BTEC Inc.

VOC Destruction Efficiency Emissions Test Report

Prepared for:

Toefco Engineered Coating Systems, Inc.

Toefco Engineered Coating Systems, Inc.
1220 North 14th Street
Niles, Michigan 49120

Project No. 14-4551.00
January 20, 2016

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

EXECUTIVE SUMMARY

BT Environmental Consulting, Inc. (BTEC) was retained by Toefco Engineered Coating Systems, Inc. (Toefco) to conduct a compliance volatile organic compound (VOC) abatement system destruction efficiency (DE) emissions test program at the Toefco facility in Niles, Michigan. The RTO DE evaluation was conducted on December 1, 2015. The purpose of this document is to summarize the results of the required emissions test program.

Michigan Department of Environmental Quality Air Quality Division Permit No. 225-07B requires that the RTO maintain a VOC destruction efficiency of at least 95%. The results of the emissions test program are summarized by Table I.

Table I
Toefco Engineered Coating Systems
RTO DE Emissions Test Result Summary
Sampling Date: December 1, 2015

Run	Time	Inlet VOC Emission Rate (lbs/hr)	Outlet VOC Emission Rate (lbs/hr)	VOC Destruction Efficiency (%)
1	16:18-17:1 8	13.6	0.7	95
2	17:13-19:21	13.0	0.7	95
3	20:13-21:13	12.6	0.6	95
	Averages:	13.1	0.7	95

*Outlet VOC emission rate corrected for methane. Test Run 2 was broken into three sampling periods due to production gaps in the coating process.

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1. Introduction

BT Environmental Consulting, Inc. (BTEC) was retained by Toefco Engineered Coating Systems, Inc. (Toefco) to conduct a compliance volatile organic compound (VOC) abatement system destruction efficiency (DE) emissions test program at the Toefco facility in Niles, Michigan. The RTO DE evaluation was conducted on December 1, 2015. The purpose of this document is to summarize the results of the required emissions 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

The RTO unit is operated at the Toefco facility located at 1220 North 14th Street in Niles, Michigan. VOC DE Testing of the RTO was conducted on December 1, 2015

1.b Purpose of Testing

The purpose of the test program was to verify the RTO VOC DE as required by Michigan Department of Environmental Quality Air Quality Division (AQD) Permit No. 225-07B.

1.c Source Description

A miscellaneous metal parts coating line (the "Super Line"). The Super Line consists of a three stage pretreatment washer, a dry off oven, two paint spray booths, two flash-off areas, and a curing oven. The two spray booths are equipped with dry filters to control particulate overspray. VOC emissions from this line are controlled by a Regenerative Thermal Oxidizer (RTO) except during exceptional operation which is identified in the permit (Permit No. 225-07B) as by-pass mode.

1.d Test Program Contact

The contacts for information regarding the test program as well as the test report are:

Mr. Artie McElwee III
President/CEO
Toefco Engineered Coating Systems, Inc.
1220 North 14th Street
Niles, Michigan 49120
269-683-0188

Mr. Randal Tysar
Senior Environmental Engineer
BT Environmental Consulting, Inc.
4949 Fernlee Avenue
Royal Oak, Michigan 48073
248-548-8070

1.e Test Personnel

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

2. Summary of Results

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

2.a Operating Data

Operating data is available in Appendix E.

2.b Applicable Permit

The RTO at the Toefco facility is regulated by Michigan Department of Environmental Quality Air Quality Division (AQD) Permit No. 225-07B.

2.c Results

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

2.d Emission Regulation Comparison

Permit No. 225-07B requires a minimum VOC destruction efficiency of 95%. As summarized by Table 2, the RTO DE is 95%.

3. Source Description

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

3.a Process Description

A miscellaneous metal parts coating line (the "Super Line"). The Super Line consists of a three stage pretreatment washer, a dry off oven, two paint spray booths, two flash-off areas, and a curing oven. The two spray booths are equipped with dry filters to control particulate overspray. VOC emissions from this line are controlled by a Regenerative Thermal Oxidizer (RTO) except during exceptional operation which is identified in the permit (Permit No. 225-07B) as by-pass mode.

3.b Process Flow Diagram

The RTO controls VOC emissions from the corresponding equipment by oxidizing organics present in the exhaust gas at elevated temperatures. Due to the simplicity of the RTO unit, a process flow diagram is not necessary.

3.c Raw and Finished Materials

Production data for the Super Line is summarized in Appendix E.

3.d Process Capacity

Typical coating application rate, based upon the metal parts' sizes, is estimated to be approximately 16 to 22 pounds per hour. Toefco's operation as a specialized "job-shop" coating facility requires the flexibility to adjust both parts and coating materials throughout the work day. Material safety data sheets for the materials used during the emissions test program are provided in Appendix E.

3.e Process Instrumentation

Process instrumentation relevant to the emissions test program includes devices to monitor the process data 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 to verify the DE of the RTO.

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 - *"Sample and Velocity Traverses for Stationary Sources"*
- 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 Methods 1 and 2. An S-type or standard pitot tube with a thermocouple assembly, calibrated in accordance with Method 2, 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 20 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 using Method 4 (with a single moisture run conducted at each sampling location). Exhaust gas was extracted and passed through (i) two impingers, each with 100 ml deionized water, (ii) an empty impinger, and (iii) an impinger filled with silica gel. Exhaust gas moisture content was then determined volumetrically (liquid impingers) and gravimetrically (silica gel impinger). A schematic drawing of the Method 4 sampling train is provided as Figure 1.

VOC concentrations were measured at the inlet and outlet of the RTO using the procedures of 40 CFR 60, Appendix A, Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." Triplicate 60-minute test runs were conducted on the RTO.

RTO inlet VOC concentrations were measured using a VIG Industries Model 20 THC gas analyzer and a J.U.M. Model 109A gas analyzer. RTO outlet VOC concentrations were measured using a J.U.M. Model 109A methane/non-methane THC gas analyzer. For each sampling location, a sample of the gas stream was drawn through a stainless-steel probe with an in-line glass fiber filter to remove any particulate and a heated Teflon® sample line to prevent the condensation of any moisture from the sample before it enters the analyzer. Data was recorded at 4-second intervals on a Laptop PC equipped with data acquisition software.

For analyzer calibrations, calibration gases were mixed to desired concentrations using an Environics Series 4040 Computerized Gas Dilution System. The Series 4040 consists of a single chassis with four mass flow controllers. The mass flow controllers are factory-calibrated using a primary flow standard traceable to the United States National Institute of Standards and Technology (NIST). Each flow controller utilizes an 11 point calibration table with linear interpolation, to increase accuracy and reduce flow controller nonlinearity. A field quality assurance check of the system was performed pursuant to Method 205 by setting the diluted concentration to a value identical to a Protocol 1 calibration gas and then verifying that the analyzer response is the same with the diluted gas as with the Protocol 1 gas. The results of the Method 205 verification test are provided in Appendix B.

A drawing of the Method 25A sampling train used for the testing program is presented as Figure 2.

4.b Recovery and Analytical Procedures

Because all measurements were conducted using on-line analyzers, no samples were recovered during the test program.

4.c Sampling Ports

RTO inlet flowrate measurements were conducted at two inlet sampling locations (the booth exhaust and the oven exhaust) and added together to determine a total inlet flowrate. VOC and methane concentrations were measured at a single RTO inlet sampling location with the sampling probe moved to three points across the duct during each emissions test run. Exhaust gas flowrate, and VOC and methane concentrations were measured at a single RTO outlet sampling location. Flowrate sampling ports at each location meet the minimum criteria of Method 1.

4.d Traverse Points

Traverse points for each exhaust flowrate sampling location consisted of six points in each direction of the round ducts with the sampling points determined according to Method 1.

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. Exhaust gas flowrates measured at each sampling location are summarized in Appendix A. Equipment calibration data is summarized in Appendix B.

5.b Discussion of Results

Permit No. 225-07B requires a minimum VOC destruction efficiency of 95%. As summarized by Table 2, the RTO DE is 95%.

5.c Sampling Procedure Variations

Due to gaps in the production process during Test Run 2, the test run consisted of three separate sampling analysis periods of fifteen minutes, six minutes, and forty-one minutes.

5.d Process or Control Device Upsets

Other than production gaps during Run 2, there were no process or control device upsets during the emissions test program.

5.e Control Device Maintenance

Routine maintenance of the RTO has been conducted as recommended by the manufacturer.

5.f Audit Sample Analyses

No samples were collected as part of the test program.

5.g Calibration Sheets

Calibration data relevant to the emissions test program is provided in Appendix B.

5.h Sample Calculations

Sample calculations are provided in Appendix C.

5.i Field Data Sheets

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

5.j Laboratory Data

No laboratory analysis was included in this test program. Raw VOC data is included on the compact disks included in Appendix D.

TABLES

Table 1
Testing Personnel

Name	Affiliation
Artie McElwee	Toefco
Randal Tysar	BTEC
Todd Wessel	BTEC
Travis Clark	BTEC
Jeremy Howe	MDEQ
Matt Deskins	MDEQ

Table 2
RTO Destruction Efficiency Summary
Toefco Engineered Coating Systems, Inc.
Niles, Michigan
RTO VOC Destruction Efficiency

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	12/1/2015	12/1/2015	12/1/2015	
Sampling Time*	16:18 - 17:18	17:40 - 17:55 18:19 - 18:25 18:40 - 19:21	12:57 - 13:57	
Inlet Flowrate (scfm)	16,327	17,332	17,249	16,969
Outlet Flowrate (scfm)	19,013	18,486	18,340	18,613
Inlet VOC Concentration (ppmv propane)	122.3	109.8	106.4	112.8
Inlet VOC Concentration (ppmv, corrected as per USEPA 7E)	121.6	109.5	106.4	112.5
Inlet VOC Mass Flowrate (lb/hr)	13.6	13.0	12.6	13.1
Outlet VOC Concentration (ppmv propane)	5.7	5.4	5.4	5.5
Outlet VOC Concentration (ppmv, corrected as per USEPA 7E)	5.5	5.4	5.4	5.5
Outlet CH4 Concentration (ppmv methane)	0.9	1.0	1.0	0.9
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	0.5	0.6	0.7	0.6
Outlet VOC Concentration (- methane)	5.3	5.2	5.1	5.2
Outlet VOC Mass Emission Rate (lb/hr)	0.7	0.7	0.6	0.7
VOC Destruction Efficiency (%)	**95**	**95**	**95**	**95**

*Test Run 2 VOC sampling was broken into three periods due to production gaps during the testing.

Inlet VOC Correction			
Co	0.02	-0.14	-0.51
Cma	250.0	250.0	250.0
Cm	251.38	250.84	250.71

Outlet VOC Correction			
Co	0.14	0.08	0.08
Cma	30.0	30.0	30.0
Cm	30.41	29.72	29.58

Outlet CH4 Correction			
Co	0.43	0.36	0.32
Cma	30.0	30.0	30.0
Cm	29.10	29.37	30.08

Method 25A Methane Response Factor: 2.35

scfm: standard cubic feet per minute
ppmv: parts per million on a volume to volume basis
lb/hr: pounds per hour
VOC: volatile organic compound
MW = molecular weight (C_3H_8 = 44.10)

FIGURES

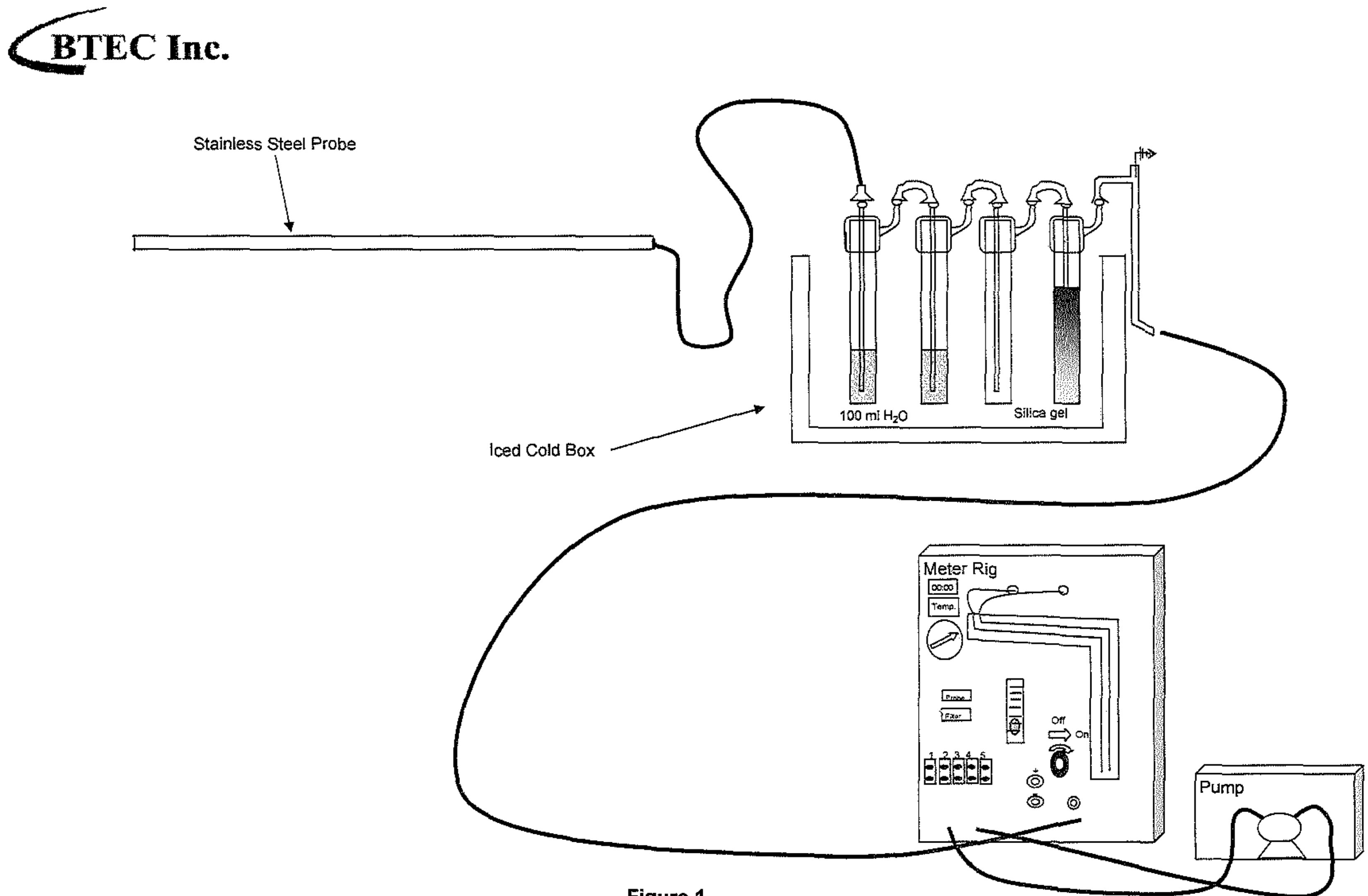

Figure 1

Site:	Sampling Date:	
USEPA Method 4 Toefco Engineered Coating Systems Niles, Michigan	December 1, 2015	BT Environmental Consulting, Inc. 4949 Fernlee Avenue Royal Oak, Michigan 48073

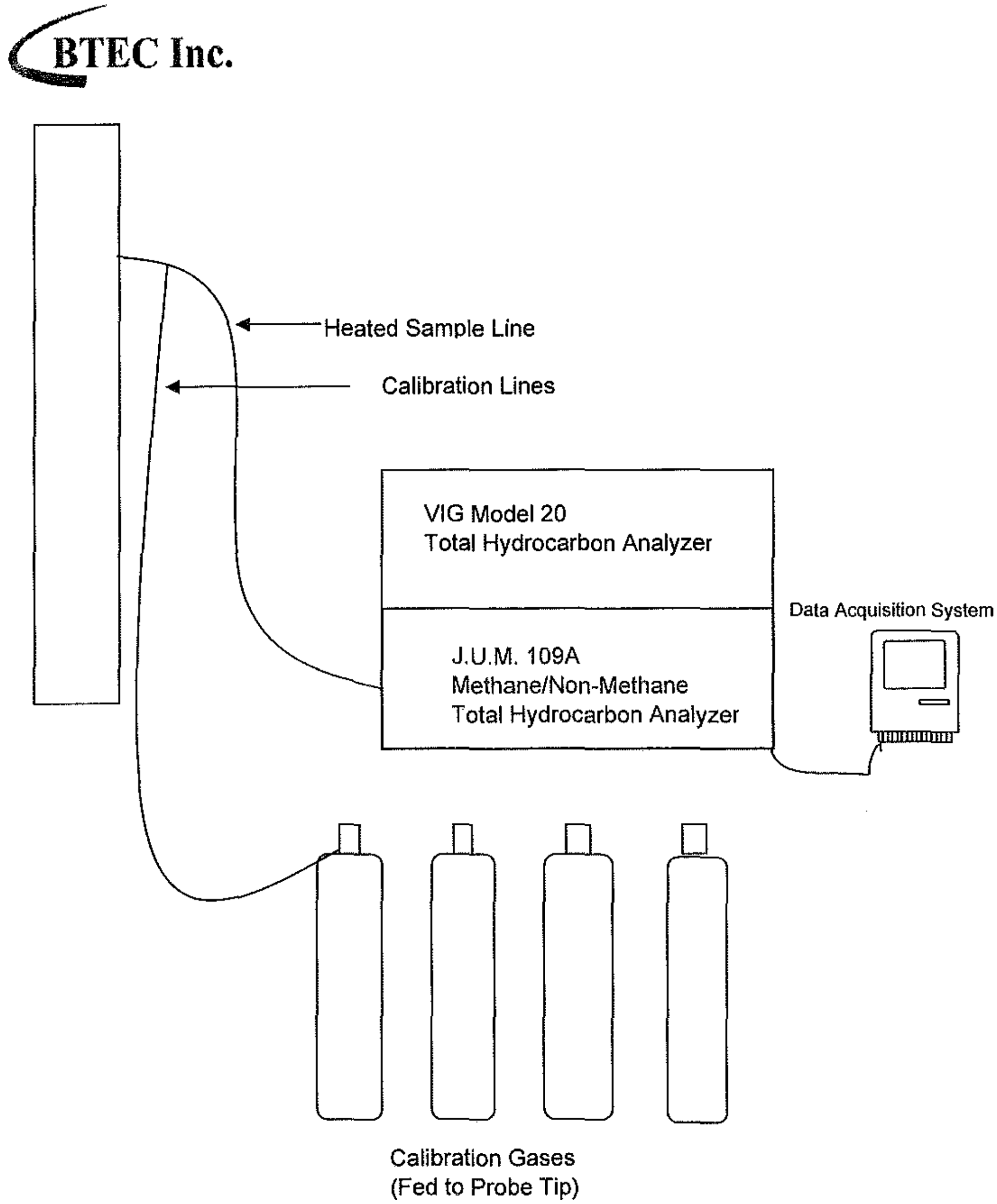

Figure 2

Site: **USEPA Method 25A** **Toefco Engineered Coating Systems** **Niles, Michigan** — **Sampling Date:** **December 1, 2015**	**BT Environmental Consulting, Inc.** **4949 Fernlee Avenue** **Royal Oak, Michigan 48073**