TRC

TOTAL HYDROCARBON REMOVAL EFFICIENCY TEST

Performed At
Worthen Coated Fabrics
One Carbon Adsorption System
Grand Rapids, Michigan

Test Date
November 8, 2022

Report No.
TRC Environmental Corporation Report 497067

Report Submittal Date
January 25, 2023

TRC Environmental Corporation
7521 Brush Hill Road
Burr Ridge, Illinois 60527
USA

T 312-533-2042
F 312-533-2070

P0634_test_20221108

Report Certification

I certify that to the best of my knowledge:

- Testing data and all corresponding information have been checked for accuracy and completeness.
- Sampling and analysis have been conducted in accordance with the approved protocol and applicable reference methods (as applicable).
- All deviations, method modifications, or sampling and analytical anomalies are summarized in the appropriate report narrative(s).

Douglas Ryan
AMS Midwest Regional Manager

January 25, 2023
Date

TRC was operating in conformance with the requirements of ASTM D7036-04 during this test program.

Bruce Randall
TRC Emission Testing Technical Director

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1.0 INTRODUCTION

TRC Environmental Corporation (TRC) performed a Total Hydrocarbon (THC) control efficiency of the mix room (EU-MixRoom) carbon adsorption system at the Worthen Coated Fabrics in Grand Rapids, Michigan on November 8, 2022. The test was authorized by and performed for Worthen Coated Fabrics.

The purpose of this test program was to determine total hydrocarbons as propane (THC as C_3H_8) DE during specified operating conditions. The test program was conducted according to the TRC Protocol 497067 dated August 30, 2022.

1.1 Project Contact Information

Participants		
Test Facility	Worthen Coated Fabrics 1125 41st Street Grand Rapids, Michigan 49508 Permit #: MI-ROP-P0634-2017 SRN: P0634	Kristi Koetje Quality/Environmental Manager (616) 325-2203 (phone) Kkoetje@worthenind.com
Air Emissions Testing Body (AETB)	TRC Environmental Corporation 7521 Brush Hill Road Burr Ridge, Illinois 60527	Gavin Lewis Project Manager (312) 533-2025 (phone) (312) 533-2070 (fax) glewis@trccompanies.com

Jeff Daniels, Ted Kalisz, and Gavin Lewis of TRC conducted the testing. Documentation of the on-site ASTM D7036-04 Qualified Individual(s) (QI) can be located in the appendix to this report.

No personnel from the Michigan Department of Environment, Great Lakes, and Energy (EGLE) observed the testing.

1.2 Facility Description

Worthen Coated Fabrics (Worthen) located at 1125 41st Street, SE in Grand Rapids is a textile coating facility that compounds coatings on-site and applies them to a variety of textiles via a coating line. Worthen operates one fabric coating line consisting of the knife over roll coating of textiles with solvent and water-based coating materials. A textile web is continuously fed to a coater stand. The coating is poured onto the fabric in a permanent total enclosure (100% capture), then scraped into an even layer by the knife blade. The excess coating is scraped from the fabric and returned to the coating pan. The fabric then passes into a drying oven (also 100% capture). Solvent is used for clean-up. The enclosure and oven emissions are exhausted to a regenerative thermal oxidizer (RTO). Both water-based and solvent-based coatings are used on the coating line.

The compounding of coatings takes place in the Mix Room. Coatings manufactured in the Mix Room are solely for use on Worthen's coating line. The Mix Room consists of three 30 horsepower high speed mixers, three stainless steel tanks (900 gallons, 1,000 gallons, 1,400 gallons), 55-gallon steel drums, one 5-gallon paint shaker and a drum lifter. One mixer is dedicated to water-based coatings. Most solvent and water-based coatings are made with the other two mixers. A maximum of two solvent-based coatings can be mixed at one time. All coatings are manufactured at room temperature and no heat is applied. No reactions are carried out during the manufacturing of the coatings. The mix room is currently operated 24 hours per day, 5 days per week. Volatile organic compound emissions from the Mix Room are controlled by a carbon adsorption system.

As part of the recent renewal application, the Mix Room and carbon adsorption system were added as an emission unit to the permit since the activities are covered by 40 CFR Part 60 Subpart VVV – Standards of Performance for Polymeric Coating of Supporting Substrates.

1.2 Process Data

The following process operation data was collected:

- Continuous Monitoring Data
- Material preparation Logs

2.0 SUMMARY OF RESULTS

The results of this test program are summarized in the table below. Detailed individual run results are presented in Section 6.0.

Source	Parameter	Measured Emissions	Measured Control Efficiency (%)	Required Control Efficiency (%)
Inlet	THC lb/hr as C_3H_8	0.120	97.4	95.0
Outlet	THC lb/hr as C_3H_8	0.003		

The table below summarizes the test methods used, as well as the number and duration at each test location:

Unit ID/ Sample Location	Parameter Measured	Test Method	No. of Runs	Run Duration
Carbon Adsorption System Outlet	Gas Velocity	Method 1 &2C	4	>5 min
	Moisture Content	ASTM E337-02	4	---
	THC as Propane	USEPA Method 25A	3	30 min
Carbon Adsorption System Outlet	THC as Propane	USEPA Method 25A	3	30 min

3.0 DISCUSSION OF RESULTS

During test runs 1 and 3, momentary exceedances of instrument range, totaling five one-minute averages, were observed at the inlet locations. These are presented in the data set as values of 1000.00. Impact to measured overall control is believed to be negligible and would reduce control efficiency (lower inlet mass), presenting a worst-case scenario.

Other than Source operation appeared normal during the entire test program. No problems were encountered with the testing equipment during the test program. No changes or problems were encountered that required modification of any procedures presented in the test plan. No adverse test or environmental conditions were encountered during the conduct of this test program. Unit operating data was recorded by plant personnel and appended to the report.

4.0 SAMPLING AND ANALYSIS PROCEDURES

All testing, sampling, analytical, and calibration procedures used for this test program were performed in accordance with the methods presented in the following sections. Where applicable, the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, USEPA 600/R-94/038c, September 1994 was used to supplement procedures.

4.1 Determination of Sample Point Locations by USEPA Method 1

This method is applicable to gas streams flowing in ducts, stacks, and flues and is designed to provide guidance for the selection of sampling ports and traverse points at which sampling for air pollutants will be performed. Sample ports must be located at least two duct diameters downstream and a half a duct diameter upstream from any flow disturbance.

The cross-section of the measurement site was divided into a number of equal areas, and the traverse points were located in the center of each area. The minimum number of points were determined from Figure 1-2 (non-particulate) of the Method.

4.2 Volumetric Flow Rate Determination in Small Stacks by USEPA Method 2C

This method is applicable for the determination of the average velocity and the volumetric flow rate of a gas stream in small stacks or ducts.

The gas velocity head (ΔP) and temperature were measured at traverse points defined by USEPA Method 1. The velocity head was measured with a standard pitot tube and oil-filled manometer; and the gas temperature was measured with a Type K thermocouple. The average gas velocity in the flue was calculated based on: the gas density (as determined by USEPA Methods 2 and ASTM Method E337-62); the flue gas pressure; the average of the square roots of the velocity heads at each traverse point, and the average flue gas temperature.

Since the test source was essential comprised of air, an analysis of O_2 and CO_2 was not conducted and a dry molecular weight of 29.0 was used per USEPA Method 2 Section 8.6.

4.3 Moisture Determination by ASTM Method E337-62

This method utilizes the flue gas wet bulb/dry bulb temperatures and absolute pressure to approximate the moisture content in the flue gas. Moisture content was calculated as follows:

$$Bws = \left[\frac{e' - AP(t - t')}{P}\right]$$

where :

e' = saturated vapor pressure of water, in. Hg, at the wet bulb temperatu re, t'

$A = 3.67 \times 10^{-4}[1 + 0.00064\ (t' - 32)]$

P = absolute pressure, in. Hg, in the duct

t = dry bulb temperatu re, °F

t' = wet bulb temperatu re, °F

4.4 Total Organic Concentration Determination by USEPA Method 25A

This method is applicable for the determination of total gaseous organic concentration of vapors consisting primarily of alkanes, alkenes, and/or arenes (aromatic hydrocarbons). The concentration is expressed in terms of propane (or other appropriate organic calibration gas) or in terms of carbon.

Due to the high concentration at the sources the gas sample was extracted from the source through a heated sample line to a M&C (or similar) gas dilution system. After dilution the sample was sent to the flame ionization analyzer (FIA). The dilution systems had an approximate dilution ratio of 200:1 at the primary condenser inlets and 100:1 at the primary condenser outlets and the secondary condenser outlet.

5.0 QUALITY ASSURANCE PROCEDURES

TRC integrates our Quality Management System (QMS) into every aspect of our testing service. We follow the procedures specified in current published versions of the test Method(s) referenced in this report. Any modifications or deviations are specifically identified in the body of the report. We routinely participate in independent, third-party audits of our activities, and maintain:

- Accreditation from the Louisiana Environmental Laboratory Accreditation Program (LELAP).
- Accreditation from the Stack Testing Accreditation Council (STAC) and the American Association for Laboratory Accreditation (A2LA) that our operations conform with the requirements of ASTM D 7036 as an Air Emission Testing Body (AETB).

These accreditations demonstrate that our systems for training, equipment maintenance and calibration, document control and project management will fully ensure that project objectives are achieved in a timely and efficient manner with a strict commitment to quality.

All calibrations are performed in accordance with the test Method(s) identified in this report. If a Method allows for more than one calibration approach, or if approved alternatives are available, the calibration documentation in the appendices specifies which approach was used. All measurement devices are calibrated or verified at set intervals against standards traceable to the National Institute of Standards and Technology (NIST). NIST traceability information is available upon request.

ASTM D7036-04 specifies that: *"AETBs shall have and shall apply procedures for estimating the uncertainty of measurement. Conformance with this section may be demonstrated by the use of approved test protocols for all tests. When such protocols are used, reference shall be made to published literature, when available, where estimates of uncertainty for test methods may be found."* TRC conforms with this section by using approved test protocols for all tests.