions test program was required by MDEQ Permit to Install No. 110-13A. The results of the emission test program are summarized by Table I.

Table I
EU-PulverDryer-Pilot Overall Emission Summary
Test Date: April 29, 2015

MDEQ Permit to Install No. 110-13A					
Pollutant	**Condition 1**	**Condition 2**	**Condition 3**	**Overall**	**Emission Limit**
	Average Emission Rate	**Average Emission Rate**	**Average Emission Rate**	**Average Emission Rate**	
PM	0.002 lbs. per 1,000 lbs. of gas[1]	0.001 lbs. per 1,000 lbs. of gas[1]	0.002 lbs. per 1,000 lbs. of gas[1]	0.002 lbs. per 1,000 lbs. of gas[1]	0.10 lbs. per 1,000 lbs. of gas[1]
PM_{10}	0.07 lb/hr	0.04 lb/hr	0.08 lb/hr	0.06 lb/hr	1.08 lb/hr
VOC	0.8 lb/hr[2]	0.7 lb/hr[2]	0.8 lb/hr[2]	0.08 lb/hr[2]	NA

[1] calculated on a wet gas basis
[2] VOC including methane subtraction

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by the City of Battle Creek, Michigan to conduct a compliance emissions test program on the EU-PulverDryer-Pilot exhaust stack associated with a sludge drying system at the City of Battle Creek wastewater treatment plant in Battle Creek, Michigan. This emissions testing program included evaluation of total filterable particulate matter (PM), condensable particulate matter (CPM), and volatile organic compounds (VOC) concentrations and emission rates from a single sampling location associated with the EU-PulverDryer-Pilot exhaust. Testing consisted of duplicate 60-minute sampling runs for PM, CPM, and VOC under each of three operating conditions. The emissions test program was conducted on April 29, 2015.

MDEQ Air Quality Division (AQD) has published a guidance document entitled "Format for Submittal of Source Emission Test Plans and Reports" (December 2013). The following is a summary of the emissions test plan in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for this emission test program was conducted on April 29, 2015 at the City of Battle Creek wastewater treatment plant in Battle Creek, Michigan. The test program included evaluation of particulate matter (PM), condensable particulate matter (CPM), and volatile organic compounds (VOC) concentrations and emission rates from a single sampling location associated with the EU-PulverDryer-Pilot exhaust.

1.b Purpose of Testing

The emissions test program was required by MDEQ Permit to Install No. 110-13A. The emission limits are summarized by Table 1.

Table 1
PM, PM_{10}, and VOC Emission Limitations
City of Battle Creek wastewater treatment plant

MDEQ Permit to Install No. 110-13A	
Pollutant	**Emission Limit**
PM	0.10 lbs. per 1,000 lbs. of gas[1]
PM_{10}	1.08 lb/hr
VOC	NA[2]

[1] calculated on a wet gas basis
[2] VOC including methane subtraction

1.c Source Description

Sampled emissions originate from the baghouse system of the EU-PulverDryer-Pilot equipment which dries sewage sludge blended with sawdust, yard clippings, or similar waste.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Philip Teague
Process Engineer
Jones & Henry Engineers, Ltd.
3103 Executive Parkway, Suite 300
Toledo, Ohio 43606
419-473-9611

Mr. Richard Beardslee
Wastewater Collection and Treatment Superintendent
City of Battle Creek, Michigan Wastewater Treatment Plant
2000 River Road
Battle Creek, Michigan 49037
(269) 966-3355 ext. 1923

Mr. Barry P. Boulianne
Senior Project Manager
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, MI 48073
313-449-2361

Names and affiliations for personnel who were present during the testing program are summarized by Table 2.

Table 2
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Richard Beardslee Wastewater Collection and Treatment Superintendent	City of Battle Creek, Michigan Wastewater Treatment Plant 2000 River Road Battle Creek, Michigan 49037	(269) 966-3355 ext. 1923
Mr. Todd Wessel Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Matt Young Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Steve Smith Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Diven Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Rex Lane Senior Environmental Quality Analyst	MDEQ 7953 Adobe Kalamazoo, MI 49009	(269) 567-3547
Mr. David Patterson Environmental Quality Analyst	MDEQ 525 West Allegan Lansing, MI 48909	(517) 284-6782

2. Summary of Results

Sections 2.a through 2.d summarize the results of the emissions compliance test program.

2.a Operating Data

Operating data recorded includes sewage sludge feed rate in pounds, wood chip feed rate in pounds, and overall run percentage of wood chips and sludge.

2.b Applicable Permit

The applicable permit for this emissions test program is MDEQ Permit to Install No. 110-13A.

2.c Results

The overall results of the emission test program are summarized by Table 3 (see Section 5.a).

3. Source Description

Sections 3.a through 3.e provide a detailed description of the process.

3.a Process Description

The EU-PulverDryer-Pilot system is powered electrically. It consists of a unit where a high velocity air stream breaks apart the blended feed, followed by two cyclones in series for solids separation from the air stream. The cyclones have a baghouse for pollution control. The baghouse exhausts through a single stack. EU-PulverDryer-Pilot has a dust collector for each stage: CD-2.

3.b Process Flow Diagram

Due to the simplicity of the EU-PulverDryer-Pilot, a process flow diagram is not necessary.

3.c Raw and Finished Materials

See section 3.a

3.d Process Capacity

The EU-PulverDryer-Pilot system shall not process more than 8,300 pounds of sewage sludge, determined as dry sludge input, in EU-PulverDryer-Pilot per day. Also, the permittee shall not operate the EU-PulverDryer-Pilot for more than 8 hours per day.

3.e Process Instrumentation

See section 3.a and 3.d.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures used.

4.a Sampling Train and Field Procedures

Sampling and analysis procedures utilized the following test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations (40 CFR 60, Appendix A):

- Method 1 - *"Location of the Sampling Site and Sampling Points"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
- Method 3 - *"Determination of Molecular Weight of Dry Stack Gas"(Fyrite)*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*
- Method 5 - *"Determination of Particulate Emissions from Stationary Sources"*

- Method 25A - *"Determination of Total Gaseous Organic concentration using a flame ionization analyzer"*
- Method 202 - *"Determination of Condensable Particulate Emissions from Stationary Sources"*

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Method 1 and Method 2. S-type pitot tubes with thermocouple assemblies, calibrated in accordance with Method 2, Section 4.1.1, were used to measure exhaust gas velocity pressures (using a manometer) and temperatures during testing. The s-type pitot tube dimensions outlined in Sections 2-6 through 2-8 were within specified limits, therefore, a baseline pitot tube coefficient of 0.84 (dimensionless) was assigned.

Cyclonic flow checks were performed at the sampling location. The existence of cyclonic flow was determined by measuring the flow angle at each sample point. The flow angle is the angle between the direction of flow and the axis of the stack. The average of the absolute values of the flow angles were less than 20, which means cyclonic flow did not exists.

Molecular weight determinations were evaluated according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consists of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. Carbon dioxide and oxygen content were analyzed using the Fyrite® procedure.

Exhaust gas moisture content was evaluated using Method 4. Exhaust gas was extracted as part of the PM sampling train (see Figure 2). Exhaust gas moisture content was determined gravimetrically.

The PM and CPM content of the exhaust gas was evaluated according to procedures outlined in 40 CFR 60, Appendix A, Method 5 and Method 202. BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consists of (1) a stainless-steel nozzle, (2) a glass probe liner, (3) a heated filter holder, (4) a vertical condenser, (5) an empty pot bellied impinger, (6) an empty modified Greenburg-Smith (GS) impinger, (7) unheated filter holder with a teflon filter, (8) a second modified GS impinger with 100 ml of deionized water, and a third modified GS impinger containing approximately 300 g of silica gel desiccant, (9) a length of sample line, and (10) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice

A sampling train leak test was conducted before and after each test run. After completion of the final leak test for each test run, the filter was recovered, and the nozzle and the front half of the filter holder assembly were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample container. The impinger train was then purged with nitrogen for one hour at a flow rate of 14 liters per minute. The CPM filter was recovered and placed in a petri dish. The back half of the filter housing, the condenser, the pot bellied impinger, the moisture drop out impinger, and the front half of the CPM filter housing and all connecting glassware were triple rinsed with deionized water and collected in a pre-cleaned sample container. The same glassware was then single rinsed with acetone and collected in a pre-cleaned sample container labeled as the organic fraction. The glassware was then double rinsed with hexane which will be added

to the same organic fraction sample bottle. The CPM samples were then sent to Maxxam for analysis.

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. A sample of the gas stream was drawn through a stainless steel probe with an in-line glass fiber filter to remove any particulate, and a heated Teflon® sample line to prevent the condensation of any moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a PC equipped with IOtech® data acquisition software. BTEC used a JUM Model 109A Methane/Non-Methane THC hydrocarbon analyzer to determine the VOC concentration.

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (as methane). Upon entry, the analyzer splits the gas stream. One FID ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of THC is then sent to the data acquisition system (DAS), where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average ppmv for THC reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the THC sample, the methane gas concentration is sent to the DAS and recorded. The methane concentration, reported as methane, can then be converted to methane, reported as propane, by dividing the measured methane concentration by the analyzer's response factor.

The analyzer's response factor is obtained by introducing a methane calibration gas to the calibrated J.U.M. 109A. The response of the analyzer's THC FID to the methane calibration gas, in ppmv as propane, is divided by the Methane analyzer's response to the methane calibration gas, in ppmv as methane. The response factor determined during testing was 2.2.

In accordance with Method 25A, a 4-point (zero, low, mid, and high) calibration check was performed on the THC analyzer. Calibration drift checks were performed at the completion of each run.

For analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11-point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A field quality assurance check of the system was performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1

calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas.

4.b Recovery and Analytical Procedures

Recovery and analytical procedures are explained in 4.a.

4.c Sampling Ports

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figure 1.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figure 1.

5. Test Results and Discussion

Sections 5.a through 5.k provide a summary of the test results.

5.a Results Tabulation

The overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Tables 4-7.

Table 3
EU-PulverDryer-Pilot Overall Emission Summary
Test Date: April 29, 2015

MDEQ Permit to Install No. 110-13A					
Pollutant	Condition 1 Average Emission Rate	Condition 2 Average Emission Rate	Condition 3 Average Emission Rate	Overall Average Emission Rate	Emission Limit
PM	0.002 lbs. per 1,000 lbs. of gas[1]	0.001 lbs. per 1,000 lbs. of gas[1]	0.002 lbs. per 1,000 lbs. of gas[1]	0.002 lbs. per 1,000 lbs. of gas[1]	0.10 lbs. per 1,000 lbs. of gas[1]
PM_{10}	0.07 lb/hr	0.04 lb/hr	0.08 lb/hr	0.06 lb/hr	1.08 lb/hr
VOC	0.8 lb/hr[2]	0.7 lb/hr[2]	0.8 lb/hr[2]	0.08 lb/hr[2]	NA

[1] calculated on a wet gas basis
[2] VOC including methane subtraction

5.b Discussion of Results

The overall results of the emission test program are summarized by Table 3 (see Section 5.a). VOC emissions from EU-PulverDryer-Pilots were 0.7 lb/hr. PM emissions were 0.002 lbs. per 1,000 lbs of gas, which is below the limit of 0.1 lbs. per 1,000 lbs. of gas (both calculated on a wet gas basis). PM_{10} emissions were 0.06 lb/hr which is lower than the limit of 1.08 lb/hr.

5.c Sampling Procedure Variations

There were no sampling procedure variations during the emissions test program.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

There was no control equipment maintenance performed during the emissions test program.

5.f Re-Test

The emissions test program was not a re-test.

5.g Audit Sample Analyses

No audit samples were collected as part of the test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided in Appendix B.

5.i Sample Calculations

Sample calculations are provided in Appendix C.

5.j Field Data Sheets

Field documents relevant to the emissions test program are presented in Appendix A.

5.k Laboratory Data

The laboratory results for this test program are located in Appendix D.

Table 4
EU-PulverDryer-Pilot Particulate Matter Emission Rates Condition 1

Company	Jones and Henry		
Source Designation	Pulver Dryer BH		
Test Date	4/29/2015	4/29/2015	
Meter/Nozzle Information	Run 1	Run 4	Average
Meter Temperature Tm (F)	59.7	73.4	66.6
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3
Measured Sample Volume (Vm)	44.1	45.5	44.8
Sample Volume (Vm-Std ft3)	44.2	43.5	43.8
Sample Volume (Vm-Std m3)	1.25	1.23	1.24
Condensate Volume (Vw-std)	1.198	1.405	1.301
Gas Density (Ps(std) lbs/ft3) (wet)	0.0738	0.0737	0.0737
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.35	3.31	3.33
Total weight of sampled gas (m g lbs) (dry)	3.30	3.24	3.27
Nozzle Size - An (sq. ft.)	0.000158	0.000158	0.000158
Isokinetic Variation - I	99.7	100.1	99.9
Stack Data			
Average Stack Temperature - Ts (F)	87.7	99.7	93.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.986	0.984	0.985
Percent Moisture (Bws)	2.64	3.13	2.88
Water Vapor Volume (fraction)	0.0264	0.0313	0.0288
Pressure - Ps ("Hg)	28.5	28.5	28.5
Average Stack Velocity - Vs (ft/sec)	87.4	88.0	87.7
Area of Stack (ft2)	1.8	1.8	1.8
Exhaust Gas Flowrate			
Flowrate ft^3(Actual)	9,259	9,321	9,290
Flowrate ft^3 (Standard Wet)	8,505	8,378	8,442
Flowrate ft^3 (Standard Dry)	8,281	8,116	8,198
Flowrate m^3 (standard dry)	234	230	232
Total Particulate Weights (mg)			
Total Nozzle/Probe/Filter	1.3	1.8	1.6
Organic Condensible Particulate	0.0	0.0	0.0
Inorganic Condensible Particulate	2.6	4.2	3.4
Condensible Blank Correction	2.0	2.0	2.0
Total Condensible Particulate	0.6	2.2	1.4
Total Filterable and Condensible Particulate	1.9	4.0	3.0
Filterable Particulate Concentration			
lb/1000 lb (wet)	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001
mg/dscm (dry)	1.0	1.5	1.3
gr/dscf	0.0005	0.0006	0.0005
Filterable Particulate Emission Rate			
lb/ hr	0.03	0.04	0.04
Condensible Particulate Concentration			
lb/1000 lb (wet)	0.000	0.001	0.001
lb/1000 lb (dry)	0.000	0.001	0.001
mg/dscm (dry)	0.5	1.8	1.1
gr/dscf	0.0002	0.0008	0.0005
Condensible Particulate Emission Rate			
lb/ hr	0.01	0.05	0.03
Total Particulate Concentration			
lb/1000 lb (wet)	0.001	0.003	0.002
lb/1000 lb (dry)	0.001	0.003	0.002
mg/dscm (dry)	1.5	3.2	2.4
gr/dscf	0.0007	0.0014	0.0010
Total Particulate Emission Rate			
lb/ hr	0.05	0.10	0.07

Table 5
EU-PulverDryer-Pilot Particulate Matter Emission Rates Condition 2

Company	**Jones and Henry**		
Source Designation	**Pulver Dryer BH**		
Test Date	**4/29/2015**	**4/29/2015**	
Meter/Nozzle Information	Run 2	Run 5	Average
Meter Temperature Tm (F)	60.3	77.0	68.7
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3
Measured Sample Volume (Vm)	43.2	44.6	43.9
Sample Volume (Vm-Std ft3)	42.4	43.3	42.8
Sample Volume (Vm-Std m3)	1.20	1.22	1.21
Condensate Volume (Vw-std)	1.311	1.466	1.389
Gas Density (Ps(std) lbs/ft3) (wet)	0.0737	0.0736	0.0737
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.22	3.29	3.26
Total weight of sampled gas (m g lbs) (dry)	3.16	3.22	3.19
Nozzle Size - An (sq. ft.)	0.000158	0.000158	0.000158
Isokinetic Variation - I	100.0	100.2	100.1
Stack Data			
Average Stack Temperature - Ts (F)	98.3	98.9	98.6
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.984	0.983	0.984
Percent Moisture (Bws)	3.00	3.28	3.14
Water Vapor Volume (fraction)	0.0300	0.0328	0.0314
Pressure - Ps ("Hg)	28.5	28.5	28.5
Average Stack Velocity -Vs (ft/sec)	85.4	87.4	86.4
Area of Stack (ft2)	1.8	1.8	1.8
Exhaust Gas Flowrate			
Flowrate ft^3(Actual)	9,046	9,264	9,155
Flowrate ft^3 (Standard Wet)	8,151	8,339	8,245
Flowrate ft^3 (Standard Dry)	7,907	8,065	7,986
Flowrate m^3 (standard dry)	224	228	226
Total Particulate Weights (mg)			
Total Nozzle/Probe/Filter	1.1	0.6	0.9
Organic Condensible Particulate	0.0	0.0	0.0
Inorganic Condensible Particulate	3.0	2.4	2.7
Condensible Blank Correction	2.0	2.0	2.0
Total Condensible Particulate	1.0	0.4	0.7
Total Filterable and Condensible Particulate	2.1	1.0	1.6
Filterable Particulate Concentration			
lb/1000 lb (wet)	0.001	0.000	0.001
lb/1000 lb (dry)	0.001	0.000	0.001
mg/dscm (dry)	0.9	0.5	0.7
gr/dscf	0.0004	0.0002	0.0003
Filterable Particulate Emission Rate			
lb/ hr	0.03	0.01	0.02
Condensible Particulate Concentration			
lb/1000 lb (wet)	0.001	0.000	0.000
lb/1000 lb (dry)	0.001	0.000	0.000
mg/dscm (dry)	0.8	0.3	0.6
gr/dscf	0.0004	0.0001	0.0003
Condensible Particulate Emission Rate			
lb/ hr	0.02	0.01	0.02
Total Particulate Concentration			
lb/1000 lb (wet)	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001
mg/dscm (dry)	1.8	0.8	1.3
gr/dscf	0.0008	0.0004	0.0006
Total Particulate Emission Rate			
lb/ hr	0.05	0.02	0.04

Table 6
EU-PulverDryer-Pilot Particulate Matter Emission Rates Condition 3

Company	**Jones and Henry**		
Source Designation	**Pulver Dryer BH**		
Test Date	**4/29/2015**	**4/29/2015**	
Meter/Nozzle Information	Run 3	Run 6	Average
Meter Temperature Tm (F)	70.0	78.2	74.1
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3
Measured Sample Volume (Vm)	44.2	46.3	45.2
Sample Volume (Vm-Std ft3)	43.4	43.9	43.6
Sample Volume (Vm-Std m3)	1.23	1.24	1.24
Condensate Volume (Vw-std)	1.358	1.433	1.396
Gas Density (Ps(std) lbs/ft3) (wet)	0.0737	0.0736	0.0737
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.30	3.34	3.32
Total weight of sampled gas (m g lbs) (dry)	3.23	3.27	3.25
Nozzle Size - An (sq. ft.)	0.000158	0.000158	0.000158
Isokinetic Variation - I	100.1	100.0	100.1
Stack Data			
Average Stack Temperature - Ts (F)	98.0	100.6	99.3
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.5	28.5
Stack Gas Specific Gravity (Gs)	0.984	0.984	0.984
Percent Moisture (Bws)	3.04	3.16	3.10
Water Vapor Volume (fraction)	0.0304	0.0316	0.0310
Pressure - Ps ("Hg)	28.5	28.5	28.5
Average Stack Velocity -Vs (ft/sec)	87.4	89.0	88.2
Area of Stack (ft2)	1.8	1.8	1.8
Exhaust Gas Flowrate			
Flowrate ft^3(Actual)	9,259	9,435	9,347
Flowrate ft^3 (Standard Wet)	8,347	8,467	8,407
Flowrate ft^3 (Standard Dry)	8,093	8,199	8,146
Flowrate m^3 (standard dry)	229	232	231
Total Particulate Weights (mg)			
Total Nozzle/Probe/Filter	1.4	0.0	0.7
Organic Condensible Particulate	0.0	0.0	0.0
Inorganic Condensible Particulate	5.1	3.7	4.4
Condensible Blank Correction	2.0	2.0	2.0
Total Condensible Particulate	3.1	1.7	2.4
Total Filterable and Condensible Particulate	4.5	1.7	3.1
Filterable Particulate Concentration			
lb/1000 lb (wet)	0.001	0.000	0.000
lb/1000 lb (dry)	0.001	0.000	0.000
mg/dscm (dry)	1.1	0.0	0.6
gr/dscf	0.0005	0.0000	0.0002
Filterable Particulate Emission Rate			
lb/ hr	0.03	0.00	0.02
Condensible Particulate Concentration			
lb/1000 lb (wet)	0.002	0.001	0.002
lb/1000 lb (dry)	0.002	0.001	0.002
mg/dscm (dry)	2.5	1.4	1.9
gr/dscf	0.0011	0.0006	0.0009
Condensible Particulate Emission Rate			
lb/ hr	0.08	0.04	0.06
Total Particulate Concentration			
lb/1000 lb (wet)	0.003	0.001	0.002
lb/1000 lb (dry)	0.003	0.001	0.002
mg/dscm (dry)	3.7	1.4	2.5
gr/dscf	0.0016	0.0006	0.0011
Total Particulate Emission Rate			
lb/ hr	0.11	0.04	0.08

Table 7
EU-PulverDryer-Pilot VOC Emission Rates
Jones and Henry
Battle Creek, MI
BTEC Project No. 15-4685.00
Sampling Dates: 4/29/15

Parameter	Run 1	Run 2	Run 3	Run 4	Run 5	Run 6	Averages Condition 1	Condition 2	Condition 3	Overall
Condition	1	2	3	1	2	3	Run 1 and Run 4	Run 2 and Run 5	Run 4 and Run 6	
Test Run Date	4/29/2015	4/29/2015	4/29/2015	4/29/2015	4/29/2015	4/29/2015				
Test Run Time	7:45-8:45	8:57-9:57	10:09-11:09	11:30-12:30	13:27-14:27	14:43-15:43				
Outlet Flowrate (dscfm)	8,281	7,907	8,093	8,116	8,065	8,199	8,199	7,986	8,146	**8,110**
Outlet Flowrate (scfm)	8,505	8,151	8,347	8,378	8,339	8,467	8,442	8,245	8,407	**8,365**
Outlet VOC Concentration (ppmv as propane)	13.1	12.2	12.3	17.6	15.4	13.2	15.3	13.8	12.8	**14.0**
Outlet Methane Concentration (ppmv as methane)	2.3	2.1	2.2	2.2	2.3	2.3	2.2	2.2	2.2	**2.2**
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	13.0	12.0	12.2	17.6	15.3	13.1	15.3	13.6	12.6	**13.9**
Outlet Methane Concentration (ppmv, corrected as per USEPA 7E)	2.2	1.9	2.0	2.0	2.0	1.9	2.1	2.0	2.0	**2.0**
Outlet VOC Concentration (ppmv propane, -Methane)	12.1	11.4	11.4	16.7	14.5	12.3	14.4	12.9	11.9	**13.1**
Outlet VOC Concentration (ppmv propane, -Methane, corrected as per USEPA 7E)	12.1	11.2	11.4	16.8	14.5	12.3	14.5	12.9	11.9	**13.1**
VOC Emission Rate as Propane (lb/hr) (-Methane)	**0.7**	**0.6**	**0.7**	**1.0**	**0.8**	**0.7**	**0.8**	**0.7**	**0.7**	**0.7**
VOC Emission Rate as Propane(lb/hr) (-Methane) (corrected as per USEPA 7E)	**0.7**	**0.6**	**0.6**	**1.0**	**0.8**	**0.7**	**0.8**	**0.7**	**0.7**	**0.7**

scfm = standard cubic feet per minute
dscfm = dry standard cubic feet per minute
ppmv = parts per million on a volume-to-volume basis
lb/hr = pounds per hour
MW = molecular weight (C_3H_8 = 44.10)
24.14 = molar volume of air at standard conditions (70°F, 29.92" Hg)
35.31 = ft^3 per m^3
453600 = mg per lb
Response factor obtained from introducing propane into methane analyzer: **2.49**

VOC Correction	R1	R2	R3	R4	R5	R6
Co	0.19	0.38	0.33	0.28	0.34	0.25
Cma	25	25	25	25	25	25
Cm	25.02	25.04	24.94	24.89	24.96	24.97

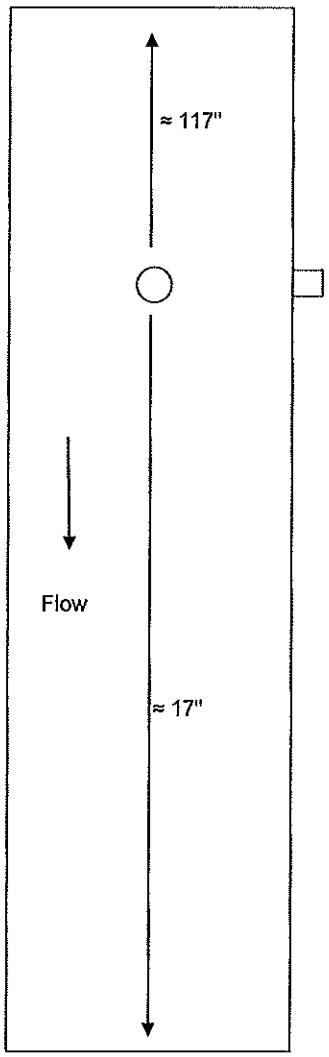
Methane Correction	R1	R2	R3	R4	R5	R6
Co	0.10	0.18	0.23	0.27	0.34	0.37
Cma	25	25	25	25	25	25
Cm	25.17	25.00	24.62	24.69	24.69	24.83

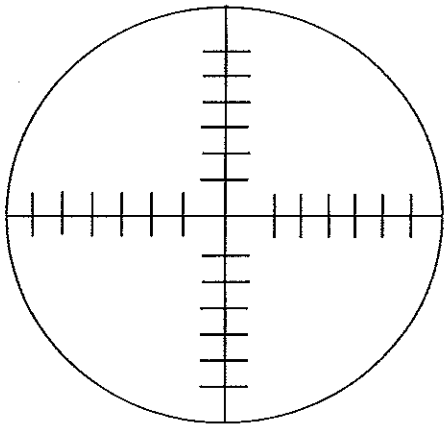
Equations
lb/hr = ppmv * MW/24.14 * 1/35.31 * 1/453,600 * *scfm* * 60 *for* VOC

Figures

BTEC Inc.

diameter = 18 inches





Not to Scale

Points	Distance "
1	0.4
2	1.2
3	2.1
4	3.2
5	4.5
6	6.4
7	11.6
8	13.5
9	14.8
10	15.9
11	16.8
12	17.6

Figure No. 1

Site:	Sampling Date:	
EU-PulverDryer-Pilot Exhaust	April 29, 2015	BT Environmental Consulting, Inc.
City of Battle Creek Wastewater Treatment Plant		4949 Fernlee Avenue
Battle Creek, MI		Royal Oak, Michigan 48073

BTEC Inc.

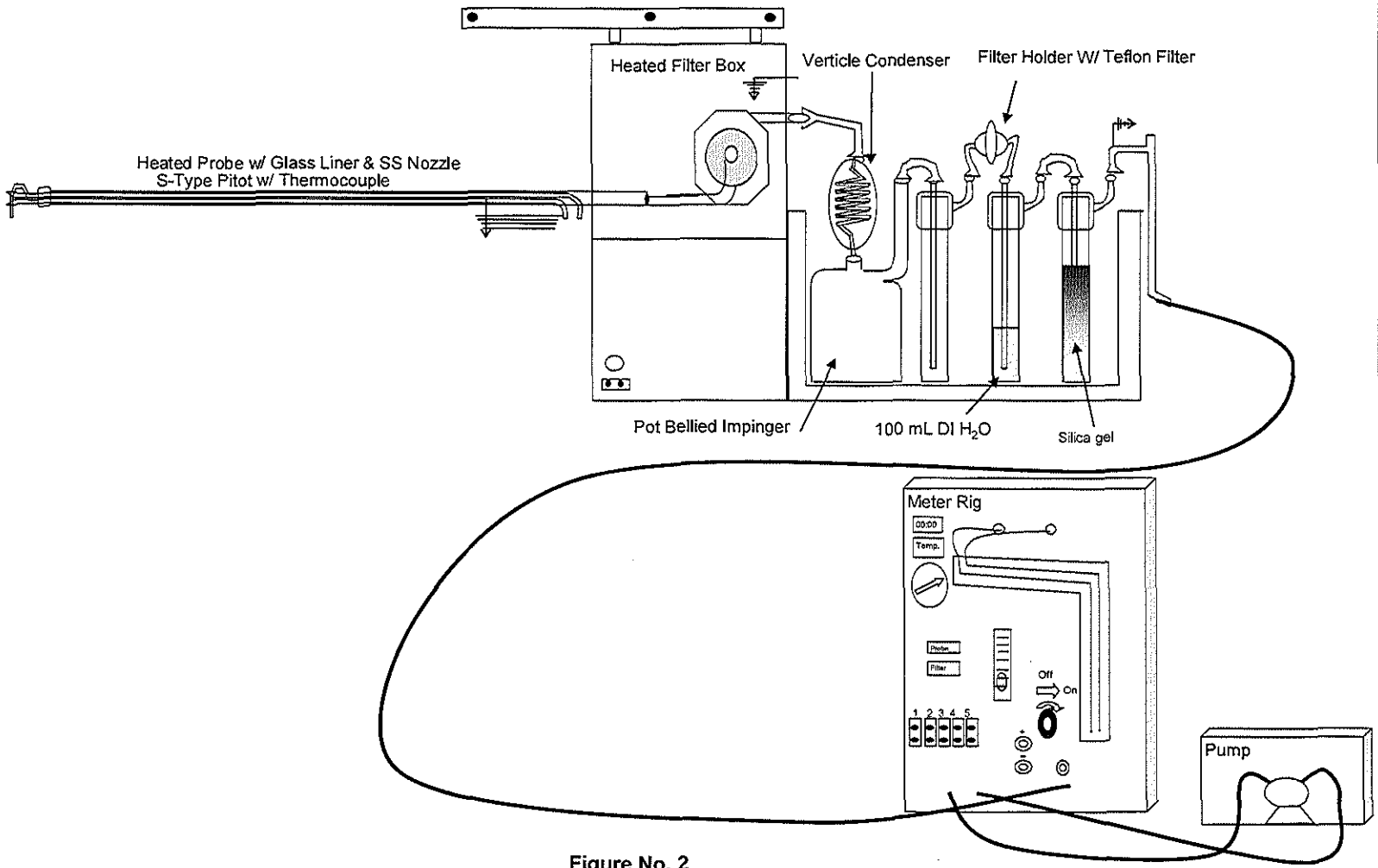


Figure No. 2

Site: **USEPA Method 5/202** **City of Battle Creek Wastewater Treatment Plant** **Battle Creek, MI**	**Sampling Date:** **April 29, 2015**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**

BTEC Inc.

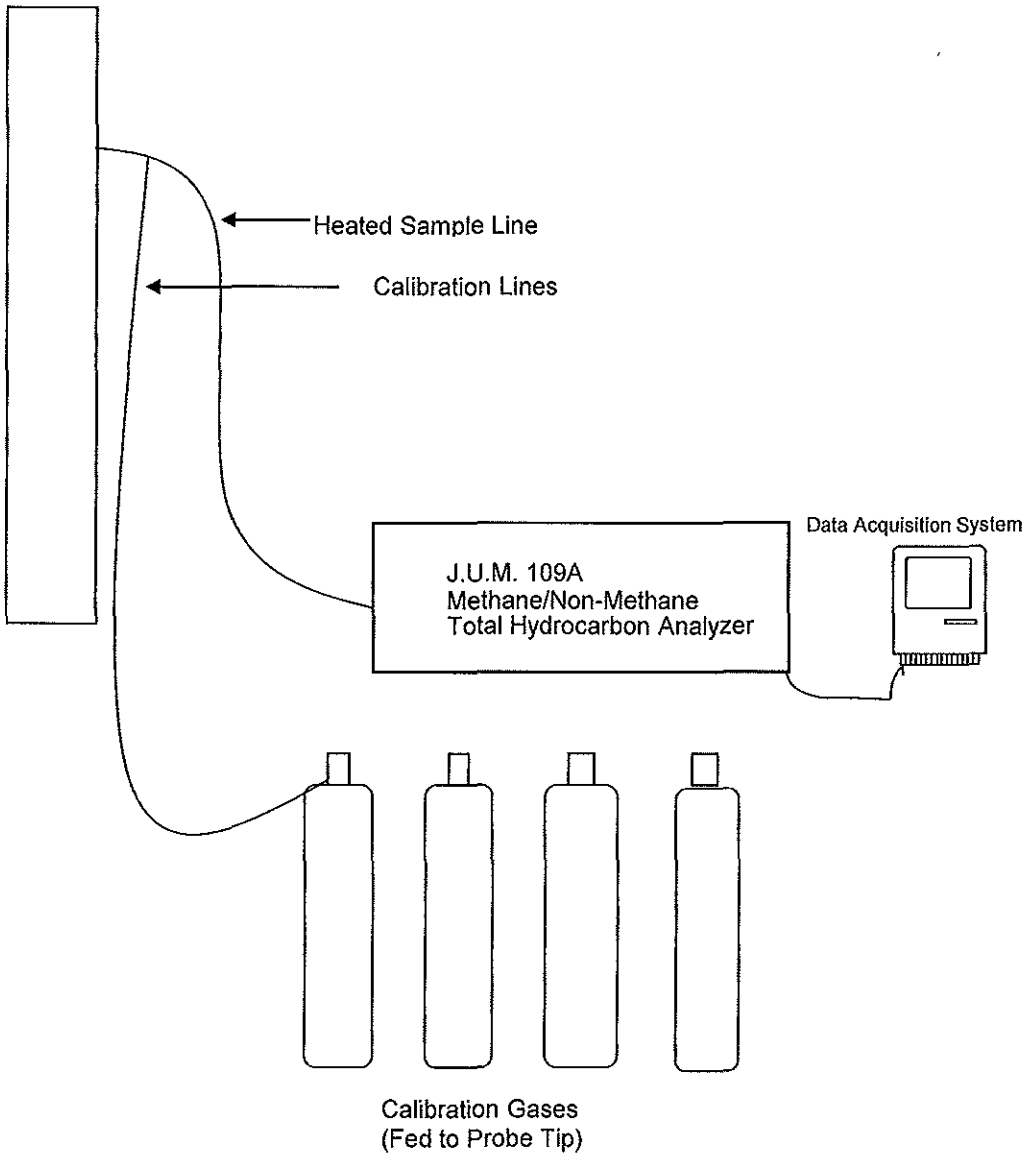


Figure No. 3

Site: **Sampling Date:** **USEPA Method 25A** **April 29, 2015** **City of Battle Creek Wastewater Treatment Plant** **Battle Creek, MI**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**