BTEC Inc.

Unit 3 Particulate Matter Emission Test Summary Report

Prepared for:

DTE Energy

River Rouge, Michigan

DTE River Rouge Power Plant
1 Belanger Park Drive
River Rouge, MI 48218

Project No. 13-4451.00
November 5, 2013

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

BTEC Inc.

Executive Summary

BT Environmental Consulting, Inc. (BTEC) was retained by DTE Energy (DTE) to evaluate filterable particulate matter (PM) emission rates from DTE River Rouge Power Plant (RRPP) Unit 3 located in River Rouge, Michigan. Testing for this project was conducted on September 17, 2013.

Testing consisted of triplicate 60 minute test runs for particulate matter. Sampling and analysis was performed utilizing United States Environmental Protection Agency (USEPA) 40 CFR 60, Appendix A Reference Test Methods.

The PM emission limitation for RRPP Unit 3 is 0.175 pounds per 1,000 pounds of exhaust gases on a wet basis corrected to 50% excess air. The average PM test result for the September 17, 2013 test program was 0.010 pounds per 1,000 pounds of exhaust gases on a wet basis corrected to 50% excess air.

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

BTEC Inc.

1.0 Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by DTE Energy (DTE) to evaluate filterable particulate matter (PM) emission rates from DTE River Rouge Power Plant (RRPP) Unit 3 located in River Rouge, Michigan. Testing for this project was conducted on September 17, 2013.

Testing consisted of triplicate 60 minute test runs for particulate matter. Sampling and analysis was performed utilizing United States Environmental Protection Agency (USEPA) 40 CFR 60, Appendix A Reference Test Methods.

The following BTEC professionals participated in conducting this study: Jeffrey Peitzsch, Project Manager, and Paul Molenda, Environmental Technician. Mr. Fred Meinecke, Sr. Environmental Technician with DTE, provided on-site coordination throughout this project.

2.0 Process Description

Steam Generating Unit No. 3 is a 2670 MMBtu per hour capacity boiler. The boiler is fueled by pulverized coal, natural gas, blast furnace gas, and coke oven gas. The boiler is equipped with Low-NOx burners and an electrostatic precipitator. At the point of sampling, the Unit 3 exhaust stack is 282 inches in diameter.

3.0 Sampling and Analytical Methodologies

Sampling and analytical methodologies for the emissions test program can be separated into two categories as follows:

(1) Measurement of exhaust gas velocity, molecular weight, and moisture content; and
(2) Measurement of exhaust gas particulate matter concentration.

Sampling and analytical methodologies by category are summarized by Sections 3.1 and 3.2, respectively.

3.1 Exhaust Gas Velocity, Molecular Weight, and Moisture Content

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 - *"Sample and Velocity Traverses for Stationary Sources"*
- Method 2 - *"Determination of Stack Gas Velocity and Volumetric Flowrate"*
- Method 3A - *"Determination of Oxygen and Carbon Dioxide (CO_2) Concentrations in Emissions from Stationary Sources" (Instrumental Analyzer Procedure)*
- 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. S-type pitot tubes with thermocouple assemblies, constructed in

accordance with the baseline pitot tube coefficient (0.84) specifications of Method 2, Section 10, were 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 diagram of the sampling location is provided as Figure 1.

Cyclonic flow checks were performed at the exhaust stack. 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 20 degrees at each sampling point.

Molecular weight was measured according to Method 3A. Dry exhaust gas samples were collected in Tedlar Bags from the meter box exhaust and analyzed for O_2 and CO_2 content using instrumental analyzers.

Exhaust gas was extracted as part of the Method 5 sampling train (see Section 3.2) and passed through two impingers filled with 100 ml of deionized water, a third empty impinger, and a fourth impinger filled with silica gel. Exhaust gas moisture content was then determined gravimetrically.

3.2 Particulate Matter (USEPA Method 5)

40 CFR 60, Appendix A, Method 5, *"Determination of Particulate Emissions from Stationary Sources"* was used to evaluate PM concentrations. The Method 5 sampling train consisted of: (1) a heated stainless steel probe liner; (2) a heated borosilicate or quartz glass filter holder containing a pre-weighed 90-mm diameter filter with Teflon filter support; (3) a set of three Greensburg-Smith (GS) impingers with the first two containing 100 ml of DI water, (4) a modified GS impinger containing a known weight 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. Figure 2 provides an illustration of the Method 5 sample train.

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, probe, and front half of the filter holder assembly were brushed and triple rinsed with acetone. The acetone rinses were collected in a pre-cleaned sample containers.

BTEC 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. BTEC personnel carried all samples to BTEC's laboratory (for filter and acetone gravimetric analysis) in Royal Oak, Michigan.

4.0 Test Results

The PM emission limitation for RRPP Unit 3 is 0.175 pounds per 1,000 pounds of exhaust gases on a wet basis corrected to 50% excess air. The average PM test result for the September 17, 2013 test program was 0.010 pounds per 1,000 pounds of exhaust gases on a wet basis corrected to 50% excess air.

Detailed test data for this project is presented in Table 1. Field and computer generated data sheets are available in Appendix A. Equipment calibration information is available in Appendix B. Example calculations for equations covered in this report are presented in Appendix C. Laboratory data and O_2 and CO_2 analytical data is presented in Appendix D. Process operating data is provided in Appendix E.

Limitations

The information and opinions rendered in this report are exclusively for use by DTE Energy. BTEC will not distribute or publish this report without consent from DTE Energy except as required by law or court order. BTEC accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report was prepared by: _____
Matthew Young
Project Manager

This report was reviewed by: _____
Brandon Chase
Staff Environmental Engineer

TABLES

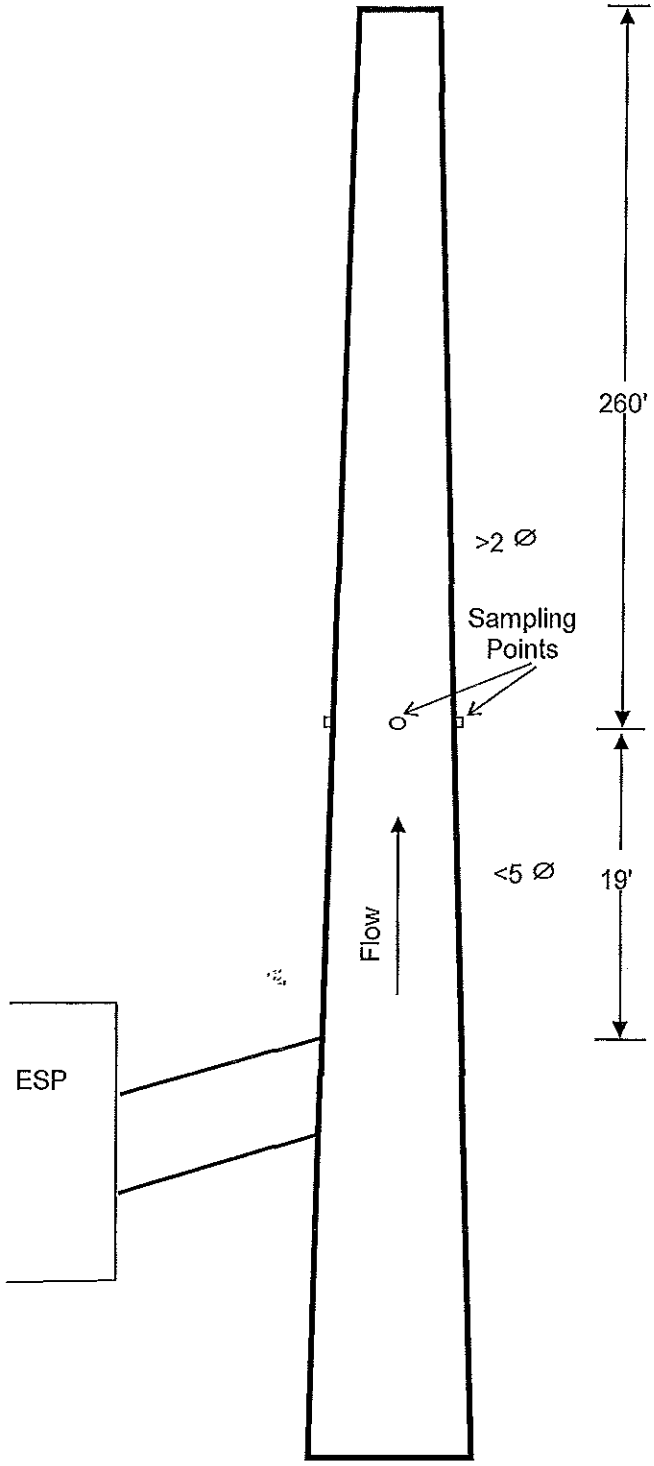
Table 1
Unit #3 Particulate Matter Emission Rates

Company	DTE RRP			
Source Designation	Unit 3			
Test Date	9/17/2013	9/17/2013	9/17/2013	
Meter/Nozzle Information	P-1	P-2	P-3	Average
Meter Temperature Tm (F)	61.9	74.9	76.6	71.1
Meter Pressure - Pm (in. Hg)	29.3	29.3	29.3	29.3
Measured Sample Volume (Vm)	46.1	47.6	48.0	47.2
Sample Volume (Vm-Std ft3)	46.2	46.7	46.8	46.6
Sample Volume (Vm-Std m3)	1.31	1.32	1.33	1.32
Condensate Volume (Vw-std)	4.526	4.574	4.479	4.526
Gas Density (Ps(std) lbs/ft3) (wet)	0.0751	0.0753	0.0753	0.0752
Gas Density (Ps(std) lbs/ft3) (dry)	0.0778	0.0781	0.0780	0.0780
Total weight of sampled gas (m g lbs) (wet)	3.81	3.85	3.86	3.84
Total weight of sampled gas (m g lbs) (dry)	3.60	3.64	3.65	3.63
Nozzle Size - An (sq. ft.)	0.000507	0.000507	0.000507	0.000507
Isokinetic Variation - I	98.6	98.9	99.5	99.0
Stack Data				
Average Stack Temperature - Ts (F)	323.1	326.7	328.9	326.2
Molecular Weight Stack Gas- dry (Md)	30.1	30.2	30.2	30.2
Molecular Weight Stack Gas-wet (Ms)	29.0	29.1	29.1	29.1
Stack Gas Specific Gravity (Gs)	1.003	1.005	1.006	1.005
Percent Moisture (Bws)	8.92	8.93	8.73	8.86
Water Vapor Volume (fraction)	0.0892	0.0893	0.0873	0.0886
Pressure - Ps ("Hg)	29.3	29.3	29.3	29.3
Average Stack Velocity -Vs (ft/sec)	42.6	43.1	43.1	42.9
Area of Stack (ft2)	433.5	433.5	433.5	433.5
Exhaust Gas Flowrate				
Flowrate ft^3(Actual)	1,108,916	1,121,234	1,120,089	1,116,746
Flowrate ft^3 (Standard Wet)	732,878	737,643	734,788	735,103
Flowrate ft^3 (Standard Dry)	667,517	671,788	670,649	669,985
Flowrate m^3 (standard dry)	18,902	19,023	18,991	18,972
Total Particulate Weights (mg)				
Nozzle/Probe/Filter	14.9	14.6	17.3	15.6
Total Particulate Concentration				
lb/1000 lb (wet)	0.009	0.008	0.010	0.009
lb/1000 lb (dry)	0.009	0.009	0.010	0.009
lb/1000 lb corrected to 50% Excess Air (wet)	0.010	0.009	0.010	0.010
mg/dscm (dry)	11.4	11.1	13.0	11.8
gr/dscf	0.0050	0.0048	0.0057	0.0052
Total Particulate Emission Rate				
lb/ hr	28.6	27.9	32.9	29.8

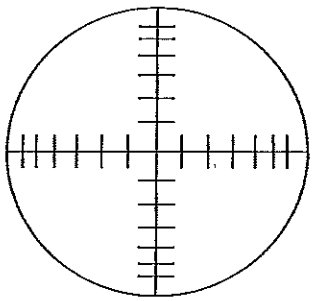
FIGURES

DTE Energy

Figure 1 – Sampling Location
River Rouge Power Plant - Unit 3



Stack Diameter 282"



Velocity Measurement Points

Points	Distance From Inner Wall
1	5.92
2	18.89
3	33.28
4	49.91
5	70.50
6	100.39

BTEC Inc.

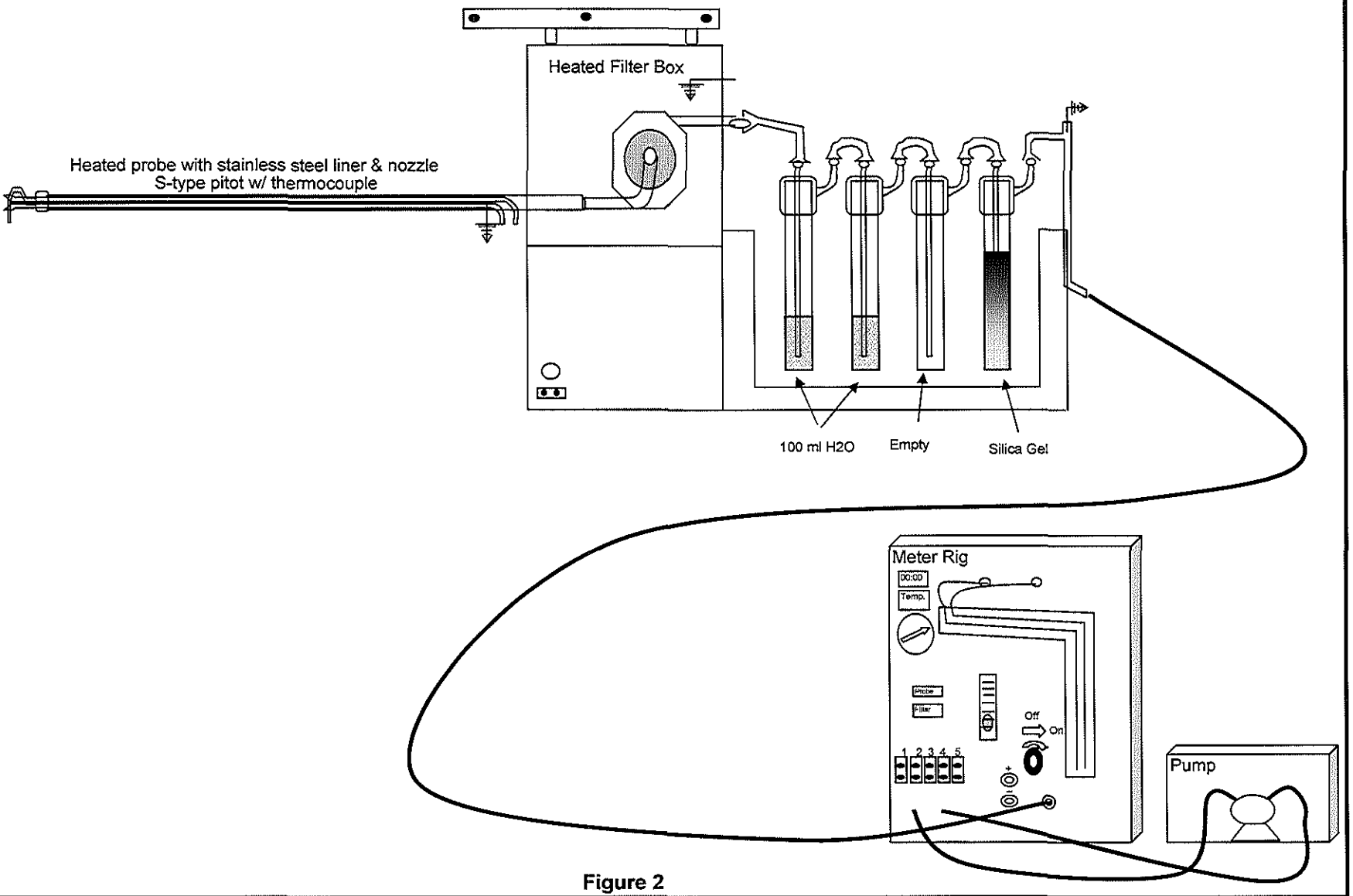


Figure 2

Site:	Sampling Date:	
USEPA Method 5 Sampling Train DTE Energy River Rouge Power Plant	September 17, 2013	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan