BTEC Inc.

900-13 and Fines-48 Particulate Matter Emissions Test Report

Prepared for:

Kellogg USA, Inc.

Kellogg USA, Inc.
425 Porter Street
Battle Creek, Michigan 49014

Project No. 13-4435.00
February 28, 2014

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EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Kellogg USA Inc. (Kellogg) to evaluate Particulate Matter (PM_{10}) and ($PM_{2.5}$) from the 900-13 and Fines 48 Rotoclones at the Kellogg facility located at 425 Porter Street in Battle Creek, Michigan. The purpose of the test program was to show compliance with Michigan Permit to Install 9-08G, which limits PM from the 900-13 Exhaust to 0.36 lbs/hr, and the Fines-48 exhaust to 0.54 lbs/hr.

Testing consisted of triplicate 60-minute test runs. Sampling and analysis for the emission test program was conducted on December 5th, 2013 for the 900-13, and January 15th, 2014 for the Fines-48. The results of this test program are summarized by the following table.

Table I
Test Program Summary

Source	Permit Limitation Emission Rate	Average PM Emission Rate
900-13	0.36 lbs/hr	0.00
	0.01 lbs/1000lbs exhaust gas (dry)	0.00
Fines-48	0.54 lbs/hr	0.03
	0.02 lbs/1000lbs exhaust gas (dry)	0.00

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Kellogg USA Inc. (Kellogg) to evaluate Particulate Matter (PM_{10}) and ($PM_{2.5}$) from the 900-13 and Fines 48 Rotoclones at the Kellogg facility located at 425 Porter Street in Battle Creek, Michigan. The purpose of the testing was to show compliance with Michigan Permit to Install 9-08G, which limits PM from the 900-13 Exhaust to 0.36 lbs/hr, and the Fines-48 exhaust to 0.54 lbs/hr. Testing was completed on December 5th, 2013 and January 15th, 2014. The purpose of this document is to document the results of the test program.

The Air Quality Division (AQD) of Michigan's Department of Environmental Quality 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 program and results in the format suggested by the aforementioned document.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on December 5th, 2013 for the 900-13, and January 15th, 2014 for the Fines-48 at the Kellogg facility in Battle Creek, Michigan. The test program included evaluation of PM emissions from both Rotoclone exhaust stacks.

1.b Purpose of Testing

The purpose of the testing is to show that both the 900-13 exhaust and the Fines-48 exhaust are in compliance with Michigan Permit to Install 9-08G. PM emission rate (in terms of pounds per hour) was verified with the Process at normal operating conditions.

1.c Source Description

- Fines-48 in EU-BULKSTORE, a dust collection system serving the facility's wheat berry storage and handling equipment for shredded wheat cereal production, and
- CoaterConveyor-900-13 in EU-DXCOATDRY, a system intended to remove broken and under-size food particles (mainly dust collection) from a conveyor line before and after the application of the coating layer.

Collection points for both systems operate at near-ambient temperatures; the exhausts from both are controlled by American Air Filter Type W Rotoclones. Note that the Rotoclones serve not only as the control device but also as the fan that drives the process exhaust. If the Rotoclone is turned off, the process exhaust is halted.

1.d Test Program Contact

The contact for information regarding the test program as well as the test report is as follows:

Ms. Erin Augustine
Environmental Manager
Kellogg Company
425 Porter Street
Battle Creek, MI 49014
269-961-6368

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

1.e Testing Personnel

Names and affiliations for all personnel who were present during the testing program are summarized by Table 1.

Table 1
Testing Personnel

Name	Affiliation
Matthew Young	BTEC
Paul Molenda	BTEC
Steve Smith	BTEC
Erin Augustine	Kellogg
Tom Gasloli	MDEQ
Dorothy Bohn	MDEQ

2. Summary of Results

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

2.a Operating Data

Operating data monitored includes the water flow rate through the rotoclones.

2.b Applicable Permit

Both the 900-13 Rotoclone and Fines-48 Rotoclone are included in Permit No. 9-08G.

2.c Results

Michigan Permit Number 9-08G limits PM from EU-DXCOATDRY process equipment to 0.36 lbs/hr, and limits PM from the EU-BULKSTORE process equipment to 0.54 lbs/hr. The average PM emission rate from the 900-13 Rotoclone was 0.00 lbs/hr. The average PM emission rate from the Fines-48 was 0.03 lb/hr. See Tables 2-3 for a detailed summary of PM emissions including all the runs.

2.d Emission Regulation Comparison

The results summarized by Tables 2-3 show that the PM emissions are below the limits summarized by section 1.b.

3. Source Description

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

3.a Process Description

- Fines-48 in EU-BULKSTORE, a dust collection system serving the facility's wheat berry storage and handling equipment for shredded wheat cereal production, and
- CoaterConveyor-900-13 in EU-DXCOATDRY, a system intended to remove broken and under-size food particles (mainly dust collection from a conveyor line prior to application of the coating layer.

Collection points for both systems operate at near-ambient temperatures; the exhausts from both are controlled by American Air Filter Type W Rotoclones. Note that the Rotoclones serve not only as the control device but also as the fan that drives the process exhaust. If the Rotoclone is turned off, the process exhaust is halted.

3.b Process Flow Diagram

Due to the simplicity of the process, a process flow diagram is not necessary.

3.c Raw and Finished Materials

Raw Material used includes rice, corn, and wheat.

3.d Process Capacity

The material throughput rating of the process equipment is confidential. Records of the material throughput rate are retained automatically by the plants control systems and will be made available to Michigan DEQ upon request.

3.e Process Instrumentation

The only process operating parameters relevant to the emissions test program are the flowrate of water through the Rotoclones. The material throughput rating of the process equipment is confidential. Records of the material throughput rate are retained automatically by the plants control systems and will be made available to Michigan DEQ upon request.

4. Sampling and Analytical Procedures

Sections 4.a through 4.d provide a summary of the sampling and analytical procedures that were used to test for PM emissions.

4.a Sampling Train and Field Procedures

To evaluate PM mass emission rates, BTEC utilized the following reference test methods codified at Title 40, Part 60, Appendix A of the Code of Federal Regulations:

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

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Methods 1 and 2. Figure 1 presents the test port and traverse/sampling point locations used. An S-type pitot tube and thermocouple assembly calibrated in accordance with Method 2, Section 4.1.1 was used to measure exhaust gas velocity pressures and temperatures during testing. Because the pitot tube dimensions outlined in Sections 2-6 through 2-8 were within the specified limits, the baseline pitot tube coefficient of 0.84 (dimensionless) was assigned for this testing.

Molecular weight determinations were conducted according to Method 3. The equipment used for this evaluation consisted of a one-way squeeze bulb with connecting tubing and a set of Fyrite® combustion gas analyzers. Moisture content was determined from the condensate collected in the Method 5 sampling train according to Method 4.

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary Sources"* was used to measure PM concentrations and calculate PM emission rates (see Figure 1 for a schematic of the sampling train). Triplicate 60-minute test runs were conducted on each Rotoclone exhaust stack.

BTEC's Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel nozzle, (2) a heated glass lined probe, (3) a heated filter box, (4) a set of four Greensburg-Smith (GS) impingers with the first modified and second standard GS impingers each containing 100 milliliters (mL) of deionized water, a third dry modified GS impinger and a fourth modified GS impinger containing approximately 300 grams of silica gel desiccant, (5) a length of sample line, and (6) a Nutech® control case equipped with a pump, dry gas meter, and calibrated orifice.

After completion of the final leak test for each test run, the filters were recovered, and the nozzle, probe, and the front half of the filter holder assemblies of the Method 5 train were brushed and triple rinsed with acetone and collected in a pre-cleaned sample container. BTEC labeled the containers with the test number, test location, and test date, and marked the level of liquid on the outside of each container. BTEC personnel transported all samples to BTEC's laboratory in Royal Oak, Michigan for analysis.

4.b Recovery and Analytical Procedures

Recovery and analytical procedures were described in Section 4.a.

4.c Sampling Ports

Sampling port and traverse point locations for the 900-13 and Fines-48 exhaust stacks are illustrated by Figure 2-3.

4.d Traverse Points

Sampling port and traverse point locations for the 900-13 and Fines-48 exhaust stacks are illustrated by Figure 2-3.

5. Test Results and Discussion

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

5.a Results Tabulation

The results of the test program are summarized by Table 2-3.

5.b Discussion of Results

Michigan Permit Number 9-08G limits PM from EU-DXCOATDRY process equipment to 0.36 lbs/hr, and PM from EU-BULKSTORE process equipment to 0.54 lbs/hr. The average PM emission rate from the 900-13 Rotoclone was 0.002 lbs/hr. The average PM emission rate from the Fines-48 Rotoclone was 0.03 lbs/hr. See Tables 2-3 for a detailed summary of PM emissions including all the runs.

5.c Sampling Procedure Variations

No sampling procedure variations were used during testing.

5.d Process or Control Device Upsets

No upset conditions occurred during testing.

5.e Control Device Maintenance

No maintenance was performed during the test program.

5.f Re-Test Changes

The test program performed was not previously performed.

5.g Audit Sample Analyses

Audit samples were not applicable to this test program.

5.h Calibration Sheets

Relevant equipment calibration documents are provided as Appendix B.

5.i Sample Calculations

Sample calculations are provided as Appendix C.

5.j Field Data Sheets

Copies of field data sheets and relevant field notes are provided in Appendix A.

5.k Laboratory Data

Laboratory Data is provided in Appendix D

Tables

Table 2
900-13 Particulate Matter Emission Rate Summary

Company	**Kellogg**			
Source Designation	**900-13**			
Test Date	**12/5/2013**	**12/5/2013**	**12/5/2013**	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	84.7	91.7	93.6	90.0
Meter Pressure - Pm (in. Hg)	28.9	28.9	28.9	28.9
Measured Sample Volume (Vm)	44.1	43.3	45.2	44.2
Sample Volume (Vm-Std ft3)	41.3	40.0	41.7	41.0
Sample Volume (Vm-Std m3)	1.17	1.13	1.18	1.16
Condensate Volume (Vw-std)	0.754	0.754	0.754	0.754
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0740	0.0740	0.0740
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.11	3.02	3.14	3.09
Total weight of sampled gas (m g lbs) (dry)	3.08	2.98	3.11	3.05
Nozzle Size - An (sq. ft.)	0.000250	0.000250	0.000250	0.000250
Isokinetic Variation - I	99.4	99.2	99.6	99.4
Stack Data				
Average Stack Temperature - Ts (F)	81.0	81.7	81.2	81.3
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.6	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.989	0.989	0.989	0.989
Percent Moisture (Bws)	1.79	1.85	1.78	1.81
Water Vapor Volume (fraction)	0.0179	0.0185	0.0178	0.0181
Pressure - Ps ("Hg)	28.9	28.9	28.9	28.9
Average Stack Velocity -Vs (ft/sec)	49.9	48.5	50.3	49.6
Area of Stack (ft2)	2.6	2.6	2.6	2.6
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	7,901	7,685	7,966	7,851
Flowrate ft^3 (Standard Wet)	7,443	7,231	7,502	7,392
Flowrate ft^3 (Standard Dry)	7,310	7,098	7,369	7,259
Flowrate m^3 (standard dry)	207	201	209	206
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	0.0	0.1	0.2	0.1
Total Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.000	0.000
lb/1000 lb (dry)	0.000	0.000	0.000	0.000
mg/dscm (dry)	0.0	0.1	0.2	0.1
gr/dscf	0.0000	0.0000	0.0001	0.0000
Total Particulate Emission Rate				
lb/ hr	0.00	0.00	0.00	0.00

Table 3
Fines-48 Particulate Matter Emission Rate Summary

Company	Kellogg			
Source Designation	Fines 48			
Test Date	1/15/2014	1/15/2014	1/15/2013	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	81.7	91.3	94.1	89.0
Meter Pressure - Pm (in. Hg)	29.4	29.3	29.3	29.3
Measured Sample Volume (Vm)	73.9	61.5	63.8	66.4
Sample Volume (Vm-Std ft3)	70.7	57.5	59.4	62.5
Sample Volume (Vm-Std m3)	2.00	1.63	1.68	1.77
Condensate Volume (Vw-std)	0.707	0.424	0.566	0.566
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0743	0.0743	0.0743
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	5.30	4.30	4.45	4.69
Total weight of sampled gas (m g lbs) (dry)	5.27	4.29	4.43	4.66
Nozzle Size - An (sq. ft.)	0.000406	0.000333	0.000333	0.000357
Isokinetic Variation - I	96.6	97.6	97.8	97.3
Stack Data				
Average Stack Temperature - Ts (F)	70.1	71.1	70.8	70.7
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.7	28.8	28.7	28.7
Stack Gas Specific Gravity (Gs)	0.992	0.993	0.992	0.992
Percent Moisture (Bws)	0.99	0.73	0.94	0.89
Water Vapor Volume (fraction)	0.0099	0.0073	0.0094	0.0089
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	51.7	50.9	52.6	51.7
Area of Stack (ft2)	1.8	1.8	1.8	1.8
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	5,484	5,395	5,571	5,483
Flowrate ft^3 (Standard Wet)	5,347	5,251	5,425	5,341
Flowrate ft^3 (Standard Dry)	5,294	5,213	5,374	5,293
Flowrate m^3 (standard dry)	150	148	152	150
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	3.5	2.3	3.2	3.0
Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.002	0.001
lb/1000 lb (dry)	0.001	0.001	0.002	0.001
mg/dscm (dry)	1.7	1.4	1.9	1.7
gr/dscf	0.0008	0.0006	0.0008	0.0007
Total Particulate Emission Rate				
lb/ hr	0.03	0.03	0.04	0.03

Figures

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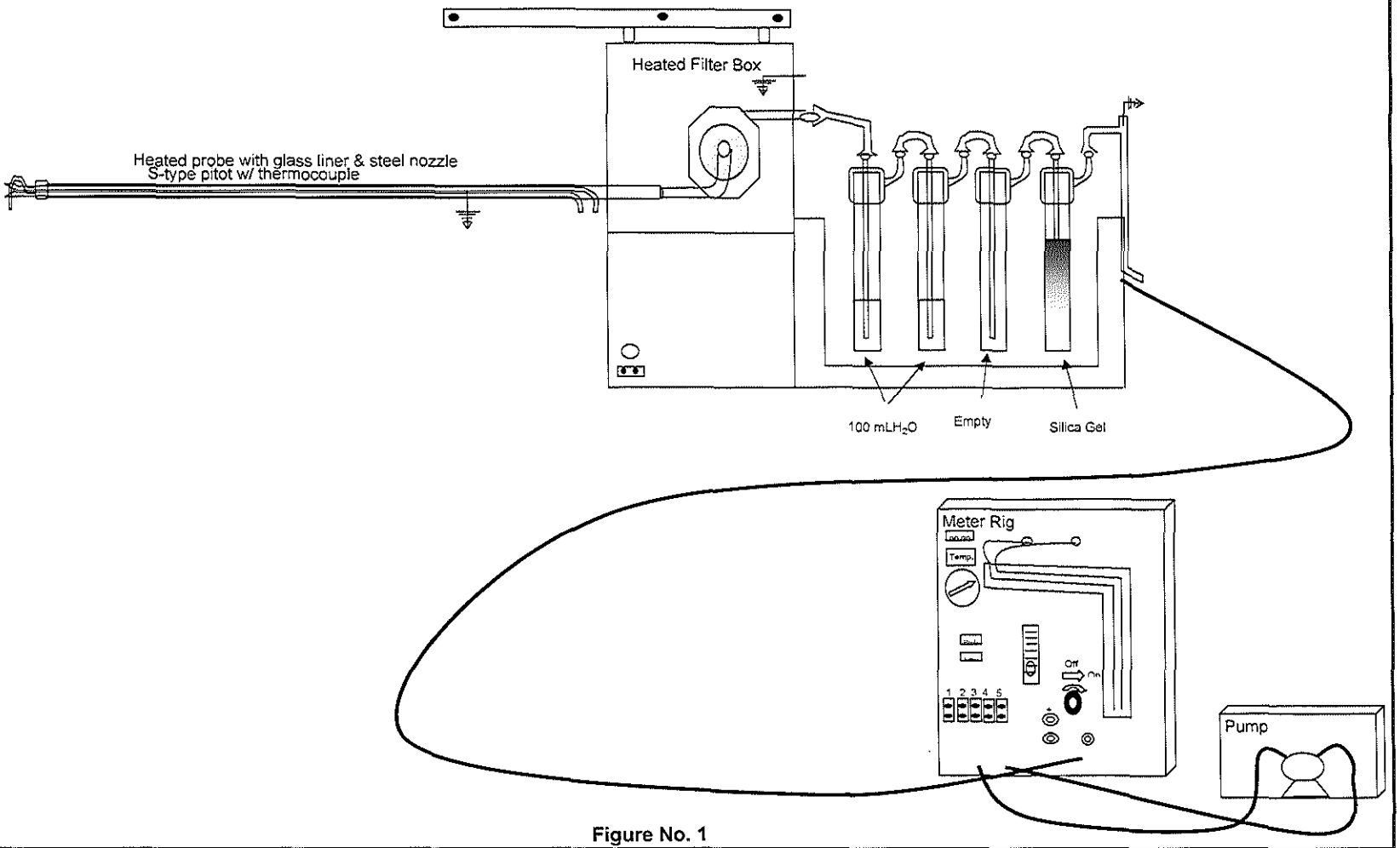

Figure No. 1

Site: USEPA Method 5 Kellogg Battle Creek, Michigan	Sampling Dates: December 5, 2013 and January 15, 2014	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

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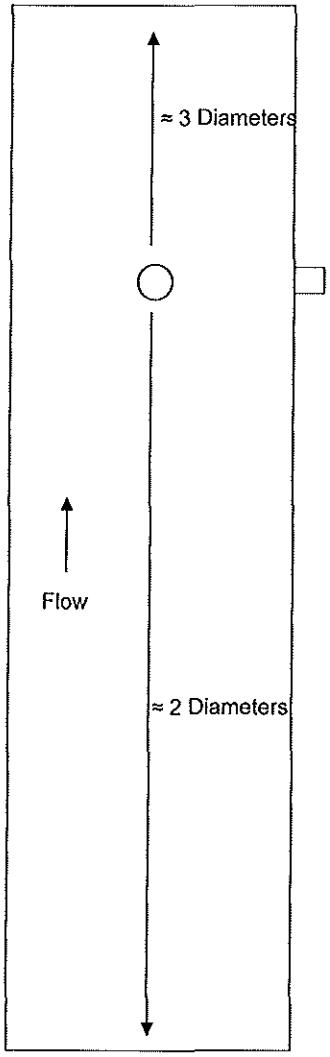
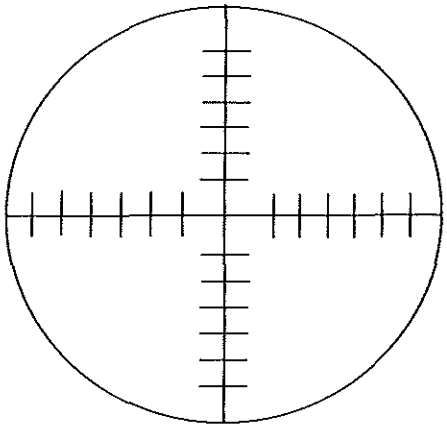
diameter = 22 inches





Not to Scale

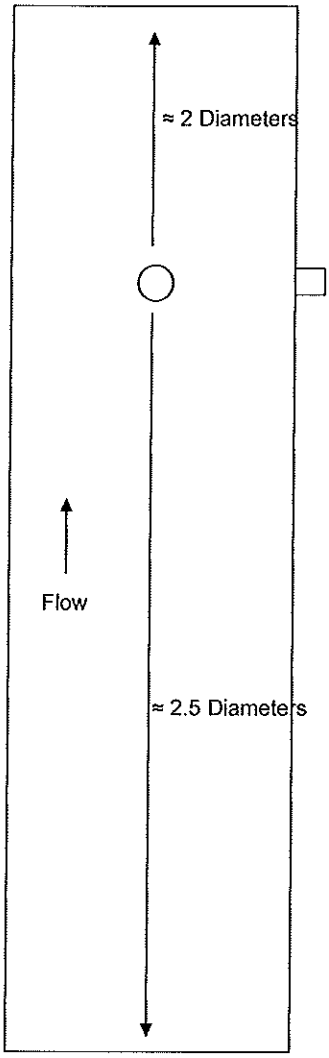
Points	Distance "
1	0.5
2	1.5
3	2.6
4	3.9
5	5.5
6	7.8
7	14.2
8	16.5
9	18.1
10	19.4
11	20.5
12	21.5

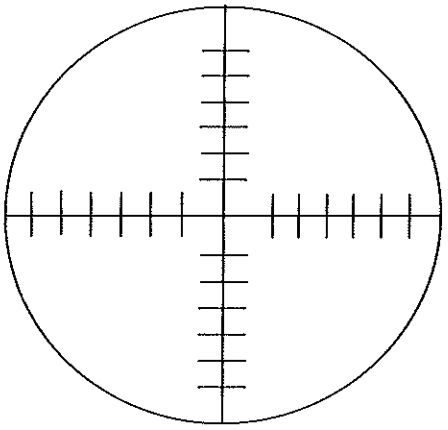
Figure No. 2

Site:	Sampling Date:	
900-13 Exhaust Stack Kellogg Battle Creek, Michigan	December 5, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

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. 3

Site: **Fines 48 Exhaust Stack** **Kellogg** **Battle Creek, Michigan**	**Sampling Date:** **January 15, 2014**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**