BTEC Inc.

Pickle Line Scrubber
HCl Emissions Test Report

Prepared for:

PGP Corporation
Voss Industries

Voss Industries
7925 Beech Daly Road
Taylor, Michigan

Project No. 17-5048.00
July 31, 2017

BT Environmental Consulting, Inc.
4949 Fernlee Ave.
Royal Oak, Michigan 48073
(248) 548-8070

BTEC Inc.

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Voss Industries (Voss) to evaluate hydrogen chloride (HCl) mass emission rates at the inlet and outlet of a wet scrubber system at the Voss facility in Taylor, Michigan. The emissions test program was conducted on June 1, 2017.

Testing of the wet scrubber system consisted of triplicate 60-minute test runs at two inlet locations and triplicate 64-minute test runs at one outlet. The emissions test program was required by MDEQ Air Quality Division Permit Numbers B-3472, C-3516, and C-4501. The results of the emission test program are summarized by Table I.

Table I
Overall Emission Summary
Test Date: June 1st, 2017

Source	HCL Emission Rate (lb/hr)
Main Scrubber Inlet	78.03
Secondary Scrubber Inlet	0.91
Scrubber Outlet	1.15
Source	**HCL Concentration (ppmv dry)**
Main Scrubber Inlet	1666
Secondary Scrubber Inlet	435
Scrubber Outlet	**22**
Scrubber Removal Efficiency	**98.5%**

1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Voss Industries (Voss) to evaluate hydrogen chloride (HCL) emission rates from the inlet and outlet of a wet scrubber system at the Voss facility located in Taylor, Michigan. The emissions test program was conducted on June 1, 2017. The purpose of this report is to document the results of the test program.

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 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 June 1, 2017 at the Voss facility located in Taylor, Michigan. The test program included evaluation of HCl at the inlet and outlet of a wet scrubber system.

1.b Purpose of Testing

The process is affected by Title 40, Part 63, Subpart CCC of the Code of Federal Regulations, the scrubbers is required to achieve a minimum HCl collection efficiency of 97% or a maximum outlet HCl concentration of 18 ppmv (ref. 40 CFR 63.1157(a)).

1.c Source Description

Emissions from the pickling line are controlled by two packed bed scrubbers.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Robert Squiers
President
PGP Corporation
Voss Taylor Division
7925 Beech Daly
Taylor, Michigan 48180

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

Table 1
Test Personnel

Name and Title	Affiliation	Telephone
Mr. Barry Boulianne Senior Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Diven Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Paul Molenda Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Randal Tysar Senior Environmental Engineer	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Dave Trahan Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Josh Boulianne Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Tom Maza	MDEQ Air Quality Division	(313) 456-4709
Mr. Robert Squires President	PGP Corporation Voss Taylor Division 7925 Beech Daly Taylor, Michigan 48180	(313) 291 7500

2. Summary of Results

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

2.a Operating Data

Process data monitored during the emissions test program included steel processing rate. In addition, pursuant to the requirements of 40 CFR 63.1161(b), scrubber makeup water flowrate and recirculation water flowrate will be monitored and recorded at 15-minute intervals during the emissions test program.

2.b Applicable Permit

Installation permits for the steel pickling line were issued by the Wayne County Air Pollution Control Division. These permits did not include special conditions.

2.c Results

The overall results of the emission test program are summarized by Table 2 (see Section 5.a).

3. Source Description

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

3.a Process Description

Emissions from the pickling line are controlled by two packed bed scrubbers. Each is 84 inches in diameter. The first scrubber has a packing depth of 96 inches while the second has a packing depth of 60 inches. The second scrubber is equipped with a demister pad which is continually wetted off the re-circulation pump line. The process is equipped with two fans; one in use and the other on standby. The flue gas is ducted to an exhaust stack measuring 36 inches in diameter and 124 inches in length

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

The raw material used by the process is steel. Steel processing rates were recorded during the emissions test program are summarized by the process field data sheets included in Appendix E.

3.d Process Capacity

In 2016, the processing rate averaged about 110 tons per hour (tph) and would probably max out at 125 tph with the current equipment.

3.e Process Instrumentation

Process data monitored during the emissions test program is included in Appendix E.

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

Measurement of exhaust gas velocity, molecular weight, and moisture content was conducted using the following reference 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"*

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

A cyclonic flow check was performed at each sampling location. The existence of cyclonic flow is 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. If the average of the absolute values of the flow angles is greater than 20 degrees, cyclonic flow exists. The null angle was determined to be less than 5 degrees at each sampling point.

Molecular weight was determined according to USEPA Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." The equipment used for this evaluation consisted 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 in conjunction with the USEPA Method 26A sampling train. Exhaust gas was extracted and passed through a set of four impingers, the first two containing 100 ml of 0.1 Normal Sulfuric Acid (0.1 N H_2SO_4) followed by an empty impinger, followed by a modified GS impinger containing a known weight of silica gel desiccant. Exhaust gas moisture content was then determined gravimetrically.

Hydrogen Chloride Concentrations

Measurement of hydrogen chloride concentrations were conducted using the following reference test methods codified at 40 CFR 60, Appendix A:

- Method 26A - *"Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources(isokinetic method)"*

The Method 26A sampling train consists of: (1) a heated borosilicate or quartz probe liner; (2) a heated borosilicate or quartz glass filter holder containing a pre-weighed 110-mm diameter washed quartz filter with Teflon filter support; (3) a set of three Greensburg-Smith (GS) impingers, the first two containing 100 ml of 0.1 Normal Sulfuric Acid (0.1 N H_2SO_4) followed by an empty impinger, (4) a modified GS impinger containing a known weight of silica gel desiccant; (5) a length of sample line, and (7) a Nutech control case equipped with a pump, dry gas meter, and calibrated orifice. Figure 1 provides an illustration of the Method 26A sample train.

After completion of the final leak test for each test run, the impinger train was carefully disassembled. The liquid volume of each impinger was measured gravimetrically and any volume increase was noted on field sheets. The impinger catch solution was then transferred to pre-cleaned sample containers. The impingers were then triple rinsed with deionized water (DI H_2O), and the rinses added to the H_2SO_4 sample containers. The back-half of the filter holder was rinsed and added to the H_2SO_4 sample container. The containers were labeled with the test number, test location, test date, and the level of liquid was marked on the outside of each container. Immediately after recovery, the sample containers were placed in a sealed cooler for storage. All samples were curried by Maxxam Analytics (Maxxam) personnel to Maxxam's laboratory in Mississauga, Ontario for analysis.

4.b Recovery and Analytical Procedures

See section 4.a.

4.c Sampling Ports

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figures 2-4.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figure 2-4

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 2. Detailed results for the emissions test program are summarized by Tables 3 through 5.

Table 2
Overall Emission Summary
Test Date: June 1st, 2017

Source	HCL Emission Rate (lb/hr)
Main Scrubber Inlet	78.03
Secondary Scrubber Inlet	0.91
Scrubber Outlet	1.15
Source	**HCL Concentration (ppmv dry)**
Main Scrubber Inlet	1666
Secondary Scrubber Inlet	435
Scrubber Outlet	**22**
Scrubber Removal Efficiency	**98.5%**

5.b Discussion of Results

The scrubber has an HCl removal efficiency of 98.5% which is greater than the 97% required. The scrubber exhaust has an HCl concentration of 22 ppm,dry which is greater than the limit of 18 ppm,dry, however the scrubber is only required to meet one of the emission limits, not both.

5.c Sampling Procedure Variations

There were no sampling variations used during the emission compliance 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.

Table 3
Main Scrubber Inlet HCl Emission Test Results Summary

Company	**Voss**			
Source Designation	**Main Scrubber Inlet**			
Test Date	**6/1/2017**	**6/1/2017**	**6/1/2017**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	73.7	80.0	82.9	78.9
Meter Pressure - Pm (in. Hg)	29.6	29.6	29.6	29.6
Measured Sample Volume (Vm)	57.9	55.7	54.8	56.1
Sample Volume (Vm-Std ft3)	56.0	53.2	52.0	53.7
Sample Volume (Vm-Std m3)	1.59	1.51	1.47	1.52
Condensate Volume (Vw-std)	8.016	8.251	7.780	8.016
Gas Density (Ps(std) lbs/ft3) (wet)	0.0710	0.0708	0.0709	0.0709
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.55	4.35	4.24	4.38
Total weight of sampled gas (m g lbs) (dry)	4.17	3.96	3.88	4.00
Nozzle Size - An (sq. ft.)	0.000727	0.000727	0.000727	0.000727
Isokinetic Variation - I	107.4	104.8	104.9	105.7
Stack Data				
Average Stack Temperature - Ts (F)	125.0	127.1	128.2	126.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	27.5	27.4	27.4	27.4
Stack Gas Specific Gravity (Gs)	0.949	0.945	0.947	0.947
Percent Moisture (Bws)	12.52	13.43	13.02	12.99
Water Vapor Volume (fraction)	0.1252	0.1343	0.1302	0.1299
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	25.8	25.4	24.8	25.3
Area of Stack (ft2)	7.1	7.1	7.1	7.1
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	10,916	10,781	10,499	10,732
Flowrate ft^3 (Standard Wet)	9,656	9,502	9,236	9,465
Flowrate ft^3 (Standard Dry)	8,446	8,226	8,034	8,236
Flowrate m^3 (standard dry)	239	233	227	233
Total HCl Weight (ug)				
Sample Catch	4000000.00	3900000.00	3600000.00	3833333.33
Blank correction	0.00	0.00	0.00	0.00
Total	4000000.00	3900000.00	3600000.00	3833333.33
Total HCl Concentration				
lb/1000 lb (wet)	1.940	1.977	1.873	1.930
lb/1000 lb (dry)	2.113	2.169	2.048	2.110
mg/dscm (dry)	2522.9	2589.4	2445.2	2519.2
ppmv (wet)	1455.3	1478.2	1402.6	1445.3
ppmv (dry)	1668.6	1712.3	1617.0	1666.0
Total HCl Emission Rate				
lb/ hr	80.13	80.09	73.86	78.03

Table 4
Secondary Scrubber Inlet HCl Emission Test Results Summary

Company	**Voss**			
Source Designation	**Secondary Inlet**			
Test Date	**6/1/2017**	**6/1/2017**	**6/1/2017**	
Meter/Nozzle Information	Run I	Run 2	Run 3	Average
Meter Temperature Tm (F)	84.3	89.2	92.0	88.5
Meter Pressure - Pm (in. Hg)	29.6	29.6	29.6	29.6
Measured Sample Volume (Vm)	61.3	63.2	61.6	62.0
Sample Volume (Vm-Std ft3)	58.8	60.1	58.2	59.0
Sample Volume (Vm-Std m3)	1.66	1.70	1.65	1.67
Condensate Volume (Vw-std)	1.886	1.839	2.452	2.059
Gas Density (Ps(std) lbs/ft3) (wet)	0.0737	0.0737	0.0734	0.0736
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.47	4.56	4.45	4.49
Total weight of sampled gas (m g lbs) (dry)	4.38	4.48	4.34	4.40
Nozzle Size - An (sq. ft.)	0.002117	0.002117	0.002117	0.002117
Isokinetic Variation - I	98.7	99.5	100.5	99.6
Stack Data				
Average Stack Temperature - Ts (F)	76.2	84.0	91.4	83.8
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.5	28.5	28.4	28.5
Stack Gas Specific Gravity (Gs)	0.984	0.985	0.981	0.983
Percent Moisture (Bws)	3.11	2.97	4.04	3.37
Water Vapor Volume (fraction)	0.0311	0.0297	0.0404	0.0337
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	8.4	8.6	8.4	8.5
Area of Stack (ft2)	0.8	0.8	0.8	0.8
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	393	404	397	398
Flowrate ft^3 (Standard Wet)	380	385	373	379
Flowrate ft^3 (Standard Dry)	368	373	358	366
Flowrate m^3 (standard dry)	10	11	10	10
Total HCl Weight (ug)				
Sample Catch	1100000.00	1100000.00	1100000.00	1100000.00
Blank correction	0.00	0.00	0.00	0.00
Total	1100000.00	1100000.00	1100000.00	1100000.00
Total HCl Concentration				
lb/1000 lb (wet)	0.543	0.532	0.545	0.540
lb/1000 lb (dry)	0.553	0.542	0.559	0.551
mg/dscm (dry)	660.8	646.8	667.5	658.4
ppmv (wet)	422.2	413.8	422.4	419.5
ppmv (dry)	437.0	427.7	441.4	435.4
Total HCl Emission Rate				
lb/ hr	0.91	0.91	0.90	0.91

Table 5
Scrubber Outlet HCl Emission Test Results Summary

Company	**Voss**			
Source Designation	**Outlet**			
Test Date	**6/1/2017**	**6/1/2017**	**6/1/2017**	
Meter/Nozzle Information	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	74.5	90.5	96.0	87.0
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.5	29.5
Measured Sample Volume (Vm)	57.4	59.6	60.0	59.0
Sample Volume (Vm-Std ft3)	55.9	56.3	56.1	56.1
Sample Volume (Vm-Std m3)	1.58	1.60	1.59	1.59
Condensate Volume (Vw-std)	6.554	6.318	7.167	6.680
Gas Density (Ps(std) lbs/ft3) (wet)	0.0716	0.0717	0.0714	0.0716
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	4.47	4.49	4.52	4.49
Total weight of sampled gas (m g lbs) (dry)	4.16	4.20	4.18	4.18
Nozzle Size - An (sq. ft.)	0.000594	0.000594	0.000594	0.000594
Isokinetic Variation - I	101.1	101.2	101.6	101.3
Stack Data				
Average Stack Temperature - Ts (F)	119.8	120.0	120.1	119.9
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	27.7	27.7	27.6	27.7
Stack Gas Specific Gravity (Gs)	0.956	0.958	0.953	0.956
Percent Moisture (Bws)	10.50	10.08	11.32	10.63
Water Vapor Volume (fraction)	0.1050	0.1008	0.1132	0.1063
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	30.3	30.4	30.6	30.4
Area of Stack (ft2)	6.3	6.3	6.3	6.3
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	11,459	11,505	11,571	11,512
Flowrate ft^3 (Standard Wet)	10,233	10,270	10,328	10,277
Flowrate ft^3 (Standard Dry)	9,159	9,234	9,159	9,184
Flowrate m^3 (standard dry)	259	261	259	260
Total HCl Weight (ug)				
Sample Catch	33000.00	55000.00	71000.00	53000.00
Blank correction	0.00	0.00	0.00	0.00
Total	33000.00	55000.00	71000.00	53000.00
Total HCl Concentration				
lb/1000 lb (wet)	0.016	0.027	0.035	0.026
lb/1000 lb (dry)	0.017	0.029	0.037	0.028
mg/dscm (dry)	20.9	34.5	44.7	33.3
ppmv (wet)	12.3	20.4	26.1	19.6
ppmv (dry)	13.8	22.8	29.5	22.0
Total HCl Emission Rate				
lb/ hr	0.72	1.20	1.54	1.15
Main Inlet HCl (lb/hr)	80.13	80.09	73.86	78.03
Secondary Inlet HCl (lb/hr)	0.91	0.91	0.90	0.91
Total Inlet HCl (lb/hr)	81.04	80.99	74.76	78.93
HCl Removal Efficiency	99.1	98.5	97.9	98.5

BTEC Inc.

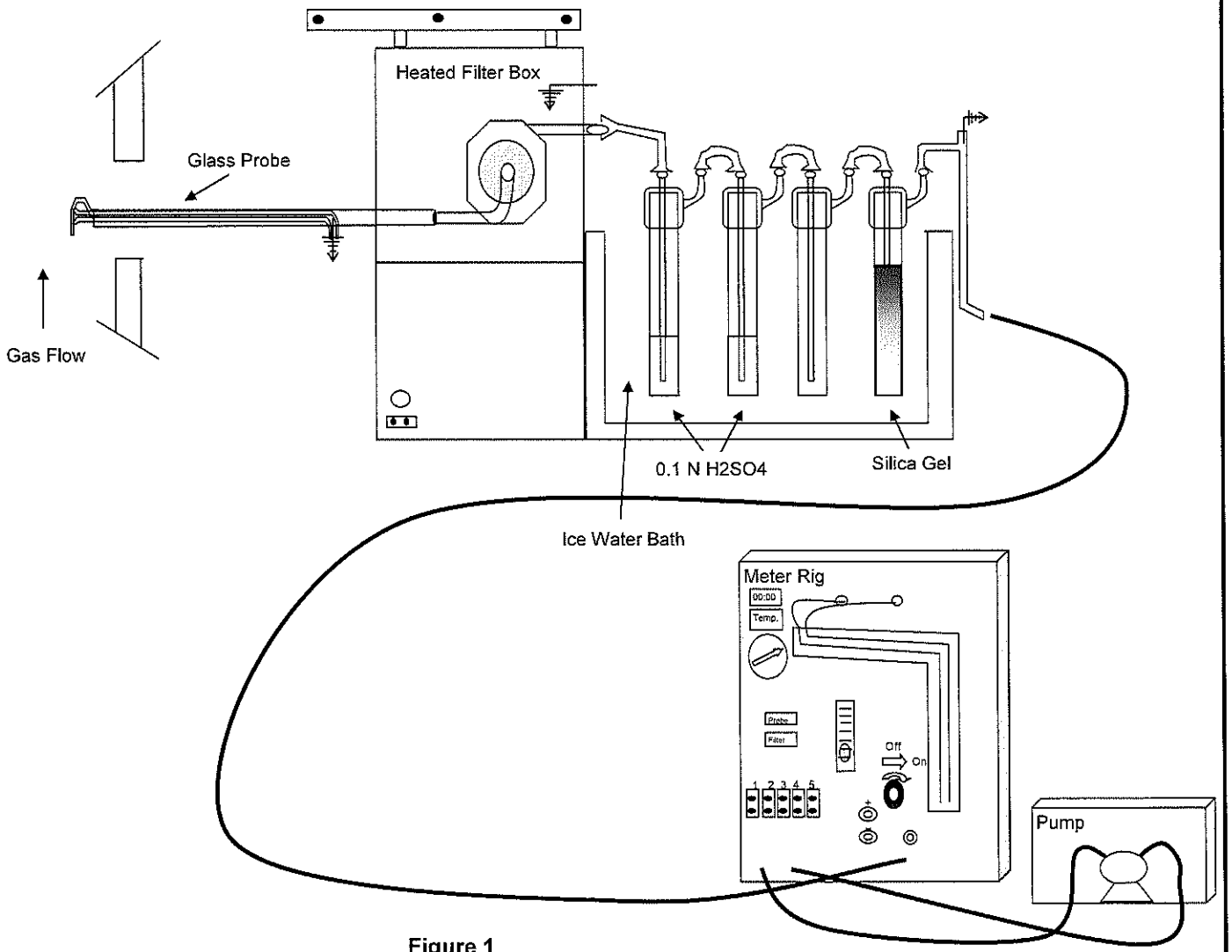


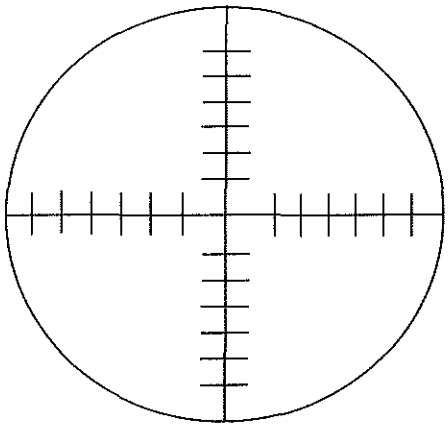
Figure 1

Site: **USEPA Method 26A Sampling Train** **Voss Industries** **Taylor, Michigan**	**Sampling Date:** **June 1, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee Ave** **Royal Oak, Michigan**

BTEC Inc.

diameter = 36"

Points	Distance "
1	0.8
2	2.4
3	4.2
4	6.4
5	9.0
6	12.8
7	23.2
8	27.0
9	29.6
10	31.8
11	33.59
12	35.24



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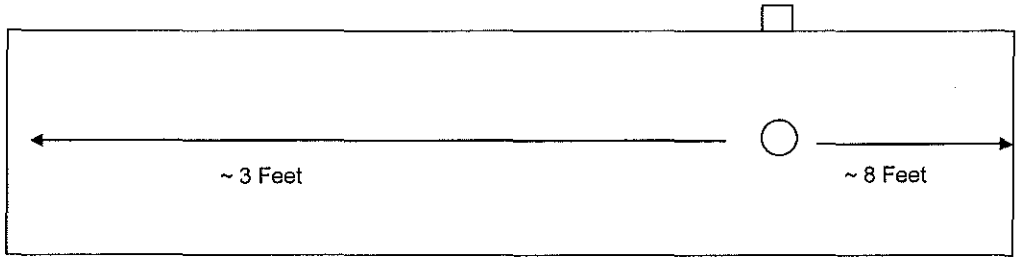
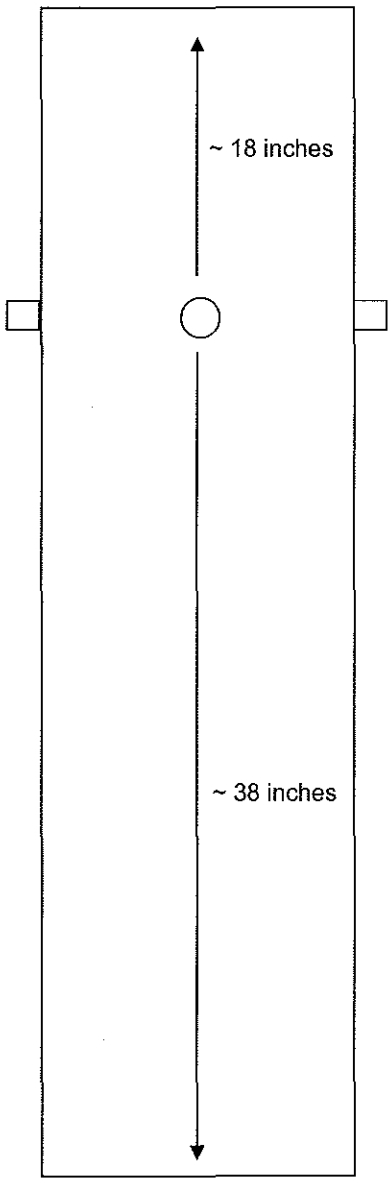


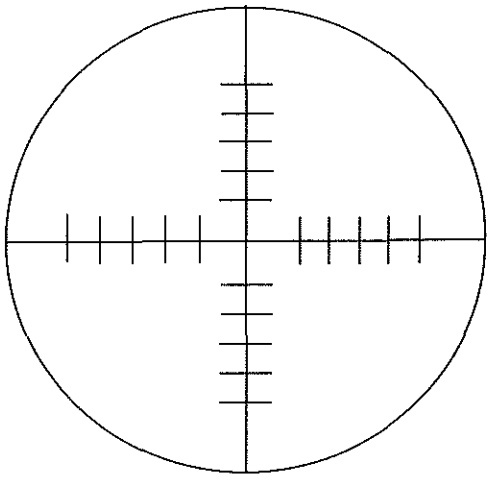
Figure No. 2

Site: **Main Scrubber Inlet** **Voss Industries** **Taylor, MI**	**Sampling Date:** **June 1, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**

BTEC Inc.

diameter = 12"





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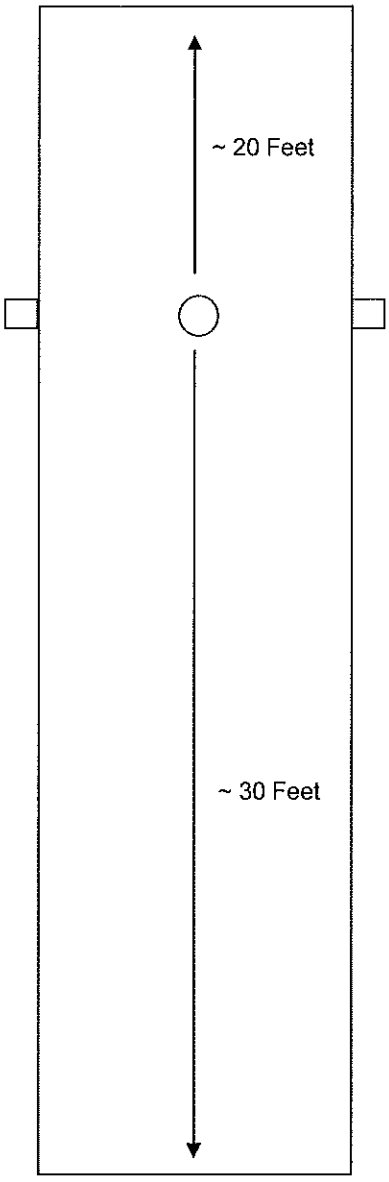
Points	Distance "
1	0.3
2	1.0
3	1.8
4	2.7
5	4.1
6	7.9
7	9.3
8	10.2
9	11.0
10	11.7

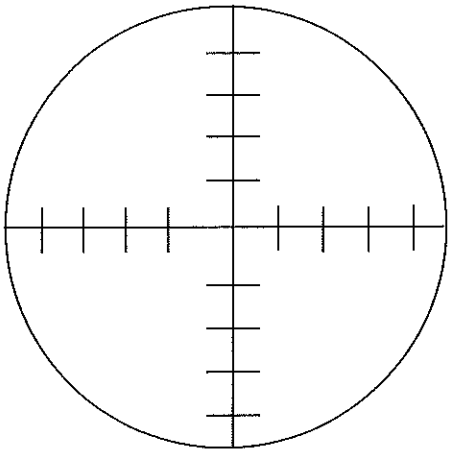
Figure 3

Site: **Secondary Scrubber Inlet** **Voss Industries** **Taylor, MI**	**Sampling Dates:** **June 1, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**

BTEC Inc.

diameter = 34"





Not to Scale

Points	Distance "
1	1.1
2	3.6
3	6.6
4	11.0
5	23.0
6	27.4
7	30.4
8	32.9

Figure 4

Site: **Scrubber Outlet** **Voss Industries** **Taylor, MI**	**Sampling Dates:** **June 1, 2017**	**BT Environmental Consulting, Inc.** **4949 Fernlee** **Royal Oak, Michigan**