



Electric Induction Furnace Emissions Test Report

Prepared for:

Blue Diamond Steel Casting LLC

Pigeon, Michigan

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SEP 05 2017

AIR QUALITY DIVISION

Blue Diamond Steel Casting LLC
125 Sturm Road
Pigeon, Michigan 48755

Project No. 17-5069.00
September 1, 2017

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



EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Blue Diamond Steel Casting, LLC (Blue Diamond) to evaluate particulate matter (PM) emission rates from one electric induction steel induction furnace and one electric arc ladle reheat station of a no bake furnace line in Pigeon, Michigan. This steel foundry is affected by the National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries Area Sources codified at Title 40, Part 63, Subpart ZZZZZ of the Code of Federal Regulations (40 CFR 63, Subpart ZZZZZ) and PTI 129-08D. The emissions test program was conducted on July 6, 2017.

Testing of electric induction steel induction furnace and electric arc ladle consisted of triplicate 96-minute test runs while operating under normal conditions. The results of the emission test program are summarized by Table I.

Table I
Overall Emission Summary
Test Date: July 6th, 2017

EU-NBFURNACE		
Pollutant	Average Emission Rate	Emission Limit
Particulate (Total PM)	0.001 grains/dscf	0.005 grains/dscf
	0.1 lbs per ton of metal charged	0.1 lbs per ton of metal charged

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Blue Diamond Steel Casting, LLC (Blue Diamond) to evaluate particulate matter (PM) emission rates from one electric induction steel induction furnace and one electric arc ladle reheat station of a no bake furnace line in Pigeon, Michigan. This steel foundry is affected by the National Emission Standards for Hazardous Air Pollutants for Iron and Steel Foundries Area Sources codified at Title 40, Part 63, Subpart ZZZZZ of the Code of Federal Regulations (40 CFR 63, Subpart ZZZZZ) and PTI 129-08D. The emissions test program was conducted on July 6, 2017.

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 July 6, 2017 at the Blue Diamond facility located in Pigeon, Michigan. The test program included evaluation of total particulate matter emissions.

1.b Purpose of Testing

AQD issued Permit to Install No. 129-08D to Blue Diamond on March 16, 2016. This permit limits emissions from the electric induction steel induction furnace and electric arc ladle reheat station as summarized by Table 1.

Table 1
Particulate Matter, Fugitive Emission Limitations
Blue Diamond Casting
Pigeon, Michigan

Facility	Permit No.	PM Emission Limit
Blue Diamond Casting	PTI No. 129-08D	0.005 grains/dscf

Particulate matter emissions from the no bake furnace (EU-NBFURNACE) is also limited to 0.1 pounds per ton of metal charged by 40 CFR 63.10895(c)(1).



1.c Source Description

The no bake furnace line consists of one electric induction furnace- 8 ton capacity melt (*permitted for two*): one electric arc ladle reheat station, and a vacuum degassing unit for an expected melting capacity of 200 tons per day. The furnaces are controlled by a 50,000 cfm baghouse (BH-01) & by a 80000 cfm baghouse (BH-22) with the exhaust re-circulated back into the furnace area.

1.d Test Program Contacts

The contact for the source and test report is:

Mr. Mike Peterson
Environmental Engineer
Blue Diamond Steel Casting, LLC
125 Sturm Road
Pigeon, Michigan 48755
(989) 453-3933, ext. 218

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. Mike Peterson Environmental Engineer	Blue Diamond Steel Casting, LLC 125 Sturm Road Pigeon, Michigan 48755	(989)453-3933 Ext. 218
Mr. Randal Tysar Senior Environmental Engineer	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Matthew Young 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. Dave Trahan Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Mike Nummer Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Shane Rabideau Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. David Patterson	MDEQ Air Quality Division	(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 is included as Appendix E.

2.b Applicable Permit

Particulate matter emissions from the no bake furnace (EU-NBFURNACE) are limited to 0.1 pounds per ton of metal charged by 40 CFR 63.10895(c)(1). In addition, particulate matter emissions are limited to 0.005 grains per dry standard cubic foot of exhaust gas by Permit No. 129-08D. Permit No. 129-08D also limits emissions of particulate matter less than 10 microns in diameter (PM₁₀) to 2.14 pounds per hour. However, testing of PM₁₀ emission rates is required by neither 40 CFR 63, Subpart ZZZZZ nor Permit No. 129-08D.

2.c Results

See section 5a.

3. Source Description

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

3.a Process Description

The electric induction furnace is operated as a batch operation with a minimum cycle time of approximately two hours. Scrap steel is charged to the furnace and melted and then alloy metals are added along with anti-slag compound. When complete, the steel is sampled and analyzed and, if acceptable, the steel is tipped into ladles and the ladles used to pour the molten steel into molds. The melted steel is transferred to the electric arc ladle reheat station and then to the degassing station.

3.b Process Flow Diagram

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

3.c Raw and Finished Materials

Scrap steel, alloy metals, and anti-slag compound are added to the no bake furnace line. The total quantity added is a maximum of 10 tons per melt.



3.d Process Capacity

The furnaces have a total permitted capacity of 200 tons per day. The baghouses are rated at 50,000 cfm. and 80,000 cfm.

3.e Process Instrumentation

Process data monitored during the test is available 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

Sampling and analysis procedures followed the methodologies specified by the following methods codified at 40 CFR 60, Appendix A:

- Method 1 - *“Sample and Velocity Traverses for Stationary Sources”* will be used to determine the velocity traverse points
- Method 2 - *“Determination of Stack Gas Velocity and Volumetric Flowrate”* will be used to determine exhaust gas velocity
- Method 3 - *“Gas Analysis for the Determination of Dry Molecular Weight” (Fyrite Procedure)* will be used to determine exhaust gas molecular weight
- Method 4 - *“Determination of Moisture Content in Stack Gases”* will be used to determine exhaust gas moisture content
- Method 5- *“Determination of Particulate Matter Emissions from Stationary Sources”* will be used to determine particulate matter concentrations and emission rates.
- Method 202- *“Determination of Condensable Particulate Matter Emissions from Stationary Sources”* will be used to determine condensable particulate matter concentrations and emission rates.

BTEC’s Nutech® Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel nozzle, (2) a borosilicate glass probe liner, (3) a 90mm glass fiber filter (4) a vertical condenser, (5) an empty pot bellied impinger, (6) an empty modified Greenburg-Smith (GS) impinger, (7) unheated borosilicate filter holder with a teflon filter and Teflon filter support, (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 is conducted before and after each test run. After completion of the final leak test for each test run, the filter is recovered, the nozzle, probe, and front half of the filter housing are brushed and triple rinsed with acetone. The acetone rinses are collected in a pre-cleaned sample container. The impinger train is then purged with nitrogen for one hour at a flow rate of 14 liters per minute. The CPM filter is 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 are triple rinsed with deionized water which is collected in a pre-cleaned sample container. The same glassware is then rinsed with acetone which was collected in a pre-cleaned sample container labeled as the organic fraction. The glassware is then double rinsed with hexane which is added to the same organic fraction sample bottle.

BTEC labels each container with the test number, test location, and test date, and marked the level of liquid on the outside of the container. In addition, blank samples of the acetone, DI water, hexane, and filter are collected.

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 2-3.

4.d Traverse Points

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figures 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 overall results of the emissions test program are summarized by Table 3. Detailed results for the emissions test program are summarized by Tables 4-5.

Table 3
Overall Emission Summary
Test Date: July 6th, 2017

EU-NBFURNACE		
Pollutant	Average Emission Rate	Emission Limit
Particulate (Total PM)	0.001 grains/dscf	0.005 grains/dscf
	0.1 lbs per ton of metal charged	0.1 lbs per ton of metal charged

5.b Discussion of Results

The total PM concentration and emission rates are within the corresponding limits.

5.c Sampling Procedure Variations

The condensable organic fraction for three runs (Inside Run 1, Inside Run 3, and Outside Run 3) were below the reportable detection limit (RDL) of 1.0 mg and have been reported as “<1.0 mg” in the laboratory analytical results report. A value of half the RDL for the organic fraction of those three runs has been used to calculate PM emission rates.

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

This is a retest from the February 28, 2017 testing.

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

Laboratory analytical results for this test program are presented in Appendix D.

Table 4
EU-NBFURNACE Inside Total Particulate Matter Emission Rates

Company Source Designation Test Date	Blue Diamond Inside			Average
	7/6/2017	7/6/2017	7/6/2017	
Meter/Nozzle Information				
	Run 1	Run 2	Run 3	Average
Meter Temperature Tm (F)	85.2	92.4	96.9	91.5
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.4	29.5
Measured Sample Volume (Vm)	78.9	83.6	77.4	80.0
Sample Volume (Vm-Std ft3)	76.0	79.6	72.8	76.1
Sample Volume (Vm-Std m3)	2.15	2.25	2.06	2.16
Condensate Volume (Vw-std)	1.471	1.334	1.683	1.496
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0741	0.0739	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)	5.73	5.99	5.50	5.74
Total weight of sampled gas (m g lbs) (dry)	5.67	5.93	5.42	5.67
Nozzle Size - An (sq. ft.)	0.000317	0.000317	0.000317	0.000317
Isokinetic Variation - I	101.3	99.9	101.0	100.7
Stack Data				
Average Stack Temperature - Ts (F)	99.8	102.4	109.7	104.0
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.6	28.7	28.6	28.6
Stack Gas Specific Gravity (Gs)	0.989	0.990	0.987	0.988
Percent Moisture (Bws)	1.90	1.65	2.26	1.94
Water Vapor Volume (fraction)	0.0190	0.0165	0.0226	0.0194
Pressure - Ps ("Hg)	29.4	29.4	29.3	29.3
Average Stack Velocity - Vs (ft/sec)	45.3	48.2	44.6	46.0
Area of Stack (ft2)	27.1	27.1	27.1	27.1
Production Data				
Metal Charged (Tons)	8.50	8.50	8.50	8.50
Length of Test (Minutes)	96.0	96.0	96.0	96.0
Metal Charged (Tons/hr)	5.31	5.31	5.31	5.31
Exhaust Gas Flowrate				
Flowrate ft ³ (Actual)	73,626	78,368	72,426	74,807
Flowrate ft ³ (Standard Wet)	68,968	72,541	66,145	69,218
Flowrate ft ³ (Standard Dry)	67,659	71,345	64,649	67,884
Flowrate m ³ (standard dry)	1,916	2,020	1,831	1,922
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	1.1	4.5	2.7	2.8
Organic Condensable Particulate	0.5	1.0	0.5	0.7
Inorganic Condensable Particulate	3.4	3.0	2.5	3.0
Condensable Blank Correction	2.0	2.0	2.0	2.0
Total Condensable Particulate	1.9	2.0	1.0	1.6
Total Filterable and Condensable Particulate	3.0	6.5	3.7	4.4
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.002	0.001	0.001
lb/1000 lb (dry)	0.000	0.002	0.001	0.001
mg/dscm (dry)	0.5	2.0	1.3	1.3
gr/dscf	0.0002	0.0009	0.0006	0.0006
Filterable Particulate Emission Rate				
lb/ hr	0.13	0.53	0.32	0.33
Condensable Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.000	0.001
lb/1000 lb (dry)	0.001	0.001	0.000	0.001
mg/dscm (dry)	0.9	0.9	0.5	0.8
gr/dscf	0.0004	0.0004	0.0002	0.0003
Condensable Particulate Emission Rate				
lb/ hr	0.22	0.24	0.12	0.19
Inside Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.002	0.001	0.002
lb/1000 lb (dry)	0.001	0.002	0.002	0.002
mg/dscm (dry)	1.4	2.9	1.8	2.0
gr/dscf	0.0006	0.0013	0.0008	0.0009
Inside Total Particulate Emission Rate				
lb/ hr	0.35	0.77	0.43	0.52
lb/ton metal charged	0.07	0.14	0.08	0.1
Outside Total Inside Particulate Emission Rate				
lb/ hr	0.20	0.31	0.28	0.27
lb/ton metal charged	0.04	0.06	0.05	0.05
gr/dscf	0.0004	0.0007	0.0007	0.0006
Total Combined Particulate Emission Rate				
lb/ hr	0.55	1.08	0.72	0.78
mg/dscm (dry)	1.20	2.26	1.67	1.71
gr/dscf	0.001	0.001	0.001	0.001
lb/ton metal charged	0.1	0.2	0.1	0.1

Table 5
EU-NBFURNACE Outside Total Particulate Matter Emission Rates

Company Source Designation Test Date	Blue Diamond Outside EU Furn			Average
	7/6/2017	7/6/2017	7/6/2017	
Meter/Nozzle Information				
	Run 1	Run 2	Run 3	
Meter Temperature Tm (F)	76.2	83.0	87.1	82.1
Meter Pressure - Pm (in. Hg)	29.5	29.5	29.4	29.5
Measured Sample Volume (Vm)	82.1	81.5	79.0	80.9
Sample Volume (Vm-Std ft3)	79.6	78.1	74.9	77.6
Sample Volume (Vm-Std m3)	2.25	2.21	2.12	2.20
Condensate Volume (Vw-std)	1.485	1.528	1.627	1.547
Gas Density (Ps(std) lbs/ft3) (wet)	0.0740	0.0740	0.0739	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)	6.00	5.89	5.66	5.85
Total weight of sampled gas (m g lbs) (dry)	5.94	5.82	5.58	5.78
Nozzle Size - An (sq. ft.)	0.000250	0.000250	0.000250	0.000250
Isokinetic Variation - I	99.6	100.1	100.1	99.9
Stack Data				
Average Stack Temperature - Ts (F)	93.0	99.6	105.7	99.4
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	0.988	0.988
Percent Moisture (Bws)	1.83	1.92	2.12	1.96
Water Vapor Volume (fraction)	0.0183	0.0192	0.0212	0.0196
Pressure - Ps ("Hg)	29.4	29.4	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	60.4	59.8	58.2	59.5
Area of Stack (ft2)	15.6	15.6	15.6	15.6
Production Data				
Metal Charged (Tons)	8.50	8.50	8.50	8.50
Length of Test (Minutes)	96.0	96.0	96.0	96.0
Metal Charged (Tons/hr)	5.31	5.31	5.31	5.31
Exhaust Gas Flowrate				
Flowrate ft ³ (Actual)	56,564	55,957	54,482	55,667
Flowrate ft ³ (Standard Wet)	52,995	51,806	49,765	51,522
Flowrate ft ³ (Standard Dry)	52,025	50,813	48,708	50,515
Flowrate m ³ (standard dry)	1,473	1,439	1,379	1,430
Total Particulate Weights (mg)				
Total Nozzle/Probe/Filter	0.5	1.4	1.5	1.1
Organic Condensable Particulate	1.0	1.2	0.5	0.9
Inorganic Condensable Particulate	2.8	3.0	3.3	3.0
Condensable Blank Correction	2.0	2.0	2.0	2.0
Total Condensable Particulate	1.8	2.2	1.8	1.9
Total Filterable and Condensable Particulate	2.3	3.6	3.3	3.1
Filterable Particulate Concentration				
lb/1000 lb (wet)	0.000	0.001	0.001	0.000
lb/1000 lb (dry)	0.000	0.001	0.001	0.000
mg/dscm (dry)	0.2	0.6	0.7	0.5
gr/dscf	0.0001	0.0003	0.0003	0.0002
Filterable Particulate Emission Rate				
lb/ hr	0.04	0.12	0.13	0.10
Condensable Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	0.8	1.0	0.8	0.9
gr/dscf	0.0003	0.0004	0.0004	0.0004
Condensable Particulate Emission Rate				
lb/ hr	0.16	0.19	0.16	0.17
Outside Total Particulate Concentration				
lb/1000 lb (wet)	0.001	0.001	0.001	0.001
lb/1000 lb (dry)	0.001	0.001	0.001	0.001
mg/dscm (dry)	1.0	1.6	1.6	1.4
gr/dscf	0.0004	0.0007	0.0007	0.0006
Outside Total Particulate Emission Rate				
lb/ hr	0.20	0.31	0.28	0.27
lb/ton metal charged	0.04	0.06	0.05	0.0
Inside Total Particulate Emission Rate				
lb/ hr	0.35	0.77	0.43	0.52
lb/ton metal charged	0.07	0.14	0.08	0.10
gr/dscf	0.0006	0.0013	0.0008	0.0009
Total Combined Particulate Emission Rate				
lb/ hr	0.55	1.08	0.72	0.78
mg/dscm (dry)	1.20	2.26	1.67	1.71
gr/dscf	0.001	0.001	0.001	0.001
lb/ton metal charged	0.1	0.2	0.1	0.1

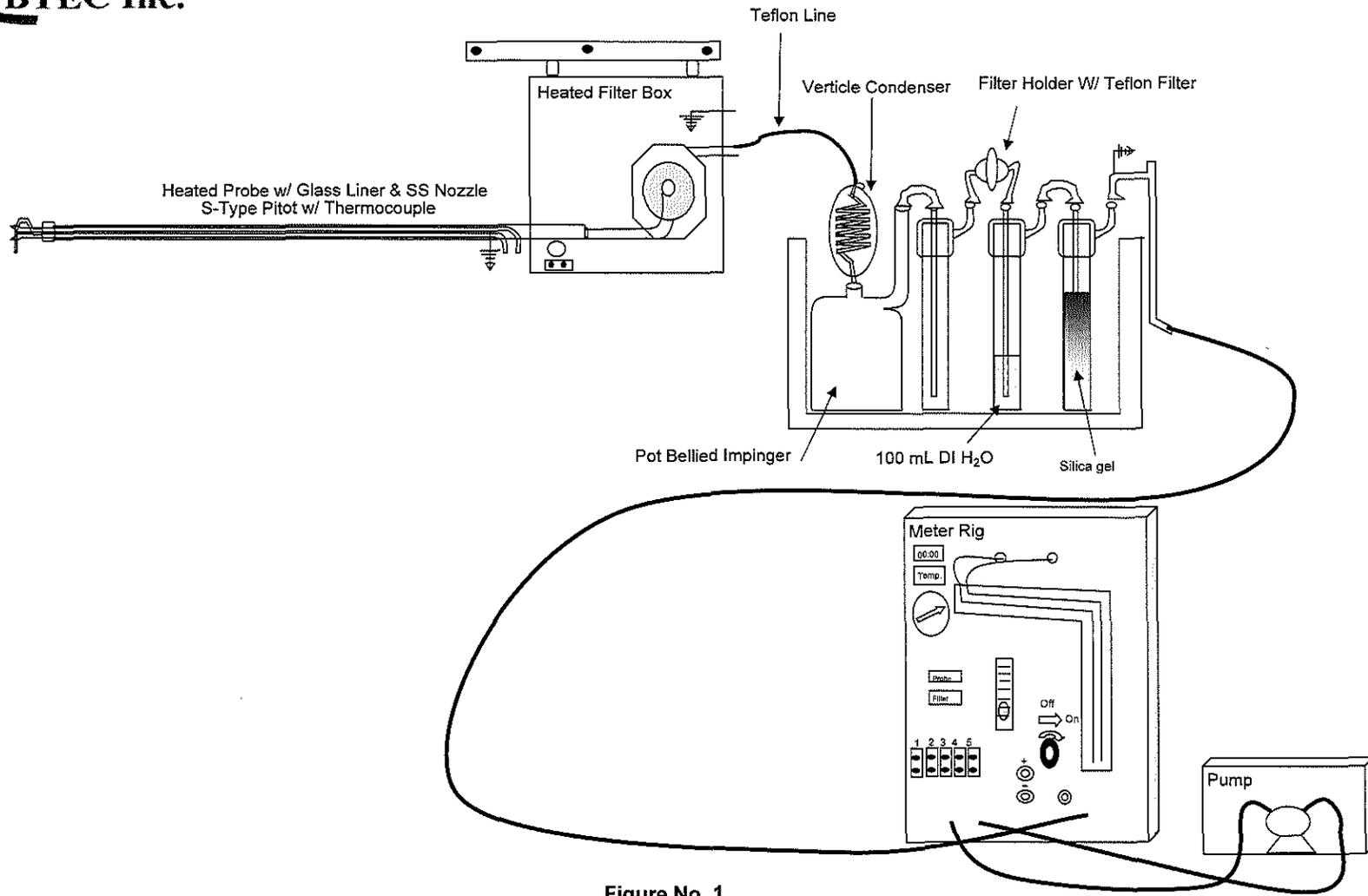


Figure No. 1

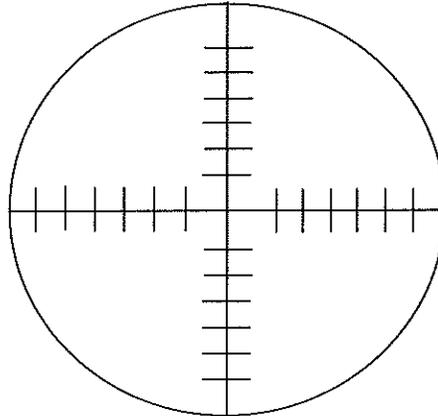
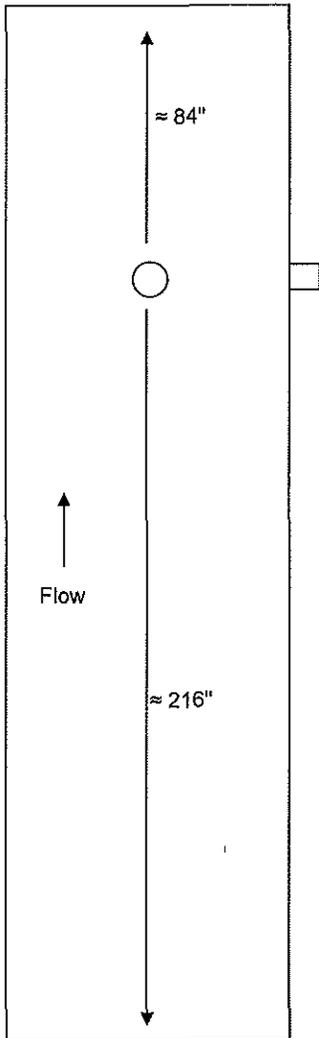
Site:
USEPA Method 5/202
Blue Diamond
Pigeon, Michigan

Sampling Date:
July 7, 2017

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073



diameter = 53.5 inches



Not to Scale

Points	Distance "
1	1.1
2	3.6
3	6.3
4	9.5
5	13.4
6	19.0
7	34.5
8	40.1
9	44.0
10	47.2
11	49.9
12	52.4

Figure No. 2

Site:
Outside
Blue Diamond
Pigeon, Michigan

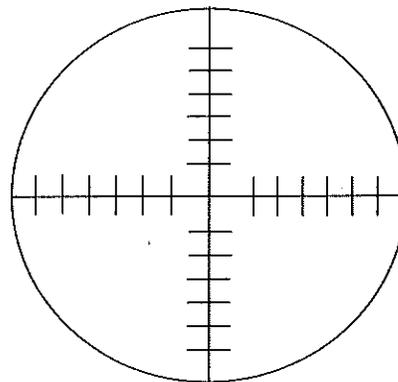
Sampling Date:
July 7, 2017

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073



diameter = 70.5 inches

Points	Distance "
1	1.5
2	4.7
3	8.3
4	12.5
5	17.6
6	25.1
7	45.4
8	52.9
9	58.0
10	62.2
11	65.8
12	69.0



Not to Scale

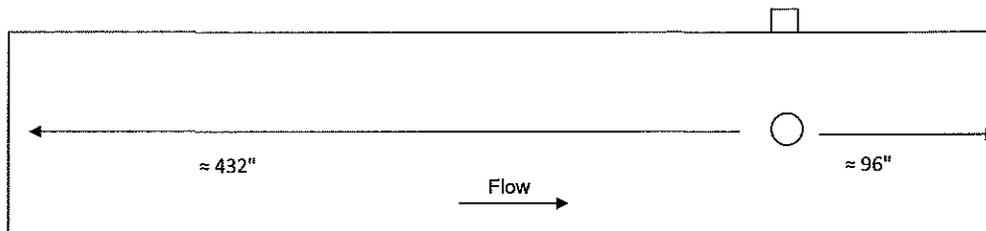


Figure No. 3

Site:
Inside
Blue Diamond
Pigeon, Michigan

Sampling Date:
July 6, 2017

BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073