FINAL REPORT

FCA US LLC

WARREN, MICHIGAN

WARREN TRUCK ASSEMBLY PLANT (WTAP) WEST PAINT SHOP: SVRTOWEST & SVBTHCONCWEST SOURCE TESTING REPORT

RWDI #2102459

April 19, 2022

SUBMITTED TO

Michigan Department of Environment, Great Lakes, and Energy (EGLE)
AQD - Technical Programs Unit (TPU)
Constitution Hall 2nd Floor | South
525 West Allegan Street
Lansing, Michigan 48933

Joyce Zhu
Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Southeast Michigan District
27700 Donald Court
Warren, Michigan 48092-2793

FCA US LLC
Warren Truck Assembly Plant (WTAP)
21500 Mound Road
Warren, Michigan 48091

SUBMITTED BY

Brad Bergeron, A.Sc.T., d.E.T.
Senior Project Manager | Principal
Brad.Bergeron@rwdi.com | ext. 2428

Mason Sakshaug, QSTI
Senior Scientist
Mason.Sakshaug@rwdi.com | ext. 3703

RWDI USA LLC
Consulting Engineers & Scientists
2239 Star Court
Rochester Hills, Michigan 48309

T: 248.841.8442
F: 519.823.1316

EXECUTIVE SUMMARY

RWDI USA Inc. (RWDI) has been retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) West Paint Shop located at 21500 Mound Road, Warren, Michigan. WTAP operates an automobile assembly plant that produces the Jeep Wagoneer.

Under Permit to Install (PTI) 13-19B (copy of PTI is provided in **Appendix A**) this compliance testing covers the required testing for validation of destruction efficiency (DE) for the regenerative thermal oxidizer (RTO)(SVRTOWEST) serving the E-Coat Tank and curing oven (EUECOATWEST), Primer/Tutone curing oven (EUPRIMERWEST), and basecoat/clearcoat curing ovens (EUTOPCOATWEST) in addition to the desorb portion from the two (2) Concentrators (SVBTHCONCWEST).

The testing included the removal efficiency for two (2) Zeolite Concentrators servicing the Primer/Tutone booth (EUPRIMERWEST) and the basecoat/clearcoat booths (EUTOPCOATWEST). In addition to destruction efficiency of the RTO and removal efficiencies of the concentrators, particulate measurements were also completed on the RTO exhaust (outlet) for PM/PM10/PM2.5 and oxides of nitrogen (NOx) on the RTO (outlet) and the concentrators (clean air exhaust). The test program was complete the week of February 14, 2022.

Executive Table i: RTO Average - Destruction Efficiency

Parameter	Concentration & Emission Rate			
	Run 2	Run 3	Run 4	Average
NMOC Inlet- (Desorb and Oven Combined) (as propane)	77.1 ppmv 23.2 lb/hr	89.5 ppmv 28.6 lb/hr	75.7 ppmv 24.1 lb/hr	80.8 ppmv 25.3 lb/hr
NMOC Outlet (as propane)	1.1 ppmv 0.3 lb/hr	1.4 ppmv 0.4 lb/hr	1.2 ppmv 0.3 lb/hr	1.3 ppmv 0.4 lb/hr
Destruction Efficiency	98.6 %	98.5 %	98.6 %	98.6 %

Executive Table ii: Combined Concentrators - Removal Efficiency

Parameter	Concentration & Emission Rate (ppmv & % Removal)			
	Run 1	Run 2	Run 3	Average
NMOC Inlet (as propane)	50.69 ppmv	86.24 ppmv	61.10 ppmv	66.01 ppmv
NMOC Outlet (as propane)	0.40 ppmv	1.60 ppmv	1.58 ppmv	1.19 ppmv
Removal Efficiency (NMOC-THC minus Methane)	99.2 %	98.1 %	97.4 %	98.3 %

Removal efficiency was taken as NMOC (THC minus Methane) from the inlet and outlet based on concentration.

Executive Table iii: RTO - Average Emission Data - Particulate Testing – Test 1-4

Parameter	Concentration & Emission Rate (grains/dscf & lb/hr)				
	Run 1	Run 2	Run 3[1]	Run 4	Average
RTO Outlet	0.0026 grains/dscf 0.91 lb/hr	0.0009 grains/dscf 0.31 lb/hr	0.0021 grains/dscf 0.75 lb/hr	0.0008 grains/dscf 0.29 lb/hr	0.0016 grains/dscf 0.57 lb/hr

Note: [1] Run 3 had foreign debris in the sample and therefore was consider not representative of operating conditions.

Executive Table iv: RTO - Average Emission Data - Particulate Testing – Test 1, 2, and 4

Parameter	Concentration & Emission Rate (grains/dscf & lb/hr)			
	Run 1	Run 2	Run 4	Average
RTO Outlet	0.0026 grains/dscf 0.91 lbs/hr	0.0009 grains/dscf 0.31 lbs/hr	0.0008 grains/dscf 0.29 lbs/hr	0.0014 grains/dscf 0.51 lbs/hr

Executive Table v: Concentrator - Average Emission Data - Particulate Testing – Test 1 to 3

Parameter	Concentration & Emission Rate (grains/dscf & lb/hr)			
	Run 1	Run 2	Run 3	Average
Concentrator Outlet	0.0004 grains/dscf 0.27 lb/hr	0.0004 grains/dscf 0.27 lb/hr	0.0009 grains/dscf 0.55 lb/hr	0.0006 grains/dscf 0.36 lb/hr

Executive Table vi: RTO & Combined Concentrators - Average Emission Data - NOx Testing

Parameter	Concentration & Emission Rate (ppmv & lb/hr)			
	Run 1	Run 2	Run 3	Average
RTO Outlet	4.17 ppmv 1.26 lb/hr	4.45 ppmv 1.34 lb/hr	4.47 ppmv 1.33 lb/hr	4.37 ppmv 1.31 lb/hr
Combined Concentrator Outlet	0.00 ppmv 0.00 lb/hr	0.00 ppmv 0.0 lb/hr	0.16 ppmv 0.3 lb/hr	0.05 ppmv 0.11 lb/hr

TABLE OF CONTENTS

LIST OF TABLES

(Found within the Report)

LIST OF TABLES

(Found After the Report)

LIST OF APPENDICES

1 INTRODUCTION

RWDI USA Inc. (RWDI) has been retained by FCA US LLC (FCA) to complete the emission sampling program at their Warren Truck Assembly Plant (WTAP) West Paint Shop located at 21500 Mound Road, Warren, Michigan. WTAP operates an automobile assembly plant that produces the Jeep Wagoneer.

Under Permit to Install (PTI) 13-19B (copy of PTI is provided in **Appendix A**) this compliance testing covers the required testing for validation of destruction efficiency (DE) for the regenerative thermal oxidizer (RTO)(SVRTOWEST) serving the E-Coat tank and curing oven (EUECOATWEST), Primer/Tutone curing oven (EUPRIMERWEST), and basecoat/clearcoat curing ovens (EUTOPCOATWEST) in addition to the desorb portion from the two (2) Concentrators (SVBTHCONCWEST).

The testing included the removal efficiency for two (2) Zeolite Concentrators servicing the Primer/Tutone booth (EUPRIMERWEST) and the basecoat/clearcoat booths (EUTOPCOATWEST). In addition to destruction efficiency of the RTO and removal efficiencies of the concentrators, particulate measurements were also completed on the RTO exhaust (outlet) for PM/PM_{10}/$PM_{2.5}$ and oxides of nitrogen (NOx) on the RTO (outlet) and the concentrators (clean air exhaust). The test program was complete the week of February 14, 2022.

2 SOURCE DESCRIPTION

2.1 Plant and Sources Overview

This section gives a detailed description of each process that exhausts to either the RTO or one of the two concentrators.

2.1.1 EUECOATWEST

An electrodeposition (E-Coat) coating process consisting of a series dip tanks, rinses, a curing oven, a cooling tunnel, followed by a prep booth (light sanding) and spot prime coating booth. Repairs take place in a prep sanding booth (light sanding), followed by manual application of a small amount of spot prime coating in a spot prime coating booth. Emissions from the E-coat tanks and the curing oven are controlled by the RTO.

2.1.2 EUPRIMERWEST

A prep tunnel, two (2) automatic primer booths, one for solvent borne main primer and one for solvent borne tutone coloring primer, a primer observation zone, an ambient flash-off area, two natural gas fired primer ovens, a cooling tunnel and two (2) booths (color prep and reprocess heavy sand) for repair of surface blemishes. Coating booth overspray is controlled by a waterwash particulate control system. A portion of the primer coating booth exhaust is filtered and recirculated to the booth air make-up system. The primer coating booth and ambient flash-off area emissions are exhausted through a bank of particulate filters, the concentrator and the RTO (via concentrator desorption exhaust). Primer Oven emissions are exhausted directly to the RTO. Emissions from the observation zones are controlled by particulate control system and exhausted to the ambient air.

2.1.3 EUTOPCOATWEST

An automatic topcoat spray application process with two parallel lines, each consisting of a waterborne basecoat coating booth, a basecoat observation zone, a basecoat ambient flash-off area, a basecoat heated flash-off area, a solvent borne clearcoat coating booth, a clearcoat observation zone, a clearcoat ambient flash-off area and a natural gas fired curing oven. Approximately 85 percent of the air from the spray zones is filtered and recirculated back into the process and the 15 percent is exhausted to the concentrator and RTO. Coating booth overspray is controlled by a waterwash particulate control system. . All booth and flash-off area emissions are exhausted through a bank of particulate filters, the concentrator, and the RTO. Oven emissions are exhausted directly to the RTO.. Emissions from the observation zones are controlled by particulate control system and exhausted to the ambient air.

2.2 Sampling Locations Overview

The sampling locations for the RTO are located outside. This following table summarizes the sampling locations.

Table 2.2.1: Summary of the Stack Characteristics– SV RTO

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test	Stack Temperature
SVRTOWEST Desorb Inlet	THC	29.5"	>8 downstream and ~7 upstream	2	8 Flow	1 THC 16 Flow	~140ºF
SVRTOWEST Oven Inlet	THC	66"	~8 downstream and ~2 upstream	2	8 Flow	1 THC 16 Flow	~245ºF
SVRTOWEST Outlet	THC, NOx, PM/PM10/PM2.5	58"	~8 downstream and ~2 Upstream	2	8 Flow	1 THC 16 PM/Flow 1 NOx	~300ºF

Table 2.2.2: Summary of the Stack Characteristics – SVBOOTHCONC

Source	Parameter	Diameter	Approximate Duct Diameters from Flow Disturbance	Number of Ports	Points per Traverse	Total Points per Test	Stack Temperature
SVBOOTH CONC Concentrator Inlet (Combined)	THC	68"	<1 Downstream and <0.5 upstream	1	-	1 THC	~85ºF
SVBOOTH CONC Concentrator Outlet (Combined)	THC and NOx	68"	~5 downstream and >2 upstream	2	8 Flow	1 THC 1 NOx 16 Flow	~95ºF

Photos of RTO (inlets (booth and oven) and outlet), concentrator (combined inlet and combined outlet) source testing locations schematics for SVRTO and SVBOOTHCONC are provided in **Appendix A**.

3 TESTING METHODOLOGIES

3.1 Description of Testing Methodologies

The following section provides brief descriptions of the sampling methods and discusses any modifications to the reference test methods that were completed with the testing.

3.1.1 Summary of Specific Methodologies

3.1.1.1 Stack Velocity, Temperature, and Volumetric Flow Rate Determination

The exhaust velocities and flow rates were determined following the US EPA Method 2, "Determination of Stack Gas Velocity and Flow Rate (Type S Pitot Tube)". Velocity measurements were taken with a pre-calibrated S-Type pitot tube and incline manometer. Volumetric flow rates were determined following the equal area method as outlined in US EPA Method 1. Temperature measurements were made simultaneously with the velocity measurements and were conducted using a chromel-alumel type "k" thermocouple in conjunction with a digital temperature indicator.

The dry molecular weights of the stack gas were determined following calculations outlined in US EPA Method 3/3A, "Determination of Molecular Weight of Dry Stack Gas". Stack moisture content was determined through direct condensation and according to US EPA Method 4, "Determination of Moisture Content of Stack Gas". Moistures were collected at a single point during each test. If the temperature was under 200 degrees F, wet bulb/dry bulb was used. Flow rate determination, temperature and moisture were collected at the outlet from the concentrators, inlet from the ovens and outlet of the RTO. For the concentrators, the two (2) concentrators combine and exhaust clean air from a single stack. The inlet to each air house combines prior to being directed to each of the two (2) concentrators. Since the inlet to the concentrators is not ideal, RWDI completed flow rate determination, temperature, and moisture from the combined exhaust only (outlet).

For the moisture tests, the following locations were tested as well as details on testing schedule/durations /volumes:

- RTO Inlets – approximately 30-minute moisture tests per Destruction Efficiency Test per inlet (2 inlets) to achieve a minimum sample volume of 21 cubic feet.
- RTO Outlet – moisture tests were completed with the Particulate Testing to obtain moisture data from the exhaust since the moisture content should not varying significantly. Velocity and temperature readings were taken during each Method 25A and 7E test as well as separate velocity and temperature readings during the PM testing. Since Method 3A was also be recorded at the same time as the Method 25A and 7E tests, this data is provided during each destruction efficiency test (only during THC/NOx testing). The PM tests consisted of a grab sample following Method 3.
- Concentrator combined Outlet – wet bulb/dry bulb moisture tests were conducted per Removal Efficiency Test.
- Concentrator combined Inlet – flowrate determination was not completed at the inlet due to non-ideal sampling location. As such no moisture measurements was taken.

3.1.1.2 Sampling for Total Hydrocarbons (Destruction Efficiency)

THC Destruction/Removal Efficiency testing was performed simultaneously on the inlet and outlet of the RTO as well as the inlet and clean air exhaust of the Zeolite Concentrators. The following section lists notes clarifying the inlet and outlet locations of the RTO and each of the concentrators:

- The inlet locations to the RTO are split prior to combining right before the RTO. Since there is no ideal measurement location in the combined duct prior to the RTO, RWDI completed separate THC, velocity, temperature, and moisture readings at each of the inlets (desorb (concentrators) and oven). The inlet data was converted into a mass emission rate (lb/hr) per inlet and added together to determine the overall inlet mass emission rate to be used for the destruction efficiency calculation.
- The outlet of the RTO is in a single exhaust stack which was used for the outlet location for velocity, temperature, moisture, THC, NOx and Particulate.
- For the two (2) concentrators, the exhaust from the air houses supplying the concentrators is combined prior to splitting to each concentrator. Since the outlet is combined for the clean air exhaust, we completed the inlet THC measurements at the combined inlet location. The concentrator inlet is a non-ideal location for flow rate and, as such, we calculated removal efficiency based on concentration and calculated the emission rate from the two (2) concentrators combined as lb/hr based on the velocity, temperature, and moisture readings from the concentrator exhaust location.

The measurements were taken continuously following the USEPA Method 25A on the inlet(s) and outlet (using a non-methane/methane analyzer). As outlined in Method 25A, the measurement location was taken at the centroid of each source.

The compliance test consisted of three 60-minute tests on each of the RTO and Zeolite Concentrators at the preferred temperature as predetermined from WTAP. Regular performance checks on the CEMS were carried out by zero and span calibration checks using USEPA Protocol calibration gases. These checks verified the ongoing precision of the monitor with time by introducing pollutant-free (zero) air followed by known calibration gas (span) into the monitor. The response of the monitor to pollutant-free air and the corresponding sensitivity to the span gases was reviewed frequently as an ongoing indication of analyzer performance.

Prior to testing, a 4-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, low, mid, and high-level calibration gases directly into the analyzer. The calibration error check was performed to confirm that the analyzer response is within ±5% of the certified calibration gas introduced. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre- and post-test system bias checks. The system bias checks were used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and upscale calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases were introduced into the sampling system at the probe outlet so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to a series of gas analyzers, which measure the pollutant or diluent concentrations in the gas. The analyzers were calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe tip was equipped with a sintered stainless-steel filter for particulate removal or heated filter system. The end of the probe was connected to a heated Teflon sample line, which delivered the sample gases from the stack to the CEM system. The heated sample line is designed to maintain the gas temperature above 250°F in order to prevent condensation of stack gas moisture within the line.

3.1.1.3 Sampling for Nitrogen Oxides, Oxygen and Carbon Dioxide

Oxides of Nitrogen (NOx), oxygen and carbon dioxide concentrations were determined utilizing RWDI's continuous emissions monitoring (CEM) system at the RTO and Concentrator outlets. Prior to testing, a 3-point analyzer calibration error check was conducted using USEPA protocol gases. The calibration error check was performed by introducing zero, mid and high-level calibration gases directly into the analyzer. The calibration error check was performed to confirm that the analyzer response is within ±2% of the certified calibration gas introduced. Prior to each test run, a system-bias test was performed where known concentrations of calibration gases were introduced at the probe tip to measure if the analyzers response was within ±5% of the introduced calibration gas concentrations. At the conclusion of each test run a system-bias check was performed to evaluate the percent drift from pre and post-test system bias checks. The system bias checks were used to confirm that the analyzer did not drift greater than ±3% throughout a test run.

Zero and upscale calibration checks were conducted both before and after each test run to quantify measurement system calibration drift and sampling system bias. Upscale is either the mid- or high-range gas, whichever most closely approximates the flue gas level. During these checks, the calibration gases were introduced into the sampling system at the probe outlet so that the calibration gases were analyzed in the same manner as the flue gas samples.

A gas sample was continuously extracted from the stack and delivered to a series of gas analyzers, which measure the pollutant or diluent concentrations in the gas. The analyzers were calibrated on-site using EPA Protocol No. 1 certified calibration mixtures. The probe tip was equipped with a sintered stainless-steel filter for particulate removal. The end of the probe was connected to a heated Teflon sample line, which will deliver the sample gases from the stack to the CEM system. The heated sample line is designed to maintain the gas temperature above 250ºF in order to prevent condensation of stack gas moisture within the line.

Before entering the analyzers, the gas sample passed directly into a refrigerated condenser, which cooled the gas to approximately 35ºF to remove the stack gas moisture. After passing through the condenser, the dry gas entered a Teflon-head diaphragm pump and a flow control panel, which delivered the gas in series to the O_2, CO_2, and NOx analyzers (as applicable). Each of these analyzers measured the respective gas concentrations on a dry volumetric basis.

3.1.1.4 Gas Dilution (Method 205)

Calibration gas was mixed using an Environics 4040 Gas Dilution System. 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. The calibration is done yearly, and the records are included in **Appendix H.** A multi-point EPA Method 205 check was executed in the field prior to testing to ensure accurate gas-mixtures. The gas dilution system consisting of calibrated orifices or mass flow controllers and dilutes a high-level calibration gas to within ±2% of predicted values. The gas divider is capable of diluting gases at set increments and was evaluated for accuracy in the field in accordance with US EPA Method 205 "*Verification of Gas Dilution Systems for Field Instrument Calibrations*". Before testing, the gas divider dilutions were measured to evaluate that the responses are within ±2% of predicted values. In addition, a certified mid-level calibration gas within ±10% of one of the tested dilution gases were introduced into an analyzer to ensure the response of the gas calibration is within ±2% of gas divider dilution concentration.

3.1.1.5 Sampling for Particulate Matter (PM, PM_{10} and $PM_{2.5}$)

Particulate matter (PM/PM_{10}/$PM_{2.5}$) was sampled following procedures outlined in U.S. EPA Method 5 and Method 202 (Condensable Particulate Matter) for the RTO outlet and concentrator clean air exhaust outlet.

As stated in Method 202, the impinger portion was recovered and included as PM since the filtration temperature exceeded 85°F. Method 202 was followed for recovery of condensable PM. In addition, nitrogen purges were not completed post sample to remove sulphates for any of the sampling. Sulfur dioxide exposure is not expected to be an issue at this source location.

4 PROCESS DATA

During the emissions testing, plant process data was monitored and collected by WTAP personnel to ensure representative operation of the facility. The following information was collected:

1. Production rate for each process (EUECOATWEST, EUPRIMERWEST, and EUTOPCOATWEST);
2. RTO combustion chamber operating temperature during each test; and
3. Desorb inlet gas temperature for Zeolite Concentrators during each test.

Process data is provided in **Appendix J**.

5 RESULTS

All calibration information for the equipment used for this study is included in **Appendix H**. The following tables summarize the testing results, and more detailed tables can be found in **Appendix C, D, E and F** for RTO PM results, RTO Destruction Efficiency results, Concentrator PM Results and the Concentrators RE results, respectively.

Table 5.1: RTO - Destruction Efficiency

Parameter	Concentration & Emission Rate			
	Run 2	Run 3	Run 4	Average
NMOC Inlet- (Desorb and Oven Combined) (as propane)	77.1 ppmv 23.2 lb/hr	89.5 ppmv 28.6 lb/hr	75.7 ppmv 24.1 lb/hr	80.8 ppmv 25.3 lb/hr
NMOC Outlet (as propane)	1.1 ppmv 0.3 lb/hr	1.4 ppmv 0.4 lb/hr	1.2 ppmv 0.3 lb/hr	1.3 ppmv 0.4 lb/hr
Destruction Efficiency	98.6 %	98.5 %	98.6 %	98.6 %

Table 5.2: Combined Concentrators - Removal Efficiency

Parameter	Concentration & Emission Rate (ppmv & % Removal)			
	Run 1	Run 2	Run 3	Average
NMOC Inlet (as propane)	50.69 ppmv	86.24 ppmv	61.10 ppmv	66.01 ppmv
NMOC Outlet (as propane)	0.40 ppmv	1.60 ppmv	1.58 ppmv	1.19 ppmv
Removal Efficiency (NMOC-THC minus Methane)	99.2 %	98.1 %	97.4 %	98.3 %

Removal efficiency was taken as NMOC (THC minus Methane) from the inlet and outlet based on concentration.

Table 5.3: RTO - Average Emission Data - Particulate Testing Test 1-4

Parameter	Concentration & Emission Rate (grains/dscf & lb/hr)				
	Run 1	Run 2	Run 3[1]	Run 4	Average
RTO Outlet	0.0026 grains/dscf 0.91 lb/hr	0.0009 grains/dscf 0.31 lb/hr	0.0021 grains/dscf 0.75 lb/hr	0.0008 grains/dscf 0.29 lb/hr	0.0016 grains/dscf 0.57 lb/hr

Note: [1] Run 3 had foreign debris in the sample and therefore was consider not representative of operating conditions.

Table 5.4: RTO - Average Emission Data - Particulate Testing Test 1, 2, and 4

Parameter	Concentration & Emission Rate (grains/dscf & lb/hr)			
	Run 1	Run 2	Run 4	Average
RTO Outlet	0.0026 grains/dscf 0.91 lb/hr	0.0009 grains/dscf 0.31 lb/hr	0.0008 grains/dscf 0.29 lb/hr	0.0014 grains/dscf 0.51 lb/hr

Table 5.5: Concentrator - Average Emission Data - Particulate Testing Test 1-3

Parameter	Concentration & Emission Rate (grains/dscf & lb/hr)			
	Run 1	Run 2	Run 3	Average
Concentrator Outlet	0.0004 grains/dscf 0.27 lbs/hr	0.0004 grains/dscf 0.27 lbs/hr	0.0009 grains/dscf 0.55 lbs/hr	0.0006 grains/dscf 0.36 lbs/hr

Table 5.6: RTO & Combined Concentrators - Average Emission Data - NOx Testing

Parameter	Concentration & Emission Rate (ppmv & lb/hr)			
	Run 2	Run 3	Run 4	Average
RTO Outlet	4.17 ppmv 1.26 lb/hr	4.45 ppmv 1.34 lb/hr	4.47 ppmv 1.33 lb/hr	4.37 ppmv 1.31 lb/hr
Combined Concentrator Outlet	0.00 ppmv 0.0 lbs/hr	0.00 ppmv 0.0 lbs/hr	0.16 ppmv 0.3 lbs/hr	0.00 ppmv 0.0 lbs/hr

6 MODIFICATIONS

For the PM testing on the RTO, Test 3 was completed, and foreign material was identified on the filter that was not representative of the other filters (Test 1 and 2). Therefore, a 4th test was completed to confirm results. All data is provided in report.

For the Destruction Efficiency Testing on the RTO, Test 1 was removed from the averages due to the low loading. All data from the Test one is included in the report.

7 OPERATING CONDITIONS

Operating conditions during the sampling were monitored by FCA personnel. All equipment was operated under normal maximum operating conditions.

Contact was maintained between the operator and the sampling team. A member of the RWDI sampling team contacted the operator before each test, to ensure that the process was at normal maximum operating conditions.

8 CONCLUSIONS

Testing was successfully completed the week of February 14th, 2022. All parameters were tested in accordance with USEPA referenced methodologies.

TABLES

Table 1: Summary of RTO Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
WTAP West RTO	4	Velocity, Temperature, and Flow Rate (CEM)	U.S. EPA [1] Methods 1, 2, and 4
	4	Velocity, Temperature, and Flow Rate (PM)	U.S. EPA [1] Methods 1-4
	4	Total Particulate Matter	U.S. EPA [1] Method 5
	4	Condensible Particluate Matter	U.S. EPA [1] Method 202
	4	O2/CO2 Concentration	U.S. EPA [1] Method 3A
	4	NOx Concentration	U.S. EPA [1] Method 7E
	4	Methane	U.S. EPA [1] Method 25A (CEM)
	4	Nonmethane Organic Compounds (NMOCs)	U.S. EPA [1] Method 25A (CEM)

__**Notes:**__

[1] U.S. EPA - United States Environmental Protection Agency

Table 2: Summary of Concenetrator Sampling Parameters and Methodology

Source Location	No. of Tests per Stack	Sampling Parameter	Sampling Method
WTAP West Concentrator	3	Velocity, Temperature, and Flow Rate (CEM)	U.S. EPA [1] Methods 1, 2, and 4
	3	Velocity, Temperature, and Flow Rate (PM)	U.S. EPA [1] Methods 1, 2, and 4
	3	Total Particulate Matter	U.S. EPA [1] Method 5
	3	Condensible Particluate Matter	U.S. EPA [1] Method 202
	6	O2/CO2 Concentration	U.S. EPA [1] Method 3A
	3	NOx Concentration	U.S. EPA [1] Method 7E
	3	Methane	U.S. EPA [1] Method 25A (CEM)
	3	Nonmethane Organic Compounds (NMOCs)	U.S. EPA [1] Method 25A (CEM)

Notes:

[1] U.S. EPA - United States Environmental Protection Agency

Table 3: Sampling Summary and Sample Log

Source and Test #	Sampling Date	Start Time	End Time	Filter ID	Laboratory
RTO Particulate Matter Testing					
Blank	-	-	-	26133	Enthalpy Analytics
Test #1	15-Feb-22	8:10 AM	1:11 PM	26140	Enthalpy Analytics
Test #2	15-Feb-22	2:04 PM	6:11 PM	26139	Enthalpy Analytics
Test #3	16-Feb-22	7:50 AM	2:37 PM	26152	Enthalpy Analytics
Test #4	18-Feb-22	9:04 AM	1:48 PM	26147	Enthalpy Analytics
RTO Destruction Effiency/NOx Testing					
Test #1	14-Feb-22	11:11 AM	1:15 PM	N/A	N/A
Test #2	14-Feb-22	2:07 PM	3:07 PM	N/A	N/A
Test #3	14-Feb-22	4:00 PM	5:00 PM	N/A	N/A
Test #4	14-Feb-22	5:32 PM	6:32 PM	N/A	N/A
Concentrator Particulate Matter Testing					
Blank	-	-	-	26133	Enthalpy Analytics
Test #1	17-Feb-22	9:35 AM	2:22 PM	26150	Enthalpy Analytics
Test #2	17-Feb-22	2:57 PM	7:26 PM	26149	Enthalpy Analytics
Test #3	18-Feb-22	8:40 AM	3:11 PM	26146	Enthalpy Analytics
Concentrator Reduction Efficiency/NOx Testing					
Test #1	15-Feb-22	2:03 PM	3:03 PM	N/A	N/A
Test #2	15-Feb-22	4:15 PM	5:15 PM	N/A	N/A
Test #3	15-Feb-22	5:32 PM	6:32 PM	N/A	N/A

Table 4: Sampling Summary - Flow Characteristics
WTAP West RTO DE

Stack Gas Parameter		Test No. 1			Test No. 2			Test No. 3			Test No. 4			Averages		
		Oven Inlet	Desorb Inlet	Outlet	Oven Inlet	Desorb Inlet	Outlet	Oven Inlet	Desorb Inlet	Outlet	Oven Inlet	Desorb Inlet	Outlet	Oven Inlet	Desorb Inlet	Outlet
Testing Date		14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22	14-Feb-22			
Stack Temperature	°F	247	146	293	244	142	296	243	142	296	247	143	295	245	143	295
	°C	119	63	145	118	61	147	117	61	147	119	62	146	118	62	146
Moisture	%	0.6%	1.5%	0.6%	0.7%	1.4%	0.3%	0.5%	1.4%	0.3%	0.7%	1.5%	0.5%	0.6%	1.5%	0.4%
Velocity	ft/s	33.8	43.20	54.10	31.80	41.80	55.60	34.20	41.80	55.50	34.00	43.20	54.80	33.45	42.50	55.00
	m/s	10.3	13.20	16.50	9.70	12.70	16.90	10.40	12.70	16.90	10.40	13.20	16.70	10.20	12.95	16.75
Actual Flow Rate	ACFM	48,112	12,313	59,543	45,265	11,892	61,215	48,801	11,899	61,049	48,538	12,314	60,305	47,679	12,105	60,528
Referenced Flow Rate[1]	DSCFM	35,601	10,615	41,221	33,641	10,321	42,211	36,324	10,328	42,065	35,927	10,667	41,618	35,373	10,483	41,779
	m^3/s	16.80	5.01	19.46	15.88	4.87	19.92	17.15	4.87	19.85	16.96	5.03	19.64	16.70	4.95	19.72

Notes:
[1] Referenced flow rate expressed as wet at 101.3 kPa, 68 °F, and Actual Oxygen

Table 5: Sampling Summary - Flow Characteristics
WTAP West RTO PM

Stack Gas Parameter		Test No. 1 Outlet	Test No. 2 Outlet	Test No. 3 Outlet	Test No. 4 Outlet	Average Outlet
	Testing Date	15-Feb-22	15-Feb-22	16-Feb-22	18-Feb-22	
Stack Temperature	°F	296	300	296	294	297
	°C	147	149	147	146	147
Moisture	%	2.3%	2.6%	2.5%	2.4%	2.4%
Velocity	ft/s	55.0	56.20	56.03	56.51	55.94
Actual Flow Rate	CFM	60,585	61,864	61,677	62,215	61,585
Referenced Flow Rate[1]	CFM	40,817	41,341	41,449	42,018	41,406
	m^3/m	1156.00	1171.00	1174.00	1167.00	1167.00

Notes:
[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 6: Sampling Summary - Flow Characteristics
WTAP West Concentrator NOx

Stack Gas Parameter		Test No. 1	Test No. 2	Test No. 3	Average
		Outlet	Outlet	Outlet	Outlet
Testing Date		15-Feb-22	15-Feb-22	15-Feb-22	
Stack Temperature	°F	95	96	94	95
	°C	35	36	34	35
Moisture	%	1.6%	1.6%	1.6%	1.6%
Velocity	ft/s	53.6	53.80	54.10	53.83
	m/s	16.3	16.40	16.50	16.40
Actual Flow Rate	CFM	81,039	81,440	81,870	81,450
Referenced Flow Rate[1]	CFM	76,706	76,990	77,597	77,098
	m^3/s	36.21	36.34	36.63	36.39

Notes:

[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen

Table 7: Sampling Summary - Flow Characteristics
WTAP West Concentrator PM

Stack Gas Parameter		Test No. 1 Outlet	Test No. 2 Outlet	Test No. 3 Outlet	Average Outlet
	Testing Date	17-Feb-22	17-Feb-22	18-Feb-22	
Stack Temperature	°F	90	91	90	90
	°C	32	33	32	32
Moisture	%	1.9%	2.0%	1.7%	1.9%
Velocity	ft/s	52.7	52.26	52.73	52.58
Actual Flow Rate	CFM	79,800	79,076	79,788	79,555
Referenced Flow Rate[1]	CFM	73,131	72,262	73,871	73,088
	m^3/m	2071	2046	2092	2070

Notes:
[1] Referenced flow rate expressed as dry at 101.3 kPa, 68 °F, and Actual Oxygen