MONTROSE AIR QUALITY SERVICES

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Project #	Task Name	Location	Project Type	Test Date
16-167	Combustion Stack 2 ICR Test Report	Monessen, PA	Report	October 10-13 2016

Comments: PDF sent via one drive to Traci Self and Rich Zavoda, cc John Hill

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EPA INFORMATION COLLECTION REQUEST
BATTERY COMBUSTION STACK 2 TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

PFID: 256899
Source IDs: Battery Combustion Stack 2
Permit #: TV-65-00853

Test Dates: October 17-20, 2016

Report Date: January 16, 2017

Prepared for:

ArcelorMittal Monessen LLC
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Prepared by:

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PA Lab Registration #02-04775

Project No. 16-167

MONTROSE AIR QUALITY SERVICES

CERTIFICATION STATEMENT

This statement certifies that "to the best of their knowledge," based on state and federal regulations, operating permits, plan approvals applicable to each source tested, and reasonable inquiry, the statements and information presented in the attached document are true, accurate, and complete.

EPA INFORMATION COLLECTION REQUEST
BATTERY COMBUSTION STACK 2 TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

Test Dates: October 17-20, 2016

Project No. 16-167

William P Cowell — 1/13/17

William P. Cowell, QSTI
Client Project Manager
Montrose Air Quality Services, LLC.

Date

1/13/17

Matthew Dallesasse
District Manager
Montrose Air Quality Services, LLC.

Date

1/13/17

Randy E. Shelton
Division Manager
ArcelorMittal Monessen LLC

Date

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EPA INFORMATION COLLECTION REQUEST
COMBUSTION STACK TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

1 INTRODUCTION

ArcelorMittal Monessen LLC (AM Monessen) contracted Montrose Air Quality Services, LLC. (Montrose) to quantify emissions from Battery 2 Combustion Stack for the ArcelorMittal Monessen Coke Plant in Monessen, Pennsylvania. Battery 2 Combustion Stack. Testing was performed at the request of the April 4, 2016 United States Environmental Protection Agency (USEPA) Coke Information Collection Request (ICR), as detailed in Enclosure 2.

USEPA specified a list of pollutants required to be tested for this source, including:

Individual Air Pollutants/Parameters (and CAS No., where available)

- Carbon Dioxide (124-38-9)
- Carbon Monoxide (630-08-0)
- Hydrogen Chloride (7647010)
- Hydrogen Cyanide (74908)
- Hydrogen Fluoride (7664393)
- Hydrogen Sulfide (7783-06-4)
- Opacity
- Oxygen (7782-44-7)
- Particulate Matter, filterable
- Particulate Matter$_{2.5}$, condensable
- Particulate Matter$_{2.5}$, filterable
- Sulfur Dioxide (7446-09-5)
- Toluene-Soluble Organics
- Visible Emissions (leaks)

HAP Metals (and CAS No.'s)

- Antimony (7440-36-0)
- Arsenic (7440-38-2)
- Beryllium (7440-41-7)
- Cadmium (7440-43-9)
- Chromium, Total (7440-47-3)
- Cobalt (7440-48-4)
- Lead (7439-92-1)
- Manganese (7439-96-5)
- Mercury (7439-97-6)
- Nickel (7440-02-0)
- Selenium (7782-49-2)

Semi-volatile HAP (Semi-Vol) and CAS No.'s

- Acenaphthene (83-32-9)
- Acenaphthylene (208-96-8)
- Anthracene (120-12-7)
- Benz[a]anthracene (56-55-3)
- Benzo[a]pyrene (50-32-8)
- Benzo[b]fluoranthene (205-99-2)
- Benzo[g,h,i]perylene (191-24-2)
- Benzo[k]fluoranthene (207-08-9)
- Chrysene (218-01-9)
- Dibenz[a,h]anthracene (53-70-3)
- Fluoranthene (206-44-0)
- Fluorene (86-73-7)
- Indeno (1,2,3-cd) pyrene (193-39-5)
- Naphthalene (91-20-3)
- Phenanthrene (85-01-8)
- Perylene (198-55-0)
- Pyrene (129-00-0)

Dioxins/Furans as 2,3,7,8-TCDD TEQs and CAS No.'s

- 1,2,3,4,6,7,8-Heptachlorodibenzofuran (67562394)
- 1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin (35822469)
- 1,2,3,4,7,8,9-Heptachlorodibenzofuran (55673897)
- 1,2,3,4,7,8-Hexachlorodibenzofuran (70648269)
- 1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin (39227286)
- 1,2,3,6,7,8-Hexachlorodibenzofuran (57117449)
- 1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin (57653857)
- 1,2,3,7,8,9-Hexachlorodibenzofuran (72918219)
- 1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin (19408743)
- 1,2,3,7,8-Pentachlorodibenzofuran (57117416)
- 1,2,3,7,8-Pentachlorodibenzo-p-Dioxin (40321764)
- 2,3,4,6,7,8-Hexachlorodibenzofuran (60851345)
- 2,3,4,7,8-Pentachlorodibenzofuran (57117314)
- 2,3,7,8-Tetrachlorodibenzofuran (51207319)
- 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (1746016)

Speciated Volatile Organic Compounds

- Formaldehyde (50-00-0)
- Acrylonitrile (107-13-1)
- Benzene (71-43-2)
- Bromoform (75-25-2)
- Bromomethane (74-83-9)
- Carbon disulfide (75-15-0)
- Carbon tetrachloride (56-23-5)
- Chlorobenzene (108-90-7)

- Chloroethane (75-00-3)
- Chloroform (67-66-3)
- Chloromethane (74-87-3)
- 1,2-Dichloroethane (107-06-2)
- 1,1-Dichloroethene (75-35-4)
- 1,2-Dichloropropane (78-87-5)
- Ethylbenzene (100-41-4)
- Iodomethane (74-88-4)
- Methylene chloride (75-09-2)
- Styrene (100-42-5)
- 1,1,2,2-Tetrachloroethane[b] (79-34-5)
- Tetrachloroethene (127-18-4)
- Toluene (108-88-3)
- 1,1,1-Trichloroethane (71-55-6)
- 1,1,2-Trichloroethane (79-00-5)
- Trichloroethene (79-01-6)
- Vinyl chloride (75-01-4)
- Xylenes (1330-20-7)

Sampling was performed in accordance with provisions USEPA Test Methods as outlined in the ICR Enclosure 2. On June 24, 2016 US EPA approved previously submitted testing at the facility which exempted them from conducting additional testing for Toluene Soluble Organics, Hydrogen Chloride, Particulate Matter$_{2.5}$, condensable PM, Sulfur Dioxide, and Carbon Monoxide at the Battery 2 Combustion Stack.

2 COMPANY AND TESTING FIRM INFORMATION

Company Contact	Testing Contact
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3 ANALYTICAL LABORATORY INFORMATION

Samples were collected and analyzed for each analyte according to the applicable method; analyses were performed by the following:

USEPA Method 15	USEPA 5/29, 0010/23, 0031 and 316
Montrose Air Quality Services, LLC. Mr. Frank Barton 1050 William Pitt Way Pittsburgh, Pennsylvania 15238 (412) 826-3636 – Telephone fbarton@montrose-env.com PA Lab Registration #02-04775	Maxxam Analytics Inc. Mr. Clayton Johnson 5555 North Service Road Burlington, Ontario, Canada L7L5H7 (905) 332-8788 –Telephone Clayton.Johnson@maxxamanalytics.com PA Lab Registration #06-01745

4 TEST DATES AND PERSONNEL INFORMATION

Testing was performed October 17-20, 2016. Key personnel involved in the test include:

Organization	Personnel	Responsibility
ArcelorMittal Monessen	Ms. Traci Self	Client Representative—Liaison to Test Company
Montrose	William P. Cowell, QSTI, Client Project Manager	Client Project Manager. Field Crew Test Leader, Method 320 Operator, Report Writer
	Frank M. Barton, Project Manager	Method 15 Operator
	John E. Wilson, QSTI, Scientist II	Stack Tester, Sample Method Recovery
	Tyler C. Larson, Technician I	Stack Tester
	Terrence J. Mulhern, Technician I	Stack Tester

5 PROCESS DESCRIPTION AND PROCESS DATA

5.1 Process Description

ArcelorMittal Monessen LLC operates a by-product recovery cokemaking plant to produce metallurgical coke. The facility includes two coke oven batteries – Battery 1B has 37 slot-type coke ovens and Battery 2 has 19 slot-type coke ovens. Figure 1 shows a block diagram of the coke manufacturing process.

Coke oven gas (COG), primarily composed of hydrogen and methane, from the by-products recovery process is used to underfire coke oven Battery 1B and Battery 2. The exhaust gas is

then exhausted through a separate combustion stack from each of the two batteries. The batteries were operated at representative conditions during the testing program.

5.2 Process Data

AM Monessen and Montrose personnel recorded pertinent process operating and production parameters for each day during the testing program. Other parameters as dictated in the Enclosure 2 package were also requested to be collected. Process parameters that were recorded are:

- ID numbers of ovens pushed/charged (from P&EF submitted as part of Enclosure 1)
- Number of ovens pushed during testing
- Type of coal charged during testing
- Average coking time per oven(s) tested (hours)
- Average temperature of coking per oven(s) tested (degrees Fahrenheit)
- Dry coal processed per oven(s) during testing (tons)
- Coke produced during test period (tons)
- Pushing period during testing (minutes)
- Charging period during testing (minutes)
- Quantity of coke oven gas generated
- Quantity of coke oven gas burned in coke battery
- Quantity of coke oven gas burned in boilers
- Quantity of natural gas burned in coke battery
- Higher heating value of coke oven gas
- Higher heating value of natural gas
- Yearly quantity of coke oven gas burned in boilers
- Yearly quantity of coke oven gas burned in coke battery
- Yearly quantity of natural gas burned in coke battery
- Yearly quantity of coke oven gas generated

Process data can be found in Appendix A. A summary of the process data is also included on each Summary Table for each run of testing.

6 TEST PROCEDURES

Testing was conducted in accordance with USEPA, Title 40, Code of Federal Regulations (CFR), Part 60, Appendix A and the procedures described below. Additional information for test procedures and sample recovery methods is contained in each listed Method and Enclosure 2. All field data sheets for testing methodologies are located in Appendix B.

6.1 Deviations from Standard Test Methodologies and Abnormalities

During the Method 0031, a condensate field blank was collected. The results of the condensate field blank showed an elevated toluene presence of very high magnitude (24,000 micrograms/liter). It is believed the deionized water in the field cleanup area was exposed to toluene from the recovery efforts of the Method 23 sampling train which contaminated not only the field blank condensate sample, but also all 9 of the individual condensate run samples. Only the condensate samples were contaminated, as the traps were very consistent on the 9 sets analyzed, and showed no signs of contamination. The high toluene hit resulted in a high dilution for all condensate analysis which raised the minimum detection levels of all compounds. To account for the high toluene field blank contamination, the lab diluted all condensate samples to a magnitude of 1,000's, which resulted in increased MDL's for all target compounds. Field personnel recall no observable condensate in the knockout impinger, so the 40 mL VOA vial was filled entirely with the DI water which was shown to be contaminated. To avoid over reporting of target compounds, Speciated Volatile Organic Compounds are calculated using only the trap fraction for this source.

6.2 Testing Station and Traverse Locations – USEPA Method 1

The principles of USEPA Method 1, *Sample and Velocity Traverses for Stationary Sources*, were utilized to determine the number and location of the traverse points. Prior to sampling, a flow check was conducted with the unit operating in a manner similar to test conditions to verify the presence or absence of cyclonic flow in accordance with §11.4 of Method 1. Results of the cyclonic flow check are included in the preliminary testing data of Appendix B. Figure 2 shows a stack sampling schematic and sample point location.

6.3 Gas Flow and Temperature Measurements – USEPA Method 2

The gas flow rate and temperature profiles for the gas stream were measured by conducting simultaneous velocity and temperature traverses during each sampling run. Gas velocity head was measured with a calibrated Type S Pitot tube that was connected to a digital low-flow manometer. The static pressure was measured using the same Pitot tube and manometer. A Chrome-Alumel thermocouple attached to a digital indicator was used to measure the gas temperature at each of the traverse points. The gas flow and temperature measurements followed

the principles of USEPA Method 2, *Determination of Stack Gas Velocity and Volumetric Flow Rate (Type S Pitot Tube).*

6.4 Moisture Content Sampling – USEPA Method 4

Moisture content sampling was conducted concurrently with each sampling run using the principles presented in USEPA Method 4, *Determination of Moisture Content in Stack Gases.* Parameters evaluated, in order to determine the gas stream moisture content, were sample gas volume, temperature, pressure and impingers, and silica gel moisture gain.

6.5 Filterable PM, Mercury and Metal Emissions – USEPA Method 5/29

USEPA Method 5 and the sampling train of USEPA Method 29, *Determination of Metals Emissions from Stationary Sources* were used to measure Total Filterable PM, Hg and various other metal emissions.

6.5.1 Sample Train Setup

Prior to sampling, all glassware was cleaned with soap and water, rinsed with tap water, and deionized water (DI H_2O). After cleaning, the glassware was soaked in a 10% nitric acid solution for at least 4 hours. Following soaking, the glassware was then rinsed with DI H_2O, and then finally rinsed with acetone and allowed to air dry.

The sampling apparatus contained a glass-lined temperature-controlled probe equipped with a Type S Pitot tube and a sharp-edged borosilicate glass button-hook nozzle. The probe liner and nozzle were connected utilizing a glass-coated stainless-steel union and graphite ferrules.

The exit of the probe was connected to a tared quartz fiber filter supported in a glass-filter holder inside an oven heated to 248°F ± 25°F, as measured by an in-stack thermocouple. The exit of the filter holder was connected to a series of six impingers. The first (modified Greenburg-Smith) and second (standard Greenburg-Smith) impingers each contained 100 milliliters (ml) of 5% nitric acid (HNO_3) / 10% hydrogen peroxide (H_2O_2), the third (modified Greenburg-Smith) was empty, the fourth and fifth (both modified Greenburg-Smith) contained 100 ml of acidic potassium permanganate ($KMnO_4$), and the sixth impinger contained pre-weighed silica gel. All six impingers were weighed to the nearest ± 0.1 gram (g) using a calibrated field balance prior to

the start of sampling for determination of moisture content in the gas stream. By weighing the impingers instead of measuring the liquid using a graduated cylinder, there was less potential for contamination of the sample.

The impinger train was connected to a commercially available metering system. Prior to sampling, the dry gas meter was calibrated utilizing the critical orifice procedures detailed in Section 16.2 of USEPA Method 5. A calibrated critical orifice set covering the anticipated sampling rates was utilized. Along with pre-test and post-test meter calibrations, the Type S Pitot, thermocouple and nozzle was also calibrated prior to and following use in the field according to USEPA Method 5 procedures. .

The sample train was assembled, allowed to reach operating temperature, and leak checked by plugging the nozzle and pulling a vacuum of approximately 15" of Hg. Once an acceptable leak check on the entire system of less than 0.02 cubic feet per minute (cfm) was achieved, the sampling train was placed at the first traverse point and sampling began immediately.

The sampling train was operated at an isokinetic rate with an isokinetic variation of 90% to 110%. At the conclusion of each test run, the sampling train was leak-checked at a vacuum equal to or greater than the maximum value reached during sampling. An acceptable leakage rate of less than 0.02 cfm was achieved.

6.5.2 Sample Recovery and Analysis

The filter (Container 1) was removed from the filter holder and placed in a labeled polystyrene Petri dish. The filter was desiccated for a minimum of 24 hours and weighed to a constant weight. The term constant weight means a difference of no more than 0.5 milligrams (mg) or 1% of total weight less tare weight (whichever is greater) between two consecutive weighings, with no less than 6 hours of desiccation time between weighings.

An acetone rinse (Container 2) consisting of the nozzle, probe, and front half of the filter holder was performed a minimum of 3 times, and consisted of 100 ml. The rinse was then evaporated to dryness in a glass 250 ml pre-weighed beaker, desiccated, and weighed to a constant weight. The total FPM catch was the sum of the acetone rinse plus the filter catch. FPM analysis results are contained in Appendix C.

Following the acetone rinse, the nozzle, probe, front-half of the filter holder and connections were rinsed with 100 ml of 0.1 N HNO_3. The rinses were stored in a labeled, sealed amber glass bottle (Container 3) for shipment to the laboratory.

The liquid in the first two impingers were weighed to the nearest ± 0.1 g using a calibrated field balance. The contents were transferred to an amber glass sample bottle. The back half of the filter holder, connecting glassware and impingers were rinsed with 100 ml 0.1 N HNO_3; these rinses were added to the same sample bottle (Container 4). The bottle was labeled and stored for shipment to the laboratory for analysis.

The liquid in the third impinger was weighed to the nearest ± 0.1 g using a calibrated field balance. The contents were transferred to an amber glass sample bottle. The impinger was rinsed with 100 ml 0.1 N HNO_3 and transferred to the same sample bottle (Container 5a). The bottle was labeled and stored for shipment to the laboratory for analysis.

The liquid in the fourth and fifth impingers was weighed to the nearest ± 0.1 g using a calibrated field balance. The contents were transferred to an amber glass sample bottle. The impingers were rinsed three times with 100 ml of fresh acidified $KMnO_4$. These rinses were added to the same sample bottle. Similarly, three rinses of the same impingers were performed using exactly 100 ml of DI H_2O. These rinses were also added to the same sample bottle (Container 5b). The bottle was labeled and stored for shipment to the laboratory for analysis.

An additional rinse of 25 ml of 8N hydrochloric acid (HCl) was conducted. The 25 ml of 8N HCl was added to Impinger 4, swirled, and then transferred to Impinger 5 and swirled. This rinse was placed in an amber glass sample bottle containing 200 ml of DI H_2O. The bottle (Container 5c) was labeled and stored for shipment to the laboratory for analysis.

Sample blanks of 300 ml of 0.1 N HNO_3 (Container 8a), 100 ml of DI H_2O (Container 8b), 200 ml of 5% HNO_3/10% H_2O_2 (Container 9), 100 ml acidified $KMnO_4$ (Container 10), 25 ml of 8N HCl in 200 ml of DI H_2O (Container 11), and 3 unused blank filters (Container 12) were prepared during the field test, labeled and stored for shipment to the laboratory for analysis.

All lab data is contained in Appendix C. The individual lab Hg fractions and the other metals front and back half fractions are reported as mg/dscm and lb/hr.

Total FPM emissions were reported as mg/dscm, gr/dscf, and lb/hr.

6.6 Semi-Volatile Organics and Dioxin/Furan Concentration – USEPA Methods 23 and 0010

The D/F emissions were determined in accordance with USEPA Method 23, *Determination of Polychlorinated Dibenzo-p-dioxins and Polychlorinated Dibenzofurans from Municipal Waste Combustors*. The Semi-Volatile Organic Compounds were combined in the same train using the principles of USEPA SW-846 Test Method 0010: Modified Method 5 Sampling Train.

6.6.1 Sampling Train Setup and Operation

The sampling apparatus contains a glass-lined temperature-controlled probe equipped with a Type S Pitot tube and a sharp-edged stainless-steel buttonhook nozzle. The exit of the probe was connected to a high-efficiency glass fiber filter supported in a glass-filter holder inside an oven heated to 248°F ± 25°F (as measured by an in-gas thermocouple at the filter exit). The exit of the filter holder was connected to a water-jacketed condenser followed by a water-jacketed packed column of adsorbent material (XAD-2) and a knock-out impinger followed by a series of four full-sized impingers. The condenser and XAD-2 trap were continually cooled with a water circulating pump inserted in the ice bath and tubing leading to the two glass pieces. Temperature entering the XAD-2 trap was monitored with an in-gas thermocouple and maintained at a temperature below 68°F. The knockout impinger was empty and the second and third impingers each contained 100 milliliters (ml) of deionized water. The fourth impinger was empty and the fifth impinger contained a pre-weighed amount of silica gel.

The impinger train was connected to a commercially available metering system. Prior to sampling, the dry gas meter was calibrated utilizing the procedures detailed in USEPA Method 5.

The sample train was assembled, allowed to reach operating temperature, and leak checked by plugging the nozzle with a rubber septum and pulling a vacuum of approximately 15" of mercury

(Hg). Sampling did not proceed until an acceptable leak check of less than 0.02 cubic feet per minute (cfm) was achieved.

6.6.2 Testing Procedures

Once an acceptable leak check was achieved, the sampling train was placed at the first traverse point and sampling began immediately. The sampling train was operated at an isokinetic rate with an isokinetic variation greater than 90% and less than 110%. Three runs were performed; each run was at least 180 minutes in duration and had a minimum sample volume of 140 dry standard cubic feet (DSCF). At the conclusion of each test run, the sample train was cooled sufficiently, utilizing ambient air or ice, to allow the nozzle to be plugged with the rubber septum. The sampling train was leak-checked at a vacuum equal to or greater than the maximum value reached during sampling.

6.6.3 Sample Recovery

Container 1 – The filter was removed from the filter holder and placed in a labeled glass petri dish and sealed with Teflon® tape.

Adsorbent Module – The module was removed for the sample train, sealed with Teflon® tape, and labeled. The module was stored on ice for transport to the laboratory.

Container 2A – Material in the nozzle, probe, front and back halves of the filter holder, impingers and connecting glassware was quantitatively rinsed with acetone. Acetone rinses were performed a minimum of 3 times. The volume of each rinse was added to Container No. 2, an amber glass sample bottle. The contents of Container 2 were sealed and submitted to the laboratory for Method 23 analysis. A methylene chloride rinse followed the acetone rinse, and was added to the same Container No. 2A.

Container 2B – Material in the probe, nozzle, probe fitting, probe liner, and front half of the filter holder by was washed with methanol/methylene chloride (1:1 v/v), and collecting into a glass container. Rinses were performed a minimum of 3 times. The volume of each rinse was added to Container No. 2B, an amber glass sample bottle. The contents of Container 2B were sealed and submitted to the laboratory for Method 0010 analysis.

Container 3 – Material in the nozzle, probe, both halves of the filter holder, impingers and connecting glassware was quantitatively rinsed with toluene three times. The volumes of these rinses were recorded and stored in an amber glass sample bottle designated as Container 3. As permitted, the toluene rinse was combined at the laboratory with the acetone rinse.

Container 4 – The volume of condensate collected in the condensate knockout section of the organic module was measured to within +1 mL by using a graduated cylinder and transferred to a prelabeled glass sample container 4. Any liquid in the back half of the filter housing and the condenser section was also added to the condensate knockout-trap catch.

Container 5 - All sampling train components located between the high-efficiency glass- or quartz-fiber filter and the first wet impinger or the final condenser system were rinsed with methanol/methylene chloride (1:1 v/v) and the rinses combined. This rinse shall be separated from the condensate. The contents of Container 5 were sealed and submitted to the laboratory for Method 0010 analysis.

Impinger Contents – The impinger contents were measured to within 1 ml, utilizing a graduated cylinder, and discarded. The volume was recorded to calculate moisture content of the effluent gas.

Silica Gel – The silica gel was transferred to the original container and weighed to the nearest ± 0.5 gram (g).

All samples were maintained at 39°F or lower and protected from light. Each fraction was recorded on the sample chain of custody and transported to the laboratory for analysis, along with one complete blank sample train. The polychlorinated dibenzodioxins (PCDD) and polychlorinated dibenzofurans (PCDF) were extracted from the sample, separated by high-resolution gas chromatography, and measured by high-resolution mass spectroscopy. Analytical results are included in Appendix C.

6.7 Formaldehyde Emissions – USEPA Method 316

Formaldehyde emissions were determined by using Method 316, *Sample and Analysis for Formaldehyde Emissions from Stationary Sources in the Mineral Wool and Wool Fiberglass Industries.*

6.7.1 Sampling Train Setup and Operation

The sampling apparatus contains a glass-lined temperature-controlled probe equipped with a Type S Pitot tube and a sharp-edged stainless-steel buttonhook nozzle. The exit of the probe was connected to a series of impingers. The first (modified Greenburg-Smith) and second impingers (Greenburg-Smith) were filled with 100mL high purity water. The third impinger (modified Greenburg-Smith) was empty and the fourth impinger was contained a pre-weighed amount of silica gel.

6.7.2 Testing Procedures

Once an acceptable leak check was achieved, the sampling train was placed at the first traverse point and sampling began immediately. The sampling train was operated at an isokinetic rate with an isokinetic variation greater than 90% and less than 110%. Gaseous and particulate pollutants were withdrawn isokinetically from the source and collected in high purity water. At the conclusion of each test run, the sample train was cooled sufficiently, utilizing ambient air or ice, to allow the nozzle to be plugged with the rubber septum. The sampling train was leak-checked at a vacuum equal to or greater than the maximum value reached during sampling. Each test run was 120 minutes in duration and collected a minimum of 35 dry standard cubic feet. Three test runs were performed at the Combustion Stack.

6.7.3 Sample Recovery

Container 1 – Probe and Impinger Catches. All surfaces to which the sample was exposed (including the probe nozzle, probe fitting, probe liner, first three impingers, and impinger connectors) were rinsed with up to 400 mL of water and added to Container #1. Then, using a graduated cylinder, the volume of the solution in the first three impingers was measured to the nearest 0.5g, and recorded. The combined impinger solution from the graduated cylinder was

transferred the same storage container as the water rinse. The container was put on ice during the entire time from collection until shipment to lab.

Container 2 – Once a test series, a sample blank of the same volume as Container 1 was prepared and handled as described above.

Silica Gel – The silica gel was transferred to the original container and weighed to the nearest ± 0.5 gram (g).

The high purity water containing formaldehyde was analyzed using the modified pararosaniline method.

6.8 Speciated Volatile Organic HAPs – SW-846 Method 0031

Speciated Volatile Organic HAP emissions were determined by using SW-846 Method 0031

6.8.1 Testing Procedures

Method 0031 employs a sampling module, a glass lined heated probe, and meter box to withdraw a nominal 20 liter sample of effluent gas containing volatile organic compounds from a stationary source at a flow rate of 0.5 L/min, using a glass-lined probe heated to 130 ± 5°C and a sampling method for volatile organic compounds (SMVOC) train. The gas stream is cooled to 20°C by passage through a water-cooled condenser and volatile organic compounds are collected on a set of sorbent traps (Tenax®-GC/Tenax®- GC/Anasorb®-747). Liquid condensate was collected in an impinger placed between the two Tenax®- GC traps and the Anasorb®-747 trap. The first and second traps contained 1.6 g of Tenax®-GC each and the third trap (back trap) contained 5.0 g of Anasorb®-747. Three sets of traps and condensate were collected every 40 minutes of sampling time, with each set collecting approximately 20 liters of sample. A leak check of the system was performed prior to starting with an acceptable leak rate of 4% of the sample rate allowed. The probe was placed at a centrally located point in the stack. Flows and moistures were run concurrently in a separate train to determine mass emission rates. A post-test leak check was performed at the highest recordable vacuum during the test.

6.8.2 Sample Recovery

Upon finishing each 40 minute sample set, the tubes were sealed and placed in a tedlar bag and put on ice for shipment to the lab. The condensate was recovered by transferring any liquid contained in the knock-out trap to a 40-mL VOA vial and rinsing the knock-out trap three times with a minimum volume of organic-free reagent water and adding the rinses to the VOA vial. The VOA vial was filled to the top with water to avoid any air bubbles, and then placed on ice for shipment to the lab. The volatile organic compounds are desorbed from the analytical traps and separated by temperature-programmed gas chromatography and detected by continuously-scanning low resolution mass spectrometry (Method 8260).

6.9 Determination of Gaseous Emissions (Continuous Emissions Monitoring)

6.9.1 Sampling System Setup

The sampling system was comprised of a 3/8" heated stainless-steel or Inconel sheathed probe, a glass-fiber 30 x 100 millimeters (mm) heated filter, a calibration "T", a heated sample line, a gas conditioner, a gas distribution manifold, and pollutant specific analyzers. Sampling components prior to the gas conditioner (i.e., probe, filter, sample line) were heated to maintain temperatures above the dew point of the exhaust gas. Prior to sampling, the entire system was leak checked by capping off the end of the sample probe and drawing a vacuum on the entire system. An acceptable leak check of 0.0 liters per minute (lpm) at 15" mercury (Hg) vacuum was measured. Data acquisition was conducted with a multi-channel Yokagawa Model HR MX100 data acquisition system (DAS) collecting data continuously at 2-second intervals, then calculating 1-minute averages from those readings.

6.9.2 Pre-test Determinations

Before testing, a stratification test was performed on following an alternative 3-point procedure detailed in Section 8 of USEPA Method 7E, *Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure).* A gas sample was continuously extracted from three sampling points at 16.7%, 50.0%, and 83.3% of the measurement line in the single Continuous Emissions Monitoring (CEM) port of the exhaust stack. The gas was passed through the heated probe, filter, and line into a gas conditioner, and then a portion of the sample was conveyed to each analyzer. Each point was sampled for a minimum of twice the system

response time. The results were evaluated using only one pollutant type to determine the sampling strategy. Stratification test results are in the preliminary testing section of Appendix B.

6.9.3 Testing Procedures

To the extent practicable, instrument spans were between 20 to 100% of the measured emissions. At the beginning of each sampling day, an internal calibration error (CE) check was performed; a zero gas and calibration gases at 40 to 60% of span and 100% of span were introduced to the analyzers. The internal calibration responses were checked against the known cylinder gas values. The difference between the cylinder values and analyzer responses was divided by the span value of the gas to give the CE. An allowable CE is 2% of analyzer span. Each analyzer demonstrated acceptable CE at all times.

The CEM system was then placed in a system calibration bias mode. Zero and upscale gases were introduced at the probe exit to allow evaluation of the sampling line, gas conditioner, and analyzer in a normal sampling mode. No adjustments to the sampling system were made and the response of each gas was recorded on the CEM bias sheets. The difference between the sampling system response in the bias mode minus the analyzer response during the internal calibration check was divided by the analyzer span value. This calculated value represents the sampling system bias. System bias did not exceed ±5% for any analyzer at any time.

After each test run was complete, a post-test sampling system bias check was conducted. No adjustments to the sampling system were made and the response of each gas was recorded on the CEM bias sheet. The difference between the sampling system response in the bias mode minus the analyzer response during the internal check was divided by the analyzer span value. This calculated value represented the sampling system bias and did not exceed ±5% for any analyzer at any time.

The responses from the post-test bias check were compared with those from the pre-test system bias check. The difference between the post-test and pre-test bias check responses were divided by the analyzer span value. This value was the amount of drift between the pre-test and post-test bias checks, and did not exceed ±3% for any analyzer at any time.

Emissions data was reported on a parts per million by dry volume (ppm_{dv}) and lb/hr basis.

6.9.4 Carbon Dioxide and Oxygen Determination – USEPA Method 3A

The principles of USEPA Method 3A, *Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)*, were utilized for the determination of oxygen (O_2) and carbon dioxide (CO_2) for the test program. A Servomex 1440 Paramagnetic Analyzer was used to determine O_2 and a Servomex infrared analyzer was used to continuously measure CO_2. Nitrogen (N_2) was determined by the difference. Concentrations of O_2 and CO_2 are reported as %, dry, and are used for molecular weight determinations for each test run. CO_2 results are also reported on a g/hr, lb/hr, and tons/hr basis.

6.10 Hydrogen Sulfide Emissions – USEPA Method 15 GC Methodology

USEPA Method 15, *Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions From Stationary Sources*, was used to measure hydrogen sulfide using an on-site direct gas chromatograph (GC) sampling approach.

A GC with a Flame Photometric Detector (FPD) system consisting of an SRI Model 8610C field GC with a heated gas sampling valve, column oven and detector was used to quantify hydrogen sulfide. A separate sample line from the CEMs unit was used for this method. A heated sampling probe with a heated out-of-stack filter was used to convey the sample to a SO_2 scrubber system (using Teflon® impingers) that was in place after the heated probe and prior to the unheated sampling line leading to the GC/FPD detector. A sampling pump was used to continuously purge the sampling line in between injections.

Six injections were made each test run. A QA recovery study was performed for by running a calibration gas standard up through the calibration line which is connected to a "T" at the back of the sampling probe. The calibration gas traversed through the sampling system in the same manner that stack gas samples travel, and passed through the heated sample line, the sampling pump, the SO_2 scrubber and into the GC detector.

Three sampling runs were performed concurrently with SO_2 emission measurement. A concurrent flow and moisture test was performed with each test run to determine mass emission

rates. Laboratory results of these tests are provided in Appendix C. Emissions are reported on a ppm_v, and lb/hr basis.

6.11 Hydrogen Fluoride and Cyanide – USEPA Method 320

USEPA Method 320, *Vapor Phase Organic & Inorganic Emissions by Extractive FTIR,* was used to measure HF and HCN emissions. The FTIR analyzer determines individual concentrations by measuring the infrared spectrum produced by atomic motion that is unique to each compound. The FTIR uses an infrared spectral-reference library that has been validated against the on-line Environmental Protection Agency (EPA) library or against National Institute for Standards and Technology (NIST) traceable gas mixtures.

6.11.1 Sampling System Setup and Operation

The system was operated by a trained analyst with understanding of the analyzer and operating methodology. The FTIR sampling system uses the same probe, filter and heated line as the CEM sampling system. The gas conditioner was placed downstream of the FTIR analyzer, however. Sampling components prior to the FTIR (i.e., probe, filter, sample line) were heated to 350°F to prevent condensation. A slipstream sample of exhaust gas was analyzed hot/wet by an MKS Model 2030 FTIR system gas cell. The analyzer output was recorded on the MKS data acquisition system (DAS), using MKS's own MG2000 software package.

Infrared spectrum readings were recorded 64 times each minute continuously during each 60-minute test run. The FTIR analyzer determines individual concentrations for HCl, HF and HCN by measuring the infrared spectrum produced by atomic motion that is unique to each compound. The FTIR uses an infrared spectral-reference library that has been validated against the on-line USEPA library or against National Institute for Standards and Technology (NIST) traceable gas mixtures.

6.11.2 Quality Assurance / Quality Control Procedures

A surrogate calibration gas of a certified concentration was used for the quality assurance spikes and calibration transfer standard (CTS) checks of the FTIR sampling system. Each gas cylinder contained a known concentration of the tracer gas SF_6 (sulfur hexafluoride) to aid in

determination of the dilution coefficient when performing the spiking procedure. The surrogates used for the spike recovery checks were as follows:

- Cyanide with SF_6 tracer for Cyanide (also used as the system CTS)
- Hydrogen Chloride with SF_6 tracer for the HF

For the CTS checks, cyanide calibration gas was introduced directly to the gas inlet of the FTIR. Five independent spectra were recorded for each CTS by first injecting the calibration gas directly to the back of the instrument for a minimum of 5 spectra readings. This procedure was then repeated with the gas being delivered at the back of the sampling probe to verify recovery and line loss of the sampling system. This check was performed prior to the start of sampling, as well as at the end of each test run. Three independent spectra readings were recorded at 1-minute intervals for each pre- and post- CTS measurement. Acceptable criteria between the pre- and post-test CTS were within ±5% of the mean value. CTS data is included in Appendix D.

The spike recovery was performed by measuring 5 independent spectra while sampling the stack gas in its "native" form. Next, a spike gas was introduced at the back of the sampling probe at a rate of ≤ 10% of the total spike gas flow (this was determined based on the % difference of the "spiked" SF_6 concentration versus the instrument-direct SF_6 concentration). Once the spike concentration stabilized, 5 independent "spiked" spectra were recorded. This procedure was alternated between "native" and "spiked" measurements a single time for each of the above noted spike gases because this method has been proven to work on this source type previously. Spike recoveries were between 70% and 130% recovery. The spike data is included in Appendix D.

Minimum detection limits (MDLs) were calculated for the compounds by taking a minimum of 5 independent spectra readings while running nitrogen through the entire system. A standard deviation was calculated for the resulting data set, and an MDL of 3 times the standard deviation was set. The reportable amount for each compound is the greater of the hourly average or the MDL for the specific compound.

6.12 Opacity and Visual Emissions – USEPA Methods 9 and 303

USEPA Method 9, *Visual Determination of the Opacity of Emissions From Stationary Sources,* was used to opacity coming from the exhaust stack during PM testing events. A certified

observer recorded readings at 15 second intervals for the duration of the PM testing. USEPA Method 303, *Determination of Visible Emissions From By-Product Coke Oven Batteries*, was used to quantify visual emissions during PM testing events. Results are reported as average % opacity observed during each run for opacity. The plant records VE emissions as part of their regular monitoring, and VE observations for the entire month of October are included in the Method 5/29 section of Appendix B, and are reported as total seconds of emissions per day of observations (per battery), and average % leaks observed for each equipment type.

6.13 Quality Assurance/Quality Control

The following field equipment calibrations are contained in Appendix D:

- Pitot and Thermocouple
- Nozzle
- Dry gas meter and orifice
- Interference data
- Calibration gas certificates
- USEPA Method 320 QA checks
- Qualified Source Testing Individual (QSTI) certifications
- Opacity Observer Certification

6.14 Calculations

Emission calculations were completed by using a computer spreadsheet format. The results of each pertinent parameter are detailed on a spreadsheet for each sampling run and provided in Appendix B. A sample calculation for one complete test run of each parameter is included in Appendix E.

7 TEST RESULTS

Test results for Battery 2 Combustion Stack are contained in the following tables:

Table 1 – Filterable Particulate Matter Test Results (Opacity and VE included)
Table 2 – Metal Test Results
Table 3 –Dioxin/Furan Test Results
Table 4 – Semi-Volatile Organic Test Results
Table 5 – Formaldehyde Test Results
Table 6 – Speciated Volatile Organic Compound Test Results
Table 7 – Gaseous Emissions Test Results
Table 8 – Acidic Gas Emission Test Results
Table 9 – Static Process Data (not test run specific)

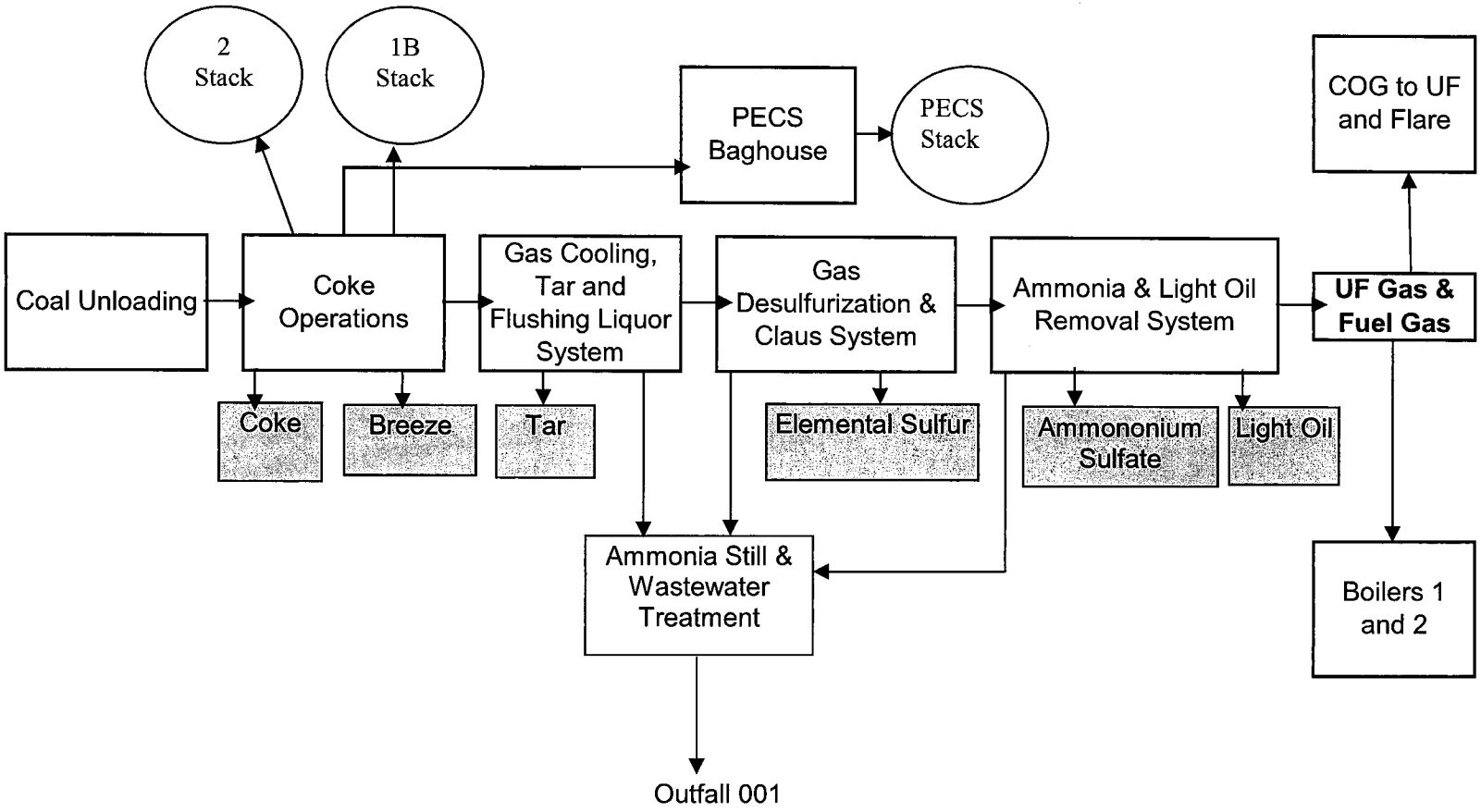
Table 10 – Table Nomenclature.

8 CONCLUSION

The ICR test program has been conducted for ArcelorMittal Monessen LLC on Battery 2 Combustion Stack at their Monessen Coke Plant on October 17-20, 2016. Test results represent data that is considered to be representative of the emission rates at the prevailing operating conditions, except as noted in Section 6.1 above.

To the best of Montrose's knowledge, this source test report has been checked for completeness and the results contained herein are accurate, error-free, and representative of the actual emissions measured during testing.

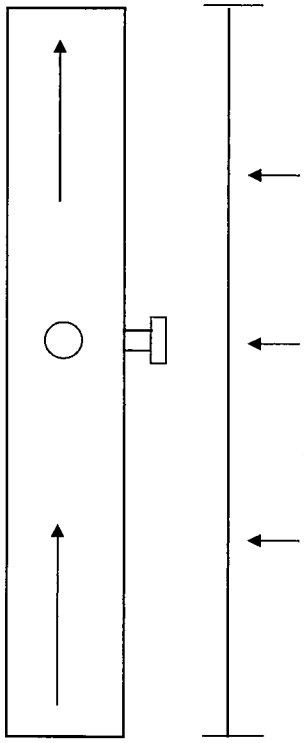
REPORT – FIGURES



MONTROSE
AIR QUALITY SERVICES

SIMPLE BLOCK DIAGRAM for COKE MANUFACTURING PROCESS ARCELORMITTAL MONESSEN, MONESSEN COKE PLANT	Figure 1

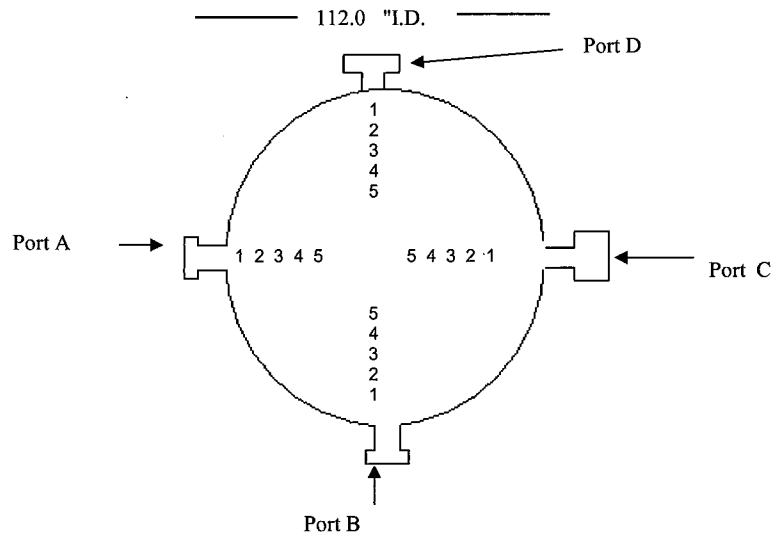
MONTROSE AIR QUALITY SERVICES, LLC.
USEPA METHOD 1 DATA SHEET



150 Feet Upstream from Nearest Disturbance
16.1 Duct Diameters

4 Sampling Ports Located 90° Apart

53 Feet Downstream from Nearest Disturbance
5.7 Duct Diameters



Point Number Each Port	Method 1 Value (inches)
1	2.9
2	9.2
3	16.4
4	25.3
5	38.3

MONTROSE

COMBUSTION STACK 2 SAMPLING LOCATION SCHEMATIC ARCELORMITTAL MONESSEN LLC	Figure 2

REPORT – TABLES

Table 1. Filterable Particulate Matter Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/19/16	10/19/16	10/19/16	
Start Time		8:25 AM	11:22 AM	2:02 PM	
End Time		10:48 AM	1:44 PM	4:21 PM	
Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)	32,134	34,769	34,626	33,843
Flow Rate	(SCFM)	18,449	18,056	17,619	18,041
Flow Rate	(DSCFM)	16,490	15,738	15,035	15,754
Sample Volume	(DSCF)	110.1	105.3	108.3	107.9
Oxygen	(dry volume %)	9.72	10.32	10.37	10.14
Carbon Dioxide	(dry volume %)	5.30	4.92	4.95	5.06
Water Vapor	(volume %)	10.62	12.84	14.67	12.71
Stack Temperature	(°F)	432.4	526.0	546.3	501.5
Percent of Isokinetic Sampling	(%)	96.6	96.9	104.3	99.3
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		8	8	8	8
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,431	2,432	2,431
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	92.8	92.8	92.8	92.8
COG generated during test	(mmscf)	1.61	1.60	1.56	1.59
COG burned in boilers during test	(mmscf)	0.43	0.42	0.41	0.42
COG burned in batteries during test	(mmscf)	0.93	0.93	0.91	0.92
Results					
Particulate Results					
Mass Collected	(mg)	55.80	28.80	57.00	47.20
Emission Concentration	(gr/dscf)	0.0078	0.0042	0.0081	0.0067
Emission Rate	(mg/dscm)	17.90	9.65	18.58	15.38
Emission Rate	(lb/hr)	1.11	0.57	1.05	0.91
Opacity Results (USEPA M9)					
Average Opacity	(%)	0.03	0.00	0.09	0.04

Table 2. Metal Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/19/16	10/19/16	10/19/16	
Start Time		8:25 AM	11:22 AM	2:02 PM	
End Time		10:48 AM	1:44 PM	4:21 PM	
Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)	32,134	34,769	34,626	33,843
Flow Rate	(SCFM)	18,449	18,056	17,619	18,041
Flow Rate	(DSCFM)	16,490	15,738	15,035	15,754
Sample Volume	(DSCF)	110.1	105.3	108.3	107.9
Oxygen	(dry volume %)	9.72	10.32	10.37	10.14
Carbon Dioxide	(dry volume %)	5.30	4.92	4.95	5.06
Water Vapor	(volume %)	10.62	12.84	14.67	12.71
Stack Temperature	(°F)	432.4	526.0	546.3	501.5
Percent of Isokinetic Sampling	(%)	96.6	96.9	104.3	99.3
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		8	8	8	8
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,431	2,432	2,431
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	92.8	92.8	92.8	92.8
COG generated during test	(mmscf)	1.61	1.60	1.56	1.59
COG burned in boilers during test	(mmscf)	0.43	0.42	0.41	0.42
COG burned in batteries during test	(mmscf)	0.93	0.93	0.91	0.92
Results					
Mercury					
Emission concentration (1B Fraction)	(mg/DSCM)	< 4.81E-06	< 5.03E-06	6.19E-06	< 5.34E-06
Emission concentration (2B Fraction)	(mg/DSCM)	7.99E-04	1.13E-03	1.05E-03	9.94E-04
Emission concentration (3A Fraction)	(mg/DSCM)	< 1.48E-06	5.43E-05	3.78E-05	< 3.12E-05
Emission concentration (3B Fraction)	(mg/DSCM)	1.18E-04	1.65E-03	1.66E-05	5.94E-04
Emission concentration (3C Fraction)	(mg/DSCM)	1.60E-03	6.03E-05	1.19E-03	9.50E-04
Emission rate (1B Fraction)	(lb/hr)	< 2.97E-07	< 2.96E-07	3.49E-07	< 3.14E-07
Emission rate (2B Fraction)	(lb/hr)	4.93E-05	6.66E-05	5.93E-05	5.84E-05
Emission rate (3A Fraction)	(lb/hr)	< 9.12E-08	3.20E-06	2.13E-06	< 1.81E-06
Emission rate (3B Fraction)	(lb/hr)	7.29E-06	9.70E-05	9.36E-07	3.51E-05
Emission rate (3C Fraction)	(lb/hr)	9.87E-05	3.56E-06	6.72E-05	5.65E-05
Antimony					
Emission Concentration Front-Half	(mg/DSCM)	< 2.57E-04	< 2.68E-04	< 2.61E-04	< 2.62E-04
Emission Concentration Back-Half	(mg/DSCM)	< 3.21E-04	< 3.35E-04	< 3.26E-04	< 3.27E-04
Emission Rate Front-Half	(lb/hr)	< 1.59E-05	< 1.58E-05	< 1.47E-05	< 1.54E-05
Emission Rate Back-Half	(lb/hr)	< 1.98E-05	< 1.98E-05	< 1.84E-05	< 1.93E-05
Arsenic					
Emission Concentration Front-Half	(mg/DSCM)	1.05E-03	1.01E-03	1.81E-03	1.29E-03
Emission Concentration Back-Half	(mg/DSCM)	< 3.21E-04	< 3.35E-04	< 3.26E-04	< 3.27E-04
Emission Rate Front-Half	(lb/hr)	6.50E-05	5.95E-05	1.02E-04	7.55E-05
Emission Rate Back-Half	(lb/hr)	< 1.98E-05	< 1.98E-05	< 1.84E-05	< 1.93E-05

Table 2. Metal Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 2		Run 3		Average
Beryllium									
Emission Concentration Front-Half	(mg/DSCM)	<	6.42E-05	<	6.70E-05	<	6.52E-05	<	6.55E-05
Emission Concentration Back-Half	(mg/DSCM)	<	8.02E-05	<	8.38E-05	<	8.15E-05	<	8.18E-05
Emission Rate Front-Half	(lb/hr)	<	3.96E-06	<	3.95E-06	<	3.67E-06	<	3.86E-06
Emission Rate Back-Half	(lb/hr)	<	4.95E-06	<	4.94E-06	<	4.59E-06	<	4.83E-06
Cadmium									
Emission Concentration Front-Half	(mg/DSCM)		4.07E-04		1.58E-04		7.82E-05		2.14E-04
Emission Concentration Back-Half	(mg/DSCM)	<	8.02E-05	<	8.38E-05	<	8.15E-05	<	8.18E-05
Emission Rate Front-Half	(lb/hr)		2.52E-05		9.29E-06		4.41E-06		1.30E-05
Emission Rate Back-Half	(lb/hr)	<	4.95E-06	<	4.94E-06	<	4.59E-06	<	4.83E-06
Chromium									
Emission Concentration Front-Half	(mg/DSCM)		1.79E-03		2.73E-03		2.48E-03		2.33E-03
Emission Concentration Back-Half	(mg/DSCM)		2.41E-03		1.91E-02		5.90E-03		9.14E-03
Emission Rate Front-Half	(lb/hr)		1.11E-04		1.61E-04		1.40E-04		1.37E-04
Emission Rate Back-Half	(lb/hr)		1.49E-04		1.13E-03		3.32E-04		5.36E-04
Cobalt									
Emission Concentration Front-Half	(mg/DSCM)		7.38E-05		9.39E-05	<	6.52E-05	<	7.76E-05
Emission Concentration Back-Half	(mg/DSCM)		1.48E-04		1.86E-03		7.30E-04		9.12E-04
Emission Rate Front-Half	(lb/hr)		4.56E-06		5.53E-06	<	3.67E-06	<	4.59E-06
Emission Rate Back-Half	(lb/hr)		9.12E-06		1.09E-04		4.11E-05		5.32E-05
Lead									
Emission Concentration Front-Half	(mg/DSCM)		1.20E-03		1.39E-03		1.30E-03		1.30E-03
Emission Concentration Back-Half	(mg/DSCM)		7.12E-03		4.59E-04		3.19E-04		2.63E-03
Emission Rate Front-Half	(lb/hr)		7.41E-05		8.18E-05		7.31E-05		7.63E-05
Emission Rate Back-Half	(lb/hr)		4.40E-04		2.71E-05		1.80E-05		1.62E-04
Manganese									
Emission Concentration Front-Half	(mg/DSCM)		1.09E-03		1.31E-03		1.14E-03		1.18E-03
Emission Concentration Back-Half	(mg/DSCM)		5.10E-03		3.49E-02		2.74E-03		1.42E-02
Emission Rate Front-Half	(lb/hr)		6.74E-05		7.71E-05		6.43E-05		6.96E-05
Emission Rate Back-Half	(lb/hr)		3.15E-04		2.06E-03		1.54E-04		8.41E-04
Nickel									
Emission Concentration Front-Half	(mg/DSCM)		2.44E-03		2.98E-03		3.13E-03		2.85E-03
Emission Concentration Back-Half	(mg/DSCM)		2.89E-03		1.17E-02		3.03E-03		5.88E-03
Emission Rate Front-Half	(lb/hr)		1.51E-04		1.76E-04		1.76E-04		1.68E-04
Emission Rate Back-Half	(lb/hr)		1.78E-04		6.92E-04		1.71E-04		3.47E-04
Selenium									
Emission Concentration Front-Half	(mg/DSCM)		9.30E-04	<	6.70E-04		1.01E-03	<	8.70E-04
Emission Concentration Back-Half	(mg/DSCM)		1.59E-02		2.28E-03		3.29E-03		7.17E-03
Emission Rate Front-Half	(lb/hr)		5.75E-05	<	3.95E-05		5.69E-05	<	5.13E-05
Emission Rate Back-Half	(lb/hr)		9.85E-04		1.34E-04		1.85E-04		4.35E-04

Table 3. Dioxin/Furan Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/17/2016	10/18/2016	10/18/2016	
Start Time		11:51 AM	8:15 AM	12:45 PM	
End Time		3:40 PM	11:36 AM	4:07 PM	
Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	37,657	34,547	33,155	35,120
Flow Rate	(SCFM)	19,282	17,856	17,975	18,371
Flow Rate	(DSCFM)	16,264	15,527	15,126	15,639
Sample Volume	(DSCF)	154.6	142.7	138.9	145.4
Oxygen	(dry volume %)	10.58	9.85	9.79	10.07
Carbon Dioxide	(dry volume %)	4.79	4.99	5.13	4.97
Water Vapor	(volume %)	15.65	13.05	15.85	14.85
Stack Temperature	(°F)	540.2	526.5	480.5	515.7
Percent of Isokinetic Sampling	(%)	103.5	100.1	100.0	101.2
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	13	10	13	12.0
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,431	2,432	2,432	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	150.8	116	150.8	139.2
COG generated during test	(mmscf)	2.57	2.26	2.27	2.37
COG burned in boilers during test	(mmscf)	0.68	0.60	0.60	0.63
COG burned in batteries during test	(mmscf)	1.49	1.31	1.32	1.37
Results					
Dioxins and Furans					
TEF Mass Collected	(ng)	0.168	0.221	< 0.011	< 0.134
TEF Emission Concentration	(ng/m^3)	0.0384	0.0548	< 0.0029	< 0.0321
TEF Emission Rate	(ng/hr)	1,062	1,446	< 75	< 861
2,3,7,8-Tetrachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	6.9E-06	1.1E-05	< 8.9E-07	< 6.2E-06
	(raw lb/hr)	4.2E-10	6.4E-10	< 5.0E-11	< 3.7E-10
	(TEF µg/m^3)	6.9E-06	1.1E-05	< 8.9E-07	< 6.2E-06
	(TEF lb/hr)	4.2E-10	6.4E-10	< 5.0E-11	< 3.7E-10
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	7.8E-06	8.1E-06	< 8.9E-07	< 5.6E-06
	(raw lb/hr)	4.8E-10	4.7E-10	< 5.0E-11	< 3.3E-10
	(TEF µg/m^3)	3.9E-06	4.0E-06	< 4.4E-07	< 2.8E-06
	(TEF lb/hr)	2.4E-10	2.3E-10	< 2.5E-11	< 1.7E-10
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	5.6E-06	5.9E-06	< 8.6E-07	< 4.1E-06
	(raw lb/hr)	3.4E-10	3.4E-10	< 4.9E-11	< 2.4E-10
	(TEF µg/m^3)	5.6E-07	5.9E-07	< 8.6E-08	< 4.1E-07
	(TEF lb/hr)	3.4E-11	3.4E-11	< 4.9E-12	< 2.4E-11
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	1.3E-05	1.4E-05	< 8.6E-07	< 9.3E-06
	(raw lb/hr)	7.9E-10	8.1E-10	< 4.9E-11	< 5.5E-10
	(TEF µg/m^3)	1.3E-06	1.4E-06	< 8.6E-08	< 9.3E-07
	(TEF lb/hr)	7.9E-11	8.1E-11	< 4.9E-12	< 5.5E-11

Table 3. Dioxin/Furan Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2		Run 3		Average
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin							
	(raw μg/m^3)	6.9E-06	8.8E-06	<	7.9E-07	<	5.5E-06
	(raw lb/hr)	4.2E-10	5.1E-10	<	4.5E-11	<	3.3E-10
	(TEF μg/m^3)	6.9E-07	8.8E-07	<	7.9E-08	<	5.5E-07
	(TEF lb/hr)	4.2E-11	5.1E-11	<	4.5E-12	<	3.3E-11
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin							
	(raw μg/m^3)	4.0E-05	4.2E-05		1.4E-06		2.8E-05
	(raw lb/hr)	2.4E-09	2.5E-09		8.1E-11		1.7E-09
	(TEF μg/m^3)	4.0E-07	4.2E-07		1.4E-08		2.8E-07
	(TEF lb/hr)	2.4E-11	2.5E-11		8.1E-13		1.7E-11
2,3,7,8-Tetrachlorodibenzofuran							
	(raw μg/m^3)	7.8E-05	1.3E-04		3.7E-06		7.0E-05
	(raw lb/hr)	4.8E-09	7.5E-09		2.1E-10		4.2E-09
	(TEF μg/m^3)	7.8E-06	1.3E-05		3.7E-07		7.0E-06
	(TEF lb/hr)	4.8E-10	7.5E-10		2.1E-11		4.2E-10
1,2,3,7,8-Pentachlorodibenzofuran							
	(raw μg/m^3)	1.9E-05	2.2E-05		1.5E-06		1.4E-05
	(raw lb/hr)	1.1E-09	1.3E-09		8.4E-11		8.4E-10
	(TEF μg/m^3)	9.3E-07	1.1E-06		7.4E-08		7.1E-07
	(TEF lb/hr)	5.7E-11	6.5E-11		4.2E-12		4.2E-11
2,3,4,7,8-Pentachlorodibenzofuran							
	(raw μg/m^3)	2.2E-05	3.3E-05	<	9.7E-07	<	1.9E-05
	(raw lb/hr)	1.3E-09	1.9E-09	<	5.5E-11	<	1.1E-09
	(TEF μg/m^3)	1.1E-05	1.7E-05	<	4.8E-07	<	9.3E-06
	(TEF lb/hr)	6.6E-10	9.7E-10	<	2.7E-11	<	5.5E-10
1,2,3,4,7,8-Hexachlorodibenzofuran							
	(raw μg/m^3)	1.7E-05	1.7E-05	<	8.4E-07	<	1.2E-05
	(raw lb/hr)	1.0E-09	9.9E-10	<	4.8E-11	<	6.9E-10
	(TEF μg/m^3)	1.7E-06	1.7E-06	<	8.4E-08	<	1.2E-06
	(TEF lb/hr)	1.0E-10	9.9E-11	<	4.8E-12	<	6.9E-11
1,2,3,6,7,8-Hexachlorodibenzofuran							
	(raw μg/m^3)	1.5E-05	1.7E-05	<	8.1E-07	<	1.1E-05
	(raw lb/hr)	9.0E-10	9.8E-10	<	4.6E-11	<	6.4E-10
	(TEF μg/m^3)	1.5E-06	1.7E-06	<	8.1E-08	<	1.1E-06
	(TEF lb/hr)	9.0E-11	9.8E-11	<	4.6E-12	<	6.4E-11
2,3,4,6,7,8-Hexachlorodibenzofuran							
	(raw μg/m^3)	1.5E-05	1.9E-05	<	8.9E-07	<	1.2E-05
	(raw lb/hr)	9.2E-10	1.1E-09	<	5.0E-11	<	6.9E-10
	(TEF μg/m^3)	1.5E-06	1.9E-06	<	8.9E-08	<	1.2E-06
	(TEF lb/hr)	9.2E-11	1.1E-10	<	5.0E-12	<	6.9E-11
1,2,3,7,8,9-Hexachlorodibenzofuran							
	(raw μg/m^3)	1.1E-06	1.5E-06	<	9.4E-07	<	1.2E-06
	(raw lb/hr)	6.7E-11	8.8E-11	<	5.3E-11	<	6.9E-11
	(TEF μg/m^3)	1.1E-07	1.5E-07	<	9.4E-08	<	1.2E-07
	(TEF lb/hr)	6.7E-12	8.8E-12	<	5.3E-12	<	6.9E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran							
	(raw μg/m^3)	3.5E-05	3.5E-05		1.5E-06		2.4E-05
	(raw lb/hr)	2.1E-09	2.0E-09		8.4E-11		1.4E-09
	(TEF μg/m^3)	3.5E-07	3.5E-07		1.5E-08		2.4E-07
	(TEF lb/hr)	2.1E-11	2.0E-11		8.4E-13		1.4E-11
1,2,3,4,7,8,9-Heptachlorodibenzofuran							
	(raw μg/m^3)	4.3E-06	3.8E-06	<	9.4E-07	<	3.0E-06
	(raw lb/hr)	2.6E-10	2.2E-10	<	5.3E-11	<	1.8E-10
	(TEF μg/m^3)	4.3E-08	3.8E-08	<	9.4E-09	<	3.0E-08
	(TEF lb/hr)	2.6E-12	2.2E-12	<	5.3E-13	<	1.8E-12

Table 4. Semi-Volatile Organics Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/17/2016	10/18/2016	10/18/2016	
Start Time		11:51 AM	8:15 AM	12:45 PM	
End Time		3:40 PM	11:36 AM	4:07 PM	
Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	37,657	34,547	33,155	35,120
Flow Rate	(SCFM)	19,282	17,856	17,975	18,371
Flow Rate	(DSCFM)	16,264	15,527	15,126	15,639
Sample Volume	(DSCF)	154.6	142.7	138.9	145.4
Oxygen	(dry volume %)	10.58	9.85	9.79	10.07
Carbon Dioxide	(dry volume %)	4.79	4.99	5.13	4.97
Water Vapor	(volume %)	15.65	13.05	15.85	14.85
Stack Temperature	(°F)	540.2	526.5	480.5	515.7
Percent of Isokinetic Sampling	(%)	103.5	100.1	100.0	101.2
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	13	10	13	12.0
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,430	2,434	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	150.8	116	150.8	139.2
COG generated during test	(mmscf)	2.57	2.26	2.27	2.37
COG burned in boilers during test	(mmscf)	0.68	0.60	0.60	0.63
COG burned in batteries during test	(mmscf)	1.49	1.31	1.32	1.37
Results					
Semi-Volatiles					
Acenaphthene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0046	< 0.0050	< 0.0051	< 0.0049
Emission Rate	(lb/hr)	< 2.8E-04	< 2.9E-04	< 2.9E-04	< 2.8E-04
Acenaphthylene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0046	< 0.0050	< 0.0051	< 0.0049
Emission Rate	(lb/hr)	< 2.8E-04	< 2.9E-04	< 2.9E-04	< 2.8E-04
Anthracene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0046	< 0.0050	< 0.0051	< 0.0049
Emission Rate	(lb/hr)	< 2.8E-04	< 2.9E-04	< 2.9E-04	< 2.8E-04
Benz[a]anthracene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0046	< 0.0050	< 0.0051	< 0.0049
Emission Rate	(lb/hr)	< 2.8E-04	< 2.9E-04	< 2.9E-04	< 2.8E-04
Benzo[a]pyrene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0046	< 0.0050	< 0.0051	< 0.0049
Emission Rate	(lb/hr)	< 2.8E-04	< 2.9E-04	< 2.9E-04	< 2.8E-04
Benzo[b]fluoranthene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0046	< 0.0050	< 0.0051	< 0.0049
Emission Rate	(lb/hr)	< 2.8E-04	< 2.9E-04	< 2.9E-04	< 2.8E-04

Table 4. Semi-Volatile Organics Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 2		Run 3		Average
Benzo[g,h,i]perylene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	0.0003	<	0.0003	<	0.0003	<	0.0003
Benzo[k]fluoranthene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.00457	<	0.00495	<	0.00509	<	0.00487
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Chrysene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Dibenz[a,h]anthracene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Fluoranthene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Fluorene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Indeno (1,2,3-cd) pyrene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Naphthalene									
Mass Collected	(ug)		71.0		116.0		78.0		88.3
Emission Concentration	(mg/m^3)		0.0162		0.0287		0.0198		0.0216
Emission Rate	(lb/hr)		9.9E-04		1.7E-03		1.1E-03		1.3E-03
Phenanthrene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04
Perylene									
Mass Collected	(ug)	<	5.0	<	5.0	<	5.0	<	5.0
Emission Concentration	(mg/m^3)	<	0.0011	<	0.0012	<	0.0013	<	0.0012
Emission Rate	(lb/hr)	<	7.0E-05	<	7.2E-05	<	7.2E-05	<	7.1E-05
Pyrene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0046	<	0.0050	<	0.0051	<	0.0049
Emission Rate	(lb/hr)	<	2.8E-04	<	2.9E-04	<	2.9E-04	<	2.8E-04

Table 5. Formaldehyde Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/20/2016	10/20/2016	10/20/2016	
Start Time		8:42 AM	12:15 PM	3:47 PM	
End Time		11:18 AM	3:21 PM	6:05 PM	
Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)	36,642	36,725	35,941	36,436
Flow Rate	(SCFM)	18,654	18,714	18,364	18,577
Flow Rate	(DSCFM)	15,636	15,959	15,535	15,710
Sample Volume	(DSCF)	39.1	40.3	40.5	40.0
Oxygen	(dry volume %)	9.65	10.54	9.98	10.06
Carbon Dioxide	(dry volume %)	5.28	4.85	5.51	5.21
Water Vapor	(volume %)	16.18	14.72	15.41	15.44
Stack Temperature	(°F)	544.4	543.7	540.7	542.9
Percent of Isokinetic Sampling	(%)	104.7	105.6	109.0	106.4
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		9	10	11	10
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,434	2,431	2,434	2,433
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	104.4	116	127.6	116.0
COG generated during test	(mmscf)	1.75	2.09	1.55	1.80
COG burned in boilers during test	(mmscf)	0.47	0.55	0.41	0.48
COG burned in batteries during test	(mmscf)	1.02	1.21	0.90	1.04
Results					
Formaldehyde					
Emission Mass	(mg)	< 0.010	< 0.011	< 0.012	< 0.011
Emission Concentration	(mg/DSCM)	< 0.0090	< 0.0096	< 0.0105	< 0.0097
Emission Rate	(lb/hr)	< 0.00053	< 0.00058	< 0.00061	< 0.00057

Table 6. Speciated Volatile Organic Compound Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/20/16	10/20/16	10/20/16	
Start Time		8:42 AM	12:15 PM	3:47 PM	
End Time		11:21 AM	3:18 PM	6:15 PM	
Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)	36,645	36,726	35,944	36,438
Flow Rate	(SCFM)	18,656	18,714	18,366	18,579
Flow Rate	(DSCFM)	15,629	15,953	15,529	15,704
VOST Sample Volume	(Liters, dry standard)	53.80	53.17	54.95	53.97
Carbon Dioxide (CO_2)	(dry volume %)	5.27	4.88	5.51	5.22
Oxygen (O_2)	(dry volume %)	9.65	10.49	9.98	10.04
Water Vapor (H_2O)	(volume %)	16.22	14.76	15.45	15.47
Stack Temperature	(°F)	544.4	543.7	540.7	542.9
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		9	10	11	10
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,434	2,431	2,434	2,433
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	104.4	116	127.6	116.0
COG generated during test	(mmscf)	1.79	2.06	1.66	1.83
COG burned in boilers during test	(mmscf)	0.47	0.55	0.44	0.49
COG burned in batteries during test	(mmscf)	1.04	1.19	0.96	1.06
Semi-volatile Results					
Acrylonitrile (107-13-1)					
Emission Mass Collected	(µg)[1]	< 0.025	< 0.025	< 0.025	< 0.025
Emission Concentration	(mg/DSCM)	< 0.00046	< 0.00047	< 0.00045	< 0.00046
Emission Rate	(lb/hr)	< 0.000027	< 0.000017	< 0.000017	< 0.000020
Benzene					
Emission Mass Collected	(µg)[1]	0.33	0.39	0.19	0.30
Emission Concentration	(mg/DSCM)	0.0061	0.0073	0.0034	0.0056
Emission Rate	(lb/hr)	0.00036	0.00026	0.00013	0.00025
Bromoform (75-25-2)					
Emission Mass Collected	(µg)[1]	< 0.014	< 0.014	< 0.014	< 0.014
Emission Concentration	(mg/DSCM)	< 0.00026	< 0.00026	< 0.00025	< 0.00026
Emission Rate	(lb/hr)	< 0.000015	< 0.000009	< 0.000010	< 0.000011
Bromomethane (74-83-9)					
Emission Mass Collected	(µg)[1]	< 0.015	< 0.015	< 0.015	< 0.015
Emission Concentration	(mg/DSCM)	< 0.00028	< 0.00028	< 0.00027	< 0.00028
Emission Rate	(lb/hr)	< 0.000016	< 0.000010	< 0.000010	< 0.000012
Carbon disulfide (75-15-0)					
Emission Mass Collected	(µg)[1]	< 0.026	< 0.026	< 0.026	< 0.026
Emission Concentration	(mg/DSCM)	< 0.00048	< 0.00049	< 0.00047	< 0.00048
Emission Rate	(lb/hr)	< 0.000028	< 0.000017	< 0.000018	< 0.000021
Carbon tetrachloride (56-23-5)					
Emission Mass Collected	(µg)[1]	< 0.016	< 0.016	< 0.016	< 0.016
Emission Concentration	(mg/DSCM)	< 0.00030	< 0.00030	< 0.00029	< 0.00030
Emission Rate	(lb/hr)	< 0.000017	< 0.000011	< 0.000011	< 0.000013
Chlorobenzene (108-90-7)					
Emission Mass Collected	(µg)[1]	< 0.011	< 0.011	< 0.011	< 0.011
Emission Concentration	(mg/DSCM)	< 0.00020	< 0.00021	< 0.00020	< 0.00020
Emission Rate	(lb/hr)	< 0.000012	< 0.000007	< 0.000008	< 0.000009
Chloroethane (75-00-3)					
Emission Mass Collected	(µg)[1]	< 0.009	< 0.009	< 0.009	< 0.009
Emission Concentration	(mg/DSCM)	< 0.00017	< 0.00017	< 0.00016	< 0.00017
Emission Rate	(lb/hr)	< 0.000010	< 0.000006	< 0.000006	< 0.000007
Chloroform (67-66-3)					
Emission Mass Collected	(µg)[1]	< 0.011	< 0.011	< 0.011	< 0.011
Emission Concentration	(mg/DSCM)	< 0.00020	< 0.00021	< 0.00020	< 0.00020
Emission Rate	(lb/hr)	< 0.000012	< 0.000007	< 0.000008	< 0.000009
Chloromethane (74-87-3)					
Emission Mass Collected	(µg)[1]	< 0.018	< 0.019	< 0.017	< 0.018
Emission Concentration	(mg/DSCM)	< 0.00033	< 0.00036	< 0.00030	< 0.00033
Emission Rate	(lb/hr)	< 0.000019	< 0.000013	< 0.000012	< 0.000015

Table 6. Speciated Volatile Organic Compound Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 2		Run 3		Average
1,2-Dichloroethane (107-06-2)									
Emission Mass Collected	(µg)[1]	<	0.007	<	0.007	<	0.007	<	0.007
Emission Concentration	(mg/DSCM)	<	0.00013	<	0.00013	<	0.00013	<	0.00013
Emission Rate	(lb/hr)	<	0.000008	<	0.000005	<	0.000005	<	0.000006
1,1-Dichloroethene (75-35-4)									
Emission Mass Collected	(µg)[1]	<	0.011	<	0.011	<	0.011	<	0.011
Emission Concentration	(mg/DSCM)	<	0.00020	<	0.00021	<	0.00020	<	0.00020
Emission Rate	(lb/hr)	<	0.000012	<	0.000007	<	0.000008	<	0.000009
1,2-Dichloropropane (78-87-5)									
Emission Mass Collected	(µg)[1]	<	0.011	<	0.011	<	0.011	<	0.011
Emission Concentration	(mg/DSCM)	<	0.00020	<	0.00021	<	0.00020	<	0.00020
Emission Rate	(lb/hr)	<	0.000012	<	0.000007	<	0.000008	<	0.000009
Ethylbenzene (100-41-4)									
Emission Mass Collected	(µg)[1]	<	0.065	<	0.030	<	0.028	<	0.041
Emission Concentration	(mg/DSCM)	<	0.00120	<	0.00056	<	0.00052	<	0.00076
Emission Rate	(lb/hr)	<	0.000070	<	0.000020	<	0.000020	<	0.000037
Iodomethane (74-88-4)									
Emission Mass Collected	(µg)[1]	<	0.015	<	0.015	<	0.015	<	0.015
Emission Concentration	(mg/DSCM)	<	0.00028	<	0.00028	<	0.00027	<	0.00028
Emission Rate	(lb/hr)	<	0.000016	<	0.000010	<	0.000010	<	0.000012
Methylene chloride (75-09-2)									
Emission Mass Collected	(µg)[1]	<	0.136	<	0.020	<	0.037	<	0.064
Emission Concentration	(mg/DSCM)	<	0.0025	<	0.0004	<	0.0007	<	0.0012
Emission Rate	(lb/hr)	<	0.000147	<	0.000013	<	0.000026	<	0.000062
Styrene (100-42-5)									
Emission Mass Collected	(µg)[1]	<	0.135		0.025	<	0.013	<	0.058
Emission Concentration	(mg/DSCM)	<	0.0025		0.0005	<	0.0002	<	0.0011
Emission Rate	(lb/hr)	<	0.000146		0.000017	<	0.000009	<	0.000057
1,1,2,2-Tetrachloroethane (79-34-5)									
Emission Mass Collected	(µg)[1]	<	0.014	<	0.014	<	0.014	<	0.014
Emission Concentration	(mg/DSCM)	<	0.00026	<	0.00026	<	0.00025	<	0.00026
Emission Rate	(lb/hr)	<	0.000015	<	0.000009	<	0.000010	<	0.000011
Tetrachloroethene (127-18-4)									
Emission Mass Collected	(µg)[1]	<	0.018	<	0.018	<	0.018	<	0.018
Emission Concentration	(mg/DSCM)	<	0.00033	<	0.00034	<	0.00033	<	0.00033
Emission Rate	(lb/hr)	<	0.000019	<	0.000012	<	0.000013	<	0.000015
Toluene (108-88-3)									
Emission Mass Collected	(µg)[1]		0.32		0.18		0.42		0.30
Emission Concentration	(mg/DSCM)		0.0060		0.0033		0.0076		0.0056
Emission Rate	(lb/hr)		0.00035		0.00012		0.00029		0.00025
1,1,1-Trichloroethane (71-55-6)									
Emission Mass Collected	(µg)[1]	<	0.014	<	0.014	<	0.014	<	0.014
Emission Concentration	(mg/DSCM)	<	0.00026	<	0.00026	<	0.00017	<	0.00023
Emission Rate	(lb/hr)	<	0.000015	<	0.000009	<	0.000010	<	0.000011
1,1,2-Trichloroethane (79-00-5)									
Emission Mass Collected	(µg)[1]	<	0.016	<	0.016	<	0.016	<	0.016
Emission Concentration	(mg/DSCM)	<	0.00030	<	0.00030	<	0.00029	<	0.00030
Emission Rate	(lb/hr)	<	0.000017	<	0.000011	<	0.000011	<	0.000013
Trichloroethene (79-01-6)									
Emission Mass Collected	(µg)[1]	<	0.011	<	0.011	<	0.011	<	0.011
Emission Concentration	(mg/DSCM)	<	0.00020	<	0.00021	<	0.00020	<	0.00020
Emission Rate	(lb/hr)	<	0.000012	<	0.000007	<	0.000008	<	0.000009
Vinyl chloride (75-01-4)									
Emission Mass Collected	(µg)[1]	<	0.013	<	0.013	<	0.013	<	0.013
Emission Concentration	(mg/DSCM)	<	0.00024	<	0.00024	<	0.00024	<	0.00024
Emission Rate	(lb/hr)	<	0.000014	<	0.000009	<	0.000009	<	0.000011
Xylenes (total) (1330-20-7)									
Emission Mass Collected	(µg)[1]		0.36	<	0.08		0.38	<	0.27
Emission Concentration	(mg/DSCM)		0.0067	<	0.0014		0.0069	<	0.0050
Emission Rate	(lb/hr)		0.00039	<	0.00005		0.00026	<	0.00024

[1] Due to the presence of an elevated hit of toluene on the field train blank condensate sample, only tube fractions reported

Table 7. Gaseous Emissions Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/20/16	10/20/16	10/20/16	
Start Time		8:42 AM	12:15 PM	3:47 PM	
End Time		11:18 AM	3:21 PM	6:05 PM	
Test Duration	(minutes)	120	120	120	
Flow Rate	(ACFM)	36,645	36,726	35,891	36,421
Flow Rate	(SCFM)	18,656	18,714	18,393	18,588
Flow Rate	(DSCFM)	15,629	15,953	15,552	15,711
Sample Volume	(DSCF)	39.0	40.2	40.3	39.8
Oxygen (O_2)	(dry volume %)	9.65	10.49	9.98	10.04
Carbon Dioxide (CO_2)	(dry volume %)	5.27	4.88	5.51	5.22
Water Vapor (H_2O)	(volume %)	16.22	14.76	15.45	15.47
Stack Temperature	(°F)	544.4	543.7	540.7	542.9
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	9	10	11	10.0
Average coking time per oven(s) teste	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,434	2,431	2,434	2,433
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	104.4	116	127.6	116.0
COG generated during test	(mmscf)	1.75	2.09	1.55	1.80
COG burned in boilers during test	(mmscf)	0.47	0.55	0.41	0.48
COG burned in batteries during test	(mmscf)	1.02	1.21	0.90	1.04
Results					
Hydrogen Sulfide (H_2S)					
Emission Concentration	(ppm_{wv})	< 0.50	< 0.50	< 0.50	< 0.50
Emission Concentration	(ppm_{dv})	< 0.60	< 0.59	< 0.59	< 0.59
Emission Rate	(lb/hr)	< 0.050	< 0.050	< 0.049	< 0.049
Carbon Dioxide (CO2)					
Emission Concentration	(ppm_{dv})	52,724	48,800	55,063	NA
Emission Rate	(g/hr)	2,561,082	2,419,526	2,661,355	NA
Emission Rate	(lb/hr)	5,646	5,334	5,867	NA
Emission Rate	(tons/hr)	2.8	2.7	2.9	NA

CEM results have been bias calibration corrected.

Table 8. Acidic Gas Emissions Test Results, Battery #2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/19/16	10/19/16	10/19/16	
Start Time		8:25 AM	11:22 AM	2:02 PM	
End Time		9:25 AM	12:22 PM	3:02 PM	
Flow Rate	(ACFM)	32,138	34,774	34,617	33,843
Flow Rate	(SCFM)	18,451	18,059	17,615	18,041
Flow Rate	(DSCFM)	16,492	15,740	15,035	15,756
Sample Volume	(DSCF)	110.1	105.3	108.5	108.0
Oxygen (O_2)	(dry volume %)	9.98	10.82	10.53	10.44
Carbon Dioxide (CO_2)	(dry volume %)	5.19	4.74	5.00	4.97
Water Vapor (H_2O)	(volume %)	10.62	12.84	14.65	12.70
Stack Temperature	(°F)	432.4	526.0	546.3	501.5
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	5	5	5	5
Average coking time per oven(s) teste	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,433	2,431	2,432	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	58	58	58	58.0
COG generated during test	(mmscf)	0.67	0.67	0.67	0.67
COG burned in boilers during test	(mmscf)	0.18	0.18	0.18	0.18
COG burned in batteries during test	(mmscf)	0.39	0.39	0.39	0.39
Results					
Hydrogen Flouride (HF)					
Emission Concentration	(ppm_{wv})	< 0.052	< 0.053	< 0.053	< 0.052
Emission Concentration	(ppm_{dv})	< 0.058	< 0.060	< 0.062	< 0.060
Emission Concentration	(mg/dscm)	< 0.052	< 0.054	< 0.055	< 0.054
Emission Rate	(lb/hr)	< 0.003	< 0.003	< 0.002	< 0.0026
Hydrogen Cyanide (HCN)					
Emission Concentration	(ppm_{wv})	< 0.41	< 0.41	< 0.41	< 0.41
Emission Concentration	(ppm_{dv})	< 0.45	< 0.47	< 0.48	< 0.47
Emission Concentration	(mg/dscm)	< 0.55	< 0.56	< 0.57	< 0.56
Emission Rate	(lb/hr)	< 0.03	< 0.03	< 0.03	< 0.03

CEM results have been bias calibration corrected.

Table 9. Static Process Data, Battery 2 Combustion Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Process Data	Units	
Emission Unit ID		805, Emission Point 3
Type of Process		Battery Stack 2
Type of Air Control Device		None
Latitude of Stack (5 decimal places)		40.16341
Longitue of Stack (5 decimal Places		-79.88632
Type of Coal Charged During Test		Metallurgical Bituminous Coal
Yearly COG Generated	(mmscf/yr)	5,904.1
Yearly COG burned in Batteries	(mmscf/yr)	3,426.9
Yearly COG burned in Boilers	(mmscf/yr)	1,567.8
Yearly Natural Gas burned in Batteries	(mmscf/yr)	133.9
Pushing period during testing	(minutes)	12
Charging period during testing	(minutes)	11
Higher Heating Value COG	(BTU/scf)	510
Higher Heating Value Natural Gas	(BTU/scf)	1,020

Table 10.

TABLE NOMENCLATURE

SYMBOL		DESCRIPTION	SYMBOL		DESCRIPTION	SYMBOL		DESCRIPTION
%	-	Percent	gpm	-	Gallons per minute	O_2	-	Oxygen
% Volume	-	Percent by volume	gr/DSCF	-	Grains per dry standard cubic feet	OSHA	-	Occupational Safety & Health Administration
°F	-	Degrees Fahrenheit	H_2O	-	Water	PADEP	-	PA Department of Environmental Protection
<	-	Less than	H_2SO_4	-	Sulfuric acid	Pb	-	Lead
>	-	Greater than	HAP	-	Hazardous air pollutant	PEL	-	Permissible exposure limit
AB	-	Acetone Blank	Hg	-	Mercury	PM	-	Particulate matter
ACFM	-	Actual cubic feet per minute	HI	-	Heat input	PM_{10}	-	Particulate matter less than 10 microns
BACT	-	Best Available Control Technology	Hp	-	Horsepower	ppb	-	Parts per billion
BHP	-	Brake horsepower	hr	-	Hour	PPE	-	Personal protective equipment
BTU	-	British thermal units	IC	-	Ion chromatography	ppm	-	Parts per million
BTU/scf	-	British thermal units per standard cubic feet	in H_2O	-	Inches of Water	ppm_{dv}	-	Parts per million, dry volume
C_3H_8	-	Propane	in Hg	-	Inches of Mercury	ppm_{wv}	-	Parts per million, wet volume
CE	-	Capture efficiency	Kg	-	Kilograms	psia	-	Pounds per square inch absolute
CEMS	-	Continuous emission monitor system	lb	-	Pound	psig	-	Pounds per square inch gauge
cf	-	Cubic foot	lb/hr	-	Pound per hour	PTI	-	Permit to Install
CFR	-	Code of Federal Regulations	lb/lb-mole	-	Pound per pound mole	PTE	-	Permanent total enclosure
CH_4	-	Methane	MACT	-	Maximum Achievable Control Technology	RA	-	Relative Accuracy
C_2H_6	-	Ethane	m^3	-	Cubic meters	RATA	-	Relative Accuracy Test Audit
Cl_2	-	Chlorine	MDL	-	Minimum detection limit	RM	-	Reference Method
CO	-	Carbon monoxide	mg	-	Milligrams	RMD	-	Relative mean difference
CO_2	-	Carbon dioxide	mg/g	-	Milligrams per gram	rpm	-	Revolutions per minute
COG	-	Coke oven gas	min	-	Minute	S	-	Sulfur
DACF	-	Dry actual cubic feet	mL	-	Milliliter	SCF	-	Standard cubic feet
DACM	-	Dry actual cubic meters	mm HG	-	Millimeters of mercury	SCFM	-	Standard cubic feet per minute
DE	-	Destruction efficiency	MMBtu	-	Million British thermal units	SCM	-	Standard cubic meters
DSCF	-	Dry standard cubic feet	MNOC	-	Maximum normal operating capacity	SO_2	-	Sulfur dioxide
DSCFM	-	Dry standard cubic feet per minute	MSDS	-	Material Safety Data Sheet	STD	-	Standard
FID	-	Flame Ionization Detector	MW	-	Megawatts	TEQ	-	Toxicity Equivalence Quotient
ft	-	Foot	N_2	-	Nitrogen	THC	-	Total hydrocarbons
ft/sec	-	Feet per second	ND	-	Non-detectable	tph	-	Tons per hour
Ft^2	-	Square feet	NDO	-	Natural draft opening	tpy	-	Tons per year
Ft^3	-	Cubic feet	NESHAP	-	National Emission Standard for Hazardous Air Pollutants	µg	-	Micrograms
ft^3/lb-mole	-	Cubic feet per pound mole	ng	-	Nanograms	USEPA	-	United States Environmental Protection Agency
g	-	Grams	NMEVOC	-	Non-methane, non-ethane volatile organic compounds	VE	-	Visible emissions
g/bhp-hr	-	Grams of brake horsepower per hour	NMVOC	-	Non-methane volatile organic compound	VOC	-	Volatile organic compound
g/mL	-	Gram per milliliter	NO_2	-	Nitrous Oxide	vol.	-	Volume
GC	-	Gas Chromatography	NO_x	-	Oxides of Nitrogen	w/o	-	With out

REPORT - APPENDIX A

Process Data

Combustion Stack

Emission Unit ID (same as Enclosure 1)	**805, Emission Point 3**
Type of Process	**Battery Stack 2**
Type of Air Control Device	**None**
Latitude of Stack (5 decimal places)	**40.16341**
Longitue of Stack (5 decimal Places	**-79.88632**
Type of Coal Charged During Test	**Metallurgical Bituminous Coal**
Yearly COG Generated (MMscf/year	**5,904.10**
Yearly COG burned in Batteries	**3,426.90**
Yearly COG burned in Boilers	**1,567.80**
Yearly Natural Gas burned in Batteries	**133.92**

Methods	*0010-23*	*0010-23*	*0010-23*

Test Data	Run 1				Run 2				Run 3			
Date	10/17/16				10/18/16				10/18/16			
Start Time	11:51 AM				8:15 AM				12:45 PM			
End Time	3:40 PM				11:36 AM				4:07 PM			
	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)	Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
Ovens Push	C17	16.19	2426	12	B6	16.19	2435	12	B20	16.19	2435	12
	B19	16.19	2435	12	C6	16.19	2435	12	C20	16.19	2426	12
	C19	16.19	2426	12	B8	16.19	2435	12	B22	16.19	2435	12
	B21	16.19	2435	12	C8	16.19	2435	12	C22	16.19	2426	12
	C21	16.19	2426	12	B10	16.19	2435	12	B24	16.19	2435	12
	B23	16.19	2435	12	C10	16.19	2426	12	C24	16.19	2426	12
	C23	16.19	2426	12	B12	16.19	2435	12	B26	16.19	2435	12
	B25	16.19	2435	12	C12	16.19	2426	12	C26	16.19	2426	12
	C25	16.19	2426	12	B14	16.19	2435	12	B28	16.19	2435	12
	B27	16.19	2435	12	C14	16.19	2426	12	B1	16.19	2435	12
	C27	16.19	2426	12					C1	16.19	2435	12
	B29	16.19	2435	12					B3	16.19	2435	12
	B2	16.19	2435	12					C3	16.19	2435	12
Total # Pushed	13	16.19	2430.8	12.0	10	16.19	2432.3	12.0	13	16.19	2432.2	12.0
				Charging Time (min)				Charging Time (min)				Charging Time (min)
Ovens Charged	C17		1201	11	B6		824	11	B20		1259	11
	B19		1213	11	C6		837	11	C20		1310	11
	C19		1225	11	B8		852	11	B22		1322	11
	B21		1318	11	C8		906	11	C22		1337	11
	C21		1330	11	B10		925	11	B24		1350	11
	B23		1341	11	C10		1038	11	C24		1404	11
	C23		1353	11	B12		1051	11	B26		1419	11
	B25		1405	11	C12		1104	11	C26		1433	11
	C25		1416	11	B14		1118	11	B28		1445	11
	B27		1428	11	C14		1132	11	B1		1459	11
	C27		1438	11					C1		1536	11
	B29		1450	11					B3		1547	11
	B2		1501	11					C3		1602	11
Coke Produced During test (tons)	150.8				116				150.8			
Avg. Coal Processed/Oven During test(	16.2				16.2				16.2			
Higher Heating Value COG	510				510				510			
Higher Heating Value of N.G.	1020				1020				1020			

Methods 5 and 29
Method 320

Run 1

10/19/16
8:25 AM
10:48 AM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B5	16.19	2435	12
C5	16.19	2435	12
B7	16.19	2435	12
C7	16.19	2435	12
B9	16.19	2435	12
C9	16.19	2426	12
B11	16.19	2435	12
C11	16.19	2426	12
8	16.19	2432.8	12.0

		Charging Time (min)
B5	825	11
C5	839	11
B7	854	11
C7	907	11
B9	921	11
C9	933	11
B11	1036	11
C11	1050	11

92.8
16.2
510
1020

Methods 5 and 29
Method 320

Run 2

10/19/16
11:22 AM
1:44 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B15	16.19	2435	12
C15	16.19	2426	12
B17	16.19	2435	12
C17	16.19	2426	12
B19	16.19	2435	12
C19	16.19	2426	12
B21	16.19	2435	12
C21	16.19	2426	12
8	16.19	2430.5	12.0

		Charging Time (min)
B15	1130	11
C15	1143	11
B17	1156	11
C17	1209	11
B19	1221	11
C19	1234	11
B21	1324	11
C21	1338	11

92.8
16.2
510
1020

Methods 5 and 29
Method 320

Run 3

10/19/16
2:02 PM
4:21 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
C23	16.19	2426	12
B25	16.19	2435	12
C25	16.19	2426	12
B27	16.19	2435	12
C27	16.19	2426	12
B29	16.19	2435	12
B2	16.19	2435	12
C2	16.19	2435	12
8	16.19	2431.6	12.0

		Charging Time (min)
C23	1403	11
B25	1416	11
C25	1429	11
B27	1442	11
C27	1455	11
B29	1541	11
B2	1612	11
C2	1626	11

92.8
16.2
510
1020

Methods 0031 and 316
Method 3A, 15

Methods 0031 and 316
Method 3A, 15

Methods 0031 and 316
Method 3A, 15

Run 1

10/20/16
8:42 AM
11:18 AM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
C4	16.19	2435	12
B6	16.19	2435	12
C6	16.19	2435	12
B8	16.19	2435	12
C8	16.19	2435	12
B10	16.19	2435	12
C10	16.19	2435	12
B12	16.19	2435	12
C12	16.19	2426	12
9	16.19	2434.0	12.0

		Charging Time (min)
C4	859	11
B6	913	11
C6	927	11
B8	940	11
C8	951	11
B10	1004	11
C10	1056	11
B12	1109	11
C12	1121	11

104.4
16.2
510
1020

Run 2

10/20/16
12:15 PM
3:21 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B18	16.19	2435	12
C18	16.19	2426	12
B20	16.19	2435	12
C20	16.19	2426	12
B22	16.19	2435	12
C22	16.19	2426	12
B24	16.19	2435	12
C24	16.19	2426	12
B26	16.19	2435	12
C26	16.19	2426	12
10	16.19	2430.5	12.0

		Charging Time (min)
B18	1226	11
C18	1239	11
B20	1327	11
C20	1344	11
B22	1402	11
C22	1418	11
B24	1435	11
C24	1449	11
B26	1505	11
C26	1519	11

116
16.2
510
1020

Run 3

10/20/16
3:47 PM
6:05 PM

Oven ID	Coking Time (hrs)	Avg. Temp (°F)	Pushing Period (minutes)
B28	16.19	2435	12
B1	16.19	2435	12
C1	16.19	2435	12
B3	16.19	2435	12
C3	16.19	2435	12
B5	16.19	2435	12
C5	16.19	2435	12
B7	16.19	2435	12
C7	16.19	2435	12
B9	16.19	2435	12
C9	16.19	2426	12
11	16.19	2434.2	12.0

		Charging Time (min)
B28	1541	11
B1	1620	11
C1	1632	11
B3	1642	11
C3	1655	11
B5	1705	11
C5	1717	11
B7	1729	11
C7	1745	11
B9	1757	11
C9	1810	11

127.6
16.2
510
1020

Battery1B

Date (Mo/day/yr)	Inspector	Hours Required for Inspection	Administrative Hours	Time In	Time Out	No. of ovens not operable	No. of doors not observed	No. of door leaks - yard	No. of door leaks - bench	No. of lids not observed	No. of lids leaks	No. of offtakes not observed	No. of offtake leaks	SECONDS OF CHARGING EMISSIONS Charge 1	Charge 2	Charge 3	Charge 4	Charge 5
10/1/2016	GB	2	0.25	10:00	12:05	0	0	2	0	4	0	2	0	5.5	6.5	6	6.5	5.5
10/2/2016	GB	2	0.25	15:15	17:10	0	0	2	0	8	0	4	0	5.5	6	6.5	6	5
10/3/2016	BD	3	0.25	7:15	10:15	0	0	0	0	0	0	0	0	4.5	6	5	5.5	4
10/4/2016	BD	2.25	0.25	7:35	9:50	0	0	0	0	8	0	4	1	5.5	7.5	12.5	6.5	11
10/5/2016	BD	2.5	0.25	7:40	10:05	0	0	0	0	8	0	4	1	4.5	9	6.5	9	6
10/6/2016	BD	2.5	0.25	7:55	10:30	0	0	0	0	8	0	4	0	7	9.5	5.5	5	8
10/7/2016	BD	2.5	0.25	8:15	10:55	0	0	0	0	4	0	2	0	5	4.5	6	3.5	5
10/8/2016	BD	2.25	0.25	8:25	10:45	0	0	1	0	4	0	2	0	5	3.5	8.5	4	4
10/9/2016	BD	2.25	0.25	6:35	8:45	0	0	0	0	4	0	2	0	5	5.5	4.5	8	7
10/10/2016	BD	2.25	0.25	8:05	10:20	0	0	0	0	4	0	2	0	5	7.5	12	6.5	6
10/11/2016	GB	2.25	0.25	9:15	11:35	0	0	1	0	4	0	2	0	18.5	10.5	6.5	6	6
10/12/2016	GB	2.5	0.25	7:10	9:40	0	0	1	0	4	0	2	0	5	6	6.5	6.5	5.5
10/13/2016	GB	2.5	0.25	7:15	9:45	0	0	0	0	4	0	2	0	6	6.5	5.5	7.5	6
10/14/2016	GB	1.75	0.25	9:40	11:30	0	0	0	0	4	0	2	0	6	7.5	6.5	7	6
10/15/2016	GB	2.5	0.25	7:15	9:45	0	0	1	0	4	0	2	1	6	5.5	6.5	6	5.5
10/16/2016	GB	2.25	0.25	7:30	9:50	0	0	0	0	4	0	2	1	5.5	6.5	6	5.5	6.5
10/17/2016	GB	2.25	0.25	7:15	9:30	0	0	1	0	8	0	4	0	6.5	5	6.5	5.5	6
10/18/2016	GB	2.5	0.25	9:45	12:10	0	0	0	0	4	0	2	0	5.5	6.5	6	7.5	6
10/19/2016	BD	1.75	0.25	6:50	9:30	0	0	0	0	12	0	6	0	4	4.5	3.5	4	5
10/20/2016	BD	2	0.25	7:50	9:50	0	0	0	0	12	0	6	1	5.5	4	10.5	3	9
10/21/2016	BD	2.25	0.25	7:35	9:50	0	0	0	0	12	0	6	0	6	4.5	4.5	7	5
10/22/2016	BD	2.25	0.25	7:30	9:50	0	0	0	0	12	0	6	0	5	8.5	5.5	5	6
10/23/2016	BD	2.5	0.25	7:25	10:00	0	0	0	0	0	0	0	0	5.5	5	4	4.5	5
10/24/2016	BD	2.5	0.25	8:05	10:30	0	0	0	0	0	0	0	0	8.5	6.5	4	6	11
10/25/2016	GB	2.5	0.25	11:15	13:45	0	0	0	0	8	0	4	0	6	6.5	5.5	6	6.5
10/26/2016	GB	2.5	0.25	7:10	9:40	0	0	2	0	4	0	2	1	5.5	8.5	6	5.5	7.5
10/27/2016	GB	2.25	0.25	11:30	13:45	0	0	1	0	8	0	4	0	8	6	6	6.5	6.5
10/28/2016	GB	2.25	0.25	7:15	9:45	0	0	0	0	4	0	2	0	6.5	6	5	6.5	5.5
10/29/2016	GB	2.25	0.25	10:45	12:55	0	0	1	0	4	0	2	0	5.5	6.5	5.5	6	6
10/30/2016	GB	2.5	0.25	7:20	9:55	0	0	0	0	4	0	2	0	7	6	6	5.5	8.5
10/31/2016	GB	2.5	0.25	15:15	17:45	0	0	0	0	4	0	2	0	9.5	6	6.5	7.5	6

DATE Month	Sum of 1st 4 charges	No. of charges	Log avg. charges (s)	Percent leaking Doors	Lids	Offtakes	No. of charges	Log avg. charges (s)	30-run rolling average Doors (%)	Lids (%)	Offtakes (%)
10/1/16	24.5	5	5.99	2.70	0.00	0.00	150	6.53	0.36	0.00	0.56
10/2/16	24.0	5	5.78	2.70	0.00	0.00	150	6.46	0.45	0.00	0.51
10/3/16	21.0	5	4.96	0.00	0.00	0.00	150	6.40	0.45	0.00	0.51
10/4/16	32.0	5	8.23	0.00	0.00	1.43	150	6.43	0.41	0.00	0.58
10/5/16	29.0	5	6.80	0.00	0.00	1.43	150	6.44	0.41	0.00	0.61
10/6/16	27.0	5	6.83	0.00	0.00	0.00	150	6.47	0.41	0.00	0.61
10/7/16	19.0	5	4.74	0.00	0.00	0.00	150	6.43	0.41	0.00	0.56
10/8/16	21.0	5	4.77	1.35	0.00	0.00	150	6.35	0.45	0.00	0.52
10/9/16	23.0	5	5.88	0.00	0.00	0.00	150	6.42	0.45	0.00	0.52
10/10/16	31.0	5	7.10	0.00	0.00	0.00	150	6.46	0.45	0.00	0.52
10/11/16	41.5	5	8.62	1.35	0.00	0.00	150	6.50	0.50	0.00	0.47
10/12/16	24.0	5	5.87	1.35	0.00	0.00	150	6.51	0.54	0.00	0.47
10/13/16	25.5	5	6.27	0.00	0.00	0.00	150	6.50	0.54	0.00	0.47
10/14/16	27.0	5	6.58	0.00	0.00	0.00	150	6.51	0.54	0.00	0.42
10/15/16	24.0	5	5.89	1.35	0.00	1.39	150	6.50	0.54	0.00	0.42
10/16/16	23.5	5	5.99	0.00	0.00	1.39	150	6.49	0.50	0.00	0.47
10/17/16	23.5	5	5.87	1.35	0.00	0.00	150	6.46	0.54	0.00	0.47
10/18/16	25.5	5	6.27	0.00	0.00	0.00	150	6.44	0.54	0.00	0.42
10/19/16	16.0	5	4.18	0.00	0.00	0.00	150	6.39	0.50	0.00	0.42
10/20/16	23.0	5	5.84	0.00	0.00	1.47	150	6.34	0.50	0.00	0.42
10/21/16	22.0	5	5.33	0.00	0.00	0.00	150	6.21	0.50	0.00	0.42
10/22/16	24.0	5	5.89	0.00	0.00	0.00	150	6.18	0.50	0.00	0.42
10/23/16	19.0	5	4.78	0.00	0.00	0.00	150	6.13	0.50	0.00	0.42
10/24/16	25.0	5	6.86	0.00	0.00	0.00	150	6.11	0.50	0.00	0.42
10/25/16	24.0	5	6.09	0.00	0.00	0.00	150	6.08	0.50	0.00	0.38
10/26/16	25.5	5	6.51	2.70	0.00	1.39	150	6.04	0.59	0.00	0.38
10/27/16	26.5	5	6.57	1.35	0.00	0.00	150	6.04	0.63	0.00	0.38
10/28/16	24.0	5	5.87	0.00	0.00	0.00	150	6.02	0.59	0.00	0.38
10/29/16	23.5	5	5.89	1.35	0.00	0.00	150	6.02	0.63	0.00	0.33
10/30/16	24.5	5	6.53	0.00	0.00	0.00	150	6.03	0.59	0.00	0.26
10/31/16	29.5	5	7.00	0.00	0.00	0.00	150	6.06	0.50	0.00	0.26
	24.9			**0.57**	**0.00**	**0.27**					

Battery 2

Date (Mo/day/yr)	Inspector	Hours Required for Inspection	Administrative Hours	Time In	Time Out	No. of ovens not operable	No. of doors not observed	No. of door leaks - yard	No. of door leaks - bench	No. of lids not observed	No. of lids leaks	No. of offtakes not observed	No. of offtakes leaks	SECONDS OF CHARGING EMISSIONS Charge 1	Charge 2	Charge 3	Charge 4	Charge 5
10/1/2016	GB	2	0.25	10:00	12:05	0	0	2	0	4	0	2	0	5.5	6.5	6	6.5	5.5
10/2/2016	GB	2	0.25	15:15	17:10	0	0	0	0	0	0	0	0	5.5	6	6.5	6	5
10/3/2016	BD	3	0.25	7:15	10:15	0	0	0	0	0	0	0	0	4.5	6	5	5.5	4
10/4/2016	BD	2.25	0.25	7:35	9:50	0	0	0	0	8	0	4	0	5.5	7.5	12.5	6.5	11
10/5/2016	BD	2.5	0.25	7:40	10:05	0	0	0	0	4	0	2	0	4.5	9	6.5	9	6
10/6/2016	BD	2.5	0.25	7:55	10:30	0	0	0	0	4	0	2	0	7	9.5	5.5	5	8
10/7/2016	BD	2.5	0.25	8:15	10:55	0	0	0	0	4	0	2	0	5	4.5	6	3.5	5
10/8/2016	BD	2.25	0.25	8:25	10:45	0	0	0	0	4	0	2	0	5	3.5	8.5	4	4
10/9/2016	BD	2.25	0.25	6:35	8:45	0	0	0	0	4	0	2	0	5	5.5	4.5	8	7
10/10/2016	BD	2.25	0.25	8:05	10:20	0	0	0	0	4	0	2	0	5	7.5	12	6.5	6
10/11/2016	GB	2.25	0.25	9:15	11:35	0	0	1	0	4	0	2	1	18.5	10.5	6.5	6	6
10/12/2016	GB	2.5	0.25	7:10	9:40	0	0	0	0	4	0	2	0	5	6	6.5	6.5	5.5
10/13/2016	GB	2.5	0.25	7:15	9:45	0	0	0	0	4	0	2	0	6	6.5	5.5	7.5	6
10/14/2016	GB	1.75	0.25	9:40	11:30	0	0	0	0	4	0	2	0	6	7.5	6.5	7	6
10/15/2016	GB	2.5	0.25	7:15	9:45	0	0	0	0	4	0	2	0	6	5.5	6.5	6	5.5
10/16/2016	GB	2.25	0.25	7:30	9:50	0	0	0	0	4	0	2	0	5.5	6.5	6	5.5	6.5
10/17/2016	GB	2.25	0.25	7:15	9:30	0	0	0	0	0	0	0	0	6.5	5	6.5	5.5	6
10/18/2016	GB	2.5	0.25	9:45	12:10	0	0	1	0	0	0	0	1	5.5	6.5	6	7.5	6
10/19/2016	BD	1.75	0.25	6:50	9:30	0	0	0	0	0	0	0	0	4	4.5	3.5	4	5
10/20/2016	BD	2	0.25	7:50	9:50	0	0	0	0	0	0	0	0	5.5	4	10.5	3	9
10/21/2016	BD	2.25	0.25	7:35	9:50	0	0	0	0	0	0	0	0	6	4.5	4.5	7	5
10/22/2016	BD	2.25	0.25	7:30	9:50	0	0	0	0	8	0	4	0	5	8.5	5.5	5	6
10/23/2016	BD	2.5	0.25	7:25	10:00	0	0	0	0	0	0	0	0	5.5	5	4	4.5	5
10/24/2016	BD	2.5	0.25	8:05	10:30	0	0	0	0	0	0	0	0	8.5	6.5	4	6	11
10/25/2016	GB	2.5	0.25	11:15	13:45	0	0	0	0	0	0	0	0	6	6.5	5.5	6	6.5
10/26/2016	GB	2.5	0.25	7:10	9:40	0	0	0	0	4	0	2	0	5.5	8.5	6	5.5	7.5
10/27/2016	GB	2.25	0.25	11:30	13:45	0	0	0	0	0	0	0	0	8	6	6	6.5	6.5
10/28/2016	GB	2.25	0.25	7:15	9:45	0	0	1	0	4	0	2	0	6.5	6	5	6.5	5.5
10/29/2016	GB	2.25	0.25	10:45	12:55	0	0	1	0	4	0	2	0	5.5	6.5	5.5	6	6
10/30/2016	GB	2.5	0.25	7:20	9:55	0	0	0	0	4	0	2	0	7	6	6	5.5	8.5

DATE Month	Sum of 1st 4 charges	No. of charges	Log avg. charges (s)	Percent leaking Doors	Lids	Offtakes	No. of charges	Log avg. charges (s)	30-run rolling average Doors (%)	Lids (%)	Offtakes (%)
10/1/16	24.5	5	5.99	5.26	0.00	0.00	150	6.53	0.61	0.00	0.18
10/2/16	24.0	5	5.78	0.00	0.00	0.00	150	6.46	0.61	0.00	0.09
10/3/16	21.0	5	4.96	0.00	0.00	0.00	150	6.40	0.53	0.00	0.09
10/4/16	32.0	5	8.23	0.00	0.00	0.00	150	6.43	0.53	0.00	0.09
10/5/16	29.0	5	6.80	0.00	0.00	0.00	150	6.44	0.44	0.00	0.09
10/6/16	27.0	5	6.83	0.00	0.00	0.00	150	6.47	0.44	0.00	0.09
10/7/16	19.0	5	4.74	0.00	0.00	0.00	150	6.43	0.44	0.00	0.09
10/8/16	21.0	5	4.77	0.00	0.00	0.00	150	6.35	0.44	0.00	0.09
10/9/16	23.0	5	5.88	0.00	0.00	0.00	150	6.42	0.44	0.00	0.09
10/10/16	31.0	5	7.10	0.00	0.00	0.00	150	6.46	0.44	0.00	0.09
10/11/16	41.5	5	8.62	2.63	0.00	2.78	150	6.50	0.53	0.00	0.19
10/12/16	24.0	5	5.87	0.00	0.00	0.00	150	6.51	0.53	0.00	0.19
10/13/16	25.5	5	6.27	0.00	0.00	0.00	150	6.50	0.53	0.00	0.19
10/14/16	27.0	5	6.58	0.00	0.00	0.00	150	6.51	0.53	0.00	0.19
10/15/16	24.0	5	5.89	0.00	0.00	0.00	150	6.50	0.53	0.00	0.19
10/16/16	23.5	5	5.99	0.00	0.00	0.00	150	6.49	0.44	0.00	0.19
10/17/16	23.5	5	5.87	0.00	0.00	0.00	150	6.46	0.35	0.00	0.19
10/18/16	25.5	5	6.27	2.63	0.00	2.63	150	6.44	0.44	0.00	0.27
10/19/16	16.0	5	4.18	0.00	0.00	0.00	150	6.39	0.44	0.00	0.27
10/20/16	23.0	5	5.84	0.00	0.00	0.00	150	6.34	0.44	0.00	0.18
10/21/16	22.0	5	5.33	0.00	0.00	0.00	150	6.21	0.44	0.00	0.18
10/22/16	24.0	5	5.89	0.00	0.00	0.00	150	6.18	0.44	0.00	0.18
10/23/16	19.0	5	4.78	0.00	0.00	0.00	150	6.13	0.44	0.00	0.18
10/24/16	25.0	5	6.86	0.00	0.00	0.00	150	6.11	0.35	0.00	0.18
10/25/16	24.0	5	6.09	0.00	0.00	0.00	150	6.08	0.35	0.00	0.18
10/26/16	25.5	5	6.51	0.00	0.00	0.00	150	6.04	0.35	0.00	0.18
10/27/16	26.5	5	6.57	0.00	0.00	0.00	150	6.04	0.35	0.00	0.18
10/28/16	24.0	5	5.87	2.63	0.00	0.00	150	6.02	0.44	0.00	0.18
10/29/16	23.5	5	5.89	2.63	0.00	0.00	150	6.02	0.53	0.00	0.18
10/30/16	24.5	5	6.53	0.00	0.00	0.00	150	6.03	0.53	0.00	0.18

REPORT - APPENDIX B

Montrose Field Data Sheets

Preliminary Data

Stratification Check

Trailer:	WPC Trailer
Date:	2016/10/17
Analyzer Range:	O2 (0-25%), O2 (0-25%),

Test conducted in accordance with section 8.1.2 of Method 7E

Requirements

3 Point sampling across centroidal area (alternately 12 points)
Sampling must be done for 2x response time
Record average at each point and mean of traverse

Stack Diameter	112 inches
Response Time	100 seconds

Point	Probe Marking (inches)	O2 (%)	Difference vs. Mean (% of mean)	Difference from Mean (%)
1	18.7	11.4	-0.41%	0.0
2	56.0	11.3	-0.08%	0.0
3	93.3	11.3	0.49%	0.1
	Mean of All Points	11.3	%	

Point	Probe Marking (inches)	CO2 (%)	Difference vs. Mean (% of mean)	Difference from Mean (%)
1	18.7	4.4	2.34%	0.1
2	56.0	4.5	-1.51%	-0.1
3	93.3	4.5	-0.83%	0.0
	Mean of All Points	4.5	%	

a) if concentration differs at each point by +/- 5% or +/-.5 ppm (whichever less restrictive)
single point sampling at point closest to mean

b) if concentration differs at each point by +/- 10% or +/- 1.0 ppm (whichever less restrictive)
tri point sampling at 16.7, 50 and 83.3 % of diameter

c) if conditions a) and b) fail, then 12 point sampling is required

This test shows sampling may be conducted at centroidally located point (meets condition a for O2/CO2)

			CH99002	CH99003	
			O2 sys 1 n	CO2 sys 1 min	
			TagComm	TagComment 99003	
Mark	Date	Time	%	%	
1	2016/10/17	11:51:32	10.73	4.66	Point 1
2	2016/10/17	11:52:32	11.62	4.26	Point 1
3	2016/10/17	11:53:32	11.62	4.26	Point 1
4	2016/10/17	11:54:32	11.49	4.32	Point 1
5	2016/10/17	11:55:32	11.37	4.36	Point 1
47	2016/10/17	12:37:32	11.37	4.52	Point 2
48	2016/10/17	12:38:32	11.98	4.25	Point 2
49	2016/10/17	12:39:32	11.69	4.36	Point 2
50	2016/10/17	12:40:32	11.51	4.47	Point 2
51	2016/10/17	12:41:32	10.91	4.72	Point 2
52	2016/10/17	12:42:32	10.50	4.93	Point 2
100	2016/10/17	13:30:32	11.44	4.42	Point 3
101	2016/10/17	13:31:32	11.34	4.45	Point 3
102	2016/10/17	13:32:32	11.27	4.49	Point 3
103	2016/10/17	13:33:32	10.98	4.64	Point 3
104	2016/10/17	13:34:32	11.05	4.63	Point 3
105	2016/10/17	13:35:32	11.48	4.43	Point 3

Method 5/29

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/19	08:15:37	9.22	5.66
2	2016/10/19	08:16:37	10.05	5.26
3	2016/10/19	08:17:37	10.91	4.84
4	2016/10/19	08:18:37	11.11	4.74
5	2016/10/19	08:19:37	10.86	4.85
6	2016/10/19	08:20:37	10.82	4.88
7	2016/10/19	08:21:37	10.61	4.97
8	2016/10/19	08:22:37	10.23	5.14
9	2016/10/19	08:23:37	11.09	4.81
10	2016/10/19	08:24:37	13.34	3.85
11	2016/10/19	08:25:37	10.35	5.11
12	2016/10/19	08:26:37	9.33	5.63
13	2016/10/19	08:27:37	9.12	5.74
14	2016/10/19	08:28:37	9.06	5.77
15	2016/10/19	08:29:37	8.94	5.85
16	2016/10/19	08:30:37	9.47	5.58
17	2016/10/19	08:31:37	10.46	5.08
18	2016/10/19	08:32:37	10.54	5.03
19	2016/10/19	08:33:37	10.43	5.07
20	2016/10/19	08:34:37	10.18	5.19
21	2016/10/19	08:35:37	10.04	5.25
22	2016/10/19	08:36:37	10.03	5.25
23	2016/10/19	08:37:37	9.49	5.52
24	2016/10/19	08:38:37	8.83	5.88
25	2016/10/19	08:39:37	8.56	6.02
26	2016/10/19	08:40:37	8.54	6.04
27	2016/10/19	08:41:37	8.26	6.18
28	2016/10/19	08:42:37	8.44	6.09
29	2016/10/19	08:43:37	10.30	5.27
30	2016/10/19	08:44:37	13.24	3.94
31	2016/10/19	08:45:37	11.35	4.67
32	2016/10/19	08:46:37	11.39	4.66
33	2016/10/19	08:47:37	11.05	4.81
34	2016/10/19	08:48:37	10.75	4.95
35	2016/10/19	08:49:37	10.66	4.98
36	2016/10/19	08:50:37	10.40	5.09
37	2016/10/19	08:51:37	9.65	5.45
38	2016/10/19	08:52:37	9.24	5.67
39	2016/10/19	08:53:37	9.09	5.75
40	2016/10/19	08:54:37	9.01	5.80
41	2016/10/19	08:55:37	8.90	5.85
42	2016/10/19	08:56:37	8.83	5.88
43	2016/10/19	08:57:37	9.04	5.77
44	2016/10/19	08:58:37	8.96	5.82
45	2016/10/19	08:59:37	9.27	5.68
46	2016/10/19	09:00:37	10.38	5.14
47	2016/10/19	09:01:37	10.58	5.03
48	2016/10/19	09:02:37	10.46	5.08
49	2016/10/19	09:03:37	12.06	4.38
50	2016/10/19	09:04:37	14.33	3.38
51	2016/10/19	09:05:37	11.15	4.76
52	2016/10/19	09:06:37	9.60	5.51
53	2016/10/19	09:07:37	8.99	5.84
54	2016/10/19	09:08:37	8.71	5.98
55	2016/10/19	09:09:37	8.61	6.03
56	2016/10/19	09:10:37	8.83	5.92
57	2016/10/19	09:11:37	8.65	6.01
58	2016/10/19	09:12:37	8.92	5.88
59	2016/10/19	09:13:37	9.96	5.33
60	2016/10/19	09:14:37	10.22	5.19
61	2016/10/19	09:15:37	10.22	5.19
62	2016/10/19	09:16:37	10.14	5.21
63	2016/10/19	09:17:37	9.94	5.30
64	2016/10/19	09:18:37	9.48	5.53
65	2016/10/19	09:19:37	9.02	5.78
66	2016/10/19	09:20:37	8.84	5.89
67	2016/10/19	09:21:37	8.43	6.10
68	2016/10/19	09:22:37	8.22	6.22
69	2016/10/19	09:23:37	10.28	5.29
70	2016/10/19	09:24:37	13.30	3.90
71	2016/10/19	09:25:37	10.49	5.07
72	2016/10/19	09:26:37	10.24	5.22
73	2016/10/19	09:27:37	10.40	5.14
74	2016/10/19	09:28:37	10.34	5.15
75	2016/10/19	09:29:37	10.30	5.16
76	2016/10/19	09:30:37	10.03	5.28
77	2016/10/19	09:31:37	9.48	5.56
78	2016/10/19	09:32:37	9.12	5.76
79	2016/10/19	09:33:37	9.06	5.79
80	2016/10/19	09:34:37	10.72	5.04
81	2016/10/19	09:35:37	12.92	4.01
82	2016/10/19	09:36:37	8.88	5.88
83	2016/10/19	09:37:37	8.95	5.84
84	2016/10/19	09:38:37	9.78	5.42

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
85	2016/10/19	09:39:37	10.28	5.17
86	2016/10/19	09:40:37	10.40	5.11
87	2016/10/19	09:41:37	10.29	5.15
88	2016/10/19	09:42:37	9.83	5.37
89	2016/10/19	09:43:37	10.85	4.98
90	2016/10/19	09:44:37	13.11	3.99
91	2016/10/19	09:45:37	10.11	5.25
92	2016/10/19	09:46:37	9.12	5.78
93	2016/10/19	09:47:37	8.78	5.96
94	2016/10/19	09:48:37	8.65	6.02
95	2016/10/19	09:49:37	8.60	6.04
96	2016/10/19	09:50:37	8.52	6.07
97	2016/10/19	09:51:37	8.47	6.09
98	2016/10/19	09:52:37	8.46	6.09
99	2016/10/19	09:53:37	8.43	6.10
100	2016/10/19	09:54:37	8.41	6.10
101	2016/10/19	09:55:37	8.38	6.11
102	2016/10/19	09:56:37	8.38	6.11
103	2016/10/19	09:57:37	8.33	6.13
104	2016/10/19	09:58:37	8.27	6.16
105	2016/10/19	09:59:37	8.30	6.14
106	2016/10/19	10:00:37	8.49	6.04
107	2016/10/19	10:01:37	8.31	6.13
108	2016/10/19	10:02:37	8.20	6.18
109	2016/10/19	10:03:37	10.10	5.35
110	2016/10/19	10:04:37	13.07	4.00
111	2016/10/19	10:05:37	10.20	5.16
112	2016/10/19	10:06:37	9.49	5.50
113	2016/10/19	10:07:37	9.29	5.61
114	2016/10/19	10:08:37	9.22	5.64
115	2016/10/19	10:09:37	9.18	5.66
116	2016/10/19	10:10:37	9.14	5.68
117	2016/10/19	10:11:37	9.28	5.60
118	2016/10/19	10:12:37	9.56	5.45
119	2016/10/19	10:13:37	9.99	5.24
120	2016/10/19	10:14:37	9.73	5.35
121	2016/10/19	10:15:37	9.49	5.47
122	2016/10/19	10:16:37	9.38	5.52
123	2016/10/19	10:17:37	9.07	5.68
124	2016/10/19	10:18:37	8.99	5.72
125	2016/10/19	10:19:37	9.02	5.70
126	2016/10/19	10:20:37	9.17	5.63
127	2016/10/19	10:21:37	8.95	5.74
128	2016/10/19	10:22:37	8.84	5.79
129	2016/10/19	10:23:37	10.68	5.00
130	2016/10/19	10:24:37	13.34	3.82
131	2016/10/19	10:25:37	10.18	5.14
132	2016/10/19	10:26:37	9.32	5.57
133	2016/10/19	10:27:37	9.05	5.71
134	2016/10/19	10:28:37	8.91	5.77
135	2016/10/19	10:29:37	8.85	5.81
136	2016/10/19	10:30:37	8.75	5.85
137	2016/10/19	10:31:37	8.69	5.88
138	2016/10/19	10:32:37	8.71	5.86
139	2016/10/19	10:33:37	8.71	5.86
140	2016/10/19	10:34:37	8.65	5.88
141	2016/10/19	10:35:37	8.62	5.90
142	2016/10/19	10:36:37	8.65	5.88
143	2016/10/19	10:37:37	8.61	5.90
144	2016/10/19	10:38:37	8.51	5.96
145	2016/10/19	10:39:37	8.80	5.81
146	2016/10/19	10:40:37	8.90	5.77
147	2016/10/19	10:41:37	9.15	5.65
148	2016/10/19	10:42:37	10.04	5.21
149	2016/10/19	10:43:37	11.65	4.51
150	2016/10/19	10:44:37	14.20	3.39
151	2016/10/19	10:45:37	11.69	4.44
152	2016/10/19	10:46:37	10.70	4.91
153	2016/10/19	10:47:37	9.93	5.26
154	2016/10/19	10:48:37	9.51	5.46
	Run 1 Average		**9.76**	**5.43**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/19	11:22:37	12.05	4.25
2	2016/10/19	11:23:37	13.32	3.70
3	2016/10/19	11:24:37	15.02	2.97
4	2016/10/19	11:25:37	11.97	4.28
5	2016/10/19	11:26:37	10.51	4.97
6	2016/10/19	11:27:37	9.88	5.26
7	2016/10/19	11:28:37	9.67	5.36
8	2016/10/19	11:29:37	9.60	5.39
9	2016/10/19	11:30:37	9.40	5.50
10	2016/10/19	11:31:37	9.34	5.52
11	2016/10/19	11:32:37	9.49	5.44
12	2016/10/19	11:33:37	9.32	5.53
13	2016/10/19	11:34:37	9.64	5.39
14	2016/10/19	11:35:37	10.59	4.95
15	2016/10/19	11:36:37	10.79	4.85
16	2016/10/19	11:37:37	10.63	4.92
17	2016/10/19	11:38:37	10.55	4.96
18	2016/10/19	11:39:37	10.39	5.02
19	2016/10/19	11:40:37	9.89	5.24
20	2016/10/19	11:41:37	9.37	5.49
21	2016/10/19	11:42:37	9.72	5.34
22	2016/10/19	11:43:37	12.48	4.10
23	2016/10/19	11:44:37	14.61	3.17
24	2016/10/19	11:45:37	11.92	4.31
25	2016/10/19	11:46:37	11.22	4.65
26	2016/10/19	11:47:37	11.13	4.70
27	2016/10/19	11:48:37	11.75	4.42
28	2016/10/19	11:49:37	12.45	4.10
29	2016/10/19	11:50:37	12.43	4.10
30	2016/10/19	11:51:37	12.48	4.07
31	2016/10/19	11:52:37	12.42	4.08
32	2016/10/19	11:53:37	11.77	4.36
33	2016/10/19	11:54:37	10.33	5.02
34	2016/10/19	11:55:37	9.48	5.44
35	2016/10/19	11:56:37	9.34	5.51
36	2016/10/19	11:57:37	9.38	5.50
37	2016/10/19	11:58:37	8.83	5.78
38	2016/10/19	11:59:37	9.01	5.69
39	2016/10/19	12:00:37	9.81	5.30
40	2016/10/19	12:01:37	9.89	5.24
41	2016/10/19	12:02:37	9.68	5.34
42	2016/10/19	12:03:37	11.42	4.60
43	2016/10/19	12:04:37	13.93	3.51
44	2016/10/19	12:05:37	10.87	4.80
45	2016/10/19	12:06:37	9.79	5.29
46	2016/10/19	12:07:37	9.47	5.44
47	2016/10/19	12:08:37	10.02	5.19
48	2016/10/19	12:09:37	11.33	4.57
49	2016/10/19	12:10:37	11.46	4.50
50	2016/10/19	12:11:37	11.49	4.48
51	2016/10/19	12:12:37	11.38	4.54
52	2016/10/19	12:13:37	11.47	4.51
53	2016/10/19	12:14:37	12.10	4.23
54	2016/10/19	12:15:37	12.26	4.16
55	2016/10/19	12:16:37	11.15	4.66
56	2016/10/19	12:17:37	11.04	4.70
57	2016/10/19	12:18:37	10.72	4.83
58	2016/10/19	12:19:37	9.98	5.16
59	2016/10/19	12:20:37	9.62	5.33
60	2016/10/19	12:21:37	9.33	5.47
61	2016/10/19	12:22:37	9.16	5.56
62	2016/10/19	12:23:37	10.99	4.78
63	2016/10/19	12:24:37	13.70	3.60
64	2016/10/19	12:25:37	10.45	4.98
65	2016/10/19	12:26:37	10.00	5.20
66	2016/10/19	12:27:37	10.51	4.98
67	2016/10/19	12:28:37	10.44	5.01
68	2016/10/19	12:29:37	10.31	5.06
69	2016/10/19	12:30:37	11.46	4.57
70	2016/10/19	12:31:37	12.74	4.03
71	2016/10/19	12:32:37	9.44	5.43
72	2016/10/19	12:33:37	9.49	5.43
73	2016/10/19	12:34:37	10.43	4.99
74	2016/10/19	12:35:37	10.77	4.81
75	2016/10/19	12:36:37	10.83	4.78
76	2016/10/19	12:37:37	10.74	4.82
77	2016/10/19	12:38:37	10.65	4.88
78	2016/10/19	12:39:37	10.92	4.76
79	2016/10/19	12:40:37	11.05	4.69
80	2016/10/19	12:41:37	10.39	5.01
81	2016/10/19	12:42:37	10.15	5.11
82	2016/10/19	12:43:37	11.78	4.40
83	2016/10/19	12:44:37	14.13	3.39
84	2016/10/19	12:45:37	10.98	4.72

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
85	2016/10/19	12:46:37	9.83	5.25
86	2016/10/19	12:47:37	9.36	5.47
87	2016/10/19	12:48:37	8.98	5.67
88	2016/10/19	12:49:37	8.87	5.72
89	2016/10/19	12:50:37	8.80	5.75
90	2016/10/19	12:51:37	8.75	5.77
91	2016/10/19	12:52:37	8.72	5.78
92	2016/10/19	12:53:37	8.71	5.78
93	2016/10/19	12:54:37	8.69	5.78
94	2016/10/19	12:55:37	8.65	5.80
95	2016/10/19	12:56:37	8.62	5.81
96	2016/10/19	12:57:37	8.61	5.81
97	2016/10/19	12:58:37	8.59	5.82
98	2016/10/19	12:59:37	8.63	5.79
99	2016/10/19	13:00:37	8.75	5.73
100	2016/10/19	13:01:37	8.59	5.81
101	2016/10/19	13:02:37	8.46	5.87
102	2016/10/19	13:03:37	10.36	5.06
103	2016/10/19	13:04:37	13.21	3.81
104	2016/10/19	13:05:37	9.81	5.22
105	2016/10/19	13:06:37	8.94	5.64
106	2016/10/19	13:07:37	8.66	5.79
107	2016/10/19	13:08:37	8.54	5.84
108	2016/10/19	13:09:37	8.44	5.89
109	2016/10/19	13:10:37	8.41	5.90
110	2016/10/19	13:11:37	8.41	5.89
111	2016/10/19	13:12:37	8.34	5.92
112	2016/10/19	13:13:37	8.32	5.93
113	2016/10/19	13:14:37	8.31	5.93
114	2016/10/19	13:15:37	8.28	5.94
115	2016/10/19	13:16:37	8.27	5.94
116	2016/10/19	13:17:37	8.24	5.95
117	2016/10/19	13:18:37	8.25	5.95
118	2016/10/19	13:19:37	8.38	5.87
119	2016/10/19	13:20:37	8.76	5.68
120	2016/10/19	13:21:37	8.81	5.64
121	2016/10/19	13:22:37	8.78	5.66
122	2016/10/19	13:23:37	10.70	4.85
123	2016/10/19	13:24:37	13.64	3.58
124	2016/10/19	13:25:37	10.62	4.80
125	2016/10/19	13:26:37	9.89	5.14
126	2016/10/19	13:27:37	9.88	5.15
127	2016/10/19	13:28:37	9.72	5.22
128	2016/10/19	13:29:37	9.96	5.13
129	2016/10/19	13:30:37	10.80	4.77
130	2016/10/19	13:31:37	11.08	4.64
131	2016/10/19	13:32:37	10.95	4.69
132	2016/10/19	13:33:37	10.87	4.73
133	2016/10/19	13:34:37	10.76	4.77
134	2016/10/19	13:35:37	10.19	5.02
135	2016/10/19	13:36:37	9.92	5.16
136	2016/10/19	13:37:37	10.70	4.82
137	2016/10/19	13:38:37	11.49	4.43
138	2016/10/19	13:39:37	11.52	4.41
139	2016/10/19	13:40:37	11.43	4.46
140	2016/10/19	13:41:37	11.16	4.60
141	2016/10/19	13:42:37	11.14	4.63
142	2016/10/19	13:43:37	12.93	3.86
	Run 2 Average		**10.34**	**5.03**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/19	14:02:37	9.64	5.42
2	2016/10/19	14:03:37	12.11	4.29
3	2016/10/19	14:04:37	14.52	3.22
4	2016/10/19	14:05:37	12.11	4.22
5	2016/10/19	14:06:37	11.44	4.56
6	2016/10/19	14:07:37	11.25	4.66
7	2016/10/19	14:08:37	11.39	4.60
8	2016/10/19	14:09:37	11.61	4.51
9	2016/10/19	14:10:37	11.33	4.65
10	2016/10/19	14:11:37	11.17	4.71
11	2016/10/19	14:12:37	11.10	4.73
12	2016/10/19	14:13:37	10.91	4.81
13	2016/10/19	14:14:37	10.34	5.06
14	2016/10/19	14:15:37	9.78	5.33
15	2016/10/19	14:16:37	9.52	5.46
16	2016/10/19	14:17:37	9.34	5.57
17	2016/10/19	14:18:37	9.28	5.59
18	2016/10/19	14:19:37	9.49	5.48
19	2016/10/19	14:20:37	9.54	5.46
20	2016/10/19	14:21:37	9.60	5.44
21	2016/10/19	14:22:37	10.28	5.12
22	2016/10/19	14:23:37	12.35	4.21
23	2016/10/19	14:24:37	14.67	3.19
24	2016/10/19	14:25:37	12.00	4.33
25	2016/10/19	14:26:37	10.98	4.80
26	2016/10/19	14:27:37	9.92	5.29
27	2016/10/19	14:28:37	9.45	5.53
28	2016/10/19	14:29:37	9.67	5.43
29	2016/10/19	14:30:37	10.56	4.99
30	2016/10/19	14:31:37	10.94	4.81
31	2016/10/19	14:32:37	10.81	4.87
32	2016/10/19	14:33:37	10.84	4.87
33	2016/10/19	14:34:37	11.33	4.66
34	2016/10/19	14:35:37	11.65	4.50
35	2016/10/19	14:36:37	10.98	4.82
36	2016/10/19	14:37:37	10.78	4.90
37	2016/10/19	14:38:37	10.69	4.93
38	2016/10/19	14:39:37	10.35	5.07
39	2016/10/19	14:40:37	9.71	5.37
40	2016/10/19	14:41:37	8.95	5.77
41	2016/10/19	14:42:37	8.61	5.97
42	2016/10/19	14:43:37	10.37	5.20
43	2016/10/19	14:44:37	13.31	3.87
44	2016/10/19	14:45:37	10.46	5.04
45	2016/10/19	14:46:37	9.77	5.37
46	2016/10/19	14:47:37	10.00	5.28
47	2016/10/19	14:48:37	10.79	4.92
48	2016/10/19	14:49:37	10.84	4.89
49	2016/10/19	14:50:37	10.92	4.84
50	2016/10/19	14:51:37	10.75	4.91
51	2016/10/19	14:52:37	10.11	5.20
52	2016/10/19	14:53:37	9.46	5.52
53	2016/10/19	14:54:37	9.23	5.65
54	2016/10/19	14:55:37	9.17	5.68
55	2016/10/19	14:56:37	9.11	5.72
56	2016/10/19	14:57:37	9.18	5.68
57	2016/10/19	14:58:37	8.89	5.84
58	2016/10/19	14:59:37	8.82	5.90
59	2016/10/19	15:00:37	9.70	5.47
60	2016/10/19	15:01:37	10.53	5.04
61	2016/10/19	15:02:37	10.49	5.05
62	2016/10/19	15:03:37	11.93	4.42
63	2016/10/19	15:04:37	14.22	3.42
64	2016/10/19	15:05:37	11.31	4.67
65	2016/10/19	15:06:37	10.12	5.22
66	2016/10/19	15:07:37	9.32	5.61
67	2016/10/19	15:08:37	8.88	5.86
68	2016/10/19	15:09:37	8.78	5.91
69	2016/10/19	15:10:37	8.72	5.94
70	2016/10/19	15:11:37	12.44	4.17
71	2016/10/19	15:12:37	20.58	0.29
72	2016/10/19	15:13:37	20.58	0.25
73	2016/10/19	15:14:37	20.64	0.19
74	2016/10/19	15:15:37	20.64	0.19
75	2016/10/19	15:16:37	16.84	1.97
76	2016/10/19	15:17:37	8.53	5.90
77	2016/10/19	15:18:37	8.48	6.01
78	2016/10/19	15:19:37	8.52	5.99
79	2016/10/19	15:20:37	8.67	5.92
80	2016/10/19	15:21:37	8.49	6.00
81	2016/10/19	15:22:37	8.35	6.08
82	2016/10/19	15:23:37	10.28	5.22
83	2016/10/19	15:24:37	13.35	3.83
84	2016/10/19	15:25:37	10.32	5.07

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
85	2016/10/19	15:26:37	9.63	5.40
86	2016/10/19	15:27:37	9.43	5.50
87	2016/10/19	15:28:37	9.32	5.56
88	2016/10/19	15:29:37	9.21	5.61
89	2016/10/19	15:30:37	9.19	5.62
90	2016/10/19	15:31:37	9.21	5.61
91	2016/10/19	15:32:37	9.21	5.60
92	2016/10/19	15:33:37	9.20	5.60
93	2016/10/19	15:34:37	9.18	5.61
94	2016/10/19	15:35:37	9.17	5.61
95	2016/10/19	15:36:37	9.15	5.62
96	2016/10/19	15:37:37	9.15	5.62
97	2016/10/19	15:38:37	9.09	5.64
98	2016/10/19	15:39:37	9.10	5.63
99	2016/10/19	15:40:37	9.23	5.57
100	2016/10/19	15:41:37	9.01	5.68
101	2016/10/19	15:42:37	8.86	5.76
102	2016/10/19	15:43:37	10.79	4.91
103	2016/10/19	15:44:37	13.52	3.69
104	2016/10/19	15:45:37	10.16	5.14
105	2016/10/19	15:46:37	9.77	5.35
106	2016/10/19	15:47:37	10.32	5.10
107	2016/10/19	15:48:37	10.32	5.10
108	2016/10/19	15:49:37	10.41	5.04
109	2016/10/19	15:50:37	10.16	5.14
110	2016/10/19	15:51:37	9.55	5.43
111	2016/10/19	15:52:37	9.16	5.64
112	2016/10/19	15:53:37	9.10	5.67
113	2016/10/19	15:54:37	9.14	5.65
114	2016/10/19	15:55:37	9.12	5.65
115	2016/10/19	15:56:37	8.99	5.72
116	2016/10/19	15:57:37	8.86	5.79
117	2016/10/19	15:58:37	8.74	5.85
118	2016/10/19	15:59:37	8.68	5.87
119	2016/10/19	16:00:37	8.77	5.83
120	2016/10/19	16:01:37	8.56	5.93
121	2016/10/19	16:02:37	8.42	6.00
122	2016/10/19	16:03:37	10.38	5.14
123	2016/10/19	16:04:37	13.48	3.74
124	2016/10/19	16:05:37	10.40	5.02
125	2016/10/19	16:06:37	9.70	5.34
126	2016/10/19	16:07:37	9.48	5.44
127	2016/10/19	16:08:37	9.43	5.47
128	2016/10/19	16:09:37	9.38	5.50
129	2016/10/19	16:10:37	9.33	5.53
130	2016/10/19	16:11:37	9.26	5.56
131	2016/10/19	16:12:37	9.22	5.58
132	2016/10/19	16:13:37	9.18	5.60
133	2016/10/19	16:14:37	9.12	5.63
134	2016/10/19	16:15:37	9.11	5.64
135	2016/10/19	16:16:37	9.20	5.58
136	2016/10/19	16:17:37	9.14	5.62
137	2016/10/19	16:18:37	9.23	5.59
138	2016/10/19	16:19:37	9.93	5.26
139	2016/10/19	16:20:37	10.83	4.85
	Run 3 Average		**10.41**	**5.07**

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 19, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 1
Unit	Combustion Stack 2	**Start Time**	8:25
Operation	Normal	**End Time**	10:48
Tester(s)	BC, JW, TM, CB		

200' HSL to Trailer

Cal. Gas	LOW		MID		HIGH		Span	Conc. Units	Tank ID			Response Time (sec)	
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)			LOW	MID	HIGH	Up	Down
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	60	60
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	70	70
LIMITS				40 % to 60 %		100%							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.13	0.45	0.13	0.45	0.00	20.03	0.13			
	Mid	10.01	10.01	10.03	0.10	10.05	0.20	0.10	20.03	10.04	9.76	9.72	d. vol. %
CO2	Zero		0.13	0.19	0.30	0.17	0.20	-0.10	19.79	0.18			
	Mid	10.15	10.11	10.21	0.51	10.24	0.66	0.15	19.79	10.225	5.43	5.30	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 19, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Combustion Stack 2	**Start Time**	11:22
Operation	Normal	**End Time**	13:44
Tester(s)	BC, JW, TM, CB		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B
LIMITS				40 % to 60 %		100%					

	Upscale: Enter "Low" "Mid" or "High"			Initial Values		Final Values				Average of Initial and Final	Average		
Gas	below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span	Systems Responses	Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.13	0.45	0.11	0.35	-0.10	20.03	0.12			
	Mid	10.01	10.01	10.05	0.20	10.02	0.05	-0.15	20.03	10.035	10.34	10.32	d. vol. %
CO2	Zero		0.13	0.17	0.20	0.11	-0.10	-0.30	19.79	0.14			
	Mid	10.15	10.11	10.24	0.66	10.21	0.51	-0.15	19.79	10.225	5.03	4.92	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 19, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Combustion Stack 2	**Start Time**	14:02
Operation	Normal	**End Time**	16:21
Tester(s)	BC, JW, TM, CB		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Span**	**Units**	**LOW**	**MID**	**HIGH**
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B
LIMITS				**40 % to 60 %**		**100%**					

				Initial Values		Final Values							
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	**Actual Upscale Conc.**	**Analyzer Cal. Response**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**Drift (% of Span)**	**Span**	**Average of Initial and Final System Responses**	**Average Indicated Gas Conc.**	**Corrected Gas Conc.**	**Conc. Units**
O2	**Zero**		0.09	0.13	0.20	0.14	0.25	0.05	20.03	0.135			
	Mid	10.01	10.01	10.05	0.20	10.06	0.25	0.05	20.03	10.055	10.41	10.37	d. vol. %
CO2	**Zero**		0.10	0.17	0.35	0.11	0.05	-0.30	19.79	0.14			
	Mid	10.15	10.11	10.24	0.66	10.25	0.71	0.05	19.79	10.245	5.07	4.95	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	**ZERO Analyzer Response (System for THC)**	**ZERO Analyzer Cal. Error (% of Span)**	**LOW Actual Conc.**	**LOW Analyzer Response (System for THC)**	**LOW Analyzer Cal. Error (% of Span)**	**LOW System Cal. Error (% of Actual)**	**MID Actual Conc.**	**MID Analyzer Response (System for THC)**	**MID Analyzer Cal. Error (% of Span)**	**MID System Cal. Error (% of Actual)**	**HIGH Actual Conc.**	**HIGH Analyzer Response (System for THC)**	**HIGH Analyzer Cal. Error (% of Span)**	**HIGH System Calibration Error (% of Actual)**	**Span**	**Conc. Units**
O2	0.09	0.45					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Combustion Stack 2	Test Start Time:	8:25 AM
Unit Operation:	Normal	Test Finish Time:	10:48 AM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.98	% dv
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	120	minutes	Water Collected (W_f - W_i)	277.3	g
Barometric Pressure (Pbar)	29.12	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	13.075	scf
Stack Static Pressure (Pg)	-1.20	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	13.075	scf
Stack Diameter (Ds) (L if rectangular)	112.0	inches	Volume Dry Gas Metered (Vm)	114.465	dacf
Stack Width (enter 0 if circular stack)	0.0	inches	Vol. Dry Gas Metered Stand.(Vm(std))	110.074	dscf
Nozzle Diameter (Dn)	0.850	inches	Volume Dry Gas Metered (Vm(m^3))	3.241	dacm
O2	9.72	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.117	dscm
CO2	5.30	% dv	Stack Absolute Pressure (Ps)	29.03	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	892.0	R
Sample Calculation Title	Metals Testing Results		H2O Vapor Pressure @ avg Stack Temp.	717.54	in. Hg
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1062	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1062	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.24	lb/lb-mole
Meter Temperature (Tm)	81.2	F	Wet Gas Molecular Weight (Ms)	28.04	lb/lb-mole
Stack Temperature (Tsavg)	432.4	F	Gas Velocity (Vs)	7.83	ft/s
Orifice Pressure Drop (dHavg)	2.830	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head ($dP)^{1/2}$avg	0.1041	in. H_2O^1/2	Area Stack (As)	68.417	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	32,134	acfm
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu	Standard Gas Flowrate	18,449	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	16,490.08	dscfm
K1method 4	0.04707	scf/ml	Actual Gas Flowrate	910	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	522	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	467	dscm/min
K4method 5	0.0945		Area Nozzle (An)	0.003941	ft^2
Standard lb-mole volume	385.3	ft^3/lb-mole	Percent of Isokinetic Sampling (I)	96.64	%

ArcelorMittal Monessen **Run 1** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP $(in. H2O)^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.6	525	77	75
A-1	0.010	0.100	2.6	537	78	76
A-2	0.010	0.100	2.6	480	80	76
A-2	0.010	0.100	2.6	478	80	76
A-3	0.011	0.105	2.9	467	81	77
A-3	0.011	0.105	2.9	473	81	77
A-4	0.013	0.114	3.4	416	83	77
A-4	0.013	0.114	3.4	422	83	77
A-5	0.012	0.110	3.1	351	84	78
A-5	0.012	0.110	3.1	343	84	78
B-1	0.010	0.100	2.6	533	81	79
B-1	0.010	0.100	2.6	544	82	79
B-2	0.010	0.100	2.6	539	83	79
B-2	0.010	0.100	2.6	542	84	79
B-3	0.010	0.100	2.6	471	84	79
B-3	0.010	0.100	2.6	484	84	79
B-4	0.011	0.105	2.9	434	84	79
B-4	0.011	0.105	2.9	404	84	79
B-5	0.012	0.110	3.1	324	84	79
B-5	0.012	0.110	3.1	304	84	79
C-1	0.010	0.100	2.6	542	81	79
C-1	0.010	0.100	2.6	513	82	79
C-2	0.010	0.100	2.6	459	83	79
C-2	0.010	0.100	2.6	464	84	79
C-3	0.013	0.114	3.4	367	85	80
C-3	0.013	0.114	3.4	360	86	80
C-4	0.012	0.110	3.1	238	86	80
C-4	0.012	0.110	3.1	247	86	80
C-5	0.015	0.122	3.9	142	87	81
C-5	0.012	0.110	3.1	140	87	81
D-1	0.010	0.100	2.6	552	83	80
D-1	0.010	0.100	2.6	557	83	80
D-2	0.010	0.100	2.6	527	84	80
D-2	0.010	0.100	2.6	531	85	80
D-3	0.010	0.100	2.6	520	85	80
D-3	0.010	0.100	2.6	523	86	80
D-4	0.010	0.100	2.6	502	86	80
D-4	0.010	0.100	2.6	489	86	81
D-5	0.010	0.100	2.6	317	86	80
D-5	0.010	0.100	2.6	234	85	80

Metals

Mercury			
Emission mass (1B Fraction)	<	0.015	(ug)
Emission mass (2B Fraction)		2.490	(ug)
Emission mass (3A Fraction)	<	0.0046	(ug)
Emission mass (3B Fraction)		0.368	(ug)
Emission mass (3C Fraction)		4.980	(ug)
Emission concentration (1B Fraction)	<	4.81E-06	(mg/dscm)
Emission concentration (2B Fraction)		7.99E-04	(mg/dscm)
Emission concentration (3A Fraction)	<	1.48E-06	(mg/dscm)
Emission concentration (3B Fraction)		1.18E-04	(mg/dscm)
Emission concentration (3C Fraction)		1.60E-03	(mg/dscm)
Emission rate (1B Fraction)	<	2.97E-07	(lb/hr)
Emission rate (2B Fraction)		4.93E-05	(lb/hr)
Emission rate (3A Fraction)	<	9.12E-08	(lb/hr)
Emission rate (3B Fraction)		7.29E-06	(lb/hr)
Emission rate (3C Fraction)		9.87E-05	(lb/hr)
Antimony			
Front Half Mass Gained	<	0.800	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half	<	2.57E-04	(mg/dscm)
Emission Concentration Back-Half	<	3.21E-04	(mg/dscm)
Emission Rate Front-Half	<	1.59E-05	(lb/hr)
Emission Rate Back-Half	<	1.98E-05	(lb/hr)
Arsenic			
Front Half Mass Gained		3.280	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half		1.05E-03	(mg/dscm)
Emission Concentration Back-Half	<	3.21E-04	(mg/dscm)
Emission Rate Front-Half		6.50E-05	(lb/hr)
Emission Rate Back-Half	<	1.98E-05	(lb/hr)
Beryllium			
Front Half Mass Gained	<	0.200	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half	<	6.42E-05	(mg/dscm)
Emission Concentration Back-Half	<	8.02E-05	(mg/dscm)
Emission Rate Front-Half	<	3.96E-06	(lb/hr)
Emission Rate Back-Half	<	4.95E-06	(lb/hr)
Cadmium			
Front Half Mass Gained		1.270	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half		4.07E-04	(mg/dscm)
Emission Concentration Back-Half	<	8.02E-05	(mg/dscm)
Emission Rate Front-Half		2.52E-05	(lb/hr)
Emission Rate Back-Half	<	4.95E-06	(lb/hr)

Chromium		
Front Half Mass Gained	5.580	(ug)
Back Half Mass Gained	7.520	(ug)
Emission Concentration Front-Half	1.79E-03	(mg/dscm)
Emission Concentration Back-Half	2.41E-03	(mg/dscm)
Emission Rate Front-Half	1.11E-04	(lb/hr)
Emission Rate Back-Half	1.49E-04	(lb/hr)
Cobalt		
Front Half Mass Gained	0.230	(ug)
Back Half Mass Gained	0.460	(ug)
Emission Concentration Front-Half	7.38E-05	(mg/dscm)
Emission Concentration Back-Half	1.48E-04	(mg/dscm)
Emission Rate Front-Half	4.56E-06	(lb/hr)
Emission Rate Back-Half	9.12E-06	(lb/hr)
Lead		
Front Half Mass Gained	3.740	(ug)
Back Half Mass Gained	22.200	(ug)
Emission Concentration Front-Half	1.20E-03	(mg/dscm)
Emission Concentration Back-Half	7.12E-03	(mg/dscm)
Emission Rate Front-Half	7.41E-05	(lb/hr)
Emission Rate Back-Half	4.40E-04	(lb/hr)
Manganese		
Front Half Mass Gained	3.400	(ug)
Back Half Mass Gained	15.900	(ug)
Emission Concentration Front-Half	1.09E-03	(mg/dscm)
Emission Concentration Back-Half	5.10E-03	(mg/dscm)
Emission Rate Front-Half	6.74E-05	(lb/hr)
Emission Rate Back-Half	3.15E-04	(lb/hr)
Nickel		
Front Half Mass Gained	7.600	(ug)
Back Half Mass Gained	9.000	(ug)
Emission Concentration Front-Half	2.44E-03	(mg/dscm)
Emission Concentration Back-Half	2.89E-03	(mg/dscm)
Emission Rate Front-Half	1.51E-04	(lb/hr)
Emission Rate Back-Half	1.78E-04	(lb/hr)
Selenium		
Front Half Mass Gained	2.900	(ug)
Back Half Mass Gained	49.700	(ug)
Emission Concentration Front-Half	9.30E-04	(mg/dscm)
Emission Concentration Back-Half	1.59E-02	(mg/dscm)
Emission Rate Front-Half	5.75E-05	(lb/hr)
Emission Rate Back-Half	9.85E-04	(lb/hr)

Average	0.01	0.104	2.83	432.4		81.2

Initial volume	833.400	ft^3	Initial volume	0.000	liters
Final volume	947.865	ft^3	Final volume	0.000	liters
Total metered	114.465	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	813.1	725.2	87.9			0.0
2	728.3	608.7	119.6			0.0
3	620.1	607.5	12.6			0.0
4	738.8	719.9	18.9			0.0
5	752.1	748.8	3.3			0.0
6	806.1	771.1	35.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4458.5	4181.2	277.3	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Combustion Stack 2	Test Start Time:	8:25 AM
Unit Operation:	Normal	Test Finish Time:	10:48 AM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.12	in. Hg
Stack Static Pressure (Pg)	-1.2	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112	inches
Stack Width (enter 0 if circular stack)	0	inches
Nozzle Diameter (Dn)	0.85	inches
O2	9.72	% dv
CO2	5.30	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Particulate Matter Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	81.2	F
Stack Temperature (Tsavg)	432.4	F
Orifice Pressure Drop (dHavg)	2.830	in. H_2O
GasVelocity Head (dP)^avg	0.1041	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04707	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.98	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	277.3	g
Water Vapor in Silica Gel (Vwsg(std))	13.075	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	13.075	scf
Volume Dry Gas Metered (Vm)	114.465	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	110.074	dscf
Volume Dry Gas Metered (Vm(m^3))	3.241	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.117	dscm
Stack Absolute Pressure (Ps)	29.03	in. Hg
Stack Absolute Temperature (Tsavg)	892.0	R
H2O Vapor Pressure @ avg Stack Temp.	717.54	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1062	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1062	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.24	lb/lb-mole
Wet Gas Molecular Weight (Ms)	28.04	lb/lb-mole
Gas Velocity (Vs)	7.83	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	32,134	acfm
Standard Gas Flowrate	18,449	scfm
Dry Standard Gas Flowrate	16,490	dscfm
Actual Gas Flowrate	910	acm/min
Standard Gas Flowrate	522	scm/min
Dry Standard Gas Flowrate	467	dscm/min
Area Nozzle (An)	0.003941	ft^2
Percent of Isokinetic Sampling (I)	96.64	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	110	ml
Acetone Wash Weight Gain	47.1	mg
Front Half Filter Particulate	8.7	mg
Total Particulate Mass (m_n)	55.80	mg
Particulate Concentration	0.0078	gr/dscf
Particulate Concentration	17.90	mg/dscm
Particulate Emission Rate	1.11	lb/hr

ArcelorMittal Monessen Run 1 **F or C?**
Combustion Stack 2 **F=1,C=0 1**

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.6	525	77	75
A-1	0.010	0.100	2.6	537	78	76
A-2	0.010	0.100	2.6	480	80	76
A-2	0.010	0.100	2.6	478	80	76
A-3	0.011	0.105	2.9	467	81	77
A-3	0.011	0.105	2.9	473	81	77
A-4	0.013	0.114	3.4	416	83	77
A-4	0.013	0.114	3.4	422	83	77
A-5	0.012	0.110	3.1	351	84	78
A-5	0.012	0.110	3.1	343	84	78
B-1	0.010	0.100	2.6	533	81	79
B-1	0.010	0.100	2.6	544	82	79
B-2	0.010	0.100	2.6	539	83	79
B-2	0.010	0.100	2.6	542	84	79
B-3	0.010	0.100	2.6	471	84	79
B-3	0.010	0.100	2.6	484	84	79
B-4	0.011	0.105	2.9	434	84	79
B-4	0.011	0.105	2.9	404	84	79
B-5	0.012	0.110	3.1	324	84	79
B-5	0.012	0.110	3.1	304	84	79
C-1	0.010	0.100	2.6	542	81	79
C-1	0.010	0.100	2.6	513	82	79
C-2	0.010	0.100	2.6	459	83	79
C-2	0.010	0.100	2.6	464	84	79
C-3	0.013	0.114	3.4	367	85	80
C-3	0.013	0.114	3.4	360	86	80
C-4	0.012	0.110	3.1	238	86	80
C-4	0.012	0.110	3.1	247	86	80
C-5	0.015	0.122	3.9	142	87	81
C-5	0.012	0.110	3.1	140	87	81
D-1	0.010	0.100	2.6	552	83	80
D-1	0.010	0.100	2.6	557	83	80
D-2	0.010	0.100	2.6	527	84	80
D-2	0.010	0.100	2.6	531	85	80
D-3	0.010	0.100	2.6	520	85	80
D-3	0.010	0.100	2.6	523	86	80
D-4	0.010	0.100	2.6	502	86	80
D-4	0.010	0.100	2.6	489	86	81
D-5	0.010	0.100	2.6	317	86	80
D-5	0.010	0.100	2.6	234	85	80
Average	0.01	0.104	2.83	432.4		81.2

Initial volume	833.400	ft^3	Initial volume	0.000	liters
Final volume	947.865	ft^3	Final volume	0.000	liters
Total metered	114.465	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	813.1	725.2	87.9	0.0	0.0	0.0
2	728.3	608.7	119.6	0.0	0.0	0.0
3	620.1	607.5	12.6	0.0	0.0	0.0
4	738.8	719.9	18.9	0.0	0.0	0.0
5	752.1	748.8	3.3	0.0	0.0	0.0
6	806.1	771.1	35.0	0.0	0.0	0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4458.5	4181.2	277.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Combustion Stack 2	Test Start Time:	8:25 AM
Unit Operation:	Normal	Test Finish Time:	10:48 AM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Time (min)		(Opacity at seconds of minute)				Minute
		:00	:15	:30	:45	Average
0	8:25 AM	0	0	0	0	0.00
1	8:26 AM	0	0	0	0	0.00
2	8:27 AM	0	0	0	0	0.00
3	8:28 AM	0	0	0	0	0.00
4	8:29 AM	0	0	0	0	0.00
5	8:30 AM	0	0	0	0	0.00
6	8:31 AM	0	0	0	0	0.00
7	8:32 AM	0	0	0	0	0.00
8	8:33 AM	0	0	0	0	0.00
9	8:34 AM	0	0	0	0	0.00
10	8:35 AM	0	0	0	0	0.00
11	8:36 AM	0	0	0	0	0.00
12	8:37 AM	0	0	0	0	0.00
13	8:38 AM	0	0	0	0	0.00
14	8:39 AM	0	0	0	0	0.00
15	8:40 AM	0	0	0	0	0.00
16	8:41 AM	0	0	0	0	0.00
17	8:42 AM	0	0	0	0	0.00
18	8:43 AM	0	0	0	0	0.00
19	8:44 AM	0	0	0	0	0.00
20	8:45 AM	0	0	0	0	0.00
21	8:46 AM	0	0	0	0	0.00
22	8:47 AM	0	0	0	0	0.00
23	8:48 AM	0	0	0	0	0.00
24	8:49 AM	0	0	0	0	0.00
25	8:50 AM	0	0	0	0	0.00
26	8:51 AM	0	0	0	0	0.00
27	8:52 AM	0	0	0	0	0.00
28	8:53 AM	0	0	0	0	0.00
29	8:54 AM	0	0	0	0	0.00
30	8:55 AM	0	0	0	0	0.00
31	8:56 AM	0	0	0	0	0.00
32	8:57 AM	0	0	0	0	0.00
33	8:58 AM	0	0	0	0	0.00
34	8:59 AM	0	0	0	0	0.00
35	9:00 AM	0	0	0	0	0.00
36	9:01 AM	0	0	0	0	0.00
37	9:02 AM	0	0	0	0	0.00
38	9:03 AM	0	0	0	0	0.00
39	9:04 AM	0	0	0	0	0.00
40	9:05 AM	5	5	0	0	2.50
41	9:06 AM	0	0	0	0	0.00
42	9:07 AM	0	0	0	0	0.00
43	9:08 AM	0	0	0	0	0.00
44	9:09 AM	0	0	0	0	0.00
45	9:10 AM	0	0	0	0	0.00
46	9:11 AM	0	0	0	0	0.00
47	9:12 AM	0	0	0	0	0.00
48	9:13 AM	0	0	0	0	0.00
49	9:14 AM	0	0	0	0	0.00
50	9:15 AM	0	0	0	0	0.00
51	9:16 AM	0	0	0	0	0.00
52	9:17 AM	0	0	0	0	0.00
53	9:18 AM	0	0	0	0	0.00
54	9:19 AM	0	0	0	0	0.00
55	9:20 AM	0	0	0	0	0.00
56	9:21 AM	0	0	0	0	0.00
57	9:22 AM	0	0	0	0	0.00
58	9:23 AM	0	0	0	0	0.00
59	9:24 AM	0	0	0	0	0.00
0	9:25 AM	0	0	0	0	0.00
1	9:26 AM	0	0	0	0	0.00
2	9:27 AM	0	0	0	0	0.00
3	9:28 AM	0	0	0	0	0.00
4	9:29 AM	0	0	0	0	0.00
5	9:30 AM	0	0	0	0	0.00
6	9:31 AM	0	0	0	0	0.00
7	9:32 AM	0	0	0	0	0.00
8	9:33 AM	0	0	0	0	0.00
9	9:34 AM	0	0	0	0	0.00

10	9:35 AM	0	0	0	0	0.00
11	9:36 AM	0	0	0	0	0.00
12	9:37 AM	0	0	0	0	0.00
13	9:38 AM	0	0	0	0	0.00
14	9:39 AM	0	0	0	0	0.00
15	9:40 AM	0	0	0	0	0.00
16	9:41 AM	0	0	0	0	0.00
17	9:42 AM	0	0	0	0	0.00
18	9:43 AM	0	0	0	0	0.00
19	9:44 AM	0	0	0	0	0.00
20	9:45 AM	0	0	0	10	2.50
21	9:46 AM	0	0	0	0	0.00
22	9:47 AM	0	0	0	0	0.00
23	9:48 AM	0	0	0	0	0.00
24	9:49 AM	0	0	0	0	0.00
25	9:50 AM	0	0	0	0	0.00
26	9:51 AM	0	0	0	0	0.00
27	9:52 AM	0	0	0	0	0.00
28	9:53 AM	0	0	0	0	0.00
29	9:54 AM	0	0	0	0	0.00
30	9:55 AM	0	0	0	0	0.00
31	9:56 AM	0	0	0	0	0.00
32	9:57 AM	0	0	0	0	0.00
33	9:58 AM	0	0	0	0	0.00
34	9:59 AM	0	0	0	0	0.00
35	10:00 AM	0	0	0	0	0.00
36	10:01 AM	0	0	0	0	0.00
37	10:02 AM	0	0	0	0	0.00
38	10:03 AM	0	0	0	0	0.00
39	10:04 AM	0	0	0	0	0.00
40	10:05 AM	0	0	0	0	0.00
41	10:06 AM	0	0	0	0	0.00
42	10:07 AM	0	0	0	0	0.00
43	10:08 AM	0	0	0	0	0.00
44	10:09 AM	0	0	0	0	0.00
45	10:10 AM	0	0	0	0	0.00
46	10:11 AM	0	0	0	0	0.00
47	10:12 AM	0	0	0	0	0.00
48	10:13 AM	0	0	0	0	0.00
49	10:14 AM	0	0	0	0	0.00
50	10:15 AM	0	0	0	0	0.00
51	10:16 AM	0	0	0	0	0.00
52	10:17 AM	0	0	0	0	0.00
53	10:18 AM	0	0	0	0	0.00
54	10:19 AM	0	0	0	0	0.00
55	10:20 AM	0	0	0	0	0.00
56	10:21 AM	0	0	0	0	0.00
57	10:22 AM	0	0	0	0	0.00
58	10:23 AM	0	0	0	0	0.00
59	10:24 AM	0	0	0	0	0.00
0	10:25 AM	0	0	0	0	0.00
1	10:26 AM	0	0	0	0	0.00
2	10:27 AM	0	0	0	0	0.00
3	10:28 AM	0	0	0	0	0.00
4	10:29 AM	0	0	0	0	0.00
5	10:30 AM	0	0	0	0	0.00
6	10:31 AM	0	0	0	0	0.00
7	10:32 AM	0	0	0	0	0.00
8	10:33 AM	0	0	0	0	0.00
9	10:34 AM	0	0	0	0	0.00
10	10:35 AM	0	0	0	0	0.00
11	10:36 AM	0	0	0	0	0.00
12	10:37 AM	0	0	0	0	0.00
13	10:38 AM	0	0	0	0	0.00
14	10:39 AM	0	0	0	0	0.00
15	10:40 AM	0	0	0	0	0.00
16	10:41 AM	0	0	0	0	0.00
17	10:42 AM	0	0	0	0	0.00
18	10:43 AM	0	0	0	0	0.00
19	10:44 AM	0	0	0	0	0.00
20	10:45 AM	0	0	0	0	0.00
21	10:46 AM	0	0	0	0	0.00
22	10:47 AM	0	0	0	0	0.00
23	10:48 AM	0	0	0	0	0.00
					Run Average	**0.03**

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Combustion Stack 2	Test Start Time:	11:22 AM
Unit Operation:	Normal	Test Finish Time:	1:44 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.76	% dv
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	120	minutes	Water Collected (W_f - W_i)	329.1	g
Barometric Pressure (Pbar)	29.11	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	15.517	scf
Stack Static Pressure (Pg)	-1.30	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	15.517	scf
Stack Diameter (Ds) (L if rectangular)	112.0	inches	Volume Dry Gas Metered (Vm)	110.375	dacf
Stack Width (enter 0 if circular stack)	0.0	inches	Vol. Dry Gas Metered Stand.(Vm(std))	105.347	dscf
Nozzle Diameter (Dn)	0.850	inches	Volume Dry Gas Metered (Vm(m^3))	3.125	dacm
O2	10.32	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.983	dscm
CO2	4.92	% dv	Stack Absolute Pressure (Ps)	29.01	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	985.6	R
Sample Calculation Title	Metals Testing Results		H2O Vapor Pressure @ avg Stack Temp.	1741.62	in. Hg
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1284	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1284	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.20	lb/lb-mole
Meter Temperature (Tm)	85.3	F	Wet Gas Molecular Weight (Ms)	27.76	lb/lb-mole
Stack Temperature (Tsavg)	526.0	F	Gas Velocity (Vs)	8.47	ft/s
Orifice Pressure Drop (dHavg)	2.963	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head (dP)'^avg	0.1066	in. H_2O^1/2	Area Stack (As)	68.417	ft^
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	34,769	acfm
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu	Standard Gas Flowrate	18,056	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	15,738	dscfm
K1method 4	0.04707	scf/ml	Actual Gas Flowrate	985	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	511	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	446	dscm/min
K4method 5	0.0945		Area Nozzle (An)	0.003941	ft^2
Standard lb-mole volume	385.3	ft^3/lb-mole	Percent of Isokinetic Sampling (I)	96.90	%

ArcelorMittal Monessen **Run 2** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.6	508	80	78
A-1	0.010	0.100	2.6	522	81	79
A-2	0.010	0.100	2.6	528	83	79
A-2	0.010	0.100	2.6	527	84	79
A-3	0.011	0.105	2.9	520	85	79
A-3	0.011	0.105	2.9	529	86	80
A-4	0.010	0.100	2.6	513	86	80
A-4	0.010	0.100	2.6	432	86	80
A-5	0.010	0.100	2.6	294	86	80
A-5	0.010	0.100	2.6	304	85	80
B-1	0.010	0.100	2.6	544	84	81
B-1	0.010	0.100	2.6	505	85	81
B-2	0.010	0.100	2.6	541	86	82
B-2	0.010	0.100	2.6	546	87	82
B-3	0.010	0.100	2.6	548	88	82
B-3	0.011	0.105	2.9	553	89	83
B-4	0.010	0.100	2.6	555	90	83
B-4	0.010	0.100	2.6	558	90	84
B-5	0.011	0.105	2.9	528	91	84
B-5	0.010	0.100	2.6	537	92	85
C-1	0.013	0.114	3.0	555	90	86
C-1	0.013	0.114	3.4	562	92	86
C-2	0.014	0.118	3.6	527	90	85
C-2	0.014	0.118	3.6	540	90	85
C-3	0.014	0.118	3.6	544	88	84
C-3	0.015	0.122	3.9	547	87	84
C-4	0.014	0.118	3.6	550	87	84
C-4	0.014	0.118	3.6	554	88	85
C-5	0.015	0.122	3.9	555	89	85
C-5	0.015	0.122	3.9	535	89	85
D-1	0.012	0.110	3.1	549	87	85
D-1	0.012	0.110	3.1	556	88	85
D-2	0.011	0.105	2.9	558	90	86
D-2	0.011	0.105	2.9	535	90	86
D-3	0.012	0.110	3.1	540	91	86
D-3	0.012	0.110	3.1	544	90	85
D-4	0.011	0.105	2.9	543	89	85
D-4	0.011	0.105	2.9	550	88	84
D-5	0.010	0.100	2.6	550	88	84
D-5	0.010	0.100	2.6	552	88	84

Metals

Mercury

Emission mass (1B Fraction)	<	0.015	(ug)
Emission mass (2B Fraction)		3.370	(ug)
Emission mass (3A Fraction)		0.1620	(ug)
Emission mass (3B Fraction)		4.910	(ug)
Emission mass (3C Fraction)		0.180	(ug)
Emission concentration (1B Fraction)	<	5.03E-06	(mg/dscm)
Emission concentration (2B Fraction)		1.13E-03	(mg/dscm)
Emission concentration (3A Fraction)		5.43E-05	(mg/dscm)
Emission concentration (3B Fraction)		1.65E-03	(mg/dscm)
Emission concentration (3C Fraction)		6.03E-05	(mg/dscm)
Emission rate (1B Fraction)	<	2.96E-07	(lb/hr)
Emission rate (2B Fraction)		6.66E-05	(lb/hr)
Emission rate (3A Fraction)		3.20E-06	(lb/hr)
Emission rate (3B Fraction)		9.70E-05	(lb/hr)
Emission rate (3C Fraction)		3.56E-06	(lb/hr)

Antimony

Front Half Mass Gained	<	0.800	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half	<	2.68E-04	(mg/dscm)
Emission Concentration Back-Half	<	3.35E-04	(mg/dscm)
Emission Rate Front-Half	<	1.58E-05	(lb/hr)
Emission Rate Back-Half	<	1.98E-05	(lb/hr)

Arsenic

Front Half Mass Gained		3.010	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half		1.01E-03	(mg/dscm)
Emission Concentration Back-Half	<	3.35E-04	(mg/dscm)
Emission Rate Front-Half		5.95E-05	(lb/hr)
Emission Rate Back-Half	<	1.98E-05	(lb/hr)

Beryllium

Front Half Mass Gained	<	0.200	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half	<	6.70E-05	(mg/dscm)
Emission Concentration Back-Half	<	8.38E-05	(mg/dscm)
Emission Rate Front-Half	<	3.95E-06	(lb/hr)
Emission Rate Back-Half	<	4.94E-06	(lb/hr)

Cadmium

Front Half Mass Gained		0.470	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half		1.58E-04	(mg/dscm)
Emission Concentration Back-Half	<	8.38E-05	(mg/dscm)
Emission Rate Front-Half		9.29E-06	(lb/hr)
Emission Rate Back-Half	<	4.94E-06	(lb/hr)

Chromium

Front Half Mass Gained		8.140	(ug)
Back Half Mass Gained		57.000	(ug)
Emission Concentration Front-Half		2.73E-03	(mg/dscm)
Emission Concentration Back-Half		1.91E-02	(mg/dscm)
Emission Rate Front-Half		1.61E-04	(lb/hr)
Emission Rate Back-Half		1.13E-03	(lb/hr)

Cobalt

Front Half Mass Gained		0.280	(ug)
Back Half Mass Gained		5.540	(ug)
Emission Concentration Front-Half		9.39E-05	(mg/dscm)
Emission Concentration Back-Half		1.86E-03	(mg/dscm)
Emission Rate Front-Half		5.53E-06	(lb/hr)
Emission Rate Back-Half		1.09E-04	(lb/hr)

Lead

Front Half Mass Gained		4.140	(ug)
Back Half Mass Gained		1.370	(ug)
Emission Concentration Front-Half		1.39E-03	(mg/dscm)
Emission Concentration Back-Half		4.59E-04	(mg/dscm)
Emission Rate Front-Half		8.18E-05	(lb/hr)
Emission Rate Back-Half		2.71E-05	(lb/hr)

Manganese

Front Half Mass Gained		3.900	(ug)
Back Half Mass Gained		104.000	(ug)
Emission Concentration Front-Half		1.31E-03	(mg/dscm)
Emission Concentration Back-Half		3.49E-02	(mg/dscm)
Emission Rate Front-Half		7.71E-05	(lb/hr)
Emission Rate Back-Half		2.06E-03	(lb/hr)

Nickel

Front Half Mass Gained		8.900	(ug)
Back Half Mass Gained		35.000	(ug)
Emission Concentration Front-Half		2.98E-03	(mg/dscm)
Emission Concentration Back-Half		1.17E-02	(mg/dscm)
Emission Rate Front-Half		1.76E-04	(lb/hr)
Emission Rate Back-Half		6.92E-04	(lb/hr)

Selenium

Front Half Mass Gained	<	2.000	(ug)
Back Half Mass Gained		6.800	(ug)
Emission Concentration Front-Half	<	6.70E-04	(mg/dscm)
Emission Concentration Back-Half		2.28E-03	(mg/dscm)
Emission Rate Front-Half	<	3.95E-05	(lb/hr)
Emission Rate Back-Half		1.34E-04	(lb/hr)

Average	0.01	0.107	2.96	526.0	85.3

Initial volume	948.600	ft^3	Initial volume	0.000	liters
Final volume	1058.975	ft^3	Final volume	0.000	liters
Total metered	110.375	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	965.7	875.3	90.4			0.0
2	888.9	888.2	0.7			0.0
3	640.6	593.9	46.7			0.0
4	736.9	723.6	13.3			0.0
5	716.5	710.7	5.8			0.0
6	803.9	631.7	172.2			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4752.5	4423.4	329.1	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Combustion Stack 2	Test Start Time:	11:22 AM
Unit Operation:	Normal	Test Finish Time:	1:44 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.11	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.850	inches
O2	10.32	% dv
CO2	4.92	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Particulate Matter Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	85.3	F
Stack Temperature (Tsavg)	526.0	F
Orifice Pressure Drop (dHavg)	2.963	in. H_2O
GasVelocity Head (dH')^avg	0.1066	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04707	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.76	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	329.1	g
Water Vapor in Silica Gel (Vwsg(std))	15.517	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	15.517	scf
Volume Dry Gas Metered (Vm)	110.375	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	105.347	dscf
Volume Dry Gas Metered (Vm(m^3))	3.125	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.983	dscm
Stack Absolute Pressure (Ps)	29.01	in. Hg
Stack Absolute Temperature (Tsavg)	985.6	R
H2O Vapor Pressure @ avg Stack Temp.	1741.62	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1284	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1284	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.20	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.76	lb/lb-mole
Gas Velocity (Vs)	8.47	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	34,769	acfm
Standard Gas Flowrate	18,056	scfm
Dry Standard Gas Flowrate	15,738	dscfm
Actual Gas Flowrate	985	acm/min
Standard Gas Flowrate	511	scm/min
Dry Standard Gas Flowrate	446	dscm/min
Area Nozzle (An)	0.003941	ft^2
Percent of Isokinetic Sampling (I)	96.90	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	46	ml
Acetone Wash Weight Gain	23.7	mg
Front Half Filter Particulate	5.1	mg
Total Particulate Mass (m_n)	28.80	mg
Particulate Concentration	0.0042	gr/dscf
Particulate Concentration	9.65	mg/dscm
Particulate Emission Rate	0.57	lb/hr

ArcelorMittal Monessen Run 2
Combustion Stack Exhaust

F or C?
F=1,C=0 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In (F or C)	Meter Temp Out (F or C)
A-1	0.010	0.100	2.6	508	80	78
A-1	0.010	0.100	2.6	522	81	79
A-2	0.010	0.100	2.6	528	83	79
A-2	0.010	0.100	2.6	527	84	79
A-3	0.011	0.105	2.9	520	85	79
A-3	0.011	0.105	2.9	529	86	80
A-4	0.010	0.100	2.6	513	86	80
A-4	0.010	0.100	2.6	432	86	80
A-5	0.010	0.100	2.6	294	86	80
A-5	0.010	0.100	2.6	304	85	80
B-1	0.010	0.100	2.6	544	84	81
B-1	0.010	0.100	2.6	505	85	81
B-2	0.010	0.100	2.6	541	86	82
B-2	0.010	0.100	2.6	546	87	82
B-3	0.010	0.100	2.6	548	88	82
B-3	0.011	0.105	2.9	553	89	83
B-4	0.010	0.100	2.6	555	90	83
B-4	0.010	0.100	2.6	558	90	84
B-5	0.011	0.105	2.9	528	91	84
B-5	0.010	0.100	2.6	537	92	85
C-1	0.013	0.114	3.0	555	90	86
C-1	0.013	0.114	3.4	562	92	86
C-2	0.014	0.118	3.6	527	90	85
C-2	0.014	0.118	3.6	540	90	85
C-3	0.014	0.118	3.6	544	88	84
C-3	0.015	0.122	3.9	547	87	84
C-4	0.014	0.118	3.6	550	87	84
C-4	0.014	0.118	3.6	554	88	85
C-5	0.015	0.122	3.9	555	89	85
C-5	0.015	0.122	3.9	535	89	85
D-1	0.012	0.110	3.1	549	87	85
D-1	0.012	0.110	3.1	556	88	85
D-2	0.011	0.105	2.9	558	90	86
D-2	0.011	0.105	2.9	535	90	86
D-3	0.012	0.110	3.1	540	91	86
D-3	0.012	0.110	3.1	544	90	85
D-4	0.011	0.105	2.9	543	89	85
D-4	0.011	0.105	2.9	550	88	84
D-5	0.010	0.100	2.6	550	88	84
D-5	0.010	0.100	2.6	552	88	84
Average	0.01	0.107	2.96	526.0		85.3

Initial volume	948.600	ft^3	Initial volume	0.000	liters
Final volume	1058.975	ft^3	Final volume	0.000	liters
Total metered	110.375	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	965.7	875.3	90.4	0.0	0.0	0.0
2	888.9	888.2	0.7	0.0	0.0	0.0
3	640.6	593.9	46.7	0.0	0.0	0.0
4	736.9	723.6	13.3	0.0	0.0	0.0
5	716.5	710.7	5.8	0.0	0.0	0.0
6	803.9	631.7	172.2	0.0	0.0	0.0
7	0.0	0.0	0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4752.5	4423.4	329.1	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Combustion Stack 2	Test Start Time:	11:22 AM
Unit Operation:	Normal	Test Finish Time:	1:44 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Time (min)		(Opacity at seconds of minute)				Minute
		:00	:15	:30	:45	Average
0	11:22 AM	0	0	0	0	0.00
1	11:23 AM	0	0	0	0	0.00
2	11:24 AM	0	0	0	0	0.00
3	11:25 AM	0	0	0	0	0.00
4	11:26 AM	0	0	0	0	0.00
5	11:27 AM	0	0	0	0	0.00
6	11:28 AM	0	0	0	0	0.00
7	11:29 AM	0	0	0	0	0.00
8	11:30 AM	0	0	0	0	0.00
9	11:31 AM	0	0	0	0	0.00
10	11:32 AM	0	0	0	0	0.00
11	11:33 AM	0	0	0	0	0.00
12	11:34 AM	0	0	0	0	0.00
13	11:35 AM	0	0	0	0	0.00
14	11:36 AM	0	0	0	0	0.00
15	11:37 AM	0	0	0	0	0.00
16	11:38 AM	0	0	0	0	0.00
17	11:39 AM	0	0	0	0	0.00
18	11:40 AM	0	0	0	0	0.00
19	11:41 AM	0	0	0	0	0.00
20	11:42 AM	0	0	0	0	0.00
21	11:43 AM	0	0	0	0	0.00
22	11:44 AM	0	0	0	0	0.00
23	11:45 AM	0	0	0	0	0.00
24	11:46 AM	0	0	0	0	0.00
25	11:47 AM	0	0	0	0	0.00
26	11:48 AM	0	0	0	0	0.00
27	11:49 AM	0	0	0	0	0.00
28	11:50 AM	0	0	0	0	0.00
29	11:51 AM	0	0	0	0	0.00
30	11:52 AM	0	0	0	0	0.00
31	11:53 AM	0	0	0	0	0.00
32	11:54 AM	0	0	0	0	0.00
33	11:55 AM	0	0	0	0	0.00
34	11:56 AM	0	0	0	0	0.00
35	11:57 AM	0	0	0	0	0.00
36	11:58 AM	0	0	0	0	0.00
37	11:59 AM	0	0	0	0	0.00
38	12:00 PM	0	0	0	0	0.00
39	12:01 PM	0	0	0	0	0.00
40	12:02 PM	0	0	0	0	0.00
41	12:03 PM	0	0	0	0	0.00
42	12:04 PM	0	0	0	0	0.00
43	12:05 PM	0	0	0	0	0.00
44	12:06 PM	0	0	0	0	0.00
45	12:07 PM	0	0	0	0	0.00
46	12:08 PM	0	0	0	0	0.00
47	12:09 PM	0	0	0	0	0.00
48	12:10 PM	0	0	0	0	0.00
49	12:11 PM	0	0	0	0	0.00
50	12:12 PM	0	0	0	0	0.00
51	12:13 PM	0	0	0	0	0.00
52	12:14 PM	0	0	0	0	0.00
53	12:15 PM	0	0	0	0	0.00
54	12:16 PM	0	0	0	0	0.00
55	12:17 PM	0	0	0	0	0.00
56	12:18 PM	0	0	0	0	0.00
57	12:19 PM	0	0	0	0	0.00
58	12:20 PM	0	0	0	0	0.00
59	12:21 PM	0	0	0	0	0.00
0	12:22 PM	0	0	0	0	0.00
1	12:23 PM	0	0	0	0	0.00
2	12:24 PM	0	0	0	0	0.00
3	12:25 PM	0	0	0	0	0.00
4	12:26 PM	0	0	0	0	0.00
5	12:27 PM	0	0	0	0	0.00
6	12:28 PM	0	0	0	0	0.00
7	12:29 PM	0	0	0	0	0.00
8	12:30 PM	0	0	0	0	0.00
9	12:31 PM	0	0	0	0	0.00

10	12:32 PM	0	0	0	0	0.00
11	12:33 PM	0	0	0	0	0.00
12	12:34 PM	0	0	0	0	0.00
13	12:35 PM	0	0	0	0	0.00
14	12:36 PM	0	0	0	0	0.00
15	12:37 PM	0	0	0	0	0.00
16	12:38 PM	0	0	0	0	0.00
17	12:39 PM	0	0	0	0	0.00
18	12:40 PM	0	0	0	0	0.00
19	12:41 PM	0	0	0	0	0.00
20	12:42 PM	0	0	0	0	0.00
21	12:43 PM	0	0	0	0	0.00
22	12:44 PM	0	0	0	0	0.00
23	12:45 PM	0	0	0	0	0.00
24	12:46 PM	0	0	0	0	0.00
25	12:47 PM	0	0	0	0	0.00
26	12:48 PM	0	0	0	0	0.00
27	12:49 PM	0	0	0	0	0.00
28	12:50 PM	0	0	0	0	0.00
29	12:51 PM	0	0	0	0	0.00
30	12:52 PM	0	0	0	0	0.00
31	12:53 PM	0	0	0	0	0.00
32	12:54 PM	0	0	0	0	0.00
33	12:55 PM	0	0	0	0	0.00
34	12:56 PM	0	0	0	0	0.00
35	12:57 PM	0	0	0	0	0.00
36	12:58 PM	0	0	0	0	0.00
37	12:59 PM	0	0	0	0	0.00
38	1:00 PM	0	0	0	0	0.00
39	1:01 PM	0	0	0	0	0.00
40	1:02 PM	0	0	0	0	0.00
41	1:03 PM	0	0	0	0	0.00
42	1:04 PM	0	0	0	0	0.00
43	1:05 PM	0	0	0	0	0.00
44	1:06 PM	0	0	0	0	0.00
45	1:07 PM	0	0	0	0	0.00
46	1:08 PM	0	0	0	0	0.00
47	1:09 PM	0	0	0	0	0.00
48	1:10 PM	0	0	0	0	0.00
49	1:11 PM	0	0	0	0	0.00
50	1:12 PM	0	0	0	0	0.00
51	1:13 PM	0	0	0	0	0.00
52	1:14 PM	0	0	0	0	0.00
53	1:15 PM	0	0	0	0	0.00
54	1:16 PM	0	0	0	0	0.00
55	1:17 PM	0	0	0	0	0.00
56	1:18 PM	0	0	0	0	0.00
57	1:19 PM	0	0	0	0	0.00
58	1:20 PM	0	0	0	0	0.00
59	1:21 PM	0	0	0	0	0.00
0	1:22 PM	--	--	--	--	0.00
1	1:23 PM	--	--	--	--	0.00
2	1:24 PM	--	--	--	--	0.00
3	1:25 PM	--	--	0	0	0.00
4	1:26 PM	0	0	0	0	0.00
5	1:27 PM	0	0	0	0	0.00
6	1:28 PM	0	0	0	0	0.00
7	1:29 PM	0	0	0	0	0.00
8	1:30 PM	0	0	0	0	0.00
9	1:31 PM	0	0	0	0	0.00
10	1:32 PM	0	0	0	0	0.00
11	1:33 PM	0	0	0	0	0.00
12	1:34 PM	0	0	0	0	0.00
13	1:35 PM	0	0	0	0	0.00
14	1:36 PM	0	0	0	0	0.00
15	1:37 PM	0	0	0	0	0.00
16	1:38 PM	0	0	0	0	0.00
17	1:39 PM	0	0	0	0	0.00
18	1:40 PM	0	0	0	0	0.00
19	1:41 PM	0	0	0	0	0.00
20	1:42 PM	0	0	0	0	0.00
21	1:43 PM	0	0	0	0	0.00
22	1:44 PM	0	0	0	0	0.00
23	1:45 PM	0	0	0	0	0.00
24	1:46 PM	0	0	0	0	0.00
25	1:47 PM	0	0	0	0	0.00
26	1:48 PM	0	0	0	0	0.00
27	1:49 PM	0	0	0	0	0.00
28	1:50 PM	0	0	0	0	0.00
29	1:51 PM	0	0	0	0	0.00
30	1:52 PM	0	0	0	0	0.00

31	1:53 PM	0	0	0	0	0.00
32	1:54 PM	0	0	0	0	0.00
33	1:55 PM	0	0	0	0	0.00
34	1:56 PM	0	0	0	0	0.00
35	1:57 PM	0	0	0	0	0.00
36	1:58 PM	0	0	0	0	0.00
37	1:59 PM	0	0	0	0	0.00
38	2:00 PM	0	0	0	0	0.00
39	2:01 PM	0	0	0	0	0.00
40	2:02 PM	0	0	0	0	0.00
41	2:03 PM	0	0	0	0	0.00
42	2:04 PM	0	0	0	0	0.00
43	2:05 PM	0	0	0	0	0.00
44	2:06 PM	0	0	0	0	0.00
45	2:07 PM	0	0	0	0	0.00
46	2:08 PM	0	0	0	0	0.00
47	2:09 PM	0	0	0	0	0.00
48	2:10 PM	0	0	0	0	0.00
49	2:11 PM	0	0	0	0	0.00
50	2:12 PM	0	0	0	0	0.00
51	2:13 PM	0	0	0	0	0.00
52	2:14 PM	0	0	0	0	0.00
53	2:15 PM	0	0	0	0	0.00
54	2:16 PM	0	0	0	0	0.00
55	2:17 PM	0	0	0	0	0.00
56	2:18 PM	0	0	0	0	0.00
57	2:19 PM	0	0	0	0	0.00
58	2:20 PM	0	0	0	0	0.00
59	2:21 PM	0	0	0	0	0.00
0	2:22 PM	0	0	0	0	0.00
1	2:23 PM	0	0	0	0	0.00
2	2:24 PM	0	0	0	0	0.00
3	2:25 PM	0	0	0	0	0.00
4	2:26 PM	0	0	0	0	0.00
5	2:27 PM	0	0	0	0	0.00
6	2:28 PM	0	0	0	0	0.00
7	2:29 PM	0	0	0	0	0.00
8	2:30 PM	0	0	0	0	0.00
9	2:31 PM	0	0	0	0	0.00
10	2:32 PM	0	0	0	0	0.00
11	2:33 PM	0	0	0	0	0.00
12	2:34 PM	0	0	0	0	0.00
13	2:35 PM	0	0	0	0	0.00
14	2:36 PM	0	0	0	0	0.00
15	2:37 PM	0	0	0	0	0.00
16	2:38 PM	0	0	0	0	0.00
17	2:39 PM	0	0	0	0	0.00
18	2:40 PM	0	0	0	0	0.00
19	2:41 PM	0	0	0	0	0.00
20	2:42 PM	0	0	0	0	0.00
21	2:43 PM	0	0	0	0	0.00
22	2:44 PM	0	0			0.00
					Run Average	**0.00**

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Combustion Stack 2	Test Start Time:	2:02 PM
Unit Operation:	Normal	Test Finish Time:	4:21 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.68	% dv
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Test Time (Theta)	120	minutes	Water Collected (W_f - W_i)	394.9	g
Barometric Pressure (Pbar)	29.11	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	18.620	scf
Static Static Pressure (Pg)	-1.30	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	18.620	scf
Stack Diameter (Ds) (L if rectangular)	112.0	inches	Volume Dry Gas Metered (Vm)	113.113	dacf
Stack Width (enter 0 if circular stack)	0.0	inches	Vol. Dry Gas Metered Stand.(Vm(std))	108.331	dscf
Nozzle Diameter (Dn)	0.850	inches	Volume Dry Gas Metered (Vm(m^3))	3.203	dacm
O2	10.37	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.068	dscm
CO2	4.95	% dv	Stack Absolute Pressure (Ps)	29.01	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	1005.9	R
Sample Calculation Title	Metals Testing Results		H2O Vapor Pressure @ avg Stack Temp.	2064.67	in. Hg
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1467	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1467	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.21	lb/lb-mole
Meter Temperature (Tm)	83.3	F	Wet Gas Molecular Weight (Ms)	27.56	lb/lb-mole
Stack Temperature (Tsavg)	546.3	F	Gas Velocity (Vs)	8.44	ft/s
Orifice Pressure Drop (dHavg)	2.875	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head (dP)^^avg	0.1047	in. H_2O^1/2	Area Stack (As)	68.417	ft^
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	34.626	acfm
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu	Standard Gas Flowrate	17.619	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	15.035	dscfm
K1method 4	0.04707	scf/ml	Actual Gas Flowrate	981	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	499	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	426	dscm/min
K4method 5	0.0945		Area Nozzle (An)	0.003941	ft^2
Standard lb-mole volume	385.3	ft^3/lb-mole	Percent of Isokinetic Sampling (I)	104.31	%

ArcelorMittal Monessen **Run 3** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.012	0.110	3.1	502	83	82
A-1	0.014	0.118	3.6	540	84	82
A-2	0.011	0.105	2.9	544	84	81
A-2	0.012	0.110	3.1	549	85	81
A-3	0.012	0.110	3.1	552	85	81
A-3	0.012	0.110	3.1	557	85	81
A-4	0.011	0.105	2.9	559	86	81
A-4	0.011	0.105	2.9	528	87	82
A-5	0.012	0.110	3.1	544	88	82
A-5	0.012	0.110	3.1	548	89	85
B-1	0.014	0.118	3.6	561	85	82
B-1	0.012	0.110	3.1	522	85	82
B-2	0.012	0.110	3.1	540	85	82
B-2	0.013	0.114	3.4	543	85	82
B-3	0.015	0.122	3.9	547	85	82
B-3	0.015	0.122	3.9	550	86	82
B-4	0.014	0.118	3.6	553	85	82
B-4	0.014	0.118	3.6	554	85	82
B-5	0.012	0.110	3.1	537	86	82
B-5	0.012	0.110	3.1	544	87	82
C-1	0.010	0.100	2.6	557	84	81
C-1	0.010	0.100	2.6	563	83	81
C-2	0.010	0.100	2.6	538	84	81
C-2	0.010	0.100	2.6	544	84	81
C-3	0.010	0.100	2.6	543	85	82
C-3	0.010	0.100	2.6	551	86	81
C-4	0.010	0.100	2.6	540	86	81
C-4	0.005	0.071	1.3	555	86	81
C-5	0.005	0.071	1.3	556	85	81
C-5	0.010	0.100	2.6	535	86	81
D-1	0.010	0.100	2.6	549	83	81
D-1	0.010	0.100	2.6	556	83	80
D-2	0.010	0.100	2.6	556	84	80
D-2	0.010	0.100	2.6	561	85	81
D-3	0.010	0.100	2.6	538	85	81
D-3	0.011	0.105	2.9	541	85	80
D-4	0.010	0.100	2.6	546	85	81
D-4	0.010	0.100	2.6	550	86	81
D-5	0.010	0.100	2.6	546	86	81
D-5	0.010	0.100	2.6	551	87	81

Metals

Mercury			
Emission mass (1B Fraction)		0.019	(ug)
Emission mass (2B Fraction)		3.230	(ug)
Emission mass (3A Fraction)		0.1160	(ug)
Emission mass (3B Fraction)		0.051	(ug)
Emission mass (3C Fraction)		3.660	(ug)
Emission concentration (1B Fraction)		6.19E-06	(mg/dscm)
Emission concentration (2B Fraction)		1.05E-03	(mg/dscm)
Emission concentration (3A Fraction)		3.78E-05	(mg/dscm)
Emission concentration (3B Fraction)		1.66E-05	(mg/dscm)
Emission concentration (3C Fraction)		1.19E-03	(mg/dscm)
Emission rate (1B Fraction)		3.49E-07	(lb/hr)
Emission rate (2B Fraction)		5.93E-05	(lb/hr)
Emission rate (3A Fraction)		2.13E-06	(lb/hr)
Emission rate (3B Fraction)		9.36E-07	(lb/hr)
Emission rate (3C Fraction)		6.72E-05	(lb/hr)

Antimony			
Front Half Mass Gained	<	0.800	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half	<	2.61E-04	(mg/dscm)
Emission Concentration Back-Half	<	3.26E-04	(mg/dscm)
Emission Rate Front-Half	<	1.47E-05	(lb/hr)
Emission Rate Back-Half	<	1.84E-05	(lb/hr)

Arsenic			
Front Half Mass Gained		5.560	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half		1.81E-03	(mg/dscm)
Emission Concentration Back-Half	<	3.26E-04	(mg/dscm)
Emission Rate Front-Half		1.02E-04	(lb/hr)
Emission Rate Back-Half	<	1.84E-05	(lb/hr)

Beryllium			
Front Half Mass Gained	<	0.200	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half	<	6.52E-05	(mg/dscm)
Emission Concentration Back-Half	<	8.15E-05	(mg/dscm)
Emission Rate Front-Half	<	3.67E-06	(lb/hr)
Emission Rate Back-Half	<	4.59E-06	(lb/hr)

Cadmium			
Front Half Mass Gained		0.240	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half		7.82E-05	(mg/dscm)
Emission Concentration Back-Half	<	8.15E-05	(mg/dscm)
Emission Rate Front-Half		4.41E-06	(lb/hr)
Emission Rate Back-Half	<	4.59E-06	(lb/hr)

Chromium			
Front Half Mass Gained		7.610	(ug)
Back Half Mass Gained		18.100	(ug)
Emission Concentration Front-Half		2.48E-03	(mg/dscm)
Emission Concentration Back-Half		5.90E-03	(mg/dscm)
Emission Rate Front-Half		1.40E-04	(lb/hr)
Emission Rate Back-Half		3.32E-04	(lb/hr)

Cobalt			
Front Half Mass Gained	<	0.200	(ug)
Back Half Mass Gained		2.240	(ug)
Emission Concentration Front-Half	<	6.52E-05	(mg/dscm)
Emission Concentration Back-Half		7.30E-04	(mg/dscm)
Emission Rate Front-Half	<	3.67E-06	(lb/hr)
Emission Rate Back-Half		4.11E-05	(lb/hr)

Lead			
Front Half Mass Gained		3.980	(ug)
Back Half Mass Gained		0.980	(ug)
Emission Concentration Front-Half		1.30E-03	(mg/dscm)
Emission Concentration Back-Half		3.19E-04	(mg/dscm)
Emission Rate Front-Half		7.31E-05	(lb/hr)
Emission Rate Back-Half		1.80E-05	(lb/hr)

Manganese			
Front Half Mass Gained		3.500	(ug)
Back Half Mass Gained		8.400	(ug)
Emission Concentration Front-Half		1.14E-03	(mg/dscm)
Emission Concentration Back-Half		2.74E-03	(mg/dscm)
Emission Rate Front-Half		6.43E-05	(lb/hr)
Emission Rate Back-Half		1.54E-04	(lb/hr)

Nickel			
Front Half Mass Gained		9.600	(ug)
Back Half Mass Gained		9.300	(ug)
Emission Concentration Front-Half		3.13E-03	(mg/dscm)
Emission Concentration Back-Half		3.03E-03	(mg/dscm)
Emission Rate Front-Half		1.76E-04	(lb/hr)
Emission Rate Back-Half		1.71E-04	(lb/hr)

Selenium			
Front Half Mass Gained		3.100	(ug)
Back Half Mass Gained		10.100	(ug)
Emission Concentration Front-Half		1.01E-03	(mg/dscm)
Emission Concentration Back-Half		3.29E-03	(mg/dscm)
Emission Rate Front-Half		5.69E-05	(lb/hr)
Emission Rate Back-Half		1.85E-04	(lb/hr)

Average	0.01	0.105	2.88	546.3		83.3
Initial volume	59.700	ft^3	Initial volume	0.000	liters	
Final volume	172.813	ft^3	Final volume	0.000	liters	
Total metered	113.113	dacf	Total metered	0.000	dry actual liters	

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	834.2	693.8	140.4			0.0
2	807.5	680.5	127.0			0.0
3	620.8	599.4	21.4			0.0
4	737.3	725.7	11.6			0.0
5	731.2	727.0	4.2			0.0
6	796.7	706.4	90.3			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4527.7	4132.8	394.9	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Combustion Stack 2	Test Start Time:	2:02 PM
Unit Operation:	Normal	Test Finish Time:	4:21 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.11	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.850	inches
O2	10.37	% dv
CO2	4.95	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Particulate Matter Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	83.3	F
Stack Temperature (Tsavg)	546.3	F
Orifice Pressure Drop (dHavg)	2.875	in. H_2O
GasVelocity Head (dP)^^avg	0.1047	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04707	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.68	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	394.9	g
Water Vapor in Silica Gel (Vwsg(std))	18.620	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	18.620	scf
Volume Dry Gas Metered (Vm)	113.113	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	108.331	dscf
Volume Dry Gas Metered (Vm(m^3))	3.203	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.068	dscm
Stack Absolute Pressure (Ps)	29.01	in. Hg
Stack Absolute Temperature (Tsavg)	1005.9	R
H2O Vapor Pressure @ avg Stack Temp.	2064.67	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1467	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1467	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.21	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.56	lb/lb-mole
Gas Velocity (Vs)	8.44	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	34,626	acfm
Standard Gas Flowrate	17,619	scfm
Dry Standard Gas Flowrate	15,035	dscfm
Actual Gas Flowrate	981	acm/min
Standard Gas Flowrate	499	scm/min
Dry Standard Gas Flowrate	426	dscm/min
Area Nozzle (An)	0.003941	ft^2
Percent of Isokinetic Sampling (I)	104.31	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	91	ml
Acetone Wash Weight Gain	52.9	mg
Front Half Filter Particulate	4.1	mg
Total Particulate Mass (m_n)	57.00	mg
Particulate Concentration	0.0081	gr/dscf
Particulate Concentration	18.58	mg/dscm
Particulate Emission Rate	1.05	lb/hr

ArcelorMittal Monessen **Run 3** **F or C?**

Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In (F or C)	Meter Temp Out (F or C)
A-1	0.012	0.110	3.1	502	83	82
A-1	0.014	0.118	3.6	540	84	82
A-2	0.011	0.105	2.9	544	84	81
A-2	0.012	0.110	3.1	549	85	81
A-3	0.012	0.110	3.1	552	85	81
A-3	0.012	0.110	3.1	557	85	81
A-4	0.011	0.105	2.9	559	86	81
A-4	0.011	0.105	2.9	528	87	82
A-5	0.012	0.110	3.1	544	88	82
A-5	0.012	0.110	3.1	548	89	85
B-1	0.014	0.118	3.6	561	85	82
B-1	0.012	0.110	3.1	522	85	82
B-2	0.012	0.110	3.1	540	85	82
B-2	0.013	0.114	3.4	543	85	82
B-3	0.015	0.122	3.9	547	85	82
B-3	0.015	0.122	3.9	550	86	82
B-4	0.014	0.118	3.6	553	85	82
B-4	0.014	0.118	3.6	554	85	82
B-5	0.012	0.110	3.1	537	86	82
B-5	0.012	0.110	3.1	544	87	82
C-1	0.010	0.100	2.6	557	84	81
C-1	0.010	0.100	2.6	563	83	81
C-2	0.010	0.100	2.6	538	84	81
C-2	0.010	0.100	2.6	544	84	81
C-3	0.010	0.100	2.6	543	85	82
C-3	0.010	0.100	2.6	551	86	81
C-4	0.010	0.100	2.6	540	86	81
C-4	0.005	0.071	1.3	555	86	81
C-5	0.005	0.071	1.3	556	85	81
C-5	0.010	0.100	2.6	535	86	81
D-1	0.010	0.100	2.6	549	83	81
D-1	0.010	0.100	2.6	556	83	80
D-2	0.010	0.100	2.6	556	84	80
D-2	0.010	0.100	2.6	561	85	81
D-3	0.010	0.100	2.6	538	85	81
D-3	0.011	0.105	2.9	541	85	80
D-4	0.010	0.100	2.6	546	85	81
D-4	0.010	0.100	2.6	550	86	81
D-5	0.010	0.100	2.6	546	86	81
D-5	0.010	0.100	2.6	551	87	81
Average	0.01	0.105	2.88	546.3		83.3

Initial volume	59.700	ft^3	Initial volume	0.000	liters
Final volume	172.813	ft^3	Final volume	0.000	liters
Total metered	113.113	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	834.2	693.8	140.4			0.0
2	807.5	680.5	127.0			0.0
3	620.8	599.4	21.4			0.0
4	737.3	725.7	11.6			0.0
5	731.2	727.0	4.2			0.0
6	796.7	706.4	90.3			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4527.7	4132.8	394.9	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal Monessen	Test Date:	October 19, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Combustion Stack 2	Test Start Time:	2:02 PM
Unit Operation:	Normal	Test Finish Time:	4:21 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Time (min)		(Opacity at seconds of minute)				Minute
		:00	:15	:30	:45	Average
0	2:02 PM	0	0	0	0	0.00
1	2:03 PM	0	0	0	0	0.00
2	2:04 PM	0	0	0	0	0.00
3	2:05 PM	0	0	0	0	0.00
4	2:06 PM	0	0	0	0	0.00
5	2:07 PM	0	0	0	0	0.00
6	2:08 PM	0	0	0	0	0.00
7	2:09 PM	0	0	0	0	0.00
8	2:10 PM	0	0	0	0	0.00
9	2:11 PM	0	0	0	0	0.00
10	2:12 PM	0	0	0	0	0.00
11	2:13 PM	0	0	0	0	0.00
12	2:14 PM	0	0	0	0	0.00
13	2:15 PM	0	0	0	0	0.00
14	2:16 PM	0	0	0	0	0.00
15	2:17 PM	0	0	0	0	0.00
16	2:18 PM	0	0	0	0	0.00
17	2:19 PM	0	0	0	0	0.00
18	2:20 PM	0	0	0	0	0.00
19	2:21 PM	0	0	0	0	0.00
20	2:22 PM	0	0	0	0	0.00
21	2:23 PM	0	0	0	0	0.00
22	2:24 PM	0	0	0	0	0.00
23	2:25 PM	0	0	5	0	1.25
24	2:26 PM	0	0	0	0	0.00
25	2:27 PM	0	0	0	0	0.00
26	2:28 PM	0	0	0	0	0.00
27	2:29 PM	0	0	0	0	0.00
28	2:30 PM	0	0	0	0	0.00
29	2:31 PM	0	0	0	0	0.00
30	2:32 PM	0	5	0	0	1.25
31	2:33 PM	0	0	0	0	0.00
32	2:34 PM	0	0	0	0	0.00
33	2:35 PM	0	0	0	0	0.00
34	2:36 PM	0	0	0	0	0.00
35	2:37 PM	0	0	0	0	0.00
36	2:38 PM	0	0	0	0	0.00
37	2:39 PM	0	0	0	0	0.00
38	2:40 PM	0	0	0	0	0.00
39	2:41 PM	0	0	0	0	0.00
40	2:42 PM	0	0	0	0	0.00
41	2:43 PM	0	0	0	0	0.00
42	2:44 PM	0	0	0	0	0.00
43	2:45 PM	0	0	0	0	0.00
44	2:46 PM	0	0	0	0	0.00
45	2:47 PM	0	0	0	0	0.00
46	2:48 PM	0	0	0	0	0.00
47	2:49 PM	0	0	0	0	0.00
48	2:50 PM	0	0	0	0	0.00
49	2:51 PM	0	0	0	0	0.00
50	2:52 PM	0	0	0	0	0.00
51	2:53 PM	0	0	0	0	0.00
52	2:54 PM	0	0	0	0	0.00
53	2:55 PM	0	0	0	0	0.00
54	2:56 PM	0	0	0	0	0.00
55	2:57 PM	0	0	0	0	0.00
56	2:58 PM	0	0	0	0	0.00
57	2:59 PM	0	0	0	0	0.00
58	3:00 PM	0	0	0	0	0.00
59	3:01 PM	0	0	0	0	0.00
0	3:02 PM	0	0	0	0	0.00
1	3:03 PM	0	0	0	0	0.00
2	3:04 PM	0	0	0	0	0.00
3	3:05 PM	0	0	0	0	0.00
4	3:06 PM	0	0	0	0	0.00
5	3:07 PM	0	0	0	0	0.00
6	3:08 PM	0	0	0	0	0.00
7	3:09 PM	0	0	0	0	0.00
8	3:10 PM	0	0	0	0	0.00
9	3:11 PM	0	0	0	0	0.00

10	3:12 PM	0	0	0	0	0.00
11	3:13 PM	0	0	0	0	0.00
12	3:14 PM	0	0	0	0	0.00
13	3:15 PM	0	0	0	0	0.00
14	3:16 PM	0	0	0	0	0.00
15	3:17 PM	0	0	0	0	0.00
16	3:18 PM	0	0	0	0	0.00
17	3:19 PM	0	0	0	0	0.00
18	3:20 PM	0	0	0	0	0.00
19	3:21 PM	0	0	0	0	0.00
20	3:22 PM	0	0	0	0	0.00
21	3:23 PM	0	0	0	0	0.00
22	3:24 PM	0	0	0	0	0.00
23	3:25 PM	0	0	0	0	0.00
24	3:26 PM	0	0	0	0	0.00
25	3:27 PM	0	0	0	0	0.00
26	3:28 PM	0	0	0	0	0.00
27	3:29 PM	0	0	0	0	0.00
28	3:30 PM	0	0	0	0	0.00
29	3:31 PM	0	0	0	0	0.00
30	3:32 PM	0	0	0	0	0.00
31	3:33 PM	0	0	0	0	0.00
32	3:34 PM	0	0	0	0	0.00
33	3:35 PM	0	0	0	0	0.00
34	3:36 PM	0	0	0	0	0.00
35	3:37 PM	0	0	0	0	0.00
36	3:38 PM	0	0	0	0	0.00
37	3:39 PM	0	0	0	0	0.00
38	3:40 PM	0	5	0	5	2.50
39	3:41 PM	0	0	0	0	0.00
40	3:42 PM	0	0	0	0	0.00
41	3:43 PM	0	0	0	0	0.00
42	3:44 PM	0	0	0	5	1.25
43	3:45 PM	10	10	5	0	6.25
44	3:46 PM	0	0	0	0	0.00
45	3:47 PM	0	0	0	0	0.00
46	3:48 PM	0	0	0	0	0.00
47	3:49 PM	0	0	0	0	0.00
48	3:50 PM	0	0	0	0	0.00
49	3:51 PM	0	0	0	0	0.00
50	3:52 PM	0	0	0	0	0.00
51	3:53 PM	0	0	0	0	0.00
52	3:54 PM	0	0	0	0	0.00
53	3:55 PM	0	0	0	0	0.00
54	3:56 PM	0	0	0	0	0.00
55	3:57 PM	0	0	0	0	0.00
56	3:58 PM	0	0	0	0	0.00
57	3:59 PM	0	0	0	0	0.00
58	4:00 PM	0	0	0	0	0.00
59	4:01 PM	0	0	0	0	0.00
0	4:02 PM	0	0	0	0	0.00
1	4:03 PM	0	0	0	0	0.00
2	4:04 PM	0	0	0	0	0.00
3	4:05 PM	0	0	0	0	0.00
4	4:06 PM	0	0	0	0	0.00
5	4:07 PM	0	0	0	0	0.00
6	4:08 PM	0	0	0	0	0.00
7	4:09 PM	0	0	0	0	0.00
8	4:10 PM	0	0	0	0	0.00
9	4:11 PM	0	0	0	0	0.00
10	4:12 PM	0	0	0	0	0.00
11	4:13 PM	0	0	0	0	0.00
12	4:14 PM	0	0	0	0	0.00
13	4:15 PM	0	0	0	0	0.00
14	4:16 PM	0	0	0	0	0.00
15	4:17 PM	0	0	0	0	0.00
16	4:18 PM	0	0	0	0	0.00
17	4:19 PM	0	0	0	0	0.00
18	4:20 PM	0	0	0	0	0.00
					Run Average	**0.09**

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MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.977	**Start Time:**	0825
Date:	10/19/2016	**Run Number:**	1	**Meter Correction (γ):**	1.006	**Stop Time:**	1048
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.85	**Pitot Correction:**	0.84	**T/C ID:**	9-1
Sampling Location:	Comb. Stack Outlet	**Static Press (in. H_2O):**	-1.2	**Control Box ID:**	1774	**Probe ID:**	9-1
		Baro. Pres. (in. Hg):	29.12	**Assumed Moisture (%):**	14%	**Pitot ID:**	9-1
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	75	**Umbilical Length (Feet):**	200'	**Filter ID:**	Q6997
Test Crew:	BC JW CB TM	**Initial K-factor**	260			**Stack Diameter (inches):**	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Oven Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
	0:00:00	833.400										
A-1	0:03:00	837.00	0.010	2.6	8	525	254	240	64	77	75	Start 0825
A-1	0:06:00	839.67	0.010	2.6	8	537	252	241	68	78	76	
A-2	0:09:00	842.36	0.010	2.6	8	480	252	245	68	80	76	
A-2	0:12:00	845.03	0.010	2.6	8	478	253	249	67	80	76	
A-3	0:15:00	847.87	0.011	2.9	9	467	253	252	68	81	77	
A-3	0:18:00	850.71	0.011	2.9	9	473	253	254	66	81	77	
A-4	0:21:00	853.76	0.013	3.4	10	416	252	254	65	83	77	
A-4	0:24:00	856.83	0.013	3.4	10	422	254	254	64	83	77	
A-5	0:27:00	859.81	0.012	3.1	10	351	255	254	63	84	78	
A-5	0:30:00	862.756	0.012	3.1	10	343	252	254	63	84	78	
B-1	0:33:00	866.51	0.010	2.6	8	533	252	253	57	81	79	
B-1	0:36:00	869.17	0.010	2.6	8	544	253	254	58	82	79	
B-2	0:39:00	871.88	0.010	2.6	8	539	251	253	58	83	79	
B-2	0:42:00	874.58	0.010	2.6	8	542	253	254	58	84	79	
B-3	0:45:00	877.28	0.010	2.6	8	471	253	255	57	84	79	
B-3	0:48:00	879.99	0.010	2.6	8	484	253	255	57	84	79	
B-4	0:51:00	882.81	0.011	2.9	9	434	253	254	57	84	79	
B-4	0:54:00	885.65	0.011	2.9	9	404	253	254	57	84	79	
B-5	0:57:00	888.62	0.012	3.1	10	324	253	254	57	84	79	
B-5	1:00:00	891.527	0.012	3.1	10	304	253	254	57	84	79	
C-1	1:03:00	894.27	0.010	2.6	8	542	252	253	56	81	79	
C-1	1:06:00	896.98	0.010	2.6	8	513	252	254	56	82	79	
C-2	1:09:00	899.72	0.010	2.6	8	459	253	252	57	83	79	
C-2	1:12:00	902.39	0.010	2.6	8	464	252	254	57	84	79	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.001
Check	Final	15	0.001
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	E	M	S
O_2 (%)				

Fyrite Kit ID: N/A Fyrite O_2 Check N/A %

Balance ID:

Reference Weight (200g):	N/A	Tolerance = +/- 0.5 g
Reference Weight (500g):	500.0	Tolerance = +/- 0.5 g

738.8 JW

Imp	Contents	Final	Initial	Difference
1	5%HNO_3/10%H_2O_2 (g)	813.1	725.2	
2	5%HNO_3/10%H_2O_2 (g)	728.3	608.7	
3	Empty (g)	620.1	607.5	
4	10%H_2SO_4/$KMnO_4$ (g)	[illegible]	719.9	
5	10%H_2SO_4/$KMnO_4$ (g)	752.1	718.8	
6	Silica (g)	806.1	771.1	

MONTROSE METHOD 5/29 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 5/29 **Project Number:** Proj106377 (16-167)

Date: 10 / 19 / 2016 **Run Number:** 1 **Sampling Location:** Comb. Stack Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed JV JW TL T (mins)	Proj106377 (16-167) Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Oven Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:15:00	905.44	0.013	3.4	10	367	253	254	57	85	80	
C-3	1:18:00	908.59	0.013	3.4	10	360	252	254	58	86	80	
C-4	1:21:00	911.51	0.012	3.1	10	238	254	255	58	86	80	
C-4	1:24:00	914.48	0.012	3.1	10	247	253	254	58	86	80	
C-5	1:27:00	917.21	0.015	3.9	12	142	254	254	58	87	~~87~~ 81	
C-5	1:30:00	920.722	0.012	3.1	10	140	253	254	58	87	81	
D-1	1:33:00	923.47	0.010	2.6	8	552	252	253	55	83	80	
D-1	1:36:00	926.18	0.010	2.6	8	557	253	254	55	83	80	
D-2	1:39:00	928.91	0.010	2.6	8	527	253	254	55	84	80	
D-2	1:42:00	931.62	0.010	2.6	8	531	253	254	56	85	80	
D-3	1:45:00	~~933.42~~ 934.34	0.010	2.6	8	520	253	255	55	85	80	
D-3	1:48:00	937.03	0.010	2.6	8	523	251	254	55	86	80	
D-4	1:51:00	939.75	0.010	2.6	8	502	254	254	55	86	80	
D-4	1:54:00	942.43	0.010	2.6	8	489	253	254	55	86	81	
D-5	1:57:00	945.22	0.010	2.6	8	317	253	254	55	86	80	
D-5	2:00:00	947.865	0.010	2.6	8	234	254	253	57	85	80	End 1048

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.971	**Start Time:**	11:22
Date:	10/19/16	**Run Number:**	2	**Meter Correction (γ):**	~~0.998~~ 1.006	**Stop Time:**	13:44
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.850	**Pitot Correction:**	0.84	**T/C ID:**	9-1
Sampling Location:	Comb. Stack Outlet	**Static Press (in. H_2O):**	-1.3	**Control Box ID:**	1774	**Probe ID:**	9-1
		Baro. Pres. (in. Hg):	29.11	**Assumed Moisture (%):**	14%	**Pitot ID:**	9-1
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	80	**Umbilical Length (Feet):**	200'	**Filter ID:**	Q7057
Test Crew:	BC JW CB TM	**Initial K-factor**	206			**Stack Diameter (inches):**	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Oven Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
	0:00:00	948.600										
A-1	0:03:00	950.94	0.010	2.6	8	508	254	244	62	80	78	Start 11:22
A-1	0:06:00	~~41~~ 953.37	0.010	2.6	8	522	253	247	63	81	79	
A-2	0:09:00	~~955.81~~ 955.81	0.010	2.6	8	528	253	252	64	83	79	
A-2	0:12:00	~~956.2~~ 958.24	0.010	2.6	8	527	251	254	63	84	79	
A-3	0:15:00	960.78	0.011	2.9	9	520	255	254	63	85	79	
A-3	0:18:00	963.49	0.011	2.9	9	529	254	255	63	86	80	
A-4	0:21:00	965.84	0.010	2.6	8	513	253	254	61	86	80	
A-4	0:24:00	968.26	0.010	2.6	8	432	253	254	60	86	80	
A-5	0:27:00	970.66	0.010	2.6	8	294	253	255	60	86	80	
A-5	0:30:00	973.082	0.010	2.6	8	304	253	254	61	85	80	
B-1	0:33:00	975.81	0.010	2.6	8	544	252	253	57	84	81	
B-1	0:36:00	~~978.54~~ 978.54	0.010	2.6	8	505	253	254	57	85	81	
B-2	0:39:00	981.24	0.010	2.6	9	541	252	255	58	86	82	
B-2	0:42:00	983.91	0.010	2.6	9	546	253	255	57	87	82	
B-3	0:45:00	986.66	0.010	2.6	9	548	253	254	55	88	82	
B-3	0:48:00	989.50	0.011	2.9	10	553	252	254	55	89	83	
B-4	0:51:00	991.97	0.010	2.6	8	555	252	254	57	90	83	
B-4	0:54:00	994.39	0.010	2.6	8	558	253	253	58	90	84	
B-5	0:57:00	996.89	0.011	2.9	9	528	254	254	59	~~90~~ 91	84	
B-5	1:00:00	999.387	0.010	2.6	8	537	253	254	60	92	85	
C-1	1:03:00	1001.67	0.013	3.4	12	555	253	254	57	90	86	
C-1	1:06:00	1004.92	0.013	3.4	12	562	253	254	59	92	86	
C-2	1:09:00	1007.84	0.014	3.6	13	527	253	251	60	90	85	
C-2	1:12:00	1011.02	0.014	3.6	13	540	253	253	62	90	85	

(max leak rate = 0.02 ft³/min)

		(in. Hg)	(ft³/min)
Sample Train Leak Check	Initial	15	0.001
	Final	15	0.001
		Pressure (+)	Static (-)
Pitot Leak Check	Initial	✓	✓
	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	E	M	S
O_2 (%)				

Fyrite Kit ID: NA — Fyrite O_2 Check: NA %

Balance ID: BAL-017

Reference Weight (200g):	NA	Tolerance = +/- 0.5 g
Reference Weight (500g):	500.0	Tolerance = +/- 0.5 g

Imp	Contents	Final	Initial	Difference
1	5%HNO_3/10%H_2O_2 (g)	965.7	875.3	
2	5%HNO_3/10%H_2O_2 (g)	888.9	848.2	
3	Empty (g)	640.6	593.9	
4	10%H_2SO_4/$KMnO_4$ (g)	736.9	723.6	
5	10%H_2SO_4/$KMnO_4$ (g)	716.5	710.7	
6	Silica (g)	803.9	631.7	

MONTROSE METHOD 5/29 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 5/29 **Project Number:** Proj106377 (16-167)

Date: 10/19/16 **Run Number:** 2 **Sampling Location:** Comb: Stack Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed JV JW TL T (mins)	Proj106377 (16-167) Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Oven Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:15:00	1014.18	0.014	3.6	13	544	253	254	64	88	84	
C-3	1:18:00	1017.34	0.015	3.9	14	547	253	254	66	87	84	
C-4	1:21:00	1020.49	0.014	3.6	13	550	255	255	63	87	84	
C-4	1:24:00	1023.67	0.014	3.6	13	554	253	254	63	88	85	
C-5	1:27:00	1026.94	0.015	3.9	14	555	253	254	65	89	85	
C-5	1:30:00	1030.251	0.015	3.9	14	535	253	255	67	89	85	
D-1	1:33:00	1033.23	0.012	3.1	12	549	253	252	63	87	85	
D-1	1:36:00	1036.14	0.012	3.1	12	556	254	253	64	88	85	
D-2	1:39:00	1039.01	0.011	2.9	11	558	253	255	65	90	86	
D-2	1:42:00	1041.82	0.011	2.9	11	535	251	254	67	90	86	
D-3	1:45:00	1044.81	0.012	3.1	12	540	254	254	63	91	86	
D-3	1:48:00	1047.76	0.012	3.1	12	544	253	255	63	90	85	
D-4	1:51:00	1050.65	0.011	2.9	11	543	254	253	62	89	85	
D-4	1:54:00	1053.27	0.011	2.9	11	550	253	252	63	88	84	
D-5	1:57:00	1056.26	0.010	2.6	10	550	253	254	64	88	84	
D-5	2:00:00	1058.975	0.010	2.6	10	552	252	255	64	88	84	Stop 13:44

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.971	**Start Time:**	14:02
Date:	10/19/16	**Run Number:**	3	**Meter Correction (γ):**	1.008	**Stop Time:**	16:21
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.850	**Pitot Correction:**	0.84	**T/C ID:**	9-1
Sampling Location:	Comb. Stack Outlet	**Static Press (in. H_2O):**	-1.3	**Control Box ID:**	1774	**Probe ID:**	9-1
		Baro. Pres. (in. Hg):	29.11	**Assumed Moisture (%):**	14%	**Pitot ID:**	9-1
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	80	**Umbilical Length (Feet):**	200'	**Filter ID:**	Q6810
Test Crew:	BC JW CB TM	**Initial K-factor**	260			**Stack Diameter (inches):**	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Oven Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
	0:00:00	59.7										
A-1	0:03:00	62.43	0.012	3.1	9	502	244	240	64	83	82	Start 14:02
A-1	0:06:00	65.38	0.014	3.6	10	540	250	242	64	84	82	
A-2	0:09:00	68.32	0.011	2.9	8	544	252	246	61	84	81	
A-2	0:12:00	71.28	0.012	3.1	9	544	253	249	60	85	81	
A-3	0:15:00	74.18	0.012	3.1	9	552	254	252	58	85	81	
A-3	0:18:00	77.12	0.012	3.1	9	557	254	254	57	85	81	
A-4	0:21:00	80.01	0.011	2.9	8	559	252	254	56	86	81	
A-4	0:24:00	82.86	0.011	2.9	8	528	252	255	56	~~90~~ 87	82	
A-5	0:27:00	85.76	0.012	3.1	9	544	251	255	56	88	82	
A-5	0:30:00	88.712	0.012	3.1	9	548	254	253	56	89	85	
B-1	0:33:00	92.24	0.014	3.6	10	661	253	253	56	85	~~81~~ 82	
B-1	0:36:00	94.88	0.012	3.1	9	522	254	253	56	85	82	
B-2	0:39:00	97.83	0.012	3.1	9	540	253	254	58	85	82	
B-2	0:42:00	100.89	0.013	3.4	9	543	253	254	59	85	82	
B-3	0:45:00	104.16	0.015	3.9	11	547	252	255	60	85	82	
B-3	0:48:00	107.43	0.015	3.9	11	556	255	255	60	86	82	
B-4	0:51:00	110.68	0.014	3.6	10	553	254	254	61	85	82	
B-4	0:54:00	113.83	0.014	3.6	10	554	254	254	62	85	82	
B-5	0:57:00	116.83	0.012	3.1	9	537	255	253	62	86	82	
B-5	1:00:00	119.766	0.012	3.1	9	544	250	254	63	87	82	
C-1	1:03:00	122.51	0.010	2.6	7	557	256	252	60	84	81	
C-1	1:06:00	125.23	0.010	2.6	7	563	253	253	61	83	81	
C-2	1:09:00	127.94	0.010	2.6	7	535	249	253	62	84	81	
C-2	1:12:00	130.71	0.010	2.6	7	544	253	253	62	84	81	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.001
Check	Final	15	0.001
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	C	M	S
O_2 (%)				
Fyrite Kit ID:	NA	Fyrite O_2 Check		NA %
Balance ID:	OAC 017			
Reference Weight (200g):	NA	Tolerance = +/- 0.5 g		
Reference Weight (500g):	500.0	Tolerance = +/- 0.5 g		

Imp	Contents	Final	Initial	Difference
1	5%HNO_3/10%H_2O_2 (g)	834.2	693.8	
2	5%HNO_3/10%H_2O_2 (g)	807.8	680.5	
3	Empty (g)	620.8	579.4	
4	10%H_2SO_4/$KMnO_4$ (g)	737.3	725.7	
5	10%H_2SO_4/$KMnO_4$ (g)	731.2	727.0	
6	Silica (g)	796.7	706.4	

MONTROSE METHOD 5/29 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 5/29 **Project Number:** Proj106377 (16-167)

Date: 10/19/16 **Run Number:** 3 **Sampling Location:** Comb. Stack Outlet

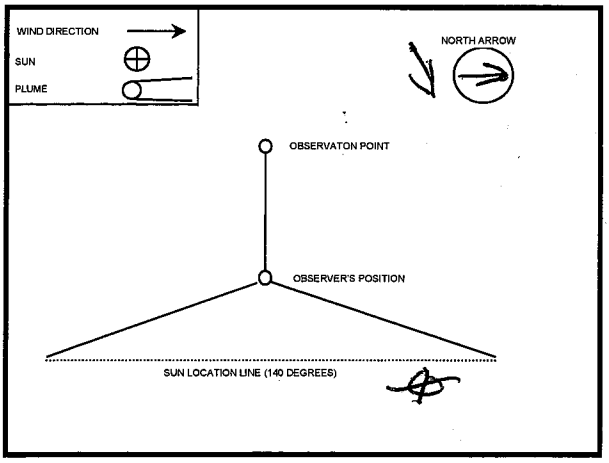
Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed JV JW TL T (mins)	Proj106377 (16-167) Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Oven Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:15:00	133.35	0.010	2.6	8	543	252	255	61	85	82	
C-3	1:18:00	136.05	0.010	2.6	8	551	250	254	61	86	81	
C-4	1:21:00	138.76	0.010	2.6	8	540	249	255	61	86	81	
C-4	1:24:00	140.93	0.005	1.3	5	555	252	254	63	86	81	
C-5	1:27:00	142.85	0.005	1.3	5	556	244	253	64	85	81	
C-5	1:30:00	145.465	0.010	2.6	8	535	253	254	64	86	81	
D-1	1:33:00	148.27	0.010	2.6	8	549	253	253	63	83	81	
D-1	1:36:00	150.99	0.010	2.6	8	556	253	255	63	83	80	
D-2	1:39:00	153.62	0.010	2.6	8	556	253	255	62	84	80	
D-2	1:42:00	156.37	0.010	2.6	8	561	253	253	64	85	81	
D-3	1:45:00	159.07	0.010	2.6	8	538	254	254	64	85	81	
D-3	1:48:00	161.91	0.011	2.9	9	541	251	255	64	85	80	
D-4	1:51:00	164.71	0.010	2.6	8	546	253	255	64	86	81	
D-4	1:54:00	167.45	0.010	2.6	8	550	251	254	65	86	81	
D-5	1:57:00	170.11	0.010	2.6	8	546	254	255	64	86	81	
D-5	2:00:00	172.813	0.010	2.6	8	551	252	255	64	87	81	Stop 16:21

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER: 16-167 RUN 1		
COMPANY NAME: ArcelorMittal Monessen LLC		
SOURCE: Combustion Stack 2		
LOCATION: 30-98 Donner Ave		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Coke Oven Battery		OPERATING MODE: Normal
CONTROL EQUIPMENT: Coke Battery		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 203 END 203	HEIGHT RELATIVE TO OBSERVER: START 203 END 203	DISTANCE FROM OBSERVER: START 2059 END
DIRECTION FROM OBSERVER: START W END W	VERTICAL ANGLE TO OBSERVATION POINT: START <30° END <30°	
DIRECTION TO OBSERVATION PT.: START E END E	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START 2059 END 2059	
DESCRIBE EMISSIONS: START NONE		
DECRIBE EMISSIONS: END NONE		
EMISSION COLOR: START N/A END N/A		
IF WATER DROPLET PLUME: ATTACHED __ DETACHED N/A N/A__		
DESCRIBE PLUME BACKGROUND: START SKY END SKY		
SKY CONDITIONS: START Mostly Cloudy END overcast		
WIND SPEED: START 0-5 END 0-5	WIND DIRECTION: START WSW END SSW	
AMBIENT TEMP: START 67 END 67	WET BULB TEMP: START 65 END 65	PERCENT HUMIDITY: START 94 END 93



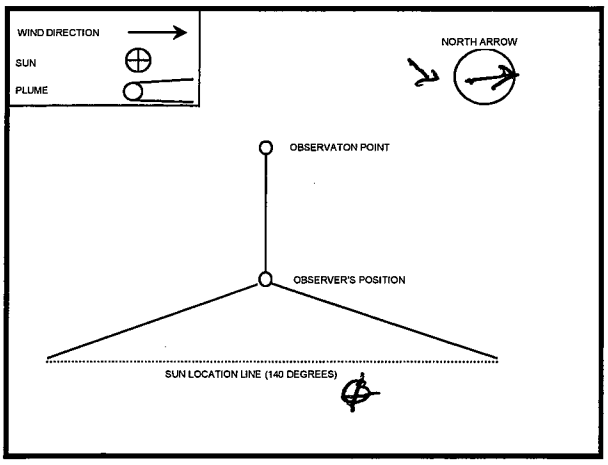
START TIME 8:25					STOP TIME 9:25				
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	5	5	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

MONTROSE ENVIRONMENTAL

OBSERVER'S NAME: Christopher Burkovich	
OBSERVER'S SIGNATURE:	DATE: 10-19-16
ORGANIZATION: Montrose	RCS
CERTIFIED BY: OpacitAir	DATE: 8/22/2016

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER 16-167		RUN 1
COMPANY NAME ArcelorMittal Monessen LLC		
SOURCE Combustion Stack 2		
LOCATION 30-98 Donner Ave		
CITY Monessen	STATE PA	ZIP 15062
PROCESS EQUIPMENT Coke Oven Battery		OPERATING MODE Normal
CONTROL EQUIPMENT Coke Battery		OPERATING MODE Normal
HEIGHT ABOVE GROUND LEVEL START 203 END 203	HEIGHT RELATIVE TO OBSERVER START 203 END 203	DISTANCE FROM OBSERVER START 2059 END 2059
DIRECTION FROM OBSERVER START W END W	VERTICAL ANGLE TO OBSERVATION POINT START <30° END <30°	
DIRECTION TO OBSERVATION PT. START E END E	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET START 2059 END 2059	
DESCRIBE EMISSIONS START NONE		
DECRIBE EMISSIONS END NONE		
EMISSION COLOR START N/A END N/A		
IF WATER DROPLET PLUME ATTACHED _ DETACHED N/A N/A_		
DESCRIBE PLUME BACKGROUND START SKY END SKY		
SKY CONDITIONS START overcast END mostly cloudy		
WIND SPEED START 0-5 END 0-5	WIND DIRECTION START SSW END WNW	
AMBIENT TEMP START 67 END 70	WET BULB TEMP START 65 END 66	PERCENT HUMIDITY START 93 END 86



START TIME 9:25 STOP TIME 10:25

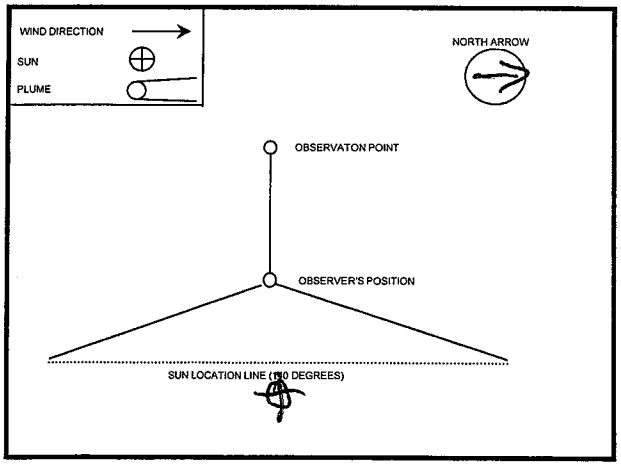
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	10	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	[signature] DATE 10-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 RUN 1
COMPANY NAME	Combustion Stack 2
SOURCE	Arcelor Mittal Monessen LLC
LOCATION	300-98 Donner Ave
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Coke Oven Battery
OPERATING MODE	Normal
CONTROL EQUIPMENT	Coke Battery
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL	START 203 END 203
HEIGHT RELATIVE TO OBSERVER	START 203 END 203
DISTANCE FROM OBSERVER	START 2059 END 2059
DIRECTION FROM OBSERVER	START W END W
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START E END E
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START 2059 END 2059
DESCRIBE EMISSIONS START	NONE
DECRIBE EMISSIONS END	NONE
EMISSION COLOR START	N/A END N/A
IF WATER DROPLET PLUME ATTACHED_ DETACHED_ N/A_	N/A
DESCRIBE PLUME BACKGROUND START	SKY END SKY
SKY CONDITIONS START	Mostly Cloudy END Mostly Cloudy
WIND SPEED START	0-5 END 0-5
WIND DIRECTION START	W END W
AMBIENT TEMP START	<70° END 71
WET BULB TEMP START	65 END 65
PERCENT HUMIDITY START	86 END 83



START TIME 10:25 STOP TIME 10:49

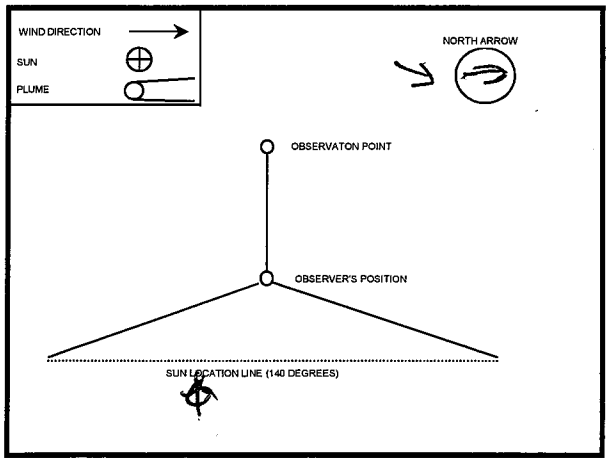
	0	15	30	45		0	15	30	45
0	0	0	0	0	30				
1	0	0	0	0	31				
2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
5	0	0	0	0	35				
6	0	0	0	0	36				
7	0	0	0	0	37				
8	0	0	0	0	38				
9	0	0	0	0	39				
10	0	0	0	0	40				
11	0	0	0	0	41				
12	0	0	0	0	42				
13	0	0	0	0	43				
14	0	0	0	0	44				
15	0	0	0	0	45				
16	0	0	0	0	46				
17	0	0	0	0	47				
18	0	0	0	0	48				
19	0	0	0	0	49				
20	0	0	0	0	50				
21	0	0	0	0	51				
22	0	0	0	0	52				
23	0	0	0	0	53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	[signature] DATE 10-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER: 16-167 RUN 2		
COMPANY NAME: ArcelorMittal Monessen LLC		
SOURCE: Combustion Stack 2		
LOCATION: 30-98 Donner Ave		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Coke Oven Battery		OPERATING MODE: Normal
CONTROL EQUIPMENT: Coke Battery		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 203 END 203	HEIGHT RELATIVE TO OBSERVER: START 203 END 203	DISTANCE FROM OBSERVER: START 2059 END 2059
DIRECTION FROM OBSERVER: START W END W	VERTICAL ANGLE TO OBSERVATION POINT: START <30° END <30°	
DIRECTION TO OBSERVATION PT.: START E END E	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START 2059 END 2059	
DESCRIBE EMISSIONS: START NONE		
DESCRIBE EMISSIONS: END NONE		
EMISSION COLOR: START N/A END N/A		
IF WATER DROPLET PLUME: ATTACHED _ DETACHED _ N/A N/A		
DESCRIBE PLUME BACKGROUND: START SKY END SKY		
SKY CONDITIONS: START Mostly Cloudy END Partly Cloudy		
WIND SPEED: START 0-5 END 0-5	WIND DIRECTION: START SSW END NNE	
AMBIENT TEMP: START 72 END 72	WET BULB TEMP: START 65 END 64	PERCENT HUMIDITY: START 79 END 75



START TIME 11:22 STOP TIME 12:22

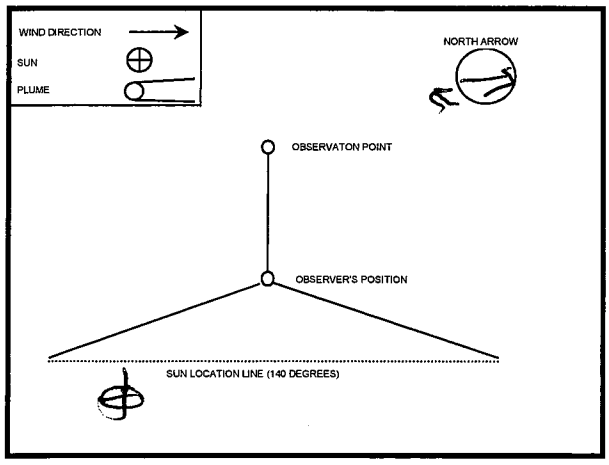
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	DATE 11-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 RUN 2
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Combustion Stack 2
LOCATION	30-98 Donner Ave
CITY / STATE / ZIP	Monessen / PA / 15062
PROCESS EQUIPMENT / OPERATING MODE	Coke Oven Battery / Normal
CONTROL EQUIPMENT / OPERATING MODE	Coke Battery / Normal
HEIGHT ABOVE GROUND LEVEL	START 203 END 203
HEIGHT RELATIVE TO OBSERVER	START 203 END 203
DISTANCE FROM OBSERVER	START 2059 END 2059
DIRECTION FROM OBSERVER	START W END W
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START E END E
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START 2059 END 2059
DESCRIBE EMISSIONS	START NONE
DECRIBE EMISSIONS	END None
EMISSION COLOR	START N/A END N/A
IF WATER DROPLET PLUME	ATTACHED _ DETACHED N/A N/A_
DESCRIBE PLUME BACKGROUND	START Sky END Sky
SKY CONDITIONS	START Partly Cloudy END Partly Cloudy
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START NNE END WNW
AMBIENT TEMP	START 72 END 76
WET BULB TEMP	START 64 END 65
PERCENT HUMIDITY	START 75 END 69



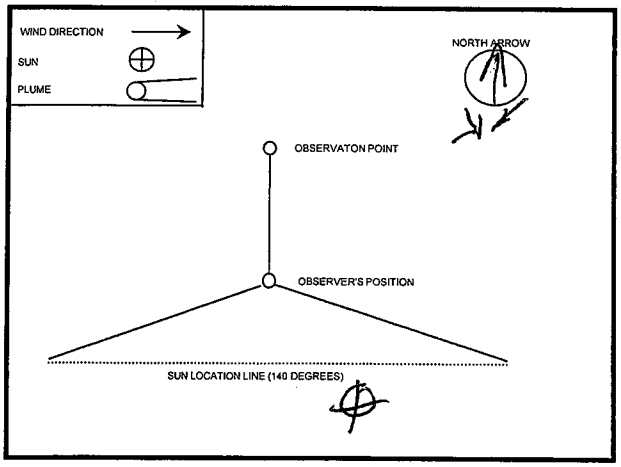
START TIME 12:22					STOP TIME 1:22				
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

MONTROSE ENVIRONMENTAL

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	DATE 10-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 RUN 2
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Combustion Stack 2
LOCATION	441 Reed Ave
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Coke Oven Battery
OPERATING MODE	Normal
CONTROL EQUIPMENT	Coke Battery
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL	START 203 END 203
HEIGHT RELATIVE TO OBSERVER	START 10' END 10'
DISTANCE FROM OBSERVER	START 1435 END 1435
DIRECTION FROM OBSERVER	START N END N
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START S END S
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START 1435 END 1435
DESCRIBE EMISSIONS	START NONE
DECRIBE EMISSIONS	END NONE
EMISSION COLOR	START N/A END N/A
IF WATER DROPLET PLUME	ATTACHED__ DETACHED__ N/A N/A__
DESCRIBE PLUME BACKGROUND	START Sky/trees END Sky/trees
SKY CONDITIONS	START Partly Cloudy END
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START WNW END ENE
AMBIENT TEMP	START 76 END 76
WET BULB TEMP	START 65 END 65
PERCENT HUMIDITY	START 69 END 68



START TIME 1:22 STOP TIME 13:44:30

	0	15	30	45		0	15	30	45
0	x	x	x	x	30				
1	x	x	x	x	31				
2	x	x	x	x	32				
3	X	X	0	0	33				
4	0	0	0	0	34				
5	0	0	0	0	35				
6	0	0	0	0	36				
7	0	0	0	0	37				
8	0	0	0	0	38				
9	0	0	0	0	39				
10	0	0	0	0	40				
11	0	0	0	0	41				
12	0	0	0	0	42				
13	0	0	5	5	43				
14	0	0	0	0	44				
15	0	0	0	0	45				
16	0	0	0	0	46				
17	0	0	0	0	47				
18	0	0	0	0	48				
19	0	0	0	0	49				
20	0	0	0	0	50				
21	0	0	0	0	51				
22	0	0			52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

Moved to Reed Ave

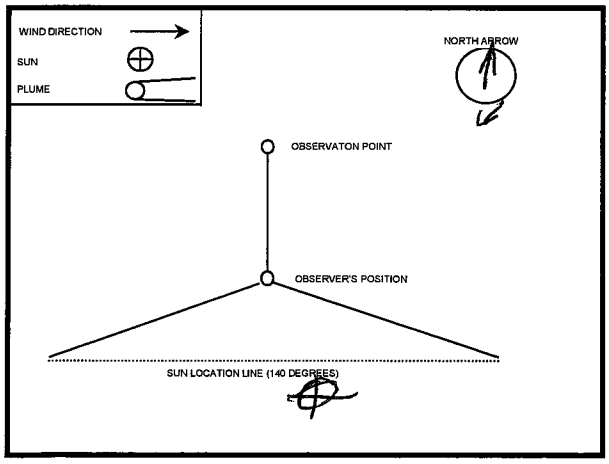
No Further Entries this page 10-19-16

MONTROSE ENVIRONMENTAL

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	[signature] DATE 10-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER: 16-167 RUN 3		
COMPANY NAME: ArcelorMittal Monessen LLC		
SOURCE: Combustion Stack 2		
LOCATION: 441 Reed		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Coke Oven Battery		OPERATING MODE: Normal
CONTROL EQUIPMENT: Coke Battery		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 203 END 203	HEIGHT RELATIVE TO OBSERVER: START 10' END 10'	DISTANCE FROM OBSERVER: START 1435 END 1435
DIRECTION FROM OBSERVER: START N END N	VERTICAL ANGLE TO OBSERVATION POINT: START <30° END <30°	
DIRECTION TO OBSERVATION PT.: START S END S	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START 1435 END 1435	
DESCRIBE EMISSIONS: START NONE		
DECRIBE EMISSIONS: END None		
EMISSION COLOR: START N/A END N/A		
IF WATER DROPLET PLUME: ATTACHED __ DETACHED N/A		
DESCRIBE PLUME BACKGROUND: START Trees/Sky END Trees/Sky		
SKY CONDITIONS: START Partly Cloudy END Partly Cloudy		
WIND SPEED: START 0-5 END 0-5	WIND DIRECTION: START ENE END W	
AMBIENT TEMP: START 76 END 77	WET BULB TEMP: START 65 END 63	PERCENT HUMIDITY: START 68 END 63



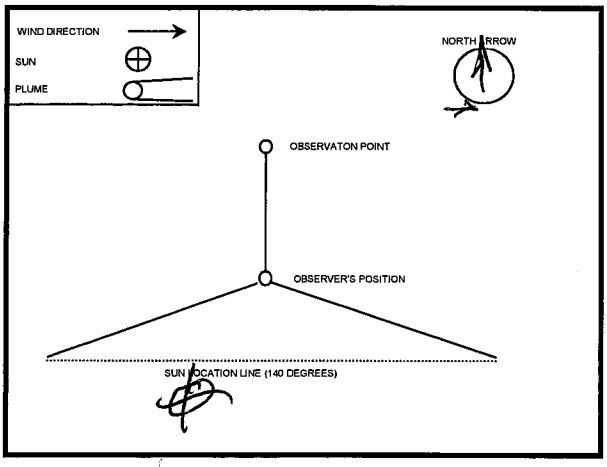
START TIME 2:02					STOP TIME 3:02				
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	5	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	5	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	5	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

MONTROSE ENVIRONMENTAL

OBSERVER'S NAME: Christopher Burkovich		
OBSERVER'S SIGNATURE: [signature]		DATE: 11-19-16
ORGANIZATION: Montrose RCS		
CERTIFIED BY: OpacitAir		DATE: 8/22/2016

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER: 16-167 Run 3		
COMPANY NAME: ArcelorMittal Monessen LLC		
SOURCE: Combustion Stack 2		
LOCATION: 441 Reed Ave		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Coke Oven Battery		OPERATING MODE: Normal
CONTROL EQUIPMENT: Coke Battery		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 203 END 203	HEIGHT RELATIVE TO OBSERVER: START 10 END 10	DISTANCE FROM OBSERVER: START 1435 END 1435
DIRECTION FROM OBSERVER: START N END N	VERTICAL ANGLE TO OBSERVATION POINT: START 130° END 130°	
DIRECTION TO OBSERVATION PT.: START S END S	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START 1435 END 1435	
DESCRIBE EMISSIONS: START NONE		
DECRIBE EMISSIONS: END NONE		
EMISSION COLOR: START N/A END N/A		
IF WATER DROPLET PLUME: ATTACHED __ DETACHED N/A N/A__		
DESCRIBE PLUME BACKGROUND: START Trees/sky END Trees/sky		
SKY CONDITIONS: START Partly Cloudy END Partly Cloudy		
WIND SPEED: START 0-5 END 0-5	WIND DIRECTION: START W END NNE	
AMBIENT TEMP: START 77 END 80	WET BULB TEMP: START 63 END 63	PERCENT HUMIDITY: START 63 END 57



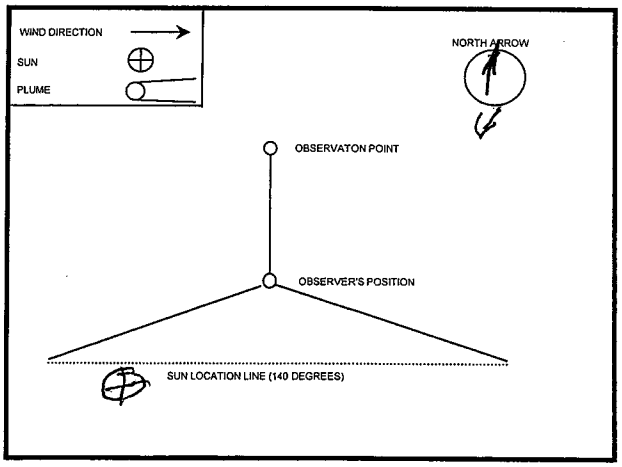
START TIME 3:02					STOP TIME 4:02				
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	5	0	5
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	5
13	0	0	0	0	43	10	10	5	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	5	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	0	0	0
27	0	0	0	0	57	0	0	0	0
28	0	0	0	0	58	0	0	0	0
29	0	0	0	0	59	0	0	0	0

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	DATE 10-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 Run 3
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Combustion Stack 2
LOCATION	441 Reed Ave
CITY / STATE / ZIP	Monessen / PA / 15062
PROCESS EQUIPMENT / OPERATING MODE	Coke Oven Battery / Normal
CONTROL EQUIPMENT / OPERATING MODE	Coke Battery / Normal
HEIGHT ABOVE GROUND LEVEL	START 203 END 203
HEIGHT RELATIVE TO OBSERVER	START 10 END 10
DISTANCE FROM OBSERVER	START 1435 END 1435
DIRECTION FROM OBSERVER	START N END N
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START S END S
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START 1435 END 1435
DESCRIBE EMISSIONS	START NONE
DECRIBE EMISSIONS	END NONE
EMISSION COLOR	START N/A END N/A
IF WATER DROPLET PLUME	ATTACHED _ DETACHED N/A N/A_
DESCRIBE PLUME BACKGROUND	START Trees/sky END Trees/sky
SKY CONDITIONS	START Partly Cloudy END Partly Cloudy
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START NNE END NE
AMBIENT TEMP	START 80 END 79
WET BULB TEMP	START 63 END 63
PERCENT HUMIDITY	START 57 END 58



START TIME 4:02PM STOP TIME 16:21

	0	15	30	45		0	15	30	45
0	0	0	0	0	30				
1	0	0	0	0	31				
2	0	0	0	0	32				
3	0	0	0	0	33				
4	0	0	0	0	34				
5	0	0	0	0	35				
6	0	0	0	0	36				
7	0	0	0	0	37				
8	0	0	0	0	38				
9	0	0	0	0	39				
10	0	0	0	0	40				
11	0	0	0	0	41				
12	0	0	0	0	42				
13	0	0	0	0	43				
14	0	0	0	0	44				
15	0	0	0	0	45				
16	0	0	0	0	46				
17	0	0	0	0	47				
18	0	0	0	0	48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

No Fugitive Emissions observed

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	[signature] DATE 10-19-16
ORGANIZATION	Montrose RCS
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

ArcelorMittal
Report of Emissions Observations

Observer: [illegible] Date: 10-19-16

Charging Oven	Visible Emissions (sec) 12 sec oven/limit				Time of Observation: Comments		
1 C1	:04				7:43	7:47	
2 B3	:04.5				7:56	8:00	
3 C3	:03.5		>	:21	8:11	8:15	
4 B5	:04				8:25	8:29	
5 C5	:03.5				8:40	8:44	

Doors Battery 1B — Time of Observation:
Total Number of Leaks: 0
Total Number of Leaks Allowed = 2
7:15 – 7:25

Doors Battery 2 — Time of Observation:
Total Number of Leaks: 0
Total Number of Leaks Allowed = 1
7:18 – 7:22

Offtakes Battery 1B — Time of Observation:
Total Number of Leaks: 0
Total Number of Leaks Allowed = 1
8:01 – 8:06

Offtakes Battery 2 — Time of Observation:
Total Number of Leaks: 0
Total Number of Leaks Allowed = 0
7:31 – 7:34

Lids Battery 1B — Time of Observation:
Total Number of Leaks: 0
Total Number of Leaks Allowed = 0
8:01 – 8:06

Lids Battery 2 — Time of Observation:
Total Number of Leaks: 0
Total Number of Leaks Allowed = 0
7:31 – 7:34

Method 0010/23

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/17	11:51:32	10.73	4.66
2	2016/10/17	11:52:32	11.62	4.26
3	2016/10/17	11:53:32	11.62	4.26
4	2016/10/17	11:54:32	11.49	4.32
5	2016/10/17	11:55:32	11.37	4.36
6	2016/10/17	11:56:32	11.02	4.55
7	2016/10/17	11:57:32	11.18	4.49
8	2016/10/17	11:58:32	11.74	4.27
9	2016/10/17	11:59:32	11.77	4.25
10	2016/10/17	12:00:32	11.79	4.24
11	2016/10/17	12:01:32	11.56	4.35
12	2016/10/17	12:02:32	11.70	4.31
13	2016/10/17	12:03:32	12.04	4.16
14	2016/10/17	12:04:32	15.21	2.82
15	2016/10/17	12:05:32	13.29	3.65
16	2016/10/17	12:06:32	13.35	3.63
17	2016/10/17	12:07:32	14.03	3.33
18	2016/10/17	12:08:32	14.00	3.34
19	2016/10/17	12:09:32	14.15	3.26
20	2016/10/17	12:10:32	14.28	3.19
21	2016/10/17	12:11:32	13.91	3.34
22	2016/10/17	12:12:32	13.24	3.65
23	2016/10/17	12:13:32	13.03	3.75
24	2016/10/17	12:14:32	12.94	3.80
25	2016/10/17	12:15:32	12.91	3.81
26	2016/10/17	12:16:32	12.84	3.83
27	2016/10/17	12:17:32	11.49	4.41
28	2016/10/17	12:18:32	11.62	4.39
29	2016/10/17	12:19:32	12.50	4.01
30	2016/10/17	12:20:32	12.45	4.04
31	2016/10/17	12:21:32	12.38	4.07
32	2016/10/17	12:22:32	12.17	4.15
33	2016/10/17	12:23:32	12.23	4.11
34	2016/10/17	12:24:32	14.98	2.95
35	2016/10/17	12:25:32	12.27	4.13
36	2016/10/17	12:26:32	12.42	4.05
37	2016/10/17	12:27:32	12.06	4.20
38	2016/10/17	12:28:32	12.24	4.13
39	2016/10/17	12:29:32	11.68	4.38
40	2016/10/17	12:30:32	12.36	4.08
41	2016/10/17	12:31:32	13.45	3.63
42	2016/10/17	12:32:32	12.99	3.80
43	2016/10/17	12:33:32	13.56	3.57
44	2016/10/17	12:34:32	13.21	3.70
45	2016/10/17	12:35:32	12.70	3.92
46	2016/10/17	12:36:32	12.14	4.17
47	2016/10/17	12:37:32	11.37	4.52
48	2016/10/17	12:38:32	11.98	4.25
49	2016/10/17	12:39:32	11.69	4.36
50	2016/10/17	12:40:32	11.51	4.47
51	2016/10/17	12:41:32	10.91	4.72
52	2016/10/17	12:42:32	10.50	4.93
53	2016/10/17	12:43:32	11.45	4.52
54	2016/10/17	12:44:32	18.93	1.00
55	2016/10/17	12:45:32	11.40	4.47
56	2016/10/17	12:46:32	10.34	4.98
57	2016/10/17	12:47:32	10.27	5.00
58	2016/10/17	12:48:32	9.56	5.30
59	2016/10/17	12:49:32	9.38	5.38
60	2016/10/17	12:50:32	9.22	5.46
61	2016/10/17	12:51:32	9.19	5.47
62	2016/10/17	12:52:32	9.17	5.48

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/17	12:53:32	9.14	5.49
64	2016/10/17	12:54:32	9.13	5.49
65	2016/10/17	12:55:32	9.12	5.48
66	2016/10/17	12:56:32	9.10	5.49
67	2016/10/17	12:57:32	9.04	5.53
68	2016/10/17	12:58:32	9.00	5.54
69	2016/10/17	12:59:32	8.90	5.59
70	2016/10/17	13:00:32	9.14	5.47
71	2016/10/17	13:01:32	9.00	5.53
72	2016/10/17	13:02:32	8.85	5.61
73	2016/10/17	13:03:32	9.35	5.39
74	2016/10/17	13:04:32	14.47	3.17
75	2016/10/17	13:05:32	10.56	4.83
76	2016/10/17	13:06:32	9.55	5.28
77	2016/10/17	13:07:32	9.27	5.40
78	2016/10/17	13:08:32	9.17	5.45
79	2016/10/17	13:09:32	9.09	5.50
80	2016/10/17	13:10:32	9.07	5.50
81	2016/10/17	13:11:32	8.97	5.54
82	2016/10/17	13:12:32	8.99	5.53
83	2016/10/17	13:13:32	8.92	5.56
84	2016/10/17	13:14:32	8.85	5.60
85	2016/10/17	13:15:32	8.82	5.60
86	2016/10/17	13:16:32	8.79	5.60
87	2016/10/17	13:17:32	8.79	5.59
88	2016/10/17	13:18:32	8.77	5.60
89	2016/10/17	13:19:32	8.58	5.70
90	2016/10/17	13:20:32	9.00	5.50
91	2016/10/17	13:21:32	8.81	5.60
92	2016/10/17	13:22:32	8.74	5.63
93	2016/10/17	13:23:32	9.92	5.11
94	2016/10/17	13:24:32	14.30	3.24
95	2016/10/17	13:25:32	12.41	3.95
96	2016/10/17	13:26:32	11.28	4.50
97	2016/10/17	13:27:32	11.01	4.61
98	2016/10/17	13:28:32	10.41	4.89
99	2016/10/17	13:29:32	10.53	4.86
100	2016/10/17	13:30:32	11.44	4.42
101	2016/10/17	13:31:32	11.34	4.45
102	2016/10/17	13:32:32	11.27	4.49
103	2016/10/17	13:33:32	10.98	4.64
104	2016/10/17	13:34:32	11.05	4.63
105	2016/10/17	13:35:32	11.48	4.43
106	2016/10/17	13:36:32	12.30	4.08
107	2016/10/17	13:37:32	12.55	3.97
108	2016/10/17	13:38:32	12.60	3.93
109	2016/10/17	13:39:32	12.56	3.93
110	2016/10/17	13:40:32	11.97	4.19
111	2016/10/17	13:41:32	10.65	4.80
112	2016/10/17	13:42:32	17.15	2.03
113	2016/10/17	13:43:32	10.89	4.51
114	2016/10/17	13:44:32	11.67	4.44
115	2016/10/17	13:45:32	11.74	4.25
116	2016/10/17	13:46:32	10.19	5.06
117	2016/10/17	13:47:32	11.13	4.64
118	2016/10/17	13:48:32	10.93	4.73
119	2016/10/17	13:49:32	10.87	4.75
120	2016/10/17	13:50:32	10.79	4.77
121	2016/10/17	13:51:32	10.58	4.85
122	2016/10/17	13:52:32	9.92	5.15
123	2016/10/17	13:53:32	9.47	5.35
124	2016/10/17	13:54:32	8.97	5.62
125	2016/10/17	13:55:32	8.90	5.67

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/17	13:56:32	8.82	5.71
127	2016/10/17	13:57:32	8.70	5.77
128	2016/10/17	13:58:32	9.06	5.61
129	2016/10/17	13:59:32	10.38	4.98
130	2016/10/17	14:00:32	10.77	4.81
131	2016/10/17	14:01:32	10.49	4.92
132	2016/10/17	14:02:32	10.29	5.01
133	2016/10/17	14:03:32	10.49	4.90
134	2016/10/17	14:04:32	14.77	3.05
135	2016/10/17	14:05:32	11.02	4.68
136	2016/10/17	14:06:32	9.80	5.23
137	2016/10/17	14:07:32	9.77	5.24
138	2016/10/17	14:08:32	9.55	5.33
139	2016/10/17	14:09:32	9.52	5.35
140	2016/10/17	14:10:32	10.41	4.97
141	2016/10/17	14:11:32	10.99	4.71
142	2016/10/17	14:12:32	10.97	4.71
143	2016/10/17	14:13:32	10.98	4.70
144	2016/10/17	14:14:32	10.96	4.69
145	2016/10/17	14:15:32	10.43	4.92
146	2016/10/17	14:16:32	9.64	5.28
147	2016/10/17	14:17:32	9.06	5.59
148	2016/10/17	14:18:32	9.14	5.54
149	2016/10/17	14:19:32	8.91	5.66
150	2016/10/17	14:20:32	9.15	5.56
151	2016/10/17	14:21:32	9.61	5.36
152	2016/10/17	14:22:32	10.82	4.79
153	2016/10/17	14:23:32	11.41	4.53
154	2016/10/17	14:24:32	15.44	2.74
155	2016/10/17	14:25:32	12.27	4.13
156	2016/10/17	14:26:32	10.84	4.77
157	2016/10/17	14:27:32	9.71	5.30
158	2016/10/17	14:28:32	9.10	5.60
159	2016/10/17	14:29:32	9.20	5.55
160	2016/10/17	14:30:32	9.13	5.58
161	2016/10/17	14:31:32	9.05	5.64
162	2016/10/17	14:32:32	9.52	5.42
163	2016/10/17	14:33:32	10.44	4.98
164	2016/10/17	14:34:32	10.36	5.01
165	2016/10/17	14:35:32	10.35	5.01
166	2016/10/17	14:36:32	10.34	5.00
167	2016/10/17	14:37:32	9.77	5.25
168	2016/10/17	14:38:32	9.20	5.54
169	2016/10/17	14:39:32	8.75	5.78
170	2016/10/17	14:40:32	8.86	5.74
171	2016/10/17	14:41:32	8.74	5.79
172	2016/10/17	14:42:32	8.45	5.96
173	2016/10/17	14:43:32	8.77	5.78
174	2016/10/17	14:44:32	14.66	3.16
175	2016/10/17	14:45:32	15.71	2.66
176	2016/10/17	14:46:32	17.36	1.64
177	2016/10/17	14:47:32	11.84	4.31
178	2016/10/17	14:48:32	11.88	4.31
179	2016/10/17	14:49:32	11.32	4.56
180	2016/10/17	14:50:32	10.79	4.82
181	2016/10/17	14:51:32	10.08	5.15
182	2016/10/17	14:52:32	9.60	5.35
183	2016/10/17	14:53:32	9.04	5.65
184	2016/10/17	14:54:32	9.00	5.69
185	2016/10/17	14:55:32	9.24	5.58
186	2016/10/17	14:56:32	10.26	5.08
187	2016/10/17	14:57:32	10.17	5.13
188	2016/10/17	14:58:32	10.25	5.09

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
189	2016/10/17	14:59:32	10.23	5.08
190	2016/10/17	15:00:32	9.72	5.31
191	2016/10/17	15:01:32	8.97	5.71
192	2016/10/17	15:02:32	8.56	5.94
193	2016/10/17	15:03:32	9.33	5.56
194	2016/10/17	15:04:32	14.20	3.39
195	2016/10/17	15:05:32	10.40	5.03
196	2016/10/17	15:06:32	10.03	5.23
197	2016/10/17	15:07:32	10.46	5.03
198	2016/10/17	15:08:32	10.25	5.12
199	2016/10/17	15:09:32	10.18	5.14
200	2016/10/17	15:10:32	9.95	5.23
201	2016/10/17	15:11:32	9.54	5.42
202	2016/10/17	15:12:32	9.08	5.67
203	2016/10/17	15:13:32	8.76	5.84
204	2016/10/17	15:14:32	8.57	5.94
205	2016/10/17	15:15:32	8.51	5.97
206	2016/10/17	15:16:32	8.51	5.97
207	2016/10/17	15:17:32	8.49	5.97
208	2016/10/17	15:18:32	8.44	5.99
209	2016/10/17	15:19:32	8.33	6.04
210	2016/10/17	15:20:32	8.54	5.94
211	2016/10/17	15:21:32	8.42	5.99
212	2016/10/17	15:22:32	8.28	6.06
213	2016/10/17	15:23:32	8.73	5.86
214	2016/10/17	15:24:32	13.51	3.71
215	2016/10/17	15:25:32	10.60	4.87
216	2016/10/17	15:26:32	9.47	5.43
217	2016/10/17	15:27:32	9.24	5.56
218	2016/10/17	15:28:32	9.09	5.63
219	2016/10/17	15:29:32	9.01	5.68
220	2016/10/17	15:30:32	8.99	5.67
221	2016/10/17	15:31:32	8.98	5.67
222	2016/10/17	15:32:32	8.97	5.68
223	2016/10/17	15:33:32	8.91	5.71
224	2016/10/17	15:34:32	8.85	5.73
225	2016/10/17	15:35:32	8.73	5.80
226	2016/10/17	15:36:32	8.96	5.67
227	2016/10/17	15:37:32	8.90	5.70
228	2016/10/17	15:38:32	8.85	5.75
229	2016/10/17	15:39:32	9.29	5.53
RUN 1 AVERAGES			**10.68**	**4.84**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/18	08:28:28	9.96	5.10
2	2016/10/18	08:29:28	9.75	5.19
3	2016/10/18	08:30:28	9.74	5.19
4	2016/10/18	08:31:28	10.50	4.87
5	2016/10/18	08:32:28	11.11	4.57
6	2016/10/18	08:33:28	11.01	4.61
7	2016/10/18	08:34:28	10.88	4.66
8	2016/10/18	08:35:28	10.88	4.66
9	2016/10/18	08:36:28	10.52	4.81
10	2016/10/18	08:37:28	10.05	5.03
11	2016/10/18	08:38:28	9.69	5.19
12	2016/10/18	08:39:28	9.51	5.27
13	2016/10/18	08:40:28	9.35	5.34
14	2016/10/18	08:41:28	9.43	5.30
15	2016/10/18	08:42:28	9.47	5.29
16	2016/10/18	08:43:28	8.66	5.70
17	2016/10/18	08:44:28	8.82	5.66
18	2016/10/18	08:45:28	10.93	4.68
19	2016/10/18	08:46:28	15.12	2.82
20	2016/10/18	08:47:28	11.60	4.32
21	2016/10/18	08:48:28	11.01	4.60
22	2016/10/18	08:49:28	10.68	4.74
23	2016/10/18	08:50:28	9.91	5.07
24	2016/10/18	08:51:28	9.41	5.31
25	2016/10/18	08:52:28	9.18	5.41
26	2016/10/18	08:53:28	9.05	5.48
27	2016/10/18	08:54:28	8.97	5.52
28	2016/10/18	08:55:28	8.91	5.55
29	2016/10/18	08:56:28	9.11	5.44
30	2016/10/18	08:57:28	8.99	5.50
31	2016/10/18	08:58:28	8.99	5.52
32	2016/10/18	08:59:28	9.84	5.14
33	2016/10/18	09:00:28	10.31	4.92
34	2016/10/18	09:01:28	10.19	4.96
35	2016/10/18	09:02:28	10.25	4.93
36	2016/10/18	09:03:28	10.30	4.89
37	2016/10/18	09:04:28	9.97	5.02
38	2016/10/18	09:05:28	10.01	5.04
39	2016/10/18	09:06:28	13.19	3.74
40	2016/10/18	09:07:28	10.81	4.61
41	2016/10/18	09:08:28	9.32	5.34
42	2016/10/18	09:09:28	8.87	5.57
43	2016/10/18	09:10:28	8.85	5.59
44	2016/10/18	09:11:28	8.83	5.59
45	2016/10/18	09:12:28	8.78	5.63
46	2016/10/18	09:13:28	9.34	5.38
47	2016/10/18	09:14:28	10.06	5.02
48	2016/10/18	09:15:28	9.86	5.10
49	2016/10/18	09:16:28	9.83	5.10
50	2016/10/18	09:17:28	9.71	5.14
51	2016/10/18	09:18:28	9.29	5.31
52	2016/10/18	09:19:28	8.86	5.53
53	2016/10/18	09:20:28	8.56	5.69
54	2016/10/18	09:21:28	8.43	5.76
55	2016/10/18	09:22:28	8.53	5.72
56	2016/10/18	09:23:28	8.49	5.72
57	2016/10/18	09:24:28	8.33	5.81
58	2016/10/18	09:25:28	8.90	5.59
59	2016/10/18	09:26:28	12.05	4.27
60	2016/10/18	09:27:28	11.54	4.22

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
61	2016/10/18	09:28:28	9.69	5.14
62	2016/10/18	09:29:28	9.25	5.33
63	2016/10/18	09:30:28	9.31	5.32
64	2016/10/18	09:31:28	9.28	5.32
65	2016/10/18	09:32:28	9.28	5.33
66	2016/10/18	09:33:28	10.19	4.96
67	2016/10/18	09:34:28	10.57	4.77
68	2016/10/18	09:35:28	10.44	4.82
69	2016/10/18	09:36:28	10.54	4.76
70	2016/10/18	09:37:28	10.25	4.87
71	2016/10/18	09:38:28	9.46	5.22
72	2016/10/18	09:39:28	9.13	5.38
73	2016/10/18	09:40:28	9.03	5.43
74	2016/10/18	09:41:28	8.97	5.46
75	2016/10/18	09:42:28	8.99	5.45
76	2016/10/18	09:43:28	9.04	5.41
77	2016/10/18	09:44:28	8.87	5.50
78	2016/10/18	09:45:28	9.17	5.39
79	2016/10/18	09:46:28	11.30	4.55
80	2016/10/18	09:47:28	12.36	3.83
81	2016/10/18	09:48:28	9.63	5.14
82	2016/10/18	09:49:28	9.16	5.34
83	2016/10/18	09:50:28	9.00	5.42
84	2016/10/18	09:51:28	8.86	5.49
85	2016/10/18	09:52:28	8.83	5.51
86	2016/10/18	09:53:28	8.80	5.53
87	2016/10/18	09:54:28	8.77	5.54
88	2016/10/18	09:55:28	8.74	5.55
89	2016/10/18	09:56:28	8.70	5.57
90	2016/10/18	09:57:28	9.23	5.37
91	2016/10/18	09:58:28	12.01	4.27
92	2016/10/18	09:59:28	10.59	4.66
93	2016/10/18	10:00:28	9.59	5.10
94	2016/10/18	10:01:28	8.61	5.57
95	2016/10/18	10:02:28	8.59	5.60
96	2016/10/18	10:03:28	8.70	5.52
97	2016/10/18	10:04:28	8.49	5.63
98	2016/10/18	10:05:28	8.74	5.56
99	2016/10/18	10:06:28	10.82	4.73
100	2016/10/18	10:07:28	12.84	3.59
101	2016/10/18	10:08:28	9.98	4.94
102	2016/10/18	10:09:28	9.59	5.12
103	2016/10/18	10:10:28	9.45	5.18
104	2016/10/18	10:11:28	9.40	5.20
105	2016/10/18	10:12:28	9.34	5.22
106	2016/10/18	10:13:28	9.29	5.24
107	2016/10/18	10:14:28	9.26	5.25
108	2016/10/18	10:15:28	9.25	5.25
109	2016/10/18	10:16:28	9.24	5.25
110	2016/10/18	10:17:28	9.21	5.26
111	2016/10/18	10:18:28	9.17	5.27
112	2016/10/18	10:19:28	9.16	5.27
113	2016/10/18	10:20:28	9.17	5.27
114	2016/10/18	10:21:28	9.16	5.26
115	2016/10/18	10:22:28	9.13	5.28
116	2016/10/18	10:23:28	9.33	5.19
117	2016/10/18	10:24:28	9.10	5.28
118	2016/10/18	10:25:28	9.07	5.29
119	2016/10/18	10:26:28	10.11	4.87
120	2016/10/18	10:27:28	14.13	3.14
121	2016/10/18	10:28:28	10.36	4.71
122	2016/10/18	10:29:28	9.53	5.10
123	2016/10/18	10:30:28	9.30	5.20

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
124	2016/10/18	10:31:28	9.16	5.26
125	2016/10/18	10:32:28	9.06	5.30
126	2016/10/18	10:33:28	9.06	5.30
127	2016/10/18	10:34:28	9.05	5.30
128	2016/10/18	10:35:28	9.01	5.31
129	2016/10/18	10:36:28	8.96	5.33
130	2016/10/18	10:37:28	8.93	5.34
131	2016/10/18	10:38:28	8.92	5.35
132	2016/10/18	10:39:28	8.92	5.34
133	2016/10/18	10:40:28	8.92	5.34
134	2016/10/18	10:41:28	8.91	5.34
135	2016/10/18	10:42:28	8.68	5.45
136	2016/10/18	10:43:28	8.90	5.35
137	2016/10/18	10:44:28	8.70	5.43
138	2016/10/18	10:45:28	8.51	5.55
139	2016/10/18	10:46:28	9.36	5.24
140	2016/10/18	10:47:28	13.33	3.62
141	2016/10/18	10:48:28	12.52	3.75
142	2016/10/18	10:49:28	11.29	4.32
143	2016/10/18	10:50:28	10.94	4.49
144	2016/10/18	10:51:28	10.83	4.54
145	2016/10/18	10:52:28	10.75	4.56
146	2016/10/18	10:53:28	10.19	4.81
147	2016/10/18	10:54:28	9.68	5.04
148	2016/10/18	10:55:28	9.44	5.14
149	2016/10/18	10:56:28	9.35	5.19
150	2016/10/18	10:57:28	9.54	5.10
151	2016/10/18	10:58:28	9.58	5.08
152	2016/10/18	10:59:28	9.75	5.02
153	2016/10/18	11:00:28	10.65	4.65
154	2016/10/18	11:01:28	10.94	4.49
155	2016/10/18	11:02:28	10.79	4.56
156	2016/10/18	11:03:28	10.86	4.54
157	2016/10/18	11:04:28	10.81	4.53
158	2016/10/18	11:05:28	10.11	4.84
159	2016/10/18	11:06:28	10.03	4.93
160	2016/10/18	11:07:28	12.08	4.17
161	2016/10/18	11:08:28	12.42	3.77
162	2016/10/18	11:09:28	10.04	4.89
163	2016/10/18	11:10:28	9.50	5.14
164	2016/10/18	11:11:28	9.34	5.23
165	2016/10/18	11:12:28	9.83	5.05
166	2016/10/18	11:13:28	10.74	4.64
167	2016/10/18	11:14:28	11.11	4.46
168	2016/10/18	11:15:28	11.00	4.51
169	2016/10/18	11:16:28	10.75	4.71
170	2016/10/18	11:17:28	10.59	4.71
171	2016/10/18	11:18:28	10.03	4.91
172	2016/10/18	11:19:28	9.44	5.16
173	2016/10/18	11:20:28	9.17	5.29
174	2016/10/18	11:21:28	9.02	5.36
175	2016/10/18	11:22:28	8.83	5.45
176	2016/10/18	11:23:28	9.08	5.35
177	2016/10/18	11:24:28	8.98	5.39
178	2016/10/18	11:25:28	8.99	5.41
179	2016/10/18	11:26:28	10.50	4.80
180	2016/10/18	11:27:28	14.71	3.06
181	2016/10/18	11:28:28	12.41	3.88
182	2016/10/18	11:29:28	11.48	4.31
183	2016/10/18	11:30:28	11.20	4.44
184	2016/10/18	11:31:28	11.00	4.54
185	2016/10/18	11:32:28	10.42	4.79
186	2016/10/18	11:33:28	10.17	4.92

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
187	2016/10/18	11:34:28	9.87	5.05
188	2016/10/18	11:35:28	9.64	5.16
RUN 2 AVERAGES			**9.86**	**5.04**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/18	12:45:28	10.76	4.72
2	2016/10/18	12:46:28	9.89	5.14
3	2016/10/18	12:47:28	9.61	5.26
4	2016/10/18	12:48:28	9.46	5.31
5	2016/10/18	12:49:28	9.41	5.33
6	2016/10/18	12:50:28	9.39	5.33
7	2016/10/18	12:51:28	9.35	5.34
8	2016/10/18	12:52:28	9.38	5.32
9	2016/10/18	12:53:28	9.37	5.33
10	2016/10/18	12:54:28	9.33	5.34
11	2016/10/18	12:55:28	9.30	5.35
12	2016/10/18	12:56:28	9.24	5.36
13	2016/10/18	12:57:28	9.21	5.37
14	2016/10/18	12:58:28	9.19	5.38
15	2016/10/18	12:59:28	9.19	5.38
16	2016/10/18	13:00:28	9.31	5.33
17	2016/10/18	13:01:28	9.11	5.42
18	2016/10/18	13:02:28	9.26	5.34
19	2016/10/18	13:03:28	9.94	5.07
20	2016/10/18	13:04:28	13.71	3.51
21	2016/10/18	13:05:28	11.85	4.22
22	2016/10/18	13:06:28	11.10	4.58
23	2016/10/18	13:07:28	10.79	4.72
24	2016/10/18	13:08:28	10.72	4.74
25	2016/10/18	13:09:28	10.46	4.85
26	2016/10/18	13:10:28	9.64	5.21
27	2016/10/18	13:11:28	9.07	5.48
28	2016/10/18	13:12:28	8.70	5.69
29	2016/10/18	13:13:28	8.82	5.62
30	2016/10/18	13:14:28	8.54	5.76
31	2016/10/18	13:15:28	8.67	5.72
32	2016/10/18	13:16:28	10.08	5.06
33	2016/10/18	13:17:28	10.35	4.93
34	2016/10/18	13:18:28	10.26	4.97
35	2016/10/18	13:19:28	10.18	5.00
36	2016/10/18	13:20:28	10.15	5.00
37	2016/10/18	13:21:28	9.48	5.29
38	2016/10/18	13:22:28	8.81	5.63
39	2016/10/18	13:23:28	9.41	5.41
40	2016/10/18	13:24:28	13.31	3.75
41	2016/10/18	13:25:28	10.75	4.73
42	2016/10/18	13:26:28	9.85	5.16
43	2016/10/18	13:27:28	10.05	5.08
44	2016/10/18	13:28:28	11.06	4.63
45	2016/10/18	13:29:28	10.87	4.72
46	2016/10/18	13:30:28	10.80	4.74
47	2016/10/18	13:31:28	10.91	4.68
48	2016/10/18	13:32:28	10.61	4.80
49	2016/10/18	13:33:28	9.87	5.14
50	2016/10/18	13:34:28	9.48	5.31
51	2016/10/18	13:35:28	9.29	5.40
52	2016/10/18	13:36:28	9.22	5.45
53	2016/10/18	13:37:28	9.14	5.49
54	2016/10/18	13:38:28	9.00	5.56
55	2016/10/18	13:39:28	8.99	5.56
56	2016/10/18	13:40:28	9.05	5.53
57	2016/10/18	13:41:28	8.79	5.65
58	2016/10/18	13:42:28	9.06	5.57
59	2016/10/18	13:43:28	11.26	4.57
60	2016/10/18	13:44:28	14.40	3.24
61	2016/10/18	13:45:28	11.79	4.31
62	2016/10/18	13:46:28	10.91	4.72

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/18	13:47:28	10.66	4.81
64	2016/10/18	13:48:28	9.93	5.13
65	2016/10/18	13:49:28	9.27	5.44
66	2016/10/18	13:50:28	8.91	5.64
67	2016/10/18	13:51:28	8.79	5.71
68	2016/10/18	13:52:28	8.78	5.72
69	2016/10/18	13:53:28	8.90	5.64
70	2016/10/18	13:54:28	8.79	5.71
71	2016/10/18	13:55:28	9.46	5.39
72	2016/10/18	13:56:28	10.46	4.92
73	2016/10/18	13:57:28	10.33	4.98
74	2016/10/18	13:58:28	10.38	4.95
75	2016/10/18	13:59:28	10.34	4.95
76	2016/10/18	14:00:28	9.82	5.19
77	2016/10/18	14:01:28	9.05	5.56
78	2016/10/18	14:02:28	8.59	5.82
79	2016/10/18	14:03:28	9.37	5.51
80	2016/10/18	14:04:28	13.34	3.78
81	2016/10/18	14:05:28	10.64	4.83
82	2016/10/18	14:06:28	9.60	5.33
83	2016/10/18	14:07:28	9.22	5.52
84	2016/10/18	14:08:28	8.94	5.68
85	2016/10/18	14:09:28	9.09	5.62
86	2016/10/18	14:10:28	10.36	5.02
87	2016/10/18	14:11:28	10.81	4.79
88	2016/10/18	14:12:28	10.82	4.78
89	2016/10/18	14:13:28	10.85	4.74
90	2016/10/18	14:14:28	10.64	4.83
91	2016/10/18	14:15:28	9.95	5.14
92	2016/10/18	14:16:28	9.41	5.39
93	2016/10/18	14:17:28	9.12	5.55
94	2016/10/18	14:18:28	8.98	5.63
95	2016/10/18	14:19:28	8.86	5.69
96	2016/10/18	14:20:28	8.94	5.65
97	2016/10/18	14:21:28	9.00	5.61
98	2016/10/18	14:22:28	8.86	5.69
99	2016/10/18	14:23:28	10.39	5.02
100	2016/10/18	14:24:28	17.51	1.82
101	2016/10/18	14:25:28	11.66	4.41
102	2016/10/18	14:26:28	10.84	4.79
103	2016/10/18	14:27:28	10.58	4.90
104	2016/10/18	14:28:28	10.25	5.04
105	2016/10/18	14:29:28	9.47	5.40
106	2016/10/18	14:30:28	8.94	5.67
107	2016/10/18	14:31:28	8.74	5.78
108	2016/10/18	14:32:28	8.66	5.82
109	2016/10/18	14:33:28	8.57	5.86
110	2016/10/18	14:34:28	8.33	5.99
111	2016/10/18	14:35:28	8.53	5.89
112	2016/10/18	14:36:28	8.53	5.88
113	2016/10/18	14:37:28	8.49	5.90
114	2016/10/18	14:38:28	9.20	5.57
115	2016/10/18	14:39:28	10.30	5.02
116	2016/10/18	14:40:28	10.36	5.01
117	2016/10/18	14:41:28	10.22	5.05
118	2016/10/18	14:42:28	10.03	5.13
119	2016/10/18	14:43:28	10.19	5.08
120	2016/10/18	14:44:28	13.49	3.71
121	2016/10/18	14:45:28	10.89	4.74
122	2016/10/18	14:46:28	9.66	5.32
123	2016/10/18	14:47:28	9.50	5.40
124	2016/10/18	14:48:28	9.45	5.41
125	2016/10/18	14:49:28	9.45	5.42

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/18	14:50:28	9.71	5.32
127	2016/10/18	14:51:28	10.51	4.96
128	2016/10/18	14:52:28	10.67	4.87
129	2016/10/18	14:53:28	10.64	4.88
130	2016/10/18	14:54:28	10.67	4.85
131	2016/10/18	14:55:28	10.14	5.09
132	2016/10/18	14:56:28	9.56	5.35
133	2016/10/18	14:57:28	9.25	5.52
134	2016/10/18	14:58:28	9.04	5.63
135	2016/10/18	14:59:28	8.99	5.66
136	2016/10/18	15:00:28	9.15	5.58
137	2016/10/18	15:01:28	9.10	5.60
138	2016/10/18	15:02:28	8.90	5.71
139	2016/10/18	15:03:28	9.63	5.41
140	2016/10/18	15:04:28	13.51	3.72
141	2016/10/18	15:05:28	11.38	4.54
142	2016/10/18	15:06:28	10.40	5.03
143	2016/10/18	15:07:28	10.09	5.15
144	2016/10/18	15:08:28	9.83	5.26
145	2016/10/18	15:09:28	9.20	5.56
146	2016/10/18	15:10:28	8.85	5.76
147	2016/10/18	15:11:28	8.65	5.87
148	2016/10/18	15:12:28	8.71	5.84
149	2016/10/18	15:13:28	8.59	5.89
150	2016/10/18	15:14:28	8.65	5.86
151	2016/10/18	15:15:28	8.61	5.87
152	2016/10/18	15:16:28	8.57	5.89
153	2016/10/18	15:17:28	8.58	5.88
154	2016/10/18	15:18:28	8.55	5.89
155	2016/10/18	15:19:28	8.41	5.96
156	2016/10/18	15:20:28	8.67	5.83
157	2016/10/18	15:21:28	8.57	5.87
158	2016/10/18	15:22:28	8.41	5.96
159	2016/10/18	15:23:28	9.25	5.59
160	2016/10/18	15:24:28	13.24	3.84
161	2016/10/18	15:25:28	10.75	4.79
162	2016/10/18	15:26:28	9.67	5.30
163	2016/10/18	15:27:28	9.46	5.40
164	2016/10/18	15:28:28	9.42	5.42
165	2016/10/18	15:29:28	9.31	5.47
166	2016/10/18	15:30:28	9.24	5.50
167	2016/10/18	15:31:28	9.32	5.45
168	2016/10/18	15:32:28	9.30	5.46
169	2016/10/18	15:33:28	9.18	5.51
170	2016/10/18	15:34:28	9.19	5.51
171	2016/10/18	15:35:28	9.15	5.53
172	2016/10/18	15:36:28	9.00	5.60
173	2016/10/18	15:37:28	8.97	5.63
174	2016/10/18	15:38:28	9.16	5.52
175	2016/10/18	15:39:28	9.09	5.57
176	2016/10/18	15:40:28	9.43	5.41
177	2016/10/18	15:41:28	10.28	5.02
178	2016/10/18	15:42:28	10.50	4.93
179	2016/10/18	15:43:28	11.16	4.65
180	2016/10/18	15:44:28	14.28	3.30
181	2016/10/18	15:45:28	11.72	4.35
182	2016/10/18	15:46:28	10.02	5.15
183	2016/10/18	15:47:28	9.20	5.56
184	2016/10/18	15:48:28	8.83	5.76
185	2016/10/18	15:49:28	8.91	5.72
186	2016/10/18	15:50:28	8.86	5.74
187	2016/10/18	15:51:28	8.88	5.75
188	2016/10/18	15:52:28	9.63	5.37

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Test Location:

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
189	2016/10/18	15:53:28	10.04	5.17
190	2016/10/18	15:54:28	10.12	5.13
191	2016/10/18	15:55:28	10.11	5.12
192	2016/10/18	15:56:28	9.70	5.30
193	2016/10/18	15:57:28	8.91	5.72
194	2016/10/18	15:58:28	8.74	5.81
195	2016/10/18	15:59:28	8.57	5.90
196	2016/10/18	16:00:28	8.76	5.80
197	2016/10/18	16:01:28	8.57	5.89
198	2016/10/18	16:02:28	8.30	6.04
199	2016/10/18	16:03:28	9.23	5.63
200	2016/10/18	16:04:28	13.33	3.79
201	2016/10/18	16:05:28	10.73	4.82
202	2016/10/18	16:06:28	10.03	5.18
RUN 3 AVERAGES			**9.81**	**5.24**

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 17, 2016
Project No	16-167	**Location**	Combstion Stack 2
Plant	Monessen, PA	**Run**	Run 1
Unit	Combustion Stack 2	**Start Time**	11:51
Operation	Normal	**End Time**	15:40
Tester(s)	BC, CB, JW, TM		

200' HSL to Trailer

Cal. Gas	LOW		MID		HIGH		Span	Conc. Units	Tank ID			Response Time (sec)	
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)			LOW	MID	HIGH	Up	Down
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	65	65
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	65	65
LIMITS				40 % to 60 %		100%							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.18	0.70	0.11	0.35	-0.35	20.03	0.145			
	Mid	10.01	10.01	10.20	0.95	10.01	0.00	-0.95	20.03	10.105	10.68	10.58	d. vol. %
CO2	Zero		0.13	0.20	0.35	0.16	0.15	-0.20	19.79	0.18			
	Mid	10.15	10.11	10.08	-0.15	10.01	-0.51	-0.35	19.79	10.045	4.84	4.79	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 18, 2016
Project No	16-167	**Location**	Combstion Stack 2
Plant	Monessen, PA	**Run**	Run 2
Unit	Combustion Stack 2	**Start Time**	8:15
Operation	Normal	**End Time**	11:36
Tester(s)	BC, CB, JW, TM		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B
LIMITS				40 % to 60 %		100%					

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.11	0.35	0.16	0.60	0.25	20.03	0.135			
	Mid	10.01	10.01	10.01	0.00	10.03	0.10	0.10	20.03	10.02	9.86	9.85	d. vol. %
CO2	Zero		0.13	0.16	0.15	0.18	0.25	0.10	19.79	0.17			
	Mid	10.15	10.11	10.01	-0.51	10.16	0.25	0.76	19.79	10.085	5.04	4.99	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 18, 2016
Project No	16-167	**Location**	Combstion Stack 2
Plant	Monessen, PA	**Run**	Run 3
Unit	Combustion Stack 2	**Start Time**	12:45
Operation	Normal	**End Time**	16:07
Tester(s)	BC, CB, JW, TM		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B
LIMITS				40 % to 60 %		100%					

				Initial Values		Final Values							
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.16	0.60	0.13	0.45	-0.15	20.03	0.15			
	Mid	10.01	10.01	10.03	0.10	10.03	0.10	0.00	20.03	10.03	9.81	9.79	d. vol. %
CO2	Zero		0.13	0.18	0.25	0.19	0.30	0.05	19.79	0.19			
	Mid	10.15	10.11	10.16	0.25	10.21	0.51	0.25	19.79	10.19	5.24	5.13	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen	Test Date:	October 17, 2016
Project No.:	16-167	Test Location:	Combstion Stack 2
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Combustion Stack 2	Test Start Time:	11:51 AM
Unit Operation:	Normal	Test Finish Time:	3:40 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.11	in. Hg
Stack Static Pressure (Pg)	-1.20	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.800	inches
O2	10.58	% dv
CO2	4.79	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Semi-Volatile Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	85.2	F
Stack Temperature (Tsavg)	540.2	F
Orifice Pressure Drop (dHavg)	2.685	in. H_2O
Gas Velocity Head (dP)^avg	0.1140	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.62	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	608.3	g
Water Vapor in Silica Gel (Vwsg(std))	28.681	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	28.681	scf
Volume Dry Gas Metered (Vm)	162.013	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	154.564	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	4.588	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.377	dscm
Stack Absolute Pressure (Ps)	29.02	in. Hg
Stack Absolute Temperature (Tsavg)	999.9	R
H2O Vapor Pressure @ avg Stack Temp.	1963.99	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1565	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1565	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.19	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.44	lb/lb-mole
Gas Velocity (Vs)	9.17	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	37,657	acfm
Standard Gas Flowrate	19,282	scfm
Dry Standard Gas Flowrate	16,264	dscfm
Dry Standard Exhaust Gas Flowrate	73.9	1000 lb/hr
Actual Gas Flowrate	1,066	acm/min
Standard Gas Flowrate	546	scm/min
Dry Standard Gas Flowrate	461	dscm/min
Area Nozzle (An)	0.003491	ft^2
Percent of Isokinetic Sampling (I)	103.54	%

Dioxin Furan

	Analyte	TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
1	2378-TCDD	1	30.1	0.0301	0.0301
2	12378-PeCDD	0.5	34.2	0.0342	0.0171
3	123478-HxCDD	0.1	24.5	0.0245	0.00245
4	123678-HxCDD	0.1	56.9	0.0569	0.00569
5	123789-HxCDD	0.1	30	0.0300	0.003
6	1234678-HpCDD	0.01	174	0.1740	0.00174
1	2378-TCDF (DB 225)	0.1	342	0.3420	0.0342
2	12378-PeCDF	0.05	81.6	0.0816	0.00408
3	23478-PeCDF	0.5	94.7	0.0947	0.04735
4	123478-HxCDF	0.1	73.4	0.0734	0.00734
5	123678-HxCDF	0.1	64.4	0.0644	0.00644
6	234678-HxCDF	0.1	65.9	0.0659	0.00659
7	123789-HxCDF	0.1	4.8	0.0048	0.00048
8	1234678-HpCDF	0.01	153	0.1530	0.00153
9	1234789-HpCDF	0.01	18.8	0.0188	0.000188

TEF Factors taken from USEPA 40 CFR, Chapter 1, Part 266, Appendix IX, Table 4.0.1 — TEF ADJUSTED TOTAL 0.168

TEF Total Mass Collected	0.168	ng
TEF Emission Concentration	0.0384	ng/m^3
TEF Emission Rate	1,062	ng/hr
Emission Rate	1.64E-05	gr/hr
Emission Rate	2.3E-09	lb/hr

ArcelorMittal Monessen **Run 1** **F or C?**
Combustion Stack 2 **F=1,C=0 1**

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.4	540	76	76
A-1	0.010	0.100	2.4	546	76	76
A-2	0.012	0.110	2.9	553	78	77
A-2	0.012	0.110	2.9	552	78	77
A-3	0.015	0.122	3.2	543	82	77
A-3	0.015	0.122	3.2	546	83	78
A-4	0.013	0.114	3.1	552	82	78
A-4	0.013	0.114	3.1	552	82	78
A-5	0.015	0.122	3.2	541	84	80
A-5	0.015	0.122	3.2	543	85	80
B-1	0.012	0.110	2.9	537	85	83
B-1	0.012	0.110	2.9	538	85	83
B-2	0.015	0.122	3.2	557	86	83
B-2	0.015	0.122	3.2	552	86	84
B-3	0.020	0.141	3.2	540	87	84
B-3	0.020	0.141	3.2	544	87	84
B-4	0.017	0.130	3.2	543	87	84
B-4	0.017	0.130	3.2	550	87	85
B-5	0.018	0.134	3.2	489	89	85
B-5	0.018	0.134	3.2	492	88	85
C-1	0.009	0.095	1.8	526	86	85
C-1	0.009	0.095	1.8	545	86	85
C-2	0.013	0.114	2.6	553	88	86
C-2	0.013	0.114	2.6	559	89	86
C-3	0.010	0.100	2.0	540	90	86
C-3	0.010	0.100	2.0	544	90	86
C-4	0.012	0.110	2.4	552	90	86
C-4	0.012	0.110	2.4	554	90	86
C-5	0.015	0.122	3.0	536	90	86
C-5	0.015	0.122	3.0	541	90	87
D-1	0.009	0.095	1.8	550	87	87
D-1	0.009	0.095	1.8	556	88	86
D-2	0.010	0.100	2.0	518	89	87
D-2	0.010	0.100	2.0	520	89	87
D-3	0.012	0.110	2.4	523	91	87
D-3	0.012	0.110	2.4	533	91	87
D-4	0.014	0.118	2.8	545	92	87
D-4	0.014	0.118	2.8	528	92	88
D-5	0.012	0.110	2.4	535	92	88
D-5	0.012	0.110	2.4	540	91	88
Average	0.013	0.114	2.69	540.2		85.2

Client:	ArcelorMittal Monessen	Test Date:	October 17, 2016
Project No.:	16-167	Test Location:	Combstion Stack 2
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Combustion Stack 2	Test Start Time:	11:51 AM
Unit Operation:	Normal	Test Finish Time:	3:40 PM

Initial volume	370.800	ft^3	Initial volume	0.000	liters
Final volume	532.813	ft^3	Final volume	0.000	liters
Total metered	162.013	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	877.1	340.2	536.9			0.0
2	699.9	676.0	23.9			0.0
3	704.8	698.9	5.9			0.0
4	601.4	598.5	2.9			0.0
5	805.0	766.3	38.7			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	3688.2	3079.9	608.3	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

USEPA Method 23 Individual Emission Rates

Compound	Mass (pg)	Mass (µg)	Adjusted TEF Mass (µg)	Raw Concentration (µg/m³)	Raw Emissions (lb/hr)	TEF Conc. (µg/m³)	TEF Emissions (lb/hr)
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	30.1	0.0000301	0.0000301	6.9E-06	4.2E-10	6.9E-06	4.2E-10
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	34.2	0.0000342	0.0000171	7.8E-06	4.8E-10	3.9E-06	2.4E-10
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	24.5	0.0000245	0.00000245	5.6E-06	3.4E-10	5.6E-07	3.4E-11
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	56.9	0.0000569	0.00000569	1.3E-05	7.9E-10	1.3E-06	7.9E-11
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	30	0.00003	0.000003	6.9E-06	4.2E-10	6.9E-07	4.2E-11
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	174	0.000174	0.00000174	4.0E-05	2.4E-09	4.0E-07	2.4E-11
2,3,7,8-Tetrachlorodibenzofuran	342	0.000342	0.0000342	7.8E-05	4.8E-09	7.8E-06	4.8E-10
1,2,3,7,8-Pentachlorodibenzofuran	81.6	0.0000816	0.00000408	1.9E-05	1.1E-09	9.3E-07	5.7E-11
2,3,4,7,8-Pentachlorodibenzofuran	94.7	0.0000947	0.00004735	2.2E-05	1.3E-09	1.1E-05	6.6E-10
1,2,3,4,7,8-Hexachlorodibenzofuran	73.4	0.0000734	0.00000734	1.7E-05	1.0E-09	1.7E-06	1.0E-10
1,2,3,6,7,8-Hexachlorodibenzofuran	64.4	0.0000644	0.00000644	1.5E-05	9.0E-10	1.5E-06	9.0E-11
2,3,4,6,7,8-Hexachlorodibenzofuran	65.9	0.0000659	0.00000659	1.5E-05	9.2E-10	1.5E-06	9.2E-11
1,2,3,7,8,9-Hexachlorodibenzofuran	4.8	0.0000048	0.00000048	1.1E-06	6.7E-11	1.1E-07	6.7E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran	153	0.000153	0.00000153	3.5E-05	2.1E-09	3.5E-07	2.1E-11
1,2,3,4,7,8,9-Heptachlorodibenzofuran	18.8	0.0000188	0.000000188	4.3E-06	2.6E-10	4.3E-08	2.6E-12

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene	<	20	0.0046	2.8E-04
Acenaphthylene	<	20	0.0046	2.8E-04
Anthracene	<	20	0.0046	2.8E-04
Benz[a]anthracene	<	20	0.0046	2.8E-04
Benzo[a]pyrene	<	20	0.0046	2.8E-04
Benzo[b]fluoranthene	<	20	0.0046	2.8E-04
Benzo[g,h,i]perylene	<	20	0.0046	2.8E-04
Benzo[k]fluoranthene	<	20	0.0046	2.8E-04
Chrysene	<	20	0.0046	2.8E-04
Dibenz[a,h]anthracene	<	20	0.0046	2.8E-04
Fluoranthene	<	20	0.0046	2.8E-04
Fluorene	<	20	0.0046	2.8E-04
Indeno (1,2,3-cd) pyrene	<	20	0.0046	2.8E-04
Naphthalene		71	0.0162	9.9E-04
Phenanthrene	<	20	0.0046	2.8E-04
Perylene	<	5	0.0011	7.0E-05
Pyrene	<	20	0.0046	2.8E-04

Client:	ArcelorMittal Monessen	Test Date:	October 18, 2016
Project No.:	16-167	Test Location:	Combstion Stack 2
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Combustion Stack 2	Test Start Time:	8:15 AM
Unit Operation:	Normal	Test Finish Time:	11:36 AM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	28.99	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.800	inches
O2	9.85	% dv
CO2	4.99	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Semi-Volatile Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	81.8	F
Stack Temperature (Tsavg)	526.5	F
Orifice Pressure Drop (dHavg)	2.250	in. H_2O
Gas Velocity Head (dP) avg	0.1056	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	85.16	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	454.0	g
Water Vapor in Silica Gel (Vwsg(std))	21.406	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	21.406	scf
Volume Dry Gas Metered (Vm)	149.395	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	142.670	dscf
Volume Dry Gas Metered (Vm(m^3))	4.230	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.040	dscm
Stack Absolute Pressure (Ps)	28.89	in. Hg
Stack Absolute Temperature (Tsavg)	986.2	R
H2O Vapor Pressure @ avg Stack Temp.	1750.20	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1305	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1305	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.19	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.73	lb/lb-mole
Gas Velocity (Vs)	8.42	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	34,547	acfm
Standard Gas Flowrate	17,856	scfm
Dry Standard Gas Flowrate	15,527	dscfm
Dry Standard Exhaust Gas Flowrate	70.6	1000 lb/hr
Actual Gas Flowrate	978	acm/min
Standard Gas Flowrate	506	scm/min
Dry Standard Gas Flowrate	440	dscm/min
Area Nozzle (An)	0.003491	ft^2
Percent of Isokinetic Sampling (I)	100.11	%

Dioxin Furan

Analyte	TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
2378-TCDD	1	44.3	0.0443	0.0443
12378-PeCDD	0.5	32.6	0.0326	0.0163
123478-HxCDD	0.1	23.9	0.0239	0.00239
123678-HxCDD	0.1	56.1	0.0561	0.00561
123789-HxCDD	0.1	35.7	0.0357	0.00357
1234678-HpCDD	0.01	171	0.1710	0.00171
2378-TCDF (DB 225)	0.1	521	0.5210	0.0521
12378-PeCDF	0.05	89.8	0.0898	0.00449
23478-PeCDF	0.5	135	0.1350	0.0675
123478-HxCDF	0.1	68.8	0.0688	0.00688
123678-HxCDF	0.1	68.2	0.0682	0.00682
234678-HxCDF	0.1	76.3	0.0763	0.00763
123789-HxCDF	0.1	6.1	0.0061	0.00061
1234678-HpCDF	0.01	141	0.1410	0.00141
1234789-HpCDF	0.01	15.5	0.0155	0.000155
			TEF ADJUSTED TOTAL	0.221

TEF Factors taken from USEPA 40 CFR, Chapter 1, Part 266, Appendix IX, Table 4.0.1

TEF Total Mass Collected	0.22	ng
TEF Emission Concentration	0.05	ng/m^3
TEF Emission Rate	1,446	ng/hr
Emission Rate	2.23E-05	gr/hr
Emission Rate	3.2E-09	lb/hr

ArcelorMittal Monessen Run 2
Combustion Stack 2

F or C?
F=1,C=0 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.0	540	71	71
A-1	0.010	0.100	2.0	557	72	70
A-2	0.011	0.105	2.2	530	74	71
A-2	0.011	0.105	2.2	539	76	72
A-3	0.010	0.100	2.0	528	77	72
A-3	0.010	0.100	2.0	529	79	73
A-4	0.010	0.100	2.0	513	80	74
A-4	0.010	0.100	2.0	520	80	74
A-5	0.015	0.122	3.0	526	82	75
A-5	0.012	0.110	2.4	533	82	75
B-1	0.010	0.100	2.0	542	80	76
B-1	0.010	0.100	2.0	548	81	77
B-2	0.010	0.100	2.0	553	82	77
B-2	0.010	0.100	2.0	530	83	78
B-3	0.010	0.100	2.0	532	84	78
B-3	0.008	0.089	1.6	535	84	78
B-4	0.011	0.105	2.2	532	85	78
B-4	0.011	0.105	2.2	539	86	80
B-5	0.014	0.118	2.8	528	86	80
B-5	0.014	0.118	2.8	534	86	81
C-1	0.012	0.110	2.4	555	84	81
C-1	0.010	0.100	2.0	536	84	81
C-2	0.010	0.100	2.0	531	85	81
C-2	0.010	0.100	2.0	538	86	82
C-3	0.013	0.114	2.6	504	87	82
C-3	0.013	0.114	2.6	488	88	82
C-4	0.016	0.126	3.2	478	89	83
C-4	0.016	0.126	3.2	481	88	83
C-5	0.018	0.134	3.6	437	88	84
C-5	0.015	0.122	3.0	466	88	84
D-1	0.010	0.100	2.0	548	86	84
D-1	0.010	0.100	2.0	555	87	84
D-2	0.010	0.100	2.0	508	88	84
D-2	0.010	0.100	2.0	537	90	85
D-3	0.010	0.100	2.0	537	90	85
D-3	0.010	0.100	2.0	545	89	84
D-4	0.010	0.100	2.0	551	89	84
D-4	0.010	0.100	2.0	515	90	84
D-5	0.010	0.100	2.0	529	90	84
D-5	0.010	0.100	2.0	534	90	85
Average	0.011	0.106	2.25	526.5		81.8

Client:	ArcelorMittal Monessen	Test Date:	October 18, 2016
Project No.:	16-167	Test Location:	Combstion Stack 2
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Combustion Stack 2	Test Start Time:	8:15 AM
Unit Operation:	Normal	Test Finish Time:	11:36 AM

Initial volume	533.700	ft³
Final volume	683.095	ft³
Total metered	149.395	dacf

Initial volume	0.000	liters
Final volume	0.000	liters
Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	826.1	368.7	457.4			0.0
2	693.1	695.8	-2.7			0.0
3	678.8	689.3	-10.5			0.0
4	607.4	608.0	-0.6			0.0
5	674.6	664.2	10.4			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	3480.0	3026.0	454.0	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

USEPA Method 23 Individual Emission Rates

Compound	Mass (pg)	Mass (µg)	Adjusted TEF Mass (µg)	Raw Concentration (µg/m³)	Raw Emissions (lb/hr)	TEF Conc. (µg/m³)	TEF Emissions (lb/hr)
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	44.3	0.0000443	0.0000443	1.1E-05	6.4E-10	1.1E-05	6.4E-10
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	32.6	0.0000326	0.0000163	8.1E-06	4.7E-10	4.0E-06	2.3E-10
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	23.9	0.0000239	0.00000239	5.9E-06	3.4E-10	5.9E-07	3.4E-11
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	56.1	0.0000561	0.00000561	1.4E-05	8.1E-10	1.4E-06	8.1E-11
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	35.7	0.0000357	0.00000357	8.8E-06	5.1E-10	8.8E-07	5.1E-11
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin	171	0.000171	0.00000171	4.2E-05	2.5E-09	4.2E-07	2.5E-11
2,3,7,8-Tetrachlorodibenzofuran	521	0.000521	0.0000521	1.3E-04	7.5E-09	1.3E-05	7.5E-10
1,2,3,7,8-Pentachlorodibenzofuran	89.8	0.0000898	0.00000449	2.2E-05	1.3E-09	1.1E-06	6.5E-11
2,3,4,7,8-Pentachlorodibenzofuran	135	0.000135	0.0000675	3.3E-05	1.9E-09	1.7E-05	9.7E-10
1,2,3,4,7,8-Hexachlorodibenzofuran	68.8	0.0000688	0.00000688	1.7E-05	9.9E-10	1.7E-06	9.9E-11
1,2,3,6,7,8-Hexachlorodibenzofuran	68.2	0.0000682	0.00000682	1.7E-05	9.8E-10	1.7E-06	9.8E-11
2,3,4,6,7,8-Hexachlorodibenzofuran	76.3	0.0000763	0.00000763	1.9E-05	1.1E-09	1.9E-06	1.1E-10
1,2,3,7,8,9-Hexachlorodibenzofuran	6.1	0.0000061	0.00000061	1.5E-06	8.8E-11	1.5E-07	8.8E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran	141	0.000141	0.00000141	3.5E-05	2.0E-09	3.5E-07	2.0E-11
1,2,3,4,7,8,9-Heptachlorodibenzofuran	15.5	0.0000155	0.000000155	3.8E-06	2.2E-10	3.8E-08	2.2E-12

USEPA Method 0010 Individual Emission Rates

Compound		Mass (mg)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene	<	20	0.0050	2.9E-04
Acenaphthylene	<	20	0.0050	2.9E-04
Anthracene	<	20	0.0050	2.9E-04
Benz[a]anthracene	<	20	0.0050	2.9E-04
Benzo[a]pyrene	<	20	0.0050	2.9E-04
Benzo[b]fluoranthene	<	20	0.0050	2.9E-04
Benzo[g,h,i]perylene	<	20	0.0050	2.9E-04
Benzo[k]fluoranthene	<	20	0.0050	2.9E-04
Chrysene	<	20	0.0050	2.9E-04
Dibenz[a,h]anthracene	<	20	0.0050	2.9E-04
Fluoranthene	<	20	0.0050	2.9E-04
Fluorene	<	20	0.0050	2.9E-04
Indeno (1,2,3-cd) pyrene	<	20	0.0050	2.9E-04
Naphthalene		116	0.0287	1.7E-03
Phenanthrene	<	20	0.0050	2.9E-04
Perylene	<	5	0.0012	7.2E-05
Pyrene	<	20	0.0050	2.9E-04

Client:	ArcelorMittal Monessen	Test Date:	October 18, 2016
Project No.:	16-167	Test Location:	Combstion Stack 2
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Combustion Stack 2	Test Start Time:	12:45 PM
Unit Operation:	Normal	Test Finish Time:	4:07 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	28.99	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.800	inches
O2	9.79	% dv
CO2	5.13	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Semi-Volatile Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	91.2	F
Stack Temperature (Tsavg)	480.5	F
Orifice Pressure Drop (dHavg)	2.185	in. H_2O
Gas Velocity Head (dP) avg	0.1033	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	85.08	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	554.8	g
Water Vapor in Silica Gel (Vwsg(std))	26.159	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	26.159	scf
Volume Dry Gas Metered (Vm)	147.991	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	138.884	dscf
Volume Dry Gas Metered (Vm(m^3))	4.191	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.933	dscm
Stack Absolute Pressure (Ps)	28.89	in. Hg
Stack Absolute Temperature (Tsavg)	940.2	R
H2O Vapor Pressure @ avg Stack Temp.	1158.29	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1585	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1585	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.21	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.44	lb/lb-mole
Gas Velocity (Vs)	8.08	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	33,155	acfm
Standard Gas Flowrate	17,975	scfm
Dry Standard Gas Flowrate	15,126	dscfm
Dry Standard Exhaust Gas Flowrate	68.8	1000 lb/hr
Actual Gas Flowrate	939	acm/min
Standard Gas Flowrate	509	scm/min
Dry Standard Gas Flowrate	428	dscm/min
Area Nozzle (An)	0.003491	ft^2
Percent of Isokinetic Sampling (I)	100.04	%

Dioxin Furan

Analyte		TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
2378-TCDD	<	1	3.5	0.0035	0.0035
12378-PeCDD	<	0.5	3.5	0.0035	0.00175
123478-HxCDD	<	0.1	3.4	0.0034	0.00034
123678-HxCDD	<	0.1	3.4	0.0034	0.00034
123789-HxCDD	<	0.1	3.1	0.0031	0.00031
1234678-HpCDD		0.01	5.6	0.0056	0.000056
2378-TCDF (DB 225)		0.1	14.7	0.0147	0.00147
12378-PeCDF		0.05	5.8	0.0058	0.00029
23478-PeCDF	<	0.5	3.8	0.0038	0.0019
123478-HxCDF	<	0.1	3.3	0.0033	0.00033
123678-HxCDF	<	0.1	3.2	0.0032	0.00032
234678-HxCDF	<	0.1	3.5	0.0035	0.00035
123789-HxCDF	<	0.1	3.7	0.0037	0.00037
1234678-HpCDF		0.01	5.8	0.0058	0.000058
1234789-HpCDF	<	0.01	3.7	0.0037	0.000037
				TEF ADJUSTED TOTAL	0.011

TEF Factors taken from USEPA 40 CFR, Chapter 1, Part 266, Appendix IX, Table 4.0.1

TEF Total Mass Collected	<	0.01	ng
TEF Emission Concentration	<	0.00	ng/m^3
TEF Emission Rate	<	75	ng/hr
Emission Rate	<	1.15E-06	gr/hr
Emission Rate	<	1.6E-10	lb/hr

ArcelorMittal Monessen **Run 3** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.0	538	88	86
A-1	0.010	0.100	2.0	547	90	86
A-2	0.008	0.089	1.6	549	91	87
A-2	0.008	0.089	1.6	556	91	87
A-3	0.010	0.100	2.0	523	91	87
A-3	0.010	0.100	2.0	532	92	87
A-4	0.010	0.100	2.0	532	91	87
A-4	0.010	0.100	2.0	528	91	87
A-5	0.009	0.095	1.8	386	91	88
A-5	0.009	0.095	1.8	410	92	87
B-1	0.010	0.100	2.0	550	89	87
B-1	0.010	0.100	2.0	555	90	87
B-2	0.008	0.089	1.6	500	89	87
B-2	0.008	0.089	1.6	500	91	87
B-3	0.010	0.100	2.0	445	90	87
B-3	0.010	0.100	2.0	445	91	87
B-4	0.015	0.122	3.1	408	93	88
B-4	0.015	0.122	3.1	402	93	92
B-5	0.016	0.126	3.3	256	94	89
B-5	0.016	0.126	3.3	220	94	89
C-1	0.010	0.100	2.0	547	91	89
C-1	0.010	0.100	2.0	553	92	89
C-2	0.010	0.100	2.0	559	93	89
C-2	0.010	0.100	2.0	538	94	90
C-3	0.010	0.100	2.0	529	95	90
C-3	0.010	0.100	2.0	534	95	90
C-4	0.011	0.105	2.3	525	96	91
C-4	0.011	0.105	2.3	446	96	91
C-5	0.013	0.114	2.7	433	96	91
C-5	0.015	0.122	3.1	432	97	91
D-1	0.010	0.100	2.0	513	94	91
D-1	0.010	0.100	2.0	534	94	91
D-2	0.010	0.100	2.0	510	95	92
D-2	0.010	0.100	2.0	521	96	91
D-3	0.011	0.105	2.3	504	96	92
D-3	0.011	0.105	2.3	440	97	92
D-4	0.011	0.105	2.3	455	97	92
D-4	0.011	0.105	2.3	470	97	92
D-5	0.012	0.110	2.5	372	98	93
D-5	0.012	0.110	2.5	423	98	93
Average	0.011	0.103	2.19	480.5		91.2

Client:	ArcelorMittal Monessen	Test Date:	October 18, 2016
Project No.:	16-167	Test Location:	Combstion Stack 2
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Combustion Stack 2	Test Start Time:	12:45 PM
Unit Operation:	Normal	Test Finish Time:	4:07 PM

Initial volume	684.405	ft^3
Final volume	832.396	ft^3
Total metered	147.991	dacf

Initial volume	0.000	liters
Final volume	0.000	liters
Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	854.5	351.3	503.2			0.0
2	695.3	699.0	-3.7			0.0
3	709.4	698.6	10.8			0.0
4	616.2	611.0	5.2			0.0
5	807.4	768.1	39.3			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	3682.8	3128.0	554.8	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

USEPA Method 23 Individual Emission Rates

Compound		Mass (pg)	Mass (µg)	Adjusted TEF Mass (µg)	Raw Concentration (µg/m³)	Raw Emissions (lb/hr)	TEF Conc. (µg/m³)	TEF Emissions (lb/hr)
2,3,7,8-Tetrachlorodibenzo-p-Dioxin	<	3.5	0.0000035	0.0000035	8.9E-07	5.0E-11	8.9E-07	5.0E-11
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	3.5	0.0000035	0.00000175	8.9E-07	5.0E-11	4.4E-07	2.5E-11
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.4	0.0000034	0.00000034	8.6E-07	4.9E-11	8.6E-08	4.9E-12
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	<	3.4	0.0000034	0.00000034	8.6E-07	4.9E-11	8.6E-08	4.9E-12
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	<	3.1	0.0000031	0.00000031	7.9E-07	4.5E-11	7.9E-08	4.5E-12
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		5.6	0.0000056	0.000000056	1.4E-06	8.1E-11	1.4E-08	8.1E-13
2,3,7,8-Tetrachlorodibenzofuran		14.7	0.0000147	0.00000147	3.7E-06	2.1E-10	3.7E-07	2.1E-11
1,2,3,7,8-Pentachlorodibenzofuran		5.8	0.0000058	0.00000029	1.5E-06	8.4E-11	7.4E-08	4.2E-12
2,3,4,7,8-Pentachlorodibenzofuran	<	3.8	0.0000038	0.0000019	9.7E-07	5.5E-11	4.8E-07	2.7E-11
1,2,3,4,7,8-Hexachlorodibenzofuran	<	3.3	0.0000033	0.00000033	8.4E-07	4.8E-11	8.4E-08	4.8E-12
1,2,3,6,7,8-Hexachlorodibenzofuran	<	3.2	0.0000032	0.00000032	8.1E-07	4.6E-11	8.1E-08	4.6E-12
2,3,4,6,7,8-Hexachlorodibenzofuran	<	3.5	0.0000035	0.00000035	8.9E-07	5.0E-11	8.9E-08	5.0E-12
1,2,3,7,8,9-Hexachlorodibenzofuran	<	3.7	0.0000037	0.00000037	9.4E-07	5.3E-11	9.4E-08	5.3E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran		5.8	0.0000058	0.000000058	1.5E-06	8.4E-11	1.5E-08	8.4E-13
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.7	0.0000037	0.000000037	9.4E-07	5.3E-11	9.4E-09	5.3E-13

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene	<	20	0.0051	2.9E-04
Acenaphthylene	<	20	0.0051	2.9E-04
Anthracene	<	20	0.0051	2.9E-04
Benz[a]anthracene	<	20	0.0051	2.9E-04
Benzo[a]pyrene	<	20	0.0051	2.9E-04
Benzo[b]fluoranthene	<	20	0.0051	2.9E-04
Benzo[g,h,i]perylene	<	20	0.0051	2.9E-04
Benzo[k]fluoranthene	<	20	0.0051	2.9E-04
Chrysene	<	20	0.0051	2.9E-04
Dibenz[a,h]anthracene	<	20	0.0051	2.9E-04
Fluoranthene	<	20	0.0051	2.9E-04
Fluorene	<	20	0.0051	2.9E-04
Indeno (1,2,3-cd) pyrene	<	20	0.0051	2.9E-04
Naphthalene		78	0.0198	1.1E-03
Phenanthrene	<	20	0.0051	2.9E-04
Perylene	<	5	0.0013	7.2E-05
Pyrene	<	20	0.0051	2.9E-04

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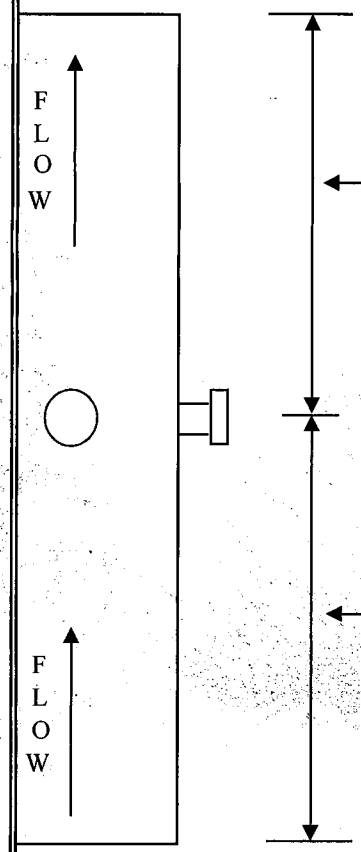
Montrose Environmental PRELIMINARY DATA SHEET

Client: Arcelormittal
Date: 10/17/16
Plant Loc.: Monessen, PA
Stack ID: Combustion Stack
Project No.: 16-167

Pitot Corr.: 0.84
Ambient Temp.: 64°F
Control Box No.: 1774
Umbilical Length: 200'
Test Crew: BC JW TJ TL
(Please Circle Initials of Meter Box Operator)

Circular Stacks

Eq. D = $\frac{\pi D^2}{4}$



150 **INCHES** or **FEET** Upstream from Nearest Disturbance

4 Number of Sampling Ports Located 90° Apart

53 **INCHES** or **FEET** Downstream from Nearest Disturbance

112 Stack inside diameter in **INCHES**

Traverse Points	Velocity (ΔP) (in. H_2O)	Stack Temp. (°F)	Cyclonic Flow (° from Horiz.)	Static Press. (in. H_2O)
A-1	0.010	536	2	-0.36
2	0.010	550	1	
3	0.010	546	0	
4	0.013	551	0	
5	0.015	543	0	
B-1	0.012	538	0	
2	0.016	555	0	
3	0.021	557	0	
4	0.016	544	2	
5	0.020	496	2	
C-1	0.008	528	3	
2	0.010	550	2	
3	0.010	545	0	
4	0.011	541	0	
5	0.015	536	1	
D-1	0.008	550	2	
2	0.009	526	1	
3	0.011	538	0	
4	0.014	539	0	
5	0.012	543	1	

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.977	Start Time:	1151
Date:	10/17/16	Run Number:	1	Meter Correction (γ):	1.006	Stop Time:	15:40
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.800	Pitot Correction:	0.84	T/C ID:	9-5
Sampling Location:	Comb. Stack Outlet	Static Press (in. H_2O):	-1.2	Control Box ID:	1774	Probe ID:	9-5
		Baro. Pres. (in. Hg):	29.11	Assumed Moisture (%):	~~7%~~ 14%	Pitot ID:	9-5
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	75	Umbilical Length (Feet):	200'	Filter ID:	NA/ Trap # 1
Test Crew:	BC JW CB TM	Initial K-factor	240 ~~210~~ 203			Stack Diameter (inches):	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 370.800	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:04:30	374.4	0.01	2.40	10	540	253	254	61	54	76	76	Start 1151
A-1	0:09:00	378.1	0.01	2.40	10	546	253	254	61	54	76	76	
A-2	0:13:30	381.9	0.012	2.9	11	553	253	254	67	61	78	77	
A-2	0:18:00	386.1	0.012	2.9	11	552	253	254	67	58	78	77	
A-3	0:22:30	389.1	0.015	~~3.6~~ 3.2	~~13~~ 15	543	250	253	67	60	82	77	
A-3	0:27:00	394.6	0.015	~~3.6~~ 3.2	~~13~~ 15	546	251	254	67	61	83	78	
A-4	0:31:30	398.9	0.013	3.1	14	552	251	252	68	63	82	78	
A-4	0:36:00	403.2	0.013	3.1	14	552	251	252	67	63	82	78	
A-5	0:40:30	407.8	0.015	~~3.6~~ 3.2	15	541	254	254	66	61	84	80	
A-5	0:45:00	412.513	0.015	~~3.6~~ 3.2	15	543	243	254	65	59	85	80	
B-1	0:49:30	417.0	0.012	2.9	14	537	250	252	60	58	85	83	
B-1	0:54:00	421.1	0.012	2.9	14	538	254	253	60	60	85	83	
B-2	0:58:30	425.5	0.015	~~3.6~~ 3.2	15	557	253	255	63	64	86	83	
B-2	1:03:00	430.1	0.015	~~3.6~~ 3.2	15	552	253	253	65	62	86	83	
B-3	1:07:30	434.6	0.02	3.2	15	540	252	253	68	66	87	84	New K-factor = 210
B-3	1:12:00	439.3	0.02	3.2	15	544	252	254	68	66	87	84	
B-4	1:16:30	443.6	0.017	3.2	15	543	253	254	66	66	87	84	
B-4	1:21:00	448.0	0.017	3.2	15	550	253	255	65	66	87	84	
B-5	1:25:30	452.1	0.018	3.2	15	489	253	254	67	67	89	85	New K-factor = 203
B-5	1:30:00	456.263	0.018	3.2	15	492	253	254	67	65	88	85	
C-1	1:34:30	459.6	0.009	1.8	10	526	248	252	68	66	86	85	
C-1	1:39:00	463.2	0.009	1.8	10	545	254	253	67	65	86	85	
C-2	1:43:30	467.0	0.013	2.6	13	553	247	253	68	58	88	86	
C-2	1:48:00	471.1	0.013	2.6	13	559	249	254	67	58	89	86	

(max leak rate = 0.02 ft³/min)

Sample Train Leak Check		(in. Hg)	(ft³/min)
	Initial	17	0.02
	Final	17	0.000
		Pressure (+)	Static (-)
Pitot Leak Check	Initial	✓	✓
	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	C	M	S
O_2 (%)				

Fyrite Kit ID: NA Fyrite O_2 Check: NA %

Balance ID: BAL-017

Reference Weight (200g): NA Tolerance = +/- 0.5 g

Reference Weight (500g): 500.1 Tolerance = +/- 0.5 g

Imp	Contents	Final	Initial	Difference
1	Empty (g)	877.1	340.2	
2	H_2O (g)	699.9	676.0	
3	H_2O (g)	704.8	698.9	
4	Empty (g)	601.4	598.5	
5	Silica (g)	805.0	766.3	

MONTROSE METHOD 0010/23 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 0010/23 **Project Number:** Proj106377 (16-167)

Date: 10/17/16 **Run Number:** 1 **Sampling Location:** Comb. Stack Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:52:30	474.9	0.01	~~0.~~ 2.0	11	540	250	255	68	57	90	~~80~~	
C-3	1:57:00	478.7	0.01	~~0.~~ 2.0	11	544	250	253	67	56	90	86	
C-4	2:01:30	482.0	0.012	2.4	11	552	250	254	65	57	90	86	
C-4	2:06:00	485.8	0.012	2.4	11	554	252	254	65	57	90	86	
C-5	2:10:30	489.6	0.015	3.0	14	536	243	254	65	58	90	86	
C-5	2:15:00	494.415	0.015	3.0	14	541	243	254	66	60	90	87	
D-1	2:19:30	498.3	0.009	1.8	13	550	253	252	63	58	87	87	
D-1	2:24:00	501.9	0.009	1.8	13	556	254	254	61	55	88	86	
D-2	2:28:30	505.4	0.010	2.0	10	518	253	254	59	51	89	87	
D-2	2:33:00	510.0	0.010	2.0	10	520	253	255	58	51	89	87	
D-3	2:37:30	512.6	0.012	2.4	12	523	254	255	58	55	91	87	
D-3	2:42:00	516.5	0.012	2.4	12	533	253	254	59	56	91	87	
D-4	2:46:30	520.7	0.014	2.8	14	545	253	254	59	56	92	87	
D-4	2:51:00	524.9	0.014	2.8	14	528	254	253	59	58	92	88	
D-5	2:55:30	528.8	~~0.012~~	2.4	13	535	253	254	60	57	92	88	0.012
D-5	3:00:00	532.813	0.012	2.4	13	540	248	253	61	58	91	88	Stop 1540

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.977	Start Time:	08:15
Date:	10/18/16	Run Number:	2	Meter Correction (γ):	1.006	Stop Time:	11:36
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.800	Pitot Correction:	0.84	T/C ID:	9-5
Sampling Location:	Comb. Stack Outlet	Static Press (in. H_2O):	-1.3	Control Box ID:	1774	Probe ID:	9-5
		Baro. Pres. (in. Hg):	28.99	Assumed Moisture (%):	14%	Pitot ID:	9-5
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	80	Umbilical Length (Feet):	200'	Filter ID:	NA/ Trap # 2
Test Crew:	BC JW CB(TM)	Initial K-factor	260 205			Stack Diameter (inches):	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 533.700	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:04:30	537.21	0.01	2.0	7	540	254	252	60	54	71	71	Start 08:15
A-1	0:09:00	540.65	0.01	2.0	7	557	253	252	62	56	72	70	
A-2	0:13:30	544.31	0.011	2.2	10	530	248	254	66	60	74	71	
A-2	0:18:00	548.01	0.011	2.2	10	539	251	254	67	60	76	72	
A-3	0:22:30	551.52	0.01	2.0	9	528	253	255	68	62	77	72	
A-3	0:27:00	555.03	0.01	2.0	9	529	253	254	68	58	79	73	
A-4	0:31:30	558.55	0.01	2.0	9	513	253	254	67	56	80	74	
A-4	0:36:00	562.03	0.01	2.0	9	520	253	254	67	58	80	74	
A-5	0:40:30	566.24	0.015	3.0	13	526	253	253	67	63	82	75	
A-5	0:45:00	570.165	0.012	2.4	11	533	253	254	68	62	82	75	
B-1	0:49:30	573.74	0.01	2.0	9	542	250	253	67	63	80	76	
B-1	0:54:00	577.39	0.01	2.0	9	548	253	254	64	57	81	77	
B-2	0:58:30	580.86	0.01	2.0	9	553	254	253	60	56	82	77	
B-2	1:03:00	584.48	0.01	2.0	9	530	253	254	60	55	83	78	
B-3	1:07:30	587.92	0.01	2.0	9	532	249	255	60	55	84	78	
B-3	1:12:00	591.18	0.008	1.6	8	535	253	253	61	54	84	78	
B-4	1:16:30	594.81	0.011	2.2	10	532	253	254	61	56	85	78	
B-4	1:21:00	598.49	0.011	2.2	10	539	250	254	62	57	86	80	
B-5	1:25:30	602.64	0.014	2.8	13	528	251	255	63	61	86	80	
B-5	1:30:00	606.845	0.014	2.8	13	534	252	254	64	63	86	81	
C-1	1:34:30	610.79	0.012	2.4	11	555	249	254	64	58	84	81	
C-1	1:39:00	614.39	0.01	2.0	~~10~~ 9	536	253	254	63	55	84	81	
C-2	1:43:30	617.93	0.01	2.0	9	531	254	254	62	52	85	81	
C-2	1:48:00	621.48	0.01	2.0	9	538	252	255	62	54	86	82	

(max leak rate = 0.02 ft³/min)

Sample Train Leak Check		(in. Hg)	(ft³/min)
	Initial	16	0.002
	Final	17	0.003
		Pressure (+)	Static (-)
Pitot Leak Check	Initial	✓	✓
	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	C	M	S
O_2 (%)				

Fyrite Kit ID: NA Fyrite O_2 Check NA %

Balance ID: BAL017

Reference Weight (200g): NA Tolerance = +/- 0.5 g

Reference Weight (500g): 500.0 Tolerance = +/- 0.5 g

Imp	Contents	Final	Initial	Difference
1	Empty (g)	826.1	368.7	
2	H_2O (g)	693.1	695.8	
3	H_2O (g)	678.8	689.3	
4	Empty (g)	607.4	608.0	
5	Silica (g)	674.6	~~764.2~~ 664.2 BC	

MONTROSE METHOD 0010/23 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 0010/23 **Project Number:** Proj106377 (16-167)

Date: 10/18/16 **Run Number:** 2 **Sampling Location:** Comb. Stack Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:52:30	625.52	0.013	2.6	11	504	254	254	62	57	87	82	
C-3	1:57:00	629.57	0.013	2.6	11	488	252	254	62	57	88	82	
C-4	2:01:30	634.07	0.016	3.2	14	478	252	253	64	64	89	83	
C-4	2:06:00	638.56	0.016	3.2	14	481	252	254	67	67	88	83	
C-5	2:10:30	643.13	0.018	3.6	15	437	253	253	66	64	88	84	
C-5	2:15:00	647.507	0.015	3.0	13	466	252	255	66	62	88	84	
D-1	2:19:30	651.14	0.01	2.0	9	548	249	253	64	57	86	84	
D-1	2:24:00	654.73	0.01	2.0	9	555	248	254	65	54	87	84	
D-2	2:28:30	658.29	0.01	2.0	9	508	249	255	63	51	88	84	
D-2	2:33:00	661.85	0.01	2.0	9	537	248	253	63	54	90	85	
D-3	2:37:30	665.39	0.01	2.0	9	537	249	252	63	54	90	85	New Kf = 205
D-3	2:42:00	668.94	0.01	2.0	9	545	253	248	61	55	89	84	
D-4	2:46:30	672.48	0.01	2.0	9	551	252	249	63	57	89	84	
D-4	2:51:00	675.24	0.01	2.0	9	515	250	252	63	57	90	84	
D-5	2:55:30	679.56	0.01	2.0	9	529	248	248	63	61	90	84	
D-5	3:00:00	683.095	0.01	2.0	9	534	251	253	66	65	90	85	Stop 11:36

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.971	Start Time:	12:45
Date:	10/18/16	Run Number:	3	Meter Correction (γ):	1.066	Stop Time:	16:07
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.800	Pitot Correction:	0.84	T/C ID:	9-6
Sampling Location:	Comb. Stack Outlet	Static Press (in. H_2O):	-1.3	Control Box ID:	1774	Probe ID:	9-6
		Baro. Pres. (in. Hg):	28.99	Assumed Moisture (%):	14%	Pitot ID:	9-6
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	78	Umbilical Length (Feet):	200'	Filter ID:	NA/ Trap # 3
Test Crew:	BC JW CB TM	Initial K-factor	205			Stack Diameter (inches):	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 684.405	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:04:30	687.74	0.010	2.0	7	538	253	254	54	48	88	86	Start 1245
A-1	0:09:00	691.21	0.010	2.0	8	547	249	252	59	52	90	86	
A-2	0:13:30	694.49	0.008	1.6	7	549	251	253	58	48	91	87	
A-2	0:18:00	697.64	0.008	1.6	7	556	249	250	57	46	91	87	
A-3	0:22:30	701.14	0.010	2.0	8	523	248	250	57	47	91	87	
A-3	0:27:00	704.65	0.010	2.0	8	532	251	255	56	49	92	87	
A-4	0:31:30	708.23	0.010	~~2.8~~ 2.0	8	532	252	254	58	48	91	87	
A-4	0:36:00	711.82	0.010	2.0	8	528	254	251	60	52	91	87	
A-5	0:40:30	715.26	0.009	1.8	8	386	249	254	61	51	91	88	
A-5	0:45:00	718.605	0.009	1.8	8	410	253	254	62	50	92	87	
B-1	0:49:30	722.13	0.010	2.0	8	550	252	252	57	47	89	87	
B-1	0:54:00	725.71	0.010	2.0	8	555	252	254	57	49	90	87	
B-2	0:58:30	728.93	0.008	1.6	7	500	254	254	60	48	89	87	
B-2	1:03:00	732.13	0.008	1.6	7	500	253	254	59	50	91	87	
B-3	1:07:30	735.63	0.010	2.0	9	445	252	253	62	53	90	87	
B-3	1:12:00	739.26	0.010	2.0	9	445	253	253	61	52	91	87	
B-4	1:16:30	743.57	0.015	~~2.8~~ 3.1	~~9~~ 12	408	253	254	62	58	93	88	
B-4	1:21:00	747.64	0.015	3.1	12	402	253	254	64	58	93	92	
B-5	1:25:30	752.53	0.016	3.3	13	256	256	254	65	59	94	89	
B-5	1:30:00	756.817	0.016	3.3	13	220	253	254	67	61	94	89	
C-1	1:34:30	760.51	0.010	2.0	9	547	251	251	63	55	91	89	
C-1	1:39:00	764.11	0.010	2.0	9	553	252	253	60	50	92	89	
C-2	1:43:30	767.79	0.010	2.0	9	559	249	253	58	47	93	89	
C-2	1:48:00	771.27	0.010	2.0	9	538	250	255	57	49	94	90	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak Check	Initial	~~15~~ 16	0.001
	Final	15	0.001
		Pressure (+)	Static (-)
Pitot Leak Check	Initial	✓	✓
	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	C	M	S
O_2 (%)				

Fyrite Kit ID: NA Fyrite O_2 Check NA %

Balance ID: BAL-017

Reference Weight (200g): NA Tolerance = +/- 0.5 g

Reference Weight (500g): 500.0 Tolerance = +/- 0.5 g

Imp	Contents	Final	Initial	Difference
1	Empty (g)	854.5	351.3	
2	H_2O (g)	699.3	699.0	
3	H_2O (g)	709.4	698.6	
4	Empty (g)	616.2	611.0	
5	Silica (g)	807.4	768.1	

MONTROSE METHOD 0010/23 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 0010/23 **Project Number:** Proj106377 (16-167)

Date: 10/18/16 **Run Number:** 3 **Sampling Location:** Comb. Stack Outlet

Test Crew: BC JW CB TM

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°-273°	Oven Temp. (°F) 248°-273°	Imp Exit Temp. (°F) ≤ 68°	Condenser Temp. (°F) ≤68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:52:30	774.82	0.016	2.0	9	529	250	254	57	48	95	90	
C-3	1:57:00	778.36	0.010	2.0	9	534	248	254	57	49	95	90	
C-4	2:01:30	782.21	0.011	2.3	10	525	249	253	58	53	96	91	
C-4	2:06:00	786.07	0.011	2.3	10	446	250	254	59	52	96	91	
C-5	2:10:30	790.15	0.013	2.7	11	433	249	255	59	55	96	91	
C-5	2:15:00	794.560	0.015	3.1	12	432	250	254	61	60	97	91	
D-1	2:19:30	798.22	0.010	2.0	9	513	251	254	63	60	94	91	
D-1	2:24:00	801.79	0.010	2.0	9	534	253	254	64	68	94	91	
D-2	2:28:30	805.42	0.010	2.0	9	510	252	254	63	61	95	92	
D-2	2:33:00	809.03	0.010	2.0	9	521	253	254	61	56	96	91	
D-3	2:37:30	812.87	0.011	2.3	10	504	252	252	61	58	96	92	
D-3	2:42:00	816.75	0.011	2.3	10	440	253	254	61	58	97	92	
D-4	2:46:30	820.57	0.011	2.3	10	455	253	255	63	59	97	92	
D-4	2:51:00	824.40	0.011	2.3	10	470	254	254	64	61	97	92	
D-5	2:55:30	827.93	0.012	2.5	11	372	253	254	66	64	98	93	
D-5	3:00:00	832.396	0.012	2.5	11	423	252	254	67	65	98	93	Stop 16:07

Method 316

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/20	08:42:35	9.61	5.42
2	2016/10/20	08:43:35	11.61	4.51
3	2016/10/20	08:44:35	14.53	3.22
4	2016/10/20	08:45:35	11.68	4.45
5	2016/10/20	08:46:35	10.82	4.86
6	2016/10/20	08:47:35	10.47	5.02
7	2016/10/20	08:48:35	10.39	5.05
8	2016/10/20	08:49:35	9.77	5.33
9	2016/10/20	08:50:35	9.25	5.59
10	2016/10/20	08:51:35	9.00	5.74
11	2016/10/20	08:52:35	8.89	5.79
12	2016/10/20	08:53:35	8.84	5.81
13	2016/10/20	08:54:35	8.81	5.82
14	2016/10/20	08:55:35	8.77	5.84
15	2016/10/20	08:56:35	8.74	5.85
16	2016/10/20	08:57:35	8.75	5.84
17	2016/10/20	08:58:35	8.70	5.86
18	2016/10/20	08:59:35	8.66	5.88
19	2016/10/20	09:00:35	8.77	5.82
20	2016/10/20	09:01:35	8.70	5.85
21	2016/10/20	09:02:35	8.58	5.92
22	2016/10/20	09:03:35	10.37	5.13
23	2016/10/20	09:04:35	14.08	3.46
24	2016/10/20	09:05:35	11.39	4.58
25	2016/10/20	09:06:35	10.76	4.89
26	2016/10/20	09:07:35	10.28	5.10
27	2016/10/20	09:08:35	10.10	5.17
28	2016/10/20	09:09:35	10.07	5.18
29	2016/10/20	09:10:35	9.54	5.42
30	2016/10/20	09:11:35	8.81	5.82
31	2016/10/20	09:12:35	8.52	5.97
32	2016/10/20	09:13:35	8.32	6.07
33	2016/10/20	09:14:35	8.16	6.15
34	2016/10/20	09:15:35	8.37	6.04
35	2016/10/20	09:16:35	8.32	6.07
36	2016/10/20	09:17:35	8.49	5.99
37	2016/10/20	09:18:35	9.49	5.49
38	2016/10/20	09:19:35	10.25	5.10
39	2016/10/20	09:20:35	10.62	4.94
40	2016/10/20	09:21:35	10.38	5.04
41	2016/10/20	09:22:35	9.94	5.23
42	2016/10/20	09:23:35	11.44	4.58
43	2016/10/20	09:24:35	14.31	3.33
44	2016/10/20	09:25:35	11.10	4.70
45	2016/10/20	09:26:35	9.58	5.43
46	2016/10/20	09:27:35	9.11	5.67
47	2016/10/20	09:28:35	9.14	5.66
48	2016/10/20	09:29:35	8.99	5.73
49	2016/10/20	09:30:35	9.00	5.74
50	2016/10/20	09:31:35	9.84	5.33
51	2016/10/20	09:32:35	10.60	4.95
52	2016/10/20	09:33:35	10.28	5.09
53	2016/10/20	09:34:35	9.98	5.23
54	2016/10/20	09:35:35	10.13	5.15
55	2016/10/20	09:36:35	9.77	5.31
56	2016/10/20	09:37:35	9.30	5.54
57	2016/10/20	09:38:35	8.96	5.72
58	2016/10/20	09:39:35	8.79	5.80
59	2016/10/20	09:40:35	8.90	5.75
60	2016/10/20	09:41:35	8.65	5.87
61	2016/10/20	09:42:35	8.50	5.95
62	2016/10/20	09:43:35	10.44	5.07

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/20	09:44:35	13.52	3.71
64	2016/10/20	09:45:35	10.22	5.11
65	2016/10/20	09:46:35	10.07	5.21
66	2016/10/20	09:47:35	10.26	5.11
67	2016/10/20	09:48:35	10.13	5.16
68	2016/10/20	09:49:35	10.13	5.15
69	2016/10/20	09:50:35	9.56	5.41
70	2016/10/20	09:51:35	8.85	5.78
71	2016/10/20	09:52:35	8.44	6.00
72	2016/10/20	09:53:35	8.41	6.02
73	2016/10/20	09:54:35	8.51	5.96
74	2016/10/20	09:55:35	8.44	6.01
75	2016/10/20	09:56:35	8.96	5.75
76	2016/10/20	09:57:35	9.94	5.23
77	2016/10/20	09:58:35	9.64	5.37
78	2016/10/20	09:59:35	9.65	5.36
79	2016/10/20	10:00:35	9.87	5.26
80	2016/10/20	10:01:35	9.31	5.52
81	2016/10/20	10:02:35	8.81	5.79
82	2016/10/20	10:03:35	11.95	4.34
83	2016/10/20	10:04:35	18.40	1.26
84	2016/10/20	10:05:35	11.79	4.26
85	2016/10/20	10:06:35	9.47	5.45
86	2016/10/20	10:07:35	9.19	5.60
87	2016/10/20	10:08:35	9.37	5.53
88	2016/10/20	10:09:35	10.23	5.13
89	2016/10/20	10:10:35	10.39	5.04
90	2016/10/20	10:11:35	10.38	5.04
91	2016/10/20	10:12:35	10.32	5.05
92	2016/10/20	10:13:35	9.57	5.40
93	2016/10/20	10:14:35	9.04	5.67
94	2016/10/20	10:15:35	8.88	5.76
95	2016/10/20	10:16:35	8.84	5.77
96	2016/10/20	10:17:35	8.83	5.77
97	2016/10/20	10:18:35	8.82	5.77
98	2016/10/20	10:19:35	8.89	5.73
99	2016/10/20	10:20:35	8.92	5.71
100	2016/10/20	10:21:35	8.77	5.78
101	2016/10/20	10:22:35	8.67	5.83
102	2016/10/20	10:23:35	10.33	5.10
103	2016/10/20	10:24:35	13.40	3.74
104	2016/10/20	10:25:35	10.12	5.11
105	2016/10/20	10:26:35	9.18	5.57
106	2016/10/20	10:27:35	8.91	5.71
107	2016/10/20	10:28:35	8.80	5.76
108	2016/10/20	10:29:35	8.72	5.79
109	2016/10/20	10:30:35	8.66	5.82
110	2016/10/20	10:31:35	8.64	5.82
111	2016/10/20	10:32:35	8.61	5.83
112	2016/10/20	10:33:35	8.58	5.84
113	2016/10/20	10:34:35	8.57	5.84
114	2016/10/20	10:35:35	8.53	5.85
115	2016/10/20	10:36:35	8.51	5.86
116	2016/10/20	10:37:35	8.53	5.84
117	2016/10/20	10:38:35	8.47	5.87
118	2016/10/20	10:39:35	8.46	5.86
119	2016/10/20	10:40:35	8.63	5.78
120	2016/10/20	10:41:35	8.46	5.86
121	2016/10/20	10:42:35	8.36	5.91
122	2016/10/20	10:43:35	10.05	5.18
123	2016/10/20	10:44:35	13.38	3.71
124	2016/10/20	10:45:35	10.44	4.89
125	2016/10/20	10:46:35	9.65	5.26

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/20	10:47:35	9.40	5.37
127	2016/10/20	10:48:35	9.30	5.41
128	2016/10/20	10:49:35	9.25	5.43
129	2016/10/20	10:50:35	9.20	5.45
130	2016/10/20	10:51:35	9.16	5.47
131	2016/10/20	10:52:35	9.13	5.48
132	2016/10/20	10:53:35	9.09	5.50
133	2016/10/20	10:54:35	9.09	5.50
134	2016/10/20	10:55:35	9.06	5.51
135	2016/10/20	10:56:35	9.05	5.51
136	2016/10/20	10:57:35	9.58	5.27
137	2016/10/20	10:58:35	10.82	4.71
138	2016/10/20	10:59:35	10.88	4.67
139	2016/10/20	11:00:35	10.87	4.69
140	2016/10/20	11:01:35	10.96	4.66
141	2016/10/20	11:02:35	11.77	4.29
142	2016/10/20	11:03:35	13.36	3.61
143	2016/10/20	11:04:35	15.31	2.78
144	2016/10/20	11:05:35	12.30	4.08
145	2016/10/20	11:06:35	10.58	4.86
146	2016/10/20	11:07:35	9.72	5.25
147	2016/10/20	11:08:35	9.18	5.50
148	2016/10/20	11:09:35	8.96	5.62
149	2016/10/20	11:10:35	8.76	5.73
150	2016/10/20	11:11:35	8.61	5.81
151	2016/10/20	11:12:35	8.75	5.73
152	2016/10/20	11:13:35	8.73	5.74
153	2016/10/20	11:14:35	9.00	5.62
154	2016/10/20	11:15:35	9.91	5.18
155				
156				
RUN 1 AVERAGES			**9.8**	**5.3**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
Run 2				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15	2016/10/20	12:29:35	7.95	6.17
16	2016/10/20	12:30:35	8.01	6.15
17	2016/10/20	12:31:35	8.94	5.75
18	2016/10/20	12:32:35	9.35	5.55
19	2016/10/20	12:33:35	9.96	5.26
20	2016/10/20	12:34:35	10.26	5.11
21	2016/10/20	12:35:35	9.99	5.22
22	2016/10/20	12:36:35	9.39	5.49
23	2016/10/20	12:37:35	9.35	5.52
24	2016/10/20	12:38:35	9.89	5.25
25	2016/10/20	12:39:35	9.94	5.23
26	2016/10/20	12:40:35	10.00	5.20
27	2016/10/20	12:41:35	9.86	5.27
28	2016/10/20	12:42:35	9.77	5.32
29	2016/10/20	12:43:35	10.84	4.87
30	2016/10/20	12:44:35	13.64	3.65
31	2016/10/20	12:45:35	12.48	4.11
32	2016/10/20	12:46:35	11.77	4.45
33	2016/10/20	12:47:35	11.69	4.50
34	2016/10/20	12:48:35	13.10	3.90
35	2016/10/20	12:49:35	16.07	2.48
36	2016/10/20	12:50:35	15.52	2.62
37	2016/10/20	12:51:35	11.90	4.35
38	2016/10/20	12:52:35	10.70	4.89
39	2016/10/20	12:53:35	9.50	5.41
40	2016/10/20	12:54:35	9.11	5.59
41	2016/10/20	12:55:35	9.01	5.64
42	2016/10/20	12:56:35	8.95	5.66
43	2016/10/20	12:57:35	8.94	5.66
44	2016/10/20	12:58:35	8.88	5.68
45	2016/10/20	12:59:35	8.84	5.69
46	2016/10/20	13:00:35	8.84	5.69
47	2016/10/20	13:01:35	8.91	5.65
48	2016/10/20	13:02:35	8.87	5.64
49	2016/10/20	13:03:35	8.73	5.70
50	2016/10/20	13:04:35	9.47	5.43
51	2016/10/20	13:05:35	11.42	4.63
52	2016/10/20	13:06:35	10.82	4.71
53	2016/10/20	13:07:35	9.22	5.47
54	2016/10/20	13:08:35	8.89	5.62
55	2016/10/20	13:09:35	8.77	5.67
56	2016/10/20	13:10:35	8.70	5.69
57	2016/10/20	13:11:35	8.68	5.70
58	2016/10/20	13:12:35	8.63	5.71
59	2016/10/20	13:13:35	8.59	5.72
60	2016/10/20	13:14:35	8.59	5.72
61	2016/10/20	13:15:35	8.60	5.71
62	2016/10/20	13:16:35	8.56	5.72

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/20	13:17:35	8.47	5.74
64	2016/10/20	13:18:35	8.40	5.77
65	2016/10/20	13:19:35	8.44	5.80
66	2016/10/20	13:20:35	8.70	5.73
67	2016/10/20	13:21:35	8.86	5.61
68	2016/10/20	13:22:35	8.94	5.54
69	2016/10/20	13:23:35	9.05	5.51
70	2016/10/20	13:24:35	9.30	5.39
71	2016/10/20	13:25:35	9.33	5.36
72	2016/10/20	13:26:35	9.74	5.24
73	2016/10/20	13:27:35	11.08	4.75
74	2016/10/20	13:28:35	11.39	4.47
75	2016/10/20	13:29:35	10.67	4.78
76	2016/10/20	13:30:35	10.23	4.98
77	2016/10/20	13:31:35	10.05	5.06
78	2016/10/20	13:32:35	9.97	5.08
79	2016/10/20	13:33:35	9.87	5.13
80	2016/10/20	13:34:35	10.05	5.09
81	2016/10/20	13:35:35	10.55	4.91
82	2016/10/20	13:36:35	10.93	4.73
83	2016/10/20	13:37:35	10.99	4.69
84	2016/10/20	13:38:35	10.99	4.69
85	2016/10/20	13:39:35	10.97	4.69
86	2016/10/20	13:40:35	10.73	4.77
87	2016/10/20	13:41:35	10.30	4.95
88	2016/10/20	13:42:35	10.01	5.08
89	2016/10/20	13:43:35	9.91	5.14
90	2016/10/20	13:44:35	9.85	5.16
91	2016/10/20	13:45:35	9.79	5.18
92	2016/10/20	13:46:35	10.47	4.95
93	2016/10/20	13:47:35	12.12	4.29
94	2016/10/20	13:48:35	11.66	4.35
95	2016/10/20	13:49:35	10.95	4.68
96	2016/10/20	13:50:35	10.58	4.85
97	2016/10/20	13:51:35	10.47	4.92
98	2016/10/20	13:52:35	10.73	4.84
99	2016/10/20	13:53:35	11.22	4.63
100	2016/10/20	13:54:35	11.44	4.52
101	2016/10/20	13:55:35	11.48	4.48
102	2016/10/20	13:56:35	11.36	4.52
103	2016/10/20	13:57:35	10.92	4.70
104	2016/10/20	13:58:35	10.46	4.90
105	2016/10/20	13:59:35	10.22	5.01
106	2016/10/20	14:00:35	10.20	5.04
107	2016/10/20	14:01:35	10.26	5.01
108	2016/10/20	14:02:35	10.41	4.95
109	2016/10/20	14:03:35	10.79	4.78
110	2016/10/20	14:04:35	10.94	4.71
111	2016/10/20	14:05:35	11.08	4.66
112	2016/10/20	14:06:35	11.94	4.31
113	2016/10/20	14:07:35	12.95	3.77
114	2016/10/20	14:08:35	11.63	4.36
115	2016/10/20	14:09:35	11.25	4.58
116	2016/10/20	14:10:35	11.56	4.47
117	2016/10/20	14:11:35	11.82	4.34
118	2016/10/20	14:12:35	11.81	4.33
119	2016/10/20	14:13:35	11.79	4.34
120	2016/10/20	14:14:35	11.66	4.39
121	2016/10/20	14:15:35	11.37	4.52
122	2016/10/20	14:16:35	11.36	4.54
123	2016/10/20	14:17:35	11.51	4.47
124	2016/10/20	14:18:35	11.49	4.46
125	2016/10/20	14:19:35	11.42	4.49

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/20	14:20:35	11.25	4.56
127	2016/10/20	14:21:35	10.82	4.74
128	2016/10/20	14:22:35	10.63	4.84
129	2016/10/20	14:23:35	10.51	4.90
130	2016/10/20	14:24:35	10.44	4.95
131	2016/10/20	14:25:35	10.96	4.78
132	2016/10/20	14:26:35	12.39	4.17
133	2016/10/20	14:27:35	13.50	3.55
134	2016/10/20	14:28:35	12.69	3.91
135	2016/10/20	14:29:35	12.31	4.10
136	2016/10/20	14:30:35	12.02	4.22
137	2016/10/20	14:31:35	11.64	4.40
138	2016/10/20	14:32:35	11.33	4.54
139	2016/10/20	14:33:35	10.87	4.73
140	2016/10/20	14:34:35	10.08	5.06
141	2016/10/20	14:35:35	9.69	5.24
142	2016/10/20	14:36:35	9.56	5.30
143	2016/10/20	14:37:35	9.47	5.34
144	2016/10/20	14:38:35	9.40	5.38
145	2016/10/20	14:39:35	9.42	5.37
146	2016/10/20	14:40:35	9.44	5.36
147	2016/10/20	14:41:35	9.44	5.37
148	2016/10/20	14:42:35	9.86	5.22
149	2016/10/20	14:43:35	10.59	4.90
150	2016/10/20	14:44:35	10.73	4.83
151	2016/10/20	14:45:35	10.92	4.77
152	2016/10/20	14:46:35	12.01	4.33
153	2016/10/20	14:47:35	12.78	3.85
154	2016/10/20	14:48:35	11.37	4.51
155	2016/10/20	14:49:35	11.11	4.67
156	2016/10/20	14:50:35	11.42	4.53
157	2016/10/20	14:51:35	11.53	4.46
158	2016/10/20	14:52:35	11.50	4.47
159	2016/10/20	14:53:35	11.44	4.49
160	2016/10/20	14:54:35	11.34	4.54
161	2016/10/20	14:55:35	11.23	4.60
162	2016/10/20	14:56:35	11.25	4.60
163	2016/10/20	14:57:35	11.72	4.41
164	2016/10/20	14:58:35	12.28	4.14
165	2016/10/20	14:59:35	12.45	4.04
166	2016/10/20	15:00:35	12.46	4.03
167	2016/10/20	15:01:35	12.44	4.03
168	2016/10/20	15:02:35	12.24	4.11
169	2016/10/20	15:03:35	11.86	4.28
170	2016/10/20	15:04:35	11.45	4.47
171	2016/10/20	15:05:35	11.15	4.64
172	2016/10/20	15:06:35	11.61	4.49
173	2016/10/20	15:07:35	11.97	4.20
174	2016/10/20	15:08:35	10.39	4.94
175	2016/10/20	15:09:35	9.85	5.20
176	2016/10/20	15:10:35	9.72	5.26
177	2016/10/20	15:11:35	9.63	5.30
178	2016/10/20	15:12:35	9.88	5.22
179	2016/10/20	15:13:35	10.53	4.96
180	2016/10/20	15:14:35	10.80	4.82
181	2016/10/20	15:15:35	10.82	4.81
182	2016/10/20	15:16:35	10.73	4.84
183	2016/10/20	15:17:35	10.66	4.86
184	2016/10/20	15:18:35	10.59	4.89
185	2016/10/20	15:19:35	10.31	5.00
186	2016/10/20	15:20:35	10.22	5.06
RUN 2 AVERAGES			**10.58**	**4.89**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal Monessen	**Unit:**	Combustion Stack 2
Project No.:	16-167	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/20	15:47:35	9.03	6.48
2	2016/10/20	15:48:35	8.77	6.39
3	2016/10/20	15:49:35	9.85	5.54
4	2016/10/20	15:50:35	10.31	4.77
5	2016/10/20	15:51:35	9.96	5.56
6	2016/10/20	15:52:35	10.26	5.08
7	2016/10/20	15:53:35	9.98	5.47
8	2016/10/20	15:54:35	9.49	6.02
9	2016/10/20	15:55:35	10.35	5.16
10	2016/10/20	15:56:35	12.16	2.94
11	2016/10/20	15:57:35	9.55	5.66
12	2016/10/20	15:58:35	8.51	7.00
13	2016/10/20	15:59:35	8.33	7.01
14	2016/10/20	16:00:35	7.73	7.31
15	2016/10/20	16:01:35	8.09	7.69
16	2016/10/20	16:02:35	7.84	7.79
17	2016/10/20	16:03:35	8.77	7.22
18	2016/10/20	16:04:35	9.07	6.00
19	2016/10/20	16:05:35	9.60	5.63
20	2016/10/20	16:06:35	9.70	5.78
21	2016/10/20	16:07:35	9.98	5.73
22	2016/10/20	16:08:35	8.83	6.83
23	2016/10/20	16:09:35	8.70	6.37
24	2016/10/20	16:10:35	9.86	6.08
25	2016/10/20	16:11:35	9.63	5.39
26	2016/10/20	16:12:35	9.79	5.64
27	2016/10/20	16:13:35	9.71	5.37
28	2016/10/20	16:14:35	9.38	5.67
29	2016/10/20	16:15:35	9.99	5.31
30	2016/10/20	16:16:35	12.57	2.59
31	2016/10/20	16:17:35	11.70	3.58
32	2016/10/20	16:18:35	11.24	4.23
33	2016/10/20	16:19:35	11.24	4.34
34	2016/10/20	16:20:35	12.46	3.40
35	2016/10/20	16:21:35	14.52	1.40
36	2016/10/20	16:22:35	14.50	0.70
37	2016/10/20	16:23:35	11.47	4.46
38	2016/10/20	16:24:35	10.26	5.55
39	2016/10/20	16:25:35	10.30	4.75
40	2016/10/20	16:26:35	9.15	6.23
41	2016/10/20	16:27:35	8.16	7.02
42	2016/10/20	16:28:35	8.57	7.39
43	2016/10/20	16:29:35	8.99	6.27
44	2016/10/20	16:30:35	8.72	6.88
45	2016/10/20	16:31:35	8.49	7.34
46	2016/10/20	16:32:35	8.79	7.20
47	2016/10/20	16:33:35	8.77	6.47
48	2016/10/20	16:34:35	9.09	6.84
49	2016/10/20	16:35:35	8.26	7.39
50	2016/10/20	16:36:35	9.37	6.59
51	2016/10/20	16:37:35	11.34	4.10
52	2016/10/20	16:38:35	10.49	5.35
53	2016/10/20	16:39:35	9.11	6.71
54	2016/10/20	16:40:35	8.68	6.63
55	2016/10/20	16:41:35	9.22	5.97
56	2016/10/20	16:42:35	8.71	7.06
57	2016/10/20	16:43:35	8.54	7.12
58	2016/10/20	16:44:35	8.30	7.52
59	2016/10/20	16:45:35	7.84	7.42
60	2016/10/20	16:46:35	8.25	7.73
61	2016/10/20	16:47:35	8.53	6.49
62	2016/10/20	16:48:35	8.67	7.12

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 1
Unit	Combustion Stack 2	**Start Time**	8:42
Operation	Normal	**End Time**	11:18
Tester(s)	BC, JW, TM, CB		

Cal.	LOW		MID		HIGH			Conc.	Tank ID			Response Time (sec)	
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH	Up	Down
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC22473	CC98694	60	60
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC98694	CC22473	70	70
LIMITS				40 % to 60 %		100%							

				Initial Values		Final Values							
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.14	0.50	0.17	0.65	0.15	20.03	0.16			
	Mid	10.01	10.01	10.18	0.85	10.07	0.30	-0.55	20.03	10.13	9.76	9.65	d. vol. %
CO2	Zero		0.13	0.07	-0.30	0.15	0.10	0.40	19.79	0.11			
	Mid	10.15	10.11	10.16	0.25	10.10	-0.05	-0.30	19.79	10.13	5.32	5.28	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Combustion Stack 2	**Start Time**	12:15
Operation	Normal	**End Time**	15:21
Tester(s)	BC, JW, TM, CB		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Conc.**	**(% of Span)**	**Span**	**Units**	**LOW**	**MID**	**HIGH**
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC22473	CC98694
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC98694	CC22473
LIMITS				**40 % to 60 %**		**100%**					

				Initial Values		Final Values								
Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	**Actual Upscale Conc.**	**Analyzer Cal. Response**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**System Cal. Response**	**System Cal. Bias (% of Span)**	**Drift (% of Span)**	**Span**	**Average of Initial and Final System Responses**	**Average Indicated Gas Conc.**	**Corrected Gas Conc.**	**Conc. Units**
O2	**Zero**		0.04	0.17	0.65	0.23	0.95	0.30	20.03	0.20			
	Mid	10.01	10.01	10.07	0.30	10.04	0.15	-0.15	20.03	10.06	10.58	10.54	d. vol. %
CO2	**Zero**		0.13	0.15	0.10	0.20	0.35	0.25	19.79	0.18			
	Mid	10.15	10.11	10.10	-0.05	9.97	-0.71	-0.66	19.79	10.04	4.89	4.85	d. vol. %
LIMITS					**+/- 5 %**		**+/- 5 %**	**+/- 3 %**					

Gas	**ZERO Analyzer Response (System for THC)**	**ZERO Analyzer Cal. Error (% of Span)**	**LOW Actual Conc.**	**LOW Analyzer Response (System for THC)**	**LOW Analyzer Cal. Error (% of Span)**	**LOW System Cal. Error (% of Actual)**	**MID Actual Conc.**	**MID Analyzer Response (System for THC)**	**MID Analyzer Cal. Error (% of Span)**	**MID System Cal. Error (% of Actual)**	**HIGH Actual Conc.**	**HIGH Analyzer Response (System for THC)**	**HIGH Analyzer Cal. Error (% of Span)**	**HIGH System Calibration Error (% of Actual)**	**Span**	**Conc. Units**
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		**+/- 2 %**			**+/- 2 %**	**+/- 5 %**			**+/- 2 %**	**+/- 5 %**			**+/- 2 %**	**+/- 5 %**		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Combustion Stack 2	**Start Time**	15:47
Operation	Normal	**End Time**	18:05
Tester(s)	BC, JW, TM, CB		

Cal.	LOW		MID		HIGH			Conc.	Tank ID		
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC22473	CC98694
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC98694	CC22473
LIMITS				40 % to 60 %		100%					

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.00	0.23	1.15	0.19	0.95	-0.20	20.03	0.21			
	Mid	10.01	10.01	10.04	0.15	10.05	0.20	0.05	20.03	10.05	10.01	9.98	d. vol. %
CO2	Zero		0.20	0.20	0.00	0.17	-0.15	-0.15	19.79	0.19			
	Mid	10.15	10.11	9.97	-0.71	10.04	-0.35	0.35	19.79	10.01	5.51	5.51	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.0	0.00					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.2	1.01					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen	Test Date:	October 20, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Combustion Stack 2	Test Start Time:	8:42 AM
Unit Operation:	Normal	Test Finish Time:	11:18 AM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.500	inches
O2	9.65	% dv
CO2	5.28	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Formaldehyde Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	75.3	F
Stack Temperature (Tsavg)	544.4	F
Orifice Pressure Drop (dHavg)	0.371	in. H_2O
GasVelocity Head (dP)^^avg	0.1105	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	85.08	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	160.2	g
Water Vapor in Silica Gel (Vwsg(std))	7.553	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	7.553	scf
Volume Dry Gas Metered (Vm)	40.565	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	39.127	dscf
Volume Dry Gas Metered (Vm(m^3))	1.149	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.108	dscm
Stack Absolute Pressure (Ps)	28.97	in. Hg
Stack Absolute Temperature (Tsavg)	1004.0	R
H2O Vapor Pressure @ avg Stack Temp.	2032.64	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1618	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1618	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.23	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.41	lb/lb-mole
Gas Velocity (Vs)	8.93	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft"
Actual Gas Flowrate	36,642	acfm
Standard Gas Flowrate	18,654	scfm
Dry Standard Gas Flowrate	15,636	dscfm
Dry Standard Exhaust Gas Flowrate	71.2	1000 lb/hr
Actual Gas Flowrate	1,038	acm/min
Standard Gas Flowrate	528	scm/min
Dry Standard Gas Flowrate	443	dscm/min
Area Nozzle (An)	0.001364	ft^2
Percent of Isokinetic Sampling (I)	104.69	%

Formaldehyde

Front Half Gain	<	10.00	(µg)
Back Half Gain			(µg)
Emission Mass	<	0.0100	(mg)
Emission Concentration	<	0.0090	(mg/DSCM)
Emission Rate	<	0.00053	(lb/hr)

ArcelorMittal Monessen **Run 1** **F or C?**
Combustion Stack 2 **F=1,C=0 1**

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.017	0.130	0.51	502	66	66
A-1	0.023	0.152	0.69	545	67	67
A-2	0.015	0.122	0.45	548	67	67
A-2	0.015	0.122	0.45	552	68	67
A-3	0.013	0.114	0.39	552	68	67
A-3	0.013	0.114	0.39	511	69	67
A-4	0.011	0.105	0.33	547	69	67
A-4	0.011	0.105	0.33	548	69	70
A-5	0.010	0.100	0.30	549	70	68
A-5	0.010	0.100	0.30	552	70	68
B-1	0.011	0.105	0.39	551	71	70
B-1	0.016	0.126	0.48	552	71	70
B-2	0.013	0.114	0.39	555	72	70
B-2	0.013	0.114	0.39	558	73	71
B-3	0.011	0.105	0.33	561	74	71
B-3	0.011	0.105	0.33	537	75	72
B-4	0.010	0.100	0.30	539	75	72
B-4	0.010	0.100	0.30	544	76	73
B-5	0.010	0.100	0.30	521	76	73
B-5	0.010	0.100	0.30	543	77	74
C-1	0.011	0.105	0.33	544	77	75
C-1	0.011	0.105	0.33	549	78	76
C-2	0.010	0.100	0.30	552	78	76
C-2	0.011	0.105	0.33	554	79	77
C-3	0.011	0.105	0.33	524	80	77
C-3	0.014	0.118	0.42	540	80	77
C-4	0.014	0.118	0.42	543	80	78
C-4	0.014	0.118	0.42	549	81	78
C-5	0.011	0.105	0.33	552	81	79
C-5	0.011	0.105	0.33	555	82	79
D-1	0.012	0.110	0.36	538	82	80
D-1	0.012	0.110	0.36	542	82	80
D-2	0.010	0.100	0.30	545	82	80
D-2	0.012	0.110	0.36	549	83	80
D-3	0.011	0.105	0.33	552	83	81
D-3	0.013	0.114	0.39	555	84	81
D-4	0.014	0.118	0.42	532	84	82
D-4	0.014	0.118	0.42	542	85	82
D-5	0.012	0.110	0.36	542	85	82
D-5	0.012	0.110	0.36	548	85	83
Average	0.012	0.1105	0.37	544.4		75.3

Initial volume	173.700	ft^3	Initial volume	0.000	liters
Final volume	214.265	ft^3	Final volume	0.000	liters
Total metered	40.565	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	841.2	707.0	134.2			0.0
2	712.9	700.8	12.1			0.0
3	622.1	619.4	2.7			0.0
4	781.7	770.5	11.2			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2957.9	2797.7	160.2	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal Monessen	Test Date:	October 20, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Combustion Stack 2	Test Start Time:	12:15 PM
Unit Operation:	Normal	Test Finish Time:	3:21 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-1.20	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.500	inches
O2	10.54	% dv
CO2	4.85	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Formaldehyde Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	91.2	F
Stack Temperature (Tsavg)	543.7	F
Orifice Pressure Drop (dHavg)	0.387	in. H_2O
GasVelocity Head (dP)^^avg	0.1111	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.61	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	147.5	g
Water Vapor in Silica Gel (Vwsg(std))	6.955	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	6.955	scf
Volume Dry Gas Metered (Vm)	43.012	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	40.296	dscf
Volume Dry Gas Metered (Vm(m^3))	1.218	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.141	dscm
Stack Absolute Pressure (Ps)	28.98	in. Hg
Stack Absolute Temperature (Tsavg)	1003.3	R
H2O Vapor Pressure @ avg Stack Temp.	2021.35	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1472	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1472	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.20	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.55	lb/lb-mole
Gas Velocity (Vs)	8.95	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^
Actual Gas Flowrate	36,725	acfm
Standard Gas Flowrate	18,714	scfm
Dry Standard Gas Flowrate	15,959	dscfm
Dry Standard Exhaust Gas Flowrate	72.6	1000 lb/hr
Actual Gas Flowrate	1,040	acm/min
Standard Gas Flowrate	530	scm/min
Dry Standard Gas Flowrate	452	dscm/min
Area Nozzle (An)	0.001364	ft^2
Percent of Isokinetic Sampling (I)	105.64	%

Formaldehyde

Front Half Gain	<	11.00	(µg)
Back Half Gain			(µg)
Emission Mass	<	0.0110	(mg)
Emission Concentration	<	0.0096	(mg/DSCM)
Emission Rate	<	0.00058	(lb/hr)

ArcelorMittal Monessen **Run 2** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.011	0.105	0.30	558	87	86
A-1	0.015	0.122	0.50	558	87	86
A-2	0.015	0.122	0.50	516	88	86
A-2	0.015	0.122	0.50	539	88	86
A-3	0.016	0.126	0.50	545	89	87
A-3	0.016	0.126	0.50	548	90	87
A-4	0.014	0.118	0.40	551	90	87
A-4	0.015	0.122	0.50	557	90	87
A-5	0.013	0.114	0.40	551	91	88
A-5	0.013	0.114	0.40	531	91	88
B-1	0.012	0.110	0.40	542	91	90
B-1	0.011	0.105	0.34	539	91	90
B-2	0.010	0.100	0.31	548	91	90
B-2	0.012	0.110	0.37	549	91	90
B-3	0.015	0.122	0.47	552	92	91
B-3	0.015	0.122	0.47	523	92	91
B-4	0.013	0.114	0.40	531	92	91
B-4	0.011	0.105	0.34	537	92	91
B-5	0.012	0.110	0.37	534	93	91
B-5	0.012	0.110	0.37	541	93	91
C-1	0.011	0.105	0.34	534	93	92
C-1	0.011	0.105	0.34	544	92	92
C-2	0.011	0.105	0.34	550	92	92
C-2	0.011	0.105	0.34	554	92	92
C-3	0.013	0.114	0.40	563	92	92
C-3	0.013	0.114	0.40	532	92	92
C-4	0.010	0.100	0.31	536	93	92
C-4	0.010	0.100	0.31	546	93	92
C-5	0.010	0.100	0.31	546	93	92
C-5	0.010	0.100	0.31	556	93	92
D-1	0.010	0.100	0.31	545	93	92
D-1	0.010	0.100	0.31	543	93	93
D-2	0.014	0.118	0.43	550	93	93
D-2	0.014	0.118	0.43	556	94	93
D-3	0.012	0.110	0.37	523	94	93
D-3	0.011	0.105	0.34	539	94	93
D-4	0.015	0.122	0.47	532	94	93
D-4	0.015	0.122	0.47	546	94	93
D-5	0.010	0.100	0.31	547	94	93
D-5	0.010	0.100	0.31	555	94	93
Average	0.012	0.111	0.39	543.7		91.2

Initial volume	216.500	ft^3	Initial volume	0.000	liters
Final volume	259.512	ft^3	Final volume	0.000	liters
Total metered	43.012	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	827.3	704.1	123.2			0.0
2	634.1	622.5	11.6			0.0
3	616.2	615.1	1.1			0.0
4	794.8	783.2	11.6			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2872.4	2724.9	147.5	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- Vi)

Client:	ArcelorMittal Monessen	Test Date:	October 20, 2016
Project No.:	16-167	Test Location:	Combustion Stack Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Combustion Stack 2	Test Start Time:	3:47 PM
Unit Operation:	Normal	Test Finish Time:	6:05 PM

Blue is data input. Red is a calculation. Pink is a reference to a cell on another sheet. Green is a reference to a cell on this sheet.

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Test Time (Theta)	120	minutes
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.500	inches
O2	9.98	% dv
CO2	5.51	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Formaldehyde Test Results	
F_d @ 68 F and 760 mm Hg	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	84.6	F
Stack Temperature (Tsavg)	540.7	F
Orifice Pressure Drop (dHavg)	0.370	in. H_2O
GasVelocity Head (dP)''avg	0.1089	in. H_2O^1/2
F_d @ Standard Conditions	0	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	0	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.52	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	156.3	g
Water Vapor in Silica Gel (Vwsg(std))	7.370	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	7.370	scf
Volume Dry Gas Metered (Vm)	42.674	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	40.461	dscf
Volume Dry Gas Metered (Vm(m^3))	1.208	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.146	dscm
Stack Absolute Pressure (Ps)	28.97	in. Hg
Stack Absolute Temperature (Tsavg)	1000.4	R
H2O Vapor Pressure @ avg Stack Temp.	1972.17	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1541	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1541	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.28	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.54	lb/lb-mole
Gas Velocity (Vs)	8.76	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft"
Actual Gas Flowrate	35,941	acfm
Standard Gas Flowrate	18,364	scfm
Dry Standard Gas Flowrate	15,535	dscfm
Dry Standard Exhaust Gas Flowrate	70.8	1000 lb/hr
Actual Gas Flowrate	1,018	acm/min
Standard Gas Flowrate	520	scm/min
Dry Standard Gas Flowrate	440	dscm/min
Area Nozzle (An)	0.001364	ft^2
Percent of Isokinetic Sampling (I)	108.97	%

Formaldehyde

Front Half Gain	<	12.00	(µg)
Back Half Gain			(µg)
Emission Mass	<	0.0120	(mg)
Emission Concentration	<	0.0105	(mg/DSCM)
Emission Rate	<	0.00061	(lb/hr)

ArcelorMittal Monessen **Run 3** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.016	0.126	0.50	531	84	84
A-1	0.016	0.126	0.50	544	85	83
A-2	0.015	0.122	0.47	550	85	83
A-2	0.014	0.118	0.43	557	85	83
A-3	0.013	0.114	0.40	551	85	83
A-3	0.013	0.114	0.40	531	85	84
A-4	0.014	0.118	0.43	540	85	85
A-4	0.014	0.118	0.43	545	85	85
A-5	0.012	0.110	0.37	547	86	85
A-5	0.012	0.110	0.37	551	86	85
B-1	0.018	0.134	0.56	526	86	85
B-1	0.015	0.122	0.47	534	87	85
B-2	0.014	0.118	0.43	540	87	85
B-2	0.014	0.118	0.43	546	87	85
B-3	0.013	0.114	0.40	552	87	86
B-3	0.013	0.114	0.40	555	87	86
B-4	0.011	0.105	0.34	561	87	86
B-4	0.011	0.105	0.34	531	87	86
B-5	0.010	0.100	0.31	538	87	86
B-5	0.010	0.100	0.31	542	87	86
C-1	0.010	0.100	0.31	528	86	86
C-1	0.010	0.100	0.31	555	86	86
C-2	0.010	0.100	0.31	528	86	86
C-2	0.010	0.100	0.31	539	86	86
C-3	0.010	0.100	0.31	539	86	86
C-3	0.010	0.100	0.31	522	86	86
C-4	0.010	0.100	0.31	540	86	86
C-4	0.010	0.100	0.31	550	86	86
C-5	0.010	0.100	0.31	507	86	86
C-5	0.010	0.100	0.31	521	86	86
D-1	0.011	0.105	0.34	543	85	85
D-1	0.011	0.105	0.34	553	84	84
D-2	0.014	0.118	0.43	555	83	83
D-2	0.014	0.118	0.43	532	82	82
D-3	0.010	0.100	0.31	529	82	81
D-3	0.010	0.100	0.31	542	82	81
D-4	0.010	0.100	0.31	538	81	80
D-4	0.010	0.100	0.31	546	80	79
D-5	0.010	0.100	0.31	539	80	79
D-5	0.010	0.100	0.31	550	80	79
Average	0.012	0.109	0.37	540.7		84.6

Initial volume	260.100	ft^3	Initial volume	0.000	liters
Final volume	302.774	ft^3	Final volume	0.000	liters
Total metered	42.674	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	843.4	711.3	132.1			0.0
2	714.6	700.4	14.2			0.0
3	622.3	621.5	0.8			0.0
4	801.8	792.6	9.2			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2982.1	2825.8	156.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

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MONTROSE METHOD 316 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 316 Formaldehyde	Meter ΔH :	1.977 ~~1.971~~	Start Time:	08:42
Date:	10/20/16	Run Number:	1	Meter Correction (γ):	1.006 ~~1.003~~	Stop Time:	11:18
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.500	Pitot Correction:	0.84	T/C ID:	9-1
Sampling Location:	Comb. Stack Outlet	Static Press (in. H_2O):	-1.3	Control Box ID:	1774	Probe ID:	9-1
		Baro. Pres. (in. Hg):	29.07	Assumed Moisture (%):	14%	Pitot ID:	9-1
Project Number:	106377 (16-167)	Ambient Temp (°F):	80	Umbilical Length (Feet):	200'	Filter ID:	NA
Test Crew:	BC JW TM CB	Initial K-factor	30			Stack Diameter (inches):	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 172.700	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:03:00	175.14	0.017	0.51	3	502	251	N/A	49	66	66	Start 0842
A-1	0:06:00	176.46	0.023	0.69	3	545	253		47	67	67	
A-2	0:09:00	177.55	~~0.010~~	0.45	3	548	254		42	67	67	0.015 for ΔP
A-2	0:12:00	178.66	0.015	0.45	3	552	252		50	68	67	Pause at 8:56
A-3	0:15:00	179.72	0.013	0.39	3	552	252		53	68	67	Restart at 902
A-3	0:18:00	180.77	0.013	0.39	3	511	253		53	69	67	
A-4	0:21:00	181.73	0.011	0.33	2	547	255		53	69	67	
A-4	0:24:00	182.66	0.011	0.33	2	548	252		47	69	70	
A-5	0:27:00	183.58	0.010	0.30	2	549	252		47	70	~~88~~ 68	
A-5	0:30:00	184.48	0.010	0.30	2	552	252		47	70	68	
B-1	0:33:00	185.45	0.011	0.39	2	551	254		51	71	70	
B-1	0:36:00	186.52	~~0.16~~	0.48	3	552	253		50	71	70	ΔP = 0.016
B-2	0:39:00	187.55	0.013	0.39	3	555	256		52	72	70	
B-2	0:42:00	188.59	0.013	0.39	3	558	252		50	73	71	
B-3	0:45:00	189.53	0.011	0.33	2	561	253		52	74	71	
B-3	0:48:00	190.55	0.011	0.33	2	537	253		53	75	72	
B-4	0:51:00	191.39	0.010	0.30	2	539	254		53	75	72	
B-4	0:54:00	192.30	0.010	0.30	2	544	253		53	76	73	
B-5	0:57:00	193.21	0.010	0.30	2	521	252		54	76	73	
B-5	1:00:00	194.12	0.010	0.30	2	543	252		55	77	74	
C-1	1:03:00	195.19	0.011	0.33	2	544	255		57	77	75	
C-1	1:06:00	196.05	0.011	0.33	2	549	252		51	78	76	
C-2	1:09:00	196.98	0.010	0.30	2	552	256		50	78	76	
C-2	1:12:00	197.92	0.011	0.33	3	554	253	✓	50	79	77	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.001
Check	Final	5	0.000
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	E	M	S
O_2 (%)				
Fyrite Kit ID:	NA	Fyrite O_2 Check		NA %
Balance ID:	BAL-017			
Ref. Weight (200g):	NA	Tolerance = +/- 0.5 g		
Ref. Weight (500g):	500.0	Tolerance = +/- 0.5 g		

Imp	Contents	Final	Initial	Difference
1	H_2O (g)*	841.2	707.0	
2	H_2O (g)*	712.9	700.8	
3	Empty (g)	622.1	619.4	
4	Silica (g)	781.7	770.5	

* Type 1 High Purity HPLC Water

MONTROSE METHOD 316 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 316 Formaldehyde **Project Number:** 106377 (16-167)

Date: 10/20/16 **Run Number:** 1 **Sampling Location:** Comb. Stack Outlet

Test Crew: BC JW TM CB

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:15:00	197.89	~~0.010~~	0.33	~~524~~ 3	524	255	N/A	51	80	77	ΔP = 0.011
C-3	1:18:00	199.91	0.014	0.42	3	540	253		50	80	77	
C-4	1:21:00	201.01	0.014	0.42	3	543	252		50	80	78	
C-4	1:24:00	202.10	0.014	0.42	3	549	250		51	81	78	
C-5	1:27:00	203.06	0.011	0.33	3	552	240		55	81	79	
C-5	1:30:00	204.02	0.011	0.33	3	555	238		57	82	79	
D-1	1:33:00	205.03	0.012	0.36	3	538	255		59	82	80	
D-1	1:36:00	206.05	0.012	0.36	3	542	251		58	82	80	
D-2	1:39:00	207.04	0.010	0.30	3	545	242		60	82	80	
D-2	1:42:00	208.03	0.012	0.36	3	549	247		59	83	80	
D-3	1:45:00	209.01	0.011	0.33	3	552	249		61	83	81	
D-3	1:48:00	210.04	0.013	0.39	3	555	248		60	84	81	
D-4	1:51:00	211.13	0.014	0.42	3	532	248		60	84	82	
D-4	1:54:00	212.22	0.014	0.42	3	542	248		62	85	82	
D-5	1:57:00	213.28	0.012	0.36	3	542	240		62	85	82	
D-5	2:00:00	214.265	0.012	0.36	3	548	252		63	85	83	Stop ~~1018~~ 1118

MONTROSE METHOD 316 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 316 Formaldehyde	Meter ΔH :	1.977	Start Time:	1215
Date:	10/20/16	Run Number:	2	Meter Correction (γ):	1.006	Stop Time:	1521
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.500	Pitot Correction:	0.84	T/C ID:	9-1
Sampling Location:	Comb. Stack Outlet	Static Press (in. H_2O):	-1.2	Control Box ID:	1774	Probe ID:	9-1
		Baro. Pres. (in. Hg):	29.07	Assumed Moisture (%):	14%	Pitot ID:	9-1
Project Number:	106377 (16-167)	Ambient Temp (°F):	60°F	Umbilical Length (Feet):	200'	Filter ID:	NA
Test Crew:	BC JW TM CB	Initial K-factor	31			Stack Diameter (inches):	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 216.500	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:03:00	217.46	0.011	0.30	2	558	242	~~68~~	~~68~~ 68	87	86	Start 1215
A-1	0:06:00	218.94	0.015	0.5	3	558	240	~~68~~	68	87	86	
A-2	0:09:00	220.23	0.015	0.5	3	516	243		67	88	86	
A-2	0:12:00	221.40	0.015	0.5	3	539	247		67	88	86	
A-3	0:15:00	222.61	0.016	0.5	3	545	246		68	89	87	
A-3	0:18:00	223.81	0.016	0.5	3	548	250		68	90	87	
A-4	0:21:00	224.98	0.014	0.4	2	551	253		65	90	87	
A-4	0:24:00	226.14	0.015	0.5	3	557	256		62	90	87	
A-5	0:27:00	227.18	0.013	0.4	2	551	241		66	91	88	
A-5	0:30:00	228.26	0.013	0.40	2	531	246		65	91	88	
B-1	0:33:00	229.58	0.012	0.40	2	542	244		68	91	90	
B-1	0:36:00	230.57	0.011	0.34	2	579	241		67	91	90	
B-2	0:39:00	231.54	0.010	0.31	2	548	245		66	91	90	
B-2	0:42:00	232.57	0.012	0.37	2	549	247		65	91	90	
B-3	0:45:00	233.75	0.015	0.47	3	552	246		66	92	91	
B-3	0:48:00	234.91	0.015	0.47	3	523	242		66	92	91	
B-4	0:51:00	236.01	0.013	0.40	2	531	242		67	92	91	
B-4	0:54:00	237.02	0.011	0.34	2	537	254		68	92	91	
B-5	0:57:00	238.06	0.012	0.37	2	534	247		68	93	91	
B-5	1:00:00	239.09	0.012	0.37	2	541	245		60	93	91	
C-1	1:03:00	240.12	0.011	0.34	2	534	244		66	93	92	
C-1	1:06:00	241.12	0.011	0.34	2	544	249		64	92	92	
C-2	1:09:00	242.13	0.011	0.34	2	550	253		63	92	92	
C-2	1:12:00	243.13	0.011	0.34	2	554	252		63	92	92	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.001
Check	Final	15	0.001
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	E	M	S
O_2 (%)				
Fyrite Kit ID:	NA	Fyrite O_2 Check		NA %
Balance ID:	BAL-017			
Ref. Weight (200g):	NA	Tolerance = +/- 0.5 g		
Ref. Weight (500g):	500.0	Tolerance = +/- 0.5 g		

Imp	Contents	Final	Initial	Difference
1	H_2O (g)*	827.5	704.1	
2	H_2O (g)*	634.1	622.5	
3	Empty (g)	616.2	615.1	
4	Silica (g)	794.8	783.2	

* Type 1 High Purity HPLC Water

MONTROSE METHOD 316 DATA SHEET

Client: ArcelorMittal
Test Type: Method 316 Formaldehyde
Project Number: 106377 (16-167)
Date: 10/20/16
Run Number: 2
Sampling Location: Comb. Stack Outlet
Test Crew: BC JW TM CB
(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:15:00	244.21	0.013	0.40	2	563	253	N/A	62	92	92	
C-3	1:18:00	245.29	0.013	0.40	2	532	246		63	92	92	
C-4	1:21:00	246.26	0.010	0.31	2	536	246		65	93	92	
C-4	1:24:00	247.20	0.010	0.31	2	546	250		66	93	92	
C-5	1:27:00	248.14	0.016	0.31	2	546	240		67	93	92	
C-5	1:30:00	249.090	0.010	0.31	2	556	248		67	93	92	PC 1448
D-1	1:33:00	250.097	0.010	0.31	2	545	252		68	93	92	
D-1	1:36:00	251.094	0.010	0.31	2	543	252		68	93	93	
D-2	1:39:00	252.08	0.014	0.43	2	550	253		63	93	93	
D-2	1:42:00	253.18	0.014	0.43	2	556	252		64	94	93	
D-3	1:45:00	254.27	0.012	0.37	2	523	249		65	94	93	
D-3	1:48:00	255.26	0.011	0.34	2	539	253		65	94	93	
D-4	1:51:00	256.42	0.015	0.47	3	532	253		63	94	93	
D-4	1:54:00	257.60	0.015	0.47	3	546	251		63	94	93	
D-5	1:57:00	258.63	0.010	0.31	2	547	253		66	94	93	
D-5	2:00:00	259.512	0.010	0.31	2	555	253		66	94	93	Stop 1521

MONTROSE METHOD 316 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 316 Formaldehyde	Meter ΔH :	1.977	Start Time:	1547
Date:	10/20/16	Run Number:	3	Meter Correction (γ):	1.006	Stop Time:	1805
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.500	Pitot Correction:	0.84	T/C ID:	9-1
Sampling Location:	Comb. Stack Outlet	Static Press (in. H_2O):	-1.3	Control Box ID:	1774	Probe ID:	9-1
		Baro. Pres. (in. Hg):	29.07	Assumed Moisture (%):	14%	Pitot ID:	9-1
Project Number:	106377 (16-167)	Ambient Temp (°F):	80°F	Umbilical Length (Feet):	200'	Filter ID:	NA
Test Crew:	BC JW TM CB	Initial K-factor	31			Stack Diameter (inches):	112"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
		260.100										
A-1	0:03:00	261.64	0.016	0.50	3	531	241	N/A	61	84	84	start 1547
A-1	0:06:00	262.83	0.016	0.50	3	544	243		57	85	83	
A-2	0:09:00	263.99	0.015	0.47	3	550	247		55	85	83	
A-2	0:12:00	265.09	0.014	0.43	3	557	253		55	85	83	
A-3	0:15:00	266.14	0.013	0.40	2	551	253		56	85	83	
A-3	0:18:00	267.21	0.013	0.40	2	531	253		58	85	84	
A-4	0:21:00	268.34	0.014	0.43	3	540	252		57	85	85	
A-4	0:24:00	269.41	0.014	0.43	3	545	253		57	85	85	
A-5	0:27:00	270.45	0.012	0.37	2	547	249		59	86	85	
A-5	0:30:00	271.475	0.012	0.37	2	551	253		59	86	85	PC 1617
B-1	0:33:00	272.63	0.018	0.56	3	526	253		56	86	85	Start 1621
B-1	0:36:00	273.94	0.015	0.47	3	534	254		56	87	85	
B-2	0:39:00	275.14	0.014	0.43	3	540	253		55	87	85	
B-2	0:42:00	276.23	0.014	0.43	3	546	253		56	87	85	
B-3	0:45:00	277.99	0.013	0.40	2	552	252		57	87	86	
B-3	0:48:00	278.36	0.013	0.40	2	555	253		57	87	86	
B-4	0:51:00	279.36	0.011	0.34	2	561	252		58	87	86	
B-4	0:54:00	280.32	0.011	0.34	2	531	253		58	87	86	
B-5	0:57:00	281.27	0.010	0.31	2	538	253		58	87	86	
B-5	1:00:00	282.224	0.010	0.31	2	542	253		59	87	86	PC 1651
C-1	1:03:00	283.54	0.01	0.31	2	528	253		60	86	86	restart 1659
C-1	1:06:00	285.01	0.01	0.31	2	555	253		54	86	86	
C-2	1:09:00	286.38	0.01	0.31	2	528	253		55	86	86	
C-2	1:12:00	287.27	0.01	0.31	2	539	252		59	86	86	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.001
Check	Final	15	0.001
		Pressure (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	C	M	S
O_2 (%)				
Fyrite Kit ID:	NA	Fyrite O_2 Check		NA %
Balance ID:	BAL017			
Ref. Weight (200g):	NA	Tolerance = +/- 0.5 g		
Ref. Weight (500g):	500-0	Tolerance = +/- 0.5 g		

Imp	Contents	Final	Initial	Difference
1	H_2O (g)*	843.4	711.3	
2	H_2O (g)*	714.6	700.4	
3	Empty (g)	627.3	621.5	
4	Silica (g)	801.0	792.6	

* Type 1 High Purity HPLC Water

MONTROSE METHOD 316 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 316 Formaldehyde **Project Number:** 106377 (16-167)

Date: 10/20/16 **Run Number:** 3 **Sampling Location:** Comb. Stack Outlet

Test Crew: BC JW TM CB

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³)	Velocity Head (ΔP) (in. H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
C-3	1:15:00	288.22	0.01	0.31	2	539	245	N/A	61	86	86	
C-3	1:18:00	289.14	0.01	0.31	2	522	246		61	86	86	
C-4	1:21:00	290.68	0.01	0.31	2	540	247		60	86	86	
C-4	1:24:00	291.62	0.01	0.31	2	550	247		61	86	86	
C-5	1:27:00	292.07	0.01	0.31	2	507	252		61	86	86	
C-5	1:30:00	292.920	0.01	0.31	2	521	253		61	86	86	PC 1730
D-1	1:33:00	294.02	0.011	0.34	2	543	254		62	85	85	Restart 1735
D-1	1:36:00	294.89	0.011	0.34	2	553	253		60	84	84	
D-2	1:39:00	296.02	0.014	0.43	3	555	248		59	83	83	
D-2	1:42:00	297.10	0.014	0.43	3	532	247		60	82	82	
D-3	1:45:00	298.06	0.01	0.31	2	529	240		61	82	81	
D-3	1:48:00	299.01	0.01	0.31	2	542	252		61	82	81	
D-4	1:51:00	300.04	0.01	0.31	2	538	242		62	81	80	
D-4	1:54:00	300.89	0.01	0.31	2	546	234		62	80	79	
D-5	1:57:00	301.84	0.01	0.31	2	539	242		62	80	79	
D-5	2:00:00	302.774	0.01	0.31	2	550	238		62	80	79	Stop 1805

Methods 0031

Client:	ArcelorMittal Monessen		Test Date:	October 20, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Combustion Stack 2		Test Start Time:	8:42 AM	
Unit Operation:	Normal		Test Finish Time:	11:21 AM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774	
Meter DH@ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter NA if circular)	NA	inches
O2 (taken from CEMs spreadsheet)	9.65	% dv
CO2 (taken from CEMs spreadsheet)	5.27	% dv
Product Rate (enter NA if not needed)	NA	ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	M0031-Volatile Organics	
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	75.4	F
Stack Temperature (Tsavg)	544.4	F
Orifice Pressure Drop (dHavg)	0.371	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.1105	in. H_2O^1/2
F_d @ Standard Conditions	NA	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	85.08	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	0.0	g
Water Vapor in Silica Gel (Vwsg(std))	0.000	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	0.000	scf
Volume Dry Gas Metered (Vm)	0.000	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	0.000	dscf
Volume Dry Gas Metered (Vm(m^3))	0.000	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	0.000	dscm
Stack Absolute Pressure (Ps)	28.97	in. Hg
Stack Absolute Temperature (Tsavg)	1004.0	R
H2O Vapor Pressure @ avg Stack Temp.	2032.64	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1622	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1622	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.23	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.41	lb/lb-mole
Gas Velocity (Vs)	8.93	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	36,645	acfm
Standard Gas Flowrate	18,656	scfm
Dry Standard Gas Flowrate	15,629	dscfm
Actual Gas Flowrate	1,038	acm/min
Standard Gas Flowrate	528	scm/min
Dry Standard Gas Flowrate	443	dscm/min

Acrylonitrile (107-13-1)

Emission Mass	<	0.03	µg
Molecular Weight		53.06	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	2.88E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}
Emission Rate	<	0.00003	lb/hr

Benzene

Emission Mass		0.33	µg
Molecular Weight		78.11	lb/lb-mole
Emission Concentration		0.0061	mg/DSCM
Emission Concentration		3.79E-10	lb/dscf
Emission Concentration		0.0019	ppm_{dv}
Emission Rate		0.00036	lb/hr

Bromoform (75-25-2)

Emission Mass	<	0.01	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.61E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Bromomethane (74-83-9)

Emission Mass	<	0.02	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.73E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Carbon disulfide (75-15-0)

Emission Mass	<	0.03	µg
Molecular Weight		76.139	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	3.00E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}
Emission Rate	<	0.00003	lb/hr

Carbon tetrachloride (56-23-5)

Emission Mass	<	0.02	µg
Molecular Weight		153.82	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.84E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Ethylbenzene (100-41-4)

Emission Mass	<	0.06	µg
Molecular Weight		106.17	lb/lb-mole
Emission Concentration	<	0.0012	mg/DSCM
Emission Concentration	<	7.46E-11	lb/dscf
Emission Concentration	<	0.0003	ppm_{dv}
Emission Rate	<	0.00007	lb/hr

Iodomethane (74-88-4)

Emission Mass	<	0.02	µg
Molecular Weight		141.94	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.73E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Methylene chloride (75-09-2)

Emission Mass	<	0.14	µg
Molecular Weight		84.93	lb/lb-mole
Emission Concentration	<	0.0025	mg/DSCM
Emission Concentration	<	1.56E-10	lb/dscf
Emission Concentration	<	0.0007	ppm_{dv}
Emission Rate	<	0.00015	lb/hr

Styrene (100-42-5)

Emission Mass	<	0.13	µg
Molecular Weight		104.15	lb/lb-mole
Emission Concentration	<	0.0025	mg/DSCM
Emission Concentration	<	1.55E-10	lb/dscf
Emission Concentration	<	0.0006	ppm_{dv}
Emission Rate	<	0.00015	lb/hr

1,1,2,2-Tetrachloroethane (79-34-5)

Emission Mass	<	0.01	µg
Molecular Weight		167.848	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.61E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Tetrachloroethene (127-18-4)

Emission Mass	<	0.02	µg
Molecular Weight		165.82	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	2.08E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

ArcelorMittal Monessen Run 1
Combustion Stack 2

F or C?
F=1,C=0 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)	Sample Train Temp Side A
A-1	0.017	0.130	0.51	502	66	66	15
A-1	0.023	0.152	0.69	545	67	68	16
A-2	0.015	0.122	0.45	548	67	67	17
A-2	0.015	0.122	0.45	552	68	67	17
A-3	0.013	0.114	0.39	552	68	67	17
A-3	0.013	0.114	0.39	511	69	67	18
A-4	0.011	0.105	0.33	547	69	67	19
A-4	0.011	0.105	0.33	548	69	70	19
A-5	0.010	0.100	0.30	549	70	68	21
A-5	0.010	0.100	0.30	552	70	68	21
B-1	0.011	0.105	0.39	551	71	70	22
B-1	0.016	0.126	0.48	552	71	70	22
B-2	0.013	0.114	0.39	555	72	70	23
B-2	0.013	0.114	0.39	558	73	71	23
B-3	0.011	0.105	0.33	561	74	71	24
B-3	0.011	0.105	0.33	537	75	72	24
B-4	0.010	0.100	0.30	539	75	72	25
B-4	0.010	0.100	0.30	544	76	73	25
B-5	0.010	0.100	0.30	521	76	73	26
B-5	0.010	0.100	0.30	543	77	74	26
C-1	0.011	0.105	0.33	544	77	75	27
C-1	0.011	0.105	0.33	549	78	76	27
C-2	0.010	0.100	0.30	552	78	76	27
C-2	0.011	0.105	0.33	554	79	77	27
C-3	0.011	0.105	0.33	524	80	77	
C-3	0.014	0.118	0.42	540	80	77	
C-4	0.014	0.118	0.42	543	80	78	
C-4	0.014	0.118	0.42	549	81	78	
C-5	0.011	0.105	0.33	552	81	79	
C-5	0.011	0.105	0.33	555	82	79	
D-1	0.012	0.110	0.36	538	82	80	
D-1	0.012	0.110	0.36	542	82	80	
D-2	0.010	0.100	0.30	545	82	80	
D-2	0.012	0.110	0.36	549	83	80	
D-3	0.011	0.105	0.33	552	83	81	
D-3	0.013	0.114	0.39	555	84	81	
D-4	0.014	0.118	0.42	532	84	82	
D-4	0.014	0.118	0.42	542	85	82	
D-5	0.012	0.110	0.36	542	85	82	
D-5	0.012	0.110	0.36	548	85	83	
Average	0.0123	0.1105	0.37	544.4	75.4		22.0

1st Set of Tubes

Initial volume	0.000	liters
Final volume	18.330	liters
Total metered	18.330	dry actual liters

Leak Check Volume -18.330 dry actual liters

2nd Set of Tubes

Initial volume	0.000	liters
Final volume	18.129	liters
Total metered	18.129	dry actual liters

Leak Check Volume -18.129 dry actual liters

3rd Set of Tubes

Initial volume	0.000	liters
Final volume	18.871	liters
Total metered	18.871	dry actual liters

Sample Train Volume	55.330	(liters)
Unspiked Train Meter ID	VOST-1	
Meter Correction Factor	1.008	
VOST meter Temp	22.0	(def C)
VOST meter Temp	71.6	(def F)
Corrected Volume	53.800	(liters, dry standard)
Corrected Volume	0.054	(dscm)

Chlorobenzene (108-90-7)

Emission Mass	<	0.01	µg
Molecular Weight		112.56	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.27E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

Chloroethane (75-00-3)

Emission Mass	<	0.01	µg
Molecular Weight		64.51	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.04E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

Chloroform (67-66-3)

Emission Mass	<	0.01	µg
Molecular Weight		119.38	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.27E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

Chloromethane (74-87-3)

Emission Mass	<	0.02	µg
Molecular Weight		50.488	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	2.08E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

1,2-Dichloroethane (107-06-2)

Emission Mass	<	0.01	µg
Molecular Weight		98.95	lb/lb-mole
Emission Concentration	<	0.0001	mg/DSCM
Emission Concentration	<	8.07E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

1,1-Dichloroethene (75-35-4)

Emission Mass	<	0.01	µg
Molecular Weight		96.94	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.27E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

1,2-Dichloropropane (78-87-5)

Emission Mass	<	0.01	µg
Molecular Weight		112.98	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.27E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

Toluene (108-88-3)

Emission Mass		0.32	µg
Molecular Weight		92.14	lb/lb-mole
Emission Concentration		0.0060	mg/DSCM
Emission Concentration		3.70E-10	lb/dscf
Emission Concentration		0.0015	ppm_{dv}
Emission Rate		0.00035	lb/hr

1,1,1-Trichloroethane (71-55-6)

Emission Mass	<	0.01	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.61E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

1,1,2-Trichloroethane (79-00-5)

Emission Mass	<	0.02	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.84E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Trichloroethene (79-01-6)

Emission Mass	<	0.01	µg
Molecular Weight		131.4	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.27E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

Vinyl chloride (75-01-4)

Emission Mass	<	0.01	µg
Molecular Weight		62.498	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.50E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.00001	lb/hr

Xylenes (total) (1330-20-7)

Emission Mass		0.36	µg
Molecular Weight		106.16	lb/lb-mole
Emission Concentration		0.0067	mg/DSCM
Emission Concentration		4.16E-10	lb/dscf
Emission Concentration		0.0015	ppm_{dv}
Emission Rate		0.00039	lb/hr

Client:	ArcelorMittal Monessen		Test Date:	October 20, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Combustion Stack 2		Test Start Time:	12:15 PM	
Unit Operation:	Normal		Test Finish Time:	3:18 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-1.20	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112	inches
Stack Width (enter NA if circular)	NA	inches
O2 (taken from CEMs spreadsheet)	10.49	% dv
CO2 (taken from CEMs spreadsheet)	4.88	% dv
Product Rate (enter NA if not needed)	NA	ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Flow, Moisture, Phenol	
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	91.2	F
Stack Temperature (Tsavg)	543.7	F
Orifice Pressure Drop (dHavg)	0.387	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.1111	in. H_2O^1/2
F_d @ Standard Conditions	NA	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.63	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	0.0	g
Water Vapor in Silica Gel (Vwsg(std))	0.000	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	0.000	scf
Volume Dry Gas Metered (Vm)	0.000	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	0.000	dscf
Volume Dry Gas Metered (Vm(m^3))	0.000	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	0.000	dscm
Stack Absolute Pressure (Ps)	28.98	in. Hg
Stack Absolute Temperature (Tsavg)	1003.3	R
H2O Vapor Pressure @ avg Stack Temp.	2021.35	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1476	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1476	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.20	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.55	lb/lb-mole
Gas Velocity (Vs)	8.95	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	36,726	acfm
Standard Gas Flowrate	18,714	scfm
Dry Standard Gas Flowrate	15,953	dscfm
Actual Gas Flowrate	1,040	acm/min
Standard Gas Flowrate	530	scm/min
Dry Standard Gas Flowrate	452	dscm/min

Acrylonitrile (107-13-1)

Emission Mass	<	0.03	µg
Molecular Weight		53.06	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	1.75E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Benzene

Emission Mass		0.39	µg
Molecular Weight		78.11	lb/lb-mole
Emission Concentration		0.0073	mg/DSCM
Emission Concentration		2.74E-10	lb/dscf
Emission Concentration		0.0013	ppm_{dv}
Emission Rate		0.000	lb/hr

Bromoform (75-25-2)

Emission Mass	<	0.01	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	9.81E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Bromomethane (74-83-9)

Emission Mass	<	0.02	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Carbon disulfide (75-15-0)

Emission Mass	<	0.03	µg
Molecular Weight		76.139	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	1.82E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Carbon tetrachloride (56-23-5)

Emission Mass	<	0.02	µg
Molecular Weight		153.82	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Ethylbenzene (100-41-4)

Emission Mass	<	0.03	µg
Molecular Weight		106.17	lb/lb-mole
Emission Concentration	<	0.0006	mg/DSCM
Emission Concentration	<	2.10E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Iodomethane (74-88-4)

Emission Mass	<	0.02	µg
Molecular Weight		141.94	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Methylene chloride (75-09-2)

Emission Mass	<	0.02	µg
Molecular Weight		84.93	lb/lb-mole
Emission Concentration	<	0.0004	mg/DSCM
Emission Concentration	<	1.38E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Styrene (100-42-5)

Emission Mass		0.03	µg
Molecular Weight		104.15	lb/lb-mole
Emission Concentration		0.0005	mg/DSCM
Emission Concentration		1.77E-11	lb/dscf
Emission Concentration		0.0001	ppm_{dv}
Emission Rate		0.000	lb/hr

1,1,2,2-Tetrachloroethane (79-34-5)

Emission Mass	<	0.01	µg
Molecular Weight		167.848	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	9.81E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Tetrachloroethene (127-18-4)

Emission Mass	<	0.02	µg
Molecular Weight		165.82	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.26E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

ArcelorMittal Monessen Run 2
Combustion Stack 2

F or C?
F=1,C=0 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)	Sample Train Temp Side A
A-1	0.011	0.105	0.30	558	87	86	28
A-1	0.015	0.122	0.50	558	87	86	29
A-2	0.015	0.122	0.50	516	88	86	29
A-2	0.015	0.122	0.50	539	88	86	29
A-3	0.016	0.126	0.50	545	89	87	30
A-3	0.016	0.126	0.50	548	90	87	30
A-4	0.014	0.118	0.40	551	90	87	30
A-4	0.015	0.122	0.50	557	90	87	31
A-5	0.013	0.114	0.40	551	91	88	31
A-5	0.013	0.114	0.40	531	91	88	31
B-1	0.012	0.110	0.40	542	91	90	32
B-1	0.011	0.105	0.34	539	91	90	32
B-2	0.010	0.100	0.31	548	91	90	32
B-2	0.012	0.110	0.37	549	91	90	32
B-3	0.015	0.122	0.47	552	92	91	33
B-3	0.015	0.122	0.47	523	92	91	33
B-4	0.013	0.114	0.40	531	92	91	32
B-4	0.011	0.105	0.34	537	92	91	32
B-5	0.012	0.110	0.37	534	93	91	33
B-5	0.012	0.110	0.37	541	93	91	33
C-1	0.011	0.105	0.34	534	93	92	33
C-1	0.011	0.105	0.34	544	92	92	33
C-2	0.011	0.105	0.34	550	92	92	33
C-2	0.011	0.105	0.34	554	92	92	33
C-3	0.013	0.114	0.40	563	92	92	
C-3	0.013	0.114	0.40	532	92	92	
C-4	0.010	0.100	0.31	536	93	92	
C-4	0.010	0.100	0.31	546	93	92	
C-5	0.010	0.100	0.31	546	93	92	
C-5	0.010	0.100	0.31	556	93	92	
D-1	0.010	0.100	0.31	545	93	92	
D-1	0.010	0.100	0.31	543	93	93	
D-2	0.014	0.118	0.43	550	93	93	
D-2	0.014	0.118	0.43	556	94	93	
D-3	0.012	0.110	0.37	523	94	93	
D-3	0.011	0.105	0.34	539	94	93	
D-4	0.015	0.122	0.47	532	94	93	
D-4	0.015	0.122	0.47	546	94	93	
D-5	0.010	0.100	0.31	547	94	93	
D-5	0.010	0.100	0.31	555	94	93	
Average	0.0124	0.1111	0.39	543.7	91.2		31.4

1st Set of Tubes

Initial volume	0.000	liters
Final volume	18.402	liters
Total metered	18.402	dry actual liters

Leak Check Volume -18.402 dry actual liters

2nd Set of Tubes

Initial volume	0.000	liters
Final volume	18.641	liters
Total metered	18.641	dry actual liters

Leak Check Volume -18.641 dry actual liters

3rd Set of Tubes

Initial volume	0.000	liters
Final volume	19.380	liters
Total metered	19.380	dry actual liters

Sample Train Volume	56.423	(liters)
Unspiked Train Meter ID	VOST-1	
Meter Correction Factor	1.01	
VOST meter Temp	31.4	(def C)
VOST meter Temp	88.6	(def F)
Corrected Volume	53.167	(liters, dry standard)
Corrected Volume	0.053	(dscm)

Chlorobenzene (108-90-7)

Emission Mass	<	0.01	µg
Molecular Weight		112.56	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	7.71E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Chloroethane (75-00-3)

Emission Mass	<	0.01	µg
Molecular Weight		64.51	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	6.30E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Chloroform (67-66-3)

Emission Mass	<	0.01	µg
Molecular Weight		119.38	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	7.71E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Chloromethane (74-87-3)

Emission Mass	<	0.02	µg
Molecular Weight		50.488	lb/lb-mole
Emission Concentration	<	0.0004	mg/DSCM
Emission Concentration	<	1.35E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,2-Dichloroethane (107-06-2)

Emission Mass	<	0.01	µg
Molecular Weight		98.95	lb/lb-mole
Emission Concentration	<	0.0001	mg/DSCM
Emission Concentration	<	4.90E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,1-Dichloroethene (75-35-4)

Emission Mass	<	0.01	µg
Molecular Weight		96.94	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	7.71E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,2-Dichloropropane (78-87-5)

Emission Mass	<	0.01	µg
Molecular Weight		112.98	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	7.71E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Toluene (108-88-3)

Emission Mass		0.18	µg
Molecular Weight		92.14	lb/lb-mole
Emission Concentration		0.0033	mg/DSCM
Emission Concentration		1.24E-10	lb/dscf
Emission Concentration		0.0005	ppm_{dv}
Emission Rate		0.000	lb/hr

1,1,1-Trichloroethane (71-55-6)

Emission Mass	<	0.01	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	9.81E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,1,2-Trichloroethane (79-00-5)

Emission Mass	<	0.02	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.12E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Trichloroethene (79-01-6)

Emission Mass	<	0.01	µg
Molecular Weight		131.4	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	7.71E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Vinyl chloride (75-01-4)

Emission Mass	<	0.01	µg
Molecular Weight		62.498	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	9.11E-12	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Xylenes (total) (1330-20-7)

Emission Mass	<	0.08	µg
Molecular Weight		106.16	lb/lb-mole
Emission Concentration	<	0.0014	mg/DSCM
Emission Concentration	<	5.39E-11	lb/dscf
Emission Concentration	<	0.0002	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Client:	ArcelorMittal Monessen		Test Date:	October 20, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Combustion Stack 2		Test Start Time:	3:47 PM	
Unit Operation:	Normal		Test Finish Time:	6:15 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774	
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112.0	inches
Stack Width (enter NA if circular)	NA	inches
O2 (taken from CEMs spreadsheet)	9.98	% dv
CO2 (taken from CEMs spreadsheet)	5.51	% dv
Product Rate (enter NA if not needed)	NA	ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Flow, Moisture, Phenol	
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	84.6	F
Stack Temperature (Tsavg)	540.7	F
Orifice Pressure Drop (dHavg)	0.370	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.1089	in. H_2O^1/2
F_d @ Standard Conditions	NA	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.52	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	0.0	g
Water Vapor in Silica Gel (Vwsg(std))	0.000	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	0.000	scf
Volume Dry Gas Metered (Vm)	0.000	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	0.000	dscf
Volume Dry Gas Metered (Vm(m^3))	0.000	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	0.000	dscm
Stack Absolute Pressure (Ps)	28.97	in. Hg
Stack Absolute Temperature (Tsavg)	1000.4	R
H2O Vapor Pressure @ avg Stack Temp.	1972.17	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1545	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1545	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.28	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.54	lb/lb-mole
Gas Velocity (Vs)	8.76	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	35,944	acfm
Standard Gas Flowrate	18,366	scfm
Dry Standard Gas Flowrate	15,529	dscfm
Actual Gas Flowrate	1,018	acm/min
Standard Gas Flowrate	520	scm/min
Dry Standard Gas Flowrate	440	dscm/min

Acrylonitrile (107-13-1)

Emission Mass	<	0.03	µg
Molecular Weight		53.06	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	1.88E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.00002	lb/hr

Benzene

Emission Mass		0.19	µg
Molecular Weight		78.11	lb/lb-mole
Emission Concentration		0.0034	mg/DSCM
Emission Concentration		1.39E-10	lb/dscf
Emission Concentration		0.0007	ppm_{dv}
Emission Rate		0.000	lb/hr

Bromoform (75-25-2)

Emission Mass	<	0.01	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Bromomethane (74-83-9)

Emission Mass	<	0.02	µg
Molecular Weight		252.731	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.13E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Carbon disulfide (75-15-0)

Emission Mass	<	0.03	µg
Molecular Weight		76.139	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	1.95E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Carbon tetrachloride (56-23-5)

Emission Mass	<	0.02	µg
Molecular Weight		153.82	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.20E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Ethylbenzene (100-41-4)

Emission Mass	<	0.03	µg
Molecular Weight		106.17	lb/lb-mole
Emission Concentration	<	0.0005	mg/DSCM
Emission Concentration	<	2.13E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Iodomethane (74-88-4)

Emission Mass	<	0.02	µg
Molecular Weight		141.94	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.13E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Methylene chloride (75-09-2)

Emission Mass	<	0.04	µg
Molecular Weight		84.93	lb/lb-mole
Emission Concentration	<	0.0007	mg/DSCM
Emission Concentration	<	2.75E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Styrene (100-42-5)

Emission Mass	<	0.01	µg
Molecular Weight		104.15	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	9.76E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,1,2,2-Tetrachloroethane (79-34-5)

Emission Mass	<	0.01	µg
Molecular Weight		167.848	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Tetrachloroethene (127-18-4)

Emission Mass	<	0.02	µg
Molecular Weight		165.82	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.35E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

ArcelorMittal Monessen Run 3 — **Combustion Stack 2** — **F or C? F=1,C=0 1**

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)	Sample Train Temp Side A
A-1	0.016	0.126	0.50	531	84	84	29
A-1	0.016	0.126	0.50	544	85	83	29
A-2	0.015	0.122	0.47	550	85	83	29
A-2	0.014	0.118	0.43	557	85	83	29
A-3	0.013	0.114	0.40	551	85	83	29
A-3	0.013	0.114	0.40	531	85	84	29
A-4	0.014	0.118	0.43	540	85	85	29
A-4	0.014	0.118	0.43	545	85	85	29
A-5	0.012	0.110	0.37	547	86	85	28
A-5	0.012	0.110	0.37	551	86	85	29
B-1	0.018	0.134	0.56	526	86	85	29
B-1	0.015	0.122	0.47	534	87	85	29
B-2	0.014	0.118	0.43	540	87	85	29
B-2	0.014	0.118	0.43	546	87	85	28
B-3	0.013	0.114	0.40	552	87	86	28
B-3	0.013	0.114	0.40	555	87	86	29
B-4	0.011	0.105	0.34	561	87	86	28
B-4	0.011	0.105	0.34	531	87	86	28
B-5	0.010	0.100	0.31	538	87	86	27
B-5	0.010	0.100	0.31	542	87	86	27
C-1	0.010	0.100	0.31	528	86	86	26
C-1	0.010	0.100	0.31	555	86	86	26
C-2	0.010	0.100	0.31	528	86	86	26
C-2	0.010	0.100	0.31	539	86	86	26
C-3	0.010	0.100	0.31	539	86	86	
C-3	0.010	0.100	0.31	522	86	86	
C-4	0.010	0.100	0.31	540	86	86	
C-4	0.010	0.100	0.31	550	86	86	
C-5	0.010	0.100	0.31	507	86	86	
C-5	0.010	0.100	0.31	521	86	86	
D-1	0.011	0.105	0.34	543	85	85	
D-1	0.011	0.105	0.34	553	84	84	
D-2	0.014	0.118	0.43	555	83	83	
D-2	0.014	0.118	0.43	532	82	82	
D-3	0.010	0.100	0.31	529	82	81	
D-3	0.010	0.100	0.31	542	82	81	
D-4	0.010	0.100	0.31	538	81	80	
D-4	0.010	0.100	0.31	546	80	79	
D-5	0.010	0.100	0.31	539	80	79	
D-5	0.010	0.100	0.31	550	80	79	
Average	0.0120	0.1089	0.37	540.7	84.6		28.1

1st Set of Tubes		
Initial volume	0.000	liters
Final volume	19.083	liters
Total metered	19.083	dry actual liters

Leak Check Volume 0.000 dry actual liters

2nd Set of Tubes		
Initial volume	0.000	liters
Final volume	19.087	liters
Total metered	19.087	dry actual liters

Leak Check Volume 0.000 dry actual liters

3rd Set of Tubes		
Initial volume	0.000	liters
Final volume	19.513	liters
Total metered	19.513	dry actual liters

Sample Train Volume	57.683	(liters)
Unspiked Train Meter ID	VOST-1	
Meter Correction Factor	1.01	
VOST meter Temp	28.1	(def C)
VOST meter Temp	82.6	(def F)
Corrected Volume	54.948	(liters, dry standard)
Corrected Volume	0.055	(dscm)

Chlorobenzene (108-90-7)

Emission Mass	<	0.01	µg
Molecular Weight		112.56	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	8.26E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Chloroethane (75-00-3)

Emission Mass	<	0.01	µg
Molecular Weight		64.51	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	6.76E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Chloroform (67-66-3)

Emission Mass	<	0.01	µg
Molecular Weight		119.38	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	8.26E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Chloromethane (74-87-3)

Emission Mass	<	0.02	µg
Molecular Weight		50.488	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.25E-11	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,2-Dichloroethane (107-06-2)

Emission Mass	<	0.01	µg
Molecular Weight		98.95	lb/lb-mole
Emission Concentration	<	0.0001	mg/DSCM
Emission Concentration	<	5.26E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,1-Dichloroethene (75-35-4)

Emission Mass	<	0.01	µg
Molecular Weight		96.94	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	8.26E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,2-Dichloropropane (78-87-5)

Emission Mass	<	0.01	µg
Molecular Weight		112.98	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	8.26E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Toluene (108-88-3)

Emission Mass		0.42	µg
Molecular Weight		92.14	lb/lb-mole
Emission Concentration		0.0076	mg/DSCM
Emission Concentration		3.12E-10	lb/dscf
Emission Concentration		0.0013	ppm_{dv}
Emission Rate		0.000	lb/hr

1,1,1-Trichloroethane (71-55-6)

Emission Mass	<	0.01	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	1.05E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

1,1,2-Trichloroethane (79-00-5)

Emission Mass	<	0.02	µg
Molecular Weight		133.4	lb/lb-mole
Emission Concentration	<	0.0003	mg/DSCM
Emission Concentration	<	1.20E-11	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Trichloroethene (79-01-6)

Emission Mass	<	0.01	µg
Molecular Weight		131.4	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	8.26E-12	lb/dscf
Emission Concentration	<	0.0000	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Vinyl chloride (75-01-4)

Emission Mass	<	0.01	µg
Molecular Weight		62.498	lb/lb-mole
Emission Concentration	<	0.0002	mg/DSCM
Emission Concentration	<	9.76E-12	lb/dscf
Emission Concentration	<	0.0001	ppm_{dv}
Emission Rate	<	0.000	lb/hr

Xylenes (total) (1330-20-7)

Emission Mass		0.38	µg
Molecular Weight		106.16	lb/lb-mole
Emission Concentration		0.0069	mg/DSCM
Emission Concentration		2.84E-10	lb/dscf
Emission Concentration		0.0010	ppm_{dv}
Emission Rate		0.000	lb/hr

Method 0031 Data Sheet
Solid Waste 846 Method
Volatile Organic HAPs (VOHAPS)

Company Name: **Arcelormittal**

Location: **Monessen, PA**

Source Name: **Coke Oven Battery**

Description of Location Sampled (include description of all control devices, quenches, air inlets, etc.): **Coke Battery Combustion Stack**

Run Number: 1
Start Time: 842
End Time: 1121
Date: 10/20/16

Crew: BC JW TM CB
Circle initials of meterbox operator

Field Train Blank System Leak Check Tubes 10A, 10B and 10C

Time: 715 Initial Measurement (L/min): 0.000
Time: 717 Final Measurement (L/min): 0.000

Leak Check Criteria - ≤2% of the sampling rate of 1.0 LPM, vacuum 15 in. Hg Vost-1 (Avogadro) Y=1.008

Measurement System Leak Check

Tube set 1 1A, 1B and 1C			Tube set 2 2A, 2B, 2C			Tube set 3 3A, 3B, & 3C		
Pre (L/min):	0.000	Time: 815	Pre (L/min):	0.000	Time: 940	Pre (L/min):	0.000	Time: 1038
Post (L/min):	0.000	Time: 932	Post (L/min):	0.000	Time: 1026	Post (L/min):	0.000	Time: 1148

Leak Check Criteria - ≤2% of the sampling rate of 1.0 LPM, Pre-test vacuum 15 in. Hg, post-test at highest sample vacuum
Initial leak check done from tip of probe. Subsequent leak checks done from 3 way valve.

Measurement System Purge Flows

Tube set 1			Tube set 2			Tube set 3		
Pre (1 L/min):	✓	Time: 839	Pre (1 L/min):	✓	Time: 940	Pre (1 L/min):	✓	Time: 1037

Temperature, Pressure and Dry Gas Meter Measurements

	Ambient		Time Recorded
Beginning	60	°F	842
End	74	°F	1121

	Barometric		
Beginning	29.07	"Hg	842
End	29.07	"Hg	1121

Notes:

Sample Recovery Notes.
Transfer condensate into vial. Rinses can use 1 or more vials. Fill bottle to eliminate headspace. Use ONLY Type 1 high purity HPLC water for all rinses.

Place all 3 tubes in ziplocks with VOA bottle and chill.

QA/QC:
One Field train blank is required

One Trip blank is required per source also.

	Time	Meter	L/min	Vacuum in. hg	Probe °F	In Meter °F	Out Meter °C	
Tube set 1	0.0	0.000	0.5					842 Start
	5.0	2.350		5	255	NA	15	
	10.0	4.65		5	252		16	Pause @ 85
	15.0	6.73		5	255		17	Start @ 90
	20.0	8.86		5	252		17	
	25.0	11.07		5	254		17	
	30.0	13.34		5	254		18	
	35.0	16.07		5	250		19	930
	40.0	18.37		5	253		19	922 Stop
Tube set 2	0.0	0.000	0.5					943 Start
	5.0	2.20		5	254	NA	21	
	10.0	4.51		5	254		21	
	15.0	6.77		5	253		22	
	20.0	9.03		5	253		22	
	25.0	11.34		5	256		23	
	30.0	13.56		5	252		23	
	35.0	15.86		5	251		24	
	40.0	18.129		5	249		24	1023 Stop
Tube set 3	0.0	0.000	0.5					
	5.0	2.29		5	248	NA	25	Start 1041
	10.0	4.73		5	249		25	
	15.0	7.18		5	240		26	
	20.0	9.55		5	242		26	
	25.0	11.86		5	251		27	
	30.0	14.20		5	243		27	
	35.0	16.54		5	249		27	
	40.0	18.871		5	248		27	Stop 1121

Method 0031 Data Sheet
Solid Waste 846 Method
Volatile Organic HAPs (VOHAPS)

Company Name: **Arcelormittal**

Location: **Monessen, PA**

Source Name: **Coke Oven Battery**

Description of Location Sampled (include description of all control devices, quenches, air inlets, etc.): **Coke Battery Combustion Stack**

Run Number: 2
Start Time: 1215
End Time: 1518
Date: 10/20/16

Crew: BC JW TM CB
Circle initia

Field Train Blank System Leak Check Tubes 10A, 10B and 10C

Time: 715 Initial Measurement (L/min): 0.000
Time: 717 Final Measurement (L/min): 0.000

Leak Check Criteria - ≤2% of the sampling rate of 1.0 LPM, vacuum 15 in. Hg VOST-1 (Avogadro) Y=1.008

Measurement System Leak Check

Tube set 1	4A, 4B, 4C		Tube set 2	5A, 5B and 5C		Tube set 3	6A, 6B, 6C	
Pre (L/min):	0.000	Time: 1142	Pre (L/min):	0.000	Time: 1310	Pre (L/min):	0.001	Time: 1435
Post (L/min):	0.000	Time: 1258	Post (L/min):	0.000	Time: 1353	Post (L/min):	0.001	Time: 1520

Leak Check Criteria - ≤2% of the sampling rate of 1.0 LPM, Pre-test vacuum 15 in. Hg, post-test at highest sample vacuum
Initial leak check done from tip of probe. Subsequent leak checks done from 3 way valve.

Measurement System Purge Flows

Tube set 1		Tube set 2		Tube set 3	
Pre (1 L/min):	✓ Time: 1139	Pre (1 L/min):	✓ Time: 1307	Pre (1 L/min):	✓ Time: 1432

Temperature, Pressure and Dry Gas Meter Measurements

	Ambient		Time Recorded
Beginning	74	°F	1114
End	82	°F	1518

	Barometric		
Beginning	29.07	"Hg	1114
End	28.93	"Hg	1518

Notes:

Sample Recovery Notes.
Transfer condensate into vial. Rinses can use 1 or more vials. Fill bottle to eliminate headspace. Use ONLY Type 1 high purity HPLC water for all rinses.

Place all 3 tubes in ziplocks with VOA bottle and chill.

QA/QC:
One Field train blank is required

One Trip blank is required per source also.

	Time	Meter	L/min	Vacuum in. hg	Probe °F	In Meter °F	Out Meter °F	°C
Tube set 1	0.0	0.000	0.5					
	5.0	2.36		5	251	NA	28	Strt 1215
	10.0	4.60		5	242		29	
	15.0	6.80		3	245		29	
	20.0	9.09		3	250		29	
	25.0	11.34		3	248		30	
	30.0	13.66		3	243		30	
	35.0	15.98		3	250		30	
	40.0	18.402		3	253		31	Stop 1245
Tube set 2	0.0	0.000	0.5					
	5.0	2.38		3	244	NA	31	Start 1312
	10.0	4.83		3	247		31	
	15.0	7.18		3	247		32	
	20.0	9.45		3	253		32	
	25.0	11.73		3	245		32	
	30.0	14.11		3	247		32	
	35.0	16.42		3	253		33	
	40.0	18.641		3	253		33	Stop 135
Tube set 3	0.0	0.000	0.5					
	5.0	2.32		6	252	NA	32	Start 1438
	10.0	5.30		4	253		32	
	15.0	7.52		4	253		~~32~~ 33	
	20.0	9.94		3	254		33	
	25.0	12.29		3	254		33	
	30.0	14.61		3	253		33	
	35.0	17.00		3	253		33	
	40.0	19.380		3	253		33	Stop 1518

Method 0031 Data Sheet
Solid Waste 846 Method
Volatile Organic HAPs (VOHAPS)

Company Name: **Arcelormittal**

Location: **Monessen, PA**

Source Name: **Coke Oven Battery**

Description of Location Sampled (include description of all control devices, quenches, air inlets, etc.): **Coke Battery Combustion Stack**

Run Number: 3
Start Time: 1547
End Time: 1815
Date: 10/20/16

Crew: BC JW (TM) CB
Circle initia

Field Train Blank System Leak Check

Time: 715 Initial Measurement (L/min): 0.000
Time: 717 Final Measurement (L/min): 0.000

Leak Check Criteria - ≤2% of the sampling rate of 1.0 LPM, vacuum 15 in. Hg

VOST-1 (Analog) Y=1.008

Measurement System Leak Check

Tube set 1	7A, 7B and 7C		Tube set 2	8A, 8B and 8C		Tube set 3	9A, 9B and 9C	
Pre (L/min):	0.000	Time: 1531	Pre (L/min):	0.000	Time: 1641	Pre (L/min):	0.000	Time: 1734
Post (L/min):	0.000	Time: 1628	Post (L/min):	0.000	Time: 1724	Post (L/min):		Time:

Leak Check Criteria - ≤2% of the sampling rate of 1.0 LPM, Pre-test vacuum 15 in. Hg, post-test at highest sample vacuum
Initial leak check done from tip of probe. Subsequent leak checks done from 3 way valve.

Measurement System Purge Flows

Tube set 1			Tube set 2			Tube set 3		
Pre (1 L/min):	✓	Time: 1528	Pre (1 L/min):	✓	Time: 1637	Pre (1 L/min):	✓	Time: 1731

Temperature, Pressure and Dry Gas Meter Measurements

	Ambient		Time Recorded
Beginning	83	°F	1542
End	71	°F	1815

	Barometric		
Beginning	28.93	"Hg	1542
End		"Hg	1815

Notes:

Sample Recovery Notes.
Transfer condensate into vial. Rinses can use 1 or more vials. Fill bottle to eliminate headspace. Use ONLY Type 1 high purity HPLC water for all rinses.

Place all 3 tubes in ziplocks with VOA bottle and chill.

QA/QC:
One Field train blank is required

One Trip blank is required per source also.

	Time	Meter	L/min	Vacuum in. hg	Probe °F	In Meter °F	Out Meter °F	
Tube set 1	0.0	0.000	0.5					
	5.0	2.03		3	243	NA	29	Start 154
	10.0	4.51		3	253		29	
	15.0	7.03		3	253		29	
	20.0	9.42		3	252		29	
	25.0	11.91		3	253		29	
	30.0	14.41		3	252		29	
	35.0	16.76		3	253		29	
	40.0	19.083		3	253		29	Stop 1627
Tube set 2	0.0	0.000	0.5					
	5.0	2.32		4	253	NA	28	Start 164
	10.0	4.79		4	253		29	
	15.0	7.26		4	253		29	
	20.0	9.78		3	253		29	
	25.0	12.16		3	252		29	
	30.0	14.47		3	251		28	
	35.0	16.77		3	244		28	
	40.0	19.087		3	252		29	Stop 172
Tube set 3	0.0	0.000	0.5					
	5.0	2.10		4	251	NA	28	Start 173
	10.0	4.37		4	247		28	
	15.0	7.26		4	251		27	
	20.0	9.66		4	237		27	
	25.0	12.12		4	242		26	
	30.0	14.59		4	243		26	
	35.0	17.02		3	240		26	
	40.0	19.513		3	241		26	Stop 1815

Methods 3A, 15

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/20	08:42:35	9.61	5.42
2	2016/10/20	08:43:35	11.61	4.51
3	2016/10/20	08:44:35	14.53	3.22
4	2016/10/20	08:45:35	11.68	4.45
5	2016/10/20	08:46:35	10.82	4.86
6	2016/10/20	08:47:35	10.47	5.02
7	2016/10/20	08:48:35	10.39	5.05
8	2016/10/20	08:49:35	9.77	5.33
9	2016/10/20	08:50:35	9.25	5.59
10	2016/10/20	08:51:35	9.00	5.74
11	2016/10/20	08:52:35	8.89	5.79
12	2016/10/20	08:53:35	8.84	5.81
13	2016/10/20	08:54:35	8.81	5.82
14	2016/10/20	08:55:35	8.77	5.84
15	2016/10/20	08:56:35	8.74	5.85
16	2016/10/20	08:57:35	8.75	5.84
17	2016/10/20	08:58:35	8.70	5.86
18	2016/10/20	08:59:35	8.66	5.88
19	2016/10/20	09:00:35	8.77	5.82
20	2016/10/20	09:01:35	8.70	5.85
21	2016/10/20	09:02:35	8.58	5.92
22	2016/10/20	09:03:35	10.37	5.13
23	2016/10/20	09:04:35	14.08	3.46
24	2016/10/20	09:05:35	11.39	4.58
25	2016/10/20	09:06:35	10.76	4.89
26	2016/10/20	09:07:35	10.28	5.10
27	2016/10/20	09:08:35	10.10	5.17
28	2016/10/20	09:09:35	10.07	5.18
29	2016/10/20	09:10:35	9.54	5.42
30	2016/10/20	09:11:35	8.81	5.82
31	2016/10/20	09:12:35	8.52	5.97
32	2016/10/20	09:13:35	8.32	6.07
33	2016/10/20	09:14:35	8.16	6.15
34	2016/10/20	09:15:35	8.37	6.04
35	2016/10/20	09:16:35	8.32	6.07
36	2016/10/20	09:17:35	8.49	5.99
37	2016/10/20	09:18:35	9.49	5.49
38	2016/10/20	09:19:35	10.25	5.10
39	2016/10/20	09:20:35	10.62	4.94
40	2016/10/20	09:21:35	10.38	5.04
41	2016/10/20	09:22:35	9.94	5.23
42	2016/10/20	09:23:35	11.44	4.58
43	2016/10/20	09:24:35	14.31	3.33
44	2016/10/20	09:25:35	11.10	4.70
45	2016/10/20	09:26:35	9.58	5.43
46	2016/10/20	09:27:35	9.11	5.67
47	2016/10/20	09:28:35	9.14	5.66
48	2016/10/20	09:29:35	8.99	5.73
49	2016/10/20	09:30:35	9.00	5.74
50	2016/10/20	09:31:35	9.84	5.33
51	2016/10/20	09:32:35	10.60	4.95
52	2016/10/20	09:33:35	10.28	5.09
53	2016/10/20	09:34:35	9.98	5.23
54	2016/10/20	09:35:35	10.13	5.15
55	2016/10/20	09:36:35	9.77	5.31
56	2016/10/20	09:37:35	9.30	5.54
57	2016/10/20	09:38:35	8.96	5.72
58	2016/10/20	09:39:35	8.79	5.80
59	2016/10/20	09:40:35	8.90	5.75
60	2016/10/20	09:41:35	8.65	5.87
61	2016/10/20	09:42:35	8.50	5.95

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
62	2016/10/20	09:43:35	10.44	5.07
63	2016/10/20	09:44:35	13.52	3.71
64	2016/10/20	09:45:35	10.22	5.11
65	2016/10/20	09:46:35	10.07	5.21
66	2016/10/20	09:47:35	10.26	5.11
67	2016/10/20	09:48:35	10.13	5.16
68	2016/10/20	09:49:35	10.13	5.15
69	2016/10/20	09:50:35	9.56	5.41
70	2016/10/20	09:51:35	8.85	5.78
71	2016/10/20	09:52:35	8.44	6.00
72	2016/10/20	09:53:35	8.41	6.02
73	2016/10/20	09:54:35	8.51	5.96
74	2016/10/20	09:55:35	8.44	6.01
75	2016/10/20	09:56:35	8.96	5.75
76	2016/10/20	09:57:35	9.94	5.23
77	2016/10/20	09:58:35	9.64	5.37
78	2016/10/20	09:59:35	9.65	5.36
79	2016/10/20	10:00:35	9.87	5.26
80	2016/10/20	10:01:35	9.31	5.52
81	2016/10/20	10:02:35	8.81	5.79
82	2016/10/20	10:03:35	11.95	4.34
83	2016/10/20	10:04:35	18.40	1.26
84	2016/10/20	10:05:35	11.79	4.26
85	2016/10/20	10:06:35	9.47	5.45
86	2016/10/20	10:07:35	9.19	5.60
87	2016/10/20	10:08:35	9.37	5.53
88	2016/10/20	10:09:35	10.23	5.13
89	2016/10/20	10:10:35	10.39	5.04
90	2016/10/20	10:11:35	10.38	5.04
91	2016/10/20	10:12:35	10.32	5.05
92	2016/10/20	10:13:35	9.57	5.40
93	2016/10/20	10:14:35	9.04	5.67
94	2016/10/20	10:15:35	8.88	5.76
95	2016/10/20	10:16:35	8.84	5.77
96	2016/10/20	10:17:35	8.83	5.77
97	2016/10/20	10:18:35	8.82	5.77
98	2016/10/20	10:19:35	8.89	5.73
99	2016/10/20	10:20:35	8.92	5.71
100	2016/10/20	10:21:35	8.77	5.78
101	2016/10/20	10:22:35	8.67	5.83
102	2016/10/20	10:23:35	10.33	5.10
103	2016/10/20	10:24:35	13.40	3.74
104	2016/10/20	10:25:35	10.12	5.11
105	2016/10/20	10:26:35	9.18	5.57
106	2016/10/20	10:27:35	8.91	5.71
107	2016/10/20	10:28:35	8.80	5.76
108	2016/10/20	10:29:35	8.72	5.79
109	2016/10/20	10:30:35	8.66	5.82
110	2016/10/20	10:31:35	8.64	5.82
111	2016/10/20	10:32:35	8.61	5.83
112	2016/10/20	10:33:35	8.58	5.84
113	2016/10/20	10:34:35	8.57	5.84
114	2016/10/20	10:35:35	8.53	5.85
115	2016/10/20	10:36:35	8.51	5.86
116	2016/10/20	10:37:35	8.53	5.84
117	2016/10/20	10:38:35	8.47	5.87
118	2016/10/20	10:39:35	8.46	5.86
119	2016/10/20	10:40:35	8.63	5.78
120	2016/10/20	10:41:35	8.46	5.86
121	2016/10/20	10:42:35	8.36	5.91
122	2016/10/20	10:43:35	10.05	5.18
123	2016/10/20	10:44:35	13.38	3.71

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
124	2016/10/20	10:45:35	10.44	4.89
125	2016/10/20	10:46:35	9.65	5.26
126	2016/10/20	10:47:35	9.40	5.37
127	2016/10/20	10:48:35	9.30	5.41
128	2016/10/20	10:49:35	9.25	5.43
129	2016/10/20	10:50:35	9.20	5.45
130	2016/10/20	10:51:35	9.16	5.47
131	2016/10/20	10:52:35	9.13	5.48
132	2016/10/20	10:53:35	9.09	5.50
133	2016/10/20	10:54:35	9.09	5.50
134	2016/10/20	10:55:35	9.06	5.51
135	2016/10/20	10:56:35	9.05	5.51
136	2016/10/20	10:57:35	9.58	5.27
137	2016/10/20	10:58:35	10.82	4.71
138	2016/10/20	10:59:35	10.88	4.67
139	2016/10/20	11:00:35	10.87	4.69
140	2016/10/20	11:01:35	10.96	4.66
141	2016/10/20	11:02:35	11.77	4.29
142	2016/10/20	11:03:35	13.36	3.61
143	2016/10/20	11:04:35	15.31	2.78
144	2016/10/20	11:05:35	12.30	4.08
145	2016/10/20	11:06:35	10.58	4.86
146	2016/10/20	11:07:35	9.72	5.25
147	2016/10/20	11:08:35	9.18	5.50
148	2016/10/20	11:09:35	8.96	5.62
149	2016/10/20	11:10:35	8.76	5.73
150	2016/10/20	11:11:35	8.61	5.81
151	2016/10/20	11:12:35	8.75	5.73
152	2016/10/20	11:13:35	8.73	5.74
153	2016/10/20	11:14:35	9.00	5.62
154	2016/10/20	11:15:35	9.91	5.18
155	2016/10/20	11:16:35	10.15	5.07
156	2016/10/20	11:17:35	10.02	5.12
RUN 1 AVERAGES			**9.8**	**5.3**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/20	12:15:35	9.15	5.61
2	2016/10/20	12:16:35	9.06	5.67
3	2016/10/20	12:17:35	9.49	5.48
4	2016/10/20	12:18:35	10.43	5.06
5	2016/10/20	12:19:35	10.69	4.94
6	2016/10/20	12:20:35	10.78	4.89
7	2016/10/20	12:21:35	10.62	4.95
8	2016/10/20	12:22:35	10.18	5.13
9	2016/10/20	12:23:35	10.84	4.86
10	2016/10/20	12:24:35	12.79	4.03
11	2016/10/20	12:25:35	9.98	5.23
12	2016/10/20	12:26:35	8.71	5.82
13	2016/10/20	12:27:35	8.14	6.09
14	2016/10/20	12:28:35	8.20	6.06
15	2016/10/20	12:29:35	7.95	6.17
16	2016/10/20	12:30:35	8.01	6.15
17	2016/10/20	12:31:35	8.94	5.75
18	2016/10/20	12:32:35	9.35	5.55
19	2016/10/20	12:33:35	9.96	5.26
20	2016/10/20	12:34:35	10.26	5.11
21	2016/10/20	12:35:35	9.99	5.22
22	2016/10/20	12:36:35	9.39	5.49
23	2016/10/20	12:37:35	9.35	5.52
24	2016/10/20	12:38:35	9.89	5.25
25	2016/10/20	12:39:35	9.94	5.23
26	2016/10/20	12:40:35	10.00	5.20
27	2016/10/20	12:41:35	9.86	5.27
28	2016/10/20	12:42:35	9.77	5.32
29	2016/10/20	12:43:35	10.84	4.87
30	2016/10/20	12:44:35	13.64	3.65
31	2016/10/20	12:45:35	12.48	4.11
32	2016/10/20	12:46:35	11.77	4.45
33	2016/10/20	12:47:35	11.69	4.50
34	2016/10/20	12:48:35	13.10	3.90
35	2016/10/20	12:49:35	16.07	2.48
36	2016/10/20	12:50:35	15.52	2.62
37	2016/10/20	12:51:35	11.90	4.35
38	2016/10/20	12:52:35	10.70	4.89
39	2016/10/20	12:53:35	9.50	5.41
40	2016/10/20	12:54:35	9.11	5.59
41	2016/10/20	12:55:35	9.01	5.64
42	2016/10/20	12:56:35	8.95	5.66
43	2016/10/20	12:57:35	8.94	5.66
44	2016/10/20	12:58:35	8.88	5.68
45	2016/10/20	12:59:35	8.84	5.69
46	2016/10/20	13:00:35	8.84	5.69
47	2016/10/20	13:01:35	8.91	5.65
48	2016/10/20	13:02:35	8.87	5.64
49	2016/10/20	13:03:35	8.73	5.70
50	2016/10/20	13:04:35	9.47	5.43
51	2016/10/20	13:05:35	11.42	4.63
52	2016/10/20	13:06:35	10.82	4.71
53	2016/10/20	13:07:35	9.22	5.47
54	2016/10/20	13:08:35	8.89	5.62
55	2016/10/20	13:09:35	8.77	5.67
56	2016/10/20	13:10:35	8.70	5.69
57	2016/10/20	13:11:35	8.68	5.70
58	2016/10/20	13:12:35	8.63	5.71
59	2016/10/20	13:13:35	8.59	5.72
60	2016/10/20	13:14:35	8.59	5.72
61	2016/10/20	13:15:35	8.60	5.71

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
62	2016/10/20	13:16:35	8.56	5.72
63	2016/10/20	13:17:35	8.47	5.74
64	2016/10/20	13:18:35	8.40	5.77
65	2016/10/20	13:19:35	8.44	5.80
66	2016/10/20	13:20:35	8.70	5.73
67	2016/10/20	13:21:35	8.86	5.61
68	2016/10/20	13:22:35	8.94	5.54
69	2016/10/20	13:23:35	9.05	5.51
70	2016/10/20	13:24:35	9.30	5.39
71	2016/10/20	13:25:35	9.33	5.36
72	2016/10/20	13:26:35	9.74	5.24
73	2016/10/20	13:27:35	11.08	4.75
74	2016/10/20	13:28:35	11.39	4.47
75	2016/10/20	13:29:35	10.67	4.78
76	2016/10/20	13:30:35	10.23	4.98
77	2016/10/20	13:31:35	10.05	5.06
78	2016/10/20	13:32:35	9.97	5.08
79	2016/10/20	13:33:35	9.87	5.13
80	2016/10/20	13:34:35	10.05	5.09
81	2016/10/20	13:35:35	10.55	4.91
82	2016/10/20	13:36:35	10.93	4.73
83	2016/10/20	13:37:35	10.99	4.69
84	2016/10/20	13:38:35	10.99	4.69
85	2016/10/20	13:39:35	10.97	4.69
86	2016/10/20	13:40:35	10.73	4.77
87	2016/10/20	13:41:35	10.30	4.95
88	2016/10/20	13:42:35	10.01	5.08
89	2016/10/20	13:43:35	9.91	5.14
90	2016/10/20	13:44:35	9.85	5.16
91	2016/10/20	13:45:35	9.79	5.18
92	2016/10/20	13:46:35	10.47	4.95
93	2016/10/20	13:47:35	12.12	4.29
94	2016/10/20	13:48:35	11.66	4.35
95	2016/10/20	13:49:35	10.95	4.68
96	2016/10/20	13:50:35	10.58	4.85
97	2016/10/20	13:51:35	10.47	4.92
98	2016/10/20	13:52:35	10.73	4.84
99	2016/10/20	13:53:35	11.22	4.63
100	2016/10/20	13:54:35	11.44	4.52
101	2016/10/20	13:55:35	11.48	4.48
102	2016/10/20	13:56:35	11.36	4.52
103	2016/10/20	13:57:35	10.92	4.70
104	2016/10/20	13:58:35	10.46	4.90
105	2016/10/20	13:59:35	10.22	5.01
106	2016/10/20	14:00:35	10.20	5.04
107	2016/10/20	14:01:35	10.26	5.01
108	2016/10/20	14:02:35	10.41	4.95
109	2016/10/20	14:03:35	10.79	4.78
110	2016/10/20	14:04:35	10.94	4.71
111	2016/10/20	14:05:35	11.08	4.66
112	2016/10/20	14:06:35	11.94	4.31
113	2016/10/20	14:07:35	12.95	3.77
114	2016/10/20	14:08:35	11.63	4.36
115	2016/10/20	14:09:35	11.25	4.58
116	2016/10/20	14:10:35	11.56	4.47
117	2016/10/20	14:11:35	11.82	4.34
118	2016/10/20	14:12:35	11.81	4.33
119	2016/10/20	14:13:35	11.79	4.34
120	2016/10/20	14:14:35	11.66	4.39
121	2016/10/20	14:15:35	11.37	4.52
122	2016/10/20	14:16:35	11.36	4.54
123	2016/10/20	14:17:35	11.51	4.47

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
124	2016/10/20	14:18:35	11.49	4.46
125	2016/10/20	14:19:35	11.42	4.49
126	2016/10/20	14:20:35	11.25	4.56
127	2016/10/20	14:21:35	10.82	4.74
128	2016/10/20	14:22:35	10.63	4.84
129	2016/10/20	14:23:35	10.51	4.90
130	2016/10/20	14:24:35	10.44	4.95
131	2016/10/20	14:25:35	10.96	4.78
132	2016/10/20	14:26:35	12.39	4.17
133	2016/10/20	14:27:35	13.50	3.55
134	2016/10/20	14:28:35	12.69	3.91
135	2016/10/20	14:29:35	12.31	4.10
136	2016/10/20	14:30:35	12.02	4.22
137	2016/10/20	14:31:35	11.64	4.40
138	2016/10/20	14:32:35	11.33	4.54
139	2016/10/20	14:33:35	10.87	4.73
140	2016/10/20	14:34:35	10.08	5.06
141	2016/10/20	14:35:35	9.69	5.24
142	2016/10/20	14:36:35	9.56	5.30
143	2016/10/20	14:37:35	9.47	5.34
144	2016/10/20	14:38:35	9.40	5.38
145	2016/10/20	14:39:35	9.42	5.37
146	2016/10/20	14:40:35	9.44	5.36
147	2016/10/20	14:41:35	9.44	5.37
148	2016/10/20	14:42:35	9.86	5.22
149	2016/10/20	14:43:35	10.59	4.90
150	2016/10/20	14:44:35	10.73	4.83
151	2016/10/20	14:45:35	10.92	4.77
152	2016/10/20	14:46:35	12.01	4.33
153	2016/10/20	14:47:35	12.78	3.85
154	2016/10/20	14:48:35	11.37	4.51
155	2016/10/20	14:49:35	11.11	4.67
156	2016/10/20	14:50:35	11.42	4.53
157	2016/10/20	14:51:35	11.53	4.46
158	2016/10/20	14:52:35	11.50	4.47
159	2016/10/20	14:53:35	11.44	4.49
160	2016/10/20	14:54:35	11.34	4.54
161	2016/10/20	14:55:35	11.23	4.60
162	2016/10/20	14:56:35	11.25	4.60
163	2016/10/20	14:57:35	11.72	4.41
164	2016/10/20	14:58:35	12.28	4.14
165	2016/10/20	14:59:35	12.45	4.04
166	2016/10/20	15:00:35	12.46	4.03
167	2016/10/20	15:01:35	12.44	4.03
168	2016/10/20	15:02:35	12.24	4.11
169	2016/10/20	15:03:35	11.86	4.28
170	2016/10/20	15:04:35	11.45	4.47
171	2016/10/20	15:05:35	11.15	4.64
172	2016/10/20	15:06:35	11.61	4.49
173	2016/10/20	15:07:35	11.97	4.20
174	2016/10/20	15:08:35	10.39	4.94
175	2016/10/20	15:09:35	9.85	5.20
176	2016/10/20	15:10:35	9.72	5.26
177	2016/10/20	15:11:35	9.63	5.30
178	2016/10/20	15:12:35	9.88	5.22
179	2016/10/20	15:13:35	10.53	4.96
180	2016/10/20	15:14:35	10.80	4.82
181	2016/10/20	15:15:35	10.82	4.81
182	2016/10/20	15:16:35	10.73	4.84
183	2016/10/20	15:17:35	10.66	4.86
184	2016/10/20	15:18:35	10.59	4.89
185	2016/10/20	15:19:35	10.31	5.00

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
186	2016/10/20	15:20:35	10.22	5.06
RUN 2 AVERAGES			**10.5**	**4.9**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/20	15:47:35	9.03	6.48
2	2016/10/20	15:48:35	8.77	6.39
3	2016/10/20	15:49:35	9.85	5.54
4	2016/10/20	15:50:35	10.31	4.77
5	2016/10/20	15:51:35	9.96	5.56
6	2016/10/20	15:52:35	10.26	5.08
7	2016/10/20	15:53:35	9.98	5.47
8	2016/10/20	15:54:35	9.49	6.02
9	2016/10/20	15:55:35	10.35	5.16
10	2016/10/20	15:56:35	12.16	2.94
11	2016/10/20	15:57:35	9.55	5.66
12	2016/10/20	15:58:35	8.51	7.00
13	2016/10/20	15:59:35	8.33	7.01
14	2016/10/20	16:00:35	7.73	7.31
15	2016/10/20	16:01:35	8.09	7.69
16	2016/10/20	16:02:35	7.84	7.79
17	2016/10/20	16:03:35	8.77	7.22
18	2016/10/20	16:04:35	9.07	6.00
19	2016/10/20	16:05:35	9.60	5.63
20	2016/10/20	16:06:35	9.70	5.78
21	2016/10/20	16:07:35	9.98	5.73
22	2016/10/20	16:08:35	8.83	6.83
23	2016/10/20	16:09:35	8.70	6.37
24	2016/10/20	16:10:35	9.86	6.08
25	2016/10/20	16:11:35	9.63	5.39
26	2016/10/20	16:12:35	9.79	5.64
27	2016/10/20	16:13:35	9.71	5.37
28	2016/10/20	16:14:35	9.38	5.67
29	2016/10/20	16:15:35	9.99	5.31
30	2016/10/20	16:16:35	12.57	2.59
31	2016/10/20	16:17:35	11.70	3.58
32	2016/10/20	16:18:35	11.24	4.23
33	2016/10/20	16:19:35	11.24	4.34
34	2016/10/20	16:20:35	12.46	3.40
35	2016/10/20	16:21:35	14.52	1.40
36	2016/10/20	16:22:35	14.50	0.70
37	2016/10/20	16:23:35	11.47	4.46
38	2016/10/20	16:24:35	10.26	5.55
39	2016/10/20	16:25:35	10.30	4.75
40	2016/10/20	16:26:35	9.15	6.23
41	2016/10/20	16:27:35	8.16	7.02
42	2016/10/20	16:28:35	8.57	7.39
43	2016/10/20	16:29:35	8.99	6.27
44	2016/10/20	16:30:35	8.72	6.88
45	2016/10/20	16:31:35	8.49	7.34
46	2016/10/20	16:32:35	8.79	7.20
47	2016/10/20	16:33:35	8.77	6.47
48	2016/10/20	16:34:35	9.09	6.84
49	2016/10/20	16:35:35	8.26	7.39
50	2016/10/20	16:36:35	9.37	6.59
51	2016/10/20	16:37:35	11.34	4.10
52	2016/10/20	16:38:35	10.49	5.35
53	2016/10/20	16:39:35	9.11	6.71
54	2016/10/20	16:40:35	8.68	6.63
55	2016/10/20	16:41:35	9.22	5.97
56	2016/10/20	16:42:35	8.71	7.06
57	2016/10/20	16:43:35	8.54	7.12
58	2016/10/20	16:44:35	8.30	7.52
59	2016/10/20	16:45:35	7.84	7.42
60	2016/10/20	16:46:35	8.25	7.73
61	2016/10/20	16:47:35	8.53	6.49

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
62	2016/10/20	16:48:35	8.67	7.12
63	2016/10/20	16:49:35	8.85	7.13
64	2016/10/20	16:50:35	8.05	7.78
65	2016/10/20	16:51:35	8.63	6.94
66	2016/10/20	16:52:35	9.13	5.93
67	2016/10/20	16:53:35	8.73	6.85
68	2016/10/20	16:54:35	9.04	6.26
69	2016/10/20	16:55:35	9.29	6.43
70	2016/10/20	16:56:35	9.42	6.45
71	2016/10/20	16:57:35	9.77	5.98
72	2016/10/20	16:58:35	9.21	6.35
73	2016/10/20	16:59:35	10.98	4.92
74	2016/10/20	17:00:35	10.45	5.50
75	2016/10/20	17:01:35	10.12	4.98
76	2016/10/20	17:02:35	9.81	6.02
77	2016/10/20	17:03:35	9.80	5.60
78	2016/10/20	17:04:35	9.67	5.74
79	2016/10/20	17:05:35	9.39	6.44
80	2016/10/20	17:06:35	9.39	5.90
81	2016/10/20	17:07:35	10.01	5.28
82	2016/10/20	17:08:35	10.18	5.21
83	2016/10/20	17:09:35	10.42	5.02
84	2016/10/20	17:10:35	10.26	5.71
85	2016/10/20	17:11:35	10.24	5.71
86	2016/10/20	17:12:35	10.44	5.36
87	2016/10/20	17:13:35	9.56	6.15
88	2016/10/20	17:14:35	9.88	5.53
89	2016/10/20	17:15:35	9.27	5.99
90	2016/10/20	17:16:35	9.86	5.67
91	2016/10/20	17:17:35	9.03	6.21
92	2016/10/20	17:18:35	9.99	5.67
93	2016/10/20	17:19:35	10.98	4.26
94	2016/10/20	17:20:35	11.14	4.28
95	2016/10/20	17:21:35	10.33	5.26
96	2016/10/20	17:22:35	9.99	5.84
97	2016/10/20	17:23:35	10.33	4.92
98	2016/10/20	17:24:35	9.91	5.60
99	2016/10/20	17:25:35	10.37	5.26
100	2016/10/20	17:26:35	10.79	4.62
101	2016/10/20	17:27:35	10.85	5.11
102	2016/10/20	17:28:35	10.58	5.34
103	2016/10/20	17:29:35	10.72	4.90
104	2016/10/20	17:30:35	10.88	4.45
105	2016/10/20	17:31:35	10.11	5.81
106	2016/10/20	17:32:35	10.11	4.98
107	2016/10/20	17:33:35	9.81	5.58
108	2016/10/20	17:34:35	10.05	5.37
109	2016/10/20	17:35:35	10.17	5.82
110	2016/10/20	17:36:35	10.68	4.92
111	2016/10/20	17:37:35	10.49	4.76
112	2016/10/20	17:38:35	11.28	4.36
113	2016/10/20	17:39:35	12.38	3.38
114	2016/10/20	17:40:35	10.89	4.62
115	2016/10/20	17:41:35	11.01	4.80
116	2016/10/20	17:42:35	11.67	3.86
117	2016/10/20	17:43:35	11.42	3.98
118	2016/10/20	17:44:35	10.67	4.64
119	2016/10/20	17:45:35	10.55	4.48
120	2016/10/20	17:46:35	10.79	4.48
121	2016/10/20	17:47:35	10.85	4.35
122	2016/10/20	17:48:35	11.35	4.13
123	2016/10/20	17:49:35	10.95	4.81

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
124	2016/10/20	17:50:35	10.95	4.25
125	2016/10/20	17:51:35	10.48	5.02
126	2016/10/20	17:52:35	10.94	4.41
127	2016/10/20	17:53:35	10.14	5.35
128	2016/10/20	17:54:35	10.20	5.57
129	2016/10/20	17:55:35	10.37	4.83
130	2016/10/20	17:56:35	9.97	5.49
131	2016/10/20	17:57:35	10.43	5.24
132	2016/10/20	17:58:35	11.92	3.09
133	2016/10/20	17:59:35	12.50	3.33
134	2016/10/20	18:00:35	11.93	3.93
135	2016/10/20	18:01:35	11.59	4.33
136	2016/10/20	18:02:35	11.13	4.51
137	2016/10/20	18:03:35	10.61	5.18
138	2016/10/20	18:04:35	9.99	5.73
RUN 3 AVERAGES			**10.0**	**5.5**

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 1
Unit	Combustion Stack 2	**Start Time**	8:42
Operation	Normal	**End Time**	11:18
Tester(s)	BC, JW, TL, CS		

Cal. Gas	LOW Conc.	LOW (% of Span)	MID Conc.	MID (% of Span)	HIGH Conc.	HIGH (% of Span)	Span	Conc. Units	If Using M205, denote Mass Flow Controller: Tank ID LOW	MID	HIGH	M205 Dilution System Information: Dilution Cylinder ID	Cylinder Concentration	Response Time (up)	Response Time (down)
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A	60	60
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A	70	70
LIMITS				40 % to 60 %		100%									
THC LIMITS		25 % to 35 %		45 % to 55 %		80 % to 90 %									

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values: System Cal. Response	Initial Values: System Cal. Bias (% of Span)	Final Values: System Cal. Response	Final Values: System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.14	0.50	0.17	0.65	0.15	20.03	0.155			
	Mid	10.01	10.01	10.18	0.85	10.07	0.30	-0.55	20.03	10.125	9.77	9.65	d. vol. %
CO2	Zero		0.13	0.07	-0.30	0.15	0.10	0.40	19.79	0.11			
	Mid	10.15	10.11	10.16	0.25	10.10	-0.05	-0.30	19.79	10.13	5.31	5.27	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Combustion Stack 2	**Start Time**	12:15
Operation	Normal	**End Time**	15:21
Tester(s)	BC, JW, TL, CS		

Cal.	LOW		MID		HIGH			Conc.	If Using M205, denote Mass Flow Controller Tank ID			M205 Dilution System Information	
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH	Dilution Cylinder ID	Cylinder Concentration
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
LIMITS				**40 % to 60 %**		**100%**							
THC LIMITS		**25 % to 35 %**		**45 % to 55 %**		**80 % to 90 %**							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.17	0.65	0.23	0.95	0.30	20.03	0.20			
	Mid	10.01	10.01	10.07	0.30	10.04	0.15	-0.15	20.03	10.06	10.53	10.49	d. vol. %
CO2	Zero		0.13	0.15	0.10	0.20	0.35	0.25	19.79	0.18			
	Mid	10.15	10.11	10.10	-0.05	9.97	-0.71	-0.66	19.79	10.04	4.92	4.88	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Combustion Stack 2	**Start Time**	15:47
Operation	Normal	**End Time**	18:05
Tester(s)	BC, JW, TL, CS		

Cal.	LOW		MID		HIGH			Conc.	If Using M205, denote Mass Flow Controller			M205 Dilution System Information	
									Tank ID			Dilution	Cylinder
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Units	LOW	MID	HIGH	Cylinder ID	Concentration
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
LIMITS				**40 % to 60 %**		**100%**							
THC LIMITS		**25 % to 35 %**		**45 % to 55 %**		**80 % to 90 %**							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.23	0.95	0.19	0.75	-0.20	20.03	0.21			
	Mid	10.01	10.01	10.04	0.15	10.05	0.20	0.05	20.03	10.05	10.01	9.98	d. vol. %
CO2	Zero		0.13	0.20	0.35	0.17	0.20	-0.15	19.79	0.19			
	Mid	10.15	10.11	9.97	-0.71	10.04	-0.35	0.35	19.79	10.01	5.51	5.51	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.0	0.00		20.03	19.9	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.1	-0.20		19.79	19.7	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen		Test Date:	October 20, 2016	
Project No.:	16-167		0	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Combustion Stack 2		Test Start Time:	8:42 AM	
Unit Operation:	Normal		Test Finish Time:	11:18 AM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	
Data Input			**Calculations**		
Control Box:	1774		CO + N2	85.08	% dv
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.003		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.07	in. Hg	Water Collected (W_f - W_i)	160.2	g
Stack Static Pressure (Pg)	-1.30	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	7.553	scf
Stack Diameter (Ds) (L if rectangular)	112.0	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	7.553	scf
Stack Width (enter NA if circular)	0.0	inches	Volume Dry Gas Metered (Vm)	40.565	dacf
O2	9.65	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	39.009	dscf
CO2	5.27	% dv	Volume Dry Gas Metered (Vm(m^3))	1.149	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.105	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	28.97	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	1004.0	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	2032.64	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1622	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1622	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.23	lb/lb-mole
Meter Temperature (Tm)	75.4	F	Wet Gas Molecular Weight (Ms)	27.41	lb/lb-mole
Stack Temperature (Tsavg)	544.4	F	Gas Velocity (Vs)	8.93	ft/s
Orifice Pressure Drop (dHavg)	0.371	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.1105	in. H_2O^1/2	Area Stack (As)	68.417	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	36,645	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	18,656	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	15,629	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1,038	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	528	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	443	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Hydrogen Sulfide			**Carbon Dioxide (CO2)**		
MW	34.1	lb/lb-mole	MW	44	lb/lb-mole
Concentration	< 0.50	ppm_{wv}	Concentration	52,724.0	ppm_{dv}
Concentration	< 0.60	ppm_{dv}	Emission	2,561,081.6	g/hr
Emission	< 0.0495	lb/hr	Emission	5,646.2	lb/hr
			Emission	2.8	tons/hr

ArcelorMittal Monessen **Run 1** **F or C?**

Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.017	0.130	0.51	502	66	66
A-1	0.023	0.152	0.69	545	67	68
A-2	0.015	0.122	0.45	548	67	67
A-2	0.015	0.122	0.45	552	68	67
A-3	0.013	0.114	0.39	552	68	67
A-3	0.013	0.114	0.39	511	69	67
A-4	0.011	0.105	0.33	547	69	67
A-4	0.011	0.105	0.33	548	69	70
A-5	0.010	0.100	0.30	549	70	68
A-5	0.010	0.100	0.30	552	70	68
B-1	0.011	0.105	0.39	551	71	70
B-1	0.016	0.126	0.48	552	71	70
B-2	0.013	0.114	0.39	555	72	70
B-2	0.013	0.114	0.39	558	73	71
B-3	0.011	0.105	0.33	561	74	71
B-3	0.011	0.105	0.33	537	75	72
B-4	0.010	0.100	0.30	539	75	72
B-4	0.010	0.100	0.30	544	76	73
B-5	0.010	0.100	0.30	521	76	73
B-5	0.010	0.100	0.30	543	77	74
C-1	0.011	0.105	0.33	544	77	75
C-1	0.011	0.105	0.33	549	78	76
C-2	0.010	0.100	0.30	552	78	76
C-2	0.011	0.105	0.33	554	79	77
C-3	0.011	0.105	0.33	524	80	77
C-3	0.014	0.118	0.42	540	80	77
C-4	0.014	0.118	0.42	543	80	78
C-4	0.014	0.118	0.42	549	81	78
C-5	0.011	0.105	0.33	552	81	79
C-5	0.011	0.105	0.33	555	82	79
D-1	0.012	0.110	0.36	538	82	80
D-1	0.012	0.110	0.36	542	82	80
D-2	0.010	0.100	0.30	545	82	80
D-2	0.012	0.110	0.36	549	83	80
D-3	0.011	0.105	0.33	552	83	81
D-3	0.013	0.114	0.39	555	84	81
D-4	0.014	0.118	0.42	532	84	82
D-4	0.014	0.118	0.42	542	85	82
D-5	0.012	0.110	0.36	542	85	82
D-5	0.012	0.110	0.36	548	85	83
Average	0.0123	0.1105	0.37	544.4		75.4

Initial volume	173.700	ft^3	Initial volume	0.000	liters
Final volume	214.265	ft^3	Final volume	0.000	liters
Total metered	40.565	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	841.2	707.0	134.2			0.0
2	712.9	700.8	12.1			0.0
3	622.1	619.4	2.7			0.0
4	781.7	770.5	11.2			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2957.9	2797.7	160.2	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal Monessen		Test Date:	October 20, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Combustion Stack 2		Test Start Time:	12:15 PM	
Unit Operation:	Normal		Test Finish Time:	3:21 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	
Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.63	% dv
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.003		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.07	in. Hg	Water Collected (W_f - W_i)	147.5	g
Stack Static Pressure (Pg)	-1.20	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	6.955	scf
Stack Diameter (Ds) (L if rectangular)	112	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	6.955	scf
Stack Width (enter NA if circular)	0	inches	Volume Dry Gas Metered (Vm)	43.012	dacf
O2	10.49	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	40.176	dscf
CO2	4.88	% dv	Volume Dry Gas Metered (Vm(m^3))	1.218	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.138	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	28.98	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	1003.3	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	2021.35	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1476	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1476	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.20	lb/lb-mole
Meter Temperature (Tm)	91.2	F	Wet Gas Molecular Weight (Ms)	27.55	lb/lb-mole
Stack Temperature (Tsavg)	543.7	F	Gas Velocity (Vs)	8.95	ft/s
Orifice Pressure Drop (dHavg)	0.387	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.1111	in. H_2O^1/2	Area Stack (As)	68.417	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	36,726	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	18,714	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	15,953	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1,040	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	530	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	452	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Hydrogen Sulfide			**Carbon Dioxide (CO2)**		
MW	34.1	lb/lb-mole	MW	44	lb/lb-mole
Concentration	< 0.50	ppm_{dv}	Concentration	48,799.8	ppm_{dv}
Concentration	< 0.59	ppm_{dv}	Emission	2,419,525.8	g/hr
Emission	< 0.0497	lb/hr	Emission	5,334.1	lb/hr
			Emission	2.7	tons/hr

ArcelorMittal Monessen **Run 2** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.011	0.105	0.30	558	87	86
A-1	0.015	0.122	0.50	558	87	86
A-2	0.015	0.122	0.50	516	88	86
A-2	0.015	0.122	0.50	539	88	86
A-3	0.016	0.126	0.50	545	89	87
A-3	0.016	0.126	0.50	548	90	87
A-4	0.014	0.118	0.40	551	90	87
A-4	0.015	0.122	0.50	557	90	87
A-5	0.013	0.114	0.40	551	91	88
A-5	0.013	0.114	0.40	531	91	88
B-1	0.012	0.110	0.40	542	91	90
B-1	0.011	0.105	0.34	539	91	90
B-2	0.010	0.100	0.31	548	91	90
B-2	0.012	0.110	0.37	549	91	90
B-3	0.015	0.122	0.47	552	92	91
B-3	0.015	0.122	0.47	523	92	91
B-4	0.013	0.114	0.40	531	92	91
B-4	0.011	0.105	0.34	537	92	91
B-5	0.012	0.110	0.37	534	93	91
B-5	0.012	0.110	0.37	541	93	91
C-1	0.011	0.105	0.34	534	93	92
C-1	0.011	0.105	0.34	544	92	92
C-2	0.011	0.105	0.34	550	92	92
C-2	0.011	0.105	0.34	554	92	92
C-3	0.013	0.114	0.40	563	92	92
C-3	0.013	0.114	0.40	532	92	92
C-4	0.010	0.100	0.31	536	93	92
C-4	0.010	0.100	0.31	546	93	92
C-5	0.010	0.100	0.31	546	93	92
C-5	0.010	0.100	0.31	556	93	92
D-1	0.010	0.100	0.31	545	93	92
D-1	0.010	0.100	0.31	543	93	93
D-2	0.014	0.118	0.43	550	93	93
D-2	0.014	0.118	0.43	556	94	93
D-3	0.012	0.110	0.37	523	94	93
D-3	0.011	0.105	0.34	539	94	93
D-4	0.015	0.122	0.47	532	94	93
D-4	0.015	0.122	0.47	546	94	93
D-5	0.010	0.100	0.31	547	94	93
D-5	0.010	0.100	0.31	555	94	93
Average	0.0124	0.1111	0.39	543.7		91.2

Initial volume	216.500	ft^3	Initial volume	0.000	liters
Final volume	259.512	ft^3	Final volume	0.000	liters
Total metered	43.012	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	827.3	704.1	123.2			0.0
2	634.1	622.5	11.6			0.0
3	616.2	615.1	1.1			0.0
4	794.8	783.2	11.6			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2872.4	2724.9	147.5	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal Monessen		Test Date:	October 20, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Combustion Stack 2		Test Start Time:	3:47 PM	
Unit Operation:	Normal		Test Finish Time:	6:05 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	
Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.52	% dv
Meter $DH_{@}$ (0.75 scfm)	1.971	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.003		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.07	in. Hg	Water Collected (W_f - W_i)	156.3	g
Stack Static Pressure (Pg)	-0.14	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	7.370	scf
Stack Diameter (Ds) (L if rectangular)	112	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	7.370	scf
Stack Width (enter NA if circular)	0	inches	Volume Dry Gas Metered (Vm)	42.674	dacf
O2	9.98	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	40.340	dscf
CO2	5.51	% dv	Volume Dry Gas Metered (Vm(m^3))	1.208	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.142	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.06	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	1000.4	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	1972.17	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1545	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1545	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.28	lb/lb-mole
Meter Temperature (Tm)	84.6	F	Wet Gas Molecular Weight (Ms)	27.54	lb/lb-mole
Stack Temperature (Tsavg)	540.7	F	Gas Velocity (Vs)	8.74	ft/s
Orifice Pressure Drop (dHavg)	0.370	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.1089	in. H_2O^1/2	Area Stack (As)	68.417	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	35,891	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	18,393	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	15,552	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1,016	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	521	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	440	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Hydrogen Sulfide			**Carbon Dioxide (CO2)**		
MW	34.1	lb/lb-mole	MW	44	lb/lb-mole
Concentration	< 0.50	ppm_{wv}	Concentration	55,062.8	ppm_{dv}
Concentration	< 0.59	ppm_{dv}	Emission	2,661,354.5	g/hr
Emission	< 0.0488	lb/hr	Emission	5,867.3	lb/hr
			Emission	2.9	tons/hr

ArcelorMittal Monessen **Run 3** **F or C?**
Combustion Stack 2 **F=1,C=0 1**

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. $H2O)^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.016	0.126	0.50	531	84	84
A-1	0.016	0.126	0.50	544	85	83
A-2	0.015	0.122	0.47	550	85	83
A-2	0.014	0.118	0.43	557	85	83
A-3	0.013	0.114	0.40	551	85	83
A-3	0.013	0.114	0.40	531	85	84
A-4	0.014	0.118	0.43	540	85	85
A-4	0.014	0.118	0.43	545	85	85
A-5	0.012	0.110	0.37	547	86	85
A-5	0.012	0.110	0.37	551	86	85
B-1	0.018	0.134	0.56	526	86	85
B-1	0.015	0.122	0.47	534	87	85
B-2	0.014	0.118	0.43	540	87	85
B-2	0.014	0.118	0.43	546	87	85
B-3	0.013	0.114	0.40	552	87	86
B-3	0.013	0.114	0.40	555	87	86
B-4	0.011	0.105	0.34	561	87	86
B-4	0.011	0.105	0.34	531	87	86
B-5	0.010	0.100	0.31	538	87	86
B-5	0.010	0.100	0.31	542	87	86
C-1	0.010	0.100	0.31	528	86	86
C-1	0.010	0.100	0.31	555	86	86
C-2	0.010	0.100	0.31	528	86	86
C-2	0.010	0.100	0.31	539	86	86
C-3	0.010	0.100	0.31	539	86	86
C-3	0.010	0.100	0.31	522	86	86
C-4	0.010	0.100	0.31	540	86	86
C-4	0.010	0.100	0.31	550	86	86
C-5	0.010	0.100	0.31	507	86	86
C-5	0.010	0.100	0.31	521	86	86
D-1	0.011	0.105	0.34	543	85	85
D-1	0.011	0.105	0.34	553	84	84
D-2	0.014	0.118	0.43	555	83	83
D-2	0.014	0.118	0.43	532	82	82
D-3	0.010	0.100	0.31	529	82	81
D-3	0.010	0.100	0.31	542	82	81
D-4	0.010	0.100	0.31	538	81	80
D-4	0.010	0.100	0.31	546	80	79
D-5	0.010	0.100	0.31	539	80	79
D-5	0.010	0.100	0.31	550	80	79
Average	0.01	0.109	0.37	540.7		84.6

Initial volume	260.100	ft^3	Initial volume	0.000	liters
Final volume	302.774	ft^3	Final volume	0.000	liters
Total metered	42.674	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	843.4	711.3	132.1			0.0
2	714.6	700.4	14.2			0.0
3	622.3	621.5	0.8			0.0
4	801.8	792.6	9.2			0.0
5			0.0			0.0
6			0.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	2982.1	2825.8	156.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Method 320

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	FTIR Scan #	HCN (PPMwv)	HF (PPMwv)
RUN 1							
1	2016/10/19	08:15:37	9.22	5.66	325	0.00	-0.06
2	2016/10/19	08:16:37	10.05	5.26	326	-0.03	0.05
3	2016/10/19	08:17:37	10.91	4.84	327	-0.08	0.05
4	2016/10/19	08:18:37	11.11	4.74	328	-0.10	0.06
5	2016/10/19	08:19:37	10.86	4.85	329	-0.09	0.06
6	2016/10/19	08:20:37	10.82	4.88	330	-0.12	0.06
7	2016/10/19	08:21:37	10.61	4.97	331	-0.03	0.06
8	2016/10/19	08:22:37	10.23	5.14	332	-0.05	0.06
9	2016/10/19	08:23:37	11.09	4.81	333	0.00	0.06
10	2016/10/19	08:24:37	13.34	3.85	334	-0.10	0.05
11	2016/10/19	08:25:37	10.35	5.11	335	-0.01	0.05
12	2016/10/19	08:26:37	9.33	5.63	336	-0.11	0.06
13	2016/10/19	08:27:37	9.12	5.74	337	-0.11	0.05
14	2016/10/19	08:28:37	9.06	5.77	338	-0.04	0.06
15	2016/10/19	08:29:37	8.94	5.85	339	-0.02	0.06
16	2016/10/19	08:30:37	9.47	5.58	340	-0.05	0.05
17	2016/10/19	08:31:37	10.46	5.08	341	-0.05	0.06
18	2016/10/19	08:32:37	10.54	5.03	342	0.01	0.06
19	2016/10/19	08:33:37	10.43	5.07	343	0.01	0.05
20	2016/10/19	08:34:37	10.18	5.19	344	-0.04	0.06
21	2016/10/19	08:35:37	10.04	5.25	345	0.07	0.05
22	2016/10/19	08:36:37	10.03	5.25	346	-0.08	0.05
23	2016/10/19	08:37:37	9.49	5.52	347	0.04	0.06
24	2016/10/19	08:38:37	8.83	5.88	348	-0.13	0.05
25	2016/10/19	08:39:37	8.56	6.02	349	-0.05	0.05
26	2016/10/19	08:40:37	8.54	6.04	350	-0.05	0.05
27	2016/10/19	08:41:37	8.26	6.18	351	-0.09	0.05
28	2016/10/19	08:42:37	8.44	6.09	352	0.02	0.05
29	2016/10/19	08:43:37	10.30	5.27	353	-0.05	0.05
30	2016/10/19	08:44:37	13.24	3.94	354	-0.09	0.06
31	2016/10/19	08:45:37	11.35	4.67	355	-0.10	0.05
32	2016/10/19	08:46:37	11.39	4.66	356	0.03	0.06
33	2016/10/19	08:47:37	11.05	4.81	357	-0.01	0.05
34	2016/10/19	08:48:37	10.75	4.95	358	-0.01	0.05
35	2016/10/19	08:49:37	10.66	4.98	359	-0.11	0.05
36	2016/10/19	08:50:37	10.40	5.09	360	-0.07	0.06
37	2016/10/19	08:51:37	9.65	5.45	361	-0.05	0.05
38	2016/10/19	08:52:37	9.24	5.67	362	0.04	0.05
39	2016/10/19	08:53:37	9.09	5.75	363	-0.05	0.06
40	2016/10/19	08:54:37	9.01	5.80	364	-0.09	0.05
41	2016/10/19	08:55:37	8.90	5.85	365	-0.06	0.05
42	2016/10/19	08:56:37	8.83	5.88	366	0.00	0.06
43	2016/10/19	08:57:37	9.04	5.77	367	-0.08	0.05
44	2016/10/19	08:58:37	8.96	5.82	368	-0.09	0.05
45	2016/10/19	08:59:37	9.27	5.68	369	0.00	0.05
46	2016/10/19	09:00:37	10.38	5.14	370	-0.17	0.05
47	2016/10/19	09:01:37	10.58	5.03	371	-0.04	0.05
48	2016/10/19	09:02:37	10.46	5.08	372	-0.04	0.06
49	2016/10/19	09:03:37	12.06	4.38	373	-0.04	0.06
50	2016/10/19	09:04:37	14.33	3.38	374	-0.10	0.05
51	2016/10/19	09:05:37	11.15	4.76	375	-0.14	0.05
52	2016/10/19	09:06:37	9.60	5.51	376	-0.09	0.05
53	2016/10/19	09:07:37	8.99	5.84	377	-0.02	0.05
54	2016/10/19	09:08:37	8.71	5.98	378	-0.04	0.06
55	2016/10/19	09:09:37	8.61	6.03	379	0.03	0.05
56	2016/10/19	09:10:37	8.83	5.92	380	-0.01	0.05
57	2016/10/19	09:11:37	8.65	6.01	381	-0.04	0.05
58	2016/10/19	09:12:37	8.92	5.88	382	0.00	0.06
59	2016/10/19	09:13:37	9.96	5.33	383	-0.02	0.05
60	2016/10/19	09:14:37	10.22	5.19	384	-0.03	0.05
RUN 1 AVERAGES			**10.0**	**5.3**		**-0.05**	**0.05**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	FTIR Scan #	HCN (PPMwv)	HF (PPMwv)
RUN 2							
1	2016/10/19	11:22:37	12.05	4.25	456	-0.12	0.06
2	2016/10/19	11:23:37	13.32	3.70	457	0.03	0.05
3	2016/10/19	11:24:37	15.02	2.97	458	0.01	0.06
4	2016/10/19	11:25:37	11.97	4.28	459	0.00	0.05
5	2016/10/19	11:26:37	10.51	4.97	460	0.01	0.05
6	2016/10/19	11:27:37	9.88	5.26	461	-0.11	0.06
7	2016/10/19	11:28:37	9.67	5.36	462	-0.04	0.06
8	2016/10/19	11:29:37	9.60	5.39	463	-0.02	0.05
9	2016/10/19	11:30:37	9.40	5.50	464	-0.08	0.05
10	2016/10/19	11:31:37	9.34	5.52	465	0.00	0.05
11	2016/10/19	11:32:37	9.49	5.44	466	-0.06	0.06
12	2016/10/19	11:33:37	9.32	5.53	467	0.02	0.05
13	2016/10/19	11:34:37	9.64	5.39	468	-0.01	0.05
14	2016/10/19	11:35:37	10.59	4.95	469	-0.05	0.06
15	2016/10/19	11:36:37	10.79	4.85	470	-0.08	0.05
16	2016/10/19	11:37:37	10.63	4.92	471	-0.01	0.05
17	2016/10/19	11:38:37	10.55	4.96	472	0.02	0.05
18	2016/10/19	11:39:37	10.39	5.02	473	-0.09	0.05
19	2016/10/19	11:40:37	9.89	5.24	474	-0.11	0.05
20	2016/10/19	11:41:37	9.37	5.49	475	-0.09	0.05
21	2016/10/19	11:42:37	9.72	5.34	476	-0.02	0.05
22	2016/10/19	11:43:37	12.48	4.10	477	-0.08	0.06
23	2016/10/19	11:44:37	14.61	3.17	478	-0.06	0.05
24	2016/10/19	11:45:37	11.92	4.31	479	-0.08	0.06
25	2016/10/19	11:46:37	11.22	4.65	480	-0.07	0.05
26	2016/10/19	11:47:37	11.13	4.70	481	-0.08	0.05
27	2016/10/19	11:48:37	11.75	4.42	482	0.00	0.05
28	2016/10/19	11:49:37	12.45	4.10	483	-0.03	0.05
29	2016/10/19	11:50:37	12.43	4.10	484	-0.02	0.05
30	2016/10/19	11:51:37	12.48	4.07	485	-0.04	0.06
31	2016/10/19	11:52:37	12.42	4.08	486	-0.14	0.05
32	2016/10/19	11:53:37	11.77	4.36	487	-0.12	0.05
33	2016/10/19	11:54:37	10.33	5.02	488	-0.08	0.06
34	2016/10/19	11:55:37	9.48	5.44	489	-0.03	0.05
35	2016/10/19	11:56:37	9.34	5.51	490	-0.11	0.05
36	2016/10/19	11:57:37	9.38	5.50	491	-0.03	0.05
37	2016/10/19	11:58:37	8.83	5.78	492	-0.05	0.05
38	2016/10/19	11:59:37	9.01	5.69	493	-0.01	0.05
39	2016/10/19	12:00:37	9.81	5.30	494	-0.13	0.05
40	2016/10/19	12:01:37	9.89	5.24	495	-0.01	0.05
41	2016/10/19	12:02:37	9.68	5.34	496	0.02	0.05
42	2016/10/19	12:03:37	11.42	4.60	497	0.01	0.06
43	2016/10/19	12:04:37	13.93	3.51	498	-0.02	0.05
44	2016/10/19	12:05:37	10.87	4.80	499	-0.09	0.05
45	2016/10/19	12:06:37	9.79	5.29	500	-0.13	0.05
46	2016/10/19	12:07:37	9.47	5.44	501	0.02	0.05
47	2016/10/19	12:08:37	10.02	5.19	502	0.03	0.05
48	2016/10/19	12:09:37	11.33	4.57	503	-0.03	0.05
49	2016/10/19	12:10:37	11.46	4.50	504	-0.07	0.06
50	2016/10/19	12:11:37	11.49	4.48	505	-0.09	0.05
51	2016/10/19	12:12:37	11.38	4.54	506	0.01	0.06
52	2016/10/19	12:13:37	11.47	4.51	507	-0.11	0.05
53	2016/10/19	12:14:37	12.10	4.23	508	-0.08	0.06
54	2016/10/19	12:15:37	12.26	4.16	509	-0.04	0.05
55	2016/10/19	12:16:37	11.15	4.66	510	-0.13	0.05
56	2016/10/19	12:17:37	11.04	4.70	511	-0.06	0.04
57	2016/10/19	12:18:37	10.72	4.83	512	0.04	0.05
58	2016/10/19	12:19:37	9.98	5.16	513	-0.03	0.05
59	2016/10/19	12:20:37	9.62	5.33	514	-0.09	0.06
60	2016/10/19	12:21:37	9.33	5.47	515	0.03	0.05
RUN 2 AVERAGES			**10.84**	**4.82**		**-0.05**	**0.05**

Montrose 1 Minute Average Data Sheet			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Combustion Stack Exhaust

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	FTIR Scan #	HCN (PPMwv)	HF (PPMwv)
RUN 3							
1	2016/10/19	14:02:37	9.64	5.42	544	-0.02	0.05
2	2016/10/19	14:03:37	12.11	4.29	545	-0.01	0.05
3	2016/10/19	14:04:37	14.52	3.22	546	-0.05	0.05
4	2016/10/19	14:05:37	12.11	4.22	547	-0.06	0.06
5	2016/10/19	14:06:37	11.44	4.56	548	0.01	0.05
6	2016/10/19	14:07:37	11.25	4.66	549	-0.05	0.06
7	2016/10/19	14:08:37	11.39	4.60	550	-0.08	0.06
8	2016/10/19	14:09:37	11.61	4.51	551	-0.06	0.05
9	2016/10/19	14:10:37	11.33	4.65	552	-0.06	0.05
10	2016/10/19	14:11:37	11.17	4.71	553	-0.08	0.06
11	2016/10/19	14:12:37	11.10	4.73	554	-0.06	0.05
12	2016/10/19	14:13:37	10.91	4.81	555	0.00	0.06
13	2016/10/19	14:14:37	10.34	5.06	556	-0.04	0.05
14	2016/10/19	14:15:37	9.78	5.33	557	-0.06	0.06
15	2016/10/19	14:16:37	9.52	5.46	558	-0.03	0.05
16	2016/10/19	14:17:37	9.34	5.57	559	0.02	0.05
17	2016/10/19	14:18:37	9.28	5.59	560	-0.13	0.05
18	2016/10/19	14:19:37	9.49	5.48	561	-0.09	0.05
19	2016/10/19	14:20:37	9.54	5.46	562	0.01	0.05
20	2016/10/19	14:21:37	9.60	5.44	563	0.07	0.05
21	2016/10/19	14:22:37	10.28	5.12	564	-0.16	0.05
22	2016/10/19	14:23:37	12.35	4.21	565	0.03	0.05
23	2016/10/19	14:24:37	14.67	3.19	566	-0.05	0.06
24	2016/10/19	14:25:37	12.00	4.33	567	-0.09	0.05
25	2016/10/19	14:26:37	10.98	4.80	568	-0.09	0.05
26	2016/10/19	14:27:37	9.92	5.29	569	-0.07	0.06
27	2016/10/19	14:28:37	9.45	5.53	570	-0.01	0.05
28	2016/10/19	14:29:37	9.67	5.43	571	-0.01	0.05
29	2016/10/19	14:30:37	10.56	4.99	572	-0.13	0.06
30	2016/10/19	14:31:37	10.94	4.81	573	-0.08	0.05
31	2016/10/19	14:32:37	10.81	4.87	574	-0.09	0.06
32	2016/10/19	14:33:37	10.84	4.87	575	-0.16	0.05
33	2016/10/19	14:34:37	11.33	4.66	576	-0.07	0.05
34	2016/10/19	14:35:37	11.65	4.50	577	-0.10	0.05
35	2016/10/19	14:36:37	10.98	4.82	578	-0.08	0.05
36	2016/10/19	14:37:37	10.78	4.90	579	-0.01	0.05
37	2016/10/19	14:38:37	10.69	4.93	580	-0.04	0.05
38	2016/10/19	14:39:37	10.35	5.07	581	-0.02	0.05
39	2016/10/19	14:40:37	9.71	5.37	582	-0.13	0.05
40	2016/10/19	14:41:37	8.95	5.77	583	-0.05	0.05
41	2016/10/19	14:42:37	8.61	5.97	584	-0.03	0.05
42	2016/10/19	14:43:37	10.37	5.20	585	-0.10	0.05
43	2016/10/19	14:44:37	13.31	3.87	586	-0.07	0.05
44	2016/10/19	14:45:37	10.46	5.04	587	-0.01	0.05
45	2016/10/19	14:46:37	9.77	5.37	588	-0.04	0.05
46	2016/10/19	14:47:37	10.00	5.28	589	-0.08	0.05
47	2016/10/19	14:48:37	10.79	4.92	590	-0.08	0.05
48	2016/10/19	14:49:37	10.84	4.89	591	0.00	0.05
49	2016/10/19	14:50:37	10.92	4.84	592	0.07	0.05
50	2016/10/19	14:51:37	10.75	4.91	593	0.00	0.06
51	2016/10/19	14:52:37	10.11	5.20	594	0.01	0.05
52	2016/10/19	14:53:37	9.46	5.52	595	-0.04	0.06
53	2016/10/19	14:54:37	9.23	5.65	596	-0.11	0.06
54	2016/10/19	14:55:37	9.17	5.68	597	-0.03	0.05
55	2016/10/19	14:56:37	9.11	5.72	598	-0.02	0.05
56	2016/10/19	14:57:37	9.18	5.68	599	0.05	0.05
57	2016/10/19	14:58:37	8.89	5.84	600	-0.02	0.05
58	2016/10/19	14:59:37	8.82	5.90	601	-0.04	0.05
59	2016/10/19	15:00:37	9.70	5.47	602	-0.05	0.05
60	2016/10/19	15:01:37	10.53	5.04	603	-0.07	0.06
RUN 3 AVERAGES			**10.54**	**5.02**		**-0.05**	**0.05**

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 1
Unit	Combustion Stack 2	**Start Time**	8:42
Operation	Normal	**End Time**	9:42
Tester(s)	BC, JW, TL, CS		

Cal.	LOW		MID		HIGH				If Using M205, denote Mass Flow Controller			M205 Dilution System Information			
									Tank ID						
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Conc. Units	LOW	MID	HIGH	Dilution Cylinder ID	Cylinder Concentration	Response Time (up)	Response Time (down)
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A	60	60
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A	70	70
LIMITS				40 % to 60 %		100%									
THC LIMITS		25 % to 35 %		45 % to 55 %		80 % to 90 %									

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values: System Cal. Response	Initial Values: System Cal. Bias (% of Span)	Final Values: System Cal. Response	Final Values: System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.14	0.50	0.17	0.65	0.15	20.03	0.155			
	Mid	10.01	10.01	10.18	0.85	10.07	0.30	-0.55	20.03	10.125	9.77	9.65	d. vol. %
CO2	Zero		0.13	0.07	-0.30	0.15	0.10	0.40	19.79	0.11			
	Mid	10.15	10.11	10.16	0.25	10.10	-0.05	-0.30	19.79	10.13	5.31	5.27	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Combustion Stack 2	**Start Time**	12:15
Operation	Normal	**End Time**	13:15
Tester(s)	BC, JW, TL, CS		

Cal.	LOW		MID		HIGH				If Using M205, denote Mass Flow Controller			M205 Dilution System Information	
									Tank ID			Dilution	Cylinder
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Conc. Units	LOW	MID	HIGH	Cylinder ID	Concentration
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
LIMITS				40 % to 60 %		100%							
THC LIMITS		25 % to 35 %		45 % to 55 %		80 % to 90 %							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.17	0.65	0.23	0.95	0.30	20.03	0.20			
	Mid	10.01	10.01	10.07	0.30	10.04	0.15	-0.15	20.03	10.06	10.53	10.49	d. vol. %
CO2	Zero		0.13	0.15	0.10	0.20	0.35	0.25	19.79	0.18			
	Mid	10.15	10.11	10.10	-0.05	9.97	-0.71	-0.66	19.79	10.04	4.92	4.88	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.01	0.00		20.03	19.92	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.11	-0.20		19.79	19.67	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Montrose CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 7E

Client	ArcelorMittal Monessen	**Date**	October 20, 2016
Project No	16-167	**Location**	Combustion Stack Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Combustion Stack 2	**Start Time**	11:44
Operation	Normal	**End Time**	12:44
Tester(s)	BC, JW, TL, CS		

Cal.	LOW		MID		HIGH				If Using M205, denote Mass Flow Controller			M205 Dilution System Information	
									Tank ID				
Gas	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)	Span	Conc. Units	LOW	MID	HIGH	Dilution Cylinder ID	Cylinder Concentration
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210574	XC034406B	N/A	N/A
LIMITS				40 % to 60 %		100%							
THC LIMITS		25 % to 35 %		45 % to 55 %		80 % to 90 %							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values System Cal. Response	Initial Values System Cal. Bias (% of Span)	Final Values System Cal. Response	Final Values System Cal. Bias (% of Span)	Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.04	0.23	0.95	0.19	0.75	-0.20	20.03	0.21			
	Mid	10.01	10.01	10.04	0.15	10.05	0.20	0.05	20.03	10.05	10.01	9.98	d. vol. %
CO2	Zero		0.13	0.20	0.35	0.17	0.20	-0.15	19.79	0.19			
	Mid	10.15	10.11	9.97	-0.71	10.04	-0.35	0.35	19.79	10.01	5.51	5.51	d. vol. %
LIMITS					+/- 5 %		+/- 5 %	+/- 3 %					

Gas	ZERO Analyzer Response (System for THC)	ZERO Analyzer Cal. Error (% of Span)	LOW Actual Conc.	LOW Analyzer Response (System for THC)	LOW Analyzer Cal. Error (% of Span)	LOW System Cal. Error (% of Actual)	MID Actual Conc.	MID Analyzer Response (System for THC)	MID Analyzer Cal. Error (% of Span)	MID System Cal. Error (% of Actual)	HIGH Actual Conc.	HIGH Analyzer Response (System for THC)	HIGH Analyzer Cal. Error (% of Span)	HIGH System Calibration Error (% of Actual)	Span	Conc. Units
O2	0.04	0.20					10.01	10.0	0.00		20.03	19.9	-0.55		20.03	d. vol. %
CO2	0.13	0.66					10.15	10.1	-0.20		19.79	19.7	-0.61		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen		Test Date:	October 19, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Combustion Stack 2		Test Start Time:	8:25 AM	
Unit Operation:	Normal		Test Finish Time:	9:25 AM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.83	% dv
Meter $DH_@$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.12	in. Hg	Water Collected (W_f - W_i)	277.3	g
Stack Static Pressure (Pg)	-1.20	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	13.075	scf
Stack Diameter (Ds) (L if rectangular)	112.0	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	13.075	scf
Stack Width (enter NA if circular)	0.0	inches	Volume Dry Gas Metered (Vm)	114.465	dacf
O2	9.98	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	110.074	dscf
CO2	5.19	% dv	Volume Dry Gas Metered (Vm(m^3))	3.241	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.117	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.03	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	892.0	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	717.54	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from (Bws)	0.1062	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1062	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.23	lb/lb-mole
Meter Temperature (Tm)	81.2	F	Wet Gas Molecular Weight (Ms)	28.04	lb/lb-mole
Stack Temperature (Tsavg)	432.4	F	Gas Velocity (Vs)	7.83	ft/s
Orifice Pressure Drop (dHavg)	2.830	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.1041	in. H_2O^1/2	Area Stack (As)	68.417	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	32,138	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	18,451	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	16,492	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	910	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	522	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	467	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

HF

MW		20.01	lb/lb-mole
Concentration	<	0.05	ppm_{wv}
Concentration	<	0.06	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Concentration	<	0.05	mg/dscm
Emission	<	0.003	lb/hr

HCN

MW		27.0253	lb/lb-mole
Concentration	<	0.41	ppm_{wv}
Concentration	<	0.45	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Concentration	<	0.55	mg/dscm
Emission	<	0.028	lb/hr

ArcelorMittal Monessen **Run 1** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP $(in. H2O)^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.6	525	77	75
A-1	0.010	0.100	2.6	537	78	76
A-2	0.010	0.100	2.6	480	80	76
A-2	0.010	0.100	2.6	478	80	76
A-3	0.011	0.105	2.9	467	81	77
A-3	0.011	0.105	2.9	473	81	77
A-4	0.013	0.114	3.4	416	83	77
A-4	0.013	0.114	3.4	422	83	77
A-5	0.012	0.110	3.1	351	84	78
A-5	0.012	0.110	3.1	343	84	78
B-1	0.010	0.100	2.6	533	81	79
B-1	0.010	0.100	2.6	544	82	79
B-2	0.010	0.100	2.6	539	83	79
B-2	0.010	0.100	2.6	542	84	79
B-3	0.010	0.100	2.6	471	84	79
B-3	0.010	0.100	2.6	484	84	79
B-4	0.011	0.105	2.9	434	84	79
B-4	0.011	0.105	2.9	404	84	79
B-5	0.012	0.110	3.1	324	84	79
B-5	0.012	0.110	3.1	304	84	79
C-1	0.010	0.100	2.6	542	81	79
C-1	0.010	0.100	2.6	513	82	79
C-2	0.010	0.100	2.6	459	83	79
C-2	0.010	0.100	2.6	464	84	79
C-3	0.013	0.114	3.4	367	85	80
C-3	0.013	0.114	3.4	360	86	80
C-4	0.012	0.110	3.1	238	86	80
C-4	0.012	0.110	3.1	247	86	80
C-5	0.015	0.122	3.9	142	87	81
C-5	0.012	0.110	3.1	140	87	81
D-1	0.010	0.100	2.6	552	83	80
D-1	0.010	0.100	2.6	557	83	80
D-2	0.010	0.100	2.6	527	84	80
D-2	0.010	0.100	2.6	531	85	80
D-3	0.010	0.100	2.6	520	85	80
D-3	0.010	0.100	2.6	523	86	80
D-4	0.010	0.100	2.6	502	86	80
D-4	0.010	0.100	2.6	489	86	81
D-5	0.010	0.100	2.6	317	86	80
D-5	0.010	0.100	2.6	234	85	80
Average	0.01	0.104	2.83	432.4		81.2

Initial volume	833.400	ft^3	Initial volume	0.000	liters
Final volume	947.865	ft^3	Final volume	0.000	liters
Total metered	114.465	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	813.1	725.2	87.9			0.0
2	728.3	608.7	119.6			0.0
3	620.1	607.5	12.6			0.0
4	738.8	719.9	18.9			0.0
5	752.1	748.8	3.3			0.0
6	806.1	771.1	35.0			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4458.5	4181.2	277.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal Monessen		Test Date:	October 19, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Combustion Stack 2		Test Start Time:	11:22 AM	
Unit Operation:	Normal		Test Finish Time:	12:22 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input			**Calculations**		
Control Box:	1774		CO + N2	84.44	% dv
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O	Water Collected (V_f - V_i)	0.0	ml
Meter Calibration Factor (Yd)	1.006		Water Vapor Condensed (Vwc(std))	0.000	scf
Barometric Pressure (Pbar)	29.11	in. Hg	Water Collected (W_f - W_i)	329.1	g
Stack Static Pressure (Pg)	-1.30	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	15.517	scf
Stack Diameter (Ds) (L if rectangular)	112	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	15.517	scf
Stack Width (enter NA if circular)	0	inches	Volume Dry Gas Metered (Vm)	110.375	dacf
O2	10.82	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	105.347	dscf
CO2	4.74	% dv	Volume Dry Gas Metered (Vm(m^3))	3.125	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.983	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.01	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	985.6	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	1741.62	in. Hg
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Standard Temperature	68	F	H2O in the gas from test data (Bws)	0.1284	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1284	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.19	lb/lb-mole
Meter Temperature (Tm)	85.3	F	Wet Gas Molecular Weight (Ms)	27.75	lb/lb-mole
Stack Temperature (Tsavg)	526.0	F	Gas Velocity (Vs)	8.47	ft/s
Orifice Pressure Drop (dHavg)	2.963	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.1066	in. H_2O^1/2	Area Stack (As)	68.417	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	34,774	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	18,059	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	15,740	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	985	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	511	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	446	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

HF

MW		20.01	lb/lb-mole
Concentration	<	0.05	ppm_{wv}
Concentration	<	0.06	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Concentration	<	0.05	mg/dscm
Emission	<	0.003	lb/hr

HCN

MW		27.03	lb/lb-mole
Concentration	<	0.41	ppm_{wv}
Concentration	<	0.47	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Concentration	<	0.56	mg/dscm
Emission	<	0.027	lb/hr

ArcelorMittal Monessen **Run 2** **F or C?**
Combustion Stack 2 **F=1,C=0 1**

Point	Pitot DP (dP) (in. H2O)	SQRT dP (in. H2O)$^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.010	0.100	2.6	508	80	78
A-1	0.010	0.100	2.6	522	81	79
A-2	0.010	0.100	2.6	528	83	79
A-2	0.010	0.100	2.6	527	84	79
A-3	0.011	0.105	2.9	520	85	79
A-3	0.011	0.105	2.9	529	86	80
A-4	0.010	0.100	2.6	513	86	80
A-4	0.010	0.100	2.6	432	86	80
A-5	0.010	0.100	2.6	294	86	80
A-5	0.010	0.100	2.6	304	85	80
B-1	0.010	0.100	2.6	544	84	81
B-1	0.010	0.100	2.6	505	85	81
B-2	0.010	0.100	2.6	541	86	82
B-2	0.010	0.100	2.6	546	87	82
B-3	0.010	0.100	2.6	548	88	82
B-3	0.011	0.105	2.9	553	89	83
B-4	0.010	0.100	2.6	555	90	83
B-4	0.010	0.100	2.6	558	90	84
B-5	0.011	0.105	2.9	528	91	84
B-5	0.010	0.100	2.6	537	92	85
C-1	0.013	0.114	3.0	555	90	86
C-1	0.013	0.114	3.4	562	92	86
C-2	0.014	0.118	3.6	527	90	85
C-2	0.014	0.118	3.6	540	90	85
C-3	0.014	0.118	3.6	544	88	84
C-3	0.015	0.122	3.9	547	87	84
C-4	0.014	0.118	3.6	550	87	84
C-4	0.014	0.118	3.6	554	88	85
C-5	0.015	0.122	3.9	555	89	85
C-5	0.015	0.122	3.9	535	89	85
D-1	0.012	0.110	3.1	549	87	85
D-1	0.012	0.110	3.1	556	88	85
D-2	0.011	0.105	2.9	558	90	86
D-2	0.011	0.105	2.9	535	90	86
D-3	0.012	0.110	3.1	540	91	86
D-3	0.012	0.110	3.1	544	90	85
D-4	0.011	0.105	2.9	543	89	85
D-4	0.011	0.105	2.9	550	88	84
D-5	0.010	0.100	2.6	550	88	84
D-5	0.010	0.100	2.6	552	88	84
Average	0.01	0.107	2.96	526.0		85.3

Initial volume	948.600	ft^3	Initial volume	0.000	liters
Final volume	1058.975	ft^3	Final volume	0.000	liters
Total metered	110.375	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	965.7	875.3	90.4			0.0
2	888.9	888.2	0.7			0.0
3	640.6	593.9	46.7			0.0
4	736.9	723.6	13.3			0.0
5	716.5	710.7	5.8			0.0
6	803.9	631.7	172.2			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4752.5	4423.4	329.1	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal Monessen		Test Date:	October 19, 2016	
Project No.:	16-167		Test Location:	Combustion Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Combustion Stack 2		Test Start Time:	2:02 PM	
Unit Operation:	Normal		Test Finish Time:	3:02 PM	
Blue is data input.	Red is a calculation.	Pink is a reference to a cell on another sheet.		Green is a reference to a cell on this sheet.	

Data Input

Control Box:	1774	
Meter $DH_{@}$ (0.75 scfm)	1.977	in. H_2O
Meter Calibration Factor (Yd)	1.006	
Barometric Pressure (Pbar)	29.11	in. Hg
Stack Static Pressure (Pg)	-1.30	in. H_2O
Stack Diameter (Ds) (L if rectangular)	112	inches
Stack Width (enter NA if circular)	0	inches
O2	10.53	% dv
CO2	5.00	% dv
Product Rate (enter NA if not needed)	NA	ton/hr
Is the input ton/hr metric? (YES=1)	0	
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Flow, Moisture, CEMS	
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu
Standard Temperature	68	F
Standard Pressure	760	mm Hg
Pitot Tube Constant (Kp)	85.49	

Calculations

Meter Temperature (Tm)	82.4	F
Stack Temperature (Tsavg)	546.3	F
Orifice Pressure Drop (dHavg)	2.875	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.1047	in. H_2O^1/2
F_d @ Standard Conditions	NA	dscf/MMBtu
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu
Heat Input Based on F_d	NA	MMBtu/hr
K1method 4	0.04706	scf/ml
K2method 4	0.04715	scf/g
K1method 5	17.64	R/in. Hg
K4method 5	0.0945	
Standard lb-mole volume	385.3	ft^3/lb-mole

Calculations

CO + N2	84.48	% dv
Water Collected $(V_f - V_i)$	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected $(W_f - W_i)$	394.9	g
Water Vapor in Silica Gel (Vwsg(std))	18.620	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	18.620	scf
Volume Dry Gas Metered (Vm)	113.113	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	108.516	dscf
Volume Dry Gas Metered $(Vm(m^3))$	3.203	dacm
Vol. Dry Gas Metered Stand.$(Vm(std)m^3)$	3.073	dscm
Stack Absolute Pressure (Ps)	29.01	in. Hg
Stack Absolute Temperature (Tsavg)	1005.9	R
H2O Vapor Pressure @ avg Stack Temp.	2064.67	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1465	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1465	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.22	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.58	lb/lb-mole
Gas Velocity (Vs)	8.43	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	68.417	ft^2
Actual Gas Flowrate	34,617	acfm
Standard Gas Flowrate	17,615	scfm
Dry Standard Gas Flowrate	15,035	dscfm
Actual Gas Flowrate	980	acm/min
Standard Gas Flowrate	499	scm/min
Dry Standard Gas Flowrate	426	dscm/min

HF

MW		20.01	lb/lb-mole
Concentration	<	0.05	ppm_{wv}
Concentration	<	0.06	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Concentration	<	0.06	mg/dscm
Emission	<	0.002	lb/hr

HCN

MW		27.03	lb/lb-mole
Concentration	<	0.41	ppm_{wv}
Concentration	<	0.48	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Concentration	<	0.57	mg/dscm
Emission	<	0.026	lb/hr

ArcelorMittal Monessen **Run 3** **F or C?**
Combustion Stack 2 **F=1,C=0** 1

Point	Pitot DP (dP) (in. H2O)	SQRT dP $(in. H2O)^{1/2}$	Orifice DP (dH) (in. H2O)	Stack Temp (F)	Meter Temp In/Out (F or C)	(F or C)
A-1	0.012	0.110	3.1	502	83	82
A-1	0.014	0.118	3.6	540	84	82
A-2	0.011	0.105	2.9	544	84	81
A-2	0.012	0.110	3.1	549	85	81
A-3	0.012	0.110	3.1	552	85	81
A-3	0.012	0.110	3.1	557	85	81
A-4	0.011	0.105	2.9	559	86	81
A-4	0.011	0.105	2.9	528	87	8
A-5	0.012	0.110	3.1	544	88	82
A-5	0.012	0.110	3.1	548	89	85
B-1	0.014	0.118	3.6	561	85	82
B-1	0.012	0.110	3.1	522	85	82
B-2	0.012	0.110	3.1	540	85	82
B-2	0.013	0.114	3.4	543	85	82
B-3	0.015	0.122	3.9	547	85	82
B-3	0.015	0.122	3.9	550	86	82
B-4	0.014	0.118	3.6	553	85	82
B-4	0.014	0.118	3.6	554	85	82
B-5	0.012	0.110	3.1	537	86	82
B-5	0.012	0.110	3.1	544	87	82
C-1	0.010	0.100	2.6	557	84	81
C-1	0.010	0.100	2.6	563	83	81
C-2	0.010	0.100	2.6	538	84	81
C-2	0.010	0.100	2.6	544	84	81
C-3	0.010	0.100	2.6	543	85	82
C-3	0.010	0.100	2.6	551	86	81
C-4	0.010	0.100	2.6	540	86	81
C-4	0.005	0.071	1.3	555	86	81
C-5	0.005	0.071	1.3	556	85	81
C-5	0.010	0.100	2.6	535	86	81
D-1	0.010	0.100	2.6	549	83	81
D-1	0.010	0.100	2.6	556	83	80
D-2	0.010	0.100	2.6	556	84	80
D-2	0.010	0.100	2.6	561	85	81
D-3	0.010	0.100	2.6	538	85	81
D-3	0.011	0.105	2.9	541	85	80
D-4	0.010	0.100	2.6	546	85	81
D-4	0.010	0.100	2.6	550	86	81
D-5	0.010	0.100	2.6	546	86	81
D-5	0.010	0.100	2.6	551	87	81
Average	0.01	0.105	2.88	546.3		82.4

Initial volume	59.700	ft^3	Initial volume	0.000	liters
Final volume	172.813	ft^3	Final volume	0.000	liters
Total metered	113.113	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	834.2	693.8	140.4			0.0
2	807.5	680.5	127.0			0.0
3	620.8	599.4	21.4			0.0
4	737.3	725.7	11.6			0.0
5	731.2	727.0	4.2			0.0
6	796.7	706.4	90.3			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4527.7	4132.8	394.9	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - Vi)$

REPORT - APPENDIX C

Laboratory Data

Methods 5/29

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Your Project #: 106377/ 16-167

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/08
Report #: R4240209
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N1557
Received: 2016/10/24, 18:00

Sample Matrix: Stack Sampling Train
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Mercury 3C in HCl Rinse	4	2016/11/05	2016/11/08	BRL SOP-00104	EPA M29/M0060 m
Mercury 2B in HNO3/H2O2 Imp.	4	2016/11/01	2016/11/03	BRL SOP-00104	EPA M29/M0060 m
Mercury 3A in HNO3 Rinse	4	2016/10/31	2016/11/03	BRL SOP-00104	EPA M29/M0060 m
Mercury 3B in KMnO4/H2SO4 Imp.	4	2016/11/02	2016/11/04	BRL SOP-00104	EPA M29/M0060 m
Mercury 1B in Filter + Rinse (M29)	4	2016/11/04	2016/11/07	BRL SOP-00104	EPA 29 m
Metals B.H. in H2O2/HNO3 Imp.(6020A)	4	2016/11/01	2016/11/03	BRL SOP-00103 / BRL SOP-00102	EPA M29/CARB 436 m
Metals F.H. in Filter + Rinses (6020A)	4	2016/11/04	2016/11/07	BRL SOP-00103/ BRL SOP-00102	EPA M29/CARB 436 m
Particulates/Acetone Rinse (M5/315/M201)	4	2016/10/27	2016/11/01	BRL SOP-00109	EPA 5/315 m
Particulates/Filter (M5/315/NJATM1/M201)	4	N/A	2016/11/04	BRL SOP-00109	EPA 5/315/NJATM1 m
Final Volume of Acetone Probe Rinse	4	N/A	2016/11/01	BRL SOP-00109	

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods. Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: 106377/ 16-167

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
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USA 15238

Report Date: 2016/11/08
Report #: R4240209
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N1557
Received: 2016/10/24, 18:00

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
08 Nov 2016 18:26:39 -05:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905)817-5769

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

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Maxxam Job #: B6N1557
Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M29 METALS (FRONT & BACK SEPARATE)

Maxxam ID		DIC453			DIC454	DIC455	DIC456			
Sampling Date		2016/10/19			2016/10/19	2016/10/19	2016/10/19			
	UNITS	**M5/29 BL**	**RDL**	**MDL**	**M5/29 R1**	**M5/29 R2**	**M5/29 R3**	**RDL**	**MDL**	**QC Batch**
Metals										
Front Half Antimony (Sb)	ug	<0.80	0.80	0.080	<0.80	<0.80	<0.80	0.80	0.080	4733899
Front Half Arsenic (As)	ug	<0.80	0.80	0.080	3.28	3.01	5.56	0.80	0.080	4733899
Front Half Beryllium (Be)	ug	0.34	0.20	0.040	<0.20	<0.20	<0.20	0.20	0.040	4733899
Front Half Cadmium (Cd)	ug	<0.20	0.20	0.040	1.27	0.47	0.24	0.20	0.040	4733899
Front Half Chromium (Cr)	ug	2.20	0.60	0.10	5.58	8.14	7.61	0.60	0.10	4733899
Front Half Cobalt (Co)	ug	<0.20	0.20	0.020	0.23	0.28	<0.20	0.20	0.020	4733899
Front Half Lead (Pb)	ug	<0.40	0.40	0.040	3.74	4.14	3.98	0.40	0.040	4733899
Front Half Manganese (Mn)	ug	3.3	1.5	0.10	3.4	3.9	3.5	1.5	0.10	4733899
Front Half Nickel (Ni)	ug	5.5	1.0	0.20	7.6	8.9	9.6	1.0	0.20	4733899
Front Half Selenium (Se)	ug	<2.0	2.0	0.50	2.9	<2.0	3.1	2.0	0.50	4733899
Back Half Antimony (Sb)	ug	<0.20	0.20	0.040	<1.0	<1.0	<1.0	1.0	0.20	4728305
Back Half Arsenic (As)	ug	<0.20	0.20	0.040	<1.0	<1.0	<1.0	1.0	0.20	4728305
Back Half Beryllium (Be)	ug	<0.050	0.050	0.050	<0.25	<0.25	<0.25	0.25	0.25	4728305
Back Half Cadmium (Cd)	ug	<0.050	0.050	0.030	<0.25	<0.25	<0.25	0.25	0.15	4728305
Back Half Chromium (Cr)	ug	0.99	0.15	0.070	7.52	57.0	18.1	0.75	0.35	4728305
Back Half Cobalt (Co)	ug	1.14	0.050	0.010	0.46	5.54	2.24	0.25	0.050	4728305
Back Half Lead (Pb)	ug	0.37	0.10	0.040	22.2	1.37	0.98	0.50	0.20	4728305
Back Half Manganese (Mn)	ug	142	0.25	0.060	15.9	104	8.4	1.3	0.31	4728305
Back Half Nickel (Ni)	ug	0.68	0.25	0.060	9.0	35.0	9.3	1.3	0.31	4728305
Back Half Selenium (Se)	ug	<0.50	0.50	0.20	49.7	6.8	10.1	2.5	1.0	4728305

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N1557
Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M29 MERCURY (STACK SAMPLING TRAIN)

Maxxam ID		DIC453			DIC454			DIC455			
Sampling Date		2016/10/19			2016/10/19			2016/10/19			
	UNITS	M5/29 BL	RDL	MDL	M5/29 R1	RDL	MDL	M5/29 R2	RDL	MDL	QC Batch
Metals											
1B Mercury (Hg)	ug	<0.015	0.015	0.015	<0.015	0.015	0.015	<0.015	0.015	0.015	4733819
2B Mercury (Hg)	ug	<0.15	0.15	0.03	2.49	0.34	0.068	3.37	0.35	0.07	4727388
3A Mercury (Hg)	ug	<0.005	0.005	0.005	<0.0046	0.0046	0.0046	0.162	0.0059	0.0059	4725870
3B Mercury (Hg)	ug	<0.02	0.02	0.004	0.368	0.023	0.0046	4.91	0.023	0.0046	4729864
3C Mercury (Hg)	ug	<0.013	0.013	0.0026	4.98	0.063	0.013	0.180	0.013	0.0026	4735445

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DIC456			
Sampling Date		2016/10/19			
	UNITS	M5/29 R3	RDL	MDL	QC Batch
Metals					
1B Mercury (Hg)	ug	0.019	0.015	0.015	4733819
2B Mercury (Hg)	ug	3.23	0.33	0.066	4727388
3A Mercury (Hg)	ug	0.116	0.0058	0.0058	4725870
3B Mercury (Hg)	ug	0.051	0.023	0.0046	4729864
3C Mercury (Hg)	ug	3.66	0.025	0.005	4735445

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Report Date: 2016/11/08

Montrose Air Quality Services, LLC
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EPA M5 PARTICULATE MATTER (PM)

Maxxam ID		DIC453	DIC454	DIC455	DIC456			
Sampling Date		2016/10/19	2016/10/19	2016/10/19	2016/10/19			
	UNITS	**M5/29 BL**	**M5/29 R1**	**M5/29 R2**	**M5/29 R3**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse Particulate Weight in Acetone Rinse	mg	<0.5	47.1	23.7	52.9	0.5	0.1	4721401
Front Half Particulate Weight on Filter	mg	1.90	8.70	5.10	4.10	0.30	0.060	4727886
Acetone Rinse Volume	ml	98	110	46	91	1	1	4721402

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N1557
Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DIC453
Sample ID: M5/29 BL
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4735445	2016/11/05	2016/11/08	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4727388	2016/11/01	2016/11/03	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4725870	2016/10/31	2016/11/03	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4729864	2016/11/02	2016/11/04	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4733819	2016/11/04	2016/11/07	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4728305	2016/11/01	2016/11/03	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4733899	2016/11/04	2016/11/07	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4721401	2016/10/27	2016/11/01	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4727886	N/A	2016/11/04	Brenda Moore
Final Volume of Acetone Probe Rinse		4721402	N/A	2016/11/01	Farag Farag

Maxxam ID: DIC454
Sample ID: M5/29 R1
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4735445	2016/11/05	2016/11/08	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4727388	2016/11/01	2016/11/03	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4725870	2016/10/31	2016/11/03	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4729864	2016/11/02	2016/11/04	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4733819	2016/11/04	2016/11/07	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4728305	2016/11/01	2016/11/03	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4733899	2016/11/04	2016/11/07	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4721401	2016/10/27	2016/11/01	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4727886	N/A	2016/11/04	Brenda Moore
Final Volume of Acetone Probe Rinse		4721402	N/A	2016/11/01	Farag Farag

Maxxam ID: DIC454 Dup
Sample ID: M5/29 R1
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4735445	2016/11/05	2016/11/08	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4728305	2016/11/01	2016/11/03	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4733899	2016/11/04	2016/11/07	Nan Raykha

Maxxam ID: DIC455
Sample ID: M5/29 R2
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4735445	2016/11/05	2016/11/08	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4727388	2016/11/01	2016/11/03	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4725870	2016/10/31	2016/11/03	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4729864	2016/11/02	2016/11/04	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4733819	2016/11/04	2016/11/07	Ron Morrison

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Maxxam Job #: B6N1557
Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DIC455
Sample ID: M5/29 R2
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4728305	2016/11/01	2016/11/03	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4733899	2016/11/04	2016/11/07	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4721401	2016/10/27	2016/11/01	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4727886	N/A	2016/11/04	Brenda Moore
Final Volume of Acetone Probe Rinse		4721402	N/A	2016/11/01	Farag Farag

Maxxam ID: DIC455 Dup
Sample ID: M5/29 R2
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4727388	2016/11/01	2016/11/03	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4725870	2016/10/31	2016/11/03	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4733819	2016/11/07	2016/11/07	Ron Morrison

Maxxam ID: DIC456
Sample ID: M5/29 R3
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4735445	2016/11/05	2016/11/08	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4727388	2016/11/01	2016/11/03	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4725870	2016/10/31	2016/11/03	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4729864	2016/11/02	2016/11/04	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4733819	2016/11/04	2016/11/07	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4728305	2016/11/01	2016/11/03	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4733899	2016/11/04	2016/11/07	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4721401	2016/10/27	2016/11/01	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4727886	N/A	2016/11/04	Brenda Moore
Final Volume of Acetone Probe Rinse		4721402	N/A	2016/11/01	Farag Farag

Maxxam ID: DIC456 Dup
Sample ID: M5/29 R3
Matrix: Stack Sampling Train

Collected: 2016/10/19
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4729864	2016/11/02	2016/11/04	Ron Morrison

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Client Project #: 106377/ 16-167

GENERAL COMMENTS

Sample DIC453 [M5/29 BL] : WS 4728305:
Mn data for this sample was confirmed by analyzing the Hg fraction (144 ug)

EPA M29 METALS (FRONT & BACK SEPARATE)

Metals F.H. in Filter + Rinses (6020A): Post digestion duplicate and spike were done on sample DIC454.
Metals B.H. in H2O2/HNO3 Imp.(6020A): Extra 5x dilution was required for all samples except DIC453, due to the matrix (high Sulphur content)
Post digestion duplicate and spike were done on sample DIC454.
The closing CCV recovered 112% for Be, data for Be may be slightly biased high.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
4721401	FF	Method Blank	Acetone Rinse Particulate Weight in Acetone	2016/11/01	<0.5		mg	
4725870	RON	Matrix Spike(DIC455)	3A Mercury (Hg)	2016/11/03		93	%	85 - 115
4725870	RON	MS/MSD RPD	3A Mercury (Hg)	2016/11/03	1.8		%	20
4725870	RON	Spiked Blank	3A Mercury (Hg)	2016/11/03		97	%	90 - 110
4725870	RON	RPD	3A Mercury (Hg)	2016/11/03	0.52		%	20
4725870	RON	Method Blank	3A Mercury (Hg)	2016/11/03	<0.005		ug	
4725870	RON	RPD - Sample/Sample Dup	3A Mercury (Hg)	2016/11/03	4.0		%	20
4727388	RON	Matrix Spike(DIC455)	2B Mercury (Hg)	2016/11/03		96	%	85 - 115
4727388	RON	MS/MSD RPD	2B Mercury (Hg)	2016/11/03	1.6		%	20
4727388	RON	Spiked Blank	2B Mercury (Hg)	2016/11/03		96	%	90 - 110
4727388	RON	RPD	2B Mercury (Hg)	2016/11/03	0.52		%	20
4727388	RON	Method Blank	2B Mercury (Hg)	2016/11/03	<0.015		ug	
4727388	RON	RPD - Sample/Sample Dup	2B Mercury (Hg)	2016/11/03	1.5		%	20
4728305	N_R	Matrix Spike(DIC454)	Back Half Antimony (Sb)	2016/11/03		101	%	70 - 130
			Back Half Arsenic (As)	2016/11/03		98	%	70 - 130
			Back Half Beryllium (Be)	2016/11/03		105	%	70 - 130
			Back Half Cadmium (Cd)	2016/11/03		102	%	70 - 130
			Back Half Chromium (Cr)	2016/11/03		99	%	70 - 130
			Back Half Cobalt (Co)	2016/11/03		99	%	70 - 130
			Back Half Lead (Pb)	2016/11/03		102	%	70 - 130
			Back Half Manganese (Mn)	2016/11/03		99	%	70 - 130
			Back Half Nickel (Ni)	2016/11/03		96	%	70 - 130
			Back Half Selenium (Se)	2016/11/03		102	%	70 - 130
4728305	N_R	MS/MSD RPD	Back Half Antimony (Sb)	2016/11/03	3.0		%	20
			Back Half Arsenic (As)	2016/11/03	2.1		%	20
			Back Half Beryllium (Be)	2016/11/03	1.9		%	20
			Back Half Cadmium (Cd)	2016/11/03	0		%	20
			Back Half Chromium (Cr)	2016/11/03	2.0		%	20
			Back Half Cobalt (Co)	2016/11/03	1.0		%	20
			Back Half Lead (Pb)	2016/11/03	0.99		%	20
			Back Half Manganese (Mn)	2016/11/03	2.0		%	20
			Back Half Nickel (Ni)	2016/11/03	3.1		%	20
			Back Half Selenium (Se)	2016/11/03	3.0		%	20
4728305	N_R	Spiked Blank	Back Half Antimony (Sb)	2016/11/03		102	%	85 - 115
			Back Half Arsenic (As)	2016/11/03		97	%	85 - 115
			Back Half Beryllium (Be)	2016/11/03		103	%	85 - 115
			Back Half Cadmium (Cd)	2016/11/03		103	%	85 - 115
			Back Half Chromium (Cr)	2016/11/03		102	%	85 - 115
			Back Half Cobalt (Co)	2016/11/03		103	%	85 - 115
			Back Half Lead (Pb)	2016/11/03		104	%	85 - 115
			Back Half Manganese (Mn)	2016/11/03		103	%	85 - 115
			Back Half Nickel (Ni)	2016/11/03		100	%	85 - 115
			Back Half Selenium (Se)	2016/11/03		98	%	85 - 115
4728305	N_R	RPD	Back Half Antimony (Sb)	2016/11/03	3.5		%	20
			Back Half Arsenic (As)	2016/11/03	5.1		%	20
			Back Half Beryllium (Be)	2016/11/03	2.9		%	20
			Back Half Cadmium (Cd)	2016/11/03	3.7		%	20
			Back Half Chromium (Cr)	2016/11/03	3.6		%	20
			Back Half Cobalt (Co)	2016/11/03	2.6		%	20
			Back Half Lead (Pb)	2016/11/03	2.3		%	20
			Back Half Manganese (Mn)	2016/11/03	0.060		%	20
			Back Half Nickel (Ni)	2016/11/03	3.8		%	20
			Back Half Selenium (Se)	2016/11/03	2.2		%	20
4728305	N_R	Method Blank	Back Half Antimony (Sb)	2016/11/03	<0.20		ug	

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Maxxam Job #: B6N1557
Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Back Half Arsenic (As)	2016/11/03	<0.20		ug	
			Back Half Beryllium (Be)	2016/11/03	<0.050		ug	
			Back Half Cadmium (Cd)	2016/11/03	<0.050		ug	
			Back Half Chromium (Cr)	2016/11/03	<0.15		ug	
			Back Half Cobalt (Co)	2016/11/03	<0.050		ug	
			Back Half Lead (Pb)	2016/11/03	<0.10		ug	
			Back Half Manganese (Mn)	2016/11/03	<0.25		ug	
			Back Half Nickel (Ni)	2016/11/03	<0.25		ug	
			Back Half Selenium (Se)	2016/11/03	<0.50		ug	
4728305	N_R	RPD - Sample/Sample Dup	Back Half Antimony (Sb)	2016/11/03	NC		%	20
			Back Half Arsenic (As)	2016/11/03	NC		%	20
			Back Half Beryllium (Be)	2016/11/03	NC		%	20
			Back Half Cadmium (Cd)	2016/11/03	NC		%	20
			Back Half Chromium (Cr)	2016/11/03	9.8		%	20
			Back Half Cobalt (Co)	2016/11/03	NC		%	20
			Back Half Lead (Pb)	2016/11/03	5.9		%	20
			Back Half Manganese (Mn)	2016/11/03	6.2		%	20
			Back Half Nickel (Ni)	2016/11/03	9.0		%	20
			Back Half Selenium (Se)	2016/11/03	1.3		%	20
4729864	RON	Reagent Blank	3B Mercury (Hg)	2016/11/04	<0.013		ug	
4729864	RON	Matrix Spike(DIC456)	3B Mercury (Hg)	2016/11/04		98	%	85 - 115
4729864	RON	MS/MSD RPD	3B Mercury (Hg)	2016/11/04	0.20		%	20
4729864	RON	Spiked Blank	3B Mercury (Hg)	2016/11/04		97	%	90 - 110
4729864	RON	RPD	3B Mercury (Hg)	2016/11/04	0.21		%	20
4729864	RON	Method Blank	3B Mercury (Hg)	2016/11/04	<0.013		ug	
4729864	RON	RPD - Sample/Sample Dup	3B Mercury (Hg)	2016/11/04	NC		%	20
4733819	RON	Reagent Blank	1B Mercury (Hg)	2016/11/07	<0.015		ug	
4733819	RON	Matrix Spike(DIC455)	1B Mercury (Hg)	2016/11/07		99	%	85 - 115
4733819	RON	MS/MSD RPD	1B Mercury (Hg)	2016/11/07	4.8		%	20
4733819	RON	Spiked Blank	1B Mercury (Hg)	2016/11/07		101	%	90 - 110
4733819	RON	RPD	1B Mercury (Hg)	2016/11/07	0.20		%	20
4733819	RON	Method Blank	1B Mercury (Hg)	2016/11/07	<0.015		ug	
4733819	RON	RPD - Sample/Sample Dup	1B Mercury (Hg)	2016/11/07	NC		%	20
4733899	N_R	Matrix Spike(DIC454)	Front Half Antimony (Sb)	2016/11/07		102	%	70 - 130
			Front Half Arsenic (As)	2016/11/07		95	%	70 - 130
			Front Half Beryllium (Be)	2016/11/07		97	%	70 - 130
			Front Half Cadmium (Cd)	2016/11/07		101	%	70 - 130
			Front Half Chromium (Cr)	2016/11/07		95	%	70 - 130
			Front Half Cobalt (Co)	2016/11/07		99	%	70 - 130
			Front Half Lead (Pb)	2016/11/07		105	%	70 - 130
			Front Half Manganese (Mn)	2016/11/07		95	%	70 - 130
			Front Half Nickel (Ni)	2016/11/07		98	%	70 - 130
			Front Half Selenium (Se)	2016/11/07		97	%	70 - 130
4733899	N_R	MS/MSD RPD	Front Half Antimony (Sb)	2016/11/07	0.98		%	20
			Front Half Arsenic (As)	2016/11/07	0		%	20
			Front Half Beryllium (Be)	2016/11/07	1.0		%	20
			Front Half Cadmium (Cd)	2016/11/07	1.0		%	20
			Front Half Chromium (Cr)	2016/11/07	3.1		%	20
			Front Half Cobalt (Co)	2016/11/07	0		%	20
			Front Half Lead (Pb)	2016/11/07	0.96		%	20
			Front Half Manganese (Mn)	2016/11/07	4.1		%	20
			Front Half Nickel (Ni)	2016/11/07	1.0		%	20
			Front Half Selenium (Se)	2016/11/07	1.0		%	20
4733899	N_R	Spiked Blank	Front Half Antimony (Sb)	2016/11/07		103	%	85 - 115

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Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Front Half Arsenic (As)	2016/11/07		99	%	85 - 115
			Front Half Beryllium (Be)	2016/11/07		102	%	85 - 115
			Front Half Cadmium (Cd)	2016/11/07		103	%	85 - 115
			Front Half Chromium (Cr)	2016/11/07		102	%	85 - 115
			Front Half Cobalt (Co)	2016/11/07		100	%	85 - 115
			Front Half Lead (Pb)	2016/11/07		102	%	85 - 115
			Front Half Manganese (Mn)	2016/11/07		99	%	85 - 115
			Front Half Nickel (Ni)	2016/11/07		102	%	85 - 115
			Front Half Selenium (Se)	2016/11/07		97	%	85 - 115
4733899	N_R	RPD	Front Half Antimony (Sb)	2016/11/07	0.55		%	20
			Front Half Arsenic (As)	2016/11/07	1.4		%	20
			Front Half Beryllium (Be)	2016/11/07	2.0		%	20
			Front Half Cadmium (Cd)	2016/11/07	0.83		%	20
			Front Half Chromium (Cr)	2016/11/07	1.9		%	20
			Front Half Cobalt (Co)	2016/11/07	1.1		%	20
			Front Half Lead (Pb)	2016/11/07	3.5		%	20
			Front Half Manganese (Mn)	2016/11/07	3.0		%	20
			Front Half Nickel (Ni)	2016/11/07	0.38		%	20
			Front Half Selenium (Se)	2016/11/07	0.72		%	20
4733899	N_R	Method Blank	Front Half Antimony (Sb)	2016/11/07	<0.80		ug	
			Front Half Arsenic (As)	2016/11/07	<0.80		ug	
			Front Half Beryllium (Be)	2016/11/07	<0.20		ug	
			Front Half Cadmium (Cd)	2016/11/07	<0.20		ug	
			Front Half Chromium (Cr)	2016/11/07	<0.60		ug	
			Front Half Cobalt (Co)	2016/11/07	<0.20		ug	
			Front Half Lead (Pb)	2016/11/07	<0.40		ug	
			Front Half Manganese (Mn)	2016/11/07	<1.5		ug	
			Front Half Nickel (Ni)	2016/11/07	<1.0		ug	
			Front Half Selenium (Se)	2016/11/07	<2.0		ug	
4733899	N_R	RPD - Sample/Sample Dup	Front Half Antimony (Sb)	2016/11/07	NC		%	20
			Front Half Arsenic (As)	2016/11/07	NC		%	20
			Front Half Beryllium (Be)	2016/11/07	NC		%	20
			Front Half Cadmium (Cd)	2016/11/07	0		%	20
			Front Half Chromium (Cr)	2016/11/07	1.1		%	20
			Front Half Cobalt (Co)	2016/11/07	NC		%	20
			Front Half Lead (Pb)	2016/11/07	1.6		%	20
			Front Half Manganese (Mn)	2016/11/07	NC		%	20
			Front Half Nickel (Ni)	2016/11/07	2.1		%	20
			Front Half Selenium (Se)	2016/11/07	NC		%	20
4735445	RON	Reagent Blank	3C Mercury (Hg)	2016/11/08	<0.013		ug	
4735445	RON	Matrix Spike(DIC454)	3C Mercury (Hg)	2016/11/08		99 (1)	%	85 - 115
4735445	RON	MS/MSD RPD	3C Mercury (Hg)	2016/11/08	2.9 (1)		%	20
4735445	RON	Spiked Blank	3C Mercury (Hg)	2016/11/08		101	%	90 - 110
4735445	RON	RPD	3C Mercury (Hg)	2016/11/08	0.20		%	20
4735445	RON	Method Blank	3C Mercury (Hg)	2016/11/08	<0.013		ug	

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Report Date: 2016/11/08

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
4735445	RON	RPD - Sample/Sample Dup	3C Mercury (Hg)	2016/11/08	1.7		%	20

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Reagent Blank: A blank matrix containing all reagents used in the analytical procedure. Used to determine any analytical contamination.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Samples were diluted and therefore postspiked

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Client Project #: 106377/ 16-167

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Brenda Moore

Brenda Moore, Team Lead

Frank Mo, B.Sc., Inorganic Lab. Manager

Ralph Siebert, Operations Manager - Inorganic Analyses

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Page 2 of 2

CLIENT INFORMATION

Company Name: ArcelorMittal
Project Manager: William Cowell
e-mail: wcowell@montrose-esi.com
Address: 1050 William Pitt Way, Pittsburgh, PA 15238

SECTION

Phone: 412 826 3636 Fax:
Sampled by: John Wilson

ANALYSIS REQUESTED

Field Sample ID	Total Volume Sampled	Flow Rate	Collection Date	Sample Collection Time	M23/0010 (Acrolein & metals)	M316 (Aldehydes & Organics)	M5/29 (Metals & metals)
Combustion Stack M23/0010 Run 1	~140+	150	10/17/16		✓		
" " " Run 2	↓	↓	↓		✓		
" " " Run 3	↓	↓	10/18/16		✓		
" " M316 TSO Run 1	~71+	150	10/17/16			✓	
" " " Run 2	↓	↓	↓			✓	
" " " Run 3	↓	↓	10/18/16			✓	
" " " Solvent Blanks	Grab	Grab	10/17/16			✓	
" " M5/29 Run 1	~105+	150	10/19/16				✓
" " " Run 2	↓	↓	↓				✓
" " " Run 3	↓	↓	↓				✓
" " " Solvent Blanks	Grab	Grab	↓				✓

TAT Requirement

STD 10 Business day ☑
Rush 5 Business day * ☐
Rush 2 Business day * ☐
* need approval from Maxxam

PROJECT INFORMATION

Project # 106377 (16-167)
Name: John Wilson
PO #: N/A
Maxxam Quote #:
Maxxam Contact: Clayton Johnson

REPORTING REQUIREMENTS

Summary Report only ☐
EDD ☐
Regulation

Notes

PROJECT SPECIFIC COMMENTS

Client Signature
Affiliation: Montrose
Date/Time: 10/24/16

Received by
Affiliation
Date/Time: 10-24-16

TEJASH PATEL 2016/10/24 18:00

COC-1031 (04.13) - All

Methods 0010/23

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Your Project #: 106377/ 16-167

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/26
Report #: R4263198
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N1570
Received: 2016/10/24, 18:00

Sample Matrix: Stack Sampling Train
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
SVOCs in MM5 SamplingTrain (EPA0010)	3	2016/10/31	2016/11/17	BRL SOP-00200	EPA 8270D/M0010 m
2,3,7,8-TCDF Confirmation (M23)	2	N/A	2016/11/16	BRL SOP-00404	EPA M23/23A m
2,3,7,8-TCDF Confirmation (M23)	1	N/A	2016/11/24	BRL SOP-00404	EPA M23/23A m
Dioxins/Furans in Air (Method 23)	2	2016/10/31	2016/11/16	BRL SOP-00404	EPA M23/23A m
Dioxins/Furans in Air (Method 23)	1	2016/10/31	2016/11/20	BRL SOP-00404	EPA M23/23A m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods. Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: 106377/ 16-167

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/26
Report #: R4263198
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N1570
Received: 2016/10/24, 18:00

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
28 Nov 2016 08:33:27

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905)817-5769
==========
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Maxxam Job #: B6N1570
Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DIC548							
Sampling Date		2016/10/17				TOXIC EQUIVALENCY		# of	
	UNITS	M23-R1	EDL	RDL	MDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Dioxins & Furans									
2,3,7,8-Tetra CDD *	pg	30.1 (1)	3.5	30	6.0	1.00	30.1		4748165
1,2,3,7,8-Penta CDD *	pg	34.2	3.3	30	6.0	1.00	34.2		4748165
1,2,3,4,7,8-Hexa CDD *	pg	24.5	3.3	30	6.0	0.100	2.45		4748165
1,2,3,6,7,8-Hexa CDD *	pg	56.9	3.3	30	6.0	0.100	5.69		4748165
1,2,3,7,8,9-Hexa CDD *	pg	30.0	3.0	30	6.0	0.100	3.00		4748165
1,2,3,4,6,7,8-Hepta CDD *	pg	174	3.3	30	9.0	0.0100	1.74		4748165
Total Tetra CDD *	pg	530	3.5	30	N/A			10	4748165
Total Penta CDD *	pg	862	3.3	30	N/A			10	4748165
Total Hexa CDD *	pg	1550	3.2	30	N/A			8	4748165
Total Hepta CDD *	pg	348	3.3	30	N/A			2	4748165
2,3,7,8-Tetra CDF **	pg	342	3.4	30	6.0	0.100	34.2		4748165
1,2,3,7,8-Penta CDF **	pg	81.6	3.4	30	6.0	0.0300	2.45		4748165
2,3,4,7,8-Penta CDF **	pg	94.7	3.4	30	6.0	0.300	28.4		4748165
1,2,3,4,7,8-Hexa CDF **	pg	73.4	3.3	30	6.0	0.100	7.34		4748165
1,2,3,6,7,8-Hexa CDF **	pg	64.4	3.2	30	6.0	0.100	6.44		4748165
2,3,4,6,7,8-Hexa CDF **	pg	65.9	3.5	30	6.0	0.100	6.59		4748165
1,2,3,7,8,9-Hexa CDF **	pg	4.8	3.6	30	6.0	0.100	0.480		4748165
1,2,3,4,6,7,8-Hepta CDF **	pg	153	3.1	30	9.0	0.0100	1.53		4748165
1,2,3,4,7,8,9-Hepta CDF **	pg	18.8	3.6	30	6.0	0.0100	0.188		4748165
Total Tetra CDF **	pg	1750	3.4	30	N/A			13	4748165
Total Penta CDF **	pg	891	3.4	30	N/A			13	4748165
Total Hexa CDF **	pg	578	3.4	30	N/A			15	4748165
Total Hepta CDF **	pg	220	3.3	30	N/A			4	4748165
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	248	3.6	30	N/A	0.100	24.8		4750482
TOTAL TOXIC EQUIVALENCY	pg						155		
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	112							4750482

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

N/A = Not Applicable

** CDF = Chloro Dibenzo-p-Furan

(1) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical

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Maxxam Job #: B6N1570
Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DIC548							
Sampling Date		2016/10/17				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23-R1**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
C13-1234678 HeptaCDD *	%	90							4748165
C13-1234678 HeptaCDF **	%	69							4748165
C13-123478 HexaCDD *	%	121							4748165
C13-123478 HexaCDF **	%	108							4748165
C13-1234789 HeptaCDF **	%	103							4748165
C13-123678 HexaCDD *	%	85							4748165
C13-123678 HexaCDF **	%	78							4748165
C13-12378 PentaCDD *	%	119							4748165
C13-12378 PentaCDF **	%	93							4748165
C13-123789 HexaCDF **	%	67							4748165
C13-23478 PentaCDF **	%	84							4748165
C13-2378 TetraCDD *	%	103							4748165
C13-2378 TetraCDF **	%	97							4748165
C13-Octachlorodibenzo-p-Dioxin	%	73							4748165
Cl37-2378 TetraCDD *	%	99							4748165

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

** CDF = Chloro Dibenzo-p-Furan

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Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DIC553							
Sampling Date		2016/10/17				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23-R2**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Dioxins & Furans									
2,3,7,8-Tetra CDD *	pg	44.3 (1)	4.5	30	6.0	1.00	44.3		4748165
1,2,3,7,8-Penta CDD *	pg	32.6 (1)	3.2	30	6.0	1.00	32.6		4748165
1,2,3,4,7,8-Hexa CDD *	pg	23.9	3.4	30	6.0	0.100	2.39		4748165
1,2,3,6,7,8-Hexa CDD *	pg	56.1	3.5	30	6.0	0.100	5.61		4748165
1,2,3,7,8,9-Hexa CDD *	pg	35.7	3.2	30	6.0	0.100	3.57		4748165
1,2,3,4,6,7,8-Hepta CDD *	pg	171	3.0	30	9.0	0.0100	1.71		4748165
Total Tetra CDD *	pg	977	4.5	30	N/A			11	4748165
Total Penta CDD *	pg	1490	3.2	30	N/A			7	4748165
Total Hexa CDD *	pg	1470	3.4	30	N/A			8	4748165
Total Hepta CDD *	pg	342	3.0	30	N/A			2	4748165
2,3,7,8-Tetra CDF **	pg	521	5.9	30	6.0	0.100	52.1		4748165
1,2,3,7,8-Penta CDF **	pg	89.8	5.8	30	6.0	0.0300	2.69		4748165
2,3,4,7,8-Penta CDF **	pg	135	5.8	30	6.0	0.300	40.5		4748165
1,2,3,4,7,8-Hexa CDF **	pg	68.8	3.0	30	6.0	0.100	6.88		4748165
1,2,3,6,7,8-Hexa CDF **	pg	68.2	2.9	30	6.0	0.100	6.82		4748165
2,3,4,6,7,8-Hexa CDF **	pg	76.3	3.2	30	6.0	0.100	7.63		4748165
1,2,3,7,8,9-Hexa CDF **	pg	6.1	3.3	30	6.0	0.100	0.610		4748165
1,2,3,4,6,7,8-Hepta CDF **	pg	141	2.9	30	9.0	0.0100	1.41		4748165
1,2,3,4,7,8,9-Hepta CDF **	pg	15.5	3.4	30	6.0	0.0100	0.155		4748165
Total Tetra CDF **	pg	2950	5.9	30	N/A			14	4748165
Total Penta CDF **	pg	1510	5.8	30	N/A			13	4748165
Total Hexa CDF **	pg	566	3.1	30	N/A			13	4748165
Total Hepta CDF **	pg	197	3.1	30	N/A			4	4748165
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	316	4.4	30	N/A	0.100	31.6		4763229
TOTAL TOXIC EQUIVALENCY	pg						188		
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	50							4763229

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

N/A = Not Applicable

** CDF = Chloro Dibenzo-p-Furan

(1) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical

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Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DIC553							
Sampling Date		2016/10/17				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23-R2**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
C13-1234678 HeptaCDD *	%	43							4748165
C13-1234678 HeptaCDF **	%	37							4748165
C13-123478 HexaCDD *	%	108							4748165
C13-123478 HexaCDF **	%	107							4748165
C13-1234789 HeptaCDF **	%	91							4748165
C13-123678 HexaCDD *	%	45							4748165
C13-123678 HexaCDF **	%	40							4748165
C13-12378 PentaCDD *	%	52							4748165
C13-12378 PentaCDF **	%	45							4748165
C13-123789 HexaCDF **	%	75							4748165
C13-23478 PentaCDF **	%	101							4748165
C13-2378 TetraCDD *	%	47							4748165
C13-2378 TetraCDF **	%	48							4748165
C13-Octachlorodibenzo-p-Dioxin	%	32							4748165
Cl37-2378 TetraCDD *	%	103							4748165

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

** CDF = Chloro Dibenzo-p-Furan

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EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DIC560							
Sampling Date		2016/10/18				TOXIC EQUIVALENCY		# of	
	UNITS	M23-R3	EDL	RDL	MDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
Dioxins & Furans									
2,3,7,8-Tetra CDD *	pg	<3.5	3.5	30	6.0	1.00	3.50		4748165
1,2,3,7,8-Penta CDD *	pg	<3.5	3.5	30	6.0	1.00	3.50		4748165
1,2,3,4,7,8-Hexa CDD *	pg	<3.4	3.4	30	6.0	0.100	0.340		4748165
1,2,3,6,7,8-Hexa CDD *	pg	<3.4	3.4	30	6.0	0.100	0.340		4748165
1,2,3,7,8,9-Hexa CDD *	pg	<3.1	3.1	30	6.0	0.100	0.310		4748165
1,2,3,4,6,7,8-Hepta CDD *	pg	5.6	3.1	30	9.0	0.0100	0.0560		4748165
Total Tetra CDD *	pg	39.0	3.5	30	N/A			2	4748165
Total Penta CDD *	pg	13.0	3.5	30	N/A			1	4748165
Total Hexa CDD *	pg	<34 (1)	34	30	N/A			0	4748165
Total Hepta CDD *	pg	12.4	3.1	30	N/A			2	4748165
2,3,7,8-Tetra CDF **	pg	14.7	4.1	30	6.0	0.100	1.47		4748165
1,2,3,7,8-Penta CDF **	pg	5.8	3.7	30	6.0	0.0300	0.174		4748165
2,3,4,7,8-Penta CDF **	pg	<3.8	3.8	30	6.0	0.300	1.14		4748165
1,2,3,4,7,8-Hexa CDF **	pg	<3.3	3.3	30	6.0	0.100	0.330		4748165
1,2,3,6,7,8-Hexa CDF **	pg	<3.2	3.2	30	6.0	0.100	0.320		4748165
2,3,4,6,7,8-Hexa CDF **	pg	<3.5	3.5	30	6.0	0.100	0.350		4748165
1,2,3,7,8,9-Hexa CDF **	pg	<3.7	3.7	30	6.0	0.100	0.370		4748165
1,2,3,4,6,7,8-Hepta CDF **	pg	5.8	3.2	30	9.0	0.0100	0.0580		4748165
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.7	3.7	30	6.0	0.0100	0.0370		4748165
Total Tetra CDF **	pg	49.0	4.1	30	N/A			5	4748165
Total Penta CDF **	pg	12.2	3.8	30	N/A			2	4748165
Total Hexa CDF **	pg	4.7	3.4	30	N/A			1	4748165
Total Hepta CDF **	pg	5.8	3.4	30	N/A			1	4748165
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	6.3 (2)	3.6	30	N/A	0.100	0.630		4750482
TOTAL TOXIC EQUIVALENCY	pg						11.5		
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	121							4750482

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

N/A = Not Applicable

** CDF = Chloro Dibenzo-p-Furan

(1) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

(2) EMPC / IAR - Peak detected meets S/N ratio but does not meet the ion abundance ratio.

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Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DIC560							
Sampling Date		2016/10/18				TOXIC EQUIVALENCY		# of	
	UNITS	M23-R3	EDL	RDL	MDL	TEF (2005 WHO)	TEQ(DL)	Isomers	QC Batch
C13-1234678 HeptaCDD *	%	97							4748165
C13-1234678 HeptaCDF **	%	72							4748165
C13-123478 HexaCDD *	%	125							4748165
C13-123478 HexaCDF **	%	104							4748165
C13-1234789 HeptaCDF **	%	100							4748165
C13-123678 HexaCDD *	%	91							4748165
C13-123678 HexaCDF **	%	80							4748165
C13-12378 PentaCDD *	%	123							4748165
C13-12378 PentaCDF **	%	92							4748165
C13-123789 HexaCDF **	%	69							4748165
C13-23478 PentaCDF **	%	107							4748165
C13-2378 TetraCDD *	%	108							4748165
C13-2378 TetraCDF **	%	99							4748165
C13-Octachlorodibenzo-p-Dioxin	%	76							4748165
Cl37-2378 TetraCDD *	%	99							4748165

EDL = Estimated Detection Limit

RDL = Reportable Detection Limit

TEF = Toxic Equivalency Factor, TEQ = Toxic Equivalency Quotient,
The Total Toxic Equivalency (TEQ) value reported is the sum of Toxic Equivalent Quotients for the congeners tested.

WHO(2005): The 2005 World Health Organization, Human and Mammalian Toxic Equivalency Factors for Dioxins and Dioxin-like Compounds

QC Batch = Quality Control Batch

* CDD = Chloro Dibenzo-p-Dioxin

** CDF = Chloro Dibenzo-p-Furan

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SEMI-VOLATILE ORGANICS BY GC-MS (STACK SAMPLING TRAIN)

Maxxam ID		DIC548	DIC553	DIC560			
Sampling Date		2016/10/17	2016/10/17	2016/10/18			
	UNITS	**M23-R1**	**M23-R2**	**M23-R3**	**RDL**	**MDL**	**QC Batch**
Semivolatile Organics							
Acenaphthene	ug	<20	<20	<20	20	3	4726240
Acenaphthylene	ug	<20	<20	<20	20	4	4726240
Anthracene	ug	<20	<20	<20	20	5	4726240
Benzo(a)anthracene	ug	<20	<20	<20	20	5	4726240
Benzo(a)pyrene	ug	<20	<20	<20	20	4	4726240
Benzo(b)fluoranthene	ug	<20	<20	<20	20	5	4726240
Benzo(g,h,i)perylene	ug	<20	<20	<20	20	5	4726240
Benzo(k)fluoranthene	ug	<20	<20	<20	20	4	4726240
Chrysene	ug	<20	<20	<20	20	5	4726240
Dibenz(a,h)anthracene	ug	<20	<20	<20	20	5	4726240
Fluoranthene	ug	<20	<20	<20	20	5	4726240
Fluorene	ug	<20	<20	<20	20	5	4726240
Indeno(1,2,3-cd)pyrene	ug	<20	<20	<20	20	3	4726240
Naphthalene	ug	71	116	78	20	3	4726240
Phenanthrene	ug	<20	<20	<20	20	5	4726240
Pyrene	ug	<20	<20	<20	20	4	4726240
Surrogate Recovery (%)							
2,4,6-Tribromophenol	%	109	122 (1)	105			4726240
2,6-Dibromo-4-fluorophenol (FS)	%	60	66	68			4726240
2-Fluorobiphenyl	%	97	308 (1)	275 (1)			4726240
2-Fluorophenol	%	105	307 (1)	346 (1)			4726240
D10-Pyrene (FS)	%	109	113	107			4726240
D14-Terphenyl	%	107	106	104			4726240
D5-Nitrobenzene	%	95	112	112			4726240
D5-Phenol	%	109	385 (1)	353 (1)			4726240

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
(1) Recovery or RPD for this parameter is outside control limits. The overall quality control for this analysis meets acceptability criteria.

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Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DIC548
Sample ID: M23-R1
Matrix: Stack Sampling Train

Collected: 2016/10/17
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4726240	2016/10/31	2016/11/17	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4750482	N/A	2016/11/16	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4748165	2016/10/31	2016/11/16	Owen Cosby

Maxxam ID: DIC553
Sample ID: M23-R2
Matrix: Stack Sampling Train

Collected: 2016/10/17
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4726240	2016/10/31	2016/11/17	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4763229	N/A	2016/11/24	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4748165	2016/10/31	2016/11/20	Owen Cosby

Maxxam ID: DIC560
Sample ID: M23-R3
Matrix: Stack Sampling Train

Collected: 2016/10/18
Shipped:
Received: 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4726240	2016/10/31	2016/11/17	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4750482	N/A	2016/11/16	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4748165	2016/10/31	2016/11/16	Owen Cosby

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GENERAL COMMENTS

No Perylene found in the samples. An estimated mdl is 5 ug
Perylene has not been subjected to Maxxam's standard validation procedure for this matrix. The analysis was performed with the client consent, however results should be viewed with discretion. Recovery for perylene is based on the method spike.
Perylene
Spike =97.12 %
Spike Dup = 101.435%

Sample DIC553 [M23-R2] : Archived portion analyzed and reported

ABNs- High recoveries for some surrogates due to matrix inteferance

Sample DIC560 [M23-R3] : ABNs- High recoveries for some surrogates due to matrix inteferance

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
4726240	LTO	Spiked Blank	2,4,6-Tribromophenol	2016/11/17		102	%	24 - 121
			2-Fluorobiphenyl	2016/11/17		100	%	30 - 115
			2-Fluorophenol	2016/11/17		78	%	30 - 130
			Acenaphthene	2016/11/17		101	%	40 - 125
			Acenaphthylene	2016/11/17		110	%	40 - 125
			Anthracene	2016/11/17		105	%	40 - 125
			Benzo(a)pyrene	2016/11/17		100	%	40 - 125
			Benzo(b)fluoranthene	2016/11/17		103	%	40 - 125
			Benzo(g,h,i)perylene	2016/11/17		102	%	40 - 125
			Benzo(k)fluoranthene	2016/11/17		99	%	40 - 125
			Chrysene	2016/11/17		112	%	40 - 125
			D14-Terphenyl	2016/11/17		109	%	18 - 137
			D5-Nitrobenzene	2016/11/17		93	%	23 - 120
			D5-Phenol	2016/11/17		88	%	24 - 113
			Dibenz(a,h)anthracene	2016/11/17		99	%	40 - 125
			Fluoranthene	2016/11/17		100	%	40 - 125
			Fluorene	2016/11/17		100	%	40 - 125
			Indeno(1,2,3-cd)pyrene	2016/11/17		100	%	40 - 125
			Naphthalene	2016/11/17		103	%	40 - 125
			Phenanthrene	2016/11/17		109	%	40 - 125
			Pyrene	2016/11/17		117	%	40 - 125
4726240	LTO	RPD	Acenaphthene	2016/11/17	6.8		%	50
			Acenaphthylene	2016/11/17	0.46		%	50
			Anthracene	2016/11/17	1.8		%	50
			Benzo(a)pyrene	2016/11/17	0.16		%	50
			Benzo(b)fluoranthene	2016/11/17	2.8		%	50
			Benzo(g,h,i)perylene	2016/11/17	2.5		%	50
			Benzo(k)fluoranthene	2016/11/17	4.6		%	50
			Chrysene	2016/11/17	1.5		%	50
			Dibenz(a,h)anthracene	2016/11/17	4.1		%	50
			Fluoranthene	2016/11/17	2.1		%	50
			Fluorene	2016/11/17	6.5		%	50
			Indeno(1,2,3-cd)pyrene	2016/11/17	8.2		%	50
			Naphthalene	2016/11/17	2.7		%	50
			Phenanthrene	2016/11/17	0.57		%	50
			Pyrene	2016/11/17	0.21		%	50
4726240	LTO	Method Blank	2,4,6-Tribromophenol	2016/11/17		87	%	24 - 121
			2-Fluorobiphenyl	2016/11/17		101	%	30 - 115
			2-Fluorophenol	2016/11/17		88	%	30 - 130
			Acenaphthene	2016/11/17	<20		ug	
			Acenaphthylene	2016/11/17	<20		ug	
			Anthracene	2016/11/17	<20		ug	
			Benzo(a)anthracene	2016/11/17	<20		ug	
			Benzo(a)pyrene	2016/11/17	<20		ug	
			Benzo(b)fluoranthene	2016/11/17	<20		ug	
			Benzo(g,h,i)perylene	2016/11/17	<20		ug	
			Benzo(k)fluoranthene	2016/11/17	<20		ug	
			Chrysene	2016/11/17	<20		ug	
			D14-Terphenyl	2016/11/17		111	%	18 - 137
			D5-Nitrobenzene	2016/11/17		97	%	23 - 120
			D5-Phenol	2016/11/17		93	%	24 - 113
			Dibenz(a,h)anthracene	2016/11/17	<20		ug	
			Fluoranthene	2016/11/17	<20		ug	
			Fluorene	2016/11/17	<20		ug	

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Maxxam Job #: B6N1570
Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Indeno(1,2,3-cd)pyrene	2016/11/17	<20		ug	
			Naphthalene	2016/11/17	<20		ug	
			Phenanthrene	2016/11/17	<20		ug	
			Pyrene	2016/11/17	<20		ug	
4748165	OBC	Spiked Blank	C13-1234678 HeptaCDD	2016/11/15		88	%	25 - 130
			C13-1234678 HeptaCDF	2016/11/15		69	%	25 - 130
			C13-123678 HexaCDD	2016/11/15		79	%	40 - 130
			C13-123678 HexaCDF	2016/11/15		70	%	40 - 130
			C13-12378 PentaCDD	2016/11/15		115	%	40 - 130
			C13-12378 PentaCDF	2016/11/15		90	%	40 - 130
			C13-123789 HexaCDF	2016/11/15		71	%	40 - 130
			C13-2378 TetraCDD	2016/11/15		98	%	40 - 130
			C13-2378 TetraCDF	2016/11/15		93	%	40 - 130
			C13-Octachlorodibenzo-p-Dioxin	2016/11/15		70	%	25 - 130
			2,3,7,8-Tetra CDD	2016/11/15		90	%	80 - 140
			1,2,3,7,8-Penta CDD	2016/11/15		96	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2016/11/15		116	%	80 - 140
			1,2,3,6,7,8-Hexa CDD	2016/11/15		104	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2016/11/15		107	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDD	2016/11/15		105	%	80 - 140
			2,3,7,8-Tetra CDF	2016/11/15		93	%	80 - 140
			1,2,3,7,8-Penta CDF	2016/11/15		93	%	80 - 140
			2,3,4,7,8-Penta CDF	2016/11/15		96	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2016/11/15		118	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2016/11/15		106	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2016/11/15		108	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2016/11/15		115	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2016/11/15		96	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2016/11/15		95	%	80 - 140
4748165	OBC	RPD	2,3,7,8-Tetra CDD	2016/11/15	1.1		%	20
			1,2,3,7,8-Penta CDD	2016/11/15	3.2		%	20
			1,2,3,4,7,8-Hexa CDD	2016/11/15	4.4		%	20
			1,2,3,6,7,8-Hexa CDD	2016/11/15	4.9		%	20
			1,2,3,7,8,9-Hexa CDD	2016/11/15	0		%	20
			1,2,3,4,6,7,8-Hepta CDD	2016/11/15	0		%	20
			2,3,7,8-Tetra CDF	2016/11/15	2.1		%	20
			1,2,3,7,8-Penta CDF	2016/11/15	1.1		%	20
			2,3,4,7,8-Penta CDF	2016/11/15	6.5		%	20
			1,2,3,4,7,8-Hexa CDF	2016/11/15	1.7		%	20
			1,2,3,6,7,8-Hexa CDF	2016/11/15	3.8		%	20
			2,3,4,6,7,8-Hexa CDF	2016/11/15	1.9		%	20
			1,2,3,7,8,9-Hexa CDF	2016/11/15	1.8		%	20
			1,2,3,4,6,7,8-Hepta CDF	2016/11/15	5.3		%	20
			1,2,3,4,7,8,9-Hepta CDF	2016/11/15	2.1		%	20
4748165	OBC	Method Blank	C13-1234678 HeptaCDD	2016/11/16		92	%	25 - 130
			C13-1234678 HeptaCDF	2016/11/16		72	%	25 - 130
			C13-123678 HexaCDD	2016/11/16		81	%	40 - 130
			C13-123678 HexaCDF	2016/11/16		73	%	40 - 130
			C13-12378 PentaCDD	2016/11/16		124	%	40 - 130
			C13-12378 PentaCDF	2016/11/16		96	%	40 - 130
			C13-123789 HexaCDF	2016/11/16		69	%	40 - 130
			C13-2378 TetraCDD	2016/11/16		99	%	40 - 130
			C13-2378 TetraCDF	2016/11/16		101	%	40 - 130
			C13-Octachlorodibenzo-p-Dioxin	2016/11/16		77	%	25 - 130

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Maxxam Job #: B6N1570
Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			2,3,7,8-Tetra CDD	2016/11/16	<3.6, EDL=3.6		pg	
			1,2,3,7,8-Penta CDD	2016/11/16	<3.5, EDL=3.5		pg	
			1,2,3,4,7,8-Hexa CDD	2016/11/16	<3.2, EDL=3.2		pg	
			1,2,3,6,7,8-Hexa CDD	2016/11/16	<3.2, EDL=3.2		pg	
			1,2,3,7,8,9-Hexa CDD	2016/11/16	<3.0, EDL=3.0		pg	
			1,2,3,4,6,7,8-Hepta CDD	2016/11/16	<3.1, EDL=3.1		pg	
			Total Tetra CDD	2016/11/16	<11, EDL=11 (1)		pg	
			Total Penta CDD	2016/11/16	<5.0, EDL=5.0 (1)		pg	
			Total Hexa CDD	2016/11/16	<15, EDL=15 (1)		pg	
			Total Hepta CDD	2016/11/16	<3.1, EDL=3.1		pg	
			2,3,7,8-Tetra CDF	2016/11/16	<3.2, EDL=3.2		pg	
			1,2,3,7,8-Penta CDF	2016/11/16	<3.3, EDL=3.3		pg	
			2,3,4,7,8-Penta CDF	2016/11/16	<3.3, EDL=3.3		pg	
			1,2,3,4,7,8-Hexa CDF	2016/11/16	<3.0, EDL=3.0		pg	
			1,2,3,6,7,8-Hexa CDF	2016/11/16	<2.9, EDL=2.9		pg	
			2,3,4,6,7,8-Hexa CDF	2016/11/16	<3.1, EDL=3.1		pg	
			1,2,3,7,8,9-Hexa CDF	2016/11/16	<3.3, EDL=3.3		pg	
			1,2,3,4,6,7,8-Hepta CDF	2016/11/16	<2.8, EDL=2.8		pg	
			1,2,3,4,7,8,9-Hepta CDF	2016/11/16	<3.3, EDL=3.3		pg	
			Total Tetra CDF	2016/11/16	<3.2, EDL=3.2		pg	
			Total Penta CDF	2016/11/16	<3.3, EDL=3.3		pg	
			Total Hexa CDF	2016/11/16	<3.1, EDL=3.1		pg	
			Total Hepta CDF	2016/11/16	<3.1, EDL=3.1		pg	
4750482	VCI	Method Blank	Confirmation 2,3,7,8-Tetra CDF	2016/11/16	<3.2, EDL=3.2		pg	
			Confirmation C13-2378 TetraCDF	2016/11/16		105	%	40 - 135
4763229	VCI	Method Blank	Confirmation 2,3,7,8-Tetra CDF	2016/11/24	<2.3, EDL=2.3		pg	

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Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Confirmation C13-2378 TetraCDF	2016/11/24		107	%	40 - 135

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

(1) EMPC / NDR - Peak detected does not meet ratio criteria and has resulted in an elevated detection limit.

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Maxxam Job #: B6N1570
Report Date: 2016/11/26

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Karen Nicol

Karen Nicol, Supervisor, Semi-Volatiles

Owen Cosby, BSc.C.Chem, Supervisor, HRMS Services

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BGN1557 1570

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Page 2 of 2

CLIENT INFORMATION

Company Name: ArcelorMittal
Project Manager: William Cowell
e-mail: wcowell@montrose-env.com
Address: 1050 William Pitt Way
Pittsburgh, PA 15238

SECTION

Phone: 412 826 3636 Fax:
Sampled by: John Wilson

ANALYSIS REQUESTED

Field Sample ID	Total Volume Sampled	Flow Rate	Collection Date	Sample Collection Time	RM 23/0010 Parameters emailed	RM 315 Toluene Soluble Organics Parameters emailed	RM 5/29 Parameters emailed
Combustion Stack M23/0010 Run 1	~140+	150	10/17/16		✓		
" " " Run 2	↓	↓	↓		✓		
" " " Run 3	↓	↓	10/18/16		✓		
" " M315 TSO Run 1	~71+	150	10/17/16			✓	
" " " Run 2	↓	↓	↓			✓	
" " " Run 3	↓	↓	10/18/16			✓	
" " " Solvent Blanks	Grab	Grab	10/17/16			✓	
" " M5/29 Run 1	~105+	150	10/19/16				✓
" " " Run 2	↓	↓	↓				✓
" " " Run 3	↓	↓	↓				✓
" " " Solvent Blanks	Grab	Grab	↓				✓

TAT Requirement

STD 10 Business day ☑
Rush 5 Business day * ☐
Rush 2 Business day * ☐
* need approval from Maxxam

PROJECT INFORMATION

Project #: 106377 (16-167)
Name: John Wilson
PO #: NA
Maxxam Quote #:
Maxxam Contact: Clayton Johnson

REPORTING REQUIREMENTS

Summary Report only ☐
EDD ☐
Regulation

Notes

PROJECT SPECIFIC COMMENTS

Client Signature: [signature]
Affiliation: Montrose
Date/Time: 10/21/16

Received by: [signature]
Affiliation: MAXXAM
Date/Time: 10-24-16

GL TEJASH PATEL 2016/10/24 18:00 23 2/25 8/24.7

CCC-1031 (04/13) - Air

Methods 0031/316

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Your Project #: 106377(16-167)

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/04
Report #: R4235385
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N0789
Received: 2016/10/24, 18:00

Sample Matrix: Stack Sampling Train
Samples Received: 24

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Formaldehyde (M316)	3	2016/11/03	2016/11/03	BRL SOP-00113	EPA 316 m
VOST Condensate (8260Cmod)	10	N/A	2016/10/31	CAM SOP-00226	EPA 8260C m
VOST EPA5041A, 8260C for 0030, 0031	11	N/A	2016/10/26	BRL SOP-00302	EPA5041A, 8260C
Final Volume of Impinger	3	N/A	2016/11/03		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods. Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.

Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

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Your Project #: 106377(16-167)

Attention:John Wilson

Montrose Air Quality Services, LLC
ACCI Pittsburg, PA
1050 William Pitt Way
Pittsburgh, PA
USA 15238

Report Date: 2016/11/04
Report #: R4235385
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6N0789
Received: 2016/10/24, 18:00

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
04 Nov 2016 16:35:01 -04:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Clayton Johnson, Project Manager - Air Toxics, Source Evaluation
Email: CJohnson@maxxam.ca
Phone# (905)817-5769
==========
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Maxxam Job #: B6N0789
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

Maxxam ID		DHX168			DHX169			DHX170			
Sampling Date		2016/10/20			2016/10/20			2016/10/20			
	UNITS	**M316- R1**	**RDL**	**MDL**	**M316- R2**	**RDL**	**MDL**	**M316- R3**	**RDL**	**MDL**	**QC Batch**
Aldehydes & Ketones											
Formaldehyde	ug	<10	10	6	<11	11	6.6	<12	12	7.2	4731052
Impinger Volume	ml	410	1	1	440	1	1	460	1	1	4731057

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N0789
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX174	DHX175	DHX178			
Sampling Date		2016/10/20	2016/10/20	2016/10/20			
	UNITS	**M0031- TRIB- #11 A/B/C**	**M0031- FB- #10 A/B/C**	**M0031- R1- A- #1 A/B/C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics							
Chloromethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Vinyl Chloride	ug	<0.013	<0.013	<0.013	0.013	0.013	4718714
Bromomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Chloroethane	ug	<0.0090	<0.0090	<0.0090	0.0090	0.0090	4718714
1,1-Dichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Iodomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Carbon Disulfide	ug	<0.026	<0.026	<0.026	0.026	0.026	4718714
Methylene Chloride(Dichloromethane)	ug	<0.019	<0.019	0.205	0.019	0.020	4718714
Chloroform	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
1,2-Dichloroethane	ug	<0.0070	<0.0070	<0.0070	0.0070	0.0070	4718714
1,1,1-Trichloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
Carbon Tetrachloride	ug	<0.016	<0.016	<0.016	0.016	0.016	4718714
Benzene	ug	<0.0090	<0.0090	0.275	0.0090	0.0090	4718714
1,1,2-Trichloroethane	ug	<0.016	<0.016	<0.016	0.016	0.016	4718714
1,2-Dichloropropane	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Trichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Toluene	ug	<0.014	<0.014	0.473	0.014	0.014	4718714
Tetrachloroethylene	ug	<0.018	<0.018	<0.018	0.018	0.018	4718714
Chlorobenzene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Ethylbenzene	ug	<0.014	<0.014	0.118	0.014	0.014	4718714
m / p-Xylene	ug	<0.015	<0.015	0.451	0.015	0.015	4718714
Styrene	ug	<0.012	<0.012	<0.012	0.012	0.012	4718714
o-Xylene	ug	<0.015	<0.015	0.189	0.015	0.015	4718714
Bromoform	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
Acrylonitrile	ug	<0.025	<0.025	<0.025	0.025	0.025	4718714
Surrogate Recovery (%)							
Bromofluorobenzene	%	99	99	98			4718714
D10-Ethylbenzene (FS)	%	104	98	106			4718714
D4-1,2-Dichloroethane	%	108	106	105			4718714
D8-Toluene	%	102	101	94			4718714

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N0789
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX179	DHX180	DHX181			
Sampling Date		2016/10/20	2016/10/20	2016/10/20			
	UNITS	**M0031- R1- B- #2 A/B/C**	**M0031- R1- C- #3 A/B/C**	**M0031- R2- A- #4 A/B/C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics							
Chloromethane	ug	0.018	0.021	<0.015	0.015	0.015	4718714
Vinyl Chloride	ug	<0.013	<0.013	<0.013	0.013	0.013	4718714
Bromomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Chloroethane	ug	<0.0090	<0.0090	<0.0090	0.0090	0.0090	4718714
1,1-Dichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Iodomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Carbon Disulfide	ug	<0.026	<0.026	<0.026	0.026	0.026	4718714
Methylene Chloride(Dichloromethane)	ug	<0.019	0.183	0.287	0.019	0.020	4718714
Chloroform	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
1,2-Dichloroethane	ug	<0.0070	<0.0070	<0.0070	0.0070	0.0070	4718714
1,1,1-Trichloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
Carbon Tetrachloride	ug	<0.016	<0.016	<0.016	0.016	0.016	4718714
Benzene	ug	0.151	0.560	0.480	0.0090	0.0090	4718714
1,1,2-Trichloroethane	ug	<0.016	<0.016	<0.016	0.016	0.016	4718714
1,2-Dichloropropane	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Trichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Toluene	ug	0.258	0.231	0.210	0.014	0.014	4718714
Tetrachloroethylene	ug	<0.018	<0.018	<0.018	0.018	0.018	4718714
Chlorobenzene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Ethylbenzene	ug	0.062	<0.014	<0.014	0.014	0.014	4718714
m / p-Xylene	ug	0.239	0.085	0.069	0.015	0.015	4718714
Styrene	ug	<0.012	0.046	0.029	0.012	0.012	4718714
o-Xylene	ug	0.094	0.024	0.019	0.015	0.015	4718714
Bromoform	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
Acrylonitrile	ug	<0.025	<0.025	<0.025	0.025	0.025	4718714
Surrogate Recovery (%)							
Bromofluorobenzene	%	96	96	90			4718714
D10-Ethylbenzene (FS)	%	106	92	102			4718714
D4-1,2-Dichloroethane	%	105	110	110			4718714
D8-Toluene	%	98	99	104			4718714

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N0789
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX182	DHX183	DHX184			
Sampling Date		2016/10/20	2016/10/20	2016/10/20			
	UNITS	**M0031- R2- B- #5 A/B/C**	**M0031- R2- C- #6 A/B/C**	**M0031- R3- A- #7 A/B/C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics							
Chloromethane	ug	<0.015	0.028	<0.015	0.015	0.015	4718714
Vinyl Chloride	ug	<0.013	<0.013	<0.013	0.013	0.013	4718714
Bromomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Chloroethane	ug	<0.0090	<0.0090	<0.0090	0.0090	0.0090	4718714
1,1-Dichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Iodomethane	ug	<0.015	<0.015	<0.015	0.015	0.015	4718714
Carbon Disulfide	ug	<0.026	<0.026	<0.026	0.026	0.026	4718714
Methylene Chloride(Dichloromethane)	ug	0.021	<0.019	<0.019	0.019	0.020	4718714
Chloroform	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
1,2-Dichloroethane	ug	<0.0070	<0.0070	<0.0070	0.0070	0.0070	4718714
1,1,1-Trichloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
Carbon Tetrachloride	ug	<0.016	<0.016	<0.016	0.016	0.016	4718714
Benzene	ug	0.239	0.453	0.290	0.0090	0.0090	4718714
1,1,2-Trichloroethane	ug	<0.016	<0.016	<0.016	0.016	0.016	4718714
1,2-Dichloropropane	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Trichloroethylene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Toluene	ug	0.128	0.191	0.389	0.014	0.014	4718714
Tetrachloroethylene	ug	<0.018	<0.018	<0.018	0.018	0.018	4718714
Chlorobenzene	ug	<0.011	<0.011	<0.011	0.011	0.011	4718714
Ethylbenzene	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
m / p-Xylene	ug	0.035	0.072	0.056	0.015	0.015	4718714
Styrene	ug	0.012	0.035	0.015	0.012	0.012	4718714
o-Xylene	ug	<0.015	0.021	0.017	0.015	0.015	4718714
Bromoform	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014	<0.014	0.014	0.014	4718714
Acrylonitrile	ug	<0.025	<0.025	<0.025	0.025	0.025	4718714
Surrogate Recovery (%)							
Bromofluorobenzene	%	100	99	100			4718714
D10-Ethylbenzene (FS)	%	105	108	123			4718714
D4-1,2-Dichloroethane	%	108	112	109			4718714
D8-Toluene	%	102	101	102			4718714

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX185	DHX186	DHX187			
Sampling Date		2016/10/20	2016/10/20	2016/10/20			
	UNITS	M0031- R3- B- #8 A/B/C	M0031- R3- C- #9 A/B/C	COND- FB	RDL	MDL	QC Batch
Volatile Organics							
Chloromethane	ug	<0.015	0.020		0.015	0.015	4718714
Chloromethane	ug/L			<5000	5000	5000	4723005
Vinyl Chloride	ug	<0.013	<0.013		0.013	0.013	4718714
Vinyl Chloride	ug/L			<1000	1000	1000	4723005
Bromomethane	ug	<0.015	<0.015		0.015	0.015	4718714
Bromomethane	ug/L			<7500	7500	7500	4723005
Chloroethane	ug	<0.0090	<0.0090		0.0090	0.0090	4718714
Chloroethane	ug/L			<2500	2500	2500	4723005
1,1-Dichloroethylene	ug	<0.011	<0.011		0.011	0.011	4718714
Iodomethane	ug	<0.015	<0.015		0.015	0.015	4718714
Iodomethane	ug/L			<1500	1500	1500	4723005
Carbon Disulfide	ug	<0.026	<0.026		0.026	0.026	4718714
Carbon Disulfide	ug/L			<1300	1300	1300	4723005
Methylene Chloride(Dichloromethane)	ug	0.027	0.064		0.019	0.020	4718714
Methylene Chloride(Dichloromethane)	ug/L			<2500	2500	2500	4723005
1,1-Dichloroethane	ug/L			<1000	1000	1000	4723005
Chloroform	ug	<0.011	<0.011		0.011	0.011	4718714
Chloroform	ug/L			<1000	1000	1000	4723005
1,2-Dichloroethane	ug	<0.0070	<0.0070		0.0070	0.0070	4718714
1,2-Dichloroethane	ug/L			<1300	1300	1300	4723005
1,1,1-Trichloroethane	ug	<0.014	<0.014		0.014	0.014	4718714
1,1,1-Trichloroethane	ug/L			<1300	1300	1300	4723005
Carbon Tetrachloride	ug	<0.016	<0.016		0.016	0.016	4718714
Carbon Tetrachloride	ug/L			<1300	1300	1300	4723005
Benzene	ug	0.0614	0.205		0.0090	0.0090	4718714
Benzene	ug/L			<1300	1300	1300	4723005
1,1,2-Trichloroethane	ug	<0.016	<0.016		0.016	0.016	4718714
1,2-Dichloropropane	ug	<0.011	<0.011		0.011	0.011	4718714
1,2-Dichloropropane	ug/L			<1300	1300	1300	4723005
Trichloroethylene	ug	<0.011	<0.011		0.011	0.011	4718714
Trichloroethylene	ug/L			<1300	1300	1300	4723005
Toluene	ug	0.321	0.537		0.014	0.014	4718714
Toluene	ug/L			24000	1300	1300	4723005
Tetrachloroethylene	ug	<0.018	<0.018		0.018	0.018	4718714
Tetrachloroethylene	ug/L			<1300	1300	1300	4723005
Chlorobenzene	ug	<0.011	<0.011		0.011	0.011	4718714

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX185	DHX186	DHX187			
Sampling Date		2016/10/20	2016/10/20	2016/10/20			
	UNITS	**M0031- R3- B- #8 A/B/C**	**M0031- R3- C- #9 A/B/C**	**COND- FB**	**RDL**	**MDL**	**QC Batch**
Chlorobenzene	ug/L			<1300	1300	1300	4723005
Ethylbenzene	ug	0.057	<0.014		0.014	0.014	4718714
Ethylbenzene	ug/L			<1300	1300	1300	4723005
m / p-Xylene	ug	0.250	0.058		0.015	0.015	4718714
p+m-Xylene	ug/L			<1300	1300	1300	4723005
Styrene	ug	<0.012	<0.012		0.012	0.012	4718714
Styrene	ug/L			<1300	1300	1300	4723005
o-Xylene	ug	0.079	0.018		0.015	0.015	4718714
o-Xylene	ug/L			<1300	1300	1300	4723005
Bromoform	ug	<0.014	<0.014		0.014	0.014	4718714
Bromoform	ug/L			<1000	1000	1000	4723005
1,1,2,2-Tetrachloroethane	ug	<0.014	<0.014		0.014	0.014	4718714
1,1,2,2-Tetrachloroethane	ug/L			<2500	2500	2500	4723005
Acrylonitrile	ug	<0.025	<0.025		0.025	0.025	4718714
Total Xylenes	ug/L			<1300	1300	1300	4723005
Surrogate Recovery (%)							
4-Bromofluorobenzene	%			95			4723005
D4-1,2-Dichloroethane	%			107			4723005
D8-Toluene	%			102			4723005
Bromofluorobenzene	%	98	98				4718714
D10-Ethylbenzene (FS)	%	102	98				4718714
D4-1,2-Dichloroethane	%	107	109				4718714
D8-Toluene	%	101	100				4718714

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Maxxam Job #: B6N0789
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX190	DHX191	DHX192	DHX193	DHX194			
Sampling Date		2016/10/20	2016/10/20	2016/10/20	2016/10/20	2016/10/20			
	UNITS	**COND- R1-A**	**COND- R1-B**	**COND- R1-C**	**COND- R2-A**	**COND- R2-B**	**RDL**	**MDL**	**QC Batch**
Volatile Organics									
Chloromethane	ug/L	<10000	<10000	<10000	<10000	<10000	10000	10000	4723005
Vinyl Chloride	ug/L	<2000	<2000	<2000	<2000	<2000	2000	2000	4723005
Bromomethane	ug/L	<15000	<15000	<15000	<15000	<15000	15000	15000	4723005
Chloroethane	ug/L	<5000	<5000	<5000	<5000	<5000	5000	5000	4723005
Iodomethane	ug/L	<3000	<3000	<3000	<3000	<3000	3000	3000	4723005
Carbon Disulfide	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Methylene Chloride(Dichloromethane)	ug/L	<5000	<5000	<5000	<5000	<5000	5000	5000	4723005
1,1-Dichloroethane	ug/L	<2000	<2000	<2000	<2000	<2000	2000	2000	4723005
Chloroform	ug/L	<2000	<2000	<2000	<2000	<2000	2000	2000	4723005
1,2-Dichloroethane	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
1,1,1-Trichloroethane	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Carbon Tetrachloride	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Benzene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
1,2-Dichloropropane	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Trichloroethylene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Toluene	ug/L	35000	35000	34000	32000	32000	2500	2500	4723005
Tetrachloroethylene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Chlorobenzene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Ethylbenzene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
p+m-Xylene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Styrene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
o-Xylene	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Bromoform	ug/L	<2000	<2000	<2000	<2000	<2000	2000	2000	4723005
1,1,2,2-Tetrachloroethane	ug/L	<5000	<5000	<5000	<5000	<5000	5000	5000	4723005
Total Xylenes	ug/L	<2500	<2500	<2500	<2500	<2500	2500	2500	4723005
Surrogate Recovery (%)									
4-Bromofluorobenzene	%	95	97	94	95	92			4723005
D4-1,2-Dichloroethane	%	107	108	105	106	107			4723005
D8-Toluene	%	103	105	104	104	104			4723005

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Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

VOLATILE ORGANICS BY GC/MS (STACK SAMPLING TRAIN)

Maxxam ID		DHX195			DHX196	DHX197	DHX198			
Sampling Date		2016/10/20			2016/10/20	2016/10/20	2016/10/20			
	UNITS	**COND- R2-C**	**RDL**	**MDL**	**COND- R3-A**	**COND- R3-B**	**COND- R3-C**	**RDL**	**MDL**	**QC Batch**
Volatile Organics										
Chloromethane	ug/L	<10000	10000	10000	<40000	<40000	<40000	40000	40000	4723005
Vinyl Chloride	ug/L	<2000	2000	2000	<8000	<8000	<8000	8000	8000	4723005
Bromomethane	ug/L	<15000	15000	15000	<60000	<60000	<60000	60000	60000	4723005
Chloroethane	ug/L	<5000	5000	5000	<20000	<20000	<20000	20000	20000	4723005
Iodomethane	ug/L	<3000	3000	3000	<12000	<12000	<12000	12000	12000	4723005
Carbon Disulfide	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Methylene Chloride(Dichloromethane)	ug/L	<5000	5000	5000	<20000	<20000	<20000	20000	20000	4723005
1,1-Dichloroethane	ug/L	<2000	2000	2000	<8000	<8000	<8000	8000	8000	4723005
Chloroform	ug/L	<2000	2000	2000	<8000	<8000	<8000	8000	8000	4723005
1,2-Dichloroethane	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
1,1,1-Trichloroethane	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Carbon Tetrachloride	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Benzene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
1,2-Dichloropropane	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Trichloroethylene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Toluene	ug/L	39000	2500	2500	210000	210000	200000	10000	10000	4723005
Tetrachloroethylene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Chlorobenzene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Ethylbenzene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
p+m-Xylene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Styrene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
o-Xylene	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Bromoform	ug/L	<2000	2000	2000	<8000	<8000	<8000	8000	8000	4723005
1,1,2,2-Tetrachloroethane	ug/L	<5000	5000	5000	<20000	<20000	<20000	20000	20000	4723005
Total Xylenes	ug/L	<2500	2500	2500	<10000	<10000	<10000	10000	10000	4723005
Surrogate Recovery (%)										
4-Bromofluorobenzene	%	96			96	94	95			4723005
D4-1,2-Dichloroethane	%	107			108	107	110			4723005
D8-Toluene	%	104			104	101	103			4723005

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6N0789
Report Date: 2016/11/04

Montrose Air Quality Services, LLC
Client Project #: 106377(16-167)

TEST SUMMARY

Maxxam ID: DHX168 **Collected:** 2016/10/20
Sample ID: M316- R1 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

Maxxam ID: DHX169 **Collected:** 2016/10/20
Sample ID: M316- R2 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

Maxxam ID: DHX169 Dup **Collected:** 2016/10/20
Sample ID: M316- R2 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera

Maxxam ID: DHX170 **Collected:** 2016/10/20
Sample ID: M316- R3 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Formaldehyde (M316)	/SPEC	4731052	2016/11/03	2016/11/03	Manoj Gera
Final Volume of Impinger		4731057	N/A	2016/11/03	Frank Mo

Maxxam ID: DHX174 **Collected:** 2016/10/20
Sample ID: M0031- TRIB- #11 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX175 **Collected:** 2016/10/20
Sample ID: M0031- FB- #10 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX178 **Collected:** 2016/10/20
Sample ID: M0031- R1- A- #1 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

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TEST SUMMARY

Maxxam ID: DHX179 **Collected:** 2016/10/20
Sample ID: M0031- R1- B- #2 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX180 **Collected:** 2016/10/20
Sample ID: M0031- R1- C- #3 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX181 **Collected:** 2016/10/20
Sample ID: M0031- R2- A- #4 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX182 **Collected:** 2016/10/20
Sample ID: M0031- R2- B- #5 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX183 **Collected:** 2016/10/20
Sample ID: M0031- R2- C- #6 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX184 **Collected:** 2016/10/20
Sample ID: M0031- R3- A- #7 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX185 **Collected:** 2016/10/20
Sample ID: M0031- R3- B- #8 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

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TEST SUMMARY

Maxxam ID: DHX186 **Collected:** 2016/10/20
Sample ID: M0031- R3- C- #9 A/B/C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST EPA5041A, 8260C for 0030, 0031	GC/MS	4718714	N/A	2016/10/26	Yujie Yan

Maxxam ID: DHX187 **Collected:** 2016/10/20
Sample ID: COND- FB **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX190 **Collected:** 2016/10/20
Sample ID: COND- R1- A **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX191 **Collected:** 2016/10/20
Sample ID: COND- R1- B **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX192 **Collected:** 2016/10/20
Sample ID: COND- R1- C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX193 **Collected:** 2016/10/20
Sample ID: COND- R2- A **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX194 **Collected:** 2016/10/20
Sample ID: COND- R2- B **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

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TEST SUMMARY

Maxxam ID: DHX195 **Collected:** 2016/10/20
Sample ID: COND- R2- C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX196 **Collected:** 2016/10/20
Sample ID: COND- R3- A **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX197 **Collected:** 2016/10/20
Sample ID: COND- R3- B **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

Maxxam ID: DHX198 **Collected:** 2016/10/20
Sample ID: COND- R3- C **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/24

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
VOST Condensate (8260Cmod)	P&T/MS	4723005	N/A	2016/10/31	Yujie Yan

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GENERAL COMMENTS

Condensate samples had 65mls.

Sample DHX168-01 : Sample filtered due to suspended particles

Sample DHX169-01 : Sample filtered due to suspended particles

Sample DHX170-01 : Sample filtered due to suspended particles

Sample DHX187-01 : Sample was analyzed at a 2500X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 12500ug/L

Sample DHX190-01 : Sample was analyzed at a 5000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 25000ug/L

Sample DHX191-01 : Sample was analyzed at a 5000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 25000ug/L

Sample DHX192-01 : Sample was analyzed at a 5000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 25000ug/L

Sample DHX193-01 : Sample was analyzed at a 5000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 25000ug/L

Sample DHX194-01 : Sample was analyzed at a 5000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 25000ug/L

Sample DHX195-01 : Sample was analyzed at a 5000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 25000ug/L

Sample DHX196-01 : Sample was analyzed at a 20000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 100000ug/L

Sample DHX197-01 : Sample was analyzed at a 20000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 100000ug/L

Sample DHX198-01 : Sample was analyzed at a 20000X dilution. The DL's were adjusted accordingly.
Acrylonitrile < 100000ug/L

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
4718714	YYA	Spiked Blank	Bromofluorobenzene	2016/10/26		99	%	43 - 131
			D10-Ethylbenzene (FS)	2016/10/26		101	%	47 - 157
			D4-1,2-Dichloroethane	2016/10/26		100	%	64 - 133
			D8-Toluene	2016/10/26		100	%	68 - 121
			Chloromethane	2016/10/26		108	%	50 - 150
			Vinyl Chloride	2016/10/26		98	%	50 - 150
			Bromomethane	2016/10/26		92	%	50 - 150
			Chloroethane	2016/10/26		98	%	50 - 150
			1,1-Dichloroethylene	2016/10/26		104	%	50 - 150
			Iodomethane	2016/10/26		81	%	N/A
			Carbon Disulfide	2016/10/26		96	%	50 - 150
			Methylene Chloride(Dichloromethane)	2016/10/26		101	%	50 - 150
			Chloroform	2016/10/26		103	%	50 - 150
			1,2-Dichloroethane	2016/10/26		104	%	50 - 150
			1,1,1-Trichloroethane	2016/10/26		103	%	50 - 150
			Carbon Tetrachloride	2016/10/26		104	%	50 - 150
			Benzene	2016/10/26		104	%	50 - 150
			1,1,2-Trichloroethane	2016/10/26		105	%	50 - 150
			1,2-Dichloropropane	2016/10/26		105	%	50 - 150
			Trichloroethylene	2016/10/26		104	%	50 - 150
			Toluene	2016/10/26		104	%	50 - 150
			Tetrachloroethylene	2016/10/26		105	%	50 - 150
			Chlorobenzene	2016/10/26		105	%	50 - 150
			Ethylbenzene	2016/10/26		105	%	50 - 150
			m / p-Xylene	2016/10/26		106	%	50 - 150
			Styrene	2016/10/26		105	%	50 - 150
			o-Xylene	2016/10/26		104	%	50 - 150
			Bromoform	2016/10/26		106	%	50 - 150
			1,1,2,2-Tetrachloroethane	2016/10/26		109	%	50 - 150
			Acrylonitrile	2016/10/26		115	%	N/A
4718714	YYA	Method Blank	Bromofluorobenzene	2016/10/26		100	%	43 - 131
			D10-Ethylbenzene (FS)	2016/10/26		103	%	47 - 157
			D4-1,2-Dichloroethane	2016/10/26		110	%	64 - 133
			D8-Toluene	2016/10/26		100	%	68 - 121
			Chloromethane	2016/10/26	<0.015		ug	
			Vinyl Chloride	2016/10/26	<0.013		ug	
			Bromomethane	2016/10/26	<0.015		ug	
			Chloroethane	2016/10/26	<0.0090		ug	
			1,1-Dichloroethylene	2016/10/26	<0.011		ug	
			Iodomethane	2016/10/26	<0.015		ug	
			Carbon Disulfide	2016/10/26	<0.026		ug	
			Methylene Chloride(Dichloromethane)	2016/10/26	<0.019		ug	
			Chloroform	2016/10/26	<0.011		ug	
			1,2-Dichloroethane	2016/10/26	<0.0070		ug	
			1,1,1-Trichloroethane	2016/10/26	<0.014		ug	
			Carbon Tetrachloride	2016/10/26	<0.016		ug	
			Benzene	2016/10/26	<0.0090		ug	
			1,1,2-Trichloroethane	2016/10/26	<0.016		ug	
			1,2-Dichloropropane	2016/10/26	<0.011		ug	
			Trichloroethylene	2016/10/26	<0.011		ug	
			Toluene	2016/10/26	<0.014		ug	
			Tetrachloroethylene	2016/10/26	<0.018		ug	
			Chlorobenzene	2016/10/26	<0.011		ug	
			Ethylbenzene	2016/10/26	<0.014		ug	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			m / p-Xylene	2016/10/26	<0.015		ug	
			Styrene	2016/10/26	<0.012		ug	
			o-Xylene	2016/10/26	<0.015		ug	
			Bromoform	2016/10/26	<0.014		ug	
			1,1,2,2-Tetrachloroethane	2016/10/26	<0.014		ug	
			Acrylonitrile	2016/10/26	<0.025		ug	
4723005	YYA	Spiked Blank	4-Bromofluorobenzene	2016/10/31		97	%	70 - 130
			D4-1,2-Dichloroethane	2016/10/31		107	%	70 - 130
			D8-Toluene	2016/10/31		103	%	70 - 130
			Chloromethane	2016/10/31		94	%	60 - 140
			Vinyl Chloride	2016/10/31		108	%	70 - 130
			Bromomethane	2016/10/31		68	%	60 - 140
			Chloroethane	2016/10/31		102	%	70 - 130
			Iodomethane	2016/10/31		90	%	N/A
			Carbon Disulfide	2016/10/31		108	%	N/A
			Methylene Chloride(Dichloromethane)	2016/10/31		99	%	70 - 130
			1,1-Dichloroethane	2016/10/31		104	%	70 - 130
			Chloroform	2016/10/31		103	%	70 - 130
			1,2-Dichloroethane	2016/10/31		103	%	70 - 130
			1,1,1-Trichloroethane	2016/10/31		113	%	70 - 130
			Carbon Tetrachloride	2016/10/31		123	%	70 - 130
			Benzene	2016/10/31		100	%	70 - 130
			1,2-Dichloropropane	2016/10/31		97	%	70 - 130
			Trichloroethylene	2016/10/31		98	%	70 - 130
			Toluene	2016/10/31		101	%	70 - 130
			Tetrachloroethylene	2016/10/31		100	%	70 - 130
			Chlorobenzene	2016/10/31		97	%	70 - 130
			Ethylbenzene	2016/10/31		104	%	70 - 130
			p+m-Xylene	2016/10/31		101	%	70 - 130
			Styrene	2016/10/31		96	%	70 - 130
			o-Xylene	2016/10/31		99	%	70 - 130
			Bromoform	2016/10/31		91	%	70 - 130
			1,1,2,2-Tetrachloroethane	2016/10/31		94	%	70 - 130
			Total Xylenes	2016/10/31		100	%	N/A
4723005	YYA	Method Blank	4-Bromofluorobenzene	2016/10/31		94	%	70 - 130
			D4-1,2-Dichloroethane	2016/10/31		111	%	70 - 130
			D8-Toluene	2016/10/31		103	%	70 - 130
			Chloromethane	2016/10/31	<2.0		ug/L	
			Vinyl Chloride	2016/10/31	<0.40		ug/L	
			Bromomethane	2016/10/31	<3.0		ug/L	
			Chloroethane	2016/10/31	<1.0		ug/L	
			Iodomethane	2016/10/31	<0.60		ug/L	
			Carbon Disulfide	2016/10/31	<0.50		ug/L	
			Methylene Chloride(Dichloromethane)	2016/10/31	<1.0		ug/L	
			1,1-Dichloroethane	2016/10/31	<0.40		ug/L	
			Chloroform	2016/10/31	<0.40		ug/L	
			1,2-Dichloroethane	2016/10/31	<0.50		ug/L	
			1,1,1-Trichloroethane	2016/10/31	<0.50		ug/L	
			Carbon Tetrachloride	2016/10/31	<0.50		ug/L	
			Benzene	2016/10/31	<0.50		ug/L	
			1,2-Dichloropropane	2016/10/31	<0.50		ug/L	
			Trichloroethylene	2016/10/31	<0.50		ug/L	
			Toluene	2016/10/31	<0.50		ug/L	
			Tetrachloroethylene	2016/10/31	<0.50		ug/L	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Chlorobenzene	2016/10/31	<0.50		ug/L	
			Ethylbenzene	2016/10/31	<0.50		ug/L	
			p+m-Xylene	2016/10/31	<0.50		ug/L	
			Styrene	2016/10/31	<0.50		ug/L	
			o-Xylene	2016/10/31	<0.50		ug/L	
			Bromoform	2016/10/31	<0.40		ug/L	
			1,1,2,2-Tetrachloroethane	2016/10/31	<1.0		ug/L	
			Total Xylenes	2016/10/31	<0.50		ug/L	
4731052	MGE	Matrix Spike(DHX169)	Formaldehyde	2016/11/03		67 (1)	%	80 - 120
4731052	MGE	Spiked Blank	Formaldehyde	2016/11/03		105	%	91 - 107
4731052	MGE	Method Blank	Formaldehyde	2016/11/03	<0.03		ug	
4731052	MGE	RPD - Sample/Sample Dup	Formaldehyde	2016/11/03	NC		%	20

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).

(1) Matrix Spike failed due to interference.

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Frank Mo, B.Sc., Inorganic Lab. Manager

Maureen Smith, Supervisor, Volatiles

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ANALYSIS REQUESTED

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SECTION

Phone: 412 826 3636 Fax:
Sampled by: John Kelson

Field Sample ID			Total Volume Sampled	Flow Rate	Collection Date	Sample Collection Time	Rm 316 Cr + Ni	Rm 0031 Formaldehyde emissions
Combustion stack	M316	Run 1	150 ~~[illegible]~~	150	10/20/16	~ 2 hours	✓	
"	"	Run 2	↓	↓	↓	↓	✓	
"	"	Run 3	↓	↓	↓	↓	✓	
"	"	Solvent Blank	Grab	Grab			✓	
"	M0031	Run 1	60 ~~[illegible]~~	0.5LPM				✓
"	"	Run 2	↓	↓	↓	↓		✓
"	"	Run 3	↓	↓	↓	↓		✓
"	"	Field Blank	Grab	Grab	↓	↓		✓
"	"	Trip Blank	Grab	Grab	↓	↓		✓

TAT Requirement

STD 10 Business day ☒
Rush 5 Business day * ☐
Rush 2 Business day * ☐
* need approval from Maxxam

PROJECT INFORMATION

Project #: 106377 (16-167)
Name: John Kelson
PO #: NA
Maxxam Quote #:
Maxxam Contact: Clayton Jones

REPORTING REQUIREMENTS

Summary Report only ☐
EDD ☐
Regulation

Notes

PROJECT SPECIFIC COMMENTS

Client Signature:
Affiliation: Montrose
Date/Time: 10/24/16

Received by:
Affiliation: MAXXAM
Date/Time: 10-24-16

CCC-1031 (04/13) - Air

TEJASH PATEL 2016/10/24 18:00

Method 15

COMBUSTION STACK 2 GAS
HYDROGEN SULFIDE ANALYTICAL REPORT
ARCELORMITTAL - MONESSEN, MONESSEN, PA

January 3, 2017

Prepared for:

ArcelorMittal - Monessen
Erie, PA

Prepared by:

Montrose Air Quality Services, LLC.
1050 William Pitt Way
Pittsburgh, Pennsylvania 15238
412-826-3636

PA Lab Registration #02-04775

Project No. 16-167

MONTROSE
AIR QUALITY SERVICES

CERTIFICATION STATEMENT

This statement certifies that "to the best of their knowledge," based on state and federal regulations, operating permits, plan approvals applicable to each source tested, and reasonable inquiry, the statements and information presented in the attached document are true, accurate, and complete.

COMBUSTION STACK 2 GAS
HYDROGEN SULFIDE ANALYTICAL REPORT
ARCELORMITTAL - MONESSEN, MONESSEN, PA

Project No. 16-167

1-3-2017

Date

Frank Barton, Field Project Manager
Montrose Air Quality Services, LLC.

1/3/17

Date

Matthew Dallesasse, District Manager
Montrose Air Quality Services, LLC.

Disclaimer – This document is intended solely for the use of the individual to whom it is addressed and others authorized to receive it.

Table 1. Analysis of Combustion Stack 2 Gas for Hydrogen Sulfide (H2S)
Test Date October 20, 2016
Combustion Stack 2, ArcelorMittal Monessen, Monessen, PA

	Start Time	End Time	Run Average (H2S ppm)
Run 1	8:40	9:40	< 0.5 ppm
Run 2	12:10	13:10	< 0.5 ppm
Run 3	13:12	14:12	< 0.5 ppm
			Average of Runs 1 - 3 (H2S ppm) < 0.5 ppm

< indicates below detection limit

The samples were anaylzed by gas chromatography using a flame photometric detector as described by USEPA Method 15.

Method 15

Method Narrative

COMBUSTION STACK 2 GAS
HYDROGEN SULFIDE ANALYTICAL REPORT
ARCELORMITTAL - MONESSEN, MONESSEN, PA

METHOD NARRATIVE

Gas chromatography (GC) analysis was performed on stack gas from the Combustion Stack 2 on an SRI 8610C GC Multiple Gas #3 Analyzer. The GC was configured with the following components:

1. Rotary injection valve with a 1.0 milliliter (ml) sample loop
2. A 60 meter (m) MXT 1 Column manufactured by RESTEK Corporation eluting to a Combination Flame Ionization Detector / Flame Photometric Detector (FID / FPD) for analysis of sulfur Compounds.
3. The FID / FPD is supplied hydrogen at 30 pounds per square inch (psi) and air is pumped to the detector by an internal air compressor at a rate of 3 liters per minute (lpm).
4. UHP helium is used as the carrier gas and has a flow pressure of 27 psi.

1. GC Programs and Settings

- Injection Components Temperature: 62°C
- Detector Temperature: FID / FPD 180°C
- Column Oven Temperature Program:
    - Initial injection temperature 150°C
    - Hold for 3.5 minutes

Run Events:

Time	Event
0.00 Min	Run Start
0.05 Min	Valve Rotates (sample injected)
0.50 Min	Auto Zero to Base Line
3.50 Min	Valve Rotates (run ends)

2. Test Procedures

The testing followed USEPA Method 15, *Determination of Hydrogen Sulfide, Carbonyl Sulfide, and Carbon Disulfide Emissions from Stationary Sources*, for the initial calibration and post test run procedures. Samples were analyzed for Hydrogen Sulfide (H2S) for three 1-hour runs. Each run consisted of six sample injections. Sample injection were made at ten minute intervals.

An overall calibration curve was generated prior to sampling and confirmed at the conclusion of testing. Each point on the curve was obtained by injecting gas from separate certified calibration bottled gases into the GC. Three consecutive injections were performed per calibration gas level and the results were within the required 5%.

A line loss test was conducted at the end of the testing program. The post-line loss test was performed to comply with USEPA Method 15. The post line loss test indicated no loss of H2S concentration.

2.1 Removal of SO2

Sulfur Dioxide (SO2) and COS elute though the GC column at similar times making them hard or impossible to discriminate. For that reason it is necessary to remove the SO2 from the sample gas. This is accomplished by making a citrate buffer solution that will "scrub" the SO2 from the sample gas and will have no effect on the sulfur compounds of interest. The scrubber solution is made by dissolving 300 g of potassium citrate and 41 g of anhydrous citric acid in 1 liter of water.

The effectiveness of the scrubber solution was verified before and after each run. Analysis of an SO2 calibration gas eluted through the scrubber proved the removal of SO2. Analysis of calibration gas containing H2S, COS, and CS2 eluted through the scrubber showed no effect on these compounds. Analysis results of SO2 calibration gas bypassing the scrubber contained SO2. These GC chromatograms are included with the run result chromatograms.

2.2 Sampling Components

The sampling system included a heated probe, impinger set-up, 3/8 inch line, three-way valve, GC sampling system, and sample pump.

The impinger set-up was made up of three impingers connected in series. The first two impingers contained 100 milliliters each of the citrate buffer solution (for the removal of SO2) and the third impinger was empty. Another purpose of the impingers was to remove moisture from the stack gas. This was achieved by keeping the impingers in an ice water bath condensing out the moisture as it passed through the buffer solution.

2.3 Sampling Procedure

The heated probe (heated to 300°F) was inserted into the Combustion Stack 2 sample port. To insure that fresh stack gas was being analyzed by the GC, a sample pump continually pulled exhaust gas through the probe, impinger set-up, sample line, and the three way valve. In the normal valve position (time when not sampling), the exhaust gas was vented into the outside air. When the valve was in the sampling position, the stack gas was pulled through the sample loop of the GC for a period of at least 5 seconds. The three way valve was then returned back to the venting position. The rotary valve was then actuated, introducing the gas sample to the GC column for separation and elution to the detector. Prior to the start of sampling a leak check was performed by making an air tight seal at the sample probe end while the sample pump was running. The impingers containing the citrate buffer were then observed to verify that the bubbling activity decreased to a point that air bubbles occurred at a rate of less than one per second.

Method 15

Run Results

Combustion Stack 2

Injection Run 1

Injection	Component	Retention	Area	External	Units
1	H2S	-	-	< 0.5 ppm	ppm
2	H2S	-	-	< 0.5 ppm	ppm
3	H2S	-	-	< 0.5 ppm	ppm
4	H2S	-	-	< 0.5 ppm	ppm
5	H2S	-	-	< 0.5 ppm	ppm
6	H2S	-	-	< 0.5 ppm	ppm

Combustion Stack 2

Injection Run 2

1	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
2	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
3	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
4	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
5	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
6	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm

Combustion Stack 2

Injection Run 3

1	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
2	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
3	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
4	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
5	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm
6	Component	Retention	Area	External	Units
	H2S	-	-	< 0.5 ppm	ppm

Method 15

Calibration Gas Certificates

Airgas

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Airgas, Inc.
600 Union Landing Road
Cinnaminson, NJ 08077
856-829-7878 Fax: 856-829-6576
www.airgas.com

Part Number:	E02NI99E15A0485	Reference Number:	82-124453828-1
Cylinder Number:	CC437195	Cylinder Volume:	144.3 CF
Laboratory:	ASG - Riverton - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52014	Valve Outlet:	330
Gas Code:	H2S,BALN	Certification Date:	Sep 24, 2014

Expiration Date: Sep 24, 2017

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
HYDROGEN SULFIDE	10.00 PPM	9.994 PPM	G1	+/- 1.6%	09/17/2014, 09/24/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	1242064581010	CC315795	9.994 PPM HYDROGEN SULFIDE/NITROGEN	+/- 1.6%	Apr 04, 2016
PRM	12320	D249622	10.00 PPM HYDROGEN SULFIDE/NITROGEN	+/- 1.5%	Jul 19, 2015

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Ametek AE-921-S411 H2S	NDUV	Sep 02, 2014

Triad Data Available Upon Request

Walter E Mellor

Approved for Release

Airgas

Airgas Specialty Gases
630 United Drive
Durham , NC 27713
919-544-3773 Fax: 919-544-3774
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E02NI99E15A0604	Reference Number:	122-124500606-1
Cylinder Number:	CC245222	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Durham - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22015	Valve Outlet:	330
Gas Code:	H2S,BALN	Certification Date:	Jul 07, 2015

Expiration Date: Jul 07, 2018

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
HYDROGEN SULFIDE	55.00 PPM	56.00 PPM	G1	+/- 1.1% NIST Traceable	06/29/2015, 07/07/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124139721114	CC221527	49.29 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.8%	Apr 11, 2017
RGM	12338	CC162437	49.14 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.7%	Nov 20, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Ametek 9900 H2S ZX-9900-S1170	Ultraviolet	Jun 23, 2015

Triad Data Available Upon Request

CS Williams
Approved for Release

Airgas

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Airgas, Inc.
600 Union Landing Road
Cinnaminson, NJ 08077
856-829-7878 Fax: 856-829-6576
Airgas.com

Part Number:	E02NI99E15A0445	Reference Number:	82-124479697-1
Cylinder Number:	CC448299	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Riverton - NJ	Cylinder Pressure:	2015 PSIG
PGVP Number:	B52015	Valve Outlet:	330
Gas Code:	H2S,BALN	Certification Date:	Mar 05, 2015

Expiration Date: Mar 05, 2018

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
HYDROGEN SULFIDE	150.0 PPM	145.2 PPM	G1	+/- 0.7%	02/26/2015, 03/05/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS	124395711102	CC365062	201.5 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.6%	Oct 16, 2017
RGM	12344	XC028492B	197.3 PPM HYDROGEN SULFIDE/NITROGEN	+/- 0.5%	Nov 12, 2017

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Ametek 9000 RM	NDUV	Feb 25, 2015

Triad Data Available Upon Request

Approved for Release

Method 15

H2S Calibration Data

MONTROSE CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 15

Client	ArcelorMittal - Monessen	**Date**	October 20, 2016
Project No	16-167	**Run 1**	Start: 8:40 / End: 9:40
Plant	Monessen	**Run 2**	Start: 12:10 / End: 13:10
Unit	Combustion Stack 2	**Run 3**	Start: 13:12 / End: 14:12
Operation	Normal		
Tester(s)	FB		

Cal. Gas	LOW Conc.	MID Conc.	HIGH Conc.	Tank ID or Lot Number LOW	MID	HIGH	Conc. Units
H2S	10.0	56.0	145.2	CC437195	CC245222	CC448299	ppm

Gas	Calibration Level	Initial Calibration Responses Per Injection (units of area under the curve) Injection 1	2	3	Average Area	Calibration Precision (% of each injection with relation to each other) Injection 1	2	3
H2S	Low	25.1226	25.7230	24.9062	25.2506	0.51%	1.87%	1.36%
	Mid	1315.4082	1351.9174	1334.4717	1333.9324	1.39%	1.35%	0.04%
	High	6836.1650	6796.2409	6805.8799	6812.7619	0.34%	0.24%	0.10%
LIMITS						≥5%	≥5%	≥5%

Gas	Calibration Level	Final Calibration Responses Per Injection (units of area under the curve) Injection 1	2	3	Average Area	Calibration Precision (% of each injection with relation to each other) Injection 1	2	3
H2S	Low	26.1852	24.8527	25.6491	25.5623	2.44%	2.78%	0.34%
	Mid	1373.5476	1340.3470	1379.3246	1364.4064	0.67%	1.76%	1.09%
	High	6871.7774	6744.4112	6591.6156	6735.9347	2.02%	0.13%	2.14%
LIMITS						≥5%	≥5%	≥5%

POST TEST CALIBRATION DATA

Pre and Post Calibration agreement within 5%

H2S

		Pre Calibration	Post Calibration	% of Average	Less than 5%
10.0	**ppm H2S**	25.12	26.19		
		25.72	24.85		
		24.91	25.65		
	Average	25.25	25.56	1.2%	YES

		Pre Calibration	Post Calibration	% of Average	Less than 5%
56.0	**ppm H2S**	1315.41	1373.55		
		1351.92	1340.35		
		1334.47	1379.32		
	Average	1333.93	1364.41	2.3%	YES

		Pre Calibration	Post Calibration	% of Average	Less than 5%
145.2	**ppm H2S**	6836.17	6871.78		
		6796.24	6744.41		
		6805.88	6591.62		
	Average	6812.76	6735.93	1.1%	YES

POST TEST LINE LOSS CHECK

10.0 ppm	**Average**	**Area**	**% of Average**
	1	26.0020	0.82%
	2	25.5125	1.08%
	3	25.8548	0.25%
	Average	**25.7898**	

	Area
Calibration Standard	25.3
Post Test Line Loss Injection Average	25.8
Post Test Line Loss	-2.14%

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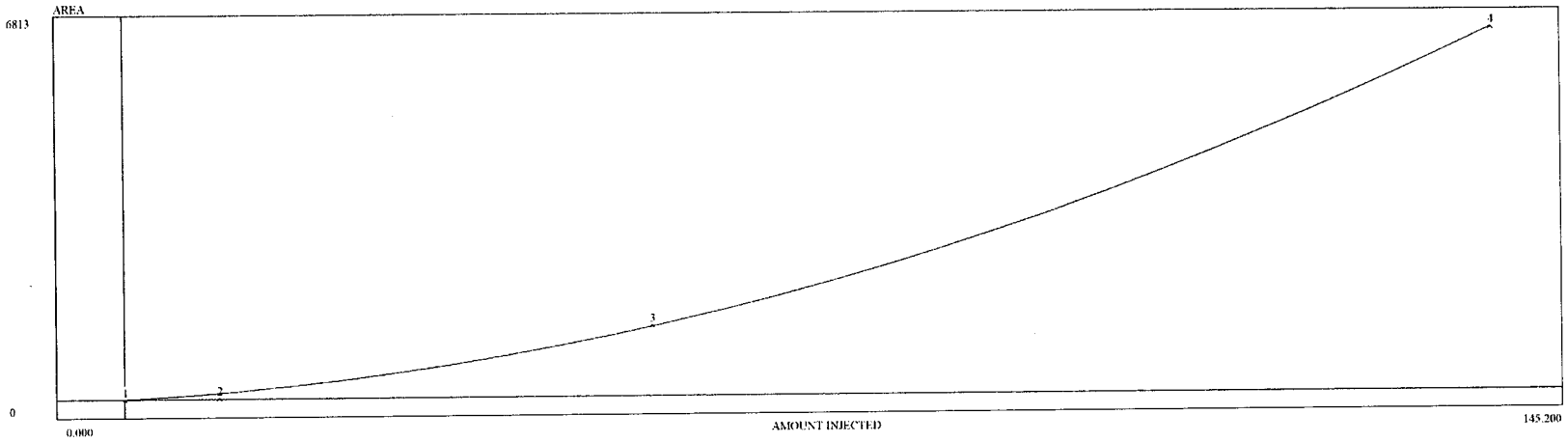
Calibration file: C:\Users\fbarton\Desktop\GC Projects\Monessen\16-167 ICR Testing\Combustion Stack\10-19 and 10-20-2016 Combustion Stack\H2S Cal 10-20-2016.cal



Avg slope of curve: 46.91
Y-axis intercept: 0.00
Linearity: 0.56
Number of levels: 4
SD/rel SD of CF's: 21.9/119.3
Y=0.2639X^2+8.6188X
r2: 0.9997
Last calibrated: Thu Oct 20 09:38:13 2016

Lvl	Area/ht.	Amount	CF	Current	Previous #1	Previous #2
1	0.000	0.000	0.000	0.000	N/A	N/A
2	25.251	9.994	2.527	25.251	N/A	N/A
3	1333.932	56.000	23.820	1333.932	N/A	N/A
4	6812.762	145.200	46.920	6812.762	N/A	N/A

Combustion Stack H2S Calibration Curve

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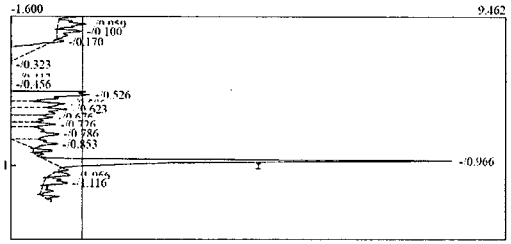
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:22:05
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Zero Cal 01

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

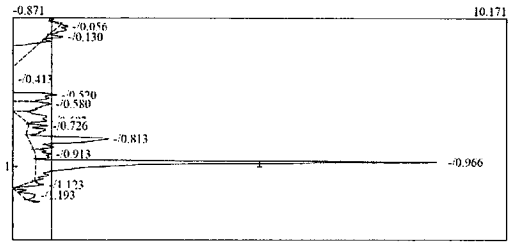
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:24:31
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Zero Cal 02

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

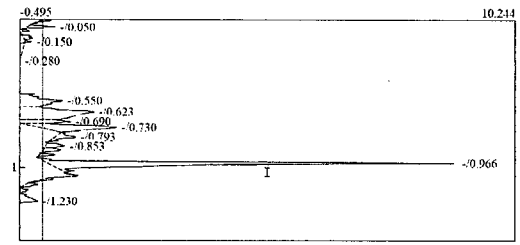
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:27:14
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Zero Cal 03

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

Combustion Stack Zero Cal

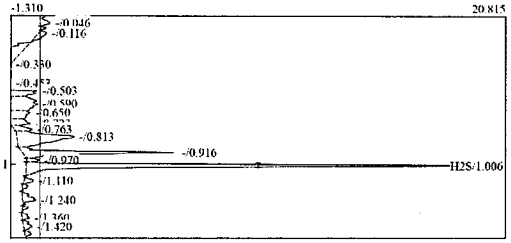
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 08:27:59
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Low Cal 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.006	25.1226
		25.1226

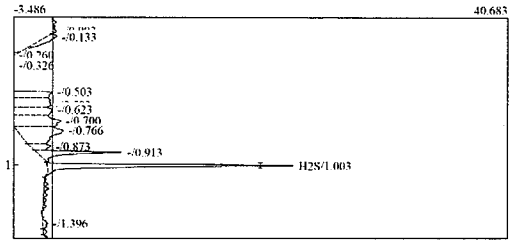
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 08:30:32
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Low Cal 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.003	25.7230
		25.7230

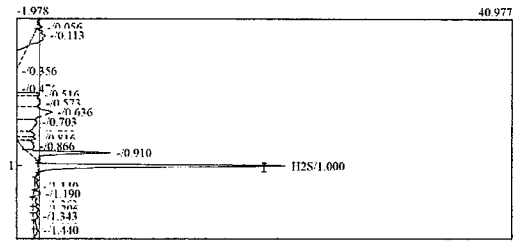
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 08:33:32
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Low Cal 03
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.000	24.9062
		24.9062

Combustion Stack Low Cal

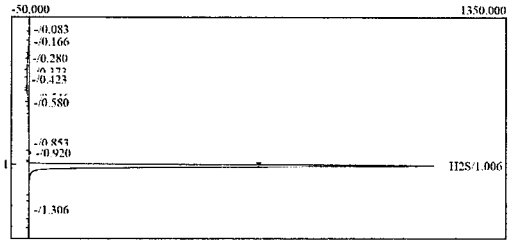
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 07:36:03
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Mid Cal 01
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.006	1315.4082
		1315.4082

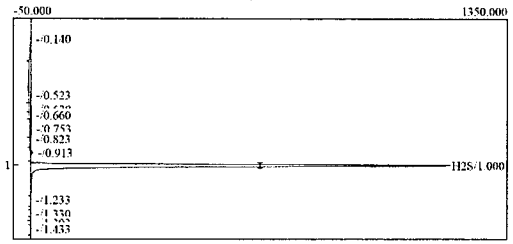
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 07:38:38
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Mid Cal 02
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.000	1351.9174
		1351.9174

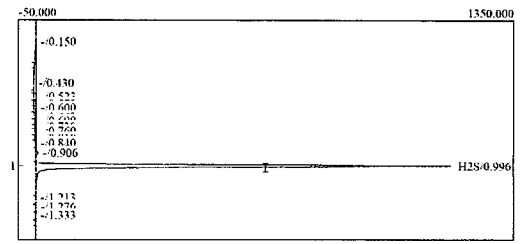
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 07:43:17
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Mid Cal 03
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.996	1334.4717
		1334.4717

Combustion Stack Mid Cal

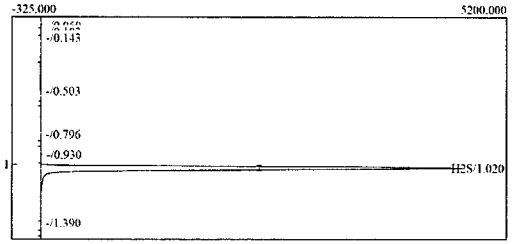
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 07:12:41
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: High Cal 01
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.020	6836.1650
		6836.1650

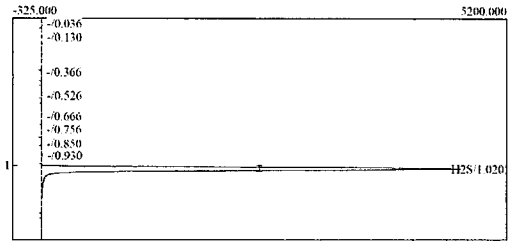
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 07:14:46
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: High Cal 02
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.020	6796.2409
		6796.2409

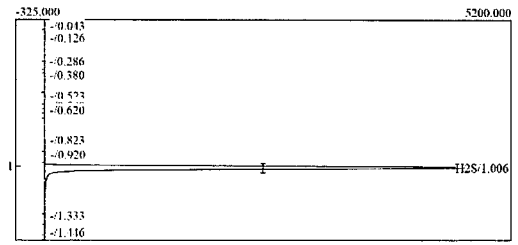
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 07:17:05
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: High Cal 03
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.006	6805.8799
		6805.8799

Combustion Stack High Cal

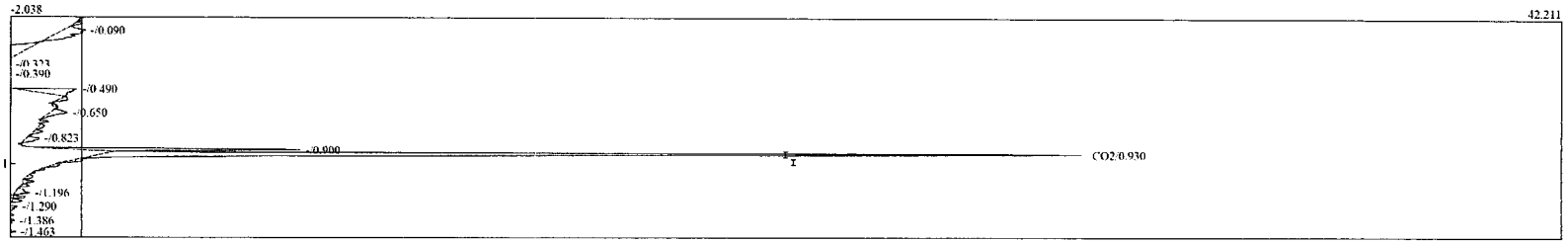
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 08:42:13
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: CO2 Time Check

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
CO2	0.930	29.9304
		29.9304

CO2 Time Check

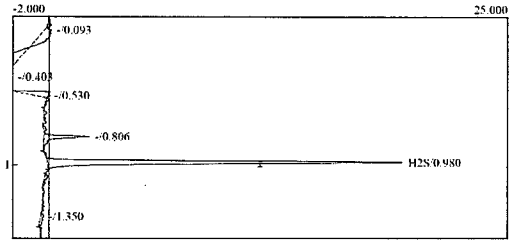
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 15:20:23
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Low Cal 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.980	26.1852
		26.1852

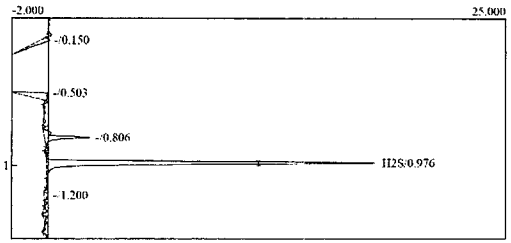
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 15:23:10
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Low Cal 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.976	24.8527
		24.8527

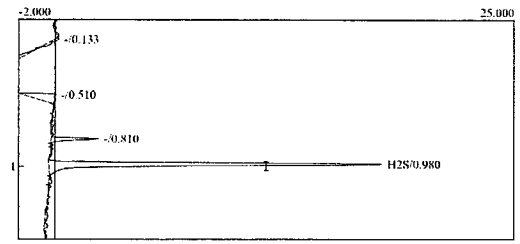
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 15:32:06
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Low Cal 03
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.980	25.6491
		25.6491

Combustion Stack Post Low Cal

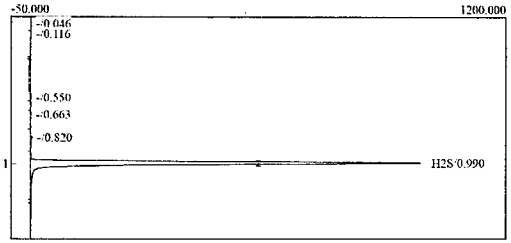
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:39:31
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Mid Cal 01
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.990	1373.5476
		1373.5476

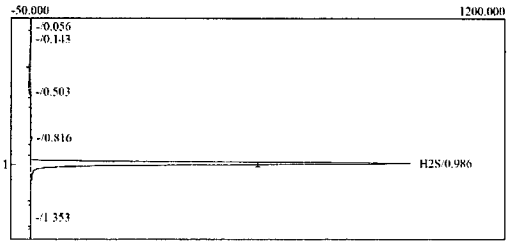
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:41:41
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Mid Cal 02
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.986	1340.3470
		1340.3470

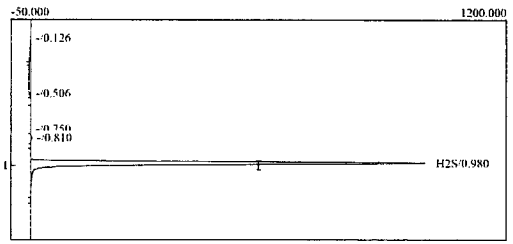
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:46:08
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Mid Cal 03
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.980	1379.3246
		1379.3246

Combustion Stack Post Mid Cal

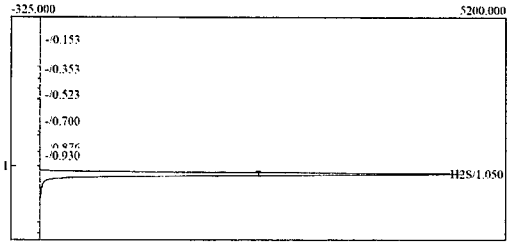
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:57:53
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post High Cal 01
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.050	6871.7774
		6871.7774

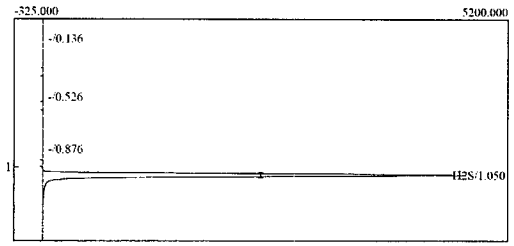
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 15:12:15
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post High Cal 02
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.050	6744.4112
		6744.4112

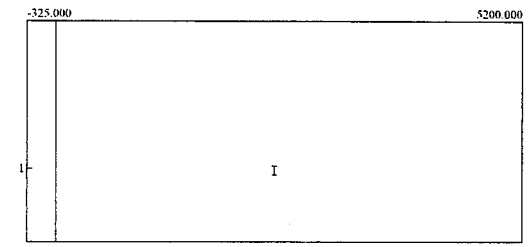
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:57:53
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post High Cal 03
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

Combustion Stack Post High Cal

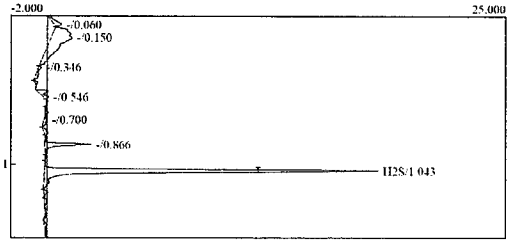
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 15:49:49
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Line Loss 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.043	26.0020
		26.0020

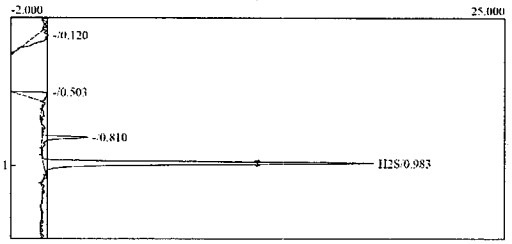
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 15:52:16
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Line Loss 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	0.983	25.5125
		25.5125

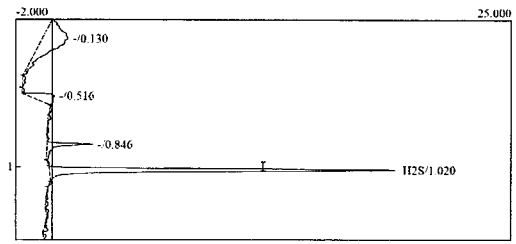
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 16:09:32
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Post Line Loss 03
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.020	25.8548
		25.8548

Combustion Stack Post Line Loss

Method 15

Run 1-3 Data and Run Chromatograms

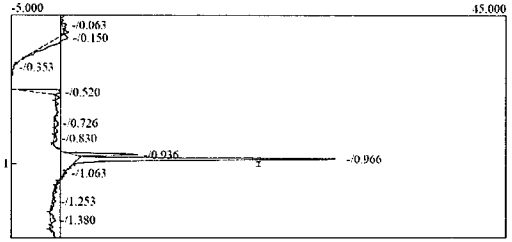
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 08:46:27
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 01

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

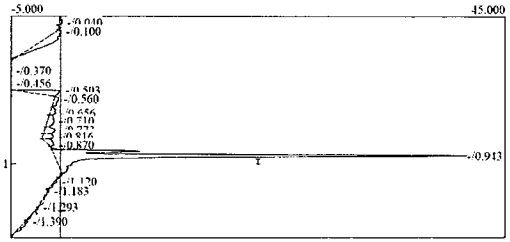
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 08:52:10
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 02

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

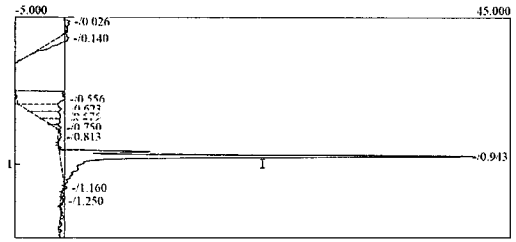
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 09:02:03
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 03

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Combustion Stack Run 1 Injections 1 - 3

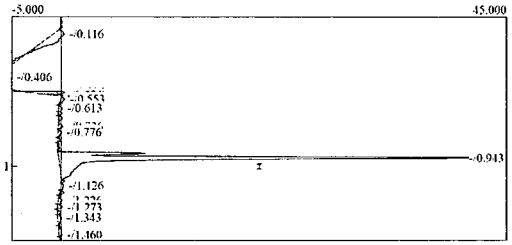
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 09:12:08
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 04

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

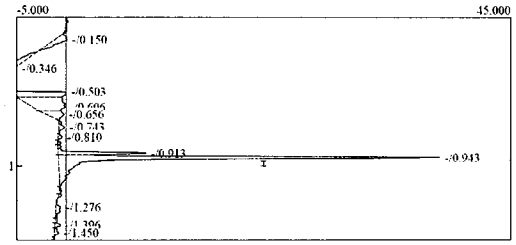
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 09:22:12
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 05

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

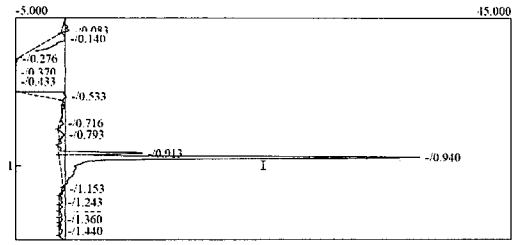
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 09:32:37
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 06

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Combustion Stack Run 1 Injections 4 - 6

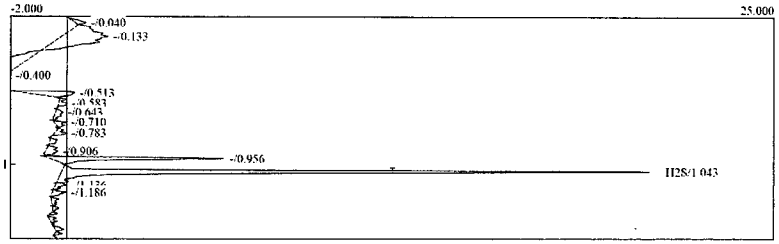
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 09:42:16
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 Low Cal Check 01
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.043	25.2206
		25.2206

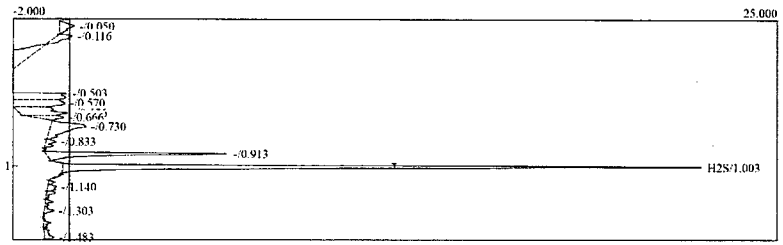
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 09:45:00
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 1 Low Cal Check 02
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.003	25.9121
		25.9121

Combustion Stack Run 1 Low Cal Check A

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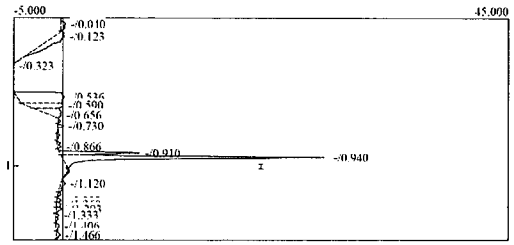
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 12:17:06
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 01

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

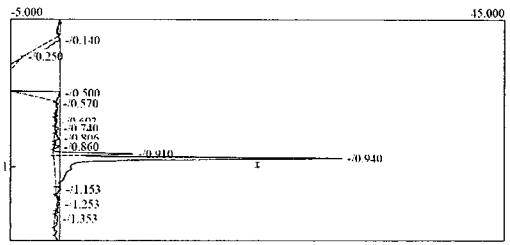
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 12:26:12
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 02

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

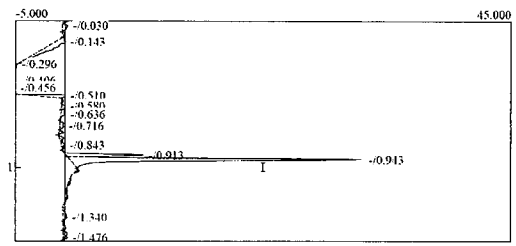
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 12:40:00
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 03

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Combustion Stack Run 2 Injections 1 - 3

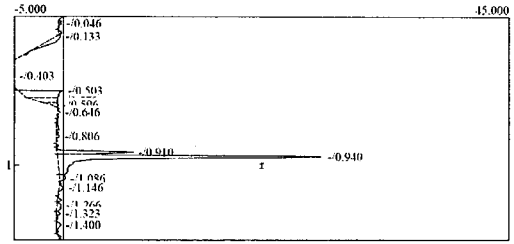
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 12:45:04
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 04

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

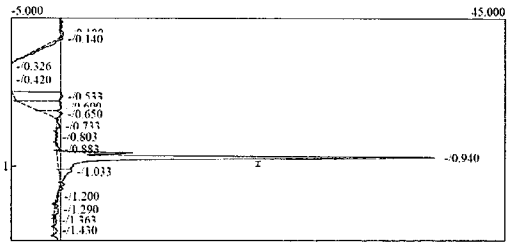
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 12:55:13
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 05

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

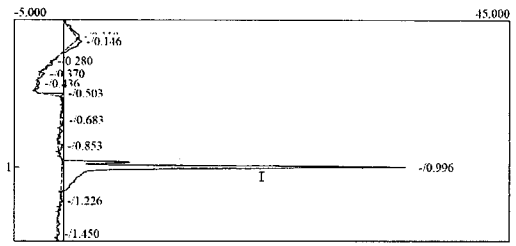
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:06:57
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 06

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Combustion Stack Run 2 Injections 4 - 6

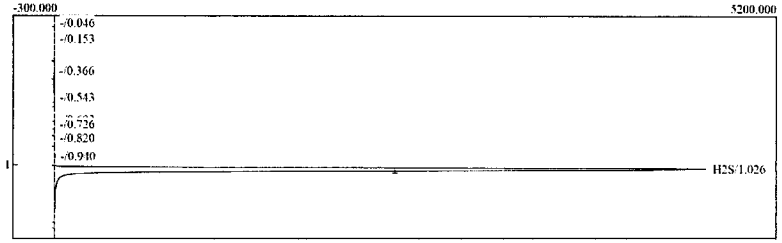
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:14:04
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 High Cal Check 01
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	1.026	6618.7535	142.8460	ppm
		6618.7535	142.8460	

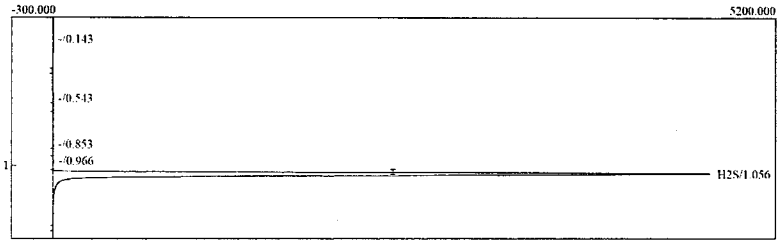
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:17:49
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 2 High Cal Check 02
Comments: H2S - 145.2 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	1.056	6729.7939	144.1721	ppm
		6729.7939	144.1721	

Combustion Stack Run 2 High Cal Check

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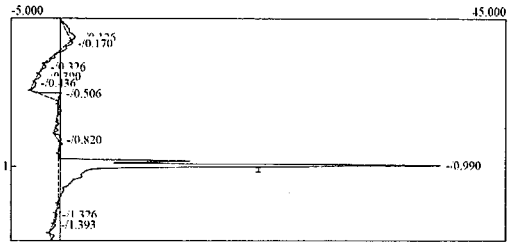
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:19:36
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 01

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

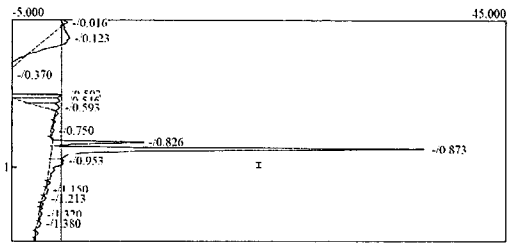
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:33:04
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 02

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

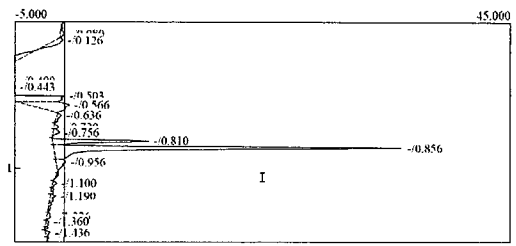
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:36:30
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 03

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Combustion Stack Run 3 Injections 1 - 3

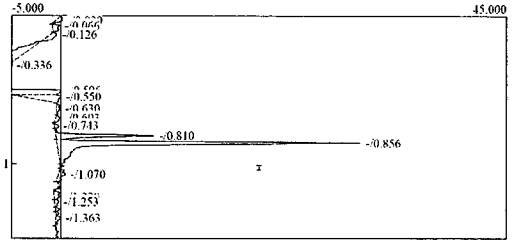
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:46:06
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 04

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

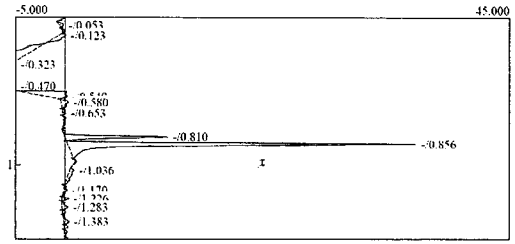
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 13:55:23
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 05

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

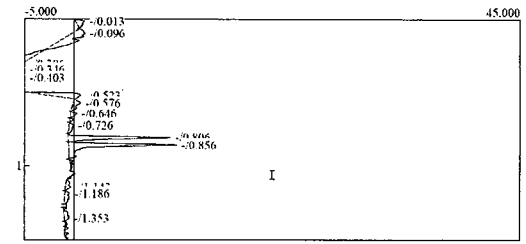
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:05:15
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 06

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
		0.0000	0.0000	

Combustion Stack Run 3 Injections 4 - 6

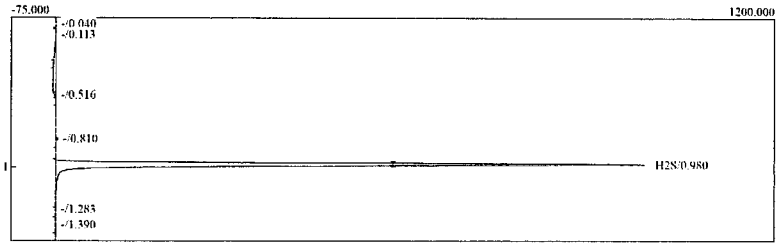
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:18:28
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 Mid Cal Check 01
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	0.980	1370.5306	57.5407	ppm
		1370.5306	57.5407	

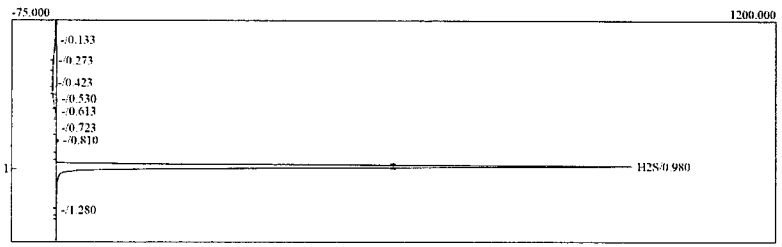
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/20/2016 14:26:37
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Combustion Stack Run 3 Mid Cal Check 02
Comments: H2S - 56.0 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area	External	Units
H2S	0.980	1335.1742	56.6040	ppm
		1335.1742	56.6040	

Combustion Stack Run 3 Mid Cal Check

APPENDIX E

Citrate Buffer Verification Files and Nomenclature

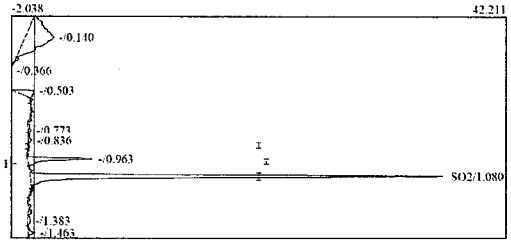
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/19/2016 11:38:45
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: SO2 Time Check
Comments: SO2 - 25 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
SO2	1.080	46.5358
		46.5358

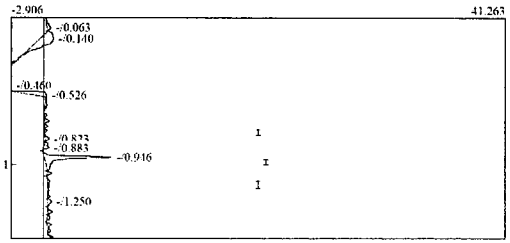
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/19/2016 11:47:32
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: SO2 Through Buffer
Comments: SO2 - 25 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
		0.0000

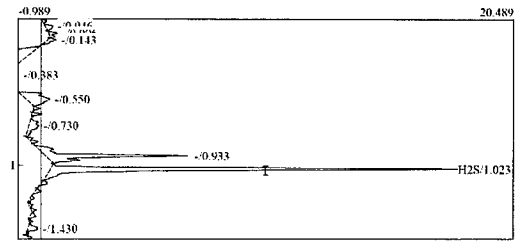
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/19/2016 11:31:20
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S low Cal Through Buffer
Comments: H2S - 9.994 ppm

Temperature program:

Init temp	Hold	Ramp	Final temp
50.00	3.500	0.000	50.00

Events:

Time	Event
0.050	ZERO
0.050	G ON (ValveRotate)
0.500	ZERO



Component	Retention	Area
H2S	1.023	21.5622
		21.5622

Buffer Verification Files

NOMENCLATURE

$\sum di^2$	-	The sum of the squares of the di values for all test runs included in RATA.
$\sum di$	-	The sum of the di values for all test runs included in RATA.
AS	-	Applicable standard.
C	-	Concentration of calibration gas for line loss testing
Cc	-	Confidence coefficient.
CEMS	-	Facility continuous emissions monitoring system value
d	-	Average difference between CEMS and RM for one test run.
di	-	Difference between CEMS and RM values for one run.
gr/100 dscf	-	Grains per 100 dry standard cubic feet
H_2S	-	Hydrogen Sulfide
k	-	Conversion factor to change ppm into gr/100 dscf
LL	-	Line Loss
LLav	-	Line Loss Average of three injections
MW	-	Molecular Weight
n	-	Number of test runs used in calculating relative accuracy.
ppm_v	-	Parts per million on a volume basis
RA		Relative accuracy.
RATA	-	Relative accuracy test audit.
RM	-	Reference method, or reference method values adjusted for line loss.
RM_{AV}	-	Arithmetic mean of all RM values for the test runs included in the RATA.
RM_{PPM}	-	Reference method sampling system value in parts per million
RMstd	-	Reference method standard
Sd	-	Standard deviation.
$t_{0.975}$	-	T-value for number of values used in RATA.

REPORT - APPENDIX D

Quality Assurance/Quality Control Data

	Previous Cal	New Cal	% Difference
Y	1.009	1.006	0.253
dH	1.898	1.977	4.075

Air Compliance Consultants, Inc.
EPA Method 5
Meter Box Calibration
Pre-Test Orifice Method
English Meter Box Units, English K' Factor
Apex Orifices

Model #: C-5000
Serial #: 1774

Date: ----------> 02/02/16 60.00
Barometric Pressure: ----------> 29.15 (in. Hg)
Theoretical Critical Vacuum:---> 13.75 (in. Hg)

Jenco 765 NIST Traceability		
NIST 161999	Jenco 765	% Difference
0	1	0.00%
400	394	1.50%
800	795	0.63%
1200	1189	0.92%
1600	1585	0.94%
1900	1878	1.16%

!!!!!!!!!
IMPORTANT For valid test results, the Actual Vacuum should be 1 to 2 in. Hg greater than the Theoretical Critical Vacuum shown above.
IMPORTANT The Critical Orifice Coefficient, K', must be entered in English units, (ft)^3*(deg R)^0.5/((in.Hg)*(min)).
!!!!!!!!!

---------- DRY GAS METER READINGS ----------									-CRITICAL ORIFICE READINGS-					
		Volume	Volume	Volume	Initial Temps.		Final Temps.		Orifice	K' Orifice	Actual	-- Ambient Temperature --		
dH (in H2O)	Time (min)	Initial (cu ft)	Final (cu ft)	Total (cu ft)	Inlet (deg F)	Outlet (deg F)	Inlet (deg F)	Outlet (deg F)	Serial# (number)	Coefficient (see above)	Vacuum (in Hg)	Initial (deg F)	Final (deg F)	Average (deg F)
0.29	17.00	740.198	745.339	5.141	73.0	73.0	74.0	73.0	40	0.2337	25.0	70.0	72.0	71.0
0.64	12.00	756.704	762.013	5.309	76.0	74.0	77.0	75.0	48	0.3408	24.0	72.0	73.0	72.5
1.10	10.00	734.100	739.978	5.878	72.0	72.0	73.0	72.0	55	0.4507	21.5	70.0	71.0	70.5
2.00	10.00	762.300	770.150	7.850	76.0	75.0	78.0	75.0	63	0.6027	20.5	73.0	73.0	73.0
3.60	10.00	745.802	756.342	10.540	74.0	73.0	77.0	74.0	73	0.8099	18.0	72.0	72.0	72.0

********** RESULTS **********

--- DRY GAS METER --- VOLUME CORRECTED	
Vm(std) (cu ft)	Vm(std) (liters)
4.961	140.5
5.106	144.6
5.694	161.3
7.569	214.3
10.232	289.8

-------- ORIFICE --------		
VOLUME CORRECTED		VOLUME NOMINAL
Vcr(std) (cu ft)	Vcr(std) (liters)	Vcr (cu ft)
5.026	142.3	5.190
5.166	146.3	5.350
5.704	161.5	5.885
7.610	215.5	7.888
10.236	289.9	10.590

-- DRY GAS METER -- CALIBRATION FACTOR	
Y Value (number)	Variation (number)
1.013	0.007
1.012	0.005
1.002	-0.005
1.005	-0.001
1.000	-0.006
Avg Y--> 1.006	

-------- ORIFICE -------- CALIBRATION FACTOR		
dH@		
Value (in H2O)	Value (mm H2O)	Variation (in H2O)
1.921	48.79	-0.056
2.005	50.92	0.028
1.957	49.71	-0.020
2.007	50.98	0.030
1.995	50.67	0.018
Avg dH@--> 1.977	50.21	

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is +-0.02.

For Orifice Calibration Factor dH@, the orifice differential pressure in inches of H20 that equates to 0.75 cfm of air at 68 F and 29.92 inches of Hg, acceptable tolerance of individual values from the average is +-0.2.

SIGNED: _____ Date: 2/2/16

Y:\1 References\Equipment\Calibrations\Meterboxes\2016 Calibrations\1774\1774 02-02-16

MONTROSE

Alternative Method 5 Post-Test Calibration Check			
Client:	ArcelorMittal Monessen		
Facility:	Monessen, PA		
Source ID:	Combustion Stack 2		
Project Number:	16-167		
Date:	10/17/2016		
Control Box ID:	1774		
	Run 1	**Run 2**	**Run 3**
Data Input			
Test time (min)	180	180	180
Volume Dry Gas Metered (dacf)	162.013	149.395	147.991
Meter Temperature (F)	85.2	81.8	91.2
Barometric Pressure (in. Hg)	29.11	28.99	28.99
Orifice Pressure Drop (in. H_2O)	2.69	2.25	2.19
Dry Gas Molecular Weight (lb/lb mol)	29.19	29.19	29.21
Original Meter Correction Value	1.006	1.006	1.006
Meter $DH_@$ (in. H_2O)	1.977	1.977	1.977
Calculated Values			
Dry Gas Meter Calibration check value (Yqa)	**0.994**	**0.986**	**0.989**
Percent Difference (%)	**-1.18%**	**-1.95%**	**-1.64%**
Results			
Average Dry Gas Meter Calibration Check Value (Yqa)	**0.990**		
Original Meter Correction Value (Y orig)	**1.006**		
Percent Difference (%)	**-1.59%**	**Pass**	

Test conducted in accordance with EMC ALT-009 - Allowable ±5%

Yqa=(time/dacf)*(sqrt((0.0319*(Tm+460))/(DH@*(Pbar+(DHavg/13.6)))*(29/Md))*SQRT(Dhavg))

VOST Annual Calibration (5 settings, single replicate)

Console Number: VOST-1

Primary Standard: mRDGM-016-001

Date of Calibration: 6/30/2016 | Calibrator: ELA | Ref Meter Y: 1.0000 | Barometric Pressure (in Hg): 29.59

Barometer ID: BR-06

Flow Rate (liters/min)	Time span minutes	Field Meter Vmf (liters)	Field Meter Pressure ‡ (in H2O)	Field Meter temperature † (F)	Standard Meter Temperature Inlet	Standard Meter Temperature Outlet	Standard Meter Temperature average	Standard Meter Vms (liters)	Corrected Volumes at 68F, 29.92" Hg Field (Vmsf)	Corrected Volumes at 68F, 29.92" Hg Standard (Vmss)	Y_f (Vmss/Vmsf)	Pass? (+/- 0.02 of Y_f)
0.2	32	7.113	0.326	73	72	72	72	7.074	6.979	6.948075	0.996	PASS
0.4	18	6.578	0.326	72	72	72	72	6.638	6.466	6.519836	1.008	PASS
0.6	12	6.334	0.315	73	72	72	72	6.404	6.214	6.290002	1.012	PASS
0.8	9	6.704	0.394	73	72	72	72	6.763	6.579	6.642611	1.010	PASS
1.0	9	8.82	0.669	73	72	72	72	8.939	8.661	8.779876	1.014	PASS

LEGEND

Enter data in shaded boxes

Do not change unshaded boxes

NECESSARY CONVERSIONS

	°C	to °F
† Convert all field meterbox temperatures from °C to °F	22	72
	mm H_2O	to in H_2O
‡ Convert field meter pressures	5	0.197
	in Hg	to in H_2O
‡ Convert field meter pressures		0.000

Average (Y_f)	1.008
Y_{min}	0.988
Y_{max}	1.028

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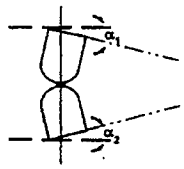
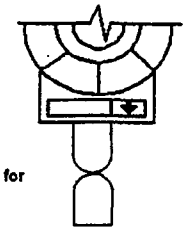
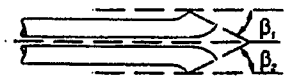
MONTROSE ENVIRONMENTAL

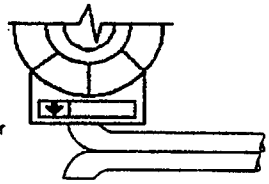
Montrose Air Quality Services (MAQS)
Type S Pitot Tube Inspection Data Sheet



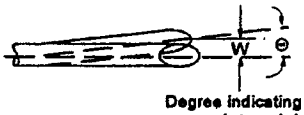


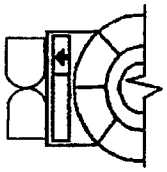
Degree indicating level position for determining α_1 and α_2.



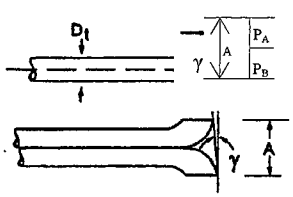


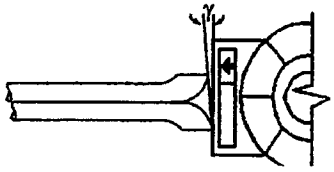
Degree indicating level position for determining β_1 and β_2.





Degree indicating level position for determining Θ.





Degree indicating level position for determining γ then calculate Z.

Allowable Range/Parameter		*Pre-Test Value*	*Post-Test Value*
Level and perpendicular?		Y☑ N☐	Y☑ N☐
Obstruction?		Y☐ N☑	Y☐ N☑
Damaged?		Y☐ N☑	Y☐ N☑
α1	(-10° < α1 < + 10°)	0	0
α2	(-10° < α2 < + 10°)	0	0
β1	(-5° < β1 < + 5°)	0	0
β2	(-5° < β2 < + 5°)	0	0
γ	(-2° < α1 < + 2°)	0	0
θ	(-1° < α1 < + 1°)	0	0
A	(for 1/4 " OD, 0.526 to 0.750 for 3/8" OD, 0.788 to 1.125)	0.892	0.892
Z =	A tan γ (≤ 0.125")	0	0
W =	A tan θ (≤ 0.03125")	0	0
P_A	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.446	0.446
P_B	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.446	0.446
P_A - P_B	(-0.063 to 0.063")	0.000	0.000
P_A/D_t	(1.05 to 1.50)	1.19	1.19
P_B/D_t	(1.05 to 1.50)	1.19	1.19
D_T	(3/16" ≤ D_t ≤ 3/8")	3/8"	3/8"

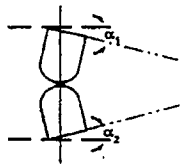
Certification:

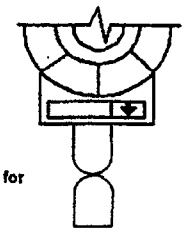
I certify that the Type S Pitot Tube/Probe ID# 9-5 calibrated by Caliper ID # CAL-017 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a Pitot tube calibration factor C_P of 0.84.

Checked by: _____ 10/17/16
(Signature / Date)

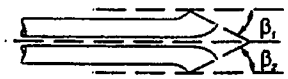
MONTROSE ENVIRONMENTAL

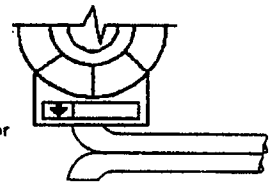
Montrose Air Quality Services (MAQS)
Type S Pitot Tube Inspection Data Sheet



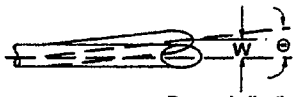


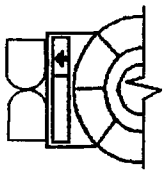
Degree indicating level position for determining α_1 and α_2.



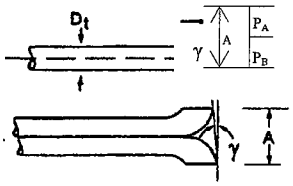


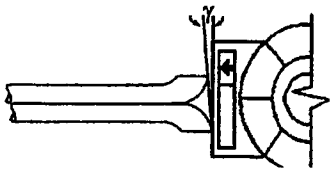
Degree indicating level position for determining β_1 and β_2.





Degree indicating level position for determining Θ.





Degree indicating level position for determining γ then calculate Z.

Allowable Range/Parameter		*Pre-Test Value*	*Post-Test Value*
Level and perpendicular?		Y☑ N☐	Y☑ N☐
Obstruction?		Y☐ N☑	Y☐ N☑
Damaged?		Y☐ N☑	Y☐ N☑
α1	(-10° < α1 < + 10°)	0	0
α2	(-10° < α2 < + 10°)	0	0
β1	(-5° < β1 < + 5°)	0	0
β2	(-5° < β2 < + 5°)	0	0
γ	(-2° < α1 < + 2°)	0	0
θ	(-1° < α1 < + 1°)	0	0
A	(for 1/4 " OD, 0.526 to 0.750 for 3/8" OD, 0.788 to 1.125)	0.880	0.880
Z =	A tan γ (≤ 0.125")	0	0
W =	A tan θ (≤ 0.03125")	0	0
P_A	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.440	0.440
P_B	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.440	0.440
P_A - P_B	(-0.063 to 0.063")	0.000	0.000
P_A/D_t	(1.05 to 1.50)	1.17	1.17
P_B/D_t	(1.05 to 1.50)	1.17	1.17
D_T	(3/16" ≤ D_t ≤ 3/8")	3/8"	3/8"

Certification:

I certify that the Type S Pitot Tube/Probe ID# 9-1 calibrated by Caliper ID # CAL-017 meets or exceeds all specifications, criteria and/or applicable design features and is hereby assigned a Pitot tube calibration factor C_P of 0.84.

Checked by: [signature] 10/19/16
(Signature / Date)

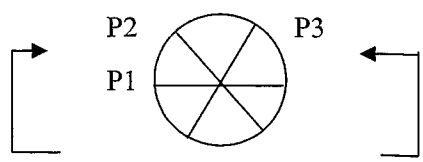
Montrose Air Quality Services (MAQS)
Nozzle Calibration Data Sheet

MONTROSE ENVIRONMENTAL

Date	Calibrated By	Nozzle ID #	Nozzle Diameter (inches)			Hi-Lo	D_{avg}
			D1	D2	D3	Delta D	
10/19/16	JW	0.850	0.850	0.850	0.850	0.000	0.850
10/17/16	JW	0.800	0.800	0.801	0.800	0.001	0.800
10/20/16	JW	0.500	0.500	0.500	0.500	0.000	0.500

Where:

D1, D2, D3 = Three different nozzle diameters at 60 degrees to each other, each measured to the nearest 0.001 in.



MEASUREMENT PLANE

Delta D = Maximum distance between any two diameters, must be ≤ 0.004 in.

D_{avg} = (D1 + D2 + D3) / 3

INSTRUCTIONS:

1. Inspect the nozzle for nicks, dents and corrosion. If these are found, they should be corrected before calibration.
2. Place a reference mark on the nozzle. Place the nozzle at the center of figure aligned with point P1. Measure and record D1.
3. Rotate the nozzle so that the reference mark is aligned with point P2. Measure and record D2.
4. Rotate the nozzle so that the reference mark is aligned with point P3. Measure and record D3.
5. Calculate Delta D and D_{avg}.

Checked by: [signature] 10/19/16 Calibrated by Caliper ID# CAL-017
(Signature / Date)

MONTROSE ENVIRONMENTAL

Montrose Air Quality Services (MAQS)
Thermocouple Calibration Data Sheet
ALT-011

Thermocouple ID: 9-1

Standard Used ID: CTC-1

EMF Meter ID 1774

Post Test

Temperature Range	Reference Thermometer (°F)	Thermocouple Thermometer (°F)	Temperature Difference (F°)
Ambient Temp.	70	70	0.0

Criteria are:
The temperature difference within 2.0 F° of Reference Standard.
Emission Measurement Center, Approved Alternative Method (ALT-011)

Checked by: 10/23/16
(Signature / Date)

MONTROSE ENVIRONMENTAL

Montrose Air Quality Services (MAQS)
Thermocouple Calibration Data Sheet
ALT-011

Thermocouple ID: 9-5

Standard Used ID: CTC-1

EMF Meter ID 1774

Post Test

Temperature Range	Reference Thermometer (°F)	Thermocouple Thermometer (°F)	Temperature Difference (F°)
Ambient Temp.	70	70	0.0

Criteria are:
The temperature difference within 2.0 F° of Reference Standard.
Emission Measurement Center, Approved Alternative Method (ALT-011)

Checked by: 10/23/16
(Signature / Date)

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O_2 Interference Test

Analyzer:	Servomex
Date:	12/19/05
Analyzer Range:	0 to 25 percent
Serial #:	3858

Test Gas	Gas Cylinder Concentration (ppm_v)	O_2 Analyzer Response (%)	Difference Percent of Span
Nitric Oxide	25.3	0.0	0.00%
Sulfur Dioxide	51.4	0.0	0.00%
Carbon Monoxide	62.2	0.0	0.00%
Carbon Dioxide			
	Total Difference Response		0.00%

Notes: CO_2 interference is not evaluated due to O_2 / CO_2 cylinder mixture.
Servomex instrument specifications indicate no interferences with infrared analysis
Acceptance criteria requires the sum of analyzer responses to be less than 2 percent
Performed in accordance with 40 CFR, Part 60, Appendix A, USEPA
Method 3A, Section 6.2 and Method 20, Section 5.4

CO_2	Carbon Dioxide
O_2	Oxygen
%	Percent
ppm_v	Parts per million by volume
USEPA	United States Environmental Protection Agency

CO_2 Interference Test

Analyzer:	Servomex
Date:	12/19/05
Analyzer Range:	0 to 25 percent
Serial #:	3858

Test Gas	Gas Cylinder Concentration (ppm_v)	CO_2 Analyzer Response (%)	Difference Percent of Span
Nitric Oxide	25.3	0.0	0.00%
Sulfur Dioxide	51.4	0.0	0.00%
Carbon Monoxide	62.2	0.0	0.00%
Oxygen			
	Total Difference Response		0.00%

Notes: O_2 interference is not evaluated due to O_2 / CO_2 cylinder mixture.
Servomex instrument specifications indicate no interferences with infrared analysis
Acceptance criteria requires the sum of analyzer responses to be less than 2 percent
Performed in accordance with 40 CFR, Part 60, Appendix A, USEPA
Method 3A, Section 6.2 and Method 20, Section 5.4

CO_2	Carbon Dioxide
O_2	Oxygen
%	Percent
ppm_v	Parts per million by volume
USEPA	United States Environmental Protection Agency

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LIQUID TECHNOLOGY CORPORATION

"INDUSTRY LEADER IN SPECIALTY GASES"

Certificate of Analysis
Primary Standard

Customer	Horizon Engineering (Portland, OR)
Date	June 29, 2016
Delivery Receipt	DR-62191
Product:	100.0 ppm Hydrogen Cyanide, 5.00 ppm Sulfur Hexafluoride/Nitrogen

Mixture Specifications

Cylinder Number: EB-0074795

Components	Requested	Actual
Hydrogen Cyanide	100.0 ppm	100.1 ppm
Sulfur Hexafluoride	5.00 ppm	5.04 ppm
Nitrogen	Balance	Balance

Traceability Information	Traceability Type	Traceable to
Blending Process:	Gravimetric	Mole Percent
Blend Tolerance:	Weight	NIST
Analytical Tolerance:	Gas Standard	NIST
Traceability Certificate:	822/266926-02	

Cylinder Data	
Cylinder Outlet:	CGA 350 (SS)
Cylinder Volume:	126 Cubic Feet
Cylinder Pressure:	1800 psig, 70°F
Analytical Tolerance:	+/- 1.0%
Expiration Date:	June 29, 2017

Certified by: Cole Dylewski

Cole Dylewski

"UNMATCHED EXCELLENCE"

2048 APEX COURT, APOPKA, FLORIDA 32703 ~ PHONE (407)-292-2990 FAX (407)-292-3313
WWW.LIQUIDTECHCORP.COM
APOPKA, FL • PASADENA, TX

Airgas

Airgas USA, LLC
2009 BELLAIRE AVE
ROYAL OAK, MI 48067
248-399-8020
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	MONTROSE ENVIRONMENTAL GROUP		
Part Number:	E03NI80E15A0138	Reference Number:	32-400717405-1
Cylinder Number:	CC210754	Cylinder Volume:	150.9 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62016	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	May 17, 2016

Expiration Date: May 17, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	10.15 %	G1	+/- 0.9% NIST Traceable	05/17/2016
OXYGEN	10.00 %	10.01 %	G1	+/- 1.0% NIST Traceable	05/17/2016
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061341	CC360799	11.002 % CARBON DIOXIDE/NITROGEN	+/-0.6%	Jan 11, 2018
NTRM	09060222	CC263070	9.961 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared(NDIR)	Apr 28, 2016
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	May 17, 2016

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVE
ROYAL OAK, MI 48067
248-399-8020
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	MONTROSE ENVIRONMENTAL GROUP		
Part Number:	E03NI60E15A0286	Reference Number:	32-400717404-1
Cylinder Number:	XC034406B	Cylinder Volume:	159.6 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62016	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	May 17, 2016

Expiration Date: May 17, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	20.00 %	19.79 %	G1	+/- 1.1% NIST Traceable	05/17/2016
OXYGEN	20.00 %	20.03 %	G1	+/- 1.0% NIST Traceable	05/17/2016
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060812	CC416634	24.04 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 16, 2019
NTRM	09061422	CC273738	22.53 % OXYGEN/NITROGEN	+/-0.4%	Mar 08, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared(NDIR)	Apr 28, 2016
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	May 17, 2016

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas, Inc.
600 Union Landing Road
Cinnaminson, NJ 08077
856-829-7878 Fax: 856-829-6576
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: PRIMARY STANDARD

Part Number:	X03NI99P15A00B1	Reference Number:	82-124518003-1
Cylinder Number:	CC222025	Cylinder Volume:	144.0 CF
Laboratory:	ASG - Riverton - NJ	Cylinder Pressure:	2000 PSIG
Analysis Date:	Nov 03, 2015	Valve Outlet:	330
Lot Number:	82-124518003-1		

Primary Standard Gas Mixtures are traceable to N.I.S.T. weights and/or N.I.S.T. Gas Mixture reference materials.

ANALYTICAL RESULTS

Component	Req Conc	Actual Concentration (Mole %)	Analytical Uncertainty
SULFUR HEXAFLUORIDE	5.000 PPM	5.229 PPM	+/- 1%
HYDROGEN CHLORIDE	45.00 PPM	44.63 PPM	+/- 2%
NITROGEN	Balance		

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVE
ROYAL OAK, MI 48067
248-399-8020
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	MONTROSE ENVIRONMENTAL GROUP		
Part Number:	E03NI70E15A0074	Reference Number:	32-400640528-1
Cylinder Number:	CC22473	Cylinder Volume:	158.2 Cubic Feet
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62015	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Dec 14, 2015

Expiration Date: Dec 14, 2023

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
OXYGEN	10.00 %	10.03 %	G1	+/- 1.0% NIST Traceable	12/14/2015
CARBON DIOXIDE	20.00 %	19.86 %	G1	+/- 0.9% NIST Traceable	12/14/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	09060222	CC263070	9.961 % OXYGEN/NITROGEN	+/- 0.3%	Nov 08, 2018
NTRM	13060811	CC416633	24.04 % CARBON DIOXIDE/NITROGEN	+/-0.6%	May 16, 2019

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared(NDIR)	Nov 30, 2015
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	Nov 24, 2015

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVENUE
ROYAL OAK, MI 48067
248-399-8020
Airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	AIR COMPLIANCE		
Part Number:	E03NI67E15A1068	Reference Number:	32-400458805-1
Cylinder Number:	CC98694	Cylinder Volume:	152.3 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62014	Valve Outlet:	590
Gas Code:	CO2,O2,BALN	Certification Date:	Nov 26, 2014

Expiration Date: Nov 26, 2022

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a volume/volume basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
CARBON DIOXIDE	10.00 %	10.16 %	G1	+/- 0.9% NIST Traceable	11/26/2014
OXYGEN	22.50 %	22.46 %	G1	+/- 1.1% NIST Traceable	11/26/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13060615	CC413610	13.359 % CARBON DIOXIDE/NITROGEN	+/- 0.6%	May 09, 2019
NTRM	12062011	CC367544	22.883 % OXYGEN/NITROGEN	+/-0.2%	Apr 24, 2018

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
CO2 SIEMENS ULTRAMAT 6 E/N 173	Nondispersive Infrared(NDIR)	Nov 04, 2014
O2 FS, SIEMENS OXYMAT 6 E/N 182	Paramagnetic	Nov 18, 2014

Triad Data Available Upon Request

Approved for Release

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Montrose Minimum Detection Limits for FTIR Compounds

Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 19, 2016	**Analyte**	HCL, HF, HCN

Scan	Date	Time	HF (ppm_{wv})	HCN (ppm_{wv})
3	10/12/2016	11:23:35 AM	0.046	-0.293
4	10/12/2016	11:24:35 AM	0.047	-0.547
5	10/12/2016	11:25:34AM	0.048	-0.112
6	10/12/2016	11:26:34 AM	0.048	-0.202
7	10/12/2016	11:27:33 AM	0.048	-0.248
8	10/12/2016	11:28:33 AM	0.045	-0.279
9	10/12/2016	11:29:33 AM	0.049	-0.224
Averages			0.047	-0.272
Standard Deviation			0.001	0.135
Calculated MDL (3 x SD, or average)			0.047	0.41
MDL Used			0.047	0.41

Montrose Raw Spike Recovery Data			
Client	ArcelorMittal Monessen	Unit	Combustion Stack 2
Project No	16-167	Operation	Normal
Plant	Monessen, PA	Location	Exhaust Stack
Date	October 19, 2016	Analyte	HCl

Data Point	Scan #	Date	Time	Analyte, Direct (ppmwv)	SF6, Direct (ppmwv)
1	88	10/12/2016	11:44:36 AM	42.84	5.20
2	89	10/12/2016	11:44:51 AM	42.94	5.20
3	90	10/12/2016	11:45:06 AM	42.77	5.20
4	91	10/12/2016	11:45:21 AM	42.80	5.22
5	92	10/12/2016	11:45:36 AM	42.87	5.21
AVERAGES				42.84	5.21

Data Point	Scan #	Date	Time	Analyte, Native (ppmwv)	Scan #	Date	Time	Analyte, Spiked (ppmwv)	SF_6, Spiked (ppmwv)
SPIKE 1									
1	125	10/12/2016	12:04:23 PM	-0.06	176	10/12/2016	12:24:37PM	3.36	0.48
2	126	10/12/2016	12:04:39 PM	-0.11	177	10/12/2016	12:24:52 PM	3.42	0.47
3	127	10/12/2016	12:04:54 PM	-0.13	178	10/12/2016	12:25:07 PM	3.43	0.47
4	128	10/12/2016	12:05:09 PM	0.03	179	10/12/2016	12:25:22 PM	3.32	0.47
5	129	10/12/2016	12:05:24 PM	-0.11	180	10/12/2016	12:25:37 PM	3.34	0.47
AVERAGES				-0.08				3.37	0.472

FTIR Spike Recovery Check

Client	ArcelorMittal Monessen
Project No	16-167
Plant	Monessen, PA
Unit	Combustion Stack 2
Operation	Normal
Date	October 19, 2016
Tester(s)	BC, JW, TM, CB

Calibration Gas	Conc.	Tank ID	Conc. Units	Response Time (sec)
HCl	44.63	CC222025	ppmdv	300
SF_6	5.229		ppmdv	

Spike 1			**% of Standard**	**Pass/Fail**
Direct Ethylene Standard Concentration	ppm_{wv}	42.84	96%	Pass
Direct SF_6 Standard Concentration	ppm_{wv}	5.207	100%	Pass
Native Concentration of Analyte	ppm_{wv}	-0.08		
Concentration of SF6, Spiked	ppm_{wv}	0.472		
Concentration of Analyte, Spiked	ppm_{wv}	3.37		
Dilution factor (%)		9.06	$\leq$ 10%	Pass
Predicted Spiked Analyte Concentration		3.81		
Spike Recovery (%)		88.60	$70 \leq \% \leq 130$	Pass

Montrose Raw Spike Recovery Data			
Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 19, 2016	**Analyte**	HCN

Data Point	Scan #	Date	Time	Analyte, Direct (ppmwv)	SF6, Direct (ppmwv)
1	104	10/12/2016	11:57:25 AM	95.27	5.06
2	105	10/12/2016	11:57:40 AM	95.30	5.06
3	106	10/12/2016	11:57:54 AM	95.27	5.06
4	107	10/12/2016	11:58:09 AM	95.37	5.05
5	108	10/12/2016	11:58:24 AM	95.27	5.05
AVERAGES				**95.29**	**5.06**

Data Point	Scan #	Date	Time	Analyte, Native (ppmwv)	Scan #	Date	Time	Analyte, Spiked (ppmwv)	SF_6, Spiked (ppmwv)
SPIKE 1									
1	194	10/12/2016	12:36:32 PM	-0.12	213	10/12/2016	12:51:20 PM	7.07	0.41
2	195	10/12/2016	12:36:46 PM	-0.15	214	10/12/2016	12:51:34 PM	7.09	0.41
3	196	10/12/2016	12:37:01 PM	-0.22	215	10/12/2016	12:51:49 PM	7.14	0.41
4	197	10/12/2016	12:37:16 PM	-0.15	216	10/12/2016	12:52:04 PM	6.89	0.41
5	198	10/12/2016	12:37:31 PM	-0.16	217	10/12/2016	12:52:19 PM	7.06	0.41
AVERAGES				**-0.16**				**7.05**	**0.413**

FTIR Spike Recovery Check

Client	ArcelorMittal Monessen
Project No	16-167
Plant	Monessen, PA
Unit	Combustion Stack 2
Operation	Normal
Date	October 19, 2016
Tester(s)	BC, JW, TM, CB

Calibration Gas	Conc.	Tank ID	Conc. Units	Response Time (sec)
HCN	100.10	EB0074795	ppmdv	50
SF_6	5.04		ppmdv	

Spike 1			**% of Standard**	**Pass/Fail**
Direct Hydrogen Cyanide Concentration	ppm_{wv}	95.29	95%	Pass
Direct SF_6 Concentration	ppm_{wv}	5.056	100%	Pass
Native Concentration of Analyte	ppm_{wv}	-0.16		
Concentration of SF6, Spiked	ppm_{wv}	0.413		
Concentration of Analyte, Spiked	ppm_{wv}	7.05		
			Allowable	
Dilution factor (%)		8.18	$\leq 10\%$	Pass
Predicted Spiked Analyte Concentration		7.65		
Spike Recovery (%)		92.20	$70 \leq \% \leq 130$	Pass

Montrose Raw CTS Data

Client	ArcelorMittal Monessen	**Unit**	Combustion Stack 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 19, 2016	**Analyte**	HCN

Data Point	Date	Time	Analyte,Calibration Gas (ppmwv)
Pre Test Internal			
1	10/12/2016	11:57 AM	95.27
2	10/12/2016	11:57 AM	95.30
3	10/12/2016	11:57 AM	95.27
4	10/12/2016	11:58 AM	95.37
5	10/12/2016	11:58 AM	95.27
AVERAGES			**95.29**
Pre Test External			
1	10/19/2017	7:54 PM	95.01
2	10/19/2017	7:55 PM	95.60
3	10/19/2017	7:56 PM	95.52
AVERAGES			**95.38**
Post Test 1 External			
1	10/19/2017	11:17 AM	95.29
2	10/19/2017	11:18 AM	95.67
3	10/19/2017	11:19 AM	95.76
AVERAGES			**95.57**
Post Test 2 External			
1	10/19/2017	12:24 PM	95.06
2	10/19/2017	12:25 PM	95.37
3	10/19/2017	12:26 PM	95.57
AVERAGES			**95.33**
Post Test 3 External			
1	10/19/2017	3:24 PM	94.97
2	10/19/2017	3:25 PM	95.74
3	10/19/2017	3:26 PM	95.73
AVERAGES			**95.48**

Montrose FTIR Stability Check Data (Calibration Transfer Standard - CTS)

Client	ArcelorMittal Monessen
Project No	16-167
Plant	Monessen, PA
Unit	Combustion Stack 2
Operation	Normal
Tester(s)	October 19, 2016
Date	BC, JW, TM, CB

Calibration Transfer Standard Gas	Concentration	Concentration Units	Tank ID
HCN	100.10	ppm_{dv}	EB0074795
SF6	5.04	ppm_{dv}	

	CTS Concentration of Analyte (ppm_{dv})	Difference From Cylinder Value (%)	Pass/Fail
Internal	95.29	-4.80	Pass
	CTS Concentration of Analyte (ppm_{dv})	**Difference From Direct Value (%)**	**Pass/Fail**
External	95.38	0.09	Pass
Post Run 1	95.57	0.29	Pass
Post Run 2	95.33	0.04	Pass
Post Run 3	95.48	0.20	Pass
		Allowable +/- 5%	

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SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

WILLIAM P. COWELL

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS

ISSUED THIS 7TH DAY OF JANUARY 2014 AND EFFECTIVE UNTIL JANUARY 6TH, 2019

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Theresa Lowe, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2009-336

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

WILLIAM P. COWELL

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 7TH DAY OF JANUARY 2014 AND EFFECTIVE UNTIL JANUARY 6TH, 2019

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Theresa Lowe, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2009-336

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOHN E. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 20TH DAY OF MARCH 2013 AND EFFECTIVE UNTIL MARCH 19TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakainis, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-768

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOHN E. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 20TH DAY OF MARCH 2013 AND EFFECTIVE UNTIL MARCH 19TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-768

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOHN E. WILSON

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

HAZARDOUS METALS MEASUREMENT SAMPLING METHODS

ISSUED THIS 20TH DAY OF MARCH 2013 AND EFFECTIVE UNTIL MARCH 19TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2013-768

OPACITAIR

OpacitAir Smoke School, LLC

certifies that

CHRISTOPHER BURKOVICH of MONTROSE AIR QUALITY SERVICES

Has met all of the requirements of EPA Reference Method 9 & 22

and is qualified as a Visible Emissions Observer.

Date: AUGUST 22 ,2016

Valid for 6 months after above date.

James Hudson

James Hudson, President

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REPORT - APPENDIX E

Sample Calculations

Method 5

Montrose SAMPLE CALCULATIONS
Particulate Matter Test Results
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
October 19, 2016
Combustion Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,458.5	g	K1method 4	0.04707	scf/ml
Wi	4,181.2	g	K2method 4	0.04715	scf/g
Vm	114.465	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.12	in. Hg	Kp	85.49	
dHavg	2.83	in. H2O			
Tm	81.2	F	π	3.141593	
O2	9.72	% dv	Ds (or L)	112.00	inches
CO2	5.30	% dv	Stack Width (W)	0.00	inches
Pg	-1.20	in. H2O	Dn	0.850	inches
Cp	0.84		Time	120	minutes
$(dP)^{1/2}$avg	0.104	in. H2O^1/2	Tsavg	432.4	F
F_d	NA	dscf/MMBtu			

Particulate Data

Acetone Wash Volume (Vaw)	94	ml
Acetone Wash Weight Gain	47.1	mg
Front Half Filter Particulate	8.7	mg

1. Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04707	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

2. Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	4,458.5	g
Wi=	4,181.2	g
Vwsg(std)=	13.075	scf

3. Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	13.075	scf
Vw(std)=	13.075	scf

4. Volume of Gas Metered

Vm = Volume metered in dacf + Volume metred in dry actual liters * (1 cf / 28.317 liters)

Volume metered in dacf=	114.465	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	114.465	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	114.465	dacf
$Vm(m^3)$=	3.241	dacm

5. Volume of Gas Metered , dry basis, STD

Vm(std) = (K1method 5 * Vm * Yd * (Pbar + (dHavg/13.6))) / (Tm + 460)

K1method 5=	17.64	R/in. Hg
Vm=	114.465	dacf
Yd=	1.0060	
Pbar=	29.12	in. Hg
dHavg=	2.83	in. H2O
Tm=	81.2	F
Vm(std)=	110.074	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	110.074	dscf
$Vm(std)m^3$=	3.117	dscm

6. Water Vapor in the Gas Stream

Bws used = the lower of $SP_{H2O@Tsavg}$ / Ps
and Vw(std) / (Vm(std) + Vw(std))

Bws = $SP_{H2O@Tsavg}$ / Ps With a maximum allowable value of 1.0

$SP_{H2O@Tsavg}$= The saturation pressure of water at stack temperature
1997 ASHRAE Handbook page 6.2 Eq. (6)
EXP(C8/T + C9 +C10*T + C11*T^2 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	432.4	F
T=	892.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	717.54	in. Hg
Ps=	29.03	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	13.075	scf
Vm(std)=	110.074	dscf
Bws=	0.1062	vol. fraction
Bws used=	0.1062	vol. fraction

7. Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	5.30	% dv
O2=	9.72	% dv
CO + N2=	84.98	% dv

8. Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	5.30	% dv
O2=	9.72	% dv
CO + N2=	84.98	% dv
Md=	29.24	lb/lb-mole

9. Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.24	lb/lb-mole
Bws=	0.1062	vol. fraction
Ms=	28.04	lb/lb-mole

10. Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.12	in. Hg
Pg=	-1.20	in. H2O
Ps=	29.03	in. Hg

11. Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2

Kp=	85.49	
Cp=	0.84	
$(dP)^{1/2}$avg=	0.1041	in. H2O^1/2
Tsavg=	432.4	F
Ps=	29.03	in. Hg
Ms=	28.04	lb/lb-mole
Vs=	7.83	ft/s

12. Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.1416	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	0.00	inches
W=	0.00	inches
As=	0.00	ft2

13. Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	7.83	ft/s
As=	68.42	ft2
Qacfm=	32,134	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	32,134	acfm
Qacm/min=	910	acm/min

14. Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	32,134	acfm
Tstandard=	68	F
Tsavg=	432.4	F
Ps=	29.03	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	18,449	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	18,449	scfm
Qscm/min=	522	scm/min

15. Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	18,449	scfm
Bws=	0.1062	vol. fraction
Qdscfm=	16,490	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	16,490	dscfm
Qdscm/min=	467	dscm/min

16. Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.850	inches
An=	0.003941	ft2

17. Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	432.4	F
Vm(std)=	110.074	dscf
Ps=	29.03	in. Hg
Vs=	7.83	ft/s
An=	0.003941	ft2
Theta=	120	minutes
Bws=	0.1062	vol. fraction
I=	96.64	%

18. Total Weight of Particulate

m_n = acetone wash weight gain - Wa + condensible + filter weight gain

Acetone wash weight gain - Wa=	47.1000	mg	With a minimum allowable value of 0
Filter weight gain=	8.7000	mg	With a minimum allowable value of 0
m_n=	55.8	mg	

19. Emission Concentration (mg/DSCM)

Particulate(gr/dscf) = (m_n / Vm(std))

m_n=	55.8	mg
Vm(std)=	3.117	dscm
Particulate(mg/dscm)=	17.90	mg/dscm

20. Emission Rate (lb/hr)

Particulate(lb/hr) = Particulate(mg/dscm) * Qdscm/min * (60 min/hr) * (1lb/453592 mg)

Particulate(mg/dscm)=	17.90	mg/dscm
Qdscfm=	467	dscm/min
Particulate(lb/hr)=	1.11	lb/hr

Method 29

Montrose SAMPLE CALCULATIONS
Metals Testing Results
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
October 19, 2016
Combustion Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,458.5	g	K1method 4	0.04707	scf/ml
Wi	4,181.2	g	K2method 4	0.04715	scf/g
Vm	114.465	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.12	in. Hg	Kp	85.49	
dHavg	2.83	in. H2O			
Tm	81.2	F	π	3.141593	
O2	9.72	% dv	Ds (or L)	112.00	inches
CO2	5.30	% dv	Stack Width (W)	0.00	inches
Pg	-1.20	in. H2O	Dn	0.850	inches
Cp	0.84		Time	120	minutes
$(dP)^{1/2}$avg	0.104	in. H2O^1/2	Tsavg	432.4	F
F_d	NA	dscf/MMBtu			

1. Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04707	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

2. Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	4,458.5	g
Wi=	4,181.2	g
Vwsg(std)=	13.075	scf

3. Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	13.075	scf
Vw(std)=	13.075	scf

4. Volume of Gas Metered

Vm = Volume metered in dacf + Volume metred in dry actual liters * (1 cf / 28.317 liters)

Volume metered in dacf=	114.465	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	114.465	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	114.465	dacf
$Vm(m^3)$=	3.241	dacm

5. Volume of Gas Metered , dry basis, STD

Vm(std) = (K1method 5 * Vm * Yd * (Pbar + (dHavg/13.6))) / (Tm + 460)

K1method 5=	17.64	R/in. Hg
Vm=	114.465	dacf
Yd=	1.0060	
Pbar=	29.12	in. Hg
dHavg=	2.83	in. H2O
Tm=	81.2	F
Vm(std)=	110.074	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	110.074	dscf
$Vm(std)m^3$=	3.117	dscm

6. Water Vapor in the Gas Stream

Bws used = the lower of $SP_{H2O@Tsavg}$ / Ps
and Vw(std) / (Vm(std) + Vw(std))

Bws = $SP_{H2O@Tsavg}$ / Ps With a maximum allowable value of 1.0

$SP_{H2O@Tsavg}$ = The saturation pressure of water at stack temperature
1997 ASHRAE Handbook page 6.2 Eq. (6)
EXP(C8/T + C9 +C10*T + C11*T^2 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	432.4	F
T=	892.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	717.54	in. Hg
Ps=	29.03	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	13.075	scf
Vm(std)=	110.074	dscf
Bws=	0.1062	vol. fraction
Bws used=	0.1062	vol. fraction

7. Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	5.30	% dv
O2=	9.72	% dv
CO + N2=	84.98	% dv

8. Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	5.30	% dv
O2=	9.72	% dv
CO + N2=	84.98	% dv
Md=	29.24	lb/lb-mole

9. Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.24	lb/lb-mole
Bws=	0.1062	vol. fraction
Ms=	28.04	lb/lb-mole

10. Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.12	in. Hg
Pg=	-1.20	in. H2O
Ps=	29.03	in. Hg

11. Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2

Kp=	85.49	
Cp=	0.84	
$(dP)^{1/2}$avg=	0.1041	in. H2O^1/2
Tsavg=	432.4	F
Ps=	29.03	in. Hg
Ms=	28.04	lb/lb-mole
Vs=	7.83	ft/s

12. Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	0.00	inches
W=	0.00	inches
As=	0.00	ft2

13. Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	7.83	ft/s
As=	68.42	ft2
Qacfm=	32,134	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	32,134	acfm
Qacm/min=	910	acm/min

14. Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	32,134	acfm
Tstandard=	68	F
Tsavg=	432.4	F
Ps=	29.03	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	18,449	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	18,449	scfm
Qscm/min=	522	scm/min

15. Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	18,449	scfm
Bws=	0.1062	vol. fraction
Qdscfm=	16,490	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	16,490	dscfm
Qdscm/min=	467	dscm/min

16. Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.850	inches
An=	0.003941	ft2

17. Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	432.4	F
Vm(std)=	110.074	dscf
Ps=	29.03	in. Hg
Vs=	7.83	ft/s
An=	0.003941	ft2
Theta=	120	minutes
Bws=	0.1062	vol. fraction
I=	96.64	%

18. Mercury Emission Concentration - Fraction 1B (mg/DSCM)

EC=(Emission mass 1B)/Vmstd/1000 (ug/mg)

Emission Mass=	0.015	ug
$Vm(std)m^3$=	3.117	dscm
EC=	4.81E-06	mg/dscm

19. Mercury Emission Rate (lb/hr)

E=(EC)* Qdscm/min *60 *(1 lb/453593 mg)

EC=	4.81E-06	mg/dscm
Qdscm/min=	467	dscm/min
E=	2.97E-07	lb/hr

Methods 0010/23

MONTROSE SAMPLE CALCULATIONS
Semi-Volatile Test Results
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
Combstion Stack 2
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,688.2	g	K1method 4	0.04706	scf/ml
Wi	3,079.9	g	K2method 4	0.04715	scf/g
Vm	162.013	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.006		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.11	in. Hg	Kp	85.49	
dHavg	2.69	in. H2O	p_a	0.0	0
Tm	85.2	F	π	3.141593	
O2	10.58	% dv	Ds (or L)	112.00	inches
CO2	4.79	% dv	Stack Width (W)	0.00	inches
Pg	-1.20	in. H2O	Dn	0.800	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.114	in. H2O^1/2	Tsavg	540.2	F
F_d	0	dscf/MMBtu	Product rate	0.00	0.00
TEF Adjusted Total	0.168	ng	2378-TCDD	1.0	TEF
Napthalene	71	mg			

Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04706	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	3,688.2	g
Wi=	3,079.9	g
Vwsg(std)=	28.681	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	28.681	scf
Vw(std)=	28.681	scf

Volume of Gas Metered

Vm = Volume metered in dacf + Volume metered in dry actual liters * (1 cf / 28.317 liters)

Volume metered in dacf=	162.013	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	162.013	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	162.013	dacf
$Vm(m^3)$=	4.588	dacm

Volume of Gas Metered , dry basis, STD

Vm(std) = (K1method 5 * Vm * Yd * (Pbar + (dHavg/13.6))) / (Tm + 460)

K1method 5=	17.64	R/in. Hg
Vm=	162.013	dacf
Yd=	1.0060	
Pbar=	29.11	in. Hg
dHavg=	2.69	in. H2O
Tm=	85.2	F
Vm(std)=	154.564	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	154.564	dscf
$Vm(std)m^3$=	4.377	dscm

Water Vapor in the Gas Stream

Bws used = the lower of $SP_{H2O@Tsavg}$ / Ps
and Vw(std) / (Vm(std) + Vw(std))

Bws = $SP_{H2O@Tsavg}$ / Ps With a maximum allowable value of 1.0

$SP_{H2O@Tsavg}$ = The saturation pressure of water at stack temperature
1997 ASHRAE Handbook page 6.2 Eq. (6)
EXP(C8/T + C9 +C10*T + C11*T^2 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	540.2	F
T=	999.9	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	1963.99	in. Hg
Ps=	29.02	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	28.681	scf
Vm(std)=	154.564	dscf
Bws=	0.1565	vol. fraction
Bws used=	0.1565	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	4.79	% dv
O2=	10.58	% dv
CO + N2=	84.62	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	4.79	% dv
O2=	10.58	% dv
CO + N2=	84.62	% dv
Md=	29.19	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.19	lb/lb-mole
Bws=	0.1565	vol. fraction
Ms=	27.44	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.11	in. Hg
Pg=	-1.20	in. H2O
Ps=	29.02	in. Hg

Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2

Kp=	85.49	
Cp=	0.84	
$(dP)^{1/2}$avg=	0.1140	in. H2O^1/2
Tsavg=	540.2	F
Ps=	29.02	in. Hg
Ms=	27.44	lb/lb-mole
Vs=	9.17	ft/s

Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	0.00	inches
W=	0.00	inches
As=	0.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	9.17	ft/s
As=	68.42	ft2
Qacfm=	37,657	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	37,657	acfm
Qacm/min=	1,066	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	37,657	acfm
Tstandard=	68	F
Tsavg=	540.2	F
Ps=	29.02	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	19,282	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	19,282	scfm
Qscm/min=	546	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	19,282	scfm
Bws=	0.1565	vol. fraction
Qdscfm=	16,264	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	16,264	dscfm
Qdscm/min=	461	dscm/min

Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.800	inches
An=	0.003491	ft2

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	540.2	F
Vm(std)=	154.564	dscf
Ps=	29.02	in. Hg
Vs=	9.17	ft/s
An=	0.003491	ft2
Theta=	180	minutes
Bws=	0.1565	vol. fraction
I=	103.5	%

PCDD/PCDF TEF Adjusted Amount

PCDD/PCDF Adj Amt = TEFcompound * Mass Detected

TEF compound 2378-TCDD =	1.0	TEF
Mass Detected =	0.0301	ng
PCDD/PCDF Adj Amt =	0.0301	ng

PCDD/PCDF Emission Concentration (ng/m3)

ng/m^3 = PCDD/PCDF Total Mass Collected /Vm(std)m^3

Total Adjusted Mass Collected =	0.1683	ng
Vm(std)m^3 =	4.377	dscm
ng/m^3	0.0384	ng/m^3

PCDD/PCDF Emission Rate (ng/hr)

ng/hr = ng/m^3 * Qdscm/min * 60

ng/m^3 =	0.0384	ng/m3
Qdscm/min =	461	dscm/min
ng/hr =	1,062	ng/hr

Naphthalene Emission Concentration (mg/m3)

mg/m3 = Sample Mass / Sample Volume / (1000 ug/mg)

Naphthalene mass =	71	micrograms
Vm(std)m^3 =	4.377	dscm
Naphthalene conc. =	0.0162	mg/dscm

Naphthalene Emission Rate (lb/hr)

lb/hr = Conc. (mg/m3) * Qdscm/min * (60 min/hr) * (2.2046e-6 lbs/mg)

Naphthalene conc. =	0.0162	mg/dscm
Qdscm/min =	461	dscm/min
Naphthalene emission rate =	0.00099	lb/hr

Method 316

MONTROSE SAMPLE CALCULATIONS
Formaldehyde Test Results
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
Combustion Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	2,957.9	g	K1method 4	0.04706	scf/ml
Wi	2,797.7	g	K2method 4	0.04715	scf/g
Vm	40.565	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.006		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.07	in. Hg	Kp	85.49	
dHavg	0.37	in. H2O	p_a	0.0	0
Tm	75.3	F	π	3.141593	
O2	9.65	% dv	Ds (or L)	112.00	inches
CO2	5.28	% dv	Stack Width (W)	0.00	inches
Pg	-1.30	in. H2O	Dn	0.500	inches
Cp	0.84		Time	120	minutes
$(dP)^{1/2}$avg	0.111	in. H2O^1/2	Tsavg	544.4	F
F_d	0	dscf/MMBtu	Product rate	10.00	(mg)
Formaldehyde Front Half Gain	10.0	ug			
Formaldehyde Back Half Gain	0.0	ug			

Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04706	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	2,957.9	g
Wi=	2,797.7	g
Vwsg(std)=	7.553	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	7.553	scf
Vw(std)=	7.553	scf

Volume of Gas Metered

Vm = Volume metered in dacf + Volume metered in dry actual liters * (1 cf / 28.317 liters)

Volume metered in dacf=	40.565	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	40.565	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	40.565	dacf
$Vm(m^3)$=	1.149	dacm

Volume of Gas Metered , dry basis, STD

Vm(std) = (K1method 5 * Vm * Yd * (Pbar + (dHavg/13.6))) / (Tm + 460)

K1method 5=	17.64	R/in. Hg
Vm=	40.565	dacf
Yd=	1.0060	
Pbar=	29.07	in. Hg
dHavg=	0.37	in. H2O
Tm=	75.3	F
Vm(std)=	39.127	dscf

$Vm(std)m^3 = Vm(std) * (1\ m^3 / 35.3145\ cf)$

Vm(std)=	39.127	dscf
$Vm(std)m^3$=	1.108	dscm

Water Vapor in the Gas Stream

Bws used = the lower of $SP_{H2O@Tsavg}$ / Ps
and Vw(std) / (Vm(std) + Vw(std))

Bws = $SP_{H2O@Tsavg}$ / Ps With a maximum allowable value of 1.0

$SP_{H2O@Tsavg}$ = The saturation pressure of water at stack temperature
1997 ASHRAE Handbook page 6.2 Eq. (6)
EXP(C8/T + C9 +C10*T + C11*T^2 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	544.4	F
T=	1004.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	2032.64	in. Hg
Ps=	28.97	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	7.553	scf
Vm(std)=	39.127	dscf
Bws=	0.1618	vol. fraction
Bws used=	0.1618	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	5.28	% dv
O2=	9.65	% dv
CO + N2=	85.08	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	5.28	% dv
O2=	9.65	% dv
CO + N2=	85.08	% dv
Md=	29.23	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.23	lb/lb-mole
Bws=	0.1618	vol. fraction
Ms=	27.41	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6		
Pbar=	29.07	in. Hg
Pg=	-1.30	in. H2O
Ps=	28.97	in. Hg

Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2		
Kp=	85.49	
Cp=	0.84	
$(dP)^{1/2}$avg=	0.1105	in. H2O^1/2
Tsavg=	544.4	F
Ps=	28.97	in. Hg
Ms=	27.41	lb/lb-mole
Vs=	8.93	ft/s

Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2		
PI=	3.141593	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2		
L=	0.00	inches
W=	0.00	inches
As=	0.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60		
Vs=	8.93	ft/s
As=	68.42	ft2
Qacfm=	36,642	acfm
Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)		
Qacfm=	36,642	acfm
Qacm/min=	1,038	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)		
Qacfm=	36,642	acfm
Tstandard=	68	F
Tsavg=	544.4	F
Ps=	28.97	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	18,654	scfm
Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)		
Qscfm=	18,654	scfm
Qscm/min=	528	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	18,654	scfm
Bws=	0.1618	vol. fraction
Qdscfm=	15,636	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	15,636	dscfm
Qdscm/min=	443	dscm/min

Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.500	inches
An=	0.001364	ft2

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	544.4	F
Vm(std)=	39.127	dscf
Ps=	28.97	in. Hg
Vs=	8.93	ft/s
An=	0.001364	ft2
Theta=	120	minutes
Bws=	0.1618	vol. fraction
I=	104.7	%

Total Weight of Formaldehyde

$mn_{Formaldehyde}$ = (Formaldehyde Front Half weight gain + Formaldehyde Back Half weight gain)/1000 ug/mg

Formaldehyde Front Half weight gain=	10.00	ug
Formaldehyde Back Half weight gain=	0.00	ug
m_n=	0.010	mg

Formaldehyde Emission Concentration (mg/dscm)

Formaldehyde(mg/dscm) = mn * Vm(std)

m_n=	0.01	mg
Vm(std)=	1.11	dscm
Formaldehyde(mg/dscm)=	0.0090	mg/dscm

Formaldehyde Emission Rate (lb/hr)

E=(Mn)*(1/1000 mg/g)/Vm(std) * Qdscfm*60*(1/453.593 gr/lb)

Emission Mass	0.01	mg
Vm(std)=	39.127	dscf
Qdscfm=	15,636	dscfm
E=	5.29E-04	lb/hr

Method 0031

Montrose SAMPLE CALCULATIONS
M0031-Volatile Organics
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
October 20, 2016
Combustion Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	0.0	g	K1method 4	0.04706	scf/ml
Wi	0.0	g	K2method 4	0.04715	scf/g
Vm	0.000	liters	K1method 5	17.64	R/in. Hg
Vm	0.000	0.000	K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.07	in. Hg	Kp	85.49	
dHavg	0.37	in. H2O	π	3.141593	
Tm	75.4	F	Ds (or L)	112.00	inches
O2	9.65	% dv	Stack Width (W)	NA	inches
CO2	5.27	% dv	Tsavg	544.4	F
Pg	-1.30	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.111	in. H2O^1/2	Bws	0.1622	vol. fraction

Method 0031 Lab Results

Benzene MW	78.11	lb/lb-mole
VOST Sample Volume	0.0538	dscm
Mass Collected	0.33	micrograms

Water Vapor in the Gas Stream

Bws used= 0.1622 vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2= 5.27 % dv
O2= 9.65 % dv
CO + N2= 85.08 % dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2= 5.27 % dv
O2= 9.65 % dv
CO + N2= 85.08 % dv
Md= 29.23 lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md= 29.23 lb/lb-mole
Bws= 0.1622 vol. fraction
Ms= 27.41 lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar= 29.07 in. Hg
Pg= -1.30 in. H2O
Ps= 28.97 in. Hg

Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2

Kp= 85.49
Cp= 0.84
$(dP)^{1/2}$avg= 0.1105 in. H2O^1/2
Tsavg= 544.4 F
Ps= 28.97 in. Hg
Ms= 27.41 lb/lb-mole
Vs= 8.93 ft/s

Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	0.00	inches
W=	NA	inches
As=	0.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	8.93	ft/s
As=	68.42	ft2
Qacfm=	36,645	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	36,645	acfm
Qacm/min=	1,038	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	36,645	acfm
Tstandard=	68	F
Tsavg=	544.4	F
Ps=	28.97	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	18,656	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	18,656	scfm
Qscm/min=	528	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	18,656	scfm
Bws=	0.1622	vol. fraction
Qdscfm=	15,629	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	15,629	dscfm
Qdscm/min=	443	dscm/min

Sample Volume (DSCF)

Sample $Volume_{DSCF}$ = Sample Volume (in liters)/ 28.136847 liters/ft^3

VOST Sample Volume =	53.7997	liters
VOST Sample Volume	1.912	DSCF

Benzene emission concentration (mg/DSCM)

Benzene (mg/DSCM) = Mass Collected (mg) /1000 mg/ug / Sample Volume (liters) * 1000 (liters/m3)

Mass Collected=	0.33	ug
Sample Volume=	0.0538	dscm
Benzene (mg/DSCM) =	0.006	mg/DSCM

Benzene Emission Rate (lb/hr)

E=(Mn)*(1/1000000 ug/g)/Vm(std) * Qdscfm*60*(1/453.593 g/lb)

Emission Mass	0.33	ug
Vm(std)=	1.91207	DSCF
Qdscfm=	15,629	dscfm
E=	3.55E-04	lb/hr

Methods 3A,15

Montrose SAMPLE CALCULATIONS
Flow, Moisture, CEMS
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
October 20, 2016
Combustion Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	2,957.9	g	K1method 4	0.04706	scf/ml
Wi	2,797.7	g	K2method 4	0.04715	scf/g
Vm	40.565	0.000	K1method 5	17.64	R/in. Hg
Vm	0.000	0.000	K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.07	in. Hg	Kp	85.49	
dHavg	0.37	in. H2O	π	3.141593	
Tm	75.4	F	Ds (or L)	112.00	inches
O2	9.65	% dv	Stack Width (W)	0.00	inches
CO2	5.27	% dv	Tsavg	544.4	F
Pg	-1.30	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.111	in. H2O^1/2			

CEMS DATA

Carbon Monoxide			Hydrogen Sulfied		
Cavg CO2	52,724.0	ppmdv	Cavg.	0.50	ppmwv
MW CO2	44.0	lb/lb-mole	MW H2S	34.1	lb/lb-mole

Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04706	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	2,957.9	g
Wi=	2,797.7	g
Vwsg(std)=	7.553	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	7.553	scf
Vw(std)=	7.553	scf

Volume of Gas Metered

Vm = Volume metered in dacf + Volume metred in dry actual liters * (1 cf / 28.317 liters)

Volume metered in dacf=	40.565	0.000
Volume metered in dry actual liters=	0.000	0.000

Vm= 40.565 dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm= 40.565 dacf

$Vm(m^3)$= 1.149 dacm

Volume of Gas Metered , dry basis, STD

Vm(std) = (K1method 5 * Vm * Yd * (Pbar + (dHavg/13.6))) / (Tm + 460)

K1method 5=	17.64	R/in. Hg
Vm=	40.565	dacf
Yd=	1.0030	
Pbar=	29.07	in. Hg
dHavg=	0.37	in. H2O
Tm=	75.4	F
Vm(std)=	39.009	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)= 39.009 dscf

$Vm(std)m^3$= 1.105 dscm

Water Vapor in the Gas Stream

Bws used = the lower of $SP_{H2O@Tsavg}$ / Ps
and Vw(std) / (Vm(std) + Vw(std))

Bws = $SP_{H2O@Tsavg}$ / Ps With a maximum allowable value of 1.0

$SP_{H2O@Tsavg}$ = The saturation pressure of water at stack temperature
1997 ASHRAE Handbook page 6.2 Eq. (6)
EXP(C8/T + C9 +C10*T + C11*T^2 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	544.4	F
T=	1004.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	2032.64	in. Hg
Ps=	28.97	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	7.553	scf
Vm(std)=	39.009	dscf
Bws=	0.1622	vol. fraction

Bws used= 0.1622 vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	5.27	% dv
O2=	9.65	% dv
CO + N2=	85.08	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	5.27	% dv
O2=	9.65	% dv
CO + N2=	85.08	% dv
Md=	29.23	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.23	lb/lb-mole
Bws=	0.1622	vol. fraction
Ms=	27.41	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.07	in. Hg
Pg=	-1.30	in. H2O
Ps=	28.97	in. Hg

Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2

Kp=	85.49	
Cp=	0.84	
$(dP)^{1/2}$avg=	0.1105	in. H2O^1/2
Tsavg=	544.4	F
Ps=	28.97	in. Hg
Ms=	27.41	lb/lb-mole
Vs=	8.93	ft/s

Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	0.00	inches
W=	0.00	inches
As=	0.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	8.93	ft/s
As=	68.42	ft2
Qacfm=	36,645	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	36,645	acfm
Qacm/min=	1,038	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	36,645	acfm
Tstandard=	68	F
Tsavg=	544.4	F
Ps=	28.97	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	18,656	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	18,656	scfm
Qscm/min=	528	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	18,656	scfm
Bws=	0.1622	vol. fraction
Qdscfm=	15,629	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	15,629	dscfm
Qdscm/min=	443	dscm/min

Hydrogen Sulfide H2Sncentration (ppmdv)

C_{H2S} = (C_{H2S} wet) / (1 -Bws)

C_{H2S} wet =	0.50	ppmwv
Bws =	0.16	vol. fraction
C_{H2S}=	0.60	ppmdv

Hydrogen Sulfide emission rate (lb/hr)

H2S(lb/hr) = CH2S / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * H2SMW

CH2S=	0.60	ppmdv
Qdscfm=	15,629	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
H2S MW=	34.1	lb/lb-mole
H2S(lb/hr)=	0.050	lb/hr

Carbon Dioxide emission rate (lb/hr)

CO2 (lb/hr) = CCO2 / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * CO2MW

CCO2=	52,724	ppmdv
Qdscfm=	15,629	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
CO2 MW=	44.0	lb/lb-mole
H2S(lb/hr)=	5,646	lb/hr

Carbon Dioxide emission rate (g/hr)

CO2 (g/hr) = CO2 (lb/hr) *453.593 g/lb

CO2 (lb/hr) =	5,646	lb/hr
CO2 (g/hr) =	2,561,082	g/hr

Carbon Dioxide emission rate (tons/hr)

CO2 (tons/hr) = CO2 (lb/hr) / 2000 lb/ton

CO2 (lb/hr) =	5,646	lb/hr
CO2 (g/hr) =	2.82	tons/hr

Method 320

Montrose SAMPLE CALCULATIONS
Flow, Moisture, CEMS
ArcelorMittal Monessen
16-167
Monessen, PA
Combustion Stack 2
Normal
October 19, 2016
Combustion Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,458.5	g	K1method 4	0.04706	scf/ml
Wi	4,181.2	g	K2method 4	0.04715	scf/g
Vm	114.465	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0060		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.12	in. Hg	Kp	85.49	
dHavg	2.83	in. H2O	π	3.141593	
Tm	81.2	F	Ds (or L)	112.00	inches
O2	9.98	% dv	Stack Width (W)	0.00	inches
CO2	5.19	% dv	Tsavg	432.4	F
Pg	-1.20	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.104	in. H2O^1/2			

CEMS DATA

HCl			HF		
$Caverage_{HCl}$	-0.10	ppmwv	$Caverage_{HF}$	0.052	ppmwv
MW HCl	36.4609	lb/lb-mole	MW HF	20.010	lb/lb-mole
HCN					
$Caverage_{HCN}$	-0.05	ppmwv			
MW HCN	27.0253	lb/lb-mole			

Volume of Water Vapor Condensed (Vwc)

Vwc(std) = K1method 4 * (Vf - Vi)

K1method 4=	0.04706	scf/ml
Vf=	0.0	ml
Vi=	0.0	ml
Vwc(std)=	0.000	scf

Volume of Water Vapor Collected in Silica Gel (Vwsg)

Vwsg(std) = K2method 4 * (Wf - Wi)

K2method 4=	0.04715	scf/g
Wf=	4,458.5	g
Wi=	4,181.2	g
Vwsg(std)=	13.075	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	13.075	scf
Vw(std)=	13.075	scf

Volume of Gas Metered

Vm = Volume metered in dacf + Volume metred in dry actual liters * (1 cf / 28.317 liters)

Volume metered in dacf=	114.465	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	114.465	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	114.465	dacf
$Vm(m^3)$=	3.241	dacm

Volume of Gas Metered , dry basis, STD

Vm(std) = (K1method 5 * Vm * Yd * (Pbar + (dHavg/13.6))) / (Tm + 460)

K1method 5=	17.64	R/in. Hg
Vm=	114.465	dacf
Yd=	1.0060	
Pbar=	29.12	in. Hg
dHavg=	2.83	in. H2O
Tm=	81.2	F
Vm(std)=	110.074	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	110.074	dscf
$Vm(std)m^3$=	3.117	dscm

Water Vapor in the Gas Stream

Bws used = the lower of $SP_{H2O@Tsavg}$ / Ps
and Vw(std) / (Vm(std) + Vw(std))

Bws = $SP_{H2O@Tsavg}$ / Ps With a maximum allowable value of 1.0

$SP_{H2O@Tsavg}$ = The saturation pressure of water at stack temperature
1997 ASHRAE Handbook page 6.2 Eq. (6)
EXP(C8/T + C9 +C10*T + C11*T^2 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	432.4	F
T=	892.0	R
C8=	-1.044040E+04	
C9=	-1.1294650E+01	
C10=	-2.702236E-02	
C11=	1.289036E-05	
C12=	-2.478068E-09	
C13=	6.545967E+00	
$SP_{H2O@Tsavg}$=	717.54	in. Hg
Ps=	29.03	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	13.075	scf
Vm(std)=	110.074	dscf
Bws=	0.1062	vol. fraction
Bws used=	0.1062	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	5.19	% dv
O2=	9.98	% dv
CO + N2=	84.83	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	5.19	% dv
O2=	9.98	% dv
CO + N2=	84.83	% dv
Md=	29.23	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.23	lb/lb-mole
Bws=	0.1062	vol. fraction
Ms=	28.04	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.12	in. Hg
Pg=	-1.20	in. H2O
Ps=	29.03	in. Hg

Average Stack Gas Velocity

Vs = Kp * Cp * $(dP)^{1/2}$avg * ((Tsavg + 460) / (Ps * Ms))^1/2

Kp=	85.49	
Cp=	0.84	
$(dP)^{1/2}$avg=	0.1041	in. H2O^1/2
Tsavg=	432.4	F
Ps=	29.03	in. Hg
Ms=	28.04	lb/lb-mole
Vs=	7.83	ft/s

Area of the Stack

If W = 0, the stack is circular.

Circular

As = PI * (Ds)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Ds=	112.00	inches
As=	68.42	ft2

Rectangular

As = L * W * (1 ft / 12 in.)^2

L=	0.00	inches
W=	0.00	inches
As=	0.00	ft2

Stack Gas Flow Rate, Actual

Qacfm = Vs * As * 60

Vs=	7.83	ft/s
As=	68.42	ft2
Qacfm=	32,138	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	32,138	acfm
Qacm/min=	910	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	32,138	acfm
Tstandard=	68	F
Tsavg=	432.4	F
Ps=	29.03	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	18,451	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	18,451	scfm
Qscm/min=	522	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	18,451	scfm
Bws=	0.1062	vol. fraction
Qdscfm=	16,492	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	16,492	dscfm
Qdscm/min=	467	dscm/min

Hydrogen Flouride concentration (ppmdv)

CHF = (CHF wet) / (1 -Bws)		
CHF (raw, M320)=	0.0516	ppmwv
CHF (MDL by M320)=	0.0473	ppmwv
CHF (used)=	0.0516	ppmwv
CHF wet =	0.052	ppmwv
Bws =	0.1062	vol. fraction
CHF=	0.058	ppmdv

Hydrogen Flouride emission rate (lb/hr)

HF(lb/hr) = CHF / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * HFMW		
CHF=	0.06	ppmdv
Qdscfm=	16,492	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
HF MW=	20.0100	lb/lb-mole
HF(lb/hr)=	0.0030	lb/hr

Hydrogen Cyanide concentration (ppmdv)

CHCN = (CHCN wet) / (1 -Bws)		
CHCN (raw, M320)=	-0.048	ppmwv
CHCN (MDL by M320)=	0.41	ppmwv
CHCN (used)=	0.41	ppmwv
CHCN wet =	0.41	ppmwv
Bws =	0.1062	vol. fraction
CHCN=	0.45	ppmdv

Hydrogen Cyanide emission rate (lb/hr)

HCN(lb/hr) = CHCN / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * HCNMW		
CHCN=	0.454	ppmdv
Qdscfm=	16,492	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
HCN MW=	27.0253	lb/lb-mole
HCN(lb/hr)=	0.032	lb/hr

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NOMENCLATURE

SYMBOL		DESCRIPTION
ACFM	-	Actual cubic feet per minute
A_s	-	Stack Area
AB	-	Acetone Blank
AB1	-	Acetone Blank Tare Weight 1
AB2	-	Acetone Blank Tare Weight 2
ABF1	-	Acetone Blank Final Weight 1
ABF2	-	Acetone Blank Final Weight 2
AT1	-	Acetone Rinse Tare Weight 1
AT2	-	Acetone Rinse Tare Weight 2
A_n	-	Nozzle Area
B_{wo}	-	Moisture content of sample gas, measured impinger collection
B_{ws}	-	Moisture content of sample gas, wet saturated
BTU	-	British Thermal Units
C	-	Carbon
C_3H_8	-	Propane
Ca	-	Acetone Blank Correction
C_M	-	Average of initial and final system calibration bias check responses for the upscale gas, ppm
cf	-	Cubic foot
C_{MA}	-	Actual concentration of the upscale calibration gas, ppm
C_d	-	Concentration of Particulate Emissions
C_O	-	Average of initial and final system calibration bias check responses for the zero gas, ppm
CO	-	Carbon monoxide
CO_2	-	Carbon dioxide
C_p	-	Pitot co-efficient, 0.84 for S-type, 0.99 for standard (English units)
CTS	-	Calibration Transfer Standard
E_{NOX}	-	Emission rate of Oxides of nitrogen as NO2, lb/hr
DACF	-	Dry actual cubic feet
DSCF	-	Dry standard cubic feet
DACM	-	Dry actual cubic meters
DSCFM	-	Dry standard cubic feet per minute
dscf/MMBtu	-	Dry standard cubic feet per Million British Thermal Units (units for Fd)
D_S	-	Stack diameter
D_N	-	Nozzle diameter
°F	-	Degrees Fahrenheit
ft	-	foot
F1	-	Filter Final Weight 1
F2	-	Filter Final Weight 2
FT1	-	Filter Tare Weight 1
FT2	-	Filter Tare Weight 2
F_c	-	CO2 based F-Factor for natural gas (1,040 SCF/MMBtu)
F_d	-	F-factor
Ft^2	-	Square feet
Ft^3	-	Cubic feet
FTIR	-	Fourier Transform Infrared
ft^3/lb-mole	-	Cubic feet per pound mole
ft/sec	-	Feet per second
g	-	Grams

g/mL	-	Gram per milliliter
gr/DSCF	-	Grains per dry standard cubic feet
HI	-	Heat Input
ΔH_{avg}	-	Average pressure drop across the meter box during test run, inches H2O
H_2O	-	Water
Hg	-	Mercury
hr	-	Hour
in Hg	-	Inches of Mercury
in H_2O	-	Inches of Water
$\sqrt{inH_2O}$	-	Square root of Inches of Water
I	-	Isokinetic Sampling
K1 method 5	-	Conversion to standard conditions, 17.64 °R/inches Hg
K1 method 4	-	Conversion to standard conditions, 0.04707 f3/ml
K2 method 4	-	Conversion to standard conditions, 0.04715 ft3/g
K4 method 5	-	Conversion to standard conditions, 0.0945
K_p	-	Pitot tube constant, 85.49 for English units
Kg	-	Killograms
L	-	Length of Stack if Rectangular
lb	-	Pound
lb/lb-mole	-	Pound per pound mole
lb-mole	-	Pound mole
lb/hr	-	Pound per hour
lb/MMBTU	-	Pound per million British thermal units
ma	-	Average Final (total) weight after evaporation - Average Tare Weigth of Acetone Blank
m^3	-	Cubic meters
mg	-	Milligrams
mg/g	-	Milligrams per gram
mL	-	Milliliter
M_d	-	Molecular weight of stack gas mixture, dry basis
MMBTU	-	Million British Thermal Units
MMBtu/hr	-	Million British Thermal Units per hour
mm HG	-	Millimeters of Mercury
M_n	-	Mass of particulate matter, g
M_s	-	Molecular weight of stack gas mixture, wet basis
M_{SAT}	-	Ratio of vapor pressure of water at stack conditions to stack pressure
M_W	-	Molecular weight of a specific compound or element
N_2	-	Nitrogen
O_2	-	Oxygen
ng	-	Nanograms
NMNEVOC	-	Non-Methane, Non-Ethane Volatile Organic Compounds
NO_x	-	Oxides of Nitrogen
NO_2	-	Nitrous Oxide
%	-	Percent
% Volume	-	Percent by volume
% dv	-	Percent by volume, dry basis
ΔP	-	Gas velocity pressure, in H2O
P_a	-	Density of Acetone
P_{BAR}	-	Barometric pressure, in H2O
P_S	-	Static Pressure, in H2O
P_g	-	Total pressure of gas at stack conditions
P_{STD}	-	Standard pressure, 760 mmHG
$\sqrt{(P)_{AVG}}$	-	Averag of the square root of gas velocity pressure, in H2O
ppm_{dv}	-	Parts per million, volume and dry basis
ppb_{dv}	-	Parts per billion, volume and dry basis
QA/QC	-	Quality Assurance/Quality Control

Q_{ACFM}	-	Flow rate of stack gas, actual cubic feet per minute
Q_{SCFM}	-	Flow rate of stack gas, standard cubic feet per minute
Q_{DSCFM}	-	Flow rate of stack gas, dry standard cubic feet per minute
°R	-	Degrees Rankin
°R/in. Hg	-	Degrees Rankin per inches of Mercury
scf/ml	-	Standard cubic feet per milliliter
scf/g	-	Standard cubic feet per gram
SCFM	-	Standard cubic feet per minute
SCM	-	Standard cubic meters
SCF	-	Standard cubic feet
$SP_{H2O@Tavg}$	-	Saturation pressure of water at average stack temperature
STD	-	Standard
s	-	Second
T	-	Stack Temperature
tph	-	Tons per hour
ton/yr	-	Tons per year
T_M	-	Temperature of the dry gas meter
T_S	-	Temperature of the stack
T_{STD}	-	Standard temperature, 68 °F
THC	-	Total Hydrocarbons
ug	-	Micrograms
Va	-	Volume of Acetone Blank, in mL
Vaw	-	Volume of Acetone Rinse, in mL
vol.	-	Volume
V/n_{std}	-	Volume mole in standard conditions, in cubic feet per pound mole
V_{lc}	-	Total volume of water vapor condensed, at STP
V_m	-	Volume of sample gas measured by the dry gas meter
V_{MSTD}	-	Volume of sample gas measured by the dry gas meter, corrrected to standard conditions
VOC	-	Volatile Organic Compounds
V_S	-	Velocity of stack gas, ft/s
$V_{Wc(std)}$	-	Volume of water condensed, corrected to standard conditions
$V_{Wsg(std)}$	-	Volume of water collected in silica gel, corrected to standard conditions
$V_{W(std)}$	-	Volume of water vapor in gas stream, corrected to standard conditions
Y_d	-	Dry gas meter calibration factor
V_f	-	Final volume of water
V_i	-	Initial volume of water
W1	-	Acetone Rinse Final Weight 1
W2	-	Acetone Rinse Final Weight 2
W	-	Width of Stack if Rectangular
Wa	-	Weight of Acetone
W_f	-	Final weight
W_i	-	Initial weight

END OF REPORT