

DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION
ACTIVITY REPORT: On-site Inspection

N314366674

FACILITY: CARROLL PRODUCTS, INC.		SRN / ID: N3143
LOCATION: 44056 Phoenix Drive, STERLING HTS		DISTRICT: Warren
CITY: STERLING HTS		COUNTY: MACOMB
CONTACT: Mike Murphy , Plant Manager		ACTIVITY DATE: 11/18/2022
STAFF: Iranna Konanahalli	COMPLIANCE STATUS: Compliance	SOURCE CLASS: SM OPT OUT
SUBJECT: FY 2023 scheduled SM CMS inspection of Carroll Products, Inc. ("Carroll" or "the company") located at 44056 Phoenix Drive, Sterling Heights, Michigan 48314-1463.		
RESOLVED COMPLAINTS:		

Carroll Products, Inc. (N3143)
44056 Phoenix Drive
Sterling Heights, Michigan 48314-1463

Subject to Rule 624 (minimum control technology for Rule 702 BACT): Mich. Admin. Code R. 336.1624.

1. Maximum of 25%, by volume, of volatile organic compounds, based upon a calendar day averaging period. OR
2. Minimum of 60%, by volume, non-volatile fraction (water-free basis), based upon a calendar day averaging period. OR
3. Overall reduction (using, for example, RTO) in volatile organic compound emissions: >75% for publishing rotogravure printing OR >65% for packaging rotogravure printing OR >60% for flexographic printing

BACT: Rule 702 BACT is based upon 2001 BACT determination because the PTI modification PTI No. 78-01 → PTI No. 78-01A does not involve change in emissions. Existing combination of CE > 70% and RTO DE > 95% is valid Rule 702 BACT. One new printing press replaced two existing presses. As explained below, 2017 BTEC tested values are: CE = 76.4% > 70% and DE = 98.9 > 95%).

RACT: Rule 336.1624 for existing graphic arts lines. Maximum 25% Volatile Organic Compounds (VOC) content or specified emissions reduction (Rule 624(3)).

PTI Application void: Permit-to-Install Number 973-92.

PTI Mod: PTI No. 78-01 → PTI No. 78-01A. The modification removed old and inefficient printing presses, known as **Carraro** and **FMC**, and incorporated new printing press known as **UTECO808**, which is much more efficient and runs at substantially higher speed

(UTECO808 1,000-1,300 feet per minute Vs old units ≈250 feet per minute). The PTI modification did not change VOC and HAP limits. In addition, the modification removed clean up tank (EU-CLEANUPTANK).

During the inspections, I confirm that the solvent clean-up tank has been removed.

Permit No. 78-01A Emission Units

Emission Unit ID	Emission Unit Description (Process Equipment & Control Devices)	Installation Date / Modification Date	Flexible Group ID
EU-WOLVERINE	Flexographic Printing Line Web Width = 38" Control Equipment: Regenerative Thermal Oxidizer (RTO)	January 1, 1986 / NA	FG-FLEXO, FGFACILITY
EU-COMEXI	Flexographic Printing Line Web Width = 48" Control Equipment: RTO	January 1, 1999 / NA	FG-FLEXO, FGFACILITY
COMEXI was also removed about December 2021 and sold for uninstallation and transportation costs.			
EU-UTECO808	Flexographic Printing Line Web Width = 49" Control Equipment: RTO	September 2016	FG-FLEXO, FGFACILITY
Currently (Nov 2022), only two presses are present and printing (operating) based upon FY 2023 inspection of November 18, 2022: High efficiency (up to 1,300 feet per minute) UTECO808 and low efficacy (up to 300 feet per minute) WOLVERINE. Most the time the highly efficient UTECO808 (1,300 ft/min) is operated, inefficient and slow WOLVERINE (250 ft/min) is operated merely 30-60 hours per month. All other (CARRARO, FMC, COMEXI) inefficient printing presses except WOLVERINE have been removed.			
Changes to the equipment described in this table are subject to the requirements of R 336.1201, except as allowed by R 336.1278 to R 336.1290.			

On **November 18, 2022**, I conducted a level-2 **FY 2023 scheduled SM CMS inspection** of Carroll Products, Inc. ("Carroll" or "the company") located at 44056 Phoenix Drive, Sterling Heights, Michigan 48314-1463. The inspection was conducted to determine compliance with the Federal Clean Air Act; Article II, Part 55, Air Pollution Control, of the Natural Resources and Environmental Protection Act, 1994, PA 451; Michigan Department of Environment, Great Lakes & Energy, Air Quality Division (EGLE-AQD) administrative rules; and Permit-to-Install Number **78-01A** (ROP and MACT Synthetic Minor) dated August 17, 2016

During the inspection, **Mr. Joseph Wolf** (Phone: 586-254-6300; Fax: 586-254-9458; Cell: 248-930-0385; E-mail: j.Wolf@CarrollProducts.com), President, one of three owners, and **Mr. Ken Kaptur** (Phone: 586-254-6300; Fax: 586-254-9458; Cell: 586-630-7542; E-mail: k@CBkgr13@gmail.com), Print Manager, assisted me.

Mr. Don Logan (586-254-6300), Maintenance Tech., was also present.

The company operates two flexographic (packaging and specialty flexography) printing units / presses identified as:

1. **Wolverine** (FG-FLEXO, EU-WOLVERINE, installed January 1, 1986): Flexographic Printing Line. Web Width = 38 inches. Control Equipment: Regenerative Thermal Oxidizer (RTO). The Wolverine 384 4-color Stack Press is equipped with four-color capability. It is not equipped with heat source and uses ambient air for between-colors and overhead dryers. Line speed = 200 feet per minute. This press is not preferably used. Inefficient Wolverine is used for merely 30-60 hours month.
2. UTECO808 (FG-FLEXO, EU-UTECO808, installed September 15, 2016): Flexographic Printing Line. Web Width = 49 inches. Control Equipment: RTO. Line speed = 500-1,000 and possible 1,300 feet per minute. Hence, production rate is much higher than other units. UTECO808 saves energy as well as it has highly efficient DC motors. Unlike other presses, which have plastic sheets as enclosures to capture VOC, UTECO808 press is completely enclosed by sheet metal with glass door; press cannot run when the door is open. An interlock system does not permit operation when the web is not fully enclosed. UTECO808 press is equipped with see-through glass and its doors cannot be opened when printing due to an interlock mechanism. Hence, UTECO808 achieves nearly 100% capture of VOC. UTECO808 is equipped with 8 print stations; four on each side. UTECO808 is equipped two ducts for VOC capture and delivery to RTO.

Printing of inks on polyethylene, polypropylene rolls of packaging materials is accomplished using these two printing presses. The two flexographic printing press lines have VOC capture systems (one for each press) that vent VOC laden air to MegTech Regenerative Thermal Oxidizer (RTO) via common exhaust manifold that is located at the roof.

Three inefficient and slow printing presses have been permanently removed: About September 2016, Carraro (EU-CARRARO) FMC (EU-FMC) have been removed as required by PTI No. 78-01A and to make room for installation of high speed UTECO808. In addition, COMEXI press was also removed about December 2021.

Regenerative thermal oxidizers (RTO)

Regenerative thermal oxidizers (RTO) offer superior heat recovery characteristics versus any other oxidation system. RTOs use recovered energy using two high heat capacity ceramic packed chambers to pre-heat incoming process air to oxidation temperatures. This significantly lowers overall operating costs. RTOs are particularly effective for process streams with low solvent loading. Carroll installed MEGTEC MILLENNIUM RTO.

The MEGTEC MILLENNIUM 8000 RTO (Design inlet flow rate 8,200 acfm @ 120 °F, Design exhaust flow rate 10,200 acfm @ 215 °F, Maximum burner heat input 1.4 MMBTU / Hour, Typical burner heat input 0.3 MMBTU / Hour) uses an inexpensive ceramic heat exchange media that is virtually indestructible. The media's exceptionally low resistance minimizes pressure drop. Typical pressure drop is 14 inches of water across the media pad. That means smooth operations are reducing electrical operating costs. The system delivers thermal efficiencies of 95%. Even at relatively low solvent (VOC) concentrations, the system can sustain thermal conditions (about 1600 °F) with the heat released during VOC oxidation — requiring no additional fuel for VOC destruction. On **Friday, November 18, 2022**, incoming VOC laden process air from four presses was at 110 °F, outgoing exhaust air to ambient atmosphere, after thermal oxidation of VOC and heat recovery was at 165 °F

(varies: 160-250 °F) and the combustion chamber temperature was at **1690°F** (PTI No. 78-01A, FG-FLEXO, IV.2 limit: 1590°F). The temperature data are logged on to strip charts (paper), which were replaced on December 08, 2017 (PTI No. 78-01A, FG-FLEXO, IV.3 limit: record the temperature). The Millennium RTO unit has two combustion chambers: one in oxidation mode and the other in heat recovery mode. Every 180 seconds (3 minutes), the chambers switch from oxidation mode to heat recovery mode and vice versa. According to $Q = m c_p \Delta T$, where m = mass of media, c_p = heat capacity of media and ΔT = temperature change, heat released and absorbed by the media. There are two ceramic packing media to exchange heat; while one media pad is in heat absorption mode and the other in heat release mode.

RTO maintenance

Once a year, Babcock & Wilcox MEGTEC, LLC (“MegTec”) of De Pere, WI 54115-5030 (Phone: 800-558-5535 or 920-337-1410) Durr, conducts preventive maintenance. It also fine-tunes performance of the Millennium RTO unit. The thermocouples are changed every year. In CY 2007, additional ceramic packing was added.

CY 2022: Durr Systems Inc. (Phone: 920-336-5715) of De Pere, WI 54115 conducted annual maintenance during April 2022 (Service Request#: US04-2208301). Durr Systems Inc. conducted annual maintenance during August 2022. Invoice No. 902719565 dated August 31, 2022, for \$13,492.38 for parts and service shows that maintenance activities were done. Actuating drive was replaced.

US EPA RM24 analysis (PTI No. 78-01A, FG-FLEXO, V.2 & VI.4 limit: US EPA RM 24 and VOC content)

CY2022: Carroll conducted US EPA RM24 analyses on November 11, 2022, using Eurofins S-F Analytical Laboratories (262-754-5300) of New Berlin, WI 53151.

Consent Order and RTO

The inks are purchased from Toyo (which replaced in 2010 Flint Ink Company). The company uses solvent-based inks due to quality problems associated with water-based inks (adhesion and gloss). Carroll does NOT use water-based inks at all. The Permit-to-Install Number 78-01A (ROP Opt-out), requires VOC control to satisfy Rule 336.1624 and Rule 336.1702 BACT. The permit and consent order are a result of an enforcement action initiated in order to ensure compliance with Rule 336.1624. Carroll installed 8,000 SCFM (12,600 Nm³ per hour) Millennium Regenerative Thermal Oxidizer (RTO) to control VOC emissions from the printing presses. On or about July 13, 2002, Carroll started operating this RTO, which delivers thermal efficiencies up to 95 percent.

RTO

The company has chosen the set point of 1590 degrees Fahrenheit (PTI No. 78-01A, FG-FLEXO, IV.2 limit: 1590°F). When the RTO operating temperature falls below the set-point, the presses shutdown automatically (PTI No. 78-01A, FG-FLEXO, IV.2 limit: 1590°F).

Temperature charts are present to record temperature continuously (PTI No. 78-01A, FG-FLEXO, IV.3 limit: temperature records). The charts are replaced every two months. At Carroll, **November 18, 2022**, temperature profile reflected high thermal efficiency: incoming VOC laden process air from four presses is at **≈110 °F**, outgoing exhaust air to ambient atmosphere, after thermal oxidation of VOC and heat recovery is at **165 °F** (varies: 160-250

°F) and the combustion chamber temperature is at **1690°F** (PTI No. 78-01A, FG-FLEXO, IV.2 limit: 1590°F).

RTO stack tests

February 2017 RTO stack test

PTI No. 78-01A, FG-FLEXO (EU-WOLVERINE, EU-COMEXI, EU-UTECO808) – February 28, 2017, Stack Tests for Capture Efficiency (CE) and RTO Destruction Efficiency (DE)

Permit-to-Install (PTI): PTI No. 78-01A (FG-FLEXO, I.1 & 2 limits: 28.9 tpy & 15.4 pph VOC; FG-FLEXO, IV.1 & 2 limits: CE > 70%, DE > 95%, RTO T > 1590°F and RTO ϵ > 0.5 seconds; FG-FLEXO, V.1: testing for VOC emission rates, VOC capture efficiency (CE), and VOC destruction efficiency (DE); FG-FACILITY, I.1 & 2 limits: 8.9 tpy Single HAP and 22.49 Aggregate HAPs) dated August 17, 2016

On February 28, 2017, BT Environmental Consulting, Inc. (BTEC, Inc. – Messrs. Randy Tysar, Barry Boulianne, Mr. Steve Smith, Paul Molenda, David Trahan; Project No. 16-4967.00; April 3, 2017) of Royal Oak, Michigan, conducted the tests using CEM methods. BTEC conducted volatile organic compound (VOC) Destruction Efficiency (DE) test by measuring VOC at inlet and outlet to one recuperative thermal oxidizer (RTO). BTEC also conducted a Capture Efficiency (CE) test by measuring VOC emission rates at the RTO inlet sampling location as well as at one uncontrolled (north wall room air) exhaust sampling location. The building is deemed Total and Permanent Enclosure (TPE) with one ventilation fan at one location, where uncontrolled emissions were measured by constructing temporary horizontal stack (in the north wall) to comply with US EPA Reference emissions measurement methods. AQD Permit-to-Install No. 78-01A requires a minimum VOC CE of 70% (by weight) and a minimum DE of 95% (by weight).

AQD received the CE and DE test protocol (Project No. 16-4967.00; December 8, 2016). Mr. Thomas Maza of AQD-TPU approved the test plan on February 15, 2017, via the letter to Mr. Joseph Wolf, dated February 15, 2017. According to the approval, VOC would be measured simultaneously at RTO inlet and at uncontrolled exhaust according to US EPA Reference Method 25A to determine Capture Efficiency (CE). Also, Destruction Efficiency (DE) would be determined by measuring simultaneously VOC at the RTO inlet and the RTO outlet at the exhaust stack. All VOC measurements during the February 28, 2017, tests were according to US EPA Reference Method 25A.

BTEC staff measured the gas flow rate and sampled emissions of volatile organic compounds (VOC) according to USEPA Methods 1-4 and 25A. The building formed a permanent total enclosure for the capture efficiency test. Sampling followed the procedures in USEPA Methods 204B, Volatile Organic Compounds Emissions in Captured Stream, and 204E, Volatile Organic Compounds Emissions in Uncaptured Stream from Building Enclosure. The test runs were performed while the printing lines (EU-WOLVERINE, EU-COMEXI, EU-UTECO808) were in operation.

AQD received the test report (Project No. 16-4967.00; April 3, 2017) on April 04, 2017. Per the report, Capture Efficiency is 76.4% (CE > 70%) and Destruction Efficiency is 98.9 (DE > 95%) (FG-FLEXO, IV.1 & 2 limits: CE > 70%, DE > 95%, RTO T > 1590°F and RTO ϵ > 0.5 seconds). In addition, RTO controlled and uncontrolled building fugitive emissions were 0.30 and 6.6 pounds of VOC per hour, respectively; 6.6 plus 0.3 = 6.9 pph VOC (FG-

FLEXO, I.1 & 2 limits: 28.9 tpy & 15.4 pph VOC). During the tests, RTO operating temperatures were 1597 (Run 1: UTECO808 and Wolverine), 1584 (Run 2: COMEXI and Wolverine) and 1586 (Run 3: UTECO808 and Wolverine) degrees Fahrenheit. Per the AQD (Tom Maza) calculations, Capture Efficiency is 75.6% (CE > 70%) and Destruction Efficiency 98.7. As both (BTEC and AQD) calculations are close, BTEC reported results (CE = 76.4% > 70% and DE = 98.9 > 95%) may be accepted for compliance calculations and determinations.

During the building permanent total enclosure CE (CE = 76.4% > 70%) tests, flow rates were: RTO Inlet = 4,396 and North Wall Room Air exhaust = 8,043 scfm.

The reported results are in compliance with the permit.

PTI No. 78-01A compliance

PTI No. 78-01A, FG-FLEXO

PTI No. 78-01A, FG-FLEXO, I. EMISSION LIMITS

CY 22: After combustion control at the Millennium RTO, while VOC emissions due to inks and diluent solvents are 1,358 pounds per month (December 2017), VOC emissions due to clean-up solvents are 446 pounds per month (December 2017). For the entire printing facility, VOC emissions are **11.27 tons** (22,557 lbs.) per 12-month rolling period for October 2022 (PTI No. 78-01A, FG-FLEXO, I.1&2 limits: 28.9 tpy and 15.4 pph VOC). Capture Efficiency of 76.4 percent (CE = 76.4% > 70%, PTI No. 78-01A, FG-FLEXO, IV.1&2) and Destruction Efficiency of 98.9 percent (DE = 98.9% > 95%, PTI No. 78-01A, FG-FLEXO, IV.1&2) were accounted for in VOC calculations.

PTI No. 78-01A, FG-FLEXO, II. MATERIAL LIMITS

NA

PTI No. 78-01A, FG-FLEXO, III. PROCESS/OPERATIONAL RESTRICTIONS

All materials (e.g., inks, solvents, rags) are handled properly such that fugitive emissions are minimized (PTI No. 78-01A, FG-FLEXO, III.1&2 limits: handle all materials properly such that fugitive emissions are minimized)

PTI No. 78-01A, FG-FLEXO, IV. DESIGN/EQUIPMENT PARAMETERS

Capture systems are installed and operating properly for EU-WOLVERINE & EU-COMEXI and curtains are inspected every day (PTI No. 78-01A, FG-FLEXO, IV.1 limit: curtain-type enclosures for EU-WOLVERINE or EU-COMEXI).

UTECO808 press is completely enclosed by sheet metal. UTECO808 press is equipped with see-through glass and its doors cannot be opened during printing due to an interlock mechanism. Hence, UTECO808 achieves nearly 100% capture of VOC (PTI No. 78-01A, FG-FLEXO, IV.1 limit: minimum overall capture efficiency of 70 percent from FG-FLEXO).

PTI No. 78-01A, FG-FLEXO, V. TESTING/SAMPLING

On February 28, 2017, BT Environmental Consulting, Inc. (BTEC, Inc. – Messrs. Randy Tysar, Barry Boulianne, Mr. Steve Smith, Paul Molenda, David Trahan; Project No. 16-

4967.00; April 3, 2017) of Royal Oak, Michigan, conducted the tests using CEM methods (PTI No. 78-01A, FG-FLEXO, V.1 & 2 limit: verification of VOC emission rates, VOC capture efficiency, and VOC destruction efficiency from FG-FLEXO by testing, CE > 70% , RTO DE > 95%, RTO T > 1590). Per the stack test report, Capture Efficiency is 76.4% (CE > 70%) and Destruction Efficiency is 98.9 (DE >95%) (PTI No. 78-01A, FG-FLEXO, IV.1 & 2 limits: CE > 70%, DE > 95%, RTO T > 1590°F and RTO ε > 0.5 seconds)

PTI No. 78-01A, FG-FLEXO, VI. MONITORING/RECORDKEEPING

All VOC and HAP calculations are performed (PTI No. 78-01A, FG-FLEXO, VI.1 limit: calculations by 15th of the month). Temperature charts are present to record temperature continuously (PTI No. 78-01A, FG-FLEXO, IV.2 limit: temperature records). VOC and HAP content records are kept (PTI No. 78-01A, FG-FLEXO, IV.3&4 limit: VOC content records). VOC & HAP capture curtain enclosures and adjustable seals for EU-WOLVERINE are inspected daily (PTI No. 78-01A, FG-FLEXO, IV.5 limit: visual inspection records)

PTI No. 78-01A, FG-FLEXO, VIII. STACK/VENT RESTRICTIONS

Stack height = 30 feet (PTI No. 78-01A, FG-FLEXO, VIII.1 limit: SV-RTO > 30 ft.)

PTI No. 78-01A, FG-FLEXO, IX. OTHER REQUIREMENTS.

EU-WOLVERINE , and EU-UTECO808 are labeled (PTI No. 78-01A, FG-FLEXO, IX, limit: equipment labels)

PTI No. 78-01A, FG-FACILITY

CY2022 HAPs emissions are 0.0 pounds per year for October 2022 (PTI No. 78-01A, FG-FACILITY, I.1&2: < 8.9 tpy Single HAP and < 22.49 tpy Aggregate HAPs). Manufacturer's formulation data is used for HAP content (PTI No. 78-01A, FG-FACILITY, V.1 limit: HAP content). HAP containing materials usage records are kept and HAP emissions calculations are performed (PTI No. 78-01A, FG-FACILITY, VI.1&2 limit: HAP content and calculations)

Conclusion:

Carroll is in compliance with PTI 78-01A.

NAME

J. S. MarshallDATE March 16, 2023 SUPERVISORJoyce