



# VOC Destruction Efficiency Emissions Test Summary Report

*Prepared for:*  
**Coding Products, A Division of ITW**

111 West Park Drive  
Kalkaska, Michigan 49646

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**AIR QUALITY DIVISION**

Project No. 16-4930.00  
June 8, 2017

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**EXECUTIVE SUMMARY**

BT Environmental Consulting, Inc. (BTEC) was retained by Coding Products, a division of ITW (CP) to conduct a volatile organic compound (VOC) Destruction Efficiency (DE) emissions test program on one recuperative thermal oxidizer (RTO) servicing EUCOATER 1,2,4,5, and 6 (FGCOATING 12456) at the CP facility located in Kalkaska, Michigan. Additionally, testing for verification of capture efficiency (CE) of the permanent total enclosure (PTE) for EUCOATERS 1,2,4,5, and 6 was performed during the same testing program. The emissions test program was conducted on April 18, 2017.

Testing of the RTO consisted of triplicate 60-minute test runs. The emissions test program was required by Permit No. MI-ROP-B6175-2013. The results of the emission test program are summarized by Table I.

**Table I**  
**RTO VOC DE Test Results Summary**  
**Test Date: April 18, 2017**

<b>Pollutant</b>	<b>DE Limit (%)</b>	<b>DE Result (%)</b>
VOC	95.0	98.8



## **1. Introduction**

BT Environmental Consulting, Inc. (BTEC) was retained by Coding Products, a division of ITW (CP) to conduct a volatile organic compound (VOC) Destruction Efficiency (DE) emissions test program on one recuperative thermal oxidizer (RTO) servicing EUCOATER 1,2,4,5, and 6 (FGCOATING 12456) at the CP facility located in Kalkaska, Michigan. Additionally, testing for verification of capture efficiency (CE) of the permanent total enclosure (PTE) for EUCOATERS 1,2,4,5, and 6 was performed during the same testing program. The emissions test program was conducted on April 18, 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 April 18, 2017 at the CP facility located in Kalkaska, Michigan. The test program included evaluation of VOC DE/CE emissions from the RTO. Also, the test program included verification of air flow directions into each of the PTE. See Appendix E for drawings and pictures of the natural draft openings (NDO) of the PTE.

### **1.b Purpose of Testing**

The AQD issued Permit No. MI-ROP-B6175-2013 to Coding Products.

### **1.c Source Description**

The emissions test program evaluated VOC emission rates at the RTO inlet and outlet sampling locations.

### **1.d Test Program Contacts**

The contact for the source and test report is:

Ms. Lisa Surowitz  
Facility Manager  
Coding Products, A Division of ITW  
111 West Park Drive  
Kalkaska, Michigan 49646



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

**Table 1  
Test Personnel**

<b>Name and Title</b>	<b>Affiliation</b>	<b>Telephone</b>
Mr. Matt Young Project Manager	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Mason Sakshaug Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Jake Zott Environmental Technician	BTEC 4949 Fernlee Royal Oak, MI 48073	(248) 548-8070
Mr. Jeremy Howe Air Quality Division	MDEQ	(231) 876-4416

## **2. Summary of Results**

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

### **2.a Operating Data**

Process operating data for this emissions test program is provided in Appendix D.

### **2.b Applicable Permit**

The applicable permit for this emissions test program is Permit No. MI-ROP-B6175-2013.

### **2.c Results**

RTO VOC DE test result is 98.8%.

## **3. Source Description**

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

### **3.a Process Description**

#### Regenerative Thermal Oxidizers (RTO)

Coding Products operates six separate web-coating lines. The facility utilizes a single RTO to control emissions from five of the six lines. VOC emissions are collected and routed to a



common air duct, and then exhausted via the RTO. The RTO operates at a temperature of at least 1,400° Fahrenheit. The Emission Units apply a continuous layer of coating material across a portion of the web substrate.

EUCOATER1 and EUCOATER2 utilize the Hot Stamp process with the Mayer Rod Coating Technology. EUCOATER4, EUCOATER5, and EUCOATER6 utilize the Thermal Transfer process with the Gravure Technology.

These emissions units are controlled by the RTO in combination with the Capture System/Permanent Total Enclosure.

### **3.b Process Flow Diagram**

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

### **3.c Raw and Finished Materials**

Pipeline quality natural gas is used in the oxidizers as combustion fuel.

### **3.d Process Capacity**

The speed of the Coating lines are a function of the material that is being produced. This can vary from 60 fpm to 600 fpm. The percent solids of the coatings also vary depending on the product and on the Coating lines. This can vary from 0.62 % solids to 55% solids.

### **3.e Process Instrumentation**

Section 3.d provides summary.

## **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 were conducted using the following reference test methods codified at 40 CFR 60, Appendix A:

- Method 1 -“Sample and Velocity Traverses for Stationary Sources”
- Method 2 -“Determination of Stack Gas Velocity and Volumetric Flow rate”
- Method 3 -“Determination of Molecular Weight of Dry Stack Gas” (Fyrite)
- Method 4 - “Determination of Moisture Content in Stack Gases”
- Method 25A -“Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer”

Stack gas velocity traverses were conducted in accordance with the procedures outlined in Methods 1 and 2. An S-type 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 the 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.

The Molecular Weight of the gas stream was evaluated according to procedures outlined in Title 40, Part 60, Appendix A, Method 3. The O<sub>2</sub> /CO<sub>2</sub> content of the gas stream was measured using an O<sub>2</sub> /CO<sub>2</sub> Fyrite gas analyzer.

Exhaust gas moisture content was evaluated using wet bulb/dry bulb procedure or Method 4. Exhaust gas was extracted as part of the moisture sampling (see Section 3.2) and passed through (i) two impingers, each with 100 ml water, (ii) an empty impinger, and (iii) an impinger filled with silica gel. Exhaust gas moisture content is then determined gravimetrically.

#### **Volatile Organic Compounds (USEPA Method 25A)**

Volatile Organic compound (VOC) concentrations were measured according to 40 CFR 60, Appendix A, Method 25A. 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 PC equipped with data acquisition software. BTEC used a VIG Model 20 THC hydrocarbon analyzer to determine the VOC concentrations at the inlet, and a JUM 109A Methane/Non-Methane THC hydrocarbon analyzer to determine the VOC concentrations at the outlet.

The VIG hydrocarbon analyzer channels a fraction of the gas sample through a capillary tube that directs the sample to the flame ionization detector (FID), where the hydrocarbons present in the sample are ionized into carbon. The carbon concentration is then determined by the detector in parts per million (ppm). This concentration is transmitted to the data acquisition system (DAS) at 4-second intervals in the form of an analog signal, specifically voltage, to produce data that can be averaged over the duration of the testing program. This data is then used to determine the average ppm for total hydrocarbons (THC) using the equivalent units of propane (calibration gas).

The JUM Model 109A analyzer utilizes two flame ionization detectors (FIDs) in order to report the average ppmv for total hydrocarbons (THC), as propane, as well as the average ppmv for methane (as methane). Upon entry, the analyzer splits the gas stream. One FID

ionizes all of the hydrocarbons in the gas stream sample into carbon, which is then detected as a concentration of total hydrocarbons. Using an analog signal, specifically voltage, the concentration of THC is then sent to the data acquisition system (DAS), where recordings are taken at 4-second intervals to produce an average based on the overall duration of the test. This average is then used to determine the average ppmv for THC reported as the calibration gas, propane, in equivalent units.

The second FID reports methane only. The sample enters a chamber containing a catalyst that destroys all of the hydrocarbons present in the gas stream other than methane. As with the THC sample, the methane gas concentration is sent to the DAS and recorded. The methane concentration, reported as methane, can then be converted to methane, reported as propane, by dividing the measured methane concentration by the analyzer's response factor.

The JUM analyzer was calibrated for a range of 0 to 1,000 ppm on each channel and the VIG analyzer was calibrated for a range of 0 to 10,000 ppm.

In accordance with Method 25A, a 3-point (zero, mid, and high) calibration check was performed on the THC analyzer. Calibration drift checks were performed at the completion of each run.

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.

#### **4.b Recovery and Analytical Procedures**

This test program did not include laboratory samples, consequently, sample recovery and analysis is not applicable to this test program.

#### **4.c Sampling Ports**

A diagram of the stack showing sampling ports in relation to upstream and downstream disturbances is included as Figures 3 and 4.

#### **4.d Traverse Points**

A diagram of the stack indicating traverse point locations and stack dimensions is included as Figures 3-4.

## 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 Table 3.

**Table 2**  
**RTO VOC DE Test Results Summary**  
**Test Date: April 18, 2017**

Pollutant	DE Limit	DE Result (%)
VOC	95.0	98.8

### 5.b Discussion of Results

The RTO VOC DE/CE test result was 98.8%, which passes the 95% limit.

### 5.c Sampling Procedure Variations

There were no sampling procedure variations.

### 5.d Process or Control Device Upsets

There were no process upsets during this test.

### 5.e Control Device Maintenance

No maintenance was performed during the test program.

### 5.f Re-Test

This is not a re-test.

### 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**

There are no laboratory results for this test program. Raw CEM data is provided electronically in Appendix D.

**Table 3**  
**RTO VOC Destruction Efficiency Testing**  
**Coding Products**  
**Kalkaska, Michigan**

Parameter	Run 1	Run 2	Run 3	Average
Sampling Date	4/18/2017	4/18/2017	4/18/2017	
Sampling Time	11:00-12:00	12:27-13:27	14:28-15:28	
Inlet Flowrate (scfm)	23,464	23,461	23,769	23,565
Outlet Flowrate (scfm)	20,164	19,379	21,406	20,317
Inlet THC Concentration (ppmv propane)	2347.6	2781.7	2037.4	2,388.9
Inlet 1 VOC Concentration (ppmv, corrected as per USEPA 7E)	2312.9	2710.1	1962.2	2,328.4
Inlet THC Mass Flowrate (lb/hr)	371.3	435.0	319.1	375.1
Outlet THC Concentration (ppmv propane)	32.20	30.45	28.81	30.5
Outlet THC Concentration (ppmv, corrected as per USEPA 7E)	32.5	31.9	30.2	31.5
Outlet CH4 Concentration (ppmv methane)	1.19	1.44	1.74	1.5
Outlet CH4 Concentration (ppmv, corrected as per USEPA 7E)	0.6	0.1	0.1	0.3
Outlet THC Concentration (- methane)	32.22	31.85	30.15	31.4
Outlet THC Mass Emission Rate (lb/hr)	4.4	4.2	4.4	4.4
THC Destruction Efficiency (%)	98.8	99.0	98.6	98.8

scfm: standard cubic feet per minute

ppmv: parts per million on a volume to volume basis

lb/hr: pounds per hour

THC: total hydrocarbons

MW: molecular weight

24.14: molar volume of air at standard conditions (70°F, 29.92" Hg)

35.31: ft<sup>3</sup> per m<sup>3</sup>

453600: mg per lb

**Equations**

lb/hr = ppmv \* MW/24.14 \* 1/35.31 \* 1/453,600 \* scfm\* 60

RF=2.43

Inlet 1 VOC Correction			
Co	20.04	37.91	35.65
Cma	2990	2990	2990
Cm	3029.07	3065.09	3085.77

Outlet VOC Correction			
Co	-0.30	-1.53	-1.40
Cma	90.29	90.29	90.29
Cm	90.12	88.97	88.93

Outlet CH4 Correction			
Co	0.64	1.33	1.65
Cma	29.9	29.9	29.9
Cm	29.80	29.30	29.54

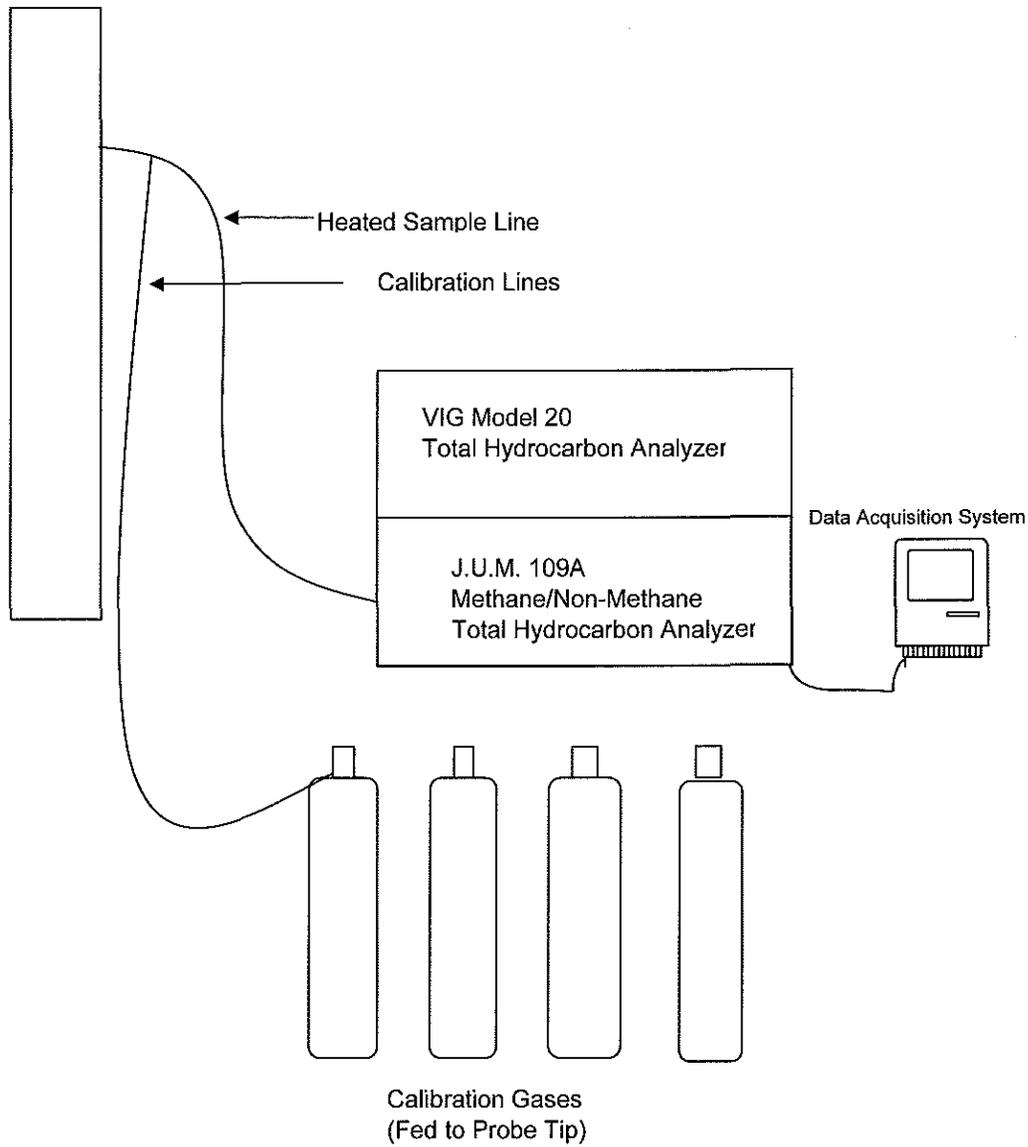


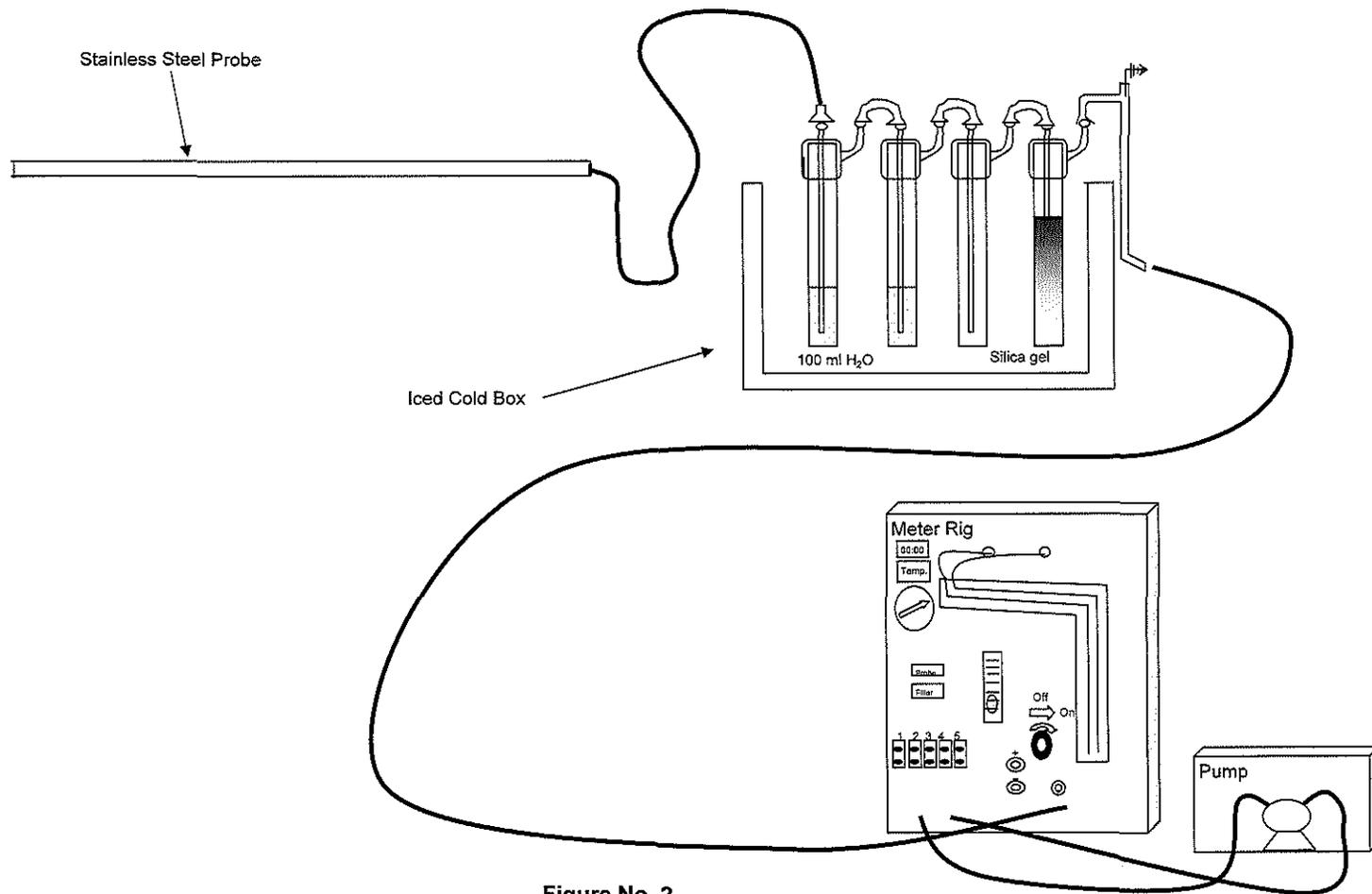
Figure No. 1

Site:  
USEPA Method 25A  
Coding Products  
Kalkaska, Michigan

Sampling Date:  
April 18, 2017

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

**BTEC Inc.**



**Figure No. 2**

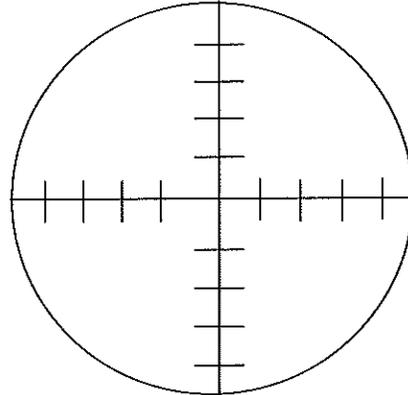
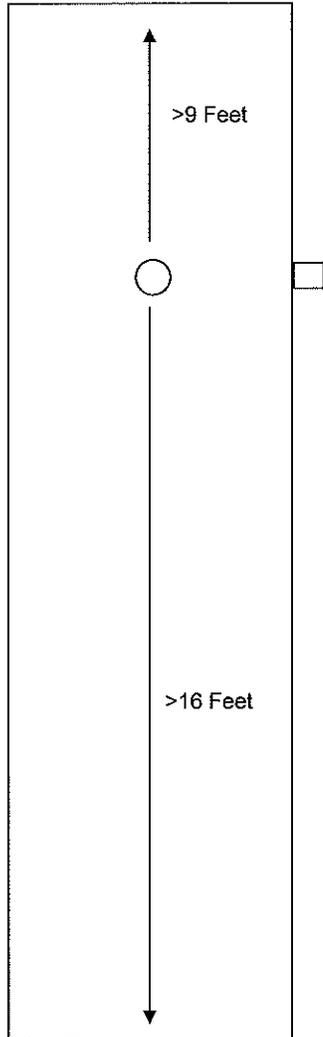
Site:  
USEPA Method 4  
Coding Products  
Kalkaska, Michigan

Sampling Date:  
April 18, 2017

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



diameter = 67.75"



Not to Scale

Points	Distance "
1	2.17
2	7.11
3	13.14
4	21.88
5	45.87
6	54.61
7	60.64
8	65.58

Figure No. 3

Site:  
RTO Outlet  
Coding Products  
Kalkaska, Michigan

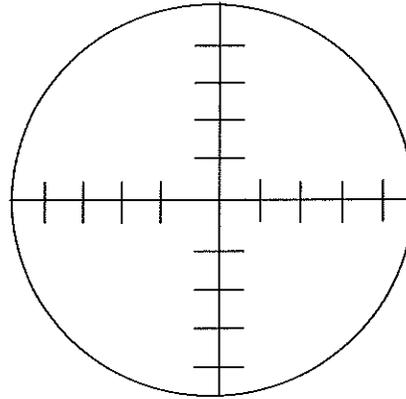
Sampling Date:  
April 18, 2017

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



diameter = 53.75"

Points	Distance "
1	1.7
2	5.6
3	10.4
4	17.4
5	36.4
6	43.3
7	48.1
8	52.0



Not to Scale



Figure No. 4

Site:  
RTO Inlet  
Coding Products  
Kalkaska, Michigan

Sampling Date:  
April 18, 2017

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