Air Emissions Testing of EU-ECOAT Oven Thermal Oxidizers TAR A and TAR B

Jefferson North Assembly Plant
2101 Conner Street
Detroit, Michigan

State Registration No. N2155
Renewable Operating Permit MI-ROP-N2155-2010

Prepared for
Chrysler Group LLC
Auburn Hills, Michigan

Bureau Veritas Project No. 11014-000300.00

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Bureau Veritas North America, Inc.
22345 Roethel Drive
Novi, Michigan 48375
248.344.1770
www.us.bureauveritas.com/hse

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Executive Summary

The purpose of the testing is to measure mass emissions of volatile organic compounds (VOC) and the VOC destruction efficiency (DE) of two incinerators controlling air emissions from the EU-ECOAT ovens. Two incinerators were replaced with equivalent units during plant shutdown the week of December 23, 2013. The EU-ECOAT incinerators are included within the facility's air permit MI-ROP-N2155-2010.

Currently, the EU-ECOAT emission unit conditions require the two thermal incinerators be installed, maintained and operated in a satisfactory manner.

1. The permittee shall not operate EU-ECOAT unless the two thermal oxidizers are both installed, maintained and operated in a satisfactory manner. Satisfactory operation of thermal oxidizer includes maintaining a minimum temperature of 1,360 °F based upon a three hour average, or at the temperature during the most recent control device performance test which demonstrated compliance, and has a minimum retention time of 0.5 seconds. In lieu of a minimum temperature, the permittee may use an average temperature of 1360°F based upon a three-hour rolling average.[2] **(R 336.1220(a), R 336.1225, R 336.1901, R336.1910, 40 CFR 64.6(c)(1)(i),(ii))**

The objective of the testing was to:

- Measure the VOC emissions at the inlet and outlet of both thermal incinerators to evaluate the VOC DE.
- Confirm the oxidizer operating temperatures at which the destruction efficiencies were established.

Air emission measurements were conducted at the inlet and outlet of the two thermal incinerators controlling air emissions from the EU-ECOAT bake ovens. The incinerators exhaust emissions to atmosphere through two stacks:

- SVST-PS-027
- SVST-PS-102

The testing was conducted February 13 and 14, 2014, and followed United States Environmental Protection Agency (USEPA) Reference Methods 1, 2, 3, 4, 25A, and 205 in 40 CFR 51, Appendix M, 40 CFR 60, Appendix A, and State of Michigan Part 10 rules.

The results of the testing are summarized in the following table.

VOC DE Emission Results

Parameter		Result			Average
		Run 1	Run 2	Run 3	
Thermal Oxidizer A (Ecoat TAR A)					
Chamber Temperature (°F)		1,319.8	1,319.8	1,320.6	1,320.1
TO Inlet†	VOC (ppmv) as propane	496	409	297	400
	VOC (lb/hr) as propane	6.4	5.2	3.8	5.1
TO Outlet†	VOC (ppmv) as propane	0.7	1.1	0.6	0.8
	VOC (lb/hr) as propane	0.01	0.02	0.01	0.01
VOC DE (%)		**99.8**	**99.7**	**99.8**	99.8
Thermal Oxidizer B (Ecoat TAR B)					
Chamber Temperature (°F)		1,320	1,320.2	1,319.9	1,320.0
TO Inlet†	VOC (ppmv) as propane	113	137	140	130
	VOC (lb/hr) as propane	6.6	8.0	8.5	7.7
TO Outlet†	VOC (ppmv) as propane	2.0	1.9	1.6	1.8
	VOC (lb/hr) as propane	0.13	0.12	0.10	0.12
VOC DE (%)		**98.0**	**98.5**	**98.8**	98.4

1.0 Introduction

Dürr Systems Inc. retained Bureau Veritas North America, Inc. to perform air emissions testing at the Chrysler Group LLC Jefferson North Assembly Plant in Detroit, Michigan. Chrysler Group LLC operates a body shop, paint shop, and final assembly line to manufacture the Dodge Durango and Jeep Grand Cherokee vehicles at this facility. This report summarizes the testing of the EU-ECOAT thermal oxidizers controlling emissions from the electrostatic deposition process bake oven performed February 13 and 14, 2014.

1.1 Summary of Test Program

Chrysler Group LLC prepares auto bodies for basecoat using an enclosed electrocoat dip tank system followed by a curing oven. Volatile organic compound (VOC) emissions from the curing oven are controlled by two thermal oxidizers. Bureau Veritas measured emissions as summarized below:

Thermal Oxidizer A. Three, 60-minute test runs were performed at the inlet and outlet of the Ecoat TAR A thermal oxidizer to measure VOC destruction efficiency (DE).

Thermal Oxidizer B. Three, 60-minute test runs were performed at the inlet and outlet of the Ecoat TAR B thermal oxidizer to measure VOC DE.

The testing was performed February 13 and 14, 2014.

1.2 Purpose of Testing

The purpose of the testing was to measure mass emissions of volatile organic compounds (VOC) and the VOC DE of two incinerators controlling air emissions from the EU-ECOAT ovens. Two incinerators were replaced with equivalent units during plant shutdown the week of December 23, 2013.

Currently, the EU-ECOAT emission unit conditions require the two thermal incinerators be installed, maintained and operated in a satisfactory manner.

1. The permittee shall not operate EU-ECOAT unless the two thermal oxidizers are both installed, maintained and operated in a satisfactory manner. Satisfactory operation of thermal oxidizer includes maintaining a minimum temperature of 1,360 °F based upon a three hour average, or at the temperature during the most recent control device performance test which demonstrated compliance, and has a minimum retention time of 0.5 seconds. In lieu of a minimum temperature, the permittee may use an average temperature of 1360°F based upon a three-hour rolling average.[2] **(R 336.1220(a), R 336.1225, R 336.1901, R336.1910, 40 CFR 64.6(c)(1)(i),(ii))**

The objective of the testing was to:

- Measure the VOC emissions at the inlet and outlet of both thermal incinerators to evaluate the VOC DE.
- Confirm the oxidizer operating temperature at which the destruction efficiencies were established.

1.3 Contact Information

Contact information is listed in Table 1-1. Mr. Dillon King, Consultant with Bureau Veritas, led the emission testing program. Ms. Kathy Malone, Project Manager with Dürr Systems, Inc. oversaw thermal oxidizer operating conditions. Mr. Rohit Patel with Chrysler Group LLC, and Mr. Andrew Whitsitt, the JNAP facility's Environmental Specialist, provided process coordination and arranged for facility operating parameters to be recorded. The testing was witnessed by Mr. Mark Dziadosz and Mr. Robert Byrnes with the Michigan Department of Environmental Quality (MDEQ).

Table 1-1
Contact Information

Facility	Emission Testing Company
Chrysler Group LLC	Bureau Veritas North America, Inc.
Rohit Patel Air Compliance Manager Corporate Office 800 Chrysler Drive Auburn Hills, Michigan 48326 Telephone: 248.512.1599 rgp6@chrysler.com	Dillon King Consultant 22345 Roethel Drive Novi, Michigan 48375 Telephone: 248.344.3002 dillon.king@us.bureauveritas.com
Andrew Whitsitt Environment Specialist Jefferson North Assembly Plant 2101 Conner Street Detroit, Michigan Telephone: 313.354.2441 AW224@chrysler.com	Kathy Malone Project Manager Dürr Systems Inc. 40600 Plymouth Road Plymouth, Michigan 48170 Telephone:734.254.2427 Kathy.malone@durrusa.com

Michigan Department of Environmental Quality	
Mark Dziadosz Environmental Quality Analyst Air Quality Division - Southeast Michigan District Office 27700 Donald Court Warren, Michigan 48092 Telephone: 586.753.3745 Facsimile: 586.753.3731 Email: dziadoszm@michigan.gov	Robert Byrnes Environmental Engineer Air Quality Division-Lansing District Office Constitution Hall 4th Floor P.O. Box 30242 Lansing, Michigan 48909 Telephone: 517.284.6632 Facsimile: 517.241.7462 Email: byrnesr@michigan.gov

2.0 Source and Sampling Locations

2.1 Process Description

Chrysler Jefferson North Assembly Plant is an automotive manufacturing facility. Currently, coatings are applied to the Durango and Grand Cherokee production models. The process tested was the pollution control equipment related to the cathodic electro deposition primer system. The basecoat primer process is commonly referred to as the E-Coat process.

After vehicle bodies have been cleaned and prepared for coating, they are conveyed into an electrodeposition tank. The electrodeposition tank contains a paint bath where direct current is applied between the vehicle bodies and a counter electrode. Paint is attracted by the electrical field to the vehicle body and is deposited. The vehicle bodies are then removed from the bath and enter a rinse to reclaim undeposited paint solids. After the rinse, the vehicle bodies are conveyed through an oven to cure the paint. Emissions from the oven are directed to thermal incinerators for pollution control. Emissions were measured at the two EU-ECOAT thermal oxidizer inlet and outlet stacks.

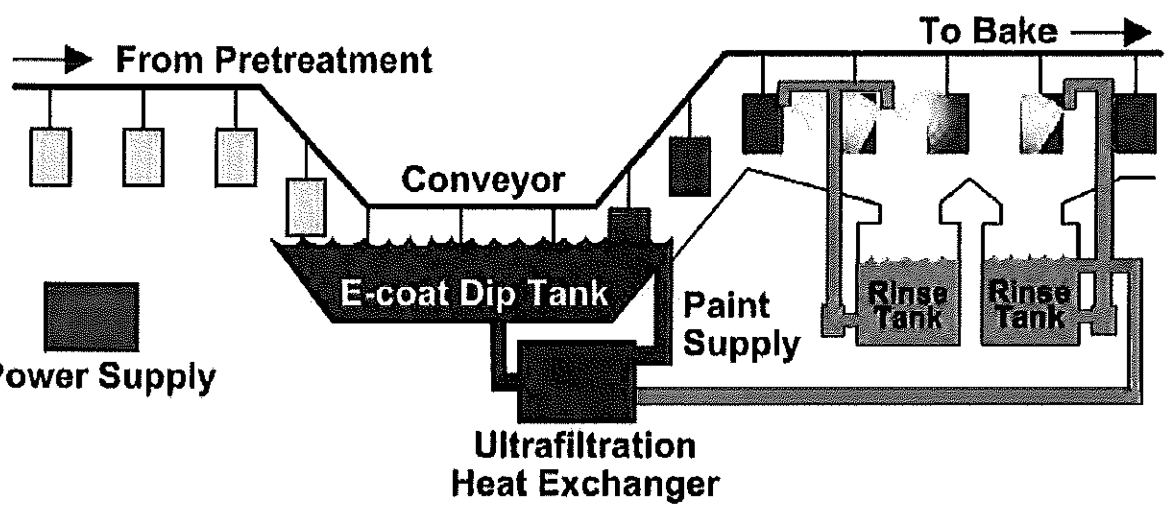

Image from:
http://www.electrocoat.org/Resources/Pictures/ecoat%20process%20moving%20diagram.swf

Figure 2-1. Electrocoat System

2.2 Control Equipment

EU-ECOAT oven emissions are captured and directed to two Dürr Systems, Inc. Ecopure® TAR thermal oxidizers. The control equipment is referenced as Ecoat TAR A and Ecoat TAR B. They use natural gas burners and have a designed a residence time of 0.6 seconds. The oxidizers are similar in design but differ in size. TAR A is designed to control 3,850 Normal cubic meters per hour (Nm^3/h) of process air. TAR B is designed to control 16,100 Nm^3/h of process air.

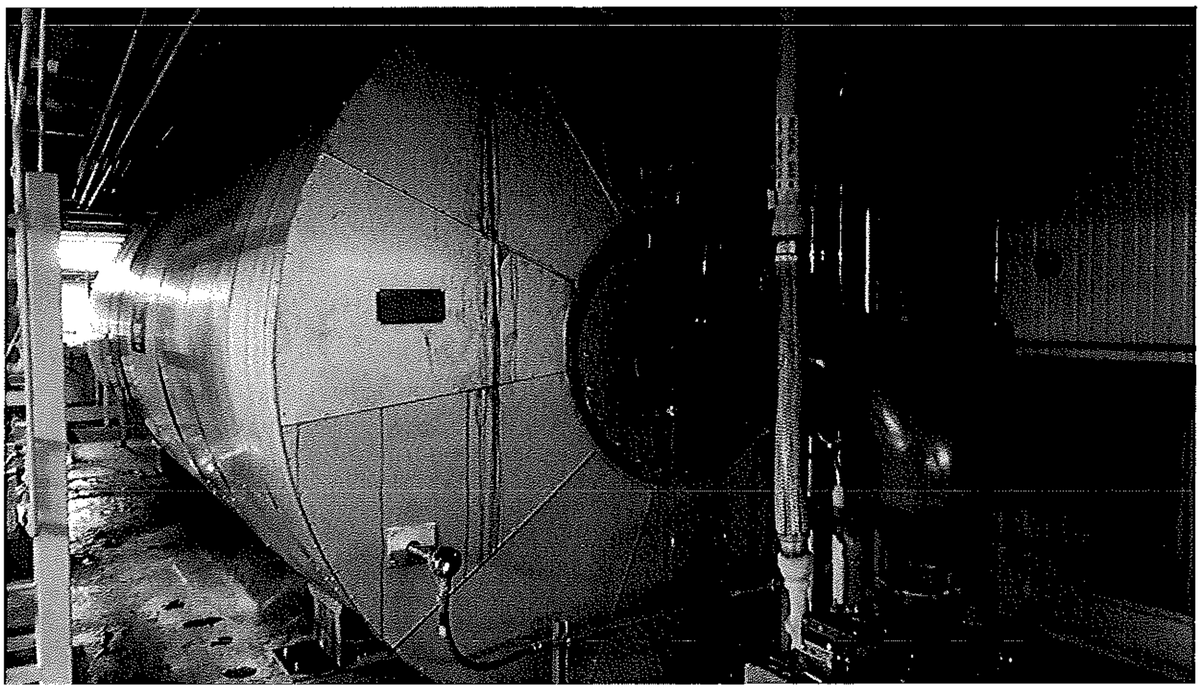

Figure 2-2. Photograph of Ecoat TAR B

The TARs are designed to oxidize volatile organic compounds prior to discharge to atmosphere. Process air enters the TAR and is pre-heated by an exhaust-air heat exchanger. The air enters the combustion chamber where the burner heats it to oxidize the VOCs producing primarily water vapor and carbon dioxide. The purified air exiting the combustion chamber is then directed through the exhaust-air heat exchanger prior to discharge to the atmosphere through stacks:

- SVST-PS-027
- SVST-PS-102

Figure 2-2 presents a photograph of TAR B and Figure 2-3 is an image of Ecopure® TAR. Drawings of the oven zones, ductwork, and incinerators are provided in Appendix E.

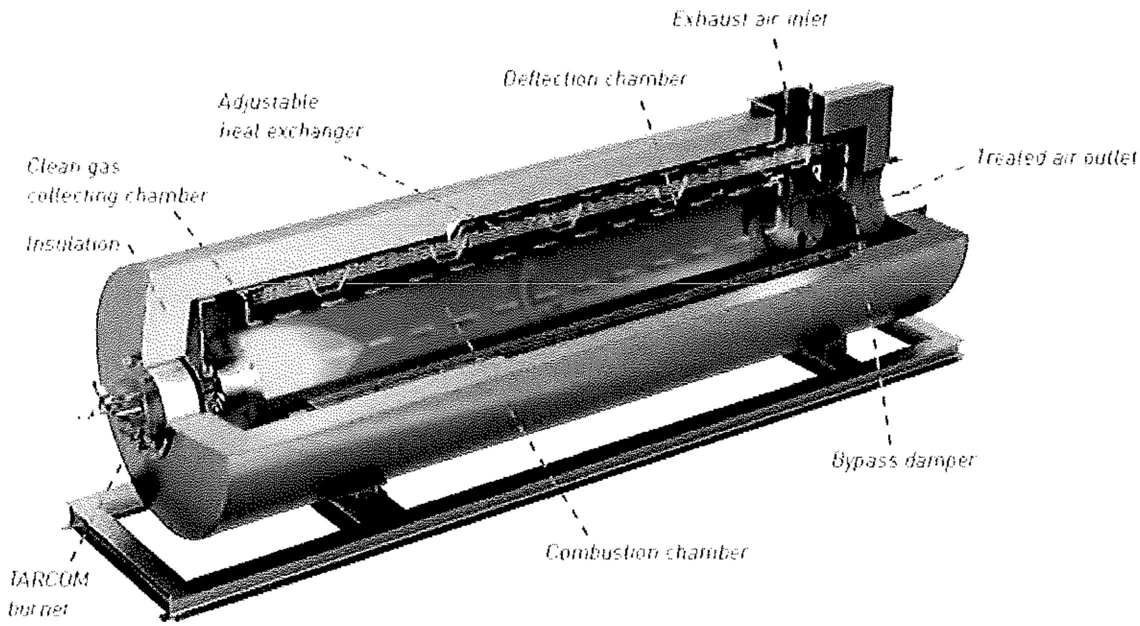

Image from: http://www.olpi-durr.it/riservata/prodotti/images/_382_CTS%20Products_ita.pdf

Figure 2-3. Dürr Ecopure® TAR Recuperative Oxidizer

2.3 Flue Gas Sampling Location

A photograph and description of the Ecoat TAR A and Ecoat TAR B inlet and outlet sampling locations are presented in the following Sections.

2.3.1 TAR A Inlet Sampling Location

Four, 2-inch-internal-diameter sampling ports are located in a straight section of the rectangular ductwork that is 14 inches wide by 14 inches deep upstream of the thermal oxidizer. The sampling ports extend 6.5 inches outward from the stack interior wall. The ports are located:

- Approximately 29 inches (~2.1 duct diameters) from the nearest upstream disturbance
- Approximately 19 inches (~1.4 duct diameters) from the nearest downstream disturbance

Figure 1 in the Appendix depicts the TAR A inlet and outlet sampling ports and traverse point locations. Figure 2-4 is a photograph of the TAR A inlet sampling location.

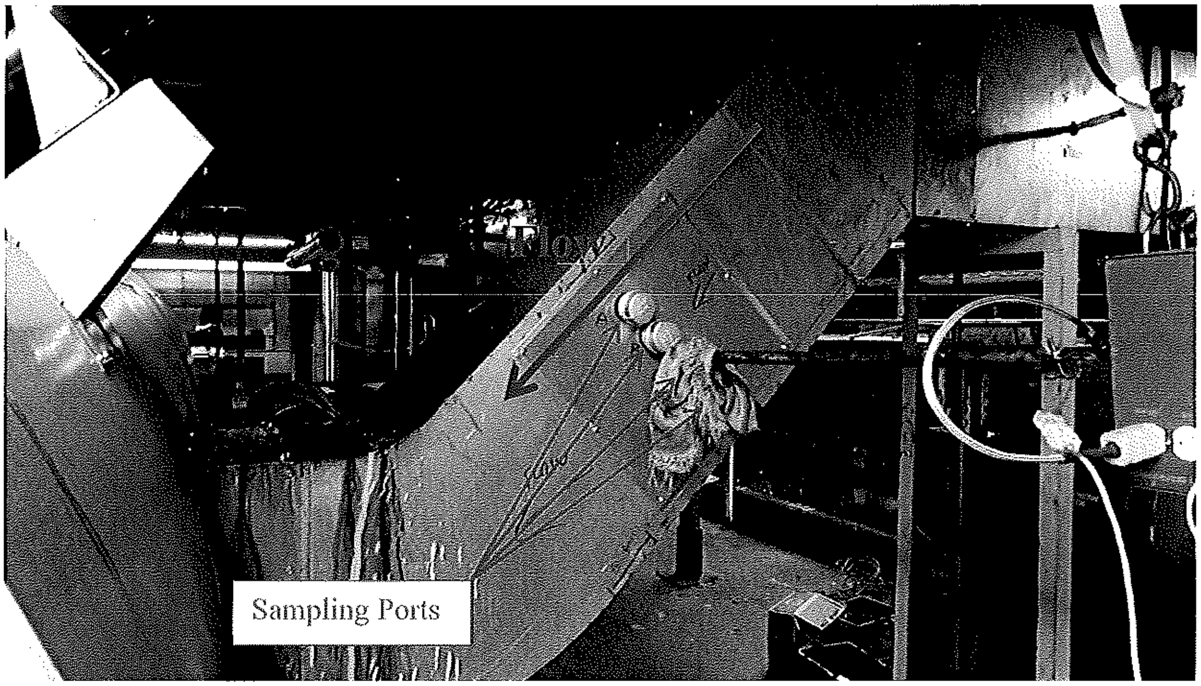

Figure 2-4. Ecoat TAR A Inlet Sampling Location

2.3.2 TAR A Outlet Sampling Location

The thermal oxidizer exhausts to atmosphere through a 20-inch-internal-diameter exhaust stack with two, 4-inch-internal-diameter sampling ports oriented at 90° to one another. The sampling ports extend 5 inches outward from the stack interior wall. The ports are located:

- Approximately 4 feet (~2.4 duct diameters) from the nearest upstream disturbance
- Approximately 5 feet (~3 duct diameters) from the nearest downstream disturbance

Figure 1 in the Appendix depicts the TAR A inlet and outlet sampling ports and traverse point locations. Figure 2-5 is a photograph of the TAR A outlet sampling location.

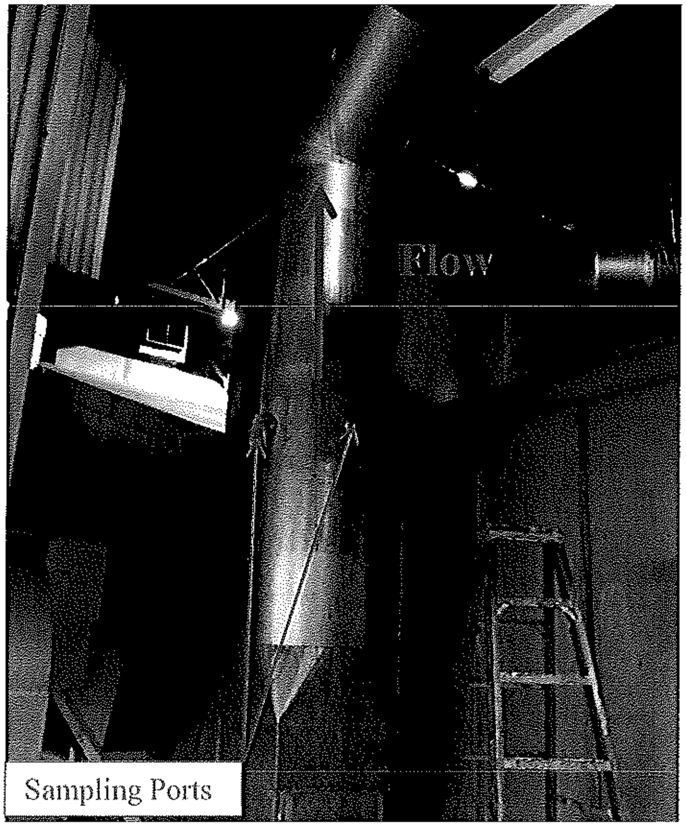

Figure 2-5. Ecoat TAR A Outlet Sampling Location

2.3.3 TAR B Inlet Sampling Location

Four, 1.5-inch-internal-diameter sampling ports are located in a straight section of the rectangular ductwork that is 40 inches wide by 24 inches deep upstream of the thermal oxidizer. The sampling ports extend 8 inches outward from the stack interior wall. The ports are located:

- Approximately 60 inches (~2 duct diameters) from the nearest upstream disturbance
- Approximately 27 inches (~0.9 duct diameter) from the nearest downstream disturbance

Figure 2 in the Appendix depicts the TAR B inlet and outlet sampling ports and traverse point locations. Figure 2-6 is a photograph of the TAR B inlet sampling location.

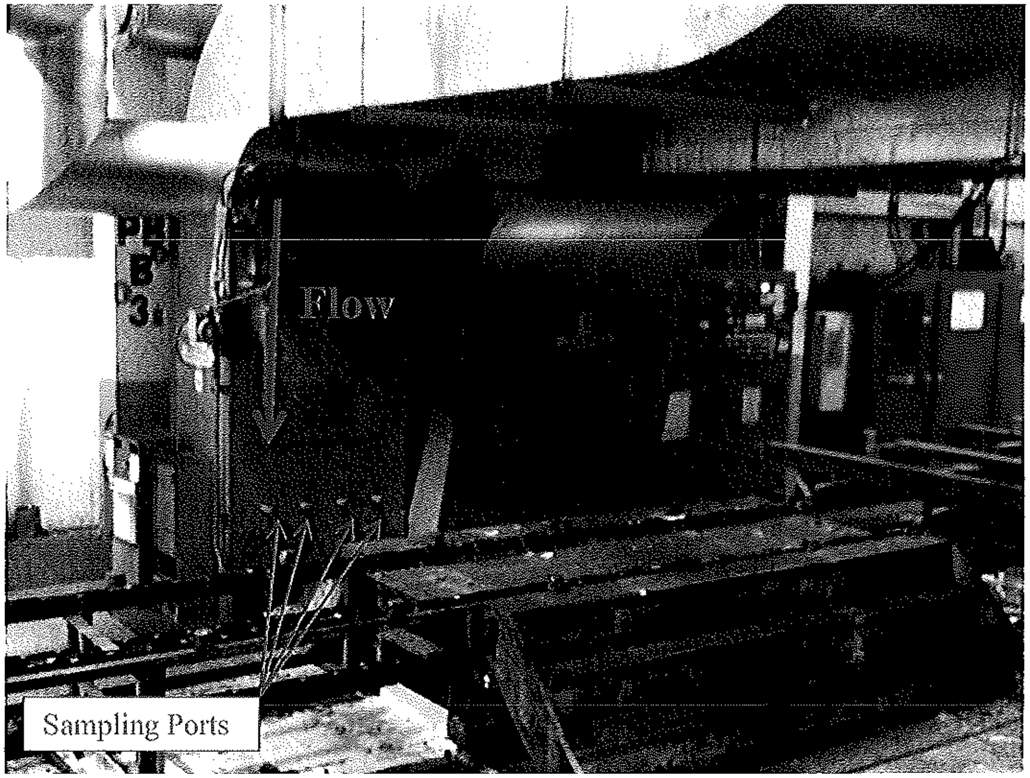

Figure 2-6. Ecoat TAR B Inlet Sampling Location

2.3.4 TAR B Outlet Sampling Location

The thermal oxidizer exhausts to atmosphere through a rectangular duct that is 29 inches wide by 40 inches deep with five, 1.5-inch-internal-diameter sampling ports. The sampling ports extend 1 inch outward from the stack interior wall. The ports are located:

- Approximately 10.8 feet (~3.9 duct diameters) from the nearest upstream disturbance
- Approximately 2.8 feet (~1 duct diameter) from the nearest downstream disturbance

Figure 2 in the Appendix depicts the TAR B outlet sampling ports and traverse point locations. Figure 2-7 is a photograph of the TAR B outlet sampling location.

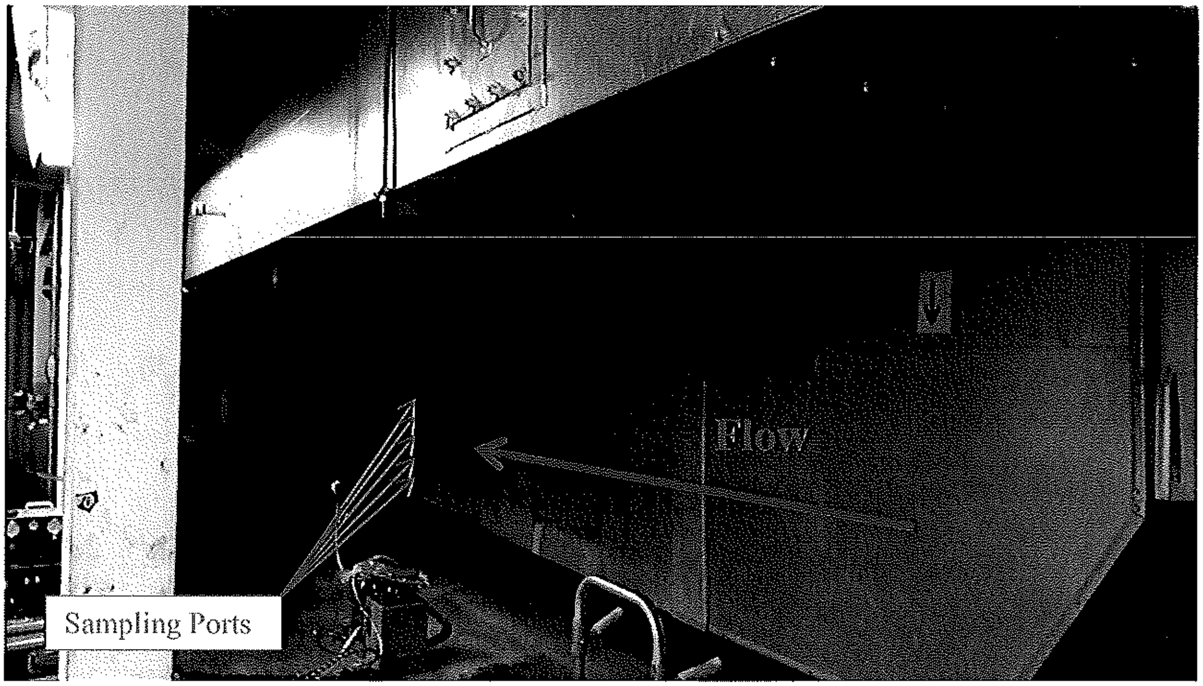

Figure 2-7. Ecoat TAR B Outlet Sampling Location

3.0 Summary and Discussion of Results

3.1 Objectives and Test Matrix

The objective of the testing was to:

- Measure the VOC emissions at the inlet and outlet of both thermal incinerators to evaluate the VOC DE.
- Confirm the oxidizer operating temperatures at which the destruction efficiencies were established.

Table 3-1 summarizes the sampling and analytical test matrix.

Table 3-1
Test Matrix

Sampling Location	Runs	Sample/Type of Pollutant	USEPA Sampling Method	Analytical Method	Run Time (min)
Inlet of Ecoat TAR A	3	Gas flowrate	1, 2, 3, and 4	Differential pressure, gravimetric	≥5
		VOCs	25A	Flame ionization	≥60
Outlet of Ecoat TAR A	3	Gas flowrate	1, 2, 3, and 4	Differential pressure, gravimetric	≥5
		VOCs	25A	Flame ionization	≥60
Inlet of Ecoat TAR B	3	Gas flowrate	1, 2, 3, and 4	Differential pressure, gravimetric	≥5
		VOCs	25A	Flame ionization	≥60
Outlet of Ecoat TAR B	3	Gas flowrate	1, 2, 3, and 4	Differential pressure, gravimetric	≥5
		VOCs	25A	Flame ionization	≥60

VOCs: volatile organic compounds

3.2 Field Test Changes and Issues

Field test changes were not required to complete the emissions testing. Communication between Chrysler Group LLC, Bureau Veritas, and MDEQ allowed the testing to be performed in accordance with established requirements. The issues presented in the following section arose.

3.2.1 Ecoat TAR B Run 3 Sample Time

Run 3 of the Ecoat TAR B VOC test started at 11:20 am; however, the VOC concentration was not recorded from 11:45 to 11:52 because a cable from the analyzer to the data acquisition system (DAS) was loose, causing the voltage signal to be lost during this time period. Due to the nature of production data being collected at 20-minute intervals, the averaging time for Run 3 was 11:20 to 11:40 and 12:00 to 12:40 to obtain a 60-minute sampling duration.

3.2.2 Ecoat TAR B Moisture Measurement

Only two reference method moisture measurements were conducted at the Ecoat TAR B exhaust. The first measurement was used to in the calculation of volumetric flowrate for Runs 1 and 2. The second Ecoat TAR B exhaust gas moisture test was used in calculations for Run 3. This measurement collected a sample volume of 15.2 standard cubic feet (scf) and less than the minimum total gas volume of 21 scf stated in USEPA Method 4. Although, the minimum sample volume was not collected, the result of 3.6% was near the anticipated moisture content estimate of 3%. These field test changes were discussed with MDEQ representatives onsite and do not materially affect the results of the study.

3.3 Results

Detailed results are presented in Tables 1 and 2 after the Tables tab of this report. Graphs of the VOC concentrations are presented after the Graphs tab of this report. Sample calculations are presented in Appendix B.