# Air Emission Test of EU-Paint 1 and FG MACTPPPP Regenerative Thermal Oxidizer

## Inteva Products, LLC
**1450 East Beecher Street**
**Adrian, Michigan**

**State Registration No. B6207**
**Renewable Operating Permit MI-ROP-B6207-2012a**

*Prepared for:*
**Inteva Products, LLC**
**Adrian, Michigan**

Bureau Veritas Project No. 11015-000102.00

June 30, 2015

***Move Forward with Confidence***

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

DEQ

MICHIGAN DEPARTMENT OF ENVIRONMENTAL QUALITY
AIR QUALITY DIVISION

# RENEWABLE OPERATING PERMIT
# REPORT CERTIFICATION

*Authorized by 1994 P.A. 451, as amended. Failure to provide this information may result in civil and/or criminal penalties.*

**Reports submitted pursuant to R 336.1213 (Rule 213), subrules (3)(c) and/or (4)(c), of Michigan's Renewable Operating Permit (ROP) program must be certified by a responsible official. Additional information regarding the reports and documentation listed below must be kept on file for at least 5 years, as specified in Rule 213(3)(b)(ii), and be made available to the Department of Environmental Quality, Air Quality Division upon request.**

Source Name: Inteva Products, LLC Adrian Operations    County: Lenawee

Source Address: 1450 East Beecher Road    City: Adrian

AQD Source ID (SRN): B6027    ROP No.: MI-ROP-B6027-2012a    ROP Section No.: C and D

Please check the appropriate box(es):

☐ **Annual Compliance Certification (Pursuant to Rule 213(4)(c))**

Reporting period (provide inclusive dates): From ________ To ________

☐ 1. During the entire reporting period, this source was in compliance with **ALL** terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference. The method(s) used to determine compliance is/are the method(s) specified in the ROP.

☐ 2. During the entire reporting period this source was in compliance with all terms and conditions contained in the ROP, each term and condition of which is identified and included by this reference, **EXCEPT** for the deviations identified on the enclosed deviation report(s). The method used to determine compliance for each term and condition is the method specified in the ROP, unless otherwise indicated and described on the enclosed deviation report(s).

☐ **Semi-Annual (or More Frequent) Report Certification (Pursuant to Rule 213(3)(c))**

Reporting period (provide inclusive dates): From ________ To ________

☐ 1. During the entire reporting period, **ALL** monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred.

☐ 2. During the entire reporting period, all monitoring and associated recordkeeping requirements in the ROP were met and no deviations from these requirements or any other terms or conditions occurred, **EXCEPT** for the deviations identified on the enclosed deviation report(s).

☒ **Other Report Certification**

Reporting period (provide inclusive dates): From ________ To ________

Additional monitoring reports or other applicable documents required by the ROP are attached as described:

Air emissions test report of EU-Paint1 source and FG-MACTPPPP emission group materials and rotary carbon concentrator and RTO VOC destruction efficiency. This form certifies that the testing was conducted in accordance with the test plan and the facility was operating in compliance with permit limits.

I certify that, based on information and belief formed after reasonable inquiry, the statements and information in this report and the supporting enclosures are true, accurate and complete

| Clive Smith | Plant Manager | (517)265-4211 |
|---|---|---|
| Name of Responsible Official (print or type) | Title | Phone Number |

Clive Smith (signature) — 6/30/2015

Signature of Responsible Official    Date

* Photocopy this form as needed.

EQP 5736 (Rev 11-04)

# Executive Summary

Inteva Products, LLC retained Bureau Veritas North America, Inc. to perform air emissions testing at the Inteva Products, LLC facility in Adrian, Michigan. Inteva Products, LLC manufactures automotive interior parts and operates four topcoat paint lines.

The purpose of the testing was to evaluate natural draft openings (NDOs) of the EU-Paint 1 spraybooth (incorporated within the FG MACTPPPP flexible group) and measure the volatile organic compound (VOC) destruction efficiency (DE) of the rotary carbon concentrator and regenerative thermal oxidizer (RTO) system controlling emissions from this source to evaluate compliance with certain limits in Michigan Department of Environmental Quality Renewable Operating Permit MI-ROP-B6027-2012a.

Inteva Products, LLC will use the RTO VOC DE results to (1) calculate monthly and 12-month rolling average VOC emission rates and (2) evaluate compliance with the emission limit of 40 tons of VOC per year.

In addition, material limits of the coatings-as-applied were evaluated using certified product data sheets.

The testing was conducted June 3, 2015, and followed United States Environmental Protection Agency (USEPA) Reference Methods 1, 2, 3, 4, 24 (as referenced in the certified product data sheets), 25A, 204, 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 tables on the following page.

## VOC DE Emission Results

| Parameter | | Result | | | Average | Permit Limit |
|---|---|---|---|---|---|---|
| | | Run 1 | Run 2 | Run 3 | | |
| **RTO Inlet** | VOC (ppmv) as propane | 113 | 127 | 138 | 126 | - |
| | VOC (lb/hr) as propane | 32.5 | 36.6 | 41.5 | 36.9 | - |
| **RTO Outlet** | NMVOC (ppmv) as propane | 4.9 | 6.9 | 7.5 | 6.4 | - |
| | NMVOC (lb/hr) as propane | 1.5 | 2.1 | 2.3 | 2.0 | - |
| **VOC DE (%)** | | **95.4** | **94.2** | **94.5** | **95** | **≥95** |

VOC = volatile organic compound
NMVOC = non-methane volatile organic compound
ppmv = part per million by volume
lb/hr = pound per hour

## Non-Fugitive Enclosure Natural Draft Opening Inward Flow Results

| Parameter | Natural Draft Opening Location | | | Permit Requirement |
|---|---|---|---|---|
| | Left Side | Center | Right Side | |
| **Differential Pressure (in $H_2O$)** | **-0.02†** | **-0.01†** | **-0.02†** | **Enclosure air pressure lower than pressure in adjacent area** |

† Negative differential pressure indicates enclosure air pressure is lower than pressure in adjacent area; this indicates air flows into the non-fugitive enclosure as required by the permit.

## Material Use Results

| Product | lb VOC/gallon as applied | |
|---|---|---|
| | Certified Product Data Sheet Information | Permit Limit |
| **G56H1106<br>GM, Light Ash Gray 9874** | **3.32** | **≤4.6** |
| **G55B5068<br>Soft Swade® G55-1, GM167A<br>Ebony/Jet Black 600R** | **4.32** | |

The results of the testing indicate compliance with the applicable permit limits.

# 1.0 Introduction

Inteva Products, LLC retained Bureau Veritas North America, Inc. to perform air emissions testing at the Inteva Products, LLC facility in Adrian, Michigan. Inteva Products, LLC manufactures automotive interior parts and operates four topcoat paint lines.

This report presents the results of air emissions testing of the rotary carbon concentrator (RCC) and regenerative thermal oxidizer (RTO) system that controls emissions from the EU-Paint 1 emission source. The testing was conducted June 3, 2015.

## 1.1 Summary of Test Program

The EU-Paint 1 process at the facility consists of Spray Booths Nos. 1 and 2, where four robotic paint applicators apply solvent-based coatings. The coatings are flashed off and baked in a transfer tunnel upstream of the EU-Paint 2 booths, where water-based coatings are applied. Volatile organic compound (VOC) emissions from the EU-Paint 1 spraybooths and transfer tunnel are controlled by the RCC-RTO system. Bureau Veritas evaluated the EU-Paint 1 line and/or coatings for the following:

- Non-fugitive enclosure (i.e., inward airflow evaluation).
- Coatings-as-applied VOC content.
- VOC mass emission rates and destruction efficiency (DE).

## 1.2 Purpose of Testing

The purpose of the testing was to evaluate natural draft openings (NDOs) of the EU-Paint 1 spraybooth (incorporated within the FG MACTPPPP flexible group) and measure the VOC DE of the RCC-RTO system.

The results were used to evaluate compliance with certain limits in Michigan Department of Environmental Quality (MDEQ) Renewable Operating Permit MI-ROP-B6027-2012a. The applicable EU-Paint 1 Design/Equipment Parameter(s) permit limits are stated in the following excerpt from the permit:

The permittee shall not operate the paint booths No. 1 and 2 and the flash-off tunnel portions of EU-Paint 1 unless the rotary carbon concentrator is installed, maintained and operated in a satisfactory manner, except during RTO by-pass mode. Satisfactory operation of the rotary carbon concentrator includes maintaining a minimum desorption gas inlet temperature of 240°F. The minimum temperature requirement may be based upon a rolling 3-hour average.[2] **(R 336.1702, R 336.1910)**

The permittee shall not operate the paint booths No. 1 and 2 and the flash-off tunnel portions of EU-Paint 1 unless the RTO is installed, maintained and operated in a satisfactory manner, except during RTO by-pass mode. Satisfactory operation of the RTO includes a minimum VOC capture efficiency of 100 percent (by weight), a minimum VOC destruction efficiency of 95 percent (by weight), and maintaining a minimum temperature of 1550°F and a minimum retention time of 0.5 seconds.[2] **(R 336.1702, R 336.1910)**

The permittee shall not operate the paint booths No. 1 and 2 and the flash off tunnel portions of EU-Paint 1 unless the non-fugitive enclosure is installed, maintained and operated in a satisfactory manner. Satisfactory operation requires that the non-fugitive enclosure is operating at a pressure lower than all adjacent areas so that air flows into the non-fugitive enclosure through all natural draft openings (NDOs). NDO is defined as any opening that is not connected to a duct in which a fan or blower is installed.[2] **(R 336.1702, R 336.1910)**

Inteva Products, LLC will use the VOC DE results to (1) calculate and report monthly and 12-month rolling average VOC emission rates and (2) evaluate compliance with the emission limit of 40 tons of VOC per year.

In addition, material limits of the coatings-as-applied were evaluated.

As required by the permit, Inteva Products, LLC recorded the rotary carbon concentrator desorption temperature and the RTO operating temperatures during the measurement of VOC DE.

## 1.3 Contact Information

Contact information is listed in Table 1-1. Messrs. Thomas Schmelter and Brian Young, Senior Project Managers with Bureau Veritas, conducted the emissions testing program. Mr. Michael Cannaert, Environmental, Health, and Safety Engineer with Inteva Products, LLC provided process coordination and arranged for facility operating parameters to be recorded. The testing was witnessed by Mr. Thomas Gasloli, Mr. Michael Gabor, and Ms. Diane Kavanaugh-Vetort, all with MDEQ.

## Table 1-1
## Contact Information

| **Inteva Products, LLC** | **BVNA** |
|---|---|
| Michael Cannaert<br>Environmental, Health and Safety Engineer<br>1450 East Beecher Street<br>Adrian, Michigan 49221<br>Telephone: 517.265.4226<br>mcannaert@intevaproducts.com | Thomas Schmelter, QSTI<br>Senior Project Manager<br>22345 Roethel Drive<br>Novi, Michigan 48375<br>Telephone: 248.344.3003<br>thomas.schmelter@us.bureauveritas.com<br><br>Brian Young<br>Senior Project Manager<br>22345 Roethel Drive<br>Novi, Michigan 48375<br>Telephone: 248.344.3020<br>brian.young@us.bureauveritas.com |
| **MDEQ** | |
| Tom Gasloli<br>Environmental Quality Analyst<br>Air Quality Division<br>Lansing District Office<br>Constitution Hall<br>525 West Allegan Street, 2th Floor South<br>Lansing, Michigan 48909<br>Telephone: 517.284.6778<br>gaslolit@michigan.gov | Michael Gabor<br>Environmental Quality Analyst<br>Air Quality Division<br>Jackson District Office<br>301 East Louis Glick Highway<br>Jackson, Michigan 48901<br>Telephone: 517.780.5496<br>gaborm@michigan.gov<br><br>Diane Kavanaugh-Vetort<br>Environmental Quality Analyst<br>Air Quality Division<br>Jackson District Office<br>301 East Louis Glick Highway<br>Jackson, Michigan 48901<br>Telephone: 517.780.7864<br>kavanaughd@michigan.gov |

# 2.0 Source and Sampling Locations

## 2.1 Process Description

Inteva Products, LLC manufactures plastic forward-extension instrument panels and window close-out trims for the automotive industry. The primary operation is plastic injection molding and instrument panel assembly. The facility operates four automated paint lines (EU-Paint1, EU-Paint2, EU-Paint3, and EU-P5) that include parts washer systems, robotic paint booths, and dryer ovens. A fifth paint booth, EU-CKIP#2, is used for small-scale research and development paint applications. The EU-Paint lines were evaluated during this test program and the process is described below.

Plastic pellets are pneumatically conveyed from delivery trucks to storage tanks via a trestle piping system. The pellets are dried and conditioned prior to being used in injection mold machines. After the plastic parts have been molded and trimmed, they are transferred to the conveyor loading area.

The parts are manually loaded onto racks positioned on an overhead monorail system. Depending on the part to be coated, the racks contain two to eight pieces. Typically, there are approximately 90 racks for each batch of product to be coated. The monorail conveyor system operates at approximately 10 feet per minute and conveys approximately 1,500 to 2,000 parts per day. From the loading area to the unloading area, the parts are conveyed through the CK3 paint line for approximately 3.5 hours.

From the loading area, the monorail conveyor transfers the parts through a deionized air station. The deionized air removes dust and eliminates static. The parts are scanned as they progress towards the paint booth.

An in-line robotic atmospheric plasma or flame surface treatment system removes surface contaminants and modifies the plastic polymer surface to promote coating adhesion. The parts are conveyed through a transfer tunnel and enter the first paint booth through an approximate 42-inch by 80-inch natural draft opening (NDO). The parts are either coated in Paint Booths 1 and 2 (EU-Paint 1) or Paint Booths 3 and 4 (EU-Paint 2).

Paint Booth 1 has two robots in series that apply solvent-based paint using automatic high-volume low-pressure (HVLP) applicators. Next, the parts enter Paint Booth 2, where robotic HVLPs applicators apply coating. The parts then enter the north flash-off transfer tunnel, prior to entering the bake oven, where the coating cures.

Next, the parts enter Paint Booths 3 and 4, where water-based coatings are applied. If the parts were coated in Paint Booths 1 and 2, they would not be coated in Paint Booths 3 and 4; conversely, if the parts were not coated in Booths 1 and 2, they would be coated in Paint Booths

3 and 4. After passing through Paint Booths 3 and 4, the parts are conveyed through an ambient transfer tunnel prior to entering a bake oven.

The coated parts are unloaded from the racks and processed in final assembly where fasteners, clips, sound deadening, and/or decorative trims are applied. After passing through a final inspection station, the parts are prepared for shipment.

Refer to Figure 1 for an overview of the EU-Paint1 and EU-Paint2 paint line processes. Production operating parameters recorded during testing are included in Appendix E.

## 2.2 Control Equipment

The spray booths use a side-draft ventilation system and water-wash system to control paint overspray. Gaseous emissions from the EU-Paint 1 source, which consists of Paint Booths 1 and 2 and the north flash-off transfer tunnel, are exhausted to a pollution control system prior to discharge to atmosphere.

The EU-Paint 1 gaseous pollution control system consists of a three-stage filtration booth, rotary carbon concentrator, and two-chamber RTO. The filter booth removes paint solids from the air stream. The rotary carbon concentrator contains activated carbon that adsorbs VOCs. The VOCs are desorbed from the carbon using heated air and directed to the RTO for destruction.

In the RTO combustion chamber, a natural gas burner heats the air to oxidize VOCs producing primarily water vapor and carbon dioxide. The air exiting the RTO is directed through a heat exchanger to pre-heat carbon desorption air prior to discharge to the atmosphere. The exhaust stack is identified as SV-RTO.

Table 2-1 summarizes the rotary carbon concentrator desorption and RTO chamber temperatures during each 60-minute test run. Operating parameters recorded at 30-second intervals during the testing are included in Appendix E.

**Table 2-1**
**Control Device Operating Parameters During Testing**

| Parameter | Run 1 | Run 2 | Run 3 | Average | Limit |
|---|---|---|---|---|---|
| **Carbon Concentrator Desorption Temperature (°F)** | 1,601 | 1,601 | 1,601 | **1,601** | **≥1,550** |
| **RTO Combustion Chamber Temperature (°F)** | 261 | 261 | 261 | **261** | **≥240** |

## 2.3 Flue Gas Sampling Location

Descriptions of the sampling locations are presented in the following sections.

### 2.3.1 RTO Inlet Sampling Location

The RTO inlet sampling location is upstream of the three-stage filter booth, rotary carbon concentrator, and RTO. Three 4-inch-internal-diameter sampling ports are located in a straight section of circular ductwork that has an internal diameter of 51 inches wide. Only two of these ports were used. The ports are located:

- Approximately 8 feet (2 equivalent duct diameters) from the nearest upstream disturbance (bend in ductwork).
- Approximately 4 feet (1 equivalent duct diameter) from the nearest downstream disturbance (bend in ductwork).

Figure 2 in the Appendix depicts the RTO inlet sampling ports and traverse point locations. A photograph of the RTO inlet sampling location is presented in Figure 2-1.

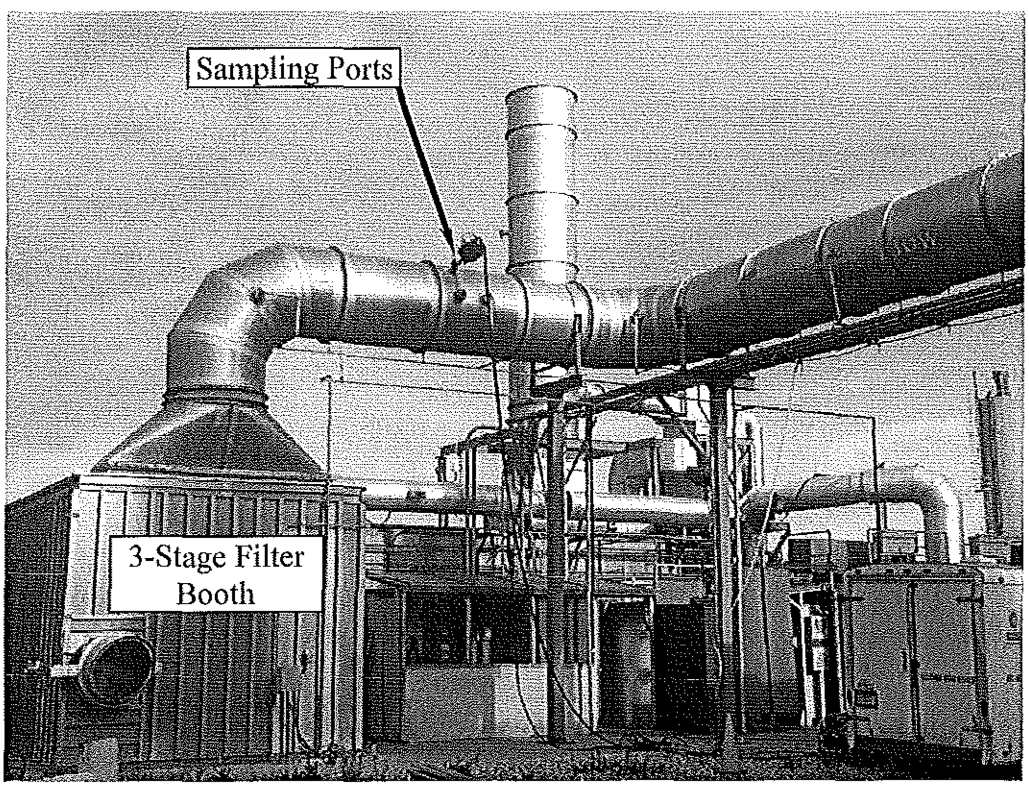



**Figure 2-1. RTO Inlet Sampling Location**

## 2.3.2 RTO Outlet Sampling Location

Downstream of the three-stage filter booth, rotary carbon concentrator, and RTO, the SV-RTO stack exhausts to atmosphere. Two 4-inch-internal-diameter sampling ports are located in the stack, which has an internal diameter of 60 inches. The ports are located:

- Approximately 10 feet (2 equivalent duct diameters) from the nearest upstream disturbance (ductwork confluence).
- Approximately 10 feet (2 equivalent duct diameters) from the nearest downstream disturbance (exhaust to atmosphere).

Figure 3 in the Appendix depicts the RTO outlet sampling ports and traverse point locations. A photograph of the RTO outlet sampling location is presented in Figure 2-2.

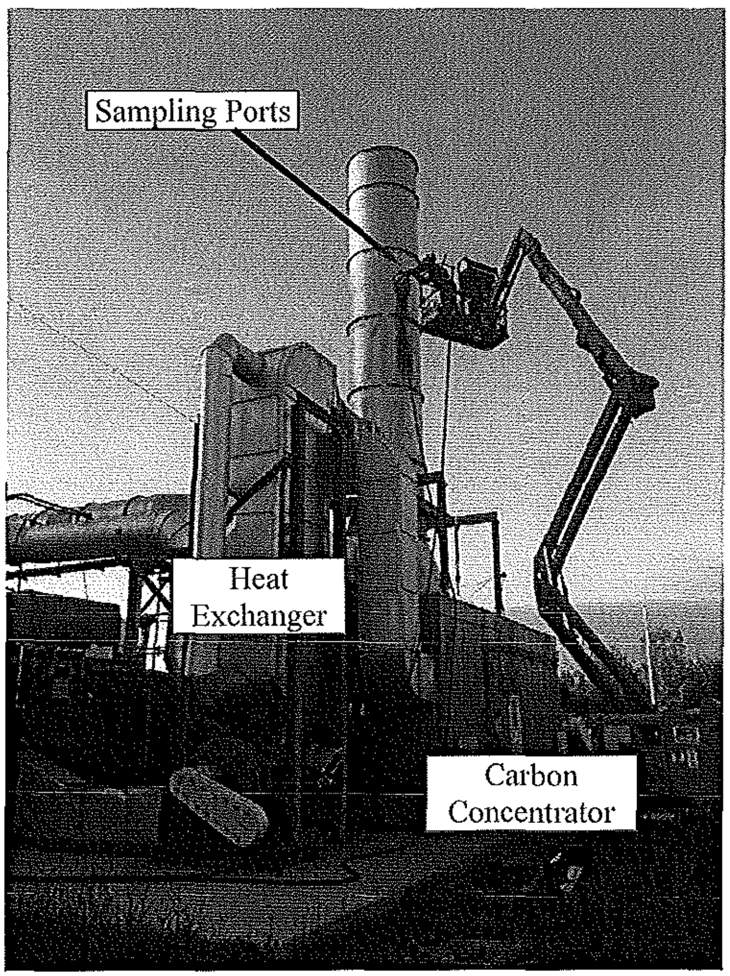



**Figure 2-2. RTO Outlet Sampling Location**

# 3.0 Summary and Discussion of Results

## 3.1 Objectives and Test Matrix

The objectives of the testing were to evaluate compliance with certain limits in MDEQ Renewable Operating Permit MI-ROP-B6027-2012a. The following objectives were completed:

- Measure the VOC mass emissions at the inlet and outlet of the RTO to evaluate VOC DE.
- Measure the rotary carbon concentrator and RTO operating temperatures at which the VOC DE was measured.
- Evaluate inward flow of EU-Paint 1 NDOs.
- Compare the VOC content of the coatings-as-applied to material use limits.

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

**Table 3-1**
**Sampling and Analytical Test Matrix**

| Sampling Location | Run | Date (2015) | Sampling Time | Parameter | USEPA Method | Analytical Method |
|---|---|---|---|---|---|---|
| Inlet and Outlet of Color 1 RTO | 1 | June 3 | 7:32-8:08<br>8:21-8:29<br>8:35-8:38<br>8:43-8:56 | Gas flowrate<br>VOCs | 1, 2, 3, 4, 25A, and 25 | Differential pressure, gravimetric, flame ionization, gas dilution |
| | 2 | June 3 | 10:08-10:30<br>10:37-10:51<br>11:12-11:36 | | | |
| | 3 | June 3 | 11:54-12:21<br>14:17-14:50 | | | |
| EU-Paint 1 NDO | 1 | June 3 | 7:55 | Inward flow | 204 | Smoke tubes, differential pressure |
| Materials Used | 1, 2, and 3 | June 3 | 7:32-14:50 | VOC content | 24 (certified data sheets) | Gravimetric |

## 3.2 Field Test Changes and Issues

Field test changes were not required to complete the emissions test. Communication between Inteva Products, LLC, Bureau Veritas, and MDEQ allowed the testing to be performed in accordance with the approved test plan. Issues identified are presented below.

**Non-continuous Test Runs**

Due to the nature of the process, where batches of parts are either coated in Paint Booths 1 and 2 (EU-Paint 1) or Paint Booths 3 and 4 (EU-Paint 2) for just-in-time delivery, continuous 60-minutes test runs were not achievable. The test times were established as the periods when coatings were being sprayed within EU-Paint 1. Refer to graphs of the VOC concentrations after the Graphs tab in the Appendix.

## 3.3 Results

The test results are summarized in Tables 3-2, 3-3, and 3-4. Figure 3-1 presents a photograph of the inward flow evaluation at the EU-Paint 1 NDO. Detailed results are presented in Table 1 after the Tables Tab of this report. Graphs of the VOC and methane concentrations measured during each test run are presented after the Graphs Tab of this report. Sample calculations are presented in Appendix B.

**Table 3-2**
**VOC DE Emission Results**

| Parameter | | Result | | | Average | Permit Limit |
|---|---|---|---|---|---|---|
| | | Run 1 | Run 2 | Run 3 | | |
| **RTO Inlet** | VOC (ppmv) as propane | 113 | 127 | 138 | 126 | - |
| | VOC (lb/hr) as propane | 32.5 | 36.6 | 41.5 | 36.9 | - |
| **RTO Outlet** | NMVOC (ppmv) as propane | 4.9 | 6.9 | 7.5 | 6.4 | - |
| | NMVOC (lb/hr) as propane | 1.5 | 2.1 | 2.3 | 2.0 | - |
| **VOC DE (%)** | | **95.4** | **94.2** | **94.5** | **95** | **≥95** |

VOC = volatile organic compound
NMVOC = non-methane volatile organic compound
ppmv = part per million by volume
lb/hr = pound per hour

## Table 3-3
## Non-Fugitive Enclosure NDO Inward Flow Results

| Parameter | NDO Location | | | Permit Requirement |
|---|---|---|---|---|
| | Left Side | Center | Right Side | |
| Differential Pressure (in $H_2O$) | -0.02 | -0.01 | -0.02 | Enclosure air pressure lower than pressure in adjacent area |

† Negative differential pressure indicates enclosure air pressure is lower than pressure in adjacent area; this indicates air flows into the non-fugitive enclosure as required by the permit.

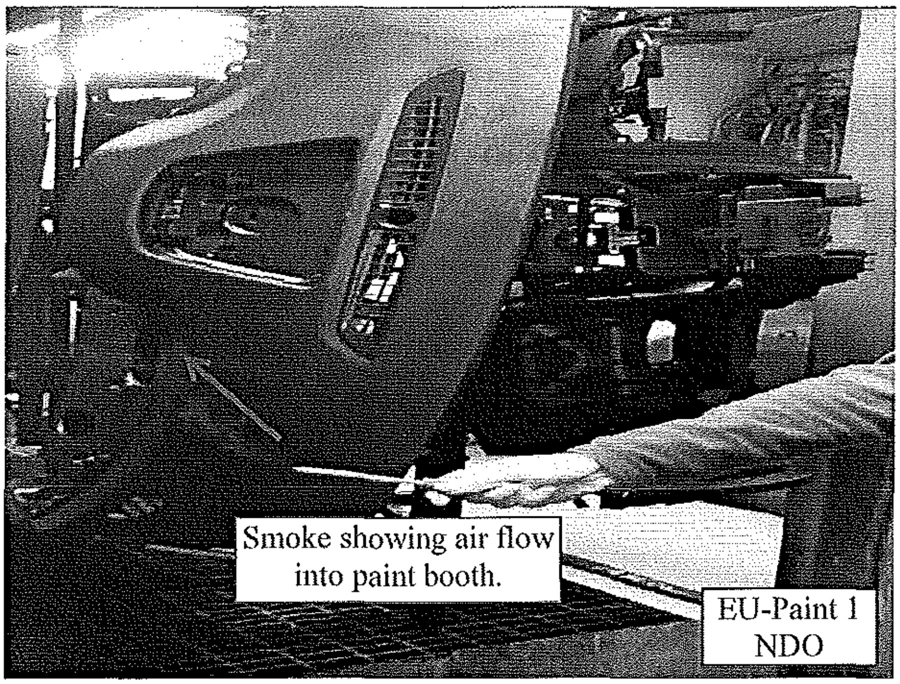



**Figure 3-1. Photograph of Inward Flow at NDO**

## Table 3-4
## Material Use Results

| Product | lb VOC/gallon as applied, minus exempt | |
|---|---|---|
| | Certified Product Data Sheet Information | Permit Limit |
| G56H1106<br>GM, Light Ash Gray 9874 | 3.32 | ≤4.6 |
| G55B5068<br>Soft Swade® G55-1, GM167A<br>Ebony/Jet Black 600R | 4.32 | |

# 4.0 Sampling and Analytical Procedures

Bureau Veritas measured emissions in accordance with the procedures specified in 40 CFR 51, Appendix M, "Recommended Test Methods for State Implementation Plans," 40 CFR 60, Appendix A, "Standards of Performance for New Stationary Sources," and State of Michigan Part 10 Rules, "Intermittent Testing and Sampling." The sampling and analytical methods used during this test program are listed in the following table.

**Table 4-1**
**Emission Test Methods**

| Sampling Method | Parameter | Analysis |
|---|---|---|
| EPA 1 and 2 | Gas stream volumetric flowrate | Field measurement, S-type Pitot tube, standard Pitot tube. |
| EPA 3 | Molecular weight | Fyrite® analyzer |
| EPA 4 | Moisture content | Gravimetric |
| EPA 24 | VOC content of coating | Gravimetric |
| EPA 25A | VOC concentration | Flame ionization detector |
| EPA 204 | Inward flow | Smoke tubes, differential pressure |
| EPA 205 | Calibration gas dilution | Field verification |

## 4.1 Emission Test Methods

The emission test parameters and sampling procedures at each sampling location are provided in Table 4-2.

**Table 4-2**
**Emission Test Parameters**

| Parameter | RTO Inlet | RTO Outlet | EU-Paint 1 NDO | VOC Content of Material | USEPA Reference | |
|---|---|---|---|---|---|---|
| | | | | | Method | Title |
| Sampling ports and traverse points | ● | ● | | | 1 | Sample and Velocity Traverses for Stationary Sources |
| Velocity and flowrate | ● | ● | | | 2 | Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube, Standard Pitot Tube) |
| Molecular weight | ● | ● | | | 3 | Gas Analysis for the Determination of Dry Molecular Weight |
| Moisture content | ● | ● | | | 4 | Determination of Moisture Content in Stack Gases |
| Density, VOC, solids, and water content | | | | ● | 24† | Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings |
| Volatile organic compounds | ● | ● | | | 25A | Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer |
| Inward flow | | | ● | | 204 | Criteria for and Verification of a Permanent or Temporary Total Enclosure |
| Calibration gas dilution | ● | ● | | | 205 | Verification of Gas Dilution Systems for Field Instrument Calibrations |

● Denotes a test parameter
† Coating samples were not collected. Instead, the information from certified product data sheets was used.

### 4.1.1 Volumetric Flowrate (USEPA Methods 1 and 2)

Method 1, "Sample and Velocity Traverses for Stationary Sources," from 40 CFR 60, Appendix A, was used to evaluate the adequacy of the sampling location and determine the number of traverse points for the measurement of velocity profiles. Details of the sampling locations and number of velocity traverse points are presented in Table 4-3. Figures 2 and 3 in the Appendix depict the RTO inlet and outlet sampling locations and traverse points.

**Table 4-3**
**Sampling Location and Number of Traverse Points**

| Sampling Location | Duct Diameter (inch) | Distance from Ports to Upstream Flow Disturbance (diameter) | Distance from Ports to Downstream Flow Disturbances (diameter) | Number of Ports used | Traverse Points per Port | Total Points | Cyclonic Flow Check Average Null Angle |
|---|---|---|---|---|---|---|---|
| RTO Inlet | 51 | 2 | 1 | 2 | 8 | 16 | 3.8° |
| RTO Outlet | 60 | 2 | 2 | 2 | 8 | 16 | 4.1° |

Method 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube)," was used to measure flue gas velocity and calculate volumetric flowrate. S-type or Standard Pitot tubes and a digital manometer to measure gas velocity. Because the dimensions of the Pitot tubes met the requirements outlined in Method 2, Section 10.0, a baseline Pitot tube coefficient of 0.84 (dimensionless) was assigned for the S-type Pitot tubes. Thermocouples were used to measure gas temperature.

The digital manometer was calibrated using calibration standards that are established by the National Institute of Standards (NIST). Refer to Appendix A for the Pitot tube, electronic manometer, and thermocouple calibration and inspection sheets.

Refer to Appendix B for sample calculations of flue gas velocity and volumetric flowrate.

**Cyclonic Flow Check.** Bureau Veritas evaluated whether cyclonic flow was present at the sampling locations. Cyclonic flow is defined as a flow condition with an average null angle greater than 20°. The direction of flow can be determined by aligning the Pitot tube to obtain a zero (null) velocity head reading where the direction is parallel to the Pitot tube face openings or perpendicular to the null position. By measuring the angle of the Pitot tube face openings in relation to the stack wall when a null angle is obtained, the direction of flow is measured. If the absolute average of the flow direction angles is greater than 20°, the flue gas is considered to be cyclonic at that sampling location and an alternate location is necessary.

The average of the flue gas velocity null angles measured at the traverse points is shown in Table 4-3.

The measurements indicate the absence of cyclonic flow at the sampling locations.

Field data sheets are included in Appendix C. Computer-generated field data sheets are included in Appendix D.

### 4.1.2 Molecular Weight (USEPA Method 3)

Molecular weight was evaluated using Method 3, "Gas Analysis for the Determination of Dry Molecular Weight." Flue gas was extracted through a probe positioned near the centroid of the duct or stack and directed into a Fyrite® gas analyzer. The concentrations of carbon dioxide ($CO_2$) and oxygen ($O_2$) were measured by chemical absorption with the Fyrite® gas analyzer to within ±0.5%. The average $CO_2$ and $O_2$ results of the samples were used to calculate molecular weight.

### 4.1.3 Moisture Content (USEPA Method 4)

The moisture content in the flue gas at the inlet to the RTO was approximated using the wet-bulb dry-bulb method. The moisture content was measured at the outlet sampling location using USEPA Method 4, "Determination of Moisture Content in Stack Gases." Bureau Veritas's modular USEPA Method 4 stack sampling system consisted of:

- A stainless steel probe.
- Tygon® umbilical line connecting the probe to the impingers.
- A set of four Greenburg-Smith (GS) impingers with the configuration shown in Table 4-4 situated in a chilled ice bath.
- A sampling line.
- An Environmental Supply® control case equipped with a pump, dry-gas meter, and calibrated orifice.

Figure 4 in the Appendix depicts the USEPA Method 4 sampling train.

**Table 4-4**
**USEPA Method 4 Impinger Configuration**

| Impinger | Type | Contents | Amount |
|---|---|---|---|
| 1 | Modified | Water | ~100 milliliters |
| 2 | Greenburg Smith | Water | ~100 milliliters |
| 3 | Modified | Empty | 0 milliliters |
| 4 | Modified | Silica desiccant | ~300 grams |

Prior to initiating a test run, the sampling train was leak-checked by capping the nozzle tip and applying a vacuum of approximately 15 inches of mercury to the sampling train. The dry-gas meter was monitored for approximately one minute to measure the sampling train leak rate; the leak rate must be less than 0.02 cubic feet per minute (cfm).

Next, the sampling probe was inserted into the sampling port near the centroid of the stack in preparation for sampling. Flue gas was extracted at a constant rate from the stack, with moisture removed from the sample stream by the chilled impingers.

At the conclusion of a test run, a post-test leak check was conducted and the impinger train was disassembled. The weight of liquid and silica gel in each impinger was measured with a scale capable of measuring ±0.5 grams. The weight of water collected within the impingers and volume of flue gas sampled were used to calculate the percent moisture content.

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

VOC concentrations were measured following USEPA Method 25A, "Determination of Total Gaseous Organic Concentration Using a Flame Ionization Analyzer." Samples were collected through a stainless steel probe and heated sample line that was inserted into the analyzer's sample port. Bureau Veritas used J.U.M. 109A and J.U.M. 3-300 hydrocarbon analyzers equipped with flame ionization detectors.

A flame ionization detector (FID) measures an average hydrocarbon concentration in parts per million by volume (ppmv) of VOC relative to the calibration gas propane. The FID is fueled by 100% hydrogen, which generates a flame with a negligible number of ions. Flue gas is introduced into the FID and enters the flame chamber. The combustion of flue gas generates electrically charged ions. The analyzer applies a polarizing voltage between two electrodes around the flame, producing an electrostatic field. Negatively charged ions (anions) migrate to a collector electrode, while positive charged ions (cations) migrate to a high-voltage electrode. The current between the electrodes is directly proportional to the hydrocarbon concentration in the sample. The flame chamber is depicted in Figure 4-1.

Using the voltage analog signal, measured by the FID, the concentration of VOCs is recorded by a data acquisition system (DAS). The average concentration of VOCs is reported as the calibration gas (i.e., propane) in equivalent units.

Before testing, the FID analyzers were calibrated by introducing a zero-calibration range gas (<1% of span value) and high-calibration range gas (80-90% span value) to the tip of the sampling probe. The span value was set to 1.5 to 2.5 times the expected concentration (e.g., 0-100 ppmv). Next, a low-calibration range gas (25-35% of span value) and mid-calibration range gas (45-55% of span value) were introduced. The analyzers were considered to be calibrated when the analyzer response was ±5% of the calibration gas value.

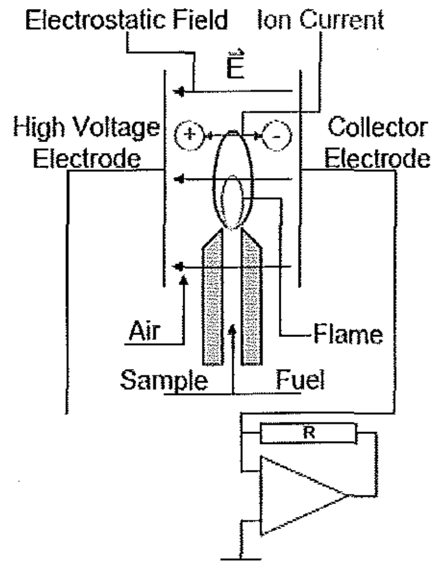



**Figure 4-1. FID Flame Chamber**

At the conclusion of a test run a calibration drift test was performed by introducing the zero- and mid- or low-calibration gas to the tip of the sampling probe. The test run data were considered valid if the calibration drift test demonstrated that the analyzers were responding within ±3% from pre-test to post-test calibrations. Figure 5 in the Appendix depicts the USEPA Method 25A sampling train. See Appendix A for calibration data.

### 4.1.5 Gas Dilution (USEPA Method 205)

A gas dilution system was used to introduce known values of calibration gases into the VOC analyzers. The gas dilution system consisted of calibrated mass flow controllers. The system diluted a high-level calibration gas to within ±2% of predicted values. This gas divider was capable of diluting gases at various increments.

Before the start of testing, the gas divider dilutions were verified to be within ±2% of predicted values. Three sets of dilutions of the high-level (844.8 ppmv propane) calibration gas were performed. Subsequently, a certified mid-level calibration gas (85.6 ppmv propane) was introduced into the analyzer; the calibration gas concentration was within ±10% of a dilution. Refer to Appendix A for the calibration gas certifications and the gas dilution field calibration. Table 4-5 presents the USEPA Method 205 gas dilution field verification measurements.

**Table 4-5**
**Gas Dilution Field Verification**

| Expected Concentration | Acceptable Range† | | Actual Concentration 1 | Actual Concentration 2 | Actual Concentration 3 | Pass? |
|---|---|---|---|---|---|---|
| | Low | High | | | | |
| (ppmv) | (ppmv) | (ppmv) | (ppmv) | (ppmv) | (ppmv) | |
| 300 | 294 | 306 | 301.2 | 300.6 | 302.4 | Yes |
| 500 | 490 | 510 | 498.6 | 500.6 | 504.2 | Yes |
| 85 | 83.3 | 86.7 | 84.4 | 85.3 | 85.9 | Yes |

† Acceptable range is ±2% of the expected concentration

## 4.2 Procedures for Obtaining Process Data

Process data were recorded by Inteva Products, LLC personnel. Refer to Sections 2.1 and 2.2 for discussions of process and control device data and Appendix E for the operating parameters recorded during testing.

## 4.3 Sampling Identification and Custody

Sample identification and chain of custody procedures were not applicable to the sampling methods used in this test program.

# 5.0 QA/QC Activities

Equipment used in this emissions test program passed quality assurance/quality control (QA/QC) procedures. Refer to Appendix A for equipment calibration and inspection sheets. Field data sheets are presented in Appendix C. Computer-generated Data Sheets are presented within Appendix D.

## 5.1 Pretest QA/QC Activities

Before testing, the sampling equipment was cleaned, inspected, and calibrated according to procedures outlined in the applicable USEPA sampling methods and USEPA's "Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods."

## 5.2 QA/QC Audits

The results of select sampling and equipment QA/QC audits and the acceptable tolerance are presented in the following sections. Calibration and inspection sheets for analyzers, dry-gas meters (DGMs), thermocouples, and Pitot tubes are presented in Appendix A.

### 5.2.1 Instrument Analyzer QA/QC Audits

The instrument analyzer sampling trains described in Section 4.1 were audited for measurement accuracy and data reliability. The analyzers passed the applicable calibration criteria. Table 5-1 summarizes the gas cylinders used during this test program. Calibration gas selection, bias, and drift checks are included in Appendix A.

**Table 5-1**
**Calibration Gas Cylinder Information**

| Parameter | Gas Vendor | Cylinder Serial Number | Cylinder Value | Expiration Date |
|---|---|---|---|---|
| Air | Airgas | CC106897 | - | Sept. 09, 2022 |
| Hydrogen | The American Gas Group | EB0002592 | 99.9995% | NA |
| Propane | Airgas | CC39834 | 844.8 ppm | July 22, 2021 |
| Propane | Airgas | EB00113535 | 85.6 ppm | April 28, 2023 |
| Methane | Airgas | CC337690 | 493.5 ppm | Sept. 27, 2020 |

### 5.2.2 Dry-Gas Meter QA/QC Audits

Table 5-2 summarizes the DGM calibration check compared to the acceptable USEPA tolerance. Refer to Appendix A for additional DGM calibration information.

**Table 5-2**
**Dry-Gas Meter Calibration QA/QC Audit**

| Meter Box | Pre-test DGM Calibration Factor (Y) (dimensionless) | Post-test DGM Calibration Check Value (Y) (dimensionless) | Absolute Difference Between Pre- and Post-test DGM Calibrations | Acceptable Tolerance | Calibration Result |
|---|---|---|---|---|---|
| 8 | 1.001<br>April 28, 2015 | 1.004<br>June 11, 2015 | 0.003 | ≤0.05 | Valid |

### 5.2.3 Thermocouple QA/QC Audits

Temperature measurements using thermocouples and digital pyrometers were compared to reference temperatures (i.e., ice water bath, boiling water) to evaluate accuracy of the equipment. The thermocouples and pyrometers measured temperatures within ±1.5% (i.e., the USEPA acceptance criterion) of the reference temperatures. Thermocouple and pyrometer calibration results are presented in the Appendix A.

## 5.3 QA/QC Problems

QA/QC problems were not encountered during this test program.

# Limitations

The information and opinions rendered in this report are exclusively for use by Inteva Products, LLC. Bureau Veritas North America, Inc. will not distribute or publish this report without Inteva Products, LLC's consent except as required by law or court order. The information and opinions are given in response to a limited assignment and should be implemented only in light of that assignment. Bureau Veritas North America, Inc. accepts responsibility for the competent performance of its duties in executing the assignment and preparing reports in accordance with the normal standards of the profession, but disclaims any responsibility for consequential damages.

This report prepared by: Thomas R Schmelter

Thomas Schmelter, QSTI
Senior Project Manager
Health, Safety, and Environmental Services

This report approved by:

Derek R. Wong, Ph.D., P.E.
Director and Vice President
Health, Safety, and Environmental Services

# Table

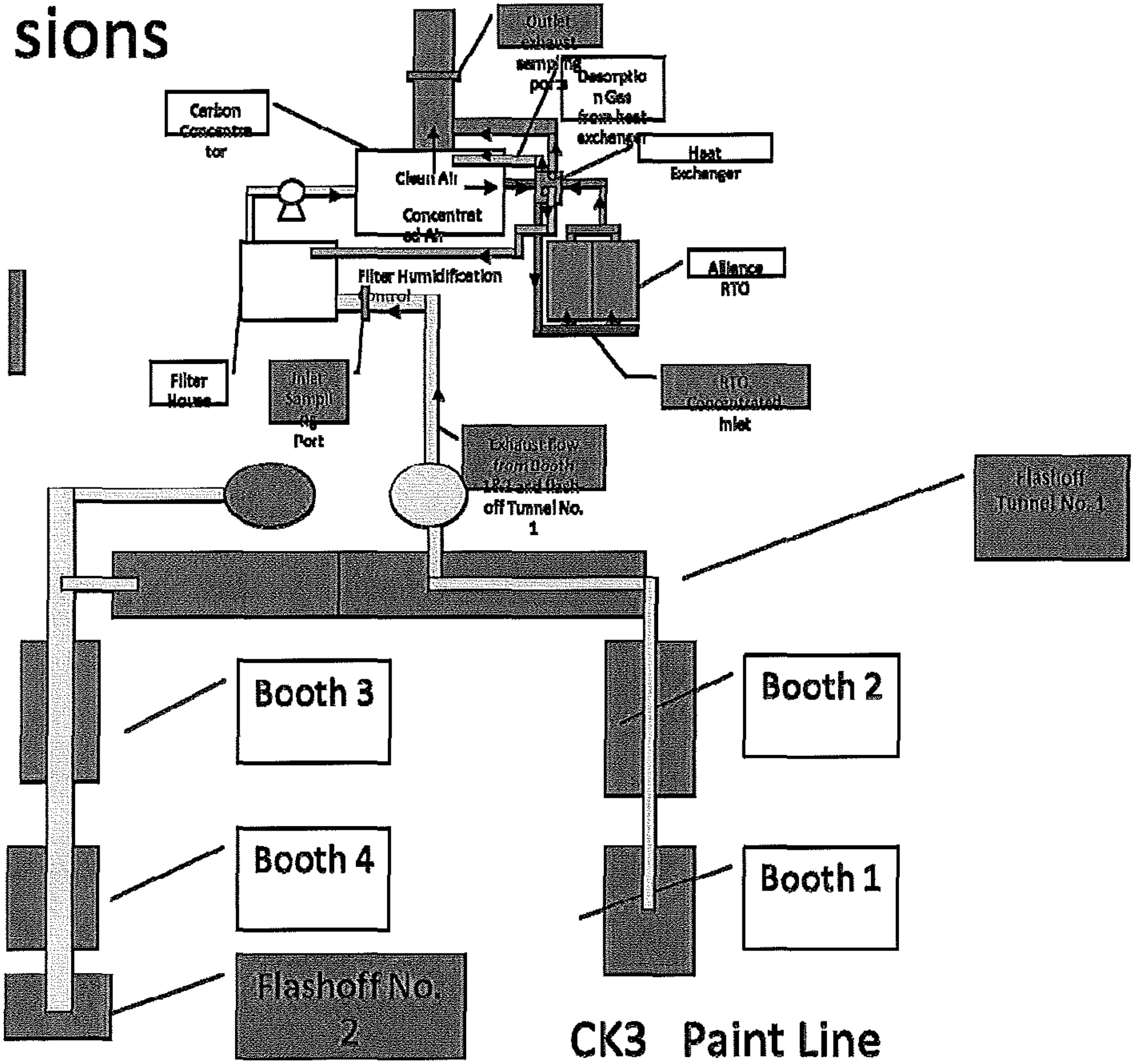
# Table 1
## Regenerative Thermal Oxidizer VOC Destruction Efficiency Results
## Inteva Products, LLC
Adrian, Michigan
Bureau Veritas Project No. 11015-000102.00
Sampling Date: June 3, 2015

| Parameter | | Units | Run 1 | Run 2 | Run 3 | Average |
|---|---|---|---|---|---|---|
| Date | | | June 3, 2015 | | | |
| Test Start Time | | | 7:34 | 10:10 | 11:54 | |
| Duration | | min | 60 | 60 | 60 | 60 |
| Inlet | Gas Stream Volumetric Flowrate | scfm | 41,973 | 41,895 | 43,995 | 42,621 |
| | VOC Concentration | ppmv, as propane | 113 | 127 | 138 | 126 |
| | Corrected VOC Concentration | ppmv, as propane | 113 | 127 | 138 | 126 |
| | Corrected VOC Concentration | ppmv, as carbon | 339 | 382 | 413 | 378 |
| | VOC Mass Emission Rate | lb/hr, as propane | 32.5 | 36.6 | 41.5 | 36.9 |
| | VOC Mass Emission Rate | lb/hr, as carbon | 26.6 | 29.9 | 34.0 | 30.2 |
| Outlet | Gas Stream Volumetric Flowrate | scfm | 44,442 | 44,978 | 44,639 | 44,686 |
| | Methane Concentration | ppmv, as methane | 7.1 | 6.6 | 13 | 8.9 |
| | VOC Concentration | ppmv, as propane | 8.0 | 9.8 | 13 | 10 |
| | Analyzer Response Factor to Methane | | 2.3 | 2.3 | 2.3 | 2.3 |
| | Outlet Methane Concentration | ppmv, as propane | 3.1 | 2.9 | 5.8 | 3.9 |
| | NMVOC Concentration | ppmv, as propane | 4.9 | 6.9 | 7.5 | 6.4 |
| | NMVOC Concentration | ppmv, as carbon | 15 | 21 | 23 | 19 |
| | NMVOC Mass Emission Rate | lb/hr, as propane | 1.5 | 2.1 | 2.3 | 2.0 |
| | NMVOC Mass Emission Rate | lb/hr, as carbon | 1.2 | 1.7 | 1.9 | 1.6 |
| **RTO VOC Destruction Efficiency Results** | | % | 95.4 | 94.2 | 94.5 | 94.7 |

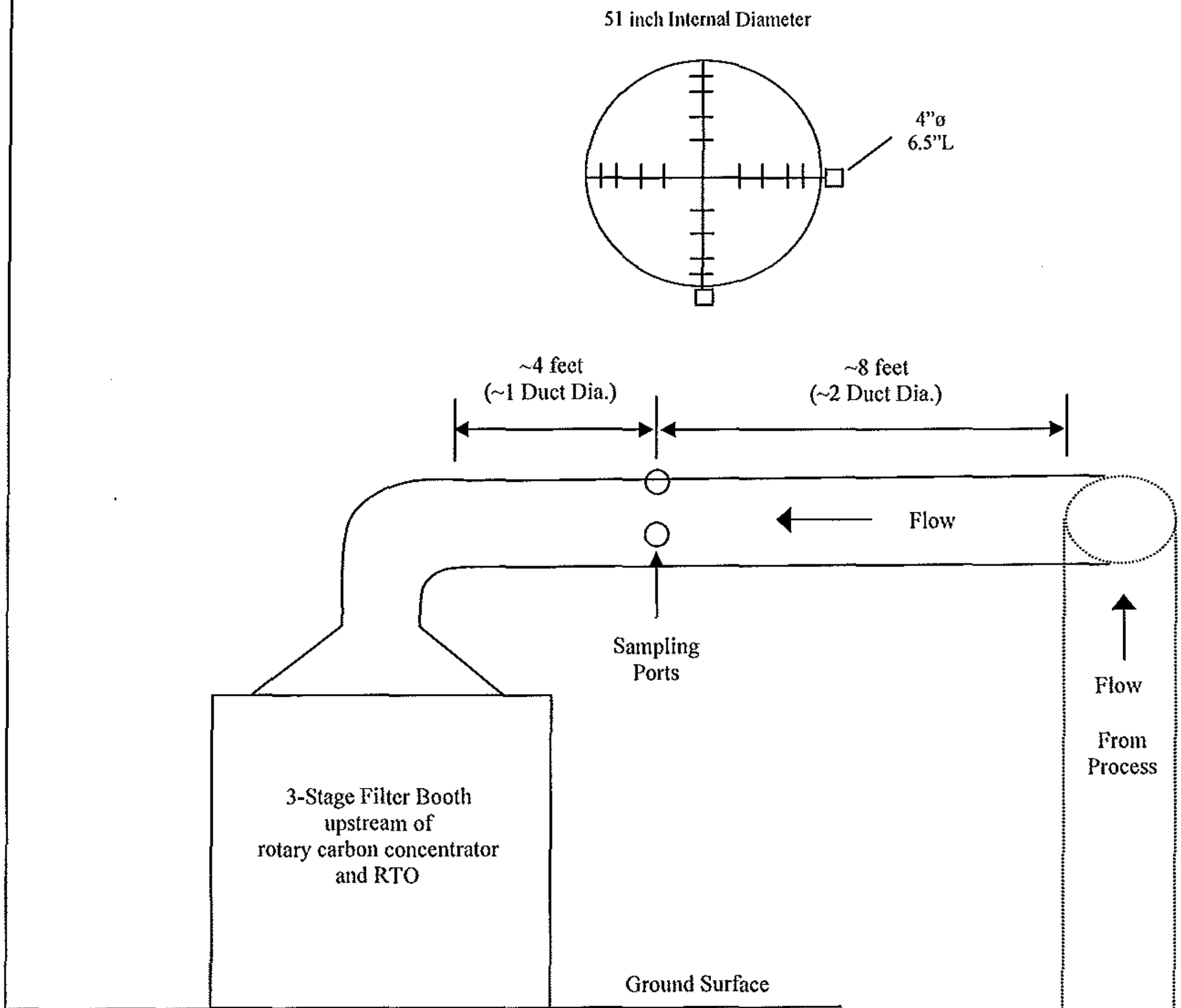
Molecular weight of propane (g/mole) 44.00
Molecular weight of carbon (g/mole) 12.01
Standard conditions 68°F and 29.92 in Hg
scfm standard cubic foot per minute
ppmv part per million by volume
NMVOC non-methane volatile organic compound

# Figure

# sions




| | | | |
|---|---|---|---|
| )verview | BUREAU VERITAS | Inteva Products, LLC<br>Adrian, Michigan | |
| | | Project No. 11015-000102.00 | Last Revision:<br>June 10, 2015 |




| Traverse Point | Distance From Stack Wall (inches) |
|---|---|
| 8 | 50.3 |
| 7 | 46.5 |
| 6 | 41.9 |
| 5 | 35.2 |
| 4 | 16.8 |
| 3 | 10.1 |
| 2 | 5.5 |
| 1 | 1.7 |

| Sample Location | Distance From Ports to Nearest Upstream Bend/Disturbance | Distance From Ports to Nearest Downstream Bend/ Disturbance |
|---|---|---|
| RTO Inlet | ~8 feet (~2 diameter) | ~4 feet (~1 diameter) |

Figure 2
RTO Inlet Sampling Ports and Traverse Points

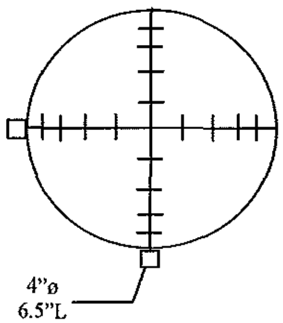
BUREAU VERITAS

Inteva Products, LLC
Adrian, Michigan

Project No. 11015-000102.00

Last Revision: June 10, 2015

60 inch Internal Diameter




| Traverse Point | Distance From Stack Wall (inches) |
|---|---|
| 8 | 58.1 |
| 7 | 53.7 |
| 6 | 48.4 |
| 5 | 40.6 |
| 4 | 19.4 |
| 3 | 11.6 |
| 2 | 6.3 |
| 1 | 1.9 |

| Sample Location | Distance From Ports to Nearest Upstream Bend/Disturbance | Distance From Ports to Nearest Downstream Bend/ Disturbance |
|---|---|---|
| RTO Outlet | ~10 feet (~2 diameter) | ~10 feet (~2 diameter) |

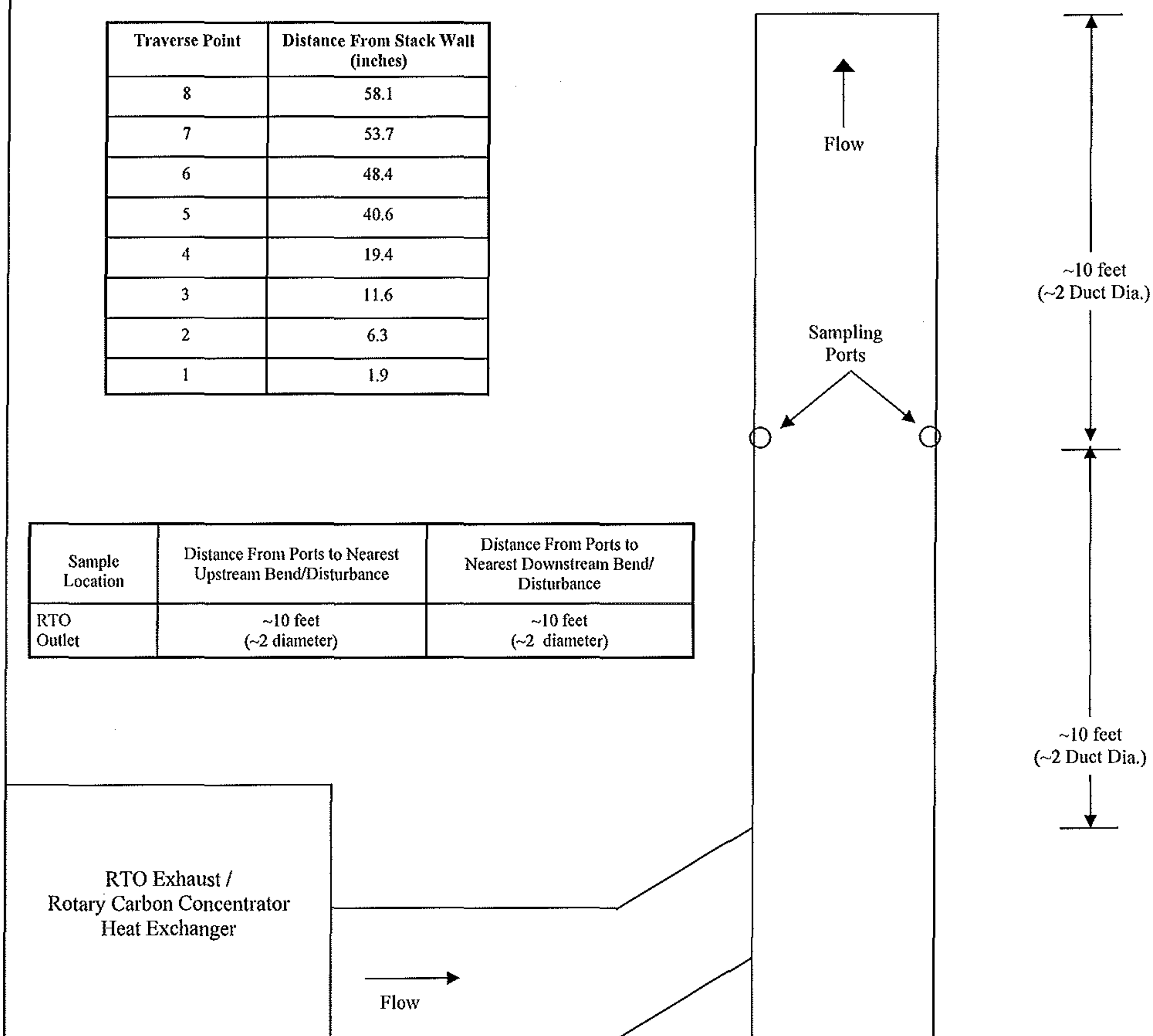
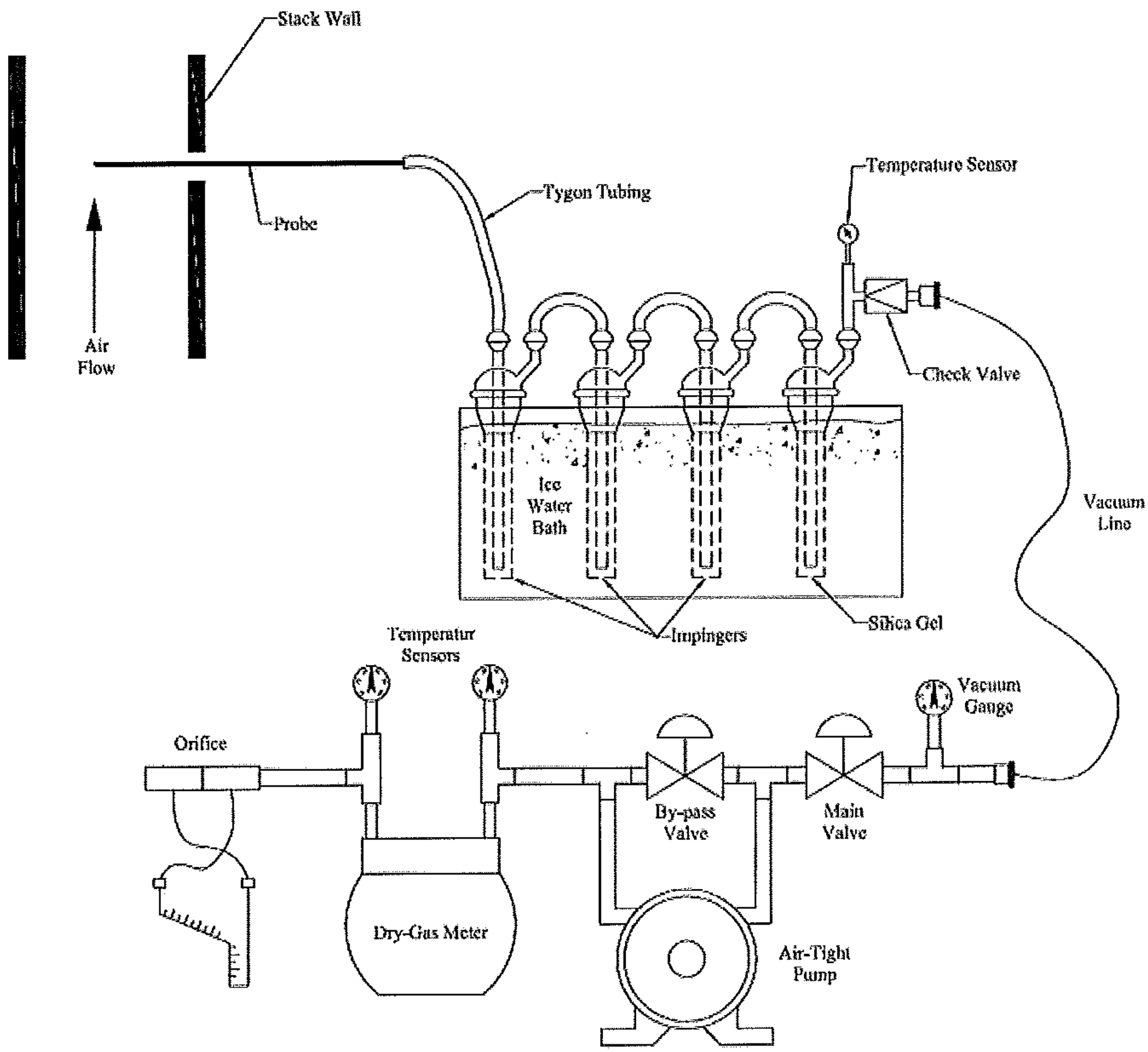



Figure 3
RTO Outlet Sampling Ports and Traverse Points

Inteva Products, LLC
Adrian, Michigan

Project No. 11015-000102.00

Last Revision:
June 10, 2015




| | | |
|---|---|---|
| Figure 4<br>USEPA Method 4 Sampling Train | BUREAU VERITAS | Inteva Products, LLC<br>Adrian, Michigan<br>Project No. 11015-000102.00 — Last Revision: June 10, 2015 |

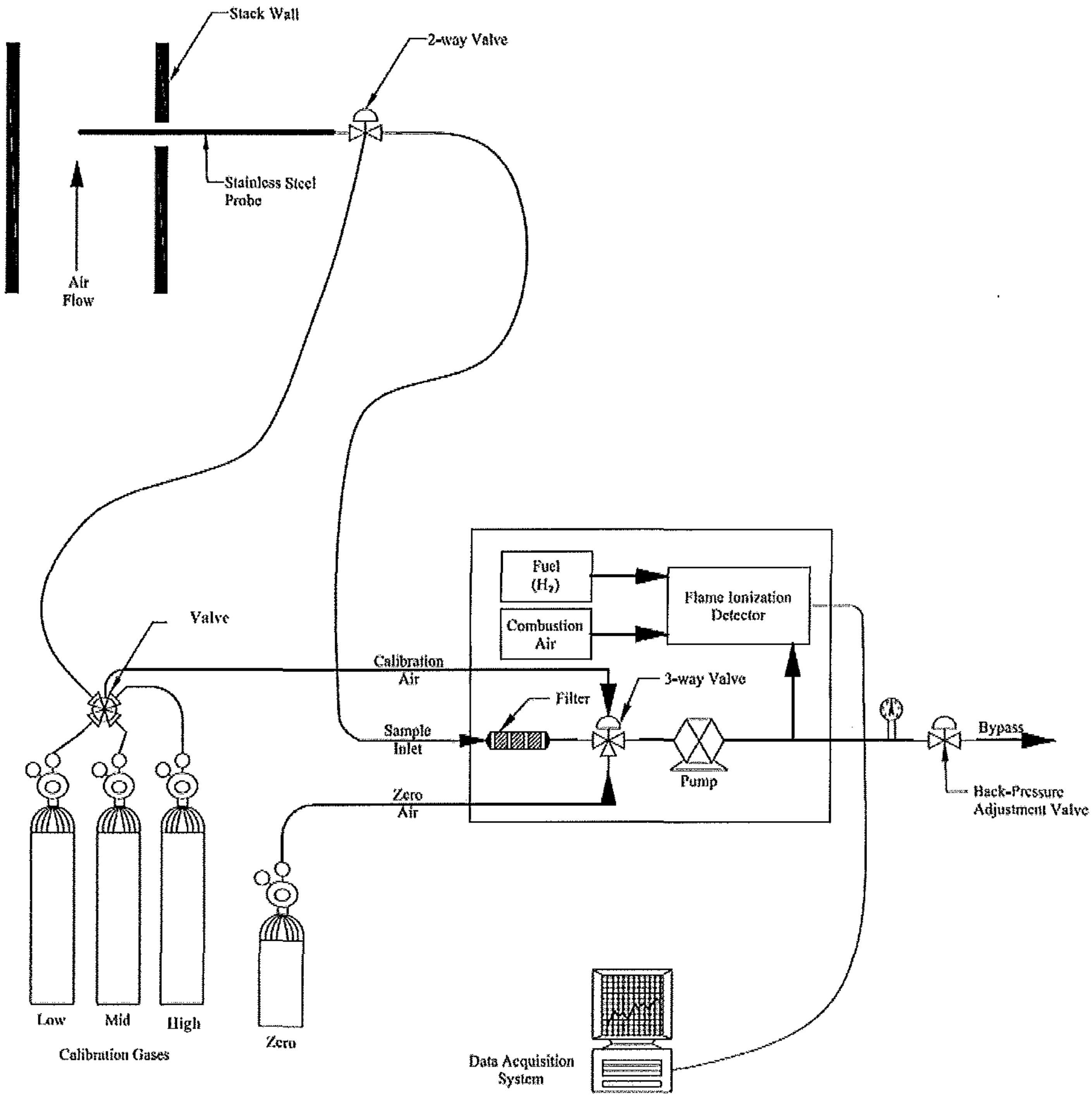



Figure 5
USEPA Method 25A Sampling Train

BUREAU VERITAS

Inteva Products, LLC
Adrian, Michigan

Project No. 11015-000102.00

Last Revision:
June 10, 2015