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Project #	Task Name	Location	Project Type	Test Date
16-167	Boiler ICR Test Report	Monessen, PA	Report	10/13/2016
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16-167	Quench Tower ICR Test Report	Monessen, PA	Report	11/2/2016
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EPA INFORMATION COLLECTION REQUEST
BOILER TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

PFID: 256899
Source IDs: Boiler #1 and #2
Permit #: TV-65-00853

Test Dates: October 10-13, 2016

Report Date: April 13, 2017

Prepared for:

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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
BOILER TEST REPORT
ARCELORMITTAL MONESSEN LLC
MONESSEN COKE PLANT
MONESSEN, PENNSYLVANIA

Test Dates: October 10-13, 2016

Project No. 16-167

William P Cowell

4/13/17

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

Date

4/13/17

Matthew Dallesasse
District Manager
Montrose Air Quality Services, LLC.

Date

4/13/17

Randy E. Shelton
Division Manager
ArcelorMittal Monessen LLC

Date

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EPA INFORMATION COLLECTION REQUEST
BOILER 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 the common stack of Boilers #1 and #2. 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
- 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)

Sampling was performed in accordance with provisions USEPA Test Methods as outlined in the ICR Enclosure 2.

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 Methods 201A/ 202, 15	USEPA 5/29, 0010-23, and 315
Montrose Air Quality Services, LLC. Ms. Erin Houpt/Mr. Frank Barton 1050 William Pitt Way Pittsburgh, Pennsylvania 15238 (412) 826-3636 – Telephone ehoupt@montrose-env.com 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

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

COG is also used to fire two 143 million British thermal units per hour (MMBtu/hr) boilers. Natural gas may also be fired in the boilers, but COG is the primary fuel, and was the only fuel fired during testing. The flue gas from the two boilers is discharged through separate ductwork to a common stack. Figure 2 shows a block diagram of the Boiler House.

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

Method 315 [*Determination of Particulate and Methylene Chloride Extractable Matter (MCEM) from Selected Sources at Primary Aluminum Production Facilities*] specifies the use of Methylene Chloride. However, toluene was used as an extraction substitute for Methylene Chloride when conducting the Modified Method 315 as required by the USEPA Coke Information Collection Request to determine Toluene Soluble Organics (TSO). Method 315 has defined maximum allowed blank values for Methylene Chloride, as Methylene Chloride specifications have very low concentrations of "Residue After Evaporation." USEPA required use of Toluene for extraction and although a high purity ACR Reagent grade Toluene was used for analysis, the "Residue After Evaporation" specification is multiple times higher than typical Methylene Chloride specifications. Toluene blank concentrations were greater than allowed by the method for Methylene Chloride and Montrose evaluated how best to subtract a representative Toluene blank. The method blanks of the Toluene were high and had values that were greater than 100% of the reported front-half filter sample results and up to 95% of the reported front-half solvent rinse sample results. Because of the high toluene residue after evaporation specification, the full reagent cleanup or lab internal extraction blank mass was subtracted from each sample fraction to avoid over reporting of TSO. For the front-half rinse blank correction, the tester's field blank data was used for correction. For the front-half filter blank correction, the lab's internal blank was used for correction and does not account for the entirety of the blank value. The calculations are found in Appendix E Sample Calculation of this report. Additional discussion of the elevated toluene blank values is provided in Sections 6.8 and 9.

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 3 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 Particulate Matter Less Than 2.5 Microns – USEPA Methods 201A/202

Particulate matter (PM) less than 2.5 microns ($PM_{2.5}$) was determined following the principles of USEPA Method 201A, *Determination of PM_{10} and $PM_{2.5}$ Emissions from Stationary Sources (Continuous Sample Rate Procedure)* and USEPA Method 202, *Determination of Condensable Particulate Emissions from Stationary Sources.*

6.5.1 Sample Train Setup and Operation

The sampling apparatus was prepped, set up, and operated in accordance with the applicable method and the procedures detailed in the test method. Each test run was approximately 220 minutes in duration.

6.5.2 Sample Recovery

The 201A 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 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.

The less than or equal to PM2.5 filterable particulate (Container 4) consisting of the brush cleaning and acetone rinses of the exit tube of the cyclone IV and the nozzle, and the front half of the filter holder, was evaporated to dryness in a pre-weighed aluminum weighing dish, desiccated, and weighed to a constant weight. The total Filterable PM2.5 (FPM2.5) catch is the sum of Containers 1 and 4. Acetone rinses were performed a minimum of 3 times.

The CPM portion of the sampling trains were purged with nitrogen (N2) for an hour at a minimum of 14 liters per minute (lpm) immediately following the completion of each run, and then recovered following the procedures in USEPA Method 202. Following the hour-long N2 purge, the contents of Impingers 1 and 2 were transferred to a graduated cylinder and the volume recorded and then transferred to a labeled poly sample bottle. The back-half of the filterable PM filter holder, probe liner, condenser, Impingers 1 and 2, connecting glassware, and the front-half of the CPM filter holder were rinsed twice with water. These rinses were added to the same sample bottle (inorganic fraction).

Following the water rinses, the same glass components were rinsed with acetone and that rinse was added to a separate labeled glass sample bottle. Finally, the components were rinsed two times with hexane. These rinses were added to the same sample bottle as the acetone rinse (organic fraction).

The CPM filter was transferred to a high-density polypropylene (HDPE) Petri dish, labeled, and stored for transportation to the lab. The CPM filter was transferred to a 50 ml extraction tube, 10 ml of deionized, ultra-filtered water was added, and the extraction tube was placed in a sonication bath for two minutes. The aqueous extract was transferred to the sample bottle containing the inorganic fraction. This procedure was performed three times and each time the aqueous extract was added to the inorganic fraction.

Next, 10 ml of hexane was added to the extraction tube and it was placed in the sonication bath for 2 minutes. The organic soluble material was transferred to the organic fraction sample bottle. This procedure was performed three times and each time the organic soluble material was transferred to the organic fraction.

The contents of the inorganic fraction were transferred to a separatory funnel; 30 ml of hexane was added and mixed well. The funnel was allowed to set for a period of time sufficient to allow separation of the two phases; the bottom inorganic phase was drained off into its original container, and the top organic phase was added to the organic fraction. This was repeated three times with 30 ml of hexane added each time, yielding approximately 90 ml of organic extract.

The inorganic fraction was transferred to a clean-baked 250 ml beaker, placed on a hot plate controlled at 221°F. The volume was reduced to 10 ml, and then the beaker was allowed to dry at room temperature. The residue was re-dissolved in 100 ml of deionized distilled ultra-filtered water. The pH of the sample was measured and recorded in the lab log book. The sample was then titrated, to remove the water of hydration, with 0.1 N ammonium hydroxide (NH4OH) to a pH of approximately 7.0 as indicated by a pH meter. The volume of titrant was recorded in the lab log book and utilized in the final calculations to subtract the NH4+ retained in the sample. The sample was then returned to the hot plate at 221°F and reduced to approximately 10 ml. The sample was then transferred to a tared aluminum weighing dish, taken to dryness at room temperature, and transferred to the desiccator for a period of 24 hours prior to weighing to a constant weight.

The organic phase was transferred to a clean-baked 250 ml beaker and allowed to evaporate at room temperature to a volume not less than 10 ml. The remaining volume was transferred to a

tared aluminum weighing dish, taken to dryness and transferred to the desiccator for a period of 24 hours prior to weighing to a constant weight.

Analyses included field reagent blanks of 200 ml acetone, 200 ml DI blank, and 200 ml hexane. Additionally, a single field train blank was prepared and analyzed according to Method 202. The total $PM_{2.5}$ filterable plus condensable catch, as well as the individual condensable and filterable results are reported in mg/dscm and lb/hr. Laboratory data can be found in Appendix C.

6.6 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.

6.6.1 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.

6.6.2 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.

6.7 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.

6.7.1 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 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.

6.7.2 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%. 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.

6.7.3 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.

6.8 Toluene Organic Soluble Emissions – Modified USEPA Method 315

Toluene Soluble Organic (TSO) emissions were determined by using a Modified Method 315, *Determination of Particulate and Methylene Chloride Extractable Matter (MCEM) From Selected Sources at Primary Aluminum Production Facilities*, but substituting the collection reagent from methylene chloride to toluene, as required by the USEPA ICR. USEPA Method 5 was also run concurrent with this method, but because a separate USEPA Method 5/29 sample was also conducted, PM results from the 315 train are not reported. The sampling apparatus contained a glass-lined temperature-controlled probe equipped with a Type S Pitot tube and a sharp-edged glass button-hook 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. The exit of the filter holder was connected to a modified Greenburg-Smith impinger, followed by a Greenburg-Smith standard tip impinger, and then by two more modified Greenburg-Smith impingers. The first and second impingers each contained 100 ml of deionized water, the third impinger was empty, and the fourth impinger contained a known mass of silica gel.

Sampling was performed at an isokinetic rate with an isokinetic variation greater than 90% and less than 110%. The sampling train was leak checked before and after each test run and operated according to the procedures detailed in USEPA Method 5. Each test run was 180 minutes in duration. Three test runs were performed at the boiler.

The PM was recovered according to USEPA Method 5 procedures, but as stated was not reported for this sampling train. The acetone rinse was evaporated to dryness, desiccated, and weighed to a constant weight. The filter was desiccated and weighed to a constant weight. Laboratory data, including data from Maxxam Analytics is located in Appendix C. It should be noted that Maxxam Analytics' results use the abbreviation of DCM for methylene chloride, the standard solvent, when the results are actually for toluene. TSO emissions are then determined by adding a toluene rinse of the probe and filter holder, extracting the condensable hydrocarbons collected in the impinger water, adding an acetone rinse followed by a toluene rinse of the sampling train components after the filter and before the silica gel impinger, and determining residue gravimetrically after evaporating the solvents. Laboratory data can be found in Appendix C. Emissions are reported on a mg/dscm and lb/hr basis. Note: As stated in Section 6.1, toluene blank concentrations were greater than allowed by the method for methylene chloride and Montrose evaluated how best to

subtract a representative toluene blank. The method blanks of the toluene were high and had values that were greater than 100% of the reported front-half filter sample results and up to 95% of the reported front-half solvent rinse sample results. Because of concerns about the high toluene residue after evaporation biasing sample results high, the full reagent cleanup or lab internal extraction blank mass rate was subtracted (by prorating volume of blank versus volume of toluene used in each sample fraction) from each sample fraction to avoid over reporting of TSO. The toluene filter extractable blank 90% upper confidence interval of 9.29 mg of residue is 36 times the Method 315 acceptable methylene chloride blank value of 0.26 mg of residue. This suggests the use of toluene extraction solvent to be the cause of the high bias residue results. The toluene laboratory processed blank of 5.8 mg of residue is more than 11 times the methylene chloride laboratory processed blank of <0.5 mg of residue. This again, would suggest the use of the toluene extraction solvent to be the cause of the high bias residue results. A copy of a report provided by Maxxam Analytics, dated March 24, 2017, is included in Section 9.0 and documents the unusually high level of toluene blank contamination. The toluene filter extraction blank and the toluene laboratory processed blank that were processed through the filtration apparatus, are extremely elevated and add significant high bias to the results which can support regarding the Modified Method 315 results with the non-standard toluene solvent, to be highly suspect and probably invalid. Assumptions and laboratory and/or cleanup toluene used in each fraction are shown in Appendix B excel run sheets.

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 Dioxides 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 as g/hr, lb/hr and tons/hr.

6.9.5 Determination of Carbon Monoxide Emissions – USEPA Method 10

The principles of USEPA Method 10, *Determination of Carbon Monoxide Emissions from Stationary Sources (Instrumental Analyzer Procedure),* were used for this test program. A gas sample was continuously extracted utilizing the same sampling system as described earlier in this test plan, and a portion of the sample was conditioned and conveyed to a gas filter correlation (GFC) non-dispersive infrared (NDIR) TECO Model 48C.

6.9.6 Verification of Gas Dilution System – USEPA Method 205

USEPA Method 205, *Verification of Gas Dilution Systems for Field Instrument Calibrations*, utilizing USEPA Protocol gases and an Environics Model 4040 Computerized Gas Dilution System, were used for select calibration values. The mass flow controller and dilution cylinder used during the calibrations were documented on the calibration bias data sheets when this methodology was utilized.

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 Chloride, Hydrogen Fluoride, and Cyanide – USEPA Method 320

USEPA Method 320, *Vapor Phase Organic & Inorganic Emissions by Extractive FTIR,* was used to measure HCl, 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 HCl and 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 Emissions – USEPA Methods 9

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. Results are reported as average % opacity observed during each run for opacity.

6.13 Quality Assurance/Quality Control

The following field equipment calibrations are contained in Appendix D:

- Pitot and Thermocouple
- Dry gas meter and orifice
- Nozzle
- Interference data
- USEPA Method 205 Verifications
- 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 Boiler 1 and 2 Combined Stack are contained in the following tables:

Table 1 – Filterable and Condensable PM2.5 Particulate Emissions

Table 2 – Filterable Particulate Matter Test Results (Opacity included)

Table 3 – Metal Test Results

Table 4 –Dioxin/Furan Test Results

Table 5 – Semi-Volatile Organic Test Results

Table 6 – Tolune Soluble Organic 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 the combined stack of the #1 and #2 Boilers at their Monessen Coke Plant on October 10-13, 2016. Test results represent data that is considered to be representative of the emission rates at the prevailing operating conditions.

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.

9 MAXXAM ANALYTICS' MODIFIED METHOD 315 (TSO) CONTAMINATION

Please see the following page for correspondence from Maxxam Analytics regarding the modified Method 315 (TSO) Contamination.

Maxxam
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MAXXAM ANALYTICS
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Toll Free 800 563 6266
Fax 905 817 5777

March 24, 2017

William Cowell **Montrose Air Quality Services**

Re: Coke ICR Modified Method 315 Blanks - Methylene Chloride Modified to Toluene

Dear William;

The Coke industry received a Clean Air Act Section 114 Information Collection Request (Coke ICR) on April 4, 2016 from US EPA to conduct emissions testing at facilities across the US. The emissions testing required to be conducted by this Coke ICR included a Method 315 (Particulate and Methylene Chloride Extractable Matter (MCEM)), except that USEPA specifically required that the standard method extraction solvent of methylene chloride be substituted with the use of toluene to determine emissions of Toluene Soluble Organics (TSO).

Based on a review of the field and lab results, the Method 315 TSO results added uncertainty due to USEPA's required deviation of switching from methylene chloride to toluene. Information was requested from Maxxam to clearly describe how TSO concentrations were derived including properly labeled references of each number with units used in the calculations, all assumptions and estimations used in the calculations and details on the determination of all blank values. The ultimate objective is to enable a third party to review the results, documentation and calculations to independently verify the results, the blanks and the blank corrected results.

1. **Toluene Filter Extractable Blanks**

Per our ongoing discussions during January - March, Maxxam performed analysis of three (3) filter blanks according to EPA Method 315 section 11.2.1.2, using toluene as the extraction solvent instead of methylene chloride, as required by USEPA's modification of the standard Method 315. An example of an unused probe filter used for this blank determination is shown in Figure 1. In total, 130 ml of toluene was used to extract and rinse each filter during the extraction procedure.

After the toluene was used to extract and rinse each filter, the toluene was passed through an Ahlin filter, glass wool and a fixed porous glass frit as shown in Figure 2, Filtration Apparatus. These three toluene filter extractable blank results were 4.9, 9.6 and 7.1 mg of residue. The mean blank result was 7.20 mg of residue. Based on USEPA's SW-846 Chapter 9 statistical analysis, the 90% upper confidence interval of these blanks was determined to be 9.29 mg of residue, as illustrated in the table below. The upper confidence interval would be the

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conservative value to represent the impact of the background contamination of the unused probe filter, laboratory toluene and filtration apparatus.

Method 315 Toluene Filter Extractable Blanks

Sample	*Blank Result*	*Units*	*Statistic*	*Value*	*Sq Rt*
1	4.9	mg	Population	3.00	1.73
2	9.6	mg	Mean	7.20	
3	7.1	mg	Std Dev	1.92	
			Std Error	1.11	
			t value	1.89	
	90 % Upper Confidence Interval			**9.29**	mg

EPA Method 315 states that a methylene chloride blank value less than 1.5 ppm, by weight, residue is acceptable. Using the sample volume above, 130 ml sample x 1.33 g/ml methylene chloride density x 1000 mg/g conversion = 172,900 mg, the acceptable residue would be 1.5×10^{-6} x 172,900 mg sample = 0.26 mg of residue.

The toluene filter extractable blank 90% upper confidence interval of 9.29 mg of residue is 36 times the Method 315 acceptable methylene chloride blank value of 0.26 mg of residue. This suggests the use of toluene extraction solvent to be the cause of the high bias residue results.

2. **Laboratory Processed Blanks – Toluene (non-standard) vs Methylene Chloride (standard)**

Maxxam also conducted a toluene laboratory processed blank that had a value of 5.8 mg of residue. This blank did not involve an unused probe filter, but did include 100 ml of Toluene that was processed using the same filtration apparatus procedure as used for the toluene filter extractable blank and included the Ahlin filter, glass wool and a fixed porous glass frit as shown in Figure 2. The 5.8 mg of residue detected in the toluene laboratory processed blank indicates background contamination from the toluene and filtration apparatus. The filtration apparatus glassware used to filter the samples was washed and solvent rinsed with methanol prior to the extraction and filtration.

Prior to the USEPA modification of Method 315 for the Coke ICR, methylene chloride was the standard extraction solvent used. Based on historical Method 315 analysis conducted by Maxxam using methylene chloride, all the laboratory processed blanks were reported to be <0.5 mg of residue in 2008, 2010 and 2016.

The toluene laboratory processed blank of 5.8 mg of residue is more than 11 times the methylene chloride laboratory processed blank of <0.5 mg of residue. This again, would suggest the use of the toluene extraction solvent to be the cause of the high bias residue results.

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3. Technical Laboratory Findings

This laboratory evaluation concludes that the use of toluene (instead of methylene chloride as the extraction solvent of the filter and probe rinse) has resulted in significantly elevated toluene filter extraction blanks and toluene laboratory processed blank results that cannot be related to the sampled sources and must be considered when attempting to report the actual Method 315 values.

Please feel free to contact me if you have further questions or concerns.

Thank you,

Susan Bigg
Sr. QA Manager
905-817-5700 ext 4049

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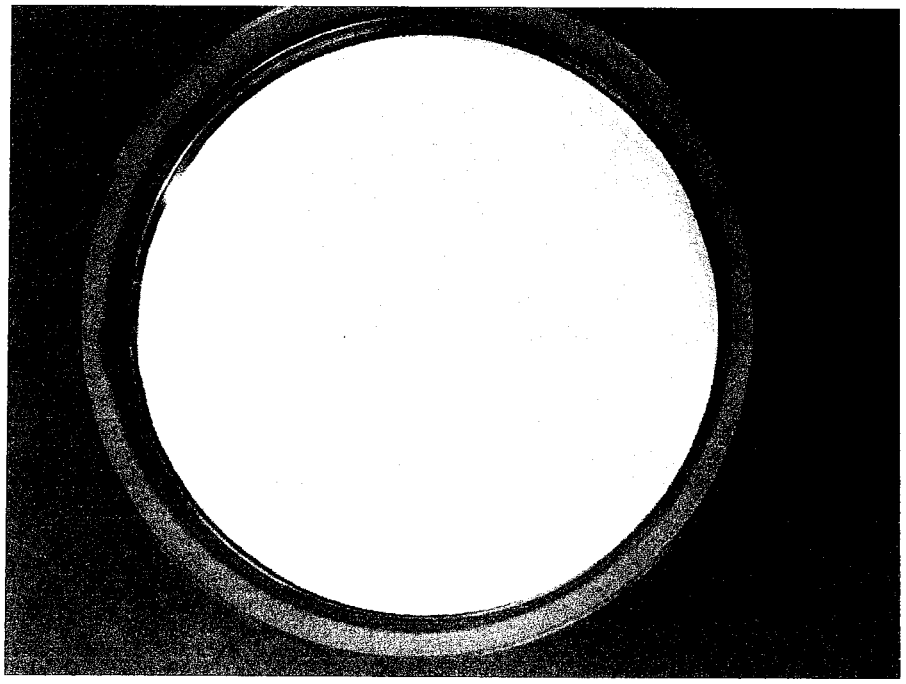

Figure 1 Method 315 Filter

Apex Instruments Glass Microfiber Filter Media 82.6 mm diameter GF-3E

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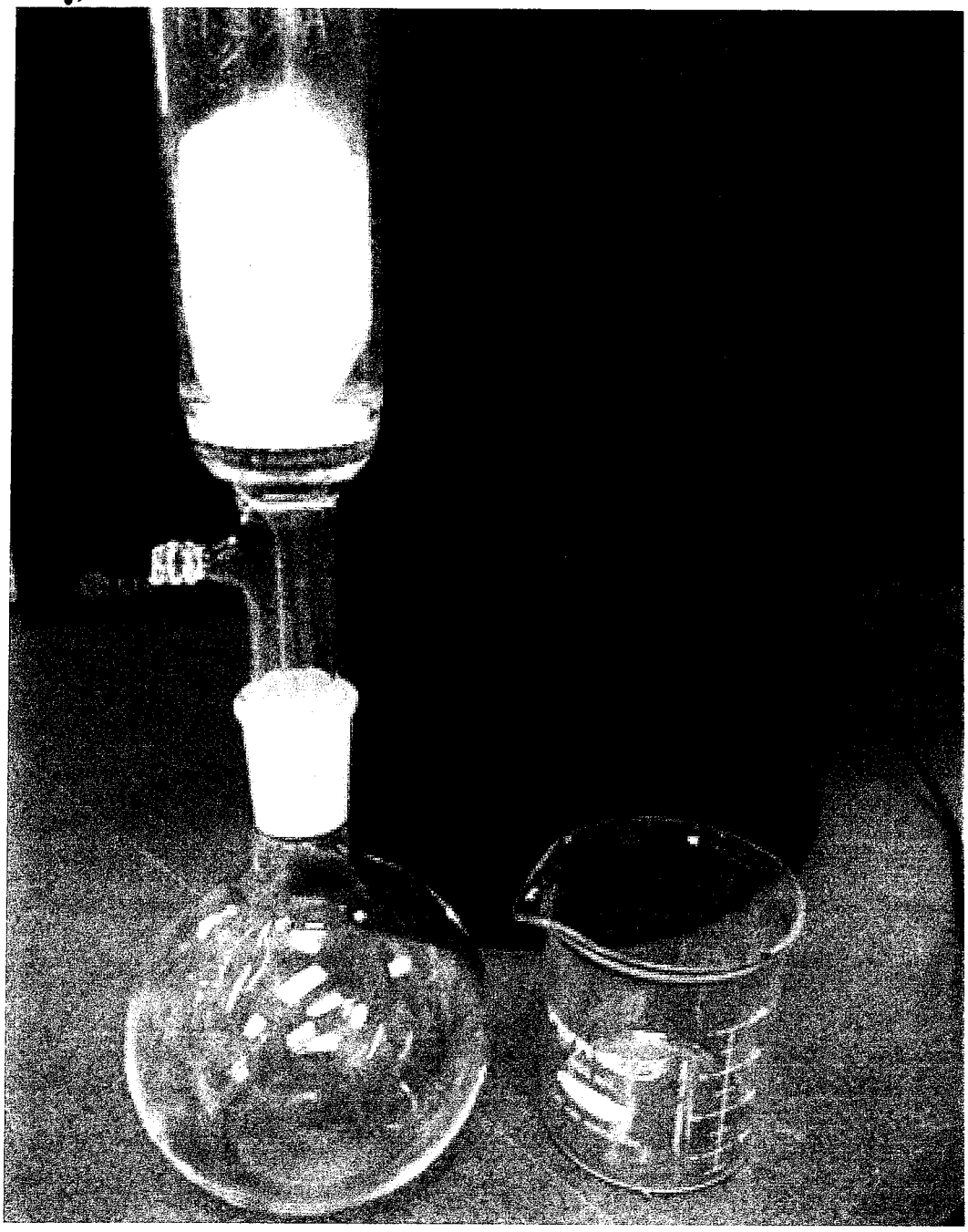
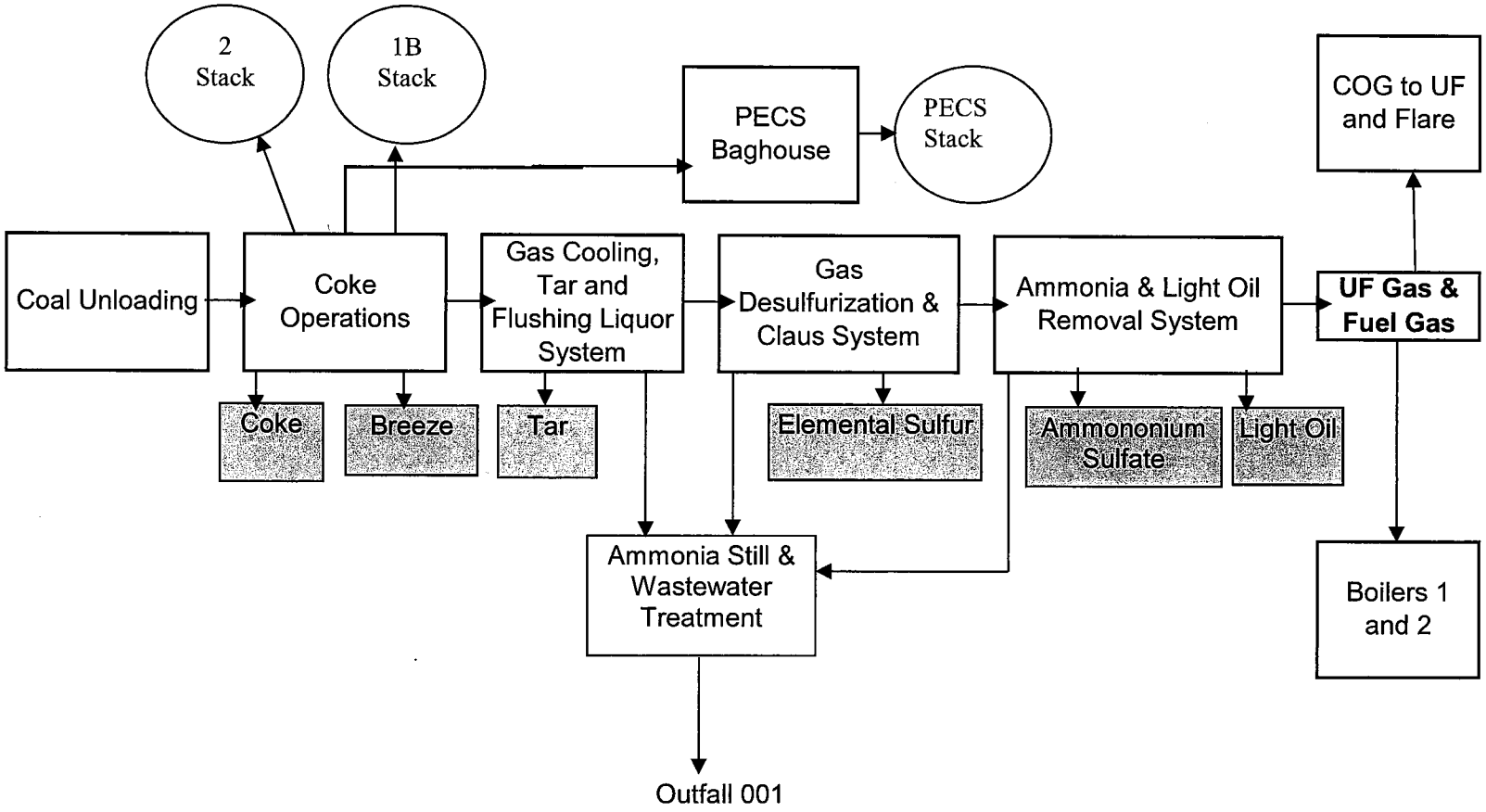


Figure 2 Filtration Apparatus



MONTROSE AIR QUALITY SERVICES

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

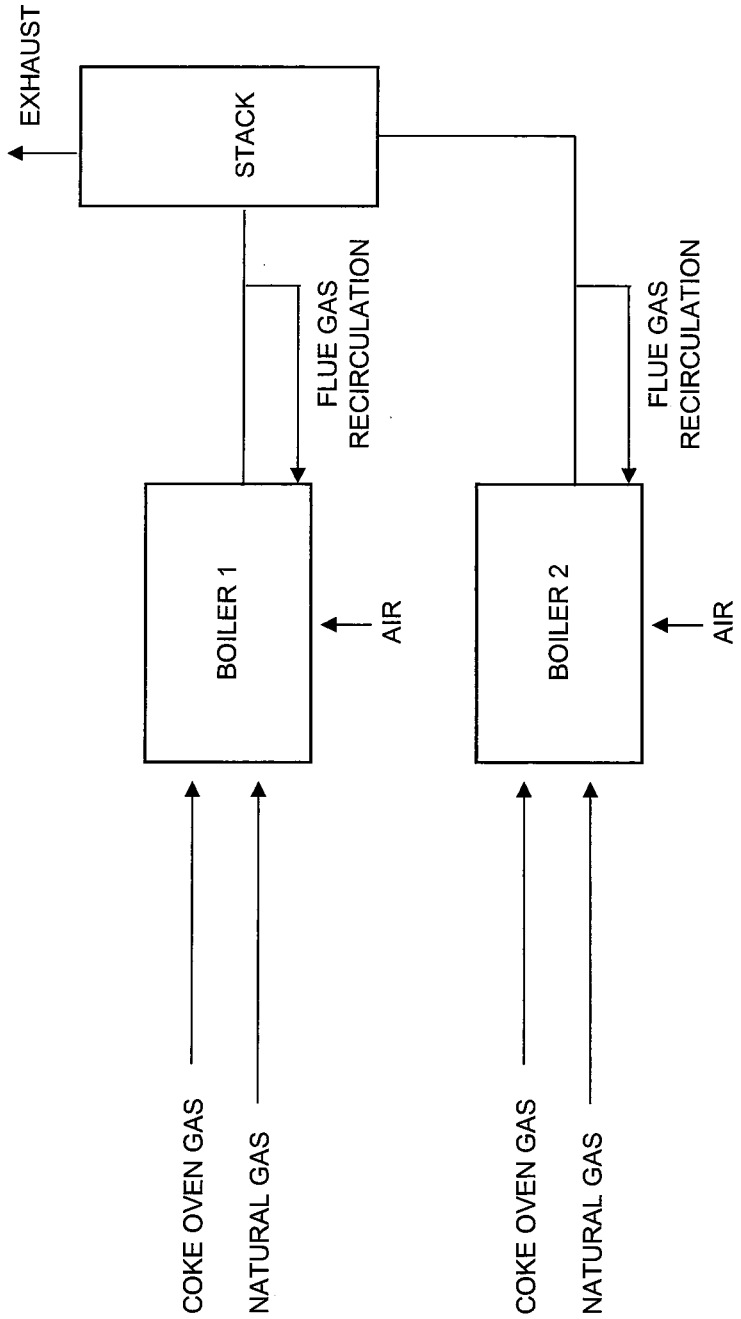
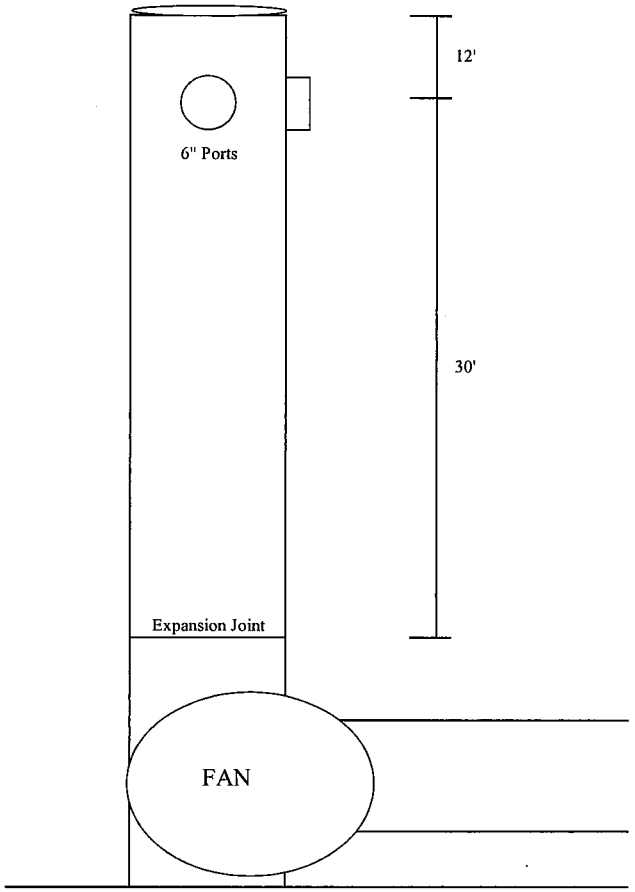
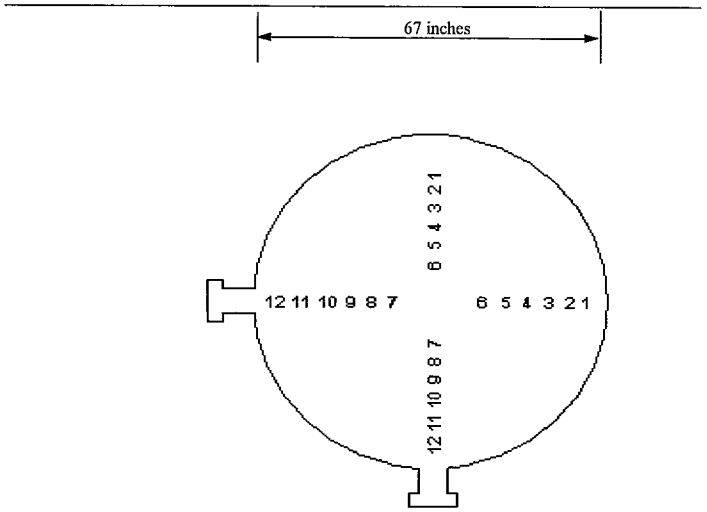


Figure 2

SIMPLE BLOCK DIAGRAM of the BOILER HOUSE ARCELORMITTAL MONESSEN, MONESSEN COKE PLANT

MONTROSE





Traverse Point	% of Diameter	Port to Point Distance (in.)
1	2.1	1.4
2	6.7	4.6
3	11.8	8.0
4	17.7	12.0
5	25.0	17.0
6	35.6	24.2
7	64.4	43.8
8	75.0	51.0
9	82.3	56.0
10	88.2	60.0
11	93.3	63.4
12	97.9	66.6

Diameters to upstream disturbance:	= (30/5.67) =	5.3	Limit: 2.0 minimum
Diameters to downstream disturbance:	= (12/5.67) =	2.1	Limit: 0.5 minimum

MONTROSE AIR QUALITY SERVICES

STACK DIAMETER SAMPLE POINTS LOCATION for the BOILER HOUSE STACK
ARCELORMITTAL MONESSEN, MONESSEN COKE PLANT

Figure 3

REPORT – TABLES

Table 1. Filterable and Condensable $PM_{2.5}$ Particulate Emissions, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/11/16	10/11/16	10/12/16	
Start Time		9:20 AM	2:30 PM	7:50 AM	
End Time		1:06 PM	6:29 PM	12:08 PM	
Duration	(minutes)	207.67	226.97	238.38	
Flow Rate	(ACFM)	50,860	51,097	52,891	51,616
Flow Rate	(SCFM)	28,309	28,442	30,206	28,986
Flow Rate	(DSCFM)	22,373	22,947	24,814	23,378
Sample Volume	(DSCF)	61.021	71.479	76.749	69.750
Oxygen	(dry volume %)	5.02	5.30	5.36	5.23
Carbon Dioxide	(dry volume %)	7.19	7.42	7.31	7.31
Water Vapor	(volume %)	20.97	19.32	17.85	19.38
Stack Temperature	(°F)	459.2	459.2	443.6	454.0
Percent Isokinetic (80 > I > 120)	(%)	92.2	96.3	91.0	93.2
$D_{50}PM_{2.5}$ *(2.25 > $D_{50}PM_{2.5}$ > 2.75)*	(microns)	2.74	2.59	2.58	2.64
Z *(.99 < Z < 1.01)*		1.01	1.007	1.007	1.008
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		12	13	14	13
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	2,431	2,431
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	139.2	150.8	162.4	150.8
COG generated during test	(mmscf)	2.54	2.68	2.90	2.71
COG burned in boilers during test	(mmscf)	0.67	0.71	0.77	0.72
COG burned in batteries during test	(mmscf)	1.47	1.56	1.68	1.57
Results					
Method 201A Summary					
PM < 2.5 microns	(mg)	9.91	6.75	6.32	7.66
PM < 2.5 microns Emission Concentration	(mg/dscm)	5.74	3.33	2.91	3.99
PM < 2.5 microns Emission Rate	(lb/hr)	0.48	0.29	0.27	0.35
Method 202 Summary					
Condensable Inorganic Particulate (Uncorrected)	(mg)	22.35	42.23	4.81	23.13
Condensable Inorganic Concentration (Uncorrected)	(mg/dscm)	12.94	20.86	2.21	12.00
Condensable Organic Particulate (Uncorrected)	(mg)	5.25	3.75	13.85	7.62
Condensable Organic Concentration (Uncorrected)	(mg/dscm)	3.04	1.85	6.37	3.75
Blank Corrected Total Condensable Mass	(mg)	26.55	44.93	17.61	29.70
Total Condensable Emission Rate	(mg/dscm)	15.37	22.20	8.10	15.22
Condensable Emission Rate	(lb/hr)	1.29	1.91	0.75	1.32
Particulate Matter ≤ 2.5μm					
Mass Collected	(mg)	36.47	51.68	23.93	37.36
Total Condensable Emission Rate	(mg/dscm)	21.10	25.53	11.01	19.22
Emission Rate	(lb/hr)	1.77	2.19	1.02	1.66

Table 2. Filterable Particulate Matter Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/11/16	10/11/16	10/12/16	
Start Time		9:20 AM	2:30 PM	7:50 AM	
End Time		1:00 PM	6:05 PM	11:40 AM	
Test Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	52,164	50,791	50,994	51,317
Flow Rate	(SCFM)	29,056	28,188	28,456	28,567
Flow Rate	(DSCFM)	23,049	22,612	22,836	22,832
Sample Volume	(DSCF)	108.287	105.052	107.041	106.793
Oxygen	(dry volume %)	4.99	5.29	5.36	5.21
Carbon Dioxide	(dry volume %)	7.15	7.43	7.42	7.33
Water Vapor	(volume %)	20.68	19.78	19.75	20.07
Stack Temperature	(°F)	458.5	461.9	458.4	459.6
Percent of Isokinetic Sampling	(%)	107.7	106.5	107.4	107.2
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		12	13	14	13
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	2,431	2,431
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	139.2	150.8	162.4	150.8
COG generated during test	(mmscf)	2.47	2.42	2.58	2.49
COG burned in boilers during test	(mmscf)	0.66	0.64	0.69	0.66
COG burned in batteries during test	(mmscf)	1.43	1.40	1.50	1.45
Results					
Particulate Results					
Mass Collected	(mg)	29.90	27.30	11.70	22.97
Emission Concentration	(gr/DSCF)	0.0043	0.0040	0.0017	0.0033
Emission Rate	(mg/dscm)	9.75	9.18	3.86	7.60
Emission Rate	(lb/hr)	0.84	0.78	0.33	0.65
Opacity Results					
Average Opacity	(%)	0.00	0.00	0.00	0.00

Table 3. Metal Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/11/16	10/11/16	10/12/16	
Start Time		9:20 AM	2:30 PM	7:50 AM	
End Time		1:00 PM	6:05 PM	11:40 AM	
Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	52,164	50,791	50,994	51,317
Flow Rate	(SCFM)	29,056	28,188	28,456	28,567
Flow Rate	(DSCFM)	23,049	22,612	22,836	22,832
Sample Volume	(DSCF)	108.29	105.05	107.04	106.79
Oxygen	(dry volume %)	4.99	5.29	5.36	5.21
Carbon Dioxide	(dry volume %)	7.15	7.43	7.42	7.33
Water Vapor	(volume %)	20.68	19.78	19.75	20.07
Stack Temperature	(°F)	458.5	461.9	458.4	459.6
Percent of Isokinetic Sampling	(%)	107.7	106.5	107.4	107.2
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
# of Ovens Pushed during test		12	13	14	13
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	2,431	2,431
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	139.2	150.8	162.4	150.8
COG generated during test	(mmscf)	2.47	2.42	2.58	2.49
COG burned in boilers during test	(mmscf)	0.66	0.64	0.69	0.66
COG burned in batteries during test	(mmscf)	1.43	1.40	1.50	1.45
Results					
Mercury					
Emission concentration (1B Fraction)	(mg/DSCM)	5.87E-06	< 5.04E-06	< 4.95E-06	< 5.29E-06
Emission concentration (2B Fraction)	(mg/DSCM)	4.37E-04	7.19E-04	8.51E-04	6.69E-04
Emission concentration (3A Fraction)	(mg/DSCM)	2.80E-05	< 1.82E-06	1.21E-05	< 1.40E-05
Emission concentration (3B Fraction)	(mg/DSCM)	1.04E-05	5.61E-05	2.31E-05	2.99E-05
Emission concentration (3C Fraction)	(mg/DSCM)	4.44E-03	4.81E-03	5.38E-03	4.87E-03
Emission rate (1B Fraction)	(lb/hr)	5.07E-07	< 4.27E-07	< 4.23E-07	< 4.52E-07
Emission rate (2B Fraction)	(lb/hr)	3.77E-05	6.09E-05	7.28E-05	5.72E-05
Emission rate (3A Fraction)	(lb/hr)	2.42E-06	< 1.54E-07	1.04E-06	< 1.20E-06
Emission rate (3B Fraction)	(lb/hr)	9.01E-07	4.75E-06	1.98E-06	2.54E-06
Emission rate (3C Fraction)	(lb/hr)	3.83E-04	4.07E-04	4.60E-04	4.17E-04
Antimony					
Emission Concentration Front-Half	(mg/DSCM)	3.78E-04	< 2.69E-04	< 2.64E-04	< 3.04E-04
Emission Concentration Back-Half	(mg/DSCM)	< 3.26E-04	< 3.36E-04	< 3.30E-04	< 3.31E-04
Emission Rate Front-Half	(lb/hr)	3.27E-05	< 2.28E-05	< 2.26E-05	< 2.60E-05
Emission Rate Back-Half	(lb/hr)	< 2.82E-05	< 2.85E-05	< 2.82E-05	< 2.83E-05

Table 3. Metal Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data			Run 1		Run 2		Run 3		Average
Arsenic									
Emission Concentration Front-Half	(mg/DSCM)		2.34E-03		2.15E-03		1.90E-03		2.13E-03
Emission Concentration Back-Half	(mg/DSCM)		3.26E-04	<	3.36E-04	<	3.30E-04	<	3.31E-04
Emission Rate Front-Half	(lb/hr)		2.02E-04		1.83E-04		1.62E-04		1.82E-04
Emission Rate Back-Half	(lb/hr)		2.82E-05	<	2.85E-05	<	2.82E-05	<	2.83E-05
Beryllium									
Emission Concentration Front-Half	(mg/DSCM)	<	6.52E-05	<	6.72E-05	<	6.60E-05	<	6.61E-05
Emission Concentration Back-Half	(mg/DSCM)	<	8.15E-05	<	8.40E-05	<	8.25E-05	<	8.27E-05
Emission Rate Front-Half	(lb/hr)	<	5.63E-06	<	5.69E-06	<	5.64E-06	<	5.66E-06
Emission Rate Back-Half	(lb/hr)	<	7.04E-06	<	7.12E-06	<	7.05E-06	<	7.07E-06
Cadmium									
Emission Concentration Front-Half	(mg/DSCM)	<	6.52E-05	<	6.72E-05	<	6.60E-05	<	6.61E-05
Emission Concentration Back-Half	(mg/DSCM)	<	8.15E-05	<	8.40E-05	<	8.25E-05	<	8.27E-05
Emission Rate Front-Half	(lb/hr)	<	5.63E-06	<	5.69E-06	<	5.64E-06	<	5.66E-06
Emission Rate Back-Half	(lb/hr)	<	7.04E-06	<	7.12E-06	<	7.05E-06	<	7.07E-06
Chromium									
Emission Concentration Front-Half	(mg/DSCM)		4.73E-03		3.73E-03		1.88E-03		3.45E-03
Emission Concentration Back-Half	(mg/DSCM)		3.78E-04		8.64E-03		3.13E-04		3.11E-03
Emission Rate Front-Half	(lb/hr)		4.08E-04		3.16E-04		1.61E-04		2.95E-04
Emission Rate Back-Half	(lb/hr)		3.27E-05		7.32E-04		2.68E-05		2.64E-04
Cobalt									
Emission Concentration Front-Half	(mg/DSCM)		1.08E-04	<	6.72E-05		6.93E-05	<	8.14E-05
Emission Concentration Back-Half	(mg/DSCM)		6.95E-04		1.80E-03		8.58E-04		1.12E-03
Emission Rate Front-Half	(lb/hr)		9.29E-06	<	5.69E-06		5.93E-06	<	6.97E-06
Emission Rate Back-Half	(lb/hr)		6.00E-05		1.52E-04		7.34E-05		9.52E-05
Lead									
Emission Concentration Front-Half	(mg/DSCM)		1.08E-03		4.74E-04		3.46E-04		6.33E-04
Emission Concentration Back-Half	(mg/DSCM)		2.80E-04		7.23E-04		1.85E-04		3.96E-04
Emission Rate Front-Half	(lb/hr)		9.32E-05		4.01E-05		2.96E-05		5.43E-05
Emission Rate Back-Half	(lb/hr)		2.42E-05		6.12E-05		1.58E-05		3.37E-05
Manganese									
Emission Concentration Front-Half	(mg/DSCM)		2.51E-03		1.71E-03		3.27E-03		2.50E-03
Emission Concentration Back-Half	(mg/DSCM)		1.14E-03		2.92E-03		9.24E-04		1.66E-03
Emission Rate Front-Half	(lb/hr)		2.17E-04		1.45E-04		2.79E-04		2.14E-04
Emission Rate Back-Half	(lb/hr)		9.85E-05		2.48E-04		7.90E-05		1.42E-04
Nickel									
Emission Concentration Front-Half	(mg/DSCM)		5.25E-03		3.06E-03		1.52E-03		3.28E-03
Emission Concentration Back-Half	(mg/DSCM)		5.87E-04		2.21E-02		4.62E-04		7.72E-03
Emission Rate Front-Half	(lb/hr)		4.53E-04		2.59E-04		1.30E-04		2.81E-04
Emission Rate Back-Half	(lb/hr)		5.07E-05		1.87E-03		3.95E-05		6.55E-04
Selenium									
Emission Concentration Front-Half	(mg/DSCM)	<	6.52E-04	<	6.72E-04	<	6.60E-04	<	6.61E-04
Emission Concentration Back-Half	(mg/DSCM)		1.17E-03		1.58E-03		1.12E-03		1.29E-03
Emission Rate Front-Half	(lb/hr)	<	5.63E-05	<	5.69E-05	<	5.64E-05	<	5.66E-05
Emission Rate Back-Half	(lb/hr)		1.01E-04		1.34E-04		9.59E-05		1.10E-04

Table 4. Dioxin/Furan Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/12/2016	10/13/2016	10/13/2016	
Start Time		1:15 PM	7:35 AM	11:35 AM	
End Time		4:58 PM	10:54 AM	2:45 PM	
Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	55,229	56,553	55,566	55,783
Flow Rate	(SCFM)	31,130	31,542	30,960	31,211
Flow Rate	(DSCFM)	25,450	25,550	25,316	25,439
Sample Volume	(DSCF)	147.1	158.1	154.0	153.1
Oxygen	(dry volume %)	5.39	5.24	5.10	5.24
Carbon Dioxide	(dry volume %)	7.33	7.29	7.25	7.29
Water Vapor	(volume %)	18.25	19.00	18.23	18.49
Stack Temperature	(°F)	455.5	458.6	459.5	457.9
Percent of Isokinetic Sampling	(%)	92.4	99.0	97.3	96.2
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	15	11	13	13.0
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)	174	127.6	150.8	150.8
COG generated during test	(mmscf)	2.50	2.24	2.13	2.29
COG burned in boilers during test	(mmscf)	0.67	0.59	0.57	0.61
COG burned in batteries during test	(mmscf)	1.45	1.30	1.24	1.33
Results					
Dioxins and Furans					
TEF Mass Collected	(ng)	< 0.018	< 0.013	< 0.018	< 0.016
TEF Emission Concentration	(ng/m^3)	< 0.0044	< 0.0029	< 0.0041	< 0.0038
TEF Emission Rate	(ng/hr)	< 189	< 127	< 176	< 164
2,3,7,8-Tetrachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 8.2E-07	< 8.0E-07	< 7.8E-07	< 8.0E-07
	(raw lb/hr)	< 7.8E-11	< 7.7E-11	< 7.4E-11	< 7.6E-11
	(TEF µg/m^3)	< 8.2E-07	< 8.0E-07	< 7.8E-07	< 8.0E-07
	(TEF lb/hr)	< 7.8E-11	< 7.7E-11	< 7.4E-11	< 7.6E-11
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 7.7E-07	< 1.1E-06	< 7.8E-07	< 9.0E-07
	(raw lb/hr)	< 7.3E-11	< 1.1E-10	< 7.4E-11	< 8.5E-11
	(TEF µg/m^3)	< 3.8E-07	< 5.7E-07	< 3.9E-07	< 4.5E-07
	(TEF lb/hr)	< 3.7E-11	< 5.5E-11	< 3.7E-11	< 4.3E-11
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 8.2E-07	< 7.4E-07	< 7.6E-07	< 7.7E-07
	(raw lb/hr)	< 7.8E-11	< 7.1E-11	< 7.2E-11	< 7.3E-11
	(TEF µg/m^3)	< 8.2E-08	< 7.4E-08	< 7.6E-08	< 7.7E-08
	(TEF lb/hr)	< 7.8E-12	< 7.1E-12	< 7.2E-12	< 7.3E-12
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 8.4E-07	< 7.4E-07	< 7.6E-07	< 7.8E-07
	(raw lb/hr)	< 8.0E-11	< 7.1E-11	< 7.2E-11	< 7.4E-11
	(TEF µg/m^3)	< 8.4E-08	< 7.4E-08	< 7.6E-08	< 7.8E-08
	(TEF lb/hr)	< 8.0E-12	< 7.1E-12	< 7.2E-12	< 7.4E-12
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	< 7.7E-07	< 6.9E-07	< 6.9E-07	< 7.2E-07
	(raw lb/hr)	< 7.3E-11	< 6.6E-11	< 6.5E-11	< 6.8E-11
	(TEF µg/m^3)	< 7.7E-08	< 6.9E-08	< 6.9E-08	< 7.2E-08
	(TEF lb/hr)	< 7.3E-12	< 6.6E-12	< 6.5E-12	< 6.8E-12

Table 4. Dioxin/Furan Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin					
	(raw µg/m^3)	1.4E-06	2.2E-06	1.4E-06	1.7E-06
	(raw lb/hr)	1.4E-10	2.1E-10	1.3E-10	1.6E-10
	(TEF µg/m^3)	1.4E-08	2.2E-08	1.4E-08	1.7E-08
	(TEF lb/hr)	1.4E-12	2.1E-12	1.3E-12	1.6E-12
2,3,7,8-Tetrachlorodibenzofuran					
	(raw µg/m^3)	7.2E-06	3.4E-06	5.0E-06	5.2E-06
	(raw lb/hr)	6.9E-10	3.3E-10	4.8E-10	5.0E-10
	(TEF µg/m^3)	7.2E-07	3.4E-07	5.0E-07	5.2E-07
	(TEF lb/hr)	6.9E-11	3.3E-11	4.8E-11	5.0E-11
1,2,3,7,8-Pentachlorodibenzofuran					
	(raw µg/m^3)	< 2.4E-06	1.0E-06	< 8.0E-07	< 1.4E-06
	(raw lb/hr)	< 2.3E-10	1.0E-10	< 7.6E-11	< 1.4E-10
	(TEF µg/m^3)	< 1.2E-07	5.2E-08	< 4.0E-08	< 7.1E-08
	(TEF lb/hr)	< 1.1E-11	5.0E-12	< 3.8E-12	< 6.8E-12
2,3,4,7,8-Pentachlorodibenzofuran					
	(raw µg/m^3)	2.7E-06	8.9E-07	3.0E-06	2.2E-06
	(raw lb/hr)	2.6E-10	8.6E-11	2.8E-10	2.1E-10
	(TEF µg/m^3)	1.4E-06	4.5E-07	1.5E-06	1.1E-06
	(TEF lb/hr)	1.3E-10	4.3E-11	1.4E-10	1.0E-10
1,2,3,4,7,8-Hexachlorodibenzofuran					
	(raw µg/m^3)	3.3E-06	9.6E-07	2.6E-06	2.3E-06
	(raw lb/hr)	3.2E-10	9.2E-11	2.5E-10	2.2E-10
	(TEF µg/m^3)	3.3E-07	9.6E-08	2.6E-07	2.3E-07
	(TEF lb/hr)	3.2E-11	9.2E-12	2.5E-11	2.2E-11
1,2,3,6,7,8-Hexachlorodibenzofuran					
	(raw µg/m^3)	1.5E-06	1.3E-06	1.7E-06	1.5E-06
	(raw lb/hr)	1.4E-10	1.2E-10	1.6E-10	1.4E-10
	(TEF µg/m^3)	1.5E-07	1.3E-07	1.7E-07	1.5E-07
	(TEF lb/hr)	1.4E-11	1.2E-11	1.6E-11	1.4E-11
2,3,4,6,7,8-Hexachlorodibenzofuran					
	(raw µg/m^3)	1.1E-06	1.2E-06	1.2E-06	1.1E-06
	(raw lb/hr)	1.0E-10	1.1E-10	1.1E-10	1.1E-10
	(TEF µg/m^3)	1.1E-07	1.2E-07	1.2E-07	1.1E-07
	(TEF lb/hr)	1.0E-11	1.1E-11	1.1E-11	1.1E-11
1,2,3,7,8,9-Hexachlorodibenzofuran					
	(raw µg/m^3)	< 7.9E-07	< 8.0E-07	< 8.3E-07	< 8.1E-07
	(raw lb/hr)	< 7.6E-11	< 7.7E-11	< 7.8E-11	< 7.7E-11
	(TEF µg/m^3)	< 7.9E-08	< 8.0E-08	< 8.3E-08	< 8.1E-08
	(TEF lb/hr)	< 7.6E-12	< 7.7E-12	< 7.8E-12	< 7.7E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran					
	(raw µg/m^3)	3.9E-06	3.4E-06	3.0E-06	3.4E-06
	(raw lb/hr)	3.8E-10	3.3E-10	2.8E-10	3.3E-10
	(TEF µg/m^3)	3.9E-08	3.4E-08	3.0E-08	3.4E-08
	(TEF lb/hr)	3.8E-12	3.3E-12	2.8E-12	3.3E-12
1,2,3,4,7,8,9-Heptachlorodibenzofuran					
	(raw µg/m^3)	< 8.6E-07	< 8.3E-07	< 8.3E-07	< 8.4E-07
	(raw lb/hr)	< 8.2E-11	< 7.9E-11	< 7.8E-11	< 8.0E-11
	(TEF µg/m^3)	< 8.6E-09	< 8.3E-09	< 8.3E-09	< 8.4E-09
	(TEF lb/hr)	< 8.2E-13	< 7.9E-13	< 7.8E-13	< 8.0E-13

Table 5. Semi-Volatile Organics Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		Run 1	Run 2	Run 3	Average
Date		10/12/2016	10/13/2016	10/13/2016	
Start Time		1:15 PM	7:35 AM	11:35 AM	
End Time		4:58 PM	10:54 AM	2:45 PM	
Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	55,229	56,553	55,566	55,783
Flow Rate	(SCFM)	31,130	31,542	30,960	31,211
Flow Rate	(DSCFM)	25,450	25,550	25,316	25,439
Sample Volume	(DSCF)	147.1	158.1	154.0	153.1
Oxygen	(dry volume %)	5.39	5.24	5.10	5.24
Carbon Dioxide	(dry volume %)	7.33	7.29	7.25	7.29
Water Vapor	(volume %)	18.25	19.00	18.23	18.49
Stack Temperature	(°F)	455.5	458.6	459.5	457.9
Percent of Isokinetic Sampling	(%)	92.4	99.0	97.3	96.2
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	15	11	13	13.0
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)	174	127.6	150.8	150.8
COG generated during test	(mmscf)	2.50	2.24	2.13	2.29
COG burned in boilers during test	(mmscf)	0.67	0.59	0.57	0.61
COG burned in batteries during test	(mmscf)	1.45	1.30	1.24	1.33
Results					
Semi-Volatiles					
Acenaphthene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0048	< 0.0045	< 0.0046	< 0.0046
Emission Rate	(lb/hr)	< 4.6E-04	< 4.3E-04	< 4.3E-04	< 4.4E-04
Acenaphthylene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0048	< 0.0045	< 0.0046	< 0.0046
Emission Rate	(lb/hr)	< 4.6E-04	< 4.3E-04	< 4.3E-04	< 4.4E-04
Anthracene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0048	< 0.0045	< 0.0046	< 0.0046
Emission Rate	(lb/hr)	< 4.6E-04	< 4.3E-04	< 4.3E-04	< 4.4E-04
Benz[a]anthracene					
Mass Collected	(ug)	< 20.0	< 20.0	< 20.0	< 20.0
Emission Concentration	(mg/m^3)	< 0.0048	< 0.0045	< 0.0046	< 0.0046
Emission Rate	(lb/hr)	< 4.6E-04	< 4.3E-04	< 4.3E-04	< 4.4E-04
Benzo[a]pyrene					
Mass Collected	(ug)	< 2.0	< 2.0	< 2.0	< 2.0
Emission Concentration	(mg/m^3)	< 0.0005	< 0.0004	< 0.0005	< 0.0005
Emission Rate	(lb/hr)	< 4.6E-05	< 4.3E-05	< 4.3E-05	< 4.4E-05
Benzo[b]fluoranthene					
Mass Collected	(ug)	< 1.0	< 1.0	< 1.0	< 1.0
Emission Concentration	(mg/m^3)	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Emission Rate	(lb/hr)	< 2.3E-05	< 2.1E-05	< 2.2E-05	< 2.2E-05

Table 5. Semi-Volatile Organics Test Results, Boiler 1 and 2 Combined 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)	<	0.0048	<	0.0045	<	0.0046	<	0.0046
Emission Rate	(lb/hr)	<	0.0005	<	0.0004	<	0.0004	<	0.0004
Benzo[k]fluoranthene									
Mass Collected	(ug)	<	2.0	<	2.0	<	2.0	<	2.0
Emission Concentration	(mg/m^3)	<	0.00048	<	0.00045	<	0.00046	<	0.00046
Emission Rate	(lb/hr)	<	4.6E-05	<	4.3E-05	<	4.3E-05	<	4.4E-05
Chrysene									
Mass Collected	(ug)	<	20.0	<	20.0	<	1.0	<	13.7
Emission Concentration	(mg/m^3)	<	0.0048	<	0.0045	<	0.0002	<	0.0032
Emission Rate	(lb/hr)	<	4.6E-04	<	4.3E-04	<	2.2E-05	<	3.0E-04
Dibenz[a,h]anthracene									
Mass Collected	(ug)	<	1.0	<	1.0	<	1.0	<	1.0
Emission Concentration	(mg/m^3)	<	0.0002	<	0.0002	<	0.0002	<	0.0002
Emission Rate	(lb/hr)	<	2.3E-05	<	2.1E-05	<	2.2E-05	<	2.2E-05
Fluoranthene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0048	<	0.0045	<	0.0046	<	0.0046
Emission Rate	(lb/hr)	<	4.6E-04	<	4.3E-04	<	4.3E-04	<	4.4E-04
Fluorene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0048	<	0.0045	<	0.0046	<	0.0046
Emission Rate	(lb/hr)	<	4.6E-04	<	4.3E-04	<	4.3E-04	<	4.4E-04
Indeno (1,2,3-cd) pyrene									
Mass Collected	(ug)	<	2.0	<	2.0	<	2.0	<	2.0
Emission Concentration	(mg/m^3)	<	0.0005	<	0.0004	<	0.0005	<	0.0005
Emission Rate	(lb/hr)	<	4.6E-05	<	4.3E-05	<	4.3E-05	<	4.4E-05
Naphthalene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0048	<	0.0045	<	0.0046	<	0.0046
Emission Rate	(lb/hr)	<	4.6E-04	<	4.3E-04	<	4.3E-04	<	4.4E-04
Phenanthrene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0048	<	0.0045	<	0.0046	<	0.0046
Emission Rate	(lb/hr)	<	4.6E-04	<	4.3E-04	<	4.3E-04	<	4.4E-04
Perylene									
Mass Collected	(ug)	<	5.0	<	5.0	<	5.0	<	5.0
Emission Concentration	(mg/m^3)	<	0.0012	<	0.0011	<	0.0011	<	0.0012
Emission Rate	(lb/hr)	<	1.1E-04	<	1.1E-04	<	1.1E-04	<	1.1E-04
Pyrene									
Mass Collected	(ug)	<	20.0	<	20.0	<	20.0	<	20.0
Emission Concentration	(mg/m^3)	<	0.0048	<	0.0045	<	0.0046	<	0.0046
Emission Rate	(lb/hr)	<	4.6E-04	<	4.3E-04	<	4.3E-04	<	4.4E-04

Table 6. Modified Method 315 Toluene Soluable Organic Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/12/16	10/13/16	10/13/16	
Start Time		1:15 PM	7:35 AM	11:35 AM	
End Time		4:58 PM	10:54 AM	2:45 PM	
Sample Duration	(minutes)	180	180	180	
Flow Rate	(ACFM)	49,767	50,826	52,846	51,146
Flow Rate	(SCFM)	27,867	28,162	29,344	28,458
Flow Rate	(DSCFM)	22,457	22,584	23,747	22,929
Sample Volume	(DSCF)	72.1	74.1	76.6	74.3
Oxygen (O_2)	(dry volume %)	5.39	5.24	5.10	5.24
Carbon Dioxide (CO_2)	(dry volume %)	7.33	7.29	7.25	7.29
Water Vapor (H_2O)	(volume %)	19.41	19.81	19.07	19.43
Stack Temperature	(°F)	461.6	464.6	462.7	463.0
Percent of Isokinetic Sampling	(%)	98.0	100.1	98.5	98.9
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	15	11	13	13
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)	174	127.6	150.8	150.8
COG generated during test	(mmscf)	2.50	2.24	2.13	2.29
COG burned in boilers during test	(mmscf)	0.67	0.59	0.57	0.61
COG burned in batteries during test	(mmscf)	1.45	1.30	1.24	1.33
Results					
Toluene Soluble Organics [1]					
Blank Corrected Mass Collected	(mg)	2.4	6.8	< 6.8	< 5.4
Emission Concentration	(mg/dscm)	1.20	3.26	< 3.13	< 2.53
Emission Rate	(lb/hr)	0.10	0.28	< 0.28	< 0.22

(1) These reported Modified Method 315 (TSO) results do not account for the entirety of the documented blank contamination value. Refer to Sections 6.1 and 6.8 and the Maxxam Analytics, Modified Method 315 (TSO) Contamination Report dated March 24, 2017 provided in Section 9.0 that states, "The toluene filter extractable blank 90% upper confidence interval of 9.29 mg of residue is 36 times the Method 315 acceptable methylene chloride blank value of 0.26 mg of residue. This suggests the use of toluene extraction solvent to be the cause of the high bias residue results."

"The toluene laboratory processed blank of 5.8 mg of residue is more than 11 times the methylene chloride laboratory processed blank of <0.5 mg of residue. This again, would suggest the use of the toluene extraction solvent to be the cause of the high bias residue results. Please refer to Appendix E for the sample calculations."

Table 7. Gaseous Emissions Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/13/16	10/13/16	10/13/16	
Start Time		9:18 AM	10:34 AM	11:44 AM	
End Time		10:18 AM	11:34 AM	12:44 PM	
Sample Duration		60	60	60	
Flow Rate	(ACFM)	56,553	56,548	55,525	56,209
Flow Rate	(SCFM)	31,542	31,539	30,957	31,346
Flow Rate	(DSCFM)	25,550	25,548	25,313	25,470
Sample Volume	(DSCF)	158.1	158.1	154.0	156.7
Oxygen (O_2)	(dry volume %)	5.25	5.21	5.14	5.20
Carbon Dioxide (CO_2)	(dry volume %)	7.28	7.34	7.41	7.34
Water Vapor (H_2O)	(volume %)	19.00	19.00	18.23	18.74
Stack Temperature	(°F)	458.6	458.6	459.5	458.9
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	1	3	4	2.7
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,430	2,430	2,434	2,431
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	11.6	34.8	46.4	30.9
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					
Carbon Monoxide (CO)					
Emission Concentration	(ppm_{dv})	38.5	45.5	60.2	48.1
Emission Rate	(lb/hr)	4.3	5.1	6.6	5.3
Sulfur Dioxide (SO_2)					
Emission Concentration	(ppm_{dv})	127.2	124.8	122.7	124.9
Emission Rate	(lb/hr)	32.4	31.8	31.0	31.7
Hydrogen Sulfide (H_2S)					
Emission Concentration	(ppm_{wv})	< 0.50	< 0.50	< 0.50	< 0.50
Emission Concentration	(ppm_{dv})	< 0.62	< 0.62	< 0.61	< 0.62
Emission Rate	(lb/hr)	< 0.084	< 0.084	< 0.082	< 0.083
Carbon Dioxide (CO2)					
Emission Concentration	(ppm_{dv})	72,844	73,355	74,132	73,444
Emission Rate	(g/hr)	5,784,409	5,824,434	5,832,038	5,813,627
Emission Rate	(lb/hr)	12,752	12,841	12,857	12,817
Emission Rate	(tons/hr)	6.4	6.4	6.4	6.4

CEM results have been bias calibration corrected.

Table 8. Acidic Gas Emissions Test Results, Boiler 1 and 2 Combined Stack
ArcelorMittal Monessen, LLC., Monessen Coke Plant, Monessen, Pennsylvania

Test Data		**Run 1**	**Run 2**	**Run 3**	**Average**
Date		10/12/16	10/12/16	10/12/16	
Start Time		1:15 PM	2:32 PM	3:46 PM	
End Time		2:15 PM	3:32 PM	4:46 PM	
Flow Rate	(ACFM)	55,216	55,201	55,222	55,213
Flow Rate	(SCFM)	31,123	31,132	31,144	31,133
Flow Rate	(DSCFM)	25,444	25,452	25,461	25,452
Sample Volume	(DSCF)	147.1	147.1	147.1	147.1
Oxygen (O_2)	(dry volume %)	5.38	5.24	5.45	5.36
Carbon Dioxide (CO_2)	(dry volume %)	7.43	7.45	7.25	7.38
Water Vapor (H_2O)	(volume %)	18.25	18.25	18.25	18.25
Stack Temperature	(°F)	455.5	455.5	455.5	455.5
Process Data					
ID #'s of Ovens Pushed/Charged			See Appendix A		
Ovens Pushed during test	(#)	4	3	5	4
Average coking time per oven(s) tested	(hours)	16.19	16.19	16.19	16.19
Average temperature of coke walls	(°F)	2,432	2,432	2,432	2,432
Coal processed during testing	(tons/oven)	16.2	16.2	16.2	16.2
Coke produced during test period	(tons)	46.4	34.8	58	46.4
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 Chloride (HCl)					
Emission Concentration	(ppm_{wv})	< 0.268	< 0.268	< 0.268	< 0.268
Emission Concentration	(ppm_{dv})	< 0.328	< 0.328	< 0.328	< 0.328
Emission Concentration	(mg/dscm)	< 0.53	< 0.53	< 0.53	< 0.53
Emission Rate	(lb/hr)	< 0.047	< 0.047	< 0.047	< 0.047
Hydrogen Flouride (HF)					
Emission Concentration	(ppm_{wv})	< 0.053	< 0.053	< 0.053	< 0.053
Emission Concentration	(ppm_{dv})	< 0.065	< 0.065	< 0.065	< 0.065
Emission Concentration	(mg/dscm)	< 0.058	< 0.058	< 0.058	< 0.058
Emission Rate	(lb/hr)	< 0.005	< 0.005	< 0.005	< 0.0051
Hydrogen Cyanide (HCN)					
Emission Concentration	(ppm_{wv})	< 0.41	< 0.41	< 0.41	< 0.41
Emission Concentration	(ppm_{dv})	< 0.50	< 0.50	< 0.50	< 0.50
Emission Concentration	(mg/dscm)	< 0.60	< 0.60	< 0.60	< 0.60
Emission Rate	(lb/hr)	< 0.05	< 0.05	< 0.05	< 0.05

CEM results have been bias calibration corrected.

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

Boilers

Emission Unit ID (same as Enclosure 1)	**032, Emission Point 4**
Type of Process	**Boiler**
Type of Air Control Device	**Low Nox burner**
Latitude of Stack (5 decimal places)	**40.16296**
Longitue of Stack (5 decimal Places	**-79.88794**
Type of Coal Charged During Test	**Metallurgical Bituminous Coal**
Yearly COG Generated (mmscf/year)	**5,904.10**
Yearly COG burned in Batteries (mmscf/yr)	**3,426.90**
Yearly COG burned in Boilers (mmscf/yr)	**1,567.80**
Yearly Natural Gas burned in Batteries (mmscf/yr)	**133.92**

Methods	*5 and 29*	*5 and 29*	*5 and 29*
	201A and 202	*201A and 202*	*201A and 202*

Test Data	Run 1				Run 2				Run 3			
Date			10/11/16				10/11/16				10/12/16	
Start Time			9:20 AM				2:30 PM				7:50 AM	
End Time			1:00 PM				6:05 PM				11:40 AM	
	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	B21	16.19	2435	12	B12	16.19	2435	12	B16	16.19	2435	12
	C21	16.19	2426	12	C12	16.19	2426	12	C16	16.19	2426	12
	B23	16.19	2435	12	B14	16.19	2435	12	B18	16.19	2435	12
	C23	16.19	2426	12	C14	16.19	2426	12	C18	16.19	2426	12
	B25	16.19	2435	12	B16	16.19	2435	12	B20	16.19	2435	12
	C25	16.19	2426	12	C16	16.19	2426	12	C20	16.19	2426	12
	B27	16.19	2435	12	B18	16.19	2435	12	B22	16.19	2435	12
	C27	16.19	2426	12	C18	16.19	2426	12	C22	16.19	2426	12
	B29	16.19	2435	12	B20	16.19	2435	12	B24	16.19	2435	12
	B2	16.19	2435	12	C20	16.19	2426	12	C24	16.19	2426	12
	C2	16.19	2435	12	B22	16.19	2435	12	B26	16.19	2435	12
	B4	16.19	2435	12	C22	16.19	2426	12	C26	16.19	2426	12
					B24	16.19	2435	12	B28	16.19	2435	12
									B1	16.19	2435	12
Total # Pushed	12	16.19	2432	12	13	16.19	2430.5	12	14	16.19	2430.5	12
			Time	Charging Time (min)			Time	Charging Time (min)			Time	Charging Time (min)
Ovens Charged	B21		956	11	B12		1433	11	B16		757	11
	C21		1012	11	C12		1450	11	C16		811	11
	B23		1025	11	B14		1502	11	B18		826	11
	C23		1038	11	C14		1542	11	C18		841	11
	B25		1051	11	B16		1555	11	B20		921	11
	C25		1103	11	C16		1608	11	C20		934	11
	B27		1115	11	B18		1624	11	B22		951	11
	C27		1128	11	C18		1636	11	C22		1002	11
	B29		1139	11	B20		1718	11	B24		1015	11
	B2		1236	11	C20		1732	11	C24		1027	11
	C2		1248	11	B22		1744	11	B26		1040	11
	B4		1259	11	C22		1756	11	C26		1052	11
					B24		1810	11	B28		1104	11
									B1		1223	11

Avg. Coke Produced During test(Ton)	139.2	150.8	162.4
Avg. Coal Processed/Oven During test(To	16.2	16.2	16.2
Higher Heating Value COG	510	510	510
Higher Heating Value of N.G.	1020	1020	1020

Methods 0010 and 23
315
Method 320 (Runs 1-3)

Methods 0010 and 23
315
CEMs (Runs 1 and 2)

Methods 0010 and 23
315
CEMs (Run 3)

Run 1				Run 2				Run 3			
	10/12/16				10/13/16				10/13/16		
	1:15 PM				7:35 AM				11:35 AM		
	4:58 PM				10:54 AM				2:45 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)
C5	16.19	2435	12	C13	16.19	2426	12	B27	16.19	2435	12
B7	16.19	2435	12	B15	16.19	2435	12	C27	16.19	2426	12
C7	16.19	2435	12	C15	16.19	2426	12	B29	16.19	2435	12
B9	16.19	2435	12	B17	16.19	2435	12	B2	16.19	2435	12
C9	16.19	2426	12	C17	16.19	2426	12	C27	16.19	2435	12
B11	16.19	2435	12	B19	16.19	2435	12	B4	16.19	2435	12
C11	16.19	2426	12	C19	16.19	2426	12	C4	16.19	2435	12
B13	16.19	2435	12	B21	16.19	2435	12	B6	16.19	2435	12
C13	16.19	2426	12	C21	16.19	2426	12	C6	16.19	2435	12
B15	16.19	2435	12	B23	16.19	2435	12	B8	16.19	2435	12
C15	16.19	2426	12	C23	16.19	2426	12	C8	16.19	2435	12
B17	16.19	2435	12					B10	16.19	2435	12
C17	16.19	2426	12					C10	16.19	2426	12
B19	16.19	2435	12								
C19	16.19	2426	12								
15	16.19	2432	12	11	16.19	2430.09	12	13	16.19	2434.25	12
		Time	Charging Time (min)			Time	Charging Time (min)			Time	Charging Time (min)
C5		1324	11	C13		743	11	B27			11
B7		1340	11	B15		758	11	C27			11
C7		1357	11	C15		814	11	B29			11
B9		1409	11	B17		833	11	B2			11
C9		1421	11	C17		856	11	C27			11
B11		1439	11	B19		911	11	B4			11
C11		1455	11	C19		928	11	C4			11
B13		1510	11	B21		1021	11	B6			11
C13		1540	11	C21		1034	11	C6			11
B15		1552	11	B23		1114	11	B8			11
C15		1603	11	C23		1058	11	C8			11
B17		1615	11					B10			11
C17		1628	11					C10			11
B19		1641	11								
C19		1656	11								
174				127.6				150.8			
16.2				16.2				16.2			
510				510				510			
1020				1020				1020			

REPORT - APPENDIX B

Montrose Field Data Sheets

Methods 201A/202

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/11	09:20:01	5.47	6.53
2	2016/10/11	09:21:01	4.59	7.59
3	2016/10/11	09:22:01	4.86	7.22
4	2016/10/11	09:23:01	5.68	6.53
5	2016/10/11	09:24:01	5.70	6.52
6	2016/10/11	09:25:01	5.83	6.22
7	2016/10/11	09:26:01	4.31	7.88
8	2016/10/11	09:27:01	5.59	6.47
9	2016/10/11	09:28:01	5.33	6.70
10	2016/10/11	09:29:01	5.04	7.17
11	2016/10/11	09:30:01	4.65	7.55
12	2016/10/11	09:31:01	4.69	7.38
13	2016/10/11	09:32:01	5.83	6.22
14	2016/10/11	09:33:01	5.53	6.55
15	2016/10/11	09:34:01	5.62	6.60
16	2016/10/11	09:35:01	5.86	6.38
17	2016/10/11	09:36:01	5.45	6.68
18	2016/10/11	09:37:01	4.40	7.70
19	2016/10/11	09:38:01	4.75	7.33
20	2016/10/11	09:39:01	5.38	6.79
21	2016/10/11	09:40:01	4.61	7.50
22	2016/10/11	09:41:01	4.85	7.16
23	2016/10/11	09:42:01	5.33	6.68
24	2016/10/11	09:43:01	5.91	6.13
25	2016/10/11	09:44:01	4.80	7.30
26	2016/10/11	09:45:01	4.71	7.40
27	2016/10/11	09:46:01	5.86	6.34
28	2016/10/11	09:47:01	5.79	6.22
29	2016/10/11	09:48:01	4.76	7.43
30	2016/10/11	09:49:01	4.37	7.71
31	2016/10/11	09:50:01	4.35	7.86
32	2016/10/11	09:51:01	5.55	6.54
33	2016/10/11	09:52:01	4.69	7.47
34	2016/10/11	09:53:01	4.53	7.55
35	2016/10/11	09:54:01	5.54	6.59
36	2016/10/11	09:55:01	5.21	6.88
37	2016/10/11	09:56:01	4.31	7.73
38	2016/10/11	09:57:01	4.44	7.71
39	2016/10/11	09:58:01	4.29	7.85
40	2016/10/11	09:59:01	4.80	7.37
41	2016/10/11	10:00:01	4.98	7.05
42	2016/10/11	10:01:01	4.40	7.76
43	2016/10/11	10:02:01	6.08	6.08
44	2016/10/11	10:03:01	4.87	7.37
45	2016/10/11	10:04:01	4.42	7.77
46	2016/10/11	10:05:01	5.61	6.44
47	2016/10/11	10:06:01	5.53	6.72
48	2016/10/11	10:07:01	5.76	6.35
49	2016/10/11	10:08:01	5.40	6.68
50	2016/10/11	10:09:01	4.33	7.83
51	2016/10/11	10:10:01	4.56	7.48
52	2016/10/11	10:11:01	5.77	6.39
53	2016/10/11	10:12:01	4.53	7.55
54	2016/10/11	10:13:01	4.62	7.60
55	2016/10/11	10:14:01	4.39	7.85
56	2016/10/11	10:15:01	5.62	6.41
57	2016/10/11	10:16:01	4.72	7.39
58	2016/10/11	10:17:01	5.17	6.86
59	2016/10/11	10:18:01	6.01	6.00
60	2016/10/11	10:19:01	5.99	6.12
61	2016/10/11	10:20:01	4.95	7.19
62	2016/10/11	10:21:01	4.75	7.45

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/11	10:22:01	6.09	5.96
64	2016/10/11	10:23:01	4.41	7.81
65	2016/10/11	10:24:01	4.45	7.66
66	2016/10/11	10:25:01	5.84	6.17
67	2016/10/11	10:26:01	4.14	8.04
68	2016/10/11	10:27:01	4.50	7.52
69	2016/10/11	10:28:01	5.48	6.58
70	2016/10/11	10:29:01	4.85	7.15
71	2016/10/11	10:30:01	5.71	6.44
72	2016/10/11	10:31:01	4.65	7.36
73	2016/10/11	10:32:01	5.05	7.15
74	2016/10/11	10:33:01	4.99	7.01
75	2016/10/11	10:34:01	6.07	6.00
76	2016/10/11	10:35:01	5.74	6.50
77	2016/10/11	10:36:01	4.77	7.28
78	2016/10/11	10:37:01	4.65	7.42
79	2016/10/11	10:38:01	5.40	6.72
80	2016/10/11	10:39:01	5.69	6.43
81	2016/10/11	10:40:01	5.66	6.45
82	2016/10/11	10:41:01	5.50	6.60
83	2016/10/11	10:42:01	5.12	7.02
84	2016/10/11	10:43:01	4.86	7.21
85	2016/10/11	10:44:01	4.31	7.71
86	2016/10/11	10:45:01	4.75	7.40
87	2016/10/11	10:46:01	5.70	6.47
88	2016/10/11	10:47:01	4.54	7.64
89	2016/10/11	10:48:01	5.14	7.00
90	2016/10/11	10:49:01	4.83	7.18
91	2016/10/11	10:50:01	5.34	6.90
92	2016/10/11	10:51:01	5.90	6.11
93	2016/10/11	10:52:01	4.37	7.75
94	2016/10/11	10:53:01	5.16	7.03
95	2016/10/11	10:54:01	5.03	7.19
96	2016/10/11	10:55:01	5.53	6.55
97	2016/10/11	10:56:01	4.36	7.70
98	2016/10/11	10:57:01	4.39	7.76
99	2016/10/11	10:58:01	5.34	6.86
100	2016/10/11	10:59:01	5.23	6.90
101	2016/10/11	11:00:01	4.30	7.95
102	2016/10/11	11:01:01	4.58	7.43
103	2016/10/11	11:02:01	4.46	7.55
104	2016/10/11	11:20:01	5.09	7.09
105	2016/10/11	11:21:01	4.54	7.53
106	2016/10/11	11:22:01	4.56	7.46
107	2016/10/11	11:23:01	4.99	7.24
108	2016/10/11	11:24:01	4.17	7.96
109	2016/10/11	11:25:01	5.62	6.61
110	2016/10/11	11:26:01	5.38	6.74
111	2016/10/11	11:27:01	5.18	6.90
112	2016/10/11	11:28:01	4.21	8.02
113	2016/10/11	11:29:01	4.92	7.30
114	2016/10/11	11:30:01	5.84	6.24
115	2016/10/11	11:31:01	5.07	7.12
116	2016/10/11	11:32:01	4.46	7.57
117	2016/10/11	11:33:01	5.95	6.19
118	2016/10/11	11:34:01	4.47	7.62
119	2016/10/11	11:35:01	5.95	6.08
120	2016/10/11	11:36:01	4.32	7.82
121	2016/10/11	11:37:01	5.71	6.45
122	2016/10/11	11:38:01	4.40	7.79
123	2016/10/11	11:39:01	4.80	7.43
124	2016/10/11	11:40:01	5.20	7.01
125	2016/10/11	11:41:01	6.12	5.98

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/11	11:42:01	6.04	6.14
127	2016/10/11	11:43:01	5.51	6.66
128	2016/10/11	11:44:01	5.49	6.67
129	2016/10/11	11:45:01	4.58	7.57
130	2016/10/11	11:46:01	5.53	6.49
131	2016/10/11	11:47:01	5.29	6.76
132	2016/10/11	11:48:01	4.29	7.73
133	2016/10/11	11:49:01	5.65	6.45
134	2016/10/11	11:50:01	6.11	5.96
135	2016/10/11	11:51:01	5.36	6.79
136	2016/10/11	11:52:01	4.79	7.22
137	2016/10/11	11:53:01	5.33	6.87
138	2016/10/11	11:54:01	4.55	7.62
139	2016/10/11	11:55:01	4.31	7.76
140	2016/10/11	11:56:01	5.98	6.15
141	2016/10/11	11:57:01	5.93	6.12
142	2016/10/11	11:58:01	4.46	7.76
143	2016/10/11	11:59:01	5.16	6.93
144	2016/10/11	12:00:01	5.53	7.21
145	2016/10/11	12:01:01	5.98	6.99
146	2016/10/11	12:02:01	5.80	7.06
147	2016/10/11	12:03:01	5.00	7.39
148	2016/10/11	12:04:01	4.35	7.69
149	2016/10/11	12:05:01	4.36	7.69
150	2016/10/11	12:06:01	4.76	7.53
151	2016/10/11	12:07:01	5.15	7.35
152	2016/10/11	12:08:01	4.99	7.42
153	2016/10/11	12:09:01	4.85	7.47
154	2016/10/11	12:10:01	4.66	7.57
155	2016/10/11	12:11:01	4.77	7.53
156	2016/10/11	12:12:01	4.47	6.99
157	2016/10/11	12:13:01	4.14	6.77
158	2016/10/11	12:14:01	4.21	6.68
159	2016/10/11	12:15:01	4.24	6.64
160	2016/10/11	12:16:01	4.20	6.77
161	2016/10/11	12:17:01	4.39	6.72
162	2016/10/11	12:18:01	4.31	6.17
163	2016/10/11	12:19:01	4.47	6.91
164	2016/10/11	12:20:01	4.42	6.84
165	2016/10/11	12:21:01	4.60	7.01
166	2016/10/11	12:22:01	4.53	7.03
167	2016/10/11	12:23:01	4.42	7.21
168	2016/10/11	12:24:01	4.65	7.15
169	2016/10/11	12:25:01	4.80	7.15
170	2016/10/11	12:26:01	4.76	7.13
171	2016/10/11	12:27:01	4.82	7.06
172	2016/10/11	12:28:01	4.77	7.16
173	2016/10/11	12:29:01	4.66	7.22
174	2016/10/11	12:30:01	4.66	7.19
175	2016/10/11	12:31:01	4.62	7.17
176	2016/10/11	12:32:01	4.78	7.11
177	2016/10/11	12:33:01	4.67	7.17
178	2016/10/11	12:34:01	4.67	7.17
179	2016/10/11	12:35:01	4.83	7.13
180	2016/10/11	12:36:01	4.65	7.20
181	2016/10/11	12:37:01	4.78	7.16
182	2016/10/11	12:38:01	4.68	7.19
183	2016/10/11	12:39:01	4.82	7.15
184	2016/10/11	12:40:01	4.86	7.13
185	2016/10/11	12:41:01	5.39	6.94
186	2016/10/11	12:42:01	6.72	6.39
187	2016/10/11	12:43:01	6.29	6.59
188	2016/10/11	12:44:01	5.67	6.88

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
189	2016/10/11	12:45:01	5.62	6.90
190	2016/10/11	12:46:01	5.38	7.01
191	2016/10/11	12:47:01	4.44	7.44
192	2016/10/11	12:48:01	4.50	7.44
193	2016/10/11	12:49:01	4.72	7.32
194	2016/10/11	12:50:01	4.99	7.24
195	2016/10/11	12:51:01	4.99	7.23
196	2016/10/11	12:52:01	5.32	7.13
197	2016/10/11	12:53:01	6.93	6.42
198	2016/10/11	12:54:01	6.23	6.74
199	2016/10/11	12:55:01	5.68	6.98
200	2016/10/11	12:56:01	5.79	6.93
201	2016/10/11	12:57:01	5.21	7.18
202	2016/10/11	12:58:01	5.50	7.05
203	2016/10/11	12:59:01	5.06	7.23
204	2016/10/11	13:00:01	4.48	7.47
205	2016/10/11	13:01:01	4.69	7.39
206	2016/10/11	13:02:01	5.03	7.26
207	2016/10/11	13:03:01	5.09	7.24
208	2016/10/11	13:04:01	6.92	6.47
RUN 1 AVERAGES			**5.06**	**7.05**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/11	14:30:01	5.83	7.07
2	2016/10/11	14:31:01	5.42	7.24
3	2016/10/11	14:32:01	4.96	7.44
4	2016/10/11	14:33:01	5.17	7.35
5	2016/10/11	14:34:01	4.97	7.42
6	2016/10/11	14:35:01	5.03	7.40
7	2016/10/11	14:36:01	5.14	7.36
8	2016/10/11	14:37:01	6.25	6.91
9	2016/10/11	14:38:01	6.61	6.75
10	2016/10/11	14:39:01	5.76	7.14
11	2016/10/11	14:40:01	5.58	7.22
12	2016/10/11	14:41:01	5.61	7.19
13	2016/10/11	14:42:01	5.67	7.15
14	2016/10/11	14:43:01	5.16	7.37
15	2016/10/11	14:44:01	4.62	7.59
16	2016/10/11	14:45:01	4.83	7.52
17	2016/10/11	14:46:01	5.17	7.36
18	2016/10/11	14:47:01	5.09	7.39
19	2016/10/11	14:48:01	4.94	7.45
20	2016/10/11	14:49:01	4.85	7.48
21	2016/10/11	14:50:01	4.88	7.47
22	2016/10/11	14:51:01	4.96	7.43
23	2016/10/11	14:52:01	4.97	7.43
24	2016/10/11	14:53:01	5.04	7.40
25	2016/10/11	14:54:01	5.80	7.10
26	2016/10/11	14:55:01	7.59	6.27
27	2016/10/11	14:56:01	6.25	6.91
28	2016/10/11	14:57:01	5.37	7.30
29	2016/10/11	14:58:01	5.90	7.06
30	2016/10/11	14:59:01	5.99	6.99
31	2016/10/11	15:00:01	5.22	7.31
32	2016/10/11	15:01:01	4.74	7.53
33	2016/10/11	15:02:01	4.84	7.49
34	2016/10/11	15:03:01	4.92	7.46
35	2016/10/11	15:04:01	5.19	7.35
36	2016/10/11	15:05:01	5.19	7.36
37	2016/10/11	15:06:01	7.00	6.59
38	2016/10/11	15:07:01	6.66	6.74
39	2016/10/11	15:08:01	5.96	7.05
40	2016/10/11	15:09:01	5.75	7.13
41	2016/10/11	15:10:01	5.73	7.13
42	2016/10/11	15:11:01	5.01	7.44
43	2016/10/11	15:12:01	4.45	7.68
44	2016/10/11	15:13:01	4.77	7.55
45	2016/10/11	15:14:01	5.02	7.43
46	2016/10/11	15:15:01	5.22	7.34
47	2016/10/11	15:16:01	5.08	7.39
48	2016/10/11	15:17:01	4.96	7.43
49	2016/10/11	15:18:01	4.91	7.46
50	2016/10/11	15:19:01	4.80	7.50
51	2016/10/11	15:20:01	4.98	7.43
52	2016/10/11	15:21:01	5.00	7.40
53	2016/10/11	15:22:01	5.05	7.39
54	2016/10/11	15:23:01	5.01	7.40
55	2016/10/11	15:24:01	4.94	7.42
56	2016/10/11	15:25:01	5.12	7.35
57	2016/10/11	15:26:01	5.02	7.38
58	2016/10/11	15:27:01	4.89	7.43
59	2016/10/11	15:28:01	4.96	7.41
60	2016/10/11	15:29:01	4.96	7.40

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
61	2016/10/11	15:30:01	5.02	7.37
62	2016/10/11	15:31:01	4.99	7.38
63	2016/10/11	15:32:01	5.03	7.36
64	2016/10/11	15:33:01	5.04	7.36
65	2016/10/11	15:34:01	4.97	7.38
66	2016/10/11	15:35:01	5.01	7.36
67	2016/10/11	15:36:01	5.13	7.31
68	2016/10/11	15:37:01	4.98	7.36
69	2016/10/11	15:38:01	5.10	7.31
70	2016/10/11	15:39:01	5.01	7.35
71	2016/10/11	15:40:01	4.83	7.42
72	2016/10/11	15:41:01	4.94	7.37
73	2016/10/11	15:42:01	4.99	7.34
74	2016/10/11	15:43:01	4.98	7.35
75	2016/10/11	15:44:01	4.90	7.38
76	2016/10/11	15:45:01	5.00	7.34
77	2016/10/11	15:46:01	5.12	7.29
78	2016/10/11	15:47:01	5.06	7.33
79	2016/10/11	15:48:01	7.55	6.25
80	2016/10/11	15:49:01	6.74	6.61
81	2016/10/11	15:50:01	5.71	7.07
82	2016/10/11	15:51:01	5.72	7.06
83	2016/10/11	15:52:01	5.45	7.15
84	2016/10/11	15:53:01	4.25	7.67
85	2016/10/11	15:54:01	4.08	7.78
86	2016/10/11	15:55:01	4.81	7.47
87	2016/10/11	15:56:01	5.28	7.25
88	2016/10/11	15:57:01	5.27	7.25
89	2016/10/11	15:58:01	5.07	7.34
90	2016/10/11	15:59:01	4.92	7.40
91	2016/10/11	16:00:01	5.68	7.11
92	2016/10/11	16:01:01	6.96	6.55
93	2016/10/11	16:02:01	6.42	6.79
94	2016/10/11	16:03:01	5.98	6.97
95	2016/10/11	16:04:01	5.78	7.04
96	2016/10/11	16:05:01	4.82	7.44
97	2016/10/11	16:06:01	4.24	7.70
98	2016/10/11	16:07:01	4.68	7.51
99	2016/10/11	16:08:01	5.14	7.30
100	2016/10/11	16:09:01	5.20	7.26
101	2016/10/11	16:10:01	5.00	7.35
102	2016/10/11	16:11:01	5.07	7.32
103	2016/10/11	16:12:01	5.01	7.35
104	2016/10/11	16:13:01	6.84	6.58
105	2016/10/11	16:14:01	7.17	6.40
106	2016/10/11	16:15:01	6.54	6.66
107	2016/10/11	16:16:01	5.84	6.98
108	2016/10/11	16:17:01	5.68	7.06
109	2016/10/11	16:18:01	5.81	7.01
110	2016/10/11	16:19:01	5.74	7.03
111	2016/10/11	16:20:01	5.91	6.94
112	2016/10/11	16:21:01	5.01	7.31
113	2016/10/11	16:22:01	4.45	7.57
114	2016/10/11	16:35:01	4.68	7.48
115	2016/10/11	16:36:01	4.52	7.55
116	2016/10/11	16:37:01	4.92	7.36
117	2016/10/11	16:38:01	4.99	7.34
118	2016/10/11	16:39:01	5.00	7.32
119	2016/10/11	16:40:01	4.92	7.36
120	2016/10/11	16:41:01	5.64	7.09
121	2016/10/11	16:42:01	7.03	6.45
122	2016/10/11	16:43:01	6.38	6.73
123	2016/10/11	16:44:01	5.81	6.99

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
124	2016/10/11	16:45:01	5.59	7.10
125	2016/10/11	16:46:01	5.74	7.01
126	2016/10/11	16:47:01	5.84	6.96
127	2016/10/11	16:48:01	5.23	7.21
128	2016/10/11	16:49:01	4.70	7.44
129	2016/10/11	16:50:01	4.81	7.40
130	2016/10/11	16:51:01	5.10	7.28
131	2016/10/11	16:52:01	5.20	7.24
132	2016/10/11	16:53:01	5.03	7.31
133	2016/10/11	16:54:01	4.94	7.34
134	2016/10/11	16:55:01	4.90	7.36
135	2016/10/11	16:56:01	4.82	7.39
136	2016/10/11	16:57:01	4.94	7.34
137	2016/10/11	16:58:01	5.09	7.27
138	2016/10/11	16:59:01	5.09	7.26
139	2016/10/11	17:00:01	4.96	7.32
140	2016/10/11	17:01:01	4.87	7.35
141	2016/10/11	17:02:01	5.01	7.29
142	2016/10/11	17:03:01	5.19	7.21
143	2016/10/11	17:04:01	5.17	7.21
144	2016/10/11	17:05:01	5.05	7.25
145	2016/10/11	17:06:01	5.01	7.27
146	2016/10/11	17:07:01	4.93	7.31
147	2016/10/11	17:08:01	4.91	7.30
148	2016/10/11	17:09:01	4.90	7.31
149	2016/10/11	17:10:01	5.07	7.23
150	2016/10/11	17:11:01	4.92	7.29
151	2016/10/11	17:12:01	4.92	7.28
152	2016/10/11	17:13:01	4.84	7.31
153	2016/10/11	17:14:01	4.99	7.25
154	2016/10/11	17:15:01	4.90	7.29
155	2016/10/11	17:16:01	5.01	7.24
156	2016/10/11	17:17:01	5.09	7.20
157	2016/10/11	17:18:01	4.98	7.25
158	2016/10/11	17:19:01	4.83	7.31
159	2016/10/11	17:20:01	4.85	7.30
160	2016/10/11	17:21:01	5.13	7.18
161	2016/10/11	17:22:01	5.17	7.18
162	2016/10/11	17:23:01	5.10	7.21
163	2016/10/11	17:24:01	5.20	7.18
164	2016/10/11	17:25:01	6.54	6.63
165	2016/10/11	17:26:01	6.90	6.47
166	2016/10/11	17:27:01	6.21	6.78
167	2016/10/11	17:28:01	5.97	6.87
168	2016/10/11	17:29:01	5.57	7.03
169	2016/10/11	17:30:01	4.94	7.29
170	2016/10/11	17:31:01	4.65	7.43
171	2016/10/11	17:32:01	5.00	7.27
172	2016/10/11	17:33:01	5.09	7.23
173	2016/10/11	17:34:01	5.24	7.17
174	2016/10/11	17:35:01	5.15	7.22
175	2016/10/11	17:36:01	5.31	7.17
176	2016/10/11	17:37:01	7.28	6.31
177	2016/10/11	17:38:01	6.66	6.58
178	2016/10/11	17:39:01	5.82	6.96
179	2016/10/11	17:40:01	5.63	7.03
180	2016/10/11	17:41:01	5.61	7.03
181	2016/10/11	17:42:01	5.45	7.07
182	2016/10/11	17:43:01	4.78	7.36
183	2016/10/11	17:44:01	4.76	7.40
184	2016/10/11	17:45:01	5.03	7.29
185	2016/10/11	17:46:01	5.12	7.25
186	2016/10/11	17:47:01	5.19	7.23

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
187	2016/10/11	17:48:01	5.10	7.28
188	2016/10/11	17:49:01	5.48	7.14
189	2016/10/11	17:50:01	6.95	6.50
190	2016/10/11	17:51:01	6.49	6.70
191	2016/10/11	17:52:01	5.78	7.01
192	2016/10/11	17:53:01	5.78	7.00
193	2016/10/11	17:54:01	5.27	7.21
194	2016/10/11	17:55:01	4.75	7.45
195	2016/10/11	17:56:01	4.73	7.46
196	2016/10/11	17:57:01	5.08	7.30
197	2016/10/11	17:58:01	5.14	7.27
198	2016/10/11	17:59:01	5.04	7.31
199	2016/10/11	18:00:01	5.11	7.29
200	2016/10/11	18:01:01	5.00	7.34
201	2016/10/11	18:02:01	7.01	6.50
202	2016/10/11	18:03:01	6.97	6.49
203	2016/10/11	18:04:01	5.95	6.95
204	2016/10/11	18:05:01	5.61	7.09
205	2016/10/11	18:06:01	5.64	7.06
206	2016/10/11	18:07:01	5.02	7.31
207	2016/10/11	18:08:01	4.45	7.57
208	2016/10/11	18:09:01	4.65	7.51
209	2016/10/11	18:10:01	5.04	7.34
210	2016/10/11	18:11:01	5.09	7.32
211	2016/10/11	18:12:01	4.91	7.40
212	2016/10/11	18:13:01	4.76	7.46
213	2016/10/11	18:14:01	5.50	7.17
214	2016/10/11	18:15:01	6.05	6.94
215	2016/10/11	18:16:01	6.68	6.68
216	2016/10/11	18:17:01	6.38	6.82
217	2016/10/11	18:18:01	5.92	7.02
218	2016/10/11	18:19:01	5.86	7.03
219	2016/10/11	18:20:01	5.60	7.13
220	2016/10/11	18:21:01	4.41	7.65
221	2016/10/11	18:22:01	4.15	7.77
222	2016/10/11	18:23:01	4.67	7.54
223	2016/10/11	18:24:01	4.93	7.43
224	2016/10/11	18:25:01	5.06	7.38
225	2016/10/11	18:26:01	4.80	7.49
226	2016/10/11	18:27:01	5.60	7.20
227	2016/10/11	18:28:01	7.62	6.26
RUN 2 AVERAGES			**5.33**	**7.21**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/12	07:50:01	6.5	6.9
2	2016/10/12	07:51:01	6.0	7.1
3	2016/10/12	07:52:01	5.0	7.5
4	2016/10/12	07:53:01	4.6	7.7
5	2016/10/12	07:54:01	5.1	7.4
6	2016/10/12	07:55:01	4.7	7.6
7	2016/10/12	07:56:01	4.9	7.6
8	2016/10/12	07:57:01	5.1	7.4
9	2016/10/12	07:58:01	5.0	7.5
10	2016/10/12	07:59:01	4.9	7.5
11	2016/10/12	08:00:01	4.7	7.6
12	2016/10/12	08:01:01	6.0	7.1
13	2016/10/12	08:02:01	7.8	6.3
14	2016/10/12	08:03:01	6.6	6.8
15	2016/10/12	08:04:01	5.4	7.4
16	2016/10/12	08:05:01	5.3	7.4
17	2016/10/12	08:06:01	5.5	7.4
18	2016/10/12	08:07:01	5.7	7.2
19	2016/10/12	08:08:01	4.4	7.8
20	2016/10/12	08:09:01	4.4	7.8
21	2016/10/12	08:10:01	4.9	7.6
22	2016/10/12	08:11:01	5.1	7.4
23	2016/10/12	08:12:01	5.0	7.5
24	2016/10/12	08:13:01	4.9	7.5
25	2016/10/12	08:14:01	5.0	7.5
26	2016/10/12	08:15:01	4.9	7.5
27	2016/10/12	08:16:01	6.3	7.0
28	2016/10/12	08:17:01	7.1	6.6
29	2016/10/12	08:18:01	6.3	6.9
30	2016/10/12	08:19:01	5.6	7.3
31	2016/10/12	08:20:01	5.8	7.2
32	2016/10/12	08:21:01	5.9	7.1
33	2016/10/12	08:22:01	6.0	7.1
34	2016/10/12	08:23:01	5.3	7.3
35	2016/10/12	08:24:01	4.7	7.6
36	2016/10/12	08:25:01	4.9	7.5
37	2016/10/12	08:26:01	4.9	7.5
38	2016/10/12	08:27:01	4.9	7.5
39	2016/10/12	08:28:01	5.0	7.5
40	2016/10/12	08:29:01	5.1	7.4
41	2016/10/12	08:30:01	5.9	7.1
42	2016/10/12	08:31:01	6.9	6.6
43	2016/10/12	08:32:01	6.0	7.0
44	2016/10/12	08:33:01	5.4	7.3
45	2016/10/12	08:34:01	5.6	7.3
46	2016/10/12	08:35:01	5.7	7.2
47	2016/10/12	08:36:01	5.5	7.3
48	2016/10/12	08:37:01	4.8	7.6
49	2016/10/12	08:38:01	4.5	7.7
50	2016/10/12	08:39:01	4.9	7.5
51	2016/10/12	08:40:01	5.0	7.5
52	2016/10/12	08:41:01	5.0	7.4
53	2016/10/12	08:42:01	4.6	7.6
54	2016/10/12	08:43:01	4.8	7.5
55	2016/10/12	08:44:01	4.9	7.5
56	2016/10/12	08:45:01	5.0	7.4
57	2016/10/12	08:46:01	6.2	6.9
58	2016/10/12	08:47:01	6.6	6.7
59	2016/10/12	08:48:01	6.1	7.0
60	2016/10/12	08:49:01	5.7	7.2
61	2016/10/12	08:50:01	5.6	7.2

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
62	2016/10/12	08:51:01	5.8	7.1
63	2016/10/12	08:52:01	6.0	7.0
64	2016/10/12	08:53:01	5.8	7.1
65	2016/10/12	08:54:01	5.3	7.3
66	2016/10/12	08:55:01	4.7	7.6
67	2016/10/12	08:56:01	4.7	7.6
68	2016/10/12	08:57:01	4.9	7.5
69	2016/10/12	08:58:01	5.0	7.4
70	2016/10/12	08:59:01	5.0	7.4
71	2016/10/12	09:00:01	4.8	7.5
72	2016/10/12	09:01:01	4.8	7.5
73	2016/10/12	09:02:01	4.7	7.6
74	2016/10/12	09:03:01	4.9	7.4
75	2016/10/12	09:04:01	4.9	7.4
76	2016/10/12	09:05:01	4.9	7.4
77	2016/10/12	09:06:01	4.8	7.5
78	2016/10/12	09:07:01	4.7	7.5
79	2016/10/12	09:08:01	4.9	7.4
80	2016/10/12	09:09:01	4.9	7.4
81	2016/10/12	09:10:01	4.9	7.4
82	2016/10/12	09:11:01	5.0	7.4
83	2016/10/12	09:12:01	5.0	7.4
84	2016/10/12	09:13:01	4.9	7.4
85	2016/10/12	09:14:01	4.8	7.4
86	2016/10/12	09:15:01	4.8	7.4
87	2016/10/12	09:16:01	4.9	7.4
88	2016/10/12	09:17:01	5.0	7.4
89	2016/10/12	09:18:01	5.1	7.3
90	2016/10/12	09:19:01	4.9	7.4
91	2016/10/12	09:20:01	4.9	7.4
92	2016/10/12	09:21:01	4.9	7.4
93	2016/10/12	09:22:01	4.9	7.4
94	2016/10/12	09:23:01	5.0	7.4
95	2016/10/12	09:24:01	5.0	7.4
96	2016/10/12	09:25:01	5.9	7.0
97	2016/10/12	09:26:01	7.2	6.4
98	2016/10/12	09:27:01	6.3	6.8
99	2016/10/12	09:28:01	5.6	7.2
100	2016/10/12	09:29:01	5.9	7.1
101	2016/10/12	09:30:01	5.9	7.0
102	2016/10/12	09:31:01	5.0	7.4
103	2016/10/12	09:32:01	4.3	7.7
104	2016/10/12	09:33:01	4.6	7.6
105	2016/10/12	09:34:01	5.2	7.3
106	2016/10/12	09:35:01	5.1	7.4
107	2016/10/12	09:36:01	4.8	7.5
108	2016/10/12	09:37:01	5.1	7.4
109	2016/10/12	09:38:01	5.1	7.4
110	2016/10/12	09:39:01	6.8	6.7
111	2016/10/12	09:40:01	6.9	6.6
112	2016/10/12	09:41:01	5.8	7.1
113	2016/10/12	09:42:01	5.5	7.3
114	2016/10/12	09:43:01	6.0	7.0
115	2016/10/12	09:44:01	5.4	7.2
116	2016/10/12	09:45:01	5.7	7.1
117	2016/10/12	09:46:01	5.4	7.2
118	2016/10/12	09:47:01	4.7	7.5
119	2016/10/12	09:48:01	4.6	7.6
120	2016/10/12	09:49:01	5.0	7.4
121	2016/10/12	09:50:01	5.2	7.4
122	2016/10/12	09:51:01	4.9	7.5
123	2016/10/12	09:52:01	5.0	7.5
124	2016/10/12	09:53:01	5.1	7.4

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
125	2016/10/12	09:54:01	5.2	7.4
126	2016/10/12	09:55:01	PORT CHANGE	PORT CHANGE
127	2016/10/12	09:56:01	PORT CHANGE	PORT CHANGE
128	2016/10/12	09:57:01	PORT CHANGE	PORT CHANGE
129	2016/10/12	09:58:01	PORT CHANGE	PORT CHANGE
130	2016/10/12	09:59:01	PORT CHANGE	PORT CHANGE
131	2016/10/12	10:00:01	PORT CHANGE	PORT CHANGE
132	2016/10/12	10:01:01	PORT CHANGE	PORT CHANGE
133	2016/10/12	10:02:01	PORT CHANGE	PORT CHANGE
134	2016/10/12	10:03:01	PORT CHANGE	PORT CHANGE
135	2016/10/12	10:04:01	PORT CHANGE	PORT CHANGE
136	2016/10/12	10:05:01	PORT CHANGE	PORT CHANGE
137	2016/10/12	10:06:01	PORT CHANGE	PORT CHANGE
138	2016/10/12	10:07:01	5.3	7.4
139	2016/10/12	10:08:01	7.5	6.4
140	2016/10/12	10:09:01	6.5	6.8
141	2016/10/12	10:10:01	5.8	7.1
142	2016/10/12	10:11:01	5.5	7.3
143	2016/10/12	10:12:01	5.4	7.3
144	2016/10/12	10:13:01	4.9	7.5
145	2016/10/12	10:14:01	4.6	7.6
146	2016/10/12	10:15:01	5.0	7.5
147	2016/10/12	10:16:01	5.1	7.4
148	2016/10/12	10:17:01	5.4	7.3
149	2016/10/12	10:18:01	5.1	7.4
150	2016/10/12	10:19:01	5.5	7.3
151	2016/10/12	10:20:01	7.4	6.5
152	2016/10/12	10:21:01	6.6	6.8
153	2016/10/12	10:22:01	5.8	7.2
154	2016/10/12	10:23:01	5.7	7.3
155	2016/10/12	10:24:01	5.6	7.3
156	2016/10/12	10:25:01	4.9	7.6
157	2016/10/12	10:26:01	4.5	7.7
158	2016/10/12	10:27:01	4.7	7.7
159	2016/10/12	10:28:01	5.1	7.5
160	2016/10/12	10:29:01	5.3	7.4
161	2016/10/12	10:30:01	4.9	7.6
162	2016/10/12	10:31:01	5.1	7.6
163	2016/10/12	10:32:01	7.6	6.4
164	2016/10/12	10:33:01	7.2	6.6
165	2016/10/12	10:34:01	6.5	6.9
166	2016/10/12	10:35:01	6.2	7.0
167	2016/10/12	10:36:01	6.1	7.0
168	2016/10/12	10:37:01	4.9	7.6
169	2016/10/12	10:38:01	3.9	8.0
170	2016/10/12	10:39:01	3.5	8.2
171	2016/10/12	10:40:01	4.5	7.8
172	2016/10/12	10:41:01	5.4	7.4
173	2016/10/12	10:42:01	5.6	7.3
174	2016/10/12	10:43:01	5.3	7.4
175	2016/10/12	10:44:01	7.0	6.7
176	2016/10/12	10:45:01	6.7	6.8
177	2016/10/12	10:46:01	5.8	7.2
178	2016/10/12	10:47:01	5.7	7.3
179	2016/10/12	10:48:01	5.9	7.2
180	2016/10/12	10:49:01	5.5	7.4
181	2016/10/12	10:50:01	4.5	7.8
182	2016/10/12	10:51:01	4.6	7.8
183	2016/10/12	10:52:01	5.2	7.5
184	2016/10/12	10:53:01	5.2	7.5
185	2016/10/12	10:54:01	5.2	7.5
186	2016/10/12	10:55:01	5.0	7.6
187	2016/10/12	10:56:01	5.1	7.5

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
188	2016/10/12	10:57:01	5.3	7.5
189	2016/10/12	10:58:01	6.5	7.0
190	2016/10/12	10:59:01	6.7	6.9
191	2016/10/12	11:00:01	5.9	7.2
192	2016/10/12	11:01:01	5.7	7.3
193	2016/10/12	11:02:01	6.0	7.2
194	2016/10/12	11:03:01	5.4	7.4
195	2016/10/12	11:04:01	4.9	7.6
196	2016/10/12	11:05:01	4.8	7.7
197	2016/10/12	11:06:01	4.9	7.6
198	2016/10/12	11:07:01	5.1	7.5
199	2016/10/12	11:08:01	5.3	7.5
200	2016/10/12	11:09:01	6.5	7.0
201	2016/10/12	11:10:01	6.9	6.8
202	2016/10/12	11:11:01	6.0	7.2
203	2016/10/12	11:12:01	5.6	7.4
204	2016/10/12	11:13:01	5.2	7.5
205	2016/10/12	11:14:01	4.6	7.8
206	2016/10/12	11:15:01	5.1	7.6
207	2016/10/12	11:16:01	5.3	7.5
208	2016/10/12	11:17:01	5.6	7.3
209	2016/10/12	11:18:01	5.6	7.3
210	2016/10/12	11:19:01	5.8	7.3
211	2016/10/12	11:20:01	5.5	7.4
212	2016/10/12	11:21:01	5.4	7.4
213	2016/10/12	11:22:01	5.7	7.3
214	2016/10/12	11:23:01	5.7	7.3
215	2016/10/12	11:24:01	5.6	7.3
216	2016/10/12	11:25:01	5.5	7.4
217	2016/10/12	11:26:01	5.8	7.2
218	2016/10/12	11:27:01	5.6	7.3
219	2016/10/12	11:28:01	5.8	7.2
220	2016/10/12	11:29:01	5.6	7.3
221	2016/10/12	11:30:01	5.8	7.2
222	2016/10/12	11:31:01	5.8	7.2
223	2016/10/12	11:32:01	5.7	7.3
224	2016/10/12	11:33:01	5.9	7.2
225	2016/10/12	11:34:01	5.9	7.2
226	2016/10/12	11:35:01	5.9	7.2
227	2016/10/12	11:36:01	5.9	7.2
228	2016/10/12	11:37:01	5.8	7.2
229	2016/10/12	11:38:01	6.0	7.1
230	2016/10/12	11:39:01	6.0	7.1
231	2016/10/12	11:40:01	6.0	7.1
232	2016/10/12	11:41:01	6.0	7.1
233	2016/10/12	11:42:01	5.9	7.2
234	2016/10/12	11:43:01	5.9	7.2
235	2016/10/12	11:44:01	6.0	7.1
236	2016/10/12	11:45:01	6.0	7.1
237	2016/10/12	11:46:01	6.1	7.1
238	2016/10/12	11:47:01	5.9	7.2
239	2016/10/12	11:48:01	5.9	7.2
240	2016/10/12	11:49:01	5.8	7.2
241	2016/10/12	11:50:01	5.7	7.3
242	2016/10/12	11:51:01	5.6	7.3
243	2016/10/12	11:52:01	5.6	7.3
244	2016/10/12	11:53:01	5.7	7.3
245	2016/10/12	11:54:01	5.7	7.2
246	2016/10/12	11:55:01	5.6	7.3
247	2016/10/12	11:56:01	5.6	7.3
248	2016/10/12	11:57:01	5.5	7.3
249	2016/10/12	11:58:01	5.5	7.3
250	2016/10/12	11:59:01	5.5	7.3

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 2
Project No.:	16-146	**Unit Operation:**	Normal
Plant:	Monessen, PA	**Test Location:**	Common Stack

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
251	2016/10/12	12:00:01	5.5	7.3
252	2016/10/12	12:01:01	5.6	7.3
253	2016/10/12	12:02:01	5.6	7.3
254	2016/10/12	12:03:01	5.3	7.4
255	2016/10/12	12:04:01	5.3	7.4
256	2016/10/12	12:05:01	5.3	7.4
RUN 3 AVERAGES			**5.45**	**7.31**

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

Client	ArcelorMittal	**Date**	October 11, 2016
Project No	16-146	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 1
Unit	Boilers 1 and 2	**Start Time**	9:20
Operation	Normal	**End Time**	13:06
Tester(s)	jv, tl, tm, jw		

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	CC210754	XC034406B	41	41
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	42	41
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		0.06	0.11	0.25	0.12	0.30	0.05	20.03	0.115			
	Mid	10.01	10.01	9.96	-0.25	9.98	-0.15	0.10	20.03	9.97	5.06	5.02	d. vol. %
CO2	Zero		0.02	0.07	0.25	0.12	0.51	0.25	19.79	0.095			
	Mid	10.15	10.05	10.00	-0.25	9.83	-1.11	-0.86	19.79	9.915	7.05	7.19	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	0.06	0.30					10.01	10.01	0.00		20.03	20.05	0.10		20.03	d. vol. %
CO2	0.02	0.10					10.15	10.05	-0.51		19.79	19.80	0.05		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	**Date**	October 11, 2016
Project No	16-146	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 2
Unit	Boilers 1 and 2	**Start Time**	14:30
Operation	Normal	**End Time**	18:29
Tester(s)	jv, tl, tm, jw		

Cal. Gas	LOW		MID		HIGH		Span	Conc. Units	Tank ID		
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)			LOW	MID	HIGH
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B
LIMITS				40 % to 60 %		100%					

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values		Final Values		Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
				System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)						
O2	Zero		0.06	0.12	0.30	0.10	0.20	-0.10	20.03	0.11			
	Mid	10.01	10.01	9.98	-0.15	9.95	-0.30	-0.15	20.03	9.965	5.33	5.30	d. vol. %
CO2	Zero		0.02	0.12	0.51	0.11	0.45	-0.05	19.79	0.115			
	Mid	10.15	10.05	9.83	-1.11	9.81	-1.21	-0.10	19.79	9.82	7.21	7.42	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	0.06	0.30					10.01	10.01	0.00		20.03	20.05	0.10		20.03	d. vol. %
CO2	0.02	0.10					10.15	10.05	-0.51		19.79	19.80	0.05		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	**Date**	October 12, 2016
Project No	16-146	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 3
Unit	Boilers 1 and 2	**Start Time**	7:50
Operation	Normal	**End Time**	12:08
Tester(s)	jv, tl, tm, jw		

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	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	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		0.1	0.11	0.10	0.12	0.15	0.05	20.03	0.115			
	Mid	10.01	10.1	10.08	-0.30	10.08	-0.30	0.00	20.03	10.08	5.45	5.36	d. vol. %
CO2	Zero		0.1	0.14	0.20	0.18	0.40	0.20	19.79	0.16			
	Mid	10.15	10.2	10.10	-0.35	10.06	-0.56	-0.20	19.79	10.08	7.31	7.31	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal	Test Date:	October 11, 2016
Project No.:	16-146	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Boilers 1 and 2	Test Start Time:	9:20 AM
Unit Operation:	Normal	Test Finish Time:	1:06 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:	1614	
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	207.67	minutes
Barometric Pressure (Pbar)	29.02	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0	inches
Nozzle Diameter (Dn)	0.253	inches
O2	5.02	% dv
CO2	7.19	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	M201A/M202	
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)	65.7	F
Stack Temperature (Tsavg)	459.2	F
Orifice Pressure Drop (dHavg)	0.360	in. H_2O
GasVelocity Head (dP)^.^avg	0.4447	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	87.79	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	343.4	g
Water Vapor in Silica Gel (Vwsg(std))	16.191	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	16.191	scf
Volume Dry Gas Metered (Vm)	62.421	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	61.021	dscf
Volume Dry Gas Metered (Vm(m^3))	1.768	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	1.728	dscm
Stack Absolute Pressure (Ps)	28.99	in. Hg
Stack Absolute Temperature (Tsavg)	918.8	R
H2O Vapor Pressure @ avg Stack Temp.	942.86	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.2097	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.2097	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.35	lb/lb-mole
Wet Gas Molecular Weight (Ms)	26.97	lb/lb-mole
Gas Velocity (Vs)	34.62	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	50,860	acfm
Standard Gas Flowrate	28,309	scfm
Dry Standard Gas Flowrate	22,373	dscfm
Actual Gas Flowrate	1,440	acm/min
Standard Gas Flowrate	802	scm/min
Dry Standard Gas Flowrate	634	dscm/min
Area Nozzle (An)	0.000349	ft^2
Percent of Isokinetic Sampling (I)	92.16	%

Particulate

PM < 2.5 Acetone Wash Container No.	438U	
PM < 2.5 Acetone Wash Volume (Vaw)	50	ml
PM < 2.5 Acetone Wash Avg. Final (total)	97,475.2	mg
PM < 2.5 Acetone Wash Avg. Tare	97,467.6	mg
PM < 2.5 Acetone Wash Weight Gain	7.55	mg
Residue in PM < 2.5 Acetone Wash (Wa)	0.19	mg
PM < 2.5 Acetone Wash Particulate	7.36	mg
$PM_{2.5}$ Filter No.	4838	
$PM_{2.5}$ Avg. Final (Total) Weight	112.45	mg
$PM_{2.5}$ Avg. Tare Weight	109.90	mg
$PM_{2.5}$ Fraction Particulate	2.55	mg
Organic Container No.	431Z	
Organic Avg. Final (Total) Weight	2330.35	mg
Organic Avg. Tare Weight	2325.10	mg
Organic Fraction Particulate	5.25	mg
Organic Emission Concentration	0.00133	gr/dscf
Inorganic Container No.	431V	
Inorganic Avg. Final (Total) Weight	2307.85	mg
Inorganic Avg. Tare Weight	2278.60	mg
Uncorrected Inorganic Fraction Particulate	29.25	mg
Normality of NH4OH	0.100	N
Volume of Titrant	4.050	mL
Mass of NH4	6.89715	mg
Weight of Inorganic Fraction, NH4 Corrected	22.35	mg
Inorganic Emission Concentration	0.00565	gr/dscf
Total Weight of Condensable Particulate	27.60	mg
Hexane and Water Field Blank Total	1.050	mg
Total Weight of Condensable Particulate - Blank	26.55	mg
Total Condensable Emissions	0.00671	gr/dscf
Total Condensable Emissions	1.29	lb/hr
Total Condensable Emissions	NA	lb/MMBtu

Particulate Acetone Blank

Acetone Wash Container No.	438R	
Acetone Density (ρ_a)	0.7899	g/ml
Acetone Blank Volume (Va)	200.0	ml
Final (Total) Weight 1 after Evaporation	113,926.60	mg
Final (Total) Weight 2 after Evaporation	113,926.80	mg
Final (Total) Weight Difference (Absolute Value)	0.20	mg
Average Final (Total) Weight after Evaporation	113,926.70	mg
Tare Weight 1	113,926.00	mg
Tare Weight 2	113,925.90	mg
Tare Weight Difference (Absolute Value)	-0.10	mg
Average Tare Weight	113,925.95	mg
Averge Final (Total) Weight minus Average Tare Weight	0.75	mg
Mass of Residue of Acetone after Evaporation (m_a)	0.75	mg
Acetone Blank Residue Concentration (Ca) Calculated	0.0047	mg/g
Acetone Blank Correction as a % of Acetone Mass	0.0005	%
Acetone Blank Residue Concentration (Ca) Used	0.0047	mg/g

PM2.5 Emission Rate Calculations

Method 201 A Combined Weight	9.91	mg
Method 201 A Emission Concentration	0.003	gr/dscf
Method 201 A Emission Concentration	5.74	mg/dscm
Method 201 A Emission Rate	0.48	lb/hr
Method 202 Inorganic Weight (uncorrected)	22.35	mg
Method 202 Inorganic Conc. (uncorrected)	12.94	mg/dscm
Method 202 Organic Weight (uncorrected)	5.25	mg
Method 202 Organic Conc. (uncorrected)	3.04	mg/dscm
Total Method 202 Combined Weight (corrected)	26.55	mg
Total Method 202 Emission Conc. (corrected)	0.007	gr/dscf
Total Method 202 Emission Conc. (corrected)	15.4	mg/dscm
Total Method 202 Emission Rate	1.29	lb/hr
Total $PM_{2.5}$ Weight	36.47	mg
Total $PM_{2.5}$ Emission Concentration	0.009	gr/dscf
Total $PM_{2.5}$ Emission Concentration	21.10	mg/dscm
Total $PM_{2.5}$ Emission Rate	1.77	lb/hr

ArcelorMittal **Run 1** **F or C?**
Boilers 1 and 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	0.17	0.412	0.36	458	53	53
2	0.18	0.424	0.36	458	53	53
3	0.19	0.436	0.36	458	57	54
4	0.18	0.424	0.36	459	60	56
5	0.23	0.480	0.36	461	62	58
6	0.25	0.500	0.36	462	66	63
B-1	0.25	0.500	0.36	459	69	66
2	0.21	0.458	0.36	460	73	68
3	0.24	0.490	0.36	460	76	71
4	0.15	0.387	0.36	458	80	74
5	0.16	0.400	0.36	458	81	75
6	0.18	0.424	0.36	459	80	76
Average	0.20	0.445	0.36	459.2		65.7

Initial volume	865.823	ft^3	Initial volume	0.000	liters
Final volume	928.244	ft^3	Final volume	0.000	liters
Total metered	62.421	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	800.1	554.6	245.5			0.0
2	632.0	603.4	28.6			0.0
3	691.2	696.6	-5.4			0.0
4	851.9	777.2	74.7			0.0
5			0.0			0.0
Total	2975.2	2631.8	343.4	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

	B1	0.15625	english
	Dp	2.25	
	C1	-150.3162	
	C2	13.4622	
	C3	3.86153E+06	
	C4	0.591123	
	C5	91.9723	
	C6	1.51761E-05	
EQ 3	μ	248.07	micropoise
EQ 4	C	1.1270	
EQ 5	$D_{50,L}$	9.5430	
EQ 6	D_{50T}	10.2715	
EQ 7	Qs (optimum)	0.711	ft3/min
EQ 8	Nre	1,979.1	
EQ 28	Q_{sST}	0.294	ft3/min
EQ 31	Qs (actual)	0.668	ft3/min
EQ 32	$D50_{PM10}$	10.7361	
EQ 33 (Used when Nre < 3162)	$D50_{PM2.5}$	2.7386	
EQ 34 (Used when Nre ≥ 3162)	$D50_{PM2.5}$	2.2979	
Actual D50 used	$D50_{PM2.5}$	2.7386	
EQ 35	Cr	1.104	
EQ 36	D_{50-1}	2.77	
EQ 37	Z	1.010	

Client:	ArcelorMittal	Test Date:	October 11, 2016
Project No.:	16-146	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Boilers 1 and 2	Test Start Time:	2:30 PM
Unit Operation:	Normal	Test Finish Time:	6:29 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:	1614	
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	226.97	minutes
Barometric Pressure (Pbar)	29.02	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0	inches
Nozzle Diameter (Dn)	0.253	inches
O2	5.30	% dv
CO2	7.42	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	M201A/M202	
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)	80.2	F
Stack Temperature (Tsavg)	459.2	F
Orifice Pressure Drop (dHavg)	0.370	in. H_2O
GasVelocity Head (dP)^-avg	0.4486	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_o	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	87.27	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	363.0	g
Water Vapor in Silica Gel (Vwsg(std))	17.115	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	17.115	scf
Volume Dry Gas Metered (Vm)	75.128	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	71.479	dscf
Volume Dry Gas Metered (Vm(m^3))	2.127	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.024	dscm
Stack Absolute Pressure (Ps)	28.99	in. Hg
Stack Absolute Temperature (Tsavg)	918.8	R
H2O Vapor Pressure @ avg Stack Temp.	942.86	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1932	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1932	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.20	lb/lb-mole
Gas Velocity (Vs)	34.78	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	51,097	acfm
Standard Gas Flowrate	28,442	scfm
Dry Standard Gas Flowrate	22,947	dscfm
Actual Gas Flowrate	1,447	acm/min
Standard Gas Flowrate	805	scm/min
Dry Standard Gas Flowrate	650	dscm/min
Area Nozzle (An)	0.000349	ft^2
Percent of Isokinetic Sampling (I)	96.31	%

Particulate

PM < 2.5 Acetone Wash Container No.	438V	
PM < 2.5 Acetone Wash Volume (Vaw)	40	ml
PM < 2.5 Acetone Wash Avg. Final (total)	103,595.5	mg
PM < 2.5 Acetone Wash Avg. Tare	103,592.4	mg
PM < 2.5 Acetone Wash Weight Gain	3.15	mg
Residue in PM < 2.5 Acetone Wash (Wa)	0.15	mg
PM < 2.5 Acetone Wash Particulate	3.00	mg
$PM_{2.5}$ Filter No.	7225	
$PM_{2.5}$ Avg. Final (Total) Weight	119.35	mg
$PM_{2.5}$ Avg. Tare Weight	115.60	mg
$PM_{2.5}$ Fraction Particulate	3.75	mg
Organic Container No.	443O	
Organic Avg. Final (Total) Weight	2332.65	mg
Organic Avg. Tare Weight	2328.90	mg
Organic Fraction Particulate	3.75	mg
Organic Emission Concentration	0.00081	gr/dscf
Inorganic Container No.	431W	
Inorganic Avg. Final (Total) Weight	2358.10	mg
Inorganic Avg. Tare Weight	2307.05	mg
Uncorrected Inorganic Fraction Particulate	51.05	mg
Normality of NH4OH	0.100	N
Volume of Titrant	5.180	mL
Mass of NH4	8.82154	mg
Weight of Inorganic Fraction, NH4 Corrected	42.23	mg
Inorganic Emission Concentration	0.00912	gr/dscf
Total Weight of Condensable Particulate	45.98	mg
Hexane and Water Field Blank Total	1.050	mg
Total Weight of Condensable Particulate - Blank	44.93	mg
Total Condensable Emissions	0.00970	gr/dscf
Total Condensable Emissions	1.91	lb/hr
Total Condensable Emissions	NA	lb/MMBtu

Particulate Acetone Blank

Acetone Wash Container No.	438R	
Acetone Density (pa)	0.7899	g/ml
Acetone Blank Volume (Va)	200.0	ml
Final (Total) Weight 1 after Evaporation	113,926.60	mg
Final (Total) Weight 2 after Evaporation	113,926.80	mg
Final (Total) Weight Difference (Absolute Value)	0.20	mg
Average Final (Total) Weight after Evaporation	113,926.70	mg
Tare Weight 1	113,926.00	mg
Tare Weight 2	113,925.90	mg
Tare Weight Difference (Absolute Value)	-0.10	mg
Average Tare Weight	113,925.95	mg
Averge Final (Total) Weight minus Average Tare Weight	0.75	mg
Mass of Residue of Acetone after Evaporation (ma)	0.75	mg
Acetone Blank Residue Concentration (Ca) Calculated	0.0047	mg/g
Acetone Blank Correction as a % of Acetone Mass	0.0005	%
Acetone Blank Residue Concentration (Ca) Used	0.0047	mg/g
PM2.5 Emission Rate Calculations		
Method 201 A Combined Weight	6.75	mg
Method 201 A Emission Concentration	0.001	gr/dscf
Method 201 A Emission Concentration	3.33	mg/dscm
Method 201 A Emission Rate	0.29	lb/hr
Method 202 Inorganic Weight (uncorrected)	42.23	mg
Method 202 Inorganic Conc. (uncorrected)	20.86	mg/dscm
Method 202 Organic Weight (uncorrected)	3.75	mg
Method 202 Organic Conc. (uncorrected)	1.85	mg/dscm
Method 202 Combined Weight (corrected)	44.93	mg
Total Method 202 Emission Conc. (corrected)	0.010	gr/dscf
Total Method 202 Emission Conc. (corrected)	22.2	mg/dscm
Total Method 202 Emission Rate	1.91	lb/hr
Total $PM_{2.5}$ Weight	51.68	mg
Total $PM_{2.5}$ Emission Concentration	0.011	gr/dscf
Total $PM_{2.5}$ Emission Concentration	25.53	mg/dscm
Total $PM_{2.5}$ Emission Rate	2.19	lb/hr

ArcelorMittal **Run 2** **F or C?**
Boilers 1 and 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	0.24	0.490	0.37	453	78	78
2	0.21	0.458	0.37	466	81	78
3	0.20	0.447	0.37	461	83	79
4	0.18	0.424	0.37	459	84	80
5	0.19	0.436	0.37	466	85	80
6	0.18	0.424	0.37	459	84	80
B-1	0.21	0.458	0.37	450	82	79
2	0.20	0.447	0.37	455	82	79
3	0.18	0.424	0.37	460	81	78
4	0.19	0.436	0.37	458	81	78
5	0.22	0.469	0.37	463	80	77
6	0.22	0.469	0.37	460	80	77
Average	0.20	0.449	0.37	459.2		80.2

Initial volume	928.500	ft^3	Initial volume	0.000	liters
Final volume	1003.628	ft^3	Final volume	0.000	liters
Total metered	75.128	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	787.3	562.2	225.1			0.0
2	707.9	610.6	97.3			0.0
3	727.2	701.4	25.8			0.0
4	887.6	872.8	14.8			0.0
5			0.0			0.0
Total	3110.0	2747.0	363.0	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

	B1	0.15625	english
	Dp	2.25	
	C1	-150.3162	
	C2	13.4622	
	C3	3.86153E+06	
	C4	0.591123	
	C5	91.9723	
	C6	1.51761E-05	
EQ 3	μ	249.57	micropoise
EQ 4	C	1.1272	
EQ 5	D_{50LL}	9.5596	
EQ 6	D_{50T}	10.2798	
EQ 7	Qs (optimum)	0.712	ft3/min
EQ 8	Nre	2,082.7	
EQ 28	Q_{sST}	0.315	ft3/min
EQ 31	Qs (actual)	0.701	ft3/min
EQ 32	$D50_{PM10}$	10.3979	
EQ 33 (Used when Nre < 3162)	$D50_{PM2.5}$	2.5892	
EQ 34 (Used when Nre ≥ 3162)	$D50_{PM2.5}$	2.2144	
Actual D50 used	$D50_{PM2.5}$	2.5892	
EQ 35	Cr	1.111	
EQ 36	D_{50-1}	2.61	
EQ 37	Z	1.007	

Client:	ArcelorMittal	Test Date:	October 12, 2016
Project No.:	16-146	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Boilers 1 and 2	Test Start Time:	7:50 AM
Unit Operation:	Normal	Test Finish Time:	12:08 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:	1614	
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	238.38	minutes
Barometric Pressure (Pbar)	29.27	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0	inches
Nozzle Diameter (Dn)	0.253	inches
O2	5.36	% dv
CO2	7.31	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	M201A/M202	
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)	67.9	F
Stack Temperature (Tsavg)	443.6	F
Orifice Pressure Drop (dHavg)	0.370	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.4717	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	87.33	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	353.7	g
Water Vapor in Silica Gel (Vwsg(std))	16.677	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	16.677	scf
Volume Dry Gas Metered (Vm)	78.165	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	76.749	dscf
Volume Dry Gas Metered (Vm(m^3))	2.213	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.173	dscm
Stack Absolute Pressure (Ps)	29.24	in. Hg
Stack Absolute Temperature (Tsavg)	903.3	R
H2O Vapor Pressure @ avg Stack Temp.	806.06	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1785	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1785	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.38	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.35	lb/lb-mole
Gas Velocity (Vs)	36.00	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	52,891	acfm
Standard Gas Flowrate	30,206	scfm
Dry Standard Gas Flowrate	24,814	dscfm
Actual Gas Flowrate	1,498	acm/min
Standard Gas Flowrate	855	scm/min
Dry Standard Gas Flowrate	703	dscm/min
Area Nozzle (An)	0.000349	ft^2
Percent of Isokinetic Sampling (I)	91.05	%

Particulate

PM < 2.5 Acetone Wash Container No.	438W	
PM < 2.5 Acetone Wash Volume (Vaw)	48	ml
PM < 2.5 Acetone Wash Avg. Final (total)	108,906.0	mg
PM < 2.5 Acetone Wash Avg. Tare	108,903.0	mg
PM < 2.5 Acetone Wash Weight Gain	3.05	mg
Residue in PM < 2.5 Acetone Wash (Wa)	0.18	mg
PM < 2.5 Acetone Wash Particulate	2.87	mg
$PM_{2.5}$ Filter No.	7226	
$PM_{2.5}$ Avg. Final (Total) Weight	118.80	mg
$PM_{2.5}$ Avg. Tare Weight	115.35	mg
$PM_{2.5}$ Fraction Particulate	3.45	mg
Organic Container No.	443P	
Organic Avg. Final (Total) Weight	2337.55	mg
Organic Avg. Tare Weight	2323.70	mg
Organic Fraction Particulate	13.85	mg
Organic Emission Concentration	0.00278	gr/dscf
Inorganic Container No.	431X	
Inorganic Avg. Final (Total) Weight	2343.15	mg
Inorganic Avg. Tare Weight	2333.50	mg
Uncorrected Inorganic Fraction Particulate	9.65	mg
Normality of NH4OH	0.100	N
Volume of Titrant	2.840	mL
Mass of NH4	4.83652	mg
Weight of Inorganic Fraction, NH4 Corrected	4.81	mg
Inorganic Emission Concentration	0.00097	gr/dscf
Total Weight of Condensable Particulate	18.66	mg
Hexane and Water Field Blank Total	1.050	mg
Total Weight of Condensable Particulate - Blank	17.61	mg
Total Condensable Emissions	0.00354	gr/dscf
Total Condensable Emissions	0.75	lb/hr
Total Condensable Emissions	NA	lb/MMBtu

Particulate Acetone Blank

Acetone Wash Container No.	438R	
Acetone Density (pa)	0.7899	g/ml
Acetone Blank Volume (Va)	200.0	ml
Final (Total) Weight 1 after Evaporation	113,926.60	mg
Final (Total) Weight 2 after Evaporation	113,926.80	mg
Final (Total) Weight Difference (Absolute Value)	0.20	mg
Average Final (Total) Weight after Evaporation	113,926.70	mg
Tare Weight 1	113,926.00	mg
Tare Weight 2	113,925.90	mg
Tare Weight Difference (Absolute Value)	-0.10	mg
Average Tare Weight	113,925.95	mg
Averge Final (Total) Weight minus Average Tare Weight	0.75	mg
Mass of Residue of Acetone after Evaporation (ma)	0.75	mg
Acetone Blank Residue Concentration (Ca) Calculated	0.0047	mg/g
Acetone Blank Correction as a % of Acetone Mass	0.0005	%
Acetone Blank Residue Concentration (Ca) Used	0.0047	mg/g

PM2.5 Emission Rate Calculations

Method 201 A Combined Weight	6.32	mg
Method 201 A Emission Concentration	0.001	gr/dscf
Method 201 A Emission Concentration	2.91	mg/dscm
Method 201 A Emission Rate	0.27	lb/hr
Method 202 Inorganic Weight (uncorrected)	4.81	mg
Method 202 Inorganic Conc. (uncorrected)	2.21	mg/dscm
Method 202 Organic Weight (uncorrected)	13.85	mg
Method 202 Organic Conc. (uncorrected)	6.37	mg/dscm
Method 202 Combined Weight (corrected)	17.61	mg
Total Method 202 Emission Conc. (corrected)	0.004	gr/dscf
Total Method 202 Emission Conc. (corrected)	8.1	mg/dscm
Total Method 202 Emission Rate	0.75	lb/hr
Total $PM_{2.5}$ Weight	23.93	mg
Total $PM_{2.5}$ Emission Concentration	0.005	gr/dscf
Total $PM_{2.5}$ Emission Concentration	11.01	mg/dscm
Total $PM_{2.5}$ Emission Rate	1.02	lb/hr

ArcelorMittal **Run 3** **F or C?**
Boilers 1 and 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	0.25	0.500	0.37	452	58	59
2	0.24	0.490	0.37	456	61	60
3	0.26	0.510	0.37	456	64	61
4	0.23	0.480	0.37	458	64	61
5	0.20	0.447	0.37	455	65	63
6	0.17	0.412	0.37	456	65	63
B-1	0.24	0.490	0.37	446	70	66
2	0.25	0.500	0.37	431	72	67
3	0.23	0.480	0.37	421	75	70
4	0.20	0.447	0.37	408	78	73
5	0.22	0.469	0.37	445	82	75
6	0.19	0.436	0.37	439	81	77
Average	0.22	0.472	0.37	443.6		67.9

Initial volume	4.000	ft^3	Initial volume	0.000	liters
Final volume	82.605	ft^3	Final volume	0.000	liters
Total metered	78.165	dacf	Total metered	0.000	dry actual liters

Leak Check performed between ports

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	796.1	555.6	240.5			0.0
2	680.1	605.6	74.5			0.0
3	719.5	702.1	17.4			0.0
4	803.2	781.9	21.3			0.0
5			0.0			0.0
Total	2998.9	2645.2	353.7	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

	BI	0.15625	english
	Dp	2.25	
	C1	-150.3162	
	C2	13.4622	
	C3	3.86153E+06	
	C4	0.591123	
	C5	91.9723	
	C6	1.51761E-05	
EQ 3	μ	247.41	micropoise
EQ 4	C	1.1236	
EQ 5	D_{50LL}	9.6103	
EQ 6	D_{50T}	10.3051	
EQ 7	Qs (optimum)	0.697	ft3/min
EQ 8	Nre	2,121.4	
EQ 28	Q_{sST}	0.322	ft3/min
EQ 31	Qs (actual)	0.686	ft3/min
EQ 32	$D50_{PM10}$	10.4255	
EQ 33 (Used when Nre < 3162)	$D50_{PM2.5}$	2.5779	
EQ 34 (Used when Nre ≥ 3162)	$D50_{PM2.5}$	2.2198	
Actual D50 used	$D50_{PM2.5}$	2.5779	
EQ 35	Cr	1.108	
EQ 36	D_{50-1}	2.60	
EQ 37	Z	1.007	

MONTROSE METHOD 201A/202 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 201A/202	**Meter ΔH :**	1.991	**Start Time:**	920
Date:	10/11/16	**Run Number:**	1	**Meter Correction (γ):**	1.003	**Stop Time:**	1306
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.253	**Pitot Correction:**	0.84	**T/C ID:**	7-4
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.38	**Control Box ID:**	1614	**Probe ID:**	7-4
		Baro. Pres. (in. Hg):	29.02	**Assumed Moisture (%):**	18	**Pitot ID:**	7-4
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	59	**Umbilical Length (Feet):**	200'	**Filter ID:**	4838
Test Crew:	JV JW TI TM	**Flowrate Setpoint**	0.36			**Stack Diameter (inches):**	67

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Dwell Time (mins)	Metered Volume (ft³) 865.823	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	CPM Temp. (°F) ≤ 85°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	9:36:00	16.18	870.57	0.17	0.36	3	458	250	60	70	53	53	
A-2	9:52:05	16.45	875.19	0.18	0.36	3	458	242	59	71	53	53	
A-3		17.17	879.48	0.19	0.36	3	458	254	57	69	57	54	32.05
A-4		1:05:17	883.82	0.18	0.36	3	459	247	58	71	60	56	49.20
A-5		1:23:07	889.15	0.23	0.36	3	461	249	61	79	62	58	~~1:57:00~~ 1:05:10
A-6		1:42:53	894.98	0.25	0.36	3	462	238	62	73	66	63	1:42:53
B-1		2:01:20	901.21	0.25	0.36	4	459	257	64	74	69	66	
B-2		2:20:07	906.94	0.22	0.36	4	460	250	61	76	73	68	0.21
B-3		2:39:09	912.58	0.24	0.36	4	460	239	59	81	76	71	
B-4		2:55:08	917.70	0.15	0.36	5	458	242	59	70	80	74	
B-5		3:10:54	922.66	0.16	0.36	5	458	239	61	70	81	75	
B-6		3:26:12	928.244	0.18	0.36	5	459	233	63	70	80	76	3:27:40

1603
1120

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.003
Check	Final	15	0.001
		Press. (+)	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

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

Imp	Contents	Final	Initial (JW)	Final Difference (JW)	H_2O Added
1	Empty (g)		554.6	800.1	
2	Empty (g)		603.4	632	
3	H2O (g)		696.6	691.2	
4	Silica (g)		772.2	851.9	

Purge Time	Purge Rate (lpm)	CPM Temp (°F)
15	20	66
30	20	65
45	20	65
60	20	64

MONTROSE METHOD 201A/202 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 201A/202	**Meter ΔH :**	1.991	**Start Time:**	1430
Date:	10/11/16	**Run Number:**	2	**Meter Correction (γ):**	1.003	**Stop Time:**	1829
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.253	**Pitot Correction:**	0.84	**T/C ID:**	7-4
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.38	**Control Box ID:**	1614	**Probe ID:**	7-4
		Baro. Pres. (in. Hg):	29.02	**Assumed Moisture (%):**	21	**Pitot ID:**	7-4
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	64	**Umbilical Length (Feet):**	200'	**Filter ID:**	7225
Test Crew:	JV JW TD TM	**Flowrate Setpoint**	0.37			**Stack Diameter (inches):**	87

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Dwell Time (mins)	Metered Volume (ft³) 928.500	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	CPM Temp. (°F) ≤ 85°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1		20:39	935.16	0.24	0.37	3.0	453	249	64	80	78	78	
A-2		39:58	941.42	0.21	0.37	3.0	466	248	60	82	81	78	
A-3		58:49	947.58	0.20	0.37	3.0	461	251	61	77	83	79	
A-4		1:16:42	952.83	0.18	0.37	3.0	459	248	61	80	84	80	
A-5		1:35:05	959.08	0.19	0.37	3.0	466	249	60	69	85	80	
A-6		1:52:58	965.01	0.18	0.37	3.0	459	250	61	69	84	80	
B-1		2:12:17	971.05	0.21	0.37	3.5	450	247	61	70	82	79	1623 1635
B-2		2:31:08	978.22	0.20	0.37	3.5	455	251	59	71	82	79	
B-3		2:49:01	982.43	0.18	0.37	3.5	460	248	59	69	81	78	
B-4		3:07:24	991.21	0.19	0.37	3.5	458	236	59	70	81	78	
B-5		3:27:11	997.24	0.22	0.37	3.5	463	246	58	69	80	77	
B-6		3:46:58	1003.628	0.22	0.37	3.5	460	245	59	69	80	77	Stop @ 1829

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	8	0.000
		Press. (+)	Static (-)
Pitot Leak	Initial	✓	✓
Check	Final	✓	✓

(≥ 3.0 inches and stable for 15 sec)

Sample #	1	2	3	Average
CO_2 (%)	C	C	M	5
O_2 (%)				

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

Balance ID: BXL017

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

Imp	Contents	Final	Initial	Difference	H_2O Added
1	Empty (mL)	787.3	562.2		0
2	Empty (mL)	707.9	510.6		
3	H2O (mL)	727.2	700.0		
4	Silica (g)	887.6	872.8		

Purge Time	Purge Rate (lpm)	CPM Temp (°F)
15	20	69
30	20	70
45	20	70
60	20	69

MONTROSE METHOD 201A/202 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 201A/202	Meter ΔH :	1.991	Start Time:	750
Date:	10/12/16	Run Number:	3	Meter Correction (γ):	1.003	Stop Time:	1208
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.253	Pitot Correction:	0.84	T/C ID:	7-4
Sampling Location:	Boiler Stack Outlet	Static Press (in. H_2O):	-0.38	Control Box ID:	1614	Probe ID:	7-4
		Baro. Pres. (in. Hg):	29.02	Assumed Moisture (%):	21	Pitot ID:	7-4
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	52	Umbilical Length (Feet):	200'	Filter ID:	7226
Test Crew:	JV JW TL TM	Flowrate Setpoint	0.37			Stack Diameter (inches):	

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Dwell Time (mins)	Metered Volume (ft³) 004.000	Velocity Head (ΔP) (in H_2O)	Orifice (ΔH) (in. H_2O)	Meter Vacuum (in. Hg)	Stack Temp. (°F)	Probe Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	CPM Temp. (°F) ≤ 85°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-1	0:21:05	21:05	010.58	0.25	0.37	2.5	452	238	53	69	58	59	Start 750
A-2	0:41:44	20:39	016.28	0.24	0.37	3.5	456	246	55	68	61	60	
A-3	1:03:14	21:30	023.02	0.26	0.37	6.0	456	241	50	70	64	61	
A-4	1:23:27	20:13	029.43	0.23	0.37	9.0	459	252	51	69	64	61	
A-5	1:42:18	18:51	035.48	0.20	0.37	11.0	455	234	51	71	65	63	
A-6	1:59:41	17:22	40.900	0.17	0.37	11.0	456	238	51	72	65	63	P/C, L/C 15"Hg (0.000 cfm), troubleshoot high vac, replace cpm L/C 0.000 @ 15 in Hg
B-1	2:20:20	20:39	49.21	0.24	0.37	2.5	446	238	53	70	70	66	Reshot 1010 V: 41.34
B-2	2:41:25	21:05	56.12	0.25	0.37	2.5	431	251	54	72	72	67	
B-3	3:01:38	20:13	63.62	~~0.75~~	0.37	2.5	421	250	58	75	75	70	0.23
B-4	3:20:49	18:51	69.38	0.20	0.37	2.5	408	251	62	76	78	73	
B-5	3:40:44	19:47	76.08	0.22	0.37	~~4.5~~	445	248	64	79	82	75	2.5
B-6	3:58:23	18:23	82.605	0.19	0.37	2.5	439	255	63	79	81	77	Stop @ 1208

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	15	0.000
		Press. (+)	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: N4 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	H_2O Added
1	Empty (mL)	796.1	555.6		
2	Empty (mL)	680.1	605.6		
3	H2O (mL)	719.5	702.1		
4	Silica (g)	803.2	781.9		

Purge Time	Purge Rate (lpm)	CPM Temp (°F)
15	20	68
30	20	69
45	20	70
60	20	70

.225
1325

Methods 5/29 w/ 9 and 303

Preliminary Data

Stratification Check

Trailer:	WPC Trailer
Date:	2016/10/12
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	67 inches
Response Time	100 seconds

Point	Probe Marking (inches)	O2 (%)	Difference vs. Mean (% of mean)	Difference from Mean (%)
1	11.2	5.9	-6.30%	-0.3
2	33.5	5.1	7.44%	0.4
3	55.8	5.6	-1.14%	-0.1
	Mean of All Points	5.5	%	

Point	Probe Marking (inches)	CO2 (%)	Difference vs. Mean (% of mean)	Difference from Mean (%)
1	11.2	7.2	1.64%	0.1
2	33.5	7.5	-1.80%	-0.1
3	55.8	7.3	0.16%	0.0
	Mean of All Points	7.3	%	

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 CO2)

			CH99002	CH99003
			O2 sys 1 n	CO2 sys 1 min
			TagComm	TagComment 99003
Mark	Date	Time	%	%
	2016/10/12	13:15:38	5.62	7.30
	2016/10/12	13:16:38	6.06	7.12
	2016/10/12	13:17:38	6.03	7.15
	2016/10/12	13:18:38	5.87	7.22
	2016/10/12	13:19:38	5.73	7.27
	2016/10/12	14:35:38	5.00	7.51
	2016/10/12	14:36:38	5.22	7.42
	2016/10/12	14:37:38	5.20	7.42
	2016/10/12	14:38:38	5.14	7.44
	2016/10/12	14:39:38	4.96	7.52
	2016/10/12	15:15:38	6.16	7.07
	2016/10/12	15:16:38	5.90	7.18
	2016/10/12	15:17:38	5.73	7.25
	2016/10/12	15:18:38	5.24	7.46
	2016/10/12	15:19:38	4.86	7.63
	2016/10/12	15:20:38	4.88	7.62

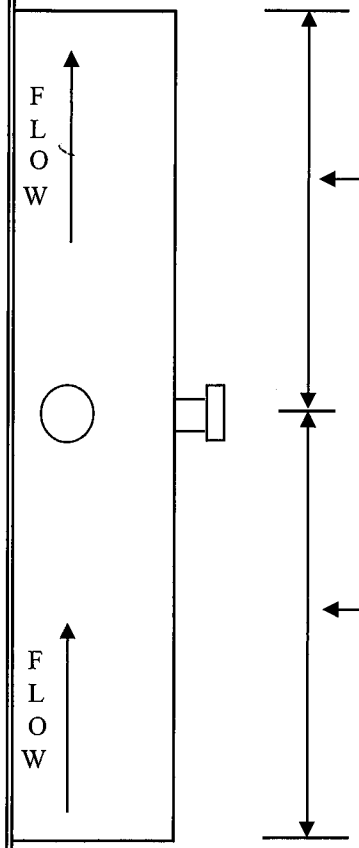
Montrose Environmental PRELIMINARY DATA SHEET

Client:	Arcelormittal	Pitot Corr.:	0.84
Date:	10/10/16	Ambient Temp.:	44 °F
Plant Loc.:	Monessen, PA	Control Box No.:	1614
Stack ID:	Boilers 1 & 2	Umbilical Length:	~150 Feet
Project No.:	16-167	Test Crew:	JW JV

(Please Circle Initials of Meter Box Operator)

Circular Stacks

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



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

2 Number of Sampling Ports Located 90° Apart

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

67" 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	0.16	462	0	-0.37
2	0.18	462	0	
3	0.18	465	0	
4	0.19	464	0	
5	0.16	460	3	
6	0.17	460	3	
7	0.19	460	4	
8	0.20	461	4	
9	0.21	460	2	
10	0.23	458	0	
11	0.23	456	0	
12	0.25	453	0	
B-1	0.26	453	0	
2	0.22	459	0	
3	0.23	461	0	
4	0.25	460	3	
5	0.18	460	3	
6	0.16	460	4	
7	0.17	460	4	
8	0.19	458	3	
9	0.20	455	0	
10	0.17	455	0	
11	0.15	458	0	
12	0.24	459	0	

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/11	09:20:01	5.47	6.53
2	2016/10/11	09:21:01	4.59	7.59
3	2016/10/11	09:22:01	4.86	7.22
4	2016/10/11	09:23:01	5.68	6.53
5	2016/10/11	09:24:01	5.70	6.52
6	2016/10/11	09:25:01	5.83	6.22
7	2016/10/11	09:26:01	4.31	7.88
8	2016/10/11	09:27:01	5.59	6.47
9	2016/10/11	09:28:01	5.33	6.70
10	2016/10/11	09:29:01	5.04	7.17
11	2016/10/11	09:30:01	4.65	7.55
12	2016/10/11	09:31:01	4.69	7.38
13	2016/10/11	09:32:01	5.83	6.22
14	2016/10/11	09:33:01	5.53	6.55
15	2016/10/11	09:34:01	5.62	6.60
16	2016/10/11	09:35:01	5.86	6.38
17	2016/10/11	09:36:01	5.45	6.68
18	2016/10/11	09:37:01	4.40	7.70
19	2016/10/11	09:38:01	4.75	7.33
20	2016/10/11	09:39:01	5.38	6.79
21	2016/10/11	09:40:01	4.61	7.50
22	2016/10/11	09:41:01	4.85	7.16
23	2016/10/11	09:42:01	5.33	6.68
24	2016/10/11	09:43:01	5.91	6.13
25	2016/10/11	09:44:01	4.80	7.30
26	2016/10/11	09:45:01	4.71	7.40
27	2016/10/11	09:46:01	5.86	6.34
28	2016/10/11	09:47:01	5.79	6.22
29	2016/10/11	09:48:01	4.76	7.43
30	2016/10/11	09:49:01	4.37	7.71
31	2016/10/11	09:50:01	4.35	7.86
32	2016/10/11	09:51:01	5.55	6.54
33	2016/10/11	09:52:01	4.69	7.47
34	2016/10/11	09:53:01	4.53	7.55
35	2016/10/11	09:54:01	5.54	6.59
36	2016/10/11	09:55:01	5.21	6.88
37	2016/10/11	09:56:01	4.31	7.73
38	2016/10/11	09:57:01	4.44	7.71
39	2016/10/11	09:58:01	4.29	7.85
40	2016/10/11	09:59:01	4.80	7.37
41	2016/10/11	10:00:01	4.98	7.05
42	2016/10/11	10:01:01	4.40	7.76
43	2016/10/11	10:02:01	6.08	6.08
44	2016/10/11	10:03:01	4.87	7.37
45	2016/10/11	10:04:01	4.42	7.77
46	2016/10/11	10:05:01	5.61	6.44
47	2016/10/11	10:06:01	5.53	6.72
48	2016/10/11	10:07:01	5.76	6.35
49	2016/10/11	10:08:01	5.40	6.68
50	2016/10/11	10:09:01	4.33	7.83
51	2016/10/11	10:10:01	4.56	7.48
52	2016/10/11	10:11:01	5.77	6.39
53	2016/10/11	10:12:01	4.53	7.55
54	2016/10/11	10:13:01	4.62	7.60
55	2016/10/11	10:14:01	4.39	7.85
56	2016/10/11	10:15:01	5.62	6.41
57	2016/10/11	10:16:01	4.72	7.39
58	2016/10/11	10:17:01	5.17	6.86
59	2016/10/11	10:18:01	6.01	6.00
60	2016/10/11	10:19:01	5.99	6.12
61	2016/10/11	10:20:01	4.95	7.19
62	2016/10/11	10:21:01	4.75	7.45
63	2016/10/11	10:22:01	6.09	5.96
64	2016/10/11	10:23:01	4.41	7.81
65	2016/10/11	10:24:01	4.45	7.66
66	2016/10/11	10:25:01	5.84	6.17
67	2016/10/11	10:26:01	4.14	8.04
68	2016/10/11	10:27:01	4.50	7.52
69	2016/10/11	10:28:01	5.48	6.58
70	2016/10/11	10:29:01	4.85	7.15
71	2016/10/11	10:30:01	5.71	6.44
72	2016/10/11	10:31:01	4.65	7.36
73	2016/10/11	10:32:01	5.05	7.15
74	2016/10/11	10:33:01	4.99	7.01
75	2016/10/11	10:34:01	6.07	6.00
76	2016/10/11	10:35:01	5.74	6.50
77	2016/10/11	10:36:01	4.77	7.28
78	2016/10/11	10:37:01	4.65	7.42
79	2016/10/11	10:38:01	5.40	6.72
80	2016/10/11	10:39:01	5.69	6.43
81	2016/10/11	10:40:01	5.66	6.45
82	2016/10/11	10:41:01	5.50	6.60
83	2016/10/11	10:42:01	5.12	7.02
84	2016/10/11	10:43:01	4.86	7.21

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
85	2016/10/11	10:44:01	4.31	7.71
86	2016/10/11	10:45:01	4.75	7.40
87	2016/10/11	10:46:01	5.70	6.47
88	2016/10/11	10:47:01	4.54	7.64
89	2016/10/11	10:48:01	5.14	7.00
90	2016/10/11	10:49:01	4.83	7.18
91	2016/10/11	10:50:01	5.34	6.90
92	2016/10/11	10:51:01	5.90	6.11
93	2016/10/11	10:52:01	4.37	7.75
94	2016/10/11	10:53:01	5.16	7.03
95	2016/10/11	10:54:01	5.03	7.19
96	2016/10/11	10:55:01	5.53	6.55
97	2016/10/11	10:56:01	4.36	7.70
98	2016/10/11	10:57:01	4.39	7.76
99	2016/10/11	10:58:01	5.34	6.86
100	2016/10/11	10:59:01	5.23	6.90
101	2016/10/11	11:00:01	4.30	7.95
102	2016/10/11	11:01:01	4.58	7.43
103	2016/10/11	11:02:01	4.46	7.55
104	2016/10/11	11:20:01	5.09	7.09
105	2016/10/11	11:21:01	4.54	7.53
106	2016/10/11	11:22:01	4.56	7.46
107	2016/10/11	11:23:01	4.99	7.24
108	2016/10/11	11:24:01	4.17	7.96
109	2016/10/11	11:25:01	5.62	6.61
110	2016/10/11	11:26:01	5.38	6.74
111	2016/10/11	11:27:01	5.18	6.90
112	2016/10/11	11:28:01	4.21	8.02
113	2016/10/11	11:29:01	4.92	7.30
114	2016/10/11	11:30:01	5.84	6.24
115	2016/10/11	11:31:01	5.07	7.12
116	2016/10/11	11:32:01	4.46	7.57
117	2016/10/11	11:33:01	5.95	6.19
118	2016/10/11	11:34:01	4.47	7.62
119	2016/10/11	11:35:01	5.95	6.08
120	2016/10/11	11:36:01	4.32	7.82
121	2016/10/11	11:37:01	5.71	6.45
122	2016/10/11	11:38:01	4.40	7.79
123	2016/10/11	11:39:01	4.80	7.43
124	2016/10/11	11:40:01	5.20	7.01
125	2016/10/11	11:41:01	6.12	5.98
126	2016/10/11	11:42:01	6.04	6.14
127	2016/10/11	11:43:01	5.51	6.66
128	2016/10/11	11:44:01	5.49	6.67
129	2016/10/11	11:45:01	4.58	7.57
130	2016/10/11	11:46:01	5.53	6.49
131	2016/10/11	11:47:01	5.29	6.76
132	2016/10/11	11:48:01	4.29	7.73
133	2016/10/11	11:49:01	5.65	6.45
134	2016/10/11	11:50:01	6.11	5.96
135	2016/10/11	11:51:01	5.36	6.79
136	2016/10/11	11:52:01	4.79	7.22
137	2016/10/11	11:53:01	5.33	6.87
138	2016/10/11	11:54:01	4.55	7.62
139	2016/10/11	11:55:01	4.31	7.76
140	2016/10/11	11:56:01	5.98	6.15
141	2016/10/11	11:57:01	5.93	6.12
142	2016/10/11	11:58:01	4.46	7.76
143	2016/10/11	11:59:01	5.16	6.93
144	2016/10/11	12:00:01	5.53	7.21
145	2016/10/11	12:01:01	5.98	6.99
146	2016/10/11	12:02:01	5.80	7.06
147	2016/10/11	12:03:01	5.00	7.39
148	2016/10/11	12:04:01	4.35	7.69
149	2016/10/11	12:05:01	4.36	7.69
150	2016/10/11	12:06:01	4.76	7.53
151	2016/10/11	12:07:01	5.15	7.35
152	2016/10/11	12:08:01	4.99	7.42
153	2016/10/11	12:09:01	4.85	7.47
154	2016/10/11	12:10:01	4.66	7.57
155	2016/10/11	12:11:01	4.77	7.53
156	2016/10/11	12:12:01	4.47	6.99
157	2016/10/11	12:13:01	4.14	6.77
158	2016/10/11	12:14:01	4.21	6.68
159	2016/10/11	12:15:01	4.24	6.64
160	2016/10/11	12:16:01	4.20	6.77
161	2016/10/11	12:17:01	4.39	6.72
162	2016/10/11	12:18:01	4.31	6.17
163	2016/10/11	12:19:01	4.47	6.91
164	2016/10/11	12:20:01	4.42	6.84
165	2016/10/11	12:21:01	4.60	7.01
166	2016/10/11	12:22:01	4.53	7.03
167	2016/10/11	12:23:01	4.42	7.21
168	2016/10/11	12:24:01	4.65	7.15
169	2016/10/11	12:25:01	4.80	7.15

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
170	2016/10/11	12:26:01	4.76	7.13
171	2016/10/11	12:27:01	4.82	7.06
172	2016/10/11	12:28:01	4.77	7.16
173	2016/10/11	12:29:01	4.66	7.22
174	2016/10/11	12:30:01	4.66	7.19
175	2016/10/11	12:31:01	4.62	7.17
176	2016/10/11	12:32:01	4.78	7.11
177	2016/10/11	12:33:01	4.67	7.17
178	2016/10/11	12:34:01	4.67	7.17
179	2016/10/11	12:35:01	4.83	7.13
180	2016/10/11	12:36:01	4.65	7.20
181	2016/10/11	12:37:01	4.78	7.16
182	2016/10/11	12:38:01	4.68	7.19
183	2016/10/11	12:39:01	4.82	7.15
184	2016/10/11	12:40:01	4.86	7.13
185	2016/10/11	12:41:01	5.39	6.94
186	2016/10/11	12:42:01	6.72	6.39
187	2016/10/11	12:43:01	6.29	6.59
188	2016/10/11	12:44:01	5.67	6.88
189	2016/10/11	12:45:01	5.62	6.90
190	2016/10/11	12:46:01	5.38	7.01
191	2016/10/11	12:47:01	4.44	7.44
192	2016/10/11	12:48:01	4.50	7.44
193	2016/10/11	12:49:01	4.72	7.32
194	2016/10/11	12:50:01	4.99	7.24
195	2016/10/11	12:51:01	4.99	7.23
196	2016/10/11	12:52:01	5.32	7.13
197	2016/10/11	12:53:01	6.93	6.42
198	2016/10/11	12:54:01	6.23	6.74
199	2016/10/11	12:55:01	5.68	6.98
200	2016/10/11	12:56:01	5.79	6.93
201	2016/10/11	12:57:01	5.21	7.18
202	2016/10/11	12:58:01	5.50	7.05
203	2016/10/11	12:59:01	5.06	7.23
204	2016/10/11	13:00:01	4.48	7.47
205	2016/10/11	13:01:01	4.69	7.39
206	2016/10/11	13:02:01	5.03	7.26
207	2016/10/11	13:03:01	5.09	7.24
208	2016/10/11	13:04:01	6.92	6.47
RUN 1 AVERAGES			**5.06**	**7.05**

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/11	14:30:01	5.83	7.07
2	2016/10/11	14:31:01	5.42	7.24
3	2016/10/11	14:32:01	4.96	7.44
4	2016/10/11	14:33:01	5.17	7.35
5	2016/10/11	14:34:01	4.97	7.42
6	2016/10/11	14:35:01	5.03	7.40
7	2016/10/11	14:36:01	5.14	7.36
8	2016/10/11	14:37:01	6.25	6.91
9	2016/10/11	14:38:01	6.61	6.75
10	2016/10/11	14:39:01	5.76	7.14
11	2016/10/11	14:40:01	5.58	7.22
12	2016/10/11	14:41:01	5.61	7.19
13	2016/10/11	14:42:01	5.67	7.15
14	2016/10/11	14:43:01	5.16	7.37
15	2016/10/11	14:44:01	4.62	7.59
16	2016/10/11	14:45:01	4.83	7.52
17	2016/10/11	14:46:01	5.17	7.36
18	2016/10/11	14:47:01	5.09	7.39
19	2016/10/11	14:48:01	4.94	7.45
20	2016/10/11	14:49:01	4.85	7.48
21	2016/10/11	14:50:01	4.88	7.47
22	2016/10/11	14:51:01	4.96	7.43
23	2016/10/11	14:52:01	4.97	7.43
24	2016/10/11	14:53:01	5.04	7.40
25	2016/10/11	14:54:01	5.80	7.10
26	2016/10/11	14:55:01	7.59	6.27
27	2016/10/11	14:56:01	6.25	6.91
28	2016/10/11	14:57:01	5.37	7.30
29	2016/10/11	14:58:01	5.90	7.06
30	2016/10/11	14:59:01	5.99	6.99
31	2016/10/11	15:00:01	5.22	7.31
32	2016/10/11	15:01:01	4.74	7.53
33	2016/10/11	15:02:01	4.84	7.49
34	2016/10/11	15:03:01	4.92	7.46
35	2016/10/11	15:04:01	5.19	7.35
36	2016/10/11	15:05:01	5.19	7.36
37	2016/10/11	15:06:01	7.00	6.59
38	2016/10/11	15:07:01	6.66	6.74
39	2016/10/11	15:08:01	5.96	7.05
40	2016/10/11	15:09:01	5.75	7.13
41	2016/10/11	15:10:01	5.73	7.13
42	2016/10/11	15:11:01	5.01	7.44
43	2016/10/11	15:12:01	4.45	7.68
44	2016/10/11	15:13:01	4.77	7.55
45	2016/10/11	15:14:01	5.02	7.43
46	2016/10/11	15:15:01	5.22	7.34
47	2016/10/11	15:16:01	5.08	7.39
48	2016/10/11	15:17:01	4.96	7.43
49	2016/10/11	15:18:01	4.91	7.46
50	2016/10/11	15:19:01	4.80	7.50
51	2016/10/11	15:20:01	4.98	7.43
52	2016/10/11	15:21:01	5.00	7.40
53	2016/10/11	15:22:01	5.05	7.39
54	2016/10/11	15:23:01	5.01	7.40
55	2016/10/11	15:24:01	4.94	7.42
56	2016/10/11	15:25:01	5.12	7.35
57	2016/10/11	15:26:01	5.02	7.38
58	2016/10/11	15:27:01	4.89	7.43
59	2016/10/11	15:28:01	4.96	7.41
60	2016/10/11	15:29:01	4.96	7.40
61	2016/10/11	15:30:01	5.02	7.37
62	2016/10/11	15:31:01	4.99	7.38
63	2016/10/11	15:32:01	5.03	7.36
64	2016/10/11	15:33:01	5.04	7.36
65	2016/10/11	15:34:01	4.97	7.38
66	2016/10/11	15:35:01	5.01	7.36
67	2016/10/11	15:36:01	5.13	7.31
68	2016/10/11	15:37:01	4.98	7.36
69	2016/10/11	15:38:01	5.10	7.31
70	2016/10/11	15:39:01	5.01	7.35
71	2016/10/11	15:40:01	4.83	7.42
72	2016/10/11	15:41:01	4.94	7.37
73	2016/10/11	15:42:01	4.99	7.34
74	2016/10/11	15:43:01	4.98	7.35
75	2016/10/11	15:44:01	4.90	7.38
76	2016/10/11	15:45:01	5.00	7.34
77	2016/10/11	15:46:01	5.12	7.29
78	2016/10/11	15:47:01	5.06	7.33
79	2016/10/11	15:48:01	7.55	6.25
80	2016/10/11	15:49:01	6.74	6.61
81	2016/10/11	15:50:01	5.71	7.07
82	2016/10/11	15:51:01	5.72	7.06
83	2016/10/11	15:52:01	5.45	7.15
84	2016/10/11	15:53:01	4.25	7.67

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
85	2016/10/11	15:54:01	4.08	7.78
86	2016/10/11	15:55:01	4.81	7.47
87	2016/10/11	15:56:01	5.28	7.25
88	2016/10/11	15:57:01	5.27	7.25
89	2016/10/11	15:58:01	5.07	7.34
90	2016/10/11	15:59:01	4.92	7.40
91	2016/10/11	16:00:01	5.68	7.11
92	2016/10/11	16:01:01	6.96	6.55
93	2016/10/11	16:02:01	6.42	6.79
94	2016/10/11	16:03:01	5.98	6.97
95	2016/10/11	16:04:01	5.78	7.04
96	2016/10/11	16:05:01	4.82	7.44
97	2016/10/11	16:06:01	4.24	7.70
98	2016/10/11	16:07:01	4.68	7.51
99	2016/10/11	16:08:01	5.14	7.30
100	2016/10/11	16:09:01	5.20	7.26
101	2016/10/11	16:10:01	5.00	7.35
102	2016/10/11	16:11:01	5.07	7.32
103	2016/10/11	16:12:01	5.01	7.35
104	2016/10/11	16:13:01	6.84	6.58
105	2016/10/11	16:14:01	7.17	6.40
106	2016/10/11	16:15:01	6.54	6.66
107	2016/10/11	16:16:01	5.84	6.98
108	2016/10/11	16:17:01	5.68	7.06
109	2016/10/11	16:18:01	5.81	7.01
110	2016/10/11	16:19:01	5.74	7.03
111	2016/10/11	16:20:01	5.91	6.94
112	2016/10/11	16:21:01	5.01	7.31
113	2016/10/11	16:22:01	4.45	7.57
114	2016/10/11	16:35:01	4.68	7.48
115	2016/10/11	16:36:01	4.52	7.55
116	2016/10/11	16:37:01	4.92	7.36
117	2016/10/11	16:38:01	4.99	7.34
118	2016/10/11	16:39:01	5.00	7.32
119	2016/10/11	16:40:01	4.92	7.36
120	2016/10/11	16:41:01	5.64	7.09
121	2016/10/11	16:42:01	7.03	6.45
122	2016/10/11	16:43:01	6.38	6.73
123	2016/10/11	16:44:01	5.81	6.99
124	2016/10/11	16:45:01	5.59	7.10
125	2016/10/11	16:46:01	5.74	7.01
126	2016/10/11	16:47:01	5.84	6.96
127	2016/10/11	16:48:01	5.23	7.21
128	2016/10/11	16:49:01	4.70	7.44
129	2016/10/11	16:50:01	4.81	7.40
130	2016/10/11	16:51:01	5.10	7.28
131	2016/10/11	16:52:01	5.20	7.24
132	2016/10/11	16:53:01	5.03	7.31
133	2016/10/11	16:54:01	4.94	7.34
134	2016/10/11	16:55:01	4.90	7.36
135	2016/10/11	16:56:01	4.82	7.39
136	2016/10/11	16:57:01	4.94	7.34
137	2016/10/11	16:58:01	5.09	7.27
138	2016/10/11	16:59:01	5.09	7.26
139	2016/10/11	17:00:01	4.96	7.32
140	2016/10/11	17:01:01	4.87	7.35
141	2016/10/11	17:02:01	5.01	7.29
142	2016/10/11	17:03:01	5.19	7.21
143	2016/10/11	17:04:01	5.17	7.21
144	2016/10/11	17:05:01	5.05	7.25
145	2016/10/11	17:06:01	5.01	7.27
146	2016/10/11	17:07:01	4.93	7.31
147	2016/10/11	17:08:01	4.91	7.30
148	2016/10/11	17:09:01	4.90	7.31
149	2016/10/11	17:10:01	5.07	7.23
150	2016/10/11	17:11:01	4.92	7.29
151	2016/10/11	17:12:01	4.92	7.28
152	2016/10/11	17:13:01	4.84	7.31
153	2016/10/11	17:14:01	4.99	7.25
154	2016/10/11	17:15:01	4.90	7.29
155	2016/10/11	17:16:01	5.01	7.24
156	2016/10/11	17:17:01	5.09	7.20
157	2016/10/11	17:18:01	4.98	7.25
158	2016/10/11	17:19:01	4.83	7.31
159	2016/10/11	17:20:01	4.85	7.30
160	2016/10/11	17:21:01	5.13	7.18
161	2016/10/11	17:22:01	5.17	7.18
162	2016/10/11	17:23:01	5.10	7.21
163	2016/10/11	17:24:01	5.20	7.18
164	2016/10/11	17:25:01	6.54	6.63
165	2016/10/11	17:26:01	6.90	6.47
166	2016/10/11	17:27:01	6.21	6.78
167	2016/10/11	17:28:01	5.97	6.87
168	2016/10/11	17:29:01	5.57	7.03
169	2016/10/11	17:30:01	4.94	7.29

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
170	2016/10/11	17:31:01	4.65	7.43
171	2016/10/11	17:32:01	5.00	7.27
172	2016/10/11	17:33:01	5.09	7.23
173	2016/10/11	17:34:01	5.24	7.17
174	2016/10/11	17:35:01	5.15	7.22
175	2016/10/11	17:36:01	5.31	7.17
176	2016/10/11	17:37:01	7.28	6.31
177	2016/10/11	17:38:01	6.66	6.58
178	2016/10/11	17:39:01	5.82	6.96
179	2016/10/11	17:40:01	5.63	7.03
180	2016/10/11	17:41:01	5.61	7.03
181	2016/10/11	17:42:01	5.45	7.07
182	2016/10/11	17:43:01	4.78	7.36
183	2016/10/11	17:44:01	4.76	7.40
184	2016/10/11	17:45:01	5.03	7.29
185	2016/10/11	17:46:01	5.12	7.25
186	2016/10/11	17:47:01	5.19	7.23
187	2016/10/11	17:48:01	5.10	7.28
188	2016/10/11	17:49:01	5.48	7.14
189	2016/10/11	17:50:01	6.95	6.50
190	2016/10/11	17:51:01	6.49	6.70
191	2016/10/11	17:52:01	5.78	7.01
RUN 2 AVERAGES			**5.32**	**7.22**

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/12	07:50:01	6.5	6.9
2	2016/10/12	07:51:01	6.0	7.1
3	2016/10/12	07:52:01	5.0	7.5
4	2016/10/12	07:53:01	4.6	7.7
5	2016/10/12	07:54:01	5.1	7.4
6	2016/10/12	07:55:01	4.7	7.6
7	2016/10/12	07:56:01	4.9	7.6
8	2016/10/12	07:57:01	5.1	7.4
9	2016/10/12	07:58:01	5.0	7.5
10	2016/10/12	07:59:01	4.9	7.5
11	2016/10/12	08:00:01	4.7	7.6
12	2016/10/12	08:01:01	6.0	7.1
13	2016/10/12	08:02:01	7.8	6.3
14	2016/10/12	08:03:01	6.6	6.8
15	2016/10/12	08:04:01	5.4	7.4
16	2016/10/12	08:05:01	5.3	7.4
17	2016/10/12	08:06:01	5.5	7.4
18	2016/10/12	08:07:01	5.7	7.2
19	2016/10/12	08:08:01	4.4	7.8
20	2016/10/12	08:09:01	4.4	7.8
21	2016/10/12	08:10:01	4.9	7.6
22	2016/10/12	08:11:01	5.1	7.4
23	2016/10/12	08:12:01	5.0	7.5
24	2016/10/12	08:13:01	4.9	7.5
25	2016/10/12	08:14:01	5.0	7.5
26	2016/10/12	08:15:01	4.9	7.5
27	2016/10/12	08:16:01	6.3	7.0
28	2016/10/12	08:17:01	7.1	6.6
29	2016/10/12	08:18:01	6.3	6.9
30	2016/10/12	08:19:01	5.6	7.3
31	2016/10/12	08:20:01	5.8	7.2
32	2016/10/12	08:21:01	5.9	7.1
33	2016/10/12	08:22:01	6.0	7.1
34	2016/10/12	08:23:01	5.3	7.3
35	2016/10/12	08:24:01	4.7	7.6
36	2016/10/12	08:25:01	4.9	7.5
37	2016/10/12	08:26:01	4.9	7.5
38	2016/10/12	08:27:01	4.9	7.5
39	2016/10/12	08:28:01	5.0	7.5
40	2016/10/12	08:29:01	5.1	7.4
41	2016/10/12	08:30:01	5.9	7.1
42	2016/10/12	08:31:01	6.9	6.6
43	2016/10/12	08:32:01	6.0	7.0
44	2016/10/12	08:33:01	5.4	7.3
45	2016/10/12	08:34:01	5.6	7.3
46	2016/10/12	08:35:01	5.7	7.2
47	2016/10/12	08:36:01	5.5	7.3
48	2016/10/12	08:37:01	4.8	7.6
49	2016/10/12	08:38:01	4.5	7.7
50	2016/10/12	08:39:01	4.9	7.5
51	2016/10/12	08:40:01	5.0	7.5
52	2016/10/12	08:41:01	5.0	7.4
53	2016/10/12	08:42:01	4.6	7.6
54	2016/10/12	08:43:01	4.8	7.5
55	2016/10/12	08:44:01	4.9	7.5
56	2016/10/12	08:45:01	5.0	7.4
57	2016/10/12	08:46:01	6.2	6.9
58	2016/10/12	08:47:01	6.6	6.7
59	2016/10/12	08:48:01	6.1	7.0
60	2016/10/12	08:49:01	5.7	7.2
61	2016/10/12	08:50:01	5.6	7.2
62	2016/10/12	08:51:01	5.8	7.1
63	2016/10/12	08:52:01	6.0	7.0
64	2016/10/12	08:53:01	5.8	7.1
65	2016/10/12	08:54:01	5.3	7.3
66	2016/10/12	08:55:01	4.7	7.6
67	2016/10/12	08:56:01	4.7	7.6
68	2016/10/12	08:57:01	4.9	7.5
69	2016/10/12	08:58:01	5.0	7.4
70	2016/10/12	08:59:01	5.0	7.4
71	2016/10/12	09:00:01	4.8	7.5
72	2016/10/12	09:01:01	4.8	7.5
73	2016/10/12	09:02:01	4.7	7.6
74	2016/10/12	09:03:01	4.9	7.4
75	2016/10/12	09:04:01	4.9	7.4
76	2016/10/12	09:05:01	4.9	7.4
77	2016/10/12	09:06:01	4.8	7.5
78	2016/10/12	09:07:01	4.7	7.5
79	2016/10/12	09:08:01	4.9	7.4
80	2016/10/12	09:09:01	4.9	7.4
81	2016/10/12	09:10:01	4.9	7.4
82	2016/10/12	09:11:01	5.0	7.4
83	2016/10/12	09:12:01	5.0	7.4
84	2016/10/12	09:13:01	4.9	7.4

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
85	2016/10/12	09:14:01	4.8	7.4
86	2016/10/12	09:15:01	4.8	7.4
87	2016/10/12	09:16:01	4.9	7.4
88	2016/10/12	09:17:01	5.0	7.4
89	2016/10/12	09:18:01	5.1	7.3
90	2016/10/12	09:19:01	4.9	7.4
91	2016/10/12	09:20:01	4.9	7.4
92	2016/10/12	09:21:01	4.9	7.4
93	2016/10/12	09:22:01	4.9	7.4
94	2016/10/12	09:23:01	5.0	7.4
95	2016/10/12	09:24:01	5.0	7.4
96	2016/10/12	09:25:01	5.9	7.0
97	2016/10/12	09:26:01	7.2	6.4
98	2016/10/12	09:27:01	6.3	6.8
99	2016/10/12	09:28:01	5.6	7.2
100	2016/10/12	09:29:01	5.9	7.1
101	2016/10/12	09:30:01	5.9	7.0
102	2016/10/12	09:31:01	5.0	7.4
103	2016/10/12	09:32:01	4.3	7.7
104	2016/10/12	09:33:01	4.6	7.6
105	2016/10/12	09:34:01	5.2	7.3
106	2016/10/12	09:35:01	5.1	7.4
107	2016/10/12	09:36:01	4.8	7.5
108	2016/10/12	09:37:01	5.1	7.4
109	2016/10/12	09:38:01	5.1	7.4
110	2016/10/12	09:39:01	6.8	6.7
111	2016/10/12	09:40:01	6.9	6.6
112	2016/10/12	09:41:01	5.8	7.1
113	2016/10/12	09:42:01	5.5	7.3
114	2016/10/12	09:43:01	6.0	7.0
115	2016/10/12	09:44:01	5.4	7.2
116	2016/10/12	09:45:01	5.7	7.1
117	2016/10/12	09:46:01	5.4	7.2
118	2016/10/12	09:47:01	4.7	7.5
119	2016/10/12	09:48:01	4.6	7.6
120	2016/10/12	09:49:01	5.0	7.4
121	2016/10/12	09:50:01	5.2	7.4
122	2016/10/12	09:51:01	4.9	7.5
123	2016/10/12	09:52:01	5.0	7.5
124	2016/10/12	09:53:01	5.1	7.4
125	2016/10/12	09:54:01	5.2	7.4
126	2016/10/12	09:55:01	PORT CHANGE	PORT CHANGE
127	2016/10/12	09:56:01	PORT CHANGE	PORT CHANGE
128	2016/10/12	09:57:01	PORT CHANGE	PORT CHANGE
129	2016/10/12	09:58:01	PORT CHANGE	PORT CHANGE
130	2016/10/12	09:59:01	PORT CHANGE	PORT CHANGE
131	2016/10/12	10:00:01	PORT CHANGE	PORT CHANGE
132	2016/10/12	10:01:01	PORT CHANGE	PORT CHANGE
133	2016/10/12	10:02:01	PORT CHANGE	PORT CHANGE
134	2016/10/12	10:03:01	PORT CHANGE	PORT CHANGE
135	2016/10/12	10:04:01	PORT CHANGE	PORT CHANGE
136	2016/10/12	10:05:01	PORT CHANGE	PORT CHANGE
137	2016/10/12	10:06:01	PORT CHANGE	PORT CHANGE
138	2016/10/12	10:07:01	5.3	7.4
139	2016/10/12	10:08:01	7.5	6.4
140	2016/10/12	10:09:01	6.5	6.8
141	2016/10/12	10:10:01	5.8	7.1
142	2016/10/12	10:11:01	5.5	7.3
143	2016/10/12	10:12:01	5.4	7.3
144	2016/10/12	10:13:01	4.9	7.5
145	2016/10/12	10:14:01	4.6	7.6
146	2016/10/12	10:15:01	5.0	7.5
147	2016/10/12	10:16:01	5.1	7.4
148	2016/10/12	10:17:01	5.4	7.3
149	2016/10/12	10:18:01	5.1	7.4
150	2016/10/12	10:19:01	5.5	7.3
151	2016/10/12	10:20:01	7.4	6.5
152	2016/10/12	10:21:01	6.6	6.8
153	2016/10/12	10:22:01	5.8	7.2
154	2016/10/12	10:23:01	5.7	7.3
155	2016/10/12	10:24:01	5.6	7.3
156	2016/10/12	10:25:01	4.9	7.6
157	2016/10/12	10:26:01	4.5	7.7
158	2016/10/12	10:27:01	4.7	7.7
159	2016/10/12	10:28:01	5.1	7.5
160	2016/10/12	10:29:01	5.3	7.4
161	2016/10/12	10:30:01	4.9	7.6
162	2016/10/12	10:31:01	5.1	7.6
163	2016/10/12	10:32:01	7.6	6.4
164	2016/10/12	10:33:01	7.2	6.6
165	2016/10/12	10:34:01	6.5	6.9
166	2016/10/12	10:35:01	6.2	7.0
167	2016/10/12	10:36:01	6.1	7.0
168	2016/10/12	10:37:01	4.9	7.6
169	2016/10/12	10:38:01	3.9	8.0

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
170	2016/10/12	10:39:01	3.5	8.2
171	2016/10/12	10:40:01	4.5	7.8
172	2016/10/12	10:41:01	5.4	7.4
173	2016/10/12	10:42:01	5.6	7.3
174	2016/10/12	10:43:01	5.3	7.4
175	2016/10/12	10:44:01	7.0	6.7
176	2016/10/12	10:45:01	6.7	6.8
177	2016/10/12	10:46:01	5.8	7.2
178	2016/10/12	10:47:01	5.7	7.3
179	2016/10/12	10:48:01	5.9	7.2
180	2016/10/12	10:49:01	5.5	7.4
181	2016/10/12	10:50:01	4.5	7.8
182	2016/10/12	10:51:01	4.6	7.8
183	2016/10/12	10:52:01	5.2	7.5
184	2016/10/12	10:53:01	5.2	7.5
185	2016/10/12	10:54:01	5.2	7.5
186	2016/10/12	10:55:01	5.0	7.6
187	2016/10/12	10:56:01	5.1	7.5
188	2016/10/12	10:57:01	5.3	7.5
189	2016/10/12	10:58:01	6.5	7.0
190	2016/10/12	10:59:01	6.7	6.9
191	2016/10/12	11:00:01	5.9	7.2
192	2016/10/12	11:01:01	5.7	7.3
193	2016/10/12	11:02:01	6.0	7.2
194	2016/10/12	11:03:01	5.4	7.4
195	2016/10/12	11:04:01	4.9	7.6
196	2016/10/12	11:05:01	4.8	7.7
197	2016/10/12	11:06:01	4.9	7.6
198	2016/10/12	11:07:01	5.1	7.5
199	2016/10/12	11:08:01	5.3	7.5
200	2016/10/12	11:09:01	6.5	7.0
201	2016/10/12	11:10:01	6.9	6.8
202	2016/10/12	11:11:01	6.0	7.2
203	2016/10/12	11:12:01	5.6	7.4
204	2016/10/12	11:13:01	5.2	7.5
205	2016/10/12	11:14:01	4.6	7.8
206	2016/10/12	11:15:01	5.1	7.6
207	2016/10/12	11:16:01	5.3	7.5
208	2016/10/12	11:17:01	5.6	7.3
209	2016/10/12	11:18:01	5.6	7.3
210	2016/10/12	11:19:01	5.8	7.3
211	2016/10/12	11:20:01	5.5	7.4
212	2016/10/12	11:21:01	5.4	7.4
213	2016/10/12	11:22:01	5.7	7.3
214	2016/10/12	11:23:01	5.7	7.3
215	2016/10/12	11:24:01	5.6	7.3
216	2016/10/12	11:25:01	5.5	7.4
217	2016/10/12	11:26:01	5.8	7.2
218	2016/10/12	11:27:01	5.6	7.3
219	2016/10/12	11:28:01	5.8	7.2
220	2016/10/12	11:29:01	5.6	7.3
221	2016/10/12	11:30:01	5.8	7.2
222	2016/10/12	11:31:01	5.8	7.2
223	2016/10/12	11:32:01	5.7	7.3
224	2016/10/12	11:33:01	5.9	7.2
225	2016/10/12	11:34:01	5.9	7.2
226	2016/10/12	11:35:01	5.9	7.2
227	2016/10/12	11:36:01	5.9	7.2
228	2016/10/12	11:37:01	5.8	7.2
229	2016/10/12	11:38:01	6.0	7.1
230	2016/10/12	11:39:01	6.0	7.1
RUN 3 AVERAGES			**5.42**	**7.32**

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

Client	ArcelorMittal Monessen	**Date**	October 11, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 1
Unit	Boilers 1 and 2	**Start Time**	9:20
Operation	Normal	**End Time**	13:00
Tester(s)	JV, JW, TL, CS		

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	CC210754	XC034406B	40	40
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	40	40
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		0.06	0.12	0.30	0.12	0.30	0.00	20.03	0.12			
	Mid	10.01	10.01	10.08	0.35	9.98	-0.15	-0.50	20.03	10.03	5.06	4.99	d. vol. %
CO2	Zero		0.02	0.18	0.81	0.12	0.51	-0.30	19.79	0.15			
	Mid	10.15	10.05	10.06	0.05	9.83	-1.11	-1.16	19.79	9.945	7.05	7.15	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	0.06	0.30					10.01	10.01	0.00		20.03	20.05	0.10		20.03	d. vol. %
CO2	0.02	0.10					10.15	10.05	-0.51		19.79	19.80	0.05		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 11, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 2
Unit	Boilers 1 and 2	**Start Time**	14:30
Operation	Normal	**End Time**	18:05
Tester(s)	JV, JW, TL, CS		

Cal. Gas	LOW		MID		HIGH		Span	Conc. Units	Tank ID		
	Conc.	(% of Span)	Conc.	(% of Span)	Conc.	(% of Span)			LOW	MID	HIGH
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B
LIMITS				40 % to 60 %		100%					

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values		Final Values		Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
				System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)						
O2	Zero		0.06	0.12	0.30	0.10	0.20	-0.10	20.03	0.11			
	Mid	10.01	10.01	9.98	-0.15	9.95	-0.30	-0.15	20.03	9.965	5.32	5.29	d. vol. %
CO2	Zero		0.02	0.12	0.51	0.11	0.45	-0.05	19.79	0.115			
	Mid	10.15	10.05	9.83	-1.11	9.81	-1.21	-0.10	19.79	9.82	7.22	7.43	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	0.06	0.30					10.01	10.01	0.00		20.03	20.05	0.10		20.03	d. vol. %
CO2	0.02	0.10					10.15	10.05	-0.51		19.79	19.80	0.05		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 12, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 3
Unit	Boilers 1 and 2	**Start Time**	7:50
Operation	Normal	**End Time**	11:40
Tester(s)	JV, JW, TL, CS		

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	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	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		0.09	0.11	0.10	0.12	0.15	0.05	20.03	0.115			
	Mid	10.01	10.14	10.08	-0.30	9.98	-0.80	-0.50	20.03	10.03	5.42	5.36	d. vol. %
CO2	Zero		0.10	0.14	0.20	0.12	0.10	-0.10	19.79	0.13			
	Mid	10.15	10.17	10.10	-0.35	9.83	-1.72	-1.36	19.79	9.965	7.32	7.42	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal Monessen	Test Date:	October 11, 2016
Project No.:	16-167	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Boilers 1 and 2	Test Start Time:	9:20 AM
Unit Operation:	Normal	Test Finish Time:	1:00 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:	1618	
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.02	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.330	inches
O2	4.99	% dv
CO2	7.15	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Metals Testing 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)	71.5	F
Stack Temperature (Tsavg)	458.5	F
Orifice Pressure Drop (dHavg)	1.267	in. H_2O
GasVelocity Head (dP)^^avg	0.4565	in. H_2O^1/2
F_d @ Standard Conditions	NA	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	87.86	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	598.6	g
Water Vapor in Silica Gel (Vwsg(std))	28.224	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	28.224	scf
Volume Dry Gas Metered (Vm)	111.738	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	108.287	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	3.164	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	3.066	dscm
Stack Absolute Pressure (Ps)	28.99	in. Hg
Stack Absolute Temperature (Tsavg)	918.2	R
H2O Vapor Pressure @ avg Stack Temp.	936.79	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.2068	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.2068	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.34	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.00	lb/lb-mole
Gas Velocity (Vs)	35.51	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	52,164	acfm
Standard Gas Flowrate	29,056	scfm
Dry Standard Gas Flowrate	23,048.62	dscfm
Actual Gas Flowrate	1,477	acm/min
Standard Gas Flowrate	823	scm/min
Dry Standard Gas Flowrate	653	dscm/min
Area Nozzle (An)	0.000594	ft^2
Percent of Isokinetic Sampling (I)	107.66	%

Metals

Mercury			
Emission mass (1B Fraction)		0.018	(ug)
Emission mass (2B Fraction)		1.340	(ug)
Emission mass (3A Fraction)		0.0859	(ug)
Emission mass (3B Fraction)		0.032	(ug)
Emission mass (3C Fraction)		13.600	(ug)
Emission concentration (1B Fraction)		5.87E-06	(mg/dscm)
Emission concentration (2B Fraction)		4.37E-04	(mg/dscm)
Emission concentration (3A Fraction)		2.80E-05	(mg/dscm)
Emission concentration (3B Fraction)		1.04E-05	(mg/dscm)
Emission concentration (3C Fraction)		4.44E-03	(mg/dscm)
Emission rate (1B Fraction)		5.07E-07	(lb/hr)
Emission rate (2B Fraction)		3.77E-05	(lb/hr)
Emission rate (3A Fraction)		2.42E-06	(lb/hr)
Emission rate (3B Fraction)		9.01E-07	(lb/hr)
Emission rate (3C Fraction)		3.83E-04	(lb/hr)

Antimony			
Front Half Mass Gained		1.160	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half		3.78E-04	(mg/dscm)
Emission Concentration Back-Half	<	3.26E-04	(mg/dscm)
Emission Rate Front-Half		3.27E-05	(lb/hr)
Emission Rate Back-Half	<	2.82E-05	(lb/hr)

Arsenic			
Front Half Mass Gained		7.190	(ug)
Back Half Mass Gained		1.000	(ug)
Emission Concentration Front-Half		2.34E-03	(mg/dscm)
Emission Concentration Back-Half		3.26E-04	(mg/dscm)
Emission Rate Front-Half		2.02E-04	(lb/hr)
Emission Rate Back-Half		2.82E-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	<	5.63E-06	(lb/hr)
Emission Rate Back-Half	<	7.04E-06	(lb/hr)

Cadmium			
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	<	5.63E-06	(lb/hr)
Emission Rate Back-Half	<	7.04E-06	(lb/hr)

Chromium			
Front Half Mass Gained		14.500	(ug)
Back Half Mass Gained		1.160	(ug)
Emission Concentration Front-Half		4.73E-03	(mg/dscm)
Emission Concentration Back-Half		3.78E-04	(mg/dscm)
Emission Rate Front-Half		4.08E-04	(lb/hr)
Emission Rate Back-Half		3.27E-05	(lb/hr)

Cobalt			
Front Half Mass Gained		0.330	(ug)
Back Half Mass Gained		2.130	(ug)
Emission Concentration Front-Half		1.08E-04	(mg/dscm)
Emission Concentration Back-Half		6.95E-04	(mg/dscm)
Emission Rate Front-Half		9.29E-06	(lb/hr)
Emission Rate Back-Half		6.00E-05	(lb/hr)

Lead			
Front Half Mass Gained		3.310	(ug)
Back Half Mass Gained		0.860	(ug)
Emission Concentration Front-Half		1.08E-03	(mg/dscm)
Emission Concentration Back-Half		2.80E-04	(mg/dscm)
Emission Rate Front-Half		9.32E-05	(lb/hr)
Emission Rate Back-Half		2.42E-05	(lb/hr)

Manganese			
Front Half Mass Gained		7.700	(ug)
Back Half Mass Gained		3.500	(ug)
Emission Concentration Front-Half		2.51E-03	(mg/dscm)
Emission Concentration Back-Half		1.14E-03	(mg/dscm)
Emission Rate Front-Half		2.17E-04	(lb/hr)
Emission Rate Back-Half		9.85E-05	(lb/hr)

Nickel			
Front Half Mass Gained		16.100	(ug)
Back Half Mass Gained		1.800	(ug)
Emission Concentration Front-Half		5.25E-03	(mg/dscm)
Emission Concentration Back-Half		5.87E-04	(mg/dscm)
Emission Rate Front-Half		4.53E-04	(lb/hr)
Emission Rate Back-Half		5.07E-05	(lb/hr)

Selenium			
Front Half Mass Gained	<	2.000	(ug)
Back Half Mass Gained		3.600	(ug)
Emission Concentration Front-Half	<	6.52E-04	(mg/dscm)
Emission Concentration Back-Half		1.17E-03	(mg/dscm)
Emission Rate Front-Half	<	5.63E-05	(lb/hr)
Emission Rate Back-Half		1.01E-04	(lb/hr)

ArcelorMittal Monessen **Run 1** **F or C?**
Boilers 1 and 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	0.22	0.469	1.3	458	54	53
A-1	0.22	0.469	1.3	457	56	53
A-1	0.22	0.469	1.3	456	56	53
A-2	0.23	0.480	1.4	456	58	53
A-2	0.23	0.480	1.4	456	59	53
A-2	0.23	0.480	1.4	455	60	54
A-3	0.24	0.490	1.4	460	61	54
A-3	0.24	0.490	1.4	459	62	54
A-3	0.24	0.490	1.4	459	62	54
A-4	0.24	0.490	1.4	459	63	55
A-4	0.24	0.490	1.4	459	63	55
A-4	0.24	0.490	1.4	460	64	56
A-5	0.19	0.436	1.1	461	65	56
A-5	0.19	0.436	1.1	460	65	57
A-5	0.19	0.436	1.1	462	66	57
A-6	0.20	0.447	1.2	462	66	57
A-6	0.20	0.447	1.2	465	67	58
A-6	0.20	0.447	1.2	462	67	58
A-7	0.16	0.400	1.0	460	68	59
A-7	0.16	0.400	1.0	460	68	59
A-7	0.16	0.400	1.0	460	69	60
A-8	0.20	0.447	1.2	465	69	60
A-8	0.20	0.447	1.2	463	69	61
A-8	0.20	0.447	1.2	462	70	61
A-9	0.17	0.412	1.0	462	70	61
A-9	0.17	0.412	1.0	462	70	62
A-9	0.17	0.412	1.0	465	71	62
A-10	0.21	0.458	1.3	465	71	63
A-10	0.21	0.458	1.3	465	72	63
A-10	0.21	0.458	1.3	465	72	63
A-11	0.16	0.400	1.0	463	72	64
A-11	0.16	0.400	1.0	464	73	64
A-11	0.16	0.400	1.0	470	73	65
A-12	0.21	0.458	1.3	466	74	65
A-12	0.21	0.458	1.3	465	74	65
A-12	0.21	0.458	1.3	464	74	66
B-1	0.22	0.469	1.3	444	73	70
B-1	0.22	0.469	1.3	462	73	70
B-1	0.22	0.469	1.3	455	74	70
B-2	0.20	0.447	1.3	445	75	71
B-2	0.20	0.447	1.3	436	78	71
B-2	0.20	0.447	1.3	459	78	71
B-3	0.21	0.458	1.3	447	79	72
B-3	0.21	0.458	1.3	455	80	72
B-3	0.21	0.458	1.3	446	81	73
B-4	0.24	0.490	1.4	448	81	73
B-4	0.24	0.490	1.4	444	82	74
B-4	0.24	0.490	1.4	434	84	75
B-5	0.19	0.436	1.1	445	84	75
B-5	0.19	0.436	1.1	444	85	75
B-5	0.19	0.436	1.1	444	85	76
B-6	0.21	0.458	1.3	459	85	76
B-6	0.21	0.458	1.3	460	86	76
B-6	0.21	0.458	1.3	459	86	77
B-7	0.20	0.447	1.3	463	87	78
B-7	0.20	0.447	1.3	462	87	78
B-7	0.20	0.447	1.3	462	88	79
B-8	0.18	0.424	1.1	461	88	79
B-8	0.18	0.424	1.1	461	88	79
B-8	0.18	0.424	1.1	461	88	80
B-9	0.21	0.458	1.3	460	88	80
B-9	0.21	0.458	1.3	460	88	81
B-9	0.21	0.458	1.3	460	88	81
B-10	0.23	0.480	1.4	462	88	81
B-10	0.23	0.480	1.4	463	88	81
B-10	0.23	0.480	1.4	463	88	81
B-11	0.26	0.510	1.6	462	88	81
B-11	0.26	0.510	1.6	459	88	81
B-11	0.26	0.510	1.6	462	88	81
B-12	0.24	0.490	1.4	465	88	81
B-12	0.24	0.490	1.4	465	88	81
B-12	0.24	0.490	1.4	464	88	81
Average	0.21	0.456	1.27	458.5		71.5

Initial volume	622.807	ft^3	Initial volume	0.000	liters
Final volume	734.545	ft^3	Final volume	0.000	liters
Total metered	111.738	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1000.9	713.5	287.4			0.0
2	915.7	656.6	259.1			0.0
3	638.4	616.4	22.0			0.0
4	762.5	752.2	10.3			0.0
5	712.2	712.5	-0.3			0.0
6	791.7	771.6	20.1			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4821.4	4222.8	598.6	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 11, 2016
Project No.:	16-167	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Boilers 1 and 2	Test Start Time:	9:20 AM
Unit Operation:	Normal	Test Finish Time:	1:00 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:	1618	
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.02	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67	inches
Stack Width (enter 0 if circular stack)	0	inches
Nozzle Diameter (Dn)	0.33	inches
O2	4.99	% dv
CO2	7.15	% 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)	71.5	F
Stack Temperature (Tsavg)	458.5	F
Orifice Pressure Drop (dHavg)	1.267	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.4565	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	87.86	% dv
Water Collected (V_f- V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f- W_i)	598.6	g
Water Vapor in Silica Gel (Vwsg(std))	28.224	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	28.224	scf
Volume Dry Gas Metered (Vm)	111.738	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	108.287	dscf
Volume Dry Gas Metered (Vm(m^3))	3.164	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.066	dscm
Stack Absolute Pressure (Ps)	28.99	in. Hg
Stack Absolute Temperature (Tsavg)	918.2	R
H2O Vapor Pressure @ avg Stack Temp.	936.79	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.2068	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.2068	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.34	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.00	lb/lb-mole
Gas Velocity (Vs)	35.51	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	52,164	acfm
Standard Gas Flowrate	29,056	scfm
Dry Standard Gas Flowrate	23,049	dscfm
Actual Gas Flowrate	1,477	acm/min
Standard Gas Flowrate	823	scm/min
Dry Standard Gas Flowrate	653	dscm/min
Area Nozzle (An)	0.000594	ft^2
Percent of Isokinetic Sampling (I)	107.66	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	94	ml
Acetone Wash Weight Gain	17.7	mg
Front Half Filter Particulate	12.2	mg
Total Particulate Mass (m_n)	29.90	mg
Particulate Concentration	0.0043	gr/dscf
Particulate Concentration	9.7510	mg/dscm
Particulate Emission Rate	0.84	lb/hr

ArcelorMittal Monessen Run 1
Boilers 1 and 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 (F or C)	Meter Temp Out (F or C)
A-1	0.22	0.469	1.3	458	54	53
A-1	0.22	0.469	1.3	457	56	53
A-1	0.22	0.469	1.3	456	56	53
A-2	0.23	0.480	1.4	456	58	53
A-2	0.23	0.480	1.4	456	59	53
A-2	0.23	0.480	1.4	455	60	54
A-3	0.24	0.490	1.4	460	61	54
A-3	0.24	0.490	1.4	459	62	54
A-3	0.24	0.490	1.4	459	62	54
A-4	0.24	0.490	1.4	459	63	55
A-4	0.24	0.490	1.4	459	63	55
A-4	0.24	0.490	1.4	460	64	56
A-5	0.19	0.436	1.1	461	65	56
A-5	0.19	0.436	1.1	460	65	57
A-5	0.19	0.436	1.1	462	66	57
A-6	0.20	0.447	1.2	462	66	57
A-6	0.20	0.447	1.2	465	67	58
A-6	0.20	0.447	1.2	462	67	58
A-7	0.16	0.400	1.0	460	68	59
A-7	0.16	0.400	1.0	460	68	59
A-7	0.16	0.400	1.0	460	69	60
A-8	0.20	0.447	1.2	465	69	60
A-8	0.20	0.447	1.2	463	69	61
A-8	0.20	0.447	1.2	462	70	61
A-9	0.17	0.412	1.0	462	70	61
A-9	0.17	0.412	1.0	462	70	62
A-9	0.17	0.412	1.0	465	71	62
A-10	0.21	0.458	1.3	465	71	63
A-10	0.21	0.458	1.3	465	72	63
A-10	0.21	0.458	1.3	465	72	63
A-11	0.16	0.400	1.0	463	72	64
A-11	0.16	0.400	1.0	464	73	64
A-11	0.16	0.400	1.0	470	73	65
A-12	0.21	0.458	1.3	466	74	65
A-12	0.21	0.458	1.3	465	74	65
A-12	0.21	0.458	1.3	464	74	66
B-1	0.22	0.469	1.3	444	73	70
B-1	0.22	0.469	1.3	462	73	70
B-1	0.22	0.469	1.3	455	74	70
B-2	0.20	0.447	1.3	445	75	71
B-2	0.20	0.447	1.3	436	78	71
B-2	0.20	0.447	1.3	459	78	71
B-3	0.21	0.458	1.3	447	79	72
B-3	0.21	0.458	1.3	455	80	72
B-3	0.21	0.458	1.3	446	81	73
B-4	0.24	0.490	1.4	448	81	73
B-4	0.24	0.490	1.4	444	82	74
B-4	0.24	0.490	1.4	434	84	75
B-5	0.19	0.436	1.1	445	84	75
B-5	0.19	0.436	1.1	444	85	75
B-5	0.19	0.436	1.1	444	85	76
B-6	0.21	0.458	1.3	459	85	76
B-6	0.21	0.458	1.3	460	86	76
B-6	0.21	0.458	1.3	459	86	77
B-7	0.20	0.447	1.3	463	87	78
B-7	0.20	0.447	1.3	462	87	78
B-7	0.20	0.447	1.3	462	88	79
B-8	0.18	0.424	1.1	461	88	79
B-8	0.18	0.424	1.1	461	88	79
B-8	0.18	0.424	1.1	461	88	80
B-9	0.21	0.458	1.3	460	88	80
B-9	0.21	0.458	1.3	460	88	81
B-9	0.21	0.458	1.3	460	88	81
B-10	0.23	0.480	1.4	462	88	81
B-10	0.23	0.480	1.4	463	88	81
B-10	0.23	0.480	1.4	463	88	81
B-11	0.26	0.510	1.6	462	88	81
B-11	0.26	0.510	1.6	459	88	81
B-11	0.26	0.510	1.6	462	88	81
B-12	0.24	0.490	1.4	465	88	81
B-12	0.24	0.490	1.4	465	88	81
B-12	0.24	0.490	1.4	464	88	81
Average	0.21	0.456	1.27	458.5		71.5

Initial volume	622.807	ft^3	Initial volume	0.000	liters
Final volume	734.545	ft^3	Final volume	0.000	liters
Total metered	111.738	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1000.9	713.5	287.4	0.0	0.0	0.0
2	915.7	656.6	259.1	0.0	0.0	0.0
3	638.4	616.4	22.0	0.0	0.0	0.0
4	762.5	752.2	10.3	0.0	0.0	0.0
5	712.2	712.5	-0.3	0.0	0.0	0.0
6	791.7	771.6	20.1	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	4821.4	4222.8	598.6	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 11, 2016
Project No.:	16-167	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Boilers 1 and 2	Test Start Time:	2:30 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:	1618	
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.02	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.330	inches
O2	5.29	% dv
CO2	7.43	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Metals Testing 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)	85.8	F
Stack Temperature (Tsavg)	461.9	F
Orifice Pressure Drop (dHavg)	1.213	in. H_2O
GasVelocity Head (dP)''avg	0.4448	in. H_2O^1/2
F_d @ Standard Conditions	NA	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	87.28	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	549.5	g
Water Vapor in Silica Gel (Vwsg(std))	25.909	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	25.909	scf
Volume Dry Gas Metered (Vm)	111.319	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	105.052	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	3.152	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	2.975	dscm
Stack Absolute Pressure (Ps)	28.99	in. Hg
Stack Absolute Temperature (Tsavg)	921.5	R
H2O Vapor Pressure @ avg Stack Temp.	968.35	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1978	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1978	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.14	lb/lb-mole
Gas Velocity (Vs)	34.57	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	50.791	acfm
Standard Gas Flowrate	28,188	scfm
Dry Standard Gas Flowrate	22,612	dscfm
Actual Gas Flowrate	1,438	acm/min
Standard Gas Flowrate	798	scm/min
Dry Standard Gas Flowrate	640	dscm/min
Area Nozzle (An)	0.000594	ft^2
Percent of Isokinetic Sampling (I)	106.46	%

Metals

Mercury				
Emission mass (1B Fraction)	<	0.015	(ug)	
Emission mass (2B Fraction)		2.140	(ug)	
Emission mass (3A Fraction)	<	0.0054	(ug)	
Emission mass (3B Fraction)		0.167	(ug)	
Emission mass (3C Fraction)		14.300	(ug)	
Emission concentration (1B Fraction)	<	5.04E-06	(mg/DSCM)	
Emission concentration (2B Fraction)		7.19E-04	(mg/DSCM)	
Emission concentration (3A Fraction)	<	1.82E-06	(mg/DSCM)	
Emission concentration (3B Fraction)		5.61E-05	(mg/DSCM)	<
Emission concentration (3C Fraction)		4.81E-03	(mg/DSCM)	
Emission rate (1B Fraction)	<	4.27E-07	(lb/hr)	<
Emission rate (2B Fraction)		6.09E-05	(lb/hr)	<
Emission rate (3A Fraction)	<	1.54E-07	(lb/hr)	<
Emission rate (3B Fraction)		4.75E-06	(lb/hr)	
Emission rate (3C Fraction)		4.07E-04	(lb/hr)	
Antimony				
Front Half Mass Gained	<	0.800	(ug)	
Back Half Mass Gained	<	1.000	(ug)	
Emission Concentration Front-Half	<	2.69E-04	(mg/DSCM)	<
Emission Concentration Back-Half	<	3.36E-04	(mg/DSCM)	<
Emission Rate Front-Half	<	2.28E-05	(lb/hr)	<
Emission Rate Back-Half	<	2.85E-05	(lb/hr)	
Arsenic				
Front Half Mass Gained		6.410	(ug)	
Back Half Mass Gained	<	1.000	(ug)	
Emission Concentration Front-Half		2.15E-03	(mg/DSCM)	<
Emission Concentration Back-Half	<	3.36E-04	(mg/DSCM)	<
Emission Rate Front-Half		1.83E-04	(lb/hr)	<
Emission Rate Back-Half	<	2.85E-05	(lb/hr)	
Beryllium				
Front Half Mass Gained	<	0.200	(ug)	
Back Half Mass Gained	<	0.250	(ug)	
Emission Concentration Front-Half	<	6.72E-05	(mg/DSCM)	<
Emission Concentration Back-Half	<	8.40E-05	(mg/DSCM)	<
Emission Rate Front-Half	<	5.69E-06	(lb/hr)	<
Emission Rate Back-Half	<	7.12E-06	(lb/hr)	
Cadmium				
Front Half Mass Gained	<	0.200	(ug)	<
Back Half Mass Gained	<	0.250	(ug)	
Emission Concentration Front-Half	<	6.72E-05	(mg/DSCM)	<
Emission Concentration Back-Half	<	8.40E-05	(mg/DSCM)	<
Emission Rate Front-Half	<	5.69E-06	(lb/hr)	<
Emission Rate Back-Half	<	7.12E-06	(lb/hr)	

Chromium				
Front Half Mass Gained		11.100	(ug)	
Back Half Mass Gained		25.700	(ug)	
Emission Concentration Front-Half		3.73E-03	(mg/DSCM)	
Emission Concentration Back-Half		8.64E-03	(mg/DSCM)	
Emission Rate Front-Half		3.16E-04	(lb/hr)	
Emission Rate Back-Half		7.32E-04	(lb/hr)	
Cobalt				
Front Half Mass Gained	<	0.200	(ug)	
Back Half Mass Gained		5.350	(ug)	
Emission Concentration Front-Half	<	6.72E-05	(mg/DSCM)	
Emission Concentration Back-Half		1.80E-03	(mg/DSCM)	
Emission Rate Front-Half	<	5.69E-06	(lb/hr)	
Emission Rate Back-Half		1.52E-04	(lb/hr)	
Lead				
Front Half Mass Gained		1.410	(ug)	
Back Half Mass Gained		2.150	(ug)	
Emission Concentration Front-Half		4.74E-04	(mg/DSCM)	
Emission Concentration Back-Half		7.23E-04	(mg/DSCM)	
Emission Rate Front-Half		4.01E-05	(lb/hr)	
Emission Rate Back-Half		6.12E-05	(lb/hr)	
Manganese				
Front Half Mass Gained		5.100	(ug)	
Back Half Mass Gained		8.700	(ug)	
Emission Concentration Front-Half		1.71E-03	(mg/DSCM)	
Emission Concentration Back-Half		2.92E-03	(mg/DSCM)	
Emission Rate Front-Half		1.45E-04	(lb/hr)	
Emission Rate Back-Half		2.48E-04	(lb/hr)	
Nickel				
Front Half Mass Gained		9.100	(ug)	
Back Half Mass Gained		65.800	(ug)	
Emission Concentration Front-Half		3.06E-03	(mg/DSCM)	
Emission Concentration Back-Half		2.21E-02	(mg/DSCM)	
Emission Rate Front-Half		2.59E-04	(lb/hr)	
Emission Rate Back-Half		1.87E-03	(lb/hr)	
Selenium				
Front Half Mass Gained	<	2.000	(ug)	
Back Half Mass Gained		4.700	(ug)	
Emission Concentration Front-Half	<	6.72E-04	(mg/DSCM)	
Emission Concentration Back-Half		1.58E-03	(mg/DSCM)	
Emission Rate Front-Half	<	5.69E-05	(lb/hr)	
Emission Rate Back-Half		1.34E-04	(lb/hr)	

ArcelorMittal Monessen Run 2
Boilers 1 and 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 (F or C)	Meter Temp Out (F or C)
A-1	0.17	0.412	1.0	464	80	80
A-1	0.17	0.412	1.0	464	80	80
A-1	0.17	0.412	1.0	464	81	80
A-2	0.18	0.424	1.1	464	81	80
A-2	0.18	0.424	1.1	464	82	80
A-2	0.18	0.424	1.1	462	83	80
A-3	0.16	0.400	1.0	462	83	80
A-3	0.16	0.400	1.0	462	84	80
A-3	0.16	0.400	1.0	462	85	81
A-4	0.19	0.436	1.2	467	86	81
A-4	0.19	0.436	1.2	465	87	81
A-4	0.19	0.436	1.2	466	87	81
A-5	0.16	0.400	1.0	463	88	81
A-5	0.16	0.400	1.0	465	88	81
A-5	0.16	0.400	1.0	461	89	80
A-6	0.21	0.458	1.3	462	89	82
A-6	0.21	0.458	1.3	462	89	82
A-6	0.21	0.458	1.3	463	90	83
A-7	0.19	0.436	1.2	462	90	83
A-7	0.19	0.436	1.2	461	90	84
A-7	0.19	0.436	1.2	462	90	83
A-8	0.23	0.480	1.4	461	91	84
A-8	0.23	0.480	1.4	462	91	84
A-8	0.23	0.480	1.4	462	91	85
A-9	0.25	0.500	1.5	460	92	84
A-9	0.25	0.500	1.5	461	92	84
A-9	0.25	0.500	1.5	460	92	84
A-10	0.24	0.490	1.4	459	92	85
A-10	0.24	0.490	1.4	460	92	85
A-10	0.24	0.490	1.4	459	92	86
A-11	0.23	0.480	1.4	461	92	85
A-11	0.23	0.480	1.4	460	92	85
A-11	0.23	0.480	1.4	462	92	85
A-12	0.23	0.480	1.4	460	91	85
A-12	0.23	0.480	1.4	461	91	85
A-12	0.23	0.480	1.4	460	92	85
B-1	0.21	0.458	1.3	456	91	85
B-1	0.21	0.458	1.3	452	91	85
B-1	0.21	0.458	1.3	453	91	85
B-2	0.19	0.436	1.1	461	90	85
B-2	0.19	0.436	1.1	462	90	85
B-2	0.19	0.436	1.1	460	90	85
B-3	0.26	0.510	1.6	465	90	85
B-3	0.26	0.510	1.6	466	90	85
B-3	0.26	0.510	1.6	463	90	85
B-4	0.23	0.480	1.4	462	89	84
B-4	0.23	0.480	1.4	461	89	84
B-4	0.23	0.480	1.4	462	89	84
B-5	0.21	0.458	1.3	462	89	84
B-5	0.21	0.458	1.3	463	89	84
B-5	0.21	0.458	1.3	467	89	84
B-6	0.17	0.412	1.0	465	89	84
B-6	0.17	0.412	1.0	464	89	84
B-6	0.17	0.412	1.0	464	89	84
B-7	0.16	0.400	1.0	462	88	83
B-7	0.16	0.400	1.0	461	88	83
B-7	0.16	0.400	1.0	462	88	83
B-8	0.16	0.400	1.0	462	88	83
B-8	0.16	0.400	1.0	462	88	83
B-8	0.16	0.400	1.0	461	88	83
B-9	0.15	0.387	0.9	461	88	82
B-9	0.15	0.387	0.9	461	88	82
B-9	0.15	0.387	0.9	460	88	83
B-10	0.17	0.412	1.0	460	87	83
B-10	0.17	0.412	1.0	460	87	83
B-10	0.17	0.412	1.0	459	87	82
B-11	0.21	0.458	1.3	464	87	82
B-11	0.21	0.458	1.3	464	87	82
B-11	0.21	0.458	1.3	462	87	82
B-12	0.22	0.469	1.3	463	87	82
B-12	0.22	0.469	1.3	463	88	82
B-12	0.22	0.469	1.3	465	88	82
Average	0.20	0.445	1.21	461.9		85.8

Initial volume	735.102	ft^3	Initial volume	0.000	liters
Final volume	846.421	ft^3	Final volume	0.000	liters
Total metered	111.319	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1027.2	731.2	296.0			0.0
2	865.4	663.6	201.8			0.0
3	631.7	618.7	13.0			0.0
4	709.8	699.9	9.9			0.0
5	709.4	705.9	3.5			0.0
6	783.8	758.5	25.3			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4727.3	4177.8	549.5	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 11, 2016
Project No.:	16-167	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Boilers 1 and 2	Test Start Time:	2:30 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:	1618	
Meter $DH_@$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.02	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.330	inches
O2	5.29	% dv
CO2	7.43	% 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)	85.8	F
Stack Temperature (Tsavg)	461.9	F
Orifice Pressure Drop (dHavg)	1.213	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.4448	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	87.28	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	549.5	g
Water Vapor in Silica Gel (Vwsg(std))	25.909	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	25.909	scf
Volume Dry Gas Metered (Vm)	111.319	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	105.052	dscf
Volume Dry Gas Metered (Vm(m^3))	3.152	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.975	dscm
Stack Absolute Pressure (Ps)	28.99	in. Hg
Stack Absolute Temperature (Tsavg)	921.5	R
H2O Vapor Pressure @ avg Stack Temp.	968.35	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1978	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1978	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.14	lb/lb-mole
Gas Velocity (Vs)	34.57	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	50,791	acfm
Standard Gas Flowrate	28,188	scfm
Dry Standard Gas Flowrate	22,612	dscfm
Actual Gas Flowrate	1,438	acm/min
Standard Gas Flowrate	798	scm/min
Dry Standard Gas Flowrate	640	dscm/min
Area Nozzle (An)	0.000594	ft^2
Percent of Isokinetic Sampling (I)	106.46	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	88	ml
Acetone Wash Weight Gain	24.5	mg
Front Half Filter Particulate	2.8	mg
Total Particulate Mass (m_n)	27.30	mg
Particulate Concentration	0.0040	gr/dscf
Particulate Concentration	9.1772	mg/dscm
Particulate Emission Rate	0.78	lb/hr

ArcelorMittal Monessen Run 2
Common Stack

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	0.17	0.412	1.0	464	80	80
A-1	0.17	0.412	1.0	464	80	80
A-1	0.17	0.412	1.0	464	81	80
A-2	0.18	0.424	1.1	464	81	80
A-2	0.18	0.424	1.1	464	82	80
A-2	0.18	0.424	1.1	462	83	80
A-3	0.16	0.400	1.0	462	83	80
A-3	0.16	0.400	1.0	462	84	80
A-3	0.16	0.400	1.0	462	85	81
A-4	0.19	0.436	1.2	467	86	81
A-4	0.19	0.436	1.2	465	87	81
A-4	0.19	0.436	1.2	466	87	81
A-5	0.16	0.400	1.0	463	88	81
A-5	0.16	0.400	1.0	465	88	81
A-5	0.16	0.400	1.0	461	89	80
A-6	0.21	0.458	1.3	462	89	82
A-6	0.21	0.458	1.3	462	89	82
A-6	0.21	0.458	1.3	463	90	83
A-7	0.19	0.436	1.2	462	90	83
A-7	0.19	0.436	1.2	461	90	84
A-7	0.19	0.436	1.2	462	90	83
A-8	0.23	0.480	1.4	461	91	84
A-8	0.23	0.480	1.4	462	91	84
A-8	0.23	0.480	1.4	462	91	85
A-9	0.25	0.500	1.5	460	92	84
A-9	0.25	0.500	1.5	461	92	84
A-9	0.25	0.500	1.5	460	92	84
A-10	0.24	0.490	1.4	459	92	85
A-10	0.24	0.490	1.4	460	92	85
A-10	0.24	0.490	1.4	459	92	86
A-11	0.23	0.480	1.4	461	92	85
A-11	0.23	0.480	1.4	460	92	85
A-11	0.23	0.480	1.4	462	92	85
A-12	0.23	0.480	1.4	460	91	85
A-12	0.23	0.480	1.4	461	91	85
A-12	0.23	0.480	1.4	460	92	85
B-1	0.21	0.458	1.3	456	91	85
B-1	0.21	0.458	1.3	452	91	85
B-1	0.21	0.458	1.3	453	91	85
B-2	0.19	0.436	1.1	461	90	85
B-2	0.19	0.436	1.1	462	90	85
B-2	0.19	0.436	1.1	460	90	85
B-3	0.26	0.510	1.6	465	90	85
B-3	0.26	0.510	1.6	466	90	85
B-3	0.26	0.510	1.6	463	90	85
B-4	0.23	0.480	1.4	462	89	84
B-4	0.23	0.480	1.4	461	89	84
B-4	0.23	0.480	1.4	462	89	84
B-5	0.21	0.458	1.3	462	89	84
B-5	0.21	0.458	1.3	463	89	84
B-5	0.21	0.458	1.3	467	89	84
B-6	0.17	0.412	1.0	465	89	84
B-6	0.17	0.412	1.0	464	89	84
B-6	0.17	0.412	1.0	464	89	84
B-7	0.16	0.400	1.0	462	88	83
B-7	0.16	0.400	1.0	461	88	83
B-7	0.16	0.400	1.0	462	88	83
B-8	0.16	0.400	1.0	462	88	83
B-8	0.16	0.400	1.0	462	88	83
B-8	0.16	0.400	1.0	461	88	83
B-9	0.15	0.387	0.9	461	88	82
B-9	0.15	0.387	0.9	461	88	82
B-9	0.15	0.387	0.9	460	88	83
B-10	0.17	0.412	1.0	460	87	83
B-10	0.17	0.412	1.0	460	87	83
B-10	0.17	0.412	1.0	459	87	82
B-11	0.21	0.458	1.3	464	87	82
B-11	0.21	0.458	1.3	464	87	82
B-11	0.21	0.458	1.3	462	87	82
B-12	0.22	0.469	1.3	463	87	82
B-12	0.22	0.469	1.3	463	88	82
B-12	0.22	0.469	1.3	465	88	82
Average	0.20	0.445	1.21	461.9		85.8

Initial volume	735.102	ft^3	Initial volume	0.000	liters
Final volume	846.421	ft^3	Final volume	0.000	liters
Total metered	111.319	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1027.2	731.2	296.0	0.0	0.0	0.0
2	865.4	663.6	201.8	0.0	0.0	0.0
3	631.7	618.7	13.0	0.0	0.0	0.0
4	709.8	699.9	9.9	0.0	0.0	0.0
5	709.4	705.9	3.5	0.0	0.0	0.0
6	783.8	758.5	25.3	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	4727.3	4177.8	549.5	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 12, 2016
Project No.:	16-167	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Boilers 1 and 2	Test Start Time:	7:50 AM
Unit Operation:	Normal	Test Finish Time:	11:40 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:	1618	
Meter $DH_{@}$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.330	inches
O2	5.36	% dv
CO2	7.42	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	Metals Testing 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)	72.0	F
Stack Temperature (Tsavg)	458.4	F
Orifice Pressure Drop (dHavg)	1.215	in. H_2O
GasVelocity Head (dP)^^avg	0.4479	in. H_2O^1/2
F_d @ Standard Conditions	NA	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	87.23	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	558.7	g
Water Vapor in Silica Gel (Vwsg(std))	26.343	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	26.343	scf
Volume Dry Gas Metered (Vm)	110.377	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	107.041	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	3.126	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	3.031	dscm
Stack Absolute Pressure (Ps)	29.04	in. Hg
Stack Absolute Temperature (Tsavg)	918.1	R
H2O Vapor Pressure @ avg Stack Temp.	936.15	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1975	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1975	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.15	lb/lb-mole
Gas Velocity (Vs)	34.71	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	50.994	acfm
Standard Gas Flowrate	28.456	scfm
Dry Standard Gas Flowrate	22.836	dscfm
Actual Gas Flowrate	1.444	acm/min
Standard Gas Flowrate	806	scm/min
Dry Standard Gas Flowrate	647	dscm/min
Area Nozzle (An)	0.000594	ft^2
Percent of Isokinetic Sampling (I)	107.41	%

Metals

Mercury

Emission mass (1B Fraction)	<	0.015	(ug)
Emission mass (2B Fraction)		2.580	(ug)
Emission mass (3A Fraction)		0.0367	(ug)
Emission mass (3B Fraction)		0.070	(ug)
Emission mass (3C Fraction)		16.300	(ug)
Emission concentration (1B Fraction)	<	4.95E-06	(mg/DSCM)
Emission concentration (2B Fraction)		8.51E-04	(mg/DSCM)
Emission concentration (3A Fraction)		1.21E-05	(mg/DSCM)
Emission concentration (3B Fraction)		2.31E-05	(mg/DSCM)
Emission concentration (3C Fraction)		5.38E-03	(mg/DSCM)
Emission rate (1B Fraction)	<	4.23E-07	(lb/hr)
Emission rate (2B Fraction)		7.28E-05	(lb/hr)
Emission rate (3A Fraction)		1.04E-06	(lb/hr)
Emission rate (3B Fraction)		1.98E-06	(lb/hr)
Emission rate (3C Fraction)		4.60E-04	(lb/hr)

Antimony

Front Half Mass Gained	<	0.800	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half	<	2.64E-04	(mg/DSCM)
Emission Concentration Back-Half	<	3.30E-04	(mg/DSCM)
Emission Rate Front-Half	<	2.26E-05	(lb/hr)
Emission Rate Back-Half	<	2.82E-05	(lb/hr)

Arsenic

Front Half Mass Gained		5.750	(ug)
Back Half Mass Gained	<	1.000	(ug)
Emission Concentration Front-Half		1.90E-03	(mg/DSCM)
Emission Concentration Back-Half	<	3.30E-04	(mg/DSCM)
Emission Rate Front-Half		1.62E-04	(lb/hr)
Emission Rate Back-Half	<	2.82E-05	(lb/hr)

Beryllium

Front Half Mass Gained	<	0.200	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half	<	6.60E-05	(mg/DSCM)
Emission Concentration Back-Half	<	8.25E-05	(mg/DSCM)
Emission Rate Front-Half	<	5.64E-06	(lb/hr)
Emission Rate Back-Half	<	7.05E-06	(lb/hr)

Cadmium

Front Half Mass Gained	<	0.200	(ug)
Back Half Mass Gained	<	0.250	(ug)
Emission Concentration Front-Half	<	6.60E-05	(mg/DSCM)
Emission Concentration Back-Half	<	8.25E-05	(mg/DSCM)
Emission Rate Front-Half	<	5.64E-06	(lb/hr)
Emission Rate Back-Half	<	7.05E-06	(lb/hr)

Chromium

Front Half Mass Gained		5.710	(ug)
Back Half Mass Gained		0.950	(ug)
Emission Concentration Front-Half		1.88E-03	(mg/DSCM)
Emission Concentration Back-Half		3.13E-04	(mg/DSCM)
Emission Rate Front-Half		1.61E-04	(lb/hr)
Emission Rate Back-Half		2.68E-05	(lb/hr)

Cobalt

Front Half Mass Gained		0.210	(ug)
Back Half Mass Gained		2.600	(ug)
Emission Concentration Front-Half		6.93E-05	(mg/DSCM)
Emission Concentration Back-Half		8.58E-04	(mg/DSCM)
Emission Rate Front-Half		5.93E-06	(lb/hr)
Emission Rate Back-Half		7.34E-05	(lb/hr)

Lead

Front Half Mass Gained		1.050	(ug)
Back Half Mass Gained		0.560	(ug)
Emission Concentration Front-Half		3.46E-04	(mg/DSCM)
Emission Concentration Back-Half		1.85E-04	(mg/DSCM)
Emission Rate Front-Half		2.96E-05	(lb/hr)
Emission Rate Back-Half		1.58E-05	(lb/hr)

Manganese

Front Half Mass Gained		9.900	(ug)
Back Half Mass Gained		2.800	(ug)
Emission Concentration Front-Half		3.27E-03	(mg/DSCM)
Emission Concentration Back-Half		9.24E-04	(mg/DSCM)
Emission Rate Front-Half		2.79E-04	(lb/hr)
Emission Rate Back-Half		7.90E-05	(lb/hr)

Nickel

Front Half Mass Gained		4.600	(ug)
Back Half Mass Gained		1.400	(ug)
Emission Concentration Front-Half		1.52E-03	(mg/DSCM)
Emission Concentration Back-Half		4.62E-04	(mg/DSCM)
Emission Rate Front-Half		1.30E-04	(lb/hr)
Emission Rate Back-Half		3.95E-05	(lb/hr)

Selenium

Front Half Mass Gained	<	2.000	(ug)
Back Half Mass Gained		3.400	(ug)
Emission Concentration Front-Half	<	6.60E-04	(mg/DSCM)
Emission Concentration Back-Half		1.12E-03	(mg/DSCM)
Emission Rate Front-Half	<	5.64E-05	(lb/hr)
Emission Rate Back-Half		9.59E-05	(lb/hr)

ArcelorMittal Monessen Run 3
Boilers 1 and 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	0.16	0.400	1.0	460	60	61
A-1	0.16	0.400	1.0	468	60	61
A-1	0.16	0.400	1.0	466	60	61
A-2	0.19	0.436	1.1	462	62	60
A-2	0.19	0.436	1.1	462	62	60
A-2	0.19	0.436	1.1	459	62	60
A-3	0.17	0.412	1.0	461	65	60
A-3	0.17	0.412	1.0	460	65	60
A-3	0.17	0.412	1.0	466	66	60
A-4	0.20	0.447	1.2	464	67	61
A-4	0.20	0.447	1.2	461	67	61
A-4	0.20	0.447	1.2	462	67	61
A-5	0.16	0.400	1.0	459	69	62
A-5	0.16	0.400	1.0	459	69	62
A-5	0.16	0.400	1.0	459	69	63
A-6	0.18	0.424	1.1	460	70	63
A-6	0.18	0.424	1.1	461	70	63
A-6	0.18	0.424	1.1	459	71	63
A-7	0.20	0.447	1.2	457	72	64
A-7	0.20	0.447	1.2	459	72	64
A-7	0.20	0.447	1.2	461	72	64
A-8	0.20	0.447	1.2	461	73	65
A-8	0.20	0.447	1.2	460	73	65
A-8	0.20	0.447	1.2	461	73	65
A-9	0.21	0.458	1.3	458	74	64
A-9	0.21	0.458	1.3	458	74	64
A-9	0.21	0.458	1.3	459	75	66
A-10	0.24	0.490	1.4	457	75	66
A-10	0.24	0.490	1.4	456	76	67
A-10	0.24	0.490	1.4	456	75	67
A-11	0.23	0.480	1.4	455	76	68
A-11	0.23	0.480	1.4	454	76	68
A-11	0.23	0.480	1.4	454	76	68
A-12	0.26	0.510	1.6	454	77	69
A-12	0.26	0.510	1.6	453	77	69
A-12	0.26	0.510	1.6	453	77	69
B-1	0.26	0.510	1.6	453	77	69
B-1	0.26	0.510	1.6	448	71	70
B-1	0.26	0.510	1.6	456	72	70
B-2	0.23	0.480	1.4	462	72	70
B-2	0.23	0.480	1.4	460	73	70
B-2	0.23	0.480	1.4	459	73	70
B-3	0.24	0.490	1.4	458	75	71
B-3	0.24	0.490	1.4	458	75	70
B-3	0.24	0.490	1.4	457	75	70
B-4	0.26	0.510	1.6	460	77	70
B-4	0.26	0.510	1.6	459	78	71
B-4	0.26	0.510	1.6	457	78	71
B-5	0.17	0.412	1.0	458	79	71
B-5	0.17	0.412	1.0	460	79	71
B-5	0.17	0.412	1.0	459	79	71
B-6	0.16	0.400	1.0	458	80	72
B-6	0.16	0.400	1.0	458	80	72
B-6	0.16	0.400	1.0	459	80	72
B-7	0.18	0.424	1.1	459	81	73
B-7	0.18	0.424	1.1	457	82	73
B-7	0.18	0.424	1.1	463	83	74
B-8	0.20	0.447	1.2	454	83	75
B-8	0.20	0.447	1.2	456	83	75
B-8	0.20	0.447	1.2	458	83	75
B-9	0.20	0.447	1.2	456	85	77
B-9	0.20	0.447	1.2	454	85	77
B-9	0.20	0.447	1.2	455	85	77
B-10	0.16	0.400	1.0	455	85	77
B-10	0.16	0.400	1.0	454	85	77
B-10	0.16	0.400	1.0	455	86	77
B-11	0.15	0.387	0.9	459	86	78
B-11	0.15	0.387	0.9	458	86	78
B-11	0.15	0.387	0.9	460	87	78
B-12	0.24	0.490	1.4	461	86	79
B-12	0.24	0.490	1.4	460	87	79
B-12	0.24	0.490	1.0	461	88	80
Average	0.20	0.448	1.22	458.4		72.0

Initial volume	846.521	ft^3	Initial volume	0.000	liters
Final volume	956.898	ft^3	Final volume	0.000	liters
Total metered	110.377	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1013.6	722.2	291.4			0.0
2	905.7	685.1	220.6			0.0
3	626.9	615.0	11.9			0.0
4	710.8	703.8	7.0			0.0
5	703.7	700.4	3.3			0.0
6	796.3	771.8	24.5			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4757.0	4198.3	558.7	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 12, 2016
Project No.:	16-167	Test Location:	Common Stack
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Boilers 1 and 2	Test Start Time:	7:50 AM
Unit Operation:	Normal	Test Finish Time:	11:40 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:	1618	
Meter $DH_{@}$ (0.75 scfm)	1.971	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.07	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	0.0	inches
Nozzle Diameter (Dn)	0.330	inches
O2	5.36	% dv
CO2	7.42	% 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)	72.0	F
Stack Temperature (Tsavg)	458.4	F
Orifice Pressure Drop (dHavg)	1.215	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.4479	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	87.23	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	558.7	g
Water Vapor in Silica Gel (Vwsg(std))	26.343	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	26.343	scf
Volume Dry Gas Metered (Vm)	110.377	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	107.041	dscf
Volume Dry Gas Metered (Vm(m^3))	3.126	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	3.031	dscm
Stack Absolute Pressure (Ps)	29.04	in. Hg
Stack Absolute Temperature (Tsavg)	918.1	R
H2O Vapor Pressure @ avg Stack Temp.	936.15	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1975	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1975	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.15	lb/lb-mole
Gas Velocity (Vs)	34.71	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	50,994	acfm
Standard Gas Flowrate	28,456	scfm
Dry Standard Gas Flowrate	22,836	dscfm
Actual Gas Flowrate	1,444	acm/min
Standard Gas Flowrate	806	scm/min
Dry Standard Gas Flowrate	647	dscm/min
Area Nozzle (An)	0.000594	ft^2
Percent of Isokinetic Sampling (I)	107.41	%

Particulate Matter

Acetone Wash Container No.	NA	
Front Half Filter No.	NA	
Acetone Wash Volume (Vaw)	93	ml
Acetone Wash Weight Gain	8.5	mg
Front Half Filter Particulate	3.2	mg
Total Particulate Mass (m_n)	11.70	mg
Particulate Concentration	0.0017	gr/dscf
Particulate Concentration	3.8600	mg/dscm
Particulate Emission Rate	0.33	lb/hr

ArcelorMittal Monessen Run 3
Boilers 1 and 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	0.16	0.400	1.0	460	60	61
A-1	0.16	0.400	1.0	468	60	61
A-1	0.16	0.400	1.0	466	60	61
A-2	0.19	0.436	1.1	462	62	60
A-2	0.19	0.436	1.1	462	62	60
A-2	0.19	0.436	1.1	459	62	60
A-3	0.17	0.412	1.0	461	65	60
A-3	0.17	0.412	1.0	460	65	60
A-3	0.17	0.412	1.0	466	66	60
A-4	0.20	0.447	1.2	464	67	61
A-4	0.20	0.447	1.2	461	67	61
A-4	0.20	0.447	1.2	462	67	61
A-5	0.16	0.400	1.0	459	69	62
A-5	0.16	0.400	1.0	459	69	62
A-5	0.16	0.400	1.0	459	69	63
A-6	0.18	0.424	1.1	460	70	63
A-6	0.18	0.424	1.1	461	70	63
A-6	0.18	0.424	1.1	459	71	63
A-7	0.20	0.447	1.2	457	72	64
A-7	0.20	0.447	1.2	459	72	64
A-7	0.20	0.447	1.2	461	72	64
A-8	0.20	0.447	1.2	461	73	65
A-8	0.20	0.447	1.2	460	73	65
A-8	0.20	0.447	1.2	461	73	65
A-9	0.21	0.458	1.3	458	74	64
A-9	0.21	0.458	1.3	458	74	64
A-9	0.21	0.458	1.3	459	75	66
A-10	0.24	0.490	1.4	457	75	66
A-10	0.24	0.490	1.4	456	76	67
A-10	0.24	0.490	1.4	456	75	67
A-11	0.23	0.480	1.4	455	76	68
A-11	0.23	0.480	1.4	454	76	68
A-11	0.23	0.480	1.4	454	76	68
A-12	0.26	0.510	1.6	454	77	69
A-12	0.26	0.510	1.6	453	77	69
A-12	0.26	0.510	1.6	453	77	69
B-1	0.26	0.510	1.6	453	77	69
B-1	0.26	0.510	1.6	448	71	70
B-1	0.26	0.510	1.6	456	72	70
B-2	0.23	0.480	1.4	462	72	70
B-2	0.23	0.480	1.4	460	73	70
B-2	0.23	0.480	1.4	459	73	70
B-3	0.24	0.490	1.4	458	75	71
B-3	0.24	0.490	1.4	458	75	70
B-3	0.24	0.490	1.4	457	75	70
B-4	0.26	0.510	1.6	460	77	70
B-4	0.26	0.510	1.6	459	78	71
B-4	0.26	0.510	1.6	457	78	71
B-5	0.17	0.412	1.0	458	79	71
B-5	0.17	0.412	1.0	460	79	71
B-5	0.17	0.412	1.0	459	79	71
B-6	0.16	0.400	1.0	458	80	72
B-6	0.16	0.400	1.0	458	80	72
B-6	0.16	0.400	1.0	459	80	72
B-7	0.18	0.424	1.1	459	81	73
B-7	0.18	0.424	1.1	457	82	73
B-7	0.18	0.424	1.1	463	83	74
B-8	0.20	0.447	1.2	454	83	75
B-8	0.20	0.447	1.2	456	83	75
B-8	0.20	0.447	1.2	458	83	75
B-9	0.20	0.447	1.2	456	85	77
B-9	0.20	0.447	1.2	454	85	77
B-9	0.20	0.447	1.2	455	85	77
B-10	0.16	0.400	1.0	455	85	77
B-10	0.16	0.400	1.0	454	85	77
B-10	0.16	0.400	1.0	455	86	77
B-11	0.15	0.387	0.9	459	86	78
B-11	0.15	0.387	0.9	458	86	78
B-11	0.15	0.387	0.9	460	87	78
B-12	0.24	0.490	1.4	461	86	79
B-12	0.24	0.490	1.4	460	87	79
B-12	0.24	0.490	1.0	461	88	80
Average	0.20	0.448	1.22	458.4		72.0

Initial volume	846.521	ft^3	Initial volume	0.000	liters
Final volume	956.898	ft^3	Final volume	0.000	liters
Total metered	110.377	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1013.6	722.2	291.4			0.0
2	905.7	685.1	220.6			0.0
3	626.9	615.0	11.9			0.0
4	710.8	703.8	7.0			0.0
5	703.7	700.4	3.3			0.0
6	796.3	771.8	24.5			0.0
7			0.0			0.0
8			0.0			0.0
9			0.0			0.0
10			0.0			0.0
Total	4757.0	4198.3	558.7	0.0	0.0	0.0
	W_f	W_i	$(W_f - W_i)$	V_f	V_i	$(V_f - V_i)$

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	JW ~~1.991~~ 1.971	**Start Time:**	920
Date:	10/11/16	**Run Number:**	1	**Meter Correction (γ):**	JW ~~1.003~~ 1.003	**Stop Time:**	1300
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.330	**Pitot Correction:**	0.84	**T/C ID:**	7-9
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.38	**Control Box ID:**	1618	**Probe ID:**	7-9
		Baro. Pres. (in. Hg):	29.02	**Assumed Moisture (%):**	18	**Pitot ID:**	7-9
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	60	**Umbilical Length (Feet):**	200'	**Filter ID:**	6783Q
Test Crew:	JV JW TL TM	**Initial K-factor**	6			**Stack Diameter (inches):**	

(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	622.807										
A-1	0:02:30	624.42	0.22	1.3	3	458	244	237	57	54	53	
A-1	0:05:00	626.95	0.22	1.3	3	457	242	241	56	56	53	
A-1	0:07:30	627.45	0.22	1.3	3	456	243	240	56	56	53	
A-2	0:10:00	628.97	0.23	1.4	3	456	243	242	57	58	53	
A-2	0:12:30	630.52	0.23	1.4	3	456	242	241	57	59	53	
A-2	0:15:00	632.08	0.23	1.4	3	455	242	242	57	60	54	
A-3	0:17:30	633.74	0.24	1.4	3	460	242	238	57	61	54	
A-3	0:20:00	635.19	0.24	1.4	3	459	243	241	57	62	54	
A-3	0:22:30	636.76	0.24	1.4	3	459	243	237	57	62	54	
A-4	0:25:00	638.32	0.24	1.4	3	459	242	242	57	63	55	
A-4	0:27:30	639.91	0.24	1.4	3	459	242	243	57	63	55	
A-4	0:30:00	641.49	0.24	1.4	3	460	242	242	58	64	56	
A-5	0:32:30	642.95	0.19	1.1	3	461	243	241	58	65	56	
A-5	0:35:00	644.39	0.19	1.1	3	460	241	243	59	65	57	
A-5	0:37:30	645.83	0.19	1.1	3	462	242	239	59	66	57	
A-6	0:40:00	647.32	0.20	1.2	3	462	242	242	60	66	57	
A-6	0:42:30	648.83	0.20	1.2	3	465	242	245	60	67	58	
A-6	0:45:00	650.35	0.20	1.2	3	462	242	240	60	67	58	
A-7	0:47:30	651.72	0.16	1.0	2.5	460	242	242	62	68	59	
A-7	0:50:00	653.08	0.16	1.0	2.5	460	243	241	64	68	59	
A-7	0:52:30	654.46	0.16	1.0	2.5	460	242	242	62	69	60	
A-8	0:55:00	655.81	0.20	1.2	3.0	465	243	241	59	69	60	
A-8	0:57:30	657.31	0.20	1.2	3.0	463	242	~~440~~	58	69	61	240
A-8	1:00:00	658.86	0.20	1.2	3.0	462	242	242	58	70	61	

(max leak rate = 0.02 ft³/min)

Sample Train Leak Check		(in. Hg)	(ft³/min)
	Initial	15	0.002
	Final	5	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):	500.0	Tolerance = +/- 0.5 g

Imp	Contents	~~Final~~	Initial	Difference
1	5%HNO_3/10%H_2O_2 (g)	713.5	1000.9	
2	5%HNO_3/10%H_2O_2 (g)	656.6	915.7	
3	Empty (g)	616.4	638.4	
4	10%H_2SO_4/$KMnO_4$ (g)	792.2	762.5	
5	10%H_2SO_4/$KMnO_4$ (g)	712.5	712.2	
6	Silica (g)	771.6	791.7	

MONTROSE METHOD 5/29 DATA SHEET

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

Date: 10/11/16 **Run Number:** 1 **Sampling Location:** Boiler Stack Outlet

Test Crew: JV JW TL 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
A-9	1:02:30	660.22	0.17	1.0	2.5	462	242	242	57	70	61	
A-9	1:05:00	661.58	0.17	1.0	2.5	462	242	242	57	70	62	
A-9	1:07:30	662.95	0.17	1.0	2.5	465	241	241	55	71	62	
A-10	1:10:00	664.31	0.21	1.3	3.0	465	243	241	54	71	63	
A-10	1:12:30	665.89	0.21	1.3	3.0	465	242	242	54	72	63	
A-10	1:15:00	667.44	0.21	1.3	3.0	465	242	239	53	72	63	
A-11	1:17:30	668.85	0.16	1.0	2.5	463	242	241	53	72	64	
A-11	1:20:00	670.24	0.16	1.0	2.5	464	243	241	53	73	64	
A-11	1:22:30	671.64	0.16	1.0	2.5	470	243	245	53	73	65	
A-12	1:25:00	673.22	0.21	1.3	3.0	466	242	241	53	74	65	
A-12	1:27:30	674.73	0.21	1.3	3.0	465	242	238	52	74	65	
A-12	1:30:00	676.28	0.21	1.3	3.0	464	242	238	52	74	66	Portchange @ 1050
B-1	1:32:30	677.90	0.22	1.3	3.0	444	242	241	52	73	70	Restart @ 1130
B-1	1:35:00	679.52	0.22	1.3	3.0	462	242	240	50	73	70	
B-1	1:37:30	681.14	0.22	1.3	3.0	455	242	241	50	74	70	
B-2	1:40:00	682.71	0.20	1.3	3.0	445	242	239	51	75	71	
B-2	1:42:30	684.32	0.20	1.3	3.0	436	242	242	52	78	71	
B-2	1:45:00	685.91	0.20	1.3	3.0	459	242	241	52	78	71	
B-3	1:47:30	687.51	0.21	1.3	3.0	447	242	241	53	79	72	
B-3	1:50:00	689.12	0.21	1.3	3.0	455	242	242	53	80	72	
B-3	1:52:30	690.23	0.21	1.3	3.0	446	242	239	53	81	73	
B-4	1:55:00	692.36	0.24	~~1.0~~	4.0	448	242	235	53	81	73	1.4
B-4	1:57:30	694.04	0.24	1.4	4.0	444	242	232	53	82	74	
B-4	2:00:00	695.73	0.24	1.4	4.0	434	242	235	53	84	75	
B-5	2:02:30	697.27	0.19	1.1	3.0	445	242	234	53	84	75	
B-5	2:05:00	698.78	0.19	1.1	3.0	444	242	244	54	85	75	
B-5	2:07:30	700.29	0.19	1.1	3.0	444	242	245	54	85	76	
B-6	2:10:00	701.89	0.21	1.3	4.0	459	242	243	54	85	76	
B-6	2:12:30	703.49	0.21	1.3	4.0	460	242	244	55	86	76	
B-6	2:15:00	705.10	0.21	1.3	4.0	459	242	237	55	86	77	
B-7	2:17:30	706.72	0.20	1.3	4.0	463	241	238	55	87	78	
B-7	2:20:00	708.31	0.20	1.3	4.0	462	240	243	56	87	78	
B-7	2:22:30	709.89	0.20	1.3	4.0	462	243	242	56	88	79	
B-8	2:25:00	711.42	0.18	1.1	4.0	461	242	241	57	88	79	
B-8	2:27:30	713.98	0.18	1.1	4.0	461	243	241	57	88	79	
B-8	2:30:00	714.51	0.18	1.1	4.0	461	242	242	58	89	80	
B-9	2:32:30	716.12	0.21	1.3	4.0	460	242	243	58	88	80	
B-9	2:35:00	717.72	0.21	1.3	4.0	460	241	240	59	88	81	

MONTROSE METHOD 5/29 DATA SHEET

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

Date: 10/11/16 **Run Number:** 1 **Sampling Location:** Boiler Stack Outlet

Test Crew: JV JW TL 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
B-9	2:37:30	719.32	0.21	1.3	4.0	460	241	242	60	88	81	
B-10	2:40:00	720.92	0.23	1.4	4.0	462	244	241	61	88	81	
B-10	2:42:30	722.54	0.23	1.4	4.0	463	240	242	61	88	81	
B-10	2:45:00	724.41	0.23	1.4	4.0	463	242	243	62	88	81	
B-11	2:47:30	725.95	0.26	1.6	4.5	462	242	243	62	88	81	
B-11	2:50:00	727.69	0.26	1.6	4.5	459	242	242	62	88	81	
B-11	2:52:30	729.43	0.26	1.6	4.5	462	243	240	63	88	81	
B-12	2:55:00	731.15	0.24	1.4	4.0	465	243	245	64	88	81	
B-12	2:57:30	732.87	0.24	1.4	4.0	465	242	244	64	88	81	
B-12	3:00:00	734.545	0.24	1.4	4.0	464	243	242	65	88	81	

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.971	**Start Time:**	1430
Date:	10/11/16	**Run Number:**	2	**Meter Correction (γ):**	1.003	**Stop Time:**	1805
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.330	**Pitot Correction:**	0.84	**T/C ID:**	7-9
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.38	**Control Box ID:**	1618	**Probe ID:**	7-9
		Baro. Pres. (in. Hg):	29.02	**Assumed Moisture (%):**	21	**Pitot ID:**	7-9
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	64	**Umbilical Length (Feet):**	200'	**Filter ID:**	7055Q
Test Crew:	JV JW (TD) TM	**Initial K-factor**	6			**Stack Diameter (inches):**	

(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	735.102										
A-1	0:02:30	736.85	0.17	1.0	3.0	464	241	241	61	80	80	
A-1	0:05:00	737.62	0.17	1.0	3.0	464	237	242	60	80	80	
A-1	0:07:30	739.46	0.17	1.0	3.0	464	242	242	61	81	80	
A-2	0:10:00	740.92	0.18	1.1	3.0	464	243	240	62	81	80	
A-2	0:12:30	742.53	0.18	1.1	3.0	464	244	242	63	82	80	
A-2	0:15:00	743.89	0.18	1.1	3.0	462	242	241	63	83	80	
A-3	0:17:30	745.29	0.16	1.0	3.0	462	242	242	63	83	80	
A-3	0:20:00	746.68	0.16	1.0	3.0	462	242	242	61	84	80	
A-3	0:22:30	748.13	0.16	1.0	3.0	462	242	240	61	85	81	
A-4	0:25:00	749.61	0.19	1.2	3.0	469	243	242	59	86	81	
A-4	0:27:30	751.15	0.19	1.2	3.0	465	242	240	59	87	81	
A-4	0:30:00	752.77	0.19	1.2	3.0	466	242	242	59	87	81	
A-5	0:32:30	754.12	0.16	1.0	3.0	463	243	239	59	88	81	
A-5	0:35:00	755.52	0.16	1.0	3.0	465	244	246	60	88	81	
A-5	0:37:30	756.94	0.16	1.0	3.0	461	241	245	60	89	80	
A-6	0:40:00	758.29	0.21	1.3	3.5	462	242	242	58	89	82	
A-6	0:42:30	759.87	0.21	1.3	3.5	462	241	244	58	89	82	
A-6	0:45:00	761.48	0.21	1.3	3.5	463	242	241	59	90	83	
A-7	0:47:30	763.02	0.19	1.2	3.0	462	242	240	59	90	83	
A-7	0:50:00	764.56	0.19	1.2	3.0	461	246	241	59	90	84	
A-7	0:52:30	766.12	0.19	1.2	3.0	462	242	241	59	90	83	
A-8	0:55:00	767.77	0.23	1.4	3.5	461	240	240	60	91	84	
A-8	0:57:30	769.48	0.23	1.4	3.5	462	242	243	60	91	84	
A-8	1:00:00	770.19	0.23	1.4	3.5	462	242	241	61	91	85	

(max leak rate = 0.02 ft³/min)

		(in. Hg)	(ft³/min)
Sample Train Leak Check	Initial	15	0.002
	Final	5	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	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)	1027.2	731.2	
2	5%HNO_3/10%H_2O_2 (g)	865.4	663.6	
3	Empty (g)	631.7	618.7	
4	10%H_2SO_4/$KMnO_4$ (g)	709.8	699.9	
5	10%H_2SO_4/$KMnO_4$ (g)	709.4	705.9	
6	Silica (g)	783.8	758.5	

MONTROSE METHOD 5/29 DATA SHEET

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

Date: 10/11/16 **Run Number:** 2 **Sampling Location:** Boiler Stack Outlet

Test Crew: JV JW (TL) 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
A-9	1:02:30	771.17	0.25	1.5	4.0	460	242	240	61	92	84	
A-9	1:05:00	773.45	0.25	1.5	4.0	461	242	241	62	92	84	
A-9	1:07:30	775.73	0.25	1.5	4.0	460	241	241	62	92	84	
A-10	1:10:00	778.01	0.24	1.4	3.5	459	241	244	59	92	85	
A-10	1:12:30	779.71	0.24	1.4	3.5	460	243	245	59	92	85	
A-10	1:15:00	781.39	0.24	1.4	3.5	459	242	235	60	92	86	
A-11	1:17:30	~~789.78~~ TL	0.23	1.4	3.5	461	242	241	58	92	85	783.085
A-11	1:20:00	784.78	0.23	1.4	3.5	460	243	241	58	92	85	
A-11	1:22:30	786.48	0.23	1.4	3.5	462	242	242	57	92	85	
A-12	1:25:00	788.13	0.23	1.4	3.5	460	241	241	57	91	85	
A-12	1:27:30	789.80	0.23	1.4	3.5	461	242	240	57	91	85	
A-12	1:30:00	791.47	0.23	1.4	3.5	460	243	239	58	92	85	
B-1	1:32:30	793.12	0.21	~~1.3~~ TL	3.0	456	242	242	58	91	85	1.3
B-1	1:35:00	794.77	0.21	1.3	3.0	452	242	242	58	91	85	
B-1	1:37:30	796.42	0.21	1.3	3.0	453	243	237	58	91	85	
B-2	1:40:00	798.01	0.19	1.1	3.0	461	241	241	60	90	85	
B-2	1:42:30	799.55	0.19	1.1	3.0	462	242	242	60	90	85	
B-2	1:45:00	801.09	0.19	1.1	3.0	460	242	244	61	90	85	
B-3	1:47:30	802.68	0.26	1.6	4.0	465	242	241	59	90	85	
B-3	1:50:00	804.48	0.26	1.6	4.0	466	242	242	59	90	85	
B-3	1:52:30	806.28	0.26	1.6	4.0	463	234	241	62	90	85	
B-4	1:55:00	808.06	0.23	1.4	3.5	462	243	241	62	89	84	
B-4	1:57:30	809.77	0.23	1.4	3.5	461	242	243	62	89	84	
B-4	2:00:00	811.41	0.23	1.4	3.5	462	243	242	61	89	84	
B-5	2:02:30	813.05	0.21	1.3	3.0	462	241	233	63	89	84	
B-5	2:05:00	814.93	0.21	1.3	3.0	463	241	243	63	89	84	
B-5	2:07:30	816.30	0.21	1.3	3.0	467	242	242	63	89	84	
B-6	2:10:00	817.77	0.17	1.0	3.0	465	242	241	62	89	84	
B-6	2:12:30	819.21	0.17	1.0	3.0	464	242	240	62	89	84	
B-6	2:15:00	820.61	0.17	1.0	3.0	464	242	240	62	89	84	
B-7	2:17:30	822.01	0.16	1.0	3.0	462	242	240	62	88	83	
B-7	2:20:00	823.40	0.16	1.0	3.0	461	243	241	61	88	83	
B-7	2:22:30	824.89	0.16	1.0	3.0	462	242	242	62	88	83	
B-8	2:25:00	826.25	0.16	1.0	3.0	462	241	241	62	88	83	
B-8	2:27:30	827.62	0.16	1.0	3.0	462	243	238	62	88	83	
B-8	2:30:00	829.02	0.16	1.0	3.0	461	243	240	62	88	83	
B-9	2:32:30	830.32	0.15	0.90	3.0	461	241	242	62	88	82	
B-9	2:35:00	831.69	0.15	0.90	3.0	461	242	239	62	88	82	

1600
1635

MONTROSE METHOD 5/29 DATA SHEET

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

Date: 10/11/16 **Run Number:** 2 **Sampling Location:** Boiler Stack Outlet

Test Crew: JV JW TL 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
B-9	2:37:30	833.06	0.15	0.90	3.0	460	240	241	63	88	83	
B-10	2:40:00	834.48	0.17	1.0	3.0	460	243	240	64	87	83	
B-10	2:42:30	835.74	0.17	1.0	3.0	460	242	242	64	87	83	
B-10	2:45:00	837.14	0.17	1.0	3.0	459	242	239	62	87	82	
B-11	2:47:30	838.56	0.21	1.3	3.0	464	243	242	62	87	82	
B-11	2:50:00	840.11	0.21	1.3	3.0	464	242	236	62	87	82	
B-11	2:52:30	841.28	0.21	1.3	3.0	462	244	242	61	87	82	
B-12	2:55:00	842.46	0.22	1.3	3.0	463	242	241	59	87	82	
B-12	2:57:30	844.81	0.22	1.3	3.0	463	242	238	59	88	82	
B-12	3:00:00	846.921	0.22	1.3	3.0	465	241	239	59	88	82	Stop 1805

MONTROSE METHOD 5/29 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 5/29	**Meter ΔH :**	1.971	**Start Time:**	750
Date:	10/12/16	**Run Number:**	3	**Meter Correction (γ):**	1.003	**Stop Time:**	1140
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	~~0.330~~ TL 0.340	**Pitot Correction:**	0.84	**T/C ID:**	7-9
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.38	**Control Box ID:**	1618	**Probe ID:**	7-9
		Baro. Pres. (in. Hg):	28.07	**Assumed Moisture (%):**	21	**Pitot ID:**	7-9
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	54	**Umbilical Length (Feet):**	200'	**Filter ID:**	7056Q
Test Crew:	JV JW TL TM	**Initial K-factor**	60			**Stack Diameter (inches):**	67

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time 0:00:00	Metered Volume (ft³) TL ~~846.52~~ 846.521	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 846.528
A-1	0:02:30	~~848.58~~ TL	0.16	1.0	2.5	460	242	238	59	60	61	Start 750 848.31
A-1	0:05:00	849.58	0.16	1.0	2.5	468	239	240	59	60	61	
A-1	0:07:30	850.87	0.16	1.0	2.5	466	239	240	59	60	61	
A-2	0:10:00	852.21	0.19	1.1	3.0	462	242	242	61	62	60	
A-2	0:12:30	853.66	0.19	1.1	3.0	462	243	243	63	62	60	
A-2	0:15:00	855.11	0.19	1.1	3.0	459	243	240	64	62	60	
A-3	0:17:30	856.51	0.17	1.0	2.5	461	242	240	60	65	60	
A-3	0:20:00	857.88	0.17	1.0	2.5	460	242	240	59	65	60	
A-3	0:22:30	859.23	0.17	1.0	2.5	466	242	242	59	66	60	
A-4	0:25:00	860.76	0.20	1.2	3.0	464	241	241	55	67	61	
A-4	0:27:30	862.33	0.20	1.2	3.0	461	242	241	55	67	61	
A-4	0:30:00	863.82	0.20	1.2	3.0	462	242	240	56	67	61	
A-5	0:32:30	865.17	0.16	1.0	2.5	459	242	239	51	69	62	
A-5	0:35:00	866.53	0.16	1.0	2.5	459	243	240	51	69	62	
A-5	0:37:30	867.91	0.16	1.0	2.5	459	242	241	51	69	63	
A-6	0:40:00	869.33	0.18	1.1	3.0	460	243	240	50	70	63	
A-6	0:42:30	870.~~88~~ 79	0.18	1.1	3.0	461	242	242	50	70	63	
A-6	0:45:00	872.30	0.18	1.1	3.0	459	242	241	50	71	63	
A-7	0:47:30	873.77	0.20	1.2	3.0	457	242	242	50	72	64	
A-7	0:50:00	875.23	0.20	1.2	3.0	459	241	242	50	72	64	
A-7	0:52:30	876.72	0.20	1.2	3.0	461	243	242	50	72	64	
A-8	0:55:00	878.37	0.20	1.2	3.0	461	242	241	51	73	65	
A-8	0:57:30	879.95	0.20	1.2	3.0	460	242	241	51	73	65	
A-8	1:00:00	881.43	0.20	1.2	3.0	461	241	240	52	73	65	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	4	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	C	A	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	5%HNO_3/10%H_2O_2 (g)	1013.6	722.2	
2	5%HNO_3/10%H_2O_2 (g)	905.7	685.1	
3	Empty (g)	626.9	615.0	
4	10%H_2SO_4/$KMnO_4$ (g)	710.8	703.8	
5	10%H_2SO_4/$KMnO_4$ (g)	703.7	700.4	
6	Silica (g)	796.3	771.8	

MONTROSE METHOD 5/29 DATA SHEET

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

Date: 10/12/16 **Run Number:** 3 **Sampling Location:** Boiler Stack Outlet

Test Crew: JV JW TL 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
A-9	1:02:30	883.99	0.21	1.3	3.5	458	241	241	51	74	64	
A-9	1:05:00	884.57	0.21	1.3	3.5	458	242	240	51	74	64	
A-9	1:07:30	886.08	0.21	1.3	3.5	459	242	241	51	75	66	
A-10	1:10:00	887.69	0.24	1.4	3.5	457	242	242	51	75	66	
A-10	1:12:30	889.32	0.24	1.4	3.5	456	241	242	52	76	67	
A-10	1:15:00	890.91	0.24	1.4	3.5	456	240	241	52	75	67	
A-11	1:17:30	891.61	0.23	1.4	3.5	455	244	241	52	76	68	
A-11	1:20:00	~~892.58~~	0.23	1.4	3.5	454	242	241	52	76	68	894.28
A-11	1:22:30	895.81	0.23	1.4	3.5	454	242	240	52	76	68	
A-12	1:25:00	897.59	0.26	1.6	4.0	454	243	241	54	77	69	
A-12	1:27:30	899.46	0.26	1.6	4.0	453	242	241	54	77	69	
A-12	1:30:00	901.13	0.26	1.6	4.0	453	242	241	55	77	69	Port change @ 0925
B-1	1:32:30	902.93	0.26	1.6	4.0	453	243	241	55	77	69	relat 1610
B-1	1:35:00	904.71	0.26	1.6	4.0	448	243	242	59	71	70	
B-1	1:37:30	906.50	0.26	1.6	4.0	456	242	242	62	72	70	
B-2	1:40:00	908.13	0.23	1.4	3.5	462	242	242	64	72	70	
B-2	1:42:30	909.82	0.23	1.4	3.5	460	242	241	64	73	70	
B-2	1:45:00	911.58	0.23	1.4	3.5	459	243	241	64	73	70	
B-3	1:47:30	913.23	0.24	1.4	3.5	458	242	241	61	75	71	
B-3	1:50:00	914.91	0.24	1.4	3.5	458	242	241	59	75	70	
B-3	1:52:30	916.64	0.24	1.4	3.5	457	242	242	59	75	70	
B-4	1:55:00	918.28	0.26	1.6	4.0	460	242	240	56	77	70	
B-4	1:57:30	920.00	0.26	1.6	4.0	459	243	241	55	78	71	
B-4	2:00:00	921.72	0.26	1.6	4.0	457	243	242	55	78	71	
B-5	2:02:30	923.11	0.17	1.0	2.5	458	242	241	55	79	71	
B-5	2:05:00	924.51	0.17	1.0	2.5	460	241	240	56	79	71	
B-5	2:07:30	925.93	0.17	1.0	2.5	459	241	241	56	79	71	
B-6	2:10:00	927.24	0.16	1.0	2.5	458	243	240	56	80	72	
B-6	2:12:30	928.75	0.16	1.0	2.5	458	242	241	56	80	72	
B-6	2:15:00	930.11	0.16	1.0	2.5	459	242	243	56	80	72	
B-7	2:17:30	931.50	0.18	1.1	3.5	459	242	240	57	81	73	
B-7	2:20:00	932.99	0.18	1.1	3.5	457	242	243	57	82	73	
B-7	2:22:30	934.52	0.18	1.1	3.5	463	242	241	57	83	74	
B-8	2:25:00	936.01	0.20	1.2	3.5	454	242	241	58	83	75	
B-8	2:27:30	937.54	0.20	1.2	3.5	456	242	243	58	83	75	
B-8	2:30:00	939.04	0.20	1.2	3.5	458	242	242	58	83	75	
B-9	2:32:30	940.51	0.20	1.2	3.5	456	242	242	60	85	77	
B-9	2:35:00	942.19	0.20	1.2	3.5	454	242	241	60	85	77	

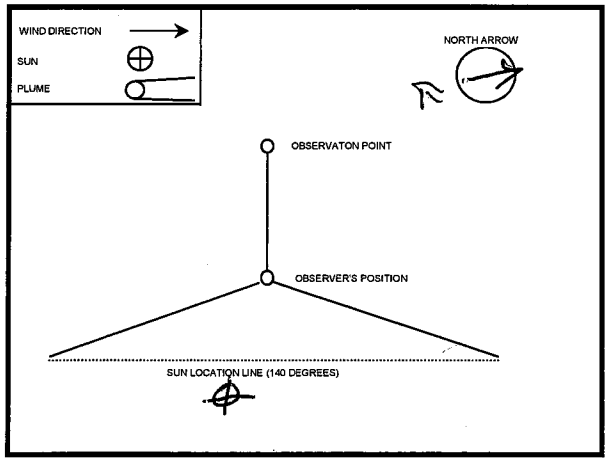
MONTROSE METHOD 5/29 DATA SHEET

Client: ArcelorMittal
Test Type: Method 5/29
Project Number: Proj106377 (16-167)
Date: 10/12/16
Run Number: 3
Sampling Location: Boiler Stack Outlet
Test Crew: JV JW (TL) 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
B-9	2:37:30	943.76	0.20	1.2	3.5	455	242	240	60	85	77	
B-10	2:40:00	945.24	0.16	1.0	3.0	455	241	240	61	85	77	
B-10	2:42:30	946.65	0.16	1.0	3.0	454	241	240	61	85	77	
B-10	2:45:00	948.13	0.16	1.0	3.0	455	242	243	62	86	77	
B-11	2:47:30	949.55	0.15	0.9	3.0	459	242	243	61	86	78	
B-11	2:50:00	950.92	0.15	0.9	3.0	458	241	243	61	86	78	
B-11	2:52:30	952.22	0.15	0.9	3.0	460	242	242	61	87	78	
B-12	2:55:00	953.62	0.24	1.4	4.0	461	243	240	62	86	79	
B-12	2:57:30	955.24	0.24	1.4	4.0	460	242	241	62	87	79	
B-12	3:00:00	956.898	0.24	1.4	4.0	461	242	242	63	88	80	Stop 1140

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 Run 1
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Boiler Stack
LOCATION	880 Donner Ave
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Steam Generator Boilers
OPERATING MODE	Normal
CONTROL EQUIPMENT	Boilers
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL START	200
HEIGHT ABOVE GROUND LEVEL END	200
HEIGHT RELATIVE TO OBSERVER START	200
HEIGHT RELATIVE TO OBSERVER END	200
DISTANCE FROM OBSERVER START	1900 ft
DISTANCE FROM OBSERVER END	1900 ft
DIRECTION FROM OBSERVER START	NW
DIRECTION FROM OBSERVER END	NW
VERTICAL ANGLE TO OBSERVATION POINT START	<30°
VERTICAL ANGLE TO OBSERVATION POINT END	<30°
DIRECTION TO OBSERVATION PT. START	SE
DIRECTION TO OBSERVATION PT. END	SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET START	~1900 ft
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET END	~1900 ft
DESCRIBE EMISSIONS START	NONE
DESCRIBE EMISSIONS END	NONE
EMISSION COLOR START	N/A
EMISSION COLOR END	N/A
IF WATER DROPLET PLUME ATTACHED / DETACHED / N/A	N/A
DESCRIBE PLUME BACKGROUND START	SKY
DESCRIBE PLUME BACKGROUND END	SKY
SKY CONDITIONS START	Clear
SKY CONDITIONS END	Some clouds
WIND SPEED START	0-5
WIND SPEED END	0-5
WIND DIRECTION START	NNE
WIND DIRECTION END	ESE
AMBIENT TEMP START	46°F
AMBIENT TEMP END	50
WET BULB TEMP START	45°C
WET BULB TEMP END	46
PERCENT HUMIDITY START	95%
PERCENT HUMIDITY END	80%



START TIME 9:20 STOP TIME 10:20

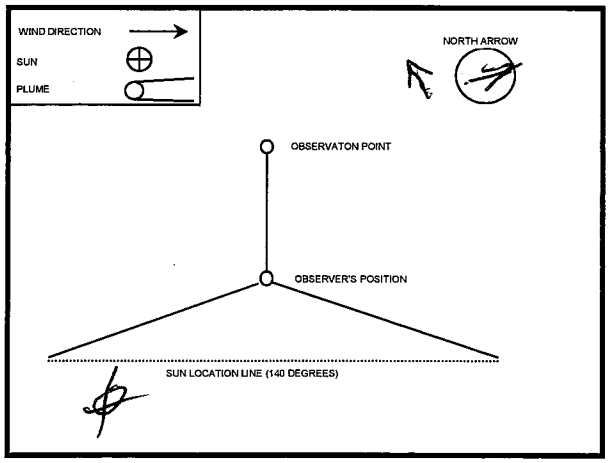
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	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	5	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	5	5	5	59	0	0	0	0

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	[signature] DATE 10/11/16
ORGANIZATION	Montrose
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 RUN 1
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Boiler Stack
LOCATION	800 DONNER Ave
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Steam Generator Boilers
OPERATING MODE	Normal
CONTROL EQUIPMENT	Boilers
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START ≈1900' END 1900' FE
DIRECTION FROM OBSERVER	START NW END NW
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START SE END SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈1900'E END ≈1900'E
DESCRIBE EMISSIONS START	NONE
DECRIBE EMISSIONS END	N/A
EMISSION COLOR START	N/A END
IF WATER DROPLET PLUME	ATTACHED _ ATTACHED N/A _ N/A _
DESCRIBE PLUME BACKGROUND	START Some Clouds END Some clouds
SKY CONDITIONS	START Sky END Sky
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START ESE END WSW
AMBIENT TEMP	START 52° END 58
WET BULB TEMP	START 46° END 41
PERCENT HUMIDITY	START 80% END 53%



START TIME 10:20 STOP TIME 11:20

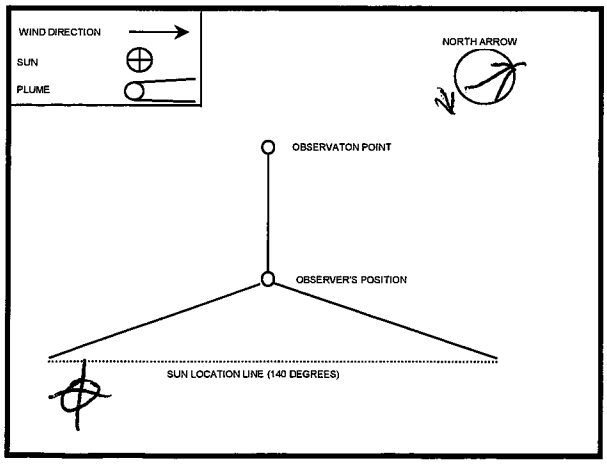
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	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 10/11/16
ORGANIZATION	Montrose
CERTIFIED BY	OpacitAir DATE 8/22/2016

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 RUN 1
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Boiler Stack
LOCATION	880 Donner Ave
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Boilers
OPERATING MODE	Normal
CONTROL EQUIPMENT	Boilers
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START ≈1900 Ft END ≈1900 Ft
DIRECTION FROM OBSERVER	START NW END NW
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START SE END SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈1900 Ft END ≈1900 Ft
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	Some Clouds END Cloudy
SKY CONDITIONS START	SKY END SKY
WIND SPEED START 0-5 END 0-5	WIND DIRECTION START WSW END WSW
AMBIENT TEMP START 52 END 63	WET BULB TEMP START 41 END 44
PERCENT HUMIDITY START 53 END 51	



START TIME 11:20 STOP TIME 12:20

	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
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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
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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
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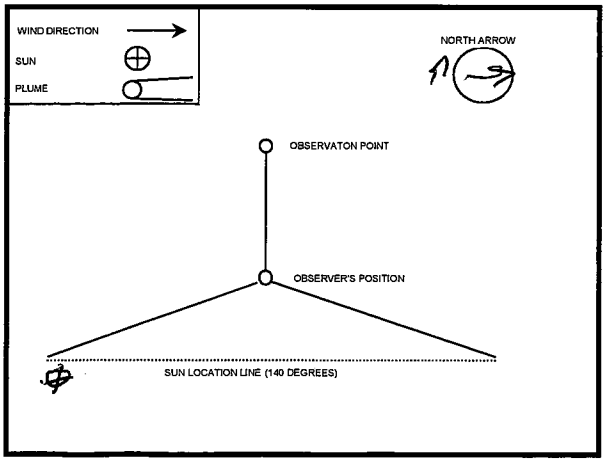
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
17	0	0	0	0	47	0	0	0	0
18	0	0	0	0	48	0	0	0	0
19	0	0	0	0	49	0	0	0	0
20	0	0	0	0	50	0	0	0	0
21	0	0	0	0	51	0	0	0	0
22	0	0	0	0	52	0	0	0	0
23	0	0	0	0	53	0	0	0	0
24	0	0	0	0	54	0	0	0	0
25	0	0	0	0	55	0	0	0	0
26	0	0	0	0	56	0	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	[signature] DATE 10/11/16
ORGANIZATION	Montrose
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 RUN 1
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Boiler Stack
LOCATION	880 Donner AVE
CITY / STATE / ZIP	Monessen / PA / 15062
PROCESS EQUIPMENT / OPERATING MODE	Boilers / Normal
CONTROL EQUIPMENT / OPERATING MODE	Boilers / Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START 1900 END 1900
DIRECTION FROM OBSERVER	START NW END NW
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START SE END SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈1900' END ≈1900'
DESCRIBE EMISSIONS	START NONE
DECRIBE EMISSIONS	END N/A
EMISSION COLOR	START N/A END N/A
IF WATER DROPLET PLUME	ATTACHED __ DETACHED N/A N/A__
DESCRIBE PLUME BACKGROUND	START Clouds END Clouds
SKY CONDITIONS	START SKY END SKY
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START WSW END SSE
AMBIENT TEMP	START 63 END 64
WET BULB TEMP	START 44 END 46
PERCENT HUMIDITY	START 51 END 49



START TIME 12:20 STOP TIME 13:06

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1	0	0	0	0	31	0	0	0	0
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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
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15	0	0	0	0	45	0	0	0	0
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	0	0	0	0	54				
25	0	0	0	0	55				
26	0	0	0	0	56				
27	0	0	0	0	57				
28	0	0	0	0	58				
29	0	0	0	0	59				

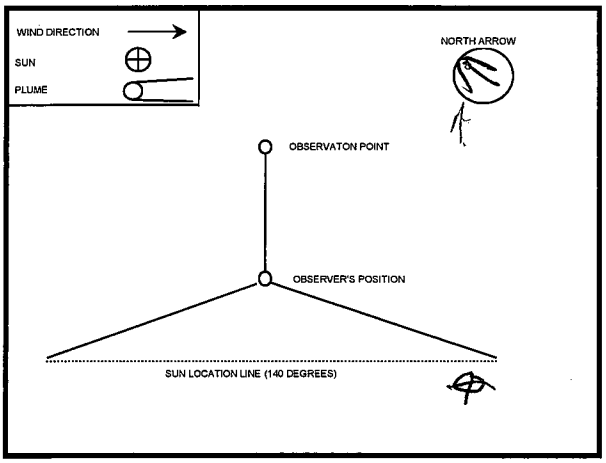
Failure to Follow Procedures 10-11-16

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	Christopher Burkovich DATE 10-11-16
ORGANIZATION	Montrose
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	Boiler Stack
LOCATION	785 DONNER AVE
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Boilers
OPERATING MODE	Normal
CONTROL EQUIPMENT	Boilers
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL START	200
HEIGHT ABOVE GROUND LEVEL END	200
HEIGHT RELATIVE TO OBSERVER START	200
HEIGHT RELATIVE TO OBSERVER END	200
DISTANCE FROM OBSERVER START	~800'
DISTANCE FROM OBSERVER END	~800'
DIRECTION FROM OBSERVER START	E
DIRECTION FROM OBSERVER END	E
VERTICAL ANGLE TO OBSERVATION POINT START	~<30°
VERTICAL ANGLE TO OBSERVATION POINT END	<30°
DIRECTION TO OBSERVATION PT START	W
DIRECTION TO OBSERVATION PT END	W
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET START	~800'
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET END	~800'
DESCRIBE EMISSIONS START	NONE
DECRIBE EMISSIONS END	NONE
EMISSION COLOR START	N/A
EMISSION COLOR END	N/A
IF WATER DROPLET PLUME ATTACHED _ DETACHED	N/A
IF WATER DROPLET PLUME N/A _	
DESCRIBE PLUME BACKGROUND START	Clouds
DESCRIBE PLUME BACKGROUND END	Clouds
SKY CONDITIONS START	SKY
SKY CONDITIONS END	SKY
WIND SPEED START	0-5
WIND SPEED END	0-5
WIND DIRECTION START	SSW
WIND DIRECTION END	WSW
AMBIENT TEMP START	67
AMBIENT TEMP END	68
WET BULB TEMP START	46
WET BULB TEMP END	46
PERCENT HUMIDITY START	46
PERCENT HUMIDITY END	45



START TIME 14:30 STOP TIME 15:30

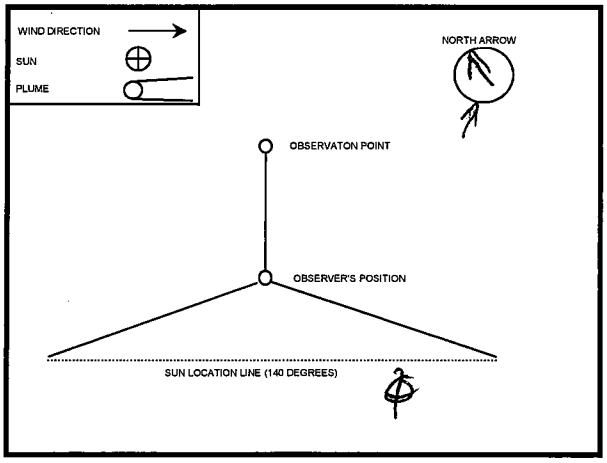
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	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	[signature] DATE 10/11/16
ORGANIZATION	Montrose
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	Boiler stack
LOCATION	785 Donner Ave
CITY / STATE / ZIP	Monessen / PA / 15062
PROCESS EQUIPMENT / OPERATING MODE	Boilers / Normal
CONTROL EQUIPMENT / OPERATING MODE	Boilers / Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START ≈800' END ≈800'
DIRECTION FROM OBSERVER	START E END E
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START W END W
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈800' END ≈800'
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 Overcast END Overcast
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START WSW END SSE
AMBIENT TEMP	START 66 END 66
WET BULB TEMP	START 46 END 45
PERCENT HUMIDITY	START 45 END 46



START TIME 15:30 STOP TIME 16:30

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1	0	0	0	0	31	0	0	0	0
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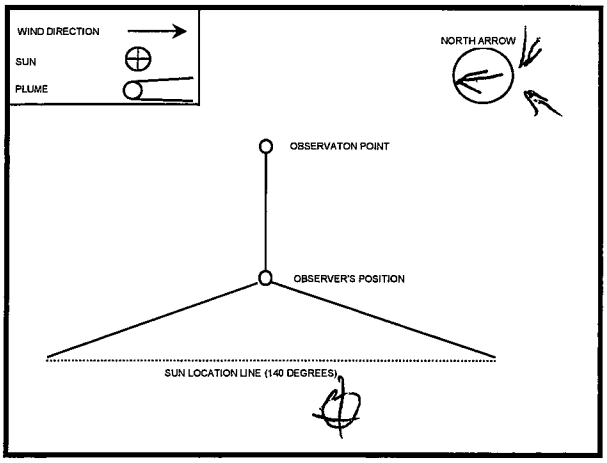
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	0	0	0	0	45	0	0	0	0
16	0	0	0	0	46	0	0	0	0
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	8/10/16
ORGANIZATION	Montrose
CERTIFIED BY / DATE	OpacitAir 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER: 16-167 Run 2		
COMPANY NAME: ArcelorMittal Monessen LLC		
SOURCE: Boiler Stack		
LOCATION: 785 Donner Ave		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Boilers		OPERATING MODE: Normal
CONTROL EQUIPMENT: Boilers		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 200 END 200	HEIGHT RELATIVE TO OBSERVER: START 200 END 200	DISTANCE FROM OBSERVER: START 800 END 800
DIRECTION FROM OBSERVER: START E END E	VERTICAL ANGLE TO OBSERVATION POINT: START 130° END 130°	
DIRECTION TO OBSERVATION PT.: START W END W	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ≈800' END ≈800'	
DESCRIBE EMISSIONS: START NONE		
DECRIBE EMISSIONS: END NONE		
EMISSION COLOR: START N/A END N/A		
IF WATER DROPLET PLUME: ATTACHED _ UNATTACHED N/A N/A_		
DESCRIBE PLUME BACKGROUND: START SKY END SKY		
SKY CONDITIONS: START Overcast END Overcast		
WIND SPEED: START 0-5 END 0-5	WIND DIRECTION: START SSE END SSE	
AMBIENT TEMP: START 66 END 64	WET BULB TEMP: START 45 END 46	PERCENT HUMIDITY: START 46 END 52



START TIME 16:30 STOP TIME 17:30

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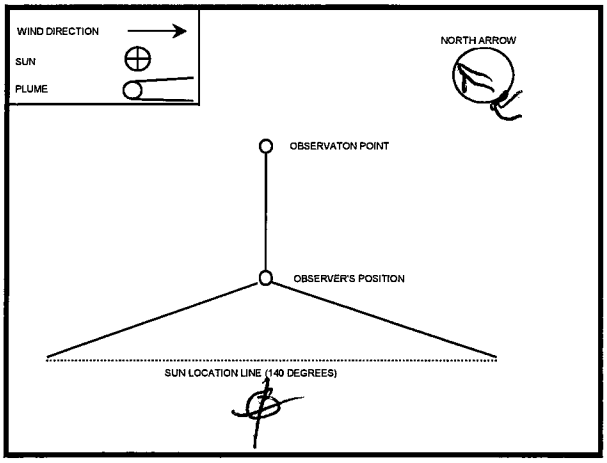
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	0	0	0	0	43	0	0	0	0
14	0	0	0	0	44	0	0	0	0
15	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 10/11/16
ORGANIZATION	Montrose
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: Boiler Stack		
LOCATION: 785 DONWER AVE		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Boilers		OPERATING MODE: Normal
CONTROL EQUIPMENT: Boilers		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 200 END 200	HEIGHT RELATIVE TO OBSERVER: START 200 END 200	DISTANCE FROM OBSERVER: START 800 END 800
DIRECTION FROM OBSERVER: START E END E	VERTICAL ANGLE TO OBSERVATION POINT: START <30° END <30°	
DIRECTION TO OBSERVATION PT.: START W END W	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ≈800' END ≈800'	
DESCRIBE EMISSIONS: START NONE		
DECRIBE EMISSIONS: END NONE		
EMISSION COLOR: START N/A END N/A		
IF WATER DROPLET PLUME: ATTACHED __ DEMONSTRATED N/A N/A__		
DESCRIBE PLUME BACKGROUND: START SKY END SKY		
SKY CONDITIONS: START Overcast END Overcast		
WIND SPEED: START 0-5 END	WIND DIRECTION: START SSE END	
AMBIENT TEMP: START 64 END	WET BULB TEMP: START 46 END	PERCENT HUMIDITY: START 52 END



17:30

START TIME ~~15:30~~ (B) STOP TIME 18:29

	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	—	—	—	—

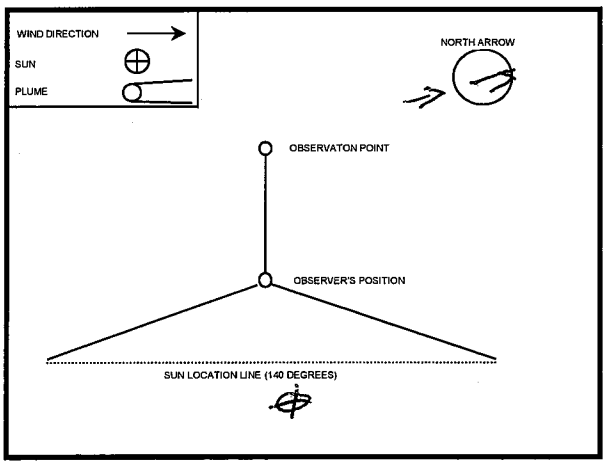
OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	Chris Burkovich DATE 10-11-16
ORGANIZATION	Montrose
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER	16-167 Run 3
COMPANY NAME	ArcelorMittal Monessen LLC
SOURCE	Boiler Stack
LOCATION	880 Donner Ave
CITY	Monessen
STATE	PA
ZIP	15062
PROCESS EQUIPMENT	Boilers
OPERATING MODE	Normal
CONTROL EQUIPMENT	Boilers
OPERATING MODE	Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START 1900 END 1900
DIRECTION FROM OBSERVER	START NW END NW
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START SE END SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈1900' END ≈1900'
DESCRIBE EMISSIONS	START N/A Not visible
DECRIBE EMISSIONS	END NONE
EMISSION COLOR	START NA END NA
IF WATER DROPLET PLUME	ATTACHED __ DETACHED N/A
DESCRIBE PLUME BACKGROUND	START SKY END SKY
SKY CONDITIONS	START Foggy To clear END Mostly Clear
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START S END SSW
AMBIENT TEMP	START 47 END 51
WET BULB TEMP	START 45 END 46
PERCENT HUMIDITY	START 94 END 84

Zero Visibility, Fog conditions



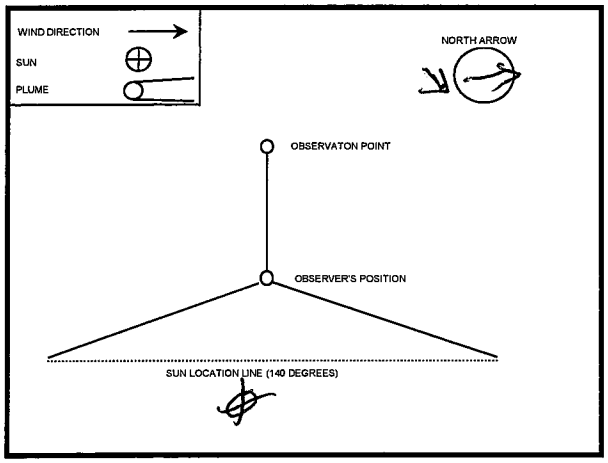
START TIME 7:50					STOP TIME 8:50				
	0	15	30	45		0	15	30	45
0	X	X	X	X	30	0	0	0	0
1	X	X	X	X	31	0	0	0	0
2	X	X	X	X	32	0	0	0	0
3	X	X	X	X	33	0	0	0	0
4	X	X	X	X	34	0	0	0	0
5	X	X	X	X	35	0	0	0	0
6	X	X	X	X	36	0	0	0	0
7	X	X	X	X	37	0	0	0	0
8	X	X	X	X	38	0	0	0	0
9	X	X	X	X	39	0	0	0	0
10	X	X	X	X	40	0	0	0	0
11	X	X	X	X	41	0	0	0	0
12	X	X	X	X	42	0	0	0	0
13	X	X	X	X	43	0	0	0	0
14	X	X	X	X	44	0	0	0	0
15	X	X	X	X	45	0	0	0	0
16	X	X	X	X	46	0	0	0	0
17	X	X	X	X	47	0	0	0	0
18	X	X	X	X	48	0	0	0	0
19	X	X	X	X	49	0	0	0	0
20	X	X	X	X	50	0	0	0	0
21	X	X	X	X	51	0	0	0	0
22	X	X	X	X	52	0	0	0	0
23	X	X	X	X	53	0	0	0	0
24	X	0	0	X	54	0	0	0	0
25	0	X	X	X	55	0	0	0	0
26	X	X	0	X	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 10/12/16
ORGANIZATION	Montrose
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: Boiler Stack		
LOCATION: 880 Dowler Ave		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Boiler		OPERATING MODE: Normal
CONTROL EQUIPMENT: Boiler		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 200 END 200	HEIGHT RELATIVE TO OBSERVER: START 200 END 200	DISTANCE FROM OBSERVER: START 1900 END 1900
DIRECTION FROM OBSERVER: START NW END NW	VERTICAL ANGLE TO OBSERVATION POINT: START <30° END <30°	
DIRECTION TO OBSERVATION PT.: START SE END SE	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ≈ 1900' END ≈ 1900'	
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, some fog	END: Sky	
SKY CONDITIONS START: mostly Clear	END: Clear	
WIND SPEED START: 0-5 END: 0-5	WIND DIRECTION START: SSW END: SSW	
AMBIENT TEMP START: 51 END: 55	WET BULB TEMP START: 46 END: 47	PERCENT HUMIDITY START: 84 END: 75



START TIME 8:50 | STOP TIME 9:50

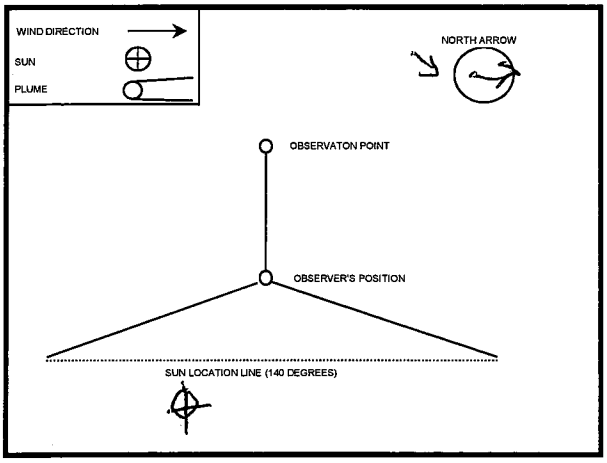
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	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	Christopher Burkovich — DATE 10/12/16
ORGANIZATION	Montrose
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	Boiler Stack
LOCATION	880 Donner Ave
CITY / STATE / ZIP	Monessen / PA / 15062
PROCESS EQUIPMENT / OPERATING MODE	Boiler / Normal
CONTROL EQUIPMENT / OPERATING MODE	Boiler / Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START 1900 END 1900
DIRECTION FROM OBSERVER	START NW END NW
VERTICAL ANGLE TO OBSERVATION POINT	START L30° END L30°
DIRECTION TO OBSERVATION PT.	START SE END SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈ 1900 END ≈ 1900
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 Clear END Clear
WIND SPEED	START 0-5 END 5-10
WIND DIRECTION	START SSW END SSW
AMBIENT TEMP	START 55 END 60
WET BULB TEMP	START 47 END 48
PERCENT HUMIDITY	START 75 END 66



START TIME 9:50 STOP TIME 10:50

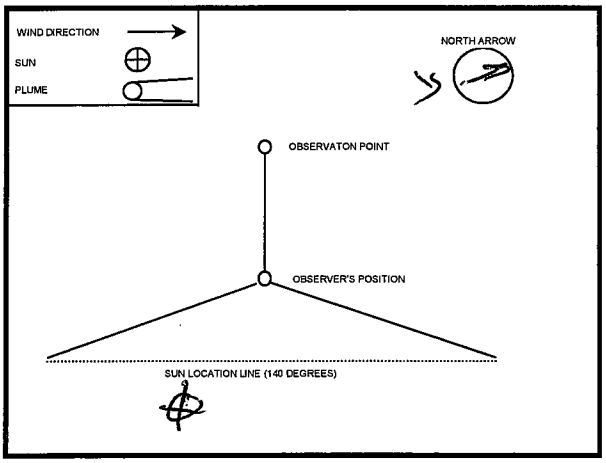
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	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	10/12/16
ORGANIZATION	Montrose
CERTIFIED BY / DATE	OpacitAir / 8/22/2016

MONTROSE ENVIRONMENTAL

VISIBLE EMISSIONS OBSERVATION FORM

PROJECT NUMBER: 16-167 RUN 3		
COMPANY NAME: ArcelorMittal Monessen LLC		
SOURCE: Boiler Stack		
LOCATION: 880 Donner AVE		
CITY: Monessen	STATE: PA	ZIP: 15062
PROCESS EQUIPMENT: Boiler		OPERATING MODE: Normal
CONTROL EQUIPMENT: Boiler		OPERATING MODE: Normal
HEIGHT ABOVE GROUND LEVEL: START 200 END 200	HEIGHT RELATIVE TO OBSERVER: START 200 END 200	DISTANCE FROM OBSERVER: START 1900 END 1900
DIRECTION FROM OBSERVER: START NW END NW	VERTICAL ANGLE TO OBSERVATION POINT: START <30° END <30°	
DIRECTION TO OBSERVATION PT.: START SE END SE	DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET: START ≈1900' END ≈1900'	
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 SKY END SKY		
SKY CONDITIONS: START Clear END Clear		
WIND SPEED: START 5-10 END 0-5	WIND DIRECTION: START SSW END SSW	
AMBIENT TEMP: START 60 END 64	WET BULB TEMP: START 48 END 50	PERCENT HUMIDITY: START 66 END 60



START TIME 10:50 | STOP TIME 11:50

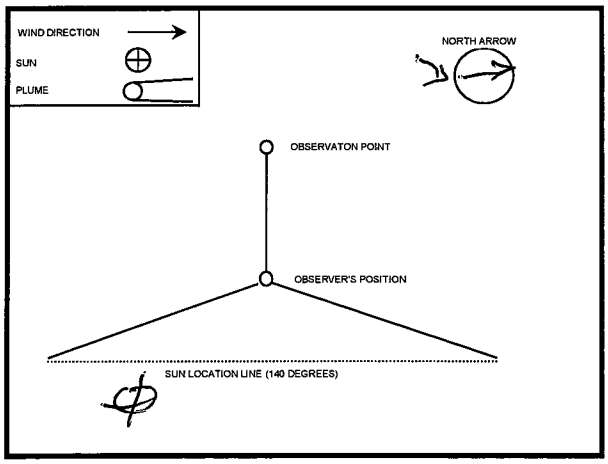
	0	15	30	45		0	15	30	45
0	0	0	0	0	30	0	0	0	0
1	0	0	0	0	31	0	0	0	0
2	0	0	0	0	32	0	0	0	0
3	0	0	0	0	33	0	0	0	0
4	0	0	0	0	34	0	0	0	0
5	0	0	0	0	35	0	0	0	0
6	0	0	0	0	36	0	0	0	0
7	0	0	0	0	37	0	0	0	0
8	0	0	0	0	38	0	0	0	0
9	0	0	0	0	39	0	0	0	0
10	0	0	0	0	40	0	0	0	0
11	0	0	0	0	41	0	0	0	0
12	0	0	0	0	42	0	0	0	0
13	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 10/12/16
ORGANIZATION	Montrose
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	Boiler Stack
LOCATION	880 Donner Ave
CITY / STATE / ZIP	Monessen / PA / 15062
PROCESS EQUIPMENT / OPERATING MODE	Boiler / Normal
CONTROL EQUIPMENT / OPERATING MODE	Boiler / Normal
HEIGHT ABOVE GROUND LEVEL	START 200 END 200
HEIGHT RELATIVE TO OBSERVER	START 200 END 200
DISTANCE FROM OBSERVER	START 1900 END 1900
DIRECTION FROM OBSERVER	START NW END NW
VERTICAL ANGLE TO OBSERVATION POINT	START <30° END <30°
DIRECTION TO OBSERVATION PT.	START SE END SE
DISTANCE OF OBSERVATION POINT FROM EMISSION OUTLET	START ≈1900' END ≈1900'
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 Clear END Clear
WIND SPEED	START 0-5 END 0-5
WIND DIRECTION	START SSW END SSW
AMBIENT TEMP	START 64 END 66
WET BULB TEMP	START 50 END 52
PERCENT HUMIDITY	START 60 END 58



START TIME 11:50 STOP TIME 12:05

	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					45				
16					46				
17					47				
18					48				
19					49				
20					50				
21					51				
22					52				
23					53				
24					54				
25					55				
26					56				
27					57				
28					58				
29					59				

Further Start Time Stop Time

OBSERVER'S NAME	Christopher Burkovich
OBSERVER'S SIGNATURE	Christ Burkovich DATE 10-12-16
ORGANIZATION	Montrose
CERTIFIED BY	OpacitAir DATE 8/22/2016

MONTROSE ENVIRONMENTAL

ArcelorMittal
Report of Emissions Observations

Observer: G.R. BALDINI Date: 10-11-16

Charging Oven	Visible Emissions (sec) 12 sec oven/limit				Time of Observation: Comments		
1 B21	18.5				0955	58	
2 C21	10.5				1011	15	
3 B23	6.5				1024	28	
4 C23	6.0				1037	40	
5 B25	6.0				1050	54	

Total sec
~~[illegible]~~
42.5

Doors Battery 1B B18 D C.S. Time of Observation:
Total Number of Leaks: =1
Total Number of Leaks Allowed = 2 0940 - 0948

Doors Battery 2 C26 D C.S. Time of Observation:
Total Number of Leaks: =1
Total Number of Leaks Allowed = 1 0938 - 0946

Offtakes Battery 1B Time of Observation:
Total Number of Leaks: =0
Total Number of Leaks Allowed = 1 1001 - 1005

Offtakes Battery 2 C20 T.C. C.S. Time of Observation:
Total Number of Leaks: =1
Total Number of Leaks Allowed = 0 1016 - 1018

Lids Battery 1B Time of Observation:
Total Number of Leaks: =0
Total Number of Leaks Allowed = 0

Lids Battery 2 Time of Observation:
Total Number of Leaks: =0
Total Number of Leaks Allowed = 0

J. Baird

ArcelorMittal
Report of Emissions Observations

Observer: G.R. Bacaini

Date: 10-12-16

Charging Oven	Visible Emissions (sec) 12 sec oven/limit				Time of Observation: Comments		
1 C14	5.0				0238	42	
2 B16	6.0				0256	0800	
3 C16	6.5				0810	0814	
4 B18	6.5				0825	0829	
5 C18	5.5				0840	44	

Total 29.5

Doors Battery 1B C08 D C.5

Total Number of Leaks: =1
Total Number of Leaks Allowed = 2

Time of Observation: 0855 - 093

Doors Battery 2

Total Number of Leaks: =0
Total Number of Leaks Allowed = 1

Time of Observation: 0853 - 0900

Offtakes Battery 1B

Total Number of Leaks: =0
Total Number of Leaks Allowed = 1

Time of Observation: 0801 - 0806

Offtakes Battery 2

Total Number of Leaks: =0
Total Number of Leaks Allowed = 0

Time of Observation: 0743 - 0747

Lids Battery 1B

Total Number of Leaks: =0
Total Number of Leaks Allowed = 0

Time of Observation:

Lids Battery 2

Total Number of Leaks: =0
Total Number of Leaks Allowed = 0

Time of Observation:

Methods 0010-23

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 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	2016/10/12	13:15:38	5.62	7.30
2	2016/10/12	13:16:38	6.06	7.12
3	2016/10/12	13:17:38	6.03	7.15
4	2016/10/12	13:18:38	5.87	7.22
5	2016/10/12	13:19:38	5.73	7.27
6	2016/10/12	13:20:38	5.44	7.38
7	2016/10/12	13:21:38	4.97	7.59
8	2016/10/12	13:22:38	4.80	7.67
9	2016/10/12	13:23:38	4.98	7.59
10	2016/10/12	13:24:38	5.11	7.52
11	2016/10/12	13:25:38	5.09	7.54
12	2016/10/12	13:26:38	5.02	7.58
13	2016/10/12	13:27:38	5.18	7.53
14	2016/10/12	13:28:38	6.64	6.88
15	2016/10/12	13:29:38	7.04	6.70
16	2016/10/12	13:30:38	6.04	7.16
17	2016/10/12	13:31:38	5.73	7.31
18	2016/10/12	13:32:38	6.06	7.14
19	2016/10/12	13:33:38	5.75	7.26
20	2016/10/12	13:34:38	5.25	7.48
21	2016/10/12	13:35:38	5.17	7.51
22	2016/10/12	13:36:38	4.99	7.60
23	2016/10/12	13:37:38	5.03	7.58
24	2016/10/12	13:38:38	5.12	7.53
25	2016/10/12	13:39:38	5.07	7.55
26	2016/10/12	13:40:38	5.03	7.58
27	2016/10/12	13:41:38	4.92	7.63
28	2016/10/12	13:42:38	5.04	7.59
29	2016/10/12	13:43:38	5.84	7.26
30	2016/10/12	13:44:38	6.53	6.96
31	2016/10/12	13:45:38	6.50	6.97
32	2016/10/12	13:46:38	6.13	7.13
33	2016/10/12	13:47:38	6.00	7.18
34	2016/10/12	13:48:38	5.41	7.42
35	2016/10/12	13:49:38	4.53	7.82
36	2016/10/12	13:50:38	4.57	7.81
37	2016/10/12	13:51:38	4.99	7.62
38	2016/10/12	13:52:38	5.18	7.53
39	2016/10/12	13:53:38	5.19	7.52
40	2016/10/12	13:54:38	4.99	7.60
41	2016/10/12	13:55:38	4.91	7.63
42	2016/10/12	13:56:38	4.94	7.61
43	2016/10/12	13:57:38	4.99	7.59
44	2016/10/12	13:58:38	5.10	7.55
45	2016/10/12	13:59:38	5.12	7.54
46	2016/10/12	14:00:38	5.06	7.55
47	2016/10/12	14:01:38	5.49	7.39
48	2016/10/12	14:02:38	6.58	6.90
49	2016/10/12	14:03:38	6.53	6.92
50	2016/10/12	14:04:38	5.83	7.24
51	2016/10/12	14:05:38	5.80	7.26
52	2016/10/12	14:06:38	6.00	7.14
53	2016/10/12	14:07:38	5.75	7.26
54	2016/10/12	14:08:38	5.38	7.41
55	2016/10/12	14:09:38	4.94	7.60
56	2016/10/12	14:10:38	4.86	7.64
57	2016/10/12	14:11:38	4.96	7.60
58	2016/10/12	14:12:38	5.15	7.53
59	2016/10/12	14:13:38	5.81	7.26
60	2016/10/12	14:14:38	6.12	7.14
61	2016/10/12	14:15:38	5.91	7.23
62	2016/10/12	14:16:38	6.19	4.76

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/12	14:17:38	Calibrating M320	Calibrating M320
64	2016/10/12	14:18:38	Calibrating M320	Calibrating M320
65	2016/10/12	14:19:38	Calibrating M320	Calibrating M320
66	2016/10/12	14:20:38	Calibrating M320	Calibrating M320
67	2016/10/12	14:21:38	Calibrating M320	Calibrating M320
68	2016/10/12	14:22:38	Calibrating M320	Calibrating M320
69	2016/10/12	14:23:38	Calibrating M320	Calibrating M320
70	2016/10/12	14:24:38	Calibrating M320	Calibrating M320
71	2016/10/12	14:25:38	Calibrating M320	Calibrating M320
72	2016/10/12	14:26:38	Calibrating M320	Calibrating M320
73	2016/10/12	14:27:38	Calibrating M320	Calibrating M320
74	2016/10/12	14:28:38	Calibrating M320	Calibrating M320
75	2016/10/12	14:29:38	Calibrating M320	Calibrating M320
76	2016/10/12	14:30:38	5.85	7.13
77	2016/10/12	14:31:38	5.81	7.16
78	2016/10/12	14:32:38	5.30	7.38
79	2016/10/12	14:33:38	4.83	7.59
80	2016/10/12	14:34:38	4.77	7.61
81	2016/10/12	14:35:38	5.00	7.51
82	2016/10/12	14:36:38	5.22	7.42
83	2016/10/12	14:37:38	5.20	7.42
84	2016/10/12	14:38:38	5.14	7.44
85	2016/10/12	14:39:38	4.96	7.52
86	2016/10/12	14:40:38	4.96	7.54
87	2016/10/12	14:41:38	5.02	7.52
88	2016/10/12	14:42:38	5.64	7.27
89	2016/10/12	14:43:38	6.30	6.99
90	2016/10/12	14:44:38	6.16	7.05
91	2016/10/12	14:45:38	5.87	7.19
92	2016/10/12	14:46:38	5.85	7.18
93	2016/10/12	14:47:38	5.66	7.25
94	2016/10/12	14:48:38	5.16	7.46
95	2016/10/12	14:49:38	4.79	7.63
96	2016/10/12	14:50:38	4.81	7.63
97	2016/10/12	14:51:38	5.04	7.51
98	2016/10/12	14:52:38	5.15	7.46
99	2016/10/12	14:53:38	5.01	7.52
100	2016/10/12	14:54:38	4.92	7.55
101	2016/10/12	14:55:38	5.07	7.49
102	2016/10/12	14:56:38	5.08	7.48
103	2016/10/12	14:57:38	4.98	7.53
104	2016/10/12	14:58:38	5.03	7.50
105	2016/10/12	14:59:38	5.10	7.48
106	2016/10/12	15:00:38	6.47	6.87
107	2016/10/12	15:01:38	6.64	6.80
108	2016/10/12	15:02:38	5.82	7.19
109	2016/10/12	15:03:38	5.74	7.23
110	2016/10/12	15:04:38	6.01	7.09
111	2016/10/12	15:05:38	5.88	7.14
112	2016/10/12	15:06:38	5.27	7.41
113	2016/10/12	15:07:38	4.79	7.62
114	2016/10/12	15:08:38	4.84	7.60
115	2016/10/12	15:09:38	5.02	7.53
116	2016/10/12	15:10:38	5.09	7.50
117	2016/10/12	15:11:38	5.24	7.44
118	2016/10/12	15:12:38	5.22	7.46
119	2016/10/12	15:13:38	5.75	7.24
120	2016/10/12	15:14:38	6.29	7.02
121	2016/10/12	15:15:38	6.16	7.07
122	2016/10/12	15:16:38	5.90	7.18
123	2016/10/12	15:17:38	5.73	7.25
124	2016/10/12	15:18:38	5.24	7.46
125	2016/10/12	15:19:38	4.86	7.63

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/12	15:20:38	4.88	7.62
127	2016/10/12	15:21:38	4.99	7.56
128	2016/10/12	15:22:38	5.16	7.48
129	2016/10/12	15:23:38	5.11	7.49
130	2016/10/12	15:24:38	4.99	7.53
131	2016/10/12	15:25:38	5.00	7.54
132	2016/10/12	15:26:38	5.01	7.53
133	2016/10/12	15:27:38	5.09	7.48
134	2016/10/12	15:28:38	5.15	7.46
135	2016/10/12	15:29:38	5.09	7.48
136	2016/10/12	15:30:38	5.07	7.48
137	2016/10/12	15:31:38	5.05	7.49
138	2016/10/12	15:32:38	5.14	7.45
139	2016/10/12	15:33:38	6.34	6.29
140	2016/10/12	15:34:38	Calibrating M320	Calibrating M320
141	2016/10/12	15:35:38	Calibrating M320	Calibrating M320
142	2016/10/12	15:36:38	Calibrating M320	Calibrating M320
143	2016/10/12	15:37:38	Calibrating M320	Calibrating M320
144	2016/10/12	15:38:38	Calibrating M320	Calibrating M320
145	2016/10/12	15:39:38	Calibrating M320	Calibrating M320
146	2016/10/12	15:40:38	Calibrating M320	Calibrating M320
147	2016/10/12	15:41:38	Calibrating M320	Calibrating M320
148	2016/10/12	15:42:38	Calibrating M320	Calibrating M320
149	2016/10/12	15:43:38	Calibrating M320	Calibrating M320
150	2016/10/12	15:44:38	6.44	6.79
151	2016/10/12	15:45:38	6.88	6.61
152	2016/10/12	15:46:38	6.05	7.00
153	2016/10/12	15:47:38	5.68	7.16
154	2016/10/12	15:48:38	5.84	7.07
155	2016/10/12	15:49:38	5.69	7.12
156	2016/10/12	15:50:38	5.43	7.23
157	2016/10/12	15:51:38	4.98	7.43
158	2016/10/12	15:52:38	4.78	7.52
159	2016/10/12	15:53:38	4.96	7.44
160	2016/10/12	15:54:38	5.07	7.40
161	2016/10/12	15:55:38	5.27	7.32
162	2016/10/12	15:56:38	6.31	6.88
163	2016/10/12	15:57:38	6.60	6.74
164	2016/10/12	15:58:38	6.15	6.94
165	2016/10/12	15:59:38	5.73	7.12
166	2016/10/12	16:00:38	5.29	7.30
167	2016/10/12	16:01:38	4.87	7.49
168	2016/10/12	16:02:38	4.84	7.51
169	2016/10/12	16:03:38	5.18	7.34
170	2016/10/12	16:04:38	5.24	7.30
171	2016/10/12	16:05:38	5.11	7.37
172	2016/10/12	16:06:38	5.12	7.37
173	2016/10/12	16:07:38	6.64	6.71
174	2016/10/12	16:08:38	7.18	6.48
175	2016/10/12	16:09:38	6.18	6.92
176	2016/10/12	16:10:38	5.76	7.11
177	2016/10/12	16:11:38	5.88	7.04
178	2016/10/12	16:12:38	5.76	7.07
179	2016/10/12	16:13:38	4.89	7.44
180	2016/10/12	16:14:38	4.15	7.78
181	2016/10/12	16:15:38	4.45	7.66
182	2016/10/12	16:16:38	5.20	7.33
183	2016/10/12	16:17:38	5.46	7.21
184	2016/10/12	16:18:38	5.40	7.23
185	2016/10/12	16:19:38	5.43	7.25
186	2016/10/12	16:20:38	6.55	6.76
187	2016/10/12	16:21:38	6.69	6.69
188	2016/10/12	16:22:38	5.92	7.05

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
189	2016/10/12	16:23:38	5.69	7.15
190	2016/10/12	16:24:38	5.76	7.11
191	2016/10/12	16:25:38	5.34	7.28
192	2016/10/12	16:26:38	4.88	7.48
193	2016/10/12	16:27:38	4.92	7.46
194	2016/10/12	16:28:38	5.09	7.38
195	2016/10/12	16:29:38	5.22	7.32
196	2016/10/12	16:30:38	5.23	7.32
197	2016/10/12	16:31:38	5.20	7.33
198	2016/10/12	16:32:38	5.25	7.30
199	2016/10/12	16:33:38	6.43	6.82
200	2016/10/12	16:34:38	7.18	6.48
201	2016/10/12	16:35:38	6.47	6.78
202	2016/10/12	16:36:38	5.90	7.03
203	2016/10/12	16:37:38	6.07	6.94
204	2016/10/12	16:38:38	5.81	7.03
205	2016/10/12	16:39:38	4.61	7.54
206	2016/10/12	16:40:38	4.07	7.81
207	2016/10/12	16:41:38	4.67	7.57
208	2016/10/12	16:42:38	5.35	7.28
209	2016/10/12	16:43:38	5.45	7.23
210	2016/10/12	16:44:38	5.32	7.29
211	2016/10/12	16:45:38	5.62	7.18
212	2016/10/12	16:46:38	6.56	6.78
213	2016/10/12	16:47:38	6.61	6.75
214	2016/10/12	16:48:38	6.07	7.00
RUN 1 AVERAGES			**5.47**	**7.29**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 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	2016/10/13	07:35:01	Calibrations	Calibrations
2	2016/10/13	07:36:01	Calibrations	Calibrations
3	2016/10/13	07:37:01	Calibrations	Calibrations
4	2016/10/13	07:38:01	Calibrations	Calibrations
5	2016/10/13	07:39:01	Calibrations	Calibrations
6	2016/10/13	07:40:01	Calibrations	Calibrations
7	2016/10/13	07:41:01	Calibrations	Calibrations
8	2016/10/13	07:42:01	Calibrations	Calibrations
9	2016/10/13	07:43:01	Calibrations	Calibrations
10	2016/10/13	07:44:01	Calibrations	Calibrations
11	2016/10/13	07:45:01	Calibrations	Calibrations
12	2016/10/13	07:46:01	Calibrations	Calibrations
13	2016/10/13	07:47:01	Calibrations	Calibrations
14	2016/10/13	07:48:01	Calibrations	Calibrations
15	2016/10/13	07:49:01	Calibrations	Calibrations
16	2016/10/13	07:50:01	Calibrations	Calibrations
17	2016/10/13	07:51:01	Calibrations	Calibrations
18	2016/10/13	07:52:01	Calibrations	Calibrations
19	2016/10/13	07:53:01	Calibrations	Calibrations
20	2016/10/13	07:54:01	Calibrations	Calibrations
21	2016/10/13	07:55:01	Calibrations	Calibrations
22	2016/10/13	07:56:01	Calibrations	Calibrations
23	2016/10/13	07:57:01	Calibrations	Calibrations
24	2016/10/13	07:58:01	Calibrations	Calibrations
25	2016/10/13	07:59:01	Calibrations	Calibrations
26	2016/10/13	08:00:01	Calibrations	Calibrations
27	2016/10/13	08:01:01	Calibrations	Calibrations
28	2016/10/13	08:02:01	Calibrations	Calibrations
29	2016/10/13	08:03:01	Calibrations	Calibrations
30	2016/10/13	08:04:01	Calibrations	Calibrations
31	2016/10/13	08:05:01	Calibrations	Calibrations
32	2016/10/13	08:06:01	Calibrations	Calibrations
33	2016/10/13	08:07:01	5.47	7.19
34	2016/10/13	08:08:01	5.49	7.20
35	2016/10/13	08:09:01	5.76	7.07
36	2016/10/13	08:10:01	4.99	7.39
37	2016/10/13	08:11:01	4.28	7.69
38	2016/10/13	08:12:01	4.62	7.54
39	2016/10/13	08:13:01	4.82	7.44
40	2016/10/13	08:14:01	5.01	7.36
41	2016/10/13	08:15:01	4.86	7.41
42	2016/10/13	08:16:01	4.61	7.51
43	2016/10/13	08:17:01	4.66	7.49
44	2016/10/13	08:18:01	4.70	7.48
45	2016/10/13	08:19:01	5.00	7.37
46	2016/10/13	08:20:01	7.62	6.22
47	2016/10/13	08:21:01	7.51	6.25
48	2016/10/13	08:22:01	6.90	6.56
49	2016/10/13	08:23:01	5.84	7.03
50	2016/10/13	08:24:01	4.97	7.41
51	2016/10/13	08:25:01	5.40	7.21
52	2016/10/13	08:26:01	5.90	6.97
53	2016/10/13	08:27:01	5.79	7.00
54	2016/10/13	08:28:01	4.52	7.54
55	2016/10/13	08:29:01	3.99	7.79
56	2016/10/13	08:30:01	4.61	7.52
57	2016/10/13	08:31:01	5.53	7.12
58	2016/10/13	08:32:01	5.71	7.03
59	2016/10/13	08:33:01	5.34	7.18
60	2016/10/13	08:34:01	5.11	7.28

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
61	2016/10/13	08:35:01	5.16	7.26
62	2016/10/13	08:36:01	5.27	7.21
63	2016/10/13	08:37:01	5.47	7.13
64	2016/10/13	08:38:01	6.87	6.53
65	2016/10/13	08:39:01	6.30	6.79
66	2016/10/13	08:40:01	5.45	7.17
67	2016/10/13	08:41:01	5.56	7.14
68	2016/10/13	08:42:01	5.62	7.11
69	2016/10/13	08:43:01	5.41	7.18
70	2016/10/13	08:44:01	4.71	7.47
71	2016/10/13	08:45:01	4.63	7.49
72	2016/10/13	08:46:01	4.90	7.38
73	2016/10/13	08:47:01	5.17	7.25
74	2016/10/13	08:48:01	5.14	7.26
75	2016/10/13	08:49:01	5.24	7.20
76	2016/10/13	08:50:01	4.99	7.31
77	2016/10/13	08:51:01	5.18	7.23
78	2016/10/13	08:52:01	5.06	7.29
79	2016/10/13	08:53:01	5.06	7.27
80	2016/10/13	08:54:01	5.07	7.27
81	2016/10/13	08:55:01	5.04	7.28
82	2016/10/13	08:56:01	5.10	7.25
83	2016/10/13	08:57:01	5.24	7.20
84	2016/10/13	08:58:01	5.26	7.17
85	2016/10/13	08:59:01	5.46	7.09
86	2016/10/13	09:00:01	5.33	7.16
87	2016/10/13	09:01:01	6.08	6.87
88	2016/10/13	09:02:01	7.88	6.03
89	2016/10/13	09:03:01	6.90	6.48
90	2016/10/13	09:04:01	5.75	7.01
91	2016/10/13	09:24:01	6.01	6.92
92	2016/10/13	09:25:01	5.93	6.94
93	2016/10/13	09:26:01	5.69	7.06
94	2016/10/13	09:27:01	5.76	7.01
95	2016/10/13	09:28:01	5.73	7.04
96	2016/10/13	09:29:01	5.65	7.06
97	2016/10/13	09:30:01	5.75	7.02
98	2016/10/13	09:31:01	5.44	7.16
99	2016/10/13	09:32:01	5.85	7.02
100	2016/10/13	09:33:01	7.63	6.22
101	2016/10/13	09:34:01	6.72	6.63
102	2016/10/13	09:35:01	5.77	7.06
103	2016/10/13	09:36:01	5.81	7.03
104	2016/10/13	09:37:01	5.78	7.02
105	2016/10/13	09:38:01	4.90	7.40
106	2016/10/13	09:39:01	4.49	7.58
107	2016/10/13	09:40:01	4.83	7.43
108	2016/10/13	09:41:01	5.11	7.30
109	2016/10/13	09:42:01	5.10	7.31
110	2016/10/13	09:43:01	5.00	7.35
111	2016/10/13	09:44:01	4.89	7.38
112	2016/10/13	09:45:01	4.86	7.40
113	2016/10/13	09:46:01	4.86	7.40
114	2016/10/13	09:47:01	4.96	7.35
115	2016/10/13	09:48:01	4.97	7.34
116	2016/10/13	09:49:01	4.86	7.39
117	2016/10/13	09:50:01	5.03	7.31
118	2016/10/13	09:51:01	4.85	7.39
119	2016/10/13	09:52:01	5.11	7.27
120	2016/10/13	09:53:01	4.96	7.34
121	2016/10/13	09:54:01	4.86	7.38
122	2016/10/13	09:55:01	4.84	7.39
123	2016/10/13	09:56:01	4.86	7.38

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
124	2016/10/13	09:57:01	4.95	7.34
125	2016/10/13	09:58:01	5.06	7.29
126	2016/10/13	09:59:01	5.01	7.31
127	2016/10/13	10:00:01	4.86	7.37
128	2016/10/13	10:01:01	5.06	7.29
129	2016/10/13	10:02:01	5.11	7.27
130	2016/10/13	10:03:01	5.02	7.30
131	2016/10/13	10:04:01	4.98	7.32
132	2016/10/13	10:05:01	4.92	7.34
133	2016/10/13	10:06:01	5.18	7.23
134	2016/10/13	10:07:01	4.95	7.33
135	2016/10/13	10:08:01	5.10	7.26
136	2016/10/13	10:09:01	5.00	7.31
137	2016/10/13	10:10:01	4.99	7.31
138	2016/10/13	10:11:01	5.22	7.21
139	2016/10/13	10:12:01	5.07	7.27
140	2016/10/13	10:13:01	4.93	7.33
141	2016/10/13	10:14:01	4.94	7.33
142	2016/10/13	10:15:01	5.01	7.30
143	2016/10/13	10:16:01	5.13	7.25
144	2016/10/13	10:17:01	5.04	7.28
145	2016/10/13	10:18:01	4.95	7.30
146	2016/10/13	10:19:01	Calibrations	Calibrations
147	2016/10/13	10:20:01	Calibrations	Calibrations
148	2016/10/13	10:21:01	Calibrations	Calibrations
149	2016/10/13	10:22:01	Calibrations	Calibrations
150	2016/10/13	10:23:01	Calibrations	Calibrations
151	2016/10/13	10:24:01	Calibrations	Calibrations
152	2016/10/13	10:25:01	Calibrations	Calibrations
153	2016/10/13	10:26:01	Calibrations	Calibrations
154	2016/10/13	10:27:01	Calibrations	Calibrations
155	2016/10/13	10:28:01	Calibrations	Calibrations
156	2016/10/13	10:29:01	Calibrations	Calibrations
157	2016/10/13	10:30:01	Calibrations	Calibrations
158	2016/10/13	10:31:01	Calibrations	Calibrations
159	2016/10/13	10:32:01	Calibrations	Calibrations
160	2016/10/13	10:33:01	4.89	7.34
161	2016/10/13	10:34:01	4.97	7.34
162	2016/10/13	10:35:01	5.05	7.31
163	2016/10/13	10:36:01	4.90	7.39
164	2016/10/13	10:37:01	4.83	7.42
165	2016/10/13	10:38:01	4.86	7.43
166	2016/10/13	10:39:01	6.24	6.86
167	2016/10/13	10:40:01	6.83	6.60
168	2016/10/13	10:41:01	6.16	6.89
169	2016/10/13	10:42:01	5.71	7.09
170	2016/10/13	10:43:01	5.68	7.09
171	2016/10/13	10:44:01	5.57	7.14
172	2016/10/13	10:45:01	5.19	7.28
173	2016/10/13	10:46:01	4.82	7.46
174	2016/10/13	10:47:01	4.79	7.46
175	2016/10/13	10:48:01	5.03	7.38
176	2016/10/13	10:49:01	4.82	7.46
177	2016/10/13	10:50:01	4.82	7.46
178	2016/10/13	10:51:01	4.80	7.47
179	2016/10/13	10:52:01	4.95	7.41
180	2016/10/13	10:53:01	4.79	7.48
RUN 2 AVERAGES			**5.30**	**7.21**

Montrose 1 Minute Average Data Sheet			
Client:	ArcelorMittal	**Unit:**	Boilers 1 and 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	2016/10/13	11:35:01	Calibrations	Calibrations
2	2016/10/13	11:36:01	Calibrations	Calibrations
3	2016/10/13	11:37:01	Calibrations	Calibrations
4	2016/10/13	11:38:01	Calibrations	Calibrations
5	2016/10/13	11:39:01	Calibrations	Calibrations
6	2016/10/13	11:40:01	Calibrations	Calibrations
7	2016/10/13	11:41:01	Calibrations	Calibrations
8	2016/10/13	11:42:01	Calibrations	Calibrations
9	2016/10/13	11:43:01	Calibrations	Calibrations
10	2016/10/13	11:44:01	4.44	7.67
11	2016/10/13	11:45:01	4.83	7.55
12	2016/10/13	11:46:01	5.15	7.42
13	2016/10/13	11:47:01	4.97	7.51
14	2016/10/13	11:48:01	5.39	7.35
15	2016/10/13	11:49:01	6.83	6.73
16	2016/10/13	11:50:01	6.41	6.90
17	2016/10/13	11:51:01	5.87	7.12
18	2016/10/13	11:52:01	5.57	7.23
19	2016/10/13	11:53:01	4.65	7.63
20	2016/10/13	11:54:01	4.47	7.69
21	2016/10/13	11:55:01	4.70	7.59
22	2016/10/13	11:56:01	5.07	7.43
23	2016/10/13	11:57:01	5.13	7.40
24	2016/10/13	11:58:01	5.11	7.42
25	2016/10/13	11:59:01	6.76	6.74
26	2016/10/13	12:00:01	7.36	6.42
27	2016/10/13	12:01:01	6.27	6.92
28	2016/10/13	12:02:01	5.26	7.38
29	2016/10/13	12:03:01	5.14	7.44
30	2016/10/13	12:04:01	5.69	7.17
31	2016/10/13	12:05:01	5.28	7.33
32	2016/10/13	12:06:01	4.63	7.62
33	2016/10/13	12:07:01	4.61	7.64
34	2016/10/13	12:08:01	5.07	7.45
35	2016/10/13	12:09:01	6.46	6.87
36	2016/10/13	12:10:01	6.77	6.72
37	2016/10/13	12:11:01	6.14	7.00
38	2016/10/13	12:12:01	5.84	7.12
39	2016/10/13	12:13:01	5.30	7.35
40	2016/10/13	12:14:01	4.41	7.74
41	2016/10/13	12:15:01	4.43	7.73
42	2016/10/13	12:16:01	4.97	7.50
43	2016/10/13	12:17:01	4.96	7.49
44	2016/10/13	12:18:01	4.90	7.52
45	2016/10/13	12:19:01	4.92	7.50
46	2016/10/13	12:20:01	4.72	7.59
47	2016/10/13	12:21:01	4.72	7.59
48	2016/10/13	12:22:01	4.74	7.59
49	2016/10/13	12:23:01	5.04	7.45
50	2016/10/13	12:24:01	4.90	7.50
51	2016/10/13	12:25:01	4.71	7.60
52	2016/10/13	12:26:01	4.95	7.49
53	2016/10/13	12:27:01	5.00	7.46
54	2016/10/13	12:28:01	4.82	7.54
55	2016/10/13	12:29:01	4.89	7.51
56	2016/10/13	12:30:01	4.77	7.56
57	2016/10/13	12:31:01	4.81	7.54
58	2016/10/13	12:32:01	4.81	7.53
59	2016/10/13	12:33:01	4.93	7.49
60	2016/10/13	12:34:01	4.87	7.51
61	2016/10/13	12:35:01	4.96	7.47
62	2016/10/13	12:36:01	4.86	7.52

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/13	12:37:01	4.92	7.48
64	2016/10/13	12:38:01	4.94	7.48
65	2016/10/13	12:39:01	4.92	7.49
66	2016/10/13	12:40:01	4.98	7.45
67	2016/10/13	12:41:01	4.77	7.55
68	2016/10/13	12:42:01	4.95	7.47
69	2016/10/13	12:43:01	4.94	7.48
70	2016/10/13	12:44:01	4.96	7.46
71	2016/10/13	12:45:01	3.81	5.78
72	2016/10/13	12:46:01	0.08	0.21
73	2016/10/13	12:47:01	0.09	0.20
74	2016/10/13	12:48:01	9.01	8.61
75	2016/10/13	12:49:01	10.01	10.06
76	2016/10/13	12:50:01	3.28	3.60
77	2016/10/13	12:51:01	0.09	0.20
78	2016/10/13	12:52:01	0.13	0.18
79	2016/10/13	12:53:01	0.21	0.25
80	2016/10/13	12:54:01	3.38	4.90
81	2016/10/13	12:55:01	4.91	7.44
82	2016/10/13	12:56:01	4.85	7.49
83	2016/10/13	12:57:01	5.02	7.41
84	2016/10/13	12:58:01	5.07	7.40
85	2016/10/13	12:59:01	4.97	7.44
86	2016/10/13	13:00:01	4.92	7.45
87	2016/10/13	13:01:01	5.06	7.40
88	2016/10/13	13:02:01	4.96	7.44
89	2016/10/13	13:03:01	4.98	7.44
90	2016/10/13	13:04:01	5.04	7.40
91	2016/10/13	13:15:01	5.85	7.12
92	2016/10/13	13:16:01	5.59	7.24
93	2016/10/13	13:17:01	5.34	7.33
94	2016/10/13	13:18:01	4.81	7.56
95	2016/10/13	13:19:01	4.92	7.50
96	2016/10/13	13:20:01	4.92	7.51
97	2016/10/13	13:21:01	5.04	7.46
98	2016/10/13	13:22:01	5.08	7.45
99	2016/10/13	13:23:01	6.63	6.81
100	2016/10/13	13:24:01	6.76	6.74
101	2016/10/13	13:25:01	6.32	6.93
102	2016/10/13	13:26:01	5.84	7.13
103	2016/10/13	13:27:01	5.19	7.40
104	2016/10/13	13:28:01	4.40	7.76
105	2016/10/13	13:29:01	4.46	7.74
106	2016/10/13	13:30:01	4.94	7.54
107	2016/10/13	13:31:01	5.18	7.43
108	2016/10/13	13:32:01	5.28	7.39
109	2016/10/13	13:33:01	7.14	6.61
110	2016/10/13	13:34:01	6.83	6.73
111	2016/10/13	13:35:01	5.77	7.21
112	2016/10/13	13:36:01	5.81	7.17
113	2016/10/13	13:37:01	4.92	7.54
114	2016/10/13	13:38:01	4.11	7.91
115	2016/10/13	13:39:01	4.62	7.68
116	2016/10/13	13:40:01	5.09	7.48
117	2016/10/13	13:41:01	5.14	7.46
118	2016/10/13	13:42:01	5.04	7.50
119	2016/10/13	13:43:01	6.24	7.01
120	2016/10/13	13:44:01	6.56	6.87
121	2016/10/13	13:45:01	6.21	7.01
122	2016/10/13	13:46:01	5.81	7.17
123	2016/10/13	13:47:01	5.27	7.39
124	2016/10/13	13:48:01	4.48	7.74
125	2016/10/13	13:49:01	4.54	7.72

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/13	13:50:01	4.99	7.53
127	2016/10/13	13:51:01	5.15	7.46
128	2016/10/13	13:52:01	5.39	7.39
129	2016/10/13	13:53:01	7.48	6.44
130	2016/10/13	13:54:01	6.36	6.95
131	2016/10/13	13:55:01	5.35	7.41
132	2016/10/13	13:56:01	5.53	7.31
133	2016/10/13	13:57:01	4.91	7.56
134	2016/10/13	13:58:01	4.42	7.79
135	2016/10/13	13:59:01	4.81	7.61
136	2016/10/13	14:00:01	4.92	7.56
137	2016/10/13	14:01:01	5.09	7.48
138	2016/10/13	14:02:01	5.06	7.51
139	2016/10/13	14:03:01	5.96	7.16
140	2016/10/13	14:04:01	7.02	6.67
141	2016/10/13	14:05:01	6.23	7.02
142	2016/10/13	14:06:01	5.72	7.23
143	2016/10/13	14:07:01	5.51	7.31
144	2016/10/13	14:08:01	4.84	7.60
145	2016/10/13	14:09:01	4.46	7.76
146	2016/10/13	14:10:01	4.78	7.62
147	2016/10/13	14:11:01	5.14	7.47
148	2016/10/13	14:12:01	4.99	7.52
149	2016/10/13	14:13:01	4.97	7.55
150	2016/10/13	14:14:01	6.66	6.84
151	2016/10/13	14:15:01	6.25	7.02
152	2016/10/13	14:16:01	5.67	7.29
153	2016/10/13	14:17:01	5.42	7.38
154	2016/10/13	14:18:01	5.02	7.54
155	2016/10/13	14:19:01	4.61	7.72
156	2016/10/13	14:20:01	4.74	7.67
157	2016/10/13	14:21:01	4.91	7.59
158	2016/10/13	14:22:01	4.97	7.57
159	2016/10/13	14:23:01	5.15	7.49
160	2016/10/13	14:24:01	5.56	7.36
161	2016/10/13	14:25:01	6.67	6.85
162	2016/10/13	14:26:01	5.97	7.16
163	2016/10/13	14:27:01	5.59	7.32
164	2016/10/13	14:28:01	5.39	7.38
165	2016/10/13	14:29:01	4.77	7.65
166	2016/10/13	14:30:01	4.40	7.81
167	2016/10/13	14:31:01	4.91	7.60
168	2016/10/13	14:32:01	5.10	7.51
169	2016/10/13	14:33:01	5.76	7.27
170	2016/10/13	14:34:01	7.06	6.68
171	2016/10/13	14:35:01	6.09	7.11
172	2016/10/13	14:36:01	5.63	7.32
173	2016/10/13	14:37:01	5.35	7.42
174	2016/10/13	14:38:01	4.36	7.85
175	2016/10/13	14:39:01	4.44	7.82
176	2016/10/13	14:40:01	4.94	7.60
177	2016/10/13	14:41:01	5.12	7.51
178	2016/10/13	14:42:01	4.92	7.59
179	2016/10/13	14:43:01	4.82	7.62
180	2016/10/13	14:44:01	4.76	7.64
RUN 3 AVERAGES			**5.14**	**7.15**

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

Client	ArcelorMittal	**Date**	October 12, 2016
Project No	16-167	**Location**	Combined Exhaust
Plant	Monessen, PA	**Run**	Run 1
Unit	Boilers 1 and 2	**Start Time**	13:15
Operation	Normal	**End Time**	16:58
Tester(s)	JV, JW, TL, TM		

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	CC210754	XC034406B	40	40
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	40	40
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		0.09	0.12	0.15	0.13	0.20	0.05	20.03	0.125			
	Mid	10.01	10.14	10.08	-0.30	10.03	-0.55	-0.25	20.03	10.055	5.47	5.39	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.18	0.40	0.00	19.79	0.18			
	Mid	10.15	10.17	10.06	-0.56	10.01	-0.81	-0.25	19.79	10.035	7.29	7.33	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		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	**Date**	October 13, 2016
Project No	16-167	**Location**	Baghouse Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Boilers 1 and 2	**Start Time**	7:35
Operation	Normal	**End Time**	10:54
Tester(s)	JV, JW, TL, 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	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	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		0.09	0.13	0.20	0.12	0.15	-0.05	20.03	0.125			
	Mid	10.01	10.14	10.03	-0.55	10.00	-0.70	-0.15	20.03	10.015	5.30	5.24	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.11	0.05	-0.35	19.79	0.145			
	Mid	10.15	10.17	10.01	-0.81	9.96	-1.06	-0.25	19.79	9.985	7.21	7.29	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		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	**Date**	Test Date:
Project No	16-167	**Location**	Test Location:
Plant	Monessen, PA	**Run**	Test Run:
Unit	Boilers 1 and 2	**Start Time**	Test Start Time:
Operation	Normal	**End Time**	Test Finish Time:
Tester(s)	JV, JW, TL, 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	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B
LIMITS				40 % to 60 %		100%					

				Initial Values		Final Values				Average of			
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	Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
O2	Zero		0.09	0.12	0.15	0.11	0.10	-0.05	20.03	0.12			
	Mid	10.01	10.14	10.00	-0.70	9.98	-0.80	-0.10	20.03	9.99	5.14	5.10	d. vol. %
CO2	Zero		0.10	0.11	0.05	0.13	0.15	0.10	19.79	0.12			
	Mid	10.15	10.17	9.96	-1.06	9.97	-1.01	0.05	19.79	9.97	7.15	7.25	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal	Test Date:	October 12, 2016
Project No.:	16-167	Test Location:	Combined Exhaust
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Boilers 1 and 2	Test Start Time:	1:15 PM
Unit Operation:	Normal	Test Finish Time:	4:58 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:	1614	
Meter $DH_{@}$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.27	in. Hg
Stack Static Pressure (Pg)	-0.37	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	NA	inches
Nozzle Diameter (Dn)	0.395	inches
O2	5.39	% dv
CO2	7.33	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	PCDD/PCDF 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)	455.5	F
Orifice Pressure Drop (dHavg)	2.540	in. H_2O
Gas velocity Head (dP) ^avg	0.4890	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	87.28	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	696.3	g
Water Vapor in Silica Gel (Vwsg(std))	32.831	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	32.831	scf
Volume Dry Gas Metered (Vm)	155.578	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	147.096	dscf
Volume Dry Gas Metered (Vm(m^3))	4.405	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.165	dscm
Stack Absolute Pressure (Ps)	29.24	in. Hg
Stack Absolute Temperature (Tsavg)	915.2	R
H2O Vapor Pressure @ avg Stack Temp.	909.55	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1825	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1825	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.39	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.31	lb/lb-mole
Gas Velocity (Vs)	37.60	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft²
Actual Gas Flowrate	55,229	acfm
Standard Gas Flowrate	31,130	scfm
Dry Standard Gas Flowrate	25,450	dscfm
Dry Standard Exhaust Gas Flowrate	116.5	1000 lb/hr
Actual Gas Flowrate	1,564	acm/min
Standard Gas Flowrate	882	scm/min
Dry Standard Gas Flowrate	721	dscm/min
Area Nozzle (An)	0.000851	ft^2
Percent of Isokinetic Sampling (I)	92.44	%

Dioxin Furan

	Analyte		TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
1	2378-TCDD	<	1	3.4	0.0034	0.0034
2	12378-PeCDD	<	0.5	3.2	0.0032	0.0016
3	123478-HxCDD	<	0.1	3.4	0.0034	0.00034
4	123678-HxCDD	<	0.1	3.5	0.0035	0.00035
5	123789-HxCDD	<	0.1	3.2	0.0032	0.00032
6	1234678-HpCDD		0.01	5.9	0.0059	0.000059
1	2378-TCDF (DB 225)		0.1	30	0.0300	0.003
2	12378-PeCDF	<	0.05	10	0.0100	0.0005
3	23478-PeCDF		0.5	11.3	0.0113	0.00565
4	123478-HxCDF		0.1	13.8	0.0138	0.00138
5	123678-HxCDF		0.1	6.1	0.0061	0.00061
6	234678-HxCDF		0.1	4.5	0.0045	0.00045
7	123789-HxCDF	<	0.1	3.3	0.0033	0.00033
8	1234678-HpCDF		0.01	16.4	0.0164	0.000164
9	1234789-HpCDF	<	0.01	3.6	0.0036	0.000036
					TEF ADJUSTED TOTAL	0.018

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

TEF Total Mass Collected	<	0.018	ng
TEF Emission Concentration	<	0.0044	ng/m^3
TEF Emission Rate	<	189	ng/hr
Emission Rate	<	2.91E-06	gr/hr
Emission Rate	<	4.2E-10	lb/hr

ArcelorMittal **Run 1** **F or C?**
Boilers 1 and 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	0.24	0.490	2.6	456	82	80
A-1	0.24	0.490	2.6	453	82	80
A-1	0.24	0.490	2.6	453	82	80
A-2	0.24	0.490	2.6	458	85	80
A-2	0.24	0.490	2.6	458	86	81
A-2	0.24	0.490	2.6	458	86	81
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-9	0.21	0.458	2.3	457	91	86
A-9	0.21	0.458	2.3	462	91	86
A-9	0.21	0.458	2.3	460	91	86
A-10	0.23	0.480	2.5	444	95	87
A-10	0.23	0.480	2.5	446	95	87
A-10	0.23	0.480	2.5	442	95	87
A-11	0.20	0.447	2.2	436	97	87
A-11	0.20	0.447	2.2	437	97	87
A-11	0.20	0.447	2.2	438	97	87
A-12	0.26	0.510	2.9	448	99	90
A-12	0.26	0.510	2.9	446	99	90
A-12	0.26	0.510	2.9	447	99	90
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	432	101	96
B-2	0.22	0.469	2.4	433	100	96
B-2	0.22	0.469	2.4	432	100	96
B-2	0.22	0.469	2.4	433	100	96
B-3	0.23	0.480	2.5	462	100	97
B-3	0.23	0.480	2.5	458	100	97
B-3	0.23	0.480	2.5	460	100	97
B-4	0.18	0.424	2.0	458	99	96
B-4	0.18	0.424	2.0	461	99	96
B-4	0.23	0.480	2.5	461	99	95
B-5	0.23	0.480	2.5	463	99	95
B-5	0.23	0.480	2.5	460	99	95
B-5	0.23	0.480	2.5	458	99	95
B-6	0.23	0.480	2.5	460	98	94
B-6	0.23	0.480	2.5	460	97	94
B-6	0.23	0.480	2.5	462	97	94
B-7	0.25	0.500	2.8	460	97	93
B-7	0.25	0.500	2.8	463	97	93
B-7	0.25	0.500	2.8	460	97	93
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	464	96	92
B-9	0.25	0.500	2.8	459	95	91
B-9	0.25	0.500	2.8	460	95	91
B-9	0.25	0.500	2.8	460	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	464	94	90
B-11	0.26	0.510	2.4	454	93	90
B-11	0.26	0.510	2.4	452	93	91
B-11	0.26	0.510	2.4	452	93	91
B-12	0.26	0.510	2.4	457	93	89
B-12	0.26	0.510	2.4	456	93	90
B-12	0.26	0.510	2.4	453	93	90
Average	0.24	0.489	2.54	455.5		91.2

Client:	ArcelorMittal	Test Date:	October 12, 2016
Project No.:	16-167	Test Location:	Combined Exhaust
Plant:	Monessen, PA	Test Run:	Run 1
Unit:	Boilers 1 and 2	Test Start Time:	1:15 PM
Unit Operation:	Normal	Test Finish Time:	4:58 PM

Initial volume	83.100	ft³
Final volume	238.678	ft³
Total metered	155.578	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	1007.9	347.8	660.1			0.0
2	668.4	674.9	-6.5			0.0
3	699.5	696.5	3.0			0.0
4	619.3	613.7	5.6			0.0
5	896.0	861.9	34.1			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	3891.1	3194.8	696.3	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	<	3.4	0.0000034	0.0000034	8.2E-07	7.8E-11	8.2E-07	7.8E-11
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	3.2	0.0000032	0.0000016	7.7E-07	7.3E-11	3.8E-07	3.7E-11
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.4	0.0000034	0.00000034	8.2E-07	7.8E-11	8.2E-08	7.8E-12
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	<	3.5	0.0000035	0.00000035	8.4E-07	8.0E-11	8.4E-08	8.0E-12
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	<	3.2	0.0000032	0.00000032	7.7E-07	7.3E-11	7.7E-08	7.3E-12
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		5.9	0.0000059	0.000000059	1.4E-06	1.4E-10	1.4E-08	1.4E-12
2,3,7,8-Tetrachlorodibenzofuran		30	0.00003	0.000003	7.2E-06	6.9E-10	7.2E-07	6.9E-11
1,2,3,7,8-Pentachlorodibenzofuran	<	10	0.00001	0.0000005	2.4E-06	2.3E-10	1.2E-07	1.1E-11
2,3,4,7,8-Pentachlorodibenzofuran		11.3	0.0000113	0.00000565	2.7E-06	2.6E-10	1.4E-06	1.3E-10
1,2,3,4,7,8-Hexachlorodibenzofuran		13.8	0.0000138	0.00000138	3.3E-06	3.2E-10	3.3E-07	3.2E-11
1,2,3,6,7,8-Hexachlorodibenzofuran		6.1	0.0000061	0.00000061	1.5E-06	1.4E-10	1.5E-07	1.4E-11
2,3,4,6,7,8-Hexachlorodibenzofuran		4.5	0.0000045	0.00000045	1.1E-06	1.0E-10	1.1E-07	1.0E-11
1,2,3,7,8,9-Hexachlorodibenzofuran	<	3.3	0.0000033	0.00000033	7.9E-07	7.6E-11	7.9E-08	7.6E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran		16.4	0.0000164	0.000000164	3.9E-06	3.8E-10	3.9E-08	3.8E-12
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.6	0.0000036	0.000000036	8.6E-07	8.2E-11	8.6E-09	8.2E-13

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene	<	20	0.0048	4.6E-04
Acenaphthylene	<	20	0.0048	4.6E-04
Anthracene	<	20	0.0048	4.6E-04
Benz[a]anthracene	<	20	0.0048	4.6E-04
Benzo[a]pyrene	<	2	0.0005	4.6E-05
Benzo[b]fluoranthene	<	1	0.0002	2.3E-05
Benzo[g,h,i]perylene	<	20	0.0048	4.6E-04
Benzo[k]fluoranthene	<	2	0.0005	4.6E-05
Chrysene	<	20	0.0048	4.6E-04
Dibenz[a,h]anthracene	<	1	0.0002	2.3E-05
Fluoranthene	<	20	0.0048	4.6E-04
Fluorene	<	20	0.0048	4.6E-04
Indeno (1,2,3-cd) pyrene	<	2	0.0005	4.6E-05
Naphthalene	<	20	0.0048	4.6E-04
Phenanthrene	<	20	0.0048	4.6E-04
Perylene	<	5	0.0012	1.1E-04
Pyrene	<	20	0.0048	4.6E-04

Client:	ArcelorMittal	Test Date:	October 13, 2016
Project No.:	16-167	Test Location:	Baghouse Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Boilers 1 and 2	Test Start Time:	7:35 AM
Unit Operation:	Normal	Test Finish Time:	10:54 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:	1614	
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.06	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	NA	inches
Nozzle Diameter (Dn)	0.395	inches
O2	5.24	% dv
CO2	7.29	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	PCDD/PCDF 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)	74.3	F
Stack Temperature (Tsavg)	458.6	F
Orifice Pressure Drop (dHavg)	2.729	in. H_2O
Gas Velocity Head (dP)avg	0.4972	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	87.47	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	786.3	g
Water Vapor in Silica Gel (Vwsg(std))	37.074	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	37.074	scf
Volume Dry Gas Metered (Vm)	163.169	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	158.092	dscf
Volume Dry Gas Metered ($Vm(m^3)$)	4.620	dacm
Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.477	dscm
Stack Absolute Pressure (Ps)	29.03	in. Hg
Stack Absolute Temperature (Tsavg)	918.3	R
H2O Vapor Pressure @ avg Stack Temp.	937.44	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1900	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1900	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.38	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.21	lb/lb-mole
Gas Velocity (Vs)	38.50	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	56,553	acfm
Standard Gas Flowrate	31,542	scfm
Dry Standard Gas Flowrate	25,550	dscfm
Dry Standard Exhaust Gas Flowrate	116.9	1000 lb/hr
Actual Gas Flowrate	1,601	acm/min
Standard Gas Flowrate	893	scm/min
Dry Standard Gas Flowrate	724	dscm/min
Area Nozzle (An)	0.000851	ft^2
Percent of Isokinetic Sampling (I)	98.96	%

Dioxin Furan

Analyte		TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
2378-TCDD	<	1	3.6	0.0036	0.0036
12378-PeCDD	<	0.5	5.1	0.0051	0.00255
123478-HxCDD	<	0.1	3.3	0.0033	0.00033
123678-HxCDD	<	0.1	3.3	0.0033	0.00033
123789-HxCDD	<	0.1	3.1	0.0031	0.00031
1234678-HpCDD		0.01	10	0.0100	0.0001
2378-TCDF (DB 225)		0.1	15.3	0.0153	0.00153
12378-PeCDF		0.05	4.7	0.0047	0.000235
23478-PeCDF		0.5	4	0.0040	0.002
123478-HxCDF		0.1	4.3	0.0043	0.00043
123678-HxCDF		0.1	5.6	0.0056	0.00056
234678-HxCDF		0.1	5.3	0.0053	0.00053
123789-HxCDF	<	0.1	3.6	0.0036	0.00036
1234678-HpCDF		0.01	15.4	0.0154	0.000154
1234789-HpCDF	<	0.01	3.7	0.0037	0.000037
				TEF ADJUSTED TOTAL	0.013

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

TEF Total Mass Collected	<	0.013	ng
TEF Emission Concentration	<	0.0029	ng/m^3
TEF Emission Rate	<	127	ng/hr
Emission Rate	<	1.95E-06	gr/hr
Emission Rate	<	2.8E-10	lb/hr

42656 0.454166667 F or C?

Boilers 1 and 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	0.23	0.480	2.5	453	69	69
A-1	0.23	0.480	2.5	454	69	69
A-1	0.23	0.480	2.5	452	70	68
A-2	0.24	0.490	2.6	453	71	68
A-2	0.24	0.490	2.6	455	71	68
A-2	0.24	0.490	2.6	455	72	69
A-3	0.29	0.539	3.2	466	73	68
A-3	0.29	0.539	3.2	465	73	69
A-3	0.29	0.539	3.2	466	74	68
A-4	0.25	0.500	2.8	464	74	69
A-4	0.25	0.500	2.8	465	74	69
A-4	0.25	0.500	2.8	464	75	69
A-5	0.30	0.548	3.3	465	75	69
A-5	0.30	0.548	3.3	465	76	69
A-5	0.30	0.548	3.3	466	76	69
A-6	0.25	0.500	2.8	471	77	70
A-6	0.25	0.500	2.8	470	77	70
A-6	0.25	0.500	2.8	471	78	71
A-7	0.32	0.566	3.5	466	78	71
A-7	0.32	0.566	3.5	466	78	71
A-7	0.32	0.566	3.5	466	78	71
A-8	0.25	0.500	2.8	463	78	71
A-8	0.25	0.500	2.8	464	78	71
A-8	0.25	0.500	2.8	464	79	71
A-9	0.27	0.520	3.0	465	79	72
A-9	0.27	0.520	3.0	466	79	72
A-9	0.27	0.520	3.0	465	77	72
A-10	0.25	0.500	2.8	462	78	72
A-10	0.25	0.500	2.8	463	79	73
A-10	0.25	0.500	2.8	461	79	73
A-11	0.29	0.539	3.2	467	80	73
A-11	0.29	0.539	3.2	463	80	73
A-11	0.29	0.539	3.2	463	80	73
A-12	0.23	0.480	2.5	446	80	73
A-12	0.23	0.480	2.5	448	80	73
A-12	0.23	0.480	2.5	446	81	73
B-1	0.19	0.436	2.1	435	77	74
B-1	0.19	0.436	2.1	433	78	74
B-1	0.19	0.436	2.1	434	78	75
B-2	0.21	0.458	2.3	457	78	74
B-2	0.21	0.458	2.3	459	78	74
B-2	0.21	0.458	2.3	460	78	74
B-3	0.24	0.490	2.6	460	79	74
B-3	0.24	0.490	2.6	460	79	75
B-3	0.24	0.490	2.6	461	79	75
B-4	0.24	0.490	2.6	461	78	73
B-4	0.24	0.490	2.6	461	78	73
B-4	0.24	0.490	2.6	460	78	74
B-5	0.20	0.447	2.2	460	79	74
B-5	0.20	0.447	2.2	461	79	74
B-5	0.20	0.447	2.2	461	79	74
B-6	0.20	0.447	2.2	460	78	73
B-6	0.20	0.447	2.2	461	78	74
B-6	0.20	0.447	2.2	463	79	74
B-7	0.24	0.490	2.6	462	78	73
B-7	0.24	0.490	2.6	460	78	73
B-7	0.24	0.490	2.6	460	78	73
B-8	0.27	0.520	3.0	460	78	72
B-8	0.27	0.520	3.0	462	78	72
B-8	0.27	0.520	3.0	462	78	72
B-9	0.28	0.529	3.0	460	77	72
B-9	0.28	0.529	3.0	460	77	72
B-9	0.28	0.529	3.0	459	76	72
B-10	0.24	0.490	2.6	457	76	72
B-10	0.24	0.490	2.6	457	76	72
B-10	0.24	0.490	2.6	456	76	72
B-11	0.28	0.529	3.1	448	76	72
B-11	0.28	0.529	3.1	446	76	72
B-11	0.28	0.529	3.1	445	76	72
B-12	0.20	0.447	2.2	444	76	71
B-12	0.20	0.447	2.2	444	76	71
B-12	0.20	0.447	2.2	445	76	71
Average	0.25	0.497	2.73	458.6		74.3

Client:	ArcelorMittal	Test Date:	October 13, 2016
Project No.:	16-167	Test Location:	Baghouse Exhaust
Plant:	Monessen, PA	Test Run:	Run 2
Unit:	Boilers 1 and 2	Test Start Time:	7:35 AM
Unit Operation:	Normal	Test Finish Time:	10:54 AM

Initial volume	239.000	ft^3	Initial volume	0.000	liters
Final volume	402.169	ft^3	Final volume	0.000	liters
Total metered	163.169	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	818.8	366.2	452.6			0.0
2	966.2	758.1	208.1			0.0
3	777.1	705.9	71.2			0.0
4	565.1	551.1	14.0			0.0
5	813.8	773.4	40.4			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	3941.0	3154.7	786.3	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	<	3.6	0.0000036	0.0000036	8.0E-07	7.7E-11	8.0E-07	7.7E-11
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	5.1	0.0000051	0.00000255	1.1E-06	1.1E-10	5.7E-07	5.5E-11
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.3	0.0000033	0.00000033	7.4E-07	7.1E-11	7.4E-08	7.1E-12
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	<	3.3	0.0000033	0.00000033	7.4E-07	7.1E-11	7.4E-08	7.1E-12
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	<	3.1	0.0000031	0.00000031	6.9E-07	6.6E-11	6.9E-08	6.6E-12
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		10	0.00001	0.0000001	2.2E-06	2.1E-10	2.2E-08	2.1E-12
2,3,7,8-Tetrachlorodibenzofuran		15.3	0.0000153	0.00000153	3.4E-06	3.3E-10	3.4E-07	3.3E-11
1,2,3,7,8-Pentachlorodibenzofuran		4.7	0.0000047	0.000000235	1.0E-06	1.0E-10	5.2E-08	5.0E-12
2,3,4,7,8-Pentachlorodibenzofuran		4	0.000004	0.000002	8.9E-07	8.6E-11	4.5E-07	4.3E-11
1,2,3,4,7,8-Hexachlorodibenzofuran		4.3	0.0000043	0.00000043	9.6E-07	9.2E-11	9.6E-08	9.2E-12
1,2,3,6,7,8-Hexachlorodibenzofuran		5.6	0.0000056	0.00000056	1.3E-06	1.2E-10	1.3E-07	1.2E-11
2,3,4,6,7,8-Hexachlorodibenzofuran		5.3	0.0000053	0.00000053	1.2E-06	1.1E-10	1.2E-07	1.1E-11
1,2,3,7,8,9-Hexachlorodibenzofuran	<	3.6	0.0000036	0.00000036	8.0E-07	7.7E-11	8.0E-08	7.7E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran		15.4	0.0000154	0.0000000154	3.4E-06	3.3E-10	3.4E-08	3.3E-12
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.7	0.0000037	0.000000037	8.3E-07	7.9E-11	8.3E-09	7.9E-13

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene	<	20	0.0045	4.3E-04
Acenaphthylene	<	20	0.0045	4.3E-04
Anthracene	<	20	0.0045	4.3E-04
Benz[a]anthracene	<	20	0.0045	4.3E-04
Benzo[a]pyrene	<	2	0.0004	4.3E-05
Benzo[b]fluoranthene	<	1	0.0002	2.1E-05
Benzo[g,h,i]perylene	<	20	0.0045	4.3E-04
Benzo[k]fluoranthene	<	2	0.0004	4.3E-05
Chrysene	<	20	0.0045	4.3E-04
Dibenz[a,h]anthracene	<	1	0.0002	2.1E-05
Fluoranthene	<	20	0.0045	4.3E-04
Fluorene	<	20	0.0045	4.3E-04
Indeno (1,2,3-cd) pyrene	<	2	0.0004	4.3E-05
Naphthalene	<	20	0.0045	4.3E-04
Phenanthrene	<	20	0.0045	4.3E-04
Perylene	<	5	0.0011	1.1E-04
Pyrene	<	20	0.0045	4.3E-04

Client:	ArcelorMittal	Test Date:	October 13, 2016
Project No.:	16-167	Test Location:	Baghouse Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Boilers 1 and 2	Test Start Time:	11:35 AM
Unit Operation:	Normal	Test Finish Time:	2:45 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:	1614	
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Test Time (Theta)	180	minutes
Barometric Pressure (Pbar)	29.06	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter 0 if circular stack)	NA	inches
Nozzle Diameter (Dn)	0.395	inches
O2	5.10	% dv
CO2	7.25	% dv
Pitot Tube Coefficient (Cp)	0.84	
Sample Calculation Title	PCDD/PCDF 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)	73.6	F
Stack Temperature (Tsavg)	459.5	F
Orifice Pressure Drop (dHavg)	2.633	in. H_2O
GasVelocity Head (dP)^ avg	0.4889	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	87.65	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	728.3	g
Water Vapor in Silica Gel (Vwsg(std))	34.339	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	34.339	scf
Volume Dry Gas Metered (Vm)	158.774	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	154.021	dscf
Volume Dry Gas Metered (Vm(m^3))	4.496	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.361	dscm
Stack Absolute Pressure (Ps)	29.03	in. Hg
Stack Absolute Temperature (Tsavg)	919.2	R
H2O Vapor Pressure @ avg Stack Temp.	945.97	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1823	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1823	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.36	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.29	lb/lb-mole
Gas Velocity (Vs)	37.82	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	55,566	acfm
Standard Gas Flowrate	30,960	scfm
Dry Standard Gas Flowrate	25,316	dscfm
Dry Standard Exhaust Gas Flowrate	115.8	1000 lb/hr
Actual Gas Flowrate	1,573	acm/min
Standard Gas Flowrate	877	scm/min
Dry Standard Gas Flowrate	717	dscm/min
Area Nozzle (An)	0.000851	ft^2
Percent of Isokinetic Sampling (I)	97.30	%

Dioxin Furan

Analyte		TEF	Raw Data mass (pg)	Adjusted Mass (ng)	TEF Adjusted Amount (ng)
2378-TCDD	<	1	3.4	0.0034	0.0034
12378-PeCDD	<	0.5	3.4	0.0034	0.0017
123478-HxCDD	<	0.1	3.3	0.0033	0.00033
123678-HxCDD	<	0.1	3.3	0.0033	0.00033
123789-HxCDD	<	0.1	3	0.0030	0.0003
1234678-HpCDD		0.01	5.9	0.0059	0.000059
2378-TCDF (DB 225)		0.1	21.9	0.0219	0.00219
12378-PeCDF	<	0.05	3.5	0.0035	0.000175
23478-PeCDF		0.5	12.9	0.0129	0.00645
123478-HxCDF		0.1	11.4	0.0114	0.00114
123678-HxCDF		0.1	7.2	0.0072	0.00072
234678-HxCDF		0.1	5.1	0.0051	0.00051
123789-HxCDF	<	0.1	3.6	0.0036	0.00036
1234678-HpCDF		0.01	12.9	0.0129	0.000129
1234789-HpCDF	<	0.01	3.6	0.0036	0.000036
				TEF ADJUSTED TOTAL	0.018

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

TEF Total Mass Collected	<	0.018	ng
TEF Emission Concentration	<	0.0041	ng/m^3
TEF Emission Rate	<	176	ng/hr
Emission Rate	<	2.71E-06	gr/hr
Emission Rate	<	3.9E-10	lb/hr

ArcelorMittal Boilers 1 and 2 **Run 3** **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	0.24	0.490	2.6	467	69	69
A-1	0.24	0.490	2.6	466	69	69
A-1	0.24	0.490	2.6	466	70	69
A-2	0.22	0.469	2.4	467	71	69
A-2	0.22	0.469	2.4	462	71	69
A-2	0.22	0.469	2.4	463	71	69
A-3	0.26	0.510	2.9	462	72	69
A-3	0.26	0.510	2.9	462	72	69
A-3	0.26	0.510	2.9	464	73	70
A-4	0.30	0.548	3.3	469	74	69
A-4	0.30	0.548	3.3	467	74	69
A-4	0.30	0.548	3.3	465	74	69
A-5	0.23	0.480	2.5	464	74	69
A-5	0.23	0.480	2.5	468	74	69
A-5	0.23	0.480	2.5	465	74	69
A-6	0.26	0.510	2.9	462	75	69
A-6	0.26	0.510	2.9	463	75	69
A-6	0.26	0.510	2.9	462	75	69
A-7	0.17	0.412	1.9	462	76	69
A-7	0.17	0.412	1.9	460	76	69
A-7	0.17	0.412	1.9	463	76	69
A-8	0.18	0.424	2.0	461	76	69
A-8	0.18	0.424	2.0	462	76	69
A-8	0.18	0.424	2.0	461	76	69
A-9	0.20	0.447	2.2	460	77	70
A-9	0.20	0.447	2.2	460	77	70
A-9	0.20	0.447	2.2	461	77	70
A-10	0.22	0.469	2.4	453	78	70
A-10	0.22	0.469	2.4	453	78	70
A-10	0.22	0.469	2.4	455	78	70
A-11	0.23	0.480	2.5	445	78	71
A-11	0.23	0.480	2.5	447	78	71
A-11	0.23	0.480	2.5	444	78	71
A-12	0.20	0.447	2.2	432	77	71
A-12	0.20	0.447	2.2	431	77	71
A-12	0.20	0.447	2.2	433	78	71
B-1	0.21	0.458	2.3	441	75	71
B-1	0.21	0.458	2.3	445	75	71
B-1	0.21	0.458	2.3	447	76	71
B-2	0.24	0.490	2.6	451	75	71
B-2	0.24	0.490	2.6	454	75	71
B-2	0.24	0.490	2.6	456	75	71
B-3	0.22	0.469	2.4	459	76	71
B-3	0.22	0.469	2.4	460	76	71
B-3	0.22	0.469	2.4	458	76	71
B-4	0.31	0.557	3.4	467	77	71
B-4	0.31	0.557	3.4	464	77	71
B-4	0.31	0.557	3.4	465	77	71
B-5	0.31	0.557	3.4	462	77	71
B-5	0.31	0.557	3.4	461	77	71
B-5	0.31	0.557	3.4	463	77	72
B-6	0.23	0.480	2.5	466	77	72
B-6	0.23	0.480	2.5	464	77	72
B-6	0.23	0.480	2.5	462	77	72
B-7	0.19	0.436	2.1	462	78	72
B-7	0.19	0.436	2.1	463	78	72
B-7	0.19	0.436	2.1	462	78	72
B-8	0.25	0.500	2.8	460	78	72
B-8	0.25	0.500	2.8	466	78	72
B-8	0.25	0.500	2.8	464	79	73
B-9	0.29	0.539	2.9	462	79	73
B-9	0.29	0.539	2.9	462	79	73
B-9	0.29	0.539	2.9	462	80	73
B-10	0.25	0.500	2.8	464	80	73
B-10	0.25	0.500	2.8	464	80	73
B-10	0.25	0.500	2.8	463	80	73
B-11	0.24	0.490	2.6	462	80	74
B-11	0.24	0.490	2.6	461	80	74
B-11	0.24	0.490	2.6	461	80	74
B-12	0.33	0.574	3.6	464	80	74
B-12	0.33	0.574	3.6	466	79	74
B-12	0.33	0.574	3.6	464	80	74
Average	0.24	0.489	2.63	459.5		73.6

Client:	ArcelorMittal	Test Date:	October 13, 2016
Project No.:	16-167	Test Location:	Baghouse Exhaust
Plant:	Monessen, PA	Test Run:	Run 3
Unit:	Boilers 1 and 2	Test Start Time:	11:35 AM
Unit Operation:	Normal	Test Finish Time:	2:45 PM

Initial volume	402.731	ft^3	Initial volume	0.000	liters
Final volume	561.505	ft^3	Final volume	0.000	liters
Total metered	158.774	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	920.6	349.2	571.4			0.0
2	813.6	714.0	99.6			0.0
3	693.4	680.7	12.7			0.0
4	621.4	618.2	3.2			0.0
5	812.6	771.2	41.4			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	3861.6	3133.3	728.3	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	<	3.4	0.0000034	0.0000034	7.8E-07	7.4E-11	7.8E-07	7.4E-11
1,2,3,7,8-Pentachlorodibenzo-p-Dioxin	<	3.4	0.0000034	0.0000017	7.8E-07	7.4E-11	3.9E-07	3.7E-11
1,2,3,4,7,8-Hexachlorodibenzo-p-Dioxin	<	3.3	0.0000033	0.00000033	7.6E-07	7.2E-11	7.6E-08	7.2E-12
1,2,3,6,7,8-Hexachlorodibenzo-p-Dioxin	<	3.3	0.0000033	0.00000033	7.6E-07	7.2E-11	7.6E-08	7.2E-12
1,2,3,7,8,9-Hexachlorodibenzo-p-Dioxin	<	3	0.000003	0.0000003	6.9E-07	6.5E-11	6.9E-08	6.5E-12
1,2,3,4,6,7,8-Heptachlorodibenzo-p-Dioxin		5.9	0.0000059	0.000000059	1.4E-06	1.3E-10	1.4E-08	1.3E-12
2,3,7,8-Tetrachlorodibenzofuran		21.9	0.0000219	0.00000219	5.0E-06	4.8E-10	5.0E-07	4.8E-11
1,2,3,7,8-Pentachlorodibenzofuran	<	3.5	0.0000035	0.000000175	8.0E-07	7.6E-11	4.0E-08	3.8E-12
2,3,4,7,8-Pentachlorodibenzofuran		12.9	0.0000129	0.00000645	3.0E-06	2.8E-10	1.5E-06	1.4E-10
1,2,3,4,7,8-Hexachlorodibenzofuran		11.4	0.0000114	0.00000114	2.6E-06	2.5E-10	2.6E-07	2.5E-11
1,2,3,6,7,8-Hexachlorodibenzofuran		7.2	0.0000072	0.00000072	1.7E-06	1.6E-10	1.7E-07	1.6E-11
2,3,4,6,7,8-Hexachlorodibenzofuran		5.1	0.0000051	0.00000051	1.2E-06	1.1E-10	1.2E-07	1.1E-11
1,2,3,7,8,9-Hexachlorodibenzofuran	<	3.6	0.0000036	0.00000036	8.3E-07	7.8E-11	8.3E-08	7.8E-12
1,2,3,4,6,7,8-Heptachlorodibenzofuran		12.9	0.0000129	0.000000129	3.0E-06	2.8E-10	3.0E-08	2.8E-12
1,2,3,4,7,8,9-Heptachlorodibenzofuran	<	3.6	0.0000036	0.000000036	8.3E-07	7.8E-11	8.3E-09	7.8E-13

USEPA Method 0010 Individual Emission Rates

Compound		Mass (ug)	Raw Concentration (mg/m³)	Raw Emissions (lb/hr)
Acenaphthene	<	20	0.0046	4.3E-04
Acenaphthylene	<	20	0.0046	4.3E-04
Anthracene	<	20	0.0046	4.3E-04
Benz[a]anthracene	<	20	0.0046	4.3E-04
Benzo[a]pyrene	<	2	0.0005	4.3E-05
Benzo[b]fluoranthene	<	1	0.0002	2.2E-05
Benzo[g,h,i]perylene	<	20	0.0046	4.3E-04
Benzo[k]fluoranthene	<	2	0.0005	4.3E-05
Chrysene	<	1	0.0002	2.2E-05
Dibenz[a,h]anthracene	<	1	0.0002	2.2E-05
Fluoranthene	<	20	0.0046	4.3E-04
Fluorene	<	20	0.0046	4.3E-04
Indeno (1,2,3-cd) pyrene	<	2	0.0005	4.3E-05
Naphthalene	<	20	0.0046	4.3E-04
Phenanthrene	<	20	0.0046	4.3E-04
Perylene	<	5	0.0011	1.1E-04
Pyrene	<	20	0.0046	4.3E-04

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 0010/23	**Meter ΔH :**	1.991	**Start Time:**	13:15
Date:	10/12/16	**Run Number:**	1	**Meter Correction (γ):**	1.003	**Stop Time:**	16:58
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.395	**Pitot Correction:**	0.84	**T/C ID:**	7.4
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.37	**Control Box ID:**	1614	**Probe ID:**	7.4
		Baro. Pres. (in. Hg):	29.27	**Assumed Moisture (%):**	21	**Pitot ID:**	7.4
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	60	**Umbilical Length (Feet):**	200'	**Filter ID:**	Trap #1
Test Crew:	BC JV JW TL TM	**Initial K-factor**	11			**Stack Diameter (inches):**	67"

(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
A-1	0:02:30	84.64	0.24	2.6	7	456	259	263	49	68	82	80	
A-1	0:05:00	87.08	0.24	2.6	7	453	259	260	51	68	82	80	
A-1	0:07:30	88.62	0.24	2.6	7	453	259	261	51	68	82	80	
A-2	0:10:00	91.02	0.24	2.6	7	458	254	260	52	68	85	80	
A-2	0:12:30	92.86	0.24	2.6	7	458	254	260	52	68	86	81	
A-2	0:15:00	94.23	0.24	2.6	7	458	254	260	52	68	86	81	
A-3	0:17:30	96.72	0.27	2.3	8	462	258	262	52	64	87	82	
A-3	0:20:00	98.84	0.27	2.3	8	462	258	262	52	64	87	82	
A-3	0:22:30	~~103.25~~	0.27	2.3	8	462	258	262	52	64	87	82	
A-4	0:25:00	~~103.25~~ 104.67	0.23	2.5	8	461	249	261	58	64	89	82	
A-4	0:27:30	106.07	0.23	2.5	8	461	249	261	58	64	89	82	
A-4	0:30:00	107.48	0.23	2.5	8	461	249	261	58	64	89	82	
A-5	0:32:30	109.63	0.27	2.3	8	463	262	262	58	67	90	82	
A-5	0:35:00	111.74	0.27	2.3	8	463	262	262	58	67	90	82	
A-5	0:37:30	113.84	0.27	2.3	8	463	266	262	58	67	90	82	
A-6	0:40:00	115.39	0.22	2.4	9	459	249	261	63	68	90	83	
A-6	0:42:30	116.85	0.22	2.4	9	459	249	261	63	68	90	83	
A-6	0:45:00	118.32	0.22	2.4	9	459	249	261	63	68	90	83	
A-7	0:47:30	119.54	0.18	2.0	9	465	247	261	56	68	90	84	
A-7	0:50:00	~~122.07~~	0.18	2.0	9	465	247	261	54	68	90	84	120.72
A-7	0:52:30	121.82	0.18	2.0	9	465	247	261	56	68	90	84	
A-8	0:55:00	122.075	0.22	2.4	9	465	247	260	56	68	90	84	Stop - T/C 0.000@15", rubble stoofunc
A-8	0:57:30	123.900	0.22	2.4	9	465	246	260	56	67	90	84	LC 0.000@15" restart
A-8	1:00:00	125.82	0.22	2.4	9	465	246	260	56	67	90	84	

(max leak rate = 0.02 ft³/min)

Sample Train Leak Check		(in. Hg)	(ft³/min)
	Initial	15.6	0.000
	Final	15	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: RALO17

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)	1007.9	347.8	
2	H_2O (g)	668.4	674.9	
3	H_2O (g)	699.5	696.5	
4	Empty (g)	619.3	613.7	
5	Silica (g)	896.0	861.9	

MONTROSE METHOD 0010/23 DATA SHEET

Page ____ of ____

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

Date: **Run Number:** **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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
A-9	1:02:30	127.5	0.21	2.3	9	457	249	251	~~68~~ 63	68	91	86	
A-9	1:05:00	130.1	0.21	2.3	9	462	246	249	63	68	91	86	
A-9	1:07:30	132.2	0.21	2.3	9	460	244	252	64	68	91	86	
A-10	1:10:00	134.3	0.23	0.25	10	444	248	261	61	68	95	87	
A-10	1:12:30	136.2	0.23	0.25	10	446	249	263	62	68	95	87	
A-10	1:15:00	138.8	0.23	0.25	10	442	248	262	62	68	95	87	
A-11	1:17:30	140.7	0.2	0.22	9	436	250	262	65	67	97	87	
A-11	1:20:00	142.9	0.2	0.22	9	437	249	261	61	67	97	87	
A-11	1:22:30	145.6	0.2	0.22	9	438	247	262	62	67	97	87	
A-12	1:25:00	147.4	0.26	0.29	10	448	240	262	61	68	99	90	
A-12	1:27:30	149.6	0.26	0.29	10	446	242	261	63	68	99	90	
A-12	1:30:00	~~152.07~~ 151.970	0.26	0.29	10	447	243	263	64	68	99	90	
B-1	1:32:30	154.3	0.22	0.24	10	431	249	261	59	67	101	96	
B-1	1:35:00	156.6	0.22	0.24	10	431	250	260	60	67	101	96	
B-1	1:37:30	158.5	0.22	0.24	10	432	251	258	60	66	101	96	
B-2	1:40:00	161.2	0.22	0.24	10	433	248	260	62	68	100	96	
B-2	1:42:30	163.7	0.22	0.24	10	432	244	259	62	67	100	96	
B-2	1:45:00	166.0	0.22	0.24	10	433	246	262	62	67	100	96	
B-3	1:47:30	168.3	0.23	2.5	10	462	237	260	60	67	100	97	
B-3	1:50:00	170.6	0.23	2.5	10	458	236	261	62	68	100	97	
B-3	1:52:30	173.1	0.23	2.5	10	460	238	255	63	68	100	97	
B-4	1:55:00	175.2	0.18	2.0	9	458	249	262	64	68	99	96	
B-4	1:57:30	177.4	0.18	2.0	9	461	250	260	65	68	99	96	
B-4	2:00:00	179.7	0.23	2.5	10	461	237	261	63	68	99	95	
B-5	2:02:30	181.9	0.23	2.5	10	463	248	262	64	68	99	95	
B-5	2:05:00	184.3	0.23	2.5	10	460	246	261	63	68	99	95	
B-5	2:07:30	186.6	0.23	2.5	10	458	241	264	63	68	99	95	
B-6	2:10:00	189.2	0.23	2.5	10	460	230	262	64	68	98	94	
B-6	2:12:30	191.0	0.23	2.5	10	460	248	261	65	68	97	94	
B-6	2:15:00	192.9	0.23	2.5	10	462	250	260	66	68	97	94	
B-7	2:17:30	197.4	0.25	2.8	10	460	252	261	67	68	97	93	
B-7	2:20:00	199.0	0.25	2.8	10	463	250	261	67	68	97	93	
B-7	2:22:30	201.3	0.25	2.8	10	460	253	260	67	68	97	93	
B-8	2:25:00	204.1	0.31	3.4	13	462	254	261	68	68	96	92	
B-8	2:27:30	206.5	0.31	3.4	13	462	252	259	67	68	96	92	
B-8	2:30:00	209.0	0.31	3.4	13	464	251	262	67	68	96	92	
B-9	2:32:30	211.5	0.25	2.8	12	459	248	262	64	68	95	91	
B-9	2:35:00	213.2	0.25	2.8	12	460	250	262	64	68	95	91	

MONTROSE METHOD 0010/23 DATA SHEET

Page ____ of ____

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

Date: **Run Number:** **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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
B-9	2:37:30	216.6	0.25	2.8	12	460	253	253	65	68	95	91	
B-10	2:40:00	219.4	0.34	3.7	14	461	249	262	66	68	95	91	
B-10	2:42:30	222.0	0.34	3.7	14	461	256	260	66	68	95	91	
B-10	2:45:00	224.6	0.34	3.7	14	464	253	263	65	66	94	90	
B-11	2:47:30	227.3	0.26	2.4	13	454	258	262	61	66	93	90	
B-11	2:50:00	229.9	0.26	2.4	13	452	257	261	60	66	93	91	
B-11	2:52:30	232.0	0.26	2.4	13	452	253	264	61	67	93	91	
B-12	2:55:00	234.3	0.26	2.4	13	457	247	261	57	65	93	89	
B-12	2:57:30	236.4	0.26	2.4	13	456	253	261	58	66	93	90	
B-12	3:00:00	238.628	0.26	2.4	13	453	250	266	60	67	93	90	Stop 1658

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 0010/23	Meter ΔH :	1.991	Start Time:	735
Date:	10/13/16	Run Number:	2	Meter Correction (γ):	1.003	Stop Time:	1054
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.395	Pitot Correction:	0.84	T/C ID:	7-4
Sampling Location:	Boiler Stack Outlet	Static Press (in. H_2O):	-0.38	Control Box ID:	1614	Probe ID:	7-4
		Baro. Pres. (in. Hg):	29.06	Assumed Moisture (%):	21	Pitot ID:	7-4
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	54	Umbilical Length (Feet):	200'	Filter ID:	Trap 2
Test Crew:	BC JV JW TL TM	Initial K-factor	11			Stack Diameter (inches):	67

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 239.000	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	0:02:30	240.83	0.23	2.5	7.5	453	250	260	59	70	69	69	
A-1	0:05:00	242.67	0.23	2.5	7.5	454	241	259	58	70	69	69	
A-1	0:07:30	244.51	0.23	2.5	7.5	452	236	259	64	71	70	68	
A-2	0:10:00	246.95	0.24	2.6	11.5	453	241	257	64	71	71	68	
A-2	0:12:30	249.39	0.24	2.6	11.5	455	242	259	64	72	71	68	
A-2	0:15:00	251.83	0.24	2.6	11.5	454	246	257	63	72	72	69	
A-3	0:17:30	253.90	0.29	3.2	13.0	466	238	261	64	73	73	68	
A-3	0:20:00	256.19	0.29	3.2	13.0	465	241	260	65	72	73	69	
A-3	0:22:30	258.63	0.29	3.2	13.0	466	242	260	63	71	74	68	
A-4	0:25:00	260.93	0.25	2.8	12.5	464	237	238	60	72	74	69	
A-4	0:27:30	263.36	0.25	2.8	12.5	465	239	237	61	73	74	69	
A-4	0:30:00	268.28	0.25	2.8	12.5	464	236	260	62	73	75	69	
A-5	0:32:30	269.34	0.30	3.3	13.0	465	231	249	56	71	75	69	
A-5	0:35:00	270.40	0.30	3.3	13.0	465	241	260	55	72	76	69	
A-5	0:37:30	271.46	0.30	3.3	13.0	466	239	251	54	72	76	70	
A-6	0:40:00	272.52	0.25	2.8	12.5	471	248	261	54	71	77	70	
A-6	0:42:30	277.56	0.25	2.8	12.5	470	248	260	54	71	77	71	
A-6	0:45:00	279.08	0.25	2.8	12.5	471	246	259	54	72	78	71	
A-7	0:47:30	282.57	0.32	3.5	14.0	466	232	260	55	73	78	71	
A-7	0:50:00	284.82	0.32	3.5	14.0	466	235	260	55	73	78	71	
A-7	0:52:30	287.67	0.32	3.5	14.0	466	237	260	55	73	78	71	
A-8	0:55:00	288.99	0.25	2.8	13.5	463	230	260	54	72	78	71	
A-8	0:57:30	292.46	0.25	2.8	13.5	464	233	260	54	71	78	71	
A-8	1:00:00	294.69	0.25	2.8	13.5	464	240	259	54	72	79	71	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak Check	Initial	15	0.003
	Final	14	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	Empty (g)	818.8	366.2	
2	H_2O (g)	966.2	758.1	
3	H_2O (g)	777.1	705.9	
4	Empty (g)	565.1	551.1	
5	Silica (g)	813.8	773.4	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 10/13/16 **Run Number:** 2 **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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
A-9	1:02:30	297.15	0.27	3.0	13	465	230	260	55	71	79	72	
A-9	1:05:00	299.53	0.27	3.0	13	466	235	259	55	71	78	72	
A-9	1:07:30	301.91	0.27	3.0	13	465	238	255	56	70	77	72	
A-10	1:10:00	304.28	0.25	2.8	13	462	239	262	55	72	78	72	
A-10	1:12:30	306.65	0.25	2.8	13	463	241	261	54	72	79	73	
A-10	1:15:00	309.02	0.25	2.8	13	461	242	258	54	74	79	73	
A-11	1:17:30	311.46	0.29	3.2	14	462	239	260	55	76	80	73	
A-11	1:20:00	313.94	0.29	3.2	14.0	463	240	260	55	76	80	73	
A-11	1:22:30	316.34	0.29	3.2	14.0	463	238	261	56	76	80	73	
A-12	1:25:00	318.73	0.23	2.5	13.0	446	245	261	54	77	80	73	
A-12	1:27:30	320.82	0.23	2.5	13.0	448	246	260	54	77	80	73	
A-12	1:30:00	322.71	0.23	2.5	13.0	446	248	257	55	79	81	73	
B-1	1:32:30	324.84	0.19	2.1	9.0	475	228	260	50	77	77	74	
B-1	1:35:00	326.97	0.19	2.1	9.0	433	232	260	50	78	78	74	
B-1	1:37:30	329.13	0.19	2.1	9.0	434	236	262	51	78	78	75	
B-2	1:40:00	330.96	0.21	2.3	9.5	457	246	261	53	76	78	74	
B-2	1:42:30	332.09	0.21	2.3	9.5	459	244	260	54	77	78	74	
B-2	1:45:00	334.62	0.21	2.3	9.5	460	246	260	54	77	78	74	
B-3	1:47:30	337.28	0.24	2.6	11.0	460	245	260	55	75	79	74	
B-3	1:50:00	339.94	0.24	2.6	11.0	460	241	260	55	75	79	75	
B-3	1:52:30	342.62	0.24	2.6	11.0	461	240	261	56	76	78	75	
B-4	1:55:00	345.33	0.24	2.6	11.0	461	249	260	56	77	78	73	
B-4	1:57:30	347.98	0.24	2.6	11.0	461	249	260	56	77	78	73	
B-4	2:00:00	350.66	0.24	2.6	11.0	460	250	260	57	76	78	74	
B-5	2:02:30	352.58	0.20	2.2	10.5	460	250	262	57	78	79	74	
B-5	2:05:00	352.58	0.20	2.2	10.5	461	249	261	58	78	79	74	351.62
B-5	2:07:30	354.54	0.20	2.2	10.5	461	247	260	58	77	79	74	
B-6	2:10:00	356.89	0.20	2.2	10.5	460	249	260	54	78	78	73	
B-6	2:12:30	358.96	0.20	2.2	10.5	461	252	260	54	77	78	74	
B-6	2:15:00	361.03	0.20	2.2	10.5	463	255	260	54	77	79	74	
B-7	2:17:30	363.27	0.24	2.6	11.0	462	241	261	53	78	78	73	
B-7	2:20:00	365.41	0.24	2.6	11.0	460	247	260	53	76	78	73	
B-7	2:22:30	367.62	0.24	2.6	11.0	460	245	260	53	76	78	73	
B-8	2:25:00	369.82	0.27	3.0	12.0	460	249	260	53	73	78	72	369.82
B-8	2:27:30	372.02	0.27	3.0	12.0	462	247	260	53	73	78	72	
B-8	2:30:00	374.22	0.27	3.0	12.0	462	249	260	53	74	78	72	
B-9	2:32:30	376.89	0.28	3.0	12.0	460	253	260	54	75	77	72	
B-9	2:35:00	379.56	0.28	3.0	12.0	460	253	260	54	75	77	72	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 10/13/16 **Run Number:** 2 **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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
B-9	2:37:30	382.23	0.28	3.0	13	459	257	260	55	75	76	72	
B-10	2:40:00	384.01	0.24	2.6	12.5	457	250	261	55	75	76	72	
B-10	2:42:30	386.52	0.24	2.6	12.5	~~447~~	246	261	55	74	76	72	457
B-10	2:45:00	388.94	0.24	2.6	12.5	456	255	261	55	73	76	72	
B-11	2:47:30	390.98	0.28	3.1	13.0	448	232	259	55	70	76	72	
B-11	2:50:00	393.32	0.28	3.1	13.0	446	247	261	56	71	76	72	
B-11	2:52:30	395.36	0.28	3.1	13.0	445	246	260	56	71	76	72	
B-12	2:55:00	398.05	0.20	2.2	13.6	444	252	260	56	70	76	71	
B-12	2:57:30	400.11	0.20	2.2	13.6	444	253	260	56	70	76	71	
B-12	3:00:00	402.169	0.20	2.2	13.0	445	249	260	57	69	76	71	861 1054

MONTROSE METHOD 0010/23 DATA SHEET

Client:	ArcelorMittal	**Test Type:**	Method 0010/23	**Meter ΔH :**	1.991	**Start Time:**	1135
Date:	10/13/16	**Run Number:**	3	**Meter Correction (Y):**	1.003	**Stop Time:**	1445
Plant:	Monessen, PA	**Nozzle Diameter (inches):**	0.395	**Pitot Correction:**	0.84	**T/C ID:**	7-4
Sampling Location:	Boiler Stack Outlet	**Static Press (in. H_2O):**	-0.36	**Control Box ID:**	1614	**Probe ID:**	7-4
		Baro. Pres. (in. Hg):	29.06	**Assumed Moisture (%):**	21	**Pitot ID:**	7-4
Project Number:	Proj106377 (16-167)	**Ambient Temp (°F):**	60	**Umbilical Length (Feet):**	200'	**Filter ID:**	Trap 3
Test Crew:	BC JV JW DL TM	**Initial K-factor**	11			**Stack Diameter (inches):**	67

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 402.731	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	0:02:30	404.72	0.24	2.6	7.0	467	240	260	55	70	69	69	
A-1	0:05:00	406.71	0.24	2.6	7.0	466	241	260	55	70	69	69	
A-1	0:07:30	408.73	0.24	2.6	7.0	466	243	260	55	70	70	69	
A-2	0:10:00	410.82	0.22	2.4	9.0	467	243	260	63	71	71	69	
A-2	0:12:30	412.98	0.22	2.4	9.0	462	242	260	63	71	71	69	
A-2	0:15:00	415.14	0.22	2.4	9.0	463	243	260	64	72	71	69	
A-3	0:17:30	417.35	0.26	2.9	9.5	462	232	261	65	72	72	69	
A-3	0:20:00	419.62	0.26	2.9	9.5	462	246	261	65	72	72	69	
A-3	0:22:30	421.86	0.26	2.9	9.5	464	232	261	64	71	73	70	
A-4	0:25:00	424.42	0.30	3.3	10.0	469	242	260	60	70	74	69	
A-4	0:27:30	426.98	0.30	3.3	10.0	467	238	260	60	70	74	69	
A-4	0:30:00	429.54	0.30	3.3	10.0	465	242	259	60	72	74	69	
A-5	0:32:30	431.32	0.23	2.5	9.5	464	243	260	58	71	74	69	
A-5	0:35:00	433.59	0.23	2.5	9.5	468	250	260	58	70	74	69	
A-5	0:37:30	435.86	0.23	2.5	9.5	465	247	261	58	70	74	69	
A-6	0:40:00	438.15	0.26	2.9	10.0	462	253	261	57	73	75	69	
A-6	0:42:30	440.44	0.26	2.9	10.0	463	242	260	58	75	75	69	
A-6	0:45:00	442.73	0.26	2.9	10.0	462	245	260	58	74	75	69	
A-7	0:47:30	444.72	0.17	1.9	8.0	462	251	260	59	76	76	69	
A-7	0:50:00	446.71	0.17	1.9	8.0	460	250	260	59	76	76	69	
A-7	0:52:30	448.77	0.17	1.9	8.0	463	250	260	59	76	76	69	
A-8	0:55:00	450.54	0.18	2.0	8.0	461	254	260	60	78	76	69	
A-8	0:57:30	452.61	0.18	2.0	8.0	462	250	260	61	78	76	69	
A-8	1:00:00	454.69	0.18	2.0	8.0	461	250	260	61	77	76	69	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	15	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: BA-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)	420.6	349.2	
2	H_2O (g)	813.6	714.0	
3	H_2O (g)	693.4	680.7	
4	Empty (g)	621.4	618.2	
5	Silica (g)	812.6	771.2	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 10/13/16 **Run Number:** 3 **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TJ 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
A-9	1:02:30	~~454.52~~	0.20	2.2	8.0	460	243	260	64	76	77	70	456.51
A-9	1:05:00	458.59	0.20	2.2	8.0	460	243	260	64	76	77	70	
A-9	1:07:30	460.67	0.20	2.2	8.0	461	240	260	63	76	77	70	
A-10	1:10:00	462.88	0.22	2.4	8.5	453	240	261	65	78	78	70	
A-10	1:12:30	465.09	0.22	2.4	8.5	453	243	260	65	78	78	70	
A-10	1:15:00	467.33	0.22	2.4	8.5	455	245	260	63	76	78	70	
A-11	1:17:30	469.18	0.23	2.5	8.5	445	244	260	61	73	78	71	
A-11	1:20:00	471.27	0.23	2.5	9.0	447	258	261	61	73	78	71	
A-11	1:22:30	473.36	0.23	2.5	9.0	444	253	261	60	70	78	71	
A-12	1:25:00	475.27	0.20	2.2	9.0	432	243	259	57	71	77	71	
A-12	1:27:30	477.28	0.20	2.2	9.0	431	246	260	56	71	77	71	
A-12	1:30:00	479.43	0.20	2.2	9.0	433	254	261	56	73	78	71	Port change @ 1305
B-1	1:32:30	481.51	0.21	2.3	9.5	441	248	260	56	74	75	71	Restart @ 1315
B-1	1:35:00	483.59	0.21	2.3	9.5	445	250	260	56	77	75	71	
B-1	1:37:30	485.67	0.21	2.3	9.5	447	253	260	55	75	76	71	
B-2	1:40:00	487.36	0.24	2.6	10.0	451	254	261	57	74	75	71	
B-2	1:42:30	489.63	0.24	2.6	10.0	454	250	261	57	74	75	71	
B-2	1:45:00	491.89	0.24	2.6	10.0	456	246	261	58	76	75	71	
B-3	1:47:30	494.26	0.22	2.4	10.0	459	246	260	60	78	76	71	
B-3	1:50:00	496.63	0.22	2.4	10.0	460	248	260	61	78	76	71	
B-3	1:52:30	499.05	0.22	2.4	10.0	458	248	260	61	77	76	71	
B-4	1:55:00	501.83	0.31	3.4	13.5	467	241	260	64	75	77	71	
B-4	1:57:30	504.39	0.31	3.4	13.5	464	243	259	64	75	77	71	
B-4	2:00:00	506.95	0.31	3.4	13.5	465	243	259	63	75	77	71	
B-5	2:02:30	509.13	0.31	3.4	13.5	462	250	260	63	74	77	71	
B-5	2:05:00	511.31	0.31	3.4	14.0	461	251	260	61	74	77	71	
B-5	2:07:30	513.51	0.31	3.4	14.0	463	253	260	59	73	77	72	
B-6	2:10:00	515.79	0.23	2.5	12.0	464	257	261	63	75	77	72	
B-6	2:12:30	518.07	0.23	2.5	12.0	464	254	261	64	75	77	72	
B-6	2:15:00	520.33	0.23	2.5	12.0	462	250	260	64	77	77	72	
B-7	2:17:30	522.48	0.19	2.1	9.5	462	255	260	63	75	78	72	
B-7	2:20:00	524.63	0.19	2.1	9.5	463	254	261	61	75	78	72	
B-7	2:22:30	526.73	0.19	2.1	9.5	462	250	260	59	73	78	72	0.25
B-8	2:25:00	528.82	~~0.25~~	2.8	10.5	460	250	260	59	73	78	72	
B-8	2:27:30	531.09	0.25	2.8	10.5	466	250	260	59	72	78	72	
B-8	2:30:00	533.36	0.25	2.8	10.5	464	244	260	58	72	79	73	
B-9	2:32:30	535.68	0.29	2.9	13.0	462	249	260	59	72	79	73	
B-9	2:35:00	537.97	0.29	2.9	13.0	462	249	260	60	73	79	73	

MONTROSE METHOD 0010/23 DATA SHEET

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

Date: 10/13/2016 **Run Number:** 3 **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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
B-9	2:37:30	540.29	0.29	2.9	13	462	243	260	60	75	80	73	
B-10	2:40:00	542.67	0.25	2.8	12.5	464	249	260	61	77	80	73	
B-10	2:42:30	545.06	0.25	2.8	12.5	464	249	260	61	79	80	73	
B-10	2:45:00	547.44	0.25	2.8	12.5	463	251	260	62	78	80	73	
B-11	2:47:30	549.81	0.24	2.6	11.0	462	252	260	63	76	80	74	
B-11	2:50:00	552.18	0.24	2.6	11.0	461	252	259	64	76	80	74	
B-11	2:52:30	554.55	0.24	2.6	11.0	461	251	259	64	74	80	74	
B-12	2:55:00	556.59	0.33	3.6	14	464	237	259	65	75	80	74	
B-12	2:57:30	558.63	0.33	3.6	14	466	240	260	65	75	79	74	
B-12	3:00:00	561.505	0.33	3.6	14	464	241	260	66	77	80	74	1445

Method 315

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 1				
1	2016/10/12	13:15:38	5.62	7.30
2	2016/10/12	13:16:38	6.06	7.12
3	2016/10/12	13:17:38	6.03	7.15
4	2016/10/12	13:18:38	5.87	7.22
5	2016/10/12	13:19:38	5.73	7.27
6	2016/10/12	13:20:38	5.44	7.38
7	2016/10/12	13:21:38	4.97	7.59
8	2016/10/12	13:22:38	4.80	7.67
9	2016/10/12	13:23:38	4.98	7.59
10	2016/10/12	13:24:38	5.11	7.52
11	2016/10/12	13:25:38	5.09	7.54
12	2016/10/12	13:26:38	5.02	7.58
13	2016/10/12	13:27:38	5.18	7.53
14	2016/10/12	13:28:38	6.64	6.88
15	2016/10/12	13:29:38	7.04	6.70
16	2016/10/12	13:30:38	6.04	7.16
17	2016/10/12	13:31:38	5.73	7.31
18	2016/10/12	13:32:38	6.06	7.14
19	2016/10/12	13:33:38	5.75	7.26
20	2016/10/12	13:34:38	5.25	7.48
21	2016/10/12	13:35:38	5.17	7.51
22	2016/10/12	13:36:38	4.99	7.60
23	2016/10/12	13:37:38	5.03	7.58
24	2016/10/12	13:38:38	5.12	7.53
25	2016/10/12	13:39:38	5.07	7.55
26	2016/10/12	13:40:38	5.03	7.58
27	2016/10/12	13:41:38	4.92	7.63
28	2016/10/12	13:42:38	5.04	7.59
29	2016/10/12	13:43:38	5.84	7.26
30	2016/10/12	13:44:38	6.53	6.96
31	2016/10/12	13:45:38	6.50	6.97
32	2016/10/12	13:46:38	6.13	7.13
33	2016/10/12	13:47:38	6.00	7.18
34	2016/10/12	13:48:38	5.41	7.42
35	2016/10/12	13:49:38	4.53	7.82
36	2016/10/12	13:50:38	4.57	7.81
37	2016/10/12	13:51:38	4.99	7.62
38	2016/10/12	13:52:38	5.18	7.53
39	2016/10/12	13:53:38	5.19	7.52
40	2016/10/12	13:54:38	4.99	7.60
41	2016/10/12	13:55:38	4.91	7.63
42	2016/10/12	13:56:38	4.94	7.61
43	2016/10/12	13:57:38	4.99	7.59
44	2016/10/12	13:58:38	5.10	7.55
45	2016/10/12	13:59:38	5.12	7.54
46	2016/10/12	14:00:38	5.06	7.55
47	2016/10/12	14:01:38	5.49	7.39
48	2016/10/12	14:02:38	6.58	6.90
49	2016/10/12	14:03:38	6.53	6.92
50	2016/10/12	14:04:38	5.83	7.24
51	2016/10/12	14:05:38	5.80	7.26
52	2016/10/12	14:06:38	6.00	7.14
53	2016/10/12	14:07:38	5.75	7.26
54	2016/10/12	14:08:38	5.38	7.41
55	2016/10/12	14:09:38	4.94	7.60
56	2016/10/12	14:10:38	4.86	7.64
57	2016/10/12	14:11:38	4.96	7.60
58	2016/10/12	14:12:38	5.15	7.53
59	2016/10/12	14:13:38	5.81	7.26
60	2016/10/12	14:14:38	6.12	7.14
61	2016/10/12	14:15:38	5.91	7.23
62	2016/10/12	14:16:38	6.19	4.76

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/12	14:17:38	Calibrating M320	Calibrating M320
64	2016/10/12	14:18:38	Calibrating M320	Calibrating M320
65	2016/10/12	14:19:38	Calibrating M320	Calibrating M320
66	2016/10/12	14:20:38	Calibrating M320	Calibrating M320
67	2016/10/12	14:21:38	Calibrating M320	Calibrating M320
68	2016/10/12	14:22:38	Calibrating M320	Calibrating M320
69	2016/10/12	14:23:38	Calibrating M320	Calibrating M320
70	2016/10/12	14:24:38	Calibrating M320	Calibrating M320
71	2016/10/12	14:25:38	Calibrating M320	Calibrating M320
72	2016/10/12	14:26:38	Calibrating M320	Calibrating M320
73	2016/10/12	14:27:38	Calibrating M320	Calibrating M320
74	2016/10/12	14:28:38	Calibrating M320	Calibrating M320
75	2016/10/12	14:29:38	Calibrating M320	Calibrating M320
76	2016/10/12	14:30:38	5.85	7.13
77	2016/10/12	14:31:38	5.81	7.16
78	2016/10/12	14:32:38	5.30	7.38
79	2016/10/12	14:33:38	4.83	7.59
80	2016/10/12	14:34:38	4.77	7.61
81	2016/10/12	14:35:38	5.00	7.51
82	2016/10/12	14:36:38	5.22	7.42
83	2016/10/12	14:37:38	5.20	7.42
84	2016/10/12	14:38:38	5.14	7.44
85	2016/10/12	14:39:38	4.96	7.52
86	2016/10/12	14:40:38	4.96	7.54
87	2016/10/12	14:41:38	5.02	7.52
88	2016/10/12	14:42:38	5.64	7.27
89	2016/10/12	14:43:38	6.30	6.99
90	2016/10/12	14:44:38	6.16	7.05
91	2016/10/12	14:45:38	5.87	7.19
92	2016/10/12	14:46:38	5.85	7.18
93	2016/10/12	14:47:38	5.66	7.25
94	2016/10/12	14:48:38	5.16	7.46
95	2016/10/12	14:49:38	4.79	7.63
96	2016/10/12	14:50:38	4.81	7.63
97	2016/10/12	14:51:38	5.04	7.51
98	2016/10/12	14:52:38	5.15	7.46
99	2016/10/12	14:53:38	5.01	7.52
100	2016/10/12	14:54:38	4.92	7.55
101	2016/10/12	14:55:38	5.07	7.49
102	2016/10/12	14:56:38	5.08	7.48
103	2016/10/12	14:57:38	4.98	7.53
104	2016/10/12	14:58:38	5.03	7.50
105	2016/10/12	14:59:38	5.10	7.48
106	2016/10/12	15:00:38	6.47	6.87
107	2016/10/12	15:01:38	6.64	6.80
108	2016/10/12	15:02:38	5.82	7.19
109	2016/10/12	15:03:38	5.74	7.23
110	2016/10/12	15:04:38	6.01	7.09
111	2016/10/12	15:05:38	5.88	7.14
112	2016/10/12	15:06:38	5.27	7.41
113	2016/10/12	15:07:38	4.79	7.62
114	2016/10/12	15:08:38	4.84	7.60
115	2016/10/12	15:09:38	5.02	7.53
116	2016/10/12	15:10:38	5.09	7.50
117	2016/10/12	15:11:38	5.24	7.44
118	2016/10/12	15:12:38	5.22	7.46
119	2016/10/12	15:13:38	5.75	7.24
120	2016/10/12	15:14:38	6.29	7.02
121	2016/10/12	15:15:38	6.16	7.07
122	2016/10/12	15:16:38	5.90	7.18
123	2016/10/12	15:17:38	5.73	7.25
124	2016/10/12	15:18:38	5.24	7.46
125	2016/10/12	15:19:38	4.86	7.63

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/12	15:20:38	4.88	7.62
127	2016/10/12	15:21:38	4.99	7.56
128	2016/10/12	15:22:38	5.16	7.48
129	2016/10/12	15:23:38	5.11	7.49
130	2016/10/12	15:24:38	4.99	7.53
131	2016/10/12	15:25:38	5.00	7.54
132	2016/10/12	15:26:38	5.01	7.53
133	2016/10/12	15:27:38	5.09	7.48
134	2016/10/12	15:28:38	5.15	7.46
135	2016/10/12	15:29:38	5.09	7.48
136	2016/10/12	15:30:38	5.07	7.48
137	2016/10/12	15:31:38	5.05	7.49
138	2016/10/12	15:32:38	5.14	7.45
139	2016/10/12	15:33:38	6.34	6.29
140	2016/10/12	15:34:38	Calibrating M320	Calibrating M320
141	2016/10/12	15:35:38	Calibrating M320	Calibrating M320
142	2016/10/12	15:36:38	Calibrating M320	Calibrating M320
143	2016/10/12	15:37:38	Calibrating M320	Calibrating M320
144	2016/10/12	15:38:38	Calibrating M320	Calibrating M320
145	2016/10/12	15:39:38	Calibrating M320	Calibrating M320
146	2016/10/12	15:40:38	Calibrating M320	Calibrating M320
147	2016/10/12	15:41:38	Calibrating M320	Calibrating M320
148	2016/10/12	15:42:38	Calibrating M320	Calibrating M320
149	2016/10/12	15:43:38	Calibrating M320	Calibrating M320
150	2016/10/12	15:44:38	6.44	6.79
151	2016/10/12	15:45:38	6.88	6.61
152	2016/10/12	15:46:38	6.05	7.00
153	2016/10/12	15:47:38	5.68	7.16
154	2016/10/12	15:48:38	5.84	7.07
155	2016/10/12	15:49:38	5.69	7.12
156	2016/10/12	15:50:38	5.43	7.23
157	2016/10/12	15:51:38	4.98	7.43
158	2016/10/12	15:52:38	4.78	7.52
159	2016/10/12	15:53:38	4.96	7.44
160	2016/10/12	15:54:38	5.07	7.40
161	2016/10/12	15:55:38	5.27	7.32
162	2016/10/12	15:56:38	6.31	6.88
163	2016/10/12	15:57:38	6.60	6.74
164	2016/10/12	15:58:38	6.15	6.94
165	2016/10/12	15:59:38	5.73	7.12
166	2016/10/12	16:00:38	5.29	7.30
167	2016/10/12	16:01:38	4.87	7.49
168	2016/10/12	16:02:38	4.84	7.51
169	2016/10/12	16:03:38	5.18	7.34
170	2016/10/12	16:04:38	5.24	7.30
171	2016/10/12	16:05:38	5.11	7.37
172	2016/10/12	16:06:38	5.12	7.37
173	2016/10/12	16:07:38	6.64	6.71
174	2016/10/12	16:08:38	7.18	6.48
175	2016/10/12	16:09:38	6.18	6.92
176	2016/10/12	16:10:38	5.76	7.11
177	2016/10/12	16:11:38	5.88	7.04
178	2016/10/12	16:12:38	5.76	7.07
179	2016/10/12	16:13:38	4.89	7.44
180	2016/10/12	16:14:38	4.15	7.78
181	2016/10/12	16:15:38	4.45	7.66
182	2016/10/12	16:16:38	5.20	7.33
183	2016/10/12	16:17:38	5.46	7.21
184	2016/10/12	16:18:38	5.40	7.23
185	2016/10/12	16:19:38	5.43	7.25
186	2016/10/12	16:20:38	6.55	6.76
187	2016/10/12	16:21:38	6.69	6.69
188	2016/10/12	16:22:38	5.92	7.05

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
189	2016/10/12	16:23:38	5.69	7.15
190	2016/10/12	16:24:38	5.76	7.11
191	2016/10/12	16:25:38	5.34	7.28
192	2016/10/12	16:26:38	4.88	7.48
193	2016/10/12	16:27:38	4.92	7.46
194	2016/10/12	16:28:38	5.09	7.38
195	2016/10/12	16:29:38	5.22	7.32
196	2016/10/12	16:30:38	5.23	7.32
197	2016/10/12	16:31:38	5.20	7.33
198	2016/10/12	16:32:38	5.25	7.30
199	2016/10/12	16:33:38	6.43	6.82
200	2016/10/12	16:34:38	7.18	6.48
201	2016/10/12	16:35:38	6.47	6.78
202	2016/10/12	16:36:38	5.90	7.03
203	2016/10/12	16:37:38	6.07	6.94
204	2016/10/12	16:38:38	5.81	7.03
205	2016/10/12	16:39:38	4.61	7.54
206	2016/10/12	16:40:38	4.07	7.81
207	2016/10/12	16:41:38	4.67	7.57
208	2016/10/12	16:42:38	5.35	7.28
209	2016/10/12	16:43:38	5.45	7.23
210	2016/10/12	16:44:38	5.32	7.29
211	2016/10/12	16:45:38	5.62	7.18
212	2016/10/12	16:46:38	6.56	6.78
213	2016/10/12	16:47:38	6.61	6.75
214	2016/10/12	16:48:38	6.07	7.00
RUN 1 AVERAGES			**5.47**	**7.29**

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 2				
1	2016/10/13	07:35:01	Calibrations	Calibrations
2	2016/10/13	07:36:01	Calibrations	Calibrations
3	2016/10/13	07:37:01	Calibrations	Calibrations
4	2016/10/13	07:38:01	Calibrations	Calibrations
5	2016/10/13	07:39:01	Calibrations	Calibrations
6	2016/10/13	07:40:01	Calibrations	Calibrations
7	2016/10/13	07:41:01	Calibrations	Calibrations
8	2016/10/13	07:42:01	Calibrations	Calibrations
9	2016/10/13	07:43:01	Calibrations	Calibrations
10	2016/10/13	07:44:01	Calibrations	Calibrations
11	2016/10/13	07:45:01	Calibrations	Calibrations
12	2016/10/13	07:46:01	Calibrations	Calibrations
13	2016/10/13	07:47:01	Calibrations	Calibrations
14	2016/10/13	07:48:01	Calibrations	Calibrations
15	2016/10/13	07:49:01	Calibrations	Calibrations
16	2016/10/13	07:50:01	Calibrations	Calibrations
17	2016/10/13	07:51:01	Calibrations	Calibrations
18	2016/10/13	07:52:01	Calibrations	Calibrations
19	2016/10/13	07:53:01	Calibrations	Calibrations
20	2016/10/13	07:54:01	Calibrations	Calibrations
21	2016/10/13	07:55:01	Calibrations	Calibrations
22	2016/10/13	07:56:01	Calibrations	Calibrations
23	2016/10/13	07:57:01	Calibrations	Calibrations
24	2016/10/13	07:58:01	Calibrations	Calibrations
25	2016/10/13	07:59:01	Calibrations	Calibrations
26	2016/10/13	08:00:01	Calibrations	Calibrations
27	2016/10/13	08:01:01	Calibrations	Calibrations
28	2016/10/13	08:02:01	Calibrations	Calibrations
29	2016/10/13	08:03:01	Calibrations	Calibrations
30	2016/10/13	08:04:01	Calibrations	Calibrations
31	2016/10/13	08:05:01	Calibrations	Calibrations
32	2016/10/13	08:06:01	Calibrations	Calibrations
33	2016/10/13	08:07:01	5.47	7.19
34	2016/10/13	08:08:01	5.49	7.20
35	2016/10/13	08:09:01	5.76	7.07
36	2016/10/13	08:10:01	4.99	7.39
37	2016/10/13	08:11:01	4.28	7.69
38	2016/10/13	08:12:01	4.62	7.54
39	2016/10/13	08:13:01	4.82	7.44
40	2016/10/13	08:14:01	5.01	7.36
41	2016/10/13	08:15:01	4.86	7.41
42	2016/10/13	08:16:01	4.61	7.51
43	2016/10/13	08:17:01	4.66	7.49
44	2016/10/13	08:18:01	4.70	7.48
45	2016/10/13	08:19:01	5.00	7.37
46	2016/10/13	08:20:01	7.62	6.22
47	2016/10/13	08:21:01	7.51	6.25
48	2016/10/13	08:22:01	6.90	6.56
49	2016/10/13	08:23:01	5.84	7.03
50	2016/10/13	08:24:01	4.97	7.41
51	2016/10/13	08:25:01	5.40	7.21
52	2016/10/13	08:26:01	5.90	6.97
53	2016/10/13	08:27:01	5.79	7.00
54	2016/10/13	08:28:01	4.52	7.54
55	2016/10/13	08:29:01	3.99	7.79
56	2016/10/13	08:30:01	4.61	7.52
57	2016/10/13	08:31:01	5.53	7.12
58	2016/10/13	08:32:01	5.71	7.03
59	2016/10/13	08:33:01	5.34	7.18
60	2016/10/13	08:34:01	5.11	7.28
61	2016/10/13	08:35:01	5.16	7.26
62	2016/10/13	08:36:01	5.27	7.21

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/13	08:37:01	5.47	7.13
64	2016/10/13	08:38:01	6.87	6.53
65	2016/10/13	08:39:01	6.30	6.79
66	2016/10/13	08:40:01	5.45	7.17
67	2016/10/13	08:41:01	5.56	7.14
68	2016/10/13	08:42:01	5.62	7.11
69	2016/10/13	08:43:01	5.41	7.18
70	2016/10/13	08:44:01	4.71	7.47
71	2016/10/13	08:45:01	4.63	7.49
72	2016/10/13	08:46:01	4.90	7.38
73	2016/10/13	08:47:01	5.17	7.25
74	2016/10/13	08:48:01	5.14	7.26
75	2016/10/13	08:49:01	5.24	7.20
76	2016/10/13	08:50:01	4.99	7.31
77	2016/10/13	08:51:01	5.18	7.23
78	2016/10/13	08:52:01	5.06	7.29
79	2016/10/13	08:53:01	5.06	7.27
80	2016/10/13	08:54:01	5.07	7.27
81	2016/10/13	08:55:01	5.04	7.28
82	2016/10/13	08:56:01	5.10	7.25
83	2016/10/13	08:57:01	5.24	7.20
84	2016/10/13	08:58:01	5.26	7.17
85	2016/10/13	08:59:01	5.46	7.09
86	2016/10/13	09:00:01	5.33	7.16
87	2016/10/13	09:01:01	6.08	6.87
88	2016/10/13	09:02:01	7.88	6.03
89	2016/10/13	09:03:01	6.90	6.48
90	2016/10/13	09:04:01	5.75	7.01
91	2016/10/13	09:24:01	6.01	6.92
92	2016/10/13	09:25:01	5.93	6.94
93	2016/10/13	09:26:01	5.69	7.06
94	2016/10/13	09:27:01	5.76	7.01
95	2016/10/13	09:28:01	5.73	7.04
96	2016/10/13	09:29:01	5.65	7.06
97	2016/10/13	09:30:01	5.75	7.02
98	2016/10/13	09:31:01	5.44	7.16
99	2016/10/13	09:32:01	5.85	7.02
100	2016/10/13	09:33:01	7.63	6.22
101	2016/10/13	09:34:01	6.72	6.63
102	2016/10/13	09:35:01	5.77	7.06
103	2016/10/13	09:36:01	5.81	7.03
104	2016/10/13	09:37:01	5.78	7.02
105	2016/10/13	09:38:01	4.90	7.40
106	2016/10/13	09:39:01	4.49	7.58
107	2016/10/13	09:40:01	4.83	7.43
108	2016/10/13	09:41:01	5.11	7.30
109	2016/10/13	09:42:01	5.10	7.31
110	2016/10/13	09:43:01	5.00	7.35
111	2016/10/13	09:44:01	4.89	7.38
112	2016/10/13	09:45:01	4.86	7.40
113	2016/10/13	09:46:01	4.86	7.40
114	2016/10/13	09:47:01	4.96	7.35
115	2016/10/13	09:48:01	4.97	7.34
116	2016/10/13	09:49:01	4.86	7.39
117	2016/10/13	09:50:01	5.03	7.31
118	2016/10/13	09:51:01	4.85	7.39
119	2016/10/13	09:52:01	5.11	7.27
120	2016/10/13	09:53:01	4.96	7.34
121	2016/10/13	09:54:01	4.86	7.38
122	2016/10/13	09:55:01	4.84	7.39
123	2016/10/13	09:56:01	4.86	7.38
124	2016/10/13	09:57:01	4.95	7.34
125	2016/10/13	09:58:01	5.06	7.29

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/13	09:59:01	5.01	7.31
127	2016/10/13	10:00:01	4.86	7.37
128	2016/10/13	10:01:01	5.06	7.29
129	2016/10/13	10:02:01	5.11	7.27
130	2016/10/13	10:03:01	5.02	7.30
131	2016/10/13	10:04:01	4.98	7.32
132	2016/10/13	10:05:01	4.92	7.34
133	2016/10/13	10:06:01	5.18	7.23
134	2016/10/13	10:07:01	4.95	7.33
135	2016/10/13	10:08:01	5.10	7.26
136	2016/10/13	10:09:01	5.00	7.31
137	2016/10/13	10:10:01	4.99	7.31
138	2016/10/13	10:11:01	5.22	7.21
139	2016/10/13	10:12:01	5.07	7.27
140	2016/10/13	10:13:01	4.93	7.33
141	2016/10/13	10:14:01	4.94	7.33
142	2016/10/13	10:15:01	5.01	7.30
143	2016/10/13	10:16:01	5.13	7.25
144	2016/10/13	10:17:01	5.04	7.28
145	2016/10/13	10:18:01	4.95	7.30
146	2016/10/13	10:19:01	Calibrations	Calibrations
147	2016/10/13	10:20:01	Calibrations	Calibrations
148	2016/10/13	10:21:01	Calibrations	Calibrations
149	2016/10/13	10:22:01	Calibrations	Calibrations
150	2016/10/13	10:23:01	Calibrations	Calibrations
151	2016/10/13	10:24:01	Calibrations	Calibrations
152	2016/10/13	10:25:01	Calibrations	Calibrations
153	2016/10/13	10:26:01	Calibrations	Calibrations
154	2016/10/13	10:27:01	Calibrations	Calibrations
155	2016/10/13	10:28:01	Calibrations	Calibrations
156	2016/10/13	10:29:01	Calibrations	Calibrations
157	2016/10/13	10:30:01	Calibrations	Calibrations
158	2016/10/13	10:31:01	Calibrations	Calibrations
159	2016/10/13	10:32:01	Calibrations	Calibrations
160	2016/10/13	10:33:01	4.89	7.34
161	2016/10/13	10:34:01	4.97	7.34
162	2016/10/13	10:35:01	5.05	7.31
163	2016/10/13	10:36:01	4.90	7.39
164	2016/10/13	10:37:01	4.83	7.42
165	2016/10/13	10:38:01	4.86	7.43
166	2016/10/13	10:39:01	6.24	6.86
167	2016/10/13	10:40:01	6.83	6.60
168	2016/10/13	10:41:01	6.16	6.89
169	2016/10/13	10:42:01	5.71	7.09
170	2016/10/13	10:43:01	5.68	7.09
171	2016/10/13	10:44:01	5.57	7.14
172	2016/10/13	10:45:01	5.19	7.28
173	2016/10/13	10:46:01	4.82	7.46
174	2016/10/13	10:47:01	4.79	7.46
175	2016/10/13	10:48:01	5.03	7.38
176	2016/10/13	10:49:01	4.82	7.46
177	2016/10/13	10:50:01	4.82	7.46
178	2016/10/13	10:51:01	4.80	7.47
179	2016/10/13	10:52:01	4.95	7.41
180	2016/10/13	10:53:01	4.79	7.48
RUN 2 AVERAGES			**5.30**	**7.21**

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
RUN 3				
1	2016/10/13	11:35:01	Calibrations	Calibrations
2	2016/10/13	11:36:01	Calibrations	Calibrations
3	2016/10/13	11:37:01	Calibrations	Calibrations
4	2016/10/13	11:38:01	Calibrations	Calibrations
5	2016/10/13	11:39:01	Calibrations	Calibrations
6	2016/10/13	11:40:01	Calibrations	Calibrations
7	2016/10/13	11:41:01	Calibrations	Calibrations
8	2016/10/13	11:42:01	Calibrations	Calibrations
9	2016/10/13	11:43:01	Calibrations	Calibrations
10	2016/10/13	11:44:01	4.44	7.67
11	2016/10/13	11:45:01	4.83	7.55
12	2016/10/13	11:46:01	5.15	7.42
13	2016/10/13	11:47:01	4.97	7.51
14	2016/10/13	11:48:01	5.39	7.35
15	2016/10/13	11:49:01	6.83	6.73
16	2016/10/13	11:50:01	6.41	6.90
17	2016/10/13	11:51:01	5.87	7.12
18	2016/10/13	11:52:01	5.57	7.23
19	2016/10/13	11:53:01	4.65	7.63
20	2016/10/13	11:54:01	4.47	7.69
21	2016/10/13	11:55:01	4.70	7.59
22	2016/10/13	11:56:01	5.07	7.43
23	2016/10/13	11:57:01	5.13	7.40
24	2016/10/13	11:58:01	5.11	7.42
25	2016/10/13	11:59:01	6.76	6.74
26	2016/10/13	12:00:01	7.36	6.42
27	2016/10/13	12:01:01	6.27	6.92
28	2016/10/13	12:02:01	5.26	7.38
29	2016/10/13	12:03:01	5.14	7.44
30	2016/10/13	12:04:01	5.69	7.17
31	2016/10/13	12:05:01	5.28	7.33
32	2016/10/13	12:06:01	4.63	7.62
33	2016/10/13	12:07:01	4.61	7.64
34	2016/10/13	12:08:01	5.07	7.45
35	2016/10/13	12:09:01	6.46	6.87
36	2016/10/13	12:10:01	6.77	6.72
37	2016/10/13	12:11:01	6.14	7.00
38	2016/10/13	12:12:01	5.84	7.12
39	2016/10/13	12:13:01	5.30	7.35
40	2016/10/13	12:14:01	4.41	7.74
41	2016/10/13	12:15:01	4.43	7.73
42	2016/10/13	12:16:01	4.97	7.50
43	2016/10/13	12:17:01	4.96	7.49
44	2016/10/13	12:18:01	4.90	7.52
45	2016/10/13	12:19:01	4.92	7.50
46	2016/10/13	12:20:01	4.72	7.59
47	2016/10/13	12:21:01	4.72	7.59
48	2016/10/13	12:22:01	4.74	7.59
49	2016/10/13	12:23:01	5.04	7.45
50	2016/10/13	12:24:01	4.90	7.50
51	2016/10/13	12:25:01	4.71	7.60
52	2016/10/13	12:26:01	4.95	7.49
53	2016/10/13	12:27:01	5.00	7.46
54	2016/10/13	12:28:01	4.82	7.54
55	2016/10/13	12:29:01	4.89	7.51
56	2016/10/13	12:30:01	4.77	7.56
57	2016/10/13	12:31:01	4.81	7.54
58	2016/10/13	12:32:01	4.81	7.53
59	2016/10/13	12:33:01	4.93	7.49
60	2016/10/13	12:34:01	4.87	7.51
61	2016/10/13	12:35:01	4.96	7.47
62	2016/10/13	12:36:01	4.86	7.52

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
63	2016/10/13	12:37:01	4.92	7.48
64	2016/10/13	12:38:01	4.94	7.48
65	2016/10/13	12:39:01	4.92	7.49
66	2016/10/13	12:40:01	4.98	7.45
67	2016/10/13	12:41:01	4.77	7.55
68	2016/10/13	12:42:01	4.95	7.47
69	2016/10/13	12:43:01	4.94	7.48
70	2016/10/13	12:44:01	4.96	7.46
71	2016/10/13	12:45:01	3.81	5.78
72	2016/10/13	12:46:01	0.08	0.21
73	2016/10/13	12:47:01	0.09	0.20
74	2016/10/13	12:48:01	9.01	8.61
75	2016/10/13	12:49:01	10.01	10.06
76	2016/10/13	12:50:01	3.28	3.60
77	2016/10/13	12:51:01	0.09	0.20
78	2016/10/13	12:52:01	0.13	0.18
79	2016/10/13	12:53:01	0.21	0.25
80	2016/10/13	12:54:01	3.38	4.90
81	2016/10/13	12:55:01	4.91	7.44
82	2016/10/13	12:56:01	4.85	7.49
83	2016/10/13	12:57:01	5.02	7.41
84	2016/10/13	12:58:01	5.07	7.40
85	2016/10/13	12:59:01	4.97	7.44
86	2016/10/13	13:00:01	4.92	7.45
87	2016/10/13	13:01:01	5.06	7.40
88	2016/10/13	13:02:01	4.96	7.44
89	2016/10/13	13:03:01	4.98	7.44
90	2016/10/13	13:04:01	5.04	7.40
91	2016/10/13	13:15:01	5.85	7.12
92	2016/10/13	13:16:01	5.59	7.24
93	2016/10/13	13:17:01	5.34	7.33
94	2016/10/13	13:18:01	4.81	7.56
95	2016/10/13	13:19:01	4.92	7.50
96	2016/10/13	13:20:01	4.92	7.51
97	2016/10/13	13:21:01	5.04	7.46
98	2016/10/13	13:22:01	5.08	7.45
99	2016/10/13	13:23:01	6.63	6.81
100	2016/10/13	13:24:01	6.76	6.74
101	2016/10/13	13:25:01	6.32	6.93
102	2016/10/13	13:26:01	5.84	7.13
103	2016/10/13	13:27:01	5.19	7.40
104	2016/10/13	13:28:01	4.40	7.76
105	2016/10/13	13:29:01	4.46	7.74
106	2016/10/13	13:30:01	4.94	7.54
107	2016/10/13	13:31:01	5.18	7.43
108	2016/10/13	13:32:01	5.28	7.39
109	2016/10/13	13:33:01	7.14	6.61
110	2016/10/13	13:34:01	6.83	6.73
111	2016/10/13	13:35:01	5.77	7.21
112	2016/10/13	13:36:01	5.81	7.17
113	2016/10/13	13:37:01	4.92	7.54
114	2016/10/13	13:38:01	4.11	7.91
115	2016/10/13	13:39:01	4.62	7.68
116	2016/10/13	13:40:01	5.09	7.48
117	2016/10/13	13:41:01	5.14	7.46
118	2016/10/13	13:42:01	5.04	7.50
119	2016/10/13	13:43:01	6.24	7.01
120	2016/10/13	13:44:01	6.56	6.87
121	2016/10/13	13:45:01	6.21	7.01
122	2016/10/13	13:46:01	5.81	7.17
123	2016/10/13	13:47:01	5.27	7.39
124	2016/10/13	13:48:01	4.48	7.74
125	2016/10/13	13:49:01	4.54	7.72

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)
126	2016/10/13	13:50:01	4.99	7.53
127	2016/10/13	13:51:01	5.15	7.46
128	2016/10/13	13:52:01	5.39	7.39
129	2016/10/13	13:53:01	7.48	6.44
130	2016/10/13	13:54:01	6.36	6.95
131	2016/10/13	13:55:01	5.35	7.41
132	2016/10/13	13:56:01	5.53	7.31
133	2016/10/13	13:57:01	4.91	7.56
134	2016/10/13	13:58:01	4.42	7.79
135	2016/10/13	13:59:01	4.81	7.61
136	2016/10/13	14:00:01	4.92	7.56
137	2016/10/13	14:01:01	5.09	7.48
138	2016/10/13	14:02:01	5.06	7.51
139	2016/10/13	14:03:01	5.96	7.16
140	2016/10/13	14:04:01	7.02	6.67
141	2016/10/13	14:05:01	6.23	7.02
142	2016/10/13	14:06:01	5.72	7.23
143	2016/10/13	14:07:01	5.51	7.31
144	2016/10/13	14:08:01	4.84	7.60
145	2016/10/13	14:09:01	4.46	7.76
146	2016/10/13	14:10:01	4.78	7.62
147	2016/10/13	14:11:01	5.14	7.47
148	2016/10/13	14:12:01	4.99	7.52
149	2016/10/13	14:13:01	4.97	7.55
150	2016/10/13	14:14:01	6.66	6.84
151	2016/10/13	14:15:01	6.25	7.02
152	2016/10/13	14:16:01	5.67	7.29
153	2016/10/13	14:17:01	5.42	7.38
154	2016/10/13	14:18:01	5.02	7.54
155	2016/10/13	14:19:01	4.61	7.72
156	2016/10/13	14:20:01	4.74	7.67
157	2016/10/13	14:21:01	4.91	7.59
158	2016/10/13	14:22:01	4.97	7.57
159	2016/10/13	14:23:01	5.15	7.49
160	2016/10/13	14:24:01	5.56	7.36
161	2016/10/13	14:25:01	6.67	6.85
162	2016/10/13	14:26:01	5.97	7.16
163	2016/10/13	14:27:01	5.59	7.32
164	2016/10/13	14:28:01	5.39	7.38
165	2016/10/13	14:29:01	4.77	7.65
166	2016/10/13	14:30:01	4.40	7.81
167	2016/10/13	14:31:01	4.91	7.60
168	2016/10/13	14:32:01	5.10	7.51
169	2016/10/13	14:33:01	5.76	7.27
170	2016/10/13	14:34:01	7.06	6.68
171	2016/10/13	14:35:01	6.09	7.11
172	2016/10/13	14:36:01	5.63	7.32
173	2016/10/13	14:37:01	5.35	7.42
174	2016/10/13	14:38:01	4.36	7.85
175	2016/10/13	14:39:01	4.44	7.82
176	2016/10/13	14:40:01	4.94	7.60
177	2016/10/13	14:41:01	5.12	7.51
178	2016/10/13	14:42:01	4.92	7.59
179	2016/10/13	14:43:01	4.82	7.62
180	2016/10/13	14:44:01	4.76	7.64
RUN 3 AVERAGES			**5.14**	**7.15**

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

Client	ArcelorMittal	**Date**	October 12, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 1
Unit	Boilers 1 and 2	**Start Time**	13:15
Operation	Normal	**End Time**	16:58
Tester(s)	JV, JW, TL, TM		

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	CC210754	XC034406B	40	40
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	40	40
LIMITS				40 % to 60 %		100%							

Gas	Upscale: Enter "Low" "Mid" or "High" below "Zero"	Actual Upscale Conc.	Analyzer Cal. Response	Initial Values		Final Values		Drift (% of Span)	Span	Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
				System Cal. Response	System Cal. Bias (% of Span)	System Cal. Response	System Cal. Bias (% of Span)						
O2	Zero		0.09	0.12	0.15	0.13	0.20	0.05	20.03	0.125			
	Mid	10.01	10.14	10.08	-0.30	10.03	-0.55	-0.25	20.03	10.055	5.47	5.39	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.18	0.40	0.00	19.79	0.18			
	Mid	10.15	10.17	10.06	-0.56	10.01	-0.81	-0.25	19.79	10.035	7.29	7.33	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		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	**Date**	October 13, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 2
Unit	Boilers 1 and 2	**Start Time**	7:35
Operation	Normal	**End Time**	10:54
Tester(s)	JV, JW, TL, 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	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B
LIMITS				40 % to 60 %		100%					

	Upscale: Enter "Low" "Mid" or "High" below "Zero"			Initial Values		Final Values				Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
Gas		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				
O2	Zero		0.09	0.13	0.20	0.12	0.15	-0.05	20.03	0.125			
	Mid	10.01	10.14	10.03	-0.55	10.00	-0.70	-0.15	20.03	10.015	5.30	5.24	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.11	0.05	-0.35	19.79	0.145			
	Mid	10.15	10.17	10.01	-0.81	9.96	-1.06	-0.25	19.79	9.985	7.21	7.29	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		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	**Date**	October 13, 2016
Project No	16-167	**Location**	Battery Stack Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Boilers 1 and 2	**Start Time**	11:35
Operation	Normal	**End Time**	14:45
Tester(s)	JV, JW, TL, 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	CC210754	XC034406B
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B
LIMITS				40 % to 60 %		100%					

				Initial Values		Final Values				Average of Initial and Final System Responses	Average Indicated Gas Conc.	Corrected Gas Conc.	Conc. Units
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				
O2	Zero		0.09	0.12	0.15	0.11	0.10	-0.05	20.03	0.12			
	Mid	10.01	10.14	10.00	-0.70	9.98	-0.80	-0.10	20.03	9.99	5.14	5.10	d. vol. %
CO2	Zero		0.10	0.11	0.05	0.13	0.15	0.10	19.79	0.12			
	Mid	10.15	10.17	9.96	-1.06	9.97	-1.01	0.05	19.79	9.97	7.15	7.25	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	October 12, 2016	
Project No.:	16-167		Test Location:	Common Stack	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Boilers 1 and 2		Test Start Time:	1:15 PM	
Unit Operation:	Normal		Test Finish Time:	4:58 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:	1618		CO + N2	87.28	% 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
Test Time (Theta)	180	minutes	Water Collected (W_f- W_i)	368.5	g
Barometric Pressure (Pbar)	29.27	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	17.375	scf
Stack Static Pressure (Pg)	-0.37	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	17.375	scf
Stack Diameter (Ds) (L if rectangular)	67.0	inches	Volume Dry Gas Metered (Vm)	76.652	dacf
Stack Width (enter NA if circular)	NA	inches	Vol. Dry Gas Metered Stand.(Vm(std))	72.124	dscf
Nozzle Diameter (Dn) (NA if NA)	0.286	inches	Volume Dry Gas Metered (Vm(m^3))	2.171	dacm
O2	5.39	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.042	dscm
CO2	7.33	% dv	Stack Absolute Pressure (Ps)	29.24	in. Hg
Product Rate (enter NA if not needed)	na	input ton/hr	Stack Absolute Temperature (Tsavg)	921.3	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	965.71	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Sample Calculation Title	Toluene Soluable		H2O in the gas from test data (Bws)	0.1941	vol. fraction
F_d @ 68 F and 760 mm Hg (NA if NA)	NA	dscf/MMBtu	H2O in the gas used (lower of the 2 Bws)	0.1941	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	29.39	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	27.18	lb/lb-mole
Calculations			Gas Velocity (Vs)	33.88	ft/s
Meter Temperature (Tm)	91.2	F	Is the stack circular or rectangular?	CIRCULAR	
Stack Temperature (Tsavg)	461.6	F	Area Stack (As)	24.484	ft^2
Orifice Pressure Drop (dHavg)	0.592	in. H_2O	Actual Gas Flowrate	49,767	acfm
Gas Velocity Head (dP)^^avg	0.4381	in. H_2O^1/2	Standard Gas Flowrate	27,867	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	22,457	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	1,409	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	789	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	636	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000446	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	97.98	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

	Residue (mg)	Volume (ml)	Blank Correction (mg/mL)
Laboratory Filter Blank	9.29	140	0.066
Laboratory Toluene Blank	5.80	100	0.058
Montrose Toluene Field Blank	9.70	200	0.049
Montrose Water Field Blank	0.00	150	0.000

Blank Correction	Montrose Volume	Lab Volume	Corrected Value (mg)
Container 1		140	9.29
Container 2	99	55	8.45
Container 3W		150	0.00
Container 3S	50		2.43

	Raw Mass	Blank Mass	Blank Corrected Mass	
(1) Front-half Filter TSO Mass (mn)	8.2	9.29	0.00	mg
(2) F1/2 Rinse TSO Mass (mn)	9.8	8.45	1.35	mg
(3W) B1/2 TSO Mass (mn)	1.1	0.00	1.10	mg
(3S) B1/2 Rinse TSO Mass (mn)	1.7	2.43	0.00	mg
Total TSO Extractable Mass			2.45	mg
TSO Concentration			1.20	mg/dscm
TSO Concentration			0.0005	gr/dscf
TSO Emission Rate			0.10	lb/hr

Notes and Assumptions

Container 1 Blank calculated using 90% upper confidence interval of 9.29 mg of residue as inidicated in the letter provided by Maxxam dated 3/24/2017
Container 2 Blank calculated by prorating the Montrose reported Container 2 volume by the Montrose Toluene Field Blank rate (0.049 mg/mL) and adding to lab verified volume of toluene (55 mL) used in extraction by the reported internal laboratory blank (.058 mg/mL)
Container 3W Blank calculated by prorating the lab verified volume of toluene (150 mL) used in extraction by the reported Montrose Water Blank (0.00 mg/L)
Container 3S Blank calculated by prorating the Montrose estimated Container 3S volume of 50 mL by the Montrose Toluene Field Blank rate (0.049 mg/mL)\

ArcelorMittal Boilers 1 and 2 — **Run 1** — **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	0.15	0.387	0.50	465	83	82
A-1	0.15	0.387	0.50	466	83	82
A-1	0.15	0.387	0.50	465	83	82
A-2	0.15	0.387	0.50	464	85	83
A-2	0.15	0.387	0.50	464	85	83
A-2	0.15	0.387	0.50	464	85	83
A-3	0.17	0.412	0.51	465	86	83
A-3	0.17	0.412	0.51	465	86	83
A-3	0.17	0.412	0.51	465	86	83
A-4	0.14	0.374	0.42	462	87	83
A-4	0.14	0.374	0.42	462	87	83
A-4	0.14	0.374	0.42	462	87	83
A-5	0.17	0.412	0.51	461	88	84
A-5	0.17	0.412	0.51	461	88	84
A-5	0.17	0.412	0.51	461	88	84
A-6	0.19	0.436	0.57	462	89	84
A-6	0.19	0.436	0.57	462	89	84
A-6	0.19	0.436	0.57	462	89	84
A-7	0.17	0.412	0.51	460	90	84
A-7	0.17	0.412	0.51	462	90	84
A-7	0.17	0.412	0.51	462	90	84
A-8	0.23	0.480	0.70	464	90	84
A-8	0.23	0.480	0.70	464	90	84
A-8	0.23	0.480	0.70	464	90	84
A-9	0.25	0.500	0.75	462	92	89
A-9	0.25	0.500	0.75	460	92	89
A-9	0.25	0.500	0.75	463	92	89
A-10	0.30	0.548	0.75	460	98	91
A-10	0.30	0.548	0.75	462	98	91
A-10	0.30	0.548	0.75	463	98	91
A-11	0.27	0.520	0.81	459	98	91
A-11	0.27	0.520	0.81	460	98	91
A-11	0.27	0.520	0.81	462	98	91
A-12	0.35	0.592	1.10	460	99	93
A-12	0.35	0.592	1.10	461	99	93
A-12	0.35	0.592	1.10	462	99	93
B-1	0.26	0.510	0.78	458	100	98
B-1	0.26	0.510	0.78	461	100	98
B-1	0.26	0.510	0.78	462	100	98
B-2	0.24	0.490	0.78	436	100	98
B-2	0.24	0.490	0.78	460	97	96
B-2	0.24	0.490	0.78	460	97	96
B-3	0.23	0.480	0.70	460	97	96
B-3	0.23	0.480	0.70	458	97	96
B-3	0.23	0.480	0.70	461	97	96
B-4	0.21	0.458	0.63	460	97	96
B-4	0.21	0.458	0.63	462	97	96
B-4	0.21	0.458	0.63	463	97	96
B-5	0.20	0.447	0.60	463	95	95
B-5	0.20	0.447	0.60	460	95	95
B-5	0.20	0.447	0.60	461	95	95
B-6	0.14	0.374	0.42	467	95	94
B-6	0.14	0.374	0.42	463	95	93
B-6	0.14	0.374	0.42	462	95	93
B-7	0.13	0.361	0.40	460	94	93
B-7	0.13	0.361	0.40	462	94	93
B-7	0.13	0.361	0.40	460	94	93
B-8	0.17	0.412	0.51	465	93	92
B-8	0.17	0.412	0.51	462	93	92
B-8	0.17	0.412	0.51	462	93	92
B-9	0.13	0.361	0.40	462	93	92
B-9	0.13	0.361	0.40	460	93	92
B-9	0.13	0.361	0.40	460	92	91
B-10	0.15	0.387	0.45	465	92	91
B-10	0.15	0.387	0.45	462	92	91
B-10	0.15	0.387	0.45	460	92	91
B-11	0.14	0.374	0.42	463	92	90
B-11	0.14	0.374	0.42	461	92	90
B-11	0.14	0.374	0.42	462	93	91
B-12	0.16	0.400	0.48	464	92	90
B-12	0.16	0.400	0.48	460	92	90
B-12	0.16	0.400	0.48	460	93	91
Average	0.20	0.438	0.59	461.6		91.2

Initial volume	957.200	ft^3	Initial volume	0.000	liters
Final volume	1033.852	ft^3	Final volume	0.000	liters
Total metered	76.652	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	960.6	707.9	252.7			0.0
2	705.8	615.4	90.4			0.0
3	621.1	619.7	1.4			0.0
4	790.8	766.8	24.0			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	3078.3	2709.8	368.5	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal		Test Date:	October 13, 2016	
Project No.:	16-167		Test Location:	Common Stack	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Boilers 1 and 2		Test Start Time:	7:35 AM	
Unit Operation:	Normal		Test Finish Time:	10:54 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:	1618		CO + N2	87.47	% 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
Test Time (Theta)	180.0	minutes	Water Collected (W_f - W_i)	388.3	g
Barometric Pressure (Pbar)	29.06	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	18.308	scf
Stack Static Pressure (Pg)	-0.38	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	18.308	scf
Stack Diameter (Ds) (L if rectangular)	67.0	inches	Volume Dry Gas Metered (Vm)	77.028	dacf
Stack Width (enter NA if circular)	NA	inches	Vol. Dry Gas Metered Stand.(Vm(std))	74.117	dscf
Nozzle Diameter (Dn) (NA if NA)	0.286	inches	Volume Dry Gas Metered (Vm(m^3))	2.181	dacm
O2	5.24	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.099	dscm
CO2	7.29	% dv	Stack Absolute Pressure (Ps)	29.03	in. Hg
Product Rate (enter NA if not needed)	na	input ton/hr	Stack Absolute Temperature (Tsavg)	924.3	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	994.77	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Sample Calculation Title	Toluene Soluable		H2O in the gas from test data (Bws)	0.1981	vol. fraction
F_d @ 68 F and 760 mm Hg (NA if NA)	na	dscf/MMBtu	H2O in the gas used (lower of the 2 Bws)	0.1981	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	29.38	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	27.12	lb/lb-mole
Calculations			Gas Velocity (Vs)	34.60	ft/s
Meter Temperature (Tm)	75.2	F	Is the stack circular or rectangular?	CIRCULAR	
Stack Temperature (Tsavg)	464.6	F	Area Stack (As)	24.484	ft^2
Orifice Pressure Drop (dHavg)	0.602	in. H_2O	Actual Gas Flowrate	50,826	acfm
GasVelocity Head (dP) ^avg	0.4446	in. H_2O^1/2	Standard Gas Flowrate	28,162	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	22,584	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	1,439	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	797	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	640	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000446	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	100.12	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

	Residue (mg)	Volume (ml)	Blank Correction (mg/mL)
Laboratory Filter Blank	9.29	140	0.066
Laboratory Toluene Blank	5.80	100	0.058
Montrose Toluene Field Blank	9.70	200	0.049
Montrose Water Field Blank	0.00	150	0.000

Blank Correction	Montrose Volume	Lab Volume	Corrected Value (mg)
Container 1		140	9.29
Container 2	76	55	7.34
Container 3W		150	0.00
Container 3S	50		2.43

	Raw Mass	Blank Mass	Blank Corrected Mass	
(1) Front-half Filter TSO Mass (mn)	6.2	9.29	0.00	mg
(2) F1/2 Rinse TSO Mass (mn)	10.2	7.34	2.86	mg
(3W) B1/2 TSO Mass (mn)	2.1	0.00	2.10	mg
(3S) B1/2 Rinse TSO Mass (mn)	4.3	2.43	1.88	mg
Total TSO Extractable Mass			6.84	mg
TSO Concentration			3.26	mg/dscm
TSO Concentration			0.0014	gr/dscf
TSO Emission Rate			0.28	lb/hr

Notes and Assumptions

Container 1 Blank calculated using 90% upper confidence interval of 9.29 mg of residue as inidicated in the letter provided by Maxxam dated 3/24/2017

Container 2 Blank calculated by prorating the Montrose reported Container 2 volume by the Montrose Toluene Field Blank rate (0.049 mg/mL) and adding to lab verified volume of toluene (55 mL) used in extraction by the reported internal laboratory blank (.058 mg/mL)

Container 3W Blank calculated by prorating the lab verified volume of toluene (150 mL) used in extraction by the reported Montrose Water Blank (0.00 mg/L)

Container 3S Blank calculated by prorating the Montrose estimated Container 3S volume of 50 mL by the Montrose Toluene Field Blank rate (0.049 mg/mL)\

ArcelorMittal Run 2 **F or C?**

Boilers 1 and 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	0.16	0.400	0.48	463	69	69
A-1	0.16	0.400	0.48	465	69	69
A-1	0.16	0.400	0.48	463	69	69
A-2	0.19	0.436	0.57	463	70	69
A-2	0.19	0.436	0.57	472	70	70
A-2	0.19	0.436	0.57	469	71	69
A-3	0.23	0.480	0.70	467	73	69
A-3	0.23	0.480	0.70	466	73	69
A-3	0.23	0.480	0.70	465	74	70
A-4	0.17	0.412	0.51	466	74	70
A-4	0.17	0.412	0.51	471	77	70
A-4	0.17	0.412	0.51	468	77	70
A-5	0.20	0.447	0.60	465	77	71
A-5	0.20	0.447	0.60	464	77	71
A-5	0.20	0.447	0.60	462	78	70
A-6	0.16	0.400	0.48	470	78	72
A-6	0.16	0.400	0.48	469	78	72
A-6	0.16	0.400	0.48	467	78	72
A-7	0.20	0.447	0.60	468	79	72
A-7	0.20	0.447	0.60	467	78	72
A-7	0.20	0.447	0.60	469	78	72
A-8	0.15	0.387	0.45	468	78	73
A-8	0.15	0.387	0.45	469	78	73
A-8	0.15	0.387	0.45	467	79	73
	0.15	0.387	0.45	467	78	73
A-9	0.15	0.387	0.45	468	78	73
A-9	0.15	0.387	0.45	467	78	73
A-10	0.17	0.412	0.51	463	79	74
A-10	0.17	0.412	0.51	463	79	74
A-10	0.17	0.412	0.51	461	79	74
A-11	0.24	0.490	0.72	466	80	74
A-11	0.24	0.490	0.72	464	80	75
A-11	0.24	0.490	0.72	464	80	75
A-12	0.18	0.424	0.54	471	81	75
A-12	0.18	0.424	0.54	472	81	75
A-12	0.18	0.424	0.54	470	81	75
B-1	0.27	0.520	0.81	467	77	76
B-1	0.27	0.520	0.81	461	78	76
B-1	0.27	0.520	0.81	460	78	76
B-2	0.29	0.539	0.87	467	78	76
B-2	0.29	0.539	0.87	465	78	76
B-2	0.29	0.539	0.87	465	78	76
B-3	0.26	0.510	0.78	462	78	76
B-3	0.26	0.510	0.78	462	78	76
B-3	0.26	0.510	0.78	464	79	76
B-4	0.25	0.500	0.75	462	78	75
B-4	0.25	0.500	0.75	462	78	75
B-4	0.25	0.500	0.75	461	78	75
B-5	0.22	0.469	0.66	462	78	75
B-5	0.22	0.469	0.66	463	78	75
B-5	0.22	0.469	0.66	463	78	75
B-6	0.22	0.469	0.66	463	78	75
B-6	0.22	0.469	0.66	465	78	75
B-6	0.22	0.469	0.66	464	77	75
B-7	0.21	0.458	0.63	464	78	74
B-7	0.21	0.458	0.63	463	78	74
B-7	0.21	0.458	0.63	464	78	74
B-8	0.18	0.424	0.54	463	77	74
B-8	0.18	0.424	0.54	463	77	73
B-8	0.18	0.424	0.54	463	77	73
B-9	0.20	0.447	0.60	463	77	74
B-9	0.20	0.447	0.60	463	77	74
B-9	0.20	0.447	0.60	462	81	74
B-10	0.16	0.400	0.48	460	77	73
B-10	0.16	0.400	0.48	460	77	73
B-10	0.16	0.400	0.48	460	77	73
B-11	0.18	0.424	0.60	463	78	73
B-11	0.18	0.424	0.60	463	78	73
B-11	0.18	0.424	0.60	461	78	73
B-12	0.15	0.387	0.45	460	78	73
B-12	0.15	0.387	0.45	460	78	73
B-12	0.15	0.387	0.45	461	78	73
Average	0.20	0.445	0.60	464.6		75.2

Initial volume	34.903	ft^3	Initial volume	0.000	liters
Final volume	111.931	ft^3	Final volume	0.000	liters
Total metered	77.028	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	939.2	714.8	224.4			0.0
2	787.5	680.4	107.1			0.0
3	638.9	617	21.9			0.0
4	779.8	744.9	34.9			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	3145.4	2757.1	388.3	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal		Test Date:	October 13, 2016	
Project No.:	16-167		Test Location:	Battery Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Boilers 1 and 2		Test Start Time:	11:35 AM	
Unit Operation:	Normal		Test Finish Time:	2:45 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:	1618		CO + N2	87.65	% 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
Test Time (Theta)	180	minutes	Water Collected (W_f - W_i)	383.1	g
Barometric Pressure (Pbar)	29.06	in. Hg	Water Vapor in Silica Gel (Vwsg(std))	18.063	scf
Stack Static Pressure (Pg)	-0.38	in. H_2O	Vol. Water Vapor in Gas Stand.(Vw(std))	18.063	scf
Stack Diameter (Ds) (L if rectangular)	67.0	inches	Volume Dry Gas Metered (Vm)	79.331	dacf
Stack Width (enter NA if circular)	NA	inches	Vol. Dry Gas Metered Stand.(Vm(std))	76.640	dscf
Nozzle Diameter (Dn) (NA if NA)	0.286	inches	Volume Dry Gas Metered (Vm(m^3))	2.246	dacm
O2 (Taken from CEMs Worksheet)	5.10	% dv	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	2.170	dscm
CO2 (Taken from CEMs Worksheet)	7.25	% dv	Stack Absolute Pressure (Ps)	29.03	in. Hg
Product Rate (enter NA if not needed)	na	input ton/hr	Stack Absolute Temperature (Tsavg)	922.4	R
Is the input ton/hr metric? (YES=1)	0		H2O Vapor Pressure @ avg Stack Temp.	976.03	in. Hg
Pitot Tube Coefficient (Cp)	0.84		H2O in the gas at saturation (Bws)	1.0000	vol. fraction
Sample Calculation Title	Toluene Soluable		H2O in the gas from test data (Bws)	0.1907	vol. fraction
F_d @ 68 F and 760 mm Hg (NA if NA)	na	dscf/MMBtu	H2O in the gas used (lower of the 2 Bws)	0.1907	vol. fraction
Standard Temperature	68	F	Is the Gas Stream Saturated With H2O?	NO	
Standard Pressure	760	mm Hg	Dry Gas Molecular Weight (Md)	29.36	lb/lb-mole
Pitot Tube Constant (Kp)	85.49		Wet Gas Molecular Weight (Ms)	27.20	lb/lb-mole
Calculations			Gas Velocity (Vs)	35.97	ft/s
Meter Temperature (Tm)	73.1	F	Is the stack circular or rectangular?	CIRCULAR	
Stack Temperature (Tsavg)	462.7	F	Area Stack (As)	24.484	ft^2
Orifice Pressure Drop (dHavg)	0.653	in. H_2O	Actual Gas Flowrate	52,846	acfm
GasVelocity Head (dP)^avg	0.4634	in. H_2O^1/2	Standard Gas Flowrate	29,344	scfm
F_d @ Standard Conditions	NA	dscf/MMBtu	Dry Standard Gas Flowrate	23,747	dscfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Actual Gas Flowrate	1,496	acm/min
Heat Input Based on F_d	NA	MMBtu/hr	Standard Gas Flowrate	831	scm/min
K1method 4	0.04706	scf/ml	Dry Standard Gas Flowrate	672	dscm/min
K2method 4	0.04715	scf/g	Area Nozzle (An)	0.000446	ft^2
K1method 5	17.64	R/in. Hg	Percent of Isokinetic Sampling (I)	98.46	%
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

	Residue (mg)	Volume (ml)	Blank Correction (mg/mL)
Laboratory Filter Blank	9.29	140	0.066
Laboratory Toluene Blank	5.80	100	0.058
Montrose Toluene Field Blank	9.70	200	0.049
Montrose Water Field Blank	0.00	150	0.000

Blank Correction	Montrose Volume	Lab Volume	Corrected Value (mg)
Container 1		140	9.29
Container 2	44	55	5.78
Container 3W		150	0.00
Container 3S	50		2.43

	Raw Mass	Blank Mass	Blank Corrected Mass	
(1) Front-half Filter TSO Mass (mn)	8.6	9.29	0.00	mg
(2) F1/2 Rinse TSO Mass (mn)	10.4	5.78	4.62	mg
(3W) B1/2 TSO Mass (mn)	< 0.5	0.00	< 0.50	mg
(3S) B1/2 Rinse TSO Mass (mn)	4.1	2.43	1.68	mg
Total TSO Extractable Mass			< 6.79	mg
TSO Concentration			< 3.13	mg/dscm
TSO Concentration			< 0.0014	gr/dscf
TSO Emission Rate			< 0.28	lb/hr

Notes and Assumptions

Container 1 Blank calculated using 90% upper confidence interval of 9.29 mg of residue as inidicated in the letter provided by Maxxam dated 3/24/2017

Container 2 Blank calculated by prorating the Montrose reported Container 2 volume by the Montrose Toluene Field Blank rate (0.049 mg/mL) and adding to lab verified volume of toluene (55 mL) used in extraction by the reported internal laboratory blank (.058 mg/mL)

Container 3W Blank calculated by prorating the lab verified volume of toluene (150 mL) used in extraction by the reported Montrose Water Blank (0.00 mg/L)

Container 3S Blank calculated by prorating the Montrose estimated Container 3S volume of 50 mL by the Montrose Toluene Field Blank rate (0.049 mg/mL)\

ArcelorMittal Boilers 1 and 2 **Run 3** **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	0.18	0.424	0.54	468	69	70
A-1	0.18	0.424	0.54	468	69	70
A-1	0.18	0.424	0.54	463	69	69
A-2	0.15	0.387	0.45	465	69	69
A-2	0.15	0.387	0.45	466	69	69
A-2	0.15	0.387	0.45	465	70	69
A-3	0.20	0.447	0.60	465	69	69
A-3	0.20	0.447	0.60	469	69	69
A-3	0.20	0.447	0.60	463	70	69
A-4	0.17	0.412	0.51	467	72	69
A-4	0.17	0.412	0.51	464	71	69
A-4	0.17	0.412	0.51	466	71	69
A-5	0.19	0.436	0.57	468	71	70
A-5	0.19	0.436	0.57	467	71	70
A-5	0.19	0.436	0.57	464	72	69
A-6	0.21	0.458	0.63	463	73	69
A-6	0.21	0.458	0.63	462	73	69
A-6	0.21	0.458	0.63	464	74	70
A-7	0.18	0.424	0.54	462	74	70
A-7	0.18	0.424	0.54	462	74	70
A-7	0.18	0.424	0.54	463	74	70
A-8	0.19	0.436	0.57	462	73	70
A-8	0.19	0.436	0.57	462	73	69
A-8	0.19	0.436	0.57	460	73	69
A-9	0.23	0.480	0.69	463	75	70
A-9	0.23	0.480	0.69	463	75	70
A-9	0.23	0.480	0.69	461	75	70
A-10	0.15	0.387	0.45	459	75	71
A-10	0.15	0.387	0.45	457	75	71
A-10	0.15	0.387	0.45	460	75	71
A-11	0.27	0.520	0.81	459	75	70
A-11	0.27	0.520	0.81	459	75	70
A-11	0.27	0.520	0.81	460	75	70
A-12	0.22	0.469	0.66	454	76	71
A-12	0.22	0.469	0.66	453	76	71
A-12	0.22	0.469	0.66	453	76	71
B-1	0.31	0.557	0.93	457	74	71
B-1	0.31	0.557	0.93	457	74	71
B-1	0.31	0.557	0.93	455	75	71
B-2	0.28	0.529	0.84	462	75	71
B-2	0.28	0.529	0.84	461	75	71
B-2	0.28	0.529	0.84	464	75	71
B-3	0.26	0.510	0.78	466	76	71
B-3	0.26	0.510	0.78	466	77	71
B-3	0.26	0.510	0.78	464	77	71
B-4	0.31	0.557	0.93	464	77	71
B-4	0.31	0.557	0.93	464	77	71
B-4	0.31	0.557	0.93	462	78	71
B-5	0.31	0.557	0.93	464	78	72
B-5	0.31	0.557	0.93	461	78	72
B-5	0.31	0.557	0.93	463	78	72
B-6	0.26	0.510	0.78	467	78	72
B-6	0.26	0.510	0.78	465	78	72
B-6	0.26	0.510	0.78	467	78	72
B-7	0.15	0.387	0.45	464	78	72
B-7	0.15	0.387	0.45	464	78	72
B-7	0.15	0.387	0.45	463	78	72
B-8	0.20	0.447	0.60	461	78	72
B-8	0.20	0.447	0.60	462	78	72
B-8	0.20	0.447	0.60	458	79	72
B-9	0.18	0.424	0.54	460	79	72
B-9	0.18	0.424	0.54	463	79	73
B-9	0.18	0.424	0.54	462	79	74
B-10	0.23	0.480	0.69	463	79	74
B-10	0.23	0.480	0.69	463	79	74
B-10	0.23	0.480	0.69	465	79	74
B-11	0.20	0.447	0.60	465	79	74
B-11	0.20	0.447	0.60	465	79	74
B-11	0.20	0.447	0.60	465	79	74
B-12	0.19	0.436	0.57	464	80	74
B-12	0.19	0.436	0.57	464	80	74
B-12	0.19	0.436	0.57	464	80	74
Average	0.22	0.463	0.65	462.7		73.1

Initial volume	112.400	ft^3	Initial volume	0.000	liters
Final volume	191.731	ft^3	Final volume	0.000	liters
Total metered	79.331	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	934.5	696.7	237.8			0.0
2	783.8	682.9	100.9			0.0
3	632.8	614.1	18.7			0.0
4	798.1	772.4	25.7			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	3149.2	2766.1	383.1	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

MONTROSE METHOD 5/315 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 315 (TSO)	Meter ΔH :	1.921	Start Time:	13:15
Date:	10/12/16	Run Number:	1	Meter Correction (γ):	1.003	Stop Time:	1698
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.286	Pitot Correction:	0.84	T/C ID:	7-9
Sampling Location:	Boiler Stack Outlet	Static Press (in. H_2O):	-0.37	Control Box ID:	1618	Probe ID:	7-9
		Baro. Pres. (in. Hg):	29.27	Assumed Moisture (%):	21	Pitot ID:	7-9
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	60	Umbilical Length (Feet):	200'	Filter ID:	7184
Test Crew:	BC JV JW (TL) TM	Initial K-factor	3			Stack Diameter (inches):	67"

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 957.20	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	0:02:30	958.22	0.15	0.50	1	465	243	246	68	83	82	
A-1	0:05:00	959.57	0.15	0.50	1	466	243	246	68	83	82	
A-1	0:07:30	960.46	0.15	0.50	1	465	~~4242~~	246	68	83	82	
A-2	0:10:00	~~961.26~~ ~~251.26~~	0.15	0.50	1	464	241	242	68	85	83	~~261.26~~ 961.26
A-2	0:12:30	~~962.56~~ ~~262.56~~	0.15	0.50	1	464	241	242	65	85	83	962.56
A-2	0:15:00	~~964.28~~	0.15	0.50	1	464	241	242	65	85	83	
A-3	0:17:30	~~264.28~~ 964.28	0.17	0.51	1	465	244	248	66	86	83	
A-3	0:20:00	965.38	0.17	0.51	1	465	244	248	66	86	83	
A-3	0:22:30	966.17	0.17	0.51	1	465	244	248	66	86	83	
A-4	0:25:00	967.21	0.14	0.42	1	462	246	242	65	87	83	
A-4	0:27:30	968.01	0.14	0.42	1	462	246	242	65	87	83	
A-4	0:30:00	968.82	0.14	0.42	1	462	246	242	65	87	83	
A-5	0:32:30	969.61	0.17	0.51	1	461	246	246	65	88	84	
A-5	0:35:00	970.46	0.17	0.51	1	461	246	246	65	88	84	
A-5	0:37:30	971.32	0.17	0.51	1	461	246	246	65	88	84	
A-6	0:40:00	972.19	0.19	0.57	1	462	247	245	64	89	84	
A-6	0:42:30	973.08	0.19	0.57	1	462	247	245	64	89	84	
A-6	0:45:00	973.95	0.19	0.57	1	462	247	245	64	89	84	
A-7	0:47:30	974.8	0.17	0.51	1	460	248	247	64	90	84	
A-7	0:50:00	975.63	0.17	0.51	1	462	248	247	64	90	84	
A-7	0:52:30	976.49	0.17	0.51	1	462	248	247	64	90	84	
A-8	0:55:00	977.62	0.23	0.70	2	464	246	247	63	90	84	
A-8	0:57:30	978.398	0.23	0.70	2	464	246	247	63	90	84	
A-8	1:00:00	979.3	0.23	0.70	2	464	246	247	63	90	84	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak Check	Initial	15.	0.000
	Final	15.	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	
O_2 (%)				S
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	DI H_2O (g)	760.6	707.9	
2	DI H_2O (g)	705.8	615.4	
3	Empty (g)	621.1	619.7	
4	Silica (g)	740.8	766.8	

MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal
Test Type: Method 315 (TSO)
Project Number: Proj106377 (16-167)
Date: 10/12/16
Run Number: 1
Sampling Location: Boiler Stack Outlet
Test Crew: BC JV JW TL 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°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-9	1:02:30	980.300	0.25	0.75	2	462	248	245	60	92	89	
A-9	1:05:00	~~987.7~~ 981.7	0.25	0.75	2	460	252	246	61	92	89	
A-9	1:07:30	982.8	0.25	0.75	2	463	251	248	61	92	89	
A-10	1:10:00	983.7	0.30	0.75	2	460	242	243	63	98	91	
A-10	1:12:30	985.5	0.30	0.75	2	462	243	245	64	98	91	
A-10	1:15:00	987.1	0.30	0.75	2	463	245	247	65	98	91	
A-11	1:17:30	988.8	0.27	0.81	2	459	246	244	64	98	91	
A-11	1:20:00	989.7	0.27	0.81	2	460	246	243	64	98	91	
A-11	1:22:30	991.0	0.27	0.81	2	462	245	241	65	98	91	
A-12	1:25:00	992.3	0.35	1.1	2	460	248	244	65	99	93	
A-12	1:27:30	994.0	0.35	1.1	2	461	247	247	66	99	93	
A-12	1:30:00	~~995.58~~	0.35	1.1	2	462	246	245	66	99	93	995.486
B-1	1:32:30	996.8	0.26	0.78	2	458	248	244	64	~~60~~ 100	98	
B-1	1:35:00	998.1	0.26	0.78	2	461	247	242	64	100	98	
B-1	1:37:30	~~1000.1~~	0.26	0.78	2	462	249	240	64	100	98	999.8
B-2	1:40:00	1000.6	0.24	0.78	2	436	232	242	61	100	98	
B-2	1:42:30	1001.8	0.24	0.78	2	466	236	245	64	97	96	
B-2	1:45:00	103.0	0.24	0.78	2	460	235	246	65	97	96	
B-3	1:47:30	1004.1	0.23	0.70	2	460	246	246	67	97	96	
B-3	1:50:00	1005.4	0.23	0.70	2	458	247	248	67	97	96	
B-3	1:52:30	1006.6	0.23	0.70	2	461	248	244	67	97	96	
B-4	1:55:00	1007.7	0.21	0.63	2	460	248	255	67	97	96	
B-4	1:57:30	1008.8	0.21	0.63	2	462	245	253	67	97	96	
B-4	2:00:00	1010.0	0.21	0.63	2	463	244	254	67	97	96	
B-5	2:02:30	1011.1	0.20	0.6	2	463	247	243	67	95	95	
B-5	2:05:00	1012.2	0.20	0.6	2	460	242	245	67	95	95	
B-5	2:07:30	1013.3	0.20	0.6	2	461	243	241	67	95	95	
B-6	2:10:00	1014.3	0.14	~~0.6~~ .42	2	467	245	244	68	95	94	
B-6	2:12:30	1015.2	0.14	~~0.6~~ .42	2	463	246	240	67	95	93	
B-6	2:15:00	1016.5	0.14	~~0.6~~ .42	2	462	244	246	67	95	93	
B-7	2:17:30	1017.9	0.13	0.4	1	460	247	250	67	94	93	
B-7	2:20:00	1018.6	0.13	0.4	1	462	242	250	67	94	93	
B-7	2:22:30	1019.3	0.13	0.4	1	460	240	248	67	94	93	
B-8	2:25:00	1020.5	0.17	0.51	1	465	248	243	66	93	92	
B-8	2:27:30	1021.3	0.17	0.51	1	462	247	243	66	93	92	
B-8	2:30:00	1022.4	0.17	0.51	1	462	247	246	64	93	92	
B-9	2:32:30	1023.3	0.13	0.4	1	462	246	245	64	93	92	
B-9	2:35:00	1024.4	0.13	0.4	1	460	244	246	63	93	92	

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MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal
Test Type: Method 315 (TSO)
Project Number: Proj106377 (16-167)
Date: 10/12/16
Run Number: 1
Sampling Location: Boiler Stack Outlet
Test Crew: BC JV JW TL 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°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
B-9	2:37:30	~~1137~~	0.13	0.4	1	460	244	246	63	92	91	1025.4
B-10	2:40:00	1026.1	0.15	0.45	2	465	247	244	63	92	91	
B-10	2:42:30	1027.0	0.15	0.45	2	462	251	243	64	92	91	
B-10	2:45:00	1028.1	0.15	0.45	2	460	248	244	64	92	91	
B-11	2:47:30	1029.0	0.14	0.42	1	463	247	244	63	92	90	
B-11	2:50:00	1029.9	0.14	0.42	1	461	245	242	63	92	90	
B-11	2:52:30	1030.8	0.14	0.42	1	462	254	244	64	93	91	
B-12	2:55:00	1031.7	0.16	0.48	+2	464	246	249	63	92	90	
B-12	2:57:30	1032.9	0.16	0.48	+2	460	245	251	63	92	90	
B-12	3:00:00	1033.852	0.16	0.48	2	460	243	243	63	93	91	1658

MONTROSE METHOD 5/315 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 315 (TSO)	Meter ΔH :	1.971	Start Time:	735
Date:	10/13/16	Run Number:	2	Meter Correction (γ):	1.003	Stop Time:	1024 1054
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.286	Pitot Correction:	0.84	T/C ID:	7-9
Sampling Location:	Boiler Stack Outlet	Static Press (in. H_2O):	-0.38	Control Box ID:	1618	Probe ID:	7-9
		Baro. Pres. (in. Hg):	29.06	Assumed Moisture (%):	21	Pitot ID:	7-9
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	54	Umbilical Length (Feet):	200'	Filter ID:	7185
Test Crew:	BC JV JW TI TM	Initial K-factor	3			Stack Diameter (inches):	67

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 034.903	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	0:02:30	035.91	0.16	0.48	2.0	463	242	240	58	69	69	
A-1	0:05:00	036.92	0.16	0.48	2.0	465	241	238	56	69	69	
A-1	0:07:30	037.92	0.16	0.48	2.0	463	241	243	56	69	69	
A-2	0:10:00	38.93	0.19	0.57	2.0	465	241	244	57	70	69	
A-2	0:12:30	39.94	0.19	0.57	2.0	472	240	234	59	70	70	
A-2	0:15:00	40.95	0.19	0.57	2.0	469	240	241	61	71	69	
A-3	0:17:30	42.28	0.23	0.70	2.5	467	236	239	61	73	69	
A-3	0:20:00	43.34	0.23	0.70	2.5	466	239	241	61	73	69	
A-3	0:22:30	~~44~~ 44.50	~~0.23~~	~~0.70~~	2.5	465	241	246	60	74	70	0.23 0.70
A-4	0:25:00	45.57	0.17	0.51	2.5	466	246	248	60	74	70	
A-4	0:27:30	46.51	0.17	0.51	2.5	471	242	242	54	77	70	
A-4	0:30:00	47.45	~~0.20~~	~~0.60~~	2.0	468	239	242	54	77	70	0.17 0.51
A-5	0:32:30	48.52	0.20	0.60	2.0	465	243	243	55	77	71	
A-5	0:35:00	49.59	0.20	0.60	2.0	464	245	241	55	77	71	
A-5	0:37:30	50.66	0.20	0.60	2.0	462	236	240	53	78	70	
A-6	0:40:00	51.73	0.16	~~0.60~~	2.0	470	240	239	53	78	72	0.48
A-6	0:42:30	52.91	0.16	~~0.60~~	2.0	469	243	241	52	78	72	0.48
A-6	0:45:00	53.75	0.16	~~0.6~~	2.0	467	241	240	56	78	72	0.48
A-7	0:47:30	54.76	0.20	0.6	2.0	468	243	239	56	79	72	
A-7	0:50:00	55.84	0.20	0.6	2.0	467	244	240	57	78	72	
A-7	0:52:30	56.92	0.20	0.6	2.0	469	246	240	58	78	72	
A-8	0:55:00	57.79	0.15	0.45	2.0	468	243	243	54	78	73	
A-8	0:57:30	58.78	0.15	0.45	2.0	469	240	242	54	78	73	
A-8	1:00:00	59.68	0.15	0.45	2.0	467	243	241	55	79	73	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	4	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	NA	S
O_2 (%)				
Fyrite Kit ID:	NA	Fyrite O_2 Check		NA %
Balance ID:	GAL-017			
Ref. Weight (200g):	NA	Tolerance = +/- 0.5 g		
Ref. Weight (500g):	500.0	Tolerance = +/- 0.5 g		

Imp	Contents	Final	Initial	Difference
1	DI H_2O (g)	939.2	914.8	
2	DI H_2O (g)	787.5	680.4	
3	Empty (g)	638.9	617.0	
4	Silica (g)	779.8	744.9	

MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 315 (TSO) **Project Number:** Proj106377 (16-167)

Date: 10/13/16 **Run Number:** 2 **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-9	1:02:30	60.64	0.15	0.45	2.0	467	241	244	55	78	73	
A-9	1:05:00	61.56	0.15	0.45	2.0	468	242	242	55	78	73	
A-9	1:07:30	62.48	0.15	0.45	2.0	467	245	241	56	78	73	
A-10	1:10:00	63.44	0.17	0.51	2.0	463	243	242	57	79	74	
A-10	1:12:30	64.41	0.17	0.51	2.0	463	243	240	57	79	74	
A-10	1:15:00	65.380	0.17	0.51	2.0	461	245	241	57	79	74	
A-11	1:17:30	66.65	0.24	0.72	2.5	466	242	242	58	80	74	
A-11	1:20:00	67.98	0.24	0.72	2.5	464	243	241	58	80	75	
A-11	1:22:30	69.31	0.24	0.72	2.5	464	243	240	58	80	75	
A-12	1:25:00	70.04	0.18	0.54	2.0	471	243	242	59	81	75	
A-12	1:27:30	71.13	0.18	0.54	2.0	472	243	242	60	81	75	
A-12	1:30:00	72.10	0.18	0.54	2.0	470	243	243	60	81	75	Portchange @ 905 924
B-1	1:32:30	73.36	0.27	0.81	2.5	462	241	241	54	77	76	
B-1	1:35:00	74.62	0.27	0.81	2.5	461	242	240	54	78	78	
B-1	1:37:30	75.88	0.27	0.81	2.5	460	242	240	54	78	78	
B-2	1:40:00	77.13	0.29	0.87	3.0	467	242	239	55	78	76	
B-2	1:42:30	78.38	0.29	0.87	3.0	465	242	239	55	78	76	
B-2	1:45:00	79.63	0.29	0.87	3.0	465	243	240	56	78	76	
B-3	1:47:30	80.89	0.26	0.78	2.5	462	244	242	57	78	76	
B-3	1:50:00	82.15	0.26	0.78	2.5	462	243	242	57	78	76	
B-3	1:52:30	83.41	0.26	0.78	2.5	464	243	243	57	79	76	
B-4	1:55:00	84.54	0.25	0.75	2.5	462	242	243	64	78	75	
B-4	1:57:30	85.68	0.25	0.75	2.5	462	242	243	64	78	75	
B-4	2:00:00	86.82	0.25	0.75	2.5	461	241	244	63	78	75	
B-5	2:02:30	~~88.12~~	0.22	0.66	2.5	462	242	241	64	78	75	87.97
B-5	2:05:00	89.12	0.22	0.66	2.5	463	241	242	65	78	75	
B-5	2:07:30	90.27	0.22	0.66	2.5	463	242	242	65	78	75	
B-6	2:10:00	91.41	0.22	0.66	2.5	463	242	242	59	78	75	
B-6	2:12:30	92.47	0.22	0.66	2.5	465	243	242	59	78	75	
B-6	2:15:00	93.53	0.22	0.66	2.5	464	242	241	58	77	74	
B-7	2:17:30	94.73	0.21	0.63	2.5	464	243	241	56	78	74	
B-7	2:20:00	95.76	0.21	0.63	2.5	463	243	240	56	78	74	
B-7	2:22:30	96.79	0.21	0.63	2.5	464	244	239	56	78	74	
B-8	2:25:00	97.82	0.18	0.54	2.0	463	242	243	55	77	74	
B-8	2:27:30	98.84	0.18	0.54	2.0	463	242	242	55	77	73	
B-8	2:30:00	99.86	0.18	0.54	2.0	463	241	243	55	77	77	
B-9	2:32:30	101.94	0.20	0.60	2.5	463	242	241	55	77	74	
B-9	2:35:00	102.02	0.20	0.60	2.5	463	242	241	55	77	74	

MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal
Test Type: Method 315 (TSO)
Project Number: Proj106377 (16-167)
Date: 10/13/16
Run Number: 2
Sampling Location: Boiler Stack Outlet
Test Crew: BC JV JW TL 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°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
B-9	2:37:30	~~104.41~~ TM	0.20	0.60	2.5	462	242	242	55	81	74	103.41
B-10	2:40:00	104.36	0.16	0.48	2.0	460	243	239	55	77	73	
B-10	2:42:30	105.13	0.16	0.48	2.0	460	243	240	55	77	73	
B-10	2:45:00	106.22	0.16	0.48	2.0	460	241	240	56	77	73	
B-11	2:47:30	107.08	0.18	0.60	2.5	463	241	241	55	78	73	
B-11	2:50:00	108.83	0.18	0.60	2.5	463	241	241	55	78	73	
B-11	2:52:30	109.66	0.18	0.60	2.5	461	241	242	55	78	73	
B-12	2:55:00	110.11	0.15	0.45	2.0	460	242	242	56	78	73	
B-12	2:57:30	111.02	0.15	0.45	2.0	460	242	241	56	78	73	
B-12	3:00:00	111.831	0.15	0.45	2.0	461	242	241	56	78	73	Stop 1084

MONTROSE METHOD 5/315 DATA SHEET

Client:	ArcelorMittal	Test Type:	Method 315 (TSO)	Meter ΔH :	1.971	Start Time:	1135
Date:	10/13/16	Run Number:	3	Meter Correction (γ):	1.003	Stop Time:	1445
Plant:	Monessen, PA	Nozzle Diameter (inches):	0.286	Pitot Correction:	0.84	T/C ID:	7-9
Sampling Location:	Boiler Stack Outlet	Static Press (in. H_2O):	-0.36	Control Box ID:	1618	Probe ID:	7-9
		Baro. Pres. (in. Hg):	29.06	Assumed Moisture (%):	21	Pitot ID:	7-9
Project Number:	Proj106377 (16-167)	Ambient Temp (°F):	60	Umbilical Length (Feet):	200'	Filter ID:	7186
Test Crew:	BC JV JW TL TM	Initial K-factor	3			Stack Diameter (inches):	67

(Please Circle Initials of Meter Box Operator)

Traverse Point Number	Elapsed Time (mins)	Metered Volume (ft³) 112.400	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	0:02:30	113.44	0.18	0.54	2.0	468	242	241	55	69	70	
A-1	0:05:00	114.41	0.18	0.54	2.0	468	241	240	55	68	70	
A-1	0:07:30	115.38	0.18	0.54	2.0	463	241	236	56	69	69	
A-2	0:10:00	116.16	0.15	0.45	2.0	465	243	234	56	69	69	
A-2	0:12:30	117.04	0.15	0.45	2.0	466	243	233	57	69	69	
A-2	0:15:00	117.98	0.15	0.45	2.0	465	245	236	57	70	69	
A-3	0:17:30	119.02	0.20	0.60	2.0	465	243	238	57	69	69	
A-3	0:20:00	120.24	0.20	0.60	2.0	469	244	240	57	69	69	
A-3	0:22:30	121.46	0.20	0.60	2.0	463	242	239	57	70	69	
A-4	0:25:00	122.40	0.17	0.51	2.0	467	240	241	57	72	69	
A-4	0:27:30	123.34	0.17	0.51	2.0	464	242	240	60	71	69	
A-4	0:30:00	124.28	0.17	0.51	2.0	466	242	240	60	71	69	
A-5	0:32:30	125.43	0.19	0.57	2.0	468	244	246	59	71	70	
A-5	0:35:00	126.48	0.19	0.57	2.0	467	245	245	59	71	70	
A-5	0:37:30	127.53	0.19	0.57	2.0	464	241	239	58	72	69	
A-6	0:40:00	128.61	0.21	0.63	2.0	463	242	236	55	73	69	
A-6	0:42:30	129.69	0.21	0.63	2.0	462	242	236	55	73	69	
A-6	0:45:00	130.77	0.21	0.63	2.0	464	243	239	55	74	70	
A-7	0:47:30	131.78	0.18	0.54	2.0	462	241	241	54	74	70	
A-7	0:50:00	132.79	0.18	0.54	2.0	462	240	242	54	74	70	
A-7	0:52:30	133.85	0.18	0.54	2.0	463	242	240	54	74	70	
A-8	0:55:00	134.93	0.19	0.57	2.0	462	242	243	55	73	70	
A-8	0:57:30	135.95	0.19	0.57	2.0	462	240	242	55	73	68	
A-8	1:00:00	137.02	0.19	0.57	2.0	460	243	244	57	73	69	

(max leak rate = 0.02 ft³/min)

Sample		(in. Hg)	(ft³/min)
Train Leak	Initial	15	0.000
Check	Final	3	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	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	DI H_2O (g)	934.5	696.7	
2	DI H_2O (g)	783.8	682.9	
3	Empty (g)	632.8	614.1	
4	Silica (g)	798.1	772.4	

MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal
Test Type: Method 315 (TSO)
Project Number: Proj106377 (16-167)
Date: 10/13/16
Run Number: 3
Sampling Location: Boiler Stack Outlet
Test Crew: BC JV JW TL 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°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
A-9	1:02:30	~~136.86~~ TL	0.23	0.69	2.5	463	244	242	57	75	70	138.97
A-9	1:05:00	139.11	0.23	0.69	2.5	463	241	243	57	75	70	
A-9	1:07:30	140.28	0.23	0.69	2.5	461	244	246	58	75	70	
A-10	1:10:00	141.23	0.15	0.45	2.0	459	240	240	61	75	71	
A-10	1:12:30	142.18	0.15	0.45	2.0	457	240	240	61	75	71	
A-10	1:15:00	143.13	0.15	0.45	2.0	460	241	238	62	75	71	
A-11	1:17:30	144.24	0.27	0.81	2.5	459	242	238	61	75	70	
A-11	1:20:00	145.54	0.27	0.81	2.5	459	242	239	61	75	70	
A-11	1:22:30	146.73	0.27	0.81	2.5	460	245	242	60	75	70	
A-12	1:25:00	147.81	0.22	0.66	2.0	454	242	240	62	76	71	
A-12	1:27:30	148.88	0.22	0.66	2.0	453	242	240	62	76	71	
A-12	1:30:00	150.11	0.22	0.66	2.0	453	241	241	63	76	71	Port Change @ 1305
B-1	1:32:30	151.48	0.31	0.93	2.5	457	242	242	62	74	71	Restart @ 1315
B-1	1:35:00	152.85	0.31	0.93	2.5	457	244	241	62	74	71	
B-1	1:37:30	154.22	0.31	0.93	2.5	455	243	243	60	75	71	
B-2	1:40:00	155.62	0.28	0.84	2.5	462	241	243	59	75	71	
B-2	1:42:30	156.79	0.28	0.84	2.5	461	242	244	57	75	71	
B-2	1:45:00	157.96	0.28	0.84	2.5	464	243	246	57	75	71	
B-3	1:47:30	159.31	0.26	0.78	2.5	466	241	241	58	76	71	
B-3	1:50:00	160.66	0.26	0.78	2.5	466	240	242	58	77	71	
B-3	1:52:30	162.01	0.26	0.78	2.5	464	241	243	58	77	71	
B-4	1:55:00	163.38	0.31	0.93	2.5	464	243	241	58	77	71	
B-4	1:57:30	164.75	0.31	0.93	2.5	464	243	241	58	77	71	
B-4	2:00:00	166.12	0.31	0.93	2.5	462	243	241	59	77	71	
B-5	2:02:30	167.25	0.31	0.93	2.5	464	243	240	61	78	72	
B-5	2:05:00	168.38	0.31	0.93	2.5	461	243	242	61	78	72	
B-5	2:07:30	169.52	0.31	0.93	2.5	463	245	242	61	78	72	
B-6	2:10:00	170.75	0.26	0.78	2.5	467	243	240	62	78	72	
B-6	2:12:30	171.98	0.26	0.78	2.5	465	246	241	62	78	72	
B-6	2:15:00	173.11	0.26	0.78	2.5	467	242	241	62	78	72	
B-7	2:17:30	174.96	0.15	0.45	2.0	464	242	240	60	78	72	
B-7	2:20:00	~~174.96~~	0.15	0.45	2.0	464	240	240	59	78	72	175.93
B-7	2:22:30	176.32	0.15	0.45	2.0	463	242	241	59	78	72	
B-8	2:25:00	177.05	0.20	0.60	2.5	461	242	241	59	78	72	
B-8	2:27:30	178.13	0.20	0.60	2.5	462	240	238	60	78	72	
B-8	2:30:00	179.02	0.20	0.60	2.5	458	242	241	60	79	72	
B-9	2:32:30	180.14	0.18	0.54	2.5	460	242	241	61	79	72	
B-9	2:35:00	181.26	0.18	0.54	2.5	463	240	242	61	79	73	

MONTROSE METHOD 5/315 DATA SHEET

Client: ArcelorMittal **Test Type:** Method 315 (TSO) **Project Number:** Proj106377 (16-167)

Date: 10/13/16 **Run Number:** 3 **Sampling Location:** Boiler Stack Outlet

Test Crew: BC JV JW TL 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°+/- 25°	Filter Exit Temp. (°F) 248°+/- 25°	Imp Exit Temp. (°F) ≤ 68°	Meter Temp. (°F) IN/AVG	Meter Temp. (°F) OUT	Comments
B-9	2:37:30	182.38	0.18	0.54	2.5	462	241	242	56	79	74	
B-10	2:40:00	183.39	0.23	0.69	2.5	463	242	242	56	79	74	
B-10	2:42:30	184.52	0.23	0.69	2.5	463	241	240	55	79	74	
B-10	2:45:00	185.61	0.23	0.69	2.5	465	238	243	55	79	74	
B-11	2:47:30	186.78	0.20	0.60	2.0	465	242	241	55	79	74	
B-11	2:50:00	187.95	0.20	0.60	2.0	465	242	241	55	79	74	
B-11	2:52:30	188.42	0.20	0.60	2.0	465	242	241	55	79	74	
B-12	2:55:00	189.78	~~0.33~~	0.57	2.0	464	241	244	56	60	74	0.19
B-12	2:57:30	190.72	~~0.33~~	0.57	2.0	464	242	244	57	80	74	0.19
B-12	3:00:00	191.731	~~0.33~~	0.57	2.0	464	242	243	57	80	74	0.19 Stop 1445

Method 3A, 6C, 10, 15

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	CO (PPMdv)	SO_2 (PPMdv)
RUN 1						
1	2016/10/13	09:18:01	6.11	6.89	0.6	129.8
2	2016/10/13	09:19:01	5.86	7.01	0.7	131.9
3	2016/10/13	09:20:01	5.57	7.11	3.1	128.9
4	2016/10/13	09:21:01	5.45	7.18	16.7	126.4
5	2016/10/13	09:22:01	5.85	6.99	28.3	123.0
6	2016/10/13	09:23:01	6.14	6.87	46.8	119.3
7	2016/10/13	09:24:01	6.01	6.92	54.0	118.5
8	2016/10/13	09:25:01	5.93	6.94	52.8	118.8
9	2016/10/13	09:26:01	5.69	7.06	62.1	120.2
10	2016/10/13	09:27:01	5.76	7.01	43.5	119.3
11	2016/10/13	09:28:01	5.73	7.04	43.3	118.9
12	2016/10/13	09:29:01	5.65	7.06	47.0	119.4
13	2016/10/13	09:30:01	5.75	7.02	58.0	119.3
14	2016/10/13	09:31:01	5.44	7.16	59.8	120.1
15	2016/10/13	09:32:01	5.85	7.02	50.2	119.0
16	2016/10/13	09:33:01	7.63	6.22	5.7	116.1
17	2016/10/13	09:34:01	6.72	6.63	0.5	125.9
18	2016/10/13	09:35:01	5.77	7.06	0.6	134.8
19	2016/10/13	09:36:01	5.81	7.03	0.7	137.3
20	2016/10/13	09:37:01	5.78	7.02	0.9	135.5
21	2016/10/13	09:38:01	4.90	7.40	1.4	135.3
22	2016/10/13	09:39:01	4.49	7.58	11.6	135.0
23	2016/10/13	09:40:01	4.83	7.43	26.2	129.4
24	2016/10/13	09:41:01	5.11	7.30	41.9	125.0
25	2016/10/13	09:42:01	5.10	7.31	34.0	124.4
26	2016/10/13	09:43:01	5.00	7.35	43.2	126.0
27	2016/10/13	09:44:01	4.89	7.38	71.4	126.0
28	2016/10/13	09:45:01	4.86	7.40	68.9	125.7
29	2016/10/13	09:46:01	4.86	7.40	75.0	125.0
30	2016/10/13	09:47:01	4.96	7.35	64.3	124.8
31	2016/10/13	09:48:01	4.97	7.34	61.8	125.2
32	2016/10/13	09:49:01	4.86	7.39	56.0	124.6
33	2016/10/13	09:50:01	5.03	7.31	37.9	123.6
34	2016/10/13	09:51:01	4.85	7.39	49.1	124.9
35	2016/10/13	09:52:01	5.11	7.27	61.3	122.2
36	2016/10/13	09:53:01	4.96	7.34	45.7	123.1
37	2016/10/13	09:54:01	4.86	7.38	60.8	123.6
38	2016/10/13	09:55:01	4.84	7.39	71.2	123.9
39	2016/10/13	09:56:01	4.86	7.38	59.5	124.5
40	2016/10/13	09:57:01	4.95	7.34	64.8	122.6
41	2016/10/13	09:58:01	5.06	7.29	55.9	121.7
42	2016/10/13	09:59:01	5.01	7.31	27.8	121.7
43	2016/10/13	10:00:01	4.86	7.37	48.9	124.0
44	2016/10/13	10:01:01	5.06	7.29	47.3	120.9
45	2016/10/13	10:02:01	5.11	7.27	41.7	120.8
46	2016/10/13	10:03:01	5.02	7.30	35.5	120.9
47	2016/10/13	10:04:01	4.98	7.32	35.6	122.2
48	2016/10/13	10:05:01	4.92	7.34	44.7	121.9
49	2016/10/13	10:06:01	5.18	7.23	52.3	119.8
50	2016/10/13	10:07:01	4.95	7.33	32.5	120.9
51	2016/10/13	10:08:01	5.10	7.26	40.3	120.0
52	2016/10/13	10:09:01	5.00	7.31	31.1	121.6
53	2016/10/13	10:10:01	4.99	7.31	37.8	120.4
54	2016/10/13	10:11:01	5.22	7.21	30.0	118.0
55	2016/10/13	10:12:01	5.07	7.27	29.8	120.8
56	2016/10/13	10:13:01	4.93	7.33	43.0	120.4
57	2016/10/13	10:14:01	4.94	7.33	57.4	121.1
58	2016/10/13	10:15:01	5.01	7.30	37.2	120.0
59	2016/10/13	10:16:01	5.13	7.25	29.9	118.6
60	2016/10/13	10:17:01	5.04	7.28	27.1	118.9
RUN 1 AVERAGES			**5.3**	**7.2**	**39.5**	**123.5**

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	CO (PPMdv)	SO_2 (PPMdv)
RUN 2						
1	2016/10/13	10:34:01	4.97	7.34	53.7	113.4
2	2016/10/13	10:35:01	5.05	7.31	40.8	114.8
3	2016/10/13	10:36:01	4.90	7.39	37.3	118.0
4	2016/10/13	10:37:01	4.83	7.42	43.5	119.4
5	2016/10/13	10:38:01	4.86	7.43	59.7	119.7
6	2016/10/13	10:39:01	6.24	6.86	31.0	115.0
7	2016/10/13	10:40:01	6.83	6.60	1.7	116.2
8	2016/10/13	10:41:01	6.16	6.89	1.7	122.4
9	2016/10/13	10:42:01	5.71	7.09	1.4	126.2
10	2016/10/13	10:43:01	5.68	7.09	1.4	127.0
11	2016/10/13	10:44:01	5.57	7.14	1.4	128.3
12	2016/10/13	10:45:01	5.19	7.28	1.5	128.6
13	2016/10/13	10:46:01	4.82	7.46	3.6	126.6
14	2016/10/13	10:47:01	4.79	7.46	23.7	124.5
15	2016/10/13	10:48:01	5.03	7.38	21.8	121.4
16	2016/10/13	10:49:01	4.82	7.46	26.4	120.7
17	2016/10/13	10:50:01	4.82	7.46	80.8	119.1
18	2016/10/13	10:51:01	4.80	7.47	74.8	118.5
19	2016/10/13	10:52:01	4.95	7.41	76.0	117.5
20	2016/10/13	10:53:01	4.79	7.48	76.0	117.1
21	2016/10/13	10:54:01	4.71	7.49	100.3	116.6
22	2016/10/13	10:55:01	4.70	7.50	136.5	118.8
23	2016/10/13	10:56:01	4.76	7.48	126.1	117.6
24	2016/10/13	10:57:01	4.58	7.55	135.3	118.0
25	2016/10/13	10:58:01	4.66	7.52	152.6	118.0
26	2016/10/13	10:59:01	4.99	7.37	80.7	115.2
27	2016/10/13	11:00:01	4.86	7.43	70.3	116.8
28	2016/10/13	11:01:01	4.71	7.48	89.1	117.8
29	2016/10/13	11:02:01	4.59	7.55	119.2	118.8
30	2016/10/13	11:03:01	4.90	7.44	163.4	118.8
31	2016/10/13	11:04:01	6.74	6.64	16.9	111.8
32	2016/10/13	11:05:01	6.51	6.74	1.8	115.4
33	2016/10/13	11:06:01	6.01	6.94	1.7	121.0
34	2016/10/13	11:07:01	5.74	7.05	1.8	124.4
35	2016/10/13	11:08:01	4.96	7.37	1.8	125.8
36	2016/10/13	11:09:01	4.29	7.68	15.1	125.9
37	2016/10/13	11:10:01	4.44	7.61	42.9	121.6
38	2016/10/13	11:11:01	4.86	7.44	67.6	117.9
39	2016/10/13	11:12:01	4.87	7.42	94.0	116.8
40	2016/10/13	11:13:01	5.03	7.36	98.4	115.5
41	2016/10/13	11:14:01	4.87	7.42	98.5	115.9
42	2016/10/13	11:15:01	4.78	7.46	104.4	116.8
43	2016/10/13	11:16:01	5.02	7.37	63.0	115.3
44	2016/10/13	11:17:01	5.04	7.37	49.7	114.7
45	2016/10/13	11:18:01	5.08	7.36	43.4	115.9
46	2016/10/13	11:19:01	7.50	6.31	18.1	106.5
47	2016/10/13	11:20:01	7.06	6.50	1.6	112.7
48	2016/10/13	11:21:01	6.09	6.93	1.6	122.2
49	2016/10/13	11:22:01	5.56	7.16	1.7	127.8
50	2016/10/13	11:23:01	4.07	7.81	6.5	130.6
51	2016/10/13	11:24:01	3.66	7.99	50.0	127.8
52	2016/10/13	11:25:01	4.58	7.61	77.6	120.6
53	2016/10/13	11:26:01	5.21	7.33	58.4	114.3
54	2016/10/13	11:27:01	5.64	7.16	33.8	113.7
55	2016/10/13	11:28:01	7.54	6.31	5.9	107.5
56	2016/10/13	11:29:01	6.54	6.77	1.8	116.4
57	2016/10/13	11:30:01	5.61	7.20	1.8	127.0
58	2016/10/13	11:31:01	5.83	7.12	1.8	127.6
59	2016/10/13	11:32:01	4.92	7.49	2.1	127.7
60	2016/10/13	11:33:01	3.99	7.90	28.7	128.7
RUN 2 AVERAGES			**5.2**	**7.3**	**47.1**	**119.6**

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

MINUTE	DATE	TIME	O2 (DV %)	CO2 (DV %)	CO (PPMdv)	SO_2 (PPMdv)
RUN 3						
1	2016/10/13	11:44:01	4.44	7.67	37.8	121.6
2	2016/10/13	11:45:01	4.83	7.55	111.7	118.4
3	2016/10/13	11:46:01	5.15	7.42	118.8	118.0
4	2016/10/13	11:47:01	4.97	7.51	106.7	119.3
5	2016/10/13	11:48:01	5.39	7.35	83.6	119.6
6	2016/10/13	11:49:01	6.83	6.73	10.6	116.0
7	2016/10/13	11:50:01	6.41	6.90	1.9	118.0
8	2016/10/13	11:51:01	5.87	7.12	1.8	123.1
9	2016/10/13	11:52:01	5.57	7.23	2.0	126.0
10	2016/10/13	11:53:01	4.65	7.63	4.5	125.5
11	2016/10/13	11:54:01	4.47	7.69	29.9	121.6
12	2016/10/13	11:55:01	4.70	7.59	59.6	118.8
13	2016/10/13	11:56:01	5.07	7.43	87.8	116.6
14	2016/10/13	11:57:01	5.13	7.40	92.0	114.1
15	2016/10/13	11:58:01	5.11	7.42	111.8	113.7
16	2016/10/13	11:59:01	6.76	6.74	34.1	109.8
17	2016/10/13	12:00:01	7.36	6.42	2.2	111.5
18	2016/10/13	12:01:01	6.27	6.92	1.9	120.2
19	2016/10/13	12:02:01	5.26	7.38	1.8	129.6
20	2016/10/13	12:03:01	5.14	7.44	2.0	130.7
21	2016/10/13	12:04:01	5.69	7.17	2.0	125.1
22	2016/10/13	12:05:01	5.28	7.33	2.4	121.1
23	2016/10/13	12:06:01	4.63	7.62	12.1	120.8
24	2016/10/13	12:07:01	4.61	7.64	55.2	120.1
25	2016/10/13	12:08:01	5.07	7.45	69.5	115.6
26	2016/10/13	12:09:01	6.46	6.87	38.2	113.3
27	2016/10/13	12:10:01	6.77	6.72	2.5	113.6
28	2016/10/13	12:11:01	6.14	7.00	2.3	119.1
29	2016/10/13	12:12:01	5.84	7.12	2.0	123.0
30	2016/10/13	12:13:01	5.30	7.35	2.2	124.4
31	2016/10/13	12:14:01	4.41	7.74	9.3	124.5
32	2016/10/13	12:15:01	4.43	7.73	56.2	121.9
33	2016/10/13	12:16:01	4.97	7.50	97.9	117.0
34	2016/10/13	12:17:01	4.96	7.49	106.7	115.9
35	2016/10/13	12:18:01	4.90	7.52	132.6	116.1
36	2016/10/13	12:19:01	4.92	7.50	84.7	114.9
37	2016/10/13	12:20:01	4.72	7.59	142.5	116.5
38	2016/10/13	12:21:01	4.72	7.59	144.2	116.1
39	2016/10/13	12:22:01	4.74	7.59	112.2	116.4
40	2016/10/13	12:23:01	5.04	7.45	87.3	114.0
41	2016/10/13	12:24:01	4.90	7.50	89.4	114.6
42	2016/10/13	12:25:01	4.71	7.60	121.2	116.6
43	2016/10/13	12:26:01	4.95	7.49	85.6	115.2
44	2016/10/13	12:27:01	5.00	7.46	65.4	114.1
45	2016/10/13	12:28:01	4.82	7.54	84.7	116.4
46	2016/10/13	12:29:01	4.89	7.51	73.3	114.4
47	2016/10/13	12:30:01	4.77	7.56	90.2	114.6
48	2016/10/13	12:31:01	4.81	7.54	116.0	115.4
49	2016/10/13	12:32:01	4.81	7.53	102.9	115.2
50	2016/10/13	12:33:01	4.93	7.49	77.2	114.3
51	2016/10/13	12:34:01	4.87	7.51	77.9	114.2
52	2016/10/13	12:35:01	4.96	7.47	76.7	113.4
53	2016/10/13	12:36:01	4.86	7.52	68.3	114.1
54	2016/10/13	12:37:01	4.92	7.48	67.1	113.2
55	2016/10/13	12:38:01	4.94	7.48	62.7	113.1
56	2016/10/13	12:39:01	4.92	7.49	74.2	113.2
57	2016/10/13	12:40:01	4.98	7.45	54.0	113.2
58	2016/10/13	12:41:01	4.77	7.55	81.0	114.4
59	2016/10/13	12:42:01	4.95	7.47	67.5	113.6
60	2016/10/13	12:43:01	4.94	7.48	72.7	113.1
RUN 3 AVERAGES			**5.2**	**7.4**	**61.2**	**117.5**

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

Client	ArcelorMittal	**Date**	October 13, 2016
Project No	16-167	**Location**	Stack Exhaust
Plant	Monessen, PA	**Run**	Run 1
Unit	Boilers	**Start Time**	9:18
Operation	Normal Load	**End Time**	10:18
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	CC210754	XC034406B	N/A	N/A	44	43
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A	45	45
CO	N/A	N/A	100	50.0	200	100.0	200	ppmdv	N/A	M205 (mfc2)	M205 (mfc2)	SG9107317BAL	246.7	95	100
SO2	N/A	N/A	100	50.0	200	100.0	200	ppmdv	N/A	M205 (mfc2)	M205 (mfc2)	CC405423	250.6	80	75
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		0.08	0.11	0.15	0.07	-0.05	-0.20	20.03	0.09			
	Mid	10.01	10.00	10.01	0.05	9.98	-0.10	-0.15	20.03	9.995	5.29	5.25	d. vol. %
CO2	Zero		0.09	0.13	0.20	0.18	0.45	0.25	19.79	0.155			
	Mid	10.15	9.99	9.98	-0.05	9.99	0.00	0.05	19.79	9.985	7.21	7.28	d. vol. %
CO	Zero		0.1	0.4	0.15	2.2	1.05	0.90	200	1.3			
	Mid	100	100.2	100.1	-0.05	100.6	0.20	0.25	200	100.35	39.45	38.52	ppmdv
SO2	Zero		0.1	1.0	0.45	2.2	1.05	0.60	200	1.6			
	Mid	100	99.7	98.6	-0.55	96.3	-1.70	-1.15	200	97.45	123.53	127.21	ppmdv
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	0.08	0.40					10.01	10.00	-0.05		20.03	20.05	0.10		20.03	d. vol. %
CO2	0.09	0.45					10.15	9.99	-0.81		19.79	19.82	0.15		19.79	d. vol. %
CO	0.1	0.05					100.00	100.2	0.10		200.0	200.0	0.00		200	ppmdv
SO2	0.1	0.00					100.0	99.7	-0.15		200.0	199.9	-0.05		200	ppmdv
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	**Date**	October 13, 2016
Project No	16-167	**Location**	Stack Exhaust
Plant	Monessen, PA	**Run**	Run 2
Unit	Boilers	**Start Time**	10:34
Operation	Normal Load	**End Time**	11:34
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	Tank ID MID	Tank ID HIGH	M205 Dilution System Information: Dilution Cylinder ID	Cylinder Concentration
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A
CO	N/A	N/A	100	50.0	200	100.0	200	ppmdv	N/A	M205 (mfc2)	M205 (mfc2)	SG9107317BAL	246.7
SO2	N/A	N/A	100	50.0	200	100.0	200	ppmdv	N/A	M205 (mfc2)	M205 (mfc2)	CC405423	250.6
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		0.08	0.07	-0.05	0.06	-0.10	-0.05	20.03	0.07			
	Mid	10.01	10.00	9.98	-0.10	10.01	0.05	0.15	20.03	10.00	5.24	5.21	d. vol. %
CO2	Zero		0.09	0.18	0.45	0.18	0.45	0.00	19.79	0.18			
	Mid	10.15	9.99	9.99	0.00	10.03	0.20	0.20	19.79	10.01	7.28	7.34	d. vol. %
CO	Zero		0.1	2.2	1.05	2.6	1.25	0.20	200	2.4			
	Mid	100	100.2	100.6	0.20	100.6	0.20	0.00	200	100.6	47.06	45.48	ppmdv
SO2	Zero		0.1	2.2	1.05	3.5	1.70	0.65	200	2.85			
	Mid	100	99.7	96.3	-1.70	96.5	-1.60	0.10	200	96.4	119.61	124.81	ppmdv
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	0.08	0.40					10.01	10.0	-0.05		20.03	20.1	0.10		20.03	d. vol. %
CO2	0.09	0.45					10.15	10.0	-0.81		19.79	19.8	0.15		19.79	d. vol. %
CO	0.10	0.05					100	100.2	0.10		200	200.0	0.00		200	ppmdv
SO2	0.10	0.00					100	99.7	-0.15		200	199.9	-0.05		200	ppmdv
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	**Date**	October 13, 2016
Project No	16-167	**Location**	Stack Exhaust
Plant	Monessen, PA	**Run**	Run 3
Unit	Boilers	**Start Time**	11:44
Operation	Normal Load	**End Time**	12:44
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	Tank ID MID	Tank ID HIGH	M205 Dilution System Information: Dilution Cylinder ID	Cylinder Concentration
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A
CO	N/A	N/A	100	50.0	200	100.0	200	ppmdv	N/A	M205 (mfc2)	M205 (mfc2)	SG9107317BAL	246.7
SO2	N/A	N/A	100	50.0	200	100.0	200	ppmdv	N/A	M205 (mfc2)	M205 (mfc2)	CC405423	250.6
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		0.08	0.06	-0.10	0.07	-0.05	0.05	20.03	0.07			
	Mid	10.01	10.00	10.01	0.05	10.04	0.20	0.15	20.03	10.03	5.18	5.14	d. vol. %
CO2	Zero		0.09	0.18	0.45	0.17	0.40	-0.05	19.79	0.18			
	Mid	10.15	9.99	10.03	0.20	10.09	0.51	0.30	19.79	10.06	7.39	7.41	d. vol. %
CO	Zero		0.1	2.6	1.25	1.2	0.55	-0.70	200	1.9			
	Mid	100	100.2	100.6	0.20	100.1	-0.05	-0.25	200	100.35	61.21	60.24	ppmdv
SO2	Zero		0.1	3.5	1.70	2.8	1.35	-0.35	200	3.15			
	Mid	100	99.7	96.5	-1.60	96.1	-1.80	-0.20	200	96.3	117.46	122.72	ppmdv
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	0.08	0.40					10.01	10.0	-0.05		20.03	20.1	0.10		20.03	d. vol. %
CO2	0.09	0.45					10.15	10.0	-0.81		19.79	19.8	0.15		19.79	d. vol. %
CO	0.10	0.05					100	100.2	0.10		200	200.0	0.00		200	ppmdv
SO2	0.10	0.00					100	99.7	-0.15		200	199.9	-0.05		200	ppmdv
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	October 13, 2016	
Project No.:	16-167		0	Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Boilers		Test Start Time:	9:18 AM	
Unit Operation:	Normal Load		Test Finish Time:	10:18 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:	1614	
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O
Meter Calibration Factor (Yd)	1.003	
Barometric Pressure (Pbar)	29.06	in. Hg
Stack Static Pressure (Pg)	-0.38	in. H_2O
Stack Diameter (Ds) (L if rectangular)	67.0	inches
Stack Width (enter NA if circular)	0.0	inches
O2	5.25	% dv
CO2	7.28	% 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)	74.3	F
Stack Temperature (Tsavg)	458.6	F
Orifice Pressure Drop (dH avg)	2.729	in. H_2O
GasVelocity Head $(dP)^{1/2}$avg	0.4972	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	87.46	% dv
Water Collected (V_f - V_i)	0.0	ml
Water Vapor Condensed (Vwc(std))	0.000	scf
Water Collected (W_f - W_i)	786.3	g
Water Vapor in Silica Gel (Vwsg(std))	37.074	scf
Vol. Water Vapor in Gas Stand.(Vw(std))	37.074	scf
Volume Dry Gas Metered (Vm)	163.169	dacf
Vol. Dry Gas Metered Stand.(Vm(std))	158.092	dscf
Volume Dry Gas Metered (Vm(m^3))	4.620	dacm
Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.477	dscm
Stack Absolute Pressure (Ps)	29.03	in. Hg
Stack Absolute Temperature (Tsavg)	918.3	R
H2O Vapor Pressure @ avg Stack Temp.	937.44	in. Hg
H2O in the gas at saturation (Bws)	1.0000	vol. fraction
H2O in the gas from test data (Bws)	0.1900	vol. fraction
H2O in the gas used (lower of the 2 Bws)	0.1900	vol. fraction
Is the Gas Stream Saturated With H2O?	NO	
Dry Gas Molecular Weight (Md)	29.38	lb/lb-mole
Wet Gas Molecular Weight (Ms)	27.21	lb/lb-mole
Gas Velocity (Vs)	38.50	ft/s
Is the stack circular or rectangular?	CIRCULAR	
Area Stack (As)	24.484	ft^2
Actual Gas Flowrate	56,553	acfm
Standard Gas Flowrate	31,542	scfm
Dry Standard Gas Flowrate	25,550	dscfm
Actual Gas Flowrate	1,601	acm/min
Standard Gas Flowrate	893	scm/min
Dry Standard Gas Flowrate	724	dscm/min

Carbon Monoxide (CO)

MW	28.0	lb/lb-mole
Concentration	38.52	ppm_{dv}
Emission	4.3	lb/hr

Carbon Dioxide (CO2)

MW	44	lb/lb-mole
Concentration	72,843.8	ppm_{dv}
Emission	5,784,409.4	g/hr
Emission	12,752.4	lb/hr
Emission	6.4	tons/hr

Sulfur Dioxide (SO2)

MW	64.0	lb/lb-mole
Concentration	127.21	ppm_{dv}
Emission	32.4	lb/hr

Hydrogen Sulfide

MW	34.1	lb/lb-mole
Concentration	< 0.50	ppm_{wv}
Concentration	< 0.62	ppm_{dv}
Emission	< 0.0837	lb/hr

ArcelorMittal Boilers — **Run 1** — **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	0.23	0.480	2.5	453	69	69
A-1	0.23	0.480	2.5	454	69	69
A-1	0.23	0.480	2.5	452	70	68
A-2	0.24	0.490	2.6	453	71	68
A-2	0.24	0.490	2.6	455	71	68
A-2	0.24	0.490	2.6	455	72	69
A-3	0.29	0.539	3.2	466	73	68
A-3	0.29	0.539	3.2	465	73	69
A-3	0.29	0.539	3.2	466	74	68
A-4	0.25	0.500	2.8	464	74	69
A-4	0.25	0.500	2.8	465	74	69
A-4	0.25	0.500	2.8	464	75	69
A-5	0.30	0.548	3.3	465	75	69
A-5	0.30	0.548	3.3	465	76	69
A-5	0.30	0.548	3.3	466	76	69
A-6	0.25	0.500	2.8	471	77	70
A-6	0.25	0.500	2.8	470	77	70
A-6	0.25	0.500	2.8	471	78	71
A-7	0.32	0.566	3.5	466	78	71
A-7	0.32	0.566	3.5	466	78	71
A-7	0.32	0.566	3.5	466	78	71
A-8	0.25	0.500	2.8	463	78	71
A-8	0.25	0.500	2.8	464	78	71
A-8	0.25	0.500	2.8	464	79	71
A-9	0.27	0.520	3.0	465	79	72
A-9	0.27	0.520	3.0	466	79	72
A-9	0.27	0.520	3.0	465	77	72
A-10	0.25	0.500	2.8	462	78	72
A-10	0.25	0.500	2.8	463	79	73
A-10	0.25	0.500	2.8	461	79	73
A-11	0.29	0.539	3.2	467	80	73
A-11	0.29	0.539	3.2	463	80	73
A-11	0.29	0.539	3.2	463	80	73
A-12	0.23	0.480	2.5	446	80	73
A-12	0.23	0.480	2.5	448	80	73
A-12	0.23	0.480	2.5	446	81	73
B-1	0.19	0.436	2.1	435	77	74
B-1	0.19	0.436	2.1	433	78	74
B-1	0.19	0.436	2.1	434	78	75
B-2	0.21	0.458	2.3	457	78	74
B-2	0.21	0.458	2.3	459	78	74
B-2	0.21	0.458	2.3	460	78	74
B-3	0.24	0.490	2.6	460	79	74
B-3	0.24	0.490	2.6	460	79	75
B-3	0.24	0.490	2.6	461	79	75
B-4	0.24	0.490	2.6	461	78	73
B-4	0.24	0.490	2.6	461	78	73
B-4	0.24	0.490	2.6	460	78	74
B-5	0.20	0.447	2.2	460	79	74
B-5	0.20	0.447	2.2	461	79	74
B-5	0.20	0.447	2.2	461	79	74
B-6	0.20	0.447	2.2	460	78	73
B-6	0.20	0.447	2.2	461	78	74
B-6	0.20	0.447	2.2	463	79	74
B-7	0.24	0.490	2.6	462	78	73
B-7	0.24	0.490	2.6	460	78	73
B-7	0.24	0.490	2.6	460	78	73
B-8	0.27	0.520	3.0	460	78	72
B-8	0.27	0.520	3.0	462	78	72
B-8	0.27	0.520	3.0	462	78	72
B-9	0.28	0.529	3.0	460	77	72
B-9	0.28	0.529	3.0	460	77	72
B-9	0.28	0.529	3.0	459	76	72
B-10	0.24	0.490	2.6	457	76	72
B-10	0.24	0.490	2.6	457	76	72
B-10	0.24	0.490	2.6	456	76	72
B-11	0.28	0.529	3.1	448	76	72
B-11	0.28	0.529	3.1	446	76	72
B-11	0.28	0.529	3.1	445	76	72
B-12	0.20	0.447	2.2	444	76	71
B-12	0.20	0.447	2.2	444	76	71
B-12	0.20	0.447	2.2	445	76	71
Average	0.2483	0.4972	2.73	458.6		74.3

Initial volume	239.000	ft^3	Initial volume	0.000	liters
Final volume	402.169	ft^3	Final volume	0.000	liters
Total metered	163.169	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	818.8	366.2	452.6			0.0
2	966.2	758.1	208.1			0.0
3	777.1	705.9	71.2			0.0
4	565.1	551.1	14.0			0.0
5	813.8	773.4	40.4			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	3941.0	3154.7	786.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal		Test Date:	October 13, 2016	
Project No.:	16-167		Test Location:	Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Boilers		Test Start Time:	10:34 AM	
Unit Operation:	Normal Load		Test Finish Time:	11:34 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:	1614		**Calculations**		
Meter $DH_@$ (0.75 scfm)	1.991	in. H_2O	CO + N2	87.45	% dv
Meter Calibration Factor (Yd)	1.003		Water Collected (V_f - V_i)	0.0	ml
Barometric Pressure (Pbar)	29.06	in. Hg	Water Vapor Condensed (Vwc(std))	0.000	scf
Stack Static Pressure (Pg)	-0.38	in. H_2O	Water Collected (W_f - W_i)	786.3	g
Stack Diameter (Ds) (L if rectangular)	67	inches	Water Vapor in Silica Gel (Vwsg(std))	37.074	scf
Stack Width (enter NA if circular)	0	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	37.074	scf
O2	5.21	% dv	Volume Dry Gas Metered (Vm)	163.169	dacf
CO2	7.34	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	158.092	dscf
Product Rate (enter NA if not needed)	NA	ton/hr	Volume Dry Gas Metered (Vm(m^3))	4.620	dacm
Is the input ton/hr metric? (YES=1)	0		Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.477	dscm
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Pressure (Ps)	29.03	in. Hg
			Stack Absolute Temperature (Tsavg)	918.3	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	937.44	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)	0.1900	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1900	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.38	lb/lb-mole
Meter Temperature (Tm)	74.3	F	Wet Gas Molecular Weight (Ms)	27.22	lb/lb-mole
Stack Temperature (Tsavg)	458.6	F	Gas Velocity (Vs)	38.49	ft/s
Orifice Pressure Drop (dHavg)	2.729	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.4972	in. H_2O^1/2	Area Stack (As)	24.484	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	56.548	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	31.539	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	25.548	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1.601	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	893	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	723	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

Carbon Monoxide (CO)			**Carbon Dioxide (CO2)**		
MW	28.0	lb/lb-mole	MW	44	lb/lb-mole
Concentration	45.48	ppm_{dv}	Concentration	73,355.0	ppm_{dv}
Emission	5.1	lb/hr	Emission	5,824,434.1	g/hr
			Emission	12,840.7	lb/hr
Sulfur Dioxide (SO2)			Emission	6.4	tons/hr
MW	64.0	lb/lb-mole			
Concentration	124.81	ppm_{dv}			
Emission	31.8	lb/hr			
Hydrogen Sulfide					
MW	34.1	lb/lb-mole			
Concentration	< 0.50	ppm_{dv}			
Concentration	< 0.62	ppm_{dv}			
Emission	< 0.0837	lb/hr			

ArcelorMittal Boilers **Run 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	0.23	0.480	2.5	453	69	69
A-1	0.23	0.480	2.5	454	69	69
A-1	0.23	0.480	2.5	452	70	68
A-2	0.24	0.490	2.6	453	71	68
A-2	0.24	0.490	2.6	455	71	68
A-2	0.24	0.490	2.6	455	72	69
A-3	0.29	0.539	3.2	466	73	68
A-3	0.29	0.539	3.2	465	73	69
A-3	0.29	0.539	3.2	466	74	68
A-4	0.25	0.500	2.8	464	74	69
A-4	0.25	0.500	2.8	465	74	69
A-4	0.25	0.500	2.8	464	75	69
A-5	0.30	0.548	3.3	465	75	69
A-5	0.30	0.548	3.3	465	76	69
A-5	0.30	0.548	3.3	466	76	69
A-6	0.25	0.500	2.8	471	77	70
A-6	0.25	0.500	2.8	470	77	70
A-6	0.25	0.500	2.8	471	78	71
A-7	0.32	0.566	3.5	466	78	71
A-7	0.32	0.566	3.5	466	78	71
A-7	0.32	0.566	3.5	466	78	71
A-8	0.25	0.500	2.8	463	78	71
A-8	0.25	0.500	2.8	464	78	71
A-8	0.25	0.500	2.8	464	79	71
A-9	0.27	0.520	3.0	465	79	72
A-9	0.27	0.520	3.0	466	79	72
A-9	0.27	0.520	3.0	465	77	72
A-10	0.25	0.500	2.8	462	78	72
A-10	0.25	0.500	2.8	463	79	73
A-10	0.25	0.500	2.8	461	79	73
A-11	0.29	0.539	3.2	467	80	73
A-11	0.29	0.539	3.2	463	80	73
A-11	0.29	0.539	3.2	463	80	73
A-12	0.23	0.480	2.5	446	80	73
A-12	0.23	0.480	2.5	448	80	73
A-12	0.23	0.480	2.5	446	81	73
B-1	0.19	0.436	2.1	435	77	74
B-1	0.19	0.436	2.1	433	78	74
B-1	0.19	0.436	2.1	434	78	75
B-2	0.21	0.458	2.3	457	78	74
B-2	0.21	0.458	2.3	459	78	74
B-2	0.21	0.458	2.3	460	78	74
B-3	0.24	0.490	2.6	460	79	74
B-3	0.24	0.490	2.6	460	79	75
B-3	0.24	0.490	2.6	461	79	75
B-4	0.24	0.490	2.6	461	78	73
B-4	0.24	0.490	2.6	461	78	73
B-4	0.24	0.490	2.6	460	78	74
B-5	0.20	0.447	2.2	460	79	74
B-5	0.20	0.447	2.2	461	79	74
B-5	0.20	0.447	2.2	461	79	74
B-6	0.20	0.447	2.2	460	78	73
B-6	0.20	0.447	2.2	461	78	74
B-6	0.20	0.447	2.2	463	79	74
B-7	0.24	0.490	2.6	462	78	73
B-7	0.24	0.490	2.6	460	78	73
B-7	0.24	0.490	2.6	460	78	73
B-8	0.27	0.520	3.0	460	78	72
B-8	0.27	0.520	3.0	462	78	72
B-8	0.27	0.520	3.0	462	78	72
B-9	0.28	0.529	3.0	460	77	72
B-9	0.28	0.529	3.0	460	77	72
B-9	0.28	0.529	3.0	459	76	72
B-10	0.24	0.490	2.6	457	76	72
B-10	0.24	0.490	2.6	457	76	72
B-10	0.24	0.490	2.6	456	76	72
B-11	0.28	0.529	3.1	448	76	72
B-11	0.28	0.529	3.1	446	76	72
B-11	0.28	0.529	3.1	445	76	72
B-12	0.20	0.447	2.2	444	76	71
B-12	0.20	0.447	2.2	444	76	71
B-12	0.20	0.447	2.2	445	76	71
Average	0.2483	0.4972	2.73	458.6		74.3

Initial volume	239.000	ft^3	Initial volume	0.000	liters
Final volume	402.169	ft^3	Final volume	0.000	liters
Total metered	163.169	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	818.8	366.2	452.6			0.0
2	966.2	758.1	208.1			0.0
3	777.1	705.9	71.2			0.0
4	565.1	551.1	14.0			0.0
5	813.8	773.4	40.4			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	3941.0	3154.7	786.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - Vi)

Client:	ArcelorMittal		Test Date:	October 13, 2016	
Project No.:	16-167		Test Location:	Stack Exhaust	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Boilers		Test Start Time:	11:44 AM	
Unit Operation:	Normal Load		Test Finish Time:	12:44 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:	1614		CO + N2	87.45	% dv
Meter $DH_@$ (0.75 scfm)	1.991	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)	29.06	in. Hg	Water Collected (W_f - W_i)	728.3	g
Stack Static Pressure (Pg)	-0.14	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	34.339	scf
Stack Diameter (Ds) (L if rectangular)	67	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	34.339	scf
Stack Width (enter NA if circular)	0	inches	Volume Dry Gas Metered (Vm)	158.774	dacf
O2	5.14	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	154.021	dscf
CO2	7.41	% dv	Volume Dry Gas Metered (Vm(m^3))	4.496	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.361	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.05	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	919.2	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	945.97	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)	0.1823	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1823	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.39	lb/lb-mole
Meter Temperature (Tm)	73.6	F	Wet Gas Molecular Weight (Ms)	27.31	lb/lb-mole
Stack Temperature (Tsavg)	459.5	F	Gas Velocity (Vs)	37.80	ft/s
Orifice Pressure Drop (dHavg)	2.633	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.4889	in. H_2O^1/2	Area Stack (As)	24.484	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	55.525	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	30.957	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	25.313	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1.572	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	877	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	717	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			
Carbon Monoxide (CO)			**Carbon Dioxide (CO2)**		
MW	28.0	lb/lb-mole	MW	44	lb/lb-mole
Concentration	60.24	ppm_{dv}	Concentration	74,131.9	ppm_{dv}
Emission	6.6	lb/hr	Emission	5,832,038.4	g/hr
			Emission	12,857.4	lb/hr
Sulfur Dioxide (SO2)			Emission	6.4	tons/hr
MW	64.0	lb/lb-mole			
Concentration	122.72	ppm_{dv}			
Emission	31.0	lb/hr			
Hydrogen Sulfide					
MW	34.1	lb/lb-mole			
Concentration	< 0.50	ppm_{dv}			
Concentration	< 0.61	ppm_{dv}			
Emission	< 0.0821	lb/hr			

ArcelorMittal Run 3 **F or C?**

Boilers **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	0.24	0.490	2.6	467	69	69
A-1	0.24	0.490	2.6	466	69	69
A-1	0.24	0.490	2.6	466	70	69
A-2	0.22	0.469	2.4	467	71	69
A-2	0.22	0.469	2.4	462	71	69
A-2	0.22	0.469	2.4	463	71	69
A-3	0.26	0.510	2.9	462	72	69
A-3	0.26	0.510	2.9	462	72	69
A-3	0.26	0.510	2.9	464	73	70
A-4	0.30	0.548	3.3	469	74	69
A-4	0.30	0.548	3.3	467	74	69
A-4	0.30	0.548	3.3	465	74	69
A-5	0.23	0.480	2.5	464	74	69
A-5	0.23	0.480	2.5	468	74	69
A-5	0.23	0.480	2.5	465	74	69
A-6	0.26	0.510	2.9	462	75	69
A-6	0.26	0.510	2.9	463	75	69
A-6	0.26	0.510	2.9	462	75	69
A-7	0.17	0.412	1.9	462	76	69
A-7	0.17	0.412	1.9	460	76	69
A-7	0.17	0.412	1.9	463	76	69
A-8	0.18	0.424	2.0	461	76	69
A-8	0.18	0.424	2.0	462	76	69
A-8	0.18	0.424	2.0	461	76	69
A-9	0.20	0.447	2.2	460	77	70
A-9	0.20	0.447	2.2	460	77	70
A-9	0.20	0.447	2.2	461	77	70
A-10	0.22	0.469	2.4	453	78	70
A-10	0.22	0.469	2.4	453	78	70
A-10	0.22	0.469	2.4	455	78	70
A-11	0.23	0.480	2.5	445	78	71
A-11	0.23	0.480	2.5	447	78	71
A-11	0.23	0.480	2.5	444	78	71
A-12	0.20	0.447	2.2	432	77	71
A-12	0.20	0.447	2.2	431	77	71
A-12	0.20	0.447	2.2	433	78	71
B-1	0.21	0.458	2.3	441	75	71
B-1	0.21	0.458	2.3	445	75	71
B-1	0.21	0.458	2.3	447	76	71
B-2	0.24	0.490	2.6	451	75	71
B-2	0.24	0.490	2.6	454	75	71
B-2	0.24	0.490	2.6	456	75	71
B-3	0.22	0.469	2.4	459	76	71
B-3	0.22	0.469	2.4	460	76	71
B-3	0.22	0.469	2.4	458	76	71
B-4	0.31	0.557	3.4	467	77	71
B-4	0.31	0.557	3.4	464	77	71
B-4	0.31	0.557	3.4	465	77	71
B-5	0.31	0.557	3.4	462	77	71
B-5	0.31	0.557	3.4	461	77	71
B-5	0.31	0.557	3.4	463	77	72
B-6	0.23	0.480	2.5	466	77	72
B-6	0.23	0.480	2.5	464	77	72
B-6	0.23	0.480	2.5	462	77	72
B-7	0.19	0.436	2.1	462	78	72
B-7	0.19	0.436	2.1	463	78	72
B-7	0.19	0.436	2.1	462	78	72
B-8	0.25	0.500	2.8	460	78	72
B-8	0.25	0.500	2.8	466	78	72
B-8	0.25	0.500	2.8	464	79	73
B-9	0.29	0.539	2.9	462	79	73
B-9	0.29	0.539	2.9	462	79	73
B-9	0.29	0.539	2.9	462	80	73
B-10	0.25	0.500	2.8	464	80	73
B-10	0.25	0.500	2.8	464	80	73
B-10	0.25	0.500	2.8	463	80	73
B-11	0.24	0.490	2.6	462	80	74
B-11	0.24	0.490	2.6	461	80	74
B-11	0.24	0.490	2.6	461	80	74
B-12	0.33	0.574	3.6	464	80	74
B-12	0.33	0.574	3.6	466	79	74
B-12	0.33	0.574	3.6	464	80	74
Average	0.24	0.489	2.63	459.5		73.6

Initial volume	402.731	ft^3	Initial volume	0.000	liters
Final volume	561.505	ft^3	Final volume	0.000	liters
Total metered	158.774	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	920.6	349.2	571.4			0.0
2	813.6	714.0	99.6			0.0
3	693.4	680.7	12.7			0.0
4	621.4	618.2	3.2			0.0
5	812.6	771.2	41.4			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	3861.6	3133.3	728.3	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Method 320

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

MINUTE	FTIR Scan #	DATE	TIME	HCl (PPMwv)	HCN (PPMwv)	HF (PPMwv)	O2 (DV %)	CO2 (DV %)
RUN 1								
1	49	10/12/2016	13:15:51	-0.06	-0.06	0.05	5.62	7.30
2	50	10/12/2016	13:16:52	-0.09	-0.17	0.05	6.06	7.12
3	51	10/12/2016	13:17:52	-0.02	-0.10	0.05	6.03	7.15
4	52	10/12/2016	13:18:53	-0.15	-0.21	0.05	5.87	7.22
5	53	10/12/2016	13:19:53	-0.16	0.08	0.05	5.73	7.27
6	54	10/12/2016	13:20:54	-0.13	-0.02	0.05	5.44	7.38
7	55	10/12/2016	13:21:55	-0.13	-0.05	0.05	4.97	7.59
8	56	10/12/2016	13:22:55	-0.16	-0.02	0.05	4.80	7.67
9	57	10/12/2016	13:23:56	-0.14	-0.18	0.05	4.98	7.59
10	58	10/12/2016	13:24:57	-0.04	-0.06	0.05	5.11	7.52
11	59	10/12/2016	13:25:57	-0.17	-0.08	0.05	5.09	7.54
12	60	10/12/2016	13:26:58	-0.07	0.10	0.05	5.02	7.58
13	61	10/12/2016	13:27:59	-0.09	0.03	0.05	5.18	7.53
14	62	10/12/2016	13:28:59	-0.02	-0.23	0.05	6.64	6.88
15	63	10/12/2016	13:30:00	-0.03	-0.26	0.05	7.04	6.70
16	64	10/12/2016	13:31:01	-0.07	-0.10	0.05	6.04	7.16
17	65	10/12/2016	13:32:01	-0.13	-0.11	0.05	5.73	7.31
18	66	10/12/2016	13:33:02	-0.01	-0.12	0.05	6.06	7.14
19	67	10/12/2016	13:34:02	-0.10	0.18	0.05	5.75	7.26
20	68	10/12/2016	13:35:03	-0.04	-0.20	0.05	5.25	7.48
21	69	10/12/2016	13:36:04	-0.08	0.05	0.05	5.17	7.51
22	70	10/12/2016	13:37:05	-0.03	-0.13	0.05	4.99	7.60
23	71	10/12/2016	13:38:05	-0.03	-0.12	0.05	5.03	7.58
24	72	10/12/2016	13:39:06	-0.18	-0.15	0.05	5.12	7.53
25	73	10/12/2016	13:40:06	-0.10	0.06	0.05	5.07	7.55
26	74	10/12/2016	13:41:07	-0.01	0.04	0.05	5.03	7.58
27	75	10/12/2016	13:42:08	-0.11	-0.22	0.05	4.92	7.63
28	76	10/12/2016	13:43:08	-0.05	-0.13	0.05	5.04	7.59
29	77	10/12/2016	13:44:09	-0.05	0.07	0.05	5.84	7.26
30	78	10/12/2016	13:45:10	-0.10	0.01	0.05	6.53	6.96
31	79	10/12/2016	13:46:10	-0.14	0.03	0.05	6.50	6.97
32	80	10/12/2016	13:47:11	-0.15	-0.15	0.05	6.13	7.13
33	81	10/12/2016	13:48:12	-0.13	-0.24	0.05	6.00	7.18
34	82	10/12/2016	13:49:12	-0.13	-0.15	0.05	5.41	7.42
35	83	10/12/2016	13:50:13	-0.19	-0.09	0.05	4.53	7.82
36	84	10/12/2016	13:51:13	-0.15	-0.24	0.05	4.57	7.81
37	85	10/12/2016	13:52:14	-0.07	0.14	0.05	4.99	7.62
38	86	10/12/2016	13:53:15	-0.15	-0.01	0.05	5.18	7.53
39	87	10/12/2016	13:54:15	-0.17	-0.03	0.05	5.19	7.52
40	88	10/12/2016	13:55:16	-0.13	-0.05	0.05	4.99	7.60
41	89	10/12/2016	13:56:17	-0.01	0.02	0.05	4.91	7.63
42	90	10/12/2016	13:57:17	-0.14	-0.10	0.05	4.94	7.61
43	91	10/12/2016	13:58:18	-0.05	-0.02	0.05	4.99	7.59
44	92	10/12/2016	13:59:19	-0.13	-0.35	0.05	5.10	7.55
45	93	10/12/2016	14:00:19	-0.14	-0.08	0.05	5.12	7.54
46	94	10/12/2016	14:01:20	-0.08	-0.02	0.05	5.06	7.55
47	95	10/12/2016	14:02:21	-0.10	-0.10	0.05	5.49	7.39
48	96	10/12/2016	14:03:21	-0.10	-0.16	0.05	6.58	6.90
49	97	10/12/2016	14:04:22	-0.14	-0.19	0.05	6.53	6.92
50	98	10/12/2016	14:05:22	-0.07	-0.07	0.05	5.83	7.24
51	99	10/12/2016	14:06:23	-0.10	-0.01	0.05	5.80	7.26
52	100	10/12/2016	14:07:24	-0.11	-0.03	0.05	6.00	7.14
53	101	10/12/2016	14:08:24	-0.17	-0.06	0.05	5.75	7.26
54	102	10/12/2016	14:09:25	-0.07	-0.17	0.05	5.38	7.41
55	103	10/12/2016	14:10:26	-0.15	-0.30	0.05	4.94	7.60
56	104	10/12/2016	14:11:26	0.03	-0.16	0.05	4.86	7.64
57	105	10/12/2016	14:12:27	-0.14	-0.24	0.05	4.96	7.60
58	106	10/12/2016	14:13:28	-0.07	-0.06	0.05	5.15	7.53
59	107	10/12/2016	14:14:28	-0.07	-0.22	0.05	5.81	7.26
60	108	10/12/2016	14:15:29	-0.07	-0.18	0.05	6.12	7.14
RUN 1 AVERAGES				**-0.10**	**-0.09**	**0.05**	**5.5**	**7.4**

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

MINUTE	FTIR Scan #	DATE	TIME	HCl (PPMwv)	HCN (PPMwv)	HF (PPMwv)	O2 (DV %)	CO2 (DV %)
RUN 2								
1	125	10/12/2016	14:32:40	0.10	0.59	0.05	5.30	7.38
2	126	10/12/2016	14:33:41	0.16	0.41	0.05	4.83	7.59
3	127	10/12/2016	14:34:41	0.04	0.27	0.05	4.77	7.61
4	128	10/12/2016	14:35:42	-0.13	0.39	0.05	5.00	7.51
5	129	10/12/2016	14:36:42	-0.10	0.17	0.05	5.22	7.42
6	130	10/12/2016	14:37:43	-0.04	0.21	0.05	5.20	7.42
7	131	10/12/2016	14:38:44	-0.02	0.15	0.05	5.14	7.44
8	132	10/12/2016	14:39:44	-0.08	0.28	0.05	4.96	7.52
9	133	10/12/2016	14:40:45	-0.05	-0.01	0.05	4.96	7.54
10	134	10/12/2016	14:41:46	-0.02	-0.15	0.05	5.02	7.52
11	135	10/12/2016	14:42:46	-0.04	0.05	0.05	5.64	7.27
12	136	10/12/2016	14:43:47	-0.08	0.16	0.05	6.30	6.99
13	137	10/12/2016	14:44:47	-0.07	0.35	0.05	6.16	7.05
14	138	10/12/2016	14:45:48	-0.07	0.09	0.05	5.87	7.19
15	139	10/12/2016	14:46:49	-0.12	0.14	0.05	5.85	7.18
16	140	10/12/2016	14:47:49	-0.01	0.19	0.05	5.66	7.25
17	141	10/12/2016	14:48:50	-0.06	0.09	0.05	5.16	7.46
18	142	10/12/2016	14:49:51	-0.12	0.00	0.05	4.79	7.63
19	143	10/12/2016	14:50:51	-0.19	-0.07	0.05	4.81	7.63
20	144	10/12/2016	14:51:52	-0.14	0.27	0.05	5.04	7.51
21	145	10/12/2016	14:52:53	-0.13	0.05	0.05	5.15	7.46
22	146	10/12/2016	14:53:53	-0.10	0.20	0.05	5.01	7.52
23	147	10/12/2016	14:54:54	-0.14	0.19	0.05	4.92	7.55
24	148	10/12/2016	14:55:55	-0.01	0.21	0.05	5.07	7.49
25	149	10/12/2016	14:56:55	-0.05	0.22	0.05	5.08	7.48
26	150	10/12/2016	14:57:56	-0.21	0.21	0.05	4.98	7.53
27	151	10/12/2016	14:58:56	-0.12	0.01	0.05	5.03	7.50
28	152	10/12/2016	14:59:57	-0.09	-0.37	0.05	5.10	7.48
29	153	10/12/2016	15:00:58	-0.01	0.04	0.05	6.47	6.87
30	154	10/12/2016	15:01:58	-0.18	0.33	0.05	6.64	6.80
31	155	10/12/2016	15:02:59	-0.11	0.32	0.05	5.82	7.19
32	156	10/12/2016	15:04:00	-0.12	0.14	0.05	5.74	7.23
33	157	10/12/2016	15:05:00	-0.10	0.02	0.05	6.01	7.09
34	158	10/12/2016	15:06:01	-0.12	0.11	0.05	5.88	7.14
35	159	10/12/2016	15:07:02	-0.07	0.38	0.05	5.27	7.41
36	160	10/12/2016	15:08:02	-0.06	0.09	0.05	4.79	7.62
37	161	10/12/2016	15:09:03	-0.05	0.04	0.05	4.84	7.60
38	162	10/12/2016	15:10:03	-0.12	0.18	0.05	5.02	7.53
39	163	10/12/2016	15:11:04	-0.22	0.00	0.05	5.09	7.50
40	164	10/12/2016	15:12:05	-0.15	0.08	0.05	5.24	7.44
41	165	10/12/2016	15:13:05	0.02	-0.15	0.05	5.22	7.46
42	166	10/12/2016	15:14:06	-0.07	-0.01	0.05	5.75	7.24
43	167	10/12/2016	15:15:07	-0.06	0.04	0.05	6.29	7.02
44	168	10/12/2016	15:16:07	-0.17	-0.08	0.05	6.16	7.07
45	169	10/12/2016	15:17:08	-0.01	-0.27	0.05	5.90	7.18
46	170	10/12/2016	15:18:09	-0.05	0.21	0.05	5.73	7.25
47	171	10/12/2016	15:19:09	-0.17	0.11	0.05	5.24	7.46
48	172	10/12/2016	15:20:10	-0.09	0.03	0.05	4.86	7.63
49	173	10/12/2016	15:21:10	-0.10	-0.04	0.05	4.88	7.62
50	174	10/12/2016	15:22:11	-0.01	-0.14	0.05	4.99	7.56
51	175	10/12/2016	15:23:12	-0.06	-0.19	0.05	5.16	7.48
52	176	10/12/2016	15:24:12	-0.16	-0.13	0.05	5.11	7.49
53	177	10/12/2016	15:25:13	-0.10	-0.43	0.05	4.99	7.53
54	178	10/12/2016	15:26:14	-0.10	-0.03	0.05	5.00	7.54
55	179	10/12/2016	15:27:14	0.01	-0.15	0.05	5.01	7.53
56	180	10/12/2016	15:28:15	-0.05	-0.06	0.05	5.09	7.48
57	181	10/12/2016	15:29:16	-0.08	-0.20	0.05	5.15	7.46
58	182	10/12/2016	15:30:16	-0.04	-0.04	0.05	5.09	7.48
59	183	10/12/2016	15:31:17	-0.09	-0.14	0.05	5.07	7.48
60	184	10/12/2016	15:32:18	-0.03	-0.11	0.05	5.05	7.49
RUN 2 AVERAGES				**-0.08**	**0.07**	**0.05**	**5.31**	**7.40**

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

MINUTE	FTIR Scan #	DATE	TIME	HCl (PPMwv)	HCN (PPMwv)	HF (PPMwv)	O2 (DV %)	CO2 (DV %)
RUN 3								
1	198	10/12/2016	15:46:26	-0.02	0.34	0.05	6.05	7.00
2	199	10/12/2016	15:47:27	-0.05	0.28	0.05	5.68	7.16
3	200	10/12/2016	15:48:28	-0.07	0.37	0.05	5.84	7.07
4	201	10/12/2016	15:49:28	-0.04	0.66	0.05	5.69	7.12
5	202	10/12/2016	15:50:29	-0.07	0.23	0.05	5.43	7.23
6	203	10/12/2016	15:51:30	-0.06	0.22	0.05	4.98	7.43
7	204	10/12/2016	15:52:30	-0.11	0.33	0.05	4.78	7.52
8	205	10/12/2016	15:53:31	-0.07	0.05	0.05	4.96	7.44
9	206	10/12/2016	15:54:32	-0.05	0.03	0.05	5.07	7.40
10	207	10/12/2016	15:55:32	0.06	0.22	0.05	5.27	7.32
11	208	10/12/2016	15:56:33	-0.21	0.18	0.05	6.31	6.88
12	209	10/12/2016	15:57:34	0.02	0.09	0.05	6.60	6.74
13	210	10/12/2016	15:58:34	-0.04	-0.02	0.05	6.15	6.94
14	211	10/12/2016	15:59:35	-0.03	0.24	0.05	5.73	7.12
15	212	10/12/2016	16:00:36	-0.14	0.04	0.05	5.29	7.30
16	213	10/12/2016	16:01:36	-0.05	0.27	0.05	4.87	7.49
17	214	10/12/2016	16:02:37	-0.13	-0.05	0.05	4.84	7.51
18	215	10/12/2016	16:03:37	-0.01	-0.09	0.05	5.18	7.34
19	216	10/12/2016	16:04:38	-0.01	-0.11	0.05	5.24	7.30
20	217	10/12/2016	16:05:39	-0.07	0.21	0.05	5.11	7.37
21	218	10/12/2016	16:06:39	-0.10	0.13	0.05	5.12	7.37
22	219	10/12/2016	16:07:40	-0.04	0.23	0.05	6.64	6.71
23	220	10/12/2016	16:08:41	-0.10	0.14	0.05	7.18	6.48
24	221	10/12/2016	16:09:41	-0.05	0.24	0.05	6.18	6.92
25	222	10/12/2016	16:10:42	-0.02	0.03	0.05	5.76	7.11
26	223	10/12/2016	16:11:42	0.08	0.06	0.05	5.88	7.04
27	224	10/12/2016	16:12:43	-0.07	0.22	0.05	5.76	7.07
28	225	10/12/2016	16:13:44	-0.15	0.05	0.05	4.89	7.44
29	226	10/12/2016	16:14:45	-0.08	-0.18	0.05	4.15	7.78
30	227	10/12/2016	16:15:45	-0.02	-0.01	0.05	4.45	7.66
31	228	10/12/2016	16:16:46	0.00	0.23	0.05	5.20	7.33
32	229	10/12/2016	16:17:46	-0.06	0.22	0.05	5.46	7.21
33	230	10/12/2016	16:18:47	-0.11	-0.08	0.05	5.40	7.23
34	231	10/12/2016	16:19:48	-0.08	0.08	0.05	5.43	7.25
35	232	10/12/2016	16:20:48	0.00	0.09	0.05	6.55	6.76
36	233	10/12/2016	16:21:49	0.09	0.09	0.05	6.69	6.69
37	234	10/12/2016	16:22:50	-0.09	0.05	0.05	5.92	7.05
38	235	10/12/2016	16:23:50	-0.16	0.07	0.05	5.69	7.15
39	236	10/12/2016	16:24:51	-0.09	0.05	0.05	5.76	7.11
40	237	10/12/2016	16:25:51	-0.02	-0.06	0.05	5.34	7.28
41	238	10/12/2016	16:26:52	-0.09	-0.19	0.05	4.88	7.48
42	239	10/12/2016	16:27:53	0.00	-0.14	0.05	4.92	7.46
43	240	10/12/2016	16:28:53	-0.16	-0.21	0.05	5.09	7.38
44	241	10/12/2016	16:29:54	-0.12	-0.16	0.05	5.22	7.32
45	242	10/12/2016	16:30:55	-0.13	-0.14	0.05	5.23	7.32
46	243	10/12/2016	16:31:55	-0.10	-0.14	0.05	5.20	7.33
47	244	10/12/2016	16:32:56	-0.10	0.00	0.05	5.25	7.30
48	245	10/12/2016	16:33:57	-0.06	-0.06	0.05	6.43	6.82
49	246	10/12/2016	16:34:57	-0.02	0.10	0.05	7.18	6.48
50	247	10/12/2016	16:35:58	-0.05	0.16	0.05	6.47	6.78
51	248	10/12/2016	16:36:59	-0.01	-0.23	0.05	5.90	7.03
52	249	10/12/2016	16:37:59	-0.03	0.15	0.05	6.07	6.94
53	250	10/12/2016	16:39:00	-0.09	-0.08	0.05	5.81	7.03
54	251	10/12/2016	16:40:00	-0.21	-0.49	0.05	4.61	7.54
55	252	10/12/2016	16:41:01	-0.10	-0.20	0.05	4.07	7.81
56	253	10/12/2016	16:42:02	-0.08	-0.37	0.05	4.67	7.57
57	254	10/12/2016	16:43:02	-0.11	-0.25	0.05	5.35	7.28
58	255	10/12/2016	16:44:03	-0.16	-0.41	0.05	5.45	7.23
59	256	10/12/2016	16:45:04	0.03	-0.45	0.05	5.32	7.29
60	257	10/12/2016	16:46:04	-0.03	-0.08	0.05	5.62	7.18
RUN 3 AVERAGES				**-0.06**	**0.03**	**0.05**	**5.52**	**7.20**

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

Client	ArcelorMittal	**Date**	October 12, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 1
Unit	Boilers 1 and 2	**Start Time**	13:15
Operation	Normal	**End Time**	14:15
Tester(s)	BC, JV, JW, TL, TM		

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	CC210754	XC034406B	N/A	N/A	45	45
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A	50	50
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		0.09	0.12	0.15	0.13	0.20	0.05	20.03	0.125			
	Mid	10.01	10.14	10.08	-0.30	10.03	-0.55	-0.25	20.03	10.055	5.47	5.38	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.18	0.40	0.00	19.79	0.18			
	Mid	10.15	10.17	10.06	-0.56	10.01	-0.81	-0.25	19.79	10.035	7.39	7.43	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		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	**Date**	October 12, 2016
Project No	16-167	**Location**	Common Stack
Plant	Monessen, PA	**Run**	Run 2
Unit	Boilers 1 and 2	**Start Time**	14:32
Operation	Normal	**End Time**	15:32
Tester(s)	BC, JV, JW, TL, TM		

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	CC210754	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A
LIMITS				40 % to 60 %		100%							
THC LIMITS		25 % to 35 %		45 % to 55 %		80 % to 90 %							

				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	0.13	0.20	0.00	20.03	0.13			
	Mid	10.01	10.14	10.03	-0.55	10.03	-0.55	0.00	20.03	10.03	5.31	5.24	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.18	0.40	0.00	19.79	0.18			
	Mid	10.15	10.17	10.01	-0.81	10.01	-0.81	0.00	19.79	10.01	7.40	7.45	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		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	Date	October 12, 2016
Project No	16-167	Location	Common Stack
Plant	Monessen, PA	Run	Run 3
Unit	Boilers 1 and 2	Start Time	15:46
Operation	Normal	End Time	16:46
Tester(s)	BC, JV, JW, TL, TM		

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
O2	N/A	N/A	10.01	50.0	20.03	100.0	20.03	d. vol. %	N/A	CC210754	XC034406B	N/A	N/A
CO2	N/A	N/A	10.15	51.3	19.79	100.0	19.79	d. vol. %	N/A	CC210754	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		0.09	0.13	0.20	0.13	0.20	0.00	20.03	0.13			
	Mid	10.01	10.14	10.03	-0.55	10.03	-0.55	0.00	20.03	10.03	5.52	5.45	d. vol. %
CO2	Zero		0.10	0.18	0.40	0.18	0.40	0.00	19.79	0.18			
	Mid	10.15	10.17	10.01	-0.81	10.01	-0.81	0.00	19.79	10.01	7.20	7.25	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	10.14	0.65		20.03	20.00	-0.15		20.03	d. vol. %
CO2	0.10	0.51					10.15	10.17	0.10		19.79	19.82	0.15		19.79	d. vol. %
LIMITS		+/- 2 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %			+/- 2 %	+/- 5 %		

Client:	ArcelorMittal		Test Date:	October 12, 2016	
Project No.:	16-167		Test Location:	Common Stack	
Plant:	Monessen, PA		Test Run:	Run 1	
Unit:	Boilers 1 and 2		Test Start Time:	1:15 PM	
Unit Operation:	Normal		Test Finish Time:	2:15 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			**Calculations**		
Control Box:	1614		CO + N2	87.19	% dv
Meter $DH_@$ (0.75 scfm)	1.991	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)	29.27	in. Hg	Water Collected (W_f - W_i)	696.3	g
Stack Static Pressure (Pg)	-0.37	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	32.831	scf
Stack Diameter (Ds) (L if rectangular)	67.0	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	32.831	scf
Stack Width (enter NA if circular)	NA	inches	Volume Dry Gas Metered (Vm)	155.578	dacf
O2	5.38	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	147.096	dscf
CO2	7.43	% dv	Volume Dry Gas Metered ($Vm(m^3)$)	4.405	dscm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.($Vm(std)m^3$)	4.165	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.24	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	915.2	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	909.55	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)	0.1825	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1825	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Meter Temperature (Tm)	91.2	F	Wet Gas Molecular Weight (Ms)	27.32	lb/lb-mole
Stack Temperature (Tsavg)	455.5	F	Gas Velocity (Vs)	37.59	ft/s
Orifice Pressure Drop (dHavg)	2.540	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.4890	in. H_2O ^1/2	Area Stack (As)	24.484	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	55,216	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	31,123	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	25,444	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1,564	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	881	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	720	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

HCl

MW	36.46094	lb/lb-mole
Concentration	< 0.27	ppm_{wv}
Concentration	< 0.33	ppm_{dv}
Concentration	< 0.0000000	lb/dscf
Concentration	< 0.53	mg/dscm
Emission	< 0.047	lb/hr

HF

MW	20.01	lb/lb-mole
Concentration	< 0.05	ppm_{wv}
Concentration	< 0.06	ppm_{dv}
Concentration	< 0.0000000	lb/dscf
Emission	< 0.06	mg/dscm
Emission	< 0.005	lb/hr

HCN

MW	27.0253	lb/lb-mole
Concentration	< 0.41	ppm_{wv}
Concentration	< 0.50	ppm_{dv}
Concentration	< 0.0000000	lb/dscf
Emission	< 0.60	mg/dscm
Emission	< 0.053	lb/hr

ArcelorMittal Boilers 1 and 2 — **Run 1** — **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	0.24	0.490	2.6	456	82	80
A-1	0.24	0.490	2.6	453	82	80
A-1	0.24	0.490	2.6	453	82	80
A-2	0.24	0.490	2.6	458	85	80
A-2	0.24	0.490	2.6	458	86	81
A-2	0.24	0.490	2.6	458	86	81
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-9	0.21	0.458	2.3	457	91	86
A-9	0.21	0.458	2.3	462	91	86
A-9	0.21	0.458	2.3	460	91	86
A-10	0.23	0.480	2.5	444	95	87
A-10	0.23	0.480	2.5	446	95	87
A-10	0.23	0.480	2.5	442	95	87
A-11	0.20	0.447	2.2	436	97	87
A-11	0.20	0.447	2.2	437	97	87
A-11	0.20	0.447	2.2	438	97	87
A-12	0.26	0.510	2.9	448	99	90
A-12	0.26	0.510	2.9	446	99	90
A-12	0.26	0.510	2.9	447	99	90
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	432	101	96
B-2	0.22	0.469	2.4	433	100	96
B-2	0.22	0.469	2.4	432	100	96
B-2	0.22	0.469	2.4	433	100	96
B-3	0.23	0.480	2.5	462	100	97
B-3	0.23	0.480	2.5	458	100	97
B-3	0.23	0.480	2.5	460	100	97
B-4	0.18	0.424	2.0	458	99	96
B-4	0.18	0.424	2.0	461	99	96
B-4	0.23	0.480	2.5	461	99	95
B-5	0.23	0.480	2.5	463	99	95
B-5	0.23	0.480	2.5	460	99	95
B-5	0.23	0.480	2.5	458	99	95
B-6	0.23	0.480	2.5	460	98	94
B-6	0.23	0.480	2.5	460	97	94
B-6	0.23	0.480	2.5	462	97	94
B-7	0.25	0.500	2.8	460	97	93
B-7	0.25	0.500	2.8	463	97	93
B-7	0.25	0.500	2.8	460	97	93
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	464	96	92
B-9	0.25	0.500	2.8	459	95	91
B-9	0.25	0.500	2.8	460	95	91
B-9	0.25	0.500	2.8	460	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	464	94	90
B-11	0.26	0.510	2.4	454	93	90
B-11	0.26	0.510	2.4	452	93	91
B-11	0.26	0.510	2.4	452	93	91
B-12	0.26	0.510	2.4	457	93	89
B-12	0.26	0.510	2.4	456	93	90
B-12	0.26	0.510	2.4	453	93	90
Average	0.24	0.489	2.54	455.5		91.2

Initial volume	83.100	ft^3	Initial volume	0.000	liters
Final volume	238.678	ft^3	Final volume	0.000	liters
Total metered	155.578	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1007.9	347.8	660.1			0.0
2	668.4	674.9	-6.5			0.0
3	699.5	696.5	3.0			0.0
4	619.3	613.7	5.6			0.0
5	896.0	861.9	34.1			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	3891.1	3194.8	696.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

Client:	ArcelorMittal		Test Date:	October 12, 2016	
Project No.:	16-167		Test Location:	Common Stack	
Plant:	Monessen, PA		Test Run:	Run 2	
Unit:	Boilers 1 and 2		Test Start Time:	2:32 PM	
Unit Operation:	Normal		Test Finish Time:	3:32 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:	1614		CO + N2	87.31	% dv
Meter $DH_{@}$ (0.75 scfm)	1.991	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)	29.27	in. Hg	Water Collected (W_f- W_i)	696.3	g
Stack Static Pressure (Pg)	-0.14	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	32.831	scf
Stack Diameter (Do) (L if rectangular)	67	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	32.831	scf
Stack Width (enter NA if circular)	NA	inches	Volume Dry Gas Metered (Vm)	155.578	dacf
O2	5.24	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	147.096	dscf
CO2	7.45	% dv	Volume Dry Gas Metered (Vm(m^3))	4.405	dscm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m^3)	4.165	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.26	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	915.2	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	909.55	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)	0.1825	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1825	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.40	lb/lb-mole
Meter Temperature (Tm)	91.2	F	Wet Gas Molecular Weight (Ms)	27.32	lb/lb-mole
Stack Temperature (Tsavg)	455.5	F	Gas Velocity (Vs)	37.58	ft/s
Orifice Pressure Drop (dHavg)	2.540	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head (dP)$^{1/2}$avg	0.4890	in. H_2O^1/2	Area Stack (As)	24.484	ft^2
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	55.201	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	31.132	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	25.452	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1.563	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	882	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	721	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft^3/lb-mole			

HCl

MW		36.46	lb/lb-mole
Concentration	<	0.27	ppm_{wv}
Concentration	<	0.33	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Emission	<	0.53	mg/dscm
Emission	<	0.047	lb/hr

HF

MW		20.01	lb/lb-mole
Concentration	<	0.05	ppm_{wv}
Concentration	<	0.06	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Emission	<	0.06	mg/dscm
Emission	<	0.005	lb/hr

HCN

MW		27.03	lb/lb-mole
Concentration	<	0.41	ppm_{wv}
Concentration	<	0.50	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Emission	<	0.60	mg/dscm
Emission	<	0.053	lb/hr

ArcelorMittal Run 2 F or C? F=1,C=0 1
Boilers 1 and 2

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	0.24	0.490	2.6	456	82	80
A-1	0.24	0.490	2.6	453	82	80
A-1	0.24	0.490	2.6	453	82	80
A-2	0.24	0.490	2.6	458	85	80
A-2	0.24	0.490	2.6	458	86	81
A-2	0.24	0.490	2.6	458	86	81
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-9	0.21	0.458	2.3	457	91	86
A-9	0.21	0.458	2.3	462	91	86
A-9	0.21	0.458	2.3	460	91	86
A-10	0.23	0.480	2.5	444	95	87
A-10	0.23	0.480	2.5	446	95	87
A-10	0.23	0.480	2.5	442	95	87
A-11	0.20	0.447	2.2	436	97	87
A-11	0.20	0.447	2.2	437	97	87
A-11	0.20	0.447	2.2	438	97	87
A-12	0.26	0.510	2.9	448	99	90
A-12	0.26	0.510	2.9	446	99	90
A-12	0.26	0.510	2.9	447	99	90
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	432	101	96
B-2	0.22	0.469	2.4	433	100	96
B-2	0.22	0.469	2.4	432	100	96
B-2	0.22	0.469	2.4	433	100	96
B-3	0.23	0.480	2.5	462	100	97
B-3	0.23	0.480	2.5	458	100	97
B-3	0.23	0.480	2.5	460	100	97
B-4	0.18	0.424	2.0	458	99	96
B-4	0.18	0.424	2.0	461	99	96
B-4	0.23	0.480	2.5	461	99	95
B-5	0.23	0.480	2.5	463	99	95
B-5	0.23	0.480	2.5	460	99	95
B-5	0.23	0.480	2.5	458	99	95
B-6	0.23	0.480	2.5	460	98	94
B-6	0.23	0.480	2.5	460	97	94
B-6	0.23	0.480	2.5	462	97	94
B-7	0.25	0.500	2.8	460	97	93
B-7	0.25	0.500	2.8	463	97	93
B-7	0.25	0.500	2.8	460	97	93
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	464	96	92
B-9	0.25	0.500	2.8	459	95	91
B-9	0.25	0.500	2.8	460	95	91
B-9	0.25	0.500	2.8	460	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	464	94	90
B-11	0.26	0.510	2.4	454	93	90
B-11	0.26	0.510	2.4	452	93	91
B-11	0.26	0.510	2.4	452	93	91
B-12	0.26	0.510	2.4	457	93	89
B-12	0.26	0.510	2.4	456	93	90
B-12	0.26	0.510	2.4	453	93	90
Average	0.24	0.489	2.54	455.5		91.2

Initial volume	83.100	ft^3	Initial volume	0.000	liters
Final volume	238.678	ft^3	Final volume	0.000	liters
Total metered	155.578	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1007.9	347.8	660.1			0.0
2	668.4	674.9	-6.5			0.0
3	699.5	696.5	3.0			0.0
4	619.3	613.7	5.6			0.0
5	896.0	861.9	34.1			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	3891.1	3194.8	696.3	0.0	0.0	0.0
	W_f	W_i	(W_f- W_i)	V_f	V_i	(V_f- V_i)

Client:	ArcelorMittal		Test Date:	October 12, 2016	
Project No.:	16-167		Test Location:	Common Stack	
Plant:	Monessen, PA		Test Run:	Run 3	
Unit:	Boilers 1 and 2		Test Start Time:	3:46 PM	
Unit Operation:	Normal		Test Finish Time:	4:46 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:	1614		CO + N2	87.30	% dv
Meter $DH_@$ (0.75 scfm)	1.991	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)	29.27	in. Hg	Water Collected (W_f - W_i)	696.3	g
Stack Static Pressure (Pg)	-0.14	in. H_2O	Water Vapor in Silica Gel (Vwsg(std))	32.831	scf
Stack Diameter (Dx) (L if rectangular)	67	inches	Vol. Water Vapor in Gas Stand.(Vw(std))	32.831	scf
Stack Width (enter NA if circular)	NA	inches	Volume Dry Gas Metered (Vm)	155.578	dacf
O2	5.45	% dv	Vol. Dry Gas Metered Stand.(Vm(std))	147.096	dscf
CO2	7.25	% dv	Volume Dry Gas Metered (Vmfm³)	4.405	dacm
Product Rate (enter NA if not needed)	NA	ton/hr	Vol. Dry Gas Metered Stand.(Vm(std)m³)	4.165	dscm
Is the input ton/hr metric? (YES=1)	0		Stack Absolute Pressure (Ps)	29.26	in. Hg
Pitot Tube Coefficient (Cp)	0.84		Stack Absolute Temperature (Tsavg)	915.2	R
Sample Calculation Title	Flow, Moisture, CEMS		H2O Vapor Pressure @ avg Stack Temp.	909.55	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)	0.1825	vol. fraction
Standard Pressure	760	mm Hg	H2O in the gas used (lower of the 2 Bws)	0.1825	vol. fraction
Pitot Tube Constant (Kp)	85.49		Is the Gas Stream Saturated With H2O?	NO	
Calculations			Dry Gas Molecular Weight (Md)	29.38	lb/lb-mole
Meter Temperature (Tm)	91.2	F	Wet Gas Molecular Weight (Ms)	27.30	lb/lb-mole
Stack Temperature (Tsavg)	455.5	F	Gas Velocity (Vs)	37.59	ft/s
Orifice Pressure Drop (dHavg)	2.540	in. H_2O	Is the stack circular or rectangular?	CIRCULAR	
GasVelocity Head $(dP)^{1/2}$avg	0.4890	in. H_2O ^1/2	Area Stack (As)	24.484	ft²
F_d @ Standard Conditions	NA	dscf/MMBtu	Actual Gas Flowrate	55.222	acfm
F_d @ Stan. Cond. & Actual O2	NA	dscf/MMBtu	Standard Gas Flowrate	31.144	scfm
Heat Input Based on F_d	NA	MMBtu/hr	Dry Standard Gas Flowrate	25.461	dscfm
K1method 4	0.04706	scf/ml	Actual Gas Flowrate	1.564	acm/min
K2method 4	0.04715	scf/g	Standard Gas Flowrate	882	scm/min
K1method 5	17.64	R/in. Hg	Dry Standard Gas Flowrate	721	dscm/min
K4method 5	0.0945				
Standard lb-mole volume	385.3	ft³/lb-mole			

HCl

MW		36.46	lb/lb-mole
Concentration	<	0.27	ppm_{wv}
Concentration	<	0.33	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Emission	<	0.53	mg/dscm
Emission	<	0.047	lb/hr

HF

MW		20.01	lb/lb-mole
Concentration	<	0.05	ppm_{wv}
Concentration	<	0.06	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Emission	<	0.06	mg/dscm
Emission	<	0.005	lb/hr

HCN

MW		27.03	lb/lb-mole
Concentration	<	0.41	ppm_{wv}
Concentration	<	0.50	ppm_{dv}
Concentration	<	0.0000000	lb/dscf
Emission	<	0.60	mg/dscm
Emission	<	0.053	lb/hr

ArcelorMittal Boilers 1 and 2 — **Run 3** — **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	0.24	0.490	2.6	456	82	80
A-1	0.24	0.490	2.6	453	82	80
A-1	0.24	0.490	2.6	453	82	80
A-2	0.24	0.490	2.6	458	85	80
A-2	0.24	0.490	2.6	458	86	81
A-2	0.24	0.490	2.6	458	86	81
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-3	0.27	0.520	2.3	462	87	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-4	0.23	0.480	2.5	461	89	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-5	0.27	0.520	2.3	463	90	82
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-6	0.22	0.469	2.4	459	90	83
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-7	0.18	0.424	2.0	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-8	0.22	0.469	2.4	465	90	84
A-9	0.21	0.458	2.3	457	91	86
A-9	0.21	0.458	2.3	462	91	86
A-9	0.21	0.458	2.3	460	91	86
A-10	0.23	0.480	2.5	444	95	87
A-10	0.23	0.480	2.5	446	95	87
A-10	0.23	0.480	2.5	442	95	87
A-11	0.20	0.447	2.2	436	97	87
A-11	0.20	0.447	2.2	437	97	87
A-11	0.20	0.447	2.2	438	97	87
A-12	0.26	0.510	2.9	448	99	90
A-12	0.26	0.510	2.9	446	99	90
A-12	0.26	0.510	2.9	447	99	90
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	431	101	96
B-1	0.22	0.469	2.4	432	101	96
B-2	0.22	0.469	2.4	433	100	96
B-2	0.22	0.469	2.4	432	100	96
B-2	0.22	0.469	2.4	433	100	96
B-3	0.23	0.480	2.5	462	100	97
B-3	0.23	0.480	2.5	458	100	97
B-3	0.23	0.480	2.5	460	100	97
B-4	0.18	0.424	2.0	458	99	96
B-4	0.18	0.424	2.0	461	99	96
B-4	0.23	0.480	2.5	461	99	95
B-5	0.23	0.480	2.5	463	99	95
B-5	0.23	0.480	2.5	460	99	95
B-5	0.23	0.480	2.5	458	99	95
B-6	0.23	0.480	2.5	460	98	94
B-6	0.23	0.480	2.5	460	97	94
B-6	0.23	0.480	2.5	462	97	94
B-7	0.25	0.500	2.8	460	97	93
B-7	0.25	0.500	2.8	463	97	93
B-7	0.25	0.500	2.8	460	97	93
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	462	96	92
B-8	0.31	0.557	3.4	464	96	92
B-9	0.25	0.500	2.8	459	95	91
B-9	0.25	0.500	2.8	460	95	91
B-9	0.25	0.500	2.8	460	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	461	95	91
B-10	0.34	0.583	3.7	464	94	90
B-11	0.26	0.510	2.4	454	93	90
B-11	0.26	0.510	2.4	452	93	91
B-11	0.26	0.510	2.4	452	93	91
B-12	0.26	0.510	2.4	457	93	89
B-12	0.26	0.510	2.4	456	93	90
B-12	0.26	0.510	2.4	453	93	90
Average	0.24	0.489	2.54	455.5		91.2

Initial volume	83.100	ft³	Initial volume	0.000	liters
Final volume	238.678	ft³	Final volume	0.000	liters
Total metered	155.578	dacf	Total metered	0.000	dry actual liters

Impinger	Final grams	Initial grams	Gram Gain	Final ml	Initial ml	ml Gain
1	1007.9	347.8	660.1			0.0
2	668.4	674.9	-6.5			0.0
3	699.5	696.5	3.0			0.0
4	619.3	613.7	5.6			0.0
5	896.0	861.9	34.1			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	3891.1	3194.8	696.3	0.0	0.0	0.0
	W_f	W_i	(W_f - W_i)	V_f	V_i	(V_f - V_i)

REPORT - APPENDIX C

Laboratory Data

Method 201A/202

EPA METHOD 201A/202
ACETONE BLANK ANALYTICAL DATA

Client:	ArcelorMittal
Project No:	16-146
Location:	Monessen, PA
Blank Sample Date:	October 11, 2016
Test Date(s):	October 11-12, 2016
Analysis Dates:	10/19/2016-11/01/2016
Analyst:	EMH
Acetone Blank No:	**438R**

ACETONE BLANK	UNITS	
Acetone density (p_a)	g/ml	0.7899
Acetone blank volume (Va)	ml	200
Final (total) weight 1	mg	113,926.60
Final (total) weight 2	mg	113,926.80
Final (total) weight difference (absolute value) (1)	mg	0.20
Average final (total) weight	mg	113,926.70
Tare weight 1	mg	113,926.00
Tare weight 2	mg	113,925.90
Tare weight difference (absolute value) (1)	mg	-0.10
Average tare weight	mg	113,925.95
Average final (total) weight minus average tare weight	mg	0.75
Mass of residue of acetone (m_a) (2)	mg	0.75
Acetone blank residue concentration (Ca) calculated (3)	mg/g	0.0047
Acetone blank correction as a % of acetone mass	%	0.0005
Acetone blank residue concentration (Ca) used (4)	**mg/g**	**0.0047**

ANALYST SIGNATURE: (5) Em Hoyt

COMMENTS:

NOTES:

(1) "Constant weight" is defined in EPA Method 5 as "a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings."

(2) If the "Mass of residue of acetone after evaporation" is negative, the value will be set equal to 0.

(3) Units of mg/g are being used instead of mg/mg.

(4) The maximum allowable blank correction is 0.001 % of the weight of acetone used for recovery of the sample train. 0.001 % is equivalent to 0.01 mg/g. If "Ca calculated" is greater than 0.01 mg/g, "Ca used" will be set equal to 0.01 mg/g.

(5) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data have been checked for completeness, and that the results presented are accurate, error-free, legible, and have been conducted in accordance with the methods in the approved protocol.

g/ml - Grams per milliliter
mg - Milligrams
mg/g - Milligrams per gram
ml - Milliliters

EPA METHOD 202
WATER BLANK ANALYTICAL DATA

Client:	ArcelorMittal
Project No:	16-146
Location:	Monessen, PA
Blank Sample Date:	October 11, 2016
Test Date(s):	October 11-12, 2016
Analysis Dates:	10/19/2016-11/01/2016
Analyst:	EMH
Water Blank No.:	**438S**

WATER BLANK	UNITS	
Water Density (p_a)	g/ml	1.0000
Water blank volume (Va)	ml	200
Final (total) weight 1	mg	106,556.3
Final (total) weight 2	mg	106,556.5
Final (total) weight difference (absolute value) (1)	mg	0.20
Average final (total) weight	mg	106,556.40
Tare weight 1	mg	106,555.7
Tare weight 2	mg	106,555.6
Tare weight difference (absolute value) (1)	mg	-0.10
Average tare weight	mg	106,555.65
Average final (total) weight minus average tare weight	mg	0.75
Water blank Total Weight	**mg**	**0.7500**

ANALYST SIGNATURE: (3) Em Hart

COMMENTS:

NOTES:

(1) "Constant weight" is defined in EPA Method 5 as "a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings."

(2) If the "Mass of residue of water after evaporation" is negative, the value will be set equal to 0.

(3) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data have been checked for completeness, and that the results presented are accurate, error-free, legible, and have been conducted in accordance with the methods in the approved protocol.

g/ml - Grams per milliliter
mg - Milligrams
mg/g - Milligrams per gram
ml - Milliliters

EPA METHOD 202
HEXANE BLANK ANALYTICAL DATA

Client:	ArcelorMittal
Project No:	16-146
Location:	Monessen, PA
Blank Sample Date:	October 11, 2016
Test Date(s):	October 11-12, 2016
Analysis Dates:	10/19/2016-11/01/2016
Analyst:	EMH
Hexane Blank No.:	**438T**

HEXANE BLANK	UNITS	
Hexane Density (p_a)	g/ml	0.6548
Hexane Blank volume (Va)	ml	200
Final (total) weight 1	mg	103,120.5
Final (total) weight 2	mg	103,120.8
Final (total) weight difference (absolute value) (1)	mg	0.30
Average final (total) weight	mg	103,120.65
Tare weight 1	mg	103,119.9
Tare weight 2	mg	103,119.9
Tare weight difference (absolute value) (1)	mg	0.00
Average tare weight	mg	103,119.90
Average final (total) weight minus average tare weight	mg	0.75
Hexane Blank	**mg**	**0.7500**

ANALYST SIGNATURE: (3) Em Horpt

COMMENTS:

NOTES:

(1) "Constant weight" is defined in EPA Method 5 as "a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings."

(2) If the "Mass of residue of Hexane after evaporation" is negative, the value will be set equal to 0.

(3) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data have been checked for completeness, and that the results presented are accurate, error-free, legible, and have been conducted in accordance with the methods in the approved protocol.

g/ml - Grams per milliliter
mg - Milligrams
mg/g - Milligrams per gram
ml - Milliliters

EPA METHOD 202
FIELD TRAIN BLANK ANALYTICAL DATA

Client:	ArcelorMittal
Project No:	16-146
Location:	Monessen, PA
Blank Sample Date:	October 11, 2016
Test Date(s):	October 11-12, 2016
Analysis Dates:	10/19/2016-11/01/2016
Analyst:	EMH

INORGANIC FRACTION FIELD TRAIN BLANK	UNITS	
Water Blank Beaker number		NA
Water density (p_a)	g/ml	1.0000
Evaporated water blank tin number		431Y
Water blank volume (Va)	ml	232
Final (total) weight 1 tin	mg	2,297.0
Final (total) weight 2 tin	mg	2,296.9
Final (total) weight difference (absolute value) (1)	mg	0.10
Average final (total) weight	mg	2,296.95
Tare weight 1 tin	mg	2,296.6
Tare weight 2 tin	mg	2,296.6
Tare weight difference (absolute value) (1)	mg	0.00
Average tare weight	mg	2,296.60
Average final (total) weight minus average tare weight	mg	0.35
Mass of residue of water (m_{ib})	**mg**	**0.350**

ORGANIC FRACTION FIELD TRAIN BLANK	UNITS	
Hexane Blank Beaker number		NA
Hexane density (p_a)	g/ml	0.6548
Evaporated Hexane blank tin number		443Q
Hexane blank volume (Va)	ml	220
Final (total) weight 1 tin	mg	2,335.4
Final (total) weight 2 tin	mg	2,335.2
Final (total) weight difference (absolute value) (1)	mg	0.20
Average final (total) weight	mg	2,335.30
Tare weight 1 tin	mg	2,334.6
Tare weight 2 tin	mg	2,334.6
Tare weight difference (absolute value) (1)	mg	0.00
Average tare weight	mg	2,334.60
Average final (total) weight minus average tare weight	mg	0.70
Mass of residue of Hexane (m_{ob})	**mg**	**0.700**

Total Field Train blank (m_{fb})	**mg**	**1.050**

ANALYST SIGNATURE: (5) _____

COMMENTS: _____

NOTES:

(1) "Constant weight" is defined in EPA Method 5 as "a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings."

EPA METHOD 201A/202
PARTICULATE ANALYTICAL DATA

Client: ArcelorMittal
Project No: 16-146
Location: Monessen, PA
Test Date(s): October 11-12, 2016
Analysis Dates: 10/19/2016-11/01/2016
Analyst: EMH
Blank No: 438R

	UNITS	RUN NO. 1	RUN NO. 2	RUN NO. 3
METHOD 201A				
PM < 2.5 MICRONS ACETONE WASH				
Acetone wash container No.		**438U**	**438V**	**438W**
Acetone volume used in wash (Vaw)	ml	50	40	48
Acetone density (p_a)	g/ml	0.7899	0.7899	0.7899
Acetone blank residue concentration (Ca)	mg/g	0.0047	0.0047	0.0047
Weight of residue in acetone wash (Wa)	mg	0.1875	0.1500	0.1800
Final (total) weight 1	mg	97,475.30	103,595.60	108,906.10
Final (total) weight 2	mg	97,475.00	103,595.40	108,905.90
Final (total) weight difference (absolute value) (1)	mg	0.30	0.20	0.20
Average final (total) weight	mg	97,475.15	103,595.50	108,906.00
Tare weight 1	mg	97,467.60	103,592.40	108,903.00
Tare weight 2	mg	97,467.60	103,592.30	108,902.90
Tare weight difference (absolute value) (1)	mg	0.00	0.10	0.10
Average tare weight	mg	97,467.60	103,592.35	108,902.95
Weight gain	mg	7.55	3.15	3.05
Weight of PM < 2.5 microns in acetone wash	**mg**	**7.36**	**3.00**	**2.87**
$PM_{2.5}$ FILTER				
$PM_{2.5}$ Filter No.		**4838**	**7225**	**7226**
Final (total) weight 1	mg	112.4	119.3	118.7
Final (total) weight 2	mg	112.5	119.4	118.9
Final (total) weight difference (absolute value) (1)	mg	0.10	0.10	0.20
Average final (total) weight	mg	112.45	119.35	118.80
Tare weight 1	mg	109.9	115.6	115.4
Tare weight 2	mg	109.9	115.6	115.3
Tare weight difference (absolute value) (1)	mg	0.00	0.00	0.10
Average tare weight	mg	109.90	115.60	115.35
Weight of particulate matter on $PM_{2.5}$ filter (weight gain)	**mg**	**2.55**	**3.75**	**3.45**

EPA METHOD 201A/202
PARTICULATE ANALYTICAL DATA

Client:	ArcelorMittal
Project No:	16-146
Location:	Monessen, PA
Test Date(s):	October 11-12, 2016
Analysis Dates:	10/19/2016-11/01/2016
Analyst:	EMH
Blank No:	438R

	UNITS	RUN NO. 1	RUN NO. 2	RUN NO. 3
METHOD 202				
Condensable PARTICULATE				
Inorganic Fraction (H_2O)				
Container No.		**431V**	**431W**	**431X**
Organic Fraction volume	ml	340	540	486
Initial pH		2.28	1.84	3.14
Final pH after titration		7.05	7.02	7.03
Final (total) weight 1	mg	2,307.7	2,358.0	2,343.1
Final (total) weight 2	mg	2,308.0	2,358.2	2,343.2
Final (total) weight difference (absolute value) (1)	mg	0.30	0.20	0.10
Average final (total) weight	mg	2,307.85	2,358.10	2,343.15
Tare weight 1	mg	2,278.6	2,307.0	2,333.5
Tare weight 2	mg	2,278.6	2,307.1	2,333.5
Tare weight difference (absolute value) (1)	mg	0.00	0.10	0.00
Average tare weight	mg	2,278.60	2,307.05	2,333.50
Uncorrected Inorganic Fraction particulate weight	mg	29.25	51.05	9.65
Normality of NH_4OH	N	0.10	0.10	0.10
Volume of Titrant	ml	4.050	5.180	2.840
Mass of NH4	mg	6.90	8.82	4.84
Weight of inorganic fraction, ammonia corrected (2)	**mg**	**22.35**	**42.23**	**4.81**
Organic Fraction (HEX)				
Container No.		**431Z**	**443O**	**443P**
Inorganic Fraction volume	ml	190	186	192
Final (total) weight 1	mg	2,330.30	2,332.80	2,337.70
Final (total) weight 2	mg	2,330.40	2,332.50	2,337.40
Final (total) weight difference (absolute value) (1)	mg	0.10	0.30	0.30
Average final (total) weight	mg	2,330.35	2,332.65	2,337.55
Tare weight 1	mg	2,325.00	2,328.90	2,323.70
Tare weight 2	mg	2,325.20	2,328.90	2,323.70
Tare weight difference (absolute value) (1)	mg	0.20	0.00	0.00
Average tare weight	mg	2,325.10	2,328.90	2,323.70
Organic Fraction particulate weight (2)	**mg**	**5.25**	**3.75**	**13.85**
Total weight of Condensable particulate	mg	27.60	45.98	18.66
Hexane and Water Field Blank Total	mg	1.05	1.05	1.05
Total weight of Condensable particulate - blank	**mg**	**26.55**	**44.93**	**17.61**
TOTAL PARTICULATE				
Weight of PM < 2.5 microns in acetone wash	**mg**	**7.36**	**3.00**	**2.87**
Weight of PM2.5 on front-half filter	**mg**	**2.55**	**3.75**	**3.45**
Weight of Condensable particulate	**mg**	**26.55**	**44.93**	**17.61**
TOTAL WEIGHT OF PARTICULATE >$PM_{2.5}$	**mg**	**36.47**	**51.68**	**23.93**

ANALYST SIGNATURE: (3) _____

COMMENTS: _____

NOTES:

(1) "Constant weight" is defined in EPA Method 5 as "a difference of no more than 0.5 mg or 1 percent of total weight less tare weight, whichever is greater, between two consecutive weighings."

(2) If a particulate weight is negative, the value will be set equal to 0.

(3) By signing, the analyst is certifying that "to the best of their knowledge" the analytical data have been checked for completeness, and that the results presented are accurate, error-free, legible, and have been conducted in accordance with the methods in the approved protocol.

Methods 5/29/315

Maxxam
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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: 2016/11/01
Report #: R4231710
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6M4474
Received: 2016/10/17, 23:30

Sample Matrix: Stack Sampling Train
Samples Received: 15

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Mercury 3C in HCl Rinse	4	2016/10/28	2016/11/01	BRL SOP-00104	EPA M29/M0060 m
Mercury 2B in HNO3/H2O2 Imp.	4	2016/10/26	2016/10/27	BRL SOP-00104	EPA M29/M0060 m
Mercury 3A in HNO3 Rinse	4	2016/10/25	2016/10/26	BRL SOP-00104	EPA M29/M0060 m
Mercury 3B in KMnO4/H2SO4 Imp.	4	2016/10/27	2016/11/01	BRL SOP-00104	EPA M29/M0060 m
Mercury 1B in Filter + Rinse (M29)	4	2016/10/27	2016/11/01	BRL SOP-00104	EPA 29 m
Metals B.H. in H2O2/HNO3 Imp.(6020A)	4	2016/10/27	2016/10/31	BRL SOP-00103 / BRL SOP-00102	EPA M29/CARB 436 m
Metals F.H. in Filter + Rinses (6020A)	4	2016/10/27	2016/10/31	BRL SOP-00103/ BRL SOP-00102	EPA M29/CARB 436 m
Particulates/Acetone Rinse (M5/315/M201)	8	2016/10/20	2016/10/23	BRL SOP-00109	EPA 5/315 m
Particulates B. H. Water Imp. (M315)	4	2016/10/31	2016/10/31	BRL SOP-00109	EPA 315
Particulates/Filter (M5/315/NJATM1/M201)	7	N/A	2016/10/24	BRL SOP-00109	EPA 5/315/NJATM1 m
Final Volume of Acetone Probe Rinse	4	N/A	2016/10/23	BRL SOP-00109	
Final Volume of Acetone Probe Rinse	4	N/A	2016/10/24	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.
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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: 2016/11/01
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CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6M4474
Received: 2016/10/17, 23:30

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.

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
01 Nov 2016 17:57:20 -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

==========

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 #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M29 METALS (FRONT & BACK SEPARATE)

Maxxam ID		DGR070			DGR131	DGR132	DGR133			
Sampling Date		2016/10/11			2016/10/11	2016/10/11	2016/10/12			
	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	1.16	<0.80	<0.80	0.80	0.080	4721656
Front Half Arsenic (As)	ug	<0.80	0.80	0.080	7.19	6.41	5.75	0.80	0.080	4721656
Front Half Beryllium (Be)	ug	<0.20	0.20	0.040	<0.20	<0.20	<0.20	0.20	0.040	4721656
Front Half Cadmium (Cd)	ug	<0.20	0.20	0.040	<0.20	<0.20	<0.20	0.20	0.040	4721656
Front Half Chromium (Cr)	ug	0.83	0.60	0.10	14.5	11.1	5.71	0.60	0.10	4721656
Front Half Cobalt (Co)	ug	<0.20	0.20	0.020	0.33	<0.20	0.21	0.20	0.020	4721656
Front Half Lead (Pb)	ug	<0.40	0.40	0.040	3.31	1.41	1.05	0.40	0.040	4721656
Front Half Manganese (Mn)	ug	<1.5	1.5	0.10	7.7	5.1	9.9	1.5	0.10	4721656
Front Half Nickel (Ni)	ug	<1.0	1.0	0.20	16.1	9.1	4.6	1.0	0.20	4721656
Front Half Selenium (Se)	ug	<2.0	2.0	0.50	<2.0	<2.0	<2.0	2.0	0.50	4721656
Back Half Antimony (Sb)	ug	<0.20	0.20	0.040	<1.0	<1.0	<1.0	1.0	0.20	4721705
Back Half Arsenic (As)	ug	<0.20	0.20	0.040	1.0	<1.0	<1.0	1.0	0.20	4721705
Back Half Beryllium (Be)	ug	<0.050	0.050	0.050	<0.25	<0.25	<0.25	0.25	0.25	4721705
Back Half Cadmium (Cd)	ug	<0.050	0.050	0.030	<0.25	<0.25	<0.25	0.25	0.15	4721705
Back Half Chromium (Cr)	ug	0.93	0.15	0.070	1.16	25.7	0.95	0.75	0.35	4721705
Back Half Cobalt (Co)	ug	3.52	0.050	0.010	2.13	5.35	2.60	0.25	0.050	4721705
Back Half Lead (Pb)	ug	0.34	0.10	0.040	0.86	2.15	0.56	0.50	0.20	4721705
Back Half Manganese (Mn)	ug	5.63	0.25	0.060	3.5	8.7	2.8	1.3	0.31	4721705
Back Half Nickel (Ni)	ug	1.40	0.25	0.060	1.8	65.8	1.4	1.3	0.31	4721705
Back Half Selenium (Se)	ug	<0.50	0.50	0.20	3.6	4.7	3.4	2.5	1.0	4721705

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M29 MERCURY (STACK SAMPLING TRAIN)

Maxxam ID		DGR070			DGR131			DGR132			
Sampling Date		2016/10/11			2016/10/11			2016/10/11			
	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	0.018	0.015	0.015	<0.015	0.015	0.015	4721663
2B Mercury (Hg)	ug	<0.15	0.15	0.03	1.34	0.38	0.076	2.14	0.42	0.084	4718518
3A Mercury (Hg)	ug	<0.005	0.005	0.005	0.0859	0.0065	0.0065	<0.0054	0.0054	0.0054	4717023
3B Mercury (Hg)	ug	<0.02	0.02	0.004	0.032	0.023	0.0046	0.167	0.023	0.0046	4720759
3C Mercury (Hg)	ug	<0.013	0.013	0.0026	13.6	0.25	0.05	14.3	0.25	0.05	4722914

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		DGR133			
Sampling Date		2016/10/12			
	UNITS	**M5/29 R3**	**RDL**	**MDL**	**QC Batch**
Metals					
1B Mercury (Hg)	ug	<0.015	0.015	0.015	4721663
2B Mercury (Hg)	ug	2.58	0.41	0.082	4718518
3A Mercury (Hg)	ug	0.0367	0.0048	0.0048	4717023
3B Mercury (Hg)	ug	0.07	0.02	0.004	4720759
3C Mercury (Hg)	ug	16.3	0.25	0.05	4722914

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M5 PARTICULATE MATTER (PM)

Maxxam ID		DGR070	DGR131	DGR132	DGR133			
Sampling Date		2016/10/11	2016/10/11	2016/10/11	2016/10/12			
	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	0.6	17.7	24.5	8.5	0.5	0.1	4710675
Front Half Particulate Weight on Filter	mg	2.40	12.2	2.80	3.20	0.30	0.060	4710060
Acetone Rinse Volume	ml	96	94	88	93	1	1	4710687

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

Maxxam ID		DGQ971	DGQ972	DGQ973			
Sampling Date		2016/10/12	2016/10/12	2016/10/13			
	UNITS	**M315 - FILT R1**	**M315 - FILT R2**	**M315 - FILT R3**	**RDL**	**MDL**	**QC Batch**
Front Half DCM Extractable Material	mg	8.20	6.20	8.60	0.50	N/A	4710061
Front Half Particulate Weight on Filter	mg	17.5	17.4	19.5	0.30	0.060	4710061

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam ID		DGQ974	DGQ975			
Sampling Date		2016/10/12	2016/10/12			
	UNITS	**M315 - BLANK ACE/TOL 2W/T**	**M315 - R1 ACE/TOL 2W/T**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse DCM Extractable Material	mg	9.7	9.8	0.5	N/A	4710726
Acetone Rinse Particulate Weight in Acetone Rinse	mg	1.1	5.3	0.5	0.1	4710726
Acetone Rinse Volume	ml	200	99	1	1	4710727

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam ID		DGQ976	DGQ977			
Sampling Date		2016/10/12	2016/10/13			
	UNITS	**M315 - R2 ACE/TOL 2W/T**	**M315 - R3 ACE/TOL 2W/T**	**RDL**	**MDL**	**QC Batch**
Acetone Rinse DCM Extractable Material	mg	10.2	10.4	0.5	N/A	4710726
Acetone Rinse Particulate Weight in Acetone Rinse	mg	6.6	17.6	0.5	0.1	4710726
Acetone Rinse Volume	ml	76	44	1	1	4710727

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

Maxxam ID		DGQ978	DGQ979			
Sampling Date		2016/10/12	2016/10/12			
	UNITS	**M315 - BLANK BH IMP**	**M315 - R1 BH IMP 3W/S**	**RDL**	**MDL**	**QC Batch**
Back Half DCM Extractable Material	mg	<0.5	1.1	0.5	N/A	4726549
Back Half DCM Extractable Material in Rinse	mg		1.7	0.5	N/A	4726549

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

RESULTS OF ANALYSES OF STACK SAMPLING TRAIN

Maxxam ID		DGQ980	DGQ981			
Sampling Date		2016/10/12	2016/10/13			
	UNITS	**M315 - R2 BH IMP 3W/S**	**M315 - R3 BH IMP 3W/S**	**RDL**	**MDL**	**QC Batch**
Back Half DCM Extractable Material	mg	2.1	<0.5	0.5	N/A	4726549
Back Half DCM Extractable Material in Rinse	mg	4.3	4.1	0.5	N/A	4726549

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
N/A = Not Applicable

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DGQ971 **Collected:** 2016/10/12
Sample ID: M315 - FILT R1 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710061	N/A	2016/10/24	Brenda Moore

Maxxam ID: DGQ972 **Collected:** 2016/10/12
Sample ID: M315 - FILT R2 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710061	N/A	2016/10/24	Brenda Moore

Maxxam ID: DGQ973 **Collected:** 2016/10/13
Sample ID: M315 - FILT R3 **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710061	N/A	2016/10/24	Brenda Moore

Maxxam ID: DGQ974 **Collected:** 2016/10/12
Sample ID: M315 - BLANK ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710726	2016/10/20	2016/10/23	Farag Farag
Final Volume of Acetone Probe Rinse		4710727	N/A	2016/10/24	Farag Farag

Maxxam ID: DGQ975 **Collected:** 2016/10/12
Sample ID: M315 - R1 ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710726	2016/10/20	2016/10/23	Farag Farag
Final Volume of Acetone Probe Rinse		4710727	N/A	2016/10/24	Farag Farag

Maxxam ID: DGQ976 **Collected:** 2016/10/12
Sample ID: M315 - R2 ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710726	2016/10/20	2016/10/23	Farag Farag
Final Volume of Acetone Probe Rinse		4710727	N/A	2016/10/24	Farag Farag

Maxxam ID: DGQ977 **Collected:** 2016/10/13
Sample ID: M315 - R3 ACE/TOL 2W/T **Shipped:**
Matrix: Stack Sampling Train **Received:** 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710726	2016/10/20	2016/10/23	Farag Farag
Final Volume of Acetone Probe Rinse		4710727	N/A	2016/10/24	Farag Farag

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DGQ978
Sample ID: M315 - BLANK BH IMP
Matrix: Stack Sampling Train

Collected: 2016/10/12
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4726549	2016/10/31	2016/10/31	Farag Farag

Maxxam ID: DGQ979
Sample ID: M315 - R1 BH IMP 3W/S
Matrix: Stack Sampling Train

Collected: 2016/10/12
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4726549	2016/10/31	2016/10/31	Farag Farag

Maxxam ID: DGQ980
Sample ID: M315 - R2 BH IMP 3W/S
Matrix: Stack Sampling Train

Collected: 2016/10/12
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4726549	2016/10/31	2016/10/31	Farag Farag

Maxxam ID: DGQ981
Sample ID: M315 - R3 BH IMP 3W/S
Matrix: Stack Sampling Train

Collected: 2016/10/13
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Particulates B. H. Water Imp. (M315)	BAL	4726549	2016/10/31	2016/10/31	Farag Farag

Maxxam ID: DGR070
Sample ID: M5/29 BL
Matrix: Stack Sampling Train

Collected: 2016/10/11
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4722914	2016/10/28	2016/11/01	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4718518	2016/10/26	2016/10/27	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4717023	2016/10/25	2016/10/26	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4720759	2016/10/27	2016/11/01	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4721663	2016/10/27	2016/11/01	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4721705	2016/10/27	2016/10/31	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4721656	2016/10/27	2016/10/31	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710675	2016/10/20	2016/10/23	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710060	N/A	2016/10/24	Brenda Moore
Final Volume of Acetone Probe Rinse		4710687	N/A	2016/10/23	Farag Farag

Maxxam ID: DGR131
Sample ID: M5/29 R1
Matrix: Stack Sampling Train

Collected: 2016/10/11
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4722914	2016/10/28	2016/11/01	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4718518	2016/10/26	2016/10/27	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4717023	2016/10/25	2016/10/26	Ron Morrison

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Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DGR131
Sample ID: M5/29 R1
Matrix: Stack Sampling Train

Collected: 2016/10/11
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4720759	2016/10/27	2016/11/01	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4721663	2016/10/27	2016/11/01	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4721705	2016/10/27	2016/10/31	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4721656	2016/10/27	2016/10/31	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710675	2016/10/20	2016/10/23	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710060	N/A	2016/10/24	Brenda Moore
Final Volume of Acetone Probe Rinse		4710687	N/A	2016/10/23	Farag Farag

Maxxam ID: DGR131 Dup
Sample ID: M5/29 R1
Matrix: Stack Sampling Train

Collected: 2016/10/11
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4718518	2016/10/26	2016/10/27	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4721663	2016/10/29	2016/11/01	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4721705	2016/10/27	2016/10/31	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4721656	2016/10/27	2016/10/31	Nan Raykha

Maxxam ID: DGR132
Sample ID: M5/29 R2
Matrix: Stack Sampling Train

Collected: 2016/10/11
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4722914	2016/10/28	2016/11/01	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4718518	2016/10/26	2016/10/27	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4717023	2016/10/25	2016/10/26	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4720759	2016/10/27	2016/11/01	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4721663	2016/10/27	2016/11/01	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4721705	2016/10/27	2016/10/31	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4721656	2016/10/27	2016/10/31	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710675	2016/10/20	2016/10/23	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710060	N/A	2016/10/24	Brenda Moore
Final Volume of Acetone Probe Rinse		4710687	N/A	2016/10/23	Farag Farag

Maxxam ID: DGR132 Dup
Sample ID: M5/29 R2
Matrix: Stack Sampling Train

Collected: 2016/10/11
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3A in HNO3 Rinse	CV/AA	4717023	2016/10/25	2016/10/26	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4720759	2016/10/27	2016/11/01	Ron Morrison

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TEST SUMMARY

Maxxam ID: DGR133
Sample ID: M5/29 R3
Matrix: Stack Sampling Train

Collected: 2016/10/12
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4722914	2016/10/28	2016/11/01	Ron Morrison
Mercury 2B in HNO3/H2O2 Imp.	CV/AA	4718518	2016/10/26	2016/10/27	Ron Morrison
Mercury 3A in HNO3 Rinse	CV/AA	4717023	2016/10/25	2016/10/26	Ron Morrison
Mercury 3B in KMnO4/H2SO4 Imp.	CV/AA	4720759	2016/10/27	2016/11/01	Ron Morrison
Mercury 1B in Filter + Rinse (M29)	CV/AA	4721663	2016/10/27	2016/11/01	Ron Morrison
Metals B.H. in H2O2/HNO3 Imp.(6020A)	ICP1/MS	4721705	2016/10/27	2016/10/31	Nan Raykha
Metals F.H. in Filter + Rinses (6020A)	ICP1/MS	4721656	2016/10/27	2016/10/31	Nan Raykha
Particulates/Acetone Rinse (M5/315/M201)	BAL	4710675	2016/10/20	2016/10/23	Farag Farag
Particulates/Filter (M5/315/NJATM1/M201)	BAL	4710060	N/A	2016/10/24	Brenda Moore
Final Volume of Acetone Probe Rinse		4710687	N/A	2016/10/23	Farag Farag

Maxxam ID: DGR133 Dup
Sample ID: M5/29 R3
Matrix: Stack Sampling Train

Collected: 2016/10/12
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Mercury 3C in HCl Rinse	CV/AA	4722914	2016/10/28	2016/11/01	Ron Morrison

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GENERAL COMMENTS

M315: samples were extracted with toluene instead of DCM as per client request.

EPA M29 METALS (FRONT & BACK SEPARATE)

Metals F.H. in Filter + Rinses (6020A): Post digestion duplicate and spike were done on sample DGR131.
Metals B.H. in H2O2/HNO3 Imp.(6020A): Extra 5x dilution was required for all samples except DGR070, due to the matrix (high Sulphur content)
Post digestion duplicate and spike were done on sample DGR131.
Trace level Cr was observed in the Processed Blank.

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
4710061	BLM	Method Blank	Front Half DCM Extractable Material	2016/10/24	6.40, RDL=0.30		mg	
4710675	FF	Method Blank	Acetone Rinse Particulate Weight in Acetone Rinse	2016/10/23	0.5, RDL=0.5		mg	
4710726	FF	Method Blank	Acetone Rinse DCM Extractable Material	2016/10/23	8.50		mg	
			Acetone Rinse Particulate Weight in Acetone	2016/10/23	<0.5		mg	
4717023	RON	Matrix Spike(DGR132)	3A Mercury (Hg)	2016/10/26		91	%	85 - 115
4717023	RON	MS/MSD RPD	3A Mercury (Hg)	2016/10/26	0.33		%	20
4717023	RON	Spiked Blank	3A Mercury (Hg)	2016/10/26		95	%	90 - 110
4717023	RON	RPD	3A Mercury (Hg)	2016/10/26	1.4		%	20
4717023	RON	Method Blank	3A Mercury (Hg)	2016/10/26	<0.005		ug	
4717023	RON	RPD - Sample/Sample Dup	3A Mercury (Hg)	2016/10/26	NC		%	20
4718518	RON	Matrix Spike(DGR131)	2B Mercury (Hg)	2016/10/27		97	%	85 - 115
4718518	RON	MS/MSD RPD	2B Mercury (Hg)	2016/10/27	1.7		%	20
4718518	RON	Spiked Blank	2B Mercury (Hg)	2016/10/27		100	%	90 - 110
4718518	RON	RPD	2B Mercury (Hg)	2016/10/27	0.40		%	20
4718518	RON	Method Blank	2B Mercury (Hg)	2016/10/27	<0.015		ug	
4718518	RON	RPD - Sample/Sample Dup	2B Mercury (Hg)	2016/10/27	NC		%	20
4720759	RON	Reagent Blank	3B Mercury (Hg)	2016/11/01	<0.013		ug	
4720759	RON	Matrix Spike(DGR132)	3B Mercury (Hg)	2016/11/01		97	%	85 - 115
4720759	RON	MS/MSD RPD	3B Mercury (Hg)	2016/11/01	1.1		%	20
4720759	RON	Spiked Blank	3B Mercury (Hg)	2016/11/01		93	%	90 - 110
4720759	RON	RPD	3B Mercury (Hg)	2016/11/01	2.1		%	20
4720759	RON	Method Blank	3B Mercury (Hg)	2016/11/01	<0.013		ug	
4720759	RON	RPD - Sample/Sample Dup	3B Mercury (Hg)	2016/11/01	1.6		%	20
4721656	N_R	Matrix Spike(DGR131)	Front Half Antimony (Sb)	2016/10/31		101	%	70 - 130
			Front Half Arsenic (As)	2016/10/31		106	%	70 - 130
			Front Half Beryllium (Be)	2016/10/31		103	%	70 - 130
			Front Half Cadmium (Cd)	2016/10/31		100	%	70 - 130
			Front Half Chromium (Cr)	2016/10/31		104	%	70 - 130
			Front Half Cobalt (Co)	2016/10/31		103	%	70 - 130
			Front Half Lead (Pb)	2016/10/31		104	%	70 - 130
			Front Half Manganese (Mn)	2016/10/31		102	%	70 - 130
			Front Half Nickel (Ni)	2016/10/31		103	%	70 - 130
			Front Half Selenium (Se)	2016/10/31		105	%	70 - 130
4721656	N_R	MS/MSD RPD	Front Half Antimony (Sb)	2016/10/31	2.0		%	20
			Front Half Arsenic (As)	2016/10/31	3.8		%	20
			Front Half Beryllium (Be)	2016/10/31	3.8		%	20
			Front Half Cadmium (Cd)	2016/10/31	0		%	20
			Front Half Chromium (Cr)	2016/10/31	0.97		%	20
			Front Half Cobalt (Co)	2016/10/31	3.0		%	20
			Front Half Lead (Pb)	2016/10/31	1.9		%	20
			Front Half Manganese (Mn)	2016/10/31	3.8		%	20
			Front Half Nickel (Ni)	2016/10/31	5.0		%	20
			Front Half Selenium (Se)	2016/10/31	7.9		%	20
4721656	N_R	Spiked Blank	Front Half Antimony (Sb)	2016/10/31		102	%	85 - 115
			Front Half Arsenic (As)	2016/10/31		102	%	85 - 115
			Front Half Beryllium (Be)	2016/10/31		105	%	85 - 115
			Front Half Cadmium (Cd)	2016/10/31		95	%	85 - 115
			Front Half Chromium (Cr)	2016/10/31		103	%	85 - 115
			Front Half Cobalt (Co)	2016/10/31		98	%	85 - 115
			Front Half Lead (Pb)	2016/10/31		98	%	85 - 115
			Front Half Manganese (Mn)	2016/10/31		104	%	85 - 115
			Front Half Nickel (Ni)	2016/10/31		98	%	85 - 115

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Front Half Selenium (Se)	2016/10/31		100	%	85 - 115
4721656	N_R	RPD	Front Half Antimony (Sb)	2016/10/31	1.6		%	20
			Front Half Arsenic (As)	2016/10/31	0.20		%	20
			Front Half Beryllium (Be)	2016/10/31	3.4		%	20
			Front Half Cadmium (Cd)	2016/10/31	5.7		%	20
			Front Half Chromium (Cr)	2016/10/31	4.9		%	20
			Front Half Cobalt (Co)	2016/10/31	2.5		%	20
			Front Half Lead (Pb)	2016/10/31	0.92		%	20
			Front Half Manganese (Mn)	2016/10/31	7.6		%	20
			Front Half Nickel (Ni)	2016/10/31	3.5		%	20
			Front Half Selenium (Se)	2016/10/31	2.2		%	20
4721656	N_R	Method Blank	Front Half Antimony (Sb)	2016/10/31	<0.80		ug	
			Front Half Arsenic (As)	2016/10/31	<0.80		ug	
			Front Half Beryllium (Be)	2016/10/31	<0.20		ug	
			Front Half Cadmium (Cd)	2016/10/31	<0.20		ug	
			Front Half Chromium (Cr)	2016/10/31	<0.60		ug	
			Front Half Cobalt (Co)	2016/10/31	<0.20		ug	
			Front Half Lead (Pb)	2016/10/31	<0.40		ug	
			Front Half Manganese (Mn)	2016/10/31	<1.5		ug	
			Front Half Nickel (Ni)	2016/10/31	<1.0		ug	
			Front Half Selenium (Se)	2016/10/31	<2.0		ug	
4721656	N_R	RPD - Sample/Sample Dup	Front Half Antimony (Sb)	2016/10/31	NC		%	20
			Front Half Arsenic (As)	2016/10/31	2.5		%	20
			Front Half Beryllium (Be)	2016/10/31	NC		%	20
			Front Half Cadmium (Cd)	2016/10/31	NC		%	20
			Front Half Chromium (Cr)	2016/10/31	0.83		%	20
			Front Half Cobalt (Co)	2016/10/31	NC		%	20
			Front Half Lead (Pb)	2016/10/31	1.1		%	20
			Front Half Manganese (Mn)	2016/10/31	0.63		%	20
			Front Half Nickel (Ni)	2016/10/31	4.7		%	20
			Front Half Selenium (Se)	2016/10/31	NC		%	20
4721663	RON	Reagent Blank	1B Mercury (Hg)	2016/11/01	<0.015		ug	
4721663	RON	Matrix Spike(DGR131)	1B Mercury (Hg)	2016/11/01		101	%	85 - 115
4721663	RON	MS/MSD RPD	1B Mercury (Hg)	2016/11/01	0.59		%	20
4721663	RON	Spiked Blank	1B Mercury (Hg)	2016/11/01		98	%	90 - 110
4721663	RON	RPD	1B Mercury (Hg)	2016/11/01	1.2		%	20
4721663	RON	Method Blank	1B Mercury (Hg)	2016/11/01	<0.015		ug	
4721663	RON	RPD - Sample/Sample Dup	1B Mercury (Hg)	2016/11/01	NC		%	20
4721705	N_R	Matrix Spike(DGR131)	Back Half Antimony (Sb)	2016/10/31		106	%	70 - 130
			Back Half Arsenic (As)	2016/10/31		105	%	70 - 130
			Back Half Beryllium (Be)	2016/10/31		103	%	70 - 130
			Back Half Cadmium (Cd)	2016/10/31		98	%	70 - 130
			Back Half Chromium (Cr)	2016/10/31		105	%	70 - 130
			Back Half Cobalt (Co)	2016/10/31		111	%	70 - 130
			Back Half Lead (Pb)	2016/10/31		103	%	70 - 130
			Back Half Manganese (Mn)	2016/10/31		103	%	70 - 130
			Back Half Nickel (Ni)	2016/10/31		108	%	70 - 130
			Back Half Selenium (Se)	2016/10/31		101	%	70 - 130
4721705	N_R	MS/MSD RPD	Back Half Antimony (Sb)	2016/10/31	1.9		%	20
			Back Half Arsenic (As)	2016/10/31	1.9		%	20
			Back Half Beryllium (Be)	2016/10/31	2.9		%	20
			Back Half Cadmium (Cd)	2016/10/31	0		%	20
			Back Half Chromium (Cr)	2016/10/31	9.0		%	20
			Back Half Cobalt (Co)	2016/10/31	14		%	20

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Back Half Lead (Pb)	2016/10/31	0.97		%	20
			Back Half Manganese (Mn)	2016/10/31	0.98		%	20
			Back Half Nickel (Ni)	2016/10/31	9.7		%	20
			Back Half Selenium (Se)	2016/10/31	0.99		%	20
4721705	N_R	Spiked Blank	Back Half Antimony (Sb)	2016/10/31		109	%	85 - 115
			Back Half Arsenic (As)	2016/10/31		106	%	85 - 115
			Back Half Beryllium (Be)	2016/10/31		101	%	85 - 115
			Back Half Cadmium (Cd)	2016/10/31		104	%	85 - 115
			Back Half Chromium (Cr)	2016/10/31		104	%	85 - 115
			Back Half Cobalt (Co)	2016/10/31		106	%	85 - 115
			Back Half Lead (Pb)	2016/10/31		106	%	85 - 115
			Back Half Manganese (Mn)	2016/10/31		104	%	85 - 115
			Back Half Nickel (Ni)	2016/10/31		104	%	85 - 115
			Back Half Selenium (Se)	2016/10/31		96	%	85 - 115
4721705	N_R	RPD	Back Half Antimony (Sb)	2016/10/31	0.67		%	20
			Back Half Arsenic (As)	2016/10/31	4.7		%	20
			Back Half Beryllium (Be)	2016/10/31	3.7		%	20
			Back Half Cadmium (Cd)	2016/10/31	3.7		%	20
			Back Half Chromium (Cr)	2016/10/31	1.9		%	20
			Back Half Cobalt (Co)	2016/10/31	7.6		%	20
			Back Half Lead (Pb)	2016/10/31	2.1		%	20
			Back Half Manganese (Mn)	2016/10/31	1.4		%	20
			Back Half Nickel (Ni)	2016/10/31	5.6		%	20
			Back Half Selenium (Se)	2016/10/31	2.7		%	20
4721705	N_R	Method Blank	Back Half Antimony (Sb)	2016/10/31	<0.20		ug	
			Back Half Arsenic (As)	2016/10/31	<0.20		ug	
			Back Half Beryllium (Be)	2016/10/31	<0.050		ug	
			Back Half Cadmium (Cd)	2016/10/31	<0.050		ug	
			Back Half Chromium (Cr)	2016/10/31	0.18, RDL=0.15		ug	
			Back Half Cobalt (Co)	2016/10/31	<0.050		ug	
			Back Half Lead (Pb)	2016/10/31	<0.10		ug	
			Back Half Manganese (Mn)	2016/10/31	<0.25		ug	
			Back Half Nickel (Ni)	2016/10/31	<0.25		ug	
			Back Half Selenium (Se)	2016/10/31	<0.50		ug	
4721705	N_R	RPD - Sample/Sample Dup	Back Half Antimony (Sb)	2016/10/31	NC		%	20
			Back Half Arsenic (As)	2016/10/31	NC		%	20
			Back Half Beryllium (Be)	2016/10/31	NC		%	20
			Back Half Cadmium (Cd)	2016/10/31	NC		%	20
			Back Half Cobalt (Co)	2016/10/31	4.8		%	20
			Back Half Lead (Pb)	2016/10/31	NC		%	20
			Back Half Manganese (Mn)	2016/10/31	NC		%	20
			Back Half Nickel (Ni)	2016/10/31	NC		%	20
			Back Half Selenium (Se)	2016/10/31	NC		%	20
4722914	RON	Reagent Blank	3C Mercury (Hg)	2016/11/01	<0.013		ug	
4722914	RON	Matrix Spike(DGR133)	3C Mercury (Hg)	2016/11/01		93 (1)	%	85 - 115
4722914	RON	MS/MSD RPD	3C Mercury (Hg)	2016/11/01	17 (1)		%	20
4722914	RON	Spiked Blank	3C Mercury (Hg)	2016/11/01		98	%	90 - 110
4722914	RON	RPD	3C Mercury (Hg)	2016/11/01	1.4		%	20
4722914	RON	Method Blank	3C Mercury (Hg)	2016/11/01	<0.013		ug	
4722914	RON	RPD - Sample/Sample Dup	3C Mercury (Hg)	2016/11/01	2.5		%	20
4726549	FF	Method Blank	Back Half DCM Extractable Material	2016/10/31	<0.5		mg	

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Maxxam Job #: B6M4474
Report Date: 2016/11/01

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 DCM Extractable Material in Rinse	2016/10/31	<0.5		mg	

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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Maxxam Job #: B6M4474
Report Date: 2016/11/01

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).

Frank Mo, B.Sc., Inorganic Lab. Manager

Ralph Siebert, Operations Manager - Inorganic Analyses

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B6M 4452 / B6M 4474

Maxxam

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Page 1 of 1

CLIENT INFORMATION

Company Name: Arcelor Mittal
Project Manager: William Cowell
e-mail: wcowell@montrose-env.com
Address: 1050 Wilson P. Hwy, P. Hughes, PA
Phone: 412 826 3636 Fax: —
Sampled by: Seth Wilson

SECTION

ANALYSIS REQUESTED

Field Sample ID	Total Volume Sampled	Flow Rate	Collection Date	Sample Collection Time	RM29 Metals (Hg, Cd, Pb)	RM315 Formaldehyde Phenols Total Water Soluble Organics	RM23/SW846 M0010 Metals (Hg, Cd, Pb)
Boiler M29 Run1 7 containers	~105	1.50	10/11/16	920-1300	X		
" " Run 2 "			10/11/16	1420-1805	X		
" " Run 3 "			10/12/16	750-1140	X		
" " Blanks 6 containers 3 filters	—	—	10/11/16	900	X		
" MS15 TSO Run1 5 containers	~71	1.50	10/12/16	1316-1658		X	
" " Run 2 "			10/12/16	735-1054		X	
" " Run 3 "			10/13/16	1135-1445		X	
" " Blanks 3 containers	—	—	10/12/16	700		X	
" M23/0010 Run1 7 containers	10/12/16	1.50	10/12/16	1316-1658			X
Run 2 "	10/13/16		10/13/16	735-1054			X
Run 3 "	10/13/16		10/13/16	1135-1445			X

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: Tom Wilson
PO #: NA
Maxxam Quote #:
Maxxam Contact: Clayton Johnson

REPORTING REQUIREMENTS

Summary Report only ☐
EDD ☐
Regulation

Notes

PROJECT SPECIFIC COMMENTS

Client Signature:
Affiliation: Montrose
Date/Time: 10/13/16 - 1500

Received by:
Affiliation: MAXXAM
Date/Time: 10/14/2016 15:00

COC 1051 (04/13) - Air

22.1 / 22.0 / 22.1 R. TAJSAH PATH 2016/10/17 23:30

Methods 0010/23

Maxxam
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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: 2016/11/19
Report #: R4252722
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6M4452
Received: 2016/10/17, 23:30

Sample Matrix: Stack Sampling Train
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
SVOCs in MM5 SamplingTrain (EPA0010)	3	2016/10/26	2016/11/16	BRL SOP-00200	EPA 8270D/M0010 m
2,3,7,8-TCDF Confirmation (M23)	3	N/A	2016/11/15	BRL SOP-00404	EPA M23/23A m
Dioxins/Furans in Air (Method 23)	1	2016/10/27	2016/11/13	BRL SOP-00404	EPA M23/23A m
Dioxins/Furans in Air (Method 23)	2	2016/10/27	2016/11/14	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: 2016/11/19
Report #: R4252722
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B6M4452
Received: 2016/10/17, 23:30

Encryption Key

Clayton Johnson
Project Manager - Air Toxics, Source Evaluation
21 Nov 2016 15:24:45

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 #: B6M4452
Report Date: 2016/11/19

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DGQ797							
Sampling Date		2016/10/12				**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	<3.4	3.4	30	6.0	1.00	3.40		4745849
1,2,3,7,8-Penta CDD *	pg	<3.2	3.2	30	6.0	1.00	3.20		4745849
1,2,3,4,7,8-Hexa CDD *	pg	<3.4	3.4	30	6.0	0.100	0.340		4745849
1,2,3,6,7,8-Hexa CDD *	pg	<3.5	3.5	30	6.0	0.100	0.350		4745849
1,2,3,7,8,9-Hexa CDD *	pg	<3.2	3.2	30	6.0	0.100	0.320		4745849
1,2,3,4,6,7,8-Hepta CDD *	pg	5.9	3.1	30	9.0	0.0100	0.0590		4745849
Total Tetra CDD *	pg	22.4	3.4	30	N/A			2	4745849
Total Penta CDD *	pg	<7.3 (1)	7.3	30	N/A			0	4745849
Total Hexa CDD *	pg	<30 (1)	30	30	N/A			0	4745849
Total Hepta CDD *	pg	13.5	3.1	30	N/A			2	4745849
2,3,7,8-Tetra CDF **	pg	48.8	3.4	30	6.0	0.100	4.88		4745849
1,2,3,7,8-Penta CDF **	pg	<10 (2)	10	30	6.0	0.0300	0.300		4745849
2,3,4,7,8-Penta CDF **	pg	11.3	3.6	30	6.0	0.300	3.39		4745849
1,2,3,4,7,8-Hexa CDF **	pg	13.8 (3)	3.0	30	6.0	0.100	1.38		4745849
1,2,3,6,7,8-Hexa CDF **	pg	6.1	2.9	30	6.0	0.100	0.610		4745849
2,3,4,6,7,8-Hexa CDF **	pg	4.5	3.2	30	6.0	0.100	0.450		4745849
1,2,3,7,8,9-Hexa CDF **	pg	<3.3	3.3	30	6.0	0.100	0.330		4745849
1,2,3,4,6,7,8-Hepta CDF **	pg	16.4	3.1	30	9.0	0.0100	0.164		4745849
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.6	3.6	30	6.0	0.0100	0.0360		4745849
Total Tetra CDF **	pg	95.1	3.4	30	N/A			7	4745849
Total Penta CDF **	pg	47.7	3.6	30	N/A			3	4745849
Total Hexa CDF **	pg	43.7	3.1	30	N/A			5	4745849
Total Hepta CDF **	pg	20.3	3.3	30	N/A			2	4745849
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	30.0	3.1	30	N/A	0.100	3.00		4748397
TOTAL TOXIC EQUIVALENCY	pg						17.3		

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) RT>2 seconds - PCDD/DF analysis-Peak maxima of monitored ions exceeds 2 seconds

(3) EMPC / Merged Peak

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Maxxam Job #: B6M4452
Report Date: 2016/11/19

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DGQ797							
Sampling Date		2016/10/12				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23-R1**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	108							4748397
C13-1234678 HeptaCDD *	%	98							4745849
C13-1234678 HeptaCDF **	%	67							4745849
C13-123478 HexaCDD *	%	118							4745849
C13-123478 HexaCDF **	%	99							4745849
C13-1234789 HeptaCDF **	%	100							4745849
C13-123678 HexaCDD *	%	84							4745849
C13-123678 HexaCDF **	%	76							4745849
C13-12378 PentaCDD *	%	114							4745849
C13-12378 PentaCDF **	%	86							4745849
C13-123789 HexaCDF **	%	65							4745849
C13-23478 PentaCDF **	%	112							4745849
C13-2378 TetraCDD *	%	100							4745849
C13-2378 TetraCDF **	%	93							4745849
C13-Octachlorodibenzo-p-Dioxin	%	71							4745849
Cl37-2378 TetraCDD *	%	105							4745849

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

** CDF = Chloro Dibenzo-p-Furan

* CDD = Chloro Dibenzo-p-Dioxin

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Maxxam Job #: B6M4452
Report Date: 2016/11/19

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DGQ800							
Sampling Date		2016/10/13				**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	<3.6	3.6	30	6.0	1.00	3.60		4745849
1,2,3,7,8-Penta CDD *	pg	<5.1	5.1	30	6.0	1.00	5.10		4745849
1,2,3,4,7,8-Hexa CDD *	pg	<3.3	3.3	30	6.0	0.100	0.330		4745849
1,2,3,6,7,8-Hexa CDD *	pg	<3.3	3.3	30	6.0	0.100	0.330		4745849
1,2,3,7,8,9-Hexa CDD *	pg	<3.1	3.1	30	6.0	0.100	0.310		4745849
1,2,3,4,6,7,8-Hepta CDD *	pg	10.0	3.1	30	9.0	0.0100	0.100		4745849
Total Tetra CDD *	pg	160	3.6	30	N/A			4	4745849
Total Penta CDD *	pg	43.6	5.1	30	N/A			2	4745849
Total Hexa CDD *	pg	8.2	3.2	30	N/A			1	4745849
Total Hepta CDD *	pg	19.0	3.1	30	N/A			2	4745849
2,3,7,8-Tetra CDF **	pg	43.0	3.6	30	6.0	0.100	4.30		4745849
1,2,3,7,8-Penta CDF **	pg	4.7 (1)	4.6	30	6.0	0.0300	0.141		4745849
2,3,4,7,8-Penta CDF **	pg	6.5 (1)	4.6	30	6.0	0.300	1.95		4745849
1,2,3,4,7,8-Hexa CDF **	pg	4.3 (1)	3.3	30	6.0	0.100	0.430		4745849
1,2,3,6,7,8-Hexa CDF **	pg	5.6	3.1	30	6.0	0.100	0.560		4745849
2,3,4,6,7,8-Hexa CDF **	pg	5.3	3.4	30	6.0	0.100	0.530		4745849
1,2,3,7,8,9-Hexa CDF **	pg	<3.6	3.6	30	6.0	0.100	0.360		4745849
1,2,3,4,6,7,8-Hepta CDF **	pg	15.4	3.2	30	9.0	0.0100	0.154		4745849
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.7	3.7	30	6.0	0.0100	0.0370		4745849
Total Tetra CDF **	pg	186	3.6	30	N/A			14	4745849
Total Penta CDF **	pg	40.9	4.6	30	N/A			4	4745849
Total Hexa CDF **	pg	40.2	3.3	30	N/A			6	4745849
Total Hepta CDF **	pg	15.4	3.4	30	N/A			1	4745849
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	15.3	3.1	30	N/A	0.100	1.53		4748397
TOTAL TOXIC EQUIVALENCY	pg						15.5		
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	105							4748397

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 #: B6M4452
Report Date: 2016/11/19

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DGQ800							
Sampling Date		2016/10/13				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23-R2**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
C13-1234678 HeptaCDD *	%	90							4745849
C13-1234678 HeptaCDF **	%	62							4745849
C13-123478 HexaCDD *	%	112							4745849
C13-123478 HexaCDF **	%	111							4745849
C13-1234789 HeptaCDF **	%	102							4745849
C13-123678 HexaCDD *	%	83							4745849
C13-123678 HexaCDF **	%	64							4745849
C13-12378 PentaCDD *	%	103							4745849
C13-12378 PentaCDF **	%	80							4745849
C13-123789 HexaCDF **	%	66							4745849
C13-23478 PentaCDF **	%	111							4745849
C13-2378 TetraCDD *	%	94							4745849
C13-2378 TetraCDF **	%	89							4745849
C13-Octachlorodibenzo-p-Dioxin	%	66							4745849
Cl37-2378 TetraCDD *	%	99							4745849

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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Maxxam Job #: B6M4452
Report Date: 2016/11/19

Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DGQ801							
Sampling Date		2016/10/13				**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	<3.4	3.4	30	6.0	1.00	3.40		4745849
1,2,3,7,8-Penta CDD *	pg	<3.4	3.4	30	6.0	1.00	3.40		4745849
1,2,3,4,7,8-Hexa CDD *	pg	<3.3	3.3	30	6.0	0.100	0.330		4745849
1,2,3,6,7,8-Hexa CDD *	pg	<3.3	3.3	30	6.0	0.100	0.330		4745849
1,2,3,7,8,9-Hexa CDD *	pg	<3.0	3.0	30	6.0	0.100	0.300		4745849
1,2,3,4,6,7,8-Hepta CDD *	pg	5.9	3.0	30	9.0	0.0100	0.0590		4745849
Total Tetra CDD *	pg	46.4	3.4	30	N/A			2	4745849
Total Penta CDD *	pg	<13 (1)	13	30	N/A			0	4745849
Total Hexa CDD *	pg	4.7	3.2	30	N/A			1	4745849
Total Hepta CDD *	pg	15.7	3.0	30	N/A			2	4745849
2,3,7,8-Tetra CDF **	pg	49.0	3.4	30	6.0	0.100	4.90		4745849
1,2,3,7,8-Penta CDF **	pg	<3.5	3.5	30	6.0	0.0300	0.105		4745849
2,3,4,7,8-Penta CDF **	pg	12.9	3.5	30	6.0	0.300	3.87		4745849
1,2,3,4,7,8-Hexa CDF **	pg	11.4	3.3	30	6.0	0.100	1.14		4745849
1,2,3,6,7,8-Hexa CDF **	pg	7.2	3.2	30	6.0	0.100	0.720		4745849
2,3,4,6,7,8-Hexa CDF **	pg	5.1	3.5	30	6.0	0.100	0.510		4745849
1,2,3,7,8,9-Hexa CDF **	pg	<3.6	3.6	30	6.0	0.100	0.360		4745849
1,2,3,4,6,7,8-Hepta CDF **	pg	12.9	3.0	30	9.0	0.0100	0.129		4745849
1,2,3,4,7,8,9-Hepta CDF **	pg	<3.6	3.6	30	6.0	0.0100	0.0360		4745849
Total Tetra CDF **	pg	147	3.4	30	N/A			11	4745849
Total Penta CDF **	pg	93.4	3.5	30	N/A			7	4745849
Total Hexa CDF **	pg	50.6	3.4	30	N/A			5	4745849
Total Hepta CDF **	pg	16.4	3.3	30	N/A			2	4745849
TCDF Confirmation									
Confirmation 2,3,7,8-Tetra CDF **	pg	21.9	3.3	30	N/A	0.100	2.19		4748397
TOTAL TOXIC EQUIVALENCY	pg						16.9		
Surrogate Recovery (%)									
Confirmation C13-2378 TetraCDF **	%	107							4748397

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.

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Montrose Air Quality Services, LLC
Client Project #: 106377/ 16-167

EPA M23 DIOXINS AND FURANS (STACK SAMPLING TRAIN)

Maxxam ID		DGQ801							
Sampling Date		2016/10/13				**TOXIC EQUIVALENCY**		# of	
	UNITS	**M23-R3**	**EDL**	**RDL**	**MDL**	**TEF (2005 WHO)**	**TEQ(DL)**	**Isomers**	**QC Batch**
C13-1234678 HeptaCDD *	%	92							4745849
C13-1234678 HeptaCDF **	%	66							4745849
C13-123478 HexaCDD *	%	121							4745849
C13-123478 HexaCDF **	%	105							4745849
C13-1234789 HeptaCDF **	%	98							4745849
C13-123678 HexaCDD *	%	82							4745849
C13-123678 HexaCDF **	%	70							4745849
C13-12378 PentaCDD *	%	107							4745849
C13-12378 PentaCDF **	%	85							4745849
C13-123789 HexaCDF **	%	69							4745849
C13-23478 PentaCDF **	%	106							4745849
C13-2378 TetraCDD *	%	95							4745849
C13-2378 TetraCDF **	%	89							4745849
C13-Octachlorodibenzo-p-Dioxin	%	68							4745849
Cl37-2378 TetraCDD *	%	98							4745849

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		DGQ797	DGQ800			DGQ801			
Sampling Date		2016/10/12	2016/10/13			2016/10/13			
	UNITS	**M23-R1**	**M23-R2**	**RDL**	**MDL**	**M23-R3**	**RDL**	**MDL**	**QC Batch**
Semivolatile Organics									
Acenaphthene	ug	<20	<20	20	3	<20	20	3	4718544
Acenaphthylene	ug	<20	<20	20	4	<20	20	4	4718544
Anthracene	ug	<20	<20	20	5	<20	20	5	4718544
Benzo(a)anthracene	ug	<20	<20	20	5	<20	20	5	4718544
Benzo(a)pyrene	ug	<2	<2	2	0.4	<2	2	0.4	4718544
Benzo(b)fluoranthene	ug	<1	<1	1	0.3	<1	1	0.3	4718544
Benzo(g,h,i)perylene	ug	<20	<20	20	5	<20	20	5	4718544
Benzo(k)fluoranthene	ug	<2	<2	2	0.4	<2	2	0.4	4718544
Chrysene	ug	<20	<20	20	5	<1	1	0.3	4718544
Dibenz(a,h)anthracene	ug	<1	<1	1	0.3	<1	1	0.3	4718544
Fluoranthene	ug	<20	<20	20	5	<20	20	5	4718544
Fluorene	ug	<20	<20	20	5	<20	20	5	4718544
Indeno(1,2,3-cd)pyrene	ug	<2	<2	2	0.3	<2	2	0.3	4718544
Naphthalene	ug	<20	<20	20	3	<20	20	3	4718544
Phenanthrene	ug	<20	<20	20	5	<20	20	5	4718544
Pyrene	ug	<20	<20	20	4	<20	20	4	4718544
Surrogate Recovery (%)									
2,4,6-Tribromophenol	%	114	122 (1)			6.1 (1)			4718544
2,6-Dibromo-4-fluorophenol (FS)	%	65	56			0.00 (1)			4718544
2-Fluorobiphenyl	%	96	101			96			4718544
2-Fluorophenol	%	79	96			28 (1)			4718544
D10-Pyrene (FS)	%	103	105			113			4718544
D14-Terphenyl	%	105	113			115			4718544
D5-Nitrobenzene	%	96	100			90			4718544
D5-Phenol	%	96	237 (1)			58			4718544

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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Client Project #: 106377/ 16-167

TEST SUMMARY

Maxxam ID: DGQ797
Sample ID: M23-R1
Matrix: Stack Sampling Train

Collected: 2016/10/12
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4718544	2016/10/26	2016/11/16	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4748397	N/A	2016/11/15	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4745849	2016/10/27	2016/11/13	Owen Cosby

Maxxam ID: DGQ800
Sample ID: M23-R2
Matrix: Stack Sampling Train

Collected: 2016/10/13
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4718544	2016/10/26	2016/11/16	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4748397	N/A	2016/11/15	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4745849	2016/10/27	2016/11/14	Owen Cosby

Maxxam ID: DGQ801
Sample ID: M23-R3
Matrix: Stack Sampling Train

Collected: 2016/10/13
Shipped:
Received: 2016/10/17

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
SVOCs in MM5 SamplingTrain (EPA0010)	GC/MS	4718544	2016/10/26	2016/11/16	Lidija Tomic
2,3,7,8-TCDF Confirmation (M23)	HRMS/MS	4748397	N/A	2016/11/15	Vica Cioranic
Dioxins/Furans in Air (Method 23)	HRMS/MS	4745849	2016/10/27	2016/11/14	Owen Cosby

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GENERAL COMMENTS

ABNMM5-TR:
ABNMM5-TR:
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 = 89.53 %
Spike Dup = 85.54%

Sample DGQ800 [M23-R2] : High recovery for D5-Phenol due to sample

Sample DGQ801 [M23-R3] : No recovery for 2,6-Dibromo-4-fluorophenol Field Spike
Low recoveries for 2/Fluorophenol and 2,4,6-Tribromophenol

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
4718544	LTO	Spiked Blank	2,4,6-Tribromophenol	2016/11/16		112	%	24 - 121
			2-Fluorobiphenyl	2016/11/16		104	%	30 - 115
			2-Fluorophenol	2016/11/16		63	%	30 - 130
			Acenaphthene	2016/11/16		102	%	40 - 125
			Acenaphthylene	2016/11/16		103	%	40 - 125
			Anthracene	2016/11/16		103	%	40 - 125
			Benzo(a)pyrene	2016/11/16		106	%	40 - 125
			Benzo(b)fluoranthene	2016/11/16		109	%	40 - 125
			Benzo(g,h,i)perylene	2016/11/16		104	%	40 - 125
			Benzo(k)fluoranthene	2016/11/16		108	%	40 - 125
			Chrysene	2016/11/16		111	%	40 - 125
			D14-Terphenyl	2016/11/16		110	%	18 - 137
			D5-Nitrobenzene	2016/11/16		108	%	23 - 120
			D5-Phenol	2016/11/16		89	%	24 - 113
			Dibenz(a,h)anthracene	2016/11/16		110	%	40 - 125
			Fluoranthene	2016/11/16		112	%	40 - 125
			Fluorene	2016/11/16		103	%	40 - 125
			Indeno(1,2,3-cd)pyrene	2016/11/16		109	%	40 - 125
			Naphthalene	2016/11/16		99	%	40 - 125
			Phenanthrene	2016/11/16		105	%	40 - 125
			Pyrene	2016/11/16		105	%	40 - 125
4718544	LTO	RPD	Acenaphthene	2016/11/16	3.5		%	50
			Acenaphthylene	2016/11/16	0.97		%	50
			Anthracene	2016/11/16	0.28		%	50
			Benzo(a)pyrene	2016/11/16	3.0		%	50
			Benzo(b)fluoranthene	2016/11/16	8.5		%	50
			Benzo(g,h,i)perylene	2016/11/16	2.9		%	50
			Benzo(k)fluoranthene	2016/11/16	5.2		%	50
			Chrysene	2016/11/16	4.8		%	50
			Dibenz(a,h)anthracene	2016/11/16	1.7		%	50
			Fluoranthene	2016/11/16	3.6		%	50
			Fluorene	2016/11/16	0.27		%	50
			Indeno(1,2,3-cd)pyrene	2016/11/16	0.32		%	50
			Naphthalene	2016/11/16	0.15		%	50
			Phenanthrene	2016/11/16	3.3		%	50
			Pyrene	2016/11/16	2.9		%	50
4718544	LTO	Method Blank	2,4,6-Tribromophenol	2016/11/16		94	%	24 - 121
			2-Fluorobiphenyl	2016/11/16		101	%	30 - 115
			2-Fluorophenol	2016/11/16		89	%	30 - 130
			Acenaphthene	2016/11/16	<20		ug	
			Acenaphthylene	2016/11/16	<20		ug	
			Anthracene	2016/11/16	<20		ug	
			Benzo(a)anthracene	2016/11/16	<20		ug	
			Benzo(a)pyrene	2016/11/16	<2		ug	
			Benzo(b)fluoranthene	2016/11/16	<1		ug	
			Benzo(g,h,i)perylene	2016/11/16	<20		ug	
			Benzo(k)fluoranthene	2016/11/16	<2		ug	
			Chrysene	2016/11/16	<20		ug	
			D14-Terphenyl	2016/11/16		109	%	18 - 137
			D5-Nitrobenzene	2016/11/16		110	%	23 - 120
			D5-Phenol	2016/11/16		107	%	24 - 113
			Dibenz(a,h)anthracene	2016/11/16	<1		ug	
			Fluoranthene	2016/11/16	<20		ug	
			Fluorene	2016/11/16	<20		ug	

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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	2016/11/16	<2		ug	
			Naphthalene	2016/11/16	<20		ug	
			Phenanthrene	2016/11/16	<20		ug	
			Pyrene	2016/11/16	<20		ug	
4745849	OBC	Spiked Blank	C13-1234678 HeptaCDD	2016/11/13		105	%	25 - 130
			C13-1234678 HeptaCDF	2016/11/13		80	%	25 - 130
			C13-123678 HexaCDD	2016/11/13		84	%	40 - 130
			C13-123678 HexaCDF	2016/11/13		71	%	40 - 130
			C13-12378 PentaCDD	2016/11/13		115	%	40 - 130
			C13-12378 PentaCDF	2016/11/13		93	%	40 - 130
			C13-123789 HexaCDF	2016/11/13		67	%	40 - 130
			C13-2378 TetraCDD	2016/11/13		96	%	40 - 130
			C13-2378 TetraCDF	2016/11/13		91	%	40 - 130
			C13-Octachlorodibenzo-p-Dioxin	2016/11/13		84	%	25 - 130
			2,3,7,8-Tetra CDD	2016/11/13		106	%	80 - 140
			1,2,3,7,8-Penta CDD	2016/11/13		103	%	80 - 140
			1,2,3,4,7,8-Hexa CDD	2016/11/13		124	%	80 - 140
			1,2,3,6,7,8-Hexa CDD	2016/11/13		100	%	80 - 140
			1,2,3,7,8,9-Hexa CDD	2016/11/13		121	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDD	2016/11/13		119	%	80 - 140
			2,3,7,8-Tetra CDF	2016/11/13		101	%	80 - 140
			1,2,3,7,8-Penta CDF	2016/11/13		98	%	80 - 140
			2,3,4,7,8-Penta CDF	2016/11/13		100	%	80 - 140
			1,2,3,4,7,8-Hexa CDF	2016/11/13		124	%	80 - 140
			1,2,3,6,7,8-Hexa CDF	2016/11/13		105	%	80 - 140
			2,3,4,6,7,8-Hexa CDF	2016/11/13		117	%	80 - 140
			1,2,3,7,8,9-Hexa CDF	2016/11/13		119	%	80 - 140
			1,2,3,4,6,7,8-Hepta CDF	2016/11/13		102	%	80 - 140
			1,2,3,4,7,8,9-Hepta CDF	2016/11/13		102	%	80 - 140
4745849	OBC	RPD	2,3,7,8-Tetra CDD	2016/11/13	NC		%	20
			1,2,3,7,8-Penta CDD	2016/11/13	NC		%	20
			1,2,3,4,7,8-Hexa CDD	2016/11/13	NC		%	20
			1,2,3,6,7,8-Hexa CDD	2016/11/13	NC		%	20
			1,2,3,7,8,9-Hexa CDD	2016/11/13	NC		%	20
			1,2,3,4,6,7,8-Hepta CDD	2016/11/13	NC		%	20
			2,3,7,8-Tetra CDF	2016/11/13	NC		%	20
			1,2,3,7,8-Penta CDF	2016/11/13	NC		%	20
			2,3,4,7,8-Penta CDF	2016/11/13	NC		%	20
			1,2,3,4,7,8-Hexa CDF	2016/11/13	NC		%	20
			1,2,3,6,7,8-Hexa CDF	2016/11/13	NC		%	20
			2,3,4,6,7,8-Hexa CDF	2016/11/13	NC		%	20
			1,2,3,7,8,9-Hexa CDF	2016/11/13	NC		%	20
			1,2,3,4,6,7,8-Hepta CDF	2016/11/13	NC		%	20
			1,2,3,4,7,8,9-Hepta CDF	2016/11/13	NC		%	20
4745849	OBC	Method Blank	C13-1234678 HeptaCDD	2016/11/13		100	%	25 - 130
			C13-1234678 HeptaCDF	2016/11/13		63	%	25 - 130
			C13-123678 HexaCDD	2016/11/13		76	%	40 - 130
			C13-123678 HexaCDF	2016/11/13		64	%	40 - 130
			C13-12378 PentaCDD	2016/11/13		108	%	40 - 130
			C13-12378 PentaCDF	2016/11/13		84	%	40 - 130
			C13-123789 HexaCDF	2016/11/13		70	%	40 - 130
			C13-2378 TetraCDD	2016/11/13		93	%	40 - 130
			C13-2378 TetraCDF	2016/11/13		89	%	40 - 130
			C13-Octachlorodibenzo-p-Dioxin	2016/11/13		62	%	25 - 130

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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	2016/11/13	<4.0, EDL=4.0		pg	
			1,2,3,7,8-Penta CDD	2016/11/13	<3.5, EDL=3.5		pg	
			1,2,3,4,7,8-Hexa CDD	2016/11/13	<3.2, EDL=3.2		pg	
			1,2,3,6,7,8-Hexa CDD	2016/11/13	4.0, EDL=3.3		pg	
			1,2,3,7,8,9-Hexa CDD	2016/11/13	<3.0, EDL=3.0		pg	
			1,2,3,4,6,7,8-Hepta CDD	2016/11/13	7.4, EDL=3.3		pg	
			Total Tetra CDD	2016/11/13	<14, EDL=14 (1)		pg	
			Total Penta CDD	2016/11/13	10.9, EDL=3.5		pg	
			Total Hexa CDD	2016/11/13	13.6, EDL=3.2		pg	
			Total Hepta CDD	2016/11/13	14.3, EDL=3.3		pg	
			2,3,7,8-Tetra CDF	2016/11/13	9.9, EDL=3.4		pg	
			1,2,3,7,8-Penta CDF	2016/11/13	<4.9, EDL=4.9		pg	
			2,3,4,7,8-Penta CDF	2016/11/13	6.0, EDL=4.9		pg	
			1,2,3,4,7,8-Hexa CDF	2016/11/13	<3.2, EDL=3.2		pg	
			1,2,3,6,7,8-Hexa CDF	2016/11/13	4.2, EDL=3.0		pg	
			2,3,4,6,7,8-Hexa CDF	2016/11/13	<3.3, EDL=3.3		pg	
			1,2,3,7,8,9-Hexa CDF	2016/11/13	<3.5, EDL=3.5		pg	
			1,2,3,4,6,7,8-Hepta CDF	2016/11/13	14.8, EDL=3.2		pg	
			1,2,3,4,7,8,9-Hepta CDF	2016/11/13	<3.8, EDL=3.8		pg	
			Total Tetra CDF	2016/11/13	9.9, EDL=3.4		pg	
			Total Penta CDF	2016/11/13	27.2, EDL=4.9		pg	
			Total Hexa CDF	2016/11/13	18.8, EDL=3.2		pg	
			Total Hepta CDF	2016/11/13	14.8, EDL=3.5		pg	
4748397	VCI	Method Blank	Confirmation 2,3,7,8-Tetra CDF	2016/11/14	<2.0, EDL=2.0		pg	

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B6M4452
Report Date: 2016/11/19

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	2016/11/14		103	%	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.

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) EMPC / Ratio - Isotopic ratio adjusted to meet theoretical

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Maxxam
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Maxxam Job #: B6M4452
Report Date: 2016/11/19

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

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.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

36M 4452

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Page 1 of 1

CLIENT INFORMATION

Company Name: Arcelor Mittal
Project Manager: William Cowell
e-mail: wcowell@montrose-esw.com
Address: 1050 William Pitt Way, Pittsburgh, PA

SECTION

Phone: 412 826 3636 Fax: —
Sampled by: Schawish

ANALYSIS REQUESTED

Field Sample ID	Total Volume Sampled	Flow Rate	Collection Date	Sample Collection Time	RM29, Parameters as ordered	RM 315 methyl mercaptans only, Total Soluble Organics	RM 23/SW846 M0010 Parameters as ordered
Boiler M29 Run 1 7 containers	~105	150	10/12/16	920-1300	X		
" " Run 2 "			10/12/16	1420-1805	X		
" " Run 3 "			10/12/16	750-1140	X		
" " Blanks 6 containers + 3 filters	—	—	10/12/16	900	X		
" MS15 TSO Run 1 5 containers	~71	150	10/12/16	1316-1658		X	
" " Run 2 "			10/13/16	735-1054		X	
" " Run 3 "			10/13/16	1135-1445		X	
" " Blanks 3 containers	—	—	10/12/16	700		X	
" M23/0010 Run 1 7 containers	10/12/16	150	10/12/16	1316-1658			X
Run 2 "	10/13/16		10/13/16	735-1054			X
Run 3 "	10/13/16		10/13/16	1135-1445			X

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: Sam Wilson
PO #: NA
Maxxam Quote #:
Maxxam Contact: Clayton Jensen

REPORTING REQUIREMENTS

Summary Report only ☐
EDD ☐
Regulation

Notes

PROJECT SPECIFIC COMMENTS

Client Signature:
Affiliation: Montrose
Date/Time: 10/13/16 - 1500

Received by:
Affiliation: MAXXAM
Date/Time: 10/14/2016 15:00

(CCC 1041 (06/13)) Air ... 22.1/22.0/22.1 TEJASH PATEL 2016/10/17 23:30

Method 15

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.

BOILERS 1 AND 2 COMBINED STACK 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.

BOILERS 1 AND 2 COMBINED STACK GAS HYDROGEN SULFIDE ANALYTICAL REPORT ARCELORMITTAL - MONESSEN, MONESSEN, PA

January 3, 2017

Prepared for:

ArcelorMittal - Monessen
Monessen, 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

Table 1. Analysis of Boilers 1 and 2 Combined Stack Gas for Hydrogen Sulfide (H2S)
Test Date October 13, 2016
Boilers 1 and 2 Combined Stack, ArcelorMittal Monessen, Monessen, PA

	Start Time	End Time	Run Average (H2S ppm)
Run 1	9:17	10:17	< 0.5 ppm
Run 2	10:33	11:33	< 0.5 ppm
Run 3	11:43	12:43	< 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 Narrative

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2. Test Procedures 2
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2.2 Sampling Components 3
2.3 Sampling Procedure 3

APPENDICES

A: Run Results
B: Calibration Gas Certificates
C: H2S Calibration Data
D: Runs 1-3 Data
E: Citrate Buffer Verification Files

BOILERS 1 AND 2 COMBINED STACK GAS HYDROGEN SULFIDE ANALYTICAL REPORT ARCELORMITTAL - MONESSEN, MONESSEN, PA

METHOD NARRATIVE

Gas chromatography (GC) analysis was performed on stack gas from the Boiler 1 and 2 Combined Stack 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 Boiler 1 and 2 Combined Stack 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.

APPENDIX A

Run Results

Boiler 1and 2 Combined Stack

Injection Run 1

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

Boiler 1and 2 Combined Stack

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

Boiler 1and 2 Combined Stack

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

APPENDIX B

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 Miller

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

C. 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

APPENDIX C

H2S Calibration DATA

Pre and Post Calibration DATA
Calibration Curve
Calibration Chromatograms

MONTROSE CEM Calibration, Bias and Drift Data Sheet
Based on 40 CFR Part 60, Appendix A-4, Method 15

Client	ArcelorMittal - Monessen	**Date**	October 13, 2016
Project No	16-167	**Run 1**	Start: 9:17 / End: 10:17
Plant	Monessen	**Run 2**	Start: 10:33 / End: 11:33
Unit	Boilers 1 and 2 Combined Stack	**Run 3**	Start: 11:43 / End: 12:43
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**	35.5052	35.5558	34.4332	35.1647	0.97%	1.11%	2.08%
	Mid	1323.8303	1325.6906	1287.4572	1312.3260	0.88%	1.02%	1.90%
	High	6464.3367	6395.3146	6393.3478	6417.6664	0.73%	0.35%	0.38%
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**	36.4406	35.3686	35.2446	35.6846	2.12%	0.89%	1.23%
	Mid	1276.9731	1321.0828	1271.3238	1289.7932	0.99%	2.43%	1.43%
	High	6614.9548	6618.8204	6652.0924	6628.6225	0.21%	0.15%	0.35%
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**	35.51	36.44		
		35.56	35.37		
		34.43	35.24		
	Average	35.16	35.68	1.5%	YES

		Pre Calibration	Post Calibration	% of Average	Less than 5%
56.0	**ppm H2S**	1323.83	1276.97		
		1325.69	1321.08		
		1287.46	1271.32		
	Average	1312.33	1289.79	1.7%	YES

		Pre Calibration	Post Calibration	% of Average	Less than 5%
145.2	**ppm H2S**	6464.34	6614.95		
		6395.31	6618.82		
		6393.35	6652.09		
	Average	6417.67	6628.62	3.3%	YES

POST TEST LINE LOSS CHECK

10.0 ppm	**Average**	**Area**	**% of Average**
	1	35.6330	0.18%
	2	35.1794	1.09%
	3	35.8917	0.91%
	Average	**35.5680**	

	Area
Calibration Standard	35.2
Post Test Line Loss Injection Average	35.6
Post Test Line Loss	-1.15%

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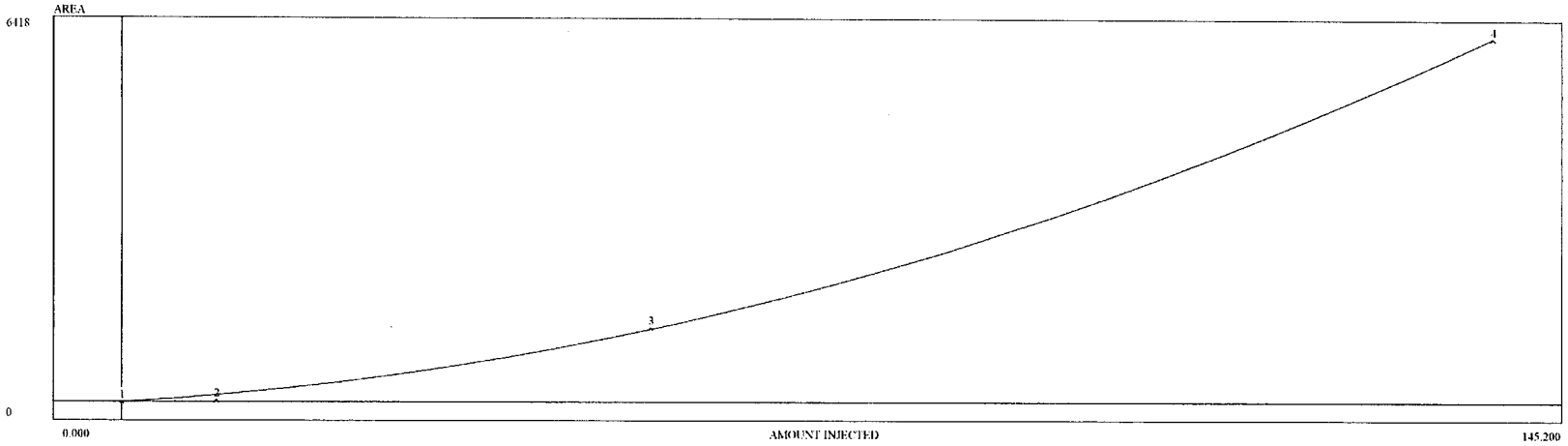
Calibration file: C:\Users\fbarton\Desktop\GC Projects\Monessen\16-167 ICR Testing\Boilers\10-12-2016 and 10-13-2016 Boilers\H2S Cal 10-13-2016.cal



Avg slope of curve: 44.22
Y-axis intercept: 0.00
Linearity: 0.57
Number of levels: 4
SD/rel SD of CFs: 20.4/114.7
Y=0.2377X*+9.7119X
r2: 0.9997
Last calibrated: Thu Oct 13 08:17:12 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	35.165	9.994	3.519	35.165	N/A	N/A
3	1312.326	56.000	23.434	1312.326	N/A	N/A
4	6417.666	145.200	44.199	6417.666	N/A	N/A

Boiler Stack H2S Calibration Curve

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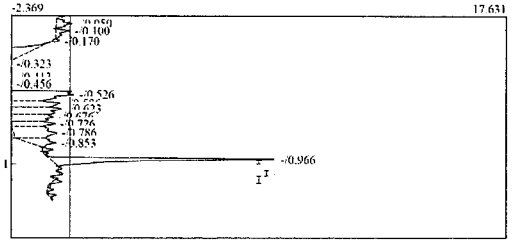
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:22:05
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Zero Cal 01
Comments: Ambient Air

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	

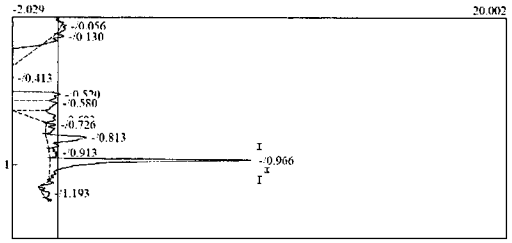
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:24:31
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Zero Cal 02
Comments: Ambient Air

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	

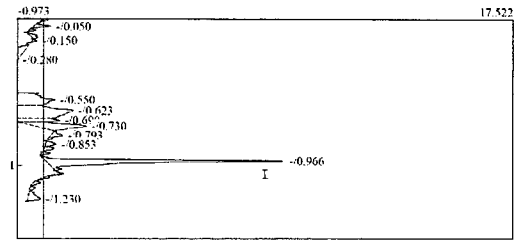
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:27:14
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Zero Cal 03
Comments: Ambient Air

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	

Zero Cal

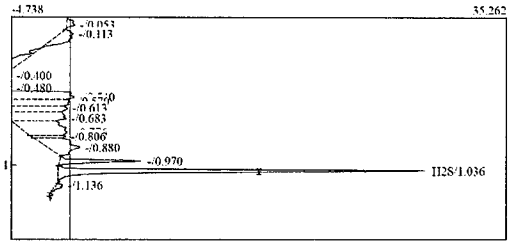
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:12:17
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Low Cal 01
Comments: H2S - 9.994 ppm

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	1.036	35.5052
		35.5052

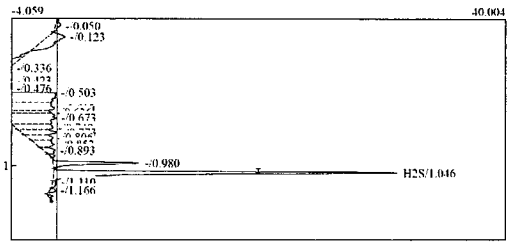
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:07:52
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Low Cal 02
Comments: H2S - 9.994 ppm

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	1.046	35.5558
		35.5558

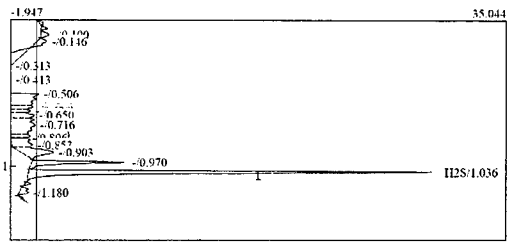
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 07:10:03
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Low Cal 03
Comments: H2S - 9.994 ppm

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	1.036	34.4332
		34.4332

H2S Low Cal

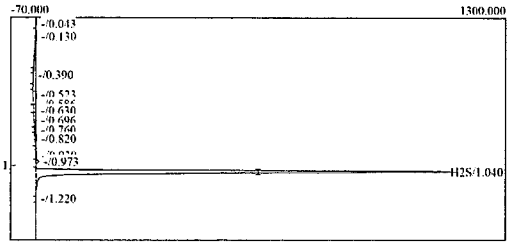
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 06:59:56
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Mid Cal 01
Comments: H2S - 56.0 ppm

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	1.040	1323.8303
		1323.8303

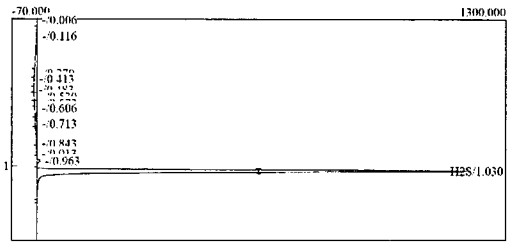
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 06:55:20
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Mid Cal 02
Comments: H2S - 56.0 ppm

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	1.030	1325.6906
		1325.6906

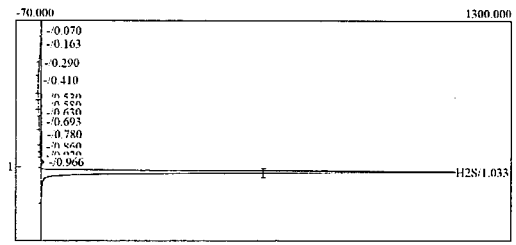
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 06:57:51
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Mid Cal 03
Comments: H2S - 56.0 ppm

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	1.033	1287.4572
		1287.4572

H2S Mid Cal

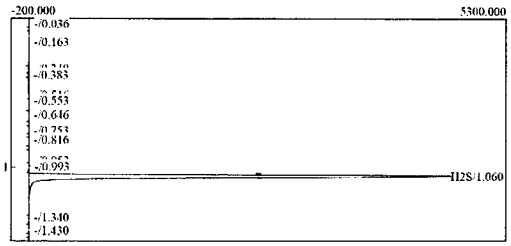
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 06:35:35
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S High Cal 01
Comments: H2S - 145.2 ppm

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	1.060	6464.3367
		6464.3367

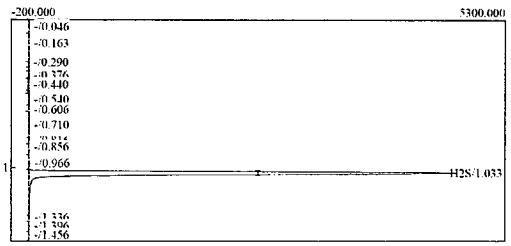
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 06:38:24
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S High Cal 02
Comments: H2S - 145.2 ppm

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	1.033	6395.3146
		6395.3146

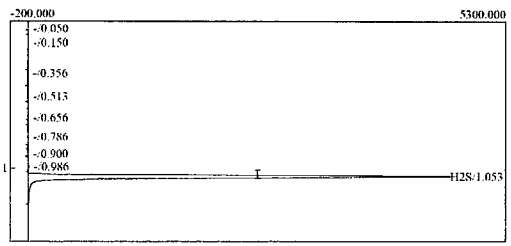
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 06:40:27
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S High Cal 03
Comments: H2S - 145.2 ppm

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	1.053	6393.3478
		6393.3478

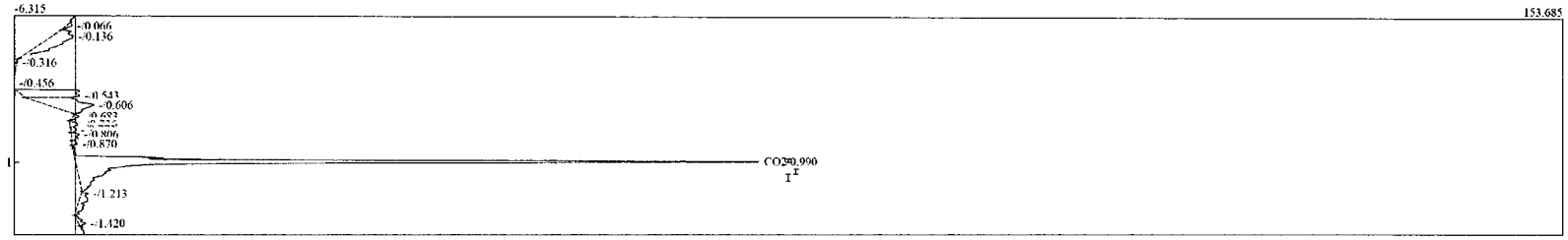
H2S High Cal

Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/12/2016 12:53:37
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: CO2 Time Check
Comments:
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
CO2	0.990	116.7894	0.0000	
		116.7894	0.0000	

CO2 Time Check

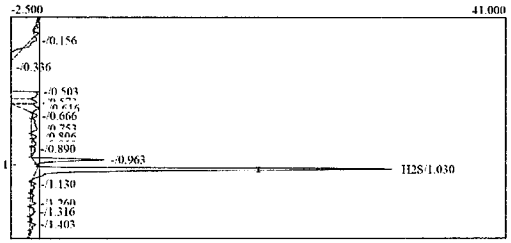
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 13:12:27
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Low Cal 01
Comments: H2S - 9.994 ppm

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	1.030	36.4406
		36.4406

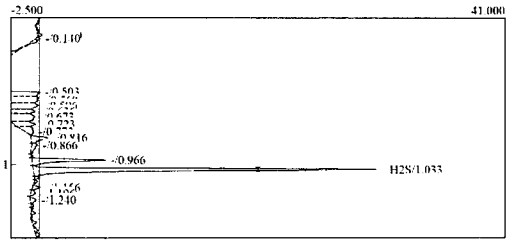
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 13:14:56
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Low Cal 02
Comments: H2S - 9.994 ppm

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	1.033	35.3686
		35.3686

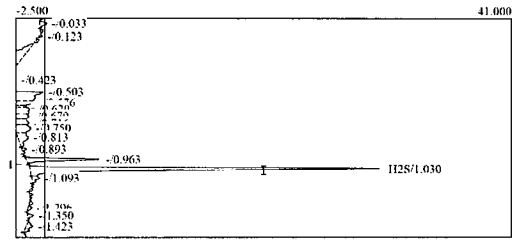
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 13:18:24
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Low Cal 03
Comments: H2S - 9.994 ppm

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	1.030	35.2446
		35.2446

H2S Post Low Cal

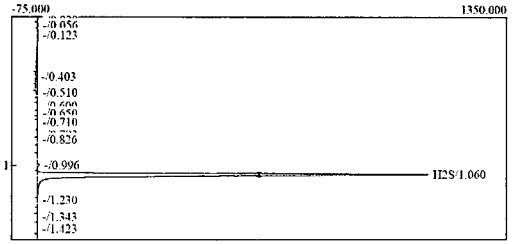
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:50:53
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Mid Cal 01
Comments: H2S - 56.0 ppm

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	1.060	1276.9731
		1276.9731

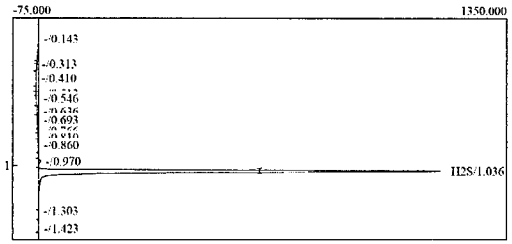
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:53:16
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Mid Cal 02
Comments: H2S - 56.0 ppm

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	1.036	1321.0828
		1321.0828

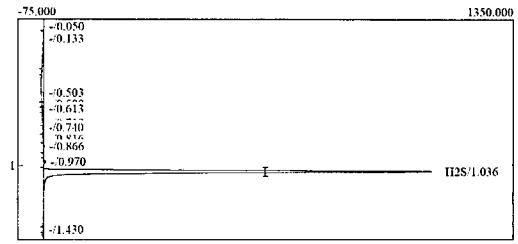
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:55:36
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Mid Cal 03
Comments: H2S - 56.0 ppm

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	1.036	1271.3238
		1271.3238

H2S Post Mid Cal

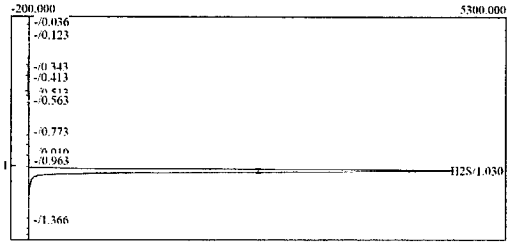
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 13:00:54
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post High Cal 01
Comments: H2S - 145.2 ppm

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	1.030	6614.9548
		6614.9548

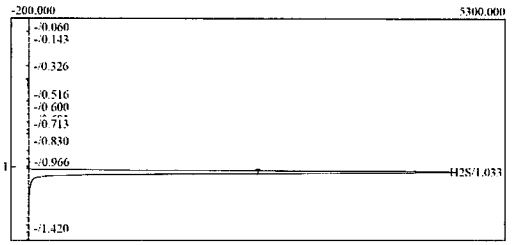
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 13:03:21
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post High Cal 02
Comments: H2S - 145.2 ppm

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	1.033	6618.8204
		6618.8204

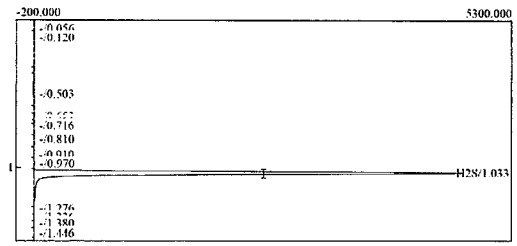
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 13:05:52
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post High Cal 03
Comments: H2S - 145.2 ppm

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
H2S	1.033	6652.0924
		6652.0924

H2S Post High Cal

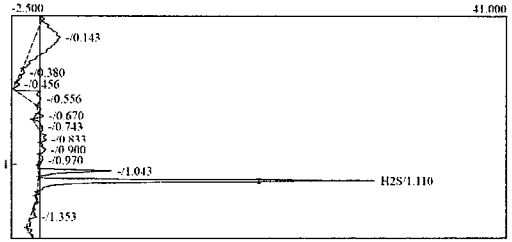
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 14:04:10
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Line Loss 01
Comments: H2S - 9.994 ppm

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	1.110	35.6330
		35.6330

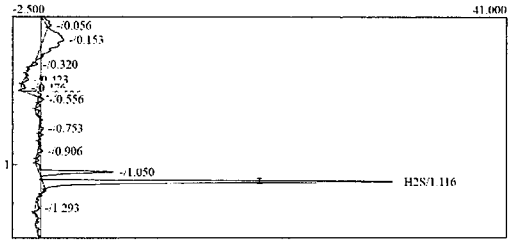
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 14:11:13
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Line Loss 02
Comments: H2S - 9.994 ppm

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	1.116	35.1794
		35.1794

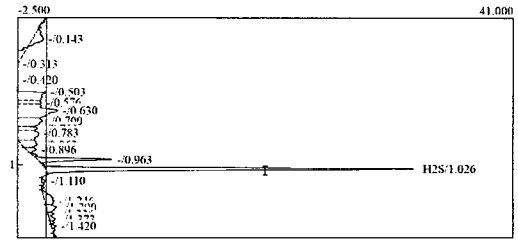
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 14:18:48
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Post Line Loss 03
Comments: H2S - 9.994 ppm

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	1.026	35.8917
		35.8917

H2S Post Line Loss

APPENDIX D

Run 1 – 3 DATA

Run Chromatograms

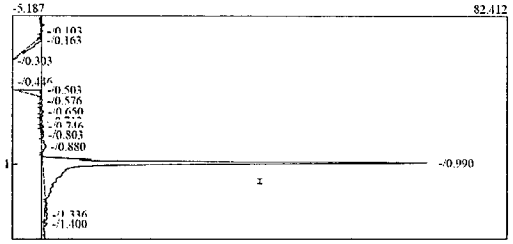
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 09:19:46
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 01

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	

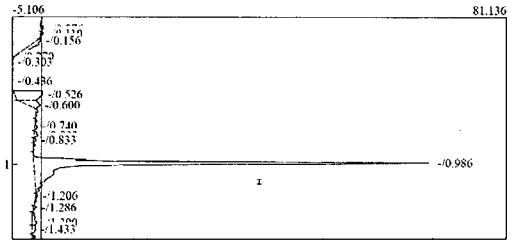
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 09:28:09
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 02

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	

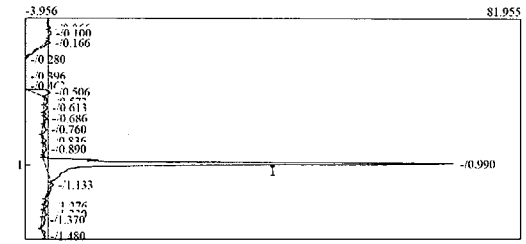
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 09:38:32
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 03

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	

Boiler Stack Run 1 Injections 1 - 3

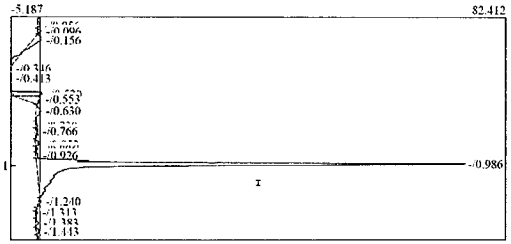
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 09:49:06
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 04

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	

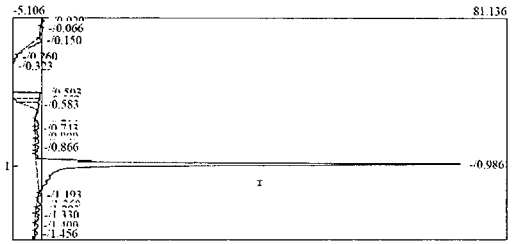
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 09:58:28
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 05

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	

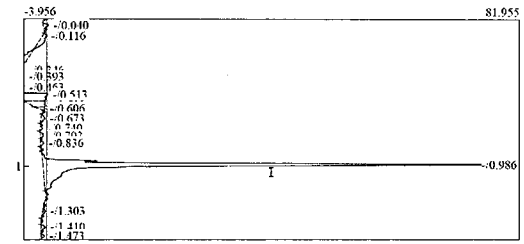
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 10:08:30
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 06

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	

Boiler Stack Run 1 Injections 4 - 6

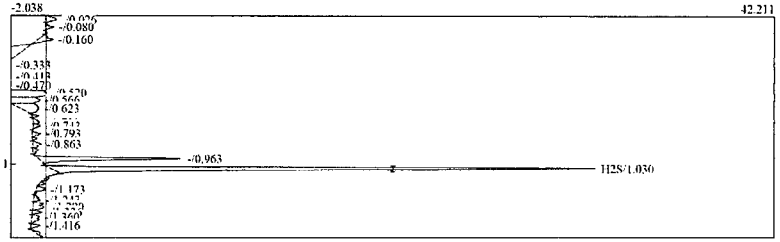
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 10:14:16
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 Low Cal Check 01
Comments: H2S - 9.994 ppm

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	1.030	34.8404
		34.8404

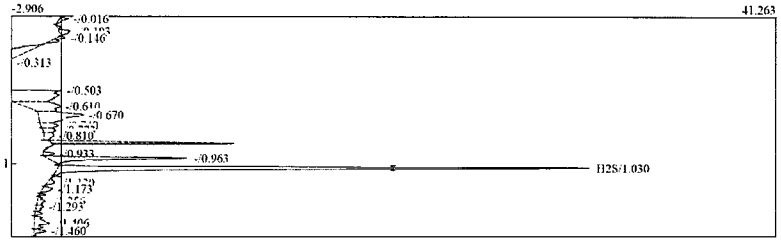
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 10:17:13
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 1 Low Cal Check 02
Comments: H2S - 9.994 ppm

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	1.030	34.2109
		34.2109

Boiler Stack Run 1 Low Cal Check A

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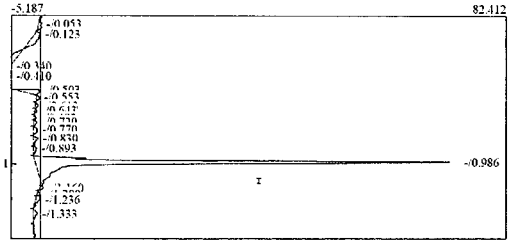
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 10:34:12
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 01

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	

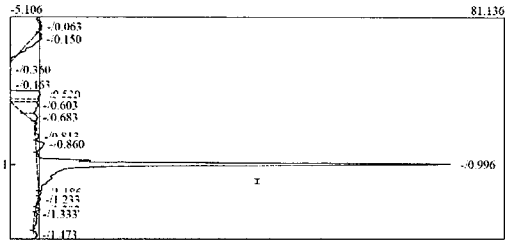
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 10:46:25
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 02

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	

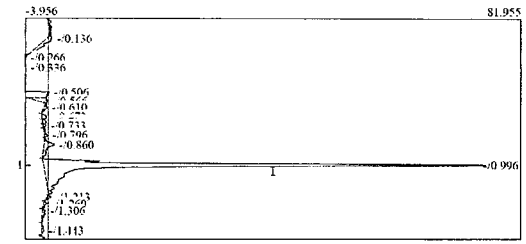
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 10:56:29
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 03

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	

Boiler Stack Run 2 Injections 1 - 3

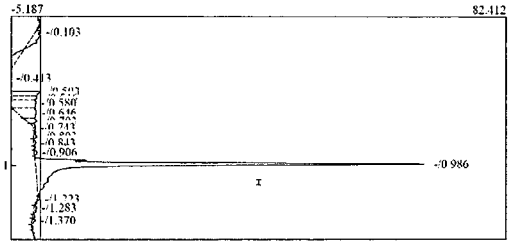
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:04:52
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 04

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	

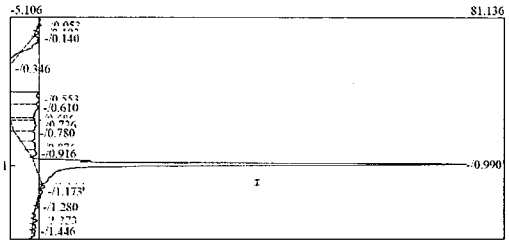
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:17:38
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 05

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	

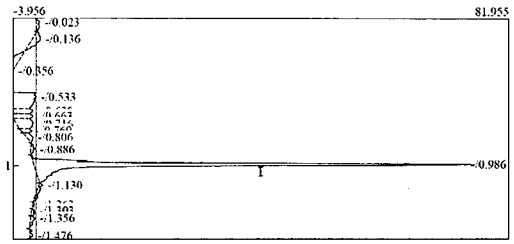
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:25:43
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 06

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	

Boiler Stack Run 2 Injections 4 - 6

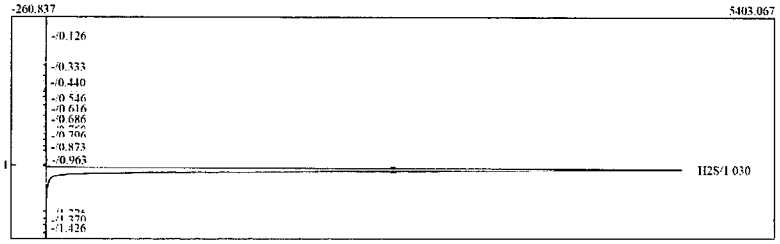
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:37:49
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 High Cal Check 01
Comments: H2S - 145.2 ppm

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	1.030	6423.2888	145.2334	ppm
		6423.2888	145.2334	

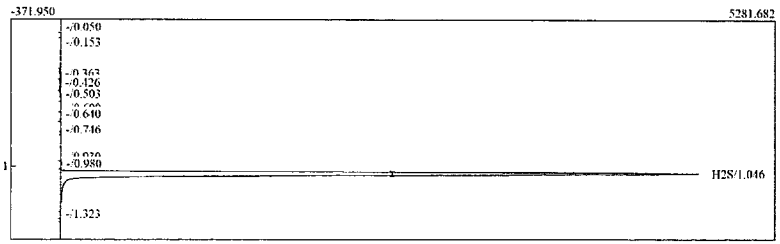
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:39:58
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 2 High Cal Check 02
Comments: H2S - 145.2 ppm

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	1.046	6496.0425	146.1740	ppm
		6496.0425	146.1740	

Boiler Stack Run 2 High Cal Check

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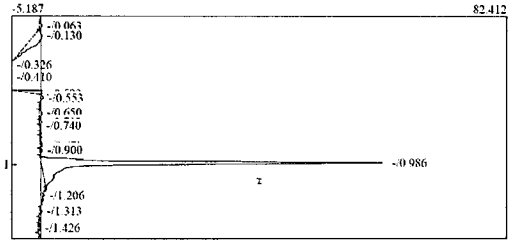
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:44:47
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 01

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	

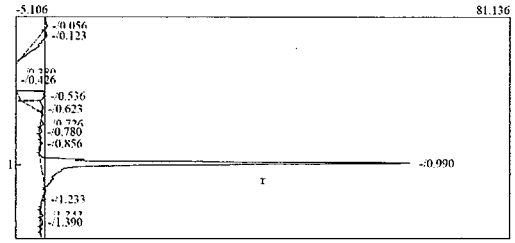
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 11:54:46
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 02

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	

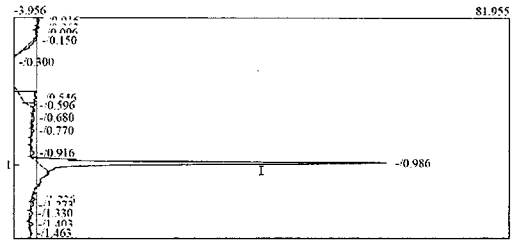
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:04:03
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 03

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	

Boiler Stack Run 3 Injections 1 - 3

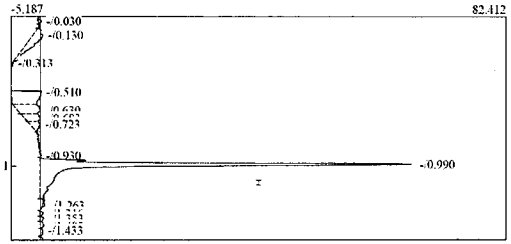
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:14:34
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 04

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	

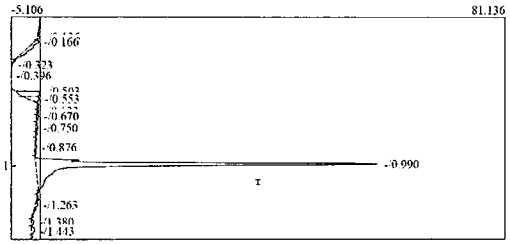
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:24:22
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 05

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	

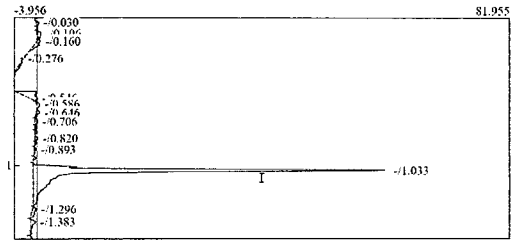
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:34:38
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 06

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	

Boiler Stack Run 3 Injections 4 - 6

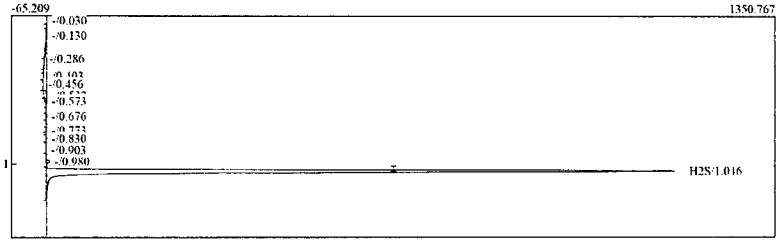
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:43:10
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 Mid Cal Check 01
Comments: H2S - 56.0 ppm

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	1.046	1310.7430	56.5492	ppm
		1310.7430	56.5492	

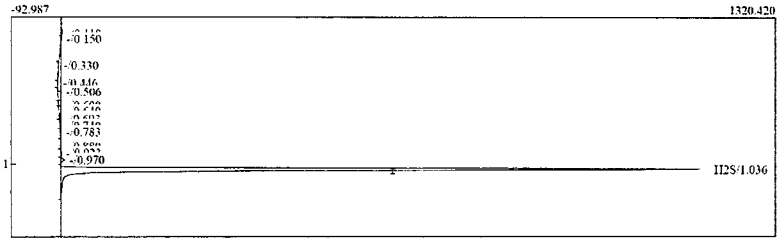
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/13/2016 12:45:17
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: Boiler Stack Run 3 Mid Cal Check 02
Comments: H2S - 56.0 ppm

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	1.036	1332.9581	57.1674	ppm
		1332.9581	57.1674	

Boiler Stack Run 3 Mid Cal Check

APPENDIX E

Citrate Buffer Verification Files and Nomenclature

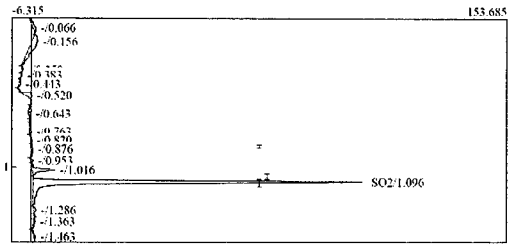
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/12/2016 12:44:41
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: SO2 Time Check
Comments: SO2 - 25 ppm

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	External	Units
SO2	1.096	132.6878	0.0000	ppm
		132.6878	0.0000	

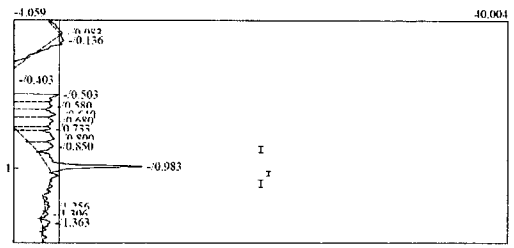
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/12/2016 12:50:29
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: SO2 Through Buffer
Comments: SO2 - 25 pppm

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	

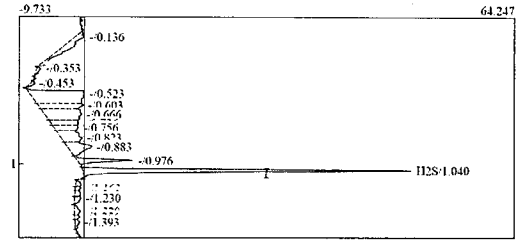
Lab name: MAQS
Client: ArcelorMittal Monessen
Client ID: 16-167
Analysis date: 10/12/2016 12:24:28
Method: Rotary Valve Injection
Description: FID-CHANNEL 1
Column: 15 METER MXT-1
Carrier: HELIUM AT 27 PSI
Sample: H2S Low Cal Gas through Buffer
Comments:

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	1.040	54.5536	0.0000	ppm
		54.5536	0.0000	

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

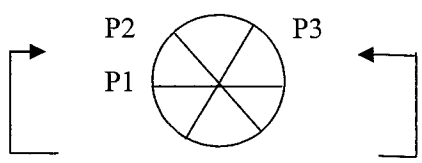
Montrose Air Quality Services (MAQS)
Nozzle Calibration Data Sheet

MONTROSE ENVIRONMENTAL

Date	Calibrated By	Nozzle ID #	Nozzle Diameter (inches)			Hi-Lo	D_{avg}
			D1	D2	D3	Delta D	
10/11/16	JW	0.330	0.330	0.330	0.330	0.000	0.330
10/11/16	JW	0.253	0.253	0.253	0.253	0.000	0.253

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 $\leq$ 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] 10/11/16 Calibrated by Caliper ID# CAL-017
(Signature / Date)

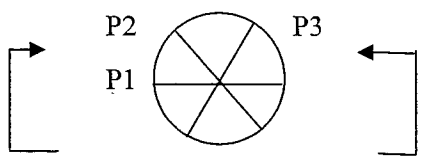
Montrose Air Quality Services (MAQS)
Nozzle Calibration Data Sheet

MONTROSE ENVIRONMENTAL

Date	Calibrated By	Nozzle ID #	Nozzle Diameter (inches)			Hi-Lo	D_{avg}
			D1	D2	D3	Delta D	
10/12/16	JW	0.395	0.395	0.395	0.395	0.000	0.395
10/12/16	JW	0.286	0.286	0.287	0.286	0.001	0.287

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] 10/12/16 Calibrated by Caliper ID# CAL-017
(Signature / Date)

MONTROSE ENVIRONMENTAL

Montrose Air Quality Services (MAQS)
Thermocouple Calibration Data Sheet
ALT-011

Thermocouple ID: 7-4

Standard Used ID: CTC-1

EMF Meter ID 1614

Post Test

Temperature Range	Reference Thermometer (°F)	Thermocouple Thermometer (°F)	Temperature Difference (F°)
Ambient Temp.	64	64	0.0

Criteria are:
The temperature difference within 2.0 F° of Reference Standard.
Emission Measurement Center, Approved Alternative Method (ALT-011)

Checked by: [signature] 10/14/16
(Signature / Date)

MONTROSE ENVIRONMENTAL

Montrose Air Quality Services (MAQS)
Thermocouple Calibration Data Sheet
ALT-011

Thermocouple ID: 7.9

Standard Used ID: CTC-1

EMF Meter ID 1618

Post Test

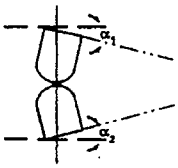
Temperature Range	Reference Thermometer (°F)	Thermocouple Thermometer (°F)	Temperature Difference (F°)
Ambient Temp.	64	64	0.0

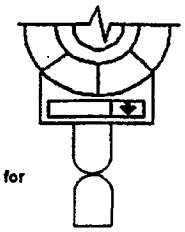
Criteria are:
The temperature difference within 2.0 F° of Reference Standard.
Emission Measurement Center, Approved Alternative Method (ALT-011)

Checked by: [signature] 10/14/16
(Signature / Date)

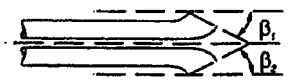
MONTROSE ENVIRONMENTAL

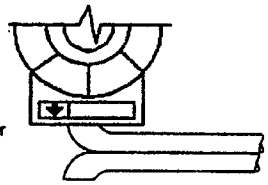
Montrose Air Quality Services (MAQS)
Type S Pitot Tube Inspection Data Sheet



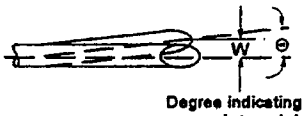


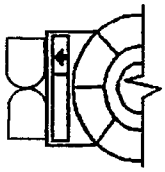
Degree indicating level position for determining α_1 and α_2.



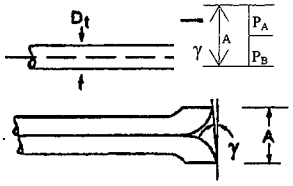


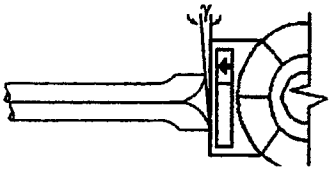
Degree indicating level position for determining β_1 and β_2.





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)	0.956	
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)	0.478	0.478
P_B	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.478	0.478
P_A - P_B	(-0.063 to 0.063")	0.000	0.000
P_A/D_t	(1.05 to 1.50)	1.27	1.27
P_B/D_t	(1.05 to 1.50)	1.27	1.27
D_T	(3/16" ≤ D_t ≤ 3/8")	3/8"	3/8"

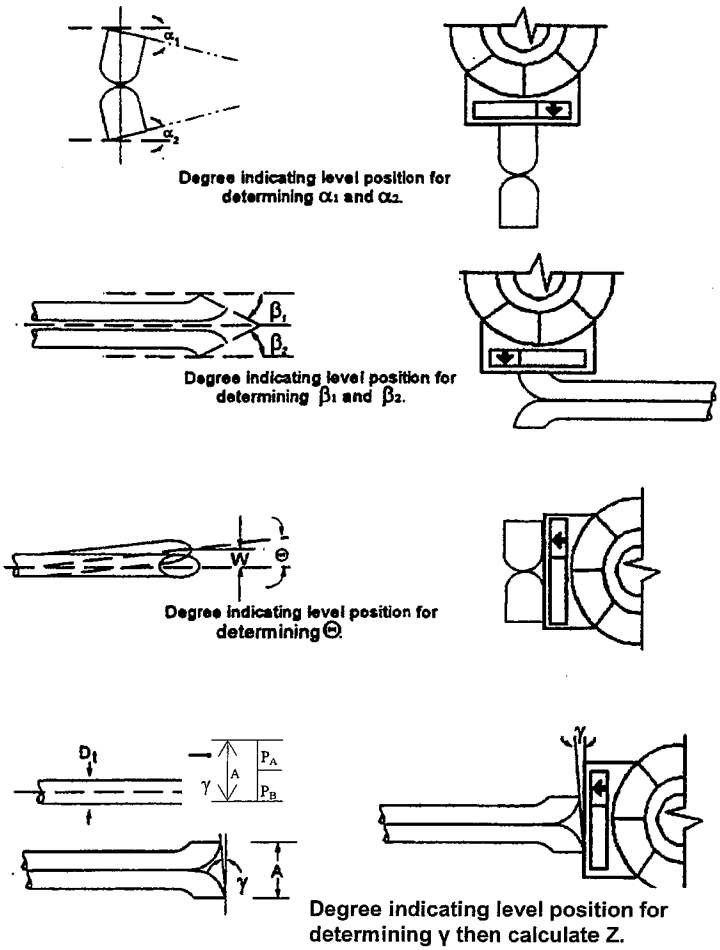
Certification:

I certify that the Type S Pitot Tube/Probe ID# 7-4 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: _____ 10/11/16
(Signature / Date)

MONTROSE ENVIRONMENTAL

Montrose Air Quality Services (MAQS)
Type S Pitot Tube Inspection Data Sheet



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)	0.900	0.900
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)	0.450	0.450
P_B	(for 1/4 " OD, 0.263 to 0.375 for 3/8" OD, 0.394 to 0.563)	0.450	0.450
P_A - P_B	(-0.063 to 0.063")	0.000	0.000
P_A/D_t	(1.05 to 1.50)	1.20	1.20
P_B/D_t	(1.05 to 1.50)	1.20	1.20
D_T	(3/16" ≤ D_t ≤ 3/8")	3/8"	3/8"

Certification:

I certify that the Type S Pitot Tube/Probe ID# 7-9 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] 10/11/16
(Signature / Date)

	Previous Cal	New Cal	% Difference
Y	1.009	1.003	0.634
dH	2.082	1.991	4.465

Air Compliance Consultants, Inc.
EPA Method 5
Meter Box Calibration
Pre-Test Orifice Method
English Meter Box Units, English K' Factor
APEX Orifices

Jenco 765 NIST Traceability		
NIST 161999	Jenco 765	% Difference
0	0	0.00%
400	397	0.75%
800	799	0.13%
1200	1195	0.42%
1600	1594	0.38%
1900	1892	0.42%

Model #: C-5000
Serial #: 1614

Date: ----------> 10/04/16 60.00
Barometric Pressure: ----------> 30.21 (in. Hg)
Theoretical Critical Vacuum:---> 14.25 (in. Hg)

!!!!!!!!!
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)
0.34	25.00	832.869	840.440	7.571	71.0	69.0	72.0	70.0	40	0.2337	20.0	72.0	73.0	72.5
0.70	15.00	850.905	857.519	6.614	74.0	70.0	74.0	71.0	48	0.3408	18.5	73.0	74.0	73.5
1.20	10.00	827.000	832.869	5.869	70.0	68.0	71.0	69.0	55	0.4507	17.5	72.0	72.0	72.0
2.20	10.00	857.519	865.332	7.813	74.0	71.0	74.0	71.0	63	0.6027	16.5	73.0	73.0	73.0
3.90	10.00	840.440	850.905	10.465	71.0	70.0	74.0	70.0	73	0.8099	14.5	72.0	73.0	72.5

********** RESULTS **********

--- DRY GAS METER --- VOLUME CORRECTED	
Vm(std) (cu ft)	Vm(std) (liters)
7.612	215.6
6.633	187.9
5.924	167.8
7.861	222.6
10.597	300.1

--------- ORIFICE ---------		
VOLUME CORRECTED		VOLUME NOMINAL
Vcr(std) (cu ft)	Vcr(std) (liters)	Vcr (cu ft)
7.649	216.6	7.643
6.686	189.4	6.694
5.903	167.2	5.893
7.887	223.3	7.888
10.603	300.3	10.595

-- DRY GAS METER -- CALIBRATION FACTOR	
Y Value (number)	Variation (number)
1.005	0.002
1.008	0.005
0.996	-0.006
1.003	0.001
1.001	-0.002
Avg Y--> 1.003	

--------- ORIFICE --------- CALIBRATION FACTOR		
dH@		
Value (in H2O)	Value (mm H2O)	Variation (in H2O)
2.054	52.17	0.063
1.996	50.70	0.005
1.947	49.46	-0.044
1.998	50.76	0.007
1.960	49.78	-0.031
Avg dH@--> 1.991	50.57	

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: John Wilson Date: 10/4/16

Y:\1 References\Equipment\Calibrations\Meterboxes\2016 Calibrations\1614\1614 10-4-16

MONTROSE

Alternative Method 5 Post-Test Calibration Check			
Client:	ArcelorMittal		
Facility:	Monessen, PA		
Source ID:	Boilers 1 and 2		
Project Number:	16-167		
Date:	10/12/2016		
Control Box ID:	1614		
	Run 1	**Run 2**	**Run 3**
Data Input			
Test time (min)	180	180	180
Volume Dry Gas Metered (dacf)	155.578	163.169	158.774
Meter Temperature (F)	91.2	74.3	73.6
Barometric Pressure (in. Hg)	29.27	29.06	29.06
Orifice Pressure Drop (in. H_2O)	2.54	2.73	2.63
Dry Gas Molecular Weight (lb/lb mol)	29.39	29.38	29.36
Original Meter Correction Value	1.003	1.003	1.003
Meter $DH_@$ (in. H_2O)	1.991	1.991	1.991
Calculated Values			
Dry Gas Meter Calibration check value (Yqa)	**1.003**	**0.979**	**0.988**
Percent Difference (%)	**0.00%**	**-2.35%**	**-1.46%**
Results			
Average Dry Gas Meter Calibration Check Value (Yqa)	**0.990**		
Original Meter Correction Value (Y orig)	**1.003**		
Percent Difference (%)	**-1.27%**	**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))

Air Compliance Consultants, Inc.
EPA Method 5
Meter Box Calibration
Pre-Test Orifice Method
English Meter Box Units, English K' Factor
Apex Orifices

	Previous Cal	New Cal	% Difference
Y	1.002	1.003	0.078
dH	1.944	1.971	1.384

Model #: C-5000
Serial #: 1618

Date: ——————> 04/07/16 60.00
Barometric Pressure: ——> 28.46 (in. Hg)
Theoretical Critical Vacuum:—> 13.42 (in. Hg)

Jenco 765 NIST Traceability		
NIST 161999	Jenco 765	% Difference
0	0	0.00%
400	398	0.50%
800	803	0.38%
1200	1200	0.00%
1600	1601	0.06%
1900	1901	0.05%

!!!!!!!!
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)
0.26	18.00	601.680	607.125	5.445	68.0	68.0	71.0	69.0	40	0.2337	23.0	67.0	67.0	67.0
0.57	15.00	617.658	624.314	6.656	73.0	70.0	74.0	71.0	48	0.3408	22.0	68.0	68.0	68.0
1.10	15.00	592.863	601.680	8.817	69.0	68.0	69.0	68.0	55	0.4507	20.0	70.0	67.0	68.5
1.90	10.00	624.314	632.172	7.858	73.0	71.0	75.0	72.0	63	0.6027	18.5	68.0	68.0	68.0
3.50	10.00	607.125	617.658	10.533	70.0	69.0	74.0	73.0	73	0.8099	16.5	67.0	69.0	68.0

RESULTS

DRY GAS METER VOLUME CORRECTED	
Vm(std) (cu ft)	Vm(std) (liters)
5.171	146.4
6.290	178.1
8.399	237.9
7.441	210.7
10.039	284.3

ORIFICE VOLUME CORRECTED		ORIFICE VOLUME NOMINAL
Vcr(std) (cu ft)	Vcr(std) (liters)	Vcr (cu ft)
5.215	147.7	5.474
6.332	179.3	6.659
8.369	237.0	8.811
7.465	211.4	7.851
10.031	284.1	10.550

DRY GAS METER CALIBRATION FACTOR Y	
Value (number)	Variation (number)
1.009	0.006
1.007	0.004
0.996	-0.006
1.003	0.000
0.999	-0.004
Avg Y--> 1.003	

ORIFICE CALIBRATION FACTOR dH@		
Value (in H2O)	Value (mm H2O)	Variation (in H2O)
1.824	46.34	-0.147
1.884	47.86	-0.087
2.095	53.22	0.124
2.005	50.92	0.034
2.047	51.99	0.076
Avg dH@--> 1.971	50.07	

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: TMull

Date: 4/7/16

MONTROSE

Alternative Method 5 Post-Test Calibration Check			
Client:	ArcelorMittal		
Facility:	Monessen, PA		
Source ID:	Boilers 1 and 2		
Project Number:	16-167		
Date:	10/12/16		
Control Box ID:	1618		
	Run 1	**Run 2**	**Run 3**
Data Input			
Test time (min)	180	180	180
Volume Dry Gas Metered (dacf)	76.652	77.028	79.331
Meter Temperature (F)	91.2	75.2	73.1
Barometric Pressure (in. Hg)	29.27	29.06	29.06
Orifice Pressure Drop (in. H_2O)	0.59	0.60	0.65
Dry Gas Molecular Weight (lb/lb mol)	29.39	27.12	29.36
Original Meter Correction Value	1.003	1.003	1.003
Meter $DH_@$ (in. H_2O)	1.971	1.971	1.971
Calculated Values			
Dry Gas Meter Calibration check value (Yqa)	**0.990**	**1.022**	**0.992**
Percent Difference (%)	**-1.31%**	**1.94%**	**-1.13%**
Results			
Average Dry Gas Meter Calibration Check Value (Yqa)	**1.001**		
Original Meter Correction Value (Y orig)	**1.003**		
Percent Difference (%)	**-0.17%**	**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))

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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

Carbon Monoxide Interference Test

Analyzer:	TECO Model 48 Gas Filter Correlation CO Analyzer
Date:	20-Aug-07
Analyzer Range:	0-1000 ppm

Test Gas	Concentration (%)	Allowable Interference (ppm)	CO Analyzer Response (ppm)
Carbon Dioxide	17.90	10	-1.2
Carbon Dioxide	9.85	10	-1.1
Carbon Dioxide	0	10	0

Note: Allowable interference is indicated if the CO analyzer response to each of the gases is less than 1% of the applicable measurement range of the analyzer.

%	Percent
CO	Carbon Monoxide
ppm_v	Parts per million by volume
ppm	Parts per million
USEPA	United States Environmental Protection Agency

Sulfur Dioxide Interference Test.

Trailer	Ametek series 900
Date	6-Nov-07
Analyzer Range	0-100 ppm
Serial #	AX-921-9746-1

Test Gas	Concentration (%)	Allowable Interference (ppm)	SO2 Analyzer Response (ppm)
Nitric Oxide	448.00	2	-0.2
Carbon Monoxide	914.00	2	-0.1
Oxygen	22.00	2	0.0
Carbon Dioxide	17.90	2	0.0

Allowable Interference is indicated if the SO2 analyzer response to each of the gases is less than 1 percent of the applicable measurement range of the analyzer.

SO2	Sulfur Dioxide
ppmv	Parts per million by volume.
ppm	Parts per million.
USEPA	U.S. Environmental Protection Agency.

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Montrose CEM Verification of Gas Dilution System for Field Instrument Calibrations
Based on EMTIC TM-205

Client	ArcelorMittal	**Date**	October 11, 2016
Project No	16-167	**Location**	Stack
Plant	Monessen, PA	**Series No.**	4040
Unit	Boilers	**S/N**	2012
Operation	mnoc	**Last Calibration**	4/20/2016
Tester(s)	jv	**Next Calibration**	4/20/2017

Mass Flow Controller	2	
Component of Protocol Calibration Gas Used	NOx	
Concentration of Protocol Gas Used	498.5	CC192432

Section 3.2.3 Prepared Dilutions	**Analyzer Output**	**Section 3.2.4 Difference from Single Injection and the Average Instrument Response**	**Section 3.2.5 Difference from Average Output Concentration and the Predicted Concentration**
Predicted Concentration 1	200.00		**0.52%**
Instrument Response 1	**200.7**	**-0.17%**	
Instrument Response 2	**201.2**	**0.08%**	
Instrument Response 3	**201.2**	**0.08%**	
Average Response	201.03		
		+/- 2 % Allowable	**+/- 2 % Allowable**
Predicted Concentration 2	99.93		**-0.33%**
Instrument Response 1	99.60	**0.00%**	
Instrument Response 2	99.60	**0.00%**	
Instrument Response 3	99.60	**0.00%**	
Average Response	99.60		
		+/- 2 % Allowable	**+/- 2 % Allowable**

Section 3.2.6 Mid-Level Supply Gas	**Analyzer Output**	**Difference between Protocol Concentration and Average Instrument Response**
Mid-Level Gas Concentration	99.93	XC032784B
Instrument Response 1	**100.2**	**0.60%**
Instrument Response 2	**100.7**	
Instrument Response 3	**100.7**	
Average Response	100.53	
		+/- 2 % Allowable

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Series 2020

System S/N 2012

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 1 Size: 10,000 SCCM

SERIAL NUMBER AW9406326

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. This is not performance data. This data is used by the system operating modes to improve the flow accuracy.

		Set Flow		True Flow	
5	%	500.0	SCCM	501.927	SCCM
10	%	1000.0	SCCM	1014.161	SCCM
20	%	2000.0	SCCM	2045.286	SCCM
30	%	3000.0	SCCM	3079.916	SCCM
40	%	4000.0	SCCM	4119.987	SCCM
50	%	5000.0	SCCM	5164.937	SCCM
60	%	6000.0	SCCM	6208.748	SCCM
70	%	7000.0	SCCM	7247.746	SCCM
80	%	8000.0	SCCM	8283.557	SCCM
90	%	9000.0	SCCM	9326.901	SCCM
100	%	10000.0	SCCM	10365.366	SCCM

Verified by: Terrie Lundmark Date: 4-20-16

Computerized Gas Mixing / Dilution / Calibration Systems
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World Wide Web: http://www.environics.com E-mail: info@environics.com

Environics®

Series 2020

System S/N 2012

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 2 Size: 10,000 SCCM

SERIAL NUMBER 0057749001

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. This is not performance data. This data is used by the system operating modes to improve the flow accuracy.

		Set Flow		True Flow	
5	%	500.0	SCCM	501.347	SCCM
10	%	1000.0	SCCM	1018.481	SCCM
20	%	2000.0	SCCM	2050.533	SCCM
30	%	3000.0	SCCM	3071.866	SCCM
40	%	4000.0	SCCM	4088.762	SCCM
50	%	5000.0	SCCM	5092.480	SCCM
60	%	6000.0	SCCM	6098.101	SCCM
70	%	7000.0	SCCM	7104.515	SCCM
80	%	8000.0	SCCM	8097.806	SCCM
90	%	9000.0	SCCM	9106.299	SCCM
100	%	10000.0	SCCM	10125.821	SCCM

Verified by: Lenie Lundmark Date: 4-20-16

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Series 2020

System S/N 2012

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 3 Size: 1000 SCCM

SERIAL NUMBER AW9409131

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. This is not performance data. This data is used by the system operating modes to improve the flow accuracy.

		Set Flow		True Flow	
5	%	50.0	SCCM	51.831	SCCM
10	%	100.0	SCCM	102.882	SCCM
20	%	200.0	SCCM	204.275	SCCM
30	%	300.0	SCCM	305.508	SCCM
40	%	400.0	SCCM	405.967	SCCM
50	%	500.0	SCCM	507.045	SCCM
60	%	600.0	SCCM	608.366	SCCM
70	%	700.0	SCCM	709.649	SCCM
80	%	800.0	SCCM	811.769	SCCM
90	%	900.0	SCCM	914.772	SCCM
100	%	1000.0	SCCM	1018.289	SCCM

Verified by: Terri Lundmark Date: 4-20-16

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Series 2020

System S/N 2012

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 4 Size: 100 SCCM

SERIAL NUMBER AW9804174

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. This is not performance data. This data is used by the system operating modes to improve the flow accuracy.

		Set Flow		True Flow	
5	%	5.0	SCCM	5.057	SCCM
10	%	10.0	SCCM	10.045	SCCM
20	%	20.0	SCCM	20.052	SCCM
30	%	30.0	SCCM	30.051	SCCM
40	%	40.0	SCCM	40.100	SCCM
50	%	50.0	SCCM	50.129	SCCM
60	%	60.0	SCCM	60.275	SCCM
70	%	70.0	SCCM	70.378	SCCM
80	%	80.0	SCCM	80.710	SCCM
90	%	90.0	SCCM	90.966	SCCM
100	%	100.0	SCCM	101.409	SCCM

Verified by: Terri Lundmark Date: 4-20-16

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Series 2020

System S/N 2012

ENVIRONICS FLOW CONTROLLER CALIBRATION SHEET

MFC # 5 Size: 10 SCCM

SERIAL NUMBER AW9407217

This flow controller was calibrated using a NIST-traceable Flow Standard. This calibration was performed with Nitrogen at a standard reference temperature and pressure of 32°F and 29.92 in. Hg. This is not performance data. This data is used by the system operating modes to improve the flow accuracy.

	Set Flow	True Flow
5 %	0.5 SCCM	0.535 SCCM
10 %	1.0 SCCM	1.068 SCCM
20 %	2.0 SCCM	2.091 SCCM
30 %	3.0 SCCM	3.114 SCCM
40 %	4.0 SCCM	4.134 SCCM
50 %	5.0 SCCM	5.148 SCCM
60 %	6.0 SCCM	6.163 SCCM
70 %	7.0 SCCM	7.180 SCCM
80 %	8.0 SCCM	8.200 SCCM
90 %	9.0 SCCM	9.228 SCCM
100 %	10.0 SCCM	10.248 SCCM

Verified by: Peri Lundmark Date: 4-20-16

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SERVICE REPORT

ATTN: John Wilson, Air Compliance Consultants Inc.

DATE OF SERVICE: 4/20/2016
SERIAL NUMBER: 2012

SERVICE TYPE: **REPAIR/RECALIBRATION**

CONDITIONS AS OBSERVED AND WORK PERFORMED:
-Unit boxed incorrectly and 2 boards disconnected and front handle broken upon arrival. Re-seated boards and filed jagged edges of handle.
-Batteries fell out of sockets, unit lost memory. Re-initialized system.
-Re-pinned power supply cable, output voltages were unsteady.
-Replaced PC204 mounting bracket that was broken.

ADDITIONAL TUNE-UP WORK PERFORMED:

- Unit powers up properly. All ports ref to N2.
- Unit cleaned and Purged.
- All valves checked, ok.
- Checked for any software updates
- Voltages checked – 5v, -15v, +15v, 24v.
- Battery voltages checked.
- Unit leak tested, cleaned port 4 solenoid.
- Tested all MFC's with each port.
- Zeros on each MFC checked and adjusted.
- All cables and screw/nuts tightened, ok.
- Spans checked on all MFCs.
- Incoming verification run on all MFCs.
- All MFCs recalibrated.
- Verified all MFC's @ 5 standard points, passed within 1.0%.

Scott Hugus
Service Technician
4/20/2016

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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

Airgas USA, LLC
2009 BELLAIRE AVENUE
ROYAL OAK, MI 48067
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E02NI99E15A3089	Reference Number:	32-400440448-1
Cylinder Number:	SG9107317BAL	Cylinder Volume:	144.3 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62014	Valve Outlet:	350
Gas Code:	CO,BALN	Certification Date:	Oct 16, 2014

Expiration Date: Oct 16, 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 MONOXIDE	245.0 PPM	246.7 PPM	G1	+/- 0.6% NIST Traceable	10/16/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12060334	CC353982	249.3 PPM CARBON MONOXIDE/NITROGEN	+/- 0.4%	Oct 26, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54 Nicolet 6700 CO	FTIR	Oct 14, 2014

Triad Data Available Upon Request

Signature on file

Approved for Release

Airgas

Airgas USA, LLC
2009 BELLAIRE AVENUE
ROYAL OAK, MI 48067
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	AIR COMPLIANCE		
Part Number:	E02NI99E15A0919	Reference Number:	32-400440450-1
Cylinder Number:	CC192432	Cylinder Volume:	144.4 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62014	Valve Outlet:	660
Gas Code:	NO,BALN	Certification Date:	Oct 28, 2014

Expiration Date: Oct 28, 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
NOX	500.0 PPM	498.5 PPM	G1	+/- 0.7% NIST Traceable	10/20/2014, 10/28/2014
NITRIC OXIDE	500.0 PPM	497.9 PPM	G1	+/- 0.7% NIST Traceable	10/20/2014, 10/28/2014
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12061044	CC359541	500.7 PPM NITRIC OXIDE/NITROGEN	+/-0.50%	Feb 16, 2018
PRM	12329	726612	25.02 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.5%	Oct 15, 2014
GMIS	A124199110104	CC323259	15.05 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.6%	Nov 08, 2016

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
E/N 54 Nicolet 6700 NO	FTIR	Oct 01, 2014
E/N 54 Nicolet 6700 NO2	FTIR	Oct 06, 2014

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:	E02NI99E15A3615	Reference Number:	32-400640527-1
Cylinder Number:	XC032784B	Cylinder Volume:	144.3 CF
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62015	Valve Outlet:	660
Gas Code:	NO,NOX,BALN	Certification Date:	Dec 22, 2015

Expiration Date: Dec 22, 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
NOX	100.0 PPM	99.93 PPM	G1	+/- 1.0% NIST Traceable	12/14/2015, 12/22/2015
NITRIC OXIDE	100.0 PPM	99.87 PPM	G1	+/- 1.0% NIST Traceable	12/14/2015, 12/22/2015
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	13061019	CC423262	99.86 PPM NITRIC OXIDE/NITROGEN	+/- 0.8%	Nov 19, 2019
PRM	12329	726612	25.02 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.5%	Oct 15, 2014
GMIS	812201409	CC500636	15.04 PPM NITROGEN DIOXIDE/NITROGEN	+/-2.0%	Aug 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
E/N 54 Nicolet 6700 NO	FTIR	Dec 07, 2015
E/N 54 Nicolet 6700 NO2	FTIR	Dec 07, 2015

Triad Data Available Upon Request

Approved for Release

Airgas

Airgas USA, LLC
2009 Bellaire Ave.
Royal Oak, MI 48067-8020
248-399-8020
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Customer:	OAKWOOD		
Part Number:	E02NI99E15A0016	Reference Number:	32-400209352-1
Cylinder Number:	CC405423	Cylinder Volume:	144.4 Cubic Feet
Laboratory:	MIC - Royal Oak-32 (SAP) - MI	Cylinder Pressure:	2015 PSIG
PGVP Number:	B62013	Valve Outlet:	660
Gas Code:	SO2,BALN	Certification Date:	Jun 18, 2013

Expiration Date: Jun 18, 2021

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
SULFUR DIOXIDE	250.0 PPM	250.6 PPM	G1	+/- 1% NIST Traceable	06/11/2013, 06/18/2013
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	11060849	CC343231	241.0 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	May 13, 2017

ANALYTICAL EQUIPMENT

Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
E/N 54, 250ppmFS SO2, Nicolet 6700	FTIR	Jun 12, 2013

Triad Data Available Upon Request

Notes:

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

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 Specialty Gases
12722 South Wentworth Avenue
Chicago, IL 60628
(773) 785-3000 Fax: (773) 785-1928
www.airgas.com

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number:	E03NI99E15A07A0	Reference Number:	54-124386145-1
Cylinder Number:	CC500514	Cylinder Volume:	144.4 CF
Laboratory:	ASG - Chicago - IL	Cylinder Pressure:	2015 PSIG
PGVP Number:	B12013	Valve Outlet:	660
Gas Code:	NO2,O2,BALN	Certification Date:	Aug 07, 2013

Expiration Date: Aug 07, 2016

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
NITROGEN DIOXIDE	100.0 PPM	101.1 PPM	G1	+/- 2.0%	07/29/2013, 08/07/2013
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
GMIS/NO2	124320129107	CC411587	195.2 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.1%	Sep 27, 2015
PRM	12315	726637	250.1 PPM NITROGEN DIOXIDE/NITROGEN	+/- 1.0%	Mar 15, 2013

The SRM or PRM 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
MKS Multigas 17707558	FTIR	Jul 10, 2013

Triad Data Available Upon Request

Notes:

Approved for Release

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Montrose Minimum Detection Limits for FTIR Compounds			
Client	ArcelorMittal	**Unit**	Boilers 1 and 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 12, 2016	**Analyte**	HCL, HF, HCN

Scan	Date	Time	HCl (ppm_{wv})	HF (ppm_{wv})	HCN (ppm_{wv})
3	10/12/2016	11:23:35 AM	-0.227	0.046	-0.293
4	10/12/2016	11:24:35 AM	-0.185	0.047	-0.547
5	10/12/2016	11:25:34AM	0.015	0.048	-0.112
6	10/12/2016	11:26:34 AM	-0.085	0.048	-0.202
7	10/12/2016	11:27:33 AM	-0.135	0.048	-0.248
8	10/12/2016	11:28:33 AM	-0.247	0.045	-0.279
9	10/12/2016	11:29:33 AM	-0.135	0.049	-0.224
Averages			-0.143	0.047	-0.272
Standard Deviation			0.089	0.001	0.135
Calculated MDL (3 x SD, or average)			0.27	0.047	0.41
MDL Used			0.27	0.047	0.41

Montrose Raw Spike Recovery Data			
Client	ArcelorMittal	**Unit**	Boilers 1 and 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 12, 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
Project No	16-167
Plant	Monessen, PA
Unit	Boilers 1 and 2
Operation	Normal
Date	October 12, 2016
Tester(s)	BC, JV, JW, TL, TM

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	**Unit**	Boilers 1 and 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 12, 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
Project No	16-167
Plant	Monessen, PA
Unit	Boilers 1 and 2
Operation	Normal
Date	October 12, 2016
Tester(s)	BC, JV, JW, TL, TM

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	**Unit**	Boilers 1 and 2
Project No	16-167	**Operation**	Normal
Plant	Monessen, PA	**Location**	Exhaust Stack
Date	October 12, 2016	**Analyte**	HCN

Data Point	Scan #	Date	Time	Analyte,Calibration Gas (ppmwv)
Pre Test Internal				
1	104	10/12/2016	11:57:25 AM	95.27
2	105	10/12/2016	11:57:40 AM	95.30
3	106	10/12/2016	11:57:54 AM	95.27
4	107	10/12/2016	11:58:09 AM	95.37
5	108	10/12/2016	11:58:24 AM	95.27
AVERAGES				**95.29**
Pre Test External				
1	7	10/12/2016	1:03:24 PM	96.93
2	8	10/12/2016	1:04:24 PM	97.35
3	9	10/12/2016	1:05:25 PM	97.50
AVERAGES				**97.26**
Post Test 1 External				
1	119	10/12/2016	2:26:36 PM	97.11
2	120	10/12/2016	2:27:37 PM	97.27
3	121	10/12/2016	2:28:37 PM	97.30
AVERAGES				**97.22**
Post Test 2 External				
1	190	10/12/2016	3:38:22 PM	96.06
2	191	10/12/2016	3:39:22 PM	96.25
3	192	10/12/2016	3:40:23 PM	96.45
AVERAGES				**96.25**
Post Test 3 External				
1	267	10/12/2016	4:56:11 PM	95.46
2	268	10/12/2016	4:57:12 PM	95.94
3	269	10/12/2016	4:58:12 PM	95.95
AVERAGES				**95.78**

Montrose FTIR Stability Check Data (Calibration Transfer Standard - CTS)

Client	ArcelorMittal
Project No	16-167
Plant	Monessen, PA
Unit	Boilers 1 and 2
Operation	Normal
Tester(s)	October 12, 2016
Date	BC, JV, JW, TL, TM

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	97.26	2.07	Pass
Post Run 1	97.22	2.03	Pass
Post Run 2	96.25	1.00	Pass
Post Run 3	95.78	0.51	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

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 7TH DAY OF JANUARY 2014 AND EFFECTIVE UNTIL JANUARY 6TH, 2019

Peter R. Westlip, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Theresa Lowe, 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

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

JOSHUA S. VARNER

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 12TH DAY OF FEBRUARY 2013 AND EFFECTIVE UNTIL FEBRUARY 11TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2008-173

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOSHUA S. VARNER

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 12TH DAY OF FEBRUARY 2013 AND EFFECTIVE UNTIL FEBRUARY 11TH, 2018

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, 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. 2008-173

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. 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

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 201A/202

SAMPLE CALCULATIONS
M201A/M202
ArcelorMittal
Monessen, PA
M201A/M202
October 11, 2016
Run 1
Common Stack

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	2,975.2	g	K1method 4	0.04706	scf/ml
Wi	2,631.8	g	K2method 4	0.04715	scf/g
Vm	62.421	dacf	K1method 5	17.64	R/in. Hg
			K4method 5	0.0945	
Yd	1.003		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.02	in. Hg	Kp	85.49	
dHavg	0.36	in. H2O	p_a	0.7899	g/ml
Tm	65.7	F	π	3.141593	
O2	5.02	% dv	Ds (or L)	67.00	inches
CO2	7.19	% dv	Stack Width (W)	0.00	inches
Pg	-0.38	in. H2O	Dn	0.253	inches
Cp	0.84		θ	207.67	minutes
$(dP)^{1/2}$avg	0.445	in. H2O^1/2	Tsavg	459.2	°F
F_d	NA	dscf/MMBtu	Ts	918.8	°R

Particulate Weight

Acetone Blank					
Va	200	ml	Inorganic Weight		
Acetone Blank W1	113,926.6	mg	Final 1	2,307.7	mg
Acetone Blank W2	113,926.8	mg	Final 2	2,308.0	mg
Acetone Blank Tare W1	113,926.0	mg	Tare 1	2,278.6	mg
Acetone Blank Tare W2	113,925.9	mg	Tare 2	2,278.6	mg
PM < 2.5 microns			Organic Weight		
Vaw(PM<2.5)	50.0	ml	Final 1	2,330.3	mg
Acetone Wash (PM<2.5) Tare W1	97,467.6	mg	Final 2	2,330.4	mg
Acetone Wash (PM<2.5) Tare W2	97,467.6	mg	Tare 1	2,325.0	mg
F2 (PM<2.5)	97,475.3	mg	Tare 2	2,325.2	mg
F1 (PM<2.5)	97,475.0	mg	Normality of NaOH	0.1	N
			Volume of Titrant	4.05	ml
PM2.5 Filter			Field Water Blank	0.3	mg
$PM_{2.5}$ Filter Tare W1	109.9	mg	Hexane Field Blank	0.70	mg
$PM_{2.5}$ Filter Tare W2	109.9	mg			
$PM_{2.5}$ Filter Final F1	112.4	mg			
$PM_{2.5}$ Filter Final F1	112.5	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=	2,975.2	g
Wi=	2,631.8	g
Vwsg(std)=	16.191	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	16.191	scf
Vw(std)=	16.191	scf

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=	62.421	dacf
Yd=	1.0030	
Pbar=	29.02	in. Hg
dHavg=	0.36	in. H2O
Tm=	65.7	F
Vm(std)=	61.021	dscf

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=	459.2 °F	
	T=	918.8 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	
	$SP_{H2O@Tsavg}$=	942.86 in. Hg	
	Ps=	28.99 in. Hg	
	Bws=	1.0000 vol. fraction	
	Bws = Vw(std) / (Vm(std) + Vw(std))		
	Vw(std)=	16.191 scf	
	Vm(std)=	61.021 dscf	
	Bws=	0.2097 vol. fraction	
	Bws used=	0.2097 vol. fraction	

Carbon Monoxide and Nitrogen in gas

	CO + N2 = 100 - (CO2 + O2)	
	CO2=	7.19 % dv
	O2=	5.02 % dv
	CO + N2=	87.79 % dv

Molecular weight of dry gas stream

	Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)	
	CO2=	7.19 % dv
	O2=	5.02 % dv
	CO + N2=	87.79 % dv
	Md=	29.35 lb/lb-mole

Molecular weight of wet gas stream

	Ms = Md * (1 - Bws) + 18 * Bws	
	Md=	29.35 lb/lb-mole
	Bws=	0.2097 vol. fraction
	Ms=	26.97 lb/lb-mole

Stack Pressure

	Ps = Pbar + Pg/13.6	
	Pbar=	29.02 in. Hg
	Pg=	-0.38 in. H2O
	Ps=	28.99 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=	0.4447 in. H2O^1/2
	Tsavg=	459.2 °F
	Ps=	28.99 in. Hg
	Ms=	26.97 lb/lb-mole
	Vs=	34.62 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=	67.00 inches
	As=	24.48 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=	34.62	ft/s
As=	24.48	ft2
Qacfm=	50,860	acfm

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)		
Qacfm=	50,860	acfm
Tstandard=	68	F
Tsavg=	459.2	°F
Ps=	28.99	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	28,309	scfm

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	28,309	scfm
Bws=	0.2097	vol. fraction
Qdscfm=	22,373	dscfm

Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2		
PI=	3.141593	
Dn=	0.253	inches
An=	0.000349	ft2

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))		
K4method5=	0.0945	
Tsavg=	459.2	°F
Vm(std)=	61.021	dscf
Ps=	28.99	in. Hg
Vs=	34.62	ft/s
An=	0.000349	ft2
Theta=	207.67	minutes
Bws=	0.2097	vol. fraction
I=	92.16	%

Acetone Blank Concentration

$Ca = m_a / (Va * p_a)$			
m_a = average final (total) weight after evaporation - average tare weight			
Final (total) weight 1 after evaporation=		113,926.6 mg	
Final (total) weight 2 after evaporation=		113,926.8 mg	
Final (total) weight difference (absolute value)=		0.2 mg	Must be <=0.5 mg
Average final (total) weight after evaporation=		113,926.70 mg	
Tare weight 1=		113,926.0 mg	
Tare weight 2=		113,925.9 mg	
Tare weight difference (absolute value)=		0.1 mg	Must be <=0.5 mg
Average tare weight		113,925.95 mg	
m_a=	0.75 mg	With a minimum allowable value of 0	
Va=	200 ml		
p_a=	0.7899 g/ml		
Ca=	0.0047 mg/g	With a maximum allowable value of 0.01	

Total Weight of Particulate (PM_{10} and $PM_{2.5}$)

Acetone Wash PM<2.5 Final (total) weight 1		97,475.3 mg	
Acetone Wash PM<2.5 Final (total) weight 2		97,475.0 mg	
Acetone Wash Final (total) weight difference (absolute value)=		0.3 mg	Must be <=0.5 mg
Average final (total) weight=		97,475.15 mg	
Tare weight 1=		97,467.6 mg	
Tare weight 2=		97,467.6 mg	
Tare weight difference (absolute value)=		0 mg	Must be <=0.5 mg
Average tare weight		97,467.60 mg	
PM<2.5 Acetone wash weight gain=	7.55 mg		
PM<2.5 Acetone Volume		50 ml	
Ca		0.00 mg/g	
p_a		0.7899 g/ml	
Wa(PM<2.5)=	0.19 mg		
PM<2.5 Acetone wash weight gain - Wa=	7.36 mg	With a minimum allowable value of 0	
Filter weight gain = average final (total) weight - average tare weight			
Final (total) weight 1		112.4 mg	
Final (total) weight 2		112.5 mg	
Final (total) weight difference (absolute value)=		0.1 mg	Must be <=0.5 mg
Average final (total) weight=		112.45 mg	
Tare weight 1=		109.9 mg	
Tare weight 2=		109.9 mg	
Tare weight difference (absolute value)=		0 mg	Must be <=0.5 mg
Average tare weight		109.90 mg	
Filter weight gain=	2.55 mg	With a minimum allowable value of 0	
Organic condensable gross weight 1		2,330.3 mg	
Organic condensable gross weight 2		2,330.4 mg	
Organic cond. (total) weight diff. (absolute value)=		0 mg	Must be <=0.5 mg
Organic condensable gross weight avg.	2,330.35 mg		
Organic condensable tare weight 1		2,325.0 mg	
Organic condensable tare weight 2		2,325.2 mg	
Organic cond. (tare) weight diff. (absolute value)=		0 mg	Must be <=0.5 mg
Organic condensable tare weight average	2,325.10 mg		
Organic fraction particulate=	5.2500 mg		
Inorganic condensable gross weight 1	2,307.7 mg		
Inorganic condensable gross weight 2	2,308.0 mg		
Inorganic cond. (total) weight diff. (absolute value)=		0 mg	Must be <=0.5 mg
Inorganic condensable gross weight avg.	2,307.85 mg		
Inorganic condensable tare weight 1	2,278.6 mg		
Inorganic condensable tare weight 2	2,278.6 mg		
Inorganic cond. (tare) weight diff. (absolute value)=		0 mg	Must be <=0.5 mg
Inorganic condensable tare weight average	2,278.6 mg		
Uncorrected Inorganic fraction particulate=	29.25 mg		
Normality of NH_4OH	0.1000 N		
Volume of Titrant	4.0500 ml		
Mass of NH4 (17.03*N*Volume)	6.90 mg		
Weight of inorganic fraction, ammonia corrected [2]	22.35 mg	With a minimum allowable value of 0	
Total condensable particulate= Organic + Inorganic - Blanks			
Organic Weight =	22.35 mg		
Inorganic Weight =	5.25 mg		
Hexane + Water Blanks =	1.05 mg		Max value of 2.0 mg
Total condensable particulate=	26.55 mg		
Total PM < 2.5 microns	36.47 mg		

PM-2.5 Emission Concentration (gr/dscf)

$PM_{2.5}$(gr/dscf) = 0.001 * (y / Vm(std)) * 15.43

$PM_{2.5}$ weight =	36.47	mg
Vm(std)=	61.021	dscf
$PM_{2.5}$(gr/dscf)=	0.009	gr/dscf

PM-2.5 Emission Rate (lb/hr)

$PM_{2.5}$(lb/hr) = PM-2.5(gr/dscf) * (1 lb / 7000 grains) * Qdscfm * (60 min / 1 hr)

$PM_{2.5}$ (gr/dscf)=	0.009	gr/dscf
Qdscfm=	22,373	dscfm
$PM_{2.5}$ (lb/hr)=	1.77	lb/hr

Gas Viscosity (Final)

$\mu = C1 + C2*Ts^{0.5} + C3*Ts^{-2} + C4*O2_{,wet} - C5*Bws + C6*Bws*Ts^2$

C1 =	-150.3162	micropoise
C2 =	13.4622	micropoise/$R^{0.5}$
C3 =	3.86E+06	micropoise/R^2
C4 =	0.591123	micropoise
C5 =	91.9723	micropoise
C6 =	1.52E-05	micropoise/R^2
Ts =	918.8	°R
O2, dry=	5.02	%, dv
Bws =	0.2097	vol. fraction
μ =	248.07	micropoise

Cunningham Correction Factor (for a 2.25 micrometer diameter particle)

$C = 1 + .0057193\ [\mu / (Ps * Dp)] * [Ts/Mw]^{0.5}$

μ =	248.07	micropoise
Ps =	28.99	in. Hg
Dp =	2.25	(set value for 2.25 micrometer calculation)
Ts =	918.8	°R
Mw =	26.97	lb/lb-mole
C =	1.1270	

Lower Limit Cut Diameter for Cyclone 1 (PM_{10}) for Nre < 3162

$D50_{LL(PM10)} = 9.507 * C^{0.3007} * [(Mw * Ps) / Ts]^{0.1993}$

C =	1.1270	
Mw =	26.97	lb/lb-mole
Ps =	28.99	in. Hg
Ts =	918.8	°R
$D50_{LL(PM10)}$ =	9.54	micrometers

Cut Diameter for Cyclone I (PM_{10}) for the Middle of the Overlap Zone

$D50_{T(PM10)} = [(11 + D50_{LL}) / 2]$

$D50_{LL(PM10)}$ =	9.54	micrometers
$D50_{T(PM10)}$ =	10.27	micrometers

$(9 < D50_{T(PM10)} < 11)$

Optimal Sampling Rate

$Q_I = Qs(optimal) = 0.07296 * \mu * [Ts / (Mw*Ps)]^{0.2949} * [1/D50_T]^{1.4102}$

μ =	248.07	micropoise
Ts =	918.8	°R
Mw =	26.97	lb/lb-mole
Ps =	28.99	in. Hg
$D50_{T(PM10)}$ =	10.27	micrometers
Q_I = Qs(optimal) =	0.711	scfm

Sampling Flow Rate @ Standard Conditions

$Qs_{ST} = Vms / \theta$

Vms =	61.021	dscf
θ=	207.67	min
Qs_{ST} =	0.294	scfm

Actual Sampling Rate

$Qs = 29.92/528*Qs_{ST}*[1/(1-Bws)]*[Ts/Ps]$

Qs_{ST} =	0.294	scfm
Bws =	0.2097	vol. fraction
Ts =	918.8	°R
Ps =	28.99	in. Hg
Qs =	0.668	scfm

Reynolds Number (Final)

$Nre = 8.64 \times 10^5 * [(Ps * Mw) / Ts] * [Qs / \mu]$

Ps =	28.99	in. Hg
Mw =	26.97	lb/lb-mole
Ts =	918.8	°R
Qs =	0.668	scfm
μ =	248.07	micropoise
Nre =	1,979.1	

Actual Particle Cut Diameter for Cyclone I (PM_{10} Actual Cut Size)

$D50_{(PM10)} = 0.15625 * [Ts/(Mw*Ps)]^{0.2091} * [\mu/Qs]^{0.7091}$

Ts =	918.8	°R
Mw =	26.97	lb/lb-mole
Ps =	28.99	in. Hg
μ =	248.07	micropoise
Qs =	0.668	scfm
$D50_{(PM10)}$ =	10.74	

Particle Cut Size for Cyclone IV ($PM_{2.5}$)

if Reynolds number is greater than 3,162, then :

$D50_{(PM2.5)} = 0.0024302 * [\mu/Qs]^{1.1791}*[1/C]^{0.5}*[Ts/(Ps*Mw]^{0.6790}$

if Reynolds number is less than or equal to 3,162, then :

$D50_{(PM2.5)} = 0.019723 * [\mu/Qs]^{0.8058}*[1/C]^{0.5}*[Ts/(Ps*Mw]^{0.3058}$

Nre =	1,979.1	
μ =	248.07	micropoise
Qs =	0.668	scfm
C=	1.1270	
Ts =	918.8	°R
Ps =	28.99	in. Hg
Mw =	26.97	lb/lb-mole
for Nre < 3,162 $D50_{(PM2.5)}$ =	2.739	micrometers
for Nre ≥ 3,162 $D50_{(PM2.5)}$ =	2.298	micrometers
$D50_{(PM2.5)}$ =	2.739	micrometers

($2.25 < D50_{(PM2.5)} < 2.75$)

Re-estimated Cunningham Correction Factor

$Cr = 1 + .0057193 [\mu / (Ps * D50_{(PM2.5)})] * [Ts/Mw]^{0.5}$

μ =	248.07	micropoise
Ps =	28.99	in. Hg
$D50_{(PM2.5)}$ =	2.739	micrometers
Ts =	918.8	°R
Mw =	26.97	lb/lb-mole
C =	1.1043	

Recalculated Particle Cut Size for Cyclone IV ($PM_{2.5}$)

if Reynolds number is greater than 3,162, then :

$D50\text{-}1_{(PM2.5)} = 0.0024302 * [\mu/Qs]^{1.1791}*[1/C]^{0.5}*[Ts/(Ps*Mw]^{0.6790}$

if Reynolds number is less than or equal to 3,162, then :

$D50\text{-}1_{(PM2.5)} = 0.019723 * [\mu/Qs]^{0.8058}*[1/C]^{0.5}*[Ts/(Ps*Mw]^{0.3058}$

Nre =	1,979.1	
μ =	248.07	micropoise
Qs =	0.668	scfm
Cr=	1.1043	
Ts =	918.8	°R
Ps =	28.99	in. Hg
Mw =	26.97	lb/lb-mole
for Nre < 3,162 $D50\text{-}1_{(PM2.5)}$ =	2.767	micrometers
for Nre ≥ 3,162 $D50\text{-}1_{(PM2.5)}$ =	2.321	micrometers
$D50\text{-}1_{(PM2.5)}$ =	2.767	micrometers

Ratio (Z) between $D50_{(PM2.5)}$ and $D50\text{-}1_{(PM2.5)}$

$Z = D50\text{-}1_{(PM2.5)} / D50_{(PM2.5)}$

$D50\text{-}1_{(PM2.5)}$ =	2.767	micrometers
$D50_{(PM2.5)}$ =	2.739	micrometers
Z =	1.010	

($0.99 < Z < 1.01$)

Method 5

SAMPLE CALCULATIONS
Particulate Matter Test Results
ArcelorMittal Monessen
16-167
Monessen, PA
Boilers 1 and 2
Normal
October 11, 2016
Common Stack
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,821.4	g	K1method 4	0.04707	scf/ml
Wi	4,222.8	g	K2method 4	0.04715	scf/g
Vm	111.738	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.02	in. Hg	Kp	85.49	
dHavg	1.27	in. H2O			
Tm	71.5	F	π	3.141593	
O2	4.99	% dv	Ds (or L)	67.00	inches
CO2	7.15	% dv	Stack Width (W)	0.00	inches
Pg	-0.38	in. H2O	Dn	0.330	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.456	in. H2O^1/2	Tsavg	458.5	F
F_d	NA	dscf/MMBtu			

Particulate Data

Acetone Wash Volume (Vaw)	94	ml
Acetone Wash Weight Gain	17.7	mg
Front Half Filter Particulate	12.2	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=	4,821.4	g
Wi=	4,222.8	g
Vwsg(std)=	28.224	scf

3. Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	28.224	scf
Vw(std)=	28.224	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=	111.738	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	111.738	dacf

$Vm(m^3) = Vm * (1\ m^3 / 35.3145\ cf)$

Vm=	111.738	dacf
$Vm(m^3)$=	3.164	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=	111.738	dacf
Yd=	1.0030	
Pbar=	29.02	in. Hg
dHavg=	1.27	in. H2O
Tm=	71.5	F
Vm(std)=	108.287	dscf

$Vm(std)m^3 = Vm(std) * (1\ m^3 / 35.3145\ cf)$

Vm(std)=	108.287	dscf
$Vm(std)m^3$=	3.066	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=	458.5	F
T=	918.2	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	
$SP_{H2O@Tsavg}$=	936.79	in. Hg
Ps=	28.99	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	28.224	scf
Vm(std)=	108.287	dscf
Bws=	0.2068	vol. fraction
Bws used=	0.2068	vol. fraction

7. Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	7.15	% dv
O2=	4.99	% dv
CO + N2=	87.86	% dv

8. Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	7.15	% dv
O2=	4.99	% dv
CO + N2=	87.86	% dv
Md=	29.34	lb/lb-mole

9. Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.34	lb/lb-mole
Bws=	0.2068	vol. fraction
Ms=	27.00	lb/lb-mole

10. Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.02	in. Hg
Pg=	-0.38	in. H2O
Ps=	28.99	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=	0.4565	in. H2O^1/2
Tsavg=	458.5	F
Ps=	28.99	in. Hg
Ms=	27.00	lb/lb-mole
Vs=	35.51	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=	67.00	inches
As=	24.48	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=	35.51	ft/s
As=	24.48	ft2
Qacfm=	52,164	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	52,164	acfm
Qacm/min=	1,477	acm/min

14. Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	52,164	acfm
Tstandard=	68	F
Tsavg=	458.5	F
Ps=	28.99	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	29,056	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	29,056	scfm
Qscm/min=	823	scm/min

15. Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	29,056	scfm
Bws=	0.2068	vol. fraction
Qdscfm=	23,049	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	23,049	dscfm
Qdscm/min=	653	dscm/min

16. Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.330	inches
An=	0.000594	ft2

17. Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	458.5	F
Vm(std)=	108.287	dscf
Ps=	28.99	in. Hg
Vs=	35.51	ft/s
An=	0.000594	ft2
Theta=	180	minutes
Bws=	0.2068	vol. fraction
I=	107.66	%

18. Total Weight of Particulate

m_n = acetone wash weight gain - Wa + condensible + filter weight gain

Acetone wash weight gain - Wa=	17.7000	mg	With a minimum allowable value of 0
Filter weight gain=	12.2000	mg	With a minimum allowable value of 0
m_n=	29.9000	mg	

19. Emission Concentration (gr/DSCF)

Particulate(gr/dscf) = 0.001 * (m_n / Vm(std)) * 15.43

m_n=	29.9000	mg
Vm(std)=	108.287	dscf
Particulate(gr/dscf)=	0.0043	gr/dscf

20. Emission Rate (lb/hr)

Particulate(lb/hr) = Particulate(gr/dscf) * (1 lb / 7000 grains) * Qdscfm * (60 min / 1 hr)

Particulate(gr/dscf)=	0.0043	gr/dscf
Qdscfm=	23,049	dscfm
Particulate(lb/hr)=	0.84	lb/hr

Method 29

SAMPLE CALCULATIONS
Metals Testing Results
ArcelorMittal Monessen
16-167
Monessen, PA
Boilers 1 and 2
Normal
October 11, 2016
Common Stack
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	4,821.4	g	K1method 4	0.04707	scf/ml
Wi	4,222.8	g	K2method 4	0.04715	scf/g
Vm	111.738	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.02	in. Hg	Kp	85.49	
dHavg	1.27	in. H2O			
Tm	71.5	F	π	3.141593	
O2	4.99	% dv	Ds (or L)	67.00	inches
CO2	7.15	% dv	Stack Width (W)	0.00	inches
Pg	-0.38	in. H2O	Dn	0.330	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.456	in. H2O^1/2	Tsavg	458.5	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=	4,821.4	g
Wi=	4,222.8	g
Vwsg(std)=	28.224	scf

3. Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	28.224	scf
Vw(std)=	28.224	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=	111.738	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	111.738	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	111.738	dacf
$Vm(m^3)$=	3.164	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=	111.738	dacf
Yd=	1.0030	
Pbar=	29.02	in. Hg
dHavg=	1.27	in. H2O
Tm=	71.5	F
Vm(std)=	108.287	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	108.287	dscf
$Vm(std)m^3$=	3.066	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=	458.5	F
T=	918.2	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	
$SP_{H2O@Tsavg}$=	936.79	in. Hg
Ps=	28.99	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	28.224	scf
Vm(std)=	108.287	dscf
Bws=	0.2068	vol. fraction
Bws used=	0.2068	vol. fraction

7. Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	7.15	% dv
O2=	4.99	% dv
CO + N2=	87.86	% dv

8. Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	7.15	% dv
O2=	4.99	% dv
CO + N2=	87.86	% dv
Md=	29.34	lb/lb-mole

9. Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.34	lb/lb-mole
Bws=	0.2068	vol. fraction
Ms=	27.00	lb/lb-mole

10. Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.02	in. Hg
Pg=	-0.38	in. H2O
Ps=	28.99	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=	0.4565	in. H2O^1/2
Tsavg=	458.5	F
Ps=	28.99	in. Hg
Ms=	27.00	lb/lb-mole
Vs=	35.51	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=	67.00	inches
As=	24.48	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=	35.51	ft/s
As=	24.48	ft2
Qacfm=	52,164	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	52,164	acfm
Qacm/min=	1,477	acm/min

14. Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	52,164	acfm
Tstandard=	68	F
Tsavg=	458.5	F
Ps=	28.99	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	29,056	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	29,056	scfm
Qscm/min=	823	scm/min

15. Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	29,056	scfm
Bws=	0.2068	vol. fraction
Qdscfm=	23,049	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	23,049	dscfm
Qdscm/min=	653	dscm/min

16. Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2

PI=	3.141593	
Dn=	0.330	inches
An=	0.000594	ft2

17. Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	458.5	F
Vm(std)=	108.287	dscf
Ps=	28.99	in. Hg
Vs=	35.51	ft/s
An=	0.000594	ft2
Theta=	180	minutes
Bws=	0.2068	vol. fraction
I=	107.66	%

18. Mercury Emission Concentration - Fraction 1B (mg/DSCM)

EC=(Emission mass 1B)/Vmstd/1000 (ug/mg)

Emission Mass=	0.018	ug
Vm(std)m^3=	3.066	dscm
EC=	5.87E-06	mg/dscm

19. Mercury Emission Rate (lb/hr)

E=(EC)* Qdscm/min *60 *(1 lb/453593 mg)

EC=	5.87E-06	mg/dscm
Qdscm/min=	653	dscm/min
E=	5.07E-07	lb/hr

Methods 0010/23

SAMPLE CALCULATIONS
PCDD/PCDF Test Results
ArcelorMittal
16-167
Monessen, PA
Boilers 1 and 2
Normal
Combined Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,891.1	g	K1method 4	0.04706	scf/ml
Wi	3,194.8	g	K2method 4	0.04715	scf/g
Vm	155.578	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.003		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.27	in. Hg	Kp	85.49	
dHavg	2.54	in. H2O	p_a	0.0	0
Tm	91.2	F	π	3.141593	
O2	5.39	% dv	Ds (or L)	67.00	inches
CO2	7.33	% dv	Stack Width (W)	NA	inches
Pg	-0.37	in. H2O	Dn	0.395	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.489	in. H2O^1/2	Tsavg	455.5	F
F_d	0	dscf/MMBtu	Product rate	0.00	0.00
TEF Adjusted Total	0.018	ng	2378-TCDD	1.0	TEF
Napthalene	20	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=	3,891.1	g
Wi=	3,194.8	g
Vwsg(std)=	32.831	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	32.831	scf
Vw(std)=	32.831	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=	155.578	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	155.578	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	155.578	dacf
$Vm(m^3)$=	4.405	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=	155.578	dacf
Yd=	1.0030	
Pbar=	29.27	in. Hg
dHavg=	2.54	in. H2O
Tm=	91.2	F
Vm(std)=	147.096	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	147.096	dscf
$Vm(std)m^3$=	4.165	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=	455.5	F
T=	915.2	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	
$SP_{H2O@Tsavg}$=	909.55	in. Hg
Ps=	29.24	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	32.831	scf
Vm(std)=	147.096	dscf
Bws=	0.1825	vol. fraction
Bws used=	0.1825	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	7.33	% dv
O2=	5.39	% dv
CO + N2=	87.28	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	7.33	% dv
O2=	5.39	% dv
CO + N2=	87.28	% dv
Md=	29.39	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.39	lb/lb-mole
Bws=	0.1825	vol. fraction
Ms=	27.31	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6		
Pbar=	29.27	in. Hg
Pg=	-0.37	in. H2O
Ps=	29.24	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=	0.4890	in. H2O^1/2
Tsavg=	455.5	F
Ps=	29.24	in. Hg
Ms=	27.31	lb/lb-mole
Vs=	37.60	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=		67.00	inches
As=		24.48	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=	37.60	ft/s
As=	24.48	ft2
Qacfm=	55,229	acfm
Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)		
Qacfm=	55,229	acfm
Qacm/min=	1,564	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)		
Qacfm=	55,229	acfm
Tstandard=	68	F
Tsavg=	455.5	F
Ps=	29.24	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	31,130	scfm
Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)		
Qscfm=	31,130	scfm
Qscm/min=	882	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	31,130	scfm
Bws=	0.1825	vol. fraction
Qdscfm=	25,450	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	25,450	dscfm
Qdscm/min=	721	dscm/min

Area of the Nozzle

An = PI * (Dn)^2 / 4 * (1 ft / 12 in.)^2		
PI=	3.141593	
Dn=	0.395	inches
An=	0.000851	ft2

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))		
K4method5=	0.0945	
Tsavg=	455.5	F
Vm(std)=	147.096	dscf
Ps=	29.24	in. Hg
Vs=	37.60	ft/s
An=	0.000851	ft2
Theta=	180	minutes
Bws=	0.1825	vol. fraction
I=	92.4	%

PCDD/PCDF TEF Adjusted Amount

PCDD/PCDF Adj Amt = TEFcompound * Mass Detected		
TEF compound 2378-TCDD =	1.0	TEF
Mass Detected =	0.0034	ng
PCDD/PCDF Adj Amt =	0.0034	ng

PCDD/PCDF Emission Concentration (ng/m3)

ng/m^3 = PCDD/PCDF Total Mass Collected /Vm(std)m^3		
Total Adjusted Mass Collected =	0.0182	ng
Vm(std)m^3 =	4.165	dscm
ng/m^3	0.0044	ng/m^3

PCDD/PCDF Emission Rate (ng/hr)

ng/hr = ng/m^3 * Qdscm/min * 60		
ng/m^3 =	0.0044	ng/m3
Qdscm/min =	721	dscm/min
ng/hr =	189	ng/hr

Naphthalene Emission Concentration (mg/m3)

mg/m3 = Sample Mass / Sample Volume / (1000 ug/mg)		
Naphthalene mass =	20	micrograms
Vm(std)m^3 =	4.165	dscm
Naphthalene conc. =	0.0048	mg/dscm

Naphthalene Emission Rate (lb/hr)

lb/hr = Conc. (mg/m3) * Qdscm/min * (60 min/hr) * (2.2046e-6 lbs/mg)		
Naphthalene conc. =	0.0048	mg/dscm
Qdscm/min =	721	dscm/min
Naphthalene emission rate =	0.00046	lb/hr

Method 315

SAMPLE CALCULATIONS
Toluene Soluable
ArcelorMittal
16-167
Monessen, PA
Boilers 1 and 2
Normal
October 12, 2016
Common Stack
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,078.3	g	K1method 4	0.04706	scf/ml
Wi	2,709.8	g	K2method 4	0.04715	scf/g
Vm	76.652	dacf	K1method 5	17.64	R/in. Hg
			K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.27	in. Hg	Kp	85.49	
dHavg	0.59	in. H2O			
Tm	91.2	F	π	3.141593	
O2	5.39	% dv	Ds (or L)	67.00	inches
CO2	7.33	% dv	Stack Width (W)	NA	inches
Pg	-0.37	in. H2O	Dn	0.286	inches
Cp	0.84		Time	180	minutes
$(dP)^{1/2}$avg	0.438	in. H2O^1/2	Tsavg	461.6	F
F_d	NA	dscf/MMBtu	An	0.0004	ft2

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=	3,078.3	g
Wi=	2,709.8	g
Vwsg(std)=	17.375	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	17.375	scf
Vw(std)=	17.375	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=		76.652 dacf	
Volume metered in dry actual liters=		0.000	0.000
Vm=	76.652 dacf		

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	76.652	dacf
$Vm(m^3)$=	2.171	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=	76.652	dacf
Yd=	1.0030	
Pbar=	29.27	in. Hg
dHavg=	0.59	in. H2O
Tm=	91.2	F
Vm(std)=	72.124	dscf

Vm(std)m^3 = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	72.124	dscf
Vm(std)m^3=	2.042	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=	461.6	F
T=	921.3	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	
$SP_{H2O@Tsavg}$=	965.71	in. Hg
Ps=	29.24	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	17.375	scf
Vm(std)=	72.124	dscf
Bws=	0.1941	vol. fraction
Bws used=	0.1941	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	7.33	% dv
O2=	5.39	% dv
CO + N2=	87.28	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	7.33	% dv
O2=	5.39	% dv
CO + N2=	87.28	% dv
Md=	29.39	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.39	lb/lb-mole
Bws=	0.1941	vol. fraction
Ms=	27.18	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6		
Pbar=	29.27	in. Hg
Pg=	-0.37	in. H2O
Ps=	29.24	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=	0.4381	in. H2O^1/2
Tsavg=	461.6	F
Ps=	29.24	in. Hg
Ms=	27.18	lb/lb-mole
Vs=	33.88	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=	67.00	inches
As=	24.48	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=	33.88	ft/s
As=	24.48	ft2
Qacfm=	49,767	acfm
Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)		
Qacfm=	49,767	acfm
Qacm/min=	1,409	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)		
Qacfm=	49,767	acfm
Tstandard=	68	F
Tsavg=	461.6	F
Ps=	29.24	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	27,867	scfm
Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)		
Qscfm=	27,867	scfm
Qscm/min=	789	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	27,867	scfm
Bws=	0.1941	vol. fraction
Qdscfm=	22,457	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	22,457	dscfm
Qdscm/min=	636	dscm/min

Percent Isokinetic

I = K4method 5 * (Tsavg + 460) * Vm(std) / (Ps * Vs * An * Theta * (1 - Bws))

K4method5=	0.0945	
Tsavg=	461.6	F
Vm(std)=	72.124	dscf
Ps=	29.24	in. Hg
Vs=	33.88	ft/s
An=	0.000446	ft2
Theta=	180	minutes
Bws=	0.1941	vol. fraction
I=	97.98	%

Total Weight of TSO

mnTSO = Blank Corrected Front Half Filter + Blank Corrected F1/2 Rinse + Blank Corrected Inorganic Rinse + Blank Corrected Organic Rinse

Front-half Filter TSO Mass (mn)		8.20 mg
F1/2 Rinse TSO Mass (mn)		9.80 mg
B1/2 TSO Mass (mn)		1.10 mg
B1/2 Rinse TSO Mass (mn)		1.70 mg
Blank Front-half Filter		9.29 mg
Blank F1/2 Rinse		8.45 mg
Blank Back Half Water		0.00 mg
Blank Back Half Toluene Rinse		2.43 mg
Blank Corrected Front Half Filter =		0.00 mg
Blank Corrected F1/2 Rinse =		1.35 mg
Blank Corrected Inorganic Mass =		1.10 mg
Blank Corrected Organic Mass =		0.00 mg
m_n=	2.4 mg	

TSO Emission Concentration (gr/DSCF)

TSO(gr/dscf) = 0.001 * (mn / Vm(std)) * 15.43

m_n=	2.45	mg
Vm(std)=	72.12	dscf
TSO(gr/dscf)=	0.0005	gr/dscf

TSO Emission Concentration (mg/dscm)

TSO(mg/dscm) = mn * Vm(std)

m_n=	2.45	mg
Vm(std)=	2.04	dscm
TSO(mg/dscm)=	1.20	mg/dscm

TSO Emission Rate (lb/hr)

TSO(lb/hr) = TSO(gr/dscf) * (1 lb / 7000 grains) * Qdscfm * (60 min / 1 hr)

TSO(gr/dscf)=	0.0005	gr/dscf
Qdscfm=	22,457	dscfm
TSO(lb/hr)=	0.10	lb/hr

Methods 3A/6C/10/15

SAMPLE CALCULATIONS
Flow, Moisture, CEMS
ArcelorMittal
16-167
Monessen, PA
Boilers
Normal Load
October 13, 2016
Stack Exhaust
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,941.0	g	K1method 4	0.04706	scf/ml
Wi	3,154.7	g	K2method 4	0.04715	scf/g
Vm	163.169	0.447	K1method 5	17.64	R/in. Hg
Vm	0.000	78.000	K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.06	in. Hg	Kp	85.49	
dHavg	2.73	in. H2O	π	3.141593	
Tm	74.3	F	Ds (or L)	67.00	inches
O2	5.25	% dv	Stack Width (W)	0.00	inches
CO2	7.28	% dv	Tsavg	458.6	F
Pg	-0.38	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.497	in. H2O^1/2			

CEMS DATA

Sulfur Dioxide					
$Caverage_{SO2}$	123.53	ppmdv			
C_{0SO2}	1.60	ppmdv			
Cma_{SO2}	100.00	ppmdv			
Cm_{SO2}	97.45	ppmdv			
MW SO2	64.0	lb/lb-mole			
Carbon Monoxide			Hydrogen Sulfied		
$Caverage_{CO}$	39.5	ppmdv	Cavg.	0.50	ppmwv
C_{0CO}	1.3	ppmdv	MW H2S	34.1	lb/lb-mole
Cma_{CO}	100.0	ppmdv			
Cm_{CO}	100.4	ppmdv			
MW CO	28.0	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=	3,941.0	g
Wi=	3,154.7	g
Vwsg(std)=	37.074	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	37.074	scf
Vw(std)=	37.074	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=	163.169	0.447
Volume metered in dry actual liters=	0.000	78.000

Vm= 163.169 dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm= 163.169 dacf

$Vm(m^3)$= 4.620 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=	163.169	dacf
Yd=	1.0030	
Pbar=	29.06	in. Hg
dHavg=	2.73	in. H2O
Tm=	74.3	F
Vm(std)=	158.092	dscf

$Vm(std)m^3$ = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)= 158.092 dscf

$Vm(std)m^3$= 4.477 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=	458.6	F
T=	918.3	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	
$SP_{H2O@Tsavg}$=	937.44	in. Hg
Ps=	29.03	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	37.074	scf
Vm(std)=	158.092	dscf
Bws=	0.1900	vol. fraction

Bws used= 0.1900 vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	7.28	% dv
O2=	5.25	% dv
CO + N2=	87.46	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	7.28	% dv
O2=	5.25	% dv
CO + N2=	87.46	% dv
Md=	29.38	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.38	lb/lb-mole
Bws=	0.1900	vol. fraction
Ms=	27.21	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.06	in. Hg
Pg=	-0.38	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=	0.4972	in. H2O^1/2
Tsavg=	458.6	F
Ps=	29.03	in. Hg
Ms=	27.21	lb/lb-mole
Vs=	38.50	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=	67.00	inches
As=	24.48	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=	38.50	ft/s
As=	24.48	ft2
Qacfm=	56,553	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	56,553	acfm
Qacm/min=	1,601	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	56,553	acfm
Tstandard=	68	F
Tsavg=	458.6	F
Ps=	29.03	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	31,542	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	31,542	scfm
Qscm/min=	893	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)

Qscfm=	31,542	scfm
Bws=	0.1900	vol. fraction
Qdscfm=	25,550	dscfm

Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)

Qdscfm=	25,550	dscfm
Qdscm/min=	724	dscm/min

Sulfur dioxide concentration (ppmdv)

$C_{SO2} = (Caverage_{SO2} - C_{0SO2}) * Cma_{SO2} / (Cm_{SO2} - C_{0SO2})$

$Caverage_{SO2}$=	123.53	ppmdv
C_{0SO2}=	1.60	ppmdv
Cma_{SO2}=	100.00	ppmdv
Cm_{SO2}=	97.45	ppmdv
C_{SO2}=	127.21	ppmdv

Sulfur dioxide emission rate (lb/hr)

$SO2(lb/hr) = C_{SO2} / 1{,}000{,}000 * Qdscfm * (60\ min / 1\ hour) / V/n_{standard} * SO2_{MW}$

C_{SO2}=	127.21	ppmdv
Qdscfm=	25,550	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
$SO2_{MW}$=	64.0	lb/lb-mole
SO2(lb/hr)=	32.39	lb/hr

Carbon Monoxide concentration (ppmdv)

$C_{CO} = (Caverage_{CO} - C0_{CO}) * Cma_{CO} / (Cm_{CO} - C0_{CO})$

$Caverage_{CO}$=	39.45	ppmdv
$C0_{CO}$=	1.30	ppmdv
Cma_{CO}=	100.00	ppmdv
Cm_{CO}=	100.35	ppmdv
C_{CO}=	38.52	ppmdv

Carbon Monoxide emission rate (lb/hr)

$CO(lb/hr) = C_{CO} / 1{,}000{,}000 * Qdscfm * (60\ min / 1\ hour) / V/n_{standard} * CO_{MW}$

C_{CO}=	38.52	ppmdv
Qdscfm=	25,550	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
COMW=	28.0	lb/lb-mole
CO(lb/hr)=	4.29	lb/hr

Hydrogen Sulfide H2Sncentration (ppmdv)

$C_{H2S} = (C_{H2S}\ wet) / (1 - Bws)$

C_{H2S} wet =	0.50	ppmwv
Bws =	0.19	vol. fraction
C_{H2S}=	0.62	ppmdv

Hydrogen Sulfide emission rate (lb/hr)

H2S(lb/hr) = CH2S / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * H2SMW

CH2S=	0.62	ppmdv
Qdscfm=	25,550	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
H2S MW=	34.1	lb/lb-mole
H2S(lb/hr)=	0.084	lb/hr

Method 320

SAMPLE CALCULATIONS
Flow, Moisture, CEMS
ArcelorMittal
16-167
Monessen, PA
Boilers 1 and 2
Normal
October 12, 2016
Common Stack
Run 1

Vf	0.0	ml	Tstandard	68	F
Vi	0.0	ml	Pstandard	760	mm Hg
Wf	3,891.1	g	K1method 4	0.04706	scf/ml
Wi	3,194.8	g	K2method 4	0.04715	scf/g
Vm	155.578	dacf	K1method 5	17.64	R/in. Hg
Vm	0.000	dry actual liters	K4method 5	0.0945	
Yd	1.0030		$V/n_{standard}$	385.3	ft3/lb-mole
Pbar	29.27	in. Hg	Kp	85.49	
dHavg	2.54	in. H2O	π	3.141593	
Tm	91.2	F	Ds (or L)	67.00	inches
O2	5.38	% dv	Stack Width (W)	NA	inches
CO2	7.43	% dv	Tsavg	455.5	F
Pg	-0.37	in. H2O	Product rate	NA	ton/hr
Cp	0.84		F_d	NA	dscf/MMBtu
$(dP)^{1/2}$avg	0.489	in. H2O^1/2			

CEMS DATA

HCl			HF		
$Caverage_{HCl}$	-0.10	ppmwv	$Caverage_{HF}$	0.053	ppmwv
MW HCl	36.4609	lb/lb-mole	MW HF	20.010	lb/lb-mole
HCN					
$Caverage_{HCN}$	-0.09	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=	3,891.1	g
Wi=	3,194.8	g
Vwsg(std)=	32.831	scf

Total Volume of Water Vapor in Gas Sample (Vw)

Vw(std) = Vwc(std) + Vwsg(std)

Vwc(std)=	0.000	scf
Vwsg(std)=	32.831	scf
Vw(std)=	32.831	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=	155.578	dacf
Volume metered in dry actual liters=	0.000	dry actual liters
Vm=	155.578	dacf

$Vm(m^3)$ = Vm * (1 m^3 / 35.3145 cf)

Vm=	155.578	dacf
$Vm(m^3)$=	4.405	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=	155.578	dacf
Yd=	1.0030	
Pbar=	29.27	in. Hg
dHavg=	2.54	in. H2O
Tm=	91.2	F
Vm(std)=	147.096	dscf

Vm(std)m^3 = Vm(std) * (1 m^3 / 35.3145 cf)

Vm(std)=	147.096	dscf
Vm(std)m^3=	4.165	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^3 + C12*T^3 + C13*ln(T)) * (29.921/14.696)

T = Tsavg + 459.67

Tsavg=	455.5	F
T=	915.2	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	
$SP_{H2O@Tsavg}$=	909.55	in. Hg
Ps=	29.24	in. Hg
Bws=	1.0000	vol. fraction

Bws = Vw(std) / (Vm(std) + Vw(std))

Vw(std)=	32.831	scf
Vm(std)=	147.096	dscf
Bws=	0.1825	vol. fraction
Bws used=	0.1825	vol. fraction

Carbon Monoxide and Nitrogen in gas

CO + N2 = 100 - (CO2 + O2)

CO2=	7.43	% dv
O2=	5.38	% dv
CO + N2=	87.19	% dv

Molecular weight of dry gas stream

Md = 0.44 * CO2 %dv + 0.32 * O2 %dv + 0.28 * (CO + N2 %dv)

CO2=	7.43	% dv
O2=	5.38	% dv
CO + N2=	87.19	% dv
Md=	29.40	lb/lb-mole

Molecular weight of wet gas stream

Ms = Md * (1 - Bws) + 18 * Bws

Md=	29.40	lb/lb-mole
Bws=	0.1825	vol. fraction
Ms=	27.32	lb/lb-mole

Stack Pressure

Ps = Pbar + Pg/13.6

Pbar=	29.27	in. Hg
Pg=	-0.37	in. H2O
Ps=	29.24	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=	0.4890	in. H2O^1/2
Tsavg=	455.5	F
Ps=	29.24	in. Hg
Ms=	27.32	lb/lb-mole
Vs=	37.59	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=	67.00	inches
As=	24.48	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=	37.59	ft/s
As=	24.48	ft2
Qacfm=	55,216	acfm

Qacm/min = Qacfm * (1 m^3 / 35.3145 cf)

Qacfm=	55,216	acfm
Qacm/min=	1,564	acm/min

Stack Gas Flow Rate, Standard

Qscfm = Qacfm * ((Tstandard + 460) / (Tsavg + 460)) * (Ps / Pstandard)

Qacfm=	55,216	acfm
Tstandard=	68	F
Tsavg=	455.5	F
Ps=	29.24	in. Hg
Pstandard=	29.92	in. Hg
Qscfm=	31,123	scfm

Qscm/min = Qscfm * (1 m^3 / 35.3145 cf)

Qscfm=	31,123	scfm
Qscm/min=	881	scm/min

Stack Gas Flow Rate, Dry Standard

Qdscfm = Qscfm * (1 - Bws)		
Qscfm=	31,123	scfm
Bws=	0.1825	vol. fraction
Qdscfm=	25,444	dscfm
Qdscm/min = Qdscfm * (1 m^3 / 35.3145 cf)		
Qdscfm=	25,444	dscfm
Qdscm/min=	720	dscm/min

Hydrogen Chloride concentration (ppmdv)

CHCl = (CHCl wet) / (1 -Bws)		
CHCl (raw, M320)=	-0.10	ppmwv
CHCl (MDL by M320)=	0.27	ppmwv
CHCl (used)=	0.27	ppmwv
CHCl wet =	0.27	ppmwv
Bws =	0.1825	vol. fraction
CHCl=	0.33	ppmdv

Hydrogen Chloride emission rate (lb/hr)

HCl(lb/hr) = CHCl / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * HClMW		
CHCl=	0.33	ppmdv
Qdscfm=	25,444	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
HCl MW=	36.4609	lb/lb-mole
HCl(lb/hr)=	0.047	lb/hr

Hydrogen Flouride concentration (ppmdv)

CHF = (CHF wet) / (1 -Bws)		
CHF (raw, M320)=	0.0528	ppmwv
CHF (MDL by M320)=	0.0473	ppmwv
CHF (used)=	0.0528	ppmwv
CHF wet =	0.053	ppmwv
Bws =	0.1825	vol. fraction
CHF=	0.065	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=	25,444	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
HF MW=	20.0100	lb/lb-mole
HF(lb/hr)=	0.0051	lb/hr

Hydrogen Cyanide concentration (ppmdv)

CHCN = (CHCN wet) / (1 -Bws)		
CHCN (raw, M320)=	-0.090	ppmwv
CHCN (MDL by M320)=	0.41	ppmwv
CHCN (used)=	0.41	ppmwv
CHCN wet =	0.41	ppmwv
Bws =	0.1825	vol. fraction
CHCN=	0.50	ppmdv

Hydrogen Cyanide emission rate (lb/hr)

HCN(lb/hr) = CHCN / 1,000,000 * Qdscfm * (60 min / 1 hour) / V/nstandard * HCNMW		
CHCN=	0.497	ppmdv
Qdscfm=	25,444	dscfm
$V/n_{standard}$=	385.3	ft3/lb-mole
HCN MW=	27.0253	lb/lb-mole
HCN(lb/hr)=	0.053	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