

**SOURCE TEST REPORT
2019 PARTICULATE MATTER TESTING
UNITED STATE STEEL
GREAT LAKES WORKS
FGPULVCOALTRANSPORT
ECORSE, MI**

Prepared For:
United States Steel
1 Quality Drive
Ecorse, MI 48229

For Submittal To:
Michigan Department of Environment, Great Lakes, and Energy
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EXECUTIVE SUMMARY

Montrose Air Quality Services (MAQS) was retained by United States Steel Corporation, Great Lakes Works (U. S. Steel) to evaluate Particulate Matter (PM) from two exhaust stacks serving the Pulverized Coal Transport (FGPULVCOALTRANSPORT) at the U. S. Steel Great Lakes Works facility located at No. 1 Quality Drive in Ecorse, Michigan. The testing was performed as a compliance demonstration for permit No. 199600132d. The compliance test program was conducted on November 26, 2019.

The testing consisted of triplicate 60-minute test runs at each location. The results of the emission test program are summarized by Table I.

Table I
Executive Summary Table PM Emission Rate Summary

Source	Emission Rate	Permit Limit
PCI Transport	0.051 lb/hr	0.26 lb/hr
	6.7 mg/dscm	21.9 mg/dscm
PCI Injection	0.002 lb/hr	0.14 lb/hr
	0.7 mg/dscm	21.9 mg/dscm

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1. Introduction

Montrose Air Quality Services (MAQS) was retained by United States Steel Corporation, Great Lakes Works (U. S. Steel) to evaluate emission rates from two exhaust stacks serving the Pulverized Coal Transport (FGPULVCOALTRANSPORT) at the U. S. Steel Great Lakes Works facility located at No. 1 Quality Drive in Ecorse, Michigan. The testing was performed as a compliance demonstration for permit No. 199600132d. The compliance test program was conducted on November 26, 2019. 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 report in the format suggested by the AQD test plan format guide.

1.a Identification, Location, and Dates of Test

Sampling and analysis for the emission test program was conducted on November 26, 2019 at the U. S. Steel facility in Ecorse, Michigan. The test program included evaluation of PM emissions from the PCI Transport exhaust stack (Transport) and the PCI Injection exhaust stack (Injection).

1.b Purpose of Testing

Permit No. ROP 199600132d, issued by State of Michigan Environment, Energy, and Great Lakes (EGLE) governs this process.

The allowable particulate emission rate for Transport by permit is:

- 0.26 pounds per hour
- 1.15 tons per year
- 21.9 mg/dscm

The allowable particulate emission rate for Injection by permit is:

- 0.14 pounds per hour
- 0.59 tons per year
- 21.9 mg/dscm

1.c Source Description

A diagram of the exhaust stacks is presented as Figures 1-2.

1.d Test Program Contact

The contacts for the source are:

Mr. Todd Wessel
Client Project Manager
Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073
Phone: (616) 885-4013

Mr. Nathan Ganhs
 U. S. Steel Environmental
 United States Steel Corporation
 Great Lakes Works
 No. 1 Quality Drive
 Ecorse, Michigan 48229
 Phone: (313) 749-3857

1.e Testing Personnel

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. Nathan Ganhs Environmental Department	U.S. Steel No. 1 Quality Drive Ecorse, Michigan 48229	(313) 749-3857
Mr. Mason Sakshaug Field Project Manager	MAQS 4949 Fernlee Avenue Royal Oak, MI 48073	(989) 323-0355
Mr. Mike Nummer Field Project Manager	MAQS 4949 Fernlee Avenue Royal Oak, MI 48073	(248) 548-8072
Mr. Mark Dziadosz Environmental Quality Analyst	EGLE Air Quality Division	(586) 753-3745

2. Summary of Results

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

2.a Operating Data

Relevant operating data is available in Appendix E.

2.b Applicable Permit

The applicable permit for this emissions test program is ROP No. 199600132d.

2.c Results

The overall results of the emission test program are summarized by Table 2 (see Section 5.a). Detailed results for each run can be found in Tables 3-4.

2.d Emission Regulation Comparison

The results are summarized by table 2 (section 5.a). The emission limits are 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

Edison Energy Services grinds coal at the DTE River Rouge power plant which is then transported through a pipeline with air to Zug Island. The air and coal are separated using a dedusting baghouse then the pulverized coal will be conveyed by a rotary valve into a large 1,080-ton storage silo.

3.b Process Instrumentation

The process operating parameters relevant to the emissions test program is the amount of coal transferred, and the differential pressure of the baghouse.

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"*
- Method 4 - *"Determination of Moisture Content in Stack Gases"*
- Method 17 - *"Determination of Particulate Emissions from Stationary Sources (In Stack Filtration)"*

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. A cyclonic flow evaluation was conducted at each sampling location. 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 17 sampling train according to Method 4.

Method 17 was used to measure particulate concentrations and calculate particulate emission rates from the exhaust stack (see Figure 3 for sampling train schematic diagram) MAQS's Nutech[®] Model 2010 modular isokinetic stack sampling system consisted of (1) a stainless-steel button-hook nozzle, (2) a stainless steel in stack filter holder with a pre weighed glass fiber filter, (3) a steel sample probe with a tygon tubing transfer line, (4) a modified Greenburg-Smith (GS) impinger with approximately 300 g 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.

A sampling train and pitot tube leak test was conducted before and after each test run. Upon completion of the final leak check 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.

MAQS labeled 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 and filter were collected. MAQS personnel transported the filters and acetone fractions to MAQS's laboratory in Royal Oak, Michigan for gravimetric analysis.

4.b Recovery and Analytical Procedures

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

4.c Sampling Ports

Sampling ports are located on the stack and meet method 1 criteria.

4.d Traverse Points

Sampling port and traverse point locations for the east PCI transport system exhaust stacks are illustrated by Figures 1-2.

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 emissions test program are summarized by Table 2.

Table 2
Test Program PM Emission Rates Summary

Source	Emission Rate	Permit Limit
PCI Transport	0.051 lb/hr	0.26 lb/hr
	6.7 mg/dscm	21.9 mg/dscm
PCI Injection	0.002 lb/hr	0.14 lb/hr
	0.7 mg/dscm	21.9 mg/dscm

Detailed data for each test run can be found in Tables 3-4.

5.b Discussion of Results

Emission limitations for Permit No. 199600132d are summarized by section 1b. The results of the emissions test program are summarized by Table 2 (see section 5.a). Detailed results for each run are summarized by Table 3-4.

5.c Sampling Procedure Variations

There were not any sampling procedure 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

No maintenance was performed during the test program.

5.f Audit Sample Analyses

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

5.g Calibration Sheets

Relevant equipment calibration documents are provided as Appendix B.

5.h Sample Calculations

Sample calculations are provided in Appendix C.

5.i Field Data Sheets

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

5.j Laboratory Data

Laboratory results are presented in Appendix D.

REVIEW AND CERTIFICATION

All work, calculations, and other activities and tasks performed and presented in this document were carried out by me or under my direction and supervision. I hereby certify that, to the best of my knowledge, Montrose operated in conformance with the requirements of the Montrose Quality Management System and ASTM D7036-04 during this test project.

Signature: _____ Date: _____

Name: Mason Sakshaug Title: Field Project Manager

I have reviewed, technically and editorially, details calculations, results, conclusions, and other appropriate written materials contained herein. I hereby certify that, to the best of my knowledge, the presented material is authentic, accurate, and conforms to the requirements of the Montrose Quality Management System and ASTM D7036-04.

Signature: _____ Date: _____

Name: Matt Young Title: Client Project Manager

Tables

**Table 3
Particulate Matter Emission Rates**

Company Source Designation Test Date	US Steel PCI Transport			Average
	11/26/2019	11/26/2019	11/26/2019	
Meter/Nozzle Information	P-1	P-2	P-3	
Meter Temperature Tm (F)	53.9	66.7	65.8	62.2
Meter Pressure - Pm (in. Hg)	29.2	29.2	29.2	29.2
Measured Sample Volume (Vm)	44.6	44.2	45.8	44.9
Sample Volume (Vm-Std ft3)	45.2	43.7	45.3	44.7
Sample Volume (Vm-Std m3)	1.28	1.24	1.28	1.27
Condensate Volume (Vw-std)	0.189	0.236	0.283	0.236
Gas Density (Ps(std) lbs/ft3) (wet)	0.0744	0.0744	0.0744	0.0744
Gas Density (Ps(std) lbs/ft3) (dry)	0.0745	0.0745	0.0745	0.0745
Total weight of sampled gas (m g lbs) (wet)	3.38	3.27	3.39	3.35
Total weight of sampled gas (m g lbs) (dry)	3.37	3.26	3.38	3.34
Nozzle Size - An (sq. ft.)	0.000739	0.000735	0.000743	0.000739
Isokinetic Variation - I	98.1	99.8	100.3	99.4
Stack Data				
Average Stack Temperature - Ts (F)	47.3	55.0	63.2	55.2
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.8	28.8	28.8
Stack Gas Specific Gravity (Gs)	0.994	0.994	0.993	0.994
Percent Moisture (Bws)	0.42	0.54	0.62	0.52
Water Vapor Volume (fraction)	0.0042	0.0054	0.0062	0.0052
Pressure - Ps ("Hg)	29.0	29.0	29.0	29.0
Average Stack Velocity -Vs (ft/sec)	17.2	16.8	17.4	17.1
Area of Stack (ft2)	2.0	2.0	2.0	2.0
Exhaust Gas Flowrate				
Flowrate ft ³ (Actual)	2,087	2,030	2,106	2,074
Flowrate ft ³ (Standard Wet)	2,108	2,020	2,062	2,063
Flowrate ft ³ (Standard Dry)	2,099	2,009	2,049	2,052
Flowrate m ³ (standard dry)	59	57	58	58
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	7.5	7.7	10.2	8.5
Total Particulate Concentration				
lb/1000 lb (wet)	0.005	0.005	0.007	0.006
lb/1000 lb (dry)	0.005	0.005	0.007	0.006
mg/dscm (dry)	5.9	6.2	7.9	6.7
gr/dscf	0.0026	0.0027	0.0035	0.0029
Total Particulate Emission Rate				
lb/ hr	0.046	0.047	0.061	0.051

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**Table 4
Particulate Matter Emission Rates**

Company Source Designation Test Date	US Steel PCI Injection			Average
	11/26/2019	11/26/2019	11/26/2019	
Meter/Nozzle Information	P-1	P-2	P-3	
Meter Temperature Tm (F)	58.5	55.0	59.3	57.6
Meter Pressure - Pm (in. Hg)	29.2	29.2	29.2	29.2
Measured Sample Volume (Vm)	45.9	46.1	46.2	46.1
Sample Volume (Vm-Std ft3)	46.2	46.7	46.4	46.4
Sample Volume (Vm-Std m3)	1.31	1.32	1.31	1.31
Condensate Volume (Vw-std)	0.330	0.283	0.330	0.314
Gas Density (Ps(std) lbs/ft3) (wet)	0.0743	0.0744	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)	3.46	3.49	3.47	3.47
Total weight of sampled gas (m g lbs) (dry)	3.44	3.48	3.46	3.46
Nozzle Size - An (sq. ft.)	0.003276	0.003276	0.003276	0.003276
Isokinetic Variation - I	99.5	100.0	99.5	99.7
Stack Data				
Average Stack Temperature - Ts (F)	55.8	51.9	51.2	53.0
Molecular Weight Stack Gas- dry (Md)	28.8	28.8	28.8	28.8
Molecular Weight Stack Gas-wet (Ms)	28.8	28.8	28.8	28.8
Stack Gas Specific Gravity (Gs)	0.993	0.993	0.993	0.993
Percent Moisture (Bws)	0.71	0.60	0.71	0.67
Water Vapor Volume (fraction)	0.0071	0.0060	0.0071	0.0067
Pressure - Ps ("Hg)	29.1	29.1	29.1	29.1
Average Stack Velocity -Vs (ft/sec)	4.0	4.0	4.0	4.0
Area of Stack (ft2)	3.1	3.1	3.1	3.1
Exhaust Gas Flowrate				
Flowrate ft ³ (Actual)	752	749	748	749
Flowrate ft ³ (Standard Wet)	747	750	751	749
Flowrate ft ³ (Standard Dry)	742	745	745	744
Flowrate m ³ (standard dry)	21	21	21	21
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	0.6	0.5	1.7	0.9
Total Particulate Concentration				
lb/1000 lb (wet)	0.000	0.000	0.001	0.001
lb/1000 lb (dry)	0.000	0.000	0.001	0.001
mg/dscm (dry)	0.5	0.4	1.3	0.7
gr/dscf	0.0002	0.0002	0.0006	0.0003
Total Particulate Emission Rate				
lb/ hr	0.001	0.001	0.004	0.002

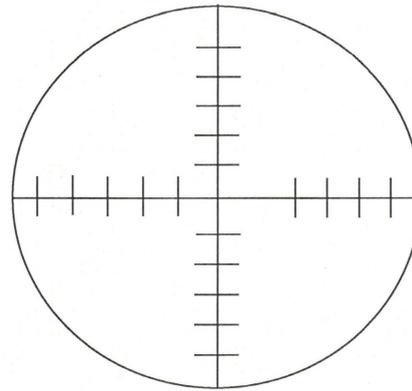
0.5 is the detection limit for particulate matter testing. Run 2 was beneath the detection limit.

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Figures

diameter = 19.25 inches

Points	Distance "
1	0.5
2	1.6
3	2.8
4	4.4
5	6.6
6	12.7
7	14.9
8	16.4
9	17.7
10	18.7



Not to Scale

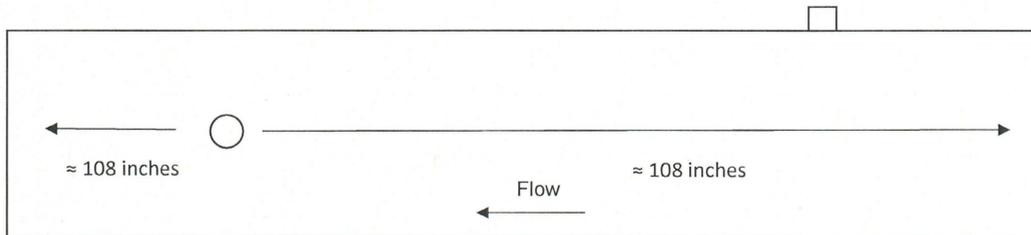


Figure No. 1

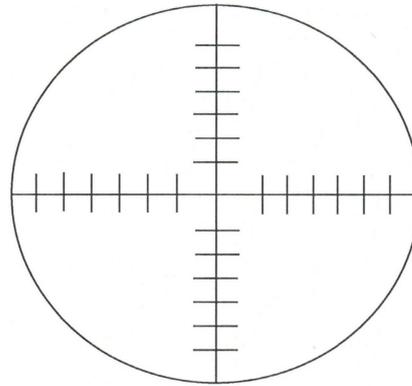
Site:
PCI Transport
US Steel
River Rouge, MI

Sampling Date:
November 26, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073

diameter = 24 inches

Points	Distance "
1	0.5
2	1.6
3	2.8
4	4.2
5	6.0
6	8.5
7	15.5
8	18.0
9	19.8
10	21.2
11	22.4
12	23.5



Not to Scale

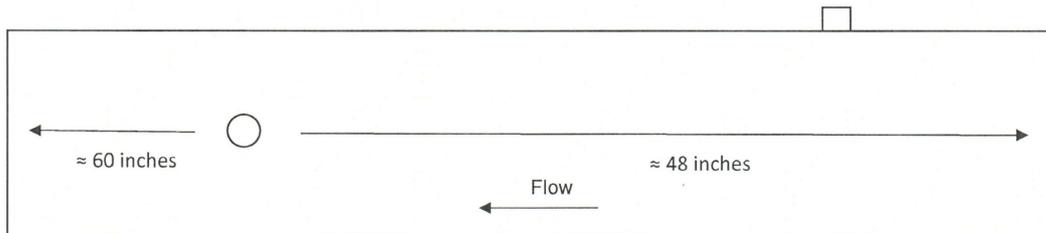


Figure No. 2

Site:
PCI Injection
US Steel
River Rouge, MI

Sampling Date:
November 26, 2019

Montrose Air Quality Services
4949 Fernlee Avenue
Royal Oak, Michigan 48073

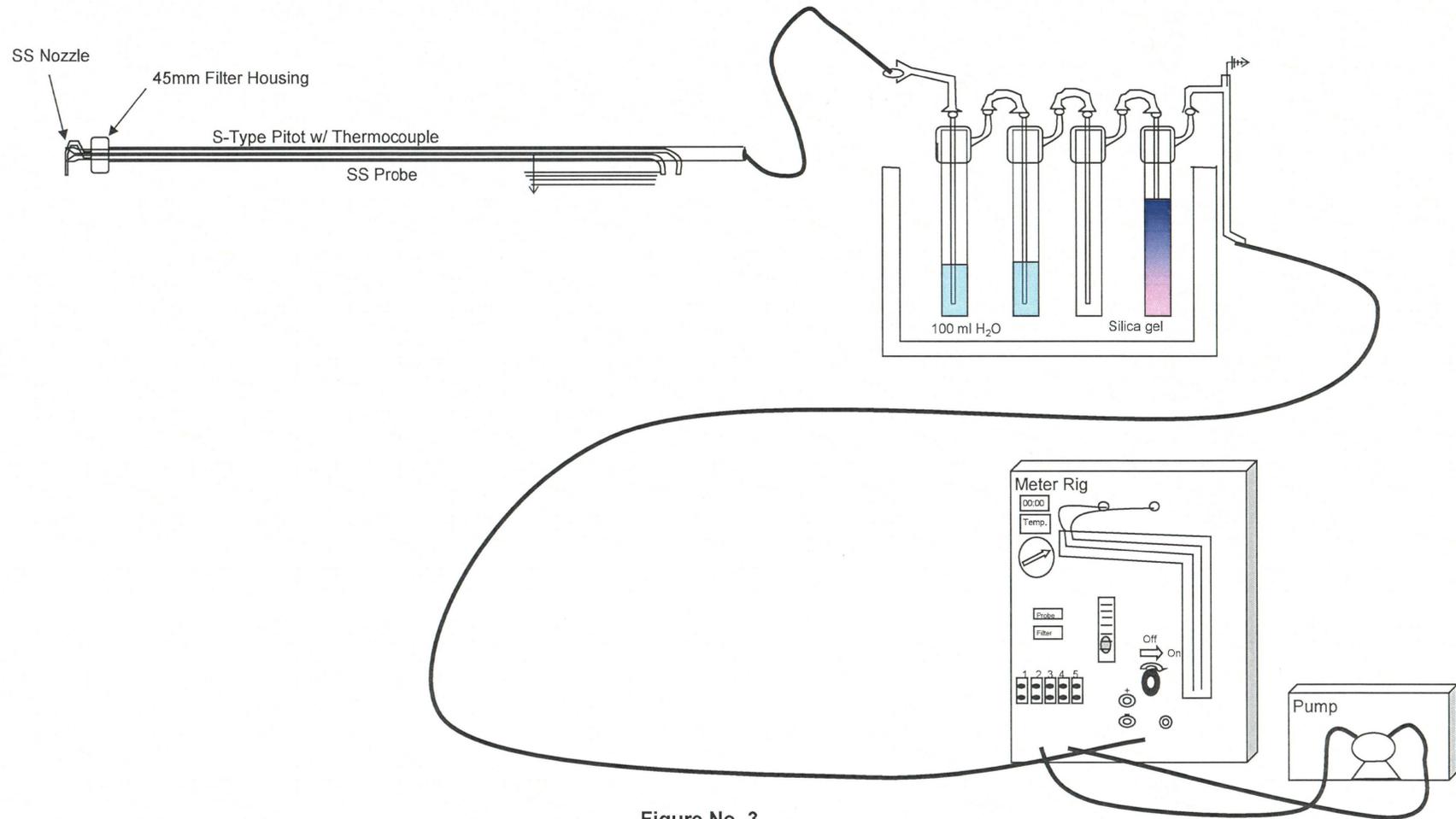


Figure No. 3

Site:
 USEPA Method 17
 US Steel
 River Rouge, MI

Sampling Date:
 November 26, 2019

Montrose Air Quality Services
 4949 Fernlee Avenue
 Royal Oak, Michigan 48073

Appendix A
Field and Computer-Generated Data Sheets